

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

NORTH LEBANON WATER ESTABLISHMENT

DESIGN AND SUPERVISION CONSULTANCY FOR REHABILITATION OF 1 KM OF WATER NETWORKS IN MENYE-DENNIYE AREA

VOLUME 4

PARTICULAR SPECIFICATIONS

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PART 1

GENERAL REQUIREMENTS

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PART 1

101. GENERAL REQUIREMENTS

101.1 APPLICATION OF PARTICULAR SPECIFICATION

This Particular Specification is to be read and construed together with the General Specification contained in Volume 3 of the Contract Documents for this Tender. In case of ambiguities or discrepancies between this Particular Specification and the General Specification, the Particular Specification shall prevail, except if and to the extent otherwise provided by the Contract or directed by the Engineer.

Whenever the term “Specification” without further qualification is used in the Contract Documents, it shall mean the General Specification together with the Particular Specification.

101.2 LOCATION OF WORKS

The aim of this project is to rehabilitate parts of the distribution network in Syr village at Denniye Caza (North Lebanon). The works cover the supply and laying of new Ductile Iron pipes with 1,230m length and 100mm Diam, in addition to HDPE pipes of 300m length and 90mm OD, in Syr village, including all necessary accessories and service connections works.

101.3 THE SITE

For work along pipelines within public roads and tracks, the limits of the Site (Conditions of Contract Sub-Clause 1.1) shall be the limits of land in public ownership which shall be taken to be any boundary fence or wall or if there is no such clearly identified boundary the width shall be taken as one meter beyond the edge of the carriageway.

For work along pipelines within private land or open country the Site shall comprise an easement width conforming to the relevant land acquisition documents.

In some areas the width of the Site will be physically restricted by physical boundaries such as boundary wall or by natural topographic features. The Contractor shall have inspected the Site (Conditions of Contract Sub-Clause 1.1) and shall have included for the provision of any additional working area that he may require outside the limits of the Site (Conditions of Contract Sub-Clause 58.2).

101.4 SCOPE OF WORK

The works in the present contract are divided into two parts: Part1 and Part 2. The works covered by each part include but not limited to the construction of water pipelines in Syr village located in Denniye Caza (North-Lebanon).

Part 1

- Construction of the following distribution network:
 - Distribution Network in Syr village to replace the deteriorated existing 3-inch pipe and to reroute the existing 4-inch pipe laid under the stairs till the water manhole near Ghanem fuel station, as shown in the drawings.

The total length of these distribution networks is 1.23 km pipe material ductile iron C40 and of 100 mm diameter with

- Installation of service connections including tapping collars, stop valves and HDPE pipes for the houses along the stairs.

Part 2

- Construction of the following distribution network:
 - Distribution Network in Syr village covering the area from the Sabil water manhole towards Syr mid part (Hay Beit Zaarour).

The total length of these distribution pipes is around 0.3 km pipe material HDPE – PN16 and 90 mm diameter.

101.5 CONDITIONS PREVAILING AT SITE OF WORKS

The Contractor's attention is drawn to his obligation to satisfy himself, before submitting his Tender, as to the conditions prevailing at the Site of Works and its surroundings (Clause 11 of Conditions of Contract) and relevant sections of the General Specification for Civil Engineering Works.

101.6 PRIVATE LANDS

The Contractor shall not enter upon or occupy with men, tools, or materials of any nature, any lands other than the working areas shown on the Drawings, except after consent shall have been received by him from the proper parties and a certified copy of such consent shall have been furnished to the Engineer. Any rentals or damages paid for occupying private lands shall be at the Contractor's expense.

101.7 EXISTING SERVICES

In the course of works, the Contractor will encounter within the limits of the working areas and in the vicinity, miscellaneous above ground and underground services such as drains, pipes, cables, telephone and electric poles and lines, water supply and similar existing services. The Contractor's attention is directed to the provisions of Clause 101.12.4 of the General Specification with regard to such existing services.

101.8 ACCESS ROADS

101.8.1 Temporary access roads

The necessity of construction of Access Roads and/or temporary roads may arise, in which case such temporary roads shall be subject to the provisions of Clause 101.12.3 of the General Specification for Civil Engineering Works, and shall be executed at the contractor's responsibility and expenses in coordination with the concerned Authorities and according to the Engineer's requirements.

101.9 PROGRAM AND MONITORING

It is a primary requirement of the Employer that a comprehensive knowledge of the status of progress to date, predicted progress, costs and cash flow forecasts is available at all times. The Contractor shall be responsible of the requisite information and shall be responsible for programming the Works, preparation of cash flow estimates and measuring and reporting the progress of the works in an approved format. In order that programming, progress measurements and reporting is executed in a timely and efficient manner, the Contractor shall program the Works, monitor progress and generate cost reports and cash flow projections by utilizing a recognized industry standard approved P.C. based Project Management software package.

The Contractor's master program and cash flow estimates and subsequent updates, submitted in accordance with Clause 14 of Conditions of Contract shall, as a minimum, detail the sequence of procurement, installing, testing and commissioning, and handing over for each of the works' items including each item described in the Bill of Quantities.

At least 21 days prior to taking possession of any portion of the Site and starting of work, the Contractor shall submit a detailed construction program for that portion of the Site. The detailed construction program shall be to a level to adequately identify the intended sequence of working on each individual item of work. The minimum level of detail shall not be less than that needed to identify each individual payment item included in the Bill of Quantities.

The Engineer's obligation to measure the Works in accordance with Sub-Clause 56.1 of the Conditions of Contract shall be dependent on the Work being programmed and progress being monitored and reported in accordance with the requirements of the Contract.

101.10 LIST OF ABBREVIATIONS

In the Contract Documents, the following abbreviations have been employed :

uPVC	- Unplasticized Polyvinyl Chloride
D.I.	- Ductile Iron
R.C.	- Reinforced Concrete
C.I.	- Cast Iron

G.S.	- General Specification
C.O.C.	- Conditions of Contract
B.O.Q.	- Bill of Quantity
PN	- Nominal Pressure
DN	- Nominal Diameter
ID	- Inner Diameter
OD	- Outer Diameter

101.11 OR EQUAL CLAUSE

Wherever references to Standard Specifications, such as British Standards, are made, they shall not be construed to restrict materials to British products. Materials from other scheduled countries will be considered provided that the producer of the material certifies its conformity to the appropriate Standard Specification.

Similarly, whenever a required material or article is specified or shown in the plans by using the name of the proprietary product or of a particular manufacturer or vendor, any material or article which will perform adequately the duties imposed by the general design will be considered equal and satisfactory provided the material or article so proposed is of equal substance and function in the Engineer's opinion. It shall not be purchased or installed without his written approval.

101.12 GOVERNMENT REGULATIONS

The Contractor shall comply with all provisions of the rules, regulations and orders of Government and Municipal agencies, such as the Public Works Department, Electricity of Lebanon, and Telecommunications Authority.

The Contractor shall co-operate with the Employer in promptly furnishing any information that may be required by such governmental agencies. It shall be the obligation of the Contractor to keep himself informed of these governmental rules, regulations, and orders and the Contractor shall make the requirements of this article a part of any sub-contract he may enter into.

101.13 FACILITIES FOR THE ENGINEER'S REPRESENTATIVE

Refer to text of section 101.22 of Volume 3 - Technical Specifications - Part 1 - General Requirements

The Contractor shall provide any necessary protective clothing and safety equipment for the use of authorized visitors to the site including the Employer and his staff and Representatives and those of any relevant authority who have reason to visit the site.

101.14 ACCESS TO WORK

The Engineer and his duly appointed representatives and the Employer or his representatives or agents may at any time and for any purpose whatsoever enter into and upon the work and the premises used by the Contractor. The Contractor shall provide free, proper, and safe facilities therefore.

101.15 SURVEY AND SETTING OUT

All levels used for construction shall be referred to the National Height Datum.

The Contractor shall be responsible for obtaining the location and values of the permanent bench Marks. In cases where such bench Marks do not exist, a site datum shall be agreed with the Engineer.

Prior to the commencement of the work the Engineer shall approve all plans showing benchmarks, limits of plot and auxiliary baselines. The Contractor, under the supervision of the Engineer, shall set out on-site and erect appropriate permanent markers where instructed by the Engineer.

The Contractor shall employ an experienced licensed Surveyor for the duration of the Contract. He shall furnish the Engineer with a duly signed map showing the various centerlines, baselines, reference points permitting the renewal of markers and boundaries of parcels and blocks, if destroyed. Before starting and during earthwork on the site, the Contractor shall set out a net of square coordinates at distances not exceeding 10 m in each direction. A peg shall be driven at each intersection and at other relevant points and levels of peg tops and of ground at the same spot shall be measured.

The levels of the ground and the levels and dimensions of existing features shown on the Drawings are not guaranteed to be correct.

Wherever dimensions or levels are marked on the Drawings such dimensions or levels shall take precedence over dimensions scaled from the Drawings. Where no dimensions or levels are shown on the Drawings, instructions shall be obtained from the Engineer. Large scale drawings shall be taken in preference to drawings of smaller scale.

101.16 NOTICE BOARDS

The Contractor shall provide and erect sign boards at the sites (Nb. 2, & refer to Annex 1 of this volume) where works are being executed, giving information to the public on the Project and the Employer and further details as will be prescribed by the Employer. The location and number of the sign boards at the sites will be indicated by the Engineer. The Contractor shall maintain, alter, move and adapt the sign boards from time to time as instructed by the Engineer. The display of any named Subcontractors or any other information associated with the Works shall be to the approval of the Engineer.

101.17 MANUFACTURE'S CERTIFICATES

The Contractor shall furnish the Engineer with a manufacture's certificate confirming compliance to the specification in respect of all items of equipment.

The original and one copy of the manufacturer's certificate shall be delivered to the Engineer not later than 14 days prior to the intended date of delivery of the Item to site.

101.18 PRECAUTIONS AGAINST CONTAMINATION OF THE WORK

The Contractor shall at all times take every possible precaution against contamination of the works. The site and all permanent and temporary works shall be kept in a clean, tidy and sanitary condition. The Contractor shall at all times take measures to avoid contamination of the existing water courses and drains by petrol, oil or other harmful materials.

101.19 ACCESS TO PROPERTIES

The Contractor shall not disrupt any private or public access way without first providing alternative arrangements.

101.20 TOPOGRAPHIC SURVEY

Where the Contractor gets the approval of the Engineer to execute a topographical survey, mapping shall be at 1:200 with contour lines at an interval of 1 meter. A ground profile along the centerline of the pipe route shall be provided and shall be at the same scale of the construction drawings relative to the contract.

The extent of mapping shall be the width of roads or dual carriage ways up to the property lines on either side of the public land, or one meter from the edge of road which ever is nearer to the road centerline.

In open areas and along water courses the mapping corridor shall be 20 meters. The mapping shall be supplied on film plotted from digital data.

All control points, and heights shall be related to the National Height Datum in meters. Station Descriptions with distances to reference objects and a list of coordinates and heights shall be submitted to the Engineer.

Permanent bench marks shall be constructed from steel pins, road nails or painted marks on existing stable features. A minimum of two site bench marks shall be established on existing stable features.

All man-made hand detail features, road edges, curbs, existing manholes, inspection covers, culverts, and underground service pipeline shall be surveyed in their true position and shown by conventional symbols. The detection of the existing services will be paid separately and must be approved by the Engineer.

Any surveyor who will subcontract topographical works from the Contractor shall be approved of by the Engineer. However, the Contractor will still be held responsible for the accuracy of the survey until it gets approved by the Engineer.

101.21 DRAWINGS AND DOCUMENTS

All drawings and documents submitted by the Contractor shall have been checked and signed, shall be ready for issue and shall bear the title of the drawing, the scale, the date, the Contract number and name, the document number complying with an approved numbering system, the name and references of the Contractor, the name of the Employer and the Engineer, the date of approval by the Contractor and the signature of the person responsible for the approval.

Unless otherwise specified, the Contractor shall allow a minimum of 15 days for approval of drawings and documents by the Engineer.

101.22 MEASUREMENT AND PAYMENT

Unless otherwise provided for in the B.O.Q, all costs incurred in complying with the requirements of this Division 101 shall be deemed to be included by the Contractor in his unit rates in the Bill of Quantities and shall not be paid for separately.

PART 2
CIVIL WORKS

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201. CONCRETE WORKS

201.1 GENERAL

201.1.1 LIFE SPAN OF CONCRETE STRUCTURE

New works are to be designed for a life of 50 years.

201.1.2 CODES AND STANDARDS

Complementary or new design shall as far as possible be carried out in compliance with relevant International Standards such as:

- BS Standards.
 - ACI and Uniform Building code.
 - EUROCODES
 - AFPS 90
- or equivalent standards

201.2 SOIL PARAMETERS

The Contractor shall carry out soil investigations to satisfy himself with the prevailing soil conditions for all sites.

201.3 MATERIALS

201.3.1 GRADES OF CONCRETE

The minimum grades of concrete for the various structures are given as follows:

Grade	Component
C30	Reinforced concrete for Reservoirs (400 Kg cement/cu.m)
C30	Reinforced concrete for Buildings and Structures (350 Kg cement/cu.m)
C25	Reinforced concrete for thrust blocks (350 Kg cement/cu.m)
C20	Mass concrete and Blinding concrete (250 Kg cement/cu.m)

Reinforced and mass concrete must be vibrated. Cement used for structures in contact with wastewater and buried surfaces in contact with underground water shall be sulfate resisting Portland cement (BS 4027). Cement for all other structures shall be ordinary or/and rapid hardening Portland cement (BS12).

Admixtures and mix design of the different Grades of concrete shall be submitted for approval prior to commencing the work.

201.3.2 REINFORCEMENT

All reinforcing steels shall be Type 2 High Yield Bars and comply with the requirement of BS 8110 and shall have a specified characteristic strength of 420 N/mm².

Dowel bars and stirrups shall be Mild Steel grade 25, $f_y = 250$ N/mm².

Lap lengths shall be 50 diameters. Mechanical bending for $\phi \geq 12$ mm is required.

201.3.3 MINIMUM COVER OF REINFORCEMENT

The concrete cover for all steel bars including stirrups shall not be less than 40 mm in structures where concrete surfaces are in contact with water.

Where concrete surfaces are in contact with soil, the cover of reinforcement shall not be less than 35 mm.

The cover of reinforcement in external surfaces of structures, and all elements of buildings shall not be less than 30 mm.

Formwork for all concrete surfaces in contact with water and/or soil and internal surface (walls and ceilings) of technical rooms shall be of form panels (marine plywood or metallic formwork) in order to obtain a regular and smooth finish.

201.3.4 CLASSES OF EXPOSURE AND CRACK WIDTH

External and internal walls, columns and beams are to be considered as subject to severe exposure as defined in Sub-Clause 3.3.4 of BS 8110.

The faces of structures in contact with ground shall also be considered as subject to severe exposure.

Concrete surfaces in contact with water are designed for a maximum crack width of 0.2 mm.

201.3.5 ADMIXTURES

Admixtures (retarders, mass waterproofing, silica fume, ...) are to be added to concrete in contact with liquid. Technical sheets and the mix design of concrete shall be submitted for approval.

202. COMMON REQUIREMENTS

All metal sheets shall be 3mm thick minimum. All metal works shall be epoxy painted over a primer. Openings for ventilation or other shall be taken into consideration.

Aluminum works shall be of first quality and glazing shall be 8mm thick.

All hardware shall be water resistant.

Buried walls shall receive a bituminous coating for protection.

Washable paint, acid resistant shall be applied elsewhere (Primer and two coats over a double layer of mastic). A tyrolean render or stone cladding shall be applied on external surfaces of buildings.

203. PIPELINES AND PIPEWORK

203.1 TRENCH EXCAVATION

Excavation for pipelines shall be carried out in accordance with Sub-Section 201.3.2 of the General Specifications. During the pipe laying, jointing, testing of pipes and backfilling, the trench shall be completely dry.

The trench shall be as per trench details included in the contract drawings.

The Contractor shall excavate the trenches without damaging existing pipes, cables and any other structure. In this respect, the Contractor shall excavate the necessary depth or change the route in order to avoid damaging the pipes, cables and culverts that cross the roads.

In case the modification of the pipe depth or route is impossible, the Contractor shall, after the approval of the Engineer, undertake all the necessary works including excavation, fill and concrete works, etc... to modify the culvert in a way to maintain the passing section of the culvert, the cost of these works, after getting the approval of the Engineer should be measured as a concrete works (according to concrete works item).

The Contractor shall clear away within the same day, all excavated material arising from trenches and headings on asphalted roads as the work proceeds, and shall keep these roads free from any accumulations and clear in a good condition, to the satisfaction of the Engineer.

In addition to Sub-Section 201.3.2 of the General Specifications, Earthwork shall not be classified in accordance with the hardness of the excavated material, all excavation should be classified as common excavation and the Contractor shall take the sole responsibility for his assessment of excavated material and conditions. He should also use all suitable materials in the permanent construction required under the contract.

In addition to all the above, the excavated material arising from trenches executed on main roads should be removed from site, transported to environmentally approved disposal areas accepted by the Engineer, all that at the contractor expenses without any extra cost, and the trenches on main roads should be backfilled with imported clean granular material.

203.2 BACKFILLING OF PIPE TRENCHES

Backfilling shall be carried out in accordance with the Ministry of Public Works decree No. 13495 dated 5/11/98 (Refer to Annex 1 of this volume) and in accordance with related general specifications of Volume 3.

In case of ambiguities or discrepancies between the content of the above-mentioned decree and the general specifications, the decree shall prevail.

All pipes shall be placed in granular material (fine, coarse) bedding and surround if the pipeline is above water table, and in gravel bedding and surround if the pipeline is below water table.

Backfilling of pipes trenches on main roads should be executed using imported clean granular material and should be compacted by layers of 30cm thick each.

a) Material unsuitable for filling:

Shall mean material other than suitable material and unless accepted by the Engineer shall include:

- Material from swamp, marshes, or bogs and solid containing more than 12% organic matter when tested in accordance with Test 8 of BS 1377, and which occurs below the top soil layer.
- Clay-based materials of liquid limit exceeding 40 and/or plasticity index exceeding 10 as and if directed by the Engineer,
- Boulders.
- Maximum granular diameter > 5 cm.

203.3 PIPELINES AND MATERIALS

As specified in the BOQ, Preferred C-class ductile iron pipes and HDPE pipes shall be used.

Moreover, the materials used shall comply with the requirements of Section 101.9 of the General Specifications. Any unsuitable material not satisfying the specifications shall be rejected by the Engineer, removed from the Site and replaced by the Contractor at his own expense.

203.3.1 SPECIAL REQUIREMENTS

203.3.1.1 MANUFACTURER'S CERTIFICATE

Materials shall be supplied with certificates, in respect of each delivery, stating that products comply with and have been factory tested in accordance with the specified Standards.

203.3.1.2 SPECIAL TESTS

Whenever required by the Engineer, the Contractor shall supply and transport to an approved testing laboratory samples of materials selected by the Engineer. The number of samples shall not be less than 0.5% of total supplied, with at least one from each class, diameter and manufacturer. Failure of any sample shall be followed by a second and if necessary, a third test from the same batch. A third test failure will result in all material from that manufacturer being rejected and replaced by material from a different manufacturer, subject to approval by the Engineer, after satisfactory testing. Laboratory test reports in an approved form shall be provided.

203.3.1.3 MANUFACTURER'S INSTRUCTIONS

The Contractor shall observe the manufacturer's written instructions and recommendation in respect of handling, protection, stacking, storage, laying, fitting, cutting, repair of the products and materials as applicable.

203.3.1.4 MARKING

Unless otherwise specified in the relevant Standard, products shall have legibly cast, stamped or indelibly painted on, the following marks, as appropriate:

- The manufacturer's name, initials and identification mark.
- Nominal diameter.
- Class designation.
- Initials and number of relevant Standard.
- Length of pipe if shorter than the standard length.
- Angle of bends in degrees.
- The date of manufacture.

203.3.1.5 SAMPLES AND STORAGE OF MATERIALS

Where required by the Engineer, the Contractor shall submit to the Engineer for approval samples of pipes, fittings and materials prior to procurement.

The Contractor shall store pipes, fittings and other materials only at places approved by the Engineer and shall at all times provide adequate supervision and watchmen to prevent theft or damage. Any loss or damage incurred will be the Contractor's responsibility.

Pipes shall not be stacked higher than recommended by the manufacturer. The area on which the pipes are to be stacked shall be free draining, the grass or other vegetation shall be kept cut and suitable timber or cradles shall be provided on which the pipes shall be laid. End stops to all stacks shall be provided.

Fittings and valves shall not be stacked more than one tier high and they shall be supported off the ground by suitable timbers.

Air valves, rubber joint rings, gaskets, bolts and similar fittings and materials shall be kept in approved locked premises and such fittings and materials shall not be distributed to the trench side until immediately prior to laying, fitting, jointing or assembly thereof. All rubber joint rings and gaskets must be stored in a cool damp location and all fittings and materials shall at all times be stored in the shade under cover and protected from the weather to the satisfaction of the Engineer.

203.3.1.6 FLANGES

Unless otherwise specified, flanges shall be faced and drilled to conform to the dimensions specified in BS EN 1092-2:1997. Flanges shall be compatible with the pressure rating of the adjacent pipework but not less than 16 bars. Bolts, nuts, and washers (two washers per bolt) shall be to BS 4504 Clause 5 or ISO 898-2:1999 and ISO 4032:2001. No bolt shall project more than two full threads beyond its nut after tightening. In no circumstances shall be shortening of excessively long bolts but cutting be allowed.

Gaskets shall comply with BS EN1514-4:1997, ISO 4633:2015 or BS 2494 Type W.

Flanges shall be painted with two coats of epoxy resin paint or with the same coating as fittings: an epoxy coating in accordance with EN 14901:2014.

203.3.1.7 MECHANICAL COUPLINGS

Unless otherwise specified or shown on the Drawings pipes and fittings shall be supplied with flexible joints.

Mechanical couplings shall be of the Dresser, Viking Johnson type without a center register.

203.3.1.8 MATERIALS FOR THE ASSEMBLY OF FLEXIBLE JOINTS

Lubricant shall be of a kind not conducive to the growth of bacteria and shall have no deleterious effects on either the joint rings or pipes. Lubricants for water supply shall not impart to water taste, color, or any effect known to be injurious to health.

203.3.2 WORKMANSHIP: OPERATIONS

- 1) Manufacturer's recommendations on handling, repairing, laying, jointing, anchoring, testing and other works for pipes and fittings shall be strictly followed.
- 2) The Contractor shall use cranes, hoists or forklifts as directed by the Engineer. The Contractor shall use hooks, spreader beams, ropes, band or wire slings etc. as recommended by the manufacturer for each type of pipe and as approved by the Engineer.
- 3) The Contractor shall stack pipes on a level surface. Pipes shall not rest on sockets or flanges and end pipes in the bottom row shall be securely chocked. Heights of stacks shall be in accordance with the manufacturer's instructions.
- 4) The Contractor shall handle material with care to avoid damage whenever moved by hand, forklifts or hoists.
- 5) The Contractor shall provide safe storage for all material. The interior of pipes, fittings etc. shall be kept free from dirt and foreign matter. The Contractor shall provide shade for materials as required by manufacturers' instructions and recommendations and to the Engineer's approval.
- 6) Pipe Cutting: The Contractor shall use hacksaws, manually operated wheel cutter or pipe cutting machine in accordance with manufacturers' instructions. If, in the opinion of the Engineer, special precautions are required to eliminate airborne particles, the Contractor shall use methods and equipment as directed by the Engineer. The Contractor shall prepare ends according to type of joint used and follow manufacturers' recommendations. The Contractor shall take care not to damage linings. The Contractor shall repair on site minor damage if so permitted by the Engineer.
- 7) The Contractor shall repair damaged coatings, sheathings or linings in accordance with the Specification and the manufacturer's instructions. The Contractor shall use material compatible with that originally used. Repairs shall be approved by the Engineer before incorporating the materials into the works.

203.3.3 SEQUENCE OF CONSTRUCTION

The Contractor shall adhere to the sequence of construction as set out below unless a justified request for modification is approved by the Engineer at least two weeks prior to commencement of work on the affected section of the network:

- 1) Stake out pipe alignments
- 2) Clear and grade the right of way (wherever required)
- 3) Carry out surveys, including trial pits, if necessary, along the alignments to verify the location, depth, size and type of existing utilities.
- 4) Prepare and submit for approval composite Shop Drawings for all utilities showing alignment, ground elevation, trench invert elevation, pipe size, class and length, station and size of fittings, valves as applicable manholes, inlets, appurtenances and structures to be demolished and reinstated (curbstone, rails, culverts, etc.). Cross sections showing location and inverts of existing pipes and those proposed shall be prepared. Pipes, structures and other utilities to be removed or relocated shall be indicated on the Shop Drawings.

- 5) Relocate, demolish and reinstate existing services and utilities interfering with pipeline alignments.
- 6) Remove pavement layers, excavate trenches and place bedding as required
- 7) Lay and join pipes, fittings, appurtenances, manholes, etc.
- 8) Place primary backfill material
- 9) Perform hydrostatic testing
- 10) Complete connections to existing services and curb/gutter inlets as required
- 11) Place final backfill
- 12) Restore or reinstate surfaces and structures as required
- 13) Carry out final surface works road surfacing curb stone, backing walls, sidewalk paving, etc.
- 14) Dispose of surplus materials.

203.3.4 DUCTILE IRON PIPES

203.3.4.1 GENERAL

- 1) Ductile iron pipes for raw and potable water pipelines shall be of Preferred C-Class unless otherwise specified pipes in conformance to BS EN 545-2010 and ISO 2531:2009. Pipes shall be to pressure rating suitable for the condition of service as denoted on the drawings and according to the allowable operating pressure of C Class. All ductile iron pipes and fittings to be supplied under this Specification shall be obtained from an approved manufacturer having an ISO9001-2015 TOTAL QUALITY ASSURANCE system based on the latest version of the ISO9001 standard.
- 2) Spigot and socket ended pipe joints shall be used for straight runs and adjacent to elbows or fittings. These joints shall be provided with rubber gaskets, and external thrust blocks at elbows or fittings. Anchored joints shall be the push-in, self-anchored type. Concrete thrust blocks are not required for anchored joints. The Contractor shall submit calculations verifying the number of restrained joints required noting that pipe pressure testing will be made when pipes are partially backfilled.
- 3) Prior to the ordering of pipe and fittings materials, the Contractor shall carry out his own calculations of the surge, the maximum allowable pressure and the Test Pressures, using approved parameters to ensure safety of the proposed system under worst working conditions, all to the approval of the Engineer. If the Contractor's approved calculations show that the resulting pipe classes needed are higher than the original Contract Documents, then the Engineer shall instruct the Contractor to adopt them; but if lower classes are needed, then the Contract classes shall prevail.
- 4) Flanges shall be provided in accordance with BS EN 1092-1:2002 and BS EN 1092-2:1997.

5) Factory protection for pipes shall be as follows:

- Internally: cement lined to BS EN 545:2010 with ordinary Portland or sulphate resisting cement (for potable water) to BS EN 197-1:2011 and ISO 4179:2005.
- Externally: 200g/m² metallic zinc shall be applied in accordance with BS EN 545:2010 and ISO 8179:2017 And a finishing layer (a bituminous varnish or equivalent anticorrosive paint) shall be uniformly covering the whole surface of the metallic zinc layer, with a minimum thickness not less than 70micron.

6) Factory protection for fittings shall be as follows:

Coated internally and externally by dipping, or other method, using hot applied coal tar-based material to BS 4164:2002 or hot applied bitumen to BS 3416:1991, Type 1, grade D, minimum thickness 250 microns or with a hot applied epoxy powder coating, minimum thickness 250 microns, over a shot blasted surface. In accordance with EN545:2010 and EN 14901:2006.

203.3.4.2 JOINTS

Joints of Ductile Iron Pipes and Fittings shall be of the Push in automatic standard type and any axial forces shall be taken by thrust and anchor blocks, where necessary and as shown on drawings.

203.3.4.3 LUBRICANT PASTE

The lubricant paste shall be a mixing of Vaseline, non-soluble in accordance with French standard AFNOR T90 M DOC8. The quantities used in the assembly joints shall be as per manufacturer recommendation. The pipes and fittings manufacturer shall supply it.

203.3.4.4 CONNECTING PIECES

All connecting pieces i.e. flexible coupling, flange adaptors, dismantling joint shall be made of ductile iron and shall be supplied from the same pipes and fittings manufacturer.

203.3.4.5 PIPES INTERNAL PROTECTION (INCLUDING WELDED FLANGED PIPES)

Pipes shall be internally lined with sulphate resisting blast furnace slag cement applied by a centrifugal process. The cement mortar lining shall be in accordance with the European Standard EN 545-2010 & with the International Standard ISO 4179-2005 with the thickness given in the following table:

	Thickness of mortar	
	Nominal mean value (mm)	Tolerance (mm)
80 – 300	4	-1.5
350 – 600	5	-2
700 – 1200	6	-2.5
1400 – 2000	9	-3

203.3.4.6 PIPES EXTERNAL PROTECTION (INCLUDING WELDED FLANGED PIPES)

Pipes shall be externally coated with:

- A metallic zinc coating in accordance with the European Standard EN545 – 2010 and the International Standard ISO 8179:2017. The quantity of zinc shall not be less than 200 g/m².
- A bituminous varnish or equivalent anticorrosive paint which shall be applied over the zinc coating in accordance with the European Standard EN545-2010 and the International Standard ISO 8179:2017, with a minimum thickness of 150 microns.

203.3.4.7 CONNECTING PIECES INTERNAL AND EXTERNAL PROTECTION

The connecting pieces (flexible couplings, flange adaptors, dismantling joint) shall be internally and externally protected with a powder epoxy coating having a minimum thickness of 150 microns or with a Rilsan nylon coating having a minimum thickness of 200 microns.

203.3.5 POLYETHYLENE PIPE FOR POTABLE WATER

- 1- Pipes and fittings shall be manufactured in accordance with DIN 8074/8075 or AWWA C906-99. Pipes shall be supplied straight with straight ends suitable for heat fusion, class 16 kg/cm².
- 2- Materials used shall have a minimum hydrostatic design basis of 1600 psi according to AWWA C906-99 Table 1.
- 3- Manufacturers shall provide certification that stress regression testing has been performed on the pipe products. Materials shall also meet elevated temperature requirements as given in Table 2 AWWA C906:99.
- 4- Fittings shall be manufactured in accordance with AWWA C906-99, extruded or injection moulded suitable for the class of pipe required.
- 5- Joints for pipes and fittings shall be made by heat fusion and in strict accordance with the pipe manufacturer's recommendations. Joints shall have a tensile strength equal to that of the pipe. Fusion temperature, interface pressure, alignment and cooling time, shall be according to the manufacturer's recommendations.
- 6- PE compounds in pipes and fittings shall contain no toxic chemicals that can migrate into the water. PE compounds shall be tested and certified suitable for potable water by an accredited testing agency as approved by the Engineer and certificates from an accredited testing agency proving, that the material compounds used during manufacturing of pipes are suitable for potable water, should be submitted to the Engineer before placing order of purchase. Tests shall be undertaken in accordance with requirements no less restrictive than those in NSF Standard No. 14 (1976), Sections 3 and 4. The seal and mark of the testing laboratory shall be included on pipes and fittings.

203.4 WARNING TAPES

Warning tapes shall be placed on well compacted backfill at 450mm below the finished level and directly above the center-line of the pipeline.

Warning tapes shall be made of pigmented low-density polyethylene and aluminum foil in a bright color or other approved material not less than 250 mm wide and 0.15 mm thick. When laid, the tapes shall provide a continuous band detectable with a metal detector if the pipe itself is not detectable. The tapes shall be continuously and alternatively labeled in Arabic and English.

Where possible, tapes shall also be laid above ducts and concrete protection slabs as directed by the Engineer.

203.5 MANHOLES

Manholes shall be constructed as specified in Sub-Sections 202.11.2, 202.14.2 and 202.14.5 of the General Specifications and according to the dimensions specified in the BOQ and the related drawings.

Steel Ladders shall be manufactured in accordance with BS 4211:2005, mild steel, galvanized to BS EN ISO 1461:1999 with 200 grams of zinc per square meter.

All concrete faces in contact with the soil shall receive a waterproofing treatment consisting of two layers of brush-applied bituminous paint, in accordance with Sub-Section 213.2.1 of the General Specifications.

203.6 CHAMBER COVERS AND SURFACE BOXES

Covers and frames shall be manufactured from ductile iron in accordance with BS EN 124:1994, non-rock, locking and solid tops. The wording on covers shall indicate the nature of the network (water supply). Grades of covers shall be Grade A, heavy duty test load 40 tons.

Manhole covers shall be of a circular pattern unless otherwise indicated on the Drawings. Frames shall be provided with openings for fixing bolts for solid frame embedment into manhole concrete necks. Covers and frames shall be coated with a bitumen-based compound to BS 3416:1991 with a minimum thickness of 200 microns.

203.7 STEP IRONS FOR VALVE CHAMBERS

Step Irons shall be manufactured in accordance with BS EN 13101: 2002.

203.8 TEMPORARY AND/OR PERMANENT RESTORATION OF PAVED ROADS

In all paved roads, trenches shall be refilled and compacted to the underside of the original road surface.

A sub-base and base layers shall be laid and compacted and shall be carried out in accordance with the Ministry of Public Works decree No. 13495 dated 5/11/98 (Refer to Annex 1 of this volume) and in accordance with related general specifications of Volume 3.

In case of ambiguities or discrepancies between the content of the above-mentioned decree and the general specifications, the decree shall prevail.

For main roads subject to a permit from the Ministry of Public Works and Transport, the Contractor, at his own expenses and sole responsibility, should deal to obtain and receive this permit, and the asphalt reinstatement works should be carried out in accordance with the specifications and conditions (if any) of the permit.

As for narrow roads not exceeding 3m width, asphalt reinstatement should be executed to cover the entire width of the road.

203.9 REMARKS

The Contractor shall lay pipes on one side of the streams and on one side of the roads (even if this is not shown of the drawings) and if possible, outside the carriageway in order to avoid damaging the roads. The Contractor shall coordinate with the Administration and the Engineer and the relevant Authorities in order to obtain official authorization prior to any construction work.

204. HYDRAULIC ACCESSORIES

204.1 ELECTRO-MAGNETIC FLOW METERS

The flowmeters shall be of electro-magnetic inductive type having a DC pulsed field with automatic zero error averaging and low power consumption. They shall have no moving or protruding parts nor cause any restriction in the flow path (Insertion type are not allowed) and be capable of setting adjustments without the need to stop the flow.

Each metering system shall comply with the latest international standard and comprise a flow sensor mounted in the pipework line and a transmitter which degree of protection is IP68; either integrally mounted or remotely located preferably within the main control panel.

Electro-magnetic system shall comply with the latest international standards at least with:

- 2014/35/EU- EN 61010-1:2013 (LVD)
- 2014/30/EU- EN 61326-1:2013 (EMC)
- OIML R49- 1:2013
- European directive 2014/32/EU (MID)
- 2014/34/UE – IEC 60079- 0, IEC 60079- 18 (ATEX- IECEx) Separate version
- EN ISO 15609-1 and EN ISO 15614-1
- UNI EN ISO 12944-2, painting for C4 class environments (on request)
- Ebonite conform to the norms WRAS, FDA e DM174
- BS 5792

The flowmeter shall have a maximum accuracy at normal operating conditions.

The uncertainty of the calibration shall be equal to 0.2% +- 2 mm/s. The repeatability of the measure shall be about 0.1%. Bi-directional measure. The sensors shall be certified under MID01 norms. Every meter shall be delivered with its calibration certificate.

Error range no larger than +/- 0.2% of the reading operating at 30% or less than the meter range, error range shall not exceed +/- 0.5%

The maximum permissible error shall be within the limits indicated in the following graph, for each sensor diameter.

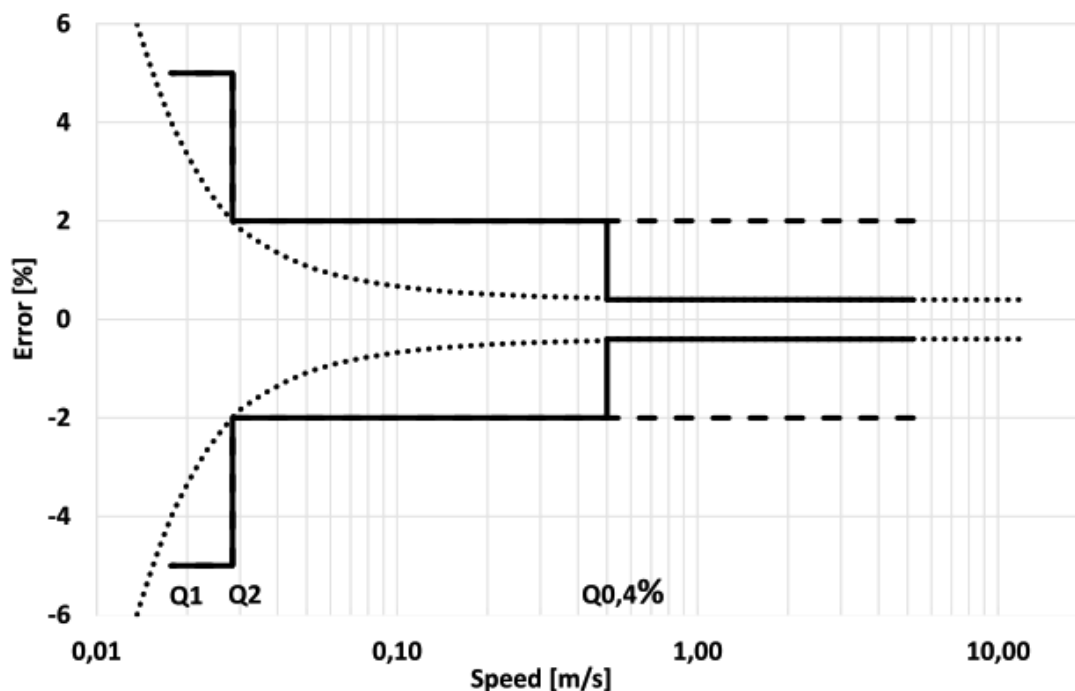


Figure 1: Graph indicating the Maximum Permissible Error

Sensor diameter	Flow [m3/h]					Ratio Q3/Q1
	Min Q1	Trans. Q2	Q0,4%	Perm. Q3	Overl. Q4	
DN50 - 2"	0,125	0,20	3,50	25,00	31,25	200
DN65 - 2"1/2	0,20	0,32	6,00	40,00	50,00	200
DN80 - 3"	0,315	0,50	9,00	63,00	78,75	200
DN100 - 4"	0,50	0,80	14,00	100,00	125,00	200
DN125 - 5"	0,80	1,28	22,00	160,00	200,00	200
DN150 - 6"	1,25	2,00	32,00	250,00	312,50	200
DN200 - 8"	3,15	5,04	57,00	630,00	787,50	200
DN250 - 10"	5,00	8,00	90,00	1000,00	1250,00	200
DN300 - 12"	8,00	12,50	128,00	1000,00	1250,00	125

Table 1: Flow rates table

- a) **Flow sensors** These shall comprise electrodes located in a meter tube which shall be made of watertight construction, suitable for operation without loss of accuracy when totally submerged to a depth of 3 metres or even buried into the ground together with the water pipe. Its degree of protection shall be IP68. They shall not contain any active components such as amplifiers or memory modules. The flowmeter shall be flanged type and the lining shall cover the external parts of both flanges

The flow tube shall be made of stainless steel AISI 304 or AISI 316, where two coils are installed on its top and lower side. The interior of the flow tube shall be electrically insulated, thus the process liquid shall no longer be in contact neither with the material of the flow tube nor with that of the flanged.

The standard internal insulating lining shall be in compliance with WRAS, FDA and DM174 standards. The flanged materials shall be made of Carbon steel (S235 JR-1.0037), AISI 304 optional, and or AISI 316 optional and shall comply with at least EN 1092-1 and ANSI 150 Standards.

The measuring electrodes shall be continuously cleaned by means which do not interrupt the process flow or the measurement. A sensing electrode shall also be provided to detect when the flow meter is not fully charged with liquid.

Electrodes shall be supplied in Hastelloy B, C, Titanium, Tantalum or Platinum. A partially empty tube detection (fourth electrode) shall be installed and should be enabled or disabled through the software.

The electromagnetic flowmeters shall guarantee a pressure drop less than 250 mbar at velocity of 8 m/s. The pressure drop shall always be less than 10 mbar at velocities lower than 1 m/s.

b) Transmitter

The converter shall be able to generate the current supplying the coils, acquire the electrodes potential difference, process the signal to calculate the flowrate and manage all the communication.

The transmitter shall have an LCD display with facility to show live flow rate. The display shall be programmed to show readings.

The transmitter shall provide the following minimum functions:

- Conversion of its supply voltage 90 to 264 Vac or 12/24 Vac/dc, battery powered supply or 12/24 Vac/dc or battery powered-2 xD Cell 3.6V (Lithium) , Lithium battery life shall be up to 10 years with the possibility of changing the batteries in order to prolong the lifetime of the pressure sensor and the transmitter.
- Supervision of the flow sensor: the transmitter shall be able to generate an alarm signal when the following conditions occur:
 - ◆ water conductivity below a preset level
 - ◆ flow meter empty
 - ◆ reverse flow direction
 - ◆ Excitation failure
 - ◆ Empty pipe on the 4th electrode
 - ◆ Empty pipe on measuring electrodes
 - ◆ High temperature
 - ◆ High voltage supply
 - ◆ Pulse overlapped
 - ◆ Wet electronic board

Status icon for alarm shall be displayed and alarm shall be logged in the datalogger.

- Output signals to inform the control/display equipment. Thus, the transmitter shall have as a minimum the following independent output signals:
 - ◆ Standard analogue current signal 4-20 mA fully isolated from input and other outputs, and where the zero and full scale mA - value are configurable as well as the measuring range. The range adjustment shall be continuous, and the units shall be configurable in flow engineering units.

- ◆ 2 pulses passive outputs (MOS), individual galvanically isolated-clean contact, with a maximum load +/- 35V DC, 100 mA short circuit protected

The Transmitter shall have an LCD display-Index menu, and symbols icon for dedicated information, it shall bear at least 4 Push buttons to access all functions and the totalizer informations shall be displayed with 5 decimal digits. The minimum information displayed shall be as follow:

- ◆ Live Flowrate
- ◆ Total positive Totalizer (t+)
- ◆ Total negative Totalizer (T-)
- ◆ Partial positive Totalizer (P+)
- ◆ Partial negative totalizer (P-)
- ◆ Time & date
- ◆ Converter temperature
- ◆ Parameters corresponding code and value

The convertor shall have an excellent data security given by the internal memory. It shall have a built in datalogger with over 100 000 data lines capacity with a frequency of log between 1 minute and 120 minutes (default 15 minutes).When full capacity is reached; cycle memory, old data shall be overwritten by new ones. Software shall be supplied with the unit to allow users to communicate with the convertor via port to any pc, laptop, windows tablet. Downloading the data, managing and programming shall be easy.

- Data shall be protected with a password, in addition, automatic firmware check and recovery during the update must be possible. As for the external verification, field verifier shall be available for calibration verification and electronic status.
- The instrument shall have at least 4 totalizers (2 positive and 2 negative)
- Software for communication and programming: Commissioning (equal settings of meters)- Data print for documentation- Data export (CSV file)- Firmware update -Read instant flowrate- Read and write all non volatile parameters- Download internal datalogger- View instrument event logger.

c) **Flowmeter Cabling**

Where remote mounted converters are specified, cables shall be provided, installed and terminated between the sensor and converter/ pulse power unit for the following purposes:

- flow signal;
- reference signal;
- coil supply;

Such cables and sealing glands shall be suitable for submersible operation (IP68) of the sensor to the depth specified. The cable length depends on the liquid conductivity. Cable entries shall be 4X PG9 Glands I/O -2X PG20 Glands junction box in remote version.

d) **Spool Piece**

A flanged steel pipe spool piece shall be provided of the same diameter and length as the respective flowmeter and flanged for insertion in the pipe should it be necessary to remove the flowmeter.

e) Accuracy

The accuracy of the flowmeter shall be independent of the range which has been selected for the analogue signal and shall be better than 0.2% +/- 2 mm/s, in addition, insertion sensors accuracy shall be 2% of rate +/- 2 mm/s.

The uncertainty of the calibration shall be equal to 0.2% +/- 2 mm/s. The repeatability of the measure shall be about 0.1%. Bi-directional measure. The sensors shall be certified under MID01 norms.

Note : the flow test shall be made on a recognised test bench which is traceable to international standards.

204.2 WATER METERS/ GAUGES FOR SERVICE CONNECTIONS

204.2.1 OVERVIEW

Contractor is requested to supply, transport, and install DN15 (1/2 inch), DN20 (3/4 inch) and DN25 (1 inch) water gauge and accessories including installation and connection of boxes to the network.

- Water gauge must at least meet the Specifications and the requirements of North Lebanon Water Establishment
- Only Water gauges manufacturers with a quality assurance system in accordance to the requirements of the Water Authorities and the manual of Quality as approved by ISO 9001:2015 shall be used
- The Gauge has to be tested at factory as per BS 6755- Part1 / BS EN 12266-1

204.2.2 WATER GAUGE LIFESPAN AND TESTING

The water gauge to be installed shall have a minimum operational lifespan (continuous operation) of 50 years.

The gauge meter being Brass, shall withstand freeze during winter. Each gauge shall be tested at the factory to withstand at least a pressure of 24 bars.

204.2.3 GAUGE CONSTRUCTION AND COMPOSITION

All gauge materials in direct contact with water need to be suitable for contact with potable water and shall withstand 2 ppm of chlorine residual and be resistant to corrosion.

The materials, which come in contact with the potable water, shall not create a toxic hazard, shall not support microbiological growth, and shall not give rise to unpleasant taste or discoloration in the water supply.

The acceptable gauge meter body material shall be either brass CW617N or CW602N suitable for potable water and shall be compliant with BS EN 12165.

The maneuvering stem with its small nut, nut of washer, filter and the (½ ", ¾ " or 1") inch short female outlet shall be made from Brass CW617 N or CW602 N meeting BS EN 1264 standards.

The big nut of the gauge stem, the metering nut inside the body of the gauge and the (½ ", ¾ " or 1") inch short female nut on the outlet shall be made from Gunmetal LG2 to BS 1400 or CC491K according to BS EN 1982.

All rubber washers including the conical rubber washer inside the gauge shall be made of EPDM Rubber, WRAS approved for use in contact with water up to 85 °C, for human consumption.

The metering nut inside the body of the gauge shall have a hole of 2 mm diameter.

The stem of the gauge shall be fully threaded and shall have two holes of 3 mm in the nuts around the (½ ", ¾ " or 1") inch short female inlet and outlet, to allow insertion of a sealing wire.

The gauge shall be tested at factory as per BS 6755- part 1/ BS EN 12266-1.

The Copper gauges shall be manufactured to PN 16 and must be suitable for temperatures up to 85 °C and shall withstand freeze during winter.

204.2.4 WATER RESILIENCE

Gauges should be able to operate normally in waters with different parameters with no impact on performance or accuracy. The following water parameter ranges can be considered:

pH	6 – 8
Total Alkalinity as CaCO ₃	Between 200 and 300 mg/l
Total hardness as CaCO ₃	Between 200 and 250 mg/l
Chlorides as Cl	Between 15 and 25 mg/l
Total Dissolved Solids (TDS)	Between 200 and 400 mg/l
Sulphates (SO ₄)	Between 30 and 40 mg/l
Free Chlorine Cl ₂	Between 0.3 and 0.9 mg/l

204.2.5 ANTI-TAMPERING

Contractor is to ensure that water gauges are supplied and transported to worksite in adequate sealing that prevents gauge tampering to take place. Contractor is to ensure that the installation of the gauges and associated accessories is to be done in a way to prevent tampering without causing any damage to the meters.

Contractor is to provide a detailed explanation of the anti-tampering capabilities of the gauges being installed.

204.2.6 PRESSURE

Water gauge used by contractor are to withstand a minimum continuous working pressure of 16 bars and shall conform to the testing in accordance with BS 6755- Part 1 /BS EN 12266-1.

The gauge shall be capable to operate in an ambient temperature of up to 85°C and shall withstand freeze during winter.

204.2.7 LITERATURE AND SAMPLES

The contractor is required to submit the following list of documents:

- Technical specifications of items being offered
- Quality assurance documentation
- Detailed drawings and construction materials
- Gauge meter typical metrological curve
- Description of gauge meter anti-tampering specifications
- Water Authorities Specifications and requirements

204.3 WATER METER/ GAUGE ACCESSORIES

A typical arrangement for water meters/gauge meters installation consists of a Quarter turn valve followed by an air valve and strainer before distributing into the different house pipes. All house pipes shall be equipped with two ball valves, one strainer installed before the water meter/ gauge meter, a subscriber meter/gauge meter and a check valve.

The pipe arrangement shall force air trapped in the service pipe to exit from the air valve. Therefore, the air valve must be located at a high point that provides at least 5 cm head room above the air valve (minimum 5 cm from the head of the air valve to the first contact with the top surface of the meter box). Supply pipes may need to be re-arranged to allow for the installation of all fittings and valves required for the installation of subscriber meters/gauges in a given location. All pipes above ground until the new water meters shall be executed with galvanized iron pipes.

204.3.1 STRAINERS AND NON-RETURN VALVES

Contractor shall ensure that water gauges bodies to be installed and jointed to a non-return valve and a strainer for the gauge meters. The strainer shall have at least 18 holes/cm² and is to be fitted at the inlet of the gauge, both the strainer and non-return valve are to be fitted in such a way that they can be removed.

204.3.2 UNION JOINTS AND WASHERS

Contractor is required to supply transport and install union joints and washers. The joints are to be used for the installation of the gauge meters. The union joints shall be of brass or stainless steel and shall be supplied in separate packaging than the gauges.

The nut of the union joint shall have two 1 mm diameter holes drilled on its side diagonally and opposite to each other. This will allow a 0.8 mm seal wire to pass through it while the meter is being installed.

204.3.3 AIR VALVES

The contractor shall install one air valve before every individual water meter/ gauge meter. The air valve is to be installed on the upper part of the pipe arrangement prior to the entry of the water meter. The pipe arrangement shall be designed in such a way to force any trapped air to exit from

the air valve. The air valve shall therefore be located at a high point that provides a minimum of 5 cm of headroom above the air valve (minimum 5 cm from the head of the air valve to the first contact with the top surface).

204.3.4 QUARTER TURN VALVES

The contractor is required to supply, transport, and install one quarter turn valve before the water meter. The quarter turn valve must allow locking/plumbing.

204.3.5 METER PROTECTION BOXES

The contractor is required to supply transport and install meter protection boxes. The meter boxes are installed in order to prevent and mitigate the risk of vandalism and tampering and therefore should be solid and are to be secured with locks in order to avoid unwanted access to water meters. A sample of water meter boxes is to be provided to the Supervising engineer for approval.

204.3.5.1 CABINET MATERIAL AND DIMENSIONS

The meter protection boxes are to be made of steel; the box shall be of off-white color and the profile of the boxes' door should be at least 1 cm curved (90 degrees), to prevent the entrance of heavy waste or rain water.

The contractor is required to ensure that the box is tested for:

- High temperature resistivity
- Electrical insulation (paint)
- Dust and weather
- Impact resistance

The box should be designed in such a way to allow for easy mounting on walls and surfaces: it should have a minimum of 4 wall mounting holes at the back, each one to be located in one of the corners.

There should be at least five sizes of gauge protection boxes:

- Box able to fit 1 gauge meter (15, 20, or 25 mm)
- Box able to fit 2-gauge meters (15, 20, or 25 mm)
- Box able to fit 4-gauge meters (15, 20, or 25 mm)
- Box able to fit 6-gauge meters (15, 20 or 25 mm)
- Box able to fit 8-gauge meters (15, 20 or 25 mm)

In these five latter cases, a collector linked to the downstream end of the service line shall distribute water to each house connection. For pricing purposes, this collector shall be considered an integral part of the water meter boxes it is supplying. The dimensions of the boxes will vary based on the water meter/gauge meter dimensions, and should allow for a minimum of 5 cm space in between water meters/ gauge meter themselves and in between the water meter/gauge meter and the walls of the box.

The contractor shall ensure that the gauge meter cabinets have built-in 20 mm incoming/outgoing water pipes opening. The number of outgoing openings will vary on the number of water meters/ gauge meters the cabinet holds.

Boxes must be equipped with built-in locks that can be locked with a triangular Allen key.

These locks shall be identical for a given number of boxes. For each group of similar locks, shall be provided a corresponding set of 5 identical keys.

204.4 INSTALLATION OF WATER METERS /GAUGES

The contractor is to follow the instructions of the manufacturer when installing the new gauge meters and related accessories. In particular, for mechanical domestic meters.

When installing a new gauge meter in place of an already existing domestic connection, the contractor is required to dismantle the existing gauge and hand them over to the water establishment. The contractor is to ensure that the subscriber's access to water is not interrupted for more than 6 hours when dismantling old gauges and installing new gauge and related cabinets.

The contractor is required to modify the supply pipe after installing the gauge in order to fit the available space conditions.

The contractor is to strive to carry out works carefully in order to avoid sand or dirt entering the gauge and boxes. For aesthetic reasons, pipes shall either be installed horizontally or vertically. Inclined pipes will not be accepted.

204.5 AIR RELEASE VALVES

For all transmission pipelines, air release valves should be exclusively double air release valves three functions type.

205. SHOP DRAWINGS, AS-BUILT DRAWINGS

Shop Drawings and all necessary material technical specification shall be submitted to the Engineer for approval at least 21 days before starting the work.

As-built drawings shall be prepared and submitted successively during the execution of works and shall be also submitted completely to the Engineer for approval one month maximum after the completion of the work.


It is the duty of the Contractor to undertake all the Engineer's recommendations, modifications and corrections at his own expense until complete satisfaction of the Engineer.

All the modifications to the design drawings coming out during execution of the works, or after ordering the relating materials (especially for pumping stations building dimensions) should be done by the contractor and approved by the Engineer.

ANNEX 1

Width (2 meters min)

50% of Width

REPUBLIC OF LEBANON MINISTRY OF ENERGY AND WATER		الجمهورية اللبنانية وزارة الطاقة والمياه
<u>PROJECT NAME:</u>	<u>اسم المشروع:</u>	
<u>FINANCEMENT:</u>	<u>التمويل:</u>	
<u>CONSULTANT:</u>	<u>الاستشاري:</u>	
<u>CONTRACTOR:</u>	<u>المتعهد:</u>	
<u>COMMENCEMENT OF WORKS:</u> <u>TIME FOR COMPLETION:</u>	<u>تاريخ المباشرة بالعمل:</u> <u>مدة التنفيذ:</u>	

Variable

Font: Helvetica, capitalized lower case, uniform size (3% of width)

Text layout: upper half in bold

Colors: background light yellow; CDR text in dark blue; all other text in black

Logos multicolor: maximum size: 10% of width

L.L = Max 40%
P.T = Max 10%

على ألا تحتوي على حجارة او مواد صلبة يزيد حجمها عن 5 سم.

- تردم هذه المواد على طبقات بسماكة 20 سم وحتى عمق 60 سم ابتداء من طبقة الاساس وحتى الوصول الى كثافة 95% بروكتور معدل.

- من 60 سم وما دون ذلك تردم المواد الصالحة بسماكة 30 سم وحتى الوصول الى كثافة 90% بروكتور معدل.

ثالثا: فرش الطبقة الاسفلتية:

تفرش الطبقة الاسفلتية فوق طبقة الاساس على الشكل التالي:

نفس سماكة الزفت الموجود على الطرق على الا يقل عن سماكة 9 سم للطرق (الدولية والرئيسية والثانوية) وعلى ألا يقل عن سماكة 4.5 سم للطرق المحلية والداخلية.

رابعا: في حال عدم توفر الردميات المنصوص عنها في البند ثانيا يتم الردم بواسطة ردميات (sraoc esab bus) على ان يتضمن المواصفات التالية:

- معادل رملي لا يقل عن 40%

- التآكل (A.L) لا يقل عن 40%

- حد اللدونة (P.I) % 6 P.I xaM

- لا يزيد حجم الحجارة او المواد الصلبة عن 5 سم.

- يتم الردم بسماكة 20 سم حتى عمق 60 سم ابتداء من طبقة الاساس حتى الوصول الى كثافة 95% بروكتور معدل.

- من مق 60 سم وما دون ذلك يتم الردم بسماكة 30 سم وحتى الوصول الى كثافة 30% بروكتور معدل.

- تدرج ضمن حدود المواصفات المطلوبة في دفتر الشروط.

مرسوم رقم 13495

تحديد دقائق تطبيق وتنفيذ المرسوم الاشتراعي رقم 68 تاريخ 83/9/9 (تنظيم أشغال الحفر لمد خطوط الخدمات العامة في الطرق وبراحاتها)

ان رئيس الجمهورية،
بناء على الدستور،
بناء على أحكام المادة الثامنة من المرسوم الاشتراعي رقم 68 تاريخ 83/9/9 (تنظيم أشغال الحفر لمد خطوط الخدمات العامة في الطرق وبراحاتها)،
بناء على اقتراح وزير الاشغال العامة ووزير الشؤون البلدية والقروية،
وبعد استشارة مجلس شورى الدولة (الرأي رقم 99-98/24 تاريخ 1998/10/22)،
وبعد موافقة مجلس الوزراء بتاريخ 1998/10/1،

يرسم ما يأتي:

المادة الأولى - مع مراعاة أحكام المادتين الرابعة والخامسة من المرسوم الاشتراعي رقم 68 تاريخ 83/9/9 (تنظيم أشغال الحفر لمد خط الخدمات العامة في الطرق وبراحاتها) تطبق عند ردم اشغال الحفر المواصفات والشروط التالية:

أولا: في طبقة الاساس

: granular base coarse (T.V)

تردم بسماكة 30 سم على طبقتين تحت طبقة الاسفلت على أن تتكون كل طبقة من مواد صلبة مكسرة خالية من المواد الدلغانية (clay) وتتضمن المواصفات التالية:

- معادل رملي لا يقل عن 50%

- التآكل (A.L) لا يقل عن 40%

- تدرج ضمن حدود المواصفات المطلوبة في دفتر الشروط.

ثانيا: المواد الصالحة للردم:

تعتبر مواد صالحة للردم Suitable material المواد ذات المواصفات التالية:

المادة 2 - يبلغ هذا المرسوم من يلزم ويعمل به فور نشره في الجريدة الرسمية.

بعيدا في 5 تشرين الثاني 1998

الامضاء: الياس الهراوي

صدر عن رئيس الجمهورية

رئيس مجلس الوزراء

الامضاء: رفيق الحريري

وزير الاشغال العامة

الامضاء: علي حراجي

وزير الشؤون البلدية والقروية بالوكالة

الامضاء: باسم السبع
