BAGUIO WATER DISTRICT

"Serving mankind is serving God"

TERMS OF REFERENCE

PIPELAYING WORKS - FOR THE PROPOSED INSTALLATION OF 8" Ø X 2,560M HDPE MAINLINE ALONG SAN CARLOS HEIGHTS, IRISAN TO MIDDLE QUEZON HILL

TECHNICAL SPECIFICATIONS

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STANDARD TECHNICAL SPECIFICATIONS

This specific provision describes the technical requirements, which is basically the elaboration of work items within the scope of work that forms part of the Contract.

DIVISION I – GENERAL REQUIREMENTS

1.1 Mobilization / Demobilization

Mobilization shall include transportation to the site of Contractor's plant, materials provided by him, equipment, employees, furnishings and temporary facilities as defined in this Section.

Demobilization shall include dismantlement and removal from the site of Contractor's plant, materials and equipment and all temporary facilities. Demobilization shall also include clean up of the site after completion of the Contract Work as approved by the BWD Engineer and transportation from the site of Contractor's employees.

1.2 Personal Protective Equipment (PPE)

The Contractor shall provide all his workers with complete sets of PPEs such as but not limited to heavy duty gloves, dust mask, reflectorized vest, ear plug/muff, clear safety glasses, and hard hat.

1.3 Special Items

The Contractor shall provide insurance, bonds and interest. The bonds and interests shall be secured for the entire duration of construction in order to safeguard the smooth implementation of the contract. Cost of such insurance, bonds and interest shall be deemed to be included in the Contractor's Overhead and Profit of unit price of every item of the contract.

a) Water Supply, Power and Lighting, and Telephone

i. Water Supply - For all operations required in the execution of the Contract, the Contractor shall be responsible for providing ample water supply under a pressure sufficient for all construction purposes.

ii. Power and Lighting - The Contractor shall make all necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for the proper completion of this Contract during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, meters and power bills.

There shall be sufficient electric lighting so that all work may be done in a workmanlike manner when there is no sufficient daylight or during night work.

1.4 Terms of Payment

The Contractor may submit a request for payment for work accomplished. Such request for payment shall be verified and certified by the BWD's Representative.

The BWD shall have the right to deduct from the Contractor's progress billing such amount as may be necessary to cover third party liabilities, as well as uncorrected discovered defects in the project.

Payments shall be adjusted by deducting therefore the amounts for advance payments and retention.

1.5 Liquidated Damages

When the supplier fails to satisfactory deliver the materials under the contract and complete the installation work within the specified delivery schedule, inclusive of duly granted time extensions, if any, the supplier shall be liable for damages for the delay and shall pay the procuring entity liquidated damages, not by way of penalty, an amount equal to one-tenth (1/10) of one percent (1%) of the cost of the delayed goods scheduled for delivery for every day of delay until such materials are finally delivered, the installation work is completed and accepted by BWD.

BWD need not prove that it has incurred actual damages to be entitled to liquidated damages. Such amount shall be deducted from any money due or which may become due to the supplier, or collected from any securities or warranties posted by the supplier, whichever is convenient to BWD. In no case shall the total sum of liquidated damages exceed ten percent (10%) of the total contract price, in which event BWD may rescind the contract and impose appropriate sanctions over and above the liquidated damages to be paid."

1.6 Contractor's Construction Equipment, Tools and Appliances

The Contractor shall provide fusamatic EF machine, clamping and re-rounder, manual and rotational scrapers, marking, pipe cutter, chamfering tools, hydrotesting pump, welding machine, cutting outfit, service vehicle, and other appliances necessary to perform and insure a rate of progress sufficient to complete the work at the specified period and at the same time effect a satisfactory quality of work. If at any time, in the opinion of the BWD Engineer, the construction equipment and tools appear inadequate and insufficient to maintain the quality and quantity for proper execution of the work, the Contractor shall provide the additional equipment and tools at no extra cost to BWD. It is being understood and agreed upon that the cost of providing and operating all equipment and tools required and necessary for proper execution of the work and of maintaining satisfactory quality are included in the unit bid prices.

Failure of the BWD Engineer to require the Contractor to provide additional equipment to properly execute all the work under this Contract shall not relieve the Contractor of his obligations to secure the quality and quantity of the work required and of completing the work within the specified time.

1.7 Warranty

The work shall be guaranteed against manufacturing and workmanship defects for a period of five (5) year from BWD's date of acceptance. Defects discovered within the 5-year warranty period shall be repaired by the Contractor at his own expense

within seven (7) calendar days upon receipt of the notice to be issued by BWD. The obligation for the warranty shall be covered by either retention money equivalent to at least one percent (1%) of every progress payment or a special bank guarantee equivalent to at least one percent (1%) of the total contract price. The said amounts shall only be released after the lapse of the 5-year warranty period.

DIVISION II - PIPING

2.1 General

The Contractor shall furnish all pipes, EF fittings, and other pipe fittings needed for the project (except for gate valves which shall be provided by BWD). The Contractor shall furnish the concrete pipe supports, steel flanges, bolts, nuts and gaskets, jointing/welding materials, and pipe coating/painting as well as labor and equipment as required for the complete installation and a workable piping system.

All exposed piping shall be adequately supported with devices of appropriate design. Where details are shown, the supports shall conform thereto and shall be placed as indicated; provided that support for all piping shall be complete and adequate regardless of whether or not supporting devices are specifically shown.

All installed GI pipes shall be painted with epoxy primer and finished with Azure Blue paint.

The Contractor shall provide to BWD the Certificate of Purchase from the manufacturers or accredited distributors where the materials were purchased.

The Certificate of Purchase shall consist of the necessary details such as quantity of purchased materials with the corresponding Sales Invoice Number, name/company of buyer, and date of issued. It should also be indicated in the Certificate that the supplied materials are original.

An accredited laboratory shall undertake all testing of sample materials taken from the project site. All tests shall be undertaken with the presence of the BWD Engineer. The cost of all tests shall be borne by the Contractor.

All the necessary certificates and test results of materials shall be submitted first to BWD prior to installation of the materials.

2.1.1 Pipelines

2.1.1.1 High Density Polyethylene (HDPE) Pipe

I. Type
- Should be made up of High-Density Polyethylene (HDPE) suitable for high quality pressure pipes, produced through conventional pipe extrusion process.
- High pressure and temperature pipes for drinking water.
- Complies with PNS ISO 4427:2002

II. Size
- The Nominal Outside Diameter of the HDPE pipe should be 225mm (8”Ø).

III. Designation of Material
- The designation of the material should be PE 100.

IV. Standard Dimension Ration (SDR)
- The ratio of the pipe’s outside diameter to its wall thickness should be 9.

V. Pressure Rating
- The nominal pressure (PN) of the HDPE pipe should be PN 20 (290 psi).

VI. Wall Thickness
- The minimum wall thickness of the 225mm HDPE pipe should be 25.20mm.

VII. Color
- Black / Blue / Black with blue stripes

VIII. Physical Characteristics and Mechanical Properties
- The bidder shall be required to submit test results in conformance to ISO and ASTM standards with reference to physical and mechanical strength of the pipes.

Properties	Typical Value	Unit	Test Method
Physical Properties			
Melt Flow Rate (190°C, 5kg)	0.25	g/10 min	ISO 1133
Density	0.952	g/cm^3	ISO 1183
Vicat Softening Point @10 N, 50°C/hr	124	°C	ASTM D1525
Melting Point	128	°C	ASTM D3418
Mechanical Properties			
Tensile Strength @ Yield	25	MPa	ISO 527
Tensile Strength @ Break	33	MPa	ISO 527
Elongation @ Break	750	%	ISO 527
Stiffness	7500	Kg/cm^2	ASTM D747

Flexural Modulus	11000	Kg/cm^2	ASTM D790
Notched Izod Impact Strength	48 (No Break)	Kg.cm/cm	ASTM D256
Durometer Hardness	64	Shore D	ASTM D2240
ESCR, F50 (condition B, 25% igepal)	>1000	hrs	ASTM D1693
Other Properties			
Carbon Black Content	-	%	ISO 6964
Oxidative Induction Time (OIT, 200°C)	-	Minutes	ISO 11357-6
Classification	-	-	ISO 12162

2.1.1.2 Electrofusion Fittings

I. Type
- Should be produced from HDPE material which conforms to International Standards for potable water.

II. Size
- The Nominal Diameter (d) of the electrofusion fittings should be 225mm.

III. Designation of Material
- The designation of the material should be PE 100.

IV. Standard Dimension Ration (SDR)
- The ratio of the fitting's outside diameter to its wall thickness should be 9.

V. Pressure Rating
- The nominal pressure (PN) of the electrofusion fittings should be at least PN 20 (290 psi).

VI. Standards
- The electrofusion fittings shall be designed, tested and quality controlled according to International Standards. These standards are based on the following: EN 1555, EN 12201, NF 136, AS/NZS 4129, WIS 4-32-14, WIS 4-32-15.

VII. Color
- Black

VIII. Features

- All electrofusion fittings should have a self-recognition system that allows the controller to read the fittings code automatically. This is to avoid human error in entering the fitting code into the controller.
- All electrofusion fittings should have only one welding time. Fitting code should be attached to the fittings with all the information, i.e brand and type of fittings, welding time, cooling time and voltage requirement. This fitting code should be identical to the controller display during welding.
- Electrofusion fittings should have a dynamic monitoring system to avoid short circuit during welding.

IX. Physical Characteristics and Mechanical Properties

- The bidder shall be required to submit test results in conformance to ISO and ASTM standards with reference to physical and mechanical strength of the fittings.

X. Other Requirements

- The contractor should have an available well-trained technician to train the end users the proper way of connecting electrofusion fittings.
- Quality Assurance Certificates showing compliance with the materials and testing standards in each fitting shall be required.
- Electrofusion connection reports should be available for future references.
- Electrofusion machine/s to be used must have BT connection features for easy monitoring of the installer.

2.1.1.3 Galvanized Iron (GI) Pipe

All GI pipes needed to complete the project shall be furnished by the contractor which shall conform to the following technical specifications:

For 8”Ø x 6m GI Pipe:

- Type = G.I. (Galvanized Iron) pipe
- Class = Std
- Schedule 40
- Nominal Diameter = 8inch
- Inside Diameter = 202.74mm
- Minimum Wall Thickness = 8.18mm
- Outside Diameter = 219.10mm
- Nominal Weight = 28.55 lb/ft
- Plain Ends
- Grade A; conforms to testing in accordance with ASTM A53-90

2.1.2 Surge Anticipating Valve

The Contractor shall furnish the Surge Anticipating Valve complete with fittings and install on the proposed location. The valve shall be original and purchased from accredited manufacturer or its distributor and shall have the following standard specifications:

- Nominal Diameter: 4inches
- Nominal Pressure: PN25

2.1.3 Tie-In / Interconnections

a) On Proposed Mains

The Contractor shall furnish all materials, labor, tools, supplies and equipment necessary to install new cross connections on new water mains. The installation shall be as directed by the BWD Engineer, and in accordance with plan.

All work included in this section shall be in accordance with the specifications and standard drawings. All necessary fittings shall be purchased from expert manufacturer and not to be fabricated.

b) On Existing Mains

The Contractor shall furnish all materials, labor, tools, supplies and equipment necessary to interconnect the proposed pipelines to the existing lines including the installation of electrofusion fittings, thrust blocks and all other works such as welding works and painting works as specified and shown on the plans/ drawings. The gate valves shall be provided by BWD but to be installed by the Contractor with chamber and valve cover made of Cast Iron.

The Contractor shall verify the location, size, depth, and type of all existing mains to be retained and connected to the proposed pipelines. Information regarding existing water mains, as shown in the plans, is based on existing records and the BWD assumes no responsibility for accuracy of such information, or any additional cost incurred by the Contractor as a result of such inaccurate information.

The Contractor shall provide at no cost to BWD all temporary valves, bulkheads, interconnections and sidelining necessary to meet the requirements of this section. Before starting work which will interfere with existing facilities, the Contractor shall do all preparatory work and shall see that all tools, materials and equipment are ready and on hand.

Some fittings shall be required for the connections between existing and proposed networks. Immediately after mobilization, the Contractor shall inspect all the existing pipes at the location where such connections have to be installed.

The Contractor shall conduct interconnections with existing mains in such a manner as to minimize the period of interruption in the water service. Work shall be coordinated such that no water interruption shall be experienced by an

area for more than 24 hours. Prior to connection work, the Contractor shall notify the BWD Engineer of such plan so that necessary notices to the consuming public can be made. Interconnection work cannot be made unless there is an approval by the BWD Engineer. Maximum sanitary precautions shall be implemented by the Contractor during interconnection work, so as to avoid any health hazard that may be precipitated by such work.

All cut-ins and connections shall be done with proper tools and equipment. Whenever tapping or cutting of pipe is required, it shall be done with a tapping or cutting machine designed for the specific purpose. Before proceeding to making the cut-in or connections, all tools, equipment and materials necessary shall be ready on hand and the cut-ins and/or connections done with least inconvenience to the consumers.

2.1.4 Pipe Bridge/Culvert Crossing

Furnish all materials, labor, tools, supplies and equipment necessary to construct all pipe crossings with all necessary fittings, thrust blocks, anchorages/straps/clamps, pipe supports, concrete encasement, concrete blocks, coating/painting and all other works as specified and as shown in the Drawings.

2.1.5 Tie-out/Plugging of Old/Existing Lines

The Contractor shall furnish all materials, labor, tools, and equipment necessary to tie-out/plug the old/existing lines. The work shall be as directed by the BWD Engineer, and in accordance with plan.

2.2 Examination of Pipes

Before installing the pipes and fittings on site, the Contractor shall in the presence of the BWD Engineer carefully examine each to ascertain that the materials are in sound condition. Damage of the materials due to mishandling by the Contractor on site shall be replaced at the expense of the Contractor.

The Contractor shall give the BWD Engineer not less than 48- hour notice to examine any pipes and fittings. The Contractor shall not proceed to install such pipes, and fittings until those have been approved as free from damage and defects by the BWD Engineer. Geometrical characteristics of the pipes shall be included in the examination.

All pipes and fittings, which are severely dented or similarly damaged, shall be discarded unless in the opinion of the BWD Engineer a portion of such pipe or fitting may usefully be salvaged in which case the contractor may cut off and discard the damaged portion only.

All pipes and fittings which are found to be cracked or which have any defect which, in the opinion of the BWD Engineer adversely affects their suitability for incorporation in the Work shall be discarded. All damaged ends shall be cut off well beyond the damaged area and machined true.

2.3 Cutting of Pipes

All pipe materials shall be cut according to directions obtained from the manufacturer. The Contractor shall be solely responsible for the provision of all equipment necessary for cutting and turning pipes.

2.4 Pipe Laying

Laying of pipes shall be executed in conformity with applicable standards and pipe manufacturer's instructions.

The same care, which was exercised during the loading, shipment, unloading and stringing of the pipe should be taken during the actual laying of the pipe in its final position.

Pipe covers, wooden disks and other transit protections fixed by the pipe and other manufacturers shall be retained in place until the pipes are inspected shortly before they are laid.

When pipes are strung adjacent to the pipe trench prior to laying they shall be supported clear of the ground on suitable approved supports to prevent any damage to the pipes or to external coating, and gaps shall be left at intervals and at well-defined tracks and roads to permit the free passage of livestock, vehicles and persons.

Steel pipe can be assembled in the trench or assembled above the trench and lowered into it by means of a series of differential chain hoists or similar equipment. The total permissible length of pre-assembled pipelines shall be limited up to four (4) segments.

2.5 Jointing

All HDPE pipes shall be connected with electrofusion fittings through electrofusion method.

2. 6 Anchor Blocks / Thrust Blocks

Anchor blocks or thrust blocks shall be provided and installed by the Contractor at strategic points to prevent unnecessary movement of the pipes during occurrence of transient pressures along the pipeline. These blocks shall be located in accordance with the drawings or as directed by the BWD Engineer.

2. 7 Evaluation of Leakage and Replacement

The Contractor shall excavate all identified leakage to be evaluated by the BWD Engineer whether or not replacement is necessary. Salvage of replaced materials shall be given to the Water District.

DIVISION III - PRESSURE AND LEAKAGE TESTING AND DISINFECTION

3.1 General

The Contractor shall furnish all equipment, labor, and other necessary materials including the water as required for testing and proper disinfection of the pipelines, except for the chlorine that

will be provided by BWD. All testing, flushing and chlorinating operations shall be done in the presence of the BWD Engineer. Disinfection of pipeline through chlorinating shall be undertaken by BWD.

3.2 Pipeline Hydrotesting

Since the maximum length for longitudinal continuous excavation as per Terms and Conditions of the Excavation Permit of DPWH is 150 meters only, the length of un-hydrotested installed pipelines shall not exceed 150m. No further pipelaying shall be allowed if this provision is not being complied;

The pipeline tested shall be thoroughly flushed out with water prior to testing. The contractor shall test the pipeline in sections prior to permanent resurfacing after trench is backfilled, but with joints still in temporary resurfacing for examination.

The pipeline shall be prepared for testing by closing the valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. During the filling of pipe and before the application of the specified pressure, all air shall be expelled from the pipeline. After the line or section has been completely filled with water, it shall be allowed to stand under light pressure for two (2) hours to allow the escape of air from any air pockets.

The test shall consist of holding pressure on each section of the line for a period of twenty-four (24) hours. The test pressure at the lowest portion should be at least 290 PSI. If the pipeline did not fail after 24 hours, it shall be subsequently tested to its operating pressure which is 350 psi for two (2) hours. Pressure gauges shall be provided at both ends of the section being tested to monitor the leaks and pressure.

During the test period, the contractor should be present together with the BWD Engineer.

The leakage shall be considered as the amount of water entering the pipeline during the two-hour test period. The allowable leakage shall not exceed 1.85 liters/millimeter (20 gallons) of diameter of pipe per kilometer (mile) per day.

Should any test of a section of the pipeline disclose joint leaks greater than the allowable leak, the Contractor shall locate, repair or replace the defective pipe, fitting, or other appurtenances at his own cost. The test shall be repeated until the leakage is within the permitted allowable.

3.3 Pipeline Flushing and Disinfection

Before the pipeline is placed in service and before certification by BWD, the new system shall be disinfected with chlorine in accordance with AWWA Standards C-601 “Standard for Disinfecting Water Mains” by the BWD. Disinfecting shall be completed not more than three (3) days prior to placing the pipeline into service unless otherwise approved by BWD. Care shall be taken into consideration to prevent contamination of the pipeline.

a. The preferred point of application of the chlorination agent is at the beginning of the pipeline or any valve section and through a corporation stop inserted at the top of the laid pipes.