على ماسورة التعبئه من النوع الزمبركي المزئبق و تزويد المرحاض بحنفيه كروم ½" رقبه طويله و جميع ما يلزم لانجاز العمل.

- تقديم و تركيب مجلى من ستانلس ستيل قياس 00ر1 × 50ر. م حوض واحد منشأاروبي أوتركي وسيفونPVC قطر 1.5" متصله مع الفائض والسلاسل والسدادات والسعر يشمل ايضا تمديدات التصريف من المجلى حتي اول مصرف ارضي بواسطة مواسير PVC قطر 2" وتزويد المجلى بخلاط كروم ½" وجميع ما يلزم لانجاز العمل .

- تقديم وتركيب مصرف ارضي فلورتراب من (P. V. C)2/4 انش مع غطائين من الكروم احدهما شبك و الاخر مغلق قياس 20 × 20 سم و السعر يشمل ايضا تمديدات التصريف الخارجيه لغاية الجاليتراب او المانهول خارج المبنى قطر 2 انش و جميع ما يلزم كاملا.

- تقديم و تركيب مرآه عاكسه قياس 60×45 سم من زجاج مصقول سماكة 6ملم و يشمل السعر ايضا رف بورسلان بطول 55 سم و كل ما يلزم لاتمام العمل.

- تقديم و تركيب مواسير المجاري P.V.C الخارجيه قطر 6" و السعر يشمل ايضا الحفريات و التسويه و التامين من رمل ناعم او العدسيه و اعادة الطمم بعد التجربه و نقل الفائض و جميع ما يلزم .

- ربط الغرفة الامتصاصية الموجودة في الموقع مع غرفة الحارس وعمل الحفريات الترابية اللازمة بالأيدي العاملة أو الآلات وحسب طبيعة العمل المطلوب للوصول إلى الأعماق المطلوبة والسعر يشمل(تمديدات صحية مواسير المجاري و التسويه و التامين من رمل ناعم او العدسيه و اعادة الطمم بعد التجربه و نقل الفائض إلى الأماكن المسموح إلقائه بها و جميع ما يلزم) وحسب المواصفات والمخططات وتعليمات المهندس المشرف.

- **اعمال الطراشة و الدهان:**

- توريد وتنفيذ وتقديم وعمل دهان بلاستيكي (املشن) Vinyl Matt من أجود الأنواع ثلاثة وجوه مع الحف و استخدام المعجون حيث ما يلزم حسب الألوان المطلوبة وذلك للأسقف والجدران وحيثما يلزم.

- توريد وتنفيذ رشة شبريز لون فاتح (بيج) مع إستخدام مواد لزيادة الربط (bond) للأسطح الخارجية أو ما يعادله للجدران الخارجية مانع للظروف الجوية والرطوبة اللون الذي يحدده المهندس مع جميع ما يلزم.

- **تنظيف الموقع من جميع المخلفات وتسوية الأرض:** و نقل الانقاض اولا باول بموجب المواصفات الفنية و حسب تعليمات المهندس المشرف.

22.الاعمال الانشائية لخزان المياه سعة (500) م2:

- **حفريات:** من كل نوع من قبل الجهات المختصه او توريد طمم من خارج الموقع في حالة عدم صلاحية او كفاية ناتج الحفر و السعر يشمل التصرف بناتج الحفريات للطمم ضمن الموقع و نقل الفائض الى الاماكن المحدده الحفريات للاعماق و المناسيب المطلوبه و حسب ارشادات المهندس .

- **توريد و عمل رصفه:** من دبش صلب سماكة 15 سم بعد الدحل مع التحشيه بالصرار و السعر يشمل التسويه الترابيه اللازمه للطبقه التاسيسيه مع الرش بالماء و الدحل قبل وبعد الرصفه بحيث لا تقل درجة الدك عن 100% .

- **تقديم و صب خرسانه مسلحة:** بقوة كسر مكعبي صغرى لا تقل عن (250 كغم / سم2 بعد 28 يوما) و السعر يشمل عمل الفواصل الانشائيه و الميول اللازمه و لا يشمل حديد التسليح .

- **تقديم و صب خرسانه مسلحة:** بقوة كسر مكعبي صغرى لا تقل عن (250 كغم / سم2 بعد 28 يوما) حسب الابعاد و المقاطع و التفاصيل المبينه على المخطط و السعر يشمل المرابط الخاصه و الطوبار اللازم لاعطاء الخرسانه سطحا ناعما و املسا (Fair Face) و يشمل تعبئه فراغ المرابط بعد فك الطوبار و لا يشمل حديد التسليح .
- **تقديم و تركيب حديد التسليح الانشائي:** من كافة الاقطار و الاطوال و السعر يشمل القص و الثني و الضياع و كراسي رفع الحديد و سلك التربيط و الدسر مع ملاحظة تامين أي طول حسب المخططات من أي مصدر كان حيث لا تحسب الاطوال الزائدة ولا يدفع لذلك اية علاوات و جميع ما يلزم.

- **توريد و تركيب وصلات مانعة لتسرب المياه:** (P V C WATER STOP) تثبت بين ارضية و جدران الخزان و جميع الفواصل العموديه و الافقيه طبقا للمخططات و المواصفات و تعليمات المهندس .

- **تنظيف الفواصل و تعبئتها بالمعجون المطاطي:** (Mastic Filler) و تعبئ بالفرد المخصص و حسب تعليمات الشركه الصانعه و موافقة المهندس.

- **توريد و تركيب سلم معدني:** طبقا للمخططات و المواصفات و السعر يشمل تركيب السلم قبل صب الخرسانه مع جميع الاعمال اللازمة.

- **توريد و تركيب اغطيه معدنيه:** مجلفنه بالتغطيس على الساخن و السعر يشمل الحلق والايدي والقفل ..... الخ و ما يلزم
- **تقديم و تركيب مواسير حديد اسود:** باطوال مختلفه (Black Steel Pipes) وباقطار مناسبة تثبت في ارضية و جدران الخزان و ذلك للمواسير الداخله و الخارجه و الفائض و التهويه و ماسورة غسيل الخزان و يشمل السعر ايضا جميع القطع و الفلنجات و الاكواع ...الخ.

- **دهان الجزء المراد ردمه من الاساسات:** و الجدران بوجه غزير من الاسفلت عيار 80 / 100 مع طبقة من الخيش و السعر يشمل جميع المواد و الاعمال بموجب تعليمات و موافقة المهندس (تقديريه) .

- **تقديم و تركيب مواسير حديد مجلفنه:** قطر (4 ") انش للتهويه فوق سطح الخزان و يشمل السعر ايضا القطع اللازمه والشبك المعدني المجلفن وجميع الاعمال اللازمه لاتمام العمل.

- **تقديم و تركيب مفاتيح بفلنجات تعمل بدولاب حديد سكب:** يدوي و يكون ملائما لضغط تشغيلي كما هو مبين ادناه و يشمل السعر القطع و الفلنجات و النقاصات.. الخ وكافة القطع اللازمه ومناهل (غرف) المفاتيح كامله مع جميع الاعمال اللازمه.
- **تقديم و تركيب مفتاح عوامه:** قطر (6") بضغط

- **تقديم و تركيب مصفاه:** معدنيه (Stainless Steel)

- **تقديم و تركيب مؤشر لخزان المياه:**لمعرفة منسوب المياه في الخزان و يجب ان يكون معتمد من المهندس المشرف مع جميع لوازمه حسب المواصفات .

- **تقديم و عمل مدة ميلان :** مصقوله للسطح من خرسانه عاديه بقوة كسر لا تقل عن (200 كغم / سم2بعد 28 يوما)

- **تقديم وفرش حصمه:** بحجم (1,5 الى 2,5) سم بسماكة (6 الى 12) سم على سطح الخزان .

- **تقديم و تركيب مواسير (P . V . C) لتصريف مياه المطر:** مع المصافي و المرابط المعدنيه و جميع القطع اللازمه.

- **توريد وتركيب وحدة أناره:** توريد وتركيب اعمدة أناره خارجية مطرية بطول 7 متر مع لمبات LED بقدرة 150واط وحسب المخططات التصميمية المرفقة وتعليمات المهندس المشرف.

23.الاعمال الانشائية للجدران الاستنادية:

- قص وحفر وقشط و تسوية وتمهيد الأرض من جهة الواجة الجنوبية الغربية وتحضير السطح للأعمال الإنشائية اللاحقة. يشمل ذلك إزالة الطبقات الخرسانية القديمة أو الأسفلتية أو أي تراكمات أخرى على السطح شاملا التصرف بناتج الحفريات للطمم ضمن الموقع و نقل الفائض خارج الموقع الى الاماكن المحدده من قبل الجهات المختصه و حسب المخططات الاسترشادية المرفقة وحسب المواصفات وتعليمات المهندس المشرف.

- تصميم وعمل وإنشاء جدار استنادي للمحطة في الواجهة الشمالية الشرقية للمحطة بطول 50 متر وسماكة 35 سم وارتفاع متر عن سطح الأرض حسب المخططات ووثائق العطاء وتعليمات المهندس المشرف.

على أن يتم تقديم التصميم شامل التوصيات الفنية لمديرية الدراسات والتصاميم/ سلطة المياه لأخذ الموافقة عليها قبل البدء بالتنفيذ.

- تصميم و تقديم وعمل جدار استنادي للمحطة في الواجهة الجنوبية الغربية للمحطة بطول 50 متر وسماكة 35 سم وارتفاع 2متر عن سطح الأرض حسب التصميمية ووثائق العطاء وتعليمات المهندس المشرف.

على أن يتم تقديم التصميم شامل التوصيات الفنية لمديرية الدراسات والتصاميم/ سلطة المياه لأخذ الموافقة عليها قبل البدء بالتنفيذ وذلك بعد إجراء فحوصات التربة اللازمة لجميع الاعمال الخاصة بالخزان والجدران الاستنادية وتعتبر كلفة هذه الفحوصات محملة على أسعار العطاء الكلية.

24.الاعمال الخارجية :

- **أعمال السياج :** توريد جميع المواد و انشاء سياج مكون من شريط شبكي مزئبق قطر3 مم وفتحة 5 × 5 مم بارتفاع حسب المخططات التفصيلية مثبت على مواسير مجلفنة قطر2 انش شكل (Y) وتركب هذه الاعمده على مسافات لا تزيد عن ثلاثة أمتار و ذلك بخلاف ما سيرد في المخططات التفصيلية وتثبت فوق الجدران الخرسانيه عموديا كل ثلاثة امتار وبعمق 35 سم داخل خرسانه الجدار بحيث يكون ارتفاع الصافي للمواسير الحديدية (1) مترا عن سطح الجدار العلوي ، ليركب على الجزء العلوي (Y) شيك حلزوني لولبي شائك . كما ويلحم في اسفل كل ماسورة قطعه من الصاج سماكة 3 مم بقياس 15 × 15 سم كما يجب ان تكون اعمدة المواسير مدعومه بالاتجاهين وجميع الاعمال بموجب المخططات و المواصفات و تعليمات المهندس المشرف.

- **توريد وتركيب بوابة:** بعرض (4 م) منزلق مكون من ذرفتين مصنوع من حديد الزاويه والحديد المبسط والصاج سماكة (5ر2 مم) والسعر يشمل جميع المواد والقطع والجسر الحامل والبيل والسكك والايدي وستوبات الباب وحلقات القفل والقفل من النوع النحاسي الثقيل ... الخ والسعر يشمل ايضا الدهان همر ثلاثة وجوه بالاضافه لوجه التاسيس وجميع ما يلزم.

- **تزفيت وتعبيد:** الساحة الخارجية وجميع الأعمال التابعة بموجب المخططات والمواصفات وحسب تعليمات المهندس.

- **توريد وتركيب اعمدة أناره:** وتوريد وتركيب اعمدة أناره خارجية مطرية بطول 7 متر مع لمبات LED بقدرة 150واط وحسب المخططات التصميمية المرفقة وتعليمات المهندس المشرف.

☒ **متطلبات خاصة لصاحب العمل في هذا العطاء يجب على المقاول أن يلتزم بها:**

1) لا يحق للمقاول المطالبة باية زيادة في اسعار البنود التي يتم زيادة/تقليل الكميات لها من قبل صاحب العمل.
2) ينبغي على المقاول حضور زيارة الموقع والتأكد من حجم الأعمال المتبقية والتحقق من الظروف المحيطة والتفاصيل لمواقع جميع الأعمال والمناسيب والخدمات القائمة وكميات وطبيعة العمل والمواد اللازمة لإتمام العمل وطرق الوصول للمواقع، وعلى المقاول الالمام بكافة المعلومات الضرورية عن المخاطر والظروف الجوية والطبيعية والمتناقضات التي يمكن أن تؤثر على عرضه.
3) المخططات المرفقة في العطاء هي مخططات استدلالية وسيتم تحديد مواقع العمل للمقاول من قبل (السلطة/ إدارة المياه المعنية) وكذلك مسارات الخطوط المقترحة ونقاط الربط والفصل عند زيارة الموقع وتزويد المقاول بأي معلومات والإجابة عن استفساراته ما أمكن حتى يتمكن من تقديم عرضه.

4) على المقاول قبل التنفيذ تقديم المخططات التنفيذية لكافة الاعمال ويحق لصاحب العمل الطلب من المقاول تقديم هذه المخططات واعتمادها من مكتب استشاري متخصص وتقديمها ليتم اعتمادها من مديرية الدراسات_ المركز و المهندس المشرف قبل تنفيذ اي عمل والتنفيذ على أساسها.

5) مخططات As built التي سيقدمها المقاول في العطاء يجب أن تشمل كافة الخطوط والأعمال التي تم تنفيذها في العطاء وتكون جميع التكاليف المترتبة على تنفيذ هذه الأعمال مشمولة ضمن الأسعار الإفرادية للبنود في جدول الكميات. ولن يتم صرف المطالبة المالية النهائية للمقاول قبل احضار هذه المخططات ويتحمل المقاول أي تأخير زمني نتيجة لذلك.

6) لا يوجد إعفاء مباشر على اعمال و بنود جدول الكميات و انما يتم إعادة المبالغ الماليه المدفوعه على شكل ضريبة مبيعات او رسوم جمركيه على المواد المستخدمه في صلب المشروع بعد تقديم المقاول الإثباتات الرسميه الخاصه بدفع هذه البنود و حسب القيمة الفعلية.

7) الكميات الواردة في جدول الكميات هي كميات استدلالية، وبعد أن يقوم المقاول بالأعمال المساحية واعمال التصميم اللازمة وتجهيز المخططات التنفيذية وتحديد الأطوال والكميات الحقيقية ، عليه أخذ الموافقة الخطية من قبل صاحب العمل وتعديل الكميات الواردة في جدول كميات العطاء شريطة عدم المطالبة بأي فروقات على الأسعار وكذلك عدم تجاوز قيمة الأعمال المنفذة قيمة العقد (قيمة الاحالة للعطاء).

8) يحق لصاحب العمل تغيير مسارات بعض خطوط المياه أو مواقع نقاط الربط والفصل وكذلك موقع أي عمل مطلوب او منسوبه لضمان تشغيل الخطوط وتحقيق الهدف من المشروع شريطة أن يكون التغيير ضمن منطقة عمل المشروع ولايحق للمقاول المطالبة باية زيادة في اسعار بنود جداول الكميات او تمديد مدة زمنية نتيجة لذلك وتكون جميع التكاليف المترتبة على تنفيذ هذه الأعمال مشمولة ضمن الأسعار الإفرادية للبنود في جدول الكميات.

9) في حال تتطلب استكمال أعمال العطاء وتحقيق الهدف من المشروع تنفيذ أي عمل ليس له بند في جدول الكميات ولم يقم المقاول بالإستفسار عنه خلال فترة الإستفسارات قبل إيداع العروض، تكون كلفة هذا العمل محملة على أسعار العطاء ويكون شاملا توريد وتركيب جميع القطع والمواد اللازمة وتنفيذ جميع الأعمال المطلوبة.

10) على المقاول قبل البدء بالتنفيذ تجهيز خطة عمل لاجراءات السلامة العامة وتقديمها إلى صاحب العمل لأخذ الموافقة عليها قبل التنفيذ على أن يلتزم المقاول بإجراءات خطة السلامة العامة الموافق عليها والمعتمدة وفي حال عدم التزام المقاول بذلك يحق لصاحب العمل اتخاذ جميع الاجراءات اللازمة بحق المقاول على سبيل المثال لا الحصر (حجز مبالغ مالية أو عدم صرف المطالبات المالية لحين التزام المقاول بمتطلبات السلامة العامة بالخطة المعتمدة بالشكل الصحيح وحسب تعليمات ممثل صاحب العمل، وتعتبر تكاليف هذه الأعمال مشمولة ضمن الأسعار الإفرادية للعطاء.

11) على المقاول أن يكون مسؤولا عن إبلاغ المهندس المشرف والسلطات الرسمية عن أي حادث يقع في الموقع ويتسبب في إصابة عامل أو مستخدم وتزويد صاحب العمل بكافة التفاصيل وبشكل رسمي، ويتحمل المقاول المسؤولية الناتجة عن أي حوادث ناجمة عن عدم الالتزام بشروط السلامة.

12) على المقاول ان يقوم بالاعمال المساحية اللازمة من قبل مساح مرخص لتحديد مواقع ومسار الخط/الخطوط والـ fittings المراد تنفيذها ونقاط الربط والفصل واي اعمال مطلوبة من محابس ومفاتيح هوايات وعدادات مياه ومناهل وخزانات مياه وكل مايلزم على مخططات اراضي محدثة مبين كافة الشوارع والخدمات القائمة من خطوط مياه وصرف صحي وكهرباء واتصالات وغيرها وبالتنسيق مع الجهات المعنية ذات العلاقة ومع ادارة المياه المعنية وتقديم مخططات تنفيذية (ShopDrawings) قبل البدء بالتنفيذ وحسب تعليمات وموافقة المهندس المشرف وجميع تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لجداول الكميات.

وزارة الميـــاه والـــري
سلطـــة الميـــاه
مديرية العطاءات والمشتريات

13) على المقاول أن يقوم بالاعمال المساحية اللازمة لتحديد مواقع/مسارات اي اعمال من خطوط مياه او محابس ومفاتيح ومناهل ومايتعلق بها من قطع ومواد تعيق الأعمال المطلوب تنفيذها والحفر عليها وازالتها ونقل هذه الاعمال او اي انقاض تنتج عنها الى الاماكن المخصصة ويشمل ذلك اعمال الطمم واعادة الاوضاع كما كانت بجميع الاسطح وبالتنسيق مع ممثل صاحب العمل (سلطة المياه/او ادارة المياه المعنية حسب كتب التفويض الصادرة عن سلطة المياه) وحسب تعليمات وموافقة المهندس المشرف وجميع تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لجداول الكميات.

14) على المقاول مخاطبة كافة الجهات المعنية والمختصة وبالتنسيق مع ممثل صاحب العمل (سلطة المياه/او ادارة المياه المعنية حسب كتب التفويض الصادرة عن سلطة المياه) والحصول على التصاريح اللازمة بشكل مسبق والتي يتطلبها المشروع تفاديا لعدم تاخر المشروع، وتعتبر هذه الاعمال ضمن مسؤولياته.

15) في حال عدم امكانية المقاول تنفيذ أعمال العطاء نظرا" لقيام وزارة الاشغال العامة/ البلدية المعنية بفتح وتعبيد الطرق على المقاول التنسيق المستمر مع وزارة الاشغال العامة والبلديات المعنية حول امكانية تنفيذ خطوط المياه بعد انشاء الشوارع وتثبيت حدود الشوارع وفي حالة حصول تأخير في التنفيذ لهذه الأسباب يحق للمقاول تمديد زمني دون أن يترتب على ذلك أي أثر مادي، شريطة إرسال إشعار من قبل المقاول إلى ممثل صاحب العمل بهذا الخصوص وضمن المدة العقدية وبخلاف ذلك لن يتم النظر في طلب المقاول بالتمديد، وفي ذات السياق في حال قيام أي جهة بتنفيذ أعمال في منطقة المشروع وتعذر تنفيذ أعمال العطاء، على المقاول إرسال إشعار إلى ممثل صاحب العمل بهذا الخصوص وضمن المدة العقدية لدراسة الإحتمالات الممكنة لتنفيذ أعمال العطاء في هذه الظروف وكذلك دراسة أحقية المقاول بتمديد مدة العطاء.

16) الصندوق السعودي للتنمية غير مسؤول عن أي ضرائب أو رسوم تفرض على أرض المقترض/المستفيد).

☒ **المتطلبات الفنية لأعمال خطوط المياه:**

1) أعمال خطوط المياه تشمل الكشف والحفر والتمديد والتركيب والتوصيل والتعقيم والصيانة والتشغيل والطمم وإعادة الأوضاع بمختلف الأنواع من الأسطح سواءا اسفلت او ترابي او صخري او خرساني او بلاط وغيرها حسب مواصفات العطاء والجهات ذات العلاقة كوزارة الاشغال العامة والاسكان، وزارة الشؤون البلدية ، وزارة الاتصالات وشركة الكهرباء مع التأكيد على الالتزام باخر التعاميم الصادرة منها بالخصوص وجميع تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية.

2) على المقاول توريد وتركيب كافة أنواع خطوط المياه والمفاتيح والهوايات وجميع القطع بأنواعها المختلفة من اكواع وتيهات ونقاصات وسدادات وفلانجات وبراغي وكسكيتات والقطع الخاصة والمرابط ومواد الوصلات وصناديق السطح ومواد عزل وتغليف الوصلات اي متطلبات واعمال تلزم لتشغيل المشروع...الخ وكافة توابع المشروع بموجب متطلبات وثائق العطاء وجميع تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لجداول الكميات.

3) في حال العمل ضمن مناطق وشوارع وزارة الاشغال العامة والاسكان فان مسار خطوط المياه والمناهل والمحابس واي معدات وجميع أعمال الحفر وإعادة الاوضاع لجميع انواع الاسطح تكون بموجب تعليمات والمواصفات الفنية لوزارة الاشغال العامة والاسكان وحسب اخر التعاميم الصادرة منها بالخصوص وجميع تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لجداول الكميات

4) في حال العمل ضمن مناطق وشوارع وزارة الشؤون البلدية فان مسار خطوط المياه والمناهل والمحابس واي معدات وجميع أعمال الحفر وإعادة الاوضاع لجميع انواع الاسطح تكون بموجب تعليمات والمواصفات الفنية المعتمده من وزارة الشؤون البلدية أو البلدية المعنية وحسب اخر التعاميم الصادرة منها وجميع تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لجداول الكميات.

5) على المقاول الالتزام بتعليمات وزارة الاشغال العامة والاسكان ووزارة الشؤون البلدية والبلديات المعنية فيما يتعلق باجراءات تصاريح العمل وتقديم الكفالات المطلوبة لمشاريع تمديد خدمات البنى التحتية ضمن حرم الطرق والمناطق التابعة لوزارة الاشغال العامة والاسكان بموجب ما ورد بكتاب وزير الاشغال العامة والاسكان رقم (5/ تصاريح طرق/1138) تاريخ2013/1/13 وكتاب عطوفة امين عام سلطة المياه رقم(852/2/7) تاريخ 2013/2/5 ومرفقاتها وجميع تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لجداول الكميات.

6) الأعمال المتعلقة بتوريد وتنفيذ خطوط المياه والمحابس والمفاتيح تشمل توريد وتمديد ووصل(ولحام ان لزم) وتشغيل وفحص وتعقيم وصيانة خطوط المياه شاملا" المحابس وخطوط الغسيل والمفاتيح والهوايات وعدادات المياه والقطع بانواعها والتوصيلات اللازمه على خطوط المياه القائمة والمقترحه واي توصيلات للمحابس والمفاتيح والمناهل وغيرها وجميع المواد والاعمال اللازمه والتابعه ضمن قيمة الاحالة وبالتنسيق مع ممثل صاحب العمل (سلطة المياه/او ادارة المياه المعنية حسب كتب التفويض الصادرة عن سلطة المياه) وحسب تعليمات المهندس المشرف وتعتبر تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات

7) على المقاول تنظيف وتسوية وتحضير مواقع ومسارات خطوط المياه لافساح المجال أمام معدات المقاول والأجهزة الفنية العاملة وتكون مسارات خطوط المياه ومواقع العمل المقترحة حسبما هو مبين على المخططات التنفيذية وحسب تعليمات المهندس المشرف وعلى المقاول فورا البدء باعمال تحضير المخططات التنفيذية وبالتنسيق مع ممثل صاحب العمل (سلطة المياه/او ادارة المياه المعنية حسب كتب التفويض الصادرة عن سلطة المياه)وحسب تعليمات المهندس المشرف على أن تكون المخططات بمقياس رسم واضح مبين عليها الخطوط القائمة والمحابس والقطع على أن تشمل كافة التفاصيل الفنية اللازمة لربط الخطوط المقترحة أو الوصلات....الخ وكذلك بالنسبة للوصلات المنزلية وأخذ الموافقة الخطية عليها قبل البدء بالتنفيذ. وفي حالة وجود عوائق تمنع التنفيذ في المواقع المبينة في المخططات يحق لممثل صاحب العمل (سلطة المياه/او ادارة المياه المعنية حسب كتب التفويض الصادرة عن سلطة المياه) اختيار موقع بديل للتنفيذ وعلى المقاول الالتزام بالموقع الجديد وتعتبر تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات.

8) على المقاول توريد وتركيب القطع والمواد اللازمة لكافة أنواع المفاتيح والهوايات بأنواعها المختلفة من أكواع وتيهات ونقاصات وسدادات وفلانجات وبراغي وكسكيتات والقطع الخاصة والمرابط ومواد الوصلات ومواد عزل وتغليف الوصلات وكل مايلزم وكافة توابع المشروع بموجب المواصفات والمخططات وفي حال عدم ذكرها في المواصفات والمخططات على المقاول تقديمها لصاحب العمل لاعتمادها والموافقة عليها وتعتبر تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات.

9) على المقاول تمديد وتوصيل الخطوط المقترحة حسب المسارات المبينة على المخططات أو حسب ما تقتضيه طبيعة العمل ان لم ترفق المخططات وعليه عمل وتقديم المخططات التفصيلية التنفيذية (Shop Drawings) قبل البدء بالتنفيذ وحسبما يقتضيه الامر وبالتنسيق مع ممثل صاحب العمل (سلطة المياه/او ادارة المياه المعنية حسب كتب التفويض الصادرة عن سلطة المياه) لأخذ الموافقة الخطية عليها قبل التنفيذ وتعتبر تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات.

10) على المقاول تثبيت مسارات خطوط المياه والاعمال التابعة لها واي اعمال مطلوبة في المشروع في حرم الشارع (من خلال مساح مرخص) وتقديم كروكي معتمد بالواقع واخذ موافقة ممثل صاحب العمل (سلطة المياه/او ادارة

المياه المعنية حسب كتب التفويض الصادرة عن سلطة المياه) على ذلك قبل البدء بالعمل، وتكون كلفة تثبيت حدود الشارع محملة على أسعار العطاء.

11) على المقاول توريد وصب خرسانه مسلحه (250كغم/سم2 بعد 28 يوما) Ready mix لعمل تغليف لمواسير المياه حيثما تتقاطع مع خطوط الصرف الصحي(RCE) أو مرورها في الأودية والعبارات وحيثما يلزم حسبما ما يتطلبه واقع العمل بموجب تعليمات المهندس شاملاً جميع الاعمال (ان لزم تغيير نوع المواسير من دكتايل الى حديد مثلا لهذا المقطع)التابعة بموجب المواصفات والمخططات وفي حال لم توجد المواصفات والمخططات على المقاول تنفيذها حسب تعليمات ممثل صاحب العمل (سلطة المياه/او ادارة المياه المعنية حسب كتب التفويض الصادرة عن سلطة المياه) وتعتبر تكاليفها مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات.

12) على المقاول تحديد اماكن المناهل والـ surface box والمحابس والهوايات وخطوط الغسيل على المخططات التنفيذية في حال لم تحدد على المخططات او كانت مواقعها اولية او عند عدم ارفاق المخططات واعتماد مواقعها على مخططات وبروفايلات تقدم من قبل المقاول لخطوط المياه والاعمال المقترحة وحسب تعليمات المهندس المشرف وتعتبر تكاليفها مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات.

13) على المقاول توريد وتركيب وانشاء المناهل(Chambers) للمحابس والمفاتيح والهوايات وصناديق السطح وأعمدة الاستطالة (Extension spindlesSurface Boxes &) للمحابس في حال لم تذكر في جداول الكميات وكانت مطلوبة في المواصفات الواردة في المخططات النموذجية (Typical Drawings) المرفقة في العطاء شاملاً الحفريات اللازمة وخرسانة النظافة والمواد المتدرجة والطوبار والخرسانة المسلحة والاعمال المعدنيه الخاصه بالمناهل، اغطية، درجات...الخ وتوريد عدد كافي من وصلات الاعمده (Extension Spindle) ومفاتيح أغطية المناهل وكافة الأعمال التابعة والدك وإعادة الطمم وإعادة الأوضاع ونقل الأنقاض شاملاً جميع الاعمال التابعة بموجب المواصفات والمخططات وحيثما يلزم بالتنسيق مع الادارة المعنية وفي حال لم توجد المواصفات والمخططات على المقاول تنفيذها حسب تعليمات صاحب العمل وموافقة المهندس المشرف وفي حال تم تحديدها في جداول الكميات فان ماورد في جداول الكميات يعتبر اولوية وكافة تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات.

14) على المقاول تحميل ونقل وتنزيل وتسليم في المستودعات التي يحددها صاحب العمل (المفاتيح والمضخات والكوابل والمواسير والقطع وأي مواد أخرى من أبواب وشبابيك وألواح زينكو، أسيجة وأعمدة سياج ... الخ إن وجدت في العطاء) التي يتم فكها بموجب هذا العطاء (مع المحافظة عليها)، وعليه أن يُجّهز جدولاً مبيناً فيه المواد والقطع التي قام بفكها وبالتنسيق مع المهندس المشرف وتعتبر التكاليف مشمولة ضمن أعمال العطاء.

15) على المقاول أن يتقيّد بما ورد في نظام المكاتب والشركات الجيولوجية الصادر عن نقابة الجيولوجيين الأردنيين، بخصوص أي أعمال ذات صبغة جيولوجية (حفر آبار ، فحص تربة ...الخ) حيث لن يتم اعتماد أو قبول أي معاملة بهذا الخصوص ما لم تكن موقعة من قبل نقابة الجيولوجيين الأردنيين. المرجع ،كتاب عطوفة أمين عام سلطة المياه رقم : س م /4/3/ 6896 تاريخ 2003/4/30.

وزارة المياه والري
سلطة المياه
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16) على المقاول الالتزام بتطبيق كودات البناء الوطني الاردني في كافة مراحل الاعمال لكافة المشاريع الهندسية كأعمال التنفيذ وأية أعمال تصميمية مطلوبه منه بموجب وثائق العطاء وكذلك أعمال التشغيل والصيانة وأعمال السلامة العامة وكل ما يترتب عليها من أعمال هندسية بموجب تعليمات تطبيق كودات البناء الوطني الاردني الصادرة عن مجلس البناء الوطني بموجب الفقرة (ز) من المادة (5) من قانون البناء الوطني الاردني وتعديلاته رقم (7) لسنة 1993. (كتاب عطوفة أمين عام سلطة المياه رقم : س م/625/2/7 تاريخ 12/ 1/2005).

☒ **المتطلبات الفنية لأعمال الخرسانة والحفريات**

1) يجب استعمال الرجاج الميكانيكي عند صب جميع أنواع الخرسانة العادية أو المسلحة للحصول على خرسانة خالية من الفجوات او التعشيش ويجري تعيين نوعية الرجاجات ومدة الرج من قبل المهندس، وفي جميع الاحوال يجب ان تكون الرجاجات من النوع الذي يعطي مالا يقل عن (5000) رجه في الدقيقة ويستعمل الرجاج بموجب المواصفات وعلى المقاول أن يزود موقع العمل قبل البدء بالصب برجاجين صالحين للعمل، واحد للاستعمال والثاني احتياط.

2) يجب ان تحفظ الخرسانة رطبه لمدة لا تقل عن (7ايام) ويتم ايناع وترطيب الخرسانه بموجب المواصفات.

3) يحظر المباشرة بصب الخرسانة قبل الحصول على موافقة المهندس الخطية وعلى المقاول تقديم طلب خطي لاخذ الموافقه على الصب قبل فترة لا تقل عن 24 ساعة.

4) على المقاول تنفيذ ما تنص عليه المواصفات الفنيه العامه بخصوص الخرسانه في الاجواء الحاره والبارده وحسب تعليمات وموافقة المهندس.

5) لغاية ضبط جودة المواد والخلطات الخرسانيه، على المقاول اجراء الفحوصات المخبريه اللازمه للمواد وفقا لما ورد في المواصفات الفنيه العامه وعلى ان يقوم بفحص الخلطات الخرسانيه بشكل دوري كما يلي:
   - لكل50م^3 خرسانه تؤخذ على الاقل 6 مكعبات ممثله بحيث تفحص 3 بعد اسبوع والثلاثه الباقيه بعد28 يوما.
   - لكل يوم صب اذا كان الصب على مراحل ، تؤخذ 6 مكعبات تفحص 3 بعد اسبوع والثلاثه الباقيه بعد 28 يوما.

6) على المقاول تقديم الجداول الخاصه بتنفيذ مخططات حديد التسليح (Bar-Schedule Binding) مبينا فيها اطوال واوزان حديد التسليح لممثل المهندس بغرض اعتمادها قبل التنفيذ.

7) الخرسانة المسلحة المستعملة في كافة أعمال العطاء تكون بقوة كسر مكعبي صغرى لا تقل عن 250 كغم/سم2 بعد 28 يوماً (ما لم يذكر خلاف ذلك).

8) الخرسانة العادية المستعملة في كافة أعمال العطاء تكون بقوة كسر مكعبي صغرى لا تقل عن 200 كغم / سم2 بعد 28 يوماً (ما لم يذكر خلاف ذلك).

9) اذا استدعت طبيعة التربة بعد التحقق من قدرة تحملها اجراء تعديل على مناسيب الحفريات او ابعادها بزيادة العمق او العرض او كليهما فعلى المقاول تنفيذ هذه الاعمال ولا يحقله الاعتراض او طلب زياده في الأسعار.

10) تكال أعمال الحفريات بالمتر المكعب كيلا" هندسياً صافياً حسب الابعاد والاقيسة المبينة على المخططات أوالتي يأمر بها المهندس ولا يدفع للمقاول علاوة الحفريات مسافات العمل (Working Space) وتعتبر تكاليفها مشمولة ضمن الأسعار الافرادية لأعمال حفريات الاساسات ما لم يذكر خلاف ذلك.

11) أعمال الطمم: في حالة عدم صلاحية أو كفاية ناتج الحفريات على المقاول توريد طمم من خارج الموقع من مواد مختارة يوافق عليها المهندس، ويتم الطمم على طبقات لا تزيد سماكة كل طبقه عن 20سم مع الرش بالماء والدحل بالاجهزه الميكانيكية لكل طبقة حتى الوصول للمنسوب اللازم.

- تكون المواد المختارة المستعملة للطمم من مواد مناسبة وموافق عليها خالية من الفضلات والشوائب ومتدرجة للحصول على درجة الدك المطلوبة وان لا تحتوي على الحجارة او قطع الخرسانة التي يزيد حجمها عن (50مم) في أي اتجاه ويكون محتوى اللدونه (Plasticity Index) اقل من (10) طبقا للمواصفات البريطانيه رقم(1377) وتكون الكثافه الجافه القصوى لها اكثر من (1.6غم/سم3) حسب فحص بروكتر القياسي للكثافة.
- تعتبر تكاليف أعمال توريد مواد الطمم وعملية الطمم مشمولة ضمن أسعار الحفريات مالم يذكر خلاف ذلك.

☒ **أعمال فحص التربة:**

- توريد التجهيزات اللازمة وعمل فحص تربه للوصول الى الأعماق المطلوبة وتقديم تقرير بذلك من مكتب مؤهل ومعتمد لدى الجهات وعلى المقاول بعد الانتهاء من أعمال فحص التربة تقديم (3) نسخ من التقرير والنتائج مع التوصيات الى المهندس المشرف.

☒ **التنسيقات**

على المقاول مسؤولية التنسيق المسبق مع وزارة الاشغال العامة والاسكان والبلدية المعنيه ودائرة الاراضي والمساحة وادارة المرور وشركة الاتصالات وشركة الكهرباء واية جهه رسمية اخرى وتقديم جميع متطلبات الجهات المعنية للحصول على موافقاتها للعمل في او تحت او قرب الطرق العامة والارصفة والاماكن والمواقع العامة والخاصة وعلى المقاول ان يتقيد بتعليمات ومتطلبات هذه الجهات بما فيها اشارات المرور والاشارات التحذيرية او التحويلات والحواجز وحماية المشاة والاملاك الخاصة وغيرها،وبدون اية علاوات اضافيه لقاء ذلك وكافة اعمال هذا البند تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات.

☒ **العمل في الليل :**

يحق لصاحب العمل او المهندس او ممثل صاحب العمل او اية سلطه اخرى بموافقة المهندس اصدار التعليمات للمقاول لتنفيذ أي جزء من الاعمال في ساعات الليل وذلك في الحالات التي تتطلب ذلك وعلى المقاول الالتزام بهذه التعليمات وتنفيذ الاعمال وبدون اية علاوات اضافيه لقاء ذلك وكافة اعمال هذا البند تكاليف هذه الاعمال مشمولة ضمن الاسعار الافرادية لبنود جداول الكميات.

☒ **الاعمال ضمن الاملاك الخاصه والتبليغ:**

حيثما يكون تنفيذ العمل في الاراضي الخاصة فإن صاحب العمل يكون مسؤولا عن مفاوضة أصحاب هذه الاراضي اوشاغليها والحصول على حقوق مرور في هذه الاراضي وتكون مسؤولية المقاول العمل بالسرعة المتفق عليها مع صاحب العمل والمهندس واعلامهم عن عزمه دخول هذه الممتلكات الخاصة وسرعة عمله فيها كما هو وارد في شروط العطاء، وقبل المباشرة في اعمال الحفريات في الاملاك الخاصة يتوجب على المقاول ان يتفق ويسجل مع صاحب هذه الاملاك او شاغليها على حالة سطوح هذه الاملاك مع اشارة خاصه الى اية ظواهر تتطلب عنايه خاصة واعادة الاوضاع وتعمل هذه

السجلات بمساعدة المهندس الذي يحتفظ بنسخة من هذه الاتفاقيات والسجلات، ولايحق للمقاول المطالبة باية اجور عن اية اعمال اضافيه او تاخير او توقف ينشأ عن ذلك حيث تعتبر التكاليف مشموله ضمن أسعار العطاء.

☒ **المرافق المدفونه تحت الارض :**

على المقاول ان يُراعي البنود في المواصفات العامه والتي تتعلق بمسؤوليته لتحديد الاماكن والمحافظه على المرافق المدفونة تحت الارض او فوق الارض واي منشآت او معدات بمختلف انواعها وعليه الحصول على المعلومات التامة عن مواقع هذه المرافق من الجهات المختصه وبالتنسيق مع كافة المؤسسات ذات العلاقة ومديرية/وادارة المياه المعنية ، ويقوم المقاول بتحديد اماكنها مسبقا عن طريق عمل حفر تفتيشية ان لزم الامر وعلى نفقته الخاصه وأية اضرار تتسبب لهذه المرافق والمنشئات،على المقاول القيام باصلاحها على نفقته الخاصه طبقا للبنود ذات العلاقة في العقد وحسب تعليمات المهندس.

☒ **مستخدمو المقاول :**

على المقاول ان يوفر التجهيزات الانشائيه المناسبه واليات بالاضافة لكوادر فنية وادارية مؤهلة بالكميات والعدد الكافي من مدير مشروع ومهندسي موقع ومساحين ومراقبين وعمال مهره وعمال عاديين مما يمكنه من العمل في مواقع متعدده في ان واحد بغض النظر عن حجم العمل ومواقعه وحسب البرنامج الموافق عليه وان يتم تسليم الاعمال المحالة اليه طبقا لمتطلبات وثائق العطاء وشروطه وموافقة المهندس ضمن مدة العطاء.

☒ **استعمال اجزاء من المشروع عند الانتهاء**

لصاحب العمل الحق (اذا رغب في ذلك) في استعمال او تشغيل أي جزء او اجزاء من المشروع مباشرة حين الانتهاء من تنفيذها ولا يعفي ذلك المقاول من مسؤولياته تجاه الصيانه ولا يعطيه الحق لاية دفعات اضافيه بسبب ضياع الوقت او عدم ملائمة العمل التي يمكن ان يتعرض لها نتيجة لهذا العمل من قبل صاحب العمل.

☒ **المياه للأعمال:**

1) يكون المقاول مسؤولا عن تامين جميع احتياجاته من المياه في موقع العمل لاستعمال عماله ومستخدميه ومستخدمي صاحب العمل والمهندس (لتنفيذ الاعمال المشموله بهذا العقد بما في ذلك فحص الضغط والتعقيم والغسيل) وتخزينها في أوعيه نظيفة (يوافق عليها المهندس) بالكميات الكافيه لتضمن سير العمل وعلى نفقته الخاصه.

2) في حال توفر مصدر للمياه تابع للسلطه في موقع العمل أوقريب منه فيمكن للمقاول (بعد موافقة صاحب العمل) الحصول على احتياجاته من المياه مقابل التسعيره الرسميه المعتمده علنان يقوم المقاول (وعلى نفقته الخاصة) بنقل المياه بواسطة الصهاريج او توفير المواسير والقطع والمفاتيح وعمل التمديدات اللازمه لايصال المياه الى موقع العمل وتركيب عداد مياه يوافق عليه المهندس وادارة المياه المعنيه وازالة هذه التمديدات والعداد عند انتهاء العمل في هذا العقد، وعليه ان يقوم بتشغيل وصيانة اماكن التخزين والمواسير والتوصيلات والمضخات والصهاريج المتحركه وكافة الاعمال المؤقته لنقل المياه من نقطه التزويد الى المكان الذي يكون بحاجه اليه .

☒ **كميات المواسير والمفاتيح والقطع الخاصة**

قبل طلب المواسير على المقاول أن يعمل مسحا لخطوط المواسير والتاكد من الاطوال المطلوبه من كل نوع من المواسير والقطع الملائمه والمفاتيح والقطع الخاصه اللازمه لاتمام الاعمال .

واية كميات من المواسير والقطع تزيد عن الكميات المطلوبه للاستعمال يتحملها المقاول، اما اذا رغب صاحب العمل ان ياخذ الكميات الزائده من المواسير والقطع لاستعمالها مستقبلا فيدفع للمقاول ثمنها كاملا زائداً (15 %) ويكون توريد هذه القطع في هذه الحالة في مستودعات صاحب العمل حسب تعليمات المهندس .

☒ **مختبر فحص المواد**

أولا: على المقاول الفائز بالعطاء تسمية مختبر مؤهل ومعتمد ومرخص من قبل الجهات المختصة لإجراء الفحوصات المخبرية، مع ضرورة إرفاق شهادة تأهيل صادرة من دائرة العطاءات الحكومية وشهادة اعتماد صادرة من وحدة الإعتماد وتكون الشهادات سارية المفعول وكافة الوثائق اللازمة لغايات اعتماده من قبل JASحسب نظام الإعتماد الأردني صاحب العمل (سلطة المياه) وذلك لاجراء وعمل الفحوصات المطلوبة بانواعها المختلفة (على سبيل المثال وليس حصراً: فحوصات دك التربة ، قوة كسر المكعبات الخرسانية بأنواعها، الفحوصات التي تتعلق بالأسفلت وطبقات الفرشيات الحصوية ... الخ) وكذلك الفحوصات التي يطلبها المهندس. أما الفحوصات الخاصة بمطابقة المواد مع المواصفات القياسية لهذه المواد والتي تتعلق بالأنابيب، المفاتيح، المرابط والقطع الأخرى حسب شروط ومواصفات العطاء يتم فحصها في الجمعية العلمية الملكية وفي حال تعذر فحصها في الجمعية العلمية الملكية يتم أخذ موافقة صاحب العمل على أي مختبر آخر معتمد لعمل الفحوصات المطلوبة.

ثانياً: تحدد آلية وأسلوب إجراء الفحوصات المخبرية كالتالي:

1) يجب أخذ العينات من موقع العمل من قبل ممثل المختبر المعتمد (على أن يكون مؤهل ومختص في هذا المجال) وبحضور ممثل المقاول والمهندس المشرف أو من يُمثله.
2) يجب نقل العينة / العينات إلى المختبر بواسطة ممثل المقاول وممثل المهندس و يتم إدخالها وتسليمها إلى المختبر بموجب محضر رسمي موقّع من الطرفين .
3) على المختبر أن يقوم بفحص العينة / العينات بموجب المواصفات المحددة في وثائق العطاء وإصدار تقرير بواقع نسختين، واحدة تُسلّم إلى المهندس المشرف والأخرى تُسلّم إلى المقاول .
4) في حال حاجة المشروع لمختبر موقعي، فيتم تجهيز المختبر الموقعي والإشراف عليه وعلى أعماله من قبل المختبر المعتمد شاملاً تحمل المسؤولية الكاملة عن المختبر.

ثالثاً: في حالة فشل الفحوصات المخبرية لأي مادة أو عمل، فيتم إعادة الفحوصات على حساب المقاول مهما بلغ عدد مرات الفحص لحين الحصول على نتيجة مطابقة للمواصفات.

رابعا: تعتبر تكاليف وأجور نقل العينات إلى ومن المختبر وإجراء كافة الفحوصات أو إعادة اجراؤها وتحضير التقارير من مسؤولية المقاول وتعتبر مشمولة ضمن الأسعار الإفرادية لبنود جداول الكميات.

☒ **مخططات العقد:**

مخططات العقد هي المخططات التي تم تحضيرها لهذا العقد والمرفقه مع وثائق العطاء، واية مخططات معدله او تفصيليه او ملحقه يمكن ان يصدرها صاحب العمل اثناء سير العمل في اعمال العطاء وكذلك المخططات التفصيلية والتنفيذية المقدمة من المقاول والموافق عليها خطيا من قبل صاحب العمل.

المخططات التنفيذية (Shop Drawings):

- على المقاول عمل الدراسة المساحية من قبل مساح مرخص لجميع أعمال المشروع على مخططات اراضي ومخططات تنظيمية محدثة وضمن المواقع والمسارات المعتمدة من كافة الجهات الرسمية سواءا وزارة الاشغال والبلديات وغيرها.
- على المقاول ان يقدم لصاحب العمل لاخذ موافقته على المخططات التنفيذية التفصيلية لكافة اعمال ومكونات المشروع تشمل لا الحصر خطوط المياه والصرف الصحي والمحابس والمفاتيح والاكواع والتيهات (واية قطع وتفاصيل) والهوايات والوصلات المنزلية والمناهل واي اعمال اخرى متعلقة بمحطات الضخ والرفع وخزانات المياه واي منشات مدنية اومعدات ميكانيكية او كهربائية وغيرها.
- لايجوز المباشرة بتصنيع أوتوريد اي مواد ما لم يقدم المقاول المخططات التنفيذية (ما لم يطلب صاحب العمل غير ذلك) لها والحصول على موافقة صاحب العمل عليها .
- يقدم المقاول إلى المهندس(3) ثلاثة نسخ ملونة ورقية(بحجم A1) ورقمية (بصيغةAutoCAD2007)موقعة من المقاول بموجب كتاب خطي بذلك وتسلم لصاحب العمل في موقع العمل او حسب طلب المهندس.
- على المقاولأن يقوم بتصحيح اية ملاحظات او تعديلات يطلبها صاحب العمل ويتحمل المقاول مسؤولية التاخير .
- ان موافقة صاحب العمل على هذه المخططات او المواد او الاجهزه والمواصفات لاتعفي المقاول من مسؤولية التوريد والتصنيع بالمقاسات الصحيحة وحسب المواصفات ومتطلبات العقد .
- تعتبر تكاليف اعداد المخططات التنفيذية وتجهيزها وتقديمها مشموله ضمن اسعار العطاء .

المخططات المرجعية(As Built Drawings)

- على المقاول وعند استكمال اعمال المشروع وقبل صرف الفاتوره النهائيه ان يقوم بعمل المساحة اللازمة للاعمال التي تم تنفيذها لعمل المخططات المرجعية للاعمال كما نُفذت (As Built Drawings) شاملا المسقط العلوي والمقاطع الافقية، وتبين هذه المخططات وبشكل واضح تفاصيل واقيسة ومواصفات المواد المستعملة في اعمال المشروع كما نفذت.
- على المقاول ربط كافة خطوط المياه وتوابعها (كالمفاتيح) المبينة على المخططات المرجعية بأقيسة من نقاط ومعالم ثابتة في موقع العمل وحسب تعليمات المهندس المشرف لسهولة الوصول اليها عند اعمال الصيانة .
- على المقاول تقديم النسخ الاصلية (الشفافة) و(3) ثلاثة نسخ مطبوعة من هذه المخططات الى المهندس للموافقه عليها قبل ان تعتبر هذه الاعمال منتهية وقبل تسليمها للسلطة، وعلى المقاول تعديل وتصليح اية ملاحظات يطلبها المهندس. وبعد موافقة المهندس على هذه المخططات، على المقاول تجهيز وتقديم المخططات المرجعية مرسومة كالتالي:

1) المخططات الأفقية للشبكات (Plans) يتم رسمها باستخدام نظام المعلومات الجغرافية (GIS)ذات دقة عالية وبمواصفات تتطابق مع متطلبات أنظمة المعلومات الجغرافية المعتمدة في سلطة المياه، علماً بأن عملية التدقيق على مطابقة هذه المخططات للمواصفة سيتم من قبل المختصين بأنظمة المعلومات الجغرافية في سلطة المياه وشركة مياه اليرموك.

2) باقي المخططات والرسومات المرجعية (إنشائية، كهربائية، ميكانيكية، مقاطع طولية وعرضية ... الخ فيتم إنتاجها باستخدام نظام ال (Autocad) وحسب النسخه الموجوده لدى سلطة المياه.

- على المقاول تقديم (4) أربعة نسخ الكترونية (CD's) من كامل هذه المخططات.
- تكون نوعية ورق المخططات المرجعيه الاصليه من ورق جيلاتين شفاف قياس84×62سم:
(Pure White Permatrace Gelatin Transparent Unterable Film, 0.07 mm thick).
- على المقاول تزويد سلطة المياه بنسخة رقمية من المخططات حسب التنفيذ (As Built Drawing) والتي يتم العمل عليها من خلال نظام ArcGIS/arcinfo مستخدما نسخة قاعدة البيانات المعمول بها في سلطة المياه على ان يكون شكلها النهائي Format (shp) او(Geodatabase.gdb) وكذلك نسخه ورقيه طبق الأصل عن النسخه الرقميه بحيث تحتوى على الطبقات الجغرافية (Layers) المعلومات التالية:
  - ✓ طبقة الخطوط الرئيسيه والفرعيه Lines لشبكات المياه او الصرف الصحي .
  - ✓ طبقة التجهيزات او المناهل (Manholes –Fittings) Nodes .
  - ✓ طبقة للوصلات المنزلية Lines لشبكات المياه او الصرف الصحي.
  - ✓ طبقة التجهيزات للوصلات المنزلية (Manholes–Fittings) Nodes .
  - ✓ طبقه خاصه تسمى Facilities تحوي المضخات ومحطات التنقيه والخزانات والتنكات والمفاتيح و طفيات الحريق والعدادات لشبكات الصرف الصحي والمياه.
  - ✓ ان تحوي النسخة الرقمية على الخطوط والقطع او المناهل الجديدة فقط .
  - ✓ ان يتم ربط هندسي للطبقتين الخطوط والتجهيزات ومراعاة عمل ال Snap ليظهر بدقه .
  - ✓ استخدام نفس القطع والترقيم(DLS_lots) المعمول به في سلطة المياه مع المحافظة على نظام الاحداثيات المستخدم في سلطة المياه وهو نظام (الاسقاط–التربيع) الفلسطيني (Palestine_1923_Palestine_Grid).
  - ✓ أن تحوي على نقاط الربط والعزل والفصل ان وجدت مع الشبكات القائمة مع اظهار الخطوط الملغية.
  - ✓ اعتماد مقياس رسم للمخططات 1000/1 او 2500/1. والبروفيل (1000/1) أفقي (100/1) عمودي. ورسم التفاصيل بمقياس رسم مناسب
  - ✓ ان تحوي المخططات الورقية على معلومات الهامش المبينة في المخططات المرفقة.
  - ✓ ان تكون النسخة الرقمية مطابقة الى النسخة الورقية ومعتمدة من الاشراف .
  - ✓ قبل العمل على نظام ال GIS مراجعة المختصين في سلطة المياه لاستلام نسخه فارغه من قاعدة البيانات للعمل عليها وحسب المواصفة المعتمده.
- سيتم الاستلام من قبل المقاولين حسب المواصفات والشروط المذكورة أعلاه .
- تعتبر تكاليف الاعمال المساحية وتحضير وتجهيز وتسليم هذه المخططات والنسخ الألكترونية مشموله ومحملة على اسعار بنود جدول كميات العطاء.

☒ <u>الصور الفوتوغرافية :</u>

على المقاول مسؤولية تصوير مراحل تنفيذ المشروع أثناء تقدم سير العمل حسب توجيهات المهندس وكما هو مبين فيما يلي:

- يتم أخذ صور فوتوغرافية للموقع الكلي العام للمشروع أو لمظاهر خاصة في الموقع (أو مواقع العمل) وكذلك لكل مساحة مخصصة للإنشاء وتقديم هذه الصور للمهندس في أسرع وقت .

ويتم إعادة تصوير هذه المناظر نفسها بعد إنهاء جميع نشاطات المشروع، وتقدم هذه الصور مع مطالبة المقاول النهائية.

- يعمل كل شهر مجموعة إضافية من الصور خلال تقدم سير العمل على فترات زمنية يحددها المهندس، وتقدم هذه الصور مع كل مطالبة على الحساب للمقاول.
- تكون الصور وآلة التصوير من النوع الملوّن ومن نوعية عالية الجودة، ويتم تقديم جميع النسخ السالبة (Negatives) وصورة عدد (2) إثنان (قياس 100 × 125 مم) من كل منظر تم تصويره .
- يتم تقديم جميع النسخ السالبة (Negatives) بشكل منفصل ومحدد عليها وصف المنظر والتاريخ، ويتم تقديم الصور المطبوعة ضمن مغلفات بلاستيكية (ألبومات) يوافق عليها المهندس ويتضمن كل منظر لوحة تشير إلى اسم ورقم العطاء واسم المقاول ووصف وموقع المنظر في الصورة وتاريخ أخذ الصورة .
- تعتبر تكاليف أخذ الصور وتقديمها كما هو مبين على حساب المقاول وتكون مشمولة ضمن الأسعار الإفرادية لبنودالعطاء.

أعمال تمديد أنابيب المياه وتوابعها

☒ **عـام :**

1) على المقاول الاخذ بعين الاعتباربأن خطوط المياه يجب أن تُنفذ ضمن آخر مترين (2) من حرم الطريق أو الشارع المنظّم المعتمد والموافق عليه بغض النظر عن العوائق وصعوبة التنفيذ ما لم يذكر خلاف ذلك.

وبناءً على ذلك، على المقاول التنسيق المسبق مع وزارة الاشغال العامة والاسكان ومع البلدية المعنية ودائرة الاراضي والمساحة لتحديد مسارات الخطوط وضمان تنفيذها ضمن الطرق الرسمية المعتمدة والتي يتم تسليمها إليه من قبل إدارة المياه المعنية وبالتنسيق مع المهندس المشرف، وأخذ الموافقة على مساراتخطوط المياه قبل البدء بالتنفيذ.

2) على المقاول كشف وتدقيق مواقع خطوط المياه القائمة قبل البدء في العمل حيث يشمل العمل الحفريات في أي نوع من التربة وإعادة الطمم واعادة وضع السطوح بموجب المواصفات وتعتبر تكاليف هذه الأعمال مشمولة ضمن أسعار العطاء.

3) لا يسمح باخذ المياه من خطوط المياه القائمة بدون موافقة المهندس وفي حالة موافقة السلطة على ذلك يتم حساب كميات المياه المستهلكة ومحاسبة المقاول على ذلك حسب تعليمات المهندس.

4) إن وصل الخطوط المقترحة مع الخطوط القائمة يجب أن يتم بسرعة وفاعلية من اجل التقليل ما امكن من الاخلال بالتزويد المائي للسكان.

5) إن موافقة المهندس على أي عمل او مواد مقدمة من المقاول، لا تعفي المقاول من المسؤوليات المناطة به حسب شروط هذا العطاء.

6) يتم قطع خطوط المياه المراد التوصيل عليها باستعمال معدات خاصه يوافق عليه المهندس حيث لا يسمح باستعمال اللحام الكهربائي او الغازي و يجب ان تكون عملية القص عموديه على محور الخط .

7) على المقاول اخذ الحيطة لمنع دخول الاتربة والاوساخ داخل خطوط المياه القائمة وعليه أن يوفر جميع المعدات اللازمه بما فيها مضخة مناسبة جاهزه للتشغيل لضخ المياه من موقع كل وصله قبل المباشرة بقطع الخط المراد الوصل عليه من اجل التقليل من دخول المياه الملوثة والاوساخ الى خطوط التوزيع القائمه ولتلافي التاخير في اعادة تشغيل الخطوط القائمة.

8) على المقاول اخذ الاحتياطات اللازمة لعدم الاضرار باي من خطوط المياه أو خطوط الصرف الصحي أو الكوابل وكافة المرافق القائمة (السطحية والمدفونة تحت الارض) وأية اضرار يسببها المقاول لهذه المرافق نتيجة قيامه بأعمال العقد، عليه ان يقوم باصلاحها او استبدالها كما كانت عليه قبل بدء العمل وتعتبر التكاليف مشموله ضمن اسعار العطاء ولا يعطي المقاول أي علاوات لقاء ذلك .

9) إن أي مواد يقدمها المقاول للاستعمال في اعمال العطاء يجب ان تفحص بعد اخذ موافقة المهندس المشرف المسبقه وذلك على نفقة المقاول وطبقا للمواصفات المطلوبة او اية مواصفات اخرى مكافئة. وأي مواد أُحضرت الى الموقع وكانت برأي المهندس غير صالحة أو من نوعية متدنية أو غير مناسبة للاستعمال في أعمال المشروع فعلى المقاول إخراجها من الموقع وعلى نفقته الخاصة.

10) تقديم وتوفير المياه والمضخات والكلور والمعدات اللازمه واجهزة ضغط خطوط المياه، وذلك لاجراء فحص التسرب (الضغط الهيدروليكي) وتعقيم وغسيل وتطهير خطوطا لمياه بموجب أسس ومعايير تطهير شبكات مياه الشرب من المواصفات العامة وجميع ما يلزم وتعتبر التكاليف مشموله ضمن الاسعار الافراديه لأعمال تمديد خطوط المياه.

11) توريد وتزويد أسياخ اللحام من أجود الأنواع وآلات اللحام والقص وعدد كافي من شفرات القص والمعدات والكهرباء لعمل وصلات انابيب الحديد وكذلك المعجون الخاص الخالي من الرصاص للوصلات المسننة الخاصة بالانابيب المجلفنه ولوصلات أنابيب البولي ايثيلين والمعجونة المستعملة لتنفيذ وصلات انابيب الدكتايل(Lubrication Paste) وكذلك مواد عزل وتغليف الوصلات حسب المواصفات العامة وموافقة المهندس المشرف وتعتبر تكاليف الاعمال المذكوره اعلاه مشموله ضمن السعر الافرادي لاعمال تمديد انابيب المياه.

12) في حالة وجود خطوط تالفة وغير مستخدمة (مفصولة) بعد تشغيل الخطوط الجديدة على المقاول قصها ونقلها وتسليمها لمستودعات إدارة المياه المعنية وعلى نفقته الخاصة.

13) سيتم تسليم المقاول اولا" بأول مواقع العمل ضمن مخططات رسمية.

14) لغاية الكشف عن خطوط المياه من كافة الانواع، على المقاول توريد ووضع فوق طبقة الطمم الناعم (التأمين) أحد البديلين التاليين حسب المواصفات المرفقة.وعلى المقاول أن يُوضّح في عرضه أيهما سيستعمل في أعمال العطاء، وتعتبر تكاليف استعمال أحد البديلين مشمولة ضمن الأسعار الافرادية لأعمال تمديد الأنابيب:

أ.شريط تحذيري معدني(Ferrous Tracking Tape)أو

ب. الأدلة الألكترونية (Electronic Identifiers)بالإضافة للشريط التحذيري البلاستيكي Warning Tape)

1-FERROUS TRACKING TAPE (F.T.T.):

An aluminum foil laminate with purity not less than 99.5% and having aluminum thickness of 9 microns & Width OF 50mm shall be laminated in between 2 layers of inert plastic material.

The bond for this lamination is to be made with 2-parts, self curing adhesive which withstands a hot melt bonding temperature of 180 C without dolamination. The lamination bond must also be water resistant.

The above described laminats is then laid onto an embossed extruded sheet of low density polyethylene of not less than 400 microns Thick . The width of this base layer of polyethylene shall not be less than 200 mm.

Over the top of the aluminum foil, a final layer of inert plastic film of 100 microns thickness. This bond shall be made of heat sealing and with no adhesive employed. The bond shall be complete over the base layer and also over the conductive aluminum foil.

The width of this film is the same as the width of the base layer of' embossed polyethylene.

The top surface of the film shall be printed in bath Arabic and English with suitable font by:

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Water Pipe line
تحذير
سلطةالمياه
خط مياه

The overall thickness of the complete tape shall be (500) micns+ 5 %
The breaking strain per 150 mm. of width shall hot be less than 75 kg.

2. ELECTRONIC IDENTIFIERS (EI.):

Scope :
Electronic Identifiers shall be installed over proposed underground net works being Water and Waste Water Utilities, Electric Power Utilities, and Telecommunication Utilities according to the following specs. :
b. Specifications:
- The design and construction of the Electronic Identifier shall be rugged, reliable, and durable.
- The cross sectional area, shall be small in order to fit in tight places.
- The following is the required specification

Utility	Water	Waste Water	Electric Power	Telecommuni-cation	Gas	CATV
C0lor	Blue	Green	Red	Orange	Yellow	Black Orange
Frequency	145.7 kHz	121.6 kHz	169.8 kHz	101.4 kHz	83.0kHz	77.0 kHz.
Accuracy	± 1%					
Depth Range	60 – 150 cm					
Operating Temp. C°	40 to +70c°					
Storage Temp. C°	40 to + 85 c°.					
RLC Circuit	Core of the indicator should be a ferrite core					
Housing	Rugged, with a water proof insulating materials to protect the RLC. circuit in case the casing is broken					
Life Expectancy	45 years min.					
Field Trials	Required, and cannot be conducted during the execution of the project. Any product to be suggested for use should pass a field trial test where shamble of the product is placed in position for 3 months, and tested for operation on monthly bases.					

Samples of (E.I.) shall be submitted by the Contractor to be approved by the Engineer without any additional costs.

c. Installation:
Electronic Identifiers shall be installed in the following both manners:

1) Vertically: Within the top of the soft backfill layer (Bedding), over the utility at a depth not exceeding 90 cm. from the surface of the ground.

2) Horizontally: One identifeir every (12) meters max. For straight utilities 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 locater shall be supplied by the Contractor at his own expense and shall be the property of the Contractor after completion .

Identifiers shall be positioned 10 cm. min - away from any metalic or magnetic Materials.

All Networks Record Drawings shall have a note on each, stating that the Networks in that DRG. Has Electronic Identifiers.

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

d. Electronic Idintifier Locater :

Electronic Idintifiers respond to start frequencies. The locating device should be compatible with said frequencies at:

Utility	Water	Waste Water	Electric Power	Telecommuni-Cation	Gas
Frequency	145.7 KHz	121.6 kHz	169.8 kHz	101.4 kHz	83.0kHz

Locating device should be :

1. Rugged and durable and suitable for field use.
2. Battery operated, average battery life above 20 hrs.
3. Compatible with standard EMS. Frequencies as mentioned above.
4. Able to locate tow frequencies at the same time.

e. Payment :

The cost of supply and installation of the Electronic Identifiers shall be deemed to be included in the Contract unit prices.

3. PLASTIC WARNING TAPE:

The Contractor shall lay 30cm. Above the pipelines an plastic (Warning Tape) of 200mm. Microns thickness 50mm. Wide, with a red color for primary and blue for secandary . The top surface of the tape shall be printed in bath Arabic and English with suitable font by :

CAUTION
Water Authority
Water Pipe line

تحذير

سلطة المياه

خط مياه

☒ **الحفريات والطمم :**

1. **تحضير الخندق:**

- من الضروري ان يتوفر للتربه حيثما يلزم دعما ثابتا ودائما لاجل الحصول على تمديد سليم للمواسير .
- تحفرالخنادق على عمق لايقل عن (150مم) تحت اسفل المواسير ويملاء بمواد ردم ناعمة (التامين) وعندما تكون التربه مبتله اواذا كان الاساس طريا او حيثما يكون اسفل الخندق غير منتظم فقد يكون من الضروري زيادة هذه السماكه وعلى المقاول القيام بهذه الاعمال على حسابه .
- يجب عدم حفر الخندق لمسافة كبيره قبل تمديد المواسير كما يجب الردم فوق المواسير بالسرعه الممكنه،ويكون عرض الخندق في اعلى الماسوره لايقل عما هو مبين في المخططات ويجب عدم وضع الطوب والاجسام الصلبه تحت الماسوره للدعم المؤقت او الدائم.
- يتم قص (طبقة السطح) الاسفلت بالمنشار الالي وكذلك يجب قص الخرسانه والبلاط بشكل منتظم ومستقيم بغض النظر عن طريقة الحفر لكي تكون حواف الخنادق منتظمه ومستقيمه وبزيادة 15 سم من كل جهه منحواف الخندق.
- على المقاول نقل ناتج الحفريات الفائض الى الاماكن التي تحددها الجهات المختصه وعلى نفقته الخاصه وتعتبر تكاليفها مشموله ضمن اسعار العطاء .

2. **الطمم حول الانبوب: BEDDING AND SIDE BEDDING**

- تردم جميع الأنابيب كما هو موضح في مايلي وبغض النظر عماهو مبين في المخططات (فوق وتحت وعلى الجانبين) بمواد طمم ناعمة (التأمين) وتدك يدوياً وبانتظام على طبقات لا تزيد سماكة كل طبقة عن (100مم):
  - أ. بمسافة (150مم) تحت كافة أنواع وأقطار أنابيب الدكتايل ، أنابيب الحديد.
  - ب. بمسافة (300 مم) فوق ظهر أنابيب الحديد والدكتايل.
  - ج. الجوانب لكافة أنواع الأنابيب كما هو موضح في المخططات.
- تكون مواد الطمم الناعمة (التأمين) من احدى المواد التالية وكما هو موضح في مقدمة جدول الكميات:

1. رمل خالي من الشوائب و حسب التدرج و المواصفات التالية :

البيان	حجم المنخل		نسبةالمار %
الكتله الطينيه لاتزيد عن 1 % من الوزن	9.5 مم	("8/3)	100
لا تزيد عن 1ر0 % من الوزنL C	4.75مم	(رقم 4)	95–100
لا تزيدعن 4ر0 % من الوزنSo3	1.18 مم	(16)	45–80
لا يزيدعن1% من الوزنCoal and Lignite	0.30مم	(رقم 50)	30 – 10
	0.15 مم	(رقم 100)	10 – 2
	0.075 مم	(رقم 200)	3 – 0

3. **الطمم الى السطح العلوي :**

1.3 : الخنادق في الارض (ذات السطح الترابي) :

- تكون مواد الطمم من منسوب (300مم) فوق ظهر الماسوره الى منسوب الارض من مواد مختاره موافق عليها ويجري دكها بالاجهزه الميكانيكيه مع الرش بالماء والدحل على طبقات وتكون سماكة كل طبقه منها لا تزيد عن 200مم.
- أما درجة الدك فتكون بمالا يقل عن 90 % من الكثافه الجافه للطمم وكما هو مبين على المخططات وحسب اختبار بروكتر المعدل حسب المواصفات رقم AA SHTO . T .180 .

- تكون المواد المختاره المستعملة لردم الخنادق من مواد مناسبة (موافق عليها من المهندس المشرف)، خالية من الفضلات والشوائب ومتدرجة للحصول على درجة الدك المطلوبة ولا تحتوي على الحجارة أو قطع الخرسانة التي يزيد حجمهاعن (50مم) في ايقياس ويكون محتوى اللدونه(Plasticity Index)للمواد المناسبه اقل من (10) طبقا للمواصفات البريطانيه رقم (1377) وتكون الكثافه الجافه العظمى لها اكثر من (1.6غرام/سم3) حسب فحص بركتور القياسي للكثافه، وفي حالة عدم صلاحية او كفاية مواد الحفر (ناتج الحفريات) فعلى المقاول وعلى نفقته الخاصه احضار وتوريد موادالطمم الصالحة من حفر معتمده من خارج الموقع ويوافق عليها المهندس المشرف.

2.3 :الخنادق في السطوح المعبدة (الشوارع،الساحات، الارصفة) :

- على المقاول اعادة اوضاع سطوح الطرق والساحات المعبدة (المسفلته) والارصفه والاطاريف وجميع الممتلكات والانشاءات التي تزال اثناء الحفريات او تضررت نتيجة للعمل وذلك اثناءالحفريات في الشوارع والطرق والارصفه اواية ممرات للمشاه كما كانت عليه قبل عملية الحفريات .
- تكون موادالطمم من منسوب (300 مم) فوق ظهر الماسوره الى منسوب السطح في الشوارع والساحات المعبده او الارصفه كما يلي (مع الاخذ بعين الاعتبار سماكة طبقة السطح) :

1) على طول الطرق والشوارع المعبدة (المسفلتة) سواء كانت معبدة بخلطة إسفلتيه او وجه تأسيسي او وجه ختامي (Asphalted , M C or seal coat) وممرات المشاه والساحات (سواء كانت معبده او مبلطه او خرسانيه)، كل مواد الطمم يجب ان تكون من الفرشيات الحصويه(B.C)ترش بالماء وتدحل على طبقات لا تزيد سماكة كل طبقه عن150 مم وبدرجه الدك المطلوبه حسب المخططات النموذجية.

2) عند قطع الشوارع (عرضيا او بشكل مائل) من الانواع المذكوره في الفقره (ج – 2 – 1) أعلاه فان مواد الطمم قبل طبقة السطح المعبده يجب ان تكون على طبقات كما يلي :

أ. من الخرسانة العادية سماكة (300 مم) بقوة كسر مكعبي صغرى لاتقل عن 200كغم/سم3 بعد 28 يوما حسب المخططات

ب. من اسفل طبقة الخرسانة العادية الواردة في البند (أ) اعلاه ولغاية وجه طبقة الطمم الناعم (طبقة التأمين) يجب ان تكون مواد الطمم من الركام الخشن (Base Course) حسب المواصفات ادناه وتردم وتدك كماورد سابقا حسب المخططات.

ج. يكون تدرج مادة الفرشيات الحصويه (B.C.) حسب المواصفات الفنيه العامه لاعمال إنشاء الطرق والجسور الصادره عن وزارة الاشغال العامه والاسكان لسنة 1991 الفصل (3–1) جدول(3–2) Glass B تكون كالتالي :

حجم المنخل بفتحات مربعة		المارحسب الوزن % Glass B
مم	بوصة	
50	2	100
37.5	1.5	100–70
25	1	85–55
19	¾	80–50
12.5	½	-----
9.5	8/3	70–40
4.75	رقم 4	60–30
2.00	رقم 10	50–20
0.425	رقم 40	30–10
0.075	رقم 200	15–5

4. اعادة وضع سطوح الشوارع والساحات والارصفه والاطاريف:

- على المقاول الالتزام التام بإعادة أوضاع الطرق والساحات والارصفه والاطاريف ..الخ الى ما كانت عليه بموجب المواصفات الفنية العامة لأعمال إنشاء الطرق والجسور الصادرة عن وزارة الاشغال العامة والاسكان سنة 1991 وماطرأ عليها من تعديلات وحسب التفاصيل المبينة على المخططات وحسب تعليمات وموافقة المهندس المشرف.

- تكون المواد المستعمله وكافة الاعمال المتعلقه بها مطابقه لما ورد في المواصفات الفنيه العامه لاعمال انشاء الطرق والجسور الصادره عن وزارة الاشغال العامه والاسكان لسنة 1991 وماطرأ عليها من تعديلات،وتعتبر هذه المواصفات جزء لا يتجزأ من وثائق العطاء وتقرأ وتفسر على هذا الاعتبار.
- يتم اعادة وضع الطرق والارصفه بموجب المواصفات والتفاصيل المبينه على المخططات وبموافقة المهندس، علمانه اذا تم تغيير الوضع من قبل السلطات المعنيه لسطوح هذه الطرق والارصفه اثناء تنفيذ المشروع (مثل تعبيد طرق او عمل ارصفه) فانه يتوجب على المقاول اعادة وضع هذه السطوح طبقا لاخ روضع ويتم حساب المتر الطولي للاعمال المنفذه في هذه المواضع (حسب اخر وضع جديد) حسب ما يقابله في جدول الكميات.
- تعتبر تكاليف اعادة وضع السطوح الى ماكانت عليه وازالة وترحيل الانقاض مشموله ضمن الاسعار الافراديه لاعمال تمديد خطوط المياه و لا يدفع لذلك أي علاوات مالم يذكر خلاف ذلك في جدول الكميات .
- يتم إعادة أوضاع السطوح كما يلي :

أولا : الشوارع والساحات المعبده (المسفلته):

بعد الانتهاء من اعمال الطمم والدك والوصول الى المنسوب اللازم والحصول على موافقة المهندس يتم اعادة وضع السطوح المعبده والشوارع كما يلي:

أ. توريد وتوزيع وخلط وفرش ورش بالماء والدحل لدرجة (95 %) حسب اختبار بروكتر المعدل بموجب بموجبAASHTO - T180وبسماكة 15 سم بعدالدحل وذلك لطبقة الاساس الاولي (Sub - Base Course) .

ب. توريد وتوزيع وخلط وفرش ورش بالماء والدحل لدرجة 100 % حسب تجربة بروكتر المعدلة AASHTO - T180وبسماكة 15 سم بعد الدحل وذلك لطبقة الاساس الثانيه (Base Course) .

ج. تكون موادا لطبقتين الاولى والثانيه متدرجه حسب المواصفات الفنية العامه لاعمال الطرق والجسور فصل (3 –1) جدول (3 – 2) صنف (ب) .

د. توريد ورش الوجه التاسيسيPrimeCoatمناسفلت (MC - 70) بمعدل1.5كغم / م2 ويتم الرش ميكانيكياً.

هـ. توريد وفرش ودحل الخلطه الاسفلتيه الساخنه (Hot Bituminous Concrete) وبسماكةلاتقل عن10سم بعدالدحل.

ثانيا : الأرصفة:

بعد الانتهاء من اعمال الطمم والدك والوصول الى المنسوب اللازم والحصول على موافقة المهندس تعاد وضع الارصفه الى ما كانت عليه سابقا" حسب المواصفات وبموجب تعليمات وموافقة المهندس، سواء كانت الارصفه اسفلتيه او خرسانيه او بلاط (بلاط بانواعه،شاملا مدة خرسانيه سماكة 10 سم تحت البلاط) .

ثالثا : الأطاريف :

تكون الاطاريف اما حجرية او من الخرسانة جاهزة الصنع وحسبما تكون عليه الحالة .

تركب الاطاريف حسب وضعها الاصلي باستعمال مونه الاسمنت والرمل (بنسبة 1 – 3) والعمل يشمل القاعده من الخرسانه العاديه (200 كغم / سم2 بعد 28 يوما) ومونة التركيب والتكحيل مع جميع الاعمال وبموافقة المهندس المشرف.

☒ **التغليف بالخرسانة المسلحة (Reinforced Concrete Encasement) :**

- توريد وعمل تغليف(RCE)لخطوط المياه حيثما تتقاطع مع خطوط الصرف الصحي أو في حال مرورها في الاودية والعبارات حسبما يتطلبه واقع العمل بموجب تعليمات المهندس وحسب المخططات التفصيلية.
- يعمل التغليف من الخرسانة المسلحة بقوة كسر مكعبي صغرى لا تقل عن 250 كغم / سم2 بعد 28 يوماً.
- يجب ايناع الخرسانة لمدة لا تقل عن 7 أيام قبل ردم الخنادق.

☒ **HYDROSTATIC PRESSURE TESTING OF DI PIPES**

the contractor shall review the required PRESSURE TESTING AND PROCEDURES according to the international standards for pipes and water system

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 will receive already prepared Pressure Test Protocols (format) according to DIN EN805 from the Engineer's Representative.

This detailed procedure for performing hydrostatic pressure tests of installed pipes, fittings and valves as instructed by the Engineer must be used. Procedures for performing the hydrostatic pressure test shall 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.

Primary pipes shall be tested to a maximum of 1,000 m each section.

Secondary pipes and tertiary pipes (ISO 63) shall be tested to a maximum of 500 m each section.

The pressure tests must be performed with adequate pressure loggers or recorders.

Duration of Pressure Test

The preliminary pressure test shall be performed with pressure applied for a period of 24 hours before the main 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 DN200 and six hours for pipe diameter DN250 to DN600.

The test pressure shall not be allowed to fall below 24 bars for PN16, below 37 bars for PN25 and 40 bars for PN40 for pipe 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 preliminary test will start with the working pressure, and shall reach the test pressure within the last 6 hours of the preliminary 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 (Max Design pressure+5bar) in **the contractor shall be review the required according to international standards** for the pipe, and shall not exceed the PFA, as per instruction of the Engineer's representative.

The main tests in particular 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 DN200 diameter	1.5 litres/second
Up to DN300 diameter	3.0 litres/second
Up to DN400 diameter	6.0 litres/second
Up to DN500 diameter	9.0 litres/second
Up to DN600 diameter	14.0 litres/second
Up to DN800 diameter	22.0 litres/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 litres 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, labour, 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. Shall 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.

☒ PRESSURE TEST OF HDPE PIPES

Test pressure shall be (1.5 × nominal working pressure) or 16 bars whichever is greater in **this regard the contractor shoud be review the required according to international standards**. 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 litres/km/25 mm diameter of pipe / 3 bars / 24 hours.

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

Test shall be applied on sections of length less than 800 m with uncovered joints.

Before testing the trench shall be partially backfilled 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 shall 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 shall 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 shall 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 DN 50 mm = ISO 63

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 shall be applied.

For the short test the results are deemed to be satisfactory when pressure loss from the HDPE pressure pipeline is ≤ 0.1 bar per 5 minutes.

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

☒ **Pressure Test for black steel 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. The **system test pressure (STP)** value as the followings:

SURGE HAS BEEN CALCULATED

STP = MDP + 1 Bar MDP: maximum design pressure

SURGE Has NOT been calculated

STP = MDP X 1.5 or STP = MDP+ 5 Bar (whichever is the least)

The contractor must take the value of MDP from the designer /engineer officially

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.

Procedure:

Step 1 requires the main to be Preliminary soaked & conditioned for a period of time prior to pressure Testing (I.e. Overnight for Cement lined pipe)

Step 2 Take the new main up to its System Test Pressure STD and record the time taken to achieve STP and also record the actual STP (Is it necessary to record the time to reach STP

Step 3 Maintain the STP, by pumping and adding water into the main / pipe as necessary

Step 4 Record the volume of water used to maintain STP for a period of one hour by using a volumetric Container and accurately measuring the volume of water it takes to achieve this.

Step 5 if the volumes of water recorded is in excess of the permissible / allowable water loss table, test is a fail.

Step 6 if test fails, Check main / pipe for leaks for leakage and redo the test.

Standard Allowable Volumes of leakage by diameter (Liters / Per Kilometer / Per Hour

Nominal Pipe Diameter mm	Leakage Rate (Litres/KM/Hour)
100mm	0.18
150mm	0.41
200mm	0.72
250mm	1.13
300mm	1.62
350mm	2.21
400mm	2.88
450mm	3.65
500mm	4.50
600mm	6.48
700mm	8.82
800mm	11.52
900mm	14.58
1000mm	18.00

☒ 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 laying through WAJ laboratory. The cost of disinfection and the bacteriological test shall be borne 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 cannot 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 litre. 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 litre concentration in 100 meters of pipe for the various diameters of pipe to be disinfected under this Contract.

Table 1.1: Title of the Table Goes Here

Nominal Pipe Diameter (mm)	100% Liquid Chlorine (kg)	1% Chlorine Solution (Litres)
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 labour, 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 litre throughout the length of the pipeline. Shall 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.

☒ 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 litre.

SPECIFICATIONS OF MATERIALSVALVES, PIPES AND FITTINGS

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 Societyand if these tests are not applicable in RSS, they shall be carried in similar approved Authority and has to get WAJ approval firstly.

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 specs.

Inspection or approval by the Engineer of any equipment or materials 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 or under cover as required by the Manufacture's / contractor'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 and country of origin.

The Contractor is requested to submit a list of contractors 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 contractor'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-Methylolarcylamide 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 :

1. Detailed manufacturer's proposals for pipes and fittings manufacture, coating & lining ... etc.
2. Certified copies of manufacturers quality control test results and reports .
3. 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 .
5. 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 LYTD.
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

2. Valves

i. 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.

ii. Gate Valves :

GENERAL:

1. They shall comply with EN 1171 standard latest revision. For drinking water, valves from DN 50 to 2000mm, PN (16 , 25, 40) bars, shall also comply with EN 1074-2 standard latest revision.

2. All accessories and fittings (gasket, hand wheel GG25 or carbon steel, bolt and nut of A2, flanges EN 1092-1/2 Steel flanges type (01, 11, 12) shall be provided by the contractor, this is general requirements for all kinds of valve for each .

3. The valves shall be complete with mechanical position opening indicator with hand wheel from ductile cast iron fusion bonded epoxy powder coated with spur gearbox for sizes above DN 300

4. The contractor shall provide four detailed repair manuals for the gate valves supplied; and a letter of certification from the contractor verifying that all requirements of EN Standard and these Specifications have been met.

VALVE JOINTS:

- All valves shall have, flanged ends, mechanical joint ends or screw joints to fit the pipe run in which they are used, except valves installed on push-on joint pipe shall have mechanical joint ends unless otherwise specified and the flange design on request.
- Flanges shall be raised face rated and drilled according to EN 1092-1/2 PN (16, 25, 40) Bars and face to face length according to DIN 3202 series F15 or EN558.

Regarding all standards or technical characteristics described hereafter, the contractor is required to submit certificates from third party inspectors recognized by the governmental tender directorate, its latest issue, but limited to following internationally recognized and accredited companies :

1) Bureau Veritas
2) Lloyds
3) SGS
4) WRAS
5) RSS

MATERIALS

1. Gate valve form size DN50mm and greater shall be Body wedge and bonnet of the material for pressure range 16 to 40 bars shall be ductile iron as listed in table below.

Material						
Today				Previously		
Code	Designation	Standard	Material No	Code	Designation	Standard
Ductile iron EN-GJS-400-15	EN-JS1030	EN 1563	5.3106	GGG-40	0.7040	DIN 1693-1
Ductile iron EN-GJS-500-7	EN-JS1050	EN 1563	5.3200	GGG-50	0.7050	DIN 1693-1
Ductile iron (EN-GJS-400-18-LT[1])	EN-JS1025	EN 1563	5.3103	GGG-40.3	0.7043	DIN 1693-1

2. Valve stem (shaft) shall be stainless steel with minimum 13% chromium for water system, 17% chromium for waste water system as listed in table below.

DESIGNATION	Material no	En standard
Stainless steels 316	1.4***	EN10088-1,2 or 3

3. Body, wedge and bonnet shall be of ductile cast iron GGG 40 or 50 according to DIN 1693. AndNut shall be of bronze CuSn12Ni .
4. Stem shall be of stainless steel 316 while stem sealing shall be of PTFE.
5. O-Ring made of EPDM for water system, NBR for wastewater system.
6. Bolting should be of stainless steel 316.
7. Hand wheel made of non wounding Steel or Ductile Cast Iron

DESIGN

1. Resilient seat to EN 1074-2 and EN 1171 Wedge full lining with EPDM for water system and NBR for wastewater system process for pressure range 16 bars only.
2. Wedge will be equipped with polyamide gliders to protect the gate and body guides coating from wearing. Gliders should be preferably directly fixed to the Iron Gate and protection against corrosion of the wedge shall be assumed by the system glider/rubber.
3. Metal seated to EN 1074-2 and EN 1171 non resilient seat, tapered wedge design Flexible wedge type 700HJ or Split wedge=Type 700 JJ for pressure range greater than 16 bars.
4. Fully guided wedge for resilient and non-resilient gate valves.
5. Body/bonnet junction can be either realized with or without bolts, to avoid corrosion.
6. All bolts and nuts shall be of stainless steel 316 or Bronze.
7. Face to face :

- Face to face dimension for the pressure range up to 16 bars accordance to EN558-1 basic series 14 (previously DIN 3202 F4) ;
- Face to face dimension for the pressure range 25 bars accordance to EN558-1 basic series 15 (previously DIN 3202 F5) ;
- Face to face dimension for the pressure range 40 bars accordance to EN 558-1 basic series 15 (previously DIN3202-F5,).

8. Gate valve shall be designed with flanged end on both sides rising face according to EN 1092-1/2.
9. Fixed stem seal (O ring seal) with minimum double O-Ring stem sealing and replaceable seal under pressure according to ISO 10079.
10. With draining plugs for waste water system.
11. Optional prepare for bypass for pressure range 40 bars.
12. Up to DN 200 the valves shall have a maximum operating torque of(DN) Nm. A gear box will be added if necessary to reach a maximum operating torque of 300 Nm (The valve from size 200mm and grater shall mountain with gear unite for pressure rang 25 bar and grater).
13. Inside screw stem(NRS)
14. The valves shall be complete with mechanical position opening indicator with hand wheel from ductile cast iron fusion bonded epoxy powder coated with spur gearbox for sizes above DN 300.
15. Rotation of opening :
    All valves shall open by turning to the left or counter clockwise, when viewed from the stem (clockwise closing).

COATING

1. All internal and external ferrous metal surfaces shall be fully coated, blue color, holiday free, to a minimum thickness 250 microns at least with a hot epoxy powder coating or two part thermosetting epoxy coating. Said coating shall be non-toxic, impart no taste to water, and shall be in accordance with British, French or German drinking water national regulations.

2. The valves shall be shot blasted before coating according to specifications and shall be coated inside and outside with fusion bonded epoxy powder minimum 250 microns in RAL 5015.

3. The valves shall be complete with mechanical position opening indicator with hand wheel from ductile cast iron fusion bonded epoxy powder coated with spur gearbox for sizes above DN 300.

MARKINGS

Markings shall be in accordance with EN 19 and shall include (size, working pressure, name of manufacturer, and year of manufacture).

TEST

1. Final production tests in accordance with EN 1074-2 or EN 12266-1 (when EN 1074-2 not applicable).
2. Drinking Water use valves are in accordance W270 OR British, French German drinking water national regulations.
3. Life cycle test.

iii. Butterfly Valves

GENERAL

1. Butterfly valves shall comply with EN 593 standard latest revision. For drinking water valves from DN 50 to 2000mm, PN (16 , 25 , 40)Bars shall also comply to EN 1074-2 standard latest revision. Butterfly valves shall be of the tight closing, metal seat type with recess–seat. Rubber gasket will be fixed on the butterfly and replaceable without removing the shafts.

2. Directions of flow shall be satisfactory for applications involving valve operation after long periods of inactivity. Valves being tight in the two ways will be preferred.

3. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Obturator disc will be of double accentuated type.

4. The valves shall have the possibility for horizontal and vertical installation by changing the lever position only.

5. the contractor is required to submit certificates from third party inspectors recognized by the governmental tender directorate, its latest issue, but limited to following internationally recognized and accredited companies:

   - Bureau Veritas
   - Lloyds
   - SGS
   - WRAS
   - RSS

MATERIALS

1. butterfly valve form size DN50mm and greater shall be Body wedge and bonnet for Pressure range (16 to40) Bars shall be ductile iron as listed in table below.

Material						
Today				Previously		
Code	Designation	Standard	Material No	Code	Designation	Standard
Ductile iron EN-GJS-400-15	EN-JS1030	EN 1563	5.3106	GGG-40	0.7040	DIN 1693-1
Ductile iron. EN-GJS-500-7	EN-JS1050	EN 1563	5.3200	GGG-50	0.7050	DIN 1693-1
Ductile iron. (EN-GJS-400-18-LT[1])	EN-JS1025	EN 1563	5.3103	GGG-40.3	0.7043	DIN 1693-1

2. Valve shaft shall be stainless steel minimum 13% chromium for water system 17% chromium for waste water system.

Designation	Material no	En standard
Stainless steels 316	1.4***	EN10088-3

3. Sealing seat ring (metal sealing corrosion and wear resistance sealing surface) shall welded–on or rolled on the body and made of :
   A. Stainless steel.
   B. Chrome-nickel
   C. Bronze for wastewater only.
   D. (EN 10088 -3/2,2.0975,2.1020,Ni)

4. Internal bolts shall be stainless steel minimum A2 according to EN 10088-2/3.

5. O-Ring and seat gasket shall be made of EPDM used in Drinking Water system and will be in accordance with British, French or German national regulations for water system.

DESIGN

1. Face to face to EN 558-1 basic series14 and (previously DIN 3020 F4).

2. With Flanged end on both sides rising face accordance to EN 1902-1or 2.

3. With gear box featuring position indicator (for non buried valves) and mechanical stops.

4. Bearing sealing with minimum double O-Ring on both sides.

5. Disk with close disk eyes.

6. Tight in both side.

7. Valves shall be suitable for installation in either horizontal or vertical position.
8. Double eccentric bearing of disk butterfly valve.

COATING

All internal and external ferrous metal surfaces shall be fully coated, blue color, holiday free, to a minimum thickness 250 microns at least with a hot epoxy powder coating or two part thermosetting epoxy coating. Said coating shall be non-toxic, impart no taste to water, and shall be in accordance to W270 OR British, French German drinking water national regulations.

MARKINGS

Markings shall be in accordance with EN 19 and shall include (size, working pressure, name of manufacturer, and year of manufacture).

TEST

1. Final production tests in accordance with EN 1074-2 or EN 12266-1 (when EN 1074-2 not applicable);
2. Drinking Water use valves shall be in accordance with British, French or German drinking water national regulations.
3. Life cycle test

iv.Air Valves :

Single Air Valve DN 50

Air Valves shall be single automatic air valves, PN 16, PN25, PN40 and PN50 according to the final design performed by the contractor, with body/bonnet of Acetal with PE shield for UV protection, and shall be inside and outside epoxy powder coated complying in general with DIN 30677 part 2, coating thickness shall be minimum 250µm, freedom from imperfections shall be tested by high-voltage method.

Air Valves shall be either with DN 50 female threat or with Flange DN 80.

Double Air Valve DN 100

Double orifice air valves shall be of the triple function type with a flanged inlet to EN 1092-2 PN 16, PN25, PN40 and PN50 according to the final design performed by the contractor (DIN 28605 / DIN 2501/BS 4504) and shall be suitable and approved for the use with potable water.

Body and cover shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 - DIN 1693) and shall be inside and outside epoxy powder coated complying in general with DIN 30677 part 2, coating thickness shall be minimum 250µm, freedom from imperfections shall be tested by high-voltage method.

Orifice and float balls shall be of corrosion free material (stainless steel or plastic), all seals shall be of EPDM or NBR suitable and approved for potable water.

Automatic Air Valve, Single-Chamber Type

- Single-chamber valve directly operated by the medium;
- Two-orifices venting system with 3 functions (supply and release of air as well as automatic venting during operation);
- Safe operation even under high-volume, high-speed venting up to sonic speed;
- With test and purge connection;
- Body and cap made of ductile cast iron EN-JS 1030 (GGG-40);
- Inner parts made of stainless steel grade 316 (DN 50 float made of plastic);
- Seal made of EPDM.
- Equipped with inspection valve.

Corrosion protection:

Inside and outside with epoxy coating to GSK standards for heavy-duty corrosion protection to DIN 30 677-2, coating thickness >250 µm, colour: RAL 5005 blue

- 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.

v. 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 .

vi. 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.

vii. 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 taping 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.

viii. 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.

ix. 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.

x. 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.

xi. 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.

xii. 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.

xiii. Flow Control and Shut-Off Valve for Drinking Water

- One-piece body;
- Corrosion protected bearing in the body by way of double O-ring seal and encapsulated shaft seal;
- Wear-resistant, corrosion-resistant and infiltration-proof piston guides in the body by way of micro-finished bronze weld overlay;
- Designed for cavitation-free operation in all modes of operation;
- Piston sealed by quad-ring;
- Anti-blowout shaft;
- Body made of ductile cast iron EN-JS 1030 (GGG-40);
- Made of stainless steel grade 304;
- Retaining ring made of stainless steel grade 304;
- Crank gear up to DN 600 made of stainless steel type grade 304; from DN 700 made of cast iron EN-JS 1030 (GGG-40, epoxy-coated;
- Valve seal made of EPDM;
- Valve shaft made of stainless steel grade 304
- Bolts in touch with the medium made of stainless steel grade 316;
- Maintenance-free shaft bearings made of bronze;
- With self-locking, encapsulated, maintenance-free worm gear in protection degree IP68, incl. mechanical position indicator;

xiv. CONTROL VALVE PLUNGER TYPE – TENDER TEXT

1. Main features:

a. Performance: The valve shall be designed to operate smoothly throughout the specified flow range without cavitation, excessive noise, or vibration for the conditions stated in 2.01 B below.

b. Noise:Operating noise levels shall not exceed 95 decibels (dBA) at a distance of three 1 m from the valve at the normal flow point. Flow rate as a function of pressure drop across the valve shall be linear.

c. Plunger Valve must be drop tight in closed position

d. <u>Operation Data</u>

The contractor must provide the following data for the flow control valves:

1. Maximum Flow Rate Condition Data:
   - Flow Rate:
   - Minimum Inlet Pressure:
   - Maximum Outlet Pressure:
   - Kind of operation (continuous)

2. Minimum Flow Rate Condition Data:
   - Flow Rate:
   - Maximum Inlet Pressure (Design):
   - Minimum Outlet Pressure:
   - Kind of operation (continuous)

3. Normal Flow Rate Condition Data:
   - Flow Rate (Design):
   - Normal Inlet Pressure:
   - Normal Outlet Pressure:
   - Kind of operation (continuous)

2. CONTROL VALVE OPERATING REQUIREMENTS

a. Valve Assembly Components: Each control valve assembly shall consist of a flanged short conical inlet section having an internal cone to divert the water flow into the annular chamber of the body section.
b. An oval body section with an inner annular chamber shall be formed by the body shell. The plunger with slots is part of internal slider-crank mechanism and is driven by an outside wormgear.
c. The plunger shall move in an axially flow direction to reduce or enlarge the annular flow cross section through slots in a degressive manner, and the medium will flow through the customized regulating cylinder from the outer annular chamber to the inner chamber of the plunger, shall be provided for flow control without cavitation. This has to be documented by curves
d. The outside of the plunger shall seat against a QUAD-sealing-ring at its upstream end which will be against medium pressure from both upstream and downstream sides, and shall have a profile sealing ring which will seat against a stainless steel seat at the downstream valve body end.

3. CONTROL VALVE DESIGN FEATURES

a. Control valve shall be a one-part-body design and shall feature an interior geometry that provides water flow that is guided around the streamlined internal body structure. The design shall feature a geometrically optimized design, a continuous annular cross sectional reduction

from inlet to throttle cross section, and continuous rise of flow velocity to the exit without producing cavitation.

b. Control valve design shall feature specially customized designed slotted cage to minimize cavitation. Slotted cage must be of portable type. It must be movable with the plunger. Slots shall be fully closed when the valve is placed in the closed position.
c. Control valve design, when open during operation, shall feature plunger assembly movement in the upstream side direction to release water through the slots.
d. Control valve design shall feature advance and retract axial strokes of the plunger, guided in the internal body by an internal slider-crank mechanism.
e. Motion shall be controlled by means of electric actuator or hydraulic cylinders attached to the body section.
f. The design of the annular throat cross section in any position of the plunger shall ensure linear regulation of flow.
g. The proposed valve actuator shall operate in accordance with the requirements of Section Specifications for Electric Motor Actuators.
h. Actuation: The plunger valve shall be actuated as specified by the purchasing documents, or as described in Section A – Specifications for Painting and Coatings Electric Motor Actuators shall be no more than five (5) times the normal operating force required at minimum inlet head conditions.
i. Connections: Valve end connections shall be provided by EN 1092 standard pattern flanges for the size and pressure rating specified.

xv. Electro-Magnatic Flow Meter

Electromagnetic flow meter shall be used for measurement of drinking water with a minimum conductivity of ≥ 50 µS/cm. The measuring system consist of a transmitter and a sensor in remote version: Sensor is mounted separate from the transmitter with display like two mechanical units. The length of cable between units cannot exceed 10m.

Inner diameter of flow meter shall be same like inner diameter of flow meter flanges without any reduction of diameter.

The measuring tube of the electromagnetic water meters shall be made stainless steel. Supply voltage of all measurement system shall be on electric network 240 V / 60 Hz with all protection of non-regular electric supply. This means that Contractor shall supply and install UPS with minimal 3 hour of working during interruption of power supply from electric network.

Degree of protection shall be IP67 (NEMA 4X) for transmitter and IP 68 (NEMA 6P) for sensor. Shock and vibration resistance shall be acceleration up to 2 g following IEC 600 68-2-6. Electromagnetic compatibility (EMC) shall be as per EN 61326, emission shall be to limit value for industry EN 55011. Flow meter shall be earthed.

Housing shall be of adequate metal material with proper outside/inside corrosion protection. Electromagnetic flow meter for drinking water application, used materials, assembling grease and

service lubricants shall be approved by any worldwide certificate organization for usage in system with drinking water. Flange connection shall be according to EN 1092-2.

Transmitter with display shall provide possibility to connect devices for wireless remote collecting data. Maximum measured error shall not exceed 5% on water velocity 0.05 m/s.

The transmitter display shall be clear visible, readable, with sufficient number of characters. Transmitter shall displayed flow rates, flow and total flow. Box of transmitter display shall be manufactured by robust plastic material or corrosion resistant metal. Supply and installation includes flow meters equipment, appropriate electro enclosure for electric supply, UPS for minimum 3 hours reserve, cabling and testing.

The meter shall be either programmed before dispatch from the manufacturer or be capable of being re-programmed on site to suit prevailing conditions.

The specification of the Converter shall be further as follows:

Characteristics of Converter for EMF

Installation	Remote (incl. Cable)
Housing Protection	IP 68
Bi-directional flow rate	Yes
Auto-Zero	Yes
Outputs	Programmable: 0/4-20 mA powered
Input	Programmable Remote auto zero
Self-diagnostic functions	Erroneous setting Empty pipe detection
Working Temperature (from/ to)	-15 °C to + 40°C

The Contractor shall submit a comprehensive specification regarding manufacturer, meter type, design and performance to be filled in the datasheets

xvi. Float Valves (Level Control Valve)

Float valves shall be made of GG-500, epoxy powder coated, elbow type, with flange connections as specified on the Drawings and in the Bill of Quantities.

Piston, gear and floater shall be stainless steel.

The flanges of the float valves shall be drilled to DIN 2501 - PN 16.

xvii. 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 buildup 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.

xviii. Check Valve or Non return :

Metallic sealing slanted-seat tilting-disk check valve with internal damping unit

Disk in body with double offset bearing in bushes;

Disk geometry with optimum hydraulic flow pattern to ensure low pressure losses;

Wear-resistant, corrosion-resistant and infiltration-proof sealing seat in the body and on the disk due to Microfinished chromium-nickel weld overlay;

Closing times reduced by ca. 35% due to the slanted seat;

With internal damping unit for closing behaviour with reduced pressure surges;

Tightness to DIN EN 12 266-1, leak rate D;

Body and disk made of cast iron EN-JS 1030 (GGG-40);

Valve shaft made of stainless steel grade 1.4021;

Shaft bearings made of bronze

Corrosion protection:

Inside and outside epoxy-coated, colour: RAL 5005 blue

3 Ductile Iron (DI) Pipes and Fittings

1. Scope

This Water Authority of Jordan Standard specifies the requirements and associated test methods applicable to ductile iron pipes, fittings, accessories and their joints for the construction of pipelines outside buildings.

Reference is made to EN 545:2010, 1. Scope.

2. Normative References

The indispensable referenced documents for the application of this Standard are refereed to EN 545:2010, 2. Normative References.

3. Terms and Definitions

The terms and definitions in the EN 545:2010 also apply for this Standard.

4. Technical Requirements

4.1 General

4.1.1 Ductile iron pipes, fittings and accessories

Nominal sizes, pressure classes, thicknesses, lengths and coatings are specified in the EN 545:2010, Su-Clauses 4.1.1, 4.2, 4.3.1, 4.3.3, 4.5 and 4.6.

4.1.2 Surface Condition and Repair

Reference is made to Sub-Clause 4.1.2 of the EN 545:2010.

4.1.3 Types of Joints and Interconnections

4.1.3.1 General

Elastomeric gasket made of EPDM shall comply with the requirements of EN 681-1, type WA.

4.1.3.2 Flexible Joints

Reference is made to Sub-Clause 4.1.3.2 of the EN 545:2010.

4.1.3.3 Flanged Joints

Reference is made to Sub-Clause 4.1.3.3 of the EN 545:2010.

The minimum requirement of drilling of flanges shall be PN16 according to EN 1092-2 (no PN10 drilling); other pressure classes for drillings according to EN 1092-2.

4.1.3.4 Pipe Saddles

Reference is made to Sub-Clause 4.1.3.4 of the EN 545:2010.

4.1.4 Materials in contact with water intended for human consumption

Reference is made to Sub-Clause 4.1.4 of the EN 545:2010.

All pipes, coating, and lining 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.

The Contractor is prohibited to import or to use any of the "Acryl amide and N-Methyl-poly acryl amide Grouts" or any other toxic or poisonous materials or sub materials.

The contractor is required to submit certificates from third party inspectors recognised by the governmental tender directorate, its latest issue, but limited to following internationally recognized and accredited companies:

- Bureau Veritas
- Lloyds
- SGS
- WRAS
- RSS

that all components of the supply must not be of any way toxic to the water being conveyed and can be fully used for the distribution of potable water to a temperature up to 50° C.

The Certificates must be submitted for the following materials:

a. Cement mortar lining

b. Bituminous paint

c. Epoxy paint

d. Epoxy powder coating

e. EPDM Sealing Rings and Rubber Gaskets

f. Lubricating paste

4.2 Pressure Class

Reference is made to Sub-Clause 4.2 of the EN 545:2010.

4.3 Dimensional Requirements

4.3.1 Pipes and Fittings Thickness

Reference is made to Sub-Clause 4.3.1 of the EN 545:2010

4.3.2 Diameter

4.3.2.1 External Diameter

Reference is made to Sub-Clause 4.3.2.1 of the EN 545:2010.

4.3.2.2 Internal Diameter

Reference is made to Sub-Clause 4.3.2.2 of the EN 545:2010.

4.3.3 Length

4.3.3.1 Standardized lengths of socket and spigot pipes

Reference is made to Sub-Clause 4.3.3.1 of the EN 545:2010.

4.3.3.2 Standardized lengths of flanged pipes

Reference is made to Sub-Clause 4.3.3.2 of the EN 545:2010

4.3.3.3 Standardized lengths of fittings

Reference is made to Sub-Clause 4.3.3.3 of the EN 545:2010.

4.3.3.4 Limit deviations on lengths

Reference is made to Sub-Clause 4.3.3.4 of the EN 545:2010.

4.3.4 Straightness of pipes

Reference is made to Sub-Clause 4.3.4 of the EN 545:2010.

4.4 Material characteristics

4.4.1 Tensile properties
Reference is made to Sub-Clause 4.4.1 of the EN 545:2010.

4.4.2 Hardness
Reference is made to Sub-Clause 4.4.2 of the EN 545:2010.

4.5 Coatings and linings for pipes

4.5.1 General

This Water Authority of Jordan Standard specifies for the particular requirement of coating of ductile iron pipes to be adequate for the local soil conditions following:

a. Zinc-aluminium alloy with or without other metals coating of minimum 400 g/m^2 with finishing layer of epoxy paint. The internal surface of the socket end shall be painted with a layer of zinc rich epoxy paint plus a layer of non toxic epoxy paint referring to EN 545:2010, Annex D, D.1.1, a), 2) and D.2.2.

   Evidence of the long term performance of the above mentioned solution (e.g. tests and references) should be provided by the manufacturer.

b. In difficult conditions (extremely aggressive soils, with very low resistivity under 500 Ω. Cm and/or low pH), the pipes will be protected externally with the different coatings as described in EN 545:2010, Cement mortar coating fibre reinforced, according to EN 15542, referring to EN 545:2010,

Annex D, D.1.1, a) and D.2.3, Polyurethane coating according to EN 15189 or Polyethylene according to EN 14628

For all other general requirements, reference is made to Sub-Clause 4.5.1 of the EN 545:2010. Option (a) is must unless otherwise mentioned clearly in the tender documents.

4.5.2 Coatings characteristics
Reference is made to Annex D.2.2in clause 4.1.1 of the EN 545:2010.

This Standard specifies these coating characteristics as minimum requirement for ductile iron pipes complying with Annex D.2.2 and ductile iron fittings and accessories complying with 4.6.2 May be buried in contact with a large number of soils, which can be identified by soil studies on site, except as specified in Annex D, D.2.1, Standard Coating or otherwise specified in the Tender Documents.

4.5.3 Repairs
Reference is made to Sub-Clause 4.5.2.3 of the EN 545:2010.

4.6 Internal lining of cement mortar

4.6.1 General
Reference is made to Sub-Clause 4.5.3 of the EN 545:2010. The cement mortar used should be one of those listed in Sub-Clause 4.5.3.1

4.6.2 Strength of the lining
Reference is made to Sub-Clause 4.5.3.2 of the EN 545:2010.

4.6.3Thickness and surface condition
Reference is made to Sub-Clause 4.5.3.3 of the EN 545:2010.

4.6.4Repairs
Reference is made to Sub-Clause 4.5.3.4 of the EN 545:2010.

4.7 Coatings for Fittings and Accessories

4.7.1 General
Reference is made to Sub-Clause 4.6.1 of the EN 545:2010.

This Standard specifies following coating and lining for Fittings and Accessories:

a. Coating

1. Epoxy powder coating (or epoxy paint for ND > 1000mm)
2. Zinc rich paint coating with finishing layer
3. Enamel Lining
4. Epoxy powder lining (or epoxy paint for ND > 1000mm)
5. Cement mortar lining
6. Enamel
7. thick electro-deposited coating with a minimum thickness of 50 microns applied on a blast-cleaned and phosphorated surface

Depending on the external and internal conditions of use, alternative coatings, detailed in Annex "D" of the EN 545:2010 may be required and used as specified in the tender documents.

Epoxy powder or epoxy paint lining inside and coating outside shall be according to EN 14901

- **coating thickness: minimum 200 µm**
- **zero porosity: minimum 1500 V spark test**
- **adhesion: inimum 8 N/mm²**

4.7.2 Paint coating

4.7.2.1 General

Reference is made to Sub-Clause 4.6.2.1 of the EN 545:2010.

Relevant only for bitumen, synthetic resin, zinc rich paint with finishing layer and enamel

4.7.2.2 Coating characteristics

Reference is made to Sub-Clause 4.6.2.2 of the EN 545:2010.

Relevant only for bitumen, synthetic resin, zinc rich paint with finishing layer and enamel

4.8 Marking of pipes, fittings and accessories

4.8.1 Pipes and fittings

Reference is made to Sub-Clause 4.7.1 of the EN 545:2010.

According to Sub-Clause 4.6, the manufacture's name or mark will be cast-on or cold-stamped (not painted).

4.8.2 Accessories

Reference is made to Sub-Clause 4.7.2 of the EN 545:2010.

4.9 Leak Tightness

Reference is made to Sub-Clause 4.8 of the EN 545:2010.

5.Performance Requirements for Joints and Pipe Saddles

5.1 General

To insure their fitness for purpose in the field of water supply, all the joints and pipe saddles shall fulfil the relevant performance requirements of clause 5 of the EN 545: 2010.

A. Quality Assurance System:

The manufacturer shall control the quality of his products during their manufacture by a system of process control according to EN DIN ISO 9001:2000, in order to comply with the technical requirements of the standards. The tests should confirm that the ductile iron pipes, fittings and accessories are manufactured according to EN 545:2010.

B. Traceability System:

The manufacturer shall clearly mention the method by which he can keep records and trace of the manufactured ductile iron pipes, fittings and accessories to ensure the capability of going back to the records for the manufactured item in case any problems accrues after the installation.

5.2 Flexible joints

5.2.1 General

The minimum deflection in joints shall be as in Sub-Clause 5.2.1 of the EN 545:2010.

5.2.2 Test Condition

Reference is made to Sub-Clause 5.2.2 of the EN 545:2010.

5.3 Test parameters

5.3.1 Annulus
Reference is made to Sub-Clause 5.2.3.1 of the EN 545:2010.

5.3.2 Pipe thickness
Reference is made to Sub-Clause 5.2.3.2 of the EN 545:2010.

5.3.3 Shear
Reference is made to Sub-Clause 5.2.3.3 of the EN 545:2010.

5.4 Restrained flexible joints

Reference is made to Sub-Clause 5.3 of the EN 545:2010.

Types of used restrained flexible joints should be clarified by the manufacturer with an evidence of performance and a list of references.

5.5 Flanged joints as cast, screwed, welded and adjustable

Reference is made to Sub-Clause 5.4 of the EN 545:2010.

5.6 Pipe saddles

5.6.1 Test conditions
Reference is made to Sub-Clause 5.5.1 of the EN 545:2010.

5.6.2 Annulus
Reference is made to Sub-Clause 5.5.2 of the EN 545:2010.

6. Test methods

6.1 Pipe dimensions

6.1.1 Wall thickness
Reference is made to Sub-Clause 6.1.1 of the EN 545:2010.

6.1.2 External Diameter
Reference is made to Sub-Clause 6.1.2 of the EN 545:2010.

6.1.3 Internal Diameter
Reference is made to Sub-Clause 6.1.3 of the EN 545:2010.

6.1.4 Length
Reference is made to Sub-Clause 6.1.4 of the EN 545:2010.

6.2 Straightness of pipes

Reference is made to Sub-Clause 6.2 of the EN 545:2010.

6.3 Tensile testing of ductile iron components

Reference is made to Sub-Clause 6.3 of the EN 545:2010.

6.3.1 Samples

Reference is made to Sub-Clause 6.3.1 of the EN 545:2010.

6.3.1.1 Centrifugally cast pipes

Reference is made to Sub-Clause 6.3.1.1 of the EN 545:2010.

6.3.1.2 Pipes not centrifugally cast, fittings and accessories

Reference is made to Sub-Clause 6.3.1.2 of the EN 545:2010.

6.3.2 Preparation of test bar

Reference is made to Sub-Clause 6.3.2 of the EN 545:2010.

6.3.3 Apparatus and test method

Reference is made to Sub-Clause 6.3.3 of the EN 545:2010.

6.3.4 TEST RESULTS

Reference is made to Sub-Clause 6.3.4of the EN 545:2010.

6.4 Brinell hardness of ductile iron components

Reference is made to Sub-Clause 6.4 of the EN 545:2010.

6.5 Works leak tightness test for pipes and fittings

Reference is made to Sub-Clause 6.5 of the EN 545:2010.

6.5.1 General

Reference is made to Sub-Clause 6.5.1 of the EN 545:2010.

6.5.2 Centrifugally cast pipes

Reference is made to Sub-Clause 6.5.2 of the EN 545:2010.

6.5.3 Pipes not centrifugally cast, fittings and accessories

Reference is made to Sub-Clause 6.5.3 of the EN 545:2010.

6.6 Zinc Mass

Reference is made to Sub-Clause 6.6 of the EN 545:2010.

6.7 Thickness of paint coatings

Reference is made to Sub-Clause 6.7 of the EN 545:2010.

6.8 Thickness of cement mortar lining

Reference is made to Sub-Clause 6.8 of the EN 545:2010.

7. Performance test methods

7.1 Compressive strength of the cement mortar lining

Reference is made to Sub-Clause 7.1 of the EN 545:2010.

7.2 Leak tightness of flexible joints

7.2.1 General

Reference is made to Sub-Clause 7.2.1 of the EN 545:2010.

7.2.2 Leak tightness of flexible joints to positive internal pressure

Reference is made to Sub-Clause 7.2.2 of the EN 545:2010.

7.2.3 Leak tightness of flexible joints to negative internal pressure

Reference is made to Sub-Clause 7.2.3 of the EN 545:2010.

7.2.4 Leak tightness of flexible push-in joints to positive external pressure

Reference is made to Sub-Clause 7.2.4 of the EN 545:2010.

7.2.5 Leak tightness of flexible joints to dynamic internal pressure

Reference is made to Sub-Clause 7.2.5 of the EN 545:2010.

7.3 Leak tightness and mechanical resistance of flanged joints

Reference is made to Sub-Clause 7.3 of the EN 545:2010.

7.4 Leak tightness and mechanical resistance of pipe saddles

7.4.1 Positive internal pressure

Reference is made to Sub-Clause 7.4.1 of the EN 545:2010.

7.4.2 Negative internal pressure

Reference is made to Sub-Clause 7.4.2 of the EN 545:2010.

8. Tables of dimensions

8.1 Socket and spigot pipes

General Reference is made to Sub-Clause 8.2 of the EN 545:2010.
The Water Authority Standard specifies for each DN the following minimum wall thicknesses

DN	External diameter DE mm		Minimum wall thickness *e* mm						
	Nominal	Limit deviations	Class 20	Class 25	Class 30	Class 40	Class 50	Class 64	Class 100
40	56	+1/-1,2				3,0	3,5	4, 0	4,7
50	66	+1/-1,2				3,0	3,5	4,0	4,7
60	77	+1/-1,2				3,0	3,5	4,0	4,7
65	82	+1/-1,2				3,0	3,5	4,0	4,7
80	98	+ 1/- 2,7				3,0	3,5	4,0	4,7
100	118	+1/-2,8				3,0	3,5	4,0	4,7
125	144	+1/-2,8				3,0	3,5	4,0	5,0
150	170	+1/-2,9				3,0	3,5	4,0	5,9
200	222	+1/-3,0				3,1	3,9	5,0	7,7
250	274	+ 1/- 3,1				3,9	4,8	6,1	9,5
300	326	+1/-3,3				4,6	5,7	7,3	11,2
350	378	+1/-3,4			4,7	5,3	6,6	8,5	13,0
400	429	+1/-3,5			4,8	6,0	7,5	9,6	14,8
450	480	+1/-3,6			5,1	6,8	8,4	10,7	16,6
500	532	+1/-3,8			5,6	7,5	9,3	11,9	18,3
600	635	+1/-4,0			6,7	8,9	11'1	14,2	21,9
700	738	+1/-4,3		6,8	7,8	10,4	13,0	16,5	
800	842	+1/-4,5		7,5	8,9	11,9	14,8	18,8	
900	945	+1/-4,8		8,4	10	13,3	16,6		
1 000	1 048	+1/-5,0		9,3	11,1	14,8	18,4		
1 100	1 152	+1/-6,0	8,2	10,2	12,2	16,2	20,2		
1 200	1 255	+1/-5,8	8,9	11'1	13,3	17,7	22,0		
1 400	1 462	+1/-6,6	10,4	12,9	15,5				
1 500	1 565	+1/-7,0	11'1	13,9	16,6				
1 600	1 668	+1/-7,4	11,9	14,8	17,7				
1 800	1 875	+1/-8,2	13,3	16,6	19,9				

2 000	2 082	+1/-9,0	14,8	**18,4**	22,1				

NOTE 1 The bold figures indicate the standard products which are suitable for most applications. Grey boxes represent products which are outside the scope of this standard.

NOTE 2 For smaller ON, the minimum pipe wall thickness is governed by a combination of manufacturing constraints, structural performance and installation and handling requirements.

NOTE 3 The minimum thickness is given for non-restrained joints (see 4.2.(

NOTE 4 Pressure classes between 50 and 100 may be supplied by interpolation on request.

highlighted in colour (see the following page), according to the Preferred Classes as described in EN 545:2010.

8.2Flanged pipes

Reference is made to Sub-Clause 8.2 of the EN 545:2010.

8.3 Fittings for socketed joints

Reference is made to Sub-Clause 8.3 of the EN 545:2010.

8.4 Fittings for flanged joints

Reference is made to Sub-Clause 8.4 of the EN 545:2010.

9. Evaluation of Conformity

9.1 General

Reference is made to Sub-Clause 9.1 of the EN 545:2010.

9.2 Initial Performance Testing

Reference is made to Sub-Clause 9.2 of the EN 545:2010.

9.2.1 General
Reference is made to Sub-Clause 9.2.1 of the EN 545:2010.

9.2.2 Characteristics
Reference is made to Sub-Clause 9.2.2 of the EN 545:2010.

9.2.3 Treatment of calculated values and design
Reference is made to Sub-Clause 9.2.3 of the EN 545:2010.

9.2.4 Sampling, testing and conformity criteria
Reference is made to Sub-Clause 9.2.4 of the EN 545:2010.

9.2.4.1 Sampling procedure

Reference is made to Sub-Clause 9.2.4.1 of the EN 545:2010.

9.2.4.2 Testing and compliance criteria

Reference is made to Sub-Clause 9.2.4.2 of the EN 545:2010.

9.3 Factory production control (FPC)

Reference is made to Sub-Clause 9.3 of the EN 545:2010.

1. Tests required according to the Water Authority Standard of the Hashemite Kingdom of Jordan

The manufacturer shall demonstrate the conformity of his products with the standards by submitting the performance tests specified in the standards:

2. Quality Assurance System:

The manufacturer shall control the quality of his products during their manufacture by a system of process control according to EN ISO 9001:2000, in order to comply with the technical requirements of the standards. The tests should confirm that the ductile iron pipes, fittings and accessories are manufactured according to EN 545:2010.

C. Traceability System:

The manufacturer shall clearly mention the method by which he can keep records and trace of the manufactured ductile iron pipes, fittings and accessories to ensure the capability of going back to the records for the manufactured item in case any problems accrues after the installation.

9.3.1 General
Reference is made to Sub-Clause 9.3.1 of the EN 545:2010.

9.3.2 FPC requirements for all manufacturers
Reference is made to Sub-Clause 9.3.2 of the EN 545:2010.

9.3.2.1 General

Reference is made to Sub-Clause 9.3.2.1 of the EN 545:2010.

9.3.2.2 FPC for tensile testing

Reference is made to Sub-Clause 9.3.2.2 of the EN 545:2010.

9.3.3 Manufacturer-specific FPC system requirements
Reference is made to Sub-Clause 9.3.3 of the EN 545:2010.

9.3.3.1 Personnel

Reference is made to Sub-Clause 9.3.3.1 of the EN 545:2010.

9.3.3.2 Equipment

Reference is made to Sub-Clause 9.3.3.2 of the EN 545:2010.

9.3.3.3 Design process

Reference is made to Sub-Clause 9.3.3.3 of the EN 545:2010.

9.3.3.4 Raw materials and components

Reference is made to Sub-Clause 9.3.3.4 of the EN 545:2010.

9.3.3.5 In-process control

Reference is made to Sub-Clause 9.3.3.5 of the EN 545:2010.

9.3.3.6 Non-conforming products

Reference is made to Sub-Clause 9.3.3.6 of the EN 545:2010.

9.3.3.7 Corrective action

Reference is made to Sub-Clause 9.3.3.7 of the EN 545:2010.

1. ANNEX A
(Normative)

10.1 Allowable pressures

10.1.1 A.1 General
Reference is made to Annex A.1 of the EN 545:2010.

10.1.2 A.2 Socket and spigot pipes (see 8.1)
Reference is made to Annex A.2 of the EN 545:2010.

10.1.3 A.3 Fittings for socketed joints (see 8.3)
Reference is made to Annex A.3 of the EN 545:2010.

10.1.4 A.4 Flanged pipes (see 8.2) and fittings for flanged joints (see 8.4)
Reference is made to Annex A.4 of the EN 545:2010.

10.1.5 A.5 Accessories
Reference is made to Annex A.5 of the EN 545:2010.

2. ANNEX B
(Informative)

11.1 Longitudinal bending resistance of pipes
Reference is made to Annex B of the EN 545:2010.

3. ANNEX C
(Informative)

12.1 Diametral stiffness of pipes
Reference is made to Annex C of the EN 545:2010.

13. ANNEX D
(Informative)

13.1 Specific coatings, field of use, characteristics of soils

13.1.1 D.1 Alternative coatings

13.1.1.1 D.1.1 Pipes

Reference is made to Annex D.1.1 of the EN 545:2010.

13.1.1.2 D.1 .2 Fittings and accessories

Reference is made to Annex D.1.2 of the EN 545:2010.

13.2 D.2 Field of use in relation to the characteristics of soils

13.2.1 D.2.1 Standard coating
Reference is made to Annex D.2.1 of the EN 545:2010.

13.2.2 D.2.2 Alloy of zinc and aluminium with or without other metals
Reference is made to Annex D.2.2 of the EN 545:2010.

13.2.3 D.2.3 Reinforced coatings
Reference is made to Annex D.2.3 of the EN 545:2010.

14. ANNEX E
(Informative)

14.1 Field of use, water characteristics
Reference is made to Annex E of the EN 545:2010.

15. ANNEX F
(Informative)

15.1 F.1 Calculation method of burried pipeline, height of cover.

15.1.1 F.1.1 Calculation formula

Reference is made to Annex F.1.1 of the EN 545:2010.

15.1.2 F.1.2 Pressure from earth loading

Reference is made to Annex F.1.2 of the EN 545:2010.

15.1.3 F.1.3 Pressure from traffic loading

Reference is made to Annex F.1.3 of the EN 545:2010.

15.1.4 F.1.4 Bedding factor, K

Reference is made to Annex F.1.4 of the EN 545:2010.

15.1.5 F.1.5 Factor of lateral pressure, f

Reference is made to Annex F.1.5 of the EN 545:2010.

15.1.6 F.1.6 Modulus of soil reaction, E'

Reference is made to Annex F.1.6 of the EN 545:2010.

15.2 F.2 Heights of cover

Reference is made to Annex F.2 of the EN 545:2010.

16. Bibliography

Reference is made to Bibliography of the EN 545:2010.

4. TECHNICAL SPECIFICATIONS FOR WELDED BLACK STEEL PIPES & FITTINGS

I. Specifications for Welded Steel Pipes with Beveled ends For (4", 6" and 8") diameters.

a) The pipes shall be in accordance with { API-5L, Grade of steel X42 } or {DIN. 2441} or approved equivalent standards, high-tensile, longitudinally or spirally welded steel pipes.

The wall thickness and the test pressures shall be as follows :

Nominal dia. (ND) inch.	Outside Diameter (inch)	Thickness (mm)	Test Pressure (kg/cm^2)	standards
4"	4 ½"	4.40	134	API or DIN
6"	6 ⅝"	5.20	133	API or DIN
8"	8 ⅝"	5.60	110	API or DIN

b) Working Pressure :
The maximum nominal pressure of all pipes shall not be less 40 bar.

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سلطة المياه
مديرية العطاءات والمشتريات

c) Average Length :

Pipes shall have 6 meters length, equal length must be supplied.

d) Beveld Ends For 4", 6" and 8":

End of pipes must be calibrated and beveled by 30° degrees (plus or minus 5° degrees) for elecric fusion butt welding.

e) Internal Lining and External Coating :

- Preperation of pipes surfaces befor lining and coating:
- The surfaces of pipes shall be clean and free from scale, loose rust, oil ...etc. by:
  - **a.** Acid picking.
  - **b.** Abrasive shot blasting.

  All in accordance with BS.4232 first quality as discribed in BS.534.

  Adhesion Test is required for lining and coating as discribed in BS.534.

e.1) **Internal Lining:**

All steel pipes of 4", 6" and 8" ND. Shall have internal lining either:

a. **Cement lining according to AWWA - C. 205 or BS. 534 or approved equal.**
b. Zinc galvanzation (Hot Dip) according to Din. 2441 or approved equal, which shall be odorless and tasteless suitable for the passage of chlorinated potable water 0-3 p.p.m.cl_2.
c. Non-toxic 100% solids Amine epoxy according to AWWA C210-03 (Liquid epoxy coating systems for the interior and exterior of steel water pipelines) or approved equal.
d. Non-toxic fusion bonded epoxy according to AWWA C213-01 (for the interior and exterior of steel water pipelines) or approved equal.

Lining must be suitable for drinking water. Non Metalic product for use in Contact with water must be in accordance with BS. 6920.

e.2) External Coating:

All steel pipes of 4", 6" and 8" ND. Shall have an external Coating in accordance with (BS. 534), the Coating must be as follows:

- Priming shall be applied to the pipes as specified in (BS. 534), then Bitumen sheathing or Bitumen enamel wrapping (filled Bitumen with / glass tissue) shall be applied as external coating .

-The coating shall have a total thickness of not less than 3 mm.

e.3) Protection of lining and coating:

The lined and coated pipes shall be transported through climate, so the manufacturer must take into account the choice of material.

Protection of lined and coated pipes against damages during storage, transport and handling is required either by using straw or wood wool pads.

The coating shall show no tendency of flow at a temperature of (70) degrees centigrade.

e.4) The internal lining and the external coating for bevelled ends pipes shall stop 6" from each end of the pipe

e.5) All welded and flanged joints of steel pipes, shall be protected and coated with the same coating materials of the steel pipes.

f. Marking:

The material shall be marked with the manufacturer's symbol or mark in addition to the code number, standard specification, and the inspector stamp. The pipes as well shall be stamped with the purchaser

symbol, "WAJ"

Insulation Materials for Joints of All Pipes Sizes:

Sufficient quantity of insulating materials shall be included to cover the joints and fittings after welding the pipes and its cost shall be deemed to be included in the respective unit price.

g. 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	3
Diameter	4"	6"	8"
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			
Welding process			
Type of welding			
Type of lining			
Type of coating			

II. Specifications for Welded Steel Pipes with Bevelled Ends

For 10" Diameters & Above:

a. The pipes shall be in accordance with (API - 5L, Grade of steel, x 42), or approved equivalent standards, high-tensile, longitudinally or spirally welded steel pipes .

b. The wall thicknesses and the minimum mill-inspection test pressures shall be as follows:

Nominal dia. (ND) inch	Outside diameter (mm)	(inch)	Wall Thickness (mm)	Test Pressure (kg/cm2)
10 ¾"	273.10	10 3/4"	5.6	100
12 ¾"	323.9	12 3/4"	6.4	96
16"	406.40	16"	6.4	77
20"	508.00	20"	7.1	73
24"	610.00	24"	7.1	61
32"	813.00	32"	9.5	61

c. Working Pressures:

The maximum nominal pressure of all pipes shall not be less than the value stated in the scope of works and / or Drawings.

d. Bevelled Ends:

End of pipes must be calibrated and beveled by 30° degrees (plus or minus 5° degrees) for elecric fusion butt welding.

All welded and flanged joints of steel pipes, shall be protected and coated with the same coating materials of the steel pipes.

e. Average Length :

Pipes shall have an average length of 6 and / or 12 meters and as approved by the Engineer .

f. Internal Lining and External Coating :

The internal cement mortar lining shall be of 6.0 mm. and conform to all relevant requirements of BS. 534 / 1990 or AWWA. C.205 - 85.

The unlined and / or uncoated wall of the pipe shall be protected by suitable harmless approved bituminous or epoxy paint.

The internal lining thickness shall not be less than the minimum thicknesses given in the following table :

Nominal Diameter (ND) inch	Minimum thickness (mm)	
	BS.534.1990	AWWA.C.205-85
10	6 (+2 , -0)	6 (+3.2 , -1.6)
12	6 (+2 , -0)	8 (+3.2 , -1.6)
16	7 (+2 , -0)	8 (+3.2 , -1.6)
20	7 (+2 , -0)	8 (+3.2 , -1.6)
24	7 (+2 , -0)	10 (+3.2 , -1.6)
32		10 (+3.2 , -1.6)

External coating of steel pipes and fittings shall be polyethylene sheathing (reinforced type) according to DIN. (30670), designation: Reinforced sheathing (V).

The polyethylene sheathing shall be applied at manufacturer's works (plant) extruded and melted on and homogeneous to steel pipes with API 5L-X42 for buried installation .

Between the polyethylene sheathing and the pipe steel there shall be an adhesive film which is applied electro-statically.

The polyethylene sheathing shall be made continuos extrusion and the adhesive film shall be firmly bonded to the steel surface. The coating shall be spark-free when tested with a Holiday detector at 25000 volts. The minimum coating thickness shall be 3.0 mm for pipes of nominal diameters up to 20", and 3.50 mm for 24" diameter pipes.

In addition to tests to DIN 30670 for coating and coating materials, the coating shall be tested for cathodic disbonding in accordance with ASTM G8. The polyethylene coating shall be capable of operating at a continuous temperature up to 50 C. without any effect on coating and bonding. The polyethylene and adhesive shall stop at a distance of 100mm plus the insert of the pipe for the spigot and 100mm for the end of the socket of the pipe.

g. Marking:

The material shall be marked with the manufacturer's symbol or mark in addition to the code number, standard specification, and the inspector stamp. The pipes as well shall be stamped with the purchaser symbol, "WAJ"

Insulation Materials for Joints of All Pipes Sizes:

Sufficient quantity of insulating materials shall be included to cover the joints and fittings after welding the pipes and its cost shall be deemed to be included in the respective unit price.

g.1) 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	3	4	5	6
Diameter	**10"**	**12"**	**16"**	**20"**	**24"**	**32"**
Nominal Diameter						
Outside Diameter						
Wall Thickness						
Working pressure						
Test pressure						
Wt/meter (bare)						
WT/meter with						
Length of pipe						
Standards						
Manufacturer						
Country of origin						
Welding process						
Type of welding						
Type of lining						
Thick. Of lining						
Type of coating						
Thick. of coating						

II. SPECIFICATION FOR BLACK STEEL FITTINGS

a.Scope of Use :

The fittings must be made of seamless pipes and shall be in accordance with ANST (B.16.9). The fittings shall be welded to black steel pipes type (API.5L-X42).

b. Fabrication of Fittings:

The fabrications of fittings shall be as follows:

1. Elbows must be fabricated by forging or by hot or cold forming of seamless pipes.

2. Reducers must be fabricated by hot or cold forming and annealing of seamless pipes.
3. Tees must be fabricated by forming of seamless pipe or by cold or hot forming and annealing of seamless pipes.
4. Caps must be fabricated by hot or cold stamping or forging of plates heat treated.

- Fabrication fittings by welding pieces of pipes are not accepted.

c. Materials of Fittings:

Elbows, Tees, Reducers etc. must be made of seamless pipe grade WPB.(ASTM. A 234) or approved equivalent.

d. Fittings Thickness & Pressure:

The minimum thickness of the black steel fittings shall be sufficient to withstand the pressure rating of their respective pipelines.

e. Elbows Bends:

The Elbows must be of long radius type, but short radius elbows can be offered as an alternative.

f.Reducers:

The reducers must be concentric. Thickness of each side shall be equal to thickness of related nominal diameter, if thic

g. Straight Equal Tees:

The straight equal tees, in which the run and branch (out let) is equal in nominal diameter, thickness must be equal to the thickness of its related nominal diameter.

h. Tees Reducing:

Tees Reducing, in which the Run is bigger than branch (out let) in nominal diameter thickness of the run, must be equal to the thickness of its related diameter, thickness of the branch (out let) must equal to its related nominal diameter.

i. Coating and Lining:

All fittings must be lined by corrosion proof materials and must be suitable for potable water.

The coating must be of the same coating material as the pipes. Coating and lining must stop at the beveled ends for the purpose of welding.

j.Marking:

Every fitting must be marked with:

- Trade mark.
- Nominal Diameter.
- Thickness.
- Standard.

k. Certificate of Compliance :

Certificates of compliance of required standards are required.

5.TECHNICAL SPECIFICATION for HIGH DENSITY POLYETHYLENE PIPES (HDPE)&FITTINGS

POLYETHYLENE PIPES

1. GENERAL

1.1Ambient Conditions

All pipes ,material sand equipments shall be in every respect suitable for storage, installation, use and operation in the conditions of temperature,humidity and The PH and water quality appertaining in Jordan.

Atmospheric temperature in Jordan varies between-10°C and 50°C.

1.2Potable WaterCertification

All pipes and materials shall be certified for potable water use,and all pipes and materials should be certified as safe for transporting potable water by an independent testing laboratory. All material in contact with or likely to come into contact with water for public supply shall be introduced with the requirements of BS6920 (suitability for non metallic products for use in contact with drinking water)or any equivalent standard as well as the Jordanian standard(JS286/2008) and the World Health Organization standard (WHO), and when ever the regulationis changed it is the supplier responsibility to ensure conformity with any new requirements.

Potable water certificate submitted must be for the same batch delivered toWAJ, certificates must be in English

1.3ToxicMaterials

Pipes and pipe line components,including their protective coatings and joint materials,that will or may come into contact with potable water shall not constitute a toxic hazard,shall not support microbial growth,shall not cause taste or odour,cloudiness or discolouration of the water and shallcontain no ingredientsthat may migrate into water in amounts that are considered to be toxic or otherw is dangerous for health.

Non toxicity certificate should be provided.

1.4Third Party Witness

1.4.1General

The supplier shall furnish an original certificate from accredited thirdparty inspection agency

Showing all test results and analysis required by the applicable standard(ISO 4427/2007) according to which them at erials have been manufactured.The third party inspection agency shall under this contract, have witnessed the manufacture and testing operation to verify compliancewith the technical specifications and the relevant standard. The third party inspection agency shall verify that all materials used are eligible for the relevant standard productions requirements.All certification should be from a certified and approved third party, and thec ertificates must be related to the same batch delivered toWAJ,all certificates must be valid and written in English.

1.4.2Pipes

For pipes third Party shall verify that all pipesare produced in compliance with ISO 4427-2/2007,

EN12201or equivalent,all batch release etests shall be witnessed and certified by an approved third party,and No pipe shall be accepted unlessall typeand batch release tests hav ebeen passed. The third party must clearly identify the pipe production date/code marked on the pipes,with each batch test performed.

1.5Testing afterdelivery

All materials supplied to the site in Jordan shall be subjected to acceptance tests carried out by the Royal Scientific Society. Or similar accredited authority.The test should confirm that the materials and pipes are manufacture according to ISO 4427,EN12201 or equivalent;all Tests required for polyethylene pipes must be performed according to the above standards.If any of the tests mentioned in the standards cannot beperformed by the Royal Scientific Society then the supplier should provide a third party certificate for those tests taking into considerations all the statements mentioned in"third party witness"section.

All testingcosts shouldbeborne by the supplierin all cases.

1.6Pipes Packing and Protection

- All pipes shall be bundled o rpackaged in such a manner as to provide adequate support and protection for the endsduringtransportationfromthemanufacturertothePurchaser. All special provisions foroceanshipmentshall beprovided.
- Thepackagingofpipesbythemanufacturerisnormallyconsistentwiththerequirementto prevent damageand tocomplywith safetyconsiderations. Usuallypipesare delivered strapped intoconvenient bundlesorbanded coils.Allendsmustbeclosedwith caps.

1.7 Identification

The supplier shall be responsible to ensure that each separate item,crate, or package has permanently attached to it, in aconspicuous position , an identification plate of weather- resistant materialon which are engraved or stamped;

- **The Manufacturers Name**
- **Contents Descriptionand Quantity**
- **Serial Number or Reference Number Identifiable on the Delivery Note and Cross ReferencedtothePurchaseOrderItemReferences.**
- **Weight**
- **Tender Number–variable**

In addition the container shall be marked with the following information;

- **Total gross weight**
- **Total net weight**
- **Packing list reference number**

1.8Transportand Deliveries

- The supplier shall send to the Purchasers,one-week advance notice of allc onsignments of materials. Every consignment shall be accompanied by a detailed delivery note.

- The supplier shall deliver to and off load the materials on to the storage area as directed by the Purchasers.All materials delivered will be examined and inspected by the Purchaser and taken over by him.

- The Supplier shall provide necessary details to the shipping line on precautions to be taken during loading/unloading,handling & transport of the pipes & fittings and other components.Supplier

shall provide to the purchaser a set of recommendations of manufacturer for handling,loading,unloading,transporting and storing of polyethylenepipes and fittings.

- The Purchaser shall arrange reception and storage areas only. The supplier shall be responsible for off-loading all materials.

- The materials shall be delivered to the Purchaser at WAJ stores, Amman or any other place chosen by the Purchaser.

- The supplier shall also be responsible for all handling and transport activities up to WAJ store-yard, Amman or any other place chosen by the Purchaser.

- The (DDP) price shall include all costs relating to above-mentioned requirements.

1.9 Handling

Care shall be taken during loading , transporting , and unloading to prevent damage to the pipes,. Under no circumstances shall pipes or fittings be dropped or rolled against one another. All pipes and fittings shall be examined. Any damaged materials must be rejected by the Purchasers.

1.10 Details to be provided after awarding the contract

1. Manuals and technical catalogues.

2. Dates of batches or consignment deliveries.

3. The supplier shall state which of the sections of the schedule of requirements he proposes to price and supply.
4. Any alternative standards proposed including demonstration of equivalency or superiority to the standard specified, if allowed.

5. Any alternative materials proposed including demonstration of equivalency or superiority to the standard specified,thesealternative materials should besubjected to the clients approval.

6. Where the supplier offers alternative standards, materials to those specified, the supplier shall provide prices for those specified and the alternatives proposed.

7. The supplier shall include in his price for the training elements related to the materials he proposes to supply and shall list the elements of training offered,if needed or requested.

8. The supplier shall provide prices for the equipment applicable to the sections of the schedule of requirements he intends to price.

9. The supplier shall provide full details of his materials tests and procedures.

10. Any alternative proposed specificationfor combined tracer andmarkertape.

11. ISO or EN certification for management and product.

12. CV's of proposed training staff, if necessary.

13. CostsofTrainers expenses,if requested.

14. Training program, if requested.

1.11ManualsandTechnical Specifications

The supplier shall supply full technical specifications for the items to be supplied at the time of tender .In addition he shall provide full instruction manuals,which describe the correct methods and procedures necessary to construct the pipeline system in accordance with best practice. Conformity to standard certificate must be supplied at time of tender where this certificate must be issued from accredited third party and valid up to date.

1.12Additional Services

The supplier shall provide details of additional services,which he can providee.g.technical adviceand supportand,in particular,shall state his capability for supporting the project in the Amman location at the time of tender.

1.13Conformity to standard certificate from accredited third party

All certificates must be from an accredited third party and the accreditation logo must be stamped on the certificateas per the requirements of IAF. No certificate will be accepted unlessit isfrom an accredited third party.

2. Polyethylene Pipes

2.1Technical specifications

The polyethylene pipes shall conform to the requirements of Polyethylene(PE) pipes for water supply under pressure – Specification (ISO 4427-1/2:2007), (EN12201-1, EN12201-2) or equivalent standard in which a supplier must submit a copy of that standard and a proof of equivalency to the above specifications.

Conformity to standard certificate must be supplied at time of tender where this certificate must be issued from accredited third party and valid up to date.

The pipes should have the following properties:

- Pressure class:PN16 or PN25(According to contract documents)
- The Standard Dimension Ratio (SDR) :SDR11
- Material Designation:PE100

2.2Length of Pipes

The following table shows the length of the pipes according to the diameter.

Table1.1length of pipe

Diameterofpipe(mm)	Lengthof pipe (m)
Up to 63	50or100
125	(50or100:coils) (upon request),Or(12m:standard pipes) (for maintenance dept.uses) (upo nrequest)
180 and above	1 2or standard pipes

Markings of Pipes

All PE pipesshall be in delibly marked at maximum intervals of one meter.
The markingshall show atleast the following information:

- "WAJ"
- Manufacture's name,logo and/or trademark
- Dimensions(nominal diameter)
- Materials,material class(i.e. PE100)andpressureclass (PN16)
- Production period (date and code)
- "Water"to indicate that pipes are intended for potable water
- Serial number
- Batch number
- Standard number
- Standard Dimension Ratio(SDR).

For direct purchase procurements order the marking depends on the value of the procurements order.

POLYETHYLENE FITTINGS

1. GENERAL

1.1Ambient Conditions

All fittings,materials and equipment shall be in every respect suitable for storage, installation,use and operation in the conditions of temperature, humidity and The PHof water appertaininginJordan.

Atmospheric temperature in Jordan varies between -10°Cand 50°C.

1.2Potable WaterCertification

All fittings and materials shall be certified for potable water use,and all fittings and materials should be certified as safe for transporting potable water by an independent testing laboratory. All material in contact with or likely to come into contact with water for public supply shall be introduced with the requirements of BS6920(suitability for non metallic products for use in contact withdrinking water) or any equivalent standard as well as the Jordanian standard(JS 286/2008) and the requirements of EN15664 (influence of metallic materials on water intended for human consumption) orany equivalent standardand theWorld Health Organization standard(WHO),and whenever the regulation is changed it is the supplier responsibility to ensure conformity with any new requirements.

Potable water certificate submitted must be fort hesame batch delivered toWAJ, certificates must be in English

1.3Toxic Materials

Fittings and pipe line components,including their protective coatings and joint materials, that will or may come into contact with potable water shall not constitute at oxichazard, shall not support microbial growth, shall not cause taste or odour,cloudiness or discolouration of the water and shall contain no ingredients that may migrate in to water in amounts that are considered to be toxic or otherwise dangerous for health.

Non toxicity certificate should be provided.

1.4Third Party Witness

1.4.1General

The supplier must submit at least 3 different international third party companies where WAJ or the client willchoose oneof them.

The supplier shall furnish an original certificate from the third party inspection agency showing all test results and analysis required by the applicable standard(ISO 4427 /2007) according to which the materials have been manufactured.The third party inspection agency shall under this contract,have witnessed the manufacture and testing operation to verify compliance with the technical specifications and there levant standard. The third party inspection agency shall verify that all materials used are eligible forthe relevant standard productions requirements. All certification should be from a certified and approved third party,and the certificates must be related to the same batch delivered toWAJ,allc ertificates must be valid and writtenin English.

1.4.2Fittings

For fittings third Party shall verify that fittings are produced in compliance with ISO4427-3/

2003,EN12201 or equivalent,all batch release tests shall be witnessed and certified by an approved third party,and No fitting shall be accepted unless all type and batch release tests have been passed.The third party must clearlyi dentify the fittings production date/code marked on the fittings,with each batch test performed

1.5Testing after delivery

All materials supplied to the site in Jordan shall be subjected to acceptance tests carried out by the Royal Scientific Society. Or similar accredited authority.The test should confirm that the materials and fittings are manufactured according to ISO4427,EN12201or equivalent;all Tests required for polyethylene fittings must be performed according to the above standards. If any of the tests mentioned in the standards cannot be performed by the Royal Scientific Society then the supplier should provide a third party certificate for those tests taking into consideration shall the statements mentioned in"third party witness"section.

<u>All testing costs should be borne by the supplier in all cases.</u>

1.6Fittings Packing and Protection

- All fittings must be packed in such a way to allow instantuseonsite with out additional cleaning.
- All electro-fusion fittings must be packed in transparent protective bags.The electro-fusion fittings must then be packed in carton boxes.
- All fittings shall be securely packed in crates and boxes to prevent damage during delivery. The cost of packing shall be deemed to be included in the Contract Rates and crates will not be returned.
- Fittings are normally supplied in separate cartons together with any associated small items, such as bolts and gaskets.

1.7 Identification

The supplier shall be responsible to ensure that each separate item,crate, or package has permanently attached to it, in a conspicuous position, an identification plate of weather- resistant materialon which are engraved orstamped;

- **The Manufacturers Name**
- **Contents Description and Quantity**
- **Serial Number or Reference Number Identifiable on the Delivery Note and Cross**

Referenced to the Purchase Order Item References.

- **Weight**
- **Tender Number–variable**

In addition the container shall be marked with the following information;

- **Total gross weight**
- **Total net weight**
- **Packing list reference number**

1.8Transportand Deliveries

- The supplier shall send to the Purchasers,one-week advance notice of all consignments of materials. Every consignment shall be accompanied by a detailed delivery note.
- The supplier shall deliver to and off load them at erialson to the storage are as directed by the Purchasers.All materials delivered will be examined and inspected by the Purchaser and taken over by him.
- The Supplier shall provide necessary details to the shipping line on precautions to be taken during loading/unloading,handling & transport of the pipes & fittings and other components.Supplier shall provideto the purchasera set of recommendations of manufacturer for handling,loading,unloading,transporting and storing of polyethylene pipes and fittings
- The Purchaser shall arrange reception and storage are as only.The supplier shall be responsible for off-loading all materials.
- The materials shall be delivered to the Purchaser at WAJ stores, Amman or any other place chosen by the Purchaser.
- The supplier shall also be responsible for all handling and transport activities up to WAJ store-yard, Amman
- The (DDP) price shall include all costs relating to above-mentioned requirements.

1.9 Handling

Care shall be taken during loading,transporting,and unloading to prevent damage to the pipes, or fittings. Under no circumstances shall pipes or fittings be dropped or rolled against one another. All pipes and fittings shall be examined. Any damaged materials must be rejected by the Purchasers.

1.10Details to be provided at the time of tender

All certificates must be from an accredited third party and the accreditation logo must be stamped on the certificate as per the requirements of IAF. No certificate will be accepted unless it is from an accredited third party.

1. Dates of batches or consignment deliveries.
2. The supplier shall state which of the sections of the schedule of requirements he proposes to price and supply.

3. Any alternative standards proposed including demonstration of equivalency or superiority to the standard specified, if allowed.

4. Any alternative materials proposed including demonstration of equivalency or superiority to the standard specified,these alternative materials should be subjected to the clients approval.

5. Where the supplier offers alternative standards, materials to those specified, the suppliershall provideprices forthosespecifiedandthealternativesproposed.

6. The supplier shall include in his price for the training elements related to the materials he proposes to supply and shall its the elements of training offered,if neededor requested.

7. The supplier shall provide prices for the equipment applicable to the sections of the schedule of requirements he intends to price.

8. The supplier shall provide full details of his materials tests and procedures.

9. Any alternative proposed specification for combined tracer and marker tape.

10. ISO or EN certification for management and product.

11. CV's of proposed training staff, if necessary.

12. Costs of Trainers expenses,if requested.

13. Training program, if requested.

1.11Documents to be provided upon delivery

The contractor shall submit at least the following documents:

1. Certificate of origin.
2. Packing list
3. Third Party inspection reports from accredited third party(inspection including allthe tests required in the standard)
4. Any other documents requested by the Engineer and the hand over committee

All above documents mustbe valid and in English.

1.12ManualsandTechnical Specifications

The supplier shall supply full technical specifications for the items to be supplied at the time of tender.In additionhe shall provide full instruction manuals,which describe thec orrect methods and procedures necessary to construct the pipeline system in accordance with best practice.

1.13Additional Services

The supplier shall provide details of additional services,which he can providee.g.technical adviceand supportand,in particular,shall state his capability for supporting the project in the Amman location at the time oftender.

2. Polyethylene Fittings

2.1fittings used forexisting networks

Fittings used for polyethylene pipes must be manufactured and tested according to the standards shown in the following tables. As shown, table 2.1 is standards for fittings for WAJ uses, such asmaintenancepurposesand storingin warehouses.

2.2fittings used fornewinstallations

For the new projects,WAJ recommends that all fittings should be installed using electro- fusion technology,table3.2shows the standards for the fittings used in the new projects.

2.3 Connection Type

Table 2.3Connection Type

Diameterofpipe(mm)	Connection Type	Standard
25-125	MechanicalorElectro-fusion	Accordingtotables: 3.1.a , 3.1.band3.2
125and above	Buttweldingor Electro-fusion	Machine:ISO 12176 ISO 13953,ISO 11414

The Butt welding machine must befully automatic

2.4DesignRequirements:

- The design of fittings mustensurethat the wires which coiled around the innerpart of electrofusion fittings are built in the bodyof fittings not separated from it.
- The cuer of PE EF Tapping shall becertified for potable wate ruse.

No.		Description	InstallationType	Standard No	Testing method
	1.	PEConnector	Compression	ISO14236:2000	ISO 3501,ISO 3503,
		(25mm,32mm,63 mm)			ISO 3458,ISO3459
	2.	PEEFCollar	Electro Fusion	ISO4427:2004 or	ISO 13955,ISO13954,
		(125mm, 180mm,250mm,25mm,32		Equivalent:	ISO11413
		mm,63 mm)		EN12201-3 :2003	
	3.	PEReducer	Compression	ISO14236:2000	ISO 3501,ISO3503,
		(32mmX25mm, 63mmX25mm,63X32)			ISO 3458,ISO3459
	4.	PEAdaptor	Compression		
		(2"(63mm)Male,1"(32mm)Male,			
		3/4"(25mm)Male)[a]			
	5.	PEFlangeAdaptor	Electro Fusion	ISO4427:2004 or	ISO 13955,ISO
		(125mm, 180mm,250 mm)		Equivalent:	13954, ISO 11413
				EN12201-3 :2003	
	6.	PETee	Compression	ISO14236:2000	ISO 3501,ISO3503,

		(63X63X63mm,32X32X32mm,			ISO 3458,ISO3459
		25X25X25mm,63X63X32			
		,63X63X25,32X32X25)[b]			
	7.	PEEF Tee180X125(socket)	Electro Fusion	ISO4427:2004 or	ISO 13955,ISO
				Equivalent:	13954, ISO 11413
				EN12201-3 :2003	
	8.	PEEndCap	Compression	ISO14236:2000	ISO 3501,ISO3503,
		(63mm,32mm,25 mm,.....)			ISO 3458,ISO3459
	9.	PEElbow63mm,32mm,25 mm	Compression		
	10.	PEEF Elbow90^0	Electro Fusion	ISO4427:2004 or	ISO 13955,ISO
		(180(socket),125mm,250mm, ...)		Equivalent:	13954, ISO 11413
	11.	Electrofusionendcap	Electro Fusion	EN12201-3 :2003	
		(125mm, 180mm)			
	12.	PEEF Tapping	Electro Fusion		
		(125*25, 180*25, 125*63,			
		125*32,63*32,63*25,)			
	13.	PEEF Elbow45^0	Electro Fusion	ISO4427:2004 or	ISO 13955,ISO
		(180,125mm,250 mm, ...)		Equivalent:	13954, ISO 11413
				EN12201-3 :2003	

Table 2.1Polyethylene fittings onPolyethylene pipes

Table 2.2: Fittings for new installation Tenders

No.		Description	Installation/ Type	StandardNo	Testingmethod
	1.	PEConnector	ElectroFusion		
		(25mm,32mm,63mm)			
	2.	PEEFCollar (125mm, 180mm,250mm,25mm,32mm,	ElectroFusion		
		63mm)			
	3.	PEReducer	ElectroFusion		
	4.	PEAdaptor	ElectroFusion		
		(2"(63mm),1"(32mm),3/4"(25mm))			
	5.	PEFlangeAdaptor (125mm, 180mm,250 mm)	ElectroFusion		
	6.	PETee[b] PETee	ElectroFusion		
		(63X63X63mm,32X32X32mm,			
		25X25X25mm,63X63X32			

		,63X63X25,32X32X25)[b]			
	7.	PEEFTee(socket)orsaddlebranch(lineto line)	ElectroFusion		
		(180X125,180X180,.....)			
	8.	PEEndCap	ElectroFusion		
		(63mm,32mm,25mm,.....)			
	9.	PEElbow63mm	ElectroFusion		
	10	PEEFElbow(socket)	ElectroFusion		
		(180mm,125 mm,250mm.....)			
	11	Electrofusionendcap	ElectroFusion		
		(125mm, 180mm)			
	12	PEEF Tapping	ElectroFusion		
		(125*25, 180*25, 125*63,			
		125*32,63*32,63*25,)			
	13.	Connector(25 mm,32mm)[c]	Compression	ISO14236:2000	ISO3501,ISO3503,
					ISO3458,ISO3459

a. **Adapter is used to connect Polyethylenepipes to pipe made from another material,and it should be compression from oneside and male threaded from the otherside.**
b. **ItisnotallowedtousetheweldableoutletKit**
c. **When the installation is near to the customer cabinet,whether the connection was straight connection or using elbow, compression fittings shouldbe used**

Fittings and Joints

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 nittrile elastomer "O" ring.

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

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 × 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.

3 . 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 "0" 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.

4 . 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:

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 "0" 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, "0" rings .. etc. as mentioned above (in a and b).

5. 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.

6. Electrofusion Connections

a. General :

Connection design limitations and manufacturer's joining procedures must be observed. Tools and components required to constructed 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 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 through rising 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, al least once for every 600 joined connections.

The manufacturer shall subject samples of each productions 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 filed 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 law 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.

6. TECHNICAL SPECIFICATIONS FOR Galvanized steel pipes & Fittings

A. Galvanized Steel Pipes :

1. Galvanized steel pipes must be seam-welded, galvanized threaded pipes, **(HevaySeries)** in accordance with **BS. 1387** latest edition or approved equal.
2. The wall thickness and weight for each Size of the pipe should be as follows:

Nominal Size(DN)	Designation of Thread	Outside Dia.		W.Thicknes Mm	Weight Screwed & 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
80	3"	89.5	88.1	5.0	10.5
100	4"	114.9	113.3	5.4	14.8

3. The pipe shall be supplied screwed in accordance to B.S. 21 Pipe Threads, and shall have the screw threads clean well cut and square with the axis of the pipe and be free from excessive burrs. Each pipe shall be supplied with a socket at one end and shall have a protecting ring affixed to the unsocketed end, to prevent damage to the leading thread. The end of each socket shall be chamfered internally.

4. The galvanization shall be done by the hot-dip Zinc Coating process and shall satisfy the copper sulfate test prescribed in Appendix C. of BS. 1387 latest edition.

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

6. The Socket shall in accordance with in BS. 1387 latest edition

7. Galvanization test as In BS. 1387 latest edition.

B . GALVANIZED STEEL PIPE FITTING :

1. Scope of Use:
The fitting shall be used with the heavy series of pipes according to BS. 1387 - 1985 galvanized pipes. These fittings must be suitable for this type of pipes. It must also be suitable for potable water use.

2. Designation:
The fittings shall be Malleable Cast-Iron Screwdown Pipe Fittings in accordance with BS. 143 and BS. 1256/1986 or approved equal.

3. Threading
Threads must be in accordance with BS. 21 .

4. Working Pressure:
Working pressure shall not be less than 16 bar with 24 bar hydrostatic pressure test.

5. Galvanization:
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.

6. Marking:
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 may be cast on, painted or cold stamped.

7.Technical Specifications For Horizontal Centrifugal Pumping Unit

A) Horizontal Pump

Description

Pumping machinery should be supplied having standard (ISO-9906,ISO-2548) for accepted tolerance of flow rate ,power,and effeceincy. pump type and material should be clearly mentioned, The performance curves showing the efficiency and characteristics of the pump .

Compliance sheet should be rightly filled for each and every quoted pump whereas its performance tested and certified as per ISO standards requirements.

Unless otherwise spicfied, the pump shall be centrifugal multistage type and shall be well proven in design, reliable, heavy duty and well finished material. Pump set shall be supplied robust construction skid with foundation bolts , high and low pressure gauages,air release valve, flexable coupling.

The pump shall be free from unacceptable noise. The limiting sound pressure level of the pump-set with the motor coupled up at the pump closed valve head shall not exceed 86 dBA according to operating standards,with carefully balanced rotaing parts to prevent undue vibration.

The pump shall have stable characteristic performance over the entire head range mentioned. The pump shall be designed for the BEST EFFICIENCY at duty point that required at bill of quantity and compatible to various point along the system .(no flat curve is accepted)

Design and construction of various components of the pumps shall comply to the following general specification:

Pump Stage Casing and diffuser:The casting of casing shall be cast iron free from blowholes and other defects. The pump casing shall be flanged with machine matching faces. The bowls shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated capacity or 1.5 times the shut-off head whichever is greater.

Pump impellers: The impeller shall be designed to withstand all possible stresses , properly balanced and machine groved with water passage for minimum efficiency loss Renewable wear ring: must be fitted to the casing with bronze or equivillant alloy renewable wear ring, to maintain good efficiency while operation in different water quality conditions.

Pump shaft: shall be made of high tensile stainless steel(1.4307 ,304L)or above ,. The critical shaft speed shall be well away from the operating speed and in no case less than 130% of the rated speed to avoid resonanace .

Pump coupling: The pump and motor shafts shall be connected with an adequately sized flexiable coupling (Flender Type)or equivelent of proven design with rubber spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.

Shaft sleeve: The pump shaft shall be protected from wear by renewable bornze or stainless steel sleeves.

Pump casing guide bearing: shall be of approved abrasion-resistant materials.

Bearings:

a- Heavy duty bearings Ball and Roller Type shall be sealed, grease Lubricated and protected from the ingress of dust and water, These bearing shall conform to the relevant BS, ISO, API or other equivalent standard and shall be readily obtainable and trouble free operation shall be furnished

b- The bearings offered shall be capable of taking both the radial and axial thrust coming into play durin operation.

c- Bearing shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings house

d- The bearing life 25000 hrs with continuous operation and rated conditions and at least 16000 hours at maximum loads and speed.

e- For each pump, Proper lubricating grease for the bearing shall be provided by manufacturere enough to complete at least 16000 working hrs. the bearing lubricating element does not contaminate the liquid pumped.

f- Extra bearing kit must be provided for each pump set (Pump and motor) with lubricating grease.

2. For monitoring and protection purposes, each pump bearing shall be provided with a linear resistance thermal protectioon sensors pt (100) .

3. **Stuffing Boxes**: Stuffing box design should permit replacement of packing without removing and parts other than the gland. Stuffing boxes of ring construction type shall be provided wherever specified. Packing ring stuffing boxes shall be properly lubricated and sealed as per service requirement and manufacturer's standards.

4. **Mechanical seal** ; should be of heavy duty type if provided ,rotary and stationary two parts material shall be of silicon carbide or equivalant.

5. **Base Plate:** A common base plate mounting both pump and motor shall be provided. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed to minimize misalignment caused by mechanical forces such as normal piping thrust, internal differential thermal expansion and hydraulic piping thrust. suitable draintroughs and drip lip shall be provided. the supplier shall give complete details for the foundation set on which the pumping set will be mounted.

6. **Assembly and Dismantling**: Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.

7. **Pump Efficiency**: shall not be less than 75% for pumps have shaft power more than 37kW and closest to 70% for pumps have shaft power less than 37kW.

8. The pumps speed as required in BOQ or at motor specs.

9. All bolts, nuts, studs, screws, washers etc. shall be made of galvanized or stainless steel.

10. Lables and plates non-corrodible metal and rating plates shall be securely screwed or riveted to each pump, motor casing and foundation, These shall be stamped or deeply engraved in such a way that the lettering will not be obliterated Rating plates shall include all information required by ISO 9906 or other equvilent in addition to the pump make,Output at normal duty speed, serial number, pump impeller size, head and efficiency, rated speed, power and current, operation voltage, IP, class of insulation.

11. Pressure gauges: Bourdon tube type suction and delivery pressure gauge of suitable range and graduated in both KPa and metres head of water shall be provided. the scale of suction and delivery pressure gauge shall be from -10 to +10 at the suction and from 0 to 400 m at discharge end. The gauge complete with isolating valve shall be mounted at the pump suction and delevery.

12. **Testing For Horizontal Centrifugal Pumps**: The manufacturer shall conduct all tests required to ensure that the equipment furnished shall conform to the required specification and compliance with

the requirement of applicable codes and Standards.original test certificates and performance curves have to be submitted whithin hand over.

a- **Hydrostatic Tests:** All pressure parts shall be hydraulic tested at 200% of pump rated head or at 150 % of shut off head whichever is higher.

b- **Performance Tests:** All the pumps shall be tested in Manufactur's Works at reated speed for capacity, efficiency and break horse power. Pumps shall be given running test over the entire operating range covering from the shut off head to maximum flow. Testing of pumps shall be in according to DIN EN ISO 9906:2012 or iso 2548 . A certified factory performance test should be attached. The bidder shall submit along with his offer or on the date of signing of agreement the original copies in English and the relevant standards used in the material, production test certificates,originial curves Shall be provided.

c- The test shall be preferably conducted with actual motor being furnished.

13. **Mechanical Balancing** : All Rotating components of the pumps shall be staticslly balanced . In addition to static balancing, rotating components of the pumps shall be balanced dynamically at or near the operating speed.

B) Electrical Motor

Description

The Motor shall be manufactured in compliance with National Electrical Manufacturer Association (NEMA) standards required three-phase motor shall be capable of operating at rated voltage of 400 Volts at 50 Hz. The motor should be capable of handling 10% variance in voltage and service factor 1.15. Winding of the motor shall rewind-able type with class-IC40 insulation and IP55 protection class.

The origin, make and material of the motor should be clearly mentioned in the technical data complience sheet. The winding material should be copper with Insulation class F, Insulation material quality is defined by IEC 34-1 Standards in distinct insulation classes. The motor should have non-disposable/ non-hermetically sealed winding. The insulation class of the winding material should be mentioned. For each model quoted, all the technical parameters such as rated voltage, Power factor, efficiency, full load ampere, speed and other similar parameters should be provided in the technical data sheet.

1. Driving motor should an electric squirrel cage type, totally enclosed fan cooled (T.E.F.C.) , horizontal foot mounted, construction type B3 according to DIN 42950, and shall be protected against harmful deposites of dust and water protected in accordance with ingress standard IP55.
2. shall be fitted with greaspable ball bearing.
3. each motor bearing shall be provided with temperature detector (pt100).
4. The electric motor shall be provided with a terminal conduit box of adequate size for the supply cables.
5. The electric motor shall be continuously rated (110~115) % above the maximum power absorbed by the pump at duty point.

6. The electrical motor shall be provided with inside resistance temp. demand (RTD) embeded in motor winding.
7. The electric motor Efficiency and PF shall not be less than 0.85
8. Motor should adapt taking off on all starting methods(dol., auto trans ,soft starter, variable speed
9. Operating and maintenance instruction - copies of the following shall be
    a. Operating and maintenance instructions.
    b. workshop manuals.

Material of constructio

The pump shall be manufactured from the following materials or from material superial to the following.

If discharge pressure equal 25 bar		
#	Part	Material
1	Suction	Grey Cast Iron EN-GJL-250
2	Discharge	Grey Cast Iron EN-GJL-250
3	Diffuser	Grey Cast Iron EN-GJL-250
4	Shaft	Chrome steel 1.4021
5	Impeller	Bronze CC480K-GS
6	Bearing housing	Grey Cast Iron EN-GJL-250
7	Bearing Cartridge	Ceramic SSIC
8	O-ring	EPDM 80
9	Shaft seal housing	Grey Cast Iron EN-GJL-250
10	Casing Wear Ring	Bronze CC480K-GS
11	Shaft Sleeve	Chrome steel 1.4057
12	Bearing sleeve	Ceramic SSIC

If discharge pressure higher than 25 bar		
#	Part	Material
1	Suction	Carbon steel GP 240 GH+N
2	Discharge	Carbon steel GP 240 GH+N
3	Diffuser	Carbon steel GP 240 GH+N
4	Shaft	Chrome Stainless steel 1.4021
5	Impeller	Bronze CC480K-GS
6	Bearing housing	Grey Cast Iron EN-GJL-250
7	Bearing Cartridge	Ceramic SSIC
8	O-ring	EPDM 80
9	Shaft seal housing	Grey Cast Iron EN-GJL-250
10	Casing Wear Ring	Bronze CC480K-GS
11	Shaft Sleeve	Chrome steel 1.4057
12	Bearing sleeve	Ceramic SSIC

This specification sheet must be completely filled - in by the bidder and submitted With the offer,otherwise **offer will be terminated.**

Flow Switch

GENERAL:

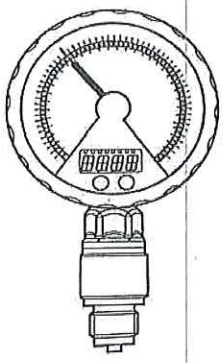
Water Flow Switches are used to monitor and control the flow rate of fluid within an industrial process system (sending trip signals to a pump to protect it in the dry running conditions)

Flow Switch Specifications	
Type	Flapper (Paddle)
Temperature Range	0 C to 50 C
Maximum Fluid Temperature Range	0 C to 50 C
Electrical Micro Switch	SPDT Rating : 220 VAC
Electrical Connections	Screw Terminals
Nominal Pressure	10 Bar
Average Flow Rate	150 m^3/hour
Pipe Diameter	300 mm
Material of Body	Pressure die-casted Brass with plastic top enclosure
Materials of wetted parts	Brass and Stainless Steel
▪ The paddle length should be appropriate to the pipe diameter according to the manufacturer recommendations.	

Digital pressure gauge

GENERAL:

Digital pressure gauges measure the pressure in a system and display the value on an integrated digital display. These gauges are more accurate and easier to read than traditional mechanical gauges and can store and transmit pressure data electronically.



Gauge Pressure Specifications	
Type	Digital, with screen
Voltage	220 VAC
Temperature Range	0 C to 50 C
Nominal Pressure	40 Bar
Average Flow Rate	150 m^3/hour
Pipe Diameter	200 mm
Material	
Pressure port / housing	stainless steel
Display housing	stainless steel
Diaphragm	Teflon or stainless steel or tantalum
Display	graphic LCD display: (resolution 128x64) or higher Measured value display: 4-7 digits.

Pressure Switch

The pressure-sensing element may be of the Bourbon tube, spiral, helical, bellows or diaphragm type, depending upon the application requirements. The pressure sensing element shall be of AISI 316 SS.
Pressure switches shall withstand the maximum pressure of the system to which it is connected. In addition, over range protection, (at least 1.5 times the maximum scale reading), shall be included for all instruments. Gauge protectors shall be included wherever required to withstand maximum surge pressure.
Set point for pressure switches shall be adjustable throughout the operating range.
Transistor or relay outputs for On/Off control or alarm function
Pressure switches shall have ½" NPT (M) process connection.
Pressure switches generally be used for ON-OFF applications with an adjustable set point and a differential gap with a reference or calibrated scale.
The switch shall also be hermetically sealed with gold plated contacts. Degree of protection shall be NEMA type 4X, IP67 or better.
Where isolating transformers are not used, the rated fused short-circuit current shall be not less than the short-circuit strength assigned to the control gear.
Hart communication.

I. Electrical and SCADA

1.1 Water Pump Station

1.1.1 Standards and Regulations

All electrical work should be done to the requirements of national technical specifications, in addition to the international codes. These standards are:

- General Technical Specifications for Buildings, Electrical Installations, Part 3 Ministry of Public Works and Housing, Jordan.
- Jordanian Electrical Codes.
- Requirements for Electrical Installations for Buildings (IEE Wiring Regulations), published by the Institute of Electrical Engineers – London (UK).
- International Electro-technical Commission (IEC) Standards.
- British Standards Institute (BSEN)
- IES/CIBSE Illumination codes.
- National Fire Protection Association (NFPA)
- Civil Defense Fire Department.
- The Client Requirements.
- The electricity company regulations and requirements

1.1.2 Pump Station Facilities

1.1.2.1 Power Transformer

1. Design of power transformer to provide power for the electrical installations of pump station.
2. The capacity of the transforms shall be determined after estimation of the demand load of the project.
3. A letter shall be issued by the Client /Consultant to the related electricity company

describing the electrical load of the project and requesting the power supply to energise the project.

4. The Contractor shall coordinate with the related Electricity Company to supply and install the power transformer in its location within the pump station site.
5. A provisional sum will be allocated in the BOQ for the transformer item to be paid through it.
6. The price of this item is equal to the total costs required by the electricity company, in addition to that 10% shall be paid to the Contractor as overhead and profit.
7. All Civil works needed for installation the transformer will be paid for the Contractor as lump sum price.

1.1.2.2 Main Distribution Board

1. Design of main distribution board (MDB) to be installed in the electric room of the pump station building.
2. The main distribution board shall include the following compartments:
    - Compartment for energy meter which is supplied and erected by the electricity company.
    - Compartment for main moulded case circuit breaker incomer.
    - Compartment for outgoing moulded case circuit breakers
    - Compartment for the UPS and 24VDC batteries and charger.
    - Compartment for the capacitor bank.
    - All power, control and monitoring devices, indication lamps etc.

1.1.2.3 Control Panels

- Design control panels (CP), one for each pump. The purpose of these control panels is to provide power and control the operation of the pumps' motors and these control panels shall be installed inside the electric room of the pump station building.
- Each control panel includes busbar, main moulded case circuit breaker, starter, power, control and monitoring devices, four-way selector switch (Local, Off, Site, SCADA), On/Off push buttons, indication lamps etc.
- The control panels enclosures shall be part of the main distribution board.

1.1.2.4 Local Control Panels

- Design local control panels (LCP) to be installed near the pumps and their motors and control the operation of the pumps' motors.
- Local control panel comprises isolator rated as per the machine load, emergency stop, On/Off push buttons, indication lamps.

1.1.2.5 Earthing System

- Design of an earthing system for the pumping station to achieve an earth resistance not more than 2 ohms.
- Earthing system includes earthing rods, earthing conductor connects the main earthing rod with the earthing busbar inside the main distribution board, earthing pits, round conductor connecting the earthing rods.
- Designer shall prepare earthing calculations using adequate calculation method to achieve the number of earthing rods and earthing pits around the pump station building in addition to the size of earthing round conductor.

1.1.2.6 Lightning System

- Design of lightning system for the pumping station and other buildings to achieve an earth resistance not more than 10 ohms.
- The lightning system includes air terminals and a lattice of tape conductors, down conductors, earthing rods, earthing conductors, earthing pits.
- Designer shall prepare the risk analysis to determine if the structure(s) need lightning system

or not.

- Lightning protection system shall comply with the requirements and recommendations of BS EN/IEC 62305-1:2011 & IEC 62305-2:2011 standard with the relevant parts and sections.

1.1.2.7 Distribution Board

- Design of 3 phase distribution board for the pump station building to provide power for lighting, power, and AC circuits.
- Distribution board includes main isolator rated 100Amp,10A MCBs for lighting,16Amp MCBs for sockets and 20Amp/25Amp MCBs for AC and Water heaters. Each AC and water heater shall have separate circuits.
- Also, any other separate building such as the Guard house shall have its own distribution board.

1.1.2.8 Main and Branch Low Voltage Power Cables

- Design and calculate the size of power cables between the transformer and the main distribution board (MDB) in addition to the branch power cables between the control panels and the related motors.
- Design and calculate the size of all branch power cables between the main distribution board (MDB) and the electrical panels.
- Cables inside electric and pumps rooms shall be installed in concrete trenches. When cables leave the trench and are connected to the terminal box of the motor, they should be installed on galvanized cable ladder or galvanized covered cable tray.
- Main power cables from the transformer and diesel generator to the automatic transfer switch (ATS)shall be single core, copper conductor, XLPE insulated, aluminium wire armoured, and PVC sheathed.
- Main power cable from the automatic transfer switch (ATS) to the main distribution board shall be single core, copper conductor, XLPE insulated, aluminium wire armoured, and PVC sheathed.
- Indoor power cables shall be multicore, copper conductor, XLPE insulated, and PVC sheathed non armoured.
- Outdoor power cables shall be multicore, copper conductor, XLPE insulated, and PVC sheathed non armoured.
- All outdoor power cables shall be installed inside UPVC pipes.
- If for limited cases where cables will be installed directly buried, they shall be armoured.
- All indoor and outdoor cable supporting systems such cable ladders, cable trays and PVC and galvanized conduits shall be included in the price of the cables.
- Designer shall use suitable software and submit voltage drop, short circuit and cables sizing calculations for all electrical loads taking into consideration that the voltage drop shall not exceed 4%.

1.1.2.9 Control, Signal and Instrumentation Cables

All control, signal and instrumentation cables which shall be installed between the motors, pumps, instruments and measuring devices and the related electrical and PLC panels shall be mentioned as an item in the BOQ. The contractor shall prepare a shop drawing for the types, sizes and routes of these cables.

1.1.2.10 Trenches for Power Cables

- Indoor concert trenches shall be located underneath the electrical panels and between the control panels and motors with size (Depth X Width) (60X60) cm. These indoor concrete trenches are covered by galvanized chequer plates.
- Outdoor cables trenches shall have 80cm depth, laying of cables inside100mm UPVC conduits, soft sand below and above the UPVC conduit, solid concrete blocks, warning tape,

and finally compacted backfilling.

1.1.2.11 Electrical Manholes

- Electrical concrete manholes (80 x 80 x 80) dimensions for outdoor installation cables with medium-duty steel covers.
- Spacing between manholes shall not be more than 50 meters.

1.1.2.12 Indoor Lighting

- Pump station building and the related buildings shall be furnished with lighting points which include PVC conduits, wiring, lighting switches, and lighting fixtures.
- Lighting points shall be 3 wire systems with 2.5mm2 wire size.
- The following table presents the types of lighting fixtures and the required illumination for the relative spaces:

Table 1-1 types of lighting fixtures and the required illumination for the relative spaces

Space	**Lighting Level (LUX)**	**Luminaire**
Pumps Hall	300	High bay LED lighting fixture with efficacy min. 120 lumen/watt, heavy die- cast aluminium, 4000K, IP-54.
Electrical Room	400	LED lighting fixture, min 120 lumen/w, 4000K, IP-20.
Operator Room	500	LED lighting fixture, min 120 lumen/w, 4000K, IP-20.

1.1.2.13 Emergency Lighting

- Emergency lighting fixtures shall be provided for the buildings and shall comprise exit and escape route luminaries to facilitate the safe evacuation of personnel from any building or major "dry" structure in the event of power failure.
- Emergency lighting shall be provided in any area where work may be required during such a power failure.
- Emergency luminaries shall be LED types with self-contained battery/charger/inverter modules.
- Emergency luminaries shall be capable of not less than 3 hours operation.

1.1.2.14 External Lighting

- Design of external lighting poles along the roads and the boundary of the pump station.
- Lighting poles shall be 7 meters height with 150watt LED luminaire.
- The spacing between lighting poles shall be 25 meters.
- Design of external lighting control panel (ELCP) including main MCCB incomer, number of outgoing MCCBs with rating not less 25 Amp., contactor, photocell and timer with 3-way selector switch (Manual, Off, Automatic).
- Each circuit shall serve 10 lighting poles as maximum.
- The ELCP shall be supplied by power from the main distribution board.
- Design of power cables with size not less than 4x16 mm2 CU/XLPE/SWA/PVC between the lighting poles.

1.1.2.15 Lighting Calculations

Appropriate lighting calculation software shall be used for indoor and external lighting to determine the adequate number of lighting fixtures and verify the LUX level.

1.1.2.16 Sockets

- Pump station building, and related buildings shall be furnished with sockets outlets and their points which include PVC conduits and wiring.
- The sockets points shall be 3 wire systems with 2.5mm2 size. For AC and water heaters, 3x4 mm2 wiring shall be used. For external installations, galvanized conduits shall be used.

1.1.2.17 Isolators

- Any mechanical machine inside or outside the pump station building such as AC units, fans, crane, service pump...etc shall be equipped with isolator (disconnect switch) for maintenance and isolation purpose.
- The rating of the isolator shall be suitable to the related machine.

1.1.2.18 Fire Alarm System

Conventional fire alarm & detection system for the pump station building and the related buildings shall be designed as per the requirements of Civil Defense department. Fire alarm system main components:

- Fire Alarm Control Panel
- Smoke detectors
- Heat detectors
- Manual call stations
- Visual / Sounder alarms
- Wiring and conduits

1.1.2.19 Satellite System

Guard house building shall be furnished with satellite dish of 80cm installed on the building roof, RJ6 wiring inside PVC conduit from the roof to appropriate point inside building.

1.1.2.20 Programmable Logic Controller (PLC)

- Design of programmable logic controller (PLC) to be installed in the electric room. The function of this PLC is to monitor and control the operation and status of the electromechanical equipment such as motors, pumps, and instruments, level meters, flow meters, actuated valves. Etc.
- Programmable logic controller (PLC) comprise enclosure with power supply, central processing unit (CPU), Digital input/output modules. Analogue input /output modules, communication module.
- Consultant shall prepare full detailed design for the PLC and prepare a list of the digital and analogue inputs/outputs which are related to the pumps and related devices and instruments with additional spare I/Os not less than 25% of the used I/Os.
- The PLC shall be supplied by power from the UPS of the main distribution board.
- The PLC shall be linked with the SCADA system via one of the following media:
- Long Term Evolution (LTE)4TH Generation technology with modem.
- Fiber Optic Cables with fiber optic/ethernet switch

1.1.2.21 Instruments and Measuring Devices

Design all needed measuring devices such as flow meters, level meters, pressure transmitters, flow switches etc. All power and control wiring between these devices and their related panels and PLC shall be provided and executed by the Contractor. All instruments shall be supplied by power from the UPS of the main distribution board. The following instruments shall be installed:

- Pressure transmitter (4-20 mA) on the main suction pipe.
- Pressure transmitter (4-20 mA) on the main discharge pipe.
- Pressure transmitter (4-20 mA) on the suction pipe of each pump.
- Pressure transmitter (4-20 mA) on the discharge pipe of each pump.
- Flow switch on the suction pipe of each pump.
- Ultrasonic level meter on the top of the treated water reservoir.
- Electromagnetic flow meter on the main discharge pipe.
- Electromagnetic flow meter on the main suction pipe which is coming from the treated water reservoir.
- Platinum Resistance Thermometer (PT100)
- PT 100 sensors shall be installed in the front and rear bearings of each pump in addition to the three windings of each motor to measure the temperatures and send them to the related PLC as analogue signals.

1.1.2.22 Valves with electrical actuators

Some valves are electrically operated and equipped with electrical actuators as per the mechanical drawings and details. The following valves are usually equipped with electrical actuators:

- Valve on the suction pipe of each pump.
- Valve on the discharge pipe of each pump.
- Valve on the main suction pipe of the pumps.
- Valve on the main discharge pipe of the pumps.
- Any other valves shown in the mechanical drawings.

Each valve actuator must incorporate local controls for Open, Close and Stop operation and a Local/Stop/Remote mode selector switch and working as follows:

- Local mode: The valve can be opened/closed from the site only via local controls.
- Stop mode: The valve is stopped, and no action can be done either locally or remotely.
- Remote mode: The valve can be opened/closed via SCADA selector soft key (Auto, Manual) and shall have two options:
    - Option 1: In the Remote mode, and the SCADA selector soft key in Auto mode, the valve shall be opened/closed automatically according to the operation of the pump.
    - Option 2: In the Remote mode, and the SCADA selector soft key in Manual mode, the valve shall be opened/closed manually by the SCADA operator.

1.1.2.23 Fiber Optic Cable

Design of single mode fiber optic cable (8 fibers) to be connected between the PLCs inside the pump station and the main SCADA system. The fiber optic cable shall be installed inside 75 mm UPVC pipe in the same trench of the pipelines. Work shall include the needed fiber optic splices (joints) and manholes.

1.1.2.24 On-Grid Photovoltaic Solar System

- Engineer shall prepare and submit for the Client feasibility study for installation On-Grid Photovoltaic Solar system for the pump station site with adequate kWp taking into consideration the payback for the system shall not be more than 7 years.
- If the result of the study is feasible, then the Consultant shall design an On-Grid Photovoltaic solar system for the pump station site.

Consultant shall submit the following:

- Product Datasheet: For each type of product indicated. Include dimensions; shipping, installed, and weights of elements; and data on features, ratings, and performance.
- Design drawings and calculations.

- Detail equipment assemblies and indicate dimensions, weights, method of field assembly, components, and location and size of each field connection. Show access and workspace requirements and required clearances.
- Wiring Diagrams for Power, signal, and control wiring. Details of internal & interconnecting wiring and differentiate between manufacturer-installed and field-installed wiring.
- Qualification Data for qualified testing agency.
- The system shall include PV panels, steel structure for rooftop mounting, all required supports and civil works according to wind and snow design calculations, DC cables, AC cables, control cables, cable trays, conduits, DC/AC Inverters, circuit breakers, electrical distribution boards, connecting the system with the power system in the buildings, and all accessories required to complete the work.
- The PV system shall be considered as an optional item in BOQ.

1.1.3 Pumps and Motors

Pumps are characterized by the flow(Q) in m3/hr and head (H) in (m). The electrical power in Kilowatt (KW) absorbed by the pump depends on the pump's flow, head and efficiency.

The following formula is used to calculate the absorbed power by the pump:

Pump absorbed power (KW) Ppump = (Q x H x 9.81) / (3600 x pump efficiency)

Motor rated power (KW) Pmotor = (P/motor efficiency) x1.2

1.1.4 Operation of Pumps

Each pump should be operated manually or automatically from either of three locations.

- Local control panel (LCP)
- Control panel (CP)
- SCADA

Table 1-2 Methods of Operation for the Pumps

CP Selector Switch				CP P.B	LCP P.B	SCADA Selector Soft Key		Emergency Stop	Description
Local	Off	Site	SCADA			Auto	Manual		
Active	NA	NA	NA	Active	N. A	NA	NA	Active	Manual Operation P.B AT CP
NA	NA	Active	NA	NA	Active	NA	NA	Active	Manual Operation P.B AT LCP
NA	NA	NA	Active	NA	NA	NA	Active	Active	Manual Operation via SACDA
NA	NA	NA	Active	NA	NA	Active	NA	Active	Fully Automation

Notes:

- NA: Not Active
- P.B: Push Button
- SCADA: Supervisory, Control and Data Acquisition
- CP: Control Panel

- LCP: Local Control Panel

1.2 Reservoir

1.2.1 Standards and Regulations

All electrical work should be done to the requirements of national technical specifications, in addition to the international codes. These standards are:

- General Technical Specifications for Buildings, Electrical Installations, Part 3 Ministry of Public Works and Housing, Jordan.
- Jordanian Electrical Codes.
- Requirements for Electrical Installations for Buildings (IEE Wiring Regulations), published by the Institute of Electrical Engineers – London (UK).
- International Electro-technical Commission (IEC) Standards.
- British Standards Institute (BSEN)
- IES/CIBSE Illumination codes.
- The Client Requirements.
- The Electricity Company and the public guidelines and regulations must be observed.

1.2.2 Reservoir Facilities

1.2.2.1 Power Supply

- Supply and install power supply to provide power for the electrical installations of the reservoir.
- Coordination with Irbid District Electricity Company shall be conducted for this purpose.
- A provisional sum will be allocated in the BOQ for the power supply item to pay through it.
- The price of this item is equal to the total costs required by the electricity company, in addition to 10% shall be paid to the Contractor as overhead and profit.

1.2.2.2 Main Distribution Board

- Main distribution board (MDB)is designed to be installed in the electrical room of the reservoir site.
- Main distribution board comprises compartment for main moulded case circuit breaker incomer, compartment for the UPS and compartment for outgoing moulded case circuit breakers.

1.2.2.3 Earthing System

- Design of an earthing system for the reservoir building to achieve an earth resistance not more than 2 ohms.
- Earthing system includes earthing rods, earthing conductor connects the main earthing rod with the earthing busbar inside the main distribution board, earthing pits, round conductor connecting the earthing rods.
- Designer shall prepare earthing calculations using adequate calculation method to achieve the number of earthing rods and earthing pits around the pump station building in addition to the size of earthing round conductor.

1.2.2.4 Distribution Board

- Design of 3 phase distribution board for the Guard and electrical building to provide power for lighting, power, and AC circuits.
- Distribution board includes main isolator rated 100Amp,10A MCBs for lighting,16Amp MCBs for sockets and 20Amp/25Amp MCBs for AC and Water heaters. Each AC and water heater shall have separate circuits.