

### **3 - SPECIFICATIONS OF MATERIALS VALVES, PIPES AND FITTINGS**

على المقاول الالتزام بالمواصفات الفنية المعدلة لمحابس المياه حسب ما وردت في كتاب عطوفة امين  
عام سلطة المياه رقم 6662/2/7 تاريخ 2015/5/27 ومرفقاته بهذا الخصوص والمرفقة بالعطاء  
وعددتها (21) صفحة .

### **3. SPECIFICATIONS OF MATERIALS VALVES, PIPES AND FITTINGS**

#### **3.1 General :**

##### **1. Supply and Quality of Materials :**

All materials shall comply with those Standards and Specifications laid down by internationally recognized institutions, for the water industrial. Preference will be given to manufacturers that are quality certified to ISO. 9001.

All materials supplied to the site in Jordan shall be subject to acceptance tests carried out by the Royal Scientific Society, or a similar approved Authority.

All materials supplied shall be subject to the Engineer's approval.

Any or all materials and manufactured articles supplied by the Contractor for use in the works, shall ( if so required by the Engineer ) be tested in advance at the Contractor's expense, in accordance with the required specifications.

Inspection or approval by the Engineer of any equipment or materials supplied by the Contractor shall not release the Contractor from any of his obligations under this Contract .

All information and specifications relating to Products and materials proposed for this Contract, must accompany each Tender Submission.

##### **2. Storage of Materials :**

The Contractor shall be responsible for the storage and well being of all materials purchased under this Contract, and any discrepancies found therein.

The Contractor shall manage and maintain stock - yards that can accommodate all materials purchased and approved by the Engineer under this Contract, stored either in the open area or under cover as required by the Manufacture's / supplier's instructions, and shall be regularly inspected by the Engineer's staff and maintained to the Engineer's satisfaction.

##### **3. Scope :**

The Contractor shall furnish and deliver to the site, all kind of pipes, valves, fittings, closure pieces, flanges, bolts, nuts gaskets, jointing materials ...etc. and appurtenances as specified and required.

All valves shall be flanged. Pipe fittings and valves shall be Suitable for buried installation.

All tapers (reducers) required at tees and other locations to meet the specified diameters may be furnished in the manufacturer's standard lengths and diameters.

#### **4. References :**

Reference to any national standard or publication ( as ISO, BS, DIN. .... etc. ) in these specifications is intended to indicate general configuration, type and quality. Goods may be furnished which meet other internationally accepted standard, provided that overall quality will be at least equal to that required by the standard specified. Supporting documents / certificates shall be submitted hereto.

#### **5. Potable Water Certification :**

All pipe and coating materials shall be certified for potable water use and shall contain no ingredients that may migrate into water in amounts that are considered to be toxic or otherwise dangerous for health. All pipes shall be certified as safe for transporting potable water by an independent testing laboratory.

#### **6. Materials and Standards :**

All materials shall be complying with ISO, BS, API & DIN. standard and shall be supplied from approved manufactures.

The Contractor is requested to submit a list of suppliers that he intends to use together with his Tender bid.

The Contractor shall also submit for the approval of the Engineer, before ordering:

**a)** Type of materials to be used, dimensions, thickness, lengths, shape, weight, class, tolerance limits and quality.

**b)** Standard to which the item is manufactured.

**c)** Details of specials, adapters, fittings and joint design.

**d)** Coating and lining methods.

#### **7. Fittings :**

Fittings unless otherwise specified shall be furnished with a type of joint compatible with the pipe system at the supplier's option. Any adaptors necessary to joint fittings to the adjacent pipes, even of different materials, shall be provided by the Contractor at no extra cost.

#### **8. Toxic Materials :**

The Contractor is prohibited to import or to use any of the "Acrylamide and N-Methylolacrylamide Grouts" or any other toxic or poisonous materials or submaterials used in piping, it's accessories, lining, coating, sealing ...etc, or in various kinds of concrete or in soil in any kind of usage. Any import or usage of the above mentioned materials by the Contractor, requires to be licensed in writing by the Employer, otherwise, the Contractor shall be subject to legal pursuance.

#### **9. Submittals :**

The Contractor shall submit :

i – Detailed manufacturer's proposals for pipes and fittings manufacture, coating and lining ... etc.

ii – Certified copies of manufacturers quality control test results and reports .

iii – Certified copies of compliance certificates for pipes, fittings and other components .

“ This is to certify that the pipes and specials delivered in this consignment comply with the required specification .

No payment shall be made in respect of any consignment of pipes and specials in case it is not accompanied by above mentioned certificates .

#### **10. Payment of Taxes and Duties :**

The contractor shall take in his consideration that all materials in this Contract shall not exempted from customs duties, import duties, sale taxes and all other kinds of duties and taxes.

#### **11. Tests After Delivery :**

The Employer & the Engineer have the right to take samples of the supplied materials, and the following tests shall be carried out in accordance with the relevant ISO, BS, DIN or regulations by an approved laboratory.

1. Hydrostatic pressure test .
2. Hardness test .
3. Tensile strength test .
4. Elongation test .
- S. Measurement and weight .
6. Test of cement mortar lining .

All tests as mentioned or directed by the Engineer shall be borne by the Contractor and the costs shall be included in the Contract unit rates.

#### **12. Third Party Control :**

The Contractor shall at his own expense provide a recognized independent third party control to monitor quality and witness testing during manufacturing process and to ensure that the products used in the works ( such as pipes , fittings , valves . various electrical and mechanical apertures, lap equipment ... etc.) are all manufactured in accordance with the specific standards in this Contract (or any other specifications approved by the Employer ) .

The third party control should also issue test certificates stating that they had witnessed all the tests performed on the products, and all materials are conforming to Specifications and they had checked and inspected all materials regarding the proper packing and shipment, and certifying the bill of lading .

Before signing the Contract , the Contractor shall inform the Employer of the name of the control party he intends to engage , and obtain the Employer's approval.

The third party control should be selected from the following list which issued by the Central Tenders Directorate :

- 1 – SGS – Societe General De Servwillance .
- 2 – Tuboscope Verco International .
- 3 – OMIC – Overseas Merchandise Inspection Company LTD .
- 4 – Baltic Control LY. TD
- 5 – Inspecturate ( suisse ) S . A .
- 6 – Control Union International .
- 7 – Socotec International Inspection .
- 8 – Bureau Veritas - Messers. Red Sea Shipping Agency W .L .L  
Box. 1284 – Amman –Jordan

### **3.2 . Valves**

#### **1. GENERAL :**

Materials used in valves shall be suitable for potable water.

All valves, on any type of pipeline must be jointed to the pipe by flanges (unless otherwise specified) and shall have a testing pressure of 1.5 times the nominal pressure.

All valves shall be of the non-rising stem type, and shall be capable with standing the specified test pressure without leaking.

The hand wheels of all valves (including those which incorporate gear )shall be arranged for clockwise closing. All hand wheels shall have, in their periphery, the words OPEN and SHUT and appropriately positioned arrows.

When valves have inaccessible positions, extension spindles shall be fitted to suit the situation.

The contractor shall submit a certificate from the manufacturer certifying that all valves have been mill tested and that they have successfully passed the tests prescribed by the relative standard specifications.

### **3. Air Valves :**

- Where shown on the Drawings, automatic air vacuum and air release valves shall be supplied and shall be of the "Double" or "Single" type , and obtained from approved manufacturer.

- Air valves shall be of the combined type with a larger venting cross section, which permits passage of large volumes of air for vacuum breaking and venting on starting up and closing down, and with a small venting cross section for release of small volumes of air under full internal pressure.

- The air valves shall be fitted with floats made of soft rubber coated carbon steel or stainless steel complying with ( DIN. 17440 ) , suitable for operation in tropical climates. A minimum of one float for each size of valve shall be included in the delivery and in the unit rates for the air valves.

- The Valve casings and covers shall be made of ductile cast iron GGG. 50 conforming with DIN. 1693 . Valve spindles shall be made of stainless steel 20 C13 , according to DIN 17440.

- The design of the air valve shall be such that the balls do not blow shut under any working or test conditions when large volumes of air are being released.

- Air valves shall be designed to limit water hammer effects, and all shall conform to the working pressures of the pipe.

- Each air valve of any type shall be supplied or fitted with an isolating valve. Where possible these shall be of the integral screwdown type and shall have gunmetal seats and stoppers and forged bronze spindles fitted with cast iron caps for key operation. The isolating valves shall be suitable for manual operation against the maximum working pressure stated. In cases where separate isolating sluice valves are supplied, these shall be so arranged, with the provision of bevel gearing if necessary, so that they may be operated by ( tee ) T - key from above.

- Each air valve shall be suitable for the maximum working pressure as stated in the Drawings .

- Single air valves shall be fitted with one large or small orifice as may be specified in the Drawings, suitable for the automatic release of small quantities of air during normal working conditions in the main .
- Double air valves shall be fitted with large and small orifices suitable for the admission and discharge of bulk volumes of air during drainage and filling of the main, and for the release of small quantities of air during normal working.
- The isolating valves and all fittings required to install the air release valve .of any type, shall be included in the unit rates of the air valve

**- Air valves shall be installed as follows:**

**A** - For black steel main pipelines, the contractor shall cut a hole in the transmission Pipeline and install and weld a black steel pipe of suitable length and diameter provided with the appropriate slip - on flange with a neck to suit the flanged air valve.

**B** - For ductile iron main pipelines, the contractor shall install a suitable flange tee (T) and install a pipe of suitable length and diameter in order to install the A.V provided with a neck to suit the flanged air valve.

**C** - The Welding and the air valve pipes welded joints together with flanged joints, shall be properly protected in accordance with the specifications.

**D** - Air valves with diameter 1 ½ “ and larger shall be installed in concrete valve chambers according to the Standard Drawings.

**E** - Air valves with diameter 1 ¼ “ and less shall be installed in the ground according to the Standard Drawings.

**4 - Wash-Outs :**

The types of wash - out specified for this contract, whether in concrete chambers or buried type are as shown on the Standard Drawings. All wash - outs will be constructed as indicated on these Standard Drawings or as instructed by the Engineer.

At places shown on the drawings or directed by the engineer, wash - outs shall be installed as follows:

**A** - For black steel main pipeline; the contractor shall cut a hole at the lower part of the transmission main, install and weld a steel pipe of suitable length and diameter provided with a slip - on welding neck flange to suit the flanged washout valve.

**B** - For ductile iron main pipelines, the contractor shall install a suitable flanged tee (T) to install the flanged washout valve.

**C** - The welding and the W.O pipes welded joints together with flanged joints of the valves shall be properly protected in accordance with the specifications.

**D** - The wash - out pipes shall be extended to such a length and reach discharge area as is required for every particular site condition as not to flood the trenches or cause any damage to the surrounding area.

The unit price of wash - out pipelines shall also include all concrete and other works at the end of W.O pipelines (outlet structure with riprap) as shown on the drawings, unless otherwise noted .

## **5 . WATER METERS :**

### **DIGITAL PROPELLER TYPE – MECHANICAL :**

The water meter shall be flange ended of the helical type and shall have a registration dial with six digit integrator calibrated to read in cubic meters and shall be of the straight reading type and shall have cover plate and a bank lid to be fitted in place of the lid fixed to the metering mechanism, in case the later is removed for repair.

The water meter shall be suitable for a working pressure as indicated on the Drawings and the Contractor shall supply the tapers and the necessary flanges required for the proper completion of the work.

The length of the pipes connected to and from the water meter shall be at least ten (10) times the diameter of each pipe away from fittings or valves.

The Contractor shall supply install and operate these type of flow meters to measure the flow in water mains, it shall be installed as located on the Drawings. The nominal working pressure of these flow meters type shall be as indicated on the Drawings.

## **6 . CHECK VALVES:**

The check valves shall be suitable for potable water and shall conform to ( BS.5153 ) for valves of working pressure up to 25 bars. They shall have cast iron bodies, hung single disc doors, the valves seating shall be gunmetal faced and the doors shall have facing of gunmetal.

For valves of maximum working pressures greater than 25 bars, the valves should be flange ended of lift type, designed for water works duty and comply with (BS 5160) or equivalent specification.

The Spindles shall be of solid forged manganese bronze or equivalent The bearings shall be designed to minimise hinge friction and be accessible for inspection and replacement from the outside of the valve. A soft packed gland shall be provided.

A plugged pressure tapping point shall be provided for the insertion of pressure monitoring devices during commissioning.



The valves shall be suitable for operating either in the vertical or horizontal position as required, and shall be non-slam type.

## **7. Pressure Gauges:**

The pressure gauges shall be from an approved manufactures.

All gauges shall have concentric dials of 150 mm. diameter ,or as approved by the Employer .

The graduation of the pressure shall be in 0.5 bar:

- a- For suction pipes from 0.00 – 5 bar.
- b- For discharge pipes from 0.00 – 25 bar or from 0.00 – 40 bar.

The cover of the facia shall not be less than 4 mm. glass.

The gauge mechanism shall be of the Bourdon tube type, having stainless steel movments and shall comply with BS.1780 . It shall be sealed from the liquid being measured by means of a diaphragm or capsule and be filled with silicon oil.

The gauge shall be fitted with a pressure snubber, I,e. orifice, to dampen pressure pulsation . In addition to a small stopcock for venting.

Each gauge must have a test certificate stating that it is tested according to BS. 1780 and confirming that it is the required accuracy.

## **8 . ALTITUDE VALVE:**

Altitude valve shall Control the level of water in reservoir via a slave ball cock in the top of the reservoir. Small-bore piping in an approved non- corrodable material shall connect the ball cock to the underside of a diaphragm in the relay valve, then through a needle cock to strainer block on the inlet side of the valve.

With a fall of water level in the reservoir and opening of the ball cock, the relay valve shall open, allowing a pressure reduction above the main valve diaphragm. This shall cause the main valve to open and allow filling of the reservoir. When the water level in the reservoir reaches top water level, closure of the ball cock shall cause the relay valve to shut. This shall in turn lead to a build up of pressure above the diaphragm and hence closure of the main valve.

The rate of response of opening and closing of the main valve shall be controlled by an adjustable needle valve which shall enable the operation to be executed slowly, preventing sudden closure likely to cause problems on the pipeline. The main valve shall open fully in response to a fall of 200 mm. or less in the water level of the reservoir.

Details and materials of altitude valve shall otherwise be as specified below . It shall be double-flanged gray or ductile cast iron. Flanges shall be to BS. 4504, PN.16. The nominal diameter shall be as shown on the Drawings.

All materials used in the manufacture of the valve shall conform with the following minimum standards :

Body, Cover and Disc:	Spheroidal graphite iron to BS.2789
Valve guide, rings etc.:	Gunmetal to BS. 1400, Grade, LG2 .
Liner:	Bronze, to BS. 2870 .
Seating Face:	Gunmetal, Synthetic or other approved material as appropriate
Indicator Rod:	Stainless steel to BS.970 part 4 Grade: 316529.
Actuating Valve Body:	Bronze to BS.2870 .
Spindle:	Stainless steel to B5.970 Part 4 Grade : 316529.
Valve Face:	Nylon
Diaphragm and Bellows:	Reinforced synthetic rubber or approved equivalent.
Orifice body and plate:	Bronze to BS.2870 .
Strainer:	Cooper wire cloth.
Spring:	Spring steel.

All detail parts not listed shall be in homogenous corrosion resistant material.

#### **10 . Pressure Reducing Valves ( PRV ) :**

The main valve shall be with throttling cone, counter piston, spring loaded. The valve shall maintain a constant downstream pressure regardless of varying inlet pressure .

The valve body shall be in cast iron GG. 25 for the minimum pressure rating as indicated on the drawings and the body shall have an epoxy coating both internally and externally.

The spring shall be of stainless steel 50 CrV4. The pilot control shall be a direct – acting, adjustable spring loaded, normally open, diaphragm. The pilot valve shall be in bronze or stainless steel and Pilot System tube in copper. The pilot valve system shall have a stopcock to isolate the valve if necessary.

The PRV. Shall have a device indicating the position of the moving part and shall have two manometers to measure the upstream and downstream pressures.

The flanges of the RRV. Shall comply with DIN. 2501. The PRV. Shall be hydrostatically tested at the factory at 1.5 times the nominal pressure. The downstream pressure shall be set as indicated on Drawings. It shall maintain the downstream pressure within a range of + 10% with respect to the pressure.

All necessary repairs shall be possible for without removing the valve from the line.

**Flexible Couplings and Flange Adaptors:**

- For connection of the existing to the new pipeline system, flexible couplings shall be installed as indicated on the drawings or as directed by the Engineer.

- Couplings must be capable of adapting to different pipe materials.

Flexible couplings and flange adaptors shall be of mild steel and of an approved type suitable for making a watertight flexible connection between plain-ended pipes, or between a plain-ended pipe and a flanged fitting (e.g. Viking-Johnson couplings as manufactured by the Victualic Co. Ltd. Or Dresser Couplings as manufactured by the Dresser Manufacturing Division in the U.S.A.' or equivalent approved by the Engineer.

- Unless otherwise specified, the external and internal surfaces of couplings and adaptors shall be cleaned down to a metallic finish, then primed and painted with epoxy resin paint, applied by an electro static process.

- All mechanical couplings shall be of appropriate internal diameter and shall be capable of withstanding the maximum working test pressure specified for the pipes they are to connect, including a joint deflection of up to 3 degrees in any direction.

- All mechanical couplings and flange adaptors shall be supplied complete with all necessary coupling rings, nuts, bolts, washers and rubber rings. Wedge joint rings shall comply with BS. 2494, and shall be made of nitrile rubber, ethylene propylene rubber (EPDM) or styrene butadiene rubber (SBR) or other approved materials.

- Bolts and nuts of galvanized steel shall be hexagonal with dimensions in accordance with BS. 4190 or DIN. 601/555.

- Where a Harnessed Steel Flange Adaptor is shown on the drawings, the bolts connecting the flange of the Flexible Flange Adaptor to the Flange of the adjacent fitting shall be replaced by tie-bars threaded at both ends.

- One threaded end of each tie bar shall pass through holes in the abutting flanges and be anchored by two nuts to make the flanged joints in the normal way. The other threaded end shall be anchored by two further nuts in a corresponding bolt-hole on the flange, soundly welded integrally onto the fitting which it is intended to harness to the adaptor.

- The integrally-cast flange on the flange-spigot shall be located such that, after the joint has been made and all nuts fully tightened, the integrally-cast flange is about 400 mm axially from the abutting flanges.

- The bolt circles on all the flanges shall comply with BS 4504 PN 16, as specified.

- The threaded tie bars shall be machined from steel at least equal to that specified for flange bolts of corresponding duty and threaded in the same way.

The threaded length shall allow the nuts to be run forward sufficiently to permit complete withdrawal of the tie bars from the flange of the abutting fitting without requiring any other joint to be dismantled.

- The strength of the threaded tie-bars in both tension and compression shall be appropriate to the pressure rating of the flanged joints.

### **Dismantling Joints:**

Dismantling joints shall be provided and installed with each valve as indicated on the Drawings for convenient installation or re-installation of valves or similar items.

For prevention of any move of the pipe joints adjacent to closed valves, dismantling joints shall be provided in general by restrained dismantling pieces (short version) according to DIN. 2541 or DIN 2547 or flanged adapters as indicated on drawings or as directed by the Engineer.

Body and glands of steel welded dismantling pieces shall be of pressure similar to the valve or pipeline connected to it, with bolts and nuts of stainless steel. Surface protection by epoxy resin coating or equivalent quality. Rubber sealing rings made of Perbunan material, nitrile rubber or equivalent quality, shall be used.

### **Surface Boxes**

Cast Iron surface boxes with round lid according to DIN. 4056 shall be supplied for operation of valves as described. Surface boxes shall be suitable for a 100 kN load.

The surface box made of cast iron or ductile iron shall be situated at ground level on the road or pavement.

The hinge of the lid shall be of non-corrosive material. Circular lids shall be used for valves (gate and butterfly).

Surface boxes shall have a cold applied bituminous black paint coating.

Surface boxes shall be supported by - reinforced concrete slabs of 65 mm. thickness to suit the surface box.

### **9. Reinforced Concrete Valve Chambers:**

Where shown on Drawing, a complete valve chambers of reinforced concrete shall be constructed for all kinds of valves and air relies valves.

Valve chambers and similar structures shall be built into the pipe lines as demanded and in accordance with the Standard Drawings. Given dimensions on the drawings are

to be verified by the Contractor so as to suit the pipe installation and the prevailing conditions on site.

Reinforced concrete valve chambers shall be constructed of cast in-place concrete in accordance with the detailed typical Drawings.

Valve chambers shall be allowed to cure for at least (7) days before backfilling .

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

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

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

Manhole covers with bearing capacities of 40 kN and 250 kN according to DIN. 1229 shall be installed as instructed by the Engineer.

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

As shown on the Drawings, all valve chambers shall be equipped with step irons, which shall be of malleable cast iron, according to DIN 1211 or galvanized iron or as directed by the Engineer.

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

Penetration holes with G.S. sleeve pipes shall be inserted in the ceiling slabs, details of which are shown on the Standard Drawings, so as to incorporate the extension spindles of the valves inside the concrete chambers.

Ventilation pipes as instructed shall be installed at the highest possible point in all air release valve chambers (considering traffic load) and led to the nearest convenient outlet above ground. End of pipe to be flanged with a stand pipe equipped with protection cap including non-corrosive insect screen. Ventilation pipes shall be covered by the price of the valve chamber.

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

The cost of reinforcement for concrete chambers shall be included in valve chambers.

All items as described above as well as additional excavation and back filling works shall be included in the valve chambers.

### **3.3 Ductile Iron (DI) Pipes And Fittings**

#### **1. Materials :**

Ductile iron pipes shall conform to the requirements of “Ductile iron pipes, fittings and accessories for pressure pipelines” (ISO 2531 or BS 4772) or other internationally accepted standards which ensure an equal or higher quality than the standard mentioned. All pipework shall be class K9 unless otherwise stated in the Contract Documents.

DN mm	Wall Thickness mm
80	6.0
100	6.1
150	6.3
200	6.4
250	6.8
300	7.2
400	8.1

DN mm	Wall Thickness mm
500	9.0
600	9.9
700	10.8
800	11.7
1000	13.5
1200	15.3

#### **2 . Design Conditions Requirements :**

Each length of pipe shall be designed to withstand the relevant test requirements of ISO. 2531. Hydrostatic pressure tests shall be performed prior to coating or lining of pipes.

#### **3 . Joints :**

Ductile iron pipes and fittings shall be manufactured with spigot and socket ends in which the seal is achieved by means of a suitable retained rubber gasket (push-on joint).

The gasket shall be of such size and shape that, when joined in accordance with the manufacturer's instructions, it shall provide a positive seal within the manufacturer's

range of maximum joint deflection and withdrawal under all combinations of joint and gasket dimensional tolerances and in the range of pressure specified.

The joint shall be capable of accommodating the longitudinal movement resulting from a change in temperature of the pipe of 50 degrees Celsius without loss of water tightness.

The manufacturer's allowable joint deflection shall not be more than :

5 degrees up to	DN 300
4 degrees for	DN 400
3 degrees for	DN 500 to DN 600

Where flanged connections are covered by backfill material, then all flanged joints shall be wrapped in Denso Tape or similar approved.

Where connections are in valve chambers then bolts, nuts and washers shall be of stainless steel.

All connecting materials and rubber ring gaskets (steel reinforced) or adaptors shall be provided by the supplier as necessary to connect the valves and any other fittings to the adjoining pipe material, without any additional cost.

"Push-On" joints of any type could be used, that satisfy the pressure as specified in the Tender Documents (test pressure = 1.5 x Nominal pressure) and shall be according to ISO 2531 or equivalent.

#### **4 . Rubber Ring Gaskets :**

Unless otherwise indicated rubber ring gaskets for pipe installation shall be vulcanized rubber or vulcanized synthetic rubber in accordance with the International Standard ISO 4633. Reclaimed rubber may not be used. Sufficient Lubricant as recommended by the pipe manufacturer shall be provided for pipe installation plus five (5) percent as surplus material costs to be included in the unit rates. Lubricant containers shall be adequate for extended storage and the pipe manufacturer shall supply instructions for storage limitations and environment.

#### **5 . Fittings :**

Fittings shall be made of ductile iron (ISO 2531) with push-on flexible joints . The pressure class of fittings and special castings shall be class K12 for fittings without branches and K14 for fittings with branches (unless otherwise stated in the contract documents)

#### **6. Pipe Lengths :**

Pipe lengths shall be 6m in accordance with ISO 2531.

#### **7. Lining :**

Ductile iron pipes and fittings shall have a blast furnace cement mortar lining . It shall be applied so that it adheres strongly to the pipe. For pipes the lining shall be as specified in ISO 4179 and shall be applied by a centrifugal process. The lining on fittings shall also conform with ISO 4179 and shall be applied by a projection method or by hand application with respect to thickness for straight pipes of the same diameter.

The cement mortar lining thickness for pipes and fittings will be in accordance with ISO. 4179. A thickness tolerance of plus 3 mm based on the normal value shall be permitted on pipes and plus 6 mm on fittings.

As an alternative the fittings can be internally protected with a bituminous paint (ISO 2531) or with a 150 microns minimum thickness special fusion bonded powder epoxy coating.

#### **8. External Coating :**

Ductile iron Pipes ( DIP.) shall be provided with standard external coatings for normal soil, ie. metallic zinc layer, with bituminous paint according to ISO. 8179. Fittings shall be protected with bituminous coating.

When corrosive soil are encountered, Pipes and fittings shall be supplied with polyethylene sleeving of 200 microns minimum thickness according to BS. 6076, DIN. 30674 or ISO. 8180 or approved equivalent standard.

#### **9 . Marking :**

Each pipe and fitting shall bear the mark of the year of manufacture, nominal diameter, and the word “DUCTILE” on the body of the pipe or fitting. The marks may be cast on, painted or cold stamped.

#### **10 . Testing and Inspection at Place of Manufacture:**

Inspection for external appearance, shape, dimensions, and weight shall be carried out on each pipe and fitting. Pipes and fittings shall be coated with care to avoid warping. All pipes and fittings shall be sound and free from surface defects.

Each pipe centrifugally cast shall be subjected to the hydrostatic pressure test as specified in ISO 2531. Each fittings and accessory not centrifugally cast shall be subjected to a leak tightness that carried out with water or air as specified in ISO 2531. Any pipe or fitting that leaks or does not withstand the test pressure shall be rejected.

Mechanical tests for hardness, tensile strength, and elongation shall be performed on test pipes selected at random out of castings grouped in lots. Each lot shall be made up of pipes cast successively and shall comprise 200 pipes.



10. The bidder must give full information, details, technical data require in attached sheets and must also give full technical specifications of his bid in addition to manufacturer catalogue and standards, as well as the chemical and physical analysis.

Item	1	2
<b>Diameter</b>	400mm.	150mm.
Nominal Diameter		
Outside Diameter		
Wall Thickness		
Working pressure		
Test pressure		
Wt/meter (bare)		
WT/meter with		
Lining & Coating		
Thick. Of lining		
Thick. of coating		
Length of pipe		
Standards		
Manufacturer		
Country of origin		
Type of lining		
Type of coating		

## HIGH DENSITY POLYETHYLENE PIPES (HDPE)

### 1. General

High Density Poly Ethylene pipes shall comply with ISO 4427–1996 (E) and ISO.161-1: 1996

The pipes shall be designed for a nominal working pressure Class of PN 16.

Designation of material of PE.100. Pipes designated as PE.100 shall be jointed with push-fit coupling or compression fittings or electro fusion, or mechanical fittings.

The pipes designated as PE 100 shall have maximum allowable hydrostatic design stress of 8 Mpa. and minimum Required Strength (MRS) of 10 Mpa. at 50 years and 20 °C.

The nominal outside diameter and wall thickness of the pipes are as shown in the following table :

Nominal Outside Diameter (mm)	Wall Thickness(mm)
25	2.8
32	3.6
63	7.1
125	11.4
180	16.4
250	22.7

The length of the coiled pipes shall be 50-100 m or straight lengths if the pipe are to be coiled this must be done at temperature not less than 30°C. For sizes > 63 mm all coils shall be securely, banded with tough tape which cannot be removed except by butting.

The minimum diameter of the rollers for coiled pipe should be such that kinking of the pipe is prevented.

The minimum internal diameter of the rollers shall not be less than 24 times the nominal outside diameter of the pipe. with a minimum of 600 mm

The ends of the pipe shall be plugged or covered.

## 1. Materials of pipes:

The pipes shall be manufacture from polyethylene containing only those antioxidants, UV stabilizers and pigments necessary for the manufacture of potable water pipes and shall be either black or black with blue stripes and comply with (ISO 4427).

The Contractor shall provide an approved third party certificate to verify the above.

Materials in contact with or likely to come into contact with potable water shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste or odor and cloudiness or discoloration of the water. Concentration of substances, chemicals and biological agents leached from materials in contact with potable water, and measurements of the relevant organoleptic /physical parameters shall not exceed the maximum values recommended by the World Health Organization (WHO, 1984) or as required by the EEC, Council Directive of 15 July 1980,official Journal of the European Communities ,L 229 ,pp.11 to 29) on the quality of water intended for human consumption, whichever is the more stringent in each case.

Material of unknown composition shall not be used. Only Polyethylene granules that are approved and listed by International approval bodies (i.e. DVGW Germany / DWI UK or equivalent) shall be used in the manufacturing of PE pipes supplied.

Recycled material generated from a manufacturer's own production of pipes **should not be used.**

Non-metallic products in contact with, or likely to come into contact with, potable water shall comply with the requirements of BS 6920, 1996.

Carbon black content according to ISO 6964.

The pipe manufacturer shall provide evidence of the nominal values of the density, melt flow rate (index) of the raw material.

The density of the raw material (compound) shall not be les than  $0.950 \text{ gm/cm}^3$ . The pipe manufacture shall provide evidence of the nominal value of the density once, at the beginning of the contract upon delivery of material on site, and as instructed by the Engineer.

Density test for raw material and pipes shall be performed according to ISO 1183 or equivalent.

Melt flow rate (MFR) this shall be determined to the method given in ISO 1133 or equivalent.

MFR shall be less that  $1.0 \text{ gm/10 min.}$  tested at  $190/5 \text{ kg}$ , change of (MFR) by processing shall be less than 20%.

## 2 . Quality of Pipes

The manufacturer's shall operate a quality system conforming to ISO 9001/9002 as applicable.

This shall include a quality plan whereby details and results for each test, shall be made available to the purchaser or his representative on request. The manufacturer's shall have a written declaration that the polyethylene pipes, which they produce for use in public water supplies are manufactured from the granules approved and listed by International approval bodies (i.e. DVGW Germany / DWI UK or equivalent) and that no chemicals or recycled materials are added.

### 2.1: Testing Status

#### General:

Type and batch release tests are carried out by the pipe manufacturer to demonstrate compliance with relevant standard.

#### Type Tests:

1. Short term hydrostatic strength at 20°C 100 hour according to ISO 1167/1996.
2. Long term hydrostatic strength at 80°C at 1000 hour according to ISO 1167/1996.
3. Long term 80°C stress crack resistance on notched pipe. When tested in accordance with ISO 13479. Notched pipe test the pipe shall not fail within 1000 hours when pressurized at 9.2 bar (PE 100)). This test shall be carried out on SDR 11 pipe.
4. Suitability of non-metallic products for use in contact with drinking water intended for Human consumption with regard to the Quality of Water according to BS 6920: 1996.

#### Hydrostatic Strength:

When tested in accordance with ISO 1167, the pipes shall conform to the requirements given in table below.

Table – Hydrostatic Strength of Pipes (MPa)

Pipe Material	Test Stress 100 Hour at 20°C	Test Stress 165 Hour at 80°C	Test Stress 1000 Hour at 80°C
PE100	12.4	5.5	5.0

For locally manufacture pipes; (regarding test 4 mentioned above) random samples will be taken from production under a quality assurance system once every 15 months or the requirements shall be met whenever a change or an introduction of a new or modified raw material (compound) has occurred.

For imported pipes; following the delivery of imported pipes to final destination, for each batch delivered, samples will be taken at random to be tested according to BD 6920 dated 1996.

For tests 1, 2, 3 once per size group.

## **2.2 Batch Release Test / Factory Testing**

Before releasing any batch of pipe, the supplier is required to carry out basic tests specified below:

1. Dimensions and appearance ISO 4427 1996.
2. Thermal stability ISO 4427.
3. Tensile properties, elongation – according to ISO 6259 – 1997.
3. Melt flow rate ISO 1133 – 1997.
5. Short term 80°C stress crack resistance on notched pipe ISO 13479-1997.

All type and batch release tests shall be conducted by pipe manufacturer and shall be witnessed and verified by third party.

An approved list of accredited third party agencies is issued by Governmental Tenders Directorate ( GTD ). Only recognized third party by ( GTD ) may be used by manufacturer or contractor.

Third party shall verify that pipes are produced in compliance with ISO 4427.

No pipe shall be accepted unless all type and batch release tests have been passed.

## **2.3. Test after Delivery / Acceptance Tests**

Samples of PE pipes shall be taken from site as instructed by the Engineer at random from both locally manufactured and imported pipes for every lot of 10 km of pipes with diameter 63, 110, 125 and every 5 ton consignment of pipes with a diameter 32 mm and 25 mm delivered to site.

Raw material samples shall be supplied by the imported pipes manufacturer, especially for carrying out test 2 mentioned below (MFR). The Engineer may instruct in addition to type and batch release tests to conduct any or all of the following tests on the samples taken from site.

1. Dimensions ISO 4427 – 1996 / ISO 161-1.
2. Melting flow ISO 1133 – 1997.
3. Tensile properties, elongation ISO 6259 – 1997.
4. Thermal stability ISO/TR 10837.
5. Longitudinal reversion test ISO 2505-1994.

## **2.4 Marking of Pipe**

All HDPE pipes shall be indelibly marked at maximum intervals of one meter.

The marking shall show at least the following information:

- Manufacture's name and/or trade mark.
- Dimensions (nominal diameter, wall thickness).
- Material, material class (e.g. PE 100) and pressure class e.g. (PN 16).
- Production period (date).
- "Water" to indicate that pipes are intended for potable water.
- "Water" to indicate that pipes or fittings intended for potable water.
- Serial number.
- Batch number.

The pipes and fittings (especially the plastic type) shall be rejected, if the above information for marking is not shown clearly on each piece.

## **2.5 Storage and Handling**

Polyethylene pipes, tubing and fittings should be stored according to the manufacturer's recommendations.

The following general points should be taken into consideration:

- Contact with sharp metal edges on racks, etc. should be avoided.
- The ends of pipes should be protected from damage to avoid the risk of unsatisfactory jointing.
- The pipes should be stored under cover and protected from direct sunlight including when stacked at the places of delivery. The Contractor shall take all measures such as providing covers of suitable size and durability to protect the pipes from direct sunlight especially for blue pipes.
- Coils may be stored wither on edge or stacked flat on top of the other, but in either case they should not be allowed to come into contact with hot water to steam pipes and should be kept away from hot surfaces. Coils should not be dragged over rough ground to avoid damaging the pipes.
- Storage of pipes in heated areas acceding 23°C should be avoided. If , due to unsatisfactory storage or handling, a pipe is damaged or kinked, the damaged portion should be cut out completely.
- If, due to unsatisfactory storage or handling , a pipe is damaged or kinked, the damaged portion should be cut completely at the contractors expense.

## **3. Fittings and Joints**

### **3.1. Mechanical Fittings**

Mechanical coupling, push fit or compression fitting or electro fusion, may be used. They shall be produced in acetal, gunmetal or polypropylene. The joints should

provide the system with strength in tension and water tightness. All fittings shall be designed for a nominal working pressure of PN16 and they shall be compatible to PE pipes.

The mechanical jointing shall consist of lightening the pipe by means of screwed connections with compression push in such away that water tightness is fully secured by means of elastomer "O" ring and PVC grip ring.

Push fit jointing shall consist of a PVC grip and nitrile elastomer "O" ring.

All fittings of any type shall be designed for working pressure of 16 bar.

### **3.2. Testing of Pipes and Fittings**

HDPE: Pipes and fittings shall be inspected, tested and certified by the Plastic and Rubber Laboratory in the Design and Mechanical technology Centre in the Royal Scientific Society (RSS) or any other specified firm approved by the Engineer.

#### **Pipes :**

Tests for determining the resistance of Pipes to constant internal pressure and the bursting time of these pipes are required and should comply with ISO-1167.

Two types of test are required:

1. Acceptance test, carried out at a temperature of 20°C (1 hr test). These allow a fast verification of the conformity of a batch of pipes to a specified type. At least one sample test shall be carried out for each bath of pipes.
2. Quality test (170 hr test) carried out at an elevated temperature as a nature of the pipes tested.

These allow evaluation of the standard of the production and the pipe material used.

The pipelines of transmission and water distribution system and all the joints shall be tested after laying for water tightness in accordance with cp. 312 part 3.

The procedure of test shall be as follows:

Allowable leakage < 3 liter / km / 25mm dia. of pipe / 3 bar/24 hours.

Hydrostatic testing should be carried out at ambient temperature (20°C) otherwise factor should be applied as a correction to the nominal pressure.

Test should be applied on sections of length less than (500-800)m with uncovered joints.

Partially backfill to maintain adequate support and anchoring and to avoid floating of pipes during testing, with joints exposed and valves in the open Position.

Slow fill with water (and not with compressed air to avoid danger of injury or damage).

The filling should be at a rate given a maximum water velocity of (0.5 m/s) in the pipe to ensure no surge and to give air time to be released by the installed permanent air valves or installing corporation cocks.

Leave to reach equilibrium, i.e. the same temperature as the pipe and the surrounding soil and to remove all existing air and for the saturation of pipe material, if any.

Apply test pressure slowly to avoid surge ( $1.5 \times$  max. nominal working pressure at lowest point) or 16 bars whichever is greater and hold for (one hour). The system should be isolated from the test pump, i.e. no pumping during the one hour test period allowed.

Apply the equation to decide on the success of test.

Finally after completing testing the line should be emptied slowly to prevent shocks or sudden contraction of pipes.

#### Assembled Joints:

If the pipes and fittings are produced by the same manufacture, the Contractor shall provide documents demonstrating that the assembled joints comply with the following tests:

- **ISO 3458, ISO 3459:**  
Assembled joints between fittings and polyethylene pipes under internal pressure..
- **ISO 3501**  
Polyethylene pressure pipes joints assembled with mechanical fittings test of leak proofness under internal pressure.
- **ISO 3501**  
Assembled joints between fittings and polyethylene pressure pipes test of resistance to pull out.
- **ISO 3503**  
Assembled joints between fittings and polyethylene pressure pipes test of leak proofness under internal pressure when subjected to bending.

The tests of (ISO 3458, ISO 3459, ISO 3501 & ISO 3503) for the assembled joints shall include testing of tees, bends, reducers and caps, self tapping ferrules and any other fittings to be assembled on the P.E. pipes.



Fittings which made of polypropylene shall comply with (WHO – 1984) and the requirement of ECC. Council Directive – 1980.

If the pipes and fittings are not produces by the same manufacturer, the Contractor shall perform the above test at his own expenses by an approved laboratory.

#### **4 . Pipe Tapping Saddles**

Saddles are required to be used as indicated on the Drawings for service line connections. One pipe tapping saddle shall be included for each house connection or as indicated on the Drawings. They shall be suitable for a working pressure of 16 bar.

Saddle shall be fixed around the existing and/or proposed main distribution lines of diameters equal or greater than (3"). The saddle shall be of single strap design and in two parts, flat top and bottom-bolted at both sides, pressure through the disc of max. 1.5" in diameter for mains of 100mm diameter or less, and 2" for mains of diameters greater than 100mm (4"). The inside corners of the saddle strap should be rounded to prevent digging into the pipes. The saddles shall be manufactured from gunmetal to DIN 1705 or BS 1400 to suit DI pipes. The saddle shall be supplied complete with the following:

- a - Bolts and nuts of stainless steel to ISO 3506 or equivalent. Bolt heads shall be clearlymarked with the manufacturer's name or his identification mark.
- b - Nitrile rubber sealing "O" rings, suitable for service connections to be fixed between the disc and the pipe in groove in accordance with DIN 16963 and DIN EN 681. They shall be suitable for working pressure of 16 bar.
- c - The saddles shall be suitable for use with screwdown ferrules. Saddles shall be tapped for internal pipe threads in accordance with ISO 7/1 or BS21.

#### **5 . Self Tapping Ferrule Strap**

House connections (DN 20mm and DN 25mm) shall be connected directly to the HDPE service lines by one of the following (2) two procedures:

- a. Completely self contained integral cutter self tapping ferrule and saddle as indicated on the Drawings, or as directed by the Engineer shall be used. The service saddle should be bolted around the service line and the house connection connected via the ferrule pushfit outlet. The tapping may be dry or under pressure.
- b. Suitable (Tee) made of HDPE.  
"Using of suitable (tee) is preferred when it is possible " .

The self tapping ferrule and saddle shall be manufacture from:

- 1. Gunmetal to BS 1400, and shall be supplied complete with the following:
  - a. Bolts and nuts of stainless steel to ISO 3506 or equivalent. Bolts should be clearly marked with the manufacturer's name or his identification mark.

- b. Nitrile rubber sealing "O" rings, suitable for service connections shall be fixed between the pipe and the saddle in groove in accordance with Din 16963 and DIN EN 681. Self drilling cutters shall be of aluminum bronze in accordance with Din 1725 and DIN EN 601 or approved international standards, Or
2. Polyethylene, Acetal or Polypropylene, and shall be supplied complete with bolts, nuts, "O" rings .. etc. as mentioned above (in a and b).

## **6. Ferrule**

Ferrule cock shall be designed with single outlet of 25, 32 or 63mm suitable for pipes of working pressure 16 bars. They shall be screwdown type that can take the place of a stopcock and designed as a main stem with a swivel outlet control of water flow via a threaded inner plug. The cock shall have inlets with male threads to ISO 7/1 or BS 21 for underground use. The ferrule should be easily "shut off" by means of a spindle attached to the inner plug. The single ferrule should be of push fit outlet.

The design of the ferrule shall permit service line installation via dry/under pressure machines which mount on to the ferrule/saddle assembly.

The machine manufacturer's recommendations shall be followed in respect of the tapping machine.

The screwdown ferrule cock shall be manufactured of gunmetal complying to BS 1400 with minimum percentage of zinc. Complete with nitrile rubber washer in accordance with DIN 16963 and DIN EN 681.

Cast iron surface boxes with hexagonal lid as specified shall be supplied and installed for single ferrule house connections on mains of min. dia. 3". Surface boxes shall be suitable for a 100 KN load.

Extension rod with coupling sleeve and PE-protection tube shall be installed as required, as to operate the ferrule cock from the surface box.

## **7 . Electrofusion Connections**

### **a. General :**

Connection design limitations and manufacturer's joining procedures must be observed. Tools and components required to construct and install joints shall be in accordance with the best installation practices and manufacturers recommendations, all in accordance with ASTM – F 1055-98 Standard Specifications for Electro fusions Type Polyethylene Fittings For Outside Diameter Controlled Polyethylene Pipe and Tubing". However / filed connections shall be controlled by and are the responsibility of the field installer, and shall be performed by, or under the supervision of experienced personnel provided by the pipe manufacturer or distributor (proof of personnel qualifications shall be provided by the Contractor by means of an official certificate from a certified trainer, upon request by the Engineer) with proper equipment in addition the procedures recommended by Plastic Pipe Institute (PPI) shall be taken into consideration.

### **- Electrofusion Jointing :**

Electrofusion fitting, Saddles, Tapping Tees, Tapping Valves, Connectors, Tees and Elbows shall be produced from Polyethylene material (designation PE 100) PN 16

color black and comply with ISO 4427/1996 or equivalent and shall be installed in accordance with the requirements of the manufacturers instructions using appropriate jointing welding equipment.

#### **- Fusion Compatibility**

Compound designated PE 80 or PE 100 having MFR (190°/5 kg) within the range 0.2g/10 min. to 1.3g/10 min. shall be considered compatible for fusion to each other.

Polyethylene fittings designed as PE 80 or PE 100 PN 16 can be used to join pipes with different designations.

1. All fittings shall be injection moulded from recognized top quality resin PE 100 or PE 80 complying with ISO 4427/1996.
2. All fittings must be packed in such a way to allow instant use on site without additional cleaning.
3. No heating coil may be exposed and is to be fully imbedded into the body of the fitting for protection purposes during assembly.
4. All fittings must have moulded-in identification and product information.
5. A limited path style fusion indicator as visual recognition of completed fusion cycle should be incorporated into the body of the fitting.
6. Quality control test results regarding "Wire temperature coefficient" and "Heating element and wire resistance" should be provided by manufacturer.
7. All fitting should have barcode.
8. The pipe and fittings shall be of the same material.
9. Contractor should provide certificates from manufacturers on the pressure rating for the electro fusion connection to be at least PN 16.

#### **b. General Procedures:**

The component ends to be connected must be clean, dry and free of detrimental surface defects before the connection is made.

#### **c. Cleaning:**

Before joining, and before any special surface preparation, surfaces must be clean and dry.

General dust and light soil shall be removed by wiping the surfaces with clean, dry, lint free cloths. Heavier soil shall be washed or scrubbed off with soap and water solutions, followed by thorough rinsing with clean water, and drying with dry, clean, lint free cloths.

#### **d. Safety:**

Before using chemical cleaning solvents, the potential risks and hazards to persons shall be known by the user, and appropriate safety precautions must be taken. Special handling and personal protective equipment shall be used as necessary.

The manufacturer's instructions for use, and the material safety data sheet (MSDS) for the chemical should be consulted for information on risks to persons and for safe handling and use procedures.

#### **e. Cutting Pipe:**

Joining methods shall produce square-cut ends. Pipe cutting shall be accomplished with guillotine shears, run-around cutters, and saws.

Care shall be taken to avoid cutting a spiral groove around the pipe. Guillotine and run-around cutters shall provide a clean cut without chips.

Chain saws shall be operated without chain lubrication. Bucking spikes shall be removed.

Chips shall be removed from the pipe bore and cleared from the job site. Pipes ends shall be deturred. It is essential that operators take care to ensure that jointing procedures are rigorously respected and in particular that:

- The pipe ends are properly scraped.
- All parts of the joint should be kept clean and dry prior to assembly.
- Clamps are used correctly to ensure that no movement of the joint can take place during the heating and cooling cycle.
- Welding shelters are used to ensure that rain does not contaminate the joint.

Only trained and qualified welders should weld fitting on pipes.

#### **f. Dimensions and Tolerances :**

HDPE fittings shall be manufacture to the requirements of applicable to ISO 8085/PrEN 12201-3.

- 1) The minimum wall thickness of any part of a fitting exposed to the full hydrostatic pressure shall not be less than that of a pipe of the same material with the same nominal pressure rating.
- 2) The minimum bore diameter in any cross-section, (excluding pipe penetration stops) shall be not less than the maximum outside diameter of the pipe or fittings, for which the socket is intended.

#### **g. Tests :**

The Contractor shall provide certificates from a third party demonstrating that all tests in accordance with the applicable ISO are performed on electrofusion assemblies. The tests shall include, but not limited to the following test:

- ISO 13954: 1997 Plastics pipes and fittings – Peel decohesion test for (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 900 mm.
- ISO 13955:1995 Plastics pipes and fittings – Crushing decohesion test for (PE) electrofusion assemblies.
- ISO 13956: 1995 Plastics pipes and fittings – Pull out decohesion test for (PE) electrofusion assemblies.

- EN 1716 Plastics piping systems – (PE) tapping tees – Test method for impact resistance of an assembled tapping tee.

Samples of welded fittings shall be taken as instructed by the Engineer from site for the above-mentioned tests, at least once for every 600 joined connections.

The manufacturer shall subject samples of each production lot of molded fittings to x-ray inspection for voids. Voids shall not be permitted, should voids be found in the samples, the entire production shall be x-ray inspected. If additional voids are found, the production lot shall be rejected. The x-ray testing shall be conducted by an independent laboratory and certified test report made available to the Engineer upon request. Initial sampling shall be limited to not less than 5% of the production lot.

- **Cutting Branch Outlet Holes :**

Exceeding self tapping saddle tees, hole cutting will be required for field installed side outlet Fittings. Commercial hole saws for metal shall not be used. Polyethylene pipe hole saws only shall be used.

When cutting, hole saws shall be withdrawn as frequently as necessary to clear the chips. Powered hole saws shall be operated at properly low speeds to avoid overheating and melting Material.

- **Submittals :**

Contractor should provide certificate from manufacturers on the pressure rating for the Electro fusion connections to be at least 16 bar.

- **Payment :**

All electro fusion connections works and fittings shall be included in the unit prices of the relevant pipelines.

## **2.3 GALVANIZED STEEL PIPES AND FITTINGS**

### **2.3.1 Pipes**

Galvanized iron (GI) pipes shall be seam-welded, galvanized in accordance with DIN EN 10240: 1998 with threaded sockets to DIN 2441 or ISO 65: 1996, heavy series. The wall thickness and weights for each size of pipe shall be as follows:

The wall thickness and weights for each size of the pipe should be as follows:

Nominal Size (ND)	Designation of thread	Outside Diameter (mm)		Wall Thickness (mm)	Weight/m screwed and Socketed
		max.	min.		
20	3/4"	27.2	26.6	3.2	1.88
25	1"	34.2	33.4	4.0	2.96
50	2"	60.8	59.8	4.5	6.26

The pipes shall be supplied screwed in accordance to DIN 2999 or BS 21. Pipe threads, shall have the screw threads clean, well cut and square with the axis of the pipe and be free from excessive burns.

Each pipe shall be supplied with a socket at one end and shall have a protection ring affixed to the unsocketed end, to prevent damage to the leading thread. The end of each socket shall be chamfered internally.

The Galvanization shall be done by the hot-dip zinc process according DIN 1706 and shall satisfy the copper sulphate test procedure according to DIN 50952, also prescribed in Appendix C of BS 1387 latest edition.

All pipes shall be straight, cleanly finished, free from cracks, surface flaws limitations and other defects and shall have a reasonably smooth surface. The overall pipe length, when one socket has been fitted, is to be 6 meters plus or minus 150 mm.

The socket shall be in accordance with DIN 2441 or BS 1387 latest edition.

Galvanized test shall be in accordance with DIN 50952 or BS 1387 latest edition.

Before bedding of galvanized steel pipes, insitu cold bitumen coating, of minimum thickness (0.5mm), should be applied for underground installation, and extended at least 20cm for pipes laid above the ground.

### **2.3.2. Fittings**

The fitting shall be used with the heavy series of pipes according to BS 1387-1985 galvanized pipes.

Thus fittings must be suitable for this type of pipes. It must also be suitable for potable water use.

The fittings shall be Malleable Cast Iron Screw down Pipe Fittings in accordance with BS 143 and BS 1256/ 1986 or approved equal.

Threads must be in accordance with BS 21.

Working pressure shall not be less than 16 bars with 24 bar hydrostatic pressure test.

The fittings shall be (EE, GF, Crane or equivalent in quality) and have an adequate corrosion protection of internal and external surfaces by means of hot-dip galvanization according to BS 729. Galvanization test is required.

Each pipe and fitting shall bear the mark of the year of manufacture, nominal diameter, and the letters "GS on the body of the pipe or fitting. The marks maybe cast on, painted or cold stamped.

## **2.4 VALVE INDICATOR PLATES**

### **2.4.1 General**

All valves should close when turning the handle wheel in the clockwise direction. Valve indicator plates shall be installed for all valves and the price shall be deemed to be included in the BoQ rates.

### **2.4.2 Specifications**

Valves Indicator Plates shall have the following specifications:

The size of the Plates shall be 110 mm by 70 mm. The total number of removable fields shall be 18. Plates and field shall be of blue colour whereas letters and numbers shall be of white colour.

The Plates shall provide the following information:

Valve ID Number.

Distance to the left or right in meter (with one decimal up to maximum 99.9m).

Distance to the front in meter (with one decimal up to maximum 99.9m).

The Valve Indicator Plates shall be scratch, impact and corrosion-resistant, made of non-ageing, UV-resistant and weatherproof material.

All fields shall be exchangeable and fixed by self-locking system. Blank fields shall be available as single double and triple units.

Letters and numbers on fields shall be fully impregnated and coloured through.

The Valve Indicator Plate shall be fixed on a ground plate of non-corrosive, non-ageing, UV-resistant and weatherproof material by means that do not allow unauthorized removal of the Valve Indicator Plates.

Ground plates shall be fixed to the walls or pillars by non-corrosive screws.

### **2.4.3 Locations**

For all valves, Valve Indicator Plates shall be mounted onto concrete pillars installed for this purpose.

The position of the Valve Indicator Plates needs to be marked on the as-built drawings as well as details measurements of each Valve Indicator Plate needs to be recorded separately.

## **IDENTIFIERS**

### **2.5.1 General**

Electronic identifiers shall be installed over proposed underground steel, ductile polyethylene pipelines in accordance with the following specifications.

### **2.5.2 Specifications**

The design and construction of the electronic identifiers shall be rugged, reliable and durable. The cross section area shall be small in order to fit in tight places.

The following is the required specification:

Colour	Freq- uenc y	Range (Depth)	Operat -ing Temp.	Storage Temp.	Housing	Life Expectanc y	Field Trials	RCL Circuit
Blue (Water)	145.7 KHz	60-150 cm	-40to +70 c	-40 to +85 c	Water Proof	45 Years Min.	Require d	Ferrite Core

Samples of electronic identifier shall be submitted by the Contractor to be approved by the Engineer without any additional cost.

### **2.5.3 Installation**

Electronic Identifiers shall be installed in the following both manners:



- Vertically within the top of the soft backfill layer (bedding) over the pipe at a depth not exceeding 90cm from ground surface.
- Horizontally: one identifier every (12) meters maximum for straight pipeline and (4) meters in long curves and where there are more than one pipeline in the area to the satisfaction of the Engineer.

When all identifiers are installed (before backfilling to surface and after surface reinstatement) a locator shall be used to verify that all identifiers have been installed properly. The locator shall be supplied by the Contractor at his own expense.

Identifiers shall positioned 10 cm minimum away from away metallic or magnetic materials.

All water pipelines record drawings shall have note on each, stating that the pipeline in that drawings had electronic identifiers.

For special fixtures ( such as valves, meters, bends, tees ..etc.) two identifiers shall be installed (one on each side of the fixture) 50-100 cm apart symmetrically across the main.

#### **2.5.4 Payment**

The cost of supply and installation of the electronic identifiers shall be deemed to be included in the Contract unit price.

### **2.6 Warning Tape**

Over the top of the pipelines polyethylene tape of 500 microns  $\pm$  5 % thickness shall be laid. The width of this tape shall not be less than 300mm. The top surface of this tape shall be printed in both Arabic and English with a suitable font with the following :

**Yarmouk Water Company**  
**Water Pipeline**

شركة مياه اليرموك  
خط مياه تحت الأرض

The breaking strain per 150mm of width shall not be less than 75 kg.

For primary pipelines red colored tape shall be used and blue for secondary pipeline.

## **2.7 PAINTING & METAL PROTECTION**

All items of equipment shall be painted or otherwise protected as detailed in this specification. The Contractor shall be responsible for bringing to the notice of all various suppliers the appropriate clauses concerning the painting and/or protection of their equipment.

All right metal parts shall be covered before shipment with an approved protective compound and adequately protected during shipment to site. After erection these parts shall be cleaned.

## **2.8 SURFACE BOXES**

Cast Iron surface boxes with round lid according to DIN 4056 shall be supplied for operation of valves as described. Surface boxes shall be suitable for a 100 kN load.

The surface box made of cast iron or ductile iron shall be situated at ground level on the road or pavement.

The hinge of the lid shall be of non-corrosive material. Circular lids shall be used for valves (gate and butterfly).

Surface boxes shall have a cold applied bituminous black paint coating.

Surface boxes shall be supported by reinforced concrete slabs of 65mm, thickness to suit the surface box.

The Surface boxes shall be installed as indicated in drawings or directed by the Engineer and the price shall be deemed to be included in the BoQ rates.

## **3. INSTALLATION OF PIPES AND FITTINGS**

### **GENERAL**

This section is concerned with the delivery and installation of all types of pipes, fittings and pipe equipment (valves, air valves, and connections to existing lines etc.).

The civil works of this Contract shall be carried out in accordance with the “General Specifications for Water Mains and Distribution Systems and Appurtenances” of the Ministry of Water and Irrigation of the Hashemite Kingdom of Jordan.

Pipe transport shall conform to Jordanian Laws and regulations; necessary permits being obtained at the Contractor’s expense.

The pipes and fittings are to be handled in accordance with the Manufacturer’s recommendations.

Where items to be stored have a limited life or require special storage arrangements, the method of storage shall be approved by the Engineer and in accordance with Manufacturer’s instructions.

## **EARTH WORKS**

### **3.2.1 Excavation**

All surface excavations shall be made to the lines, grades and dimensions shown on the longitudinal sections and /or the standard drawings or as directed by the Engineer. Cost of over excavation shall be included in the respective unit rates of the B.O.Q. During the progress of the work, it may be found necessary or desirable to vary the slopes or the dimensions of the excavations or the alignment of the pipeline from those shown on the drawings or as directed by the Engineer. The Contractor shall not be entitled to any additional allowance above the rates tendered due to such changes.

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 Contractor shall provide all necessary support for the excavated areas to ensure the safety of the public and the staff working in these areas so as to prevent collapse or 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 for any reason whatsoever and despite adequate measures being taken re-excavation or remedial work has to be performed on already excavated trenches, this shall be carried out by the Contractor at his own expense.

The Contractor shall also provide all site safety equipment for use by his staff and the Engineer’s site staff, such as hard hats, safety shoes, reflective jackets and when required, water-proof jackets and trousers.

As the excavation approaches underground facilities, digging by machinery shall be discontinued 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.

### **Backfilling**

All ductile iron pipes shall be laid on a 150 mm compacted sand and shall be embedded by sand as shown on drawings to depth of 300 mm above the top of the pipe.

Sand backfilling materials from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of construction without permission from the Engineer.

The sand backfilling material shall be uniformly graded and shall meet the following grading requirements:

Sieve Designation	Pass square-mesh Sieves Percentage by Weight AASHTO T27
3/8"	100
No.4	95-100
No.16	54-80
No.50	10-30
No.100	2-10

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

	DIN/AASHTO Test Method	Percentage by Weight
Clay Lumps	18123-T 112	1
Coal and Lignite	18128-T 113	1
Material Passing No.200 Sieve	18123- T11	3
C1	4030-T1 & T2-BS 812	0.1
SO3	4030-T1 & T2-BS 812	0.4
Hollow Shells		3.0

Above the level of the sand fill, the trench shall be filled, watered and compacted with selected fill material or base course in accordance with the details shown on the standard drawings, in no more than 200 mm thickness layers to a maximum dry density of 95% in accordance with the MPWH specifications (Highway Specifications, 1991)

Field density tests (density of soil according to AASHTO T191) shall be executed at every 200 m backfilling of pipe trench or at any other location as directed by the Engineer.

## RESTORING AND RESURFACING

All costs associated with reinstatement works (Asphalt, Concrete, Tiles, seal Coat, Stairs, ...etc.) shall be borne by the Contractor. Asphalted surfaces (damaged during

construction works) shall be replaced with an asphalt surface in accordance with the details shown on the standard drawings. The materials used in the asphalt replacement shall be those normally used by the Ministry of Public Works and Housing in Jordan (Highway specifications for asphalt surfaces, 1991).

## **HOUSE CONNECTIONS**

The Contractor shall make complete house connections in accordance with the requirements of the Typical Drawings and as instructed by the Engineer. Connections may be required for any combination of new and existing lines with new and existing consumers. The following Clause details the required method of carrying out the house connections. This Clause shall be read in conjunction with other contract clauses (HDPE, GI, ...etc.).

House connections of 3/4", 1" or 2" diameter HDPE pipework shall be made from service lines as indicated on the Drawings or instructed by the Engineer. Sterilization of the service connection shall be carried out at the same time as the main to which it is connected.

Service connections on existing or proposed pipelines shall be made by under pressure tapping. A gun-metal saddle is to be provided with stainless steel nuts and bolts and Nitrile rubber sealing ring/washer suitable for a working pressure of 16 bars. The tappings will be made for 3/4", 1", 1 1/2" and 2". The gunmetal ferrules shall have single outlets suitable for 25, 32, and 63 mm push-fit outlets. The Engineer's Representative will issue instructions regarding the size, location and fittings for each service connection.

Tappings shall be made into saddles affixed to the main lines as shown on the detailed Drawings and care shall be taken to avoid breaking away concrete lining. The machine manufacturer's recommendations shall be followed in respect of the tapping machine. Tappings shall be positioned on the main so that the ferrule is inserted into the main at the crown. The jointing of the threaded ferrule to the main line shall be made using lead free jointing compound or PTFE tape.

The outlet of the ferrule shall be set to point in the direction in which the service pipe is to be laid. The service pipe (HDPE) shall be laid with a cover of not less than 500 mm below the ground surface unless otherwise shown on Drawings.

The jointing on the HDPE pipe to the push-fit joint shall be in accordance with the instructions of the manufacturer of the push-fit fittings.

The house connection pipe shall be carried to about 1 m inside the property of the customer to a location to be proposed by the Contractor and approved by the Engineer. The service line shall be sleeved from where it passes through the boundary wall, to the connecting point on the GI pipe to facilitate subsequent withdrawal.

The transitional point from the HDPE to the GI pipe shall be protected as shown on the Typical Drawings with necessary excavation as instructed by the Engineer.

In all cases the house-connection line shall terminate in a gunmetal compression adapter manufactured to DIN 1705 or BS 1400, to connect existing or new GI pipe and stop valves before and behind the water meter as shown on the Drawings.

The work may include the disconnection of the old existing water meter. The same water meter or a new one (supplied by the Water Authority) shall be installed, as directed by the Engineer's Representative. Where required, pressure reducing valves shall be installed as instructed.

Pipe work on both sides of the meter assembly shall be firmly fixed to prevent movement of any flexible joints within the meter assembly. Such anchorage shall leave sufficient room for connecting and disconnecting the meter making use of the adapters provided. To simplify meter maintenance, a stop valve shall be installed on either side of the meter as indicated on the Drawings.

Where meter assemblies need to be repositioned, the meters shall be fixed horizontally as directed and approved by the Engineer's Representative and with the lowest dial not more than 1.0 m above the floor level, easily visible for reading.

The work shall also include installation of sufficient lengths of 1/2", 3/4" and 1" exposed galvanized pipe lines as may be required to connect the water-meters (in their new locations) to the existing pipe lines inside the properties of the consumers. All galvanized pipes, valves, fittings, and adaptors required for a complete connection shall be supplied and installed by the Contractor.

If existing valves are in good condition, they shall be reinstalled by the Contractor at no extra cost.

All buried fittings including the ferrule should be manufactured from gunmetal or other dezincification resistant (DZR) material and be suitable for underground use.

The Contractor must prepare house connection sheets for the deteriorated house connections to be rehabilitated in coordination with the Employer.

### **3.5 CONNECTIONS AND DISCONNECTIONS TO EXISTING WATER MAINS**

Connections shall be made to the existing lines as shown on the standard drawings. The connections shall be made from existing plugged ends or from existing lines to be cut, whether dry or under pressure.

The Contractor shall always check the level of any existing line before work is started, no matter the pipe material, diameter, level is.

The Engineer's Representative will issue to the Contractor detailed instructions regarding each interconnection that has to be made to the existing mains. Cutting into the existing main pipe and effecting the interconnection shall be made in the presence of the Engineer at the time specified by the Employer.

Cutting into the existing main pipe and installation of the interconnecting pipe work shall be carried out efficiently and rapidly so as to reduce to a minimum the interruption of the public water supply.

Existing mains shall only be cut using special equipment approved by the Engineer. Under no circumstances shall oxyacetylene or electric arc cutters be used. The cut shall be perpendicular to ensure that the new pipe work shown on the drawings may be installed. The Contractor shall agree with the Engineer's Representative the length of existing pipe work to be removed.

The Contractor shall take every care to avoid any dirt or extraneous material entering existing pipes.

Shall have available at the site of the connection an efficient dewatering pump before commencing any cut into the existing main in order that excavation remains dry at all times and to reduce the risk of dirty or contaminated water entering the existing distribution system. The work shall be carried out in a clean and efficient manner. Sufficient length of hoses shall be provided to dispose the water to safe places.

The Contractor shall provide at the site of the connection sufficient quantities of clean water containing 10 ppm chlorine solution. Every item of new pipe work to be installed shall be submerged in the chlorine solution for at least 15 minutes immediately before being installed in the permanent works.

The Contractor shall provide at the site of the connection all materials and fittings required to make the connections including any temporary measure for dealing with flow, any temporary connections required, adaptors pieces and fittings (as far as they are not included in other items) etc.

The Employer may put into use the interconnection as soon as possible after its installation and will carry out an inspection to detect any evidence of leakage; any remedial work necessary to eliminate leakage shall be carried out by the Contractor. No pipe work shall be covered or backfilled until the Engineer's Representative is totally satisfied that the interconnection is free from any leakage.

No extra cost will be paid to the Contractor for this connection work and is deemed to be included in the unit prices for the pipes in the BoQ, no matter what is the diameter or material type at all areas within Biet Ras area.

Disconnection of the old replaced network where instructed by the Engineer's Representative under the supervision of the Yarmouk Water Company shall be carried out by the Contractor. Each disconnected line shall be cut and plugged on both sides (not by closing valves). Such work shall be carried out after submitting an approved method statement to the satisfaction of both, the Engineer and the Yarmouk water Company Representative and the time for observation of any disconnection shall not be less than two rationing supply periods, the cost of all disconnection works shall be deemed to be included in the unit rate of pipes in the BoQ. including any temporary

measure for dealing with flow, blind flanges, adaptors pieces and fittings (as far as they are not included in other items) etc.

The disconnection of old house connections shall be done outside the plot boundary, before and after the water meter in the property of the customer, to the satisfaction of the Engineer, Redundant meters are to be returned to the YWC stores.

The Contractor shall construct at his own cost all thrust blocks, collars, valves, accessories, end caps,...etc as shown on the drawings to complete the job. Thrust blocks shall be constructed at all bends, tees, tapers, valves, and dead-end pipes with push-on joints.

### **3.6 HYDROSTATIC PRESSURE TESTING OF DI PIPES**

After completing the installation of a water main, or a section of the line, and before the joints are covered, a hydrostatic test of the line shall be made by the Contractor. A sufficient time for the curing of concrete thrust blocks must be allowed before the test is made. All backfilling and compaction over and around the pipes and thrust blocks must be completed except for the pipe joints to be left open for observation of any leaks, before the test is made.

The Contractor shall submit to the Engineer's Representative for approval, detailed procedure for performing hydrostatic pressure tests of installed pipes, fittings and valves. Procedures for performing the hydrostatic pressure test should indicate the location and capacity of the test pump for each test section, test pressure at the pump, procedure for venting the air from the pipeline, procedure of filling the pipe with water, length of the pipe section, and procedure for discharging water after test, flushing, drying and cleaning of the pipeline.

#### **Duration of Pressure Test**

The initial test pressure shall be applied for a period of 24 hours before all tests are assumed to begin, to allow for a soaking period. After that, all joints shall be carefully inspected for evidence of leakage. The test pressure for the main test shall be applied for at least three hours for pipe diameters up to ND 200 mm and six hours for pipe diameter ND 250 mm to ND 600 mm.

The test pressure shall not be allowed to fall below 25 bars for all lines. If and when it does during the test period, the pressure shall be increased to the stated value and a record kept of the additional water added.

#### **Procedure**

The pressure for the initial test will start with the working pressure, and shall reach the test pressure within the last 6 hours of the initial test.



Test pressure to be taken at the lowest point of the pipelines to be tested and corrected to the elevation of the test gauge.

The test pressure of the main test is 1.5 times the nominal pressure for the pipe.

The tests have to be carried out in the presence of the Engineer's Representative in accordance with the relevant standards for the pipe material applied.

When filling the pipe system, the Contractor shall not exceed the amount of water charged into the system as follows:

- |                         |                    |
|-------------------------|--------------------|
| - Up to 200 mm diameter | 1.5 liters/second  |
| - Up to 300 mm diameter | 3.0 liters/second  |
| - Up to 400 mm diameter | 6.0 liters/second  |
| - Up to 500 mm diameter | 9.0 liters/second  |
| - Up to 600 mm diameter | 14.0 liters/second |
| - Up to 800 mm diameter | 22.0 liters/second |

The test pressure shall be applied by a suitable pump equipped with connection valves and gauges, etc. to the satisfaction of the Engineer's Representative. The gauges and meters shall be new and accompanied by a certificate for test and calibration.

The results of the tests, specifying the layout of sections of system, pipes and fittings tested including all relevant data of testing as weather, time, duration, filling time, pressure, etc., shall be produced in the form of a report by the Contractor and signed by the Contractor's and the Engineer's Representative.

This report shall not relieve the Contractor of his responsibility for care and maintenance of the system until the date of final acceptance of the completed work.

## **Stop Ends**

A simple stop end consists of a section of steel pipe about 0.5-1.0m long onto which a closing plate has been welded, containing the necessary openings for accommodating ingoing water and out coming air. The stop end may also include an opening through which the test water may be pumped from the line, if necessary. The stop end may be jointed to the pipe to be tested by means of a standard coupling or other method approved by the Engineer's Representative. Thrust blocks or a temporary anchorage must be provided to hold the stop end in place against the test pressure.

## **Air Removal before Test**

Before applying the test pressure, all air shall be expelled from the pipe. After all the air has been expelled, all cocks shall be closed and the test pressure applied as specified above. The line shall be filled slowly to prevent possible water hammer.

## **Examination during Test**

All exposed pipes, fittings, valves, hydrants and joints shall be carefully examined during the pressure test. All joints showing leaks shall be rejoined until tight, or the pipe material replaced.

Any defective pipes or joints, fittings or valves discovered as a result of this pressure test shall be repaired or removed and replaced by the Contractor at his own expense with sound material and the test shall be repeated until proved satisfactory to the Engineer's Representative.

### **Permissible Addition of Water**

Additional water is defined as the quantity of water that must be applied to the laid pipe, or any section thereof, to maintain the specified test pressure after the pipe has been filled with water and the air expelled. The quantity of additional water pumped into the pipe shall be measured accurately.

No section of the water main will be accepted until the additional water calculated in liters per km per 24 hours for the test pressure is less than  $0.3 D$ , where  $D$  is the nominal diameter of the pipe in mm.

The Engineer's Representative shall prepare a written report of results of the leakage test that identifies the specific test, length of the pipe tested, the pressure, the duration of the test, and amount of additional water required. The report shall be signed by the Contractor and the Engineer's Representative.

### **Cost of Testing**

The Contractor shall provide a sufficient quantity of gauges, pumps, stop ends, and connections and all things necessary and suitable for the testing of all pipes as described herein. The Contractor shall also provide all necessary temporary works in connection with test, and shall remove the same on successful completion of the test. All tests shall be done in the presence of the Engineer's Representative and the results of such tests shall be signed by the Contractor and handed to the Engineer's Representative who shall prepare the required test reports.

All equipment, labor, materials, and water necessary for the carrying out of these tests to the complete satisfaction of the Engineer's Representative shall be provided by the Contractor at his own expense. Should any test fail, the Contractor shall, after repairing and making good any leaks, carry out further tests all as described above until such test meets the requirements contained herein. All such tests and retests shall be at the expense of the Contractor.

### **3.7 PRESSURE TEST OF HDPE PIPES**

Test pressure shall be  $(1.5 \times \text{nominal working pressure})$  or 16 bars whichever is greater. The service lines including joints, fittings and appurtenances shall be tested for water tightness in accordance with ISO 1167 as follows:

Allowable quantity of water required to restore pressure at the end of the test period : < 3 liters/km/25 mm diameter of pipe/3bar/24 hours.

Hydrostatic testing should be carried out at ambient temperature (20 °C) otherwise a correction factor should be applied to the nominal pressure.

Test should be applied on sections of length less than 800 m with uncovered joints. Partial backfilling to maintain adequate support and anchoring and to avoid floating of pipes during testing. Test procedure with joints exposed and valves in the open position.

The filling of pipes should be at a rate giving a maximum water velocity of 0.5 m/s in the pipe to ensure no surge and to give the air the necessary time to be released by the installed temporary air valves or cocks.

Leave to reach equilibrium, i.e., the same temperature as the pipe and the surrounding soil and to remove all existing air for the saturation of pipe material, if any.

Apply test pressure slowly to avoid surge and hold for one hour. The system should be isolated from the test pump, i.e., no pumping during the one hour test period allowed. Test pressure shall be applied to service lines including all couplings and fittings in the open position, with consideration to temperature variation.

Apply the equation to determine if the section under test satisfies the requirements of the above.

Finally after completion of the testing, the line should be emptied slowly to prevent shocks or sudden counteraction of pipes.

#### Short Pressure Test

The so-called “Short Test” may be used for pipelines up to approximately 30 m and nominal diameter not more than ND 50 mm.

The test pressure is applied to the pipe and the first reading taken after 30 minutes. Note that this pressure is usually slightly less than initial pressure due to the normal expansion of the pipeline under pressure, but no additional “top-up” pressure should be applied.

For the short test the results are deemed to be satisfactory when pressure loss from the HDPE pressure pipeline is  $\leq 0.1$  bar per 5 mins.

Short pressure test for testing the house connections can be applied when approved by the Engineer.

### **3.8 DISINFECTION OF PIPELINES**

After the completed pipeline is tested, approved and backfilled, disinfections shall be performed in the following manner: 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's Representative. The Contractor is also responsible for conducting bacteriological test for all pipe ling through YWC laboratory and according to their instructions and requirements. The cost of disinfection and the bacteriological test shall be born by the Contractor.

The attention of the Contractor is directed to the requirements of the Contract whereby he is responsible for preventing the entry of foreign material of any kind from entering the pipe. The Contractor shall take extreme care to keep the interior of the pipelines free of dirt and other foreign material. If in the opinion of the Engineer's Representative, dirt or other foreign material entered a pipe which can not be removed by flushing, then the Contractor shall clean and swab the interior of the pipe with a five percent hypo-chlorite disinfecting solution to the satisfaction of the Engineer's Representative.

The Contractor shall, during the initial filling of the pipeline, simultaneously introduce feed of chlorine at the same point where the pipeline is being filled. The rate of filling 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 milligrams per liter. To assure that this concentration is maintained, the chlorine residual shall be measured at blow-off, combination air valves, or other locations during the filling operation.

The following is 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 the various diameters of pipe to be disinfected under this Contract.

#### **Liquid Chlorine Required for Disinfecting 100 Meters of Pipes:**

Nominal Pipe Diameter (mm)	100% Liquid Chlorine (kg)	1% Chlorine Solution (Liters)
800	3.60	360
600	2.97	297
400	1.30	130
300	0.75	75
250	0.51	51
200	0.33	33
150	0.18	18
100	0.08	8
80	0.05	5
50	0.02	2

The use of liquid chlorine shall only be permitted when suitable equipment consisting of a solution feed chlorinator together with a booster pump of injecting the chlorine gas-water mixture into the pipeline to be disinfected is used. Introduction of chlorine gas directly from the supply cylinder shall not be allowed.

After completion of the disinfections operation for one pipeline section the Contractor may reuse this chlorinated water to disinfect adjacent sections of the pipeline by 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 pipeline including a description of all equipment to be used for the Engineer's Representative approval prior to starting the disinfections operations.

Payment for all labor, material, and equipment, including the cost of all water and chlorine required to disinfect the pipeline and appurtenances shall be included in the unit prices for pipe installation.

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 disinfect these appurtenances. At the end of the 24-hour period, the water in the pipeline shall contain no less than 25 milligrams chlorine per liter throughout the length of the pipeline. Should the pipeline fail to have the specified chlorine concentration at the end of the 24-hour period, the Contractor shall repeat the operation as necessary to provide complete disinfections.

### 3.9 FLUSHING OF THE PIPELINE

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

After draining the chlorine solution the pipe system shall be flushed with potable water until the free chlorine content is between 2 to 4 milligrams per liter.



١١٣٨

٥/ تصاريح طرق/

الرقم

٢٠١٣-٠١-١٣

التاريخ

الموافق

راجيا لإيعاز لمن يلزم بأن يتم إعلام هؤلاء المقاولين بضرورة مراعاة أن التصاريح - للقيام بأعمال الحفريات وإعادة الأوضاع للمشاريع المعنية ضمن حرم الطرق الرئيسية والثانوية التابعة لهذه الوزارة - تمنح من قبل مركز هذه الوزارة، وبحيث توجه كفالات إعادة الأوضاع لهذه المشاريع - المقدمة من هؤلاء المقاولين - إلى معالي وزير الأشغال العامة والإسكان بالإضافة إلى وظيفته وتكون هذه الكفالات مطابقة للنموذج المرفق طيا صورة عنه، أما التصاريح - لأعمال الحفريات وإعادة الأوضاع للمشاريع المعنية ضمن حرم الطرق القروية والزراعية التابعة لهذه الوزارة - فإنها تمنح من قبل مدراء الأشغال كل ضمن منطقة إختصاصه وبحيث توجه كفالات إعادة الأوضاع لهذه المشاريع إلى مدير الأشغال المعني بالإضافة إلى وظيفته وتكون هذه الكفالات مطابقة للنموذج المرفق طيا صورة عنه ويتم تزويد مركز هذه الوزارة بصورة عن هذه الكفالات من قبل هؤلاء المقاولين.

وتفضلوا بقبول الاحترام ،،،

أمين عام وزارة الأشغال العامة والإسكان

المهندس سامي هلسه

نسخة: لمطوفة مدير عام دائرة المطايع الحكومية  
نسخة: لمدير إدارة الشؤون الفنية  
نسخة: لمدير إدارة شؤون محافظات الشمال  
نسخة: لمدير إدارة شؤون محافظات الوسط  
نسخة: لمدير إدارة شؤون محافظات الجنوب  
نسخة: لمدير تفتيش خدشات البنى التحتية  
نسخة: لمدير الشؤون القانونية  
نسخة: لمدير الشؤون المالية  
نسخة: لرئيس قسم البيانات والمعلومات  
نسخة: لرئيس قسم التصاريح والمتابعة  
نسخة: لرئيس قسم إزالة الموانع  
المرفقات: صورة عن الإجراءات المشار إليها أعلاه.  
صورة عن نموذج الكفالات المشار إليه أعلاه.

### الإجراءات الواجب اتباعها لتمديد خدمات البنى التحتية ضمن حرم الطرق التابعة لهذه الوزارة:-

١. تقديم كتاب رسمي من صاحب الخدمة يبين الأعمال المطلوب منح التصريح لها واسم المقاول المنفذ.
٢. تقديم مخططات تفصيلية - موقعة ومختومة من قبل صاحب الخدمة - تبين حدود حرم الطريق المطلوب تنفيذ الأعمال ضمن حرمه ، وكذلك تبين مسار الخدمة المطلوبة بالنسبة لحرم هذا الطريق بحيث يكون هذا المسار ضمن آخر (٢) متر من حرم الطريق ، وتبين هذه المخططات أيضا العوائق والخدمات الأخرى الموجودة أصلا على طول المسار المنوي تنفيذه مع بيان كافة التفاصيل والأبعاد على هذه المخططات.
٣. التزام المقاولين المعنيين بأحكام مواد قانون الطرق رقم (٢٤) لعام ١٩٨٦ وتعديلاته وينود تصريح الخدمات الموحد وتعديلاته وشروط ومتطلبات ومواصفات هذه الوزارة حسب التعاميم والكتب الصادرة عنها بذلك الخصوص.
٤. التزام المقاولين المعنيين باستعمال تكنولوجيا تمديد الخدمات بدون الحفر (trenchless) واستخدام مادة الخرسانة السائبة (Flowable Concrete) للأعمال المطلوب تنفيذهها ضمن جسم الطرق الرئيسية والثانوية.
٥. يتم الكشف الحسي على الموقع من قبل مهندسي مديرية تنسيق خدمات البنى التحتية بحضور مندوب مديرية الأشغال المعني ومندوب صاحب الخدمة ومندوب المقاول للأعمال المطلوب تنفيذهها ضمن حرم الطرق الرئيسية والثانوية.
٦. تقديم كفالة مالية ضمانا لإعادة الأوضاع بإسم معالي وزير الأشغال العامة والإسكان بالإضافة لوظيفته وتكون هذه الكفالة مطابقة للنموذج المعتمد لدى هذه الوزارة، أو يتم تقديم شيك مصدق يعادل (١٥٠) ٪ من كلفة إعادة الأوضاع إلى ما كانت عليه سابقا وذلك للأعمال المطلوب تنفيذهها ضمن حرم الطرق الرئيسية والثانوية.
٧. يقوم مدير الأشغال المعني بإصدار تصريح العمل المطلوب بناء على موافقة خطية مسبقة من قبل عطوفة أمين عام وزارة الأشغال العامة والإسكان وذلك للأعمال المطلوب تنفيذهها ضمن حرم الطرق الرئيسية والثانوية.

٨. بالنسبة للأعمال المطلوب تنفيذها ضمن حرم الطرق القروية والزراعية تتم الإجراءات السابقة من قبل مدير الأشغال المعني مع مراعاة أن تكون كفالات إعادة الأوضاع مطابقة للنموذج المعتمد لدى هذه الوزارة بإستثناء أن تكون كفالات هذه الطرق موجهة لمدير الأشغال المعني بالإضافة لوظيفته ويتم تزويد مركز هذه الوزارة بصورة عنها، أو يتم تقديم شيك مصدق يعادل (١٥٠٪) من كلفة إعادة الأوضاع إلى ما كانت عليه.

٩. يقوم مدراء الأشغال بالتنسيق مع إدارة المختبرات وضبط الجودة لأجراء فحوصات ضبط جودة دورية لأعمال مشاريع تمديد خدمات البنى التحتية المنفذة ضمن حرم الطرق التابعة لهذه الوزارة، ويتم تزويد مركز هذه الوزارة بنتائج هذه الفحوصات أصولياً.

١٠. يلتزم المقاولون المعنيون بتقديم مخططات المسارات المنفذة حسب الواقع (Hard and Soft Copy of As-Built Drawings) مرفقة مع طلب موافقة هذه الوزارة على الإستلام الإبتدائي لأعمال المشاريع المنفذة من قبلهم لمديريات الأشغال المعنية ونسخة عن هذا الطلب ومرفقاته لمركز هذه الوزارة.

١١. يتم إشراك مندوب من مديرية تنسيق خدمات البنى التحتية في لجان الإستلام الإبتدائي والنهائي للأعمال المنفذة ضمن حرم الطرق الرئيسية والثانوية، وفي حال مطابقة الأعمال المعنية لمواصفات وشروط ومتطلبات هذه الوزارة يتم التنسيب بالإفراج عن كفالة إعادة الأوضاع من قبل مدير الأشغال المعني بناءً على موافقة لجنة الإستلام النهائي للأعمال المعنية.



البنك -----

التاريخ: -----

معالي وزير الأشغال العامة والإسكان بالإضافة لوظيفته المحترم  
عمان-الأردن

كفالة رقم: -----

استحقاق: (لمدة سنة واحدة)

مبلغ / ----- دينار أردني

يسرنا إعلامكم بان مصرفنا البنك: -----

يكفل السادة شركة: -----

المبلغ (بالأرقام): ----- دينار أردني

المبلغ (بالكلمات): ----- دينار أردني

وذلك تأمينا لالتزام المقاول بمواصفات وزارة الأشغال العامة والإسكان وإعادة  
وضع الطريق كما كان عليه سابقا مع الالتزام بشروط السلامة العامة أثناء تنفيذ  
حفريات خطوط ----- بمشروع -----

وأننا نتعهد بان ندفع لكم -- بمجرد ورود أول طلب خطي منكم المبلغ المذكور أو أي  
جزء تطلبونه منه بدون أي تحفظ أو شرط مع ذكر الأسباب الداعية لهذا الطلب بان  
المقاول قد رفض أو أخفق في تنفيذ الالتزامات فيما يخص وضع الطريق كما كان  
عليه بصرف النظر عن أي اعتراض أو مقاضاة من جانب المقاول على إجراء  
الدفع. ويتم تمديد هذه الكفالة تلقائيا ولا يتم إلغاؤها إلا بناءً على طلبكم.

وتفضلوا بقبول فائق الاحترام

عن البنك:



٥٧ / ٣ / ١ / ١٧٤٩٧ /  
١٤ - شوال - ١٤٣١ هـ  
٢٣ / ٠٩ / ٢٠١٠ م

الرقم  
التاريخ  
الموافق

معالي وزير المياه والري / سلطة المياه

إشارة لكتابكم رقم ٩١١٦/٢/٧ تاريخ ٢٠١٠/٨/١٦، أبعث لمعاليتكم بصورة عن كتاب معالي وزير الأشغال العامة والإسكان / العطاءات الحكومية رقم ع - ٤ - ٢٠٩٧/٣٧ تاريخ ٢٠١٠/٩/٧، وأوافق على استثناء مشاريع سلطة المياه وسلطة وادي الأردن من بلاغي رقم (١٩) لسنة ١٩٩٩ فيما يتعلق بتمديد مدة العطاءات وحسب الشروط التعاقدية التي تحكم هذه المشاريع والعطاءات.

واقبلوا فائق الاحترام.

رئيس الوزراء

نسخة/إلى معالي وزير المالية  
نسخة/إلى معالي وزير الأشغال العامة والإسكان/  
العطاءات الحكومية.  
نسخة/إلى عطوفة رئيس ديوان المحاسبة

من ٩/٢١



وزارة الأشغال العامة والإسكان  
دائرة العطاءات الحكومية

رئاسة الوزراء  
٢ أيار - ٢٠١٠  
الرقم ١٢٠٥٧ - ١٢٢٥٨

الرقم  
النسخ  
الموافق  
٢٠٩٧ ٣٧-٤-٤  
٢٠١٠/١٩/٧

دولة رئيس الوزراء

الموضوع : تمديد مدد العطاءات

إشارة الى كتاب دولتكم رقم ٥٧-١٣-١-١٦٠٠٧ تاريخ ٢٥/٨/٢٠١٠.  
أرجو دولتكم التفصل بالعلم بان تمديد العطاءات الخاصة بالمشاريع الإنشائية والذي يتم بناءً على طلب المقاولين العاملين في هذه المشاريع يأتي كمساعدة من الوزارة للمقاولين بسبب التأخير الناجم عن الأيام الماطرة والتي يتعذر فيها العمل في المشاريع او بسبب ظروف قاهرة عامة يتعرض لها المقاولون مثل نقص العمالة أو بسبب نقص الاسمنت في الأسواق المحلية في بعض الأوقات ويستند ذلك الى بلاغ رقم (١٩) لسنة ١٩٩٩ والذي يتطلب من الجهات الرسمية باعتماد التعليمات الصادرة عنى كوزير للأشغال العامة والإسكان وبخاصة ما يتعلق بتمديد مدة التنفيذ والتعويضات ، علماً أن هذه التعاميم تشترط عدم مطالبة المقاولين بأية مطالبات مالية ناتجة عن هذا التمديد.

لذا فإننا نرى ان موضوع استثناء مشاريع سلطة المياه وسلطة وادي الأردن من بلاغ دولتكم رقم (١٩) لسنة ١٩٩٩ وذلك فيما يتعلق بالتعاميم الصادرة من قبلي بخصوص تمديد المدة عائد لهم وحسب الشروط التعاقدية التي تحكم مشاريعهم وعطاءاتهم بصفتهم صاحب العمل .

وتفضلوا دولتكم بقبول فائق الاحترام ،،،

وزير الأشغال العامة والإسكان  
الدكتور محمد طالب عبيدات

٩/١٩

صورة طبق الاصل  
Scanner