

COORDINATION

The Contractor shall assume full responsibility for coordination of the entire Contract, including verification that all structures, piping, valves materials, instrumentation, and Plant components are compatible. The Contractor shall start up each Plant system and shall make all adjustments and tests necessary to ensure that each Plant item, system, and the entire Works are placed in proper operating condition to the satisfaction of the Engineer.

INSPECTION, SAMPLING AND TESTING SERVICE

- A. All products, Materials, and Plant shall be subject to inspection by the Engineer and Employer representative, or an independent third party proposed by the Contractor and approved by the Engineer at the place of manufacture. The Employer and the Engineer have the right to join or not the Third Party inspection.
- B. Unless otherwise indicated, all sampling and testing will be in accordance with any generally-accepted system of sampling and testing which, in the opinion of the Engineer will assure the Employer that the quality of the workmanship is in full accord with the Contract Documents.
- C. The Contractor will appoint, subject to the approval of the Engineer, and pay for the services of an independent firm to perform inspection and testing of on-site operations and materials as required by the Specification.
- D. Reports of testing will be submitted to the Engineer in duplicate, indicating persons during inspection, sampling and testing and any observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. The Contractor shall notify Engineer 24 hours prior to the expected time for operations requiring inspection and laboratory testing services
- F. Retesting required because of non-conformance to requirements shall be performed by the same independent firm on instructions by the Engineer. The Contractor shall bear all costs from such retesting.
- G. For samples and tests required for Contractor's use, the Contractor shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the Contractor's use shall be the Contractors responsibility

EXECUTION**INSTALLATION**

- A. Inspection: The Contractor shall inspect Materials or Plant upon the arrival on the Site and immediately prior to installation, and reject damaged and defective items.
- B. Measurements: The Contractor shall verify measurements and dimensions of the work, as an integral step of starting each installation.
- C. Manufacturer's Instructions: Where installations include manufactured products, the Contractor shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

MANUFACTURER WARRANTIES

The Contractor shall submit the manufacturer guarantee for all Plant against (a) Manufacturing defects, (b) improper assembly or erection, (c) defective workmanship or materials, and (d) leakage, breakage, or other failure. The guarantee period shall be as defined in the Conditions of Contract – Defects.

JOB CONDITIONS

All Plant furnished shall be designed to meet stipulated conditions and to operate satisfactorily within the environment of the Contract area.

SAFETY FEATURES

- A. The Permanent Works as installed shall have no features that could be a hazard to operators, maintenance staff, visitors, or other persons having access thereto. Guards, electrical safety devices, thermal insulation, noise suppression devices, written notices, safety colors, and the like shall be provided where needed.
- B. Adequate safeguards shall be provided to prevent personnel accidentally coming into contact with dangerous machinery, mechanisms, hot surfaces, electrically live parts, and other hazardous components or contents. During the implantation period until the completion of the contract guards shall be rigid, securely fixed and made so that they do not have to be removed during normal operation.
- C. The Contractor shall ensure that all pollutants are discharged in a controlled manner to satisfy the environmental protection requirements of the Employer.

SITE-SPECIFIC HEALTH AND SAFETY MANAGEMENT PLAN

The Contractor shall be responsible for the development and submittal a site-specific Health and Safety Management Plan and get the Engineer approval. Moreover, he shall implement this plan for the whole period of the project. Any violation of this plan will lead to stop the work until is rectified.

INSTALLATION AND OPERATION

- A. Plant shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary for proper results. When so specified, or when employees of the Contractor or his Subcontractors are not qualified, such personnel shall be field representatives of the manufacturer of the Plant or Materials being installed.
- B. All Plant installed under this Contract shall be placed in successful operation according to the written instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activities shall be provided.

OPERATION AND MAINTENANCE MANUALS

The Contractor shall provide Operation and Maintenance Manuals for each item of Plant. Manuals shall be provided in accordance with the Submittals Section.

CONTRACTOR'S SCHEDULE

The Contractor's construction schedules and reports shall be prepared and submitted to the Engineer within 7 days from the contract signing.

RECORD / AS BUILT DRAWINGS

The Contractor shall submit as-built drawings as CAD Drawings and Plans on GIS.

The Contractor shall maintain one record set of drawings at the Site. These drawings shall mark all project conditions, locations, configurations, and any other changes or deviations. All As-Built drawings shall be accessible to the Engineer at all times during the construction period.

Final payment will not be acted upon until all the As-Built drawings have been prepared and delivered to the Engineer said up-to-date As-Built drawings shall be in the form of a set of prints with carefully plotted information overlaid.

Upon Substantial Completion of the work and prior to final acceptance, the Contractor shall finalize and deliver a reproducible set of As-Built drawings, two hard copies and two electronic copies of the As-built drawings to the Employer, conforming to the construction records of the Contractor.

TRAFFIC CONTROL

Furnish all labor, equipment, materials and all incidentals required to control and maintain traffic safely and efficiently at all areas of the Site and comply with this section

1. At all times the main roads shall be open to traffic unless approval to close a lane is obtained from the local authority.
2. Make arrangements to the satisfaction of above authority such that Fridays, holidays, or nighttime emergency work can be made immediately when and if necessary while the works is in progress.
3. Do not store any materials on the roadway that would interfere with the flow of traffic.
4. Make every effort to accomplish the work as quickly and as efficiently as possible.
5. Trench protection as directed by the Engineer shall be readily available at the Site for use where necessary to protect the traveling public.

Contractor shall provide temporary (portable) traffic control signs (in the Arabic and English languages) to alert, advise and guide the traveling motorist and pedestrians of upcoming traffic restrictions.

DEMOLITION AND SITE CLEARANCE

All obstructions shall be removed, trees and shrubs grubbed up and the Site of the Works cleared at such time and to such extent as required after obtaining the necessary approvals from the concerned authorities such as local authority, and instructed by Engineer. All rubbish and material, unsuitable for further use, shall be removed and disposed of legally from the site

Any Existing concrete and asphaltic paving, curbs, sidewalk and miscellaneous yard structures within the areas designated for new construction work shall be completely demolished and all debris removed from the site. Excavation caused by demolition shall be backfilled with fill free from rubbish and debris. Work shall be performed in such manner as not to endanger the safety of the workmen or the public or cause damage to nearby structures. Contractor shall provide all barriers and precautionary measures in accordance with Employer's requirements.

All debris resulting from the demolition and removal work and trench excavation shall be disposed off the site by the Contractor as part of the work of this Contract. All other material shall be legally disposed of offsite by the Contractor at his expense. Burning of any debris resulting from the demolition will not be permitted at the site.

ALL EXCAVATION REQUIRED BY THIS CONTRACT SHALL BE UNCLASSIFIED. NO ADDITIONAL PAYMENT WILL BE MADE FOR ROCK EXCAVATION REQUIRED FOR THE INSTALLATION OF PIPE OR STRUCTURES SHOWN ON THE DRAWINGS.

EXPLOSIVES AND BLASTING

The Explosives are not allowed to be used for excavation.

EXCAVATIONS TO BE KEPT FREE OF WATER

The Contractor shall provide, maintain and operate de-watering or other pumping plant to remove water from the excavations, and shall construct such grips, drains, sumps and catch pits as may be necessary to prevent water from entering the excavations

The Contractor shall take all necessary precautions to ensure the stability of any of the Works against flotation or displacement during construction due to high subsoil water level, flood or other causes.

TRENCH EXCAVATION FOR PIPELINES

TRENCH EXCAVATION

Before commencing any trench excavations, the route of the trench shall be set out accurately, the natural ground levels recorded and the longitudinal sections prepared. The pipes and methods of jointing will be such that the locations of fittings and lengths of pipes may be adjusted in the field to suit the site conditions. A reasonable tolerance in the location of lines will be allowed but the Contractor should agree to any significant changes with the Engineer before starting work. The needed number of pipe and fittings for the excavated trench section shall be on-site.

The minimum width of the trench shall be equal to the pipe diameter plus 300 mm from each side for pipe up to DN 200 mm. (See details in contract Drawing). The mechanical excavation should be stopped sufficiently above the final elevation of the bottom of the pipe to trim the bottom of the trench and to

form proper bedding in undisturbed soil. Bulk excavation for manholes etc. shall stop 100 mm above formation level, with final trimming carried out by hand. Any excess trench excavations shall be filled with an approved material according to backfilling specification, where any excess excavations under formation level of chambers shall be filled with rubble concrete as specified at no expense to the Employer

The Contractor shall provide all necessary support for the excavated areas to ensure the safety of the public and the men working in these areas so as to prevent collapse or any fall of rock or other materials into the excavated area. The Contractor shall also ensure that all sites are kept clean and tidy at all times.

If notwithstanding such support and for any reason whatsoever and howsoever caused any such fall shall occur, the Contractor shall be entirely responsible for all renewed excavation and remedial work and shall remove the fallen material and refill the space or cavity entirely at his own cost.

As the excavation approaches pipes, conduits, cables or other underground facilities, mechanical excavation shall cease and the excavation shall be continued by means of hand tools. Where necessary, the Contractor shall provide temporary support for the existing utilities to prevent damage during his operations.

Trenches are to remain open for the shortest time possible to enable the pipe to be bedded, tested and backfilled. The Contractor is advised to seek guidance from the local authority as to the length of time a trench may remain open, as this may vary according to location and category of road or foot path, and the Contractor's performance.

All trench excavated material shall be removed immediately from the site so as not to endanger the work or any building, structures or property and to avoid obstructing sidewalks and driveways, and cause the minimum of obstructions to pedestrian and vehicular traffic.

All pipes shall be laid on a 150 mm bed of compacted sand and then shall be carefully backfilled with sand as shown on drawings to a depth of 300 mm above the crown of the pipe. Backfilling from the trench bed up to 300 mm above the crown of the pipeline shall be in layers, Bedding shall be compacted to 95% according to the requirements of the Modified Dry Density Proctor.

The sand backfill material shall not contain deleterious substances in excess of the following percentages:

Material	DIN / AASHTO / JSS Test Method	Percentage (Maximum)
Clay lumps	18123 - T 112	3
Coal and lignite	18128 - T 113	1
Material passing No. 200 Sieve	JSS 96/1987	15
Cl	4030 - T1 & T2 - BS 812	0.1

Hollow Shells	3.0
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BACKFILLING TO SURFACE:

The type of backfilling material shall be according to ground surface structure as follows:

FIRST: TRENCHES IN DIRT OR NATURAL SURFACE:

From 300 mm above the top of the pipe to the finished ground level, the trench shall be backfilled with approved selected materials, consolidated by approved mechanical methods in layers of thickness not more than 150 mm compacted thickness.

The degree of compacting shall not be less than 90% of maximum dry density based on the Modified Dry Density Proctor for backfilling in natural ground areas and as shown on the drawings.

In the event that excavated material is insufficient or unsuitable for the backfilling and filling operations on site, the contractor, and at his own expenses, shall obtain the suitable selected materials required from approved borrow pits.

SECOND: TRENCHES IN PAVED ROADS, STREETS, SIDE WALKS ETC.:

The contractor shall restore all pavements, sidewalks, curbing, or other property and surface structures removed or disturbed as a part of the work to a condition suitable and satisfactory to the Engineer. All pavements shall be sawcut 150 mm wider than the disturbed asphalted surface trench (on both sides of the trench). Also, Contractor shall use rubber-belts on all equipment to protect the existing pavement and sidewalks.

From 300 mm above the top of the pipe the surface in roads, paved areas or sidewalks shall be backfilled in layers not exceeding 150mm each after compaction and compacted 95% according to the requirements of the Modified Dry Density Proctor. Backfilling shall be according to the pipe route as follows:

1. Along Streets (Asphalted, M.C, and Seal Coated) Sidewalks and paved Areas. All the backfilling materials shall be selected material. The surface condition shall be restored with asphalt with no exception. Except for the top 300 mm, which shall be base coarse.
2. Across or Skewing Streets (Asphalted, M.C, and Seal Coated Areas). All the backfilling shall be selected material except for the top 300 mm which shall be plain concrete as shown on the standard drawings.

Base course material:

Sieve size (mm)	Sieve size (inch) & No.	Percentage by weight passing
51.00	2 in	100
37.50	1½"	70 - 100
25.00	1"	55 – 85
19.00	¾"	50 – 80
4.75	No. 4	30 – 60
2.00	No. 10	20 – 50
0.425	No. 40	10 – 30
0.075	No. 200	5 – 15

WARNING TAPE

Caution	تحذير
Water Authority	سلطة المياه
Water Pipe Line	خط مياه

SURFACE REIN-STATEMENT

In roads, streets, footpaths, agricultural areas, fields, etc. where excavation works are to be carried out, the Contractor shall use the appropriate equipment to ensure that damage to adjacent surfaces is minimized. Pavement cutting shall be in straight lines with vertical cuts.

All roads and street “improvements” excavated or damaged and any damage to adjoining property caused by construction operations shall be restored or repaired by the Contractor at his own expense to a technically sound condition at least equal to that pertaining before the Contractor started work. Materials used and work done in such restoration and repair shall be of the same kind, shall conform to the same dimensions and be of approved quality and shall conform to the requirements of the agency having jurisdiction.

WATER AND WASTEWATER PIPES LAYING AND CROSSING REQUIREMENTS

1. Water piping shall always be installed at higher elevation than adjacent sewer piping, without exception;
2. Water and sewer piping separation shall comply to the following:
 - a. If horizontal separation is greater than 1000mm horizontal length (from equipment/material or pipe outside wall) and less than or equal to 3000mm; then vertical separation shall be greater than or equal to 500mm vertical elevation (from pipe outside wall);

If horizontal separation is greater than 3000mm horizontal length (from equipment/material or pipe outside wall) then no vertical elevation differential is required

3. Separation between telemetry cabling and any wet piping system shall comply to both of the following:
 - a. Be 500mm horizontal separation from outside of piping and 300mm vertical separation from outside of piping, with cabling above (higher elevation to) wet piping.
 - b. Have physical protection of 100mm of soil overburden minimum.

FLUSHING AND DISINFECTION

After the completed pipeline has been tested, approved and backfilled, the Contractor shall disinfect the pipeline in the following manner:

The pipeline shall be flushed by potable water so as to flush out all dirt and other foreign material, sand, rubbish ...etc. that might be trapped in the pipeline during installation for time period until the line becomes clean in the opinion of the Engineer. After flushing the pipes, the system shall be drained completely, all valves shall be closed carefully and the system filled with a chlorine solution. All pipes, fittings, valves and appurtenances shall be disinfected by the Contractor as specified herein unless otherwise directed by the Engineer. All water and chlorine solution required for testing and retesting's shall be furnished by the Contractor at no additional cost to the Employer.

The Contractor shall take great care to keep the interior of the pipelines free of dirt and other foreign material. If in the opinion of the Engineer such material has entered a pipe and will not be removed by flushing, then the Contractor shall clean and swab the interior of the pipe with a five percent hypochlorite disinfecting solution to the satisfaction of the Engineer.

Simultaneously with the initial filling of the pipeline, the Contractor shall introduce a continuous feed of chlorine at the point where the pipeline is being filled. The rate of filling the pipeline and the feed rate of the chlorine shall be proportioned so that the initial concentration of the chlorine in the water in the pipeline is between 50 and 100 mg/l. To assure that this concentration is maintained, the chlorine residual shall be measured at blow-off points, combination air valves, or other suitable locations during the filling operation.

The following table shows the amount of chlorine required, if either liquid chlorine (gas at atmospheric pressure) or a one percent chlorine solution is used, to produce a 100 milligram per liter concentration in 100 meters of pipe for disinfection of the various diameters of pipe (figures given for information only):

DN(mm) Nominal	100% Liquid Chlorine (kg)	1% Chlorine Solution (liters)
250	0.51	51
200	0.33	33
150	0.18	18
100	0.08	8
80	0.05	5
50	0.02	2

After completion of the disinfection, operation for one pipeline section the Contractor may reuse this chlorinated water to disinfect adjacent sections of the pipeline, adding additional chlorine as required to produce the specified concentration of chlorine.

The Contractor shall submit a detailed description of the procedure he proposes to use to disinfect the pipelines including a description of all equipment to be used for the Engineer approval before starting the disinfection operations.

The chlorinated water shall remain in each section of the pipeline for at least 24 hours and during this period all valves and blow-off shall be operated in order to ensure that these appurtenances are adequately chlorinated

All pipelines shall be flushed by the Contractor after all hydrostatic pressure tests and disinfection operations have been performed and accepted by the Engineer.

After draining the chlorine solution, the pipe system shall be flushed with potable water until the free chlorine content is between 2 mg/l and 4 mg/l.

The Contractor at no additional cost shall furnish all water required for flushing to the Employer.