Republic of Yemen

Ministry of Water & Environment

Local Water and Sanitation Corporation –

tiaz Gov.

Maintenance and Replacement of Damaged Parts Project

in ((Al-Jahmaliyah Street, and Hawd Al-Ashraf Street (Shaeb Aldabain))

Salalah Directorate - Taizz Governorate

Technical Specification

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1. SCOPE OF WORK

1.1 DESCRIPTION

The project comprises theMaintenance and Replacement of Damaged Parts Project in 3 Neighborhoods (Al-Jahmaliyah Street, Al-Thawrah Street, and Hawd Al-Ashraf Street) in Salalah Directorate - Taizz Governorate

The work will include civil, supply, delivery and installation works of the Water distribution network according to the related drawings and BOQ which are:

- Supply, deliver and install HDPE pipes (DN25) with total length of about 184 m.
- Supply, deliver and install G.I pipes (DN25,20) with total length of about 102 m.
- Supply and Installation of UPVC, P.P, D.I, G.I Fittings.
- Supply and Installation of Valves.
- Supply and construct of Concrete Valve Chambers.
- Supply and Installation of domestic water meters
- Supply and installation of galvanized iron distribution pipes (DN 25, 20) for 311 houses.

A detailed site investigation study has been carried out for the project area, which forms part of the available information for tendering purposes. Any geotechnical investigations required during construction shall be at the Contractor expense and will be deemed to be included in his tendered rates.

1.2 Coordination

Contractor shall plan schedule and coordinate his operations in a manner, which will facilitate the simultaneous progress of the work under this Contract as well as operations being performed by the Employer and work included under other contracts outside the scope of these Contract Documents.

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1.3Work Included

The required work is described by the Drawings and Contract Documents and may be defined as including but not limited to the following:

- Site Clearing and Grubbing.
- Earthworks (filling, excavation and backfilling).
- Supply and Installation of Pipes and fittings.
- Supply and Installation of valves, and special equipment.
- Construct of chambers, surface boxes.
- Reinstatement works (asphalt and Stone Pavement pavements).

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2. GENERAL REQUIREMENTS

2.1UNIT OF MEASUREMENT

Units of measurement used in this Contract shall be in accordance with the International System of Units, which generally referred to as the SI metric system.

2.2GENERAL OBLIGATIONS

a. The Contractor shall attempt to decrease noise and environmental pollution as much as possible.

b. The Contractor shall not use the Site for purposes other than the execution of the works.

c. The Contractor shall drain floodwater and excess water by pumping to prevent damage to any third party.

d. The Contractor shall preserve trees, planted fields and fences in a suitable manner, and shall replant and replace those trees that were damaged or removed, and re-erect and restore fences to their original condition, in accordance with the Engineer's instructions.

e. In case of need to erect scaffolding on the property of any neighbor, then the Contractor shall contact the said neighbor and arrange for the proper execution, and for the removal of the scaffolding, and carry out all repairs at the completion of the work.

2.3MATERIALS AND MANUFACTURED ARTICLES

All material and workmanship shall be subject to the acceptance of the Engineer and the Engineer's Representative and shall be in conformity with acceptable modern practice.

In general, whenever the Contract Documents show or specify a particular make of material, manufactured article, device or equipment, it shall be regarded merely as a standard.

When a reference is made in the Contract Documents to standards or specifications of associations such as DIN, ISO, AWWA, ASTM, BS or others, the provisions of the latest revision of the standards or specifications shall be applicable.

In general, if two or more makes of material, manufactured articles, devices or equipment are shown or specified, each shall be regarded as the equal of the other. Any other make of material, manufactured article, device or equipment which is recognized equal of that specified, and is suitable for the purpose intended and accepted in writing by the Engineer and

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Engineer's Representative, will be accepted. However, in cases in which provision is made for tendering alternative makes of equipment, the Employer will select the alternative make that it considers will be most advantageous under the conditions

In all cases, new materials and equipment shall be used

2.4 ACCESS AND TEMPORARY ROADS

The Contractor shall be responsible for providing and maintaining such temporary access roads to and along the right-of-way as necessary for transportation of materials and equipment.

The Contractor shall furnish and install cross drains where necessary or as required by the Engineer to assure proper drainage across all access and temporary roadways to prevent pounding of water or interruption of natural surface drainage in any way.

Where such roads are on private property, the Contractor shall obtain permission for their construction, use and removal, and pay all costs pertaining thereto. Except as shown on the Drawings or specified elsewhere all temporary construction roads shall be removed upon completion of Work and the area restored to its original contours and original type of ground cover.

2.5 CONTROL OF WORK MANAGEMENT

a. The Contractor shall co-operate with the Engineer in arranging the times and dates of Site meetings, and in the preparation of Minutes of Meetings.

b. He shall co-operate with the Engineer in taking photographs for the presentation of the progress of the work, and in the preparation of the periodic progress reports.

c. He shall provide the Site with signs which show the name of the Project, Employer, Engineer, and the Contractor; in the number, size and shape which shall be agreed upon with the Engineer.

d. In case of Engineer or Engineer’s Representatives rejection of any material or work, the Contractor shall, before starting to rectify such condition, submit his proposals for such rectification or repair to the Engineer or the Engineer’s Representative, to alleviate the repetition of the error.

2.6 WORK NEAR HAZARDOUS EQUIPMENT

Any permanent fencing or other safeguards required to be erected around electrical or potentially hazardous equipment shall be completed as far as practicable before the equipment is energized or brought into operation, but where this is not practicable the Engineer's Representative may permit the use of temporary fencing or other safeguards.

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If work is to be carried out in the vicinity of live electrical equipment or of potentially hazardous equipment which is in operation, the Contractor shall put into operation a controlled access system to the approval of the Engineer's Representative. Such permission or approval shall not create any responsibility or liability on the part of the Engineer or the Engineer's Representative resulting from the use of such temporary safeguards.

The Contractor shall keep all traveled ways free of foreign object such as rocks, timber, and other items that may fall from transporting vehicles of workmen.

Spillage of material carried by or dropped from the under-carriage of any carrying vehicle or workmen resulting from the Contractor's hauling operations along or across any public traveled way shall be removed immediately and such traveled way, both within and outside of the Contract limits, shall be kept free of such spillage by the Contractor. The Contractor shall conduct the operations to keep job-related dust to a minimum.

2.7RESTORATION OF PRIVATE AND PUBLIC RIGHT-OF-WAY

Where the Work is on right-of-way provided through private property, the Contractor shall exercise special care to avoid damage. He shall confine his operations to the limits of the right-of-way provided unless he makes special arrangements with the owners. All public and private properties shall be restored by the Contractor to at least as good a condition as existed prior to entry by the Contractor to perform the Work.

All damage caused to existing roadways, walkways, ground configuration, plantings, trees, waterways, or embankment areas, fences, walls and other structures and facilities through trucking operations, delivery of materials, the actual performance of the Work, or other causes, shall be fully restored by the Contractor at his own expense to its original condition by supplying surfacing, pavement, soil grading, plants, trees, grass, topsoil, fertilizer, fencing, structural methods and such other materials and methods as may be necessary.

2.8DISPOSAL OF SURPLUS MATERIAL

The Contractor must submit for approval by the Engineer and local municipal authorities the location of all proposed surplus material disposal sites and copies of an agreement with the property owner noting conditions of such agreement. The minimum requirements by the Engineer would be that final grading blend aesthetically with the surrounding ground and that proper drainage of site be maintained.

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2.9WORK CLEAR OF WATER

The Contractor shall keep the Works well drained until the Engineer certifies that the whole of the Works is substantially complete and shall ensure that so far as is practicable all work is carried out in the dry. Excavated areas shall be kept well drained and free from standing water.

2.10 MEDICAL FACILITIES

The Contractor shall arrange for medical attention to be available when necessary and shall provide dressing stations complete with all adequate first-aid equipment within easy access of each Works area on the site. The Contractor shall display in suitable places the names of his employees who are available from time to time to render First Aid. The Contractor shall provide for the transport of serious cases to the nearest hospital

3. CONTRACT DETAILS

The Contractor shall treat the details of the Contract as private and confidential for his own information only and shall not publish or disclose the details in any trade or technical paper or elsewhere (except as necessary for the purpose hereof) without the previous consent of the Employer.

3.1 MAINTENANCE AND PROTECTION OF TRAFFIC

The Contractor shall maintain traffic and protect the public from damage to person and property, within the limits of and for the duration of the Contract. Traffic shall be maintained over a reasonable smooth traveled way, which shall be so marked by signs, delineation and/or other methods that a person who has no knowledge of conditions can safely, and with a minimum of discomfort and inconvenience, ride, drive or walk over all or any portion of the highway under construction where traffic is to be maintained.
The Contractor is placed on notice that the maintenance and protection of traffic over Project streets during construction is considered as important and necessary item of the Work as the actual construction work itself.

3.2 SUBSURFACE STRUCTURES AND ALL UTILITIES

Before beginning excavation operations, the Contractor shall contact the local municipalities and utilities and notify them of his intention to begin excavation operations

It shall be the responsibility of the Contractor to determine the exact location of such pipelines, subsurface structures and/or utilities ahead of his work by exploratory excavation or other means

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and to take suitable precautions to prevent damage to them and to prevent interruption of the services. If they are broken or damaged, they shall be restored by the Contractor or the appropriated utility at the Contractor's expense.
The Contractor shall bear the costs for relocating, altering or reconstructing water mains, sewers, poles, pole lines, overhead wires and all the facilities above ground. The work shall conform to the requirements of the local authorities concerned.

3.3 COMMISSIONING & TAKING OVER TESTS

All the fully assembled plant or equipments is to be tested again for commissioning and perfect operation after complete installation for the taking over, and all these shall be witnessed by the Engineer at site. The Contractor shall make all needed adjustments and calibrations for this purpose for all the equipments at this stage as approved by the Engineer. All testing instruments, gauges, tools used in this Taking Over tests as instructed by the Engineer shall be certified by a 3rd party (1st grade) authorized Firm

4. COORDINATION

4.1 DESCRIPTION

This section covers the Contractor's requirements for coordinating work of this Project.

4.2Project Coordination

The Contractor shall be responsible for the coordination of all work performed under these Contract Documents; including scheduling of all work, delivery of equipment and materials, establishing the work sequence, and completion of the work in accordance with the construction schedule and the specified time of completion.

4.3 COORDINATION WITH OTHER CONTRACTORS

The Contractor shall inform the Engineer, and all other parties with an interest in this project concerning his construction schedule and shall coordinate his work with that performed by others. The Contractor shall make all necessary arrangements concerning the timing, methods, and division of work required by any connections between this work and other work to be performed by others.

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4.4 RELATIONS WITH OTHER CONTRACTORS

The Contractor shall cooperate with all other contractors who may be performing work in behalf of the Employer and workmen who may be employed by the Employer on any work in the vicinity of the work to be done under this Contract, and he shall so conduct his operations as to interfere to the least possible extent with the work of such contractors or workmen. The Contractor shall promptly make good, at his own expense, any injury or damage that may be sustained by other contractors or employees of the Employer at his hands. Any difference or conflict which may arise between the Contractor and other contractors or between the Contractor and workmen of the Employer in regard to their work shall be adjusted and determined by the Engineer.

Whenever there is interference with work under other contracts, the Engineer shall decide the manner in which the work shall proceed under each contract.

4.5UNDERGROUND INSTALLATION

Existing underground installations such as water mains, gas mains, sewers, telephone lines, power lines, and buried structures in the vicinity of the work to be done hereunder are indicated on the Drawings only to the extent such information has been made available by the Employer, or discovered by the Engineer in preparing the Drawings. There is no guarantee as to the accuracy or completeness of such information, and all responsibility for the accuracy and completeness thereof is expressly disclaimed.

The Contractor shall be solely responsible for locating all existing underground installations, including service connections, in advance of excavating or trenching. The Contractor shall use his own information and shall not rely upon any information indicated on the Drawings concerning existing underground installations.

4.6**EXISTING STRUCTURES**

The dimensions and elevations and locations of existing pipelines, conduits, cables, and equipment so indicated on the Drawings (if any) were taken for the most part from the Employer's records of the existing plant and are not guaranteed for accuracy.
It shall be the responsibility of the Contractor to check all dimensions and elevations of existing structures, pipelines, conduits, cables, equipment, or other existing items, both above and below

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ground, affected by or affecting the work under this Contract, prior to the start of construction or ordering of materials and equipment affected thereby.

The Contractor's attention is directed to the General Conditions which requires that each tenderer visit the site of the work to familiarize himself with the arrangement and condition of the site.

The Contractor shall be solely responsible for determining the extent of the cost of all removal and salvage operations. Any delay or extra expense to the Contractor due to encountering construction, piping, or equipment not shown or in locations different from those indicated on the Drawings (if any) shall not constitute a claim for extra work, additional payment, or damages.

4.7 OPERATION OF EXISTING FACILITIES

The Contractor's attention is directed to the fact that all existing services must be kept in continuous operation.

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5. EXCAVATION AND BACKFILLING

The work covered by this section consists of providing all plant, labour and materials, and of performing all operations in connection with clearing and grubbing of the job site from young growth, roots, from old building, fences and debris.

Stripping of topsoil, excavation of soil and rock for buildings, general placing of soil and refilling of the working spaces and trenches including compaction. Preparation of the final grade and topsoil. The work shall include disposal of surplus material, all necessary sheeting, shoring, protection of work and dewatering as required

5.1Planks for Shoring

Planks for shoring of excavation pits shall have the same form over the entire length. Deformed planks shall not be used. If wooden planks are used, they must have a minimum thickness of 50 mm

5.2Excavation in Private Property

(a) Before commencing any excavation work in private property, the Contactor shall prepare and agree with owner or occupier of such property, a record of the state of the surface with particular reference to any features that may require special care and reinstatement. The records shall be drawn up in collaboration with the Engineer, who shall be supplied with copies of all such agreements and records. No claim for extra work, delay, or stoppage will be entertained.

(b) Road Excavation - Replace Soil by Selected Material

The subgrade in cut, where the soil is unsuitable for retention as the subgrade layer; CBR > 25%, it shall be sub excavated to a depth of 200 mm below top of subgrade to allow for subsequent placing and compaction of the subgrade layer (topping).

5.3 BACKFILLING

Satisfactory material shall be used in bringing fill to the required lines and grades. The material shall be free from roots and other organic matter, trash, debris and stones larger than 80 mm in any dimension. Material as specified above for fill and backfill shall be obtained from the required excavation on site, if acceptable, (Liquid limit less than 40 and maximum dry density

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greater than 1.7 ton/cu m. (Modified Proctor) provide that the backfill material A1,A2,A3 acceptable to the Engineer). Unsatisfactory material on surfaces or in excavated areas to receive fill shall be removed and replaced with satisfactory material. No fill material shall be placed on muddy areas or on surfaces which have not been approved and comply with the following:

1- Maximum dry density not less than 1.7 gm/cm3 (AAHSTO T-180D) 2- Organic matter not more than 5% (AAHSTO T-267)

3- No use of A-6, A-7 soil (AAHSTO M-145)

4- Maximum size not more than 2/3 of the layer thickness

5- Plasticity Index (PI) less than 15%

6- 4-day soaked CBR should not be less than 10% (AAHSTO T-193) when compacted at 90% maximum dry density in accordance with AASHTO T - 180D.

7- No use of high to medium expansive soils.

5.4 Soil Compaction

Prior to constructing the select-material layer, the previously constructed subgrade shall be cleaned of all foreign substances. Surfaces of subgrades shall meet the specified compaction and surface tolerances. Ruts or soft yielding spots that may appear in the subgrade, areas having inadequate compaction, and deviations of the surface from specified requirements shall be corrected by loosening, removing and by adding approved material, reshaping to line and grade, and re-compacting to specified density requirements.

SCOPE OF WORK Furnish all labor, materials, tools and equipment and incidental required and install 13 mm to 25 mm exposed galvanized steel piping and appurtenances as shown on the drawings and as specified herein.

5.5 RELATED WORK

Trenching, backfilling and compaction.
Concrete work.
Valves and appurtenances

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5.6 SUBMITTALS.

Shop drawings and product data and shall include the following: Installation instruction and drawings of typical pipe joints and fitting assemblies.
Description of proposed field testing and disinfecting methods, procedures and apparatus.

5.7 REFERENCE STANDARDS

British Standards BS 1378, medium series, seam welded steel tubes, hot dip galvanized,
BS 1740, fittings, galvanized
B.DIN or other Standards
DIN or other Standards DIN 2440, medium weight
ASTM A120
JSS No. 137, medium class

6. QUALITY ASSURANCE

All galvanized steel pipe and fittings of each type shall be furnished by a single manufacturer who is experienced in the manufacture of the items to be furnished; however, it shall not be a requirement that the pipe and fittings be manufactured by the same manufacturer, provided that the pipe and fittings are compatible in both composition and size. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall be suitable for the intended service.

6.1 SYSTEM DESCRIPTION

Piping shall be installed in those locations as shown on the Drawings.

The galvanized 13mm and 25mm exposed pipes are to be installed inside the property to rearrange for the water meter installation as shown on the design drawing details.

In general, new water house services will be constructed when new water mains are constructed in The length of galvanized steel pipe, fittings and required valves are based upon the Engineer's best estimate of the number of house services require; however, the Contractor is advised that the number actually installed could vary from the number estimated

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7. EXECUTION

The Contractor shall furnish all labor, materials, tools and equipment necessary for installing the galvanized steel pipe, iron fittings and appurtenances which in general will be used for house services. Installation of the galvanized steel pipe, iron fittings and appurtenances shall be as shown on the Drawings, specified herein, directed by the Engineer's Representative, and in accordance with the manufacturer's instructions. Included hereunder are protection of existing structures and facilities; the removal and replacement of curbs, sidewalks, stairs, staircases, ramps, sidewalk tiles, driveways, guard rail, posts, markers, signs, walls, fences, and other structures and facilities which must be removed to carry out the work; the removal and / or relocation of underground pipe, structures and / or utilities, where required, which are not the responsibility of the owner of facilities; the removal and replacement of shrubs; installing, cleaning, testing and disinfecting the galvanized steel pipe and iron fittings or necessary tappings; and all other work necessary to complete the Contract as shown, specified or directed

7.1 HANDLING AND STORAGE

7.1.1 All pipe, fittings and appurtenances shall be handled with every precaution to prevent damage. Pipe, fittings and appurtenances shall be loaded and unloaded by lifting with hoists or skidding in order to avoid shock or damage. Under no circumstances shall material be dropped. Pipe shall not be rolled or skidded against other pipe. All slings, hooks or other devices for lifting pipe, fittings and appurtenances shall be adequately padded to prevent damage to the pipe, fittings and appurtenances

7.1.2 Pipe, fittings, and appurtenances shall be stored so as to ensure the preservation of their quality and fitness for the work, and where they will not interfere with excavation operations, public travel or access to private

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property. All pipe, fittings and appurtenances shall be kept free form dirt, rocks or other foreign matter.

7.1.3 Products cracked, gouged, chipped, dented or otherwise damaged will not be approved and shall be removed from the Project and replaced at the Contractor's expense

7.2 INSTALLATION

7.2.1 Pipe, fittings ad appurtenances delivered to the job site shall be carefully inspected and any section found defective shall be removed from the site. Any pipe, fitting or appurtenance found to be broken or defective after it has been installed shall be removed and replaced at the Contractor's expense. All pipe, fittings and appurtenances shall be laid true to the lines and grades specified herein, as directed by the Engineer's Representative, or any that may be shown on the Drawings.

7.2.2 B. The galvanized steel pipe and iron fittings shall have threaded joints. The ends of the pipe and fittings shall be inspected prior to installation and all lumps, blisters and

7.2.3 excess coatings shall be removed. The ends of pipe and fittings shall be wiped clean and dry of all dirt, sand and foreign matter. When joining the threaded pipes and fittings, the threads shall be painted with an approved lead-free jointing compound.

7.2.4 C. Prior to installation of pipe, fittings and appurtenances, the Contractor shall familiarize himself fully with all literature furnished by the manufacturer with respect to installation of galvanized steel pipe, iron fittings and appurtenances. All installation shall be in accordance with the manufacturer's literature and recommendations, unless otherwise shown, specified or directed. Pipe, fitting and appurtenances shall be thoroughly cleaned before they are laid and shall be kept clean until acceptance of the completed work.

7.2.5 D. At the close of a day's work or whenever pipe laying is not in progress, the open ends of the pipe or fittings shall be plugged, capped or otherwise made watertight to prevent the entry of foreign material of any nature. Care must be taken to prevent pipe or fitting floatation should the trench fill

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with water. The Contractor shall be responsible for all damage to the installed pipe, fittings, appurtenances and valves resulting from flotation or any other cause.

7.2.6 E. All pipe cutting required for the installation of fittings, appurtenances and valves shall be performed with abrasive wheel-type pipe cutters. Cutting shall be accomplished in such a manner as to prevent damage to the pipe or fitting.

7.2.7 F. Any section of pipe or fitting found to be laid at the wrong grade or to have settled shall be removed and relaid to the satisfaction of the Engineer's Representative at the Contractor's expense.

7.2.8 G. Field measurements shall be taken where required prior to installation to ensure proper fitting of the work. Where pipe is threaded in the field, the threading operation shall be performed in a manner approved by the Engineer's Representative. All valves and fittings shown, specified or directed shall be incorporated into the piping systems as required.

8. CONCRETE FORMWORK

8.1DESIGN CRITERIA

Forms shall be designed to produce hardened concrete, having the shape, lines, and dimensions indicated on the Drawings. Forms, for surfaces, which will be exposed to view when constructed, shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard. Forms for exposed surfaces, shall be laid out in a regular and uniform pattern, with the long dimension of panels vertical, and all joints aligned. The forms shall produce finished surfaces, that are free from offsets, ridges, waves, and concave, or convex areas. The maximum deviation from a true plane, shall not exceed 3 mm in 2 m. The use of proprietary forming systems is encouraged by the Engineer and should be used where possible.

Plywood or lined forms will not be required for surfaces, which are normally submerged, or not ordinarily exposed to view. Unlined wooden forms may be used for surfaces, which are not restricted to plywood, or lined forms, and may be used as backing for form linings. Concrete forms, are required above all extended footings.

Flat segmental forms, not more than 600 mm in width, may be used for forming curved surfaces, 7600 mm in diameter or larger.

Forms shall be substantial and sufficiently tight, to prevent leakage of mortar. Forms shall be braced, or tied, to maintain the desired position, shape, and alignment, during

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and after concrete placement. Walers, studs, internal ties, and other form supports, shall be sized, and spaced, so that acceptable working stresses are not exceeded. Wherever the top of a wall will be exposed to weathering, the forms on at least one side, shall not extend above the top of the wall, and shall be brought to true line and grade. At other locations, forms for concrete, which is to be finished to a specified elevation, slope, or contour, shall be brought to a true line and grade, or a wooden guide strip, shall be provided at the proper location on the forms, so that the top surface can be finished with a screed, or template. At horizontal construction joints in walls, the forms on one side, shall not extend more than
0.6 meters, above the joint.
Temporary openings shall be provided, at the bottom of wall forms, and at other points, where necessary, to facilitate cleaning, and inspection.

8.2 Form Ties

Form ties, shall be of the removable end, permanently embedded body type, and shall have sufficient strength, and rigidity, to support and maintain the form in proper position, and alignment, without the use of auxiliary spreaders. Cones shall be provided, on the outer ends of each tie, and the permanently embedded portion, shall be at least 25 mm back from adjacent outer concrete faces. Form ties for water-bearing walls, shall be provided with water-seal washers, and located on the permanently embedded portions of form ties, approximately at the center of the wall. Permanently embedded portions of form ties, which are not provided with threaded ends, shall beconstructed, so that the removable ends are readily broken off, without damage to the concrete. The type of form ties used shall be acceptable to the Engineer.
Form ties in exposed surfaces, shall be uniformly spaced, and aligned in horizontal and vertical rows.

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9. CONCRETE REINFORCEMENT

9.1 Protection

Reinforcing steel shall be carefully handled, and shall be stored on supports, which will prevent the steel from contacting the ground. Proper drainage, and protection from the elements, shall be provided, to minimize corrosion.

9.2 Accessories

The Contractor shall furnish all accessories, such as reinforcing steel supports, hold-downs, spreaders, hangers, tie wire, and all other incidentals, necessary to complete an acceptable installation of all concrete reinforcement. All accessories shall be of steel, with the exception of spacers, to maintain concrete cover to reinforcement against formed or blinded surfaces, which shall be of concrete of the same texture, color, and composition, as cast-in-place concrete. Alternatively, accessories may be PVC type, if so instructed, or accepted, by the Engineer. Concrete spacers, shall be in the form of a truncated cone, or pyramid, and shall be used with the larger face toward steel reinforcement. The smaller face of truncated cone, or pyramid, shall have a minimum dimension of 50 mm.

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10. CAST-IN-PLACE CONCRETE

This section covers all cast-in-place concrete, including materials, proportioning, batching, mixing, delivering, testing, receiving, placing, compacting, finishing, curing, and other appurtenant work.

Portland cement concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, sand and admixtures and shall be proportioned and mixed as specified herein.

All cast-in-place concrete shall be accurately formed and properly placed and finished as indicated on the Drawings and specified herein.

The Contractor shall inform the Engineer at least 24 hours in advance of the times and places at which he intends to place concrete.

10.1.1 Hot Weather Concreting

A report shall be submitted for proposed methods of compliance with hot weather concreting requirements. Providing chilling plant might be required.

10.1.2 Cold Weather Concreting

A report shall be submitted for proposed methods of compliance with cold weather concreting requirements.

10.1.3 Certificates

Laboratory test reports and mill or manufacturer's certificates attesting to conformance of ingredients with the specifications shall be submitted with each mix design.
In case the source, brand or characteristic properties of the ingredients need to be varied during the term of the Contract, a revised laboratory mix report shall be submitted.
A certificate shall be submitted stating that each admixture used is identical in composition to the sample used for acceptance testing, and is compatible with all other material in the design mix

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10.2 Mix Design:

Using concrete materials acceptable to the Engineer, a tentative concrete mix shall be designed and tested for each size and gradation of aggregates and for each consistency intended for use on the work. Design quantities and test results of each mix shall be

submitted for review. Mixes shall be adjusted in the field as necessary to meet the requirements of these specifications.

The Report for each tentative concrete mix submitted shall contain the following information:

a. Slump on which design is based.

b. Total gallons of water per cubic yard.

c. Brand, type, composition, and quantity of cement.

d. Brand, type composition, and quantity of fly ash.

e. Specific gravity and gradation of each aggregate.

f. Ratio of fine to total aggregates.

g. Weight (surface dry) of each aggregate per cubic yard.

h. Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture.

i. Air content.

j. Compressive strength based on 7 day and 28 day compression tests.

k. Time of initial set.

10.3 **Packaged Cement**

When required, packaged cement shall be delivered to the mixing site in original moisture proof, sealed containers, which shall be labeled with the weight, name of

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manufacturer, brand, and type specified. Cement received in broken or damaged containers shall not be used.

Cement containers shall be stored in dry, weather-tight, and well ventilated enclosures. Containers of cement which vary in weight by more than 3 per cent shall not be accepted.

10.4 Water

Water to be used for cooling and washing aggregates, and for mixing and curing concrete shall be clean and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances. Concreting water shall not be used until tested and until the report of testing has been reviewed by the Engineer.

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11. MATERIAL, INSTALLATION AND TESTING PROCEDURES FOR HDPE PIPES for water supply system

11.1 HDPE PIPES

The pipes shall be manufactured from high density polyethylene containing only those antioxidants, UV stabilisers and pigments necessary for the manufacture of potable water black pipes and comply with ISO/DP 4427/ clause 4.1. The Contractor shall provide an approved third party certificate to verify the above. Rework material generated from a manufacturer's own production of pipes, shall not be used.
Materials in contact with or likely to come into contact with potable water shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste or odour and cloudiness or discoloration of the water. Concentration of substances, chemicals and biological agents leached from materials in contact with potable water, and measurements of the relevant organoleptic / physical parameters shall not exceed the maximum values recommended by the World Health Organisation (WHO, 1984) or as required by the EEC, Council Directive 1980, whichever is in each case is the more stringent.
The pipe manufacturer shall provide evidence of the nominal values of the density and melt flow rate (index) of the raw material. The density of the raw material (compound) shall not be less than 0.945 g/cm³.
The melt flow rate (MFR) for the raw material shall not be less then 1.0 g/10 min. tested at 190° C/5 kg. Evidence of nominal value of (MFR) for raw material shall be provided. The nominal value is the average value indicated by the pipe manufacturer as a standard value for his production. The MFR for raw material and for extruded pipe should be measured. Change of MFR by processing shall be less than 20% for the tested values. In addition, the MFR measured on the extruded pipe can deviate by ±30% from the nominal value

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11.2 Saddles

Saddles, ferrule cocks and self-contained ferrule straps/saddles shall be supplied by the Contractor for the purpose of making replacement and new house connections. Saddles shall be suitable for a working pressure of 16 bar and for fixing around the existing and proposed main distribution lines of diameters equal or greater than 100 mm (4"). The saddle shall be of single strap design and in two parts, flat top and bottom-bolted at both sides, pressure through the disc of max. 1.5" in diameter for mains of 100 mm diameter or less, and 2" for mains of diameters greater than 100 mm (4"). The inside corners of the saddle strap should be rounded to prevent digging into the pipes. The saddles shall be manufactured from gunmetal to DIN 1705 or BS 1400 to suit DI pipes. The saddles shall be supplied complete with the following:
Bolts and nuts of stainless steel to DIN 601, DIN/ISO 3506 or equivalent. Bolt heads shall be clearly marked with the manufacturer's name or his identification mark

12.VALVE CHAMBERS

Valve chambers shall be constructed of reinforced concrete C30 (fair faced class 1) for all valves with diameter ⍰200 mm and air valves on pipes with diameter ⍰ 200 mm.

Valve chambers and similar structures shall be built along the pipelines as required and in accordance with the Typical Drawings. Given dimensions on the drawings are to be verified by the Contractor so as to suit the pipe installation and the prevailing conditions on site.

Concrete supports for pipes, valves and any other fittings shall be placed at appropriate locations inside the chamber under the direction of the Engineer (even if not shown on the Typical Drawings).

Cast iron manhole covers with frames shall be installed for all valve chambers as specified or shown on the drawings. The wording on each cover shall be agreed with and approved by the Engineer prior to ordering.

Covers to be used in surfaces which are subject to vehicular traffic shall be tested for a load of 400 kN.

Manhole covers with bearing capacities of 400 kN and 250 kN according to DIN 1229 or equivalent shall be installed as instructed by the Engineer.

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Two pairs of keys for use with each type of cover shall be handed over by the Contractor after completion of the Contract at no extra cost.

All valve chambers shall be equipped with step irons, as indicated in the Drawings or as directed by the Engineer.

Step irons shall be of malleable cast iron, according to DIN 1211 galvanized iron or as directed by the Engineer.

Types of draining for the valve chambers shall be according to the Typical Drawings or decided on site.

Penetration holes with GS sleeve pipes shall be inserted into the ceiling of valve chamber (details of which are shown on the Typical Drawings), so as to incorporate the extension spindles of the valves inside the chambers.

Ventilation pipes of DI DN 100, DN 150 or DN 200 shall be installed at the highest possible point in all valve chambers (considering traffic load) and led to the nearest convenient outlet above ground. End of pipe to be flanged with a stand pipe DN 100/150/200 of ductile iron equipped with protection cap including non-corrosive insect screen.

If agreed by the Engineer, the ends of ventilation pipes may be constructed as a double flanged bend as shown on the drawing.

Exposed parts of vent pipe are to be painted with a weatherproof material as instructed by the Engineer.

Structural calculations including reinforcement drawings for all valve chambers shall be made by the Contractor. These calculations are to take into consideration the prevailing load and soil conditions.

Reinforcement of concrete chambers shall be included in the unit rates of valve chambers. Minimum requirement of steel reinforcement:

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2 layers of 12 mm dia. at 200 mm spacing crosswise, the Contractor shall submit structural calculations for the chambers for the Engineer's approval

All external pipe work before entering and after exiting a reinforced concrete chamber shall be fitted with flexible joints at a minimum distance of 300 mm from the external face of the chamber.

Isolation valve chambers shall be detailed by the Contractor to be constructed with appropriate thrust walls to resist any movement and to withstand full test pressure from either direction under closed valve condition.

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13. GATE VALVES

Gate valves furnished for installation inside structures shall be rising stem type with stuffing box stem seals. Gate valves which are buried or submerged shall be nonrising stem type with o-ring stem seals. All gate valves installed in vertical lines shall be square bottom, solid wedge type.

Design Requirements	AWWA C500
Special Requirements	
Throttling	Square bottom construction
Service	when larger than 150 mm
Vertical	Should be avoided Installation
Pressure Rating	PN 25 BAR

BALL VALVES :

All 65 mm or smaller shutoff valves shall be ball valves unless other wise shown or specified.

Ball valves - 50 mm or Smaller for Water Service

Pressure Rating	, 28 kg/cm2 nonshock (W.O.G.)
Body Material	Bronze with bronze, brass or stainless steel ball
End Type	, Threaded
Temperature Rating,	93 □C at 14 kg/cm2
Seat Material ,	Butadiene, TFE or synthetic rubber
Type ,	O-ring or packing
Material	Butadiene, TFE impregnated asbestos, or TFE
Stem Material	Bronze
Special Requirements	Three piece bodybolted together; swings out of line for repair.

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