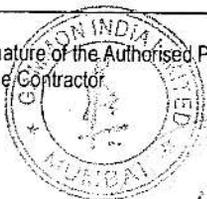


Automatic temperature setting		Yes (with PID Controller only)
Adjustable limits		Yes (with PID Controller only)
Shelves		
Standard		01
Internal Dimensions	Mm	Standard 300mm x 250mm x 100mm (6 holes) 8 ltr 355mm x 405mm x 100mm (12holes) 15 ltr
Power Consumption		
Nominal power	W	500-650
Nominal voltage	V	220-230 Volts, 50 Hz Single Phase
Frequency	Hz	50

9.5 Weiber : B.O.D. Incubator (Acm-22061-I) Digital Mode I- 4cft capacity :

Temperature Control		
Temperature variation (time)	± °C	0.5
Temperature deviation (spatial)	± °C	0.5
Readability/ Set ability	°C	0.5
Temperature range ***	°C	5 °C to 60 °C
Sensor thermocouple		Type K
Controller		Solid State digital Controller/PID optional
Display		LED/LCD
Adjustable alarm limits (visual and acoustic)		Optional
Safety thermostats		
Temperature variation (time)	± °C	3 (with PID controllers only)
Sensor thermocouple		Type K
Automatic setting		Yes (with PID Controller only).
Adjustable limits		Yes (with PID Controller only)
Light Control		
Readability/ Set ability	%	7% (optional feature)
Light intensity in the middle	Lux	As Desired (optional feature)
Light intensity in both sides	Lux	As Desired (optional feature)
Shelves		
Standard/ max		2-6 (depending on the internal size)



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Dimensions w,d	mm	As per the individual model
Max load per shelf	Kg	20
Permitted total load	Kg	80 kg (Max Internal Size)
Power consumption		
Nominal power	W	950
Nominal Voltage	V	230, 1~
Frequency	Hz	50/60

9.6 Muffle Furnace (Acm-82301) 1.0KW rating, working temperature 900°C :

Temperature Control		
Temperature variation (time)	± °C	5%
Temperature deviation (spatial)	± °C	5%
Readability/ Set ability	°C	0.5
Temperature range ***	°C	5 °C above ambient to 900/1200 °C
Sensor thermocouple		Type K
Controller		Solid State digital Controller/PID optional
Display		LED/LCD
Adjustable alarm limits (visuai and acoustic)		Optional
Safety thermostats		
Temperature variation (time)	± °C	3 (with PID controllers only)
Sensor thermocouple		Type K
Automatic setting		Yes (with PID Controller only)
Adjustable limits		Yes (with PID Controller only)
Shelves		
Standard/ max		Nil
Dimensions w,d	mm	As per the individual model
Max load per shelf	Kg	Nil
Permitted total load	Kg	20 kg (Max Internal Size)
Power consumption		
Nominal power	W	1950
Nominal Voltage	V	230, 1~
Frequency	Hz	50/60

9.7 "WEIBER" Magnetic Stirrer With Hot plate :

Type

- Maximum Speed RPM : 1800
- Stirring Capacity Ltrs : 5
- Heating Capacity Watts : 500
- Dimension (W x D x H) mm : 190 x 190 x 170
- Stirring Paddle Ø x L mm : 10 x 50

Capacity : 500ml/ 1 litre

9.8 Electronic Digital Balance :

- Large LCD display for easy view
- Standard RS 232 interface
- Parts Counting & percent weighing
- Below balance weighty facility
- Die cast aluminium design for long term stability & accurate result
- Various weighing units like ct, gm, oz, mom, GN
- ISO-GLP compliance printouts (optional)

Capacity	600 g
Increment	0.1 g

9.9 FLOCCULATOR (JAR TESTING APPARATUS) with six stirrers capacity 2 litre

Flocculator consist of geared continuous run heavy duty 1/20 HP variable speed motor from 25 to 100 RPM with built in speed control. S.S. string rods are provided with adjustable spacers to adjust the depth of stirring paddles. The stirring shaft can be removed without disturbing other stirrers. This unit is supplied without beakers to work n 220/230 volts A.C.

9.10 Weiber Heating Mantle (Model : Acm-87096Q) :

Capacity : 500ml, Wattage : 180 Watts, Voltage : 220/230 Volts AC Supply

10.0 SPECIFICATION FOR CONSUMER METER

1. GENERAL: This part applies to water meters intended for metering potable cold water with threaded end connections and of nominal sizes upto and including 50 mm. All water meters shall be good quality as per IS/ equivalent standards. Bidders may also choose for fluidic oscillation meters.

Actual size wise distribution can be made during execution. Approximate quantities are:



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Domestic Type (Multimag or Equivalent)

Class B 15 mm – 15725 nos

Class B 20 mm – 1884 nos

Commercial Type (Multimag or Equivalent)

Class B 25 mm – 292 nos

Class B 32 mm – 100 nos

Class B 40 mm – 100 nos

Industrial Type (Woltex or Equivalent)

With strainer NP10/ANSI B 16.5 - 50 mm – 700 nos

With strainer NP10/ANSI B 16.5 - 65 mm – 400 nos

With strainer NP10/ANSI B 16.5 - 80 mm – 287 nos

With strainer NP10/ANSI B 16.5 - 100 mm – 25 nos

With strainer NP10/ANSI B 16.5 - 125 mm – 4 nos

With strainer NP10/ANSI B 16.5 - 150 mm – 5 nos

With strainer NP10/ANSI B 16.5 - 200 mm – 4 nos

2. TERMINOLOGY:

- i. **Nominal Pressure:** The internal pressure, expressed in Mpa corresponding to the maximum permissible working pressure
- ii. **Flow Rate:** The volume of water passing through the water meter per unit of time; the volume being expressed in litre and the time in hours, minutes or second.
- iii. **Flow Delivered:** The total volume of water which has passed through meter in a given time.
- iv. **Maximum Flow Rate, Q max:** The highest flow rate at which the meter can function over limited periods without damage and without exceeding the maximum permissible errors and the maximum permissible value for loss of pressures, expressed in Kl/Hr.
- v. **Nominal Flow Rate, Qn:** Half the maximum flow rate, Q max; expressed in kl/h. At the nominal flow rate Qn, the meter should be able to function in normal use, i.e. in continuous and intermittent operating conditions, without exceeding the maximum permissible error.
- vi. **Minimum Flow Rate, Q min:** The lowest flow rate at which the meter is required to give indications within the prescribed maximum permissible error.
- vii. **Pressure Loss:** The pressure loss caused due to the presence of the water meter in the pipe line.

3. NOMINAL SIZES:

Water meters shall be of the following nominal sizes; 15 mm, 20 mm, 25 mm, 40 mm and 50 mm. The nominal size of the water meter shall be denoted by the nominal bore of its end connections.

4. CLASSES OF WATER METER:

The water meters to be connected mainly of two types classified as Class A with strainer and Class B based on the maximum verification scale interval and metrological characteristics.

5. MATERIALS AND MANUFACTURE

- (i) **General:** Water meters and their parts, especially parts coming in continuous contact with water shall be made of materials resistant to corrosion and shall be non-toxic and

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non-tainting. Use of dissimilar metals in contact under water shall be avoided [as for as possible] in order to minimize electrolytic corrosion

- (ii) **Construction:** The meters shall be constructed in such a way as to
 - give long service and guarantee against any fraud or tampering; and
 - conform with the provisions of these rules.
 - (iii) **Body:** The body shall be free from all manufacturing and processing defects, such as blow-holes and spongy structure and shall not be repaired by plugging, welding or by the addition of materials. The internal shape of the body shall ensure smooth flow of water and easy dismantling.
 - (iv) **Connections:** The meter casing shall be fitted in the pipe line by means of two cylindrical nipples or tailpieces with connecting nuts which shall be provided with each meter. The internal diameter of the nipple where it connects the pipeline shall be equal to that corresponding to the nominal size of the meter.
 - (v) **Strainers:** Strainers shall be of a material which is not susceptible to electrolytic corrosion. They shall be of corrosion resistant materials. They shall be rigid, easy to remove and clean and shall be fitted on the inlet side of the water meter. It shall be possible to remove and clean the strainer in such a way as not to permit disturbing the registration box or tampering with it. The strainer shall have a total area of holes not less than twice the area of the nominal inlet bore of the pipe to which the meter is connected. However in the case of meters provided with internal strainer, involving opening of the registration box for cleaning, an additional external strainer shall be fitted on the inlet side satisfying the above requirements.
- Dial:** The dial shall be of vitreous enamel powder coated on copper or plastics ensuring indestructible marking and good legibility.
- (vii) **Regulator:** Every meter shall be provided with a regulator. The regulator accessible from outside shall be operated by a key without dismantling the meter and not without breaking the seal. The internal regulating device shall not be accessible from outside.
 - (viii) **Location of Serial Number:** The serial number of the meter shall be clearly indicated on the screw cap or in any other suitable place.
 - (ix) **Frost Protection Device:** Meters liable to be damaged by frost when so ordered by the purchaser shall be protected with suitable frost protection device.

130 DATA SHEET FOR PRESSURE TRANSMITTER

Make	Siemens / Equivalent
Model	Sitrans P 300
Tag No.	As per Tag Sheet
Type	Smart, Microprocessor based
Measuring Range	As per enquiry
Communication Protocol	HART
Local Display	Provided
Range setting switches	Provided

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Calibration	Calibration for given range will be done on site.
Engineering units	Programmable with display keys
Sensor	Piezo /Capacitance
% age Accuracy	0.075
Output	Two wire 4 - 20 mA, Linear
Power Supply	24 V DC
Load Resistance	Max. 600 Ω
Zero Elevation / Suppression	Provided
Self Diagnostics	Required
Humidity Limits	5 - 100% RH @40°C
Damping Parameter	Configurable
Electrical Connections	1/2" NPT
Process Connections	As per Tag Sheet
Diaphragm	Flush mount
Turn down ratio	.1:100
Housing	SS
Conform measurement cell	EHEDG approval

12.0 SPECIFICATION FOR COMPUTERISED DISTRIBUTION MANAGEMENT

This is a system to be developed for regular estimation of UFW and NRW. The system aims at Computerized information of flow and pressure at strategic locations. Regular updating of pipe network and its connections will make it easy for getting correct information at all times.

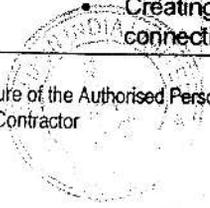
The main tasks are –

- Mapping of the pipe lines that will be laid showing
 - Important ground features of locations with respect to pipe line alignment
 - Pipe alignment every 50 ft interval reference, depth of pipe top
 - Information on pipes Size, M.O.C, Thickness
 - Location of valves and measuring devices
 - Location of connection & its details
 - Details of measuring devices
- Supply & installation of Flow & Pressure measuring devices with facility of data transfer to a central station through GSM (service provider may be Airtel, BSNL, Aircel, Reliance). Department will arrange power (230 V AC 50 Hz) at each data logger point from nearby source of schools, / govt. building / street lamp post / private houses whichever is available.

The Flow meters (full bore type) will have two sensors, one for flow and the other for pressure, which will be connected to a data logger system and to be placed at site.

Details of full bore flow meter are given in Clause 8.

- Creating consumer meter data base in oracle platform containing details of consumer connections.



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- Creating software for data transfer from Flow & Pressure monitoring sites.
 - Provision of metering & billing software.
 - Combining all these software in one package.
 - Reporting format generation.
- Daily flows & pressure, monthly UFW & NRW & updating records of mapping.

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SECTION - F

GENERAL SPECIFICATIONS OF WORKMANSHIP AND MATERIALS FOR CIVIL WORK

1. GENERAL

1.1 General Materials

1.1.1 All materials used in the permanent works shall be of the best quality of the kind and to the approval of the Engineer. Any material not covered by these Specifications, shall comply with the relevant latest Indian Standard Specifications (Referred to as IS as revised or modified up to the date one month prior to Tender date). British or American Standard Specifications shall be referred to in case any particular specification is not available in any of the aforesaid Specifications.

1.1.2 Samples of materials to be supplied and used, by the Contractor in the works shall be to the prior approval of the Engineer. For this purpose the Contractor shall furnish in advance representative samples in quantities and in the manner as directed by the Engineer for his approval. Materials brought to the Site, which in the opinion of the Engineer do not conform to the approved sample, shall, if so directed by him, be removed by the Contractor from the Site and replaced by the materials of approved quality.

1.1.3 In spite of approval of the Engineer of any materials brought to the site, he may subsequently reject the same if in his opinion the materials has since deteriorated due to long or defective storage or for any reason whatsoever and is thereby considered unfit for use in the permanent works. Any material thus rejected shall be immediately removed from the Site at Contractor's cost and expenses.

1.1.4 All materials brought to the Site shall be properly stored and guarded in the manner as directed by the Engineer and to his satisfaction.

1.1.5 The Engineer may carry out test of materials as he may decide. The Contractor shall, at his cost and expenses, for this purpose supply requisite materials and render such assistance to the Engineer as he may require. The cost of testing of the materials will have to borne by the contractor as per the provision of the tender document.

1.2 Workmanship

All works are to be carried out in proper workman like manner. Items of works not covered by these Specifications or by other tender documents shall be carried out as per best practice according to the direction of the Engineer and to his satisfaction. The relevant IS Specifications and in case of necessity British or American Standard Specifications shall be taken as guide for the purpose.

1.3 Works Included

The rates for all items, unless specifically stated otherwise in the Contract, must cover the cost of all materials, labour, tools, machinery, plant, pumps, explosives, scaffolding, staging strong props, bamboos, ropes, templates, pegs and all appliances and operations whatsoever necessary for efficient execution of work.

1.4 Ground Conditions

The Contractor is required to visit the site and ascertain local conditions, traffic restrictions, obstructions in the area and allow for extra expenses likely to be incurred due to any limitations whatsoever.



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1.5 Setting Out and Levelling

The Contractor is to set and level the works, and will be responsible for the accuracy for the same. He is to provide all instruments and proper qualified staff required for checking the Contractor's work.

1.6 Safety

The Contractor shall take adequate precaution to provide complete safety for prevention of accidents on the site.

1.7 Keeping Works Free from Water

The Contractor shall provide and maintain at his own cost, electrically or other power driven pumps and other plant and equipment to keep site excavated foundation pits and trenches free from surface as well as subsoil / leakage water from Primary Grid of any other source thereof and continue to do so to the complete satisfaction of the Engineer till the site is handed over. Method of dewatering shall need approval of the Engineer but no payment whatsoever is allowed on this count.

1.8 Rubbish

1.8.1 The Contractor shall clear all rubbish, vegetation, roots, soda etc., and dump them in the area indicated to the satisfaction of Engineer. No separate rate shall be allowed for the above work.

1.8.2 After the work is completed, the Contractor shall clear the area surrounding the buildings, of all hutments and excess stores and remnants of building materials such brick bats, metal, sand, timber, steel etc.

1.9 Bench Marks and Ground water Gauges

The Contractor shall protect surveyor's bench marks and ground water gauges, zero line marks and base line marks from damage or movement during work.

1.10 Inspection

The Contractor shall inspect the Site of works and ascertain site condition and the nature of soil to be excavated.

1.11 Contractor's Staff

The Contractor must provide at all times efficient staff of trustworthy, skilful and experienced assistance capable of carrying out the work in accordance with the drawings and specification and to correct levels. The cost this establishment should be included in his rates.

1.12 Method of Measurement

Unless otherwise specified, the method of measurement for building works shall be as per IS:1200.

1.13 Specifications Referred to

1.13.1 The specifications contained herein are not exhaustive and for such items of works which may arise and which are not covered by these specifications, the provisions in the relevant Indian Standard (Latest Edition) shall apply.

1.13.2 A list of some Indian Standards is given herein.

1.13.3 Wherever reference to the Indian Standard mentioned below, or otherwise appears in the specification, it shall be taken as reference to the latest version of the Standard.

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	IS Code No.	Description
General	IS:1200	Method of measurement of building And Civil Engineering works.
Cement	IS:269	Ordinary, Repair Hardening and Low Heat Portland Cement.
Sand	IS:1242	Sand for plaster.
Aggregates	IS:383	Aggregates-Coarse and fine, from Natural source for Concrete.
Aggregates	IS:515	Aggregates for use in Mass Conc. And other conc.
Concrete-Plain And Reinforced	IS:456	Code of Practice for Plain and Reinforced Concrete for General Building Construction.
	IS:3370	Code of Practice for Concrete Structures for the Storage of Liquids.
Brick Work	IS:1077	Common Burnt Clay Building Bricks.
Paving and Floor Finish	IS:1235	Flooring Tiles, Cement Concrete.
	IS:1443	Cement Concrete, Flooring Tiles Laying and finishing.
Plaster and Pointing	IS:1661	Cement and Cement Lime Plaster finishes on walls and Ceilings.
Steel and Iron Work	IS:226 IS:800	Structural Steel (Revised) Code of Practice for use of Structural Steel in General Building Construction.

2. EARTH WORK IN EXCAVATION & FILLINGS

2.1 General

Applicable provisions of Conditions of Concrete shall govern work under this section.

2.2 Excavation for Foundation, Trenches, Pit etc.

The excavation work shall be carried out in all kinds of Soil including Sand in workman link manner without endangering the safety of the nearby structures or works without causing any hindrance to other activities in the area. The existence of old buildings, boundary walls, hutment, sewer lines, water lines, if any very close to the area of excavation should be given careful consideration while designing carrying out the excavation work. The excavation shall be done in such method as would technically be appropriate and befitting the site conditions subject to the approval of the Engineer. All foundation trenches shall be excavated to the full width and depths shown on the approved drawing or to such ordered to the Contractor.

2.2.1 The Contractor shall not undertake any earth work without having obtained prior approval from the Engineer to the methods he proposes to employ in order to execute the work in the

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most efficient manner. He shall not modify such methods without the approval of the Engineer. This approval, however, shall not in any make the Engineer responsible for any consequent loss or damage.

- 2.2.2 Should any excavation be taken down the specified levels, the Contractor shall fill in such excavation at his own cost with concrete as specified for foundations, well rammed in position until it is brought up to the specified level.
- 2.2.3 The Contractor shall notify when the excavation is completed and no concrete or masonry shall be laid until the soil for each individual footing, rafts etc. is approved.
- 2.2.4 The Contractor shall keep the site clear of water at all times. To this end he shall provide arrangements for bailing and pumping or any special arrangements as required within his quoted prices.
- 2.2.5 All foundation pits shall be refilled to the finished ground level (formation level) with approved materials, which shall be suitably consolidated in layers to the satisfaction of the Engineer.
- 2.2.6 Nothing extra will be paid for bailing out water collecting in excavation due to rains, ordinary springs, leakage from existing primary grid etc., or any other reason.
- 2.2.7 For the work of excavation the Tenderer shall included in his quotation the shoring, sheeting, bracing and sheet piling (if required). The quotation shall also include the cost of compaction of foundation sub-base, removal and storage of excavated materials and back-filling.

2.3 Shoring

Timber shoring whenever required shall be closed boarded with minimum 50mm thick good and seasoned timber planks of sufficient length driven side-by-side to the required depth. The gaps between adjacent timber planks shall such would not allow any flow of soil particles, if necessary, the sides of the planks shall be planed smooth to ensure this. Sufficient number of bracing struts, wallings etc. are to be provided to make the shoring rigid and non-yielding by earth pressure. Where necessary, sheet piling shall be done to ensure safety to the adjoining structures, if it is found that it is not feasible to protect the structure by timber shoring only. The Tenderer is strongly advised to inspect the site before tendering and apprise himself of the requirement of any Sheet piling in addition to the timber shoring before submitting his Quotation accordingly.

2.4 Back Filling

The space around the foundations in trenches or sites shall be cleared of all trash and loose debris and filled with approved excavated earth, all clods being broken upto the finished G.L. Filling shall be done in 200mm layers, each layer to be property moistened and well rammed. Excavated materials which is surplus or which is consolidated unsuitable for back filling is to be disposed of in spoil dumps as directed by the Engineer. No extra payment will be made for this.

3. CONCRETE

3.1 General

- 3.1.1 Applicable provisions of Conditions of Concrete shall govern work under this section.
- 3.1.2 All concrete work, plain or reinforced shall be carried out strictly in accordance with this specification and any working drawing or instructions given from time to time to the Contractor.
- 3.1.3 No concrete shall be cast in the absence of the Engineer or any other person duly authorised by him. The Contractor's Engineer shall personally check that both the form work and reinforcement have been correctly placed and fixed, and shall satisfy himself that all work preparatory to the casting is completely ready, before informing the Engineer for final inspection and approval and for which purpose at least 24 hours notice shall be given by the Contractor.



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3.1.4 The Indian Standards wherever referred to here in shall be the latest addition of such standards.

3.2 Cement

Cement shall conform for IS:269. Cement tests shall have to be carried out at Contractor's expense as and when directed. Cement which has or practically set shall not be used under any circumstances.

3.3 Aggregates

The fine and coarse aggregates shall conform to all provisions and test methods of IS:383 and / or IS:515. Samples of aggregates, proposed to be used in the work shall be submitted free of charge in sufficient quantities to the Engineer with sieve analysis and other physical and chemical analysis data for his approval. Approved samples will be preserved by him for future reference. This approval will not in any way relieve the Contractor of his responsibility of producing of specified qualities.

3.3.1 Coarse Aggregates

Coarse aggregates for use all reinforced and other plain cement concrete works shall be crushed black granite trap stone obtained from approved source and shall consist of uncoated, hard, strong dense and durable pieces of crushed stone, and be free from undesirable matters, viz. Disintegrated stones soft, friable, thin, elongated or laminated pieces, dirt, salt, alkali, vegetable matter or other deleterious substances. The aggregates shall be thoroughly washed with water and cleaned before use to the satisfaction of the Engineer at no extra cost of the Employer.

The maximum size of coarse aggregates shall be as follows unless specified otherwise elsewhere.

Reinforced Concrete	:	20 mm
Plain Concrete	:	20 mm.
Thin R. C. C. Members		
With very narrow space	:	12 mm.
Mat/Lean Concrete	:	20/40 mm.

(The actual size to be agreed by the Engineer)

Grading of coarse aggregates for a particular size shall generally conform to relevant I. S. Codes and shall be such as to produce a dense concrete of the specified proportions and or strength and consistency that will work readily in position without segregation.

3.3.2 Fine Aggregates

Sand shall be clear River sand brought from approved source and consist of siliceous material, having hard, strong, durable uncoated particles, free from undesirable matters viz. dust lumps, soft or flaky particles or other deleterious substances. The amount of undesirable shall not exceed the percentage limits by weights as specified in relevant IS Codes. Washing of aggregates by approved means shall be carried out, if desired by the Engineer, at no extra cost to the Employer.

Coarse and fine sand shall be well graded within the limits by weight as specified in relevant IS Code. Fineness Modulus shall not vary by more than plus or minus 0.20 from that of the approved sample. Fineness Modulus for sand should not be less than 2.5.

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3.4 Reinforcement

3.4.1 The Contractor shall prepare and furnish to the Engineer, Bar Bending Schedules in considerations of the approved drawings for all R. C. C. works for review and checking by the Engineer before taking up the work.

3.4.2 The mild steel reinforcement shall conform to IS:432 & the tor-steel reinforcement shall conform to IS:1788.

All steel for reinforcement shall be free from loose, scale, grease, paint or other harmful matters immediately before placing the concrete.

3.4.3 The Reinforcement shall be bent to the shapes shown on the approved drawings prior to placing and all bars must be bent cold. The Steel shall be placed in such a way that it is rigidly held in position while concrete is being cast. The correct clearance from the form shall be maintained by either precast mortar blocks or by metal supporting chairs to be supplied by the Contractor free of charge.

The intersection of roads crossing one another shall be bound together with soft pliable with No. 16 to 18. S. W. G. at every intersection so that reinforcement will not be displaced in the process of depositing concrete. In piles the reinforcement will be welded. The loops of binding wire should be tightened by pliers.

3.4.4 The work of reinforcement shall also be inclusive of stirrups distribution bars, binders, initial straightening and removing of loose rust, if necessary, cutting to requisite length, hooking and bending to correct shape, placing in proper position including supplying and binding with block annealed wire as stated in clause 3.4.3 above.

3.5 Water

The Water shall be clean and free from Alkali oil or injurious amounts of deleterious materials. As far as possible, the water should be of such quality that it is potable. If any chemical analysis of water is necessary and ordered, the same shall be carried out at an approved laboratory at the Contractor's cost and expenses.

3.6 Concrete Proportioning

3.6.1 The concrete proportions shall be as indicated on the approved drawings and shall conform to IS:456 & IS:3370. The quality and character of concrete shall be governed by IS:383. It should be sampled and analyzed as per IS:1199. The concrete should stand the test specified in IS:516.

3.6.2 The minimum cover of main reinforcement shall be 25 mm or the diameter of the bar whichever is greater. Cover to any reinforcement of R. C. C. piles shall be minimum 65 mm. In case in-situ and 50 mm. In case of precast piles. Suitable spacer blocks shall be provided at intervals not exceeding 1.2 m. throughout the length of the pile.

3.6.3 The work ability shall be measured by slump. Slump for different grades of concrete shall not exceed following unless specifically permitted by the Engineer.

- i) For M 15 concrete – 3.75 cm.
- ii) For M 20 concrete – 2.50 cm.
- iii) For other grades – As per IS code.

3.6.4 All concrete works shall be thoroughly compacted and fully worked around the reinforcement, around embedded fixtures and into corners of the form work.

The Concrete shall be thoroughly and shall be efficiently vibrated during laying. The use of mechanical vibrators shall comply with IS:2608, IS:2506 and IS:4656. Whenever vibration has to be applied externally, the design of form work and deposition of vibration shall receive special consideration to ensure efficient compaction and to avoid surface blemishes.



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3.6.5 Test for Water Tightness of Structures / Pipes

For liquid retaining structures including inlet chambers etc. shall be deemed to be satisfactory water tight as per relevant clause of IS:3370. Approved corrective measures, if necessary, shall be undertaken by the Contractor at his own expenses.

As regards the pipe lines, the tests shall be performed for the Hydrostatic Pressure of 10 Kg./Sq. cm in case of Mild Steel and 1.5 times the working pressure of the pipe. The tests shall be carried out as per relevant IS Codes and pressure shall be considered satisfactory if the tests results satisfy the requirements of the relevant clauses of the Codes. The Contractor shall give all these Hydraulic Tests by making his own arrangements for water supply and filling and disposing the water after the tests. The Contractor shall rectify the defects noticed and carry out the tests again and repeat the testing operation till successful result is obtained and accepted by the Engineer. The rates Quoted for the work shall be considered as inclusive of cost of all Labour, materials and equipment required to give successful tests for Water tightness.

3.7 Workmanship

3.7.1 All Concreting work shall be carried out according to the IS:456 and IS:3370. It should, however, be noted that for every 15 CUM. of concrete placed or for every one day's volume of concrete whichever is lower, a minimum of 3 (three) Cubes shall be cast for test purpose, and tested at the Contractor's cost and expenses at a Laboratory as approved by the Authority. The number of test cubes may, however, be altered at discretion of the Engineer. It is compulsory to test 3 (three) cubes in each case.

3.7.2 Structural Concrete

Design mix Concrete shall be on all concrete works except in case of Mud-mat concrete/lean concrete where nominal mix concrete will be allowed.

Design mix Concrete will be used in Reinforced Concrete Structures.

The mix shall be designed to produce the grade of concrete having required workability and a Characteristic Strength not less than appropriate values given in relevant clause of IS:456-2000. For mix design, procedure given in Indian Standard.

Recommendation or any other standard procedure shall be adopted. As long as the quality of materials does not change a mix design done earlier may be considered adequate for later work. Batching mixing, sampling and Strength Test of concrete shall be carried out in compliance with the relevant clause of IS:456-2000 and all other relevant Indian Standards recommended therein.

The mix design by the Contractor shall be used for works only after obtaining written approval of the Engineer. Mix design shall be entirely the responsibility of the Contractor and any approval by the Engineer shall not relieve him of his responsibility in respect thereof.

The Contractor shall prepare all the Calculations, Tabulations, Graphs etc. pertaining to Mix design / Test result and supply copies of such Calculations, tabulations, Graphs etc. required by the Engineer.

On proportioning concrete, the quantity of both cement and aggregate shall be determined by weight, where the weight of cement is determined on the basis of weight per bag a reasonable number of bags be weighed periodically to check the net weight or should be either weighed or measured by volume in calibrated tanks. All measuring equipments shall be maintained in a clean serviceable condition and shall periodically check for accuracy.

The grading of coarse and fine aggregates shall be checked frequently and frequency of testing shall be determined by the Engineer. Where weight batching is not possible or practicable, the quantities of coarse and fine aggregates may be determined by volume but cement in any case shall be weighed by weight only. If fine aggregate and volume batching is adopted, allowance shall be made for bulking. The bulking shall be determined in accordance with IS:2386 (Part-III).

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The Water-Cement Ratio shall be maintained to its correct value. Surface moisture content of aggregate shall be determined as per IS:2386 (Part-III) and the amount of water to be added shall be adjusted accordingly to maintain the correct Water-Cement Ratio.

During the progress of work in order to ensure correct quality of concrete proper control should be exercised by the Contractor as specified in the Clause mentioned in the Clause 3.7.1 above. Test strength of every sample shall be determined in accordance with the recommendations of IS:456-1978. If one out of ten concrete test cubes shows a deficiency in strength up to a maximum limit of 10%, the concrete will be deemed satisfactory. If two of the test cubes out of ten show a deficiency in strength up to a limit of 10%, the concrete shall be deemed to be less satisfactory and a reduction of 1% will be made on the cost of such concrete. If three out of ten test cubes show deficiency in strength up to a limit of 10%, a reduction of 5% will be made on the cost of such concrete. If more than three test cubes show a deficiency in strength up to a limit of 10% a reduction of 10% will be made on the cost of such concrete. If more than five show a deficiency in strength up to a limit of 10%, the concrete shall be rejected. Such rejected concrete work shall have to be dismantled and replaced to the satisfaction of the Engineer by the Contractor free of cost to the Employer. No payment for the dismantled concrete, the relevant form work and reinforcement, embedded fixtures etc. wasted in the dismantled portion, shall be made. In the course of dismantling, if any damage is done to the embedded items or adjacent structures, the same shall also be made good free of charge by the Contractor to the satisfaction of the Engineer.

If the deficiency in strength of one test cubes exceeds the 10% limit, a reduction of 5% will be made on the cost of such concrete. If the deficiency in strength to two out of ten test cubes exceeds the 10% limit, a reduction of 10% will be made on the cost of such concrete. If the deficiency in strength of two out of ten test cubes exceeds the 10% limit, a reduction of 10% will be made on the cost of such concrete. If the deficiency in strength of three out of ten test cubes exceeds the 10% limit, a deduction of 20% on the cost of such concrete will be made.

With permission of the Engineer for any above mentioned grades of concrete, if the quantity of water has to be increased in special cases, cement shall also be increased proportionally to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment for additional cement will be made.

Precast Concrete

Precast Concrete items shall conform to relevant IS Specifications. Precast items shall be suitably marked with the date of casting identification marks and shall show the right way up as may be required. The arrangements to be made by the Contractor for Site manufacture and handling of precast items shall be done to the approval of the Engineer. Each precast unit shall be cast in one operation and no construction joints shall be permitted. No damaged or defective units shall be built into the works and units shall be so stored that they are not over stressed.

Precast units shall be provided in places as shown in the approved drawings. The precast units shall be cast at site strictly following the Specifications of Precast Concrete work. Proper care shall be taken to ensure that the units are obtained from the moulds without any damage. Before erecting in position the units shall be cured adequately by keeping units immersed in water.

Form Work

The Form Work shall conform to IS:456. Whenever necessary, shuttering must be provided. The work shall also include providing all necessary staging, centring, form work and moulds for placing concrete. Shuttering may be approved dressed timber true to line, not less than 37 mm. thick. Surface to be in contact with concrete are to be planed smooth. Alternatively, sufficiently rigid plywood shuttering or steel shuttering may be used. In every case, joints of the shuttering are to be such as to prevent the loss of liquid from the concrete. In timber shuttering the joints shall, therefore, be either longed or grooved or the joints must be perfectly close and lined with draft paper plythene films or other types of approved materials.

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In case of plywood or steel shuttering also the joints are to be similarly lined. All shuttering and framing must be adequately stayed and braced to the satisfaction of the Engineer for properly supporting the concrete, during concreting and the period of hardening. It shall be so constructed that it may be removed without shock or vibration to the concrete. No through bolts are allowed for holding the shuttering in water retaining structure.

3.9.2 Cleaning, Treatment and Removal of Forms

All forms shall be thoroughly cleaned of old concrete, wood shavings, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish loose concrete chippings, shavings, saw dust etc. shall be scrupulously removed from the interior of the forms before the concrete is poured. Form work shall not be used/reused, if declared unit or unserviceable by the Engineer.

If directed by the Engineer, compressed air jet/or water jet shall be kept handy along with wire brushes, brooms etc. for the purpose of cleaning.

Before shuttering is placed in position, the form surface in contact with the concrete shall be treated with approved non-staining oil or composition. Care shall be taken that the oil or composition does not come in contact with reinforcing steel or existing concrete surface. They shall not be allowed to accumulate at the bottom of the shuttering.

Forms shall be truck in accordance with the relevant clause of IS:456 or as directed by the Engineer. The Contractor shall record on the drawings or in other approved manner, the date in which the concrete is placed in each part of the work and the date on which the form work is removed there from and have this recorded checked and countersigned by the Engineer.

The Contractor shall be responsible for the safe removal of the form work, but the Engineer may delay the time of removal if he considers it necessary. Any work showing signs of damage through premature removal of form work or loading shall be entirely reconstructed without any extra cost to the Employer.

3.10 Protection and Curing of Concrete

Newly placed concrete shall be protected by approved means; from rain, sun and wind and extreme temperature. Concrete placed below the ground level shall be protected from falling earth during and after placing. Concrete placed in ground containing deleterious substance shall be kept free from contact with such ground or, with water draining from such ground during placing of concrete and for a period of at least 3 (three) days or as otherwise directed by the Engineer. The ground water around newly poured concrete shall be kept to an approved level by pumping or other approved means of drainage at the cost of the Contractor. Adequate steps shall be taken to prevent flotation or flooding. Steps, as approved by the Engineer, shall be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion, mixing with earth or other deleterious materials, etc. that may impair the strength and durability of the concrete.

As soon as the concrete has hardened sufficiently for the surfaced to be marked it should be covered with hessian, canvas, or similar materials and kept continuously wet for at least 7 (seven) days after final setting. This period may be extended at the direction of the Engineer, up to 14 (fourteen) days. Concrete slabs and floors shall be cured by flooding with water of minimum 25 mm. depth for the period mentioned above.

Approved curing compounds may be used in lieu of moist curing with the permission of the Engineer. Such compound shall be applied to all exposed surface of the concrete as soon as possible after the concrete has set. No extra payment is allowed on such count.

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3.11 Concrete Finish

The Concrete surface on removal of form work shall be such that no finish is necessary, if however, the surfaces are not satisfactory the Contractor shall, if so instructed, remove unwanted, projecting parts by chipping and smoothening the surface with cement rendering at his own expenses. The shutter marks shall invariably be removed by rubbing with carborandum stone. The Contractor shall therefore take all precaution for avoiding the shutter marks.

3.12 Construction Joints

These shall be in according with IS:337 or as directed.

3.13 Expansion Joints

Expansion joints shall be provided at position as directed and the spacing shall not exceed the limits specified in IS:456. These shall comply strictly with the details shown on approved construction drawings. Reinforcement shall not extend across any expansion joint and the break between the two sections must be complete.

3.14 Details of typical expansion joints and construction joints should comply with the suggestive arrangements shown in IS:3370 (Part-I), Clause 8.1 (a)(2), Figure 2 (for expansion joints) and Clause 8.1(a) Figure 1, Clause 8.1 (b) Figure 4 (for construction joints).

3.15 P.V.C. Water Stops

The materials shall be durable and tough and as per approval of the Engineer. The minimum thickness of PVC sealing strips shall be 6 mm. and the minimum width 225 mm. Actual shape and size shall be as per drawings. The materials should be of good quality polyvinyl chloride highly resistant to leading abrasion and corrosion as well as to chemicals likely to come in contact with during use. The physical properties will generally be as follows :

Specific Gravity	1.3 to 1.35
Shore Hardness	60 A to 80 A
Tensile Strength	100 to 150 Kg./cm ²
Minimum Safe Continuous Temperature	75°C
Ultimate Elongation	Not less than 275%
Water Absorption	Not more than 5% by weight in a 7 day test.

3.16 Rubber Water Stops

The materials must be very durable and tough and as per approval of the Engineer. The ribs shall be sufficient to ensure proper bonding with concrete. The width shall be minimum 225 mm. and thickness minimum 6 mm. The rubber water stop must be used in long lengths to avoid splicing as far as practicable. Ends shall have at least 200 mm. overlaps and vulcanized. The materials shall be natural rubber and be resistant to corrosion tear and also to attacks from acid, alkalis and chemicals normally encountered in service. The physical properties will generally be as follows :

Specific Gravity	1.1 to 1.15
Shore hardness	65 A to 75 A
Tensile Strength	250 to 300 Kg/Cm ²
Maximum safe continuous temperature	75°C
Ultimate elongation	Not less than 350%

Water Absorption

Not more than 350% by weight in a 7 day test.

3.17 **Contractor's Supervision**

The Contractor shall provide constant and strict supervision of all the items of construction during progress of work, including the proportioning and mixing of the concrete and bending and placing of reinforcement. Before any important operation such as concreting or stripping of form work adequate notice shall be given.

3.18 **Laying Cement Concrete Foundations and Under Floors**

Before laying the concrete, the bottom and sides of the trench upto the proposed height of the concrete shall be moistened.

The concrete shall be laid and not thrown, in layers not exceeding 150 mm. in depth and shall be tamped / vibrated immediately after laying.

3.19 **Chases, Holes, Recesses and Inserts**

All chases, holes and recess for foundation or other bolts, various services and other requirements must be formed as shown on the approved drawings or as directed during the execution of the work, without any extra charge. The Contractor shall fix all necessary inserts or fixtures in the concrete for support of hangers etc., for pipes and cables, ceiling clamps for lights and fans or for duct etc. If any of the inserts are to be supplied by other agencies, no extra payment will be made to the Contractor for placing the inserts in position. The approximate nos. of MS inserts required for fixing of cable tray/hangers in 400. The load carrying capacity of inserts per sq. m. may be taken as 100 kg.

3.20 **Load Testing of Structure**

Load tests shall be carried out in accordance with IS:456, if required.

4. **BRICK WORK**

4.1 Applicable provisions of Conditions of Concrete shall govern work under this section.

4.2 The Contractor shall build the whole of brick work, shown on the approved drawings with first class bricks conforming to IS:1077 and IS:2212 in cement mortar as described.

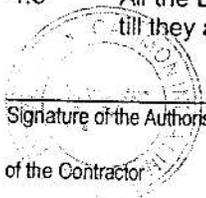
4.3 Unless otherwise specified, the proportions of cement-sand mortar for various classes of brick work shall be as given below :

Type of Work	Cement	: Sand
a) Ordinary brick work with Thickness 250 mm. above for building superstructure	1:	6
b) Brickwork in pillars and foundation	1:	4
c) Half brick or brick-on-edge portion wall with H.B. netting in every alternative 3rd layer	1:	4
d) Brickwork in water retaining structures	1:	3

The cement and sand shall be thoroughly mixed dry in specified proportions. Water shall then be added just sufficient to make a stiff and workable paste. The mortar shall be used within half an hour of mixing.

4.4 The Contractor shall build all brickwork uniformly, no one portion being raised more than 1 meter above another at a time. The joints shall not exceed 12 mm. in thickness and should extend the full thickness of the brickwork. All joints shall be properly raked and the surface washed down.

4.5 All the bricks shall be kept fully immersed in water at least for a minimum period of six hours till they are completely soaked and only thoroughly soaked bricks shall be used in the work.



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