

TECHNICAL SPECIFICATION

THARAD NAGARPALIKA – THARAD

DIST: VAV-THARAD

Name of Work

Providing & Constructing NP3 Pipe Line for Under Ground Drainage Line and Open Drain to Convert / Fixing D.I , MS Pipe Line & Monoset sub. Pump 3phase,Auto transformer starter , PVC insulated round submersible cable for Water Supply Various Areas @ Tharad Nagarpalika . Dist : Vav-Tharad

SCHEME:

SWARNIM JAYANTI MUKHYA MANTRI VIKAS YOJANA-2025-26

**CHIEF OFFICER
THARAD NAGARPALIKA
THARAD**

VOLUME II

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GENERAL

1. Employer's Drawings

1.1. The drawings listed in the Tender document are the Employer's drawings and are provided by the Employer as illustrative of the Specification.

1.2. All data and information furnished in the drawings by the Employer is given in good faith but the Employer does not accept the responsibility for the completeness and accuracy thereof. The same shall be verified by the Contractor promptly pointing out errors or discrepancies thereof to the Engineer.

2. Drawing Sheet Format

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2.1. All drawings provided by the Contractor shall be on standard size sheets, prepared on computer with AutoCAD and shall show the following particulars in a title block located in the lower right hand corner, in addition to the name of Contractor and equipment manufacturer, date, scale, drawing number, revision number (R0 for drawings submitted initially, R1, R2, etc. for drawings submitted subsequently) and title.

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A blank space of 90 mm x 100 mm shall be provided for the Engineer's approval stamp and provision shall be made for details of revisions to be recorded.

2.2. All drawings submitted by the Tenderer/Contractor shall use the English language and SI units. All drawings shall be clearly and fully cross-referenced to the other drawings as relevant.

3. Tender / Contract Drawings

3.1. Drawings submitted by the Tenderer shall show all the essential items of the Plant offered together with sufficient details to enable the general arrangement of the Plant to be determined.

3.2. The drawings and documents to be provided by the Tenderer / Contractor shall be as per the schedules of price but shall not be limited to those listed:

4. SUBMISSIONS AND APPROVAL OF DRAWINGS

4.1. The following shall be the procedure for submission and approval of drawings:

4.1.1. The Contractor shall submit 4 copies of the drawings to the Employer. All the drawings are to be signed by the Contractor or his authorized representatives

4.1.2. The Engineer's Representative will review the drawings and, if found fit for approval, the Employer will return 2 copies to the Contractor duly approved.

4.1.3. In case the drawings/documents are not fit for approval but worth for review, the Engineer's Representative will mark the comments on the drawings and return 2 copies to the Contractor. In such case, the Contractor shall resubmit the revised drawings within two

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weeks as per sub-clause 5.1.1 above and the same shall be repeated till the drawings are finally approved as per sub-clause 5.1.2 above.

4.1.4. If the submitted drawings/documents are not worth for review, the Contractor will be informed accordingly.

4.1.5. On receipt of the approved drawings as per sub-clause 5.1.2 above, the Contractor shall submit floppy and documents to the employer.

4.1.6. After tests on completion, the Contractor shall submit, within 15 days of the conclusion of the tests, floppies of the "As Built Drawings" to the Employer.

4.2. When the drawings are received by the Engineer's Representative after revision by the Contractor, he will only review the revision made and hence the Contractor shall carefully identify all the revised details / dimensions and also describe the revisions in the revision block.

4.3. No drawings, with corrections made after taking the prints, will be accepted.

4.4. Approval of drawings by the Engineer shall not relieve the Contractor of his responsibility in terms of the Contract.

5. Delivery, Unloading and Storing at Site.

5.1. The Contractor shall be responsible for checking all materials delivered to Site and shall keep the Engineer's Representative fully informed of the state of deliveries. The Contractor shall carry out, at his cost, all instructions of Engineer or his Representative for proper unloading, preservation, maintenance, storage and security of materials delivered to Site until he fulfils all his obligations under the Contract.

5.2. The Contractor shall erect and maintain on the Site any temporary storage facility as required and approved by the Engineer.

5.3. Multiple handling and movement of materials during storage and retrieval shall be avoided.

6. Spare Parts:

6.1. Spare Parts required after the taking over the Plant shall be filled up by the bidder in the price schedule.

6.2. Spares during pre-commissioning trials, commissioning tests/maintenance, guarantee etc. shall be provided by the Contractor. The necessary spares shall be brought by the Contractor prior to the pre-commissioning test so as to avoid the downtime of equipment due to non-availability of them. All these spares have to be provided as required, by Contractor free of cost.

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6.3. All spare parts shall be new, unused and strictly interchangeable with the parts for which they are intended to be replacements and shall be treated and packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be clearly marked or labelled on the outside of its packing with its description, number and purpose. When more than one spare is packed in a single case or other container, a general description of its contents shall be shown on the outside of such case or container and a detailed list enclosed. All cases, containers and other packages shall be marked and numbered in an approved manner for the purpose of identification. Spares shall be delivered to Site after the completion of erection but before start of commissioning of Plant along with technical leaflets and details. Spare parts shall be indicated in the assembly drawing showing clearly the part numbers.

6.4. All cases, containers or other packages are liable to be opened for such examination as the Engineer's Representative may require and packing shall be designed to facilitate opening and thereafter re-packing. In the event of the some specific spares offered in the Contract being withdrawn from manufacture owing to changes in design of equipment or similar reasons viz., model being obsolete etc., the Contractor shall inform the Employer before such withdrawal so that the Employer can take timely alternative steps.

7. Tools:

7.1. Tools shall be delivered to site just prior to Tests on Completion.

7.2. The specified tools shall not be used for the erection of the Plant being supplied and except that the Engineer may call upon the Contractor to demonstrate their use or effectiveness, they must be handed over to the Employer in a completely new and unused condition. Should the Contractor require any such tools at site for erection, he shall provide his own.

The test equipment shall include special purpose items essential to the testing or re-calibration of related items of Facilities.

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MATERIALS AND WORKMANSHIP

1. Introduction

1.1. This part of the Specification sets out the general standards of materials to be supplied and the workmanship required to be ensured by the Contractor. All component parts of the Works shall, unless otherwise specified, comply with the provisions of employer's requirement or be subject to the approval of the Employer. Particular attention shall be paid to a neat, orderly and well-arranged installation carried out in a methodical

competent manner.

2. Reference Specifications and Standards

2.1. Where reference is made in the Specification to a British Standard Specification (hereinafter abbreviated to 'B.S') issued by the British Standards Institution of 2, Park street, London W.1., or to an Indian Standard Specification (I.S.) issued by the Bureau of Indian Standards, (earlier known as Indian Standard Institution), Manak Bhavan, 9 Bahadur shah Zafar Marg, New Delhi 110 002, or American Society for Testing and materials (ASTM) issued by ASTM 1916 Race Street, Philadelphia, P.A., 19103, U.S.A. or American national Standards Institute (ANSI) issued by ANSI 1430, Broadway, New York, N.Y., 10018, U.S.A. or Japanese Industrial Standards (JIS) issued by Japanese Standards Association, 4-1-24, Akasaka, Minato-Ku, Tokyo 107, Japan or to any other equivalent Standard it shall be to the latest revision of that Standard at the Tender opening date.

2.2. The Contractor may propose at no extra cost to the Employer, the use of any relevant authoritative Internationally recognised Reference Standard.

2.3. All details, materials and equipment supplied and workmanship performed shall comply with the specified Standards. If Tenderer offers equipment to other Standards, the equipment/material should be equal or superior to those specified and full details of the difference shall be supplied.

2.4. In the event of conflict between this Specification and the Codes for equipment, provisions of this Specification shall govern. Certain specifications issued by national or other widely recognised bodies are referred to in this Specification. In referring to the Standard Specifications the following abbreviations are used:

IS	INDIAN STANDARD
API	AMERICAN NATIONAL STADARD INSTITUTE
API	AMERICAN PETROLEUM INSTITUTE
ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS AMERICAN WELDING SOCIETY
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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AWWA	AMERICAN WATER WORKS ASSOCIATIONS
ISO	INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
BS	BRITISH STANDARAD
IEE	INTERNATIONAL ELECROTECHNICAL COMMISION
NEMA	National Electrical Manufacturers Association
DIN	DEUTSCHES INSTITUTE FUR NORMUNG

3. Materials - General

3.1. All materials incorporated in the Works shall be the most suitable for the duty concerned and shall be new and of reputed make/approved quality, free from imperfections and selected for long life and minimum maintenance. Non-destructive tests, if called for in the Specification, shall be carried out. All submerged moving parts of the Plant, or shafts and spindles or faces etc. in contact with them shall be of corrosion resistant materials. All parts in direct contact with various chemicals, shall be

completely resistant to corrosion, or abrasion by these chemicals, and shall maintain their properties without aging due to the passages of time, exposure to light or any other cause.

4. Workmanship - General

4.1. Workmanship and general finish shall be of first class quality and in accordance with best workshop practice.

4.2. All similar items of the Plant and their component parts shall be completely interchangeable. Spare parts shall be manufactured from the same materials as the originals and shall fit all similar items.

4.3. All parts, which can be worn or damaged by dust, shall be totally enclosed in dust proof housings. All materials incorporated in the Works shall be the most suitable for the duty concerned, free from imperfections and selected for long life and minimum maintenance. All necessary accessories required for satisfactory and safe operation of the Plant shall be supplied by the Contractor unless it is specifically excluded from his scope. Suitable provision by means of eyebolts or other means are to be provided to facilitate handling of all items that are too heavy or bulky for lifting and carrying by two men.

5. Welding

5.1. Welding shall comply with the latest revision of the BS 5135 Code.

5.2. Welders shall be qualified in accordance with the requirement of the appropriate section of BS 4871. The Engineer shall have the right to call for further qualification from time to time from any welder who in the opinion of the Engineer does not produce weld in accordance with the qualification. Each welder shall be assigned a number and letter.

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Each weldments shall clearly be identified as to its welder marking the welder's Code adjacent to the welds. A record chart shall be maintained for each welder showing the procedures for which he has qualified, the date of such qualification, the type of defects produced and their frequency. The Engineer shall disqualify the welder whose Work requires a disproportionate amount of repairs. All procedures where required shall be qualified as per BS EN 283-3.

5.3. Inspection and quality of surveillance shall not be limited to the examination of finished welds. The techniques employed shall be based on methods which are known to produce good results and which have been verified at Site by actual demonstration.

5.4. Haphazard striking of the electrodes for establishing an arc shall not be permitted.

The arc shall be struck either on the joint or on a starting tag. The starting tag shall be of the same material or a material compatible with the base metal being welded. In case of any inadvertent strike on place other than the welding, the area affected shall be ground flushed and examined by liquid penetration method.

5.5. Generally, a stringer bead technique shall be used with a slight oscillation of necessary to avoid slag and to minimize the number of beads needed to fill exceed 3 times the wire diameter. Vertical welds shall be made in upward direction. For all pipes above 300 mm dia., welding shall be done whenever possible, by 2 welders working simultaneously along both sides of the pipe.

5.6. The root pass shall have less than 1.5 mm internal reinforcement. Defects like icicles, burn through and excessive "such back", etc. shall be cause for rejection of welds.

5.7. Final welds shall be suitable for appropriate fabrication of the non-destructive examination of the weld. If grinding is necessary, the weld shall be blended into the parent metal without gouging or thinning of the parent metal in any way. Uneven and excessive grinding may be a cause for rejection. Fillet weld shall preferably be convex and free from undercutting and overlap at the toe of weld. Convexity and concavity shall not exceed 1.5 mm. The leg lengths shall not exceed the specified size by more than 1.5 mm.

5.8. All attachments such as lugs, brackets and other non-pressure parts shall also be done by qualified welders in accordance with the design details and materials specifications. Temporary attachments shall be removed in a manner that will not damage the parent metal. Areas of temporary attachments shall be dressed smooth and examined by ultrasonic or liquid penetration methods.

5.9. All tack welds shall be made using qualified procedure and welders, the number of size of tack welds shall be kept as small as to consist of adequate strength and joint alignments. All tack welds shall be examined visually for defects and if found defective shall be completely removed. As welding proceeds, tack welds shall be either removed completely or shall be properly prepared by grinding or filling their starting ends so that they may be satisfactorily incorporated in the welds. Unacceptable defects shall be removed by grinding machine or chipping or gouging. Flame gouging may be permitted provided gouged surfaces are ground at least by 1.0 mm below the deepest indentation.

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5.10. All weld repairs shall be carried out using the approved welding procedures and welders.

Re-welded areas shall be re-examined by the methods specified for the original welds and the Engineer's Representative shall duly qualify repair procedures.

6. Pre-heating and Post-heating Treatment

6.1. Pre-heating and post heating treatment shall conform to the relevant application Codes.

Pre-heating not exceeding 121 deg. C for all carbon steel construction above 25 mm thickness would be mandatory. Such pre-heating would be maintained during flame cutting, flame or arc gouging, welding and repairs and may be done by gas heating by gas torches/gas rings with neutral flame. The temperature shall be checked by temperature indicating crayons. However, such pre-heating will not be necessary for welds less than 6 mm size. In large diameter pipe fabricated out of plate materials, production control test plates in accordance with the BS 4870 part 1 Table 6 to represent

30% of the long seams and each welder's performance would be mandatory.

7. Electrodes

7.1. All electrodes shall be stored in their original sealed containers under dry conditions. Electrodes shall remain identified until consumed. All electrodes shall be dried before use. Drying ovens shall be provided in Work areas for drying purposes. Electrodes withdrawn from oven shall be promptly used and excess unused electrodes shall be promptly returned to oven.

8. Examination/NDT/Radiography

8.1. The various stages of examination and types shall be as stipulated in the respective fabrication Codes. Radiographic examination shall be carried out as per provisions of BS 2600 or BS 2910; Ultrasonic tests where called for shall be carried out as per provisions of BS 3926; magnetic particle tests shall be carried out as per BS 6072. Liquid penetration tests shall be carried out as per BS 6443.

9. Stainless Steel Welding

9.1. All welding consumable such as electrodes, filler weirs, argon gas for shielding and purging shall be of high quality and the proposed brand shall be furnished for approval of the Engineer. Weld deposits shall have similar or higher physical properties and similar chemical composition to the members joined.

9.2. All electrodes shall be purchased in sealed containers only and stored in their packing intact. The packets opened shall be consumed as early as possible. The electrodes removed from the containers shall be kept in holding ovens at temperatures recommended by electrode manufacturer. Special care shall be taken in avoiding mixing of electrodes in the oven. The electrodes and filling wires shall be free from rust, oil, grease, earth and other foreign matter

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9.3. Argon gas with purity 99.5% shall be used for shielding and purging. The purity of gas shall be certified by the gas manufacturers.

9.4. Non-destructive examination of the welds shall be carried out to ensure quality of weld.

9.5. The electric current for welding shall be direct current, straight polarity (electrode negative). The welding current shall be kept minimum possible to ensure minimum heat affected zone in the parent material. Other side of the weld joint shall be periodically flushed with argon gas.

10. Castings

10.1. Cast iron shall be of standard grey close-grained quality. The structure of the castings shall be homogeneous and free from non-metallic inclusions and other injurious defects. All surfaces of castings, which are not machined, shall be smooth and shall be carefully fettled to remove all foundry irregularities.

10.2. Minor defects in depth not exceeding 12.5 percent of total metal thickness and which will not ultimately affect the strength and serviceability of the casting may be repaired by approved welding techniques. The Engineer shall be notified of large defects and no repair welding of such defects shall be carried out without prior approval of the Engineer. If the removal of metal for repair should reduce the stress resisting cross section of the casting by more than 25 percent, or to such an extent that the computed stress in the remaining metal exceeds the allowable stress by more than 25 percent, then casting shall be rejected. Test coupons cast simultaneously with the main castings shall be identified to check physical, chemical analysis of casting. Major defects on casting are not acceptable. Castings repaired by welding for minor defects shall be stress-relieved after such welding. Non-destructive tests as directed by the Engineer will be required for any casting containing defects whose extent cannot otherwise be judged, or to determine where repair welds have been properly made.

11. Forging

11.1. All major stress-bearing forging shall be made to a Standard Specification. Forging shall be subjected to magnetic particle testing or dye penetration test at the areas of fillets and change in section. The testing shall be conducted after rough machining (10 microns). Any defect, which will not machine out during the final machining, will be gouged out fully, inspected by dye penetration or magnetic particle inspection to ensure that the defect is fully removed and repaired using an approved repair procedure. Any indication, which proves to penetrate deeper than 2.5% of the finished thickness of the component, shall be reported to the Engineer giving the details like location, length, width and depth. For the magnetic particle inspection the choice of wet or dry particles shall be at the Contractor's discretion.

11.2. All forging shall be demagnetized after test and shall be heat-treated for the relief of residual stresses.

12. Design Life

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12.1. The Works as a whole shall be new, of sound workmanship, robustly designed for a long reliable operating life and shall be capable of 24 hours per day continuous operation for prolonged period in the climatic and working conditions prevailing at the Site, and with the minimum of maintenance. Particular attention shall be given to temperature changes, the stability of paint finish for high temperatures, the rating of engines, electrical machinery, thermal overload services, cooling systems and the choice of lubricants for possible high and prolonged operating temperatures. The Contractor shall be called upon to demonstrate this for any component part either by service records, or evidence of similar equipment already installed elsewhere or relevant type tests. Routine maintenance and repair shall as far as possible not require the services of highly skilled personnel.

12.2. The Plant shall be designed to provide easy access to and replacement of component parts, which are subject to wear, without the need to replace whole units. No parts in contact with water shall have a life from new to replacement or repair of less than five years.

12.3. Design features shall include the protection of Plant against damage caused by vermin, dirt, dust and dampness and to reduce risk of fire. Plant shall operate without undue vibration, and parts shall be designed to withstand the maximum stresses under the most severe condition of normal service. Materials shall have a high resistance to change in their properties due to the passage of time, exposure to light, temperature and any other cause, which may have a detrimental effect upon the performance or life of the Works.

12.4. Plant located outside lockable areas/building shall have additional features to prevent un-authorized operation.

13. Name Plate

13.1. Each item of the Plant shall have permanently attached to it in a conspicuous position, a nameplate and rating plate. Upon these shall be engraved or stamped, the manufacturer's name, type and serial number of Plant, details of the loading and duty at which the item of Plant has been designed to operate, and such diagrams as may be required by the Engineer. All indicating and operating devices shall have securely attached to them or marked upon them designations as to their function and proper manner of use.

13.2. Nameplates, rating plates and labels shall be of a non-flame propagating materials, either non-hygroscopic or transparent plastic with engraved lettering of a contrasting colour. Fixing shall be by means of non-corrosive screws; drive rivets or adhesives shall not be used.

13.3. Warning labels shall be provided where necessary to warn of dangerous circumstances or substances. Inscriptions or graphic symbols shall be black on a yellow background.

13.4. Instruction labels shall be provided where safety procedures such as wearing of protective clothing are essential to protect personnel from hazardous or potentially

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hazardous conditions. These labels shall have inscriptions or graphic symbols in white on a blue background.

14. Nuts, Bolts, Studs and Washers

14.1. Nuts, bolts, studs and washers for incorporation in the Plant shall conform to the requirements of the appropriate standard. Nuts and bolts shall be of the best quality of specified grade, machined on the shank and under the head and nut

14.2. Fitted bolts shall be a light driving fit in the reamed holes they occupy, shall have the screwed portion of such a diameter that it will not be damaged in driving and shall be marked in a conspicuous position to ensure correct assembly at Site.

14.3. Washers, locking devices and anti-vibration arrangements shall be provided where necessary. Jointing hardware for the entire Plant shall be provided with sufficient spares to cater for site losses.

14.4. Where bolts pass through structural members taper washers shall be fitted, where necessary, to ensure that no bending stress is caused in the bolt. Where there is a risk of corrosion, bolts, nuts and studs shall be designed so that the maximum stress does not exceed half the yield stress of the material under any conditions. All bolts, nuts and washers that are subject to frequent adjustment or removal in the course of maintenance and repair shall be made of nickel-bearing stainless steel.

14.5. The Contractor shall supply all holding down, alignment and leveling bolts comp. with anchorages, nuts, washers and packing required to attach the Plant to its foundations, & all bed plates, frames and other structural parts necessary to spread the loads transmitted by the Plant to concrete foundations without exceeding the design stresses.

15. Allowances for Wastage

15.1. The Contractor shall supply reasonable excess quantities to cover wastage of those consumable, which will be normally subject to waste during erection, commissioning and setting to Work.

16. Painting – General

16.1. The Contractor shall be responsible for the cleaning, preparation for painting, and priming or otherwise protecting, as specified, all parts of the Plant at the place of manufacture prior to packing.

16.2. Parts may be cleaned but surface defects may not be filled in before testing at the manufacturer's works. Parts subject to hydraulic test shall be tested before any surface treatment. After test, all surfaces shall be thoroughly cleaned and dried out, if necessary by washing with an approved de-watering fluid prior to surface treatment. Except where the specification provides to the contrary all painting materials shall be applied in strict accordance with the paint manufacturer's instructions.

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16.3. All protective coatings shall be suitable for use in warm humid climates. All primers, under coats and finishes shall be applied by brush or airless spray, except where otherwise specified. Consecutive coats shall be in distinct but appropriate shades. All paints shall be supplied from the store to the painters, ready for application, and addition of thinners or any other material shall be prohibited.

17. Painting at Place of Manufacture

17.1. Steel and cast iron parts shall be sand blasted to near white cleaning before painting. Edges, sharp corners etc. shall be ground to a curve before sand blasting. A primer coat of a zinc rich epoxy resin based coating with at least 75 microns dry film thickness is to be provided. In addition the parts are to be provided with adequate number of coats of coal tar epoxy polyamine coating to a dry film thickness of 175 microns including primer coating.

18. Painting at Site

18.1. Immediately on arrival at the site, all items of Plant shall be examined for damage to the paint coat applied at the manufacturer's works, and any damaged portions shall be cleaned down to the bare metal, all rust removed, and the paint coat made good with similar paint.

18.2. After erection, such items, which are not finish painted, shall be done so and, items that have been finish painted at the manufacturer's works shall be touched up for any damaged paintwork. For finish painting, two coats of synthetic enamel conforming to IS:

2932 shall be applied. Dry film thickness of each coat shall be at least 25 microns.

18.3. The dry paint film thickness shall be measured by Electrometer or other instruments approved by the Employer. In order to obtain the dry film thickness specified the Contractor should ensure that the coverage rate given by the paint manufacturer would

enable this thickness to be obtained. Strength of adhesion shall be measured with

an adhesion tester and this value shall not be less than 10 kg/cm². Painted

fabricated steel work which is to be stored prior to erection shall be kept clear of the ground and shall be laid out or stacked in an orderly manner that will ensure that no water or dirt can accumulate on the surface. Suitable packing shall be laid between the stacked materials. Where cover is provided, it shall be ventilated.

19. Galvanizing

19.1. Wherever galvanizing has been specified the hot dip process shall be used. The galvanized coating shall be of uniform thickness. Weight of zinc coatings for various applications shall not be less than those indicated below:

a) Fabricated steel

Thickness less than 2 mm but not less than 1.2 mm 340 gms/sq.m

Thickness 2 mm and above 460 gms/sq.m b) Fasteners

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Up to nominal size M10 270 gms/sq.m

Over M10 300 gms/sq.m

19.2 Galvanizing shall be carried out after all drilling; punching, cutting, bending and welding operations have been carried out. Burrs shall be removed before galvanizing. Any Site modification of galvanized parts should be covered well by zinc rich primer and aluminum paint.

20. Support for Pipe work & Valves

20.1. All necessary supports, saddles, sling, fixing bolts & foundation bolts shall be supplied to support the pipe work. Valve and other facilities mounted in the pipe work shall be supported independent of the pipes to which they connect.

INSPECTION AND TESTING AT MANUFACTURER'S PREMISES

1. Inspection and Tests

1.2. Pipe work

1.2.1. Testing of pipes and fitting shall be carried out in accordance with relevant Indian Standard and internationally approved standard. Pipes, fittings and expansion bellows shall be hydrostatically tested for 1.5 times the rated pressure.

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In the specifications, "as directed" / "Approved" shall be taken to mean 'as directed' / 'approved' by the Engineer-in-Charge.

Wherever a reference to any Indian Standard appears in the specifications, it shall be taken to mean as a reference to the latest edition of the same in force on the date of agreement.

Approval to the samples of various materials given by the Engineer-in-charge shall not absolve the contractor from the, responsibility of replacing defective material brought on site of materials used in the work found defective at a later date. The contractor shall have no claim to any payment of compensation whatsoever on account of any such materials being rejected by the Engineer-in-charge.

The contract rate of the item of work shall be for the work completed in all respects.

No collection of materials shall be made before it is got approved form the Engineer-in-charge.

Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent damage, deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.

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Materials, if and when rejected by the Engineer-in-charge, shall be immediately removed from the site of work.

No materials shall be stored before, during and after execution of structures in such a way as to cause or lead to damage of overloading of the various components of the structure.

All tools, templates, machinery and equipment for correct execution of the work as well as for checking lines, levels, alignment of the works during execution shall be kept in sufficient numbers and in good working condition on the site of the work.

The mode, procedure and manner of execution shall be such that it does not cause damage or over loading of the various components of the structure during execution of after completion of the structure.

Special modes of construction not adopted in general Engineering practice, if proposed to be adopted by the Contractor shall be considered only if the contractor provides satisfactory evidence that such special mode of construction is safe, sound and helps in speedy construction and completion of work to the required strength and quality.

Acceptance of the same by the Engineer-in-charge shall not, however, absolve the contractor of the responsibility of any adverse effects and consequences of adopting the same in the course of execution of completion of the work.

All installations pertaining to water supply and fixtures thereof as well as drainage lines

and sanitary fittings shall be deemed to be completed only after giving satisfactory tests by the Contractor.

The contractor shall be responsible for observing the rules and regulation imposed under "Minor Minerals Act", and such other laws and rules prescribed by Government from time to time.

All necessary safety measures and precaution (including those laid down in the various relevant India Standards) shall be taken to ensure the safety of men, materials and machinery on the works as also of the work itself.

The testing charges of all materials shall be borne by the Contractor.

Approval to any of the executed items for the work does not in any way relieve the contractor of his responsibility for the correctness, soundness and strength of the structure as per the drawings and specification.

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WATER

Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and trace of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in RCC Container for transport, storage and handling of water shall be clean, water shall conform to the standards specified in I.S. 456-2000.

If required by Engineer-in-charge, it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in I.S. 269-1979. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

Water for curing mortar, concrete or masonry should not be too alkaline. It shall be free of elements that significantly affect the hydration reaction or otherwise interfere with the hardening of concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

Hard and bitter water shall not be used for curing.

Potable water will be generally found suitable for curing mortar or concrete.

LIME

Lime shall be hydraulic lime as per I.S. 712-1973. Necessary test shall be carried out as per I.S. 6932 (Parts 1 to X), 1973.

The following field tests for lime are to be carried out:

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(A) A very rough idea can be formed about the type of lime by its visual examination i.e. at lime bears pure white color lime in form of porous lumps of dirty white color indicates quick lime, and solid lumps are the un-burnt lime stone.

(B) Acid tests for determining the carbonate content in lime, excessive amount of impurities and rough determination of class of lime.

Storage shall comply with I.S. 721-1973. The slaked lime, if stored, shall be kept in a weather proof and damp-proof shed with impervious floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged in any way shall be rejected materials shall be removed from site of work.

Field-testing shall be done according to I.S. 1624-1974 to show the acceptability of materials.

CEMENT

Cement shall be 53 Grade Ordinary Portland cement as per I.S. 12269-1976 and 43

Grade Ordinary Portland Cement as per I.S. 8112-1976.

WHITE CEMENT

The white cement shall conform to I.S. 80412-E 1978.

COLORED CEMENT

Colored cement shall be with white or gray Portland cement as specified in the item of the work.

The pigments used for colored cement shall be of approved quality and shall not exceed

10 % of cement used in the Mix. The mixture of pigment shall be properly grounded to have a uniform color and shade. The pigments shall have such properties to provide for durability under exposure to sunlight and weather.

The pigment shall have the property such that it is neither affected by the cement nor detrimental to it.

SAND

Sand shall be natural sand, clean, well graded, hard strong durable and gritty particle free from injurious amounts of dust clay, kankar nodules, soft or flaky particles, shale, alkali, salts organic matter, loam, mica or other deleterious substances and shall be got approved from the Engineer-in-charge. The sand shall not contain more than 8 percent of silt as determined by field test. If necessary the sand shall be washed to make it clean.

COURSE SAND

TECHNICAL SPECIFICATION

The fineness modules of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse shall be as under:

I.S. Sieve Designation	Percentage by weight passing Sieve	I.S. Sieve Designation	Percentage by weight passing sieve
2.36 mm	90-100	300 micron	5-70
1.18 mm	70-100	150 micron	0-50

The crushing strength of grit will be such as to allow the concrete in which it is used to build up the specified strength of concrete.

The necessary test for grit shall carried out as per the requirement of I.S. 2386 (Parts I to VII) 1963 as per instructions of the Engineer-in-charge. The necessity of test FINE

SAND

The fineness modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under:

I.S. Sieve Designation	Percentage by weight passing Sieve	I.S. Sieve Designation	Percentage by weight passing sieve
2.36 mm	100	300 micron	5-50
1.18 mm	70-100	150 micron	0-10

Cinder aggregates shall be well burnt furnace residue obtained form furnace using call fuel only. It shall be sound clean free form clay, dirt, ash of other deleterious matter.

The average grading for cinder aggregates shall be mentioned below.

LIME MORTAR

TECHNICAL SPECIFICATION

Lime shall conform to specification S-2. Water shall conform to specifications S-1. Sand: Sand shall conform to specifications S-6.

Proportion of Mix: Mortar shall consist of such proportion of slaked lime and sand as may be specified in the item. The asked lime and sand be measured by volume.

Proportion of Mortar: Lime mortar shall be prepared by wet process as per I.S. 16251971 power driven the 180 revolutions with sufficient water. Water shall be added as required

during grinding (care being taken not to add more water) that will bring the mixed material to a consistency of stiff paste. Thoroughly wetted sand shall then be added evenly and

the mixture ground for another 180 revolutions.

Storage: Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin of open sheds.

Use: All mortar shall be used as soon as possible after grinding. It should be used on the day on which it is prepared. In no case mortar made earlier then 36 hours shall be permitted for use.

CEMENT MORTAR

Water: Water shall conform to specification S-1. Cement: Cement shall conform to specification S-3. Sand: Sand shall conform to S-6.

Proportion of Mix: Cement and sand shall be mixed to specified proportion, sand being measured by measuring boxes. The proportion of cement will be by volume on the basis of 50 kg/Bag of cement being equal to 0.0342 m³. The mortar may be hand mixed or machine mixed as directed.

Preparation of Mortar: In hand mixed mortar cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogenous mixture of uniform color is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out., While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform color so

that each particle of sand shall be completely covered with a film of wet cement ratio shall be adopted as directed.

The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes.

STONE COURSE AGGREGATE FOR NOMINAL MIX CONCRETE

TECHNICAL SPECIFICATION

Coarse aggregate shall be machine-crushed stone of black trap of equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper, adhesion of mortar.

The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap of equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. However in case of reinforced cement concrete the maximum limit may be restricted to 6 mm less than the minimum lateral clear distance between bars of 6 mm less than the cover, whichever is smaller.

I.S. sieve Percentage passing from single sized aggregates of nominal size

Designation

	40 mm	20 mm	16 mm
80 mm	-	-	-
40 mm	85-100	100	-
20 mm	0-20	-	85-100
10 mm	0.5	0.02	0.30
4.75 mm	-	0.5	0.5
2.35	-	-	-

This percentage may be varied somewhat by Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

The grading test shall be taken in the beginning and at the change of source of materials. The necessary test indicated in I.S. 383-1970 and I.S. 456-2000 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean.

The necessary tests indicated in I.S. 383-1970 and I.S. 456-2000 shall have to be carried out to ensure the acceptability of the material.

If aggregate is covered with dust it shall be washed with water to make it clean.

BLACK TRAP FOR EQUIVALENT HARD STONE COURSE

TECHNICAL SPECIFICATION

Aggregate for Design Mix Concrete: Course aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard strong dense, durable clean and free from skin and coating likely to prevent proper adhesion of mortar.

The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the

Best, black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement.

The necessary tests indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability of the material.

If aggregate is covered with dust it shall be washed with water to make it clean.

BRICK BATS AGGREGATE

Brickbat aggregate shall be broken from well burnt or slightly over burnt and dense brick. It shall be homogeneous in texture roughly cubical in shape, clean and free from dirt of any other foreign material. The brickbats shall be of 40 mm to 50 mm size unless otherwise specified in the item. The under-burnt or over-burnt brick bats shall not be allowed.

The brickbats shall be measured by volume by suitable boxes or as directed.

BRICKS

Bricks shall be locally available first class bricks. Bricks shall be of size of (9" x 4 3/8" x 2

3/4") 225 x 110 x 75 mm unless otherwise specified. In all masonry works bricks of class designation 35 are to be used.

Only bricks of one standard size shall be used on one work. The following tolerances shall be permitted in the conventional size adopted in a particular work.

Length	1/8" (3.0 mm)	Width	1/16" (1.50 mm)	Height
1/16" (

The crushing strength of the bricks shall not be less than 35 kg/cm². The average water absorption shall not be more than 20 percent by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per I.S. 3495 (Part I to IV) 1976.

ALL STEEL MUST BE TMT BARS

TMT bars reinforcement for RCC work shall conform to I.S. 432 (part-II) 1966 and shall be of tested quality. It shall also comply with relevant part of I.S. 456-2000.

All the reinforcement shall be clean and free from dirt, paint, and grease, mill scale or loose or thick rust at the time of placing.

HIGH TENSILE STEEL WIRE

The high tensile wires for the use in pre-stressed concrete work shall conform to I.S.

TECHNICAL SPECIFICATION

2090-1962.

The tensile strength, of the high tensile steel bars shall be as specified in the item. In absence of the given strength, the minimum strength shall be taken as per Para 6.1 of I.S. 1985-1962. Testing shall be done as per I.S. requirements.

The high tensile steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through a pressure box containing carborundum.

The high tensile wire shall be obtained from manufactures in coil having diameter not less than 350 times the diameter of wire itself so that wire springs back straight on being uncoiled.

MILD STEEL BINDING WIRE

The mild steel wire shall be of 1.63 mm or 1.22 mm (16 or 18 gauges) diameter and shall conform to I.S. 280-1972.

The use of black wire will be permitted for binding reinforcement bars. It shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating that may prevent adhesion of cement mortar.

STRUCTURAL STEEL

All structural steel shall conform to I.S. 2062-1965. The steel shall be free from the defects mentioned in I.S. 226-1975 and shall have a smooth finish. The material shall be Rivet bars shall conform to I.S. 1148-1973.

When the Contractor supplies the steel, test certificates of the manufactures shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

SHUTTERING

The shuttering shall be either of wooden planking of 30 mm minimum thickness with or without steel lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical bellies properly cross-braced together so as to make the centering rigid. In place of bellie props, brick pillar of adequate section built in mud mortar may be used.

The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist force caused by vibration of live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout.

If at any stage of work during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid formwork. The complete formwork shall be got inspected by and got approved from the Engineer-in-charge, before the reinforcement bars are placed in position.

TECHNICAL SPECIFICATION

The props shall consist of bullies having 100 mm minimum diameter measures at max length and 80 mm at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm thick and minimum bearing area if 0-10 m² lay on sufficiently hard base.

Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.

The timber used in shuttering shall not be so dry as to absorb water from concrete and swell of bulge nor as green or wet as to shrink after creation. The timber shall be properly sawn and planed on the sides and surface coming in contact with concrete / wooden form work with metal sheet timing of steel plates stiffened by steel angles shall be permitted.

As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil of approved manufacturer may be applied in place of soap

Solution. In case of steel shuttering either soap solutions or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitted.

The shuttering for beams and slabs shall have camber of 4 mm per meter (1 in 250) or as directed by the Engineer-in-charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/750 of the projected length or as directed by the Engineer-in-charge.

NON ASBESTOS FIBRE FLAT SHUTTERS

Door Shutter's of Non Asbestos Fiber Flat Sheet conforming to IS 14862-2000 of 16mm thick compressed and heat resistance both faces finished smooth incl. 16 gauge thick galvanized steel plain sheet lipping shall be provided all round the shutter (total width of lipping (25+16+25)=66mm) incl. iron oxidized fixtures and fastenings and Handles, Aldrop, Stopper Tee Hinges, Door Stop etc. all as approved with oil painting in three coats incl. priming coat etc. comp. as per detailed drawings and directed by Engineer-in-charge or Consultant.

The thickness of the shutters shall be uniform throughout with a permissible variation of not more than 0.8mm when measured at any two points.

EARTH WORK

1. EXTENT AND INTENT

TECHNICAL SPECIFICATION

The work under this section covers all operations listed below concerning the civil work and the site development work.

- a. Clearing and grubbing b. Grading
- c. Excavation including removal of top soil d. Filling and back filling
- e. Removal and disposal of surplus material
- f. Bringing sweet earth from outside where required g. Hard stone soling to floors and paving

The Construction Manager / Developer shall provide all materials, labour, equipment, operations and incidental necessary and required for the completion of all aspects of work listed above as called for in the drawings and specifications.

2. GENERAL

The Developer shall visit the site, and decide for himself the nature of the ground and the subsoil to be excavated. No claim of extras will be entertained in consequence of any misunderstanding or incorrect information or ignorance of existing conditions.

3. ANTIQUITIES

Any ancient carvings, relics, coins or other curiosities discovered during the excavation or other work shall remain the property of the Owner and shall be handed over to the OOW.

4. EXCAVATED MATERIALS

Any sand, gravel or similar useful materials obtained from excavation site shall be the property of the Owner and shall not be disposed of or used in the construction of the works without prior written consent of the OOW. It is the intention of this contract that all benefits accruing from materials within the site shall pass to the Owner and the fair market value of any such material disposed of or used shall be alleged to the Owner by the Developer and the contract sum adjusted accordingly.

Borrow pits shall not be dug on the site without the prior written consent of the OOW.

5. CLEARING

The Developer shall clear the site of all rubbish and unwanted civil work. All disused foundation drains or other obstructions met with during excavation shall be dug out and cleared at Developer's own expense.

6. BENCHMARKS

The construction Manager / Developer shall erect sufficient permanent benchmarks in suitable locations for all the works before starting work, from which all the important levels shall be laid out. A qualified surveyor shall be engaged by the Developer to

TECHNICAL SPECIFICATION

locate all buildings, paths, roads, utility lines, etc. Developer shall provide all pegs, flags, pillars and labour required for setting out.

7. EXCAVATION

Excavation for foundations, footings, trenches, paving, walkways, etc., as called for on the drawings shall be generally made to net widths required by the drawings. "Battering" or "Benching" to the sides of excavation shall have prior approval of the OOW of Structural Designer. Extra excavations (i.e. excavations beyond the limits required by the drawings), "battering" and "benching" carried out without the prior approval of the OOW will not be measured, and such unauthorized excavations shall be filled up to the proper level with concrete of the same type and mix as for foundations or as ordered by the Architect or Structural Designer at Developer's own expense.

8. EXCAVATION IN ROCK

All rock excavation shall be carried out with the help of crowbars, chiseling or burning. Blasting shall not be carried out without the written permission of the OOW, roughly level or shelf bottom, as required and avoid shattering or removing rock beyond authorized lines and grades.

9. STACKING OF SOIL

Excavated materials shall be placed at a distance of more than 1.5 meters from the edge of the trench, or half the depth of the trench, whichever is more.

10. WATER IN EXCAVATION

All water, which may accumulate in excavation from all causes, is to be baled, pumped out or otherwise removed. Adequate pumping or other facilities shall be employed to keep all excavation clear of water constantly. Care shall be taken to see that the water is not discharged where it will cause damage to the work or other property or cause inconvenience in the legitimate use of the property. During excavation, the Construction Manager / Developer shall take particular care to avoid damage to drains, water mains, underground work

and services. Should any damage be done, the OOW and Structural Designer are to be notified immediately and the damage made good at the Developer's expense. Pipes, cables, etc. met with during the excavation are to be properly slung or otherwise supported.

11. NOTIFICATION TO ARCHITECT & STRUCTURAL DESIGNER

The Construction Manager / Developer shall notify the Architect and the Structural Designer when excavation is ready for inspection and no foundation shall be put in before they have approved the excavation. He shall give the Architect and the Structural Designer at least three working day's notice.

12. PROTECTION

TECHNICAL SPECIFICATION

The Construction Manager / Developer shall protect the excavation from the effect of harmful weather or other damage or make good such damages to the satisfaction of the Architect and Structural Designer.

13. DRESSING

Pit and trench bottoms shall be smoothed and tightly rammed to a uniform surface.

14. FILL MATERIAL

Fill materials required for fill and back fill shall be subject to the approval of the OOW and Structural Designer. Fill materials shall be hard and free from all soft or spongy material. Clods or rocks over 20 cm in greatest dimension shall not be placed within 30 cm of grade. No material over 8 cm in size shall be placed in the upper 15 cm of fill. Fill under floors, terraces and concrete beds shall be free of saltpeter, white ants etc.

15. FILL COMPACTION

The fill shall be spread in layers not exceeding 15 cm thick and each layer shall be watered and thoroughly consolidated with a ten (10) ton roller. At locations where rolling is not possible, the filling shall be carried out in layers not exceeding 15 cm thick and each layer rammed with heavy hammers till the required level is reached. The fill shall then be flooded with water for at least 24 hours, allowed to dry and then rammed and consolidated again. The finished surfaces shall be formed to correct lines, levels, slopes, shapes etc. as required. Fills at building structures, walk paths etc. shall not be executed until all foundations, footings etc. have been inspected and approved by the Architect & Structural Designer.

Return and fill in around foundations, walls etc. as described above and bring grades up to either original round levels or as required by the drawings when different from original grades.

16. FINISH GRADING

Finish grading shall be done with fertile topsoil over those area notes as 'planting' on the plans. Depths of topsoil shall be 15 cm minimum. The Architect and the Structural designer shall approve the topsoil before placement.

17. REMOVAL

Removal of excavated materials includes the separation of the useful from the useless portion (what is useful and what is useless is left to the sole discretion of the OOW) and depositing the former in regular heaps and removal of the latter. Surplus earth, if any and useless spoil shall be carted away from the site and disposed as directed at Developer's cost. Disposal shall be at authorized dumping grounds only.

18. PLANKING, STRUTTING AND SHORING

The Construction Manager / Developer shall be responsible to adopt such measures as may be needed to uphold the sides of excavation and protect excavation against

TECHNICAL SPECIFICATION

the sides of public utilities and services and other structures. The rates for excavation shall include use and waste of timber or steelwork, as planking and strutting including walls, struts and open or close poling boards as directed by the OOW or Structural Designer.

19. HARD-CORE

Hard-core (stone soling) under floors and other locations where called for, shall be approved hard broken stones 50 mm and down. The stones shall be hand packed in position, interstices between stones packed with smaller chips and the surface thoroughly, rolled with a 10-ton roller, with frequent watering. The surface shall then be blinded with murrum, watered thoroughly and consolidated with a 10-ton roller to required grade and profiles. Earth shall on no account to be used for making god or blinding purposes. Where rolling as described above is not possible, the consolidation shall be carried out using heavy hand rammers and light manually operated rollers. The consolidated thickness shall be as shown on the drawings.

FILLING (EARTH)

EARTH FILLING (BY EXCAVATED EARTH)

The work shall be taken up after the building has reached up to plinth stage or the floor level, as the case may be. The space between the walls shall be filled in with the approved earth (excavated earth) in layers of 150mm to 200mm (6" to 8") thick to required level, each layer watered and consolidated properly before putting next layer. No lumps, clods or rubbish are to be used in filling. After filling, the area to be flooded with water for a day to enable the filling to be thoroughly consolidated and allowed to get sufficiently dry after which ramming and leveling as directed by Engineer shall be done. Filling in basement over raft foundation will also come under this item.

EARTH FILLING (EARTH BROUGHT FROM OUTSIDE)

If the earth has to be bought from outside of the site, the rate includes the purchase cost of the earth, loading and unloading, its carting from outside to site, octroi, levy royalty or any other form of taxes as per prevailing rules, screening if necessary, spreading in

150mm to 200mm (6" to 8") layers and watering, ramming and consolidating with 10 ton roller, if it not possible then through electric compactors of adequate capacity. Each layer

prior to putting next layers as per the instruction of Engineer. The earth shall be got

provided prior to bring on site. The earth shall be free from trees roots, weeds, big stones, and other objectionable materials liable to decay.

CINDER FILLING

The work shall be carried out after the building is constructed up to plinth or the floor levels or at terrace or toilet sunk slab level as the case may be and the space required is filled up with cinder brought from outside to the required level and then it is properly watered and consolidated in the layers of 150 mm (6") wood ash, dirt and foreign matters. Cinder should be ground fine and screened through sieve of 9 meshes per Sq.Cm. (64 meshes per sq. in)

TECHNICAL SPECIFICATION

and residue in the sieve should be rejected. Cinder shall not contain more than 10% if un-burnt carbon (combustible matter).

CONCRETE WORK (PLAIN & REINFORCED)

1. EXTENT AND INTENT

The Developer shall provide all labour, materials, operations, equipment and incidentals necessary and required for the completion of all concrete work called for.

2. GENERAL

It is the intent of this specification to ensure that all concrete placed at various locations on the job should be durable and strong. It should wear well and be practically impervious to water. It should be free from such defects as shrinkage, cracking, honeycombing, all plain and reinforced concrete shall conform in all respects to Indian standard 456-2000.

3. MATERIALS

Cement: Ordinary / rapid hardening Ordinary Portland Cement of 43 Grade as per conforming to IS: 8112-1976 or Ordinary Portland Cement of 53 Grade conforming to IS:

12269-1976 shall be used. Cement shall have uniform color. Cement shall be fresh when delivered at site. Consignment shall be used in order or delivery. Admixtures (such as accelerators, retarders, waterproofing compounds, etc.,) shall be as far as possible

avoided, where its use is considered unavoidable it may be used only if approved by the

Architect and Structural Designer and subject to IS: 456-2000.

Water: Water used for mixing concrete shall be in accordance with clause 4/3 of IS: 456-

2000. The Construction Manager / Developer shall produce Test Results for the mixing of water used on the job, when requested by the OOW or Structural Designer.

Aggregates: Aggregates (fine and coarse) should be had and should not contain materials that are likely to decompose or change in volume when exposed to water or to affect the reinforcement. All aggregates shall be clean and free from organic impurities. The aggregates shall be free from coatings or dust and clay. Coarse aggregate shall be machine crushed hard stone and fine aggregate shall be coarse river pit sand, and both obtained from approved source. Aggregates shall be screened and washed by mechanically operated equipment, if the deleterious materials content exceeds 5 percent by volume. All aggregates used shall conform to IS: 383-1979. If the aggregates are wet, due allowance shall be made for bulking in accordance with IS: 2386-1963 (Part III)

Unless otherwise specified, the size of coarse aggregates shall conform to clause 4.2 of

IS: 456-2000.

TECHNICAL SPECIFICATION

All aggregates shall be suitably rated from the maximum certified gauge to the minimum. The construction Manager / Developer shall submit a sieve analysis of the aggregates to be used on the works and maintain a regular record of sieve analysis during the currency to the work. The grading of the aggregates will be determined from these sieve analyses to produce maximum density of concrete. All expenses of sieve analysis, mix design and trial mixes shall be borne by the developer.

4. STORAGE

Cement shall be stored in accordance with clause 5.1 of IS: 269V1967. Any cement, which has become wet, show any sign of caking, or deterioration, of contamination of any kind shall not be used, and shall be immediately removed from the site. Fine and coarse aggregates shall be stored in separate open bins scoring to sizes. The bins shall have brick wall of adequate thickness and floor paved with flat bricks.

5. BATCHING

In the case of ordinary concrete, aggregates shall be measured by volume, cement by weight (density of cement assumed to be 1.44 kg/liter. (A. 50-kg bag of cement contains

35 liters). Mixing water shall be measured in graduated liter cans.

6. MIX PROPORTIONS

All concrete not specifically designated as controlled concrete shall be treated as ordinary concrete of nominal mix as specified. Where nominal concrete mixes are described as

1:11 / 2:3, 1:2:4, 1:3:6, 1:4:8, etc., the figures denote the relative properties of cement,

dry sand and graded stone aggregate respectively. For example, concrete of nominal mix

1:2:4 shall mean a mix of 1 part cement, 2 part of washed dry coarse sand and 4 parts

crushed graded stone aggregate, the proportion being volumetric.

The cement shall be measured by weight, and aggregates shall be measured in properly constructed gauge boxes. If sand is wet, necessary allowance shall be made for bulking. The size of aggregates shall be 20 mm and down graded suitably to achieve dense concrete.

All aggregates and cement shall be measured by weights in approved high-batching equipment and water shall be measured in graduated, liter cans.

Grade of Concrete	Minimum Compressive Strength of Preliminary (Trial) Cubes	15 cm Cubes at 28 days Test Work Test Cubes
M 200	260 kg/cm ²	200 kg/cm ²
M 250	320 kg/cm ²	250 kg/cm ²
M 300	380 kg/cm ²	300 kg/cm ²
M 350	440 kg/cm ²	350 kg/cm ²

TECHNICAL SPECIFICATION

7. WATER-CEMENT RATIO

The water-cement ration shall be carefully controlled throughout the work. This calls for a regular check on the equipment used for measuring water. Only guaranteed liter-cans shall be used for this purpose.

In the case of 'ordinary' concrete, the maximum value of water-cement ration shall be

0.50 and in the case of 'controlled' the water-cement ration as determined by the mix

design shall be strictly adhered to. While determining the amount of mixing water, moisture content of aggregates shall be taken into account. Additional water if water, moisture content of aggregates shall be taken into account. Additional water if used to

improve to workability shall be accompanied by an equal volume of cement. In any case,

such additional use of water shall be subject to approval of the Architect and Structural

Designer.

8. MIXING

All concrete, whether plain or reinforced, ordinary or controlled, shall be mixed in a standard type box mixer, having minimum drum speed of 60 peripheral meters per minute. The cement and aggregates shall be first mixed dry until all articles of aggregate are coated with cement. Mixing water shall be added and mixing continued for at least two to twelve minutes to form concrete of a uniform color and consistency.

9. TRANSPORTATION

Concrete shall be placed in its final position within 20 minutes of mixing. The Construction Manager shall arrange his mixer position and a method of transportation to ensure that this period is not exceeded under any circumstance. Transportation should be smooth and free from jolting, so that there is no segregation or loss of any of the ingredients.

10. PLACING CONCRETE

The forms shall be well wetted before placing concrete. Concrete should not be dropped from a height greater than 1 meter. Properly constructed chute

shall be used in such cases where it is necessary to exceed this height. Concrete must be thoroughly worked into the forms so that they are entirely filled; reinforcing bars adequately and tightly surrounded and entrained air released from the mass of concrete. Placing shall be carried out by hand punning as well as vibrators in the manner directed

by Architect or Structural Designer. Concrete should not be moved any considerable distance in the moulds, being consolidated as nearly as possible in the place where it is dumped. The full depth of any lift shall be replaced at one pouring. In casting beams or other deep sections, concrete shall not be placed in layers.

TECHNICAL SPECIFICATION

11. CONSOLIDATION

All plain and reinforced concrete shall be consolidated by means of mechanical vibration. Adequate number of vibrators shall be used to ensure full compaction of concrete in about 10 minutes of placing. If immersion vibrators are used, these shall be inserted at places not exceeding half meter apart until it is immersed to the full depth of concrete. Wherever possible shutter vibrators shall be used and the construction Manager shall design his shuttering so that this can withstand form vibration. Care shall be taken to ensure that concrete is not over-vibrated to avoid segregation. In addition to mechanical vibration, sufficient hand tools must be used to ensure full consolidation around reinforcement and at all edges and corners.

12. TESTING

Testing of Cube: Specimens of the concrete used in the work shall be taken at intervals for crushing strength and density measurements. Test cubes shall be made and tested strictly in accordance with IS: 456-2000 and IS: 516-1964. Three to six cubes should be made for each sampling, subject to minimum requirements specified in Table V of IS 456-2000. However, cubes shall be taken for all important structural members as directed by the OOW of Structural Designer regardless of the quantity of concrete involved in such members of volume of concrete laid on any particular day. They should be taken out of the moulds 24 hours after casting and stored in a moist condition until the time of test. The Construction Manager shall carry out the tests as described above under the direction of Architect / Structural Designer and all expenses of cubes, testing and other incidentals shall be borne by the Developer.

All concrete the test results of which fall below the "Acceptance Criteria for Concrete" listed under table V of IS: 456-2000 shall be classified as substandard concrete. All such substandard concrete shall be removed and replaced with concrete of specified strength at the Developer's own cost and risk.

13. INSERTS

The Construction Manager shall fix all necessary inserts such as steel plates, pipe sleeves, bolts, etc., and make provision for holes, pockets, dowels, etc., in the shuttering of concrete work, to enable subsequent fixing of supports, brackets, ceilings, pre-cast members, etc., as indicated on the drawing or as required by the Architect of Structural Designer.

14. CURING OF CONCRETE

All exposed faces of concrete shall be covered with Hessian, sand or similar material, which shall be kept continuously, wet for a period of at least 15 days after casting. Horizontal surfaces shall be cured with the help of cement mortar bands filled with water. After removal of Hessian or sand all concrete surface shall be kept well wetted by applying water at intervals for a further period of at least three weeks.

15. REINFORCEMENT

Steel Reinforcement shall be either mild steel quality conforming to Grade I of IS: 432-

TECHNICAL SPECIFICATION

1966 or High yield Strength Deformed Bars with a guaranteed minimum yield strength of 4250 kg or 5000 kg per m² as called for on the drawings, conforming to IS: 1786-1966 or IS: 1139-1966. Fabric reinforcement where called for in topping slab or precise concrete units shall be of hard drawn mild steel mesh conforming to IS: 1566-1967. The make of the reinforcement will be from the Manufacturers listed herewith (1) Malhotra, (2) TATA, (3) Sirhind, (4) SAIL, (5) Vizag. Bars shall be free from mill scale, loose rust, oil or paint.

The reinforcement bar-ending schedule shall be prepared by the Construction Manager and submitted to the Structural Designer for his scrutiny and his concurrence obtained before commencing minimum cover as shown on structural drawings. Steel shall be rigidly held in place with the help of 18 gauge annealed steel wire. Cement mortar (1:2) cover blocks of required shape, MS chairs and spacers bars shall be used in order to ensure accurate positioning of reinforcement. All joints in mild steel reinforcement upto and including 16-mm diameter shall be overlapped. The lengths of overlap for tension and compression joints shall be as indicated on structural drawings. Joints in mild steel reinforcement above 16-mm diameter may be welded if permitted by the Architect or Structural Designer in writing.

16. COVER TO REINFORCEMENT

Care shall be taken to maintain the correct cover to reinforcement. Unless otherwise specified on the drawings, the following minimum cover (exclusive of rendering or other decorative finish) shall be provided in all reinforce concrete work.

- a. At each end of a reinforcing bar not less than 25 mm nor less than twice the diameter of bar.
- b. For longitudinal reinforcing bar in a beam neither less than 25 mm nor less than the diameter of bar.
- c. For longitudinal reinforcing bar in a column not less than 40 mm in the case of columns less than 250 mm thick, minimum cover shall be 25 mm.
- d. For tensile, compressive shear reinforcement in a slab not less than 13 mm nor less than the diameter of bar.
- e. For Vertical or horizontal reinforcement in concrete walls not less than 25 mm nor less than diameters of bar.
- f. For main or subsidiary reinforcement in concrete footings and pile caps not less than 50 mm.
- g. The minimum cover for any reinforcement steel including stirrups and ties wires shall not be less than 13 mm under any circumstances.

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For concrete members exposed to the atmospheric action or harmful chemicals (as in the case of concrete in contact with earth faces with such chemicals), acid vapor, saline atmosphere, sulfurous smoke, etc., covers given above shall be increased by 15 mm to

40 mm as directed by the Architect or Structural Designer. For concrete members of water retaining structures, covers for reinforcement shall be as stipulated in IS: 3370-(part II) - 1965.

17. FORMWORK

Formwork shall be rightly constructed of minimum 40 mm thick wrought, timber planking or steel plates or plywood. Timber used for shuttering shall be free from loose knots. Shuttering faces in contact with concrete shall be free from adhering grout, Projecting nails, splits or other defects that may mar the concrete surface. The shuttering shall be erected on battens, beams and steel props properly cross braced so as to make the form work rigid. Formwork shall be erected to line and levels and to the shapes required in the work and shall carry, without deformation, the full weight of wet concrete and other live loads. It should also withstand the effect of vibration without deflection, bulging, distortion or loosening of its component parts. The Construction Manager shall be responsible for sufficiency and adequacy of all formwork, centering and moulds.

Details of centering and formwork shall be subject to approval of the Architect or Structural Designer. The completed formwork shall also be subject to approval by the Architect or Structural Designer before placement of reinforcement. The formwork shall be designed so that the soffits of slabs and the sides of beams may be removed first leaving the formwork to the soffits of beams and their supports in position. W edges shall be, so provided as to allow accurate adjustment of form works and its easy removal.

All joints shall be sufficiently tight to prevent leakage of grout. Chamfer fillets shall be provided at all corners wherever called for on the drawings. Clean-out holes shall be provided at the bottom of all column and pier formwork and care shall be taken to remove any rubbish, wood shavings or any other foreign materials before concreting. Temporary supports shall be provided as required and / or ordered by Architect or Structural Designer.

Form work for water tanks, basements and other locations and facias, parapets and other similar vertical members shall be held tightly by means of firm ties of suitable length. The ties shall be approved design and type and have a minimum strength of 1500 kg. The ties shall be free of lugs, cones, washes, etc., which level a hole larger than 20 mm diameter or depressions back of exposed surface of concrete.

18. SPECIAL CONCRETE FORMWORK

Special Formwork for concrete work wherever called for shall be as per the detail design, made of hard wood timber planks, free from loose knots, of suitable thickness, and carved to the necessary shape. The planks shall be 40 mm thick, 100 mm to 125 mm wide with tongue and groove joints, assembled to pattern approved by the

Architect or Structural Designer. The formwork shall be so constructed, braced and stayed as to remain absolutely rigid and true during and after pouring. The boards shall

TECHNICAL SPECIFICATION

be planned of suitable thickness in order that the surface against the concrete shall not be broken at joints between boards, and the boards shall not deform. Chamfers grooves, drips, moldings, beveled edges, etc., shall be made in the form itself to the size, profiles and details called for on the drawings.

The Construction Manager shall provided shuttering quality plywood of approved make (Anchor shuttering plywood or equivalent approved by the Architect or Structural Designer) of suitable thickness in place of timer plank shuttering mentioned above for such locations as called for by the Architect / Structural Designer. The joints in the plywood shuttering shall be located as directed by the Architect / Structural Designer. The plywood shall be properly cut and adequately framed with timber to produce true surfaces and approved pattern.

19. SURFACE TREATMENT OF SHUTTERING

The Surface of shuttering exposed to concrete shall be coated with shuttering oil of approved manufacture. Shuttering oil shall be applied before placing reinforcement. The shuttering shall be thoroughly cleaned and oiled before each use.

20. REMOVAL OF FORMWORK

All form shall be kept in position until expiry of a minimum

Period after concreting as specified below:-

- | | | | | | | | |
|---|--------|-------------------------------------|--------|---------------------------------------|---------|-------------------------------------|---------|
| i. Forms supporting sides of beams, walls and columns | 2 days | ii. Bottom of slab up to 4.50m span | 7 days | iii. Bottom of slabs above 4.50m span | 14 days | iv. Bottom of beam up to 6.00m span | 21 days |
| v. Bottom of beam above 6.00m span | | | | | | | |

21. SURFACE FINISH OF CONCRETE

All formwork, centering and shuttering used for unexposed concrete work shall be rigid and straight, so as to produce all concrete members true to line level and plumb within a tolerance of + 3 mm. Only cement mortar rendering of maximum thickness 6 mm may be permitted as finishing to concrete surfaces except where terrazzo, ceramic tile or other finish are specified. All concrete surfaces scheduled to receive either plaster or similar finish shall be chipped as required if so directed by the Architect / Structural Designer. Shuttering, centering and formwork to be used for all exposed concrete work (like exposed columns, beams, ribs, slabs chhajjas, facias, etc.) shall be of such finish and rigidity as to produce all faces fair and smooth true to line, level and plumb. No. rendering or touching up shall be permitted on these faces.

22. DEFECTS IN CONCRETE

Immediately on removal of formwork, the Construction Manager shall examine the surface of concrete, and any honeycombs or other defects shall be brought to the notice of the Architect and Structural Designer. The acceptability or otherwise of such defective concrete shall be at the sole discretion of the OOW who may direct the Construction

TECHNICAL SPECIFICATION

Manager / Developer to repair the defective work or ask for demolition and replacement of such defective work at the risk, and cost of the Developer.

23. PROTECTION OF CONCRETE

All concrete shall be protected from damage by workers, equipment, overload or any other cause for a minimum period of 20 days from the date of casting.

All edges corners and projections of concrete members likely to be damaged shall be protected by means of wooden cover fillets.

24. ENGINEER

It is essential that the engineer who is in charge of the construction of all concrete work, whether plain or reinforced shall be well experienced in this class of work and shall work in relation to the permanent bench marks established at the site.

BRICK WORK

1. EXTENT AND INTENT

The Developer shall provide all labour, materials, operations, equipment and incidentals necessary and required for the completion of all brickwork called for.

2. GENERAL

Bricks and tiles shall be of selected quality, thoroughly burnt without being vitrified, of uniform deep red or copper color, regular in shape and size and shall have sharp and square sides and edges and parallel faces to ensure uniformity in the thickness of the courses of brickwork. They shall be free from cracks, chips, flaws, stones or lumps of any kind.

3. BRICKS

Bricks shall be locally available first class bricks. Bricks shall be of size 9" x 4 1/2" X 2 3/4" (22.9 cm x 11.1 cm x 7.0 cm) unless otherwise specified. In all masonry work bricks of class designation 35 are to be used.

4. SAMPLES

Samples of each type of brick and tiles taken at random from the load shall be deposited with the Architect / Structural Designer for his approval before being used in the work. All subsequent deliveries shall be up to the standard of the sample approved.

5. SOAKING OF BRICKS AND TILES

All bricks and tiles shall be thoroughly soaked before use, in specially prepared vats, tubs

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or tanks for not less than two hours and until air bubbles stop being given off. After soaking, bricks and tiles shall be kept on wooden planks or brick platforms to avoid earth

being smeared on them.

6. MORTAR

Mortar for all brickwork shall consist of cement and clean, sharp coarse sand.

7. CEMENT

Portland cement conforming to IS: 269-1967 shall be used, unless otherwise specified.

Cement shall be fresh when delivered at site.

8. SAND

Sand shall be clean, not too fine nor too coarse and shall fall within the grading zone I to IV given in table III of IS: 383-1963.

9. WATER

Water used for mixing mortar shall be in accordance with clause 4.3 of IS: 456-2000.

10. MIX PROPORTION

The mortar shall consist of one part cement and 6 parts sand for brickwork and tile work 240 mm thick and above. For brick piers, half brick walls and honey combed brickwork the mortar mix shall consist of one part cement and four parts sand.

11. MORTAR MIXING

Mixing of mortar shall be done in mechanical mixer. Hand mixing shall be resorted to only when specifically permitted by the Architect / Structural Designer. Cement and sand shall be mixed dry thoroughly and then water shall be added gradually. Wet mixing shall be continued till mortar of the consistency of a stiff paste and uniform color is obtained. Only the quantity of mortar which can be used up within 30 minutes of its mixing shall be prepared at a time.

12. LAYING BRICKWORK

All brickwork shall be built in English / Flemish bond. Each brick shall be set with bed and vertical joints filled thoroughly with mortar. Selected bricks shall be used for the face

work. The walls shall be taken up to truly plump. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. Vertical joints in alternate course shall come directly over the other. The thickness of brick courses shall be kept uniform and for this purpose wooden

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straight edge with graduation giving thickness of each brick course including joint shall be used. Necessary tools comprising of wooden straight edge, mason's spirit level, square, foot rule, plumb line and pins etc. shall be frequently and fully used by the masons to ensure that the walls are taken up true to plumb, line and levels. Both the faces of walls of thickness greater than 23 cm shall be kept in proper plane. All the connected brickwork shall be carried up nearly at one level and no portion of the work shall be raised more than one meter above the rest of the work. Any dislodged brick shall be removed and reset in fresh mortar. Before commencing the brickwork, the Construction Manager shall confer with other tradesmen / agencies to ensure that all pipes, conduit, drains, sleeves, bolts hanger, or any other materials necessary to be installed in the brickwork at the time it is built, have been fixed or provided for.

13. JOINTS

Bricks shall be so laid that all joints are full of mortar. The thickness of joints shall not be more than 10 mm. The face joints shall be raked to a minimum depth of 12 mm by a

raking tool during the progress of the work when the mortar is still green, so as to provide proper key for the plaster or pointing to be done. Where plastering or pointing is not to be done, the face of brickwork shall be cleaned duly and mortar droppings removed.

14. REINFORCED BRICKWORK

Brickwork under 11.5 cm thick shall be reinforced with 6mm M.S. Bar – 2 Nos. at every fourth course. 6mm M.S. Bar shall be embedded thoroughly in cement mortar at every fourth course. It shall be cast in or securely fixed to adjoining columns or walls.

15. CURING

All fresh brickwork shall be protected from the effects of sun, rain, etc., by suitable covering. All brickwork shall be kept constantly mist on all the face for at least ten days.

16. SCAFFOLDING

Unless otherwise instructed by the Architect / Structural Designer, double scaffolding having two sets of vertical supports shall be provided for all building work. The supports shall be sound, strong and tied together with horizontal pieces over which the scaffolding planks shall be fixed.

The Construction manager shall be responsible for providing and maintaining sufficiently strong scaffolding so as to withstand all loads likely to come upon it.

17. OPENINGS

Openings in brickwork for air-conditioning ducts, grills, pipes etc. shall be provided at the time of laying brickwork.

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18. CAULKING

After installation of piping, conduits, grilles etc. all openings left around pipes, conduits, grilles etc. shall be checked and caulked with cement mortar to render the whole work vermin proof and tidily finished.

19. TESTING

comprehensive strength, water absorption test and dimension test has to be carried out as per the relevant I.S. specifications for purchase of every one lakh bricks or part thereof, at the cost of Developer from the Government approved laboratory as directed by the Architect/Structural/Designer.

PLASTER WORK

1. EXTENT AND INTENT

The Developer shall furnish all materials, labour, scaffolding, equipment, tools, plant and incidentals necessary and required for the completion of all plaster and wall finishes. The Developer shall be responsible to take proper precautions to protect already installed work from damage.

2. GENERAL

Plaster as here in specified shall be applied to all internal and external surfaces where called for Glazed tile dado, terrazzo dado, and other wall finishes are to be provided where indicated on drawings and schedules. Areas called for on drawings and typical shall be considered to apply to appropriate, adjoining areas whether shown on same drawings or not and whether indicated or not. All plaster work and other wall finishes shall be executed by skilled workmen in a workman like manner and shall be of the best workmanship and in strict accordance with the dimensions on drawing.

3. PLASTER WORK

The primary requirements of the plaster work shall be to provide an absolutely water tight enclosure, dense, smooth and hard and devoid of cracks on the interior and exterior. The Developer shall do all that is necessary to ensure this result. All plastering shall be finished to true plane, without imperfections and square with adjoining work and shall form proper foundations for finishing materials such as paint etc.

Masonry and concrete surfaces to which plaster is to be applied shall be clean, free from efflorescence, damp and sufficiently rough and keyed to ensure proper bond.

Wherever directed all joints between concrete frames and masonry in filling shall be expressed by a groove cut in the plaster. Said groove to exactly coincide with the joint beneath.

TECHNICAL SPECIFICATION

Where grooves are not called for the joints between concrete members and masonry in filling shall be covered by 245 gauges galvanized chicken-mesh strips 40mm wide or as shown, installed before plastering.

4. CHASING

All chasing, installation of conduits, boxes etc. to be completed before any plastering or other wall finish is commenced on a surface. Chasing or cutting of plaster or other finish will not be permitted. Broken corners shall be cut back not less than 150mm on both sides and patched with Plaster of Paris or rich cement paste as directed. All corners shall be rounded to a radius of 8 mm or as directed by the Architect.

5. SAMPLES

Samples of each type of plaster and other wall finishes shall be prepared for approval of the Architect.

6. MATERIALS

Cement As specified under concrete work

Water As specified under concrete work.

Sand Washed fine sand and / or stone aggregate as called for sand and stone aggregate to conform to the requirements given under "concrete work"

7. PROPORTIONS

The materials used for plastering shall be proportioned by volume by means of gauge boxes.

8. PREPARATION OF SURFACE

The joints in all walls, both existing and freshly built shall be raked into a depth of 15mm brushed clean with wire brushes dusted and thoroughly washed before starting plaster work. Concrete surfaces shall be roughened by hacking over the entire surface shall be roughened by hacking over the entire surface as approved by the Architect to ensure proper key for the plaster.

9. MORTAR MIXING

Mortar shall be prepared as specified under "Brick Work" it shall be made in small quantities only as required and applied within 15 minutes of mixing

10. APPLIANCES

Plaster application shall be commenced only after the preparatory work is approved by the Architect. Correct thickness of plaster shall be obtained by laying plaster screeds gauges at intervals of 1.50 meters.

Mortar shall be firmly applied, well pressed into the joints, rubbed and finished as approved by the Architect to give a smooth and even surface.

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11. CURING

Finished plaster shall be kept wet for 10 day after completion. In hot weather walls exposed to sun shall be screened with matting kept wet or any other approved means.

12. WATER PROOF CEMENT PLASTER:

Specifications are same as stated above but the waterproof compound like OCNFLOW SNW2, JK WATER PROOF or any other approved quality shall be mixed with dry cement at the rate specified by the manufacturer.

NORMAL CEMENT PLASTER (IN ONE COAT)

This plaster is to be laid in one coat of 12mm thick in Cement Mortar 1:4, 1 Cement: 4 fine sand, on the surface prepared for plaster and following all the norms as stated above in PLASTER.

CEMENT PLASTER WITH NEERU + CEMENT FINISH

This kind of Plaster is normally for interior side or as specified location by Consultant to be applied as above 2. NORMAL CEMENT PLASTER and the surface shall be rubbed smooth after coating it with a thick coat of pure Portland cement slurry while the base coat is still fresh. If Neeru plus cement finish is specified floating with neat cement will not be required.

SAND FACE PLASTER (CEMENT PLASTER IN DOUBLE COAT)

This plaster is to be laid in double coat in 20mm thick in cement mortar.

Rough and fine sand plaster in single coat on shall be 12mm thick backing coat made by mixing one part of cement to three parts of clean fine sand for coat the ingredients shall be workable mix is obtained. And 8mm thick finishing coat at of cement mortar made by mixing one part of cement & two parts of clean fine sand. The plastered surfaces will be completed by means of sponges to obtain an even and granular surface all over. The entire plasterwork shall be done to perfect plumb. The sides of windows, openings such as jambs, and reveal sun breakers, drop paradis, fins, chhajjas and the like, around externally shall be finished as directed by the Consultant / Engineer- in-charge and shall be included in the rate of this item.

The plaster shall be thoroughly cured for 14 days as directed by Consultant / Engineer-in-charge. Any cracks which appear in the surface and all portions which sound hollow, when tapped or are found to be soft or otherwise defective, shall be cutout in rectangular shape and redone as directed by the Consultant / Engineer-in-charge.

2. WATER PROOF CEMENT PAINT

Water proof cement paint shall be of approved brand (like Snowcem etc.) and manufacture and of required shade, enlisted by the Consultant / Engineer-in-charge.

2.1 PREPARATION OF SURFACE :

TECHNICAL SPECIFICATION

For new work, the surface shall be thoroughly cleaned of all mortar dropping, dirt, grease and other foreign matter by rushing and washing. The surface shall be wetted by a sprinkling of water or water with fine spray. The surface shall be sprayed several times with a few minutes' intervals between each spraying to allow moisture to soak into the surface.

2.2 PREPARATION OF MIX :

Waterproof cement paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish. Waterproof cement paint shall be mixed with water in two stages. The first stage shall comprise of two parts of water stirred thoroughly and allowed to stand for five minutes, care shall be taken to add the water proof cement paint gradually to the water and not vice-versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and in uniform consistency. In all cases the manufacturer's instructions shall be followed meticulously.

The lids of cement paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly becomes air set due to its hygroscopic qualities.

2.3 APPLICATION :

The solution shall be applied on the clean and wetted surface with hairbrushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface, which is under shadow of the building so that the direct heat of the sun on the surface is avoided. The method of application of waterproof cement paint shall be similarity to oil bound distemper. The completed surface shall be watered after the days work. After the first coat of paints has hardened, it shall be wetted again before the application of second coat, at least 24 hours should elapse between the two coats. The watering should be done at least for seven days till the paint gets required strength. For new work, the

surface shall be treated with three or more coats of waterproof cement paint as found necessary to get a uniform shade.

ITEM WISE SPECIFICATION

Item-1 .1.2.3.4

(R.C.C Pipe Horizontal Cast) Providing and supplying ISI Standard R.C.C. pipes(of Sulphate Resisting Cement) in standard lengths of following class and diameter suitable for either collar joints or rubber ring joints including all taxes, insurance, transportation, freight charges, octroi, inspection charges, loading, unloading, conveyance to departmental stores, stacking etc. Note : One collar should be supplied with each full length plain ended RCC pipe, cost included in rates below. One rubber ring should be supplied with each full length socketed pipe, cost included in rates below. Class NP3 Test Pressure 0.7 Kg/sq.cm.

1.1 Scope

TECHNICAL SPECIFICATION

This specification covers the requirements for manufacturing, testing, supplying, jointing and testing at work sites of Reinforced Cement Concrete (RCC) pipes, of non pressure varieties, sewers and storm water drains. R.C.C. NP3 class pipes are to be used for sewer collecting system.

1.2 Applicable Codes

The manufacturing, testing, supplying, jointing and testing at work sites of RCC pipes shall comply with all currently applicable statutes, regulations, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the codes shall be referred to. If requirements of this specification conflict with the requirements of the codes and standards, this specification shall govern.

2.1 Materials

- (a) IS: 458 - Specification for concrete pipes (with and without reinforcement. – latest edition, 2003) (where mentioned it should be latest revised code.)
- (b) IS: 3597 - Method of tests for concrete pipes.
- (c) IS: 5382 - Specification for rubber sealing rings for gas mains, water mains & sewers.
- (d) IS: 516- Method of test for strength of concrete.

2.2 Codes of Practice

- (a) IS: 456 - Code of practice for plain and reinforced concrete.
- (b) IS: 783 - Code of practice for laying of concrete pipes.

3. Design

3.1 Design of RCC pipes shall be in accordance with the relevant clauses of IS 458.

3.2 The details of reinforcement shall be as per clause 5.2 of IS: 458-2003.

3.3 The ends of pipes shall be in accordance with relevant clauses of IS: 458.

4. Manufacturing

4.1 General

Pipe can be manufactured by spinning process or by vibrated casting process.

4.1.1 The method of manufacture shall be such that the form and the dimensions of the finished pipes are accurate within the limits specified in relevant clause of IS: 458. The surfaces and edges of the pipes shall be well defined and true, and their ends shall be square with the longitudinal axis. The ends of the pipes shall be further reinforced by an extra ring of reinforcement to avoid breakage during transportation.

4.1.2 The RCC pipes and rubber rings shall be systematically checked for any manufacturing defects by experienced supervisors so as to maintain a high standard of quality.

TECHNICAL SPECIFICATION

4.1.3 Owner representative / Engineer In-Charge shall at all reasonable times have free access to the places where the pipes and collars / rubber rings are manufactured for the purpose of examining and testing the pipes and collars / rubber rings and of witnessing the test and manufacturing.

4.1.4 All tests specified either in this specification or in the relevant Indian Standards shall be performed by Supplier / Contractor at his own cost and in presence of Owner representative / Engineer In-Charge if desired. For this, sufficient notice before testing of the pipes shall be given to Owner representative / Engineer In-Charge.

4.1.5 If the test is found unsatisfactory, Owner representative / Engineer In-Charge may reject any or all pipes of that lot. The decision of Owner representative/ Engineer In-Charge in this matter shall be final and binding on Contractor and not subject to any arbitration or appeal.

4.2 MATERIALS

4.2.1 Cement

Cement used for the manufacture of RCC pipes should be Sulfate Resisting Cement (SRC) only and shall confirm to relevant IS codes.

4.2.2 Aggregates

Aggregates used for the manufacture of RCC pipes shall conform to IS: 383. The maximum size of aggregate should not exceed one-third the thickness of the pipe or 20 mm, whichever is smaller.

4.2.3 Mixing and Curing Water

Water shall be clean, colorless and free from objectionable quantities of organic matter, alkali, acid, salts or other impurities that might reduce the strength, durability or other desirable qualities of concrete and mortar.

4.2.4 Reinforcement

Reinforcement used for the manufacture of the RCC pipes shall be mild steel Grade I or medium tensile steel bars conforming to IS: 432 (Part-I) or hard-drawn steel wire conforming to IS: 421 (Part-2). A reinforcement cage for pipes shall be as per relevant requirements of IS: 458.

4.2.5 Concrete

Concrete used for the manufacture of RCC pipes shall conform to IS: 456. The minimum cement content and minimum compressive strength of concrete shall be as per relevant requirements of IS: 458 (Latest Edition). Compressive strength tests shall be conducted on 15 cm cubes in accordance with the relevant requirements of IS: 456 and IS: 516.

4.2.6 Rubber Ring

Rubber ring chords used in pipe joints shall be EPDM rubber ring as per IS 5382: 1985.

4.3 Curing

4.3.1 Pipes manufactured in compliance with IS: 458 (Latest Edition) shall be either water cured or steam cured for minimum stipulated curing period in accordance with relevant requirements of the latest revised IS:458 (Latest Edition).

4.3. A Dimensions

4.3.A.1 The internal diameter, wall thickness and length of barrel and collar of pipes, reinforcement (longitudinal and spiral), type of ends and minimum clear cover

TECHNICAL SPECIFICATION

to reinforcement and strength test requirements shall be as per the relevant clauses / tables of IS:458 for different classes of pipes.

TECHNICAL SPECIFICATION

Table – 1
PHYSICAL TEST AND DIMENSIONAL REQUIREMENTS FOR STANDARD STRENGTH
BELL AND SPIGOT, PERFORATED NONREINFORCED
CONCRETE UNDERDRAINAGE PIPE
(clauses 4.1, 4.2, 4.3.1, 4.3.2 and fig 1 {IS: 7319 - 1974})

Internal Diameter, D mm	Minimum Thickness of Barrel, T mm	Minimum Laying Length, L m	Inside Diameter at Mouth of socket, D S mm	Depth of Socket, L S mm	Minimum Taper of Socket, H:L S	Minimum Thickness of Socket, TS	Rows of Perforation	Perforation per Row	Length of Slots mm	Spacing of Slots mm	Minimum Strength, kg/m, Three Edge Bearing Method	Maximum Absorption, %
1	2	3	4	5	6	7	8	9	10	11	12	13
80	25	1	130	40	1 : 20	$\frac{3}{4}$ T all sizes	4	9	25	50	-	8
100	25	1	150	40	1 : 20		4	9	25	75	1560	8
150	25	1	210	50	1 : 20		4	9	37.5	75	1560	8
200	25	1	275	57	1 : 20		4	9	50	100	1560	8
225	25	1	305	65	1 : 20		6	10	50	100	1670	8
250	25	1	330	65	1 : 20		6	10	50	100	1670	8
300	30	1	390	65	1 : 20		6	10	75	150	1790	8
350	32	1	475	65	1 : 20		6	10	75	150	1880	8
400	32	1	525	65	1 : 20		8	10	75	150	2020	8
450	35	1	565	70	1 : 20		8	10	75	150	2230	8

Note:

- Shorter lengths may be used for closures and specials.
- When pipes are furnished having an increase in thickness over that given in col 2, then the diameter at the inside of the socket shall be increased by an amount equal to twice the increase of the barrel.
- This measurement TS shall be taken 6 mm from the outer end of the socket.
For laying lengths greater than 1 m, the perforations per row shall be increased to Provide a spacing of approximately 75 mm.

Table – 2

TECHNICAL SPECIFICATION

Design and Strength Test Requirements of Concrete Pipes of Class NP3 Reinforced Concrete, Medium Duty, Non-Pressure Pipes

Internal Diameter of Pipes in mm	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Draws Steel	Load to Produce 0.25 mm Crack kN/linear meter	Ultimate Load
		Minimum number	Kg/linear meter	Kg/linear meter		kN/linear meter
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	40	8	0.78	1.80	15.50	23.25
400	75	8	0.78	3.30	19.16	28.74
600	85	8 or 6+6	1.18	7.01	28.74	43.11
800	95	8 or 6+6	2.66	13.04	38.32	57.48
900	100	6 + 6	2.66	18.30	43.11	64.67
1000	115	6 + 6	2.66	21.52	47.90	71.85
1200	120	8 + 8	3.55	33.57	57.48	86.22
1400	135	8 + 8	3.55	46.21	67.06	100.60
1600	140	8 + 8	3.55	65.40	76.64	114.96
1800	150	12 + 12	9.36	87.10	86.22	129.33
2000	170	12 + 12	9.36	97.90	95.80	143.70
2200	185	12 + 12	9.36	133.30	105.38	158.07

Note:

1. If mild steel is used for spiral reinforcement, the weight specified under col.5 shall be increased to 140/125.
2. The longitudinal reinforcement given in this table is valid for pipes up to 2.5 m. effective length for internal diameter of pipe up to 250 mm and up to 3 m. effective length for higher diameter pipes.
3. Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col.4 by the length of the pipe and then deducting for the cover length provided at the two ends.
4. Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days

Table – 3

Design and Strength Test Requirements of Concrete Pipes of Class NP3 Reinforced Concrete, Medium Duty, Non-Pressure Pipes Made by Vibrated Casting Process

TECHNICAL SPECIFICATION

Internal Diameter of Pipes in mm	Minimum Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Draws Steel	Load to Produce 0.25 mm Crack kN/linear meter	Ultimate Load kN/linear meter
		Minimum number	Kg/linear meter	Kg/linear meter		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	50	8	0.78	1.53	15.5	23.25
400	60	8	0.78	1.6	19.16	28.74
600	75	8 or 6 +6	1.18	2.2	28.74	43.11
800	95	8 or 6 +6	2.66	6.87	38.32	57.48
900	100	6 + 6	2.66	11.55	43.11	64.67
1000	115	6 + 6	2.66	15.7	47.9	71.85
1200	125	8 + 8	3.55	21.25	57.48	86.22
1400	140	8 + 8	3.55	30	67.06	100.6
1600	165	8 + 8	3.55	50.63	76.64	114.96
1800	180	12 + 12	9.36	64.19	86.22	129.33
2000	190	12 + 12	9.36	83.12	95.8	143.7
2200	210	12 + 12	9.36	105.53	105.4	158.07

Note: Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days

The tolerances regarding overall length, internal diameter of pipes or socket and barrel wall thickness shall be as per relevant clauses of IS: 458.

4.4 Workmanship and Finish

4.4.1 Pipes shall be straight and free from cracks except that craze cracks may be permitted. The ends of the pipes shall be square with their longitudinal axis so that when placed in a straight line in the trench no opening between ends in contact shall exceed 3 mm in pipes up to 600 mm diameter (inclusive), and 6 mm in pipes larger than 600 mm diameter.

4.4.2 The outside and inside surfaces of the pipes shall be smooth, dense and hard, and shall not be coated with cement wash or other preparation unless otherwise agreed to between Owner representative / Engineer In-Charge and the manufacturer or supplier.

4.4.3 The pipes shall be free from defects resulting from imperfect grading of the aggregate, mixing or molding.

4.4.4 The pipes shall be free from local dents or bulges greater than 3 mm in depth and extending over a length in any direction greater than twice the thickness of barrel.

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- 4.4.5** The deviation from straight in any pipes throughout its effective length, tested by means of a rigid straight edge parallel to the longitudinal axis of the pipe shall not exceed, for all diameter 3 mm for every meter run.

4.5 Testing

All pipes for testing purposes shall be selected at random from the stock of the manufacturer and shall be such as would not otherwise be rejected under the criteria of tolerances as mentioned in IS: 458.(Latest Edition)

During manufacture, tests on concrete shall be carried out as per IS: 456. The manufacturer shall supply, when required to do so by Owner representative /Engineer the results of compressive tests of concrete cubes and split tensile tests of concrete cylinders made from the concrete used for the pipes. The manufacturer shall supply cylinders or cubes for test purposes required by the Owner representative/Engineer and such cylinders or cubes shall withstand the tests prescribed by the manufacturer for the hydrostatic test pressure. For non-pressure pipes, 2 percent of the pipes shall be tested for hydrostatic test pressure.

The specimen of pipes for the following tests shall be selected in accordance with relevant clause of IS: 458(Latest Edition) and tests in accordance with the methods described in IS: 3597.

- i) Hydrostatic test
- ii) Three edge bearing test
- iii) Absorption test.

Note: Three edge bearing strength to produce 0.25 mm crack in case of special design of pipes shall be as per IS:458:2003.

For Inspection at manufacturing site 24 hrs. access shall be provided to Client's Engineers as well as engineer appointed by PMC/TPI agency. Apart from this Client will establish its own pipe testing facility where pipes will be randomly tested. The cost of transporting the pipe to the testing facility & testing charges shall be borne by the contractor

4.6 Sampling and Inspection

- 4.6.1** In any consignment, all the pipes of it class and size and manufactured under similar conditions of production shall be grouped together to constitute a lot. The conformity of a lot to the requirements of this specification shall be ascertained on the basis of tests on pipes selected from it.

- 4.6.2** The number of pipes to be selected from the lot for testing shall be in accordance with column 1 and 2 of Table 22 of IS: 458-2003.(Latest Edition)

- 4.6.3** Pipes shall be selected at random. In order to ensure randomness, all the pipes in the lot may be arranged in a serial order and starting from any pipe, every 'n' th pipe be selected till the requisite number is obtained 'n' being the integral part of N/n where N is the lot size and 'n' is the sample size.

- 4.6.4** All the pipes selected, as per clause IS: 458 shall be inspected for dimensional requirements, finish and deviation from straight. A pipe failing to satisfy one or more of these requirements shall be considered as defective.

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- 4.6.5** The number of pipes to be tested for tests under clause IS: 458 shall be in accordance with column 4 of Table 15 of IS: 458 (Latest Edition). These pipes shall be selected from pipes that have satisfied the requirements mentioned in clause above.
- 4.6.6** A lot shall be considered as conforming to the requirements of IS 458 (Latest Edition) of the following conditions are satisfied.
- (a) The number of defective pipes (those not satisfying one or more of the requirements for dimensions, finish and deviation from straight) shall not be more than the permissible number given in column 3 of Table 15 of IS: 458 (Latest Edition).
 - (b) All the pipes tested for various tests as per IS: 458 (Latest Edition) shall satisfy corresponding requirements of the tests. The Contractor shall inform the Engineer-in-Charge about the lot of pipes to be brought at site. The pipe brought as specified in IS code 458 (Latest Edition). From the lot brought on site any one pipe at random will be selected and will be broken and quality of concrete and quantity of steel (reinforcement) will be checked. If any deviation i.e. poor quality of concrete or less steel is found, the whole lot of pipes will be rejected and the Contractor shall remove the same from the site. No payment shall be made for pipe, which is broken for checking and clearing, rejected lot of pipes from the site.
 - (c) In case the number of pipes not satisfying requirements of any one or more tests, one or two further sample of same size shall be selected and tested for the test or tests in which failure has occurred. All these pipes shall satisfy the corresponding requirements of the test.
- 4.6.7.** Arrangement for inspection, testing & acceptance of pipes, collars/rubber ring at factory will be made by owner. Pipes & collars conforming to I.S. specification and accepted by owner / consultant only shall be transported to site of work.

4.7

Marking

The following information shall be clearly marked on each pipe:

- (a) Internal diameter of pipe.
 - (b) Class of pipe.
 - (c) Date of manufacture, and
 - (d) Name of manufacturer or his registered trademark or both.
 - (e) Name of scheme: Patan U/G Drainage Scheme.
- All pipes and fittings shall be manufactured as per ISI Code.

Spigot and Socket Joint (Semi-Flexible)

This joint is composed of specially shaped spigot and socket ends on the RCC pipes. A rubber ring as specified in Data Sheet - A, shall be lubricated and then placed on the spigot, which is forced into the socket of the pipe previously laid. This compresses the rubber ring as it rolls into the annular space formed between the two surfaces of the spigot and socket, stiff mixture of cement and mortar as specified in Data Sheet - A, shall then be filled into the remaining annular space and rammed with a caulking tool.

Materials:

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The required quantity of pipes and specials and fittings, both confirming to the relevant IS and suitable for rubber joints shall be brought by the agency.

The jointing materials i.e. EPDM rubber gasket (ring joints or tyton joints) shall confirm to IS 5382-1969 or its latest revision.

Lying:

Before lowering the pipe the trench section shall be got approved from the Engineer in charge. The contractor shall have to provide and maintain sight rails and bonding rods whenever required till the completion of work. The pipe shall be laid in reasonably dry condition and under no circumstances they shall rest on slushy bedding.

The pipes shall be lowered by means of chain pulley block and tripod stand or with the help of ropes and suitable size of wooden bullies slowly into the trench. They shall be brought to the required level by giving packing with wooden sleeper pieces and ultimately with well consolidated hard murrum must be got approved by the Engineer –in-charge. Under no circumstances pipe shall be allowed to be thrown in to the trenches.

The rubber gasket shall be inserted into the socket in the groove. The spigot end shall be lubricated with good quality of grease. Then the spigot and with gasket shall be supplied in to the socket by means of jack on the other end. The lubricating grease shall be got approved by Engineer in charge by the contractor. The socket ends of all pipes shall face up hill irrespective of the direction of water flow.

LAYING & JOINTING

The availability of space on sewer alignment are limited & the tendered will have to arrange open space for storage of pipes and materials, T & P, labor establishment by himself. The employee may assist by giving letters but no responsibility will be taken by employer.

Reasonable care shall be exercised in loading, transporting and unloading concrete pipes. Handling shall be such as to avoid impact. Gradual unloading by inclined planks or by chain pulley block is recommended.

Jointing of RCC pipes shall be done with SRC cement only and as per the requirements of following specifications and as per the relevant IS. The type of joints shall be as per 'Data Sheet - A'. After jointing extraneous material if any, shall be removed from the inside of the pipe and newly made joints shall be thoroughly cured. In case, rubber sealing rings are used for jointing, these shall conform to IS 5382.

1. Collar Joint (Semi-Flexible)

This joint is made up of a loose collar, which covers two specially shaped pipe ends. Each end shall be fitted with a rubber ring as specified as per relevant IS code, which when compressed between the spigot and collar, seal the joints. Stiff mixture of cement mortar as specified in Data Sheet - A, shall then be filled into the remaining annular space and rammed with a caulking tool.

2. Spigot and Socket Joint (Flexible)

The RCC pipe with the rubber ring accurately positioned on the spigot shall be pushed well home into the socket of the previously laid pipe by

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means of uniformly applied pressure with the aid of a jack or similar appliance. The RCC pipes shall be of spigot and socket type and rubber rings as specified in IS-458-2003, shall be used, and the manufacturer's instructions shall be deemed to form a part of these specifications. The rubber rings shall be lubricated before making the joint and the lubricant shall be soft soap water or an approved lubricant supplied by the manufacturer.

Socket & Spigot NP3 pipe with rubber ring roll on joint for diameter up to 900 mm should be provided as per table 14 of IS 458: 2003. (Latest Edition)

Socket & spigot NP3 pipe with rubber ring confined joint for diameter 1000 mm to 2200 mm should be provided as per Table -17 of IS 458:2003.(Latest Edition)

3. Flush Joint (Internal)

This joint shall be generally used for culvert pipe of 900mm diameter and over. The ends of the pipes are specially shaped to form a self centering joint with an internal jointing spaces 13-mm wide. The finished joint is flush, with both inside and outside with the pipe wall. The jointing space is filled with cement mortar in the proportion as specified in Data Sheet - A, mixed sufficiently dry to remain in position when forced with a trowel or rammer.

4. Flush Joint (External)

This joint is suitable for pipes which are too small for jointing from inside. This joint is composed of specially shaped pipe ends. Each end shall be butted against each other and adjusted in correct position. The jointing space shall then be filled with cement mortar as specified in Data Sheet - A, sufficiently dry and finished off flush. Great care shall be taken to ensure that the projecting ends are not damaged as no repairs can be readily affected from inside the pipe.

5. Cleaning Of Pipes

As soon as a stretch of RCC pipes has been laid complete from manhole to manhole or for a stretch as directed by Owner / Engineer In-Charge, contractor shall run through the pipes both backwards and forwards a double disc or solid or closed cylinder 75 mm less in diameter than the internal diameter of pipes. The open end of an incomplete stretch of pipeline shall be securely closed as may be directed by Owner / Engineer In-Charge to prevent entry of mud or slit etc.

If as a result of the removal of any obstruction Owner / Engineer In-Charge considers that damages may have been caused to the pipelines, he shall be entitled to order the stretch to be tested immediately. If during such test prove unsatisfactory contractor shall amend the work and carry out such further tests as area required by Owner / Engineer In-Charge.

It shall also be ascertained by Contractor that each stretch from manhole to manhole or the stretch as directed by Engineer In-Charge is absolutely clear and without any obstruction by means of visual examination of the interior of the pipe line suitably enlightened by projected sunlight or otherwise.

6. Testing At Work Site

After laying and jointing of RCC pipes is completed the pipe line shall be tested at work site as per the following specifications and as directed by Owner / Engineer In-Charge. All equipment for testing at work site shall be

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supplied and erected by contractor and shall be rectified by him to the full satisfaction of Owner / Engineer In-Charge.

The water required for the flow test shall have to be arranged by the contractor at his own cost. The entire section of the pipe line laid by the contractor shall be tested by flow test from manhole to manhole or as directed by Engineer in charge. Any earth, mud, rubbish, dummy walls etc., in the pipeline or manhole be removed and whole pipeline shall be cleaned before testing is given. In side vata etc., be rectified and completed with all respect before given hydraulic test. The water shall be poured in first manhole and it should run smoothly from manhole to manhole upto last manhole without any pounding. There shall not be accumulation of water inside the pipeline. If it accumulates in certain stretch, the laid pipeline shall have to be removed and shall be laid again in gradient as specified. If this being not attended the payment for the same stretch of pipeline shall not be paid and shall be recovered in the final bill. Necessary certificate for cleaning of pipeline in all respects shall be given in writing before hydraulic flow test is given on site by the contractor. Water used for test shall be removed from pipes and should not be released to the excavated trench.

After the joints have thoroughly set and have been checked by Owner/ Engineer and before backfilling the trenches, the entire section of the sewer drain shall be tested for water tightness by filling in pipes with water to the level of 1.50 m above the top of the highest pipe in the stretch and heading the water up for the period of one hour. The apparatus used for the purpose of testing shall be approved by Owner/Engineer. The water required for one time hydraulic testing of pipe section will be supplied by municipality at free of cost. Transportation of water to site of work is to be arranged by agency at his own cost. Contractor if required by Owner/Engineer shall dewater the excavated pit and keep it dry during the period of testing. The loss of water over a period of 30 minutes should be measured by adding water from a measuring vessel at regular 10 minutes intervals and noting the quantity required to maintain the original water level. For the approval of this test the average quantity added should not exceed 1 litre/hour/100 linear meters/10 mm of nominal internal diameter. Any leakage including excessive sweating which causes a drop in the test water level will be visible and the defective part of the work should be removed and made good without extra cost.

Measurement

All RCC pipes shall be measured accordingly to the work actually done and no allowance will be made for any waste in cutting to the exact length required. The measurement for pipes shall be in running meters nearest to a cm. of length along the centre line of pipe as actually laid at work sites.

The rate for providing, laying and jointing of RCC pipes shall be deemed to include the cost of rubber rings, jointing material, testing and the extra excavation required for ordinary bedding of pipes and also for collars and pipe sockets if any.

Notes:

- 1 *If any damage is caused to the pipeline during the execution of work or while cleaning / testing the pipeline as specified, contractor shall be held responsible for the same and shall replace the damaged pipeline and retest the same at his own cost to the full satisfaction of Owner / Engineer In-Charge.*

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2. After for testing of pipeline shall be arranged by contractor at his own cost.
3. Pipes shall be brought on site proportionate to the required progress for thirty (30) days only.

DATA SHEET - A

Sr. No.	Item	Specification
1.	Monsoon period.	First week of June to 30 th September each year.
2.	Width of the trench from invert level of pipe upto the top (Bt) and cross-section of trench.	As per Drawing
3.	Three edge bearing strength to produce 0.25 mm crack for, NP3 & NP4 class pipes.	As per latest IS Code
4.	Type of joints	Rubber ring joint
5.	Proportion of cement mortar for use in jointing of pipes. Cement should be SRC only.	1cement:1 sand
6.	Hydraulic test pressure at factory.	0.7 kg/cm ²
7.	Site test pressure	0.15 kg/cm ²

Payment: -

The measurement of pipe line is in running meter. Payment will be made on lowering and laying of pipes as per payment schedule after satisfactory hydraulic/ flow test.

Item-2

Providing and supplying D. I. K-7 grade pipes for following nominal bore diameter with internal cement mortar lining including all taxes, insurance, transportation, freight charges, octroi, inspection charges, loading, unloading, conveyance to departmental stores, stacking etc. complete. (IS 8329-2000). Rate for DI pipe based on Wholesale Price index of Pig Iron as 157.60 for the month of Dec-2022. For sewerage project cement mortar lining shall be with sulphate resistance cement

Note: Wherever International Standards or Indian standards / specifications are mentioned, their equivalent or higher standards / specifications are also acceptable

Supply and Delivery of **Ductile Iron Pipe as per IS:8329-2000** or its latest revision or amendments if any including jointing material as EPDM ring as per IS 5382-1985 and ISO: 4633-1996 or its latest revision or amendments if any

Standards

The following standards, specifications and codes are part of this specification. In all cases, the latest revision of the including all applicable official amendments and revisions shall be

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referred to. In case of discrepancy between this specification and those referred to herein, this specification shall govern.

- 1) ISO: 10803-1997 Design method for ductile iron pipes
- 2) IS:8329-2000 Centrifugally Cast (spun) ductile iron pressure pipes for water, gas and sewage
- 3) ISO:2531-1991 Ductile iron pipes, fittings and accessories for pressure pipelines.
- 4) ISO:4179-1985 Ductile iron pipes for pressure and non pressure-Centrifugal cement mortar lining – General requirements.
- 5) IS:8112 Specification for 43 Grade ordinary Portland cement.
- 6) BS:3416 Bitumen based coatings for cold application, suitable for use in contact with potable water.
- 7) ISO:8179-1995 Ductile iron pipes-External coating-Part-1 Metallic Zinc with finishing layer.
- 8) IS:638 Sheet rubber jointing and rubber insertion jointing.
- 9) ISO:4633-1996 Rubber seals-Joint rings.
- 10) IS:5382-1985 Specification for Rubber sealing rings for gas mains, water mains and sewers.
- 11) AWWA C600 Installation of ductile iron water mains and their appurtenances.

1.0 Internal Diameter:

The nominal values of the internal diameters of pipe, expressed in millimeters are approximately equal to the number indicating their nominal sizes DN.

2.0 Length:

The working length of socket and spigot pipes shall be 5 m ,5.5 m, or 6 metres.

3.0 Thickness:

The wall thickness of pipe 'e' in mm shall be calculated as a function of the nominal diameter by the following equation with minimum of 5 mm

$$e = K(0.5 + 0.001 \text{ DN})$$

where : e = wall thickness in mm, DN = the nominal diameter, K = the whole number coefficient

4.0 EPDM Rubber Gasket:

Rubber Gasket shall be suitably for Push-on-Joint.

The spigot ends shall be suitably chamfered or rounded off to facilitate smooth entry of pipe in the socket fitted with the rubber gasket

Rubber Gasket shall confirm to IS 5382-1985 and ISO : 4633-1996 its latest revision or amendments if any

5.0 Sampling Criteria:

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Sampling criteria for various tests, unless specified in IS 8329-2000, shall be as laid down in IS 11606. Mechanical test, Brinell Hardness test, Hydrostatic test etc are shall be as per IS 8329-2000

6.0 Tolerances on External Diameter:

The nominal external diameter (DE) of the spigot end of socket and spigot pipes and when measured circumferentially using a diameter tape shall confirm to the requirements specified as follow. The positive tolerance is +1 mm and applies to all thickness classes of pipes. The maximum negative tolerance of the external diameter are specified as follow:

DN	Nominal	Positive Tolerance	Negative Tolerance
80	98	+1	-2.2
100	118	+1	-2.8
125	144	+1	-2.8
150	170	+1	-2.9
200	222	+1	-3.0
250	274	+1	-3.1
300	326	+1	-3.3
350	378	+1	-3.4
400	429	+1	-3.5
450	480	+1	-3.6
500	532	+1	-3.8
600	635	+1	-4.0

7.0 Tolerance on Ovality:

Pipes shall be as far as possible circular internally and externally. The tolerance for out-of-roundness of the socket and spigot ends is given below:

Nominal Diameter in mm	Allowable Difference Between Minor Axis and DE in mm
80 to 300	1.0
350 to 600	1.75
700	2.0
750 to 800	2.4
900 to 1000	3.5

8.0 Tolerance in thickness

The tolerance on wall thickness (e) and the flange thickness (b) of the pipes shall be as below:

Dimensions	Tolerance in mm
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Wall thickness (e)	- (1.3 + 0.001 DN) ¹⁾
Flange thickness (b)	+ (2+0.05b) & - (2+0.05b)

9.0 Coating

Pipe shall be delivered internally and externally coated.

External Coating: Pipe shall be metallic zinc coated and after that it shall be given a finishing layer of bituminous paint as per IS - 8329-2000

Zinc coating shall comply with IS:8329/EN 545/ ISO 8179. Only molten zinc spray coating shall be acceptable. The average mass of sprayed metal shall not be less than 130 g/sqm with a local minimum of 110 g/sqm.

Bitumen overcoat shall be of normal thickness of 70 microns unless otherwise specified. It shall be a cold applied compound complying with the requirements of BS 3416 Type II suitable for tropical climates factory applied preferably through an automatic process.

Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

Internal lining: Internally pipe shall be Portland Cement mortar lined (as per IS - 8329-2000). The mortar shall contain by mass at least one part of cement to 3.5 part of sand.

All pipes and fittings shall be internally lined with cement mortar using high speed centrifugal process in accordance with IWO 4179/IS 8329. Cement mortar lining shall be applied at the pipe manufacturing shop in conformity with the aforesaid standards. No admixtures in the mortar shall be used without the approval of the Engineer. The sand to cement proportion of sand if justified by the sieve analysis.

Pipe lining shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be as per IS: 8329 Annex-B or ISO 4179. This is given below.

Nominal Pipe Size (mm)	Nominal lining thickness (mm)
Up to 300	3
350-600	5
700-1200	6
1400-2000	9

10.0 Joint

Jointing of DI pipes and fittings shall be push-on type

Push-on-joints

TECHNICAL SPECIFICATION

The Contractor shall source the push-on-joint gaskets only from the pipe manufactures. In turn the pipe manufacturer shall supply at least 10% additional quantity of gaskets over and above the requirement to the Contractor at no extra cost.

The gasket used for joints shall be suitable for natural and purified water conveyance. In joining DI pipes and fittings, the Contractor shall take into account the manufacturer's recommendations as to the methods and equipments to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that once the rubber ring is correctly positioned before the joint is made, does not get damaged by friction or sharp edges of the spigot Chamfer. The rubber rings and the recommend lubricant shall be obtained only through the pipe manufacturer.

Rubber ring bundles form every lot shall carry with them manufacturers test certificate for the following mechanical properties.

1. Hardness
2. Tensile strength
3. Compression set
4. Accelerated aging test
5. Water absorption test
6. Stress relaxation test

Rubber rings shall be clearly labeled in bundles to indicate the type of ring, the type of joint, the size of the pipe with which they are to be used, the manufacturer's name and trade mark, the month and year of manufacture and the shelf life.

11.0 Testing of Pipe:

The main test among others to be conducted shall be as per IS:8329-2000 or with its latest revision/amendments.

[a] Mechanical Tests

Mechanical tests shall be carried out during manufacture of pipes as specified in the Standards. The frequency and sampling of tests for each batch of pipes shall be in accordance with IS 11606-1986. The test results so obtained for all the pipes and fittings of different sizes shall be submitted to Engineer. The method for tensile tests and the minimum tensile strength requirement for pipes and fittings shall be as per IS:8329/EN 545 for pipes and IS:9523/EN 545 for fittings.

[b] Brinell Hardness Test

For checking the Brinell hardness the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS:1500. The test shall comply with the requirements specified in IS:1500/ISO 6506.

[c] Re-tests

If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the test results

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satisfy the specified requirements the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

[d] For hydrostatic test at works, the pipes and fittings shall be kept under test pressure as specified in the standard for a period of minimum 15 seconds during which the pipes shall be struck moderately with a 700 g hammer for conformation of satisfactory sound. They shall withstand the pressure test without showing any leakage, sweating or other defect of any kind. The hydrostatic test shall be conducted before surface coating and lining.

12.0 Quality Assurance

The manufacturer shall have a laid down Quality Assurance Plan for the manufacture of the products offered which shall be submitted along with the tenders.

13.0 The rates includes providing DI specials suitable to DI K-7 pipes in all categories as per requirement.

Mode of Payment : As per schedule B.

Item-3

MS Pipe:- Manufacture, Supply & Delivery of Electric Resistance Welded (Up to 400mm)/Submerged Arc Welded(Above 400mm) M.S.Pipe having beveled ends plate or coil conforming to IS-3589-2001 or its latest revision/ ammendment for following thickness outside diameter at GWSSB store or site anywhere in Gujarat State including all taxes, insurance, transportation, freight charges, octroi, inspection charges, loading, unloading conveyance to Departmental stores, stacking etc. all complete. (Rate for MS Pipe based on the ex. works price of HR Coil as Rs.58500 per MT - withouth GST (Above 3.15 mm to 10 mm) & Rs. 59000.00 per MT without GST (Above 10 mm) as onJan-23.(WPI Index of H. R Coil of Dec-22 is 144)

This specification covers the general requirements for supply, fabrication, delivery at stores of welded M.S. pipes including loading, unloading, carting and stacking etc. complete.

The pipes manufactured with Submerged Arc Welding both longitudinal and spirally welded will be acceptable provided welding is done by automatic welding machines.

APPLICABLE CODES & SPECIFICATIONS

The following specifications, standards and codes are made a part of the specification. All standards, tentative specifications, specifications, codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern.

1. IS : 2062 Steel for general structural purposes.
2. IS : 808 Dimensions for hot rolled steel beam, column, channel and angle sections.
3. IS : 814 Covered Electrodes for manual Metal Arc Welding of carbon and C-Mn steel.
4. BS EN 499 Welding Consumables. Covered Electrodes for Manual Metal Arc Welding of Non Alloy and Fine Grain Steel. Classification
5. AWS : A-5.1 Specification for Mild Steel Covered Arc Welding Electrodes.
6. IS : 3613 Acceptance Tests for Wire Flux combinations for Submerged - Arc Welding.

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7. AWS : A-5.17 Specification for Bare Mild Steel Electrodes and Fluxes for Submerged Arc Welding. IS : 1367 - Technical Supply Conditions for Threaded Fasteners
8. IS : 1367 Technical Supply Conditions for Threaded Fasteners (Parts 1 to 3).
9. IS : 2016 Plain Washers.
10. IS : 2074 Ready Mixed Paint, Red Oxide Zinc Chrome and Priming.
11. IS : 102 Ready Mixed Paint, Brushing, Red Lead, non setting, Priming.
12. IS : 816 Code of practice for use of Metal Arc Welding for General Construction in mild steel.
13. IS : 4353 Submerged Arc Welding of Mild Steel & Low Alloy Steels – Recommendations.
14. IS : 817 Code of practice for Training and Testing of Metal Arc Welders.
15. IS : 5334 Code of practice for Magnetic Particle Flaw Detection of welds.
16. IS : 3600 Methods of Testing Fusion Welded Joints & weld metal in steel (Parts 1 to 9)
17. IS : 3589 Seamless or Electrically welded steel pipes for Water Gas and Sewage (168.3 to 2032 Outside Diameter)
18. IS : 7343 Code of practice for ultrasonic Testing of Ferrous Welded Pipes and Tubular Products
19. IS : 1608 Mechanical testing of Metals.
20. IS:5504 & IS:3589 Code for SW PIPES
21. IS:10748 Requirement for Weldable Hot Rolled Carbon Steel Strip in Coils.
22. API-1104 Welding of pipeline & related facilities

MATERIALS

Mild Steel Plate conforming to IS: 2062, Fe410. Grade B. and M.S. Coil conforming to IS 10748 with Fe410 grade B Welding Consumables - such as electrodes, filler rods and wires shall conform to IS : 814, IS 3613, IS : 6419 and IS : 7280.

When requested by the Purchaser, the Bidder shall supply free of charge to the Employer, for testing suitable samples of the materials to be used/used in the Works. The cost of such tests shall be borne by the Bidder and shall be included in his item rates.

INSPECTION

GWSSB will appoint a third party agency for quality testing and quality assurance of pipes to be supplied under this contract. The agency so appointed by GWSSB shall have access, right and authority to inspect and test the pipes, both at the place of manufacturer and also post delivery at the locations mentioned in the tender. Pipes conforming to such test requirements will only be accepted.

All works and material under specification will be rigidly inspected during all phases of manufacture and testing and such inspection shall not relieve the Bidder of his responsibility to furnish materials and performed work in accordance with this specification.

The Bidder shall notify the Purchaser, in advance of the production of materials and fabrication thereof, in order that the Employer may arrange for mill and shop inspection.

TECHNICAL SPECIFICATION

The Purchaser may reject any or all materials or work that do not meet with any of the requirements of this specification. The Bidder shall rectify or replace such rejected material/performed work at his own cost, to the satisfaction of the Purchaser.

The Purchaser shall have free access to those parts of all plants or any other premises and sites that are concerned with the furnishing of materials or the performance of work under this specification.

The Bidder shall furnish to the Employer's inspector reasonable facilities and space without charge for inspection, testing and obtaining of any information he desires in respect of the character of material used and the progress and manner of the work.

The Bidder shall supply free of cost and required specimen of materials for testing by the Owner at any time during the progress of work and shall bear the cost of all such tests or retests to the satisfaction of Purchaser.

The Bidder shall provide 2 (two) sets of accurate 'Go' and 'No Go' ring gauges to measure the diameter of pipes specials and fitting for the use of the Purchaser at no extra cost.

FABRICATION OF PIPE

General

All pipes and specials shall be manufactured out of new mild steel plates, which shall be free from any cracks, surface flaws, laminations, excessive pitting or any other defects. The pipes shall be truly cylindrical, and straight in axis. The ends shall be accurately cut and prepared for field welding. The external circumference of the pipe pieces, which are to be fixed adjacent to flange adapter with fixed outer diameter, shall not deviate from theoretical one by more than 1 mm. To obtain this accuracy the pipe shall be rolled several times, if necessary, as pipe pieces should be truly cylindrical. The external longitudinal welding of this pipe shall be ground smooth flush with surface to the satisfaction of the Purchaser, for a length of 200 mm. No extra cost shall be charged by the Bidder for this grinding work..

Minor repair by welding or otherwise shall be permitted at the discretion of the Purchaser, but such repairs shall be done only after obtaining the previous permission of the Purchaser. Any pipe or part thereof, which develops injurious defects during shop welding or other operations, shall be rejected.

Permissible Stress

The permissible stress in the pipe shell shall be related to yield stress (f_y) of pipe material making due allowance for weld efficiency of the joint.

working stress for combined bending and direct tensile stress shall not exceed 60% of yield stress of the material making due allowance for efficiency of welded joint (as per IWWA M-1).

working stress for combined bending and direct compressive stress shall not exceed 50% of yield stress making due allowance for weld efficiency (as per IWWA M-1).

it is also necessary to check the shell thickness for adequate factor of safety against failure by buckling (as per IWWA M-11).

TECHNICAL SPECIFICATION

For field-welded joint, efficiency factor of 80% is generally adopted, while for shop welding joint 90% efficiency is allowed (as per IS 5822 – 1994).

Fabrication

The Bidder shall get the fabrication work done in a duly valid licensed factory of his own or that of an approved nominated Sub-Contractor. This factory meant for fabrication of pipes, specials etc. should also be involved with testing etc., machining as well as painting. For completing the work under the present contract within the contract period, the factory shall be equipped with adequate number of various equipment and plant such as :

Plate bending machines for rolling of pipe drums

Automatic welding machines (suitable for circumferential as well as longitudinal welding)

Hydraulic Testing Machines

Traveling gantry or crane of capacity 10 Tonnes or above.

Mobile cranes for loading/unloading of plates, pipes etc. 15 tonnes capacity each

Lathe for machining of the flanges rings, plates etc.

Equipment for sand blasting and applying paint by spray gun.

Equipment for cold pressing of plates up to 25 mm thick to the required curvature (specials, plug plates etc.)

Bending machine of adequate capacity for manufacturing ring girders and other necessary equipments.

The factory shall have adequate area, and shall also have stacking yard for the stacking of plates, structural, fabricated pipes etc. and the scrap.

Cutting Plates or from plates rolled as coil to the required sizes

The plates shall be indented in such length as to have minimum wastage and so as to make the pipe as far as possible with one longitudinal joint.

Before cutting, all the edges of the plates shall be cleaned by brushing/grinding on both the sides.

After the plates are cut, the edges shall be made smooth and even by polishing with an electrical or pneumatic grinder to remove all inequalities. Care shall be taken to see that the cut edges of the plate are perfectly straight. Jigs to be used for this purpose shall depend upon the types of cutting machine used. The plates cut to the required shape shall be checked for correctness before they are rolled into pipe drums. If any corrections are required, the Bidder shall do the same by re-cutting, if necessary. If any plate or flat is found to be warped, to have corrugations, the defects shall be removed by putting the plate or flat into a roller press, and no extra payment for this rectification work shall be made. The laminated or heavily corroded plate shall not be used in the manufacturing of the pipe.

Rolling of Plates

The plates prepared as mentioned above are cut to the exact size shall be put into a rolling machine to form a pipe of the required diameter as under:

The Bidder shall adjust the rolling machine so as to give a uniform curvature to the pipe throughout its circumference.

TECHNICAL SPECIFICATION

The curvature obtained shall be checked by the Bidder's foreman during the process of rolling and if proper curvature is not obtained at any place including the ends, the rolling operation shall be repeated at this stage or even after the longitudinal welding of the drum where directed.

Heating of plates to obtain the desired curvature shall not be permitted.

Tacking the Drums

The rolled drums shall be kept on an assembly platform for tacking, care being taken to ensure that the tacked drums have their end faces at right angles to the axis of the pipe. While tacking the drum, a gap of 2mm to 4mm shall be maintained, where hand welding is permitted. However, where the welding is to be done on automatic welding machine, there is no need of maintaining such gap depending on the penetration through complete thickness of the welding required. To achieve these objective, clamp spiders, tightening rings and or any other approved gadgets shall be used. Each such drum, before being taken to the assembly platform, shall be numbered on the inside with oil paint, stating the plate thickness as well.

Assembly of Drums into Pipes

The tacked drums shall then be transported to an assembly platform where they shall be tack-welded together to form suitable pipe-lengths. Plate shall be bent in the maximum possible width to reduce the number of circumferential joints.

The longitudinal joints shall be staggered at 90 deg. The drums when tacked together shall have no circumferential gap when the welding is done on automatic welding machine. But when hand welding is adopted as gap of 2mm to 4mm shall be maintained to obtain a good butt-welded joint.

The assembly shall be truly cylindrical and without any kinks. The faces shall be at right angles to the axis of the cylinder. A suitable arrangement for testing the correctness of the face shall be provided by the Bidder at the assembly platform.

Welding

All components of a standard shell, either straight or bent etc. shall be welded, wherever possible by use of automatic arc welding machine by Submerged Arc welding process with alternating current. Generally hand welding shall not be permitted except specific cases, where it is absolutely necessary. This should be done in consent with client's representative. Hand welding shall also not be permitted except for sealing runs and such other minor works at the discretion of the Purchaser. The strength of the joint shall be at least equal to that of the parent material.

The Bidder shall use electrodes of standard make bearing ISO 9001 – 2000 certification. The size of electrodes depending on the thickness of plate and the type of joint. It shall also be used with standard current and arc voltage required for the machine in use with such modifications as may be found necessary after experimental welding. For this purpose, samples of welded joints shall be prepared and tested in the presence of the Purchaser. The values once determined shall be maintained throughout the work and if any modifications are to be made, a written permission of the Purchaser shall be obtained. In the case of thin sheets, electric arc welding may not give satisfactory results and gas welding shall be resorted to. Gas welding shall be subject to the same specifications and tests as those for electric welds. Welding should be carried out inside as well as outside.

TECHNICAL SPECIFICATION

All the shop and field joints shall be welded, all welding shall conform to the requirements of IS 9595 and IS 4353.

All longitudinal and circumferential joints shall be double welded butt joints. End preparation for such welding shall conform to IS : 2825.

All circumferential welds involving plates of unequal thickness shall be so kept that the inside surfaces of plates match to provide stream lined joints without alteration in the internal diameter. As far as practicable, welding of dissimilar thickness of shells shall be carried out in the shops.

The welding shall be of the best workmanship free from flaws, burns, etc. and the Bidder shall provide for his own electrodes and equipments, ovens to keep the electrodes at the desired temperatures and dry. In order to maintain a good standard in welding, welders shall be tested by the Bidder with prior intimation to the client before they are entrusted with the job. Qualification standard for welding procedures, welders and welding operation shall conform to the requirements of IS : 7307 and IS : 7310 (latest). Periodical tests as regards their efficiency shall also be taken at intervals of about 6 months and those found inefficient shall be removed from the job. Only those who pass the test, shall be posted on the job. If an incompetent welder has already welded some pipes, all welding done by him previously shall be fully checked by X-ray in addition to the regular X-ray inspections. The defects if any, shall be set right to the satisfaction of the Purchaser. All such check tests and rectification of defects shall be entirely at the cost of the Bidder. No pipes or steel sections shall be erected unless the work of the welder concerned has been proved to be satisfactory. Specially selected welders shall do site welds.

A record shall be maintained showing the names of welders and operators who have worked on each individual joint. Hand welding shall preferably be carried out by a pair of welders (parallel welding putting two welders at a time both will be working in diametrically opposite side of the curvature. Welding shall be divided into 4 quadrants shall be welded simultaneously, so that by observing proper sequence, distortion can be avoided. A joint entrusted to a particular individual or a pair shall be as far as possible, completed by them in all respects, including sealing run. No helper or other unauthorized person shall be permitted to do any welding whatsoever. In case of infringement of above, the persons shall be punished as directed by the Purchaser.

The welded joint after welding should not become brittle or sensitive to blows and there should be no loss of toughness due to welding or heat treatment. The material after welding and heat treatment is to be tougher than the base metal and is to retain its original ductility. No allowance will be made for thinning of weld and the weld should in no point be less than the nominal thickness of plate.

Upon receipt of the order and prior to the start of fabrication, the Bidder shall submit to the Purchaser for his approval the "welding procedure" he intends to use in the shop work. Similarly, prior to the start of the field welding, procedure for the field welding must be submitted to the Purchaser for his approval. Manual welding shall be adopted only when machine welding is not possible.

Ultrasonic and Radiographic tests of Welded Joints

TECHNICAL SPECIFICATION

For the mild steel pipes manufactured in site factory/workshop, fabricated from mild steel plates / coil, **3 % of the welded joints shall be subjected to ultrasonic test.**

Tolerance

The shell in the completed work shall be substantially round. The difference between maximum and minimum inside diameters at any cross section shall not exceed 1% of the nominal diameter of the cross section under consideration subject to a maximum of 10 mm.

Machined parts shall be within the limits specified by IS 3589.

Straight pipes shall have their faces perpendicular to the axis of the section with a maximum deviation of 2 mm on either side of the plane. Pipe ends shall be beveled as per IS : 3589.

For the shell thickness, no negative tolerances are acceptable:

The length of each pipe shall not be less than 11.5 mtr.

Prior to starting manufacturing of pipes, the Quality Assurance and Quality Controls plan shall have to be got approved from purchaser.

The pipes shall have to be manufactured and supplied in accordance with the BIS specification No 3589 – 2001.

In case of International manufacturers, manufacturing pipes out side India, the pipes conforming to the International Standards or the standards of the country of origin, which are equivalent or higher, the BIS specification will be accepted.

For Indian manufacturers certification marks issued by BIS standard is mandatory requirement.

For the entire Indian as well as foreign supplier the international ISO 9001 – 2000 certification is also mandatory.

For manufacturers outside India, quality mark of applicable quality institutions will be required.

Shop Testing

After fabrication, but before application of protective coatings all pipes and specials shall be subjected to a shop hydraulic test. Standard lengths of pipes shall be directly subjected to test and non-standard pipe and elbows can be tested as standard pipe before being cut to size.

The test pressure shall ensure that the plate material works is stressed to 40% of the specified minimum tensile strength, which will give test pressure as per IS-3589.

Each pipe shall be filled with water and the pressure slowly and uniformly increased until the required test pressure is reached.

The pipe to be tested shall be given a serial no. which shall be painted on its inside together with details such as pipe No. Shell thickness, diameter, length etc. as directed. It shall be entered in the register to be maintained by the Bidder.

Prior to testing, the pipe shall be inspected thoroughly and all the apparent defects in welding such as jumps, porosity etc. shall be repaired by gouge and re-welding.

The hydraulic test shall be carried out under cover at the fabrication shop, in the presence of and to the satisfaction of the Purchaser or the inspection agency appointed by the Employer.

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For indicating the pressure inside the pipe an accurate pressure gauge of approved make duly tested and calibrated for the accuracy of readings shall be mounted on one of the closures which close the pipe ends.

The pressures shall be applied gradually by approved means and shall be maintained for at least 10 seconds or till the inspection of all welded joints is done during which time the pipe shall be hammered throughout its length with sharp blows, by means of a 1 kg. hand hammer.

The pipe shall withstand the test without showing any sign of weakness, leakage, oozing or sweating. If any leak or sweating is observed in the welded joints, the same shall be repaired by gouging and re-welding after dewatering the pipe. The repaired pipe shall be re-tested to conform to the specified pressure.

If any leak or sweating is observed in pipe shell the pipe under test shall be rejected temporarily. The Bidder shall stack such rejected pipes separately in his yard. The Purchaser, shall inspect the same and after taking cuts if necessary, shall determine the nature of repairs to be carried out thereon and shall then decide as to how and where they shall be used. No payment shall be made for handling or carrying out repairs, but, payment for the fabrication and hydraulic testing of the pipe shall be released only after acceptance of the pipe with necessary repairs and subsequent testing etc. are carried out by the Bidder to the satisfaction of the Purchaser. **The Purchaser shall be supplied with two copies of the results of all the tests carried out.**

Destructive Test of Welded Joints

The welded joints shall be tested for Tensile test, Bend test & Tre-panned plug in accordance with procedure laid down in as per the latest edition of IS No. 3600 "code of procedure for testing of fusion welded joints and weld metals in steel".

Test pieces shall be taken by the Bidders from the welded joints at the position on fabricated pipes pointed out by the Purchaser in-charge.

The sample so taken shall then be cut to the exact shape and dimensions and machined as described below and handed over to the Purchaser for testing. All the work unto and including machining and arranging for test shall be done by the Bidders.

Submission of Daily Progress Report

The Bidder shall submit to the Purchaser a daily progress report in the Proforma approved by the Purchaser, wherein all the details of the work carried out in the factory shall be fully recorded. Similarly, works done in the various units in the factory shall be separately mentioned. The Bidder shall maintain a register of all the finished materials giving dates of carrying out important operations such as testing, transport, etc. The register shall be presented at least once a week to the Purchaser who shall initial the entries after verification.

TRANSPORTING OF PIPES.

All pipes and specials fabricated in the site factory / workshop and temporarily stacked in the Bidder's yard shall be transported to the site of laying after cleaning them internally etc. **The loading in the factory shall be carried out by means of either a crane, gantry or shear legs, so as not to cause any damage to the finished material. Similarly, while unloading and stacking, great care shall be**

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taken to ensure that the material is not damaged or dented. The contrivances to be used for unloading will be different in different situations and in each case the one approved by the Purchaser shall be adopted. **The material stacked at site shall be jointly inspected by the Purchaser and the Bidder and defect or damage noticed shall be repaired to the satisfaction of the Purchaser before payment is admitted.**

Props of approved designs for maintaining circularity having wooden planks at both ends to avoid metal to metal contact shall be fixed to the pipes during transit to avoid undue sagging and consequent distortion. After the pipes are carefully stacked, props should be retained till pipes are joined in trenches and then props are re-used for subsequent similar operations. The stacking ground, both in the Bidder's yard and at the site of laying shall be selected in such a way as not to get waterlogged during monsoon. If this cannot be done, **the pipes shall be supported on sleepers to avoid contact with wet earth and subsequent rusting. In order to prevent sagging during transit, savings of steel plates** can be utilized by cutting to the required length and tacking the same to the **pipe ends**, in place of props, if approved by the Purchaser.

As explained in earlier paragraphs, materials such as pipes, tapers, etc. may be transported to the site of laying as soon as the material is finished in all respects with the permission of the Purchaser to avoid congestion in the Bidder's yard. However, materials such as expansion joints, composite bends, 'T' branches and other complicated materials shall be stacked in the Bidder's yard until they are required for laying in the field. In view of this, the work of fabrication of such materials shall be properly synchronized as far as possible with the laying operations.

Fabricated materials such as specials, appurtenances, bolts, nuts, distance pipes, flanges, saddles, collars bypass arrangements etc. shall be transported to the site of laying from the fabrication shop according to the needs of the laying operations only. In regards access roads, the Bidder shall note that access road may lead up to some points on the alignment the Bidder shall have to make his own arrangement for connecting approaches to transport the pipes cross country to the actual site of laying at his own cost. Whatever may be the mode of transport he uses it shall be incumbent on the Bidder to carry and stack the pipes and specials along the alignment as close as possible to the site of laying.

PROCEDURE FOR RECEIVING STEEL PIPES

General

To ensure that the work of erecting pipes is not held up at any stage and place, the Bidder shall maintain an adequate stock of standard specials, flange rings, plug plates, manhole covers, etc. and short length of smaller diameter pipelines, etc. at site in his field stores, in consultation with the Purchaser. Wherever possible, the Bidder shall arrange one full month's requirement of pipes, specials, etc. stacked along the alignment.

Stacking of pipes, etc. and inspection

The Bidder shall keep in each section a responsible representative to take delivery of the pipes, specials and appurtenances, etc. transported from the fabricating stockyard or received from any other work site to the site of laying and to stack along the route on timber skids. Padding shall be provided between coated pipes and timber skids to avoid

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damage to the coating. Suitable gaps in the pipes stacked shall be left at intervals to permit access from one side to the other. The pipes, specials, appurtenances so received on site shall be jointly inspected and defects recorded, if any, such as protrusions, grooves, dents, notches, damage to the internal coating etc. shall be pointed out immediately to the Purchaser at the site and in the acknowledgement challans. Such defects shall be rectified or repaired to the satisfaction of the Purchaser entirely at the Bidder's risk and cost.

Handling of Pipes.

It is essential to avoid damage to the pipes at all stages during handling. The pipes shall be handled in such a manner as not to distort their circularity or cause any damage to their surface treatment. Pipes shall not be thrown down from the trucks nor shall they be dragged or rolled along hard surfaces. Slings of canvas or equally non-abrasive materials of suitable width of special attachment shaped to fit the pipe ends shall be used to lift and lower coated pipes to prevent damage to the coating.

Great care shall be taken in handling the pipe right from the first operation of manufacture until they are laid and jointed. The Bidder will provide temporary props as described earlier in order to prevent any sagging of the pipes while they are stacked in their yard and while transporting to the site of delivery, i.e. laying. The props shall be retained until the pipes are laid and welded. If at any time these props are found to be dislodged or disturbed, the Bidder shall immediately reinstate them in such a way that the true shape of the pipe shell or specials is maintained to the satisfaction of the Purchaser. No defective or damaged pipe or special shall be allowed to be used in the work without rectification to the satisfaction of the Purchaser. Any damage to the coating shall be repaired by the Bidder at his own cost to the satisfaction of the Purchaser.

Dents

Whenever any dent, i.e. a significant alteration of the curvature of the pipe shell is noticed, the depth of the dent shall be measured between the lowest point of the dent and the pipe shell curvature line. All dents exceeding 2 percent of the outer diameter of the pipe shall be removed by cutting out a cylindrical portion of the pipe and replacing the same by an undamaged piece of the pipe. The Purchaser may permit insert patching if the diameter of the patch is less than 25 percent of the nominal diameter of the pipe. Repairs by hammering with or without heating shall not be permitted. Any damage to the coating shall also be carefully examined and rectified.

Marking

The component parts of the pipes shall be carefully marked for identification in the field. The marking shall be on the side, which will be the inside of the pipe after bending.

The marking operation shall be conducted with full size rulers and templates. Only blunt nose punches should be used.

The plates used for fabrication of pipes shall be laid out in such a way that when the shells are completed one set of original identification markings for the material will be plainly visible. In case these markings are unavoidably cut out, they shall be accurately transferred by the Bidder to a location where these markings will be visible on the completed work.

The method of marking all the pipes to be delivered under scope of contract shall ensure that all the information will remain legible even after transportation, storage in open space etc. In general the legible and marking upon the goods shall indicate the followings:

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Certification mark on each pipe, if any (like ISI).

Manufacturer's brand name and/or trade mark.

Purchaser's mark as "GWSSB" be embossed on each pipe.

Diameter and wall thickness.

Inspector's mark on each pipe.

A) TECHNICAL SPECIFICATION FOR CEMENT MORTAR LINING :

The Cement mortar lining of required thickness inside the pipe shall be carried out as per AWWA-C-205-89. The details specification for the lining work is as under;

1. SCOPE :

The standard covers the requirements for the materials and application of a cement mortar lining to the inside surface of 406.4 mm OD to 2032 mm OD new M.S. Pipes. The applications requirements are (1) that the lining of all straight pipes shall be accomplished by a machine that progresses uniformly through the pipe, applies cement mortar against the pipe surfaces, and is provided with an attachment for mechanically toweling the mortar to obtain a smooth lining of uniform thickness with smooth transitions. The inside of all pipe shall receive a cement mortar lining applied by centrifugally spinning or by a method known to provide equivalent result.

2. DEFINATION :

2.1 Workmanship :

All work shall be performed in a through & workman like manner by trained personnel under the supervision of experienced persons skilled in the applications of cement mortar lining to pipeline at factory site.

2.2 Equipment :

The contractor's equipment for cleaning, applying & trowelling cement mortar in the pipe & for curing the cement mortar lining shall be so designed & manufactured & in such a condition as to permit the workers to follow the procedure & obtain the results prescribed in this standard.

2.3 The following definitions shall apply in this standard.

1. **Accelerated curing:** The process of maintaining a constantly moist surface by creating a humid atmosphere at an elevated temperature.
2. **Autogenously healing:** The process by which cracks in concrete or cement mortar are healed by the formation of calcium carbonate in the presence of moisture.
3. **Mechanical placement:** The process of applying mortar by projecting the mortar at a high velocity against the surface or by any mechanically operated compaction system.
4. **Pneumatic placements:** The process of applying mortar by propelling the mortar against any surface using compressed air or steam.
5. **Spinning:** The process of applying mortar to the inside surface of pipe in which the mortar introduced into the pipe is spread on the surface of the pipe and compacted thereon by the centrifugal force resulting from spinning the pipe about its longitudinal axis until the mortar has consolidated sufficiently to allow removal of the pipe from the equipment.

3. MATERIALS AND WORKMANSHIP :

3.1 Materials and workmanship :

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Material furnished shall meet the provision of this standard. Work or materials that fails to conform to this standard may be rejected at any time before final acceptance thereof.

3.2 Portland Cement :

Portland Cement shall conform to the requirements of latest IS:269.

3.3 Pozzolanic Material :

Pozzolanic materials shall consist of siliceous or a combination of siliceous and aluminous material in a finely divided form that in the presence of moisture will react with calcium hydroxide, at ordinary temperatures, to form compounds possessing cementing properties. IS:1489-1976.

3.4 Admixtures :

To improve workability, density and strength in the mortar, admixtures conforming to ASTN C494 may be used at the option of the contractor, unless otherwise required by the owner's specifications, provided that the ratio of admixture to Portland Cement does not exceed that used in the qualification tests of ASTM C494. No admixtures shall be used that would have a deleterious effect on potable water flowing in the pipe after the lining has been placed.

3.5 Sand :

Sand shall consist of inert granular material. The grains shall be hard strong, durable and uncoated. The sand shall be well graded and shall pass a No. 16 mesh screen with not more than 5 percent passing a No.100 sieve. (For screen and sieve sizes, refer to ASTM E11 or IS-460-Part-I-1985.)

3.5.1 Deleterious substances in sand. Sand shall be clean and free from injurious amounts 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 3 percent of the combined weight of the substances and the sand that contains them. In addition, the following limitations shall apply to specific substances :

Substance	Minimum Allowable percentage by weight
Shale	1
Clay Lumps	1
Mica and deleterious substances other than shale and clay lumps	2

3.5.2 Organic impurities. Sand shall not show a color value darker than the "Reference standard color solution" prepared as required in IS:2386(part-2)-1963.

3.5.3 Water

Water for mixing mortar shall be clean and free of Mud, oil, and injurious amounts of organic materials or other deleterious substances. Alkali salt or other impurities that might reduces the strength durability or other desirable qualities of the mortar Potable water shall be used.

4. GENERAL CEMENT MORTAR LINING DESIGN :

4.1 Composition

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

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homogeneous lining. Unless otherwise specified by the purchaser, the mortar may also include admixtures and pozzolanic materials.

4.2 Proportions

The approximate proportions of cement and sand in the mortar for the lining shall be 1 part of Portland Cement to 1-1½ parts of sand by volume. The exact proportions shall be determined by the characteristics of the sand used. Pozzolanic material, if used, shall be substituted for a part of Portland Cement in a proportion of approximately 1 part pozzolanic material to 5 parts Portland Cement by volume. Admixtures if added, shall be used in strict compliance with the manufacturer's recommendations.

4.3 Water Content

The water content shall be the minimum quantity that produces a workable mixture, with full allowance made for moisture collecting on the interior of the pipe surfaces. Slump tests should be made periodically on freshly mixed mortar immediately before the mortar is conveyed to the lining machine. The test shall be made in accordance with ASTM C143. Nominal slumps of cement mortar mixes for application of lining are as per AWWA-C-602-89.

4.4 Mixing

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

4.5 Thickness of Lining

General requirement:-

The lining shall be uniform in thickness within the allowance tolerance, except at joints or deformations in the pipeline. Cement mortar lining thickness shall be in accordance with Table-1,

Table – 1
Recommended Thickness of Cement – Mortar Lining
for pipelines in Place – New Steel

Nominal diameter in mm	Nominal thickness of inside lining in mm
355.6 mm to 508 mm outside dia	8 mm
610 mm outside dia to 914 mm outside dia	10 mm
More then 914 mm dia	13 mm

* In all instance, tolerance for lining thickness shall be +3.2 mm with no minus tolerance. For Diameter below 406.4 mm inside epoxy painting shall be applied as per IS.

5. METHODS FOR CONSTRUCTION NEW STEEL PIPE :

5.1 Preparation of pipes surfaces

The interior surface of the pipeline shall be cleaned before placement of cement mortar lining. The pipe interior surface shall be free of oil, grease, and accumulation of water. All loss mill, scale, dirt, rust, and construction debris shall be removed from the interior surface of the new steel pipeline. This may be accomplished by use of a stiff street broom in large pipe or a drag brush in small pipe. Shot or sandblasting shall not be required.

5.2 Machine application of Mortar Lining:

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- 5.2.1 **Cleanup ahead of machine:** Immediately before the travel of the lining machine through a pipeline, all foreign material, such as sand, loose, mortar, dirt, and debris shall be removed.
- 5.2.2 **Lining procedure:** The lining shall be applied in one or more courses by a machine traveling through the pipe and discharging the mortar over all pipes. The discharge shall be from the rear of the machine so that the newly applied mortar will not be marked. The rate of travel for the machine and the rate of mortar discharge shall be mechanically regulated to produce a smooth surface and uniform thickness throughout. The mortar shall be densely packed and adhere wherever applied. There shall be no injurious rebound.

5.3 Surface Finish

The mortar lining in all pipe of the diameters covered by this standard shall be mechanically troweled except for the places where hand troweling or the placement or an untroweled lining is expressly allowed by this standard.

- 5.3.1 **Troweled linings:** The lining machine shall be provided with attachments for mechanically troweling the mortar. Both the application and troweling of the mortar shall take place at the rear of the machine so that the freshly placed and troweled mortar will not be damaged. The trowel attachment shall be such that the pressure applied to the lining will be uniform and produce a lining of uniform thickness with a smooth, finished surface, free of spiral shoulders. The finished surface of machine placed troweled lining in pipe shall be examined according to the procedure as under.

In the reach of pipe that has been lined & troweled in each day's run 10 places shall be selected in straight sections of the pipe according to a predetermined sampling method agreed on by the owner & Contractor. In each of the 10 places a 300 mm straight edge shall be laid parallel to the axis of the pipe. In 9 of the 10 places the space between the lined surface and the straight edge shall at no point be greater than 1.6 mm for smooth bore pipe in good condition and 3.2 mm for pipe with a rough or irregular interior. This test shall not apply in places where the unlined pipe is too rough or irregular for the required tolerance to be met by machine lining.

- 5.3.2 **Untroweled lining:** The finished surface shall be smooth and regular except that it may exhibit a slightly dimpled appearance similar to the surface of orange. Ridges or uneven buildup caused by irregularity in the trowel rate of the machine shall not be allowed.

5.4 Curing of lining :

- 5.4.1 **General:** Immediately after completion of spinning, the pipe sections may be moved to a curing area. Care shall be exercised at all times to prevent damage to the lining. At the option of the contractor, linings shall be accelerated cured or moist cured. Accelerated curing or moist curing may be used interchangeably on a time ratio basis of 5 1/3 h of moist curing to 1 j of accelerated curing, except that moist curing may be used only if the minimum ambient temperature exceeds 40°F (50°C) continuously during the required minimum curing period. In any case, lining shall be kept continually moist until the completion of the minimum specified curing period.
- 5.4.2 **Moist curing:** On arrival at the curing area, but later than 30 min after completion of the lining operation, pipe ends shall be covered with

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plastic or wet burlap for a minimum period of 24 Hrs. before applying the exterior coating, if such coating is specified. No credit shall be allowed for any time during which the temperature drops below 50°F (10°C). If a cement-mortar exterior coating is not specified, the lining shall be kept moist for seven days before shipment. In either case, the lining shall be cured for a total period of four days before shipment. The ends of the pipe sections shall be kept closed during the curing period, with plastic end caps except when sprinkling heads are used, the reinforcement and outside coatings are being applied, or accelerated curing is being substituted. The contractor shall exercise care and diligence to avoid drying out or cracking of the lining.

- 5.4.3 **Accelerated curing:** Accelerated curing may be applied immediately on arrival of the pipe at the curing area, but the temperature of the pipe shall not exceed 90°F (32°C) for 3 hrs. or until the mortar has taken its initial set, whichever occurs first.

The ambient vapor shall then be maintained at a temperature between 110°F and 150°F (43°C and 66°C) at a relative humidity of not less than 85 percent for a minimum curing period of 6 hrs., after which the exterior coating may be applied, if such coating is specified. If cement-mortar coating is not specified, the lining shall be cured for 18 hrs. before shipment. In either case, the lining shall be cured for a total period of 18 hrs. before shipment.

- 5.4.4 Alternative curing methods. When allowed by the purchaser, alternative-curing methods may be substituted providing the method used by the contractor produces a cured lining equivalent to that set forth in Sec. 5.4.2 and 5.4.3.

5.5 Mortar Lining Test Cylinders

- 5.5.1 **Mortar test cylinders:** A set of at least two standard test cylinders, 6 in (150 mm) in diameter by 12 in. (300 mm) in length, shall be made each day from the mortar lining for each shift to satisfy the 7-day and 28-day strength quality control requirements of Sec. 5.5.4 the mortar shall be removed from the mix in accordance with ASTM C172 or samples may be prepared by omitting sufficient water from the production mix to obtain a 1-in. to 3-in (25 mm to 75 mm) slump. Test cylinders shall be made in conformance with ASTM C31. The test cylinders shall be cured with the pipe at the same temperature and for the same total length of time. Other sized cylinders, such as 2 in x 4 in. (50 mm x 100 mm), may be used to test compressive strength. If the 7-day test attains 28-day test requirements, then the 28-days test need not be completed (Sec. 5.5.4).

- 5.5.2 **Centrifugal test cylinders:** Centrifugally spun test cylinders may be substituted for mortar test cylinders, at the option of the contractor. Test cylinders shall be spun about their longitudinal axes in 6-in. (150 mm) diameter by 12-in. (300 mm) long steel molds at a speed that will simulate the compaction of mortar in the lining to produce a spun cylinder wall thickness of at least 1 ½ in (38 mm). The net cross sectional area of the hollow cylinder shall be used to determine its compressive strength. Damaged cylinders shall not be tested.

- 5.5.3 **Test cylinders:** All test cylinders shall be tested in accordance with ASTM C39 by an approved testing laboratory unless the contractor has approved testing facilities at the work site. In such an event, the tests shall be made by the contractor. All cylinder tests shall be made

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at the expense of the contractor. Certified test reports will be submitted by the contractor. Retest are the contractor's responsibility.

- 5.5.4 **Strength of mortar lining:** Mortar test cylinders shall attain a minimum compressive strength of 2600 psi (18 Mpa) in 7 days and 4500 psi (31 Mpa) in 28 days. Pipe made with mortar lining that does not meet the strength requirements set forth herein shall be subject to rejection.

The average of any 10 consecutive strength tests of cylinders representing each mortar mix shall be equal to or greater than the specified strength, and not more than 20 percent of the strength tests shall have values less than the specified strength. No cylinder test result shall be less than 80 percent of the specified strength.

6.1 All phases Accessible to Owner:

The owner shall have free access to all areas, places, of facilities concerned with the furnishing of material or the performance of work under the provisions of this standard.

6.2 Contractor to Assist Owner:

The contractor shall furnish the purchaser reasonable assistance, at no additional cost in carrying out the inspection duties and specifically in obtaining information with respect to the character of material used and the progress and manner of the work.

6.3 Large pipe inspection procedure:

In pipe 406.4 mm OD and Larger a manual, visual inspection of the lined pipe interior should be made by the purchaser to determine the quality of the lining and to identify defective areas in the lining for repair.

- 6.4 Performance criterion surface finish. The Hazan-Williams "C" factor (Chw) is a generally accepted criterion for determining the acceptability of surface finish of cement mortar lining in pipelines as under :

Table as under is given to acceptable performance for smoothness of pipe.

Diameter of pipe	Guaranteed "C" factor (Chw)
Above 660 mm	130

Based on nominal inside pipe diameter before cement mortar lining.

B) TECHNICAL SPECIFICATION FOR EPOXY PAINTING :

The inside Epoxy painting with required base and hardener shall be provided for pipes of dia. below 406.4 mm O.D. as per instruction of Engineer-in-charge/Consultants. The detailed specifications for epoxy painting are as under;

- I)** The inside lining shall consist of 1 coat of 25 micron of Zinc rich epoxy primer and three coats each of 25 micron of non toxic high build black paint.

The inside surface of the pipes and specials is to be provided with lining with anticorrosive paint before applying paint to the surface, the surface shall be made free from rust, mill scale, dust, grease, old paint and other loose particles. The surface shall be cleaned by sand/short blasting as per IS:1477/1971 (Part-I). Cleaning shall be followed by immediate application of Zinc rich primer. The primer shall be applied by spray or brush. The application of the primer shall be as per the recommendation of the manufacturer. After application of primer in 1 coat, 3 coats of high build black non toxic paint of reputed make like Asian, Burger, Shalimar Tar Product, Goodlass, Sigma, Goa paints etc. to be approved by Engineer-in-charge

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consultant shall have to be applied after 24 hours minimum. The technical specifications of primer and paint shall be as under;

II) **Epoxy Zinc Rich Primer (2 packs) :**

Types and purpose :

A two component heavy duty prefabricated primer based on Zinc Dust and Polyamide cured epoxy resins. This paint generally conforming to specification DGS-175, Type-A. the primer shall be non phenolic.

III) **Conditions :**

The paint is supplied in two packs, fine Zinc dust mixed with epoxy resin as base and liquid hardener. They are to be mixed in following ratio.

	By Volume	By weight
Base	1.5	4.0
Hardener	1.0	1.0

IV) **Mixed Paint Properties :**

i)	Viscosity	20+3% seconds by flow
		Cup No.4 @ 30° C
ii)	Specific Gravity	1.70 + 3%
iii)	Pot life of mixture	6-8 hours
iv)	Zinc dust content on DFT basis	92 %
v)	Finish	Smooth and Matt.
vi)	Drying time	
	Surface Dry	5 minutes
	Hard Dry	Less than 1 Hour
Vii)	Over coating after	Minimum 24 hours
		Maximum No limit.
Viii)	Flash point	Above 23°C
ix)	D.F.T.	20-25 microns depending on blasting profile.
x)	Compatibility	Compatible with all systems of paints.
		Like Bituminous, conventional, chlorubber vinyl and epoxy paints.
xi)	Toxicity	Non toxic.

V) **Application by**

Brush/Spray (Air and Airless)

VI) **Thinner**

Epoxy thinner shall be used if required.

VII) **Coverage :**

10 sq.m./liter at 25 microns.

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VIII) High build black paint :

1)	Dry time	Surface dry not more than 4 hours Hard dry not more than 18 hours Film thickness per coat 75 micron.
2)	Consistency	Thixotropic liquid.
3)	Covering Capacity	5 sq.m./litre
4)	Color	Black/Brown/Black in alternate layer.

IX) Characteristics :

The paint shall be non phenolic non-toxic and shall not impart any test or odour or to the water to flow through the pipe. It shall afford a highly durable protective air tight coating to prevent corrosion or rusting of iron and steel against air moisture/water and shall be of sufficient elasticity to prevent racking, blistering or peeling. It shall retain its consistency at the ordinary atmospheric temperatures when packed in suitable containers. After application or drying, the paint shall not show any surface cracks due to drying, weathering action or expansion and contraction. Its resistance to water must be perfect. It shall also be resistant to weak acid and alkalis, natural salts and to dry heat up to 150 centigrade. It should have good brushability.

The primer as well as paint shall have to be applied as per the manufacturer's specification. The paints shall be tested in the laboratory by the Owner at the cost of the contractor if found necessary. Each lot of primer and paint supplied shall be accompanied by the certified copies of the result of tests carried out by the manufacturer. The entire procedure of applying the paint as specified shall be rigidly inspected right from cleaning stage to application of final coat. If at any time it is found that the procedure of applying the paint is not as per standard laid down, all such painting work done shall be rejected.

The consumption of paint and primer shall be as manufacturer's specification. No deviation in consumption shall be allowed.

C) TECHNICAL SPECIFICATION FOR REINFORCED CEMENT MORTAR COATING :

The Reinforced cement mortar coating of 25 mm thick outside of M.S. pipe for all dia pipes shall be carried out as per IS:1916-1989. The minimum reinforcement in the coating shall be three percent of the quantity of steel cylinder of minimum plate thickness as per IS:3589-1991. The reinforcement for coating in the form of welded wire mesh of 3.15 mm dia and suitable pitch conforming to IS:4948 be wrapped on

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the outside by tack welding. On outside 50 mm length from end of pipe shall be uncoated to facilitate welding. Guniting shall be 25 mm thick of strength not less than 25N/mm^2 at 28 days. Contractor shall have to prepare suitable moulds at his cost for taking cubes of concrete/mortar in required numbers for testing. Rebound materials shall not be used.

D) TECHNICAL SPECIFICATION FOR BITUMEN ENAMEL WRAPPING

The pipes shall be covered with a layer of bitumen containing a mineral filler applied hot in accordance to BS4147 and inner wrapping of glass tissue and outer wrapping of bitumen impregnated reinforced glass tissue in the longitudinal direction with parallel glass threads spaced 9.5 mm apart. It shall be impregnated with a material fully compatible with the coating materials to give a finished thickness of 0.75 mm.

The glass tissue wrapping shall be wound spirally or circumferentially with an overlap. There shall be not less than 1 mm of enamel between the pipe surface and the inner wrapping.

Coating

Lined pipes shall be given one coat of water resistant white wash immediately following the bitumen coating.

The white wash shall be mixed as specified under section 2.5 of AWWA.C. 203-57.

Mode of measurement and payments:

The measurement shall be recorded in running meter of pipe length laid along center line or axis of pipe line including tees, enlarges, reducers and bends correct up to 0.01 M length. No payment shall be made for overlaps etc.

The payment shall be paid after completion of whole item as mentioned in price bid on **Running Meter** basis and **5%** shall be withheld for satisfactory hydraulic testing.

Payment will be as per payment schedule.

Item-4.1.2

Manufacture, Supply & Delivery of Ductile Iron Flange socket spigot bends, tees, reducers or any other specials as per BS-EN-545/1995 Class-A series K12 suitable for use with D.I. Pipes manufactured as per IS:8329/1994 delivery of specials is to be made to GWSSB store or site of works any where in Gujarat including all taxes, loading, unloading, carting, stacking, insurance, inspection charges, octroi etc. complete.

TECHNICAL SPECIFICATION FOR CAST IRON DETACHABLE JOINTS 80 MM DIA TO 700 MM DIA (SHORT AND LONG)

I GENERAL TECHNICAL SPECIFICATIONS

1. SCOPE OF CONTRACT

The contract shall be covering manufacturing, supplying and delivering of :

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"CAST IRON DETACHABLE JOINTS WITH SYNTHETIC RUBBER RINGS CONFIRMING TO RELEVANT INDIAN STANDARDS."

2. STANDARDS :

- a) CID joints confirming to IS:8794-1988 or its latest revision.
- b) Rubber sealing rings confirming to IS:5382-1969 and IS:10292(Part - II) 1982.

3. TENDER PRICE :

The prices are inclusive of all labor, material and machinery cost necessitated to be utilized for :

- a) Proper manufacturing of the cast iron detachable joints.
- b) All tests required to be undertaken at manufacturer's premises.
- c) Transportation of the joints wither by Rail and/or Road services with all the covers duly and appropriately insured;
- d) Delivery of joints with proper loading, unloading stacking at GUDC store as indicated by Engineer-in-charge.
- e) Further towards proper discharge of all contractual obligations. The storage of all joints to be manufactured, supplied and delivered under the scope of contracts shall be in general be made as described in technical specification attached in this tender document.

4) MARKING :

The methods of marking all the joints to be delivered under scope of contract shall ensure that all the information will remain legible even after transportation storage in open space, etc. In general the legible and indelible marking upon the goods shall indicate the followings :

- i) manufacturer's brand name and/or trade mark.
- ii) purchaser's mark as " GUDC" be inscribed.
- iii) Diameter and class of joints.
- iv) Any other important matter that the manufacturer deems fit to be inscribed.
- v) ISI certification mark on each joints in case of joints with ISI mark.

5) PACKING AND HANDLING :

- 5.1 The materials shall always be packed separately and desparchea from manufacturer's works with adequate protective measures to prevent damages and deterioration while in transport or stored at any place.
- 5.2 When the materials are transported at Railway Risk. Special packing as per IRCA Rules are absolutely necessary for which the extra cost, if any, shall be borne in total by supplier only.
- 5.3 The supplier shall use proper handling instrument /equipment and shall follow to a suitable method of handling of joints as may be approved by Engineer, while unloading and stacking material in the stores.

6) MATERIAL AND WORKMANSHIP :

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- 6.1 General requirements of materials and workmanship shall mean any material or article either raw or finished one required to be used in the manufacturing process of joints.
- 6.2 All the material shall be new and of high quality.
- 6.3 In case, if materials is not specified by relevant ISS for manufacturing part or the whole as item, the supplier shall also produce in addition to manufacturer and shall seek an approval of Engineer prior to its use in the manufacture.

7) TEST CERTIFICATE :

- 7.1 The supplier shall always provide manufacturer's test certificate in accordance with every batch/lot of goods so manufactured and supplied.
- 7.2 The supplier shall also produce in addition to manufacturer's test certificate as mentioned in para 8.1 above, the inspection certificate issued by the authorized agency/person appointed by Board for for the same purpose.

II. TECHNICAL SPECIFICATIONS FOR C.I.D. JOINTS :

- 1. All CID joints shall be well machined and suitable for the A.C. PRESSURE pipes manufactured as per the ISS No. 1592/1989 with its latest revision if any. The CID joints upto 700 mm dia (Short Collar) shall be as per ISS No. 8794/1988 with its latest revision if any. The materials composition and test criteria shall be as per ISS 8794/1988 OR with its latest revision if any. For long collar joints the material composition and test criteria shall be as per ISS-8794/1988 or with its latest revision if any.
- 2. All CID joints shall withstand the pressure to the particular class of A.C. pressure pipes for which they are use. The materials specification for all joints shall be as per ISS 8794/1988 with its latest revision if any. Bolts of CID joints shall be of adequate lengths and well threaded so that while fitting the joints by hand the bolt end shall project for screwing on the nuts and at the end of the fitted nuts there should be some extra threaded length left bolt. The nuts and bolts shall be approved by the inspecting authority.

Each set CID joints shall consist of the following accessories :

- a) Joint flanges...2 Nos.
 - b) Synthetic Rubber Rings...2 Nos
 - c) Joint Collar 1 No.
 - d) M.S. bolts and nuts as per the ISS per CID joint one set of M.S. Bolts (Well threaded) and nuts sufficient in number for one joint.
- 3) The minimum weight of long collar CID joints, nuts and bolts, size and number of bolts and nuts, etc. are as under :

SR No.	Size in mm and Class	Weight of CID joints without nut and bolts & rubber rings Kg/Nos.	Size & No of Bolts(in inch.)	Remarks
1	2	3	4	5
1.	80/5,10,15	4.5	6x1/2x3	
2.	100/5,10,15	5.5	6x1/2x3	

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3.	125/5,10,15	8.9	6x1/2x4	
4.	150/5,10,15	10.7	7x1/2x4	
5.	200/5,10,15	18	9x5/8x4	
6.	250/5,10	24	10x5/8x4	
7.	250/15	27.3	10x5/8x4	
8.	300/5,10	35.0	11x5/8x4	
9.	300/15	38.0	11x5/8x5	
10.	350/5,10,15	44.0	11x5/8x6	
11.	400/5,10	60.0	11x5/8x6	
12.	400/15	63.0	11x5/8x6	
13.	450/5,10,15	65.0	11.5x5/8x7	
14.	500/5,10	82.0	11.5x3/4x8	
15.	500/15	86.0	11.5x3/4x8	
16.	600/5,10	120.0	11.5x3/4x9	
17.	600/15	125.0	11.5x3/4x9	
18.	700-5/10	239.0	11.5x3/4x9	
19.	700-15	246.0	11.5x3/4x9	

- NB :**
- 1) Tolerance in weight of long collar shall be $\pm 12\%$ as per IS:1538-1976 clause 10.1.1 the permissible tolerances on non standard fittings. This will be applicable in case of individual joint, however the tolerance in case of the whole lot should not exceed $\pm 10\%$.
 - 2) The length of bolts shall be as suitable to the width of long collars.

3. LONG COLLAR DIMENSION:

3.1 Thickness at end:

Thickness of long collars at ends shall be kept similar to the thickness of short collars at ends as per the IS:8794-1988.

3.2 Width of long collars:

Width of long collars shall be as under ;

Sr./Class	Width (mm)
80/5,10,15	83 to 85
100/5,10,15	98 to 100
125/5,10,15	114 to 128
150/5,10,15	136 to 140

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200/5,10,15	142 to 150
250/5,10,15	162 to 135
300/5,10,15	166 to 180
350/5,10,15	190 to 196
400/5,10,15	190 to 196
450/5,10,15	196 to 205
500/5,10,15	205 to 210
600/5,10,15	205 to 210
700-5,10,15	205 to 215

Over sized long collars :

They are required for maintenance purpose. The internal diameter of the oversized long collars may vary from 5 mm to 8 mm compared to standard I.D. as per the requirement for field officers.

Item-5.1.2

MS Special

- 1) Manufacture, Supply & Delivery of M.S. Specials of various diameter and class. The delivery of specials is to be made to site of works including all taxes, loading, unloading, carting, stacking, insurance, inspection charges, Octroi etc. complete.
- 2) Specials shall conform to the appropriate dimensions as Section 4 of BS 534:1990. Specials shall be formed from straight pipes butt-welded by metal arc process.
- 3) M.S. Specials with all types of diameters suitable to pipes with inner cement mortar lining.
- 4) The coating and lining on the straight pipe shall be cut back from the points to welded or cut for sufficient distance to ensure that no material intended to remain part of the coating is damaged by the cutting or welding process.
- 5) Welding of specials shall be of standard equal to that of straight pipes and are subjected to a 100% radiographic test.
- 6) All fillet welds shall be subjected to air tests appropriate and/or magnetic crack detection test.
- 7) The outside diameter of specials shall conform to the outside diameter of the standard straight pipes.
- 8) The ends of pipe-ended specials shall be truly circular and shall conform to the tolerance required for fitting of mechanical couplings and flange adaptors.
- 9) The necessary M.S. Specials required during the lowering & lying of M.S. Pipe shall be supplied by the agency and shall be as per standard specification and as per IS specification. It shall be of best quality as per requirement.
- 10) Rate shall be including loading, unloading, carting, insurance and labour charge etc. complete.

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- 11) The payment shall be made on kilogram basis.

Item-6.1 & 7.1.2.3.4

Providing and supplying ISI mark C.I. D/F Sluice valves, Butterfly valves & Reflux valves of following class & dia. incl. all taxes, insurance, transportation, freight charges, octroi, inspection charges, loading, unloading, conveyance to departmental stores, stacking etc. complete. 1) Sluice valve PN-1.6 with hand wheel / cap operated with ISI mark.

GENERAL

The contractor shall be covering manufacturing, supplying and delivery of: Sluice valve conforming to IS: 2906-1984 & IS: 780-1984 or its latest revision (Specification for sluice valves (50 to 900 mm size) with ISI certification

2.0 STANDARDS

The C.I. sluice valves to be manufactured, supplied and delivered under the scope of this contract shall be manufactured in accordance with and conforming to Indian standard specifications as given below: with ISI certification mark on each sluice valves.

3.0 TEMPERATURE VARIATION

All sluice valves manufactured, supplied and delivered shall be subjected to drinking water under variable temperature condition ranging from 4⁰ to 45⁰ C.

4.0 MARKING

The legible and in deniable marking upon each valve shall indicate the following:

- (1) ISI certification mark on each sluice valve only.
- (2) Manufacture's brand name and/or trade mark.
- (3) Size of valve and nominal pressure of valve.
- (4) Serial number of cast.
- (5) Serial number in punch
- (6) Where a valve has been tested for only open and test, it should be marked 'O' distinctly and permanently.

Any other important matter that the manufacturer deems fit to be inscribed embossed.

5.0 TEST CERTIFICATE

- 5.1 The contractor shall always provide manufacture's test certificate in accordance with every batch/ lot as valves so manufactured and supplied.
- 5.2 The contractor shall also produce; in addition to manufacture's test certificate the inspection certificate issued by the authorized person /agency appointed by Engineer/board for the same purpose. The inspection charges of the authorized person/agency as fixed by G.W.S.S.B shall have to be borne by the contractor and the necessary payment to the inspecting agency shall be paid by the contractor as per the terms and condition of G.W.S.S.B.

6.0 NOMINAL PRESSURE

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Sluice valves shall be designed by nominal pressure (PN) defined as the maximum permissible gauge working pressure in Mpa as "PN-I" (Mpa= 10 kgf/m² approx)

The nominal size shall refer to the nominal bore at any point, shall not be less than the nominal size required.

7.0 MATERIAL:

- 7.1 The materials for the different component parts of the sluice valve shall confirm to requirements given in Table

Materials for components parts of sluice valve

Sr. No	Component	Material	Ref. to	Grade of designation
1	Body, bonnet wedge stuffing box, gland thrust plate, cap.	Grey cast iron	210-FG 1978(1)	
2	Steam	High tensile brass	320-1962(2)	Ally 1 of 2
3	Wedge nut	Leaded tin bronze	318-1962(3)	2
4	Body seat ring, wedge facing ring	Leaded tin bronze	318-1962(3)	2
5	Bolts	Carbon steel	1367-1967(4)	Class 4.6
6	Nuts	Carbon steel	1367-1967(4)	Class 4
7	Bonnet gasket	Compressed fiber Board	2712-1971(5)	C
8	Gland packing	Jute & hemp	5414-1969(6)	--

- (1) Specification for grey iron castings (third revision).
(2) Specification for high tensile brass rods and sections (revised).
(3) Specification for leaded tin bronze ingots and casting (revised).
(4) Specification for technical supply condition threaded fasteners (first revision)
(5) Specification for compressed asbestos fiber jointing (first revision)
(6) Specification for gland packing, jute and hemp.

8.0 MANUFACTURE

Sluice valve bodies for 80 mm to 900 mm size valves shall be provided with double flanged ends connection.

9.0 FLANGES

The flanges and their dimensions of drilling shall be in accordance with part IV and VI of I.S. 1538 (Part I to XXII) 1976 (Specification for cast Iron fittings for pressure pipes for water gas and sewage) or its latest revision.

5.0 MODE OF MEASUREMENT AND PAYMENT

Measurement shall be paid on number basis as per relevant dia. of the item in Schedule-'B' of the tender and as per payment schedule.

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RCC precast M.H. Frame & Cover Manufacture, supply & Delivery at store or at site of work precast RCC M.200 Frame & cover suitable to drainage M.H. and as per type design & Drawing including cost of reinforcement M.S. Angles or Flat, curing mold work etc

- **Heavy duty Frame and Cover suitable for Clear opening of MH**

Precast RCC Manhole Frame & cover shall be as per IS: 12592 (part – I & II). The M.H. Frame & Cover shall be of Heavy duty of Grade designation HD-35 perforated – Circular in shape with clear opening of Man Hole. 50 cm Dia.

Materials such as cement, aggregate, water, reinforcement shall be of standard as prescribed in the material part. Other materials to be used for Frame & Cover shall be as under:

Concrete:

The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing, etc.(IS: 456 – 1978). The minimum cement content in the concrete shall be 360 Kg/m³ with a maximum water content ratio of 0.45. Concrete weaker than grade M 20 shall not be used. Compaction of concrete shall be done by table machine vibration.

Steel Fibers:

The diameter/equivalent diameter of steel fibers shall not be greater than 0.75 mm. The aspect ratio of the fibers shall be in the range of 50 to 80. The minimum volume of fibers, where used, shall be 0.5 percent of the volume of the concrete.

Additives or Admixtures:

Additives or admixtures may be added either as additives to the cement during manufacture, or as admixtures to the concrete mix. Additives or admixtures used for covers may be:

- a) Accelerating, water-reducing and air-entertaining admixtures confirming to IS: 9103-1979.
- b) Coloring pigments
- c) Fly ash confirming to IS: 3812-1981
- d) Water proofing agents conforming to IS: 2645-1975.

Dimensions and Tolerances:

Length, breadth and diameter of precast concrete manhole covers shall be such that the maximum clearance at top between the cover & frame of corresponding grade and shape shall be 5 mm. The minimum thickness of heavy duty precast manhole cover shall be 70 mm. The top surface of frame & cover is in level within a tolerance of ± 5 mm.

Placing of reinforcement, compaction of concrete & curing shall be attended as per IS: 12592. Edge Protection & Finishing shall be provided as per relevant IS.

Physical requirements

All the frame & covers shall be sound and shall be free from cracks & other defects, which interferes with the proper placing of the units or impair the

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strength or performance of the units. Minor chippings resulting from the customary methods of handling and transportation shall not be deemed ground for rejection.

Marking:

Each Cover shall have following marking:

Date of manufacture

Grade Designation

ISI mark

Patan Nagar Seva Sadan - Identification mark

Frame & covers will be tested at factory by owner / consultant & accepted goods shall be procured on site of work.

The rate shall be paid on number basis for set of Frame & Cover.

- **Light duty Frame and Cover suitable for Clear opening of MH**

Precast RCC Manhole Frame & cover shall be as per IS: 12592 (part – I & II). The M.H. Frame & Cover shall be of Heavy duty of Grade designation HD- 20 – Rectangular in shape with clear opening of Man Hole.60 x 45 cm

Materials such as cement, aggregate, water, reinforcement shall be of standard as prescribed in the material part. Other materials to be used for Frame & Cover shall be as under:

Concrete:

The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing, etc. (IS: 456 – 1978). The minimum cement content in the concrete shall be 360 Kg/m³ with a maximum water content ratio of 0.45. Concrete weaker than grade M 20 shall not be used. Compaction of concrete shall be done by table machine vibration.

Steel Fibers:

The diameter/equivalent diameter of steel fibers shall not be greater than 0.75 mm. The aspect ratio of the fibers shall be in the range of 50 to 80. The minimum volume of fibers, where used, shall be 0.5 percent of the volume of the concrete.

Additives or Admixtures:

Additives or admixtures may be added either as additives to the cement during manufacture, or as admixtures to the concrete mix. Additives or admixtures used for covers may be:

- e) Accelerating, water-reducing and air-entraining admixtures conforming to IS: 9103-1979.
- f) Coloring pigments
- g) Fly ash conforming to IS: 3812-1981
- h) Water proofing agents conforming to IS: 2645-1975.

Dimensions and Tolerances:

Length, breadth and diameter of precast concrete manhole covers shall be such that the maximum clearance at top between the cover & frame of corresponding grade and shape shall be 5 mm. The minimum thickness of heavy duty precast manhole cover shall be 70 mm. The top surface of frame & cover is in level within a tolerance of ± 5 mm.

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Placing of reinforcement, compaction of concrete & curing shall be attended as per IS: 12592. Edge Protection & Finishing shall be provided as per relevant IS.

Physical requirements

All the frame & covers shall be sound and shall be free from cracks & other defects, which interferes with the proper placing of the units or impair the strength or performance of the units. Minor chippings resulting from the customary methods of handling and transportation shall not be deemed ground for rejection.

Marking:

Each Cover shall have following marking:

Date of manufacture

Grade Designation

ISI mark

Patan Nagar Seva Sadan - Identification mark

Frame & covers will be tested at factory by owner / consultant & accepted goods shall be procured on site of work.

The rate shall be paid on number basis for set of Frame & Cover.

Item-9.1.2.3.4

Excavation for pipe line trenches, Manholes and House connection chamber incl. all safety provisions using site rails and stacking excavated stuff including disposal of extra stuff up to a lead of 90 mt. cleaning the site etc. complete for lifts and strata as specified Including Dewatering including Shoring or timbering for trench with 50 mm thick planks and suitable size truts etc. complete.

- a) In all sorts of soil and soft murrum
- b) In hard murrum, boulders including macadam road
- c) In soft rock, Masonry C: M or L: M
- d) In Hard rock, or C: C in 1:2:4 or RCC including blasting or / chiseling.
 - # 0.00 to 1.50m
 - # 1.50 to 3.00m
 - # 3.00 to 4.50m
 - # 4.50 to 6.00m
 - # 6.00 to 7.50m
 - # 7.50 to 9.00 m

1.0 General

1.1 The excavation for trenches will generally, refers to open excavation for trenches in wet / dry conditions for pipe laying work.

2.0 Clearing of Sites:

2.1 The site on which the pipelines are to be laid and shown on plan and the area required for setting out and other operations shall be cleared and all obstruction

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loose stones and materials, rubbish of all kinds, stumps, brushwood as trees shall be removed as directed the roots shall be entirely grubbed up.

2.2 The products of the clearing to restacked in such a place and in such a manner, as directed by the engineer in charge.

2.3 All holes or hollows whether originally existing or produced by digging up roots, shall be carefully filled up with earth, well watered, well rammed leveled off, as may be directed.

2.4 The agency has to obtain necessary permission for diverting the traffic or public as per requirement from competent authority for carrying out the work.

3.0 Setting Out:

The center lines of all pipe trenches etc. shall be given by the Engineer-in-charge and it will be the responsibility of the contractor to install substantial reference marks, bench marks, etc. and maintain them as long as required true to line, level curve and slopes. The contractor shall assure full responsibility for alignment, and dimension of trench.

The labour materials etc. required for setting out and establishing benchmarks and other reference marks shall be arranged by the contractor at his own cost.

4.0 Excavation

4.1 The excavation for the pipe trenches shall also include removal of all materials of whatever nature and whether wet or dry condition necessary for laying of pipelines exactly in accordance with alignment, levels grades and curves shown on the plans or as directed by the Engineer-in-charge. Trenches shall be excavated to the exact width and depth according to the size of pipe and the sides shall be left vertical as far as possible or according to the angle of repose of various soils. Unless there is a specific extra provision in the contract for shoring and strutting or for cutting side slopes the contractor shall at his own cost do the necessary shoring and strutting or cutting of slopes to the angle of repose or both approved by the Engineer-in-charge. The contractor shall notify the Engineer before starting excavation to enable him to take cross sectional levels for purpose of measurements before the ground is disturbed. The bottom of the trenches shall be leveled both longitudinally and transversely or slopped as directed by the Engineer. The contractor shall at his own cost to remove such portions of boulders or rocks, as are rectified to make the bottom of the trench level. No filling shall be allowed to bring the trench to level. If by contractor's mistake excavation is made deeper than shown on the plans and if ordered by the Engineer the extra depth shall have to be made with selected excavated stuff only with watering, ramming etc. as directed, by the Engineer and at the cost of the contractor. Other hard excavation shall be cleared of all sorts including loose materials and cut to firm surface, either level, stepped as directed by the Engineer. The Engineer may order such changes in the dimensions and alignment of pipe trench as may be deemed necessary to secure satisfactory cover over pipeline.

After each excavation is completed, the contractor shall notify the Engineer to that effect and no laying of pipeline will be allowed to be laid until Engineer has approved the depth and dimensions of trenches, level and measurements.

Excavation by the Use of Explosives

Unless otherwise stated herein, I.S. Specification "IS: 4081: Safety Code for Blasting and IS 3764-1966 safety code of Excavation works and related Drilling Operations" shall be followed. As far as possible all blasting shall be completed prior to commencement of construction. At all stages of excavation, precautions shall be

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taken to preserve the rock below and beyond the lines specified for the excavation, in the soundest possible condition. The quantity and strength of explosives used shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by Employer's Representative, shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structures as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of Employer's Representative at his cost. As excavation approaches its final lines and levels, the depth of the charge holes and amount of explosives used shall be progressively and suitably reduced.

The contractor shall obtain a valid Blasting License from the authorities concerned. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done; and surplus left after filling the holes shall be removed to the magazine. The magazine shall be built as away as possible from the area to be blasted. Employer's Representative's prior approval shall be taken for the location proposed for the magazine.

In no case shall blasting be allowed closer than 30 meters to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old. Blasting for excavation in hard rock will only be allowed if permitted by competent authority otherwise shall be done with chiseling only.

For blasting operations, the following points shall be observed.

- i) Contractor shall employ a competent and experienced supervisor and licensed blaster in-charge of each set of operation, which shall be held personally responsible to ensure that all safety regulations are carried out.
- ii) Before any blasting is carried out, Contractor shall intimate Employer's Representative and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, the nature of explosive to be used and the precautions taken for ensuring safety.
- iii) Contractor shall ensure that all workmen and the personnel at site are excluded from an area within 200 m radius from the firing point, at least 15 minutes before firing time by sounding warning whistle. The area shall also be given a warning by sounding a distinguishing whistle.
- iv) The blasting of rock near any existing buildings, equipments or any other property shall be done under cover and Contractor has to make all such necessary muffling arrangements. Covering may preferably be done by MS plates with adequate dead weight over them. Blasting shall be done with small charges only and where directed by Employer's Representative; a trench shall have to be cut by chiseling prior to the blasting operation, separating the area under blasting from the existing structures.
- v) The firing shall be supervised by a Supervisor and not more than 6 (six) holes at a time shall be set off successively. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, shall be exploded by drilling a fresh hole along the misfired hole (but not nearer than 600 mm from it) and by exploding a new charge.
- vi) A wooden tamping rod with a flat end shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charges shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth, the balance of the hole shall be filled with stemming, which may consist of sand or stone dust or similar inert material.
- vii) Contractor shall preferably detonate the explosives electrically.

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- viii) The explosives shall be exploded by means of a primer, which shall be fired by detonating a fuse instantaneous detonator (F.I.D) or other approved cables. The detonators with F.I.D. shall be connected by special nippers.
- ix) In dry weather and normal dry excavation, ordinary low explosive gunpowder may be used. In damp rock, high explosive like gelatin with detonator and fuse wire may be used. Underwater or for excavation in rock with substantial accumulated seepage electric detonation shall be used.
- x) Holes for charging explosives shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.
- xi) When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level.
- xii) Any rock excavation beyond an over break limit of 75 mm shall be filled up as instructed by Employer's Representative, with concrete of strength not less than M10. Stopping in rock excavation shall be done by hand trimming.
- xiii) Contractor shall be responsible for any accident to workmen, public or Employer's property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by Inspector of explosives, or any other Authority duly constituted under the State and / or Union Government as applicable at the place of excavation.

Stripping Loose Rock

All loose boulders, detached rocks partially and other loose material which might move therewith not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Employer's Representative, to fall or otherwise endanger the workmen, equipment, or the work shall be stripped off and removed from the area of the excavation. The method used shall be such as not to render unstable or unsafe the portion, which was originally sound and safe.

Any material not requiring removal in order to complete the permanent works, but which, in the opinion of Employer's Representative, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed.

Classification of Strata:

The decision regarding, classification of strata shall rest with the Engineer in charge and his decision shall be final and binding to the contractor.

All the materials encountered in the excavation shall be classified as under :-

Ordinary soil and soft murrum:

These will include all materials of an earthy or sandy nature, which can be easily ploughed or small shingle, and gravel, which can be easily removed.

Hard murrum:

This shall include all kinds of disintegrated rock or shale or inundated clay which can be removed with a shovel without difficulty and which do not require blasting.

Soft rock:

This shall includes all materials which is rock or hard conglomerate, all decomposed and weathered rock, highly fissured rock old masonry and also soft rock boulders bigger than 1/2 cubic meter and other varieties of rock. Which do not require blasting and which can be removed with the pie crowbars wedges and hammer.

Hard rock:

This shall include rocks, occurring in masses, which could best be removed by

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chiseling.

5.0 Shoring and Strutting:

- 5.1 Shoring & strutting if required shall have to be carried out by the contractor, for which any extra charge will not be paid.
- 5.2 During excavation if water connections, sewage connections, telephone lines khalkuva (soak pits) etc. are damaged by the contractor, the same shall have to be restored by the contractor without any extra cost.

6.0 Protection

- 6.1 The trenches shall be strongly fenced and red light signal shall be kept at night and arrangement of watchman to prevent accidents should be done. Sufficient care and protective measure shall be taken to see that the excavation shall not affect or damage the adjoining structure. The contractor shall be entirely responsible for any injury to life and damage to the properties etc. Necessary protection work such as guide ropes, crossing places, barricades, caution boards etc. shall be provided by the contractor.

- 7.0 The excavation in all sorts of soil, hard murram, soft rock or hard rock or any type of soil shall have to be carried out up to the required depth by the agency

8.0 Disposal of Excavated Stuff

- 8.1 No excavated stuff from trench are to be placed even temporarily nearer than 1.5 meter or greater distance up to 90 meter or as prescribed by the Engineer from the outer edge of trench. All excavated material will be the property of the owner. The rate of excavation includes sorting out of useful materials and stacking them separately as directed within specified lead. The excavated stuff suitable and useful for refilling or for other use shall be stacked at convenient places. The materials not useful in any way shall be disposed off as directed by the Engineer from the outer edge of trench.
- 8.2 The site should be cleared off on completion of work.

9.0 Additional Requirements

- 9.1 At the joints of pipes, the trench shall be excavated to an additional depth of 15 cm. and width of 30 cm. And length of 15 cm. beyond the edge of collar on both the sides or as directed. The rate include for such extra excavation made at the joints. The trenches shall be excavated perfectly in straight line. The bottom of the trench shall be kept as per invert level or as directed. To maintain the proper slope the usual method of site rails and boning rods shall be adopted. The contractor shall have to provide and fix and maintain sight rails and boning rods without any extra cost.

If the contractor fails or makes delay to give hydraulic test of the pipe line laid in any of the section, without any genuine reason, he shall be responsible to get any part of the length trenches refill in such case (i.e. before testing) for safety of pedestrian and/or vehicular traffic as found necessary by the engineer-in-charge without any extra cost. If found necessary and directed by the Engineer-in-charge, the contractor shall have to excavate the refilled trenches, during hydraulic test without any extra cost.

At all road crossings, trenches shall be excavated only for half width of the road and pipe shall be laid. The other half shall be excavated only after back filling over the laid pipeline is done so as to make it suitable for the traffic. The contractor shall provide diversion when the pipeline is to be laid along the road as required and shall

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maintain the diversion or any part of it, without any extra cost. At all road crossings, the pipe shall be laid below the crest of road.

- 9.2** The contractor shall break the road surface by chiseling to the exact width and length as shown on the drawing or as directed by the Engineer-in-charge.
The excavated stuff shall be deposited in uniform layers to avoid mixing with other kind of materials at non-objectionable place or as directed by the Engineer-in-charge.

10.0 Measurement and Payment

- 10.1** Payment shall be made as per actual work done. On cu mt. unit bases

- 10.2** The rate for the item of excavation shall include the following unless and otherwise mentioned.

- (a) Clearing of site
- (b) Setting out work including all materials and labour.
- (c) Providing and subsequently removing, shoring and strutting outing slopes etc.
- (d) Excavation and removal and staking of all excavated stuff as directed.
- (e) Necessary protection including labour materials equipment etc. to ensure safety and protection against risk or accident.
- (f) Providing facilities for inspection and damage to property if caused during progress of work.
- (g) Compensation for injury to life and damage to property if caused during progress of work.
- (h) Restoring of water supply connections, sewer connections, telephone lines, khalkuva soak pits Septic Tank etc. if damaged by contractor without extra payment.
- (j) Clearing the site on completion of works directed by the Engineer.

11.0 Dewatering in all Sort of Soil.

As per above item no. 1 para 1.2 Schedule-B2 (A) Cleaning Repairing and Renovation of Existing Line.

Item-10.1

Lowering, laying and jointing C. I. S & S Spun pipes suitable for Tyton joints / Mortar lined D. I. Pipes of various classes with CI / MS specials of following diameters in proper position, grade and alignment as directed by Engineer-in-charge including hydraulic testing etc. comp.

GENERAL:

The pipes & joints shall be procured, supplied by the Contractor at work site at his own cost. Every care shall be taken in carting them to site. During transportation any damage shall be occurring to pipes for fittings the replacement of pipes given by the contractor at his own cost.

The trenches shall be well leveled so that pipes are laid evenly along them. The pipes shall be fixed within two rubber rings to be supplied by department at the place shown in schedule A, if directed by the Engineer-in-charge or mentioned in item of schedule B. The

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specification for titan joints i.e. Rubber Rings shall be as per details specification material section Item No-37.

The contractor shall make his own arrangement for obtaining permission for storing & stacking of pipes etc. from land boards whether they are Government, Municipal Local Bodies or Private land owner.

Every pipes before lowering into the trenches shall be got checked and thoroughly cleaned and the beds of the trenches shall be properly graded and leveled as required on the line, without any claim for extra cost whether it is required. The pipe shall be carefully lowered into the trenches with the help of a suitable type of chain pulley blocks, which shall first be approved by the Engineer-in-Charge. Each pipe shall be properly jacked and the spigot perfectly fixed into the socket. No jointing operation shall be started unless the gradients levels are approved by the Engineer-in-Charge or his representatives.

The pipes shall be laid complete in centerline ranged accurately by means of a string attached to both marked center of site rails and no deviation shall be permissible without the permission of Engineer-in-Charge. The pipe shall be laid in reasonably dry trenches and no circumstances on slushy bedding.

The pipes shall be brushed before lowering any laying or remove any soil or dirt etc. that may have accumulated.

The inside socket and outside of the spigot-shall be carefully cleaned. The pipe shall be lowered carefully with socket and toward and the flow of water or up till or as directed and spigot and should be carefully inserted into the socket and the space shall be filled with the joint.

DI specials shall be conforming to IS 9523-2000 and flanges shall be of PN-10 class.

TESTING OF WATER PIPES:

After each section of the pipeline has been completed it shall be tested for water tightness before being covered. The contractor shall at his own cost fill up water in pipe line and given necessary hydraulic test section by section and the pipe line shall stand the pressure which shall stand the pressure which shall exceed the working pressure by (a) 50% of the highest pressure in the section. (b) 30m whichever is less without showing any leakage or sweating any where in the pipes joints specials valves etc. if any defect are found the contractor shall be made good the same at his own cost.

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Any leaking joints shall be made good and above test pressure in to be lowered gradually after satisfactory test is & over.

Local body will not be able to provide water for testing of the pipelines & water containers of the project. This shall have to be managed by the contractor at his costs and risk.

The hydraulic test shall be given again if considered necessary by the Engineer or his representative to show that no further leakages or sweating is there. The contractor shall have to make necessary arrangements for water testing as well as plugging the opened of pipes etc. as directed without claiming any extra cost. The pipelines shall be kept filled with water for a work lines shall be kept filled with water for a week or till it is situated for testing is done.

If the pipe lines are laid in detached sanctioned & not in continuous length due to any reasons such as non availability of specials or due to obstacle etc. The contractor shall see that no end of pipes length is kept open-ends are immediately covered up either by suitable blank flange or cap slug or by means of double layer gunny bags clothes tied properly by mild steel wire without any claim for extra-cost.

The pipe laying across the state highways, national highways etc. will have to be done either through open cut method or through push through method depending upon the requirement to be prescribed by the sanctioning authority. However, mostly it would be push through method.

Mode of measurement and payments

Payment will be as per payment schedule

Item-11.1.2.3.4

Lowering, laying and jointing R. C. C. pipes in C. M. 1:1 1/2 of following diameters in proper position, grade and alignment at all level as directed by Engineer-in-charge including conveyance from stores to site of work, labour, giving hydraulic testing as per ISI code. Class NP3General

The work includes providing and laying R.C.C. pipe of specified internal dia meter in slopes including loading and unloading pipes to site of work and all other materials and labour required for proper completion of work to the approved design. The pipes shall confirm the relevant Indian standard (IS 458-1991) and its latest revision. The pipes shall got approved in advance before collection to site from Engineer-in-charge

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internal diameter specified under the item shall be available through. The thickness of pipe shall be in conformity with the respective diameter of pipe.

The specification for mortar shall be as per masonry item except that the proportion shall be 1:1 hemp to be used for chaulking joint shall be of approved quality

Handling & Laying Pipes

Reasonable care shall be taken in loading, transporting and unloading pipes. Handling shall be such as to avoid impact. Gradual unloading by inclined plane or chain block is recommended. Any damage during loading, unloading carting handling or laying shall be met with from the contractors account. All pipe selections and connections shall be inspected carefully before being laid. Any broken or defective pipes or connections shall not be used. Pipes shall be laid horizontal & vertical in proper line and grade as shown in drawing or as per direction of Engineer-in-charge. The pipe shall be laid true to line and grade as specified.

The joints shall be filled with just sufficient qty. of hemp dipped into bitumen or soaked in cement slurry. The bitumen shall have to be warmed to achieve sufficient plasticity. The chaulking space shall have to be filled with mortar of cement and sand (1:1) having proper workability.

Curing Joints

Every joint shall be kept wet for not less than 28 days for curing. The section of the pipeline laid joints etc. shall be protected and covered with wet gunny bags.

The item includes all labour for necessary connection 75 mm dia drainage holes from below into the pipe and receiving 20 cm. Internal diameter porous block shaft from top and bottom of pipe. For collection of drainage required, leveling, jointing and fixing in alignment is included in the scope of work.

Testing

The pipe line laid, shall be tested hydraulically when required. The line shall be filled completely with water and shall be kept filled for a week. If the leakage is found the contractors shall make it good without any extra cost.

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Mode of Measurement & Payment

The payment shall be made on running meter basis of the completed item as laid in position with all leads and all lifts etc. complete.

Item-12.1.2

Lowering, laying, Jointing & welding in position to correct line & level M.S. Pipe with outer gunniting & inside lining/Epoxy painting on pedestal or chairs upon prepared formation or prepared bedding in trenches the rates include conveyance from store to site of work loading, unloading, joint plastering, hydrotesting etc.complete.4mm to 7mm Thick

The item includes following operations:

- i) Lowering and laying pipes and specials in trenches.
- ii) Welding of pipes and specials as per IS 5822: 1994
- iii) Testing of welding joint as specified in the IS 5822 : 1994 para 6.2.
- iv) Hydraulic testing of the pipes

M.S. pipe shall be lowered, laid and jointed by welding including preparation of ends wherever required, grinding as per relevant IS code of welding, testing etc. complete with hydraulic testing complete as per IS: 5822-1994.

SPECIFICATIONS FOR WELDING:

These specifications cover shop welding as well as site welding for requirement of M.S. pipe in particular length and M.S. specials. Following types of joints are considered for connecting the pipes or pipe and specials.

- i) Fillet weld with swaging of one end of pipe
OR
- ii) But weld without swaging of one end of pipe.

WELDING UNDER RAIN AND STRONG WIND:

If welding is to be done during rain or strong wind, suitable protection shall be provided for the parts to be welded and the welder. Pre-heating of electrodes shall be done so as to remove any moisture. Where this is not practicable, no welding shall be done on piping under such conditions.

All the types of bends, scour teed, air valve tees, tail pieces of valves and water meters etc. shall be fabricated as per standard practice from M.S. pipe to be supplied by Contractor. The contractor shall have to provide M.S. pipe pieces and 18 to 20 mm thick flanges of required diameter for branch of tees, reducer, enlargers etc. and

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paid on meter basis in item of supply of M.S. pipe. Fillet or butt weld as may be required shall do joint. Holes of appropriate diameter shall be drilled in flanges of specials at appropriate spacing to facilitate jointing of sluice valves, water meter, air valves and other types of valves.

The following does are applicable for welding:

IS: 814 code for covered electrode for metal Arc welding for mild steel.

IS: 815 CLASSIFICATION AND CODING OF COVERED ELECTRODES FOR METAL Arc WELDING OF MILD STEEL AND LOW ALLOY HIGH TENSILTE STEEL.

IS: 1663 Part – 1 / part – II regarding method of tensile testing of steel sheets and stripes.

IS: 3600 codes of procedure for testing of fusion welding joints and weld metal in steel.

ELECTRODES:

The contractor shall use preferably Advani Orelikon overcord S.S. Greecon (Blue) or other electrodes as approved by Engineer-in-Charge depending upon the thickness of the plate and type of joint. They shall use standard current and Arc Voltage required for the machine in use as per manufacturer's directions. Welding electrode shall conform to test procedure of IS:814 and IS:815. The contractor shall submit manufacturer's test certificate for each batch of electrode use by him. Electrodes shall be stored unopened in original containers. Electrodes when used shall be free of rust, oil, grease and all other matter which could be harmful for the good quality of welding.

QUALIFICATION OF WELDERS:

Only such welders who are experienced and whose workmanship is satisfactory shall be employed for the work. Welders will be individually tested for the welding skill before they are allowed to work.

WELDING PROCESS:

All welds shall be made down – hand by manual or automatic shielded arc welding process. Welding shall be done so that there shall be through fusion and complete penetration. Sealing runs in the inside shall be done manually. The joints for seams and circular welding shall be square but as per standard practice as per of IS:816 shall be accepted.

END PREPARATION:

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Ends to be welded will be preferably made by machining. However preparation of ends may be made by flame cutting provided all grooves and irregularities are ground off and all the oxidation is removed.

CLEANING:

The ends to be welded shall be properly cleaned. All paint, oil, grease, rust and oxide as well as earth, sand or any other material sticking which could be harmful to the welding should be removed. Ends shall be totally dry while welding. No dirt or debris will be permitted in the pipeline. Prior to alignment the inside of each joint shall be adequately scrapped by approved means to the satisfaction of the Engineer-in-charge.

ALIGNMENT AND SPACING:

Pipes to be welded shall be aligned and fitted with external line up clamp and spaced in a suitable manner, so as to hold ends during welding at a distance to ensure full penetration. Root opening shall not be more than as specified. Internal off set shall not exceed 1.5 mm. The pipe piece to be butt welded shall be coupled by means of pipe couplers or by yokes or bridge "c" clamps. Owner's inspector may check and approve the joint fit-up and alignment prior to the commencement of welding.

WELDING TECHNIQUE:

ROOT PASS:

a) FOR BUTT JOINTS:

The maximum electrode size shall be 3.15 mm (10 SWG) and the electrode holder shall be connected, having due regard for the polarity requirement of the electrode approved for the use for pipe in horizontal position. Upward technique shall be used with the recommended values of current.

The root pass of butt joints, regardless of the technique used, shall be such as to achieve full penetration. However, projection of weld metal into pipe bore shall not exceed more than 5 mm. Root grooves and defective restart of the welding shall be carefully avoided. For pipes having dia. greater than 500 mm all circumferential joints shall be welded on both sides i.e. outside and inside.

At each interruption of welding and on completion of each run, craters, weld irregularities and slag shall be removed by grinding or chiseling. After the welding is started and until the joint has been completed displacements, shocks, vibration or stresses shall be avoided in order to prevent cracks or breaks in the weld.

FOR FILLET WELDS:

TECHNICAL SPECIFICATION

The maximum electrode size shall be 4 mm (8 SWG). On completion of the root pass, any visual defect or irregularity shall be ground off to avoid defects or irregularities in the next pass.

JOINT COMPLETION:

Electrode size of more than 8 SWG (4 mm) shall not be allowed for filling of the weld upward

Technique shall generally be used for pipe in horizontal and vertical position welding. At each interruption of welding and after each run of welding is completed, chipping and slag removal shall be done. When the welding is completed, butt joints shall have a cover pass. It shall be slightly convex and fuse into the surface of the base metal in such a manner as to have a gradual notch free finish and good fusion at the joint edges. Welds shall have a regular appearance and shall be free from defects. Welder number shall be stamped alongside each weld whenever required by the Engineer-in-Charge / consulting engineer.

WELDING EQUIPMENT, TOOLS AND SUPPLIES:

All welding machine, line up clamps, beveling machines, cutting torches and other equipment, tools and supplies used in connection with the welding work shall be kept in good working condition so as to produce sound welds. The welding machine shall have adequate controls for obtaining current adjustment for all pipe line welding requirements. Ground clamps shall be of such design as to be dependable and should not deflect the pipe and with as large a contact area as is practicable.

PREPARATION OF PIPE FACE FOR WELDING:

Before aligning, assembling and welding pipe faces shall be cleaned by scrapping by wire brushes or by any other method approved by Engineer-in-Charge. The correctness of shape and bevel edge will be checked with templates and required corrections carried out before welding.

WELDED JOINTS:

As required in the welding work following points shall observe. The contractor shall use the standard electrode depending on thickness of the plate and type of joints. They shall also use standard current and arc voltage required for the machine in use as per the direction of the Engineer-in-Charge. Welding electrodes shall conform to IS 814 of Indian or equivalent foreign make of required quality approved by Engineer-in-Charge shall be used wherever.

GAS CUTTING:

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Gas cutting if required for preparing in site distance pieces, straps etc. and cutting out holes in the pipe line shall have to be carried out by the contractor at his own cost. After cutting the edges shall be made smooth and even by using electrical or pneumatic grinder so as to remove all inequalities. Care shall be taken to see that the shape of the material cut does not defect in any way at the time of cutting.

BALNK FLANGES:

Blank flanges shall be provided at all ends left unattached for temporary closure of work and also for commissioning a section of pipeline for testing the line laid. For temporary closure non pressure blank flanges consisting of M.S. plate tack welded at the pipe ends may be used. The blank flanges or domes designed as per requirement shall be provided. Separate payment will not be made for the flanges or domes.

STRAPS:

Whenever pipe line is to be done from two faces and / or required to be done in broken stretches due to any difficulty met at site the final connection has to be done by introducing stripes to cover the gap up to 30 cm length. Such straps shall be fabricated in field by cutting pipes splitting them longitudinally and tapping them over the ends connected in the form of collar. The collar shall be in two halves and shall have the inside diameter equal to the outside diameter of pipe to be connected. A minimum lap of 8 cm on either end of the pipe shall be kept and fillet welds shall be run for circumferential joint. The longitudinal joint of the collar shall be butt welded. The material for straps and labor for doing above work is included in the rate, and nothing extra shall be paid for material as well as labor. The joints shall be provided with Reinforced cement mortar coating outside and cement mortar lining inside.

HYDRAULIC TEST:

The final high pressure test on the completed sections over ground or in the trench shall be performed before back filling. The testing shall be carried out in strict compliance with the testing procedure that shall be specified by the Engineer-in Charge / consultant. The final hydro-static pressure test on the pipe line shall be performed with water. All arrangement required for testing shall be made by the contractor and after testing they shall be removed to the entire satisfaction of the contractor and after testing they shall be removed to the entire satisfaction of the Engineer-in-Charge. Water to be used for testing should be clean, arranged and supplied by the contractor. While the line is full, hydro-static pressure shall be applied at 1.5 times the internal design pressure and maintained on the line without significant loss. The testing shall be at least for 24 hours. Failure of the line disclosed by loss of pressure shall be located and reported by the contractor. Cost of required repairs shall be borne by the contractor. Before taking delivery and commencement he should

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inspect the pipes and if any defect is noticed at the time of taking over he should bring it to the Engineer-in-Charge.

LOWERING:

- 1) After the application and inspection of coating, the entire welded pipes shall be normally lowered into the finished trench next day after completion of the coating where ever required.
- 2) The trenches shall be of sufficient width, to enable lowering of pipe without difficulty. The trench bottom shall not be uneven.
- 3) 15 Cm thick bedding be provided using the selected excavated soil/murmur without any extra cost. The bedding shall be watered, rammed, and well consolidated before laying of pipes.
- 4) Water present in the trench at the time of lowering shall be bailed out by the contractor without any extra cost.
- 5) the pipes shall be brushed before lowering and laying or remover any soil or dirt etc. that may have accumulated".

CONTRACTOR'S SCOPE:

Cutting of pipes required for fabricated specials or for completing the gaps should be cut in such a way that the wastage shall be minimum.

THE SCOPE FOR THE ITEM COVERS:

Cost of additional excavation required for jointing, clearing the site of all shrubs, bushes and trees and dewatering whenever necessary.

Cost of all materials like steel, cement, aggregate, bolts, nuts, washers, white lead, grace, rubber packing etc. necessary for pipe lowering, laying and jointing.

Labor for laying pipes in trenches to correct alignment at required depth with tools including cutting of pipes and specials if required for laying the pipes, including connecting pipes, including connecting pipes to specials and appurtenances.

Cost of scaffolding, tools and plants, ropes etc.

Protection of exciting works from damage and cost of repairs to the damages carried out to the exciting structures, poles, sewer, pipe line, telephone/electricity cables, and electric lines. Pas pipe line, etc.

Labor for making joints including welding with all materials for joints, tools as well as test for welds including testing of welded joint as per IS 5822 : 1994 para 6.2 etc.

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Testing of pipes for leakage under water pressure, and flushing the pipes after testing. Water required for this hydraulic testing and construction work shall have to be arranged by the contractor at his own cost.

Re welding defective joints:

Providing temporary arrangements to keep the pipe clean and in position.

Labor for cutting pipes by gas cutting or any other method and laying and fixing the same. Labor for fabricating necessary specials such as bends, tees, reducers, enlarges, branch, flange etc. Using M. S. Plates including drilling holes in flanges as may be required.

Carting surplus pipes, pieces, scrap etc. to stores at plant site, head work or sub head work sites.

Supply of any other material or labor not mentioned above but required to complete the work.

METHOD OF MEASUREMENT OF PIPES:

The measurement shall be recorded in running meter of pipe length laid along center line or axis of pipe line including tees, enlarges, reducers and bends correct up to 0.01 M length. No payment shall be made for overlaps etc.

The payment shall be paid after completion of whole item as mentioned in price bid on **Running Meter** basis and 10% shall be withheld for satisfactory hydraulic testing".

Payment will be as per payment schedule.

Item-13.1.2.3.4

Lowering, laying and jointing in position following C. I. / D/F Reflux valves, Butterfly valves, Sluice valves and Air valves including cost of all labour, jointing material, including nut bolts and giving satisfactory hydraulic testing, etc. complete. Sluice valves, Butterfly Valves, Reflux

1 General

The contractor shall be covering manufacturing, supplying and delivery of: Sluice valve conforming to IS: 2906-1984 & IS: 780-1984 or its latest revision (Specification for sluice valves (50 to 900 mm size) with ISI certification. Flanges shall be machined on faces and edges to ISO 7005, IS 6392 or BS 4504.

- a) They shall be non-rising spindle type. The valve shall be furnished with bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe lining. The gap between the shoe and channel shall be limited to 1.5 mm.
- b) The gate face rings shall be securely pegged over the full circumference.

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- c) Valve of 450mm and above shall be provided with thrust bearing arrangement for case of operation.
- d) Valve of diameter 450 mm and above shall be provided with enclosed gear arrangement for case of operation. The operation gear of all valves shall be such that they can be opened and closed by one man-against an unbalanced head 15 % in excess of the maximum specified ratio. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N.
- e) All valves, spindle and hand wheels shall be positioned to give good access for operational personnel.
- f) All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.
- g) Valves shall be double flanged type and the face shall be parallel to each other and flange face should be at right angles to the valve centerline. Backside of valve flanges shall be machined or spot faced for proper seating of the head and nuts.
- h) Valves buried or installed in underground chamber, where access to a hand wheel would be impracticable, shall be operated by means of extension spindle and/ or keys.
- i) Valves shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position.
- j) The valve stem, thrust washer, screws, nuts and all other components exposed to the water shall be of a corrosion resistant grade of stainless steel.
- k) Valves shall be free from sharp projections.
- l) Butterfly, Non return valves and rising spindle sluice valves shall be provided with bypass arrangement. This may be integral with valve or connected between pipes.

2 Standards

The C.I. sluice valves to be manufactured, supplied and delivered under the scope of this contract shall be manufactured in accordance with and conforming to Indian standard specifications as given below: with ISI certification mark on each sluice valves.

3 Temperature Variation

All sluice valves manufactured, supplied and delivered shall be subjected to drinking water under variable temperature condition ranging from 4⁰ to 45⁰ C

4 Marking

The legible and in deniable marking upon each valve shall indicate the following:

- (1) ISI certification mark on each sluice valve.
- (2) Manufacture's brand name and/or trade mark.
- (3) Size of valve and nominal pressure of valve.
- (4) Serial number of cast.
- (5) Serial number in punch
- (6) Where a valve has been tested for only open end test, it should be marked 'O' distinctly and permanently.
- (7) Any other important matter that the manufacturer deems fit to be inscribed embossed.

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5 Test Certificate

- 5.1 The contractor shall always provide manufacture's test certificate in accordance with every batch/ lot as valves so manufactured and supplied.
- 5.2 The contractor shall also produce; in addition to manufacture's test certificate the inspection certificate issued by the authorized person /agency appointed by Engineer/owner for the same purpose. The inspection charges of the authorized person/agency as fixed by the owner shall have to be borne by the contractor and the necessary payment to the inspecting agency shall be paid by the contractor as per the terms and condition of the owner.

6 Nominal Pressure

- 6.1 Sluice valves shall be designed by nominal pressure (PN) defined as the maximum permissible gauge working pressure in Mpa as "PN-I" (Mpa= 10 kgf/m² approx)

Class of Valve	Working pressure of body	Working pressure for seat
PN 0.6	5 kg/sq.cm	9 kg/sq.cm
PN 1.0	10 kg/sq.cm	15 kg/sq.cm
PN 1.6	16 kg/sq.cm	24 kg/sq.cm

- 6.2 The nominal size shall refer to the nominal bore at any point, shall not be less than the nominal size required.

7 Material:

- 7.1 The materials for the different component parts of the sluice valve shall confirm to requirements given in Table

Materials for components parts of sluice valve

Sr no	Component	Material	Ref. to	Grade or designation
1	Body, bonnet dome, wedge, stool cover, stuffing box, gland thrust plate, cap, hand wheel.	Grey cast iron	210-1978(1)	FG-250
2	Stem	High tensile brass	320-1980(2)	HT - 2
3	Wedge nut	Leaded tin bronze	318-1981 (5)	LTB-2
4	Body seat ring, wedge facing ring	Leaded tin bronze	318-1981 (5)	LTB-2
5	Bolts	Carbon steel	1363-1967(7)	Class 4.6
6	Nuts	Carbon steel	1367-1967(7)	Class 4
7	Bonnet gasket	Compressed fiber Board	2712-1979(8)	C

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8	Gland packing	A) Jute & hemp b) Asbestos	5414- 1969(10) 4687- 1980(11)	-- --
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- (1) Specification for grey iron castings (third revision).
- (2) Specification for high tensile brass rods and sections (revised).
- (3) Specification for leaded tin bronze ingots and casting (revised).
- (4) Specification for technical supply condition threaded fasteners (first revision)
- (5) Specification for compressed asbestos fiber jointing (first revision)
- (6) Specification for gland packing, jute and hemp.

7.2 Cast Steel double-flanged sluice valve/butterfly valves with two tailpieces suitable to pipe shall be supplied and carted by the contractor as per latest IS. The rate shall include loading, unloading and stacking at site.

7.3 The sluice valve/butterfly valves and tailpieces shall be examined before laying for cracks and other flaws. They shall be undamaged in all respect.

7.4 The sluice valves/butterfly valves shall be operated before laying.

7.5 All grits and foreign materials shall be removed from the inside of the valves before placing.

7.6 All the four faces shall be thoroughly cleaned and coated with a thin layer of mineral grease.

7.7 The tightening of gland shall be checked with a pair of inside-calipers. Clearance between the top of stuffing box and the underside of the gland shall be uniform all the sides.

8 Manufacture:

Sluice valve bodies for 80 mm to 900 mm size valves shall be provided with double flanged ends for connection.

9 Flanges:

The flanges and their dimensions of drilling shall be in accordance with the requirements given in I.S. 1538 (Part I to XXII) 1976 (Specification for cast Iron fittings for pressure pipes for water, gas and sewage) or its latest revision.

10 Testing:

10.1 Hydraulic test:

Each valve shall be subjected to hydraulic tests as described in Appendix – B of IS: 2906-1984 to the test pressure for a duration as specified in table – 7 of IS: 2906 and shall show no sign of leakage under these tests.

10.2 Liquid Penetration Test:

The forged steel stems shall not show any sign of flaw when subjected to liquid penetration flaw detection test in accordance with IS: 3658-1981.

12 Measurement and payment:

The rate shall be paid per number of valves fixed and tested as directed.

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85% payment will be made on receipt of valves in good condition at the site of work. 10% will be released on satisfactory lowering & fixing in position of valves and remaining 5% will be paid after successful testing.

- **Lowering, laying and jointing in position following C. I. / D/F Reflux valves, Butterfly valves, Sluice valves and Air valves including cost of all labour, jointing material, including nut bolts and giving satisfactory hydraulic testing, etc. complete**

1 Lowering and jointing in position

1.1 Supply of Material

- 1.1.1 Cast iron double-flanged sluice valve with two tailpieces suitable to pipe conforming to the latest relevant IS shall be supplied and carted by the contractor to the site of work including loading, unloading and stacking at site.
- 1.1.2 The sluice valve and tailpieces shall be examined before laying for cracks and other flaws. They shall be undamaged in all respect.
- 1.1.3 The sluice valves shall be cleaned before laying.
- 1.1.4 All grits and foreign materials shall be removed from the inside of the valves before placing.
- 1.1.5 All the four faces shall be thoroughly cleaned and coated with a thin layer of mineral grease.
- 1.1.6 The tightening of gland shall be checked with a pair of inside-calipers. Clearance between the top of stuffing box and the underside of the gland shall be uniform all the sides.

1.2 Jointing Material

- 1.2.1 The contractor shall provide all necessary jointing materials such as nuts bolts, rubber packing, white zinc, jute, lead wool etc.
- 1.2.2 All tools and instruments, which are to be required for installation of sluice valve shall be provided by the contractor.
- 1.2.3 All jointing materials shall be got approved from the engineer-in-charge before use

The nuts and bolts shall conform to the relevant IS.

The rubber packing shall confirm all specifications as narrated in respective IS.

1.3 Installation

- 1.3.1 The sluice valve shall be lowered in to the trench carefully, so that no part is damaged during lowering operation.
- 1.3.2 If necessary tailpieces shall be fitted with sluice valve first outside the trench and then lowered in to the trench.

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- 1.3.3 The rubber packing shall be three ply and of approved thickness. The packing shall be of full diameter of the flange with necessary holes and the sluice valve bore. It shall be even at both the inner and outer edges.
- 1.3.4 The flange faces thoroughly greased.
- 1.3.5 If flange faces are not free, the contractor shall use thin fibers of lead wool.
- 1.3.6 After placing the packing, nuts and bolts shall be inserted and tightened to make the joint.
- 1.3.7 The valve shall be tightly closed when being installed to prevent any foreign materials from getting in between the working parts of the valve.
- 1.3.8 Each flange bolt shall be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively.
- 1.3.9 The sluice valve shall be installed in such a way that its Spindle shall remain in truly vertical position.
- 1.3.10 The other end of tailpiece shall be fitted with pipes so that continuous lines can work.
- 1.3.11 Extra excavation required for facility of lowering and fixing sluice valve shall not be paid for.

1.4 Testing

- 1.4.1 After installation of sluice valve the same is tested to 1½ times of its test pressure.
 - 1.4.2 The joints of sluice valve shall withstand the test pressure of pipelines.
 - 1.4.3 Defects noticed during test and operation of sluice valve shall be rectified by the contractor at his own cost without any extra claim to the entire satisfaction of the Engineer-in-charge.
- 1.5 Measurement and payment:**
The rate shall be paid per number of valves fixed and tested as directed.
65% payment will be made on receipt of valves in good condition at the site of work.
25% will be released on satisfactory lowering & fixing in position of valves and remaining 10% will be paid after successful testing.

Item-14.1,2,3,4

Providing and constructing Sewer manholes, scraper manholes and unit house connection chamber, as per the type design in brick masonry in C. M. 1:3 inside 20 mm thick water proof & outside 12 mm plastering in C. M. 1:3 necessary coping in R.C.C.M. 200 fixing C. I. steps and fixing manhole frame and covers (But excluding supply of manhole frame and covers) over manholes and house connection chambers and fixing Manhole covers (but excluding supplying of manhole covers) over scraper manhole etc. complete, providing and fixing safety chain wherever necessary as per

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the stipulations in the type design complete (excl. excavation).I S 4111-1986 Part 1 5455-1997 & 4883-1988.

Sewer Manholes

1. Location

Manholes shall be constructed at places approved by the Employer's Representative.

In case of manhole along the river or drain the top of Manhole shall be raised to safe height above the highest flood level of river /drain as directed by E.I.C.

2. MATERIALS

Water shall conform to M-1, Cement Conform to M-3, Stone coarse aggregate of 20 mm nominal size shall conform to M-12, Grit shall conform to M-8, Steel reinforcement shall conform to M-18-19. Flyash brick shall conform to M-15A, Cement mortar of specified proportion shall conform to M-11.

Manhole cover with frame of required size and weight shall be procured by the contractor.

3. Workmanship:

3.1 Excavation

The excavation for construction of manhole including dismantling of all types of roads surface guarding, barricading, lightening the trenches, dewatering if required, removing and replacing, shifting of telephone/electric cables, pipe line etc. and all other safety provisions like shoring and strutting etc. till refilling of trenches and completion of manhole construction, stacking of excavated stuff within the specified lead, back filling of selected excavated earth, watering and consolidation etc. complete shall be carried out as per relevant specification of Excavation.

3.2 Plain Cement Concrete

The water, sand, cement & stone aggregate of 40 mm nominal size shall be used of approved quality as per standard specification in I.S. 456. Detail specification of materials as given in General Technical Specification shall be observed.

Before starting concrete the bed of foundation trenches shall be cleared of all loose materials, leveled, watered and rammed as directed.

3.2.1 Mixing:

The concrete shall be mixed in a mechanical mixer at the site of work. Hand mixing may however be allowed for smaller quantity of work if approved by the Engineer-in-charge. When hand mixing is permitted by the Engineer-in-charge in case of breakdown of machineries and in the interest of the work, it shall be carried out on a water tight platform and shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However, in such cases 10% more cement than otherwise required shall have to be used without any extra cost. The mixing in mechanical mixer shall be done for a period of 1.5 to 2 minutes. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose.

3.2.2 Transporting and placing the concrete:

The concrete shall be handed from the place of mixing to the final position in not more than 15 minutes by the method as directed and shall be placed into

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the final position, compacted and finished within 30 minutes of mixing with water i.e. before the setting commences.

The concrete shall be laid in layers of 15 cm. to 20 cm.

3.2.3 Compacting:

The concrete shall be rammed rapidly with heavy iron rammers to get the required compaction and to allow all the interstices to be filled with mortar.

3.2.4 Curing:

After the final set, concrete shall be kept continuously wet, if required by ponding for a period of not less than 7 days from the date of placement.

4. REINFORCEMENT:

All the reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position during placing of concrete by annealed No. 1 binding wire not less than 1 mm is size and by using stay block ornatly chair spacers, metal hangers, supporting wires or other approved devices it sufficiently close intervals. Bars shall not be allowed to bag between supports nor displaced during concrete of any other operation of the work. Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To prevent reinforcement from corrosion, concrete cover shall be provided as indicated on drawings.

Bars shall be bend cold to specified shape and dismensions or as directed, attain proper radius of bends, Bars shall not be bent or staightened in a manner that will injure the materials. Bars bend during transport of handling shall be straightened before being used on the work. Unless otherwise specified for mild steel a 'U' type hook at the end of each bar shall inveriably be provided to main reinforcement.

In case which are not round and in case of deformed bars, the diameter shall be taken as the diameter of circle having an equivalent effective area. The cold twisted steel bars shall be used or without hooks at the ends. Deformed bars without hooks shall however, comply with relevant enchorage requirements.

Bars crossing each other where required shall be secured by binding woros (annealed) of size not less than 1 mm in such a manner that they do not slip over each other at the time of fixing and concreting.

As far as possible bars of full length shall be used. In case this not possible overlapping of bars shall be done as directed. The overlaps shall be staggered for different bars and located at points along the span where shear not bending moment is maximum.

When permitted or specified on the drawings joints of reinforcement bars shall butt welded so as to transmit their full stresses. Welded joints shall preferably located at points when steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section not more than 20 percent of the rods are welded. It shall be ensured that no viods are left in welding and when welding is done in two or three stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, grease,

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paint and other foreign matter before welding. Only competent welders shall be employed on the work.

Bricks for Sewer chamber:

Bricks used for construction of sewer man hole chamber shall conform to the IS 4883-1988. They shall be sound, hard, and homogeneous in texture, well burnt in kiln without being vitrified, table molded, deep red, cherry or copper colored, of regular shape and size and shall have sharp and square and parallel faces. The sewer bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing ungrounded particles and/or which absorb water more than 1/6th of their weight when soaked in water for twenty-four hours shall be rejected. Over burnt or under burnt bricks shall be liable to rejection. The bricks shall give a clear ringing sound when struck and shall have a minimum crushing strength of 50 kg/sq.cm. Unless otherwise noted in drawings. The class and quality requirements of bricks shall be as laid down in IS: 4883-1988.

The size of the brick shall be 23.0 x 11.5 x 7.5 cm. unless otherwise specified; but tolerance up to ± 3 mm in each direction shall be permitted. Only full size brick shall be used for masonry work. Brickbats shall be used only with the permission of Employer's Representative to make up required wall length or for bonding. Sample bricks shall be submitted to the Employer's Representative for approval and bricks supplied shall conform to approved samples. If required by the Employer's Representative, brick sample shall be tested as per IS: 3495 by Contractor. Bricks rejected by the Employer's Representative shall be removed from the Site within 24 hours.

5. Cement Mortar

Mortar for brick masonry shall be prepared as per IS: 2250. Manholes shall be constructed in brick masonry with cement mortar (1:3) unless otherwise specified. Gauge boxes for sand shall be of such dimensions that one bag containing 50 kg. of cement forms one unit. The sand shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be as approved by the Employer's Representative. If required by the Employer's Representative Sand shall be thoroughly washed till it is free of any contamination.

For preparing cement mortar, the ingredients shall first be mixed thoroughly in dry conditions. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall be used within 25 minutes of mixing. Mortar left unused in the specified period shall be rejected.

The Contractor shall arrange for tests on mortar samples if so required by Employer's Representative. Re tempering of mortar shall not be permitted.

6. Brick Masonry

All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work of manholes shall be in the proportion specified in drawing, and as per I S 2212-1962 Brick work 230 mm thick and over shall be laid in English Bond unless otherwise specified. 115 mm thick brick work shall be laid with stretchers. For laying bricks, a layer of mortar shall be spread over the full width of suitable length of the lower course. Each brick shall be pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall

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be laid with frogs uppermost.

All brickwork shall be in plumb and square/ circular unless otherwise shown on drawing and true to dimensions shown. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be leveled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes unless otherwise specified. All interconnected brickwork shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the work shall be left more than one course lower than the adjacent work. Where this is not possible, the work shall be raked back according to bond (and not saw toothed) at an angle not exceeding 45 degrees. But in no case the level difference between adjoining walls shall exceed 1.25 M. Workmanship shall conform to IS: 2212.

Brick shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 10 mm. The face joints shall be raked to a minimum depth of 12 mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the plastering to be done. When plastering is not required to be done, the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If mortar in the lower courses has begun to set, the joints shall be raked out to a depth of 12 mm before another course is laid.

7. Cement Plaster

All joints in masonry shall be raked to a depth of 12 mm with hooked tool made for the purpose when the mortar is still green and in any case within 48 hours of its laying. The surface to be rendered shall be washed with fresh clean water free from all dirt, loose material, grease etc. and thoroughly wetted for 6 hours before plastering work is commenced. Concrete surfaces to be rendered will however be kept dry. The wall should not be too wet but only damp at the time of plastering. The damping shall be uniform to get uniform bond between the plaster and the wall.

The proportion of the cement mortar shall be as approved on relevant drawings. Cement shall be mixed thoroughly in dry condition and then just enough water added to obtain a workable consistency. The quality of water, sand and cement shall be as per relevant I.S 383. SRC Cement to be used for internal plastering. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to remain for more than 25 minutes after mixing with water.

Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

Plastering with water proofing shall be done on inner face of brick masonry in cement mortar (1:3) and 20 mm thick unless otherwise specified, as per IS only and cement should be used SRC for inside plastering.

12 mm thick plastering in C.M. 1:3 shall be done outer face of brick masonry of chambers in C.M. 1:3, as per IS only.

Plastering work inside of M H Chamber shall be carried out in two layers, water Proof, to the inner face, the first layer being 14 mm thick and the second layer being 6 mm thick by using water proof compound as per I S

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standard. The first layer shall be dashed against the prepared surface with a trowel to obtain an even surface. The second layer shall then be applied and finished leaving an even and uniform surface, trowel finished unless otherwise approved by the Employer's Representative.

8. Cement Concrete Channel

The channel for the manhole shall be constructed in cement concrete of M 20 grade. Both sides of the channel shall be taken up to the level of the crown of the outgoing sewer. They shall be benched up in concrete and rendered in cement mortar (1:1) of 20 mm thickness and formed to a slope of 1 in 12 towards the channel.

9. Pipe Entering or Leaving Manhole

Whenever a pipe enters or leaves a manhole, bricks on edge must be cut to a proper form and laid around the upper end of the pipe so as to form an arch. All around the pipes, there shall be a joint of cement mortar (1:2) 13 mm thick between it and the bricks.

10. Scaffolding

For brick work in M.H., single scaffolding shall be permitted. In such cases, the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one meter in width, or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purpose shall be filled and made good before plastering.

11. Precast Manhole Frame & cover shall be fixed on manhole in RCC M 20 as per technical drawing.

12. Deformed / TMT bars conforming to relevant IS of grade Fe 415 shall be used with RCC work for fixing M.H. frame & cover on M.H.

13. C.I. Steps:

The steps as per detail specification shall be fixed in the fashion narrated in drawing.

Cast iron steps shall be as per IS: 5455-1969. The steps shall be of grey cast iron of grade 15 as per IS: 210. The steps shall be clean, well cast and they shall be free from air and sand holes, cold shuts and wrappings. The portion of the step which projects from the wall of the manhole shall have a raised checkered design to provide an adequate non-slip grip. C.I. steps shall weigh not less than 5.30 kg each and shall be of 165 mm x 385 mm overall dimensions. These steps shall be coated with a black bituminous composition. The coating shall be smooth and tenacious. It shall not flow when exposed to a temperature of 63°C and shall not be brittle as to chip off at temperature of 0 °C.

Where the depth of invert of manhole exceeds 800 mm, steps of approved pattern shall be fixed in the brickwork at the interval of 300 mm vertically and staggered at 380 mm horizontally centre to centre. Providing

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and fixing safety chain wherever necessary as per the stipulations in the type design etc complete.

14. 75 mm all round vata in C.M. 1:3 shall be provided at bottom of outer periphery of masonry work over foundation concrete as per drawing.

15. Curing:

All PCC, R.C.C., Brick masonry, plaster, etc. work shall be kept wet for seven days. During this period it shall be suitably protected from all damages.

16. **Mode of Measurement & payment:**

The measurement of M.H. will be taken on Number basis as per type design for specified depth. Additional depth, if any more than specified depth will be paid as an additional depth on R.M. basis.

Item-15

Refilling the pipeline trenches incl. ramming, watering, consolidating disposal of surplus stuff as directed within a radius of 3 km.

Filling in Trenches

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipe and drains have been tested and passed. The backfilling material shall be properly consolidated taking due care so that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the center line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the center line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling upto a level 30 cm above the top of the pipe shall be done with fine materials such as earth, murrum, etc. The filling up to the level of the centerline of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the centerline of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

Measurement and Payment

Payment shall be made on cubic meter basis of actual refilling done.

Providing sand or murrum bedding incl. ramming, watering, consolidating etc. Complete.

(a) From selected excavation earth.

(b) Murrum brought from outside lead up to 2 km.

(c) Filling in trench with locally available sand (for Saurashtra, kutchh & rocky area).

(d) Filling in trench with locally available sand (for rest of above areas).

TECHNICAL SPECIFICATION

- 1.1 The selected excavated stuff or murrum or sand shall be got approved from the engineer in charge before using the same for providing bedding on trench bed.
- 1.2 The filling of selected excavated stuff or murrum or sand for bedding shall be done in required thick layers and it should be well watered and consolidated. Big clods shall be broken into small pieces and trees roots, weeds and big stones and other objectionable material liable to decay shall not be used in the work.

2 Mode of measurement:

a) From selected excavation earth.

The quantity of work shall be paid on the cubical measurement of the completed bedding after proper consolidation and watering. The earth shall be used for bedding is selected excavation earth approved by Engineer in charge.

b) Murrum brought from outside lead up to 2 km.

The quantity of work shall be paid on the cubical measurement of the completed bedding after proper consolidation and watering. The murrum approved by Engineer in charge shall be used for bedding is brought from outside. The rate shall be include excavating, collecting, carting, stacking, refilling, etc. comp. directed.

c) Filling in trench with locally available sand (for Saurashtra, kutchh & rocky area).

The quantity of work shall be paid on the cubical measurement of the completed bedding after proper consolidation and watering. The material used for bedding is local available sand.

d) Filling in trench with locally available sand (for rest of above areas).

The quantity of work shall be paid on the cubical measurement of the completed bedding after proper consolidation and watering. The material used for bedding is local available sand.

Item-16

Construction of valves chambers in brick or bela stone masonry, locally available in C.M. 1:6 foundation concrete 150 mm thick in C.C. 1:4:8 of trap metal size 25 mm to 40 mm thick, inside cement plaster in C.M. 1:3 and cement pointing outside in C.M. 1:3 and top cover of precast RCC slab 15 cm thick (with key hole in two parts, each with handles or MS bar etc. complete as given size) upto 1 Mt. depth from G.L. to pipe invert level incl. complete civil works with 23cm thick brick masonry wall in C.M. 1:6 Size 1.30 x 1.30 x 1.00 m deep. with precast slab in two parts 15mm

CHAMBER

TECHNICAL SPECIFICATION

Materials such as Cement, sand, coarse aggregate, bricks, reinforcement, water etc. to be used for this work shall be confirming to specification laid down in material section.

1.1 Location

Chamber shall be constructed at places approved by the Employer's Representative. Where valves are provided for maintenance of the pipeline.

1.2 Excavation / P.C.C.

Excavation, shoring, dewatering/ P.C.C. etc. for the pits of chambers, laying of pipes and fittings/specials shall be done in accordance with Employer's Requirements described elsewhere in the document.

1.3 Bed Concrete

The bed concrete 150 mm thick for chamber shall be done in C.C. 1:4:8 as directed by the Engineer-in-charge using trap metal of 25 mm to 40 mm.

1.4 Bricks

Bricks used for construction of manholes shall conform to the relevant Indian Standards. They shall be sound, hard, and homogeneous in texture, well burnt in kiln without being vitrified, table moulded, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square and parallel faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing ungrounded particles, which absorb water more than 1/6th of their weight when soaked in water for twenty-four hours shall be rejected. Over burnt or under burnt bricks shall be liable to rejection. The bricks shall give a clear ringing sound when struck and shall have a minimum crushing strength of 50 kg/sq.cm. The class and quality requirements of bricks shall be as laid down in IS: 1077.

The size of the brick shall be 23.0 x 11.5 x 7.5 cm. unless otherwise specified; but tolerance upto ± 3 mm in each direction shall be permitted. Only full size brick shall be used for masonry work. Brick bats shall be used only with the permission of Employer's Representative to make up required wall length or for bonding. Sample bricks shall be submitted to the Employer's Representative for approval and bricks supplied shall conform to approved samples. If required by the Employer's Representative, brick sample shall be tested as per IS: 3495 by Contractor. Bricks rejected by the Employer's Representative shall be removed from the Site within 24 hours.

1.5 Cement Mortar

Mortar for masonry shall be as per IS: 2250. Chambers shall be constructed in brick masonry with cement mortar (1:6) unless otherwise specified. Gauge boxes for sand shall be of such dimensions that one bag containing 50 kg. of cement forms one unit. The sand shall be free from clay, shale, loam, alkali and organic matter and shall be

TECHNICAL SPECIFICATION

of sound, hard, clean and durable particles. Sand shall be as approved by the Employer's Representative. If required by the Employer's Representative sand shall be thoroughly washed till it is free of any contamination.

For preparing cement mortar, the ingredients shall first be mixed thoroughly in dry conditions. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall be used within 25 minutes of mixing. Mortar left unused in the specified period shall be rejected.

The Contractor shall arrange for tests on mortar samples if so required by Employer's Representative. Retempering of mortar shall not be permitted.

1.6 Brick Masonry

All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work of Chambers shall be in the proportion specified in drawing. Brick work 230 mm thick and over shall be laid in English Bond unless otherwise specified. 115 mm thick brick work shall be laid with stretchers. For laying bricks, a layer of mortar shall be spread over the full width of suitable length of the lower course. Each brick shall be pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

All brickwork shall be in plumb and square/ circular unless otherwise shown on drawing and true to dimensions shown. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be levelled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes unless otherwise specified. All interconnected brickwork shall be carried out at nearly one level so that there is uniform distribution of pressure on the supporting structure and no portion of the work shall be left more than one course lower than the adjacent work. Where this is not possible, the work shall be raked back according to bond (and not saw toothed) at an angle not exceeding 45 degrees. But in no case the level difference between adjoining walls shall exceed 1.25 M. Workmanship shall conform to IS: 2212.

Brick shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 10 mm. The face joints shall be raked to a minimum depth of 12 mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the plastering to be done. When plastering is not required to be done, the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If mortar in the lower courses has begun to set, the joints shall be raked out to a depth of 12 mm

TECHNICAL SPECIFICATION

before another course is laid.

1.7 Cement Plaster

All joints in masonry shall be raked to a depth of 12 mm with hooked tool made for the purpose when the mortar is still green and in any case within 48 hours of its laying. The surface to be rendered shall be washed with fresh clean water free from all dirt, loose material, grease etc. and thoroughly wetted for 6 hours before plastering work is commenced. Concrete surfaces to be rendered will however be kept dry. The wall should not be too wet but only damp at the time of plastering. The damping shall be uniform to get uniform bond between the plaster and the wall.

The proportion of the cement mortar shall be as approved on relevant drawings. Cement shall be mixed thoroughly in dry condition and then just enough water added to obtain a workable consistency. The quality of water, sand and cement shall be as per relevant I.S. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to remain for more than 25 minutes after mixing with water.

Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

Plastering shall be done on inner face of brick masonry in cement mortar (1:3) and 15 mm thick unless otherwise specified.

Cement pointing in C:M (1:3) shall be done on outside the chamber including racking out joints, curing etc. complete as directed by the engineer-in-charge.

1.8 Cement Concrete Block

The C.C. blocks for the chamber shall be constructed in cement concrete of M15 grade to take care of weight of valves.

1.9 Pipe Entering or Leaving Chamber

Whenever a pipe enters or leaves a chamber, bricks on edge must be cut to a proper form and laid around the upper end of the pipe so as to form an arch. All around the pipes, there shall be a joint of cement mortar (1:2) 13 mm thick between it and the bricks.

1.10 Precast Reinforced Cement Concrete Slab with key holes

Precast Reinforced cement concrete top slab shall be casted in pieces for covering the chamber. Necessary keyholes shall be provided at appropriate place for operation of spindle of valve. The minimum thickness of slab shall be 100mm and same shall be casted in C.C. of M20 grade. The required reinforcement shall be provided. The top & bottom surface of precast slab shall be finished with cement mortar 1:3.

TECHNICAL SPECIFICATION

Measurement

The items of the work shall be measured and paid on the number basis complete in all respects including all materials, labours, jointing materials, tools, transportation, taxes and other including items for completion of work.

Payment

The payment will be made as per Schedule attached

For extra depth beyond 1.0 m.

The work shall be measured and paid for additional meter depth of chamber beyond 1.0 m depth.

TECHNICAL SPECIFICATION

Item-17

Monoset sub. pump 3 phase 400/440 vott, 50 c/s. A.C. Supply & 2900 RPM , as per IS 14220 MOC : Casing: CI-FG260, Impeller : Bronze & Shaft : SS:41 Monoset sub. pump 3 phase (a) Discharge 1860 LPM (b) Head 34 METER (c) Horse Power 40 H.P (d) Cat. SM - 4.7 CAT

Item-18

Auto transformer starter suitable for local & remote pump control application consisting of Auto Transformer (vacuum impregnated, air cooled having three (3) tappings at 50%, 65% and 80%), incomer MCCB / MPCB, overload relay and contactors as per Type II coordination including digital MFM with RS 485 communication port, analogue type ammeter with selector switch, run hour meter, required protective relays & control accessories.. A. T. S. from 36 to 45 HP

Item-19

PVC insulated round submersible cable as per detailed technical specifications conforming to IS 694, IEC 60227 / 60228.. 1 R x 3 C x 25.0 mm²

As per Mechanical Specification

TECHNICAL SPECIFICATION

BREAK UP OF SCHEDULE OF PAYMENT

PIPE LINE (RCC)

Sr. No.	Stage of work	Amount admissible payment
1	2	3
1	On receipt of materials on site	65 %
2	On Lowering, laying and Jointing	20 %
3	On Hydraulic testing	5 %
4	On refilling and disposal of surplus stuff	5 %
5	After commissioning	5 %
	Total	100 %

PAYMENT SCHEDULE FOR MANHOLES, LAKE DEEPNING & OTHER MATERIALS

SR NO.	DESCRIPTION OF WORK	% OF PAYMENT ON COMPLETION
1	On Completion of construction work of MH	80%
2	After Satisfactory flow test / hydraulic testing.	10%
3	On completion of with all respect & taken over / handed over to the department / LB.	5%
4	On Completion & commissioning the section.	5%