5-1 أعمال الحفر والردم

5-1-1 الترتيب والحصول على جميع التراخيص الخاصة بأعمال الحفر للموقع من السلطات ذات الصلة كما يحددها مهندس وزارة الكهرباء والماء.

5-1-2 في حال فشل الحصول على التصاريح الضرورية لقطع أسفلت الطريق، على المقاول استخدام طريقة الحفر تحت الأرض (البورنج) لتمديد عبارات الكيبلات، والتقنية الواجب استخدامها هي حفر مسارات تحت الطرق بدون قطع الأسفلت على أن لا تتسبب هذه الطريقة بأي اضطرابات سطحية. وعلى أن تجهز ماكينة الحفر على مسافة (2) متر من مدخل الحفر وبعرض (1) متر أو أقل وعلى أن لا تزيد مسافة الحفر عن (50) متر وفي حال تعدي المسافة عن الـ (50) متر يجب استخدام طريقة الأنفاق المصغرة.

ومن أجل تجنب حدوث أي تلف للخدمات الحالية والموجودة تحت الأرض، على المقاول أولا تنفيذ فحص الموقع باستخدام الأدوات المناسبة أو الحفر التجريبية قبل البدء في أعمل الحفر الرئيسة، ويجب على المقاول استخدام نظام قابل للتوجيه لتركيب عبارات الكيبلات وأن النظام المستخدم يجب أن تكون لديه القدرة على التوجيه عن بعد لرأس الثقب وذلك على درجة عالية من الدقة ويجب تنفيذ أعمال التوجيه والرقابة المتقدمة لرأس الحفر بالتنسيق مع نظام تحديد المواقع لرأس الحفر، ويجب أن يقدم نظام تحديد الموقع المعلومات الكافية عن الأوضاع الرأسية والجانبية والعمق وأوضاع الدوران واستقرار رأس الحفر وهذه الآلية للتوجيه وتحديد المركز يجب أن تمكن من حماية الخدمات الأرضية الحالية.

كما أنه من المهم التأكيد على استخدام مزيج السوائل من الماء والبنتونيت أو البلويمر أو مواد التعبئة الأخرى المشابهة والتي سوف يتم ضخها بصورة مستمرة خلال مرحلة الحفر ومد البايبات لتشحيمها واستقرار وتعبئة الثقب. وذلك سوف يثبت البايبات التي يتم تركيبها وكذلك التربة تحت الطريق.

بالنسبة للمواسير المستخدمة في طريقة الأنفاق المصغرة فإن العمل يكون كما يلي:

أ- دراسة وتحديد موقع الحفر.

ب- إعداد تصاريح العمل للطرق.

ج- فحص الخدمات الحالية وتقديم المخططات للكيبلات والخدمات الأخرى.

د- إعداد مداخل لموقع العمل أينما تطلب ذلك.

ه- توفير المراقبة المناسبة وحراسة مخازن المعدات والمواد.

و- توريد ونقل وتسليم أنابيب الضغط بي في سي (الجودة المطلوبة نوع 10 بار).

ز- حفر مداخل ومخارج رأس الثقب وخندق البايب وأعمال الردم وتصريف طمي الحفار والمواد الصلبة وإعادة الوضع لما كان عليه وتنظيف الموقع بعد انتهاء الأعمال.

ح- توريد حواجز السلامة وفلاشرات الضوء حول منطقة الحفر.

ط- القيام بجميع الأعمال الإضافية الأخرى مثل أعمال نزح المياه والتدعيم.

5-1-3 الحصول من مهندس وزارة الكهرباء والماء على جميع مخططات الخدمات الضرورية لمسار الحفر وحماية ودعم الخدمات التي تعارض مسار الكيبل، وتثبيت جميع التغييرات التي قام بها المقاول وإظهار الوضع الجديد على المخططات الجديدة التي يقدمها بموجب تعليمات مهندس وزارة الكهرباء والماء.

5-1-4 يجب أن تتم جميع أعمال الحفر يدوياً عدا التي تتطلب موافقة كتابية من مهندس وزارة الكهرباء والماء، وسوف يكون عرض كل خندق 45 سم وعمقه متر واحد وعلى أن يزال الماء والأنقاض من الخندق.

في حال إذا كانت هناك ضرورة لتمديد أكثر من كيبل في نفس الخندق فلن تضاف أي رسوم لأعمال الحفر، حيث سيخضع ذلك كله لموافقة وزارة الكهرباء والماء. وعلى أن تكون المسافة الفاصلة بين كل كيبل 100 مم تقريبا ويكون وضع الكيبلات أفقيا.

5-1-5 أثناء القيام بأعمال الحفر في مداخل المباني، فإنه يجب وضع جسور للمارة وللسيارات فوق الخنادق المحفورة.

5-1-6 يجب توفير علامات كافية للطريق (أضواء تحذيرية) وأشرطة التحذير حول منطقة الحفر.

5-1-7 إذا تواجد بلاط حماية الكيبل في مكان الحفر فيجب إزالة هذا البلاط وتخزينه بطريقة صحيحة ويكون الحفر حتى الكيبل وحوله.

5-1-8 إزالة البلاطات العادية. وعلى أن يتم ذلك بدون التسبب بكسر هذه البلاطات. على أن يتم إرجاع البلاط حسب تعليمات مهندس الوزارة .

5-1-9 إزالة البلاطات الخاصة. وعلى أن يتم ذلك بدون التسبب بكسر هذه البلاطات. على أن يتم إرجاع البلاط حسب تعليمات مهندس الوزارة .

5-1-10 - الحفر في أرصفة المشاة المبلطة يجب أن يتم بعناية خاصة وعند نزع البلاطات يجب على المقاول اتخاذ جميع أعمال الحيطة اللازمة لتجنب حدوث أي كسر وعليه تخزين البلاطات المنزوعة بكيفية تمنع تكسرها أو تغير لونها بسبب عوامل خارجية، وفي حالة الأرصفة المسفلتة يجب اتخاذ العناية اللازمة لقطع الأسفلت على مسار الكيبل والقيام بالترتيب مع السلطات المعنية لإعادة الأسفلت على نفقته. ويجب إعادة ردم الخنادق بصورة صحيحة باستخدام المدكات الميكانيكية لدك التربة وأن يقوم بإعادة تركيب البلاطات المرصوفة وجميع هذه الأعمال يجب أن

تلقى موافقة مهندس وزارة الكهرباء والماء، وعليه إرجاع الوضع إلى حالته الطبيعية وإلا فإنه سوف يعاقب بقيمة ومقدار الأعمال الممنوحة لمقاول آخر. وجميع التكاليف المتعلقة بهذا الموضوع تخصم من المقاول الأصلي.

- أعمال قطع الأسفلت / الخرسانة وأعمال التسليم والنقل وتركيب عبارات الكيبلات الرباعية بقطر (6) بوصة عبر الشارع وبمسافة ½ متر تحت كل جانب من أعمال الرصف، ويجب إرجاع الخرسانة باستخدام الأسمنت.

5-1-11 تقديم جميع أعمال ترتيبات الحماية والأغطية للمحافظة على الخندق في حالة آمنة وجافة ومستقرة متى تطلب ذلك.

5-1-12 أشرطة التحذير والشبكات البلاستيكية للخنادق توزد على نفقة المقاول. (كذلك الرجوع للبند 2-3 وضع الكيبلات)

5-1-13 إعادة ردم الحفار ودك الخندق بمواد الحفر (خالية من الكتل الكبيرة التي قد تسبب تلف للكيبل) حتى مستوى الأرض الطبيعي.

5-1-14 إعادة ردم الحفار ودك حفرة مربعة الوصلات بمواد الحفر (خالية من أي كتل كبيرة والتي قد تسبب تلف للكيبل والوصلة) حتى مستوى الأرض الطبيعي.

5-1-15 في مناطق البناء، يجب وضع الماء والدك المناسب لأعمال الردم قبل وبعد وضع أشرطة التحذير والشبكات في خندق الكيبلات.

5-1-16 تنظيف الموقع وإزالة المواد والأنقاض والمخلفات وما شابه طبقاً لقوانين ولوائح بلدية الكويت.

5-1-17 تركيب البلاط العادي. وعلى أن يتم ذلك بدون التسبب بكسر هذه البلاطات.

5-1-18 تركيب البلاط الخاص. وعلى أن يتم ذلك بدون التسبب بكسر هذه البلاطات.

5-2 وضع الكيبلات

5-2-1 رفع ونقل الكيبلات ودرامات الكيبلات من مناطق التخزين التابعة لوزارة الكهرباء والماء إلى موقع العمل والنقل مرة ثانية إلى مناطق التخزين وتفريغها بعد وضع الكيبلات كما هو محدد من قبل مهندس وزارة الكهرباء والماء.

5-2-2 - تنظيف خندق الكيبلات من جميع الأنقاض والحصى والماء ... الخ.

- وضع طبقة رمل جديدة في الخندق بارتفاع 20 سم.
- وضع الكيبل على هذه الطبقة وتغطيته بطبقة رمل جديدة أخرى بارتفاع 20 سم.
- وضع بلاط حماية الكيبل حسب المواصفات على طبقة الرمل.
- بالإضافة إلى ذلك يجب على المقاول تزويد أشرطة تحذيرية وكل ذلك عل نفقته.
- يجب وضع أشرطة تحذيرية على عمق 30 سم .
- بالنسبة للأشرطة التحذيرية يجب أن يطبع عليها كلمة تحذيرية وهذا كله خاضع لموافقة مهندس

الوزارة.

- يجب دمك التربة جيداً .

- يجب ردم الخندق بالكيفية المطلوبة وحسب مواصفات وزارة الكهرباء والماء.

3-2-5 تمديد الكيبلات في الخنادق/ العبارات باستخدام بكرات السحب الضرورية والرافعات ... الخ، مع ترك المسافة الكافية والمناسبة لعمل الوصلات ونهايات الكيبلات وما شابه كما هو محدد من قبل مهندس / مراقب وزارة الكهرباء والماء.

4-2-5 تمديد الكيبلات في المجرى المعلق (Cable Tray) باستخدام المعدات اللازمة للسحب ، مع ترك المسافة الكافية والمناسبة لعمل الوصلات ونهايات الكيبلات وما شابه كما هو محدد من قبل مهندس / مراقب وزارة الكهرباء والماء.

5-2-5 أن الكيبلات المدخلة يجب أن تكون بذات الشكل والمسافة (الثلاثية أو المسطحة) مثل وضع الكيبلات الأصلية تماماً، أما بالنسبة لكيبلات القيادة فإنه يجب ترك مسافة بطول (1) متر عند كل وصلة باتجاه محطات التحويل الثانوية.

(الوضعة الثلاثية تستخدم في الحالات المحصورة بسبب ضيق المسافات وعلى أن تكون حسب إرشادات مهندس الوزارة)

6-2-5 **بالنسبة لتثبيت الكيبلات في العبارات الحالية الفارغة تكون حسب توجيهات مهندس وزارة الكهرباء والماء كالآتي:**

أ- إزالة أي سدادات موجودة.

ب- تنظيف واختبار العبارات وذلك عن طريق تمرير عمود دوران الخرط (يكون ذو قطر مساوي للكيبل الذي يراد تركيبه) خلال العبارات مرة واحدة في كل اتجاه.

ج- إعادة وضع سدادات العبارات بعد تركيب الكيبل.

7-2-5 **الاحتياطات العامة لتركيب الكيبلات**

أ- أثناء عمليات الشحن والتفريغ والنقل لدرامات الكيبلات يجب اتخاذ العناية اللازمة بحيث لا يحدث أي تلف للكيبل. ويجب أن تكون نهايات الكيبل مؤمنة بصورة صحيحة في الدرام.

ب- يجب تحريك الدرام حسب اتجاه التدوير كما يشار على الدرام.

ج- الرافعة المستخدمة يجب توفيرها مع جهاز الديناموميتر (Dynamometer) لتأكيد عدم تجاوز الشد المسموح به.

د- خلال العمليات يجب على المقاول اتخاذ جميع الاحتياطات الضرورية لمنع تلف الكيبلات أو الوصلات الموجودة ويجب اتخاذ احتياطات إضافية أثناء تمديد الكيبلات الجديدة. وفي

حال تسببه بتلف الكيبل القائم فإنه ملزم بتوقيع تقرير إتلاف كيبل وتتخذ جميع الإجراءات المعمول بها من قبل الوزارة.

هـ- فحص الكيبلات عند أي علامة تظهر وجود تلف قبل وبعد تمديد الكيبل.

و- سوف يدفع المقاول قيمة جميع التلفيات التي تسبب فيها.

3-5 رفع الكيبلات

على المقاول رفع أجزاء الكيبلات المقطوعة والمغطاة من قبل وزارة الكهرباء والماء. ويكون رفع الكيبلات من المواضع المشار إليها وتحميلها ونقلها إلى مخازن وزارة الكهرباء والماء وتفريغها حسب ما يحدده مهندس وزارة الكهرباء والماء. ويجب أن تكون جميع العبارات نظيفة ومختبرة ومعاد غلقها كما هو موضح بالبند 5-2-3 بعد إزالة الكيبلات.

4-5 حفر مربعات الوصلات

5-4-1 حفر مربع وصلة كيبل بطول (3) متر، وعرض (2) متر وبعمق (1) متر.

5-4-2 حفر مربع وصلة كيبل قيادي بطول (2) متر، وعرض (1.5) متر وبعمق (1) متر.

5-4-3 على المقاول توفير الكتل الخرسانية الحامية لنهايات الوصلات.

5-4-4 يكون الردم باستخدام مواد حفر خالية من الحصى حتى مستوى الأرض الحالية.

5-4-5 التخلص من المواد الفائضة بموجب لوائح وقواعد البلدية.

5-5 حفر المربعات التجريبية لفحص الموقع

5-5-1 عمل حفرة تجريبية بطول (2) متر وعرض (45) سم وعمق (1) متر.

5-5-2 بعد إجراء الفحص القيام بإعادة الردم بطريقة صحيحة.

6-5 إعداد الحُفر لماكينات الحفر (البورنج)

5-6-1 تجهيز مربع حفار لماكينات الحفر (البورنج) حيث يكون الحفر بطول (5) متر، وعرض (3.5) متر وعمق (1.5) متر.

5-6-2 بعد استكمال العمل يجب إعادة الردم بصورة صحيحة وذلك طبقا للمواصفات وحسب إرشادات مهندس الوزارة.

5-7 تمديد كيبل الضغط المنخفض أحادي القلب

يجب نقل كيبلات الضغط المنخفض أحادية القلب من مخازن وزارة الكهرباء و المخازن الأخرى والتنسيق لتمديدها داخل الخندق/ العبارة حسب تعليمات مهندس وزارة الكهرباء والماء.

5-8 رفع كيبلات الضغط المنخفض أحادية القلب التالفة

يجب إزالة كيبلات الضغط المنخفض أحادية القلب التالفة من الموقع ونقلها لمخازن وزارة الكهرباء والماء.

5-9 ربط كيبلات الضغط المنخفض أحادية القلب

كيبلات الضغط المنخفض أحادية القلب يجب توصيلها بقضبان الجهد المنخفض في محطة التحويل الثانوية أو الفيدربلر أو لوحات الجهد المنخفض للمستهلكين بعد تثبيت اللجز المناسب حسب تعليمات مهندس وزارة الكهرباء والماء.

5-10 تركيب وصلات نهاية الكيبل للمحولات

يجب نقل المواد المستخدمة لتركيب نهايات الكيبل للمحولات من مخازن وزارة الكهرباء والماء أو المواقع الأخرى وتثبيتها حسب توجيهات مهندس وزارة الكهرباء والماء.

على المقاول تزويد رقعة تبين اسم المقاول ورقم هوية لحيمي الكيبلات، وتكون تلك الرقعة مثبتة على وصلة نهاية الكيبل حسب تعليمات مهندس وزارة الكهرباء والماء.

وفي حال فشل المقاول في وضع هذه الرقعة سيتم تطبيق غرامة مناسبة عليه كما هو مبين في جدول الغرامات.

ويقوم المقاول بتوفير تلك الرقعة وتقديم نموذج أولى للاعتماد من قبل مهندس الوزارة.

وفي حالة إخفاق هذه الوصلة بسبب المهنية السيئة للحيمي الكيبلات (الجونترية) فسوف يتم تغريم المقاول بالإضافة إلى إدراجه ضمن القائمة السوداء للمناقصين.

5-11 تركيب نهايات السويتش جير (11 ك. ف)

يجب نقل مواد اللحيم الضرورية لتركيب نهايات السويتش جير من مخازن وزارة الكهرباء والماء أو المواقع الأخرى وتثبيتها حسب توجيهات مهندس وزارة الكهرباء والماء.

على المقاول تزويد رقعة تبين اسم المقاول ورقم هوية لحيمي الكيبلات، وتكون تلك الرقعة مثبتة على نهاية السويتش جير حسب تعليمات مهندس وزارة الكهرباء والماء.

وفي حال فشل المقاول في وضع هذه الرقعة سيتم تطبيق غرامة مناسبة عليه كما هو مبين في جدول الغرامة.

ويقوم المقاول بتوفير تلك الرقعة وتقديم نموذج أولى للاعتماد من قبل مهندس الوزارة.

وفي حالة إخفاق هذه الوصلة بسبب المهنية السيئة للحيمي الكيبلات (الجونترية) فسوف يتم تغريم المقاول بالإضافة إلى إدراجه ضمن القائمة السوداء للمناقصين.

12-5 تركيب الوصلة المستقيمة 11 ك. ف.

يجب نقل مواد اللحيم الضرورية لتركيب الوصلات المستقيمة 11 ك.ف من مخازن وزارة الكهرباء والماء أو المواقع الأخرى وتثبيتها حسب توجيهات مهندس وزارة الكهرباء والماء.

على المقاول تزويد رقعة تبين اسم المقاول ورقم هوية لحيمي الكيبلات، وتكون تلك الرقعة مثبتة على نهاية الوصلة حسب تعليمات مهندس وزارة الكهرباء والماء.

وفي حال فشل المقاول في وضع هذه الرقعة سيتم تطبيق غرامة مناسبة عليه كما هو مبين في جدول الغرامة.

ويقوم المقاول بتوفير تلك الرقعة وتقديم نموذج أولى للاعتماد من قبل مهندس الوزارة.

وفي حالة إخفاق هذه الوصلة بسبب المهنية السيئة للحيمي الكيبلات (الجونترية) فسوف يتم تغريم المقاول بالإضافة إلى إدراجه ضمن القائمة السوداء للمناقصين.

13-5 توريد وصلات مستقيمة للحيم كيبلات الضغط المتوسط 11 ك.ف.

المواصفات الفنية للوصلات المستقيمة 11 ك.ف.

5.13.1 ***PURCHASER'S SYSTEM***

THE CABLE JOINTS ARE REQUIRED TO EXTEND THE PURCHASER'S EXISTING 11 KV. POWER DISTRIBUTION SYSTEM, CHARACTERISTICS OF WHICH ARE AS FOLLOWS: -

A)	SYSTEM VOLTAGE	:	11 KV
B)	SYSTEM HIGH VOLTAGE	:	12 KV
C)	FREQUENCY	:	50 HZ
D)	FAULT LEVEL (MAXIMUM)	:	350 MVA, AT 11 KV, (500 MVA FOR 11 KV, 3-CORE 300 SQ., U/G CABLE WITH COPPER CONDUCTOR).
E)	MAXIMUM TIME FOR WHICH SUCH A FAULT MAY EXIST	:	1.25 SECONDS.
F)	METHOD OF EARTHING	:	SOLIDLY EARTHED OR THROUGH A 10.5 OHMS RESISTANCE.

SITE CONDITION

5.13.2 CLIMATIC CONDITIONS IN KUWAIT ARE RIGOROUS AND THE SUMMER SEASON DURING WHICH THE JOINTS WILL WORK UNDER CONTINUOUS MAXIMUM LOAD CONDITION IS LONG AND SHALL BE CONSIDERED TO FALL DURING THE PERIOD STARTING FROM 15TH OF APRIL TILL 15TH NOVEMBER. THE REMAINDER OF THE YEAR SHALL BE CONSIDERED AS A WINTER SEASON SINCE AUTUMN AND SPRING SEASONS ARE VERY SHORT IN KUWAIT.

THE FOLLOWING ARE PREVALENT ATMOSPHERIC CONDITIONS BASED ON OUR LATEST RECORDS: -

A)	MAXIMUM SUN RADIATION'S TEMPERATURE MEASURED WITH BLACK BULB THERMOMETER	:	85 DEGREE CENTIGRADE
B)	HIGHEST SHADE TEMPERATURE	:	52 DEGREE CENTIGRADE.
C)	AVERAGE MAXIMUM AMBIENT TEMPERATURE	:	45 DEGREE CENTIGRADE
D)	LOWEST TEMPERATURE DURING WINTER	:	-6 DEGREE CENTIGRADE.

A TYPICAL ANALYSIS OF A SOIL SAMPLE IS AS FOLLOWS :-

-	APPEARANCE	:	WET COARSE SAND, WITH SOME CLAY.
-	PH VALUE OF WATER IN CONTACT WITH THE SAND	:	10.0
-	CALCIUM CARBONATE AS CACO3	:	50.00% DRY BASIS
-	CALCIUM SULPHATE AS CASO4	:	25.00% DRY BASIS
-	SILICA AS SIO2	:	22.00% DRY BASIS
-	MAGNESIUM SULPHATE AS MGSO4	:	6.00% DRY BASIS
-	SODIUM CHLORIDES AS NAC1	:	5.00% DRY BASIS
-	IRON AS FE203	:	3.00% DRY BASIS
-	SULPHATE REDUCING BACTERIA	:	PRESENT

-	MOISTURE	:	15.00%

5.13.3 ***TECHNICAL DESCRIPTION OF CABLE ASSOCIATED WITH JOINTS:-***

X.L.P.E. 11 KV CABLES:

THE UNDER MENTIONED 300 SQ. MM., XLPE CABLE IS IN GENERAL USE IN KUWAIT.

I	CONDUCTOR	:	300 SQ. MM., ALUMINUM COMPACT CIRCULAR STRANDED, IN ACCORDANCE WITH BS 6791(SEE NOTE BELOW), OR 300 SQ. MM., COPPER.
II	CONDUCTOR SCREEN	:	EXTRUDED SEMI-CONDUCTING COMPOUND LAYER.
III	INSULATION	:	CROSS-LINKED POLYETHYLENE IN ACCORDANCE WITH I.E.C. 502. EXTRUDED SOLID DIELECTRIC INSULATED POWER CABLE.
IV	INSULATION SCREEN	:	EXTRUDED SEMI-CONDUCTING COMPOUND LAYER.
V	METALLIC SCREEN	:	NONE (SEE NOTE BELOW).
VI	CORE ASSEMBLY	:	LONGITUDINAL APPLIED TAPE FILLERS.
VII	BEDDING	:	4 LAYERS OF SEMI-CONDUCTING TAPE.
VIII	ARMOUR	:	GALVANIZED STEEL WIRE OF 3.15 MM., DIA. (COMPRISING A TOTAL OF ABOUT 65 WIRES).
IX	OUTER SHEATH	:	RED PVC IN ACCORDANCE WITH BS 6746:TYPE 9.

NOTE:-

OTHER 11 KV XLPE CABLES MAY BE USED. THE MAIN DIFFERENCE BEING THE USE OF A METALLIC CORE SCREEN AND STRANDED SECTOR SHAPED ALUMINUM CONDUCTORS.

5.13.4 ***DETAILS AND TECHNICAL REQUIREMENTS OF THE JOINTS FOR 11 KV. XLPE/XLPE***

A) THE JOINTS SHALL BE DESIGNED SUCH THAT THEY ARE FULLY SUITABLE FOR JOINTING THE TYPES OF CABLES AS MENTIONED IN THIS SPECIFICATION.

CABLES ARE DIRECTLY BURIED AT A DEPTH OF APPROXIMATELY (1) ONE MTR. WITHOUT ANY SORT OF MECHANICAL PROTECTION. THE JOINTS SHALL BE OF AN APPROVED DESIGN AND SHALL BE SUITABLE IN THE CONSTRUCTION STAGE AND OPERATION TO MEET ALL THE MECHANICAL/ELECTRICAL STRESS EXPECTED UNDER THE SEVERE CLIMATIC AND SITE CONDITIONS ENCOUNTERED IN KUWAIT.

THE JOINTING ACCESSORIES SHALL BE OF GOOD QUALITY. THE JOINTS SHALL BE AMPLY DIMENSIONED AND THE JOINTING TECHNIQUE EMPLOYED IN THE CONSTRUCTION OF THE JOINT SHALL BE A SIMPLE AND EASY JOINTING PROCESS RENDERING THE JOINT ROBUST AND SAFE.

ALL THE COMPONENTS OF THE JOINT WHICH HAVE A COATING ON THE INSIDE (SUCH AS OUTER TUBES, INNER TUBES, BREAK-OUT), ARE TO BE SUPPLIED WITH A PAPER INSET TO PREVENT ADHESION PRIOR TO APPLICATION. ALSO, TWO SHEETS OF GREASE PROOF PAPER TO BE SUPPLIED WITH EACH JOINT TO KEEP DIRT OUT OF THE JOINT DURING CONSTRUCTION.

THE JOINTS SHALL BE REQUIRED FOR STRAIGHT JOINTING, XLPE CABLES

ONLY JOINTS EMPLOYING HEAT SHRINKABLE CONSTRUCTION WILL BE CONSIDERED. STRESS CONTROL TUBING, INSULATING TUBING AND CONDUCTIVE MOLDINGS AND TUBING SHALL COMPLY WITH RELEVANT SECTIONS OF ESI: 09-13 LATEST EDITION AND OTHER INTERNATIONAL STANDARDS INDICATED IN THIS SPECIFICATION.

B) ***JOINT TYPE***

B-1 TYPE "A", 11 KV, STRAIGHT JOINT FOR JOINTING 3-CORE, 300 SQ. MM. XLPE TO 3-CORE, 300 SQ. MM. XLPE CABLE.

- WITH AL CONDUCTOR.
- WITH CU CONDUCTOR.

C) ***DIMENSIONS OF THE COMPONENTS***

THE DIMENSIONS OF THE COMPONENTS SHALL BE AS PER PURCHASERS REQUIREMENTS. HOWEVER THE LENGTHS FOR THE CANISTER SHALL BE AS FOLLOWS.

C-1 TYPE “A” JOINTS - 1400-MM.

THE CORROSION PROTECTION TUBE SHALL BE IN THREE PIECES WITH ADEQUATE LENGTH TO COVER THE ABOVE.

D) ***CONDUCTOR FITTINGS***

THE CONDUCTOR FITTING FOR THE JOINT TYPES "A" SHALL BE COMPRESSION FERRULES FOR BOTH ALUMINUM AND COPPER CONDUCTORS AND AS DETAILED HERE UNDER.

D-1 ***ALUMINUM CONDUCTOR***

THE COMPRESSION FERRULES SHALL BE SIMILAR TO B.I.C.C. BAP 300 ASL OR CEMBRE MTMAD – 300/1. THE COMPRESSION TOOL USED TO INDENT THE FERRULES WILL BE B.I.C.C. G14H HEAD WITH FP10 FOOT PUMP EMPLOYING DIE NO. P300D, OR CEMBRE RHU 130 COMPRESSION TOOL WITH CRIMPING DIE SET AU-130-140, MUA-DIES, PS-130 & AC-130P.

D-2 ***COPPER CONDUCTORS***

THE COMPRESSION FERRULES SHALL BE SIMILAR TO B.I.C.C. BTH-300 CS (OLD REF. YCS 300T). THE COMPRESSION TOOLS USED TO INDENT THE FERRULES WILL BE B.I.C.C G14H HEAD WITH FP10 FOOT PUMP NO. P300D OR CEMBRE MT 315S-TD (COMPRESSION FERRULE) WITH RUH 130 C COMPRESSION TOOL WITH ME 60-C DIE

SHOULD THE TENDERER OFFER ANY OTHER MAKES OF FERRULES, THEN THESE WILL BE APPROVED ONLY IF THEY CAN SATISFACTORILY BE INDENTED WITH THE COMPRESSION TOOL AND DIE NO. INDICATED ABOVE. AN APPROVED TEST CERTIFICATE IS ALSO REQUIRED FOR THESE FERRULES.

5.13.5 ***NON TRACKING EROSION AND WEATHER RESISTANT INSULATING TUBING AND MOULDED PARTS.***

1. THE NAME AND ADDRESS OF THE MANUFACTURER OF THE COMPONENT (TUBING MOULDED PARTS).
2. THE QUALITY ASSURANCE PLAN OF THE MANUFACTURER AND THEIR CONFIRMATION THAT THE COMPONENT (TUBING MOULDED PARTS) SUPPLIED FULLY MEETS THE QUALITY ASSURANCE PLAN. THIS IS TO BE SUPPORTED WITH ROUTINE TEST CERTIFICATES FOR THE PARTICULAR BATCH.
3. MANUFACTURER MUST SUPPLY PROOF OF ACCELERATED LABORATORY AND LONG TERM FIELD USAGE TO CONFIRM THE ADEQUACY AND THE RETENTION OF THE NON TRACKING, EROSION AND WEATHER RESISTANT PROPERTIES WITHIN PERMISSIBLE LIMITS. THIS MUST BE AS PER RELEVANT STANDARDS.

5.13.6 ***JOINT INSULATING MATERIALS***

FULL TECHNICAL DETAILS, MANUFACTURER'S LITERATURE AND TEST RESULTS OF INSULATING MATERIALS SHALL BE SUBMITTED WITH THE OFFER. THE HEAT SHRINKABLE PRODUCTS USED IN THE JOINT SHALL BE EITHER EXTRUDED OR MOULDED CROSS-LINKED POLYMERIC NON-TRACKING INSULATING MATERIAL, SUITABLE FOR USE WITH X.L.P.E. CABLES TO I.E.C. 502. SUITABLE MEANS OF PREVENTING THE INGRESS OF MOISTURE INTO THE LAYERS OF THE FERRULE INSULATION SHALL BE PROVIDED.

5.13.7 ***OTHER JOINTING MATERIALS***

A) THE JOINT KIT SHALL CONTAIN ALL THE NECESSARY MATERIALS AND ACCESSORIES TO COMPLETE THE JOINT.

B) THE MAIN JOINT KIT WILL ALSO CONTAIN THE FOLLOWING ITEMS SUFFICIENT TO COMPLETE THE JOINT.

B-1 ONE BOX OF TISSUES NO LESS THAN 30 NOS. FOR CLEANING PURPOSE.

B-2 100 ML. OF SUITABLE CLEANING AGENT OR EQUIVALENT CLEANING TISSUES FOR XLPE INSULATION.

B-3 ALUMINUM OXIDE STRIP OR SIMILAR ABRASIVE STRIP.

B-4 PROTECTIVE 20 MM. WIDE COTTON TAPE SIMILAR TO B.I.C.C. 0515.

C) WHERE THE JOINT CONTAINS PLUMBING METAL, IT SHALL BE TO BRITISH STANDARD GRADE "D" AND SUPPLIED IN APPROXIMATELY 500 GMS. STICKS. EACH STICK SHALL BE INDELIBLY BRANDED "MEW".

D) THE MATERIALS SUPPLIED FOR INSULATING AND OTHER PURPOSES SHALL BE TO THE BEST OF THEIR KIND TO SUIT THE APPLICATION AND SHALL SATISFY THE REQUIREMENTS OF LATEST INTERNATIONAL STANDARDS NAMELY IEEE 48, BRITISH STANDARD SPECIFICATION, IEC AND GERMAN STANDARD VDE 0278.

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JOINT 11 KV STRAIGHT JOINT FOR 3-CORE 300 SQ.MM. AL. CONDUCTOR XLPE CABLE TO 3 – CORE 300 SQ.MM. AL. CONDUCTOR XLPE CABLE COMPLETE AS SPECIFIED

Sr. No.	Description	Quantity
1	Stress Control Tubing	3
2	Elastomeric Screened Insu. Tubing	3
3	Void Filler (Yellow)	6
4	Void Filler (Yellow)	6
5	Outer Sealing Sleeve	1
6	Outer Sealing Sleeve	1
7	Tinned Copper Mesh	3
8	Aluminum Connector 300mm^2	3
9	Wire Armour Case	1
10	Adjustable Support Ring	2
11	S.S. Clip	4
12	Textile Tape	1
13	Cleaning Tissue	8
14	Abrasive Cloth	1
15	PVC Tape	1
16	Installation Instruction	1

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JOINT 11 KV STRAIGHT JOINT FOR 3-CORE 300 SQ.MM. CU. CONDUCTOR XLPE CABLE TO 3 -CORE 300 SQ.MM. CU. CONDUCTOR XLPE CABLE COMPLETE AS SPECIFIED.

Sr. No.	Description	Quantity
1	Stress Control Tubing	3
2	Elastomeric Screened Insu. Tubing	3
3	Void Filler (Yellow)	6
4	Void Filler (Yellow)	6
5	Outer Sealing Sleeve	1
6	Outer Sealing Sleeve	1
7	Tinned Copper Mesh	3
8	Copper Connector 300mm2	3
9	Wire Armour Case	1
10	Adjustable Support Ring	2
11	S.S. Clip	4
12	Textile Tape	1
13	Cleaning Tissue	8
14	Abrasive Cloth	1
15	PVC Tape	1
16	Installation Instruction	1

5.13.8 ***GUARANTEE***

THE TENDERER SHALL GUARANTEE THE JOINTS FOR A PERIOD OF TWELVE (12) CALENDAR MONTHS AFTER DELIVERY OF THE LAST CONSIGNMENT.

ALL MATERIALS AND EQUIPMENT'S SHALL COMPLY AS A MINIMUM WITH:-

A) THE LATEST RELEVANT RECOMMENDATIONS OF THE INTERNATIONAL ELECTRO-TECHNICAL COMMISSION (I.E.C.) AND OTHER INTERNATIONAL STANDARDS INDICATED IN THIS SPECIFICATION.

B) THIS APPLIES TO QUALITY OF MATERIAL AND TESTING, ETC., IF STANDARDS AS MENTIONED ABOVE CONTRADICT WITH THIS TENDER SPECIFICATIONS, THEN THE REQUIREMENTS OF THIS SPECIFICATION SHALL APPLY.

14–5 توصيل كيبل التحكم بكابينة المحطة الثانوية :-

من الضروري نقل مواد اللحيم الخاصة بتركيب كيبل التحكم في كابينة المحطة الثانوية حسب ما هو محدد من قبل مهندس وزارة الكهرباء والماء . ويتم تركيب / إعادة تركيب الـــ Cable Gland بطريقة صحيحة أينما تطلب ذلك .

15–5 تركيب وصلة نهاية كيبل خارجية 11 ك. ف.

يجب نقل مواد اللحيم الضرورية لتركيب النهايات الخارجية 11 ك.ف من مخازن وزارة الكهرباء والماء أو المواقع الأخرى وتثبيتها حسب توجيهات مهندس وزارة الكهرباء والماء.

على المقاول تزويد رقعة تبين اسم المقاول ورقم هوية لحيمي الكيبلات، وتكون تلك الرقعة مثبتة على نهاية الوصلة حسب تعليمات مهندس وزارة الكهرباء والماء .

وفي حال فشل المقاول في وضع هذه الرقعة سيتم تطبيق غرامة مناسبة عليه كما هو مبين في جدول الغرامة.

ويقوم المقاول بتوفير تلك الرقعة وتقديم نموذج أولى للاعتماد من قبل مهندس الوزارة.

وفي حالة إخفاق هذه الوصلة بسبب المهنية السيئة للحيمي الكيبلات (الجونترية) فسوف يتم تغريم المقاول بالإضافة إلى إدراجه ضمن القائمة السوداء للمناقصين.

16–5 توريد وصلات نهاية كيبل داخلية وخارجية 11 ك.ف

المواصفات الفنية لوصلات نهاية الكيبل 11 ك.ف.

5.16.1 ***PURCHASER'S SYSTEM***

The cable termination are required to extend the purchaser's existing 11 KV power distribution system, characteristics of which are as follows: -

A)	System voltage	:	11 kv
B)	System high voltage	:	12 kv
C)	Frequency	:	50 hz
D)	Fault level (maximum)	:	350 mva, at 11 kv, (500 mva for 11 kv, 3-core 300 SQ.mm, u/g cable with copper conductor).
E)	Maximum time for which such a fault may exist	:	1.25 seconds.
F)	Method of earthing	:	Solidly earthed or through a 10.5 ohms resistance.

5.16.2 ***SITE CONDITION***

Climatic conditions in kuwait are rigorous and the summer season during which the termination's will work under continuous maximum load condition is long and shall be considered to fall during the period starting from 15th of april till 15th november. The remainder of the year shall be considered as a winter season since autumn and spring seasons are very short in kuwait.

The following are prevalent atmospheric conditions based on our latest records.

A)	Maximum sun radiation's temperature measured with black bulb thermometer	:	85 degree centigrade
B)	Highest shade temperature	:	52 degree centigrade.
C)	Average maximum ambient temperature	:	45 degree centigrade
D)	Lowest temperature during winter	:	-6 degree centigrade.

Periods of high humidity are common and relative humidity of 100% at 30 degree centigrade has been recorded. Violent sand and dust storms occur and even on comparatively still days. Fine dust is carried in suspension in the atmosphere.

The termination will be installed near the seashore where the atmosphere is salt laden and very corrosive.

An average rain fall during the year is about 15 CMS. But this may be concentrated in two or three severe downpours.

The termination offered must give continuous and trouble free service under the arduous condition mentioned above.

5.16.3 ***STANDARD SPECIFICATIONS***

Attention of all tenderers are hereby drawn to the following:-

All materials and equipment shall comply as minimum with:-

A) The latest relevant recommendations of the international electrotechnical commission (i.e.c.), bss, ieee 48. And german standard vde 0278

B) This applies to quality of material and testing, etc. If standards as mentioned above contradict with this tender specification, then the requirements of this specification shall apply.

5.16.4 ***GENERAL***

Only termination employing heat shrinkable materials construction will be considered. The heat shrinkable materials such as mouldings, tubing and sealant etc. shall be fully in accordance with and tested to the latest standards namely ieee, bss, iec and german standard vde 0278. The combined severe test conditions of the above shall be applicable. Test reports from an independent authority (asta/kema/cesi or CPRI) for the proposed termination's and accessories shall be submitted with each offer.

The termination shall be designed such that they are fully suitable for terminating the 11 kv cables specified in this specification. The termination shall be of an approved design and shall be suitable in construction and operation to withstand all the mechanical/electrical stresses expected under the severe climatic and site conditions encountered in the state of kuwait. Evidence shall be submitted with the offer, to prove that termination identical in design to the proposed are working satisfactorily for the last 5 years in identical weather conditions.

All tubing's & moulded parts must be marked clearly with the manufacturer's name, part number and quality assurance batch number.

A) Heat shrinkable termination kit (indoor)

The termination kits are for use inside cable-end boxes of switch-gears and transformers and shall be suitable in all respects for the below mentioned types of 11 kv, aluminum and copper conductor cables, which are generally according to iec/6502 for XLPE cables or bss 6480 for pilc cables.
3-core 300 or 185 SQ.MM. CU or AL SC / XLPE / SC / SWA / PVC cables or 3-core 300
Construction details of the cables are given in the specification.

The kits shall be complete with all accessories such as sealing boots, stress control tubing, non-tracking weather resistant tubes, sealant, tapes etc., and shall be suitable for a cable tail length of 650 MM. The components and accessories shall be of good quality. The tubing's /mouldings/sealant etc., shall be flame retardant having good electrical/mechanical strength and resistance to tracking, corrosion, fungus, weather and the ingress of water, moisture etc.
Kits shall be complete with the required earthing accessories suitable for use with the above mentioned heat shrinkable termination and shall include Cable gland brass type heavy duty CW-90 L with earth stud, clamps, fixing bolts, earth bonding braids, lugs sealant, tape, heat shrinkable tubing etc., compression type mechanical glands are not acceptable. Clamping of armour by worm drive clips will not be accepted. The offered earthing system should have a minimum short time rating of 20 KA for 3 seconds. Evidence to this effect shall be submitted in the form of a test report from an Internationally recognized testing authority.
Full technical details including dimensional drawings, catalogues, type test reports from an Internationally recognized testing authority as mentioned above shall be submitted for the offered termination kits. A dimensional drawing, to scale, of the assembled termination, showing all the dimensions and clearances, shall be submitted with the offer along with the instruction manuals and a sample kit for our consideration.

Contents list

Content of Heat Shrinkable Termination Kit for XLPE Cable Termination (IN -DOOR TYPE)

Sr.	Description	Quantity
1	Heat shrinkable, adhesive lined conductive breakout made from erosion and weather resistant polymer.	1 NO.
2	Heat shrinkable non tracking, weather resistant earthing sealing sleeve (gland sleeve) length (350 MM.)	1 NO.
3	Heat shrinkable non-tracking tubing length (650 MM.)	3 NOS.
4	Heat shrinkable stress control tubing length (190 MM.)	3 NOS.
5	Heat shrinkable lug sleeve made from insulating and non tracking weather resistance polymer. And internally coated with hot-melt sealant length (120 MM.).	3 NOS.
6	Red sealant mastic tape (100 MM.)	6 NOS.
7	Cable Gland Brass type heavy duty CW-90 L	1 SET.
8	Electric grade copper wire.	1 ROLL
9	Yellow stress relief mastic (100 MM.)	3 PCS.
10	Nylon string for cutting XLPE insulation.	3 MTRS.
11	Aloxite emery tape (750 MM.) Long.	I PC.
12	Core cleaning solvent (100 CC.)	1 PC.
13	Self-vulcanizing insulation tape for lug sealing (38 MM. * 2 MTRS.).	I ROLL.
14	Mopping cloth + disposable gloves.	1 SET.
15	Insulated (50 SQ.MM.) Earth conductor, (750 MM.) Long with pre-installed lugs size 50-12mmsq. At both ends.	1 PC.
16	White sealant mastic (500 MM.)	1 PC.
17	Silicon grease	1 PACK
18	Installation instructions	1 NO.

B) Heat shrinkable termination kits (outdoor)

These termination kits are for use as outdoors pole termination's and shall be suitable in all respects for use with the below mentioned types of 11 KV copper and aluminum conductor cables.

3-core 300 or 185 SQ.MM. CU or AL SC / XLPE / SC / SWA / PVC cables

Construction details of the cables are given in the specification.

The outdoors pole termination's shall include the following accessories, in addition to those mentioned under (A) above.

I Umbrella skirt.

Ii Watershed skirts.

Iii Support insulators.

The kits shall be suitable for a cable tail length of at least 650 MM. The components and accessories shall be of good quality. The tubing /mouldings/sealant etc., shall be flame-retardant, having good electrical/mechanical strength and resistance to tracking, corrosion, fungus, weather and the ingress of water, moisture etc.

The umbrella skirts and watershed skirts shall be heat shrinkable, flexible, polymeric moulding, possessing anti-tracking and erosion resistant properties, for application over the prepared cores of the above specified cables. The watershed shall confirm to the requirements of latest International standard.

The pole termination support insulators shall be made from a polymeric material, and this shall be clearly confirmed in the offer. Insulators made of glass or ceramic materials are not acceptable. The support insulator shall be outdoor type, vandal proof, unaffected by heavy pollution, resistant to weather ingress of water/moisture etc.

The termination kits shall be complete with the required earthing accessories suitable for use with specific termination, and shall include marine alloy clamps, fixing bolts, earth bonding straps, sealant, tape, fixing bolts/nuts/washers, heat shrinkable tubing etc. Clamping of armour by means of worm drive clips will not be accepted. The offered earthing system should have a minimum short time rating of 20 KA for 3 seconds. Evidence to this effect shall be submitted in the form of a test report from an internationally approved testing authority. Compression type mechanical glands are not acceptable.

A complete list of materials supplied in each type of termination kit along with the part No. And quantity is to be submitted with the offer.

Full technical details including dimensional drawings, catalogues, type test reports from an internationally recognized testing authority as mentioned above shall be submitted for the offered termination kits.

A dimensional drawing, to scale, of the assembled termination, showing all dimensions and clearances, shall also be submitted with the offer along with the instruction manuals and a sample kit for our consideration.

Contents list

Content of Heat Shrinkable Termination Kit for XLPE Cable Termination

(OUT -DOOR TYPE)

Sr.	Description	Quantity
1	Heat shrinkable, adhesive lined conductive breakout made from erosion and weather resistant polymer.	1 NO.
2	Heat shrinkable non tracking weather resistant earthing, sleeve length (300 MM.)	1 PC.
3	Heat shrinkable non tracking tubing length (650 MM.)	3 NOS.
4	Heat shrinkable stress control tubing length (190 MM.)	3 NOS.
5	Heat shrinkable lug sleeve made from insulating and non-tracking weather resistance polymer. And internally coated with hot-melt sealant length (120 MM.).	3 NOS.
6	Heat shrinkable anti-tracking skirts.	6 NOS.
7	Red sealant mastic tape (100 MM.)	6 NOS.
8	Armour earthing clamping rings set.	1 NO.
9	Electric grade copper wire.	1 ROLL
10	Yellow stress relief mastic (100 MM.)	3 PCS.
11	Nylon string for cutting XLPE insulation.	3 MTRS.
12	Aloxite emery tape (750 MM.) Long.	I PC.
13	Core cleaning solvent (100 cc.).	I PC.
14	Disposable gloves.	1 SET.
15	Insulated (50 SQ.MM.) Earth conductor, (500 MM.) Long with pre-installed lugs at two ends.	1 PC.
16	Allen key for clamping ring bolts	1 PC.
17	White sealant mastic (500 MM.)	1 PC.
18	Support insulator set consisting of (3) polymeric vandal proof support insulators.	1 SET.
19	Silicon grease	1 PACK
20	Installation instructions	1 NO.

NOTES:- The main termination kit will also contains the following items sufficient to complete the termination.

1- One box of tissues not less than 30 Nos. For cleaning purpose.

2- 100 ml. of suitable cleaning agent or equivalent cleaning tissues for XLPE insulation.

3- Aluminum oxide strip or similar abrasive strip.

4- Protective 20 MM. Wide cotton tape similar to BICC 0515.

5- Where the termination contains plumbing metal, it shall be to British standard grade "D" and supplied in approximately 500 GMS. Sticks. Each stick shall be indelibly branded "MEW".

6 The materials supplied for insulating and other purposes shall be to the best of their kind to suit the application and shall satisfy the relevant British standard specification as a minimum requirement.

C) STRAIGHT BOOTS

The straight boots shall be used to cover the cable lugs connection between the cable and the switchgear.

The straight boots shall be of the same material of the heat/cold shrinkable cable termination's offered, suitable for both (3 x 300 and 3 x 185 SQ. MM.) XLPE or PILC cables with a larger diameter at the switchgear side to fit around the switchgear terminal. The length of the straight boot shall not be less than (23 CMS).

Each kit of straight boots shall consist of

I 3 NOS. Straight boots.

Ii 150 CMS. X 7 CMS. Black mastic sealing tape.

Iii Installation Instructions

D) RIGHT ANGLE BOOTS

The right angle boots shall be used to cover the cable lugs connection between the cable and the switchgear or transformer. The right angle boots shall be of the same material of the offered heat/cold shrinkable termination's, suitable for both (3 x 300 and 3 x 185 SQ. MM.) XLPE or PILC cables, with a larger diameter at the bushing side to fit around the bushing. The portion of the bushing covered by the right angle boot shall not be less than 12 CMS.

Each kit of right angle boots shall consist of

I 3 Nos. Right angle boots.

Ii 150 CMS. X 7 CMS. Black mastic sealing tape.

Iii Installation Instructions

E) STRAIGHT RIGHT ANGLE BOOTS – Flexible Cold Application

The flexible insulating boot cold applied is to cover the lugs connection between the cable and the switchgear or transformer medium voltage termination, suitable for 3Core x 185 to 300 SQ.MM XLPE or PILC cables, the flexible boot shall have 35-400mm2 cable range and with 46-70mm in bushing diameter range

Each kit of right angle boots shall consist of

I Set of 3 elastomeric flexible bushing boots

Ii Silicon grease

Iii Installation Instructions

5.16.5 ***TECHNICAL DESCRIPTION OF CABLE ASSOCIATED WITH TERMINATION'S***

A) XLPE 11 KV Cables

The under mentioned (3 x 300 or 3 x 185 SQ.MM.), XLPE cable is in general use in Kuwait.

I	Conductor	:	300 SQ.MM., copper or aluminum compact circular stranded, in accordance with BS 6791 (see note below).
II	Conductor screen	:	Extruded semi-conducting compound layer.
III	Insulation	:	Cross-linked polyethylene in accordance with I.E.C. 6502. Extruded solid dielectric insulated power cable
IV	Insulation screen	:	Extruded semi-conducting compound layer.
V	Metallic screen	:	None (see note below).
VI	Core assembly	:	Longitudinal applied tape fillers.
VII	Bedding	:	4 layers of semi-conducting tape.
VIII	Armour	:	Galvanized steel wire of 3.15 MM, DIA (comprising a total of about 65 wires).
IX	Outer sheath	:	Red PVC in accordance with BS 6746; type 9.

Note:- Other 11 KV XLPE cables may be used. The main difference being the use of a metallic core screen and stranded sector shaped aluminum conductors.

Standard PILC cables are also used.

B) Conductor Fittings

The conductor fitting for the termination shall be compression lugs for both aluminum and copper conductors and the same shall be supplied as spare items. Further bimetallic compression lug suitable for 300 SQMM Aluminium conductor with copper palm shall be supplied.

Also copper compression lug for 185 SQMM copper conductor cable shall be supplied. The compression lugs shall be suitable for crimping with crimping tools CEMBRE or BICC.

C) Termination Materials

I General

The completed termination shall be sufficiently strong and fully suitable for the climatic conditions of Kuwait. The supplier must submit full technical details of materials used in the termination's in respect of mechanical and electrical properties and all other relevant information to enable the purchaser to assess the suitability of the cable termination.

II **Termination Insulating Materials**

The insulating materials of the termination shall be heat shrinkable material. Full technical details, manufacturer's literature and test results of insulating materials shall be submitted with the offer. The heat shrinkable products used in the termination shall be either extruded or moulded cross-linked polymeric non-tracking insulating material, suitable for use with XLPE cables TO I.E.C. 6502. Suitable means of preventing the ingress of moisture into the layers of the lugs insulation shall be provided.

5.16.6 ***GUARANTEE***

The tenderer shall guarantee the termination for a period of twelve (12) calendar months after delivery of the last consignment.

5.16.7 ***INSTALLED TERMINATION'S***

The installed termination's must provide the following

I Complete external leakage insulation between high voltage conductor and earth potential using anti-track shrink material.

II Electrical stress control using a stress relief tube incorporated inside the PST silicone rubber shrink insulator.

III The installed termination's shall meet the electrical requirement's laid down in this specification.

17–5 تركيب الوصلة المستقيمة (لكيبل القيادة)

يجب نقل مواد اللحيم الضرورية لتركيب الوصلات المستقيمة 11 ك.ف (لكيبل القيادة) من مخازن وزارة الكهرباء والماء أو المواقع الأخرى وتثبيتها حسب توجيهات مهندس وزارة الكهرباء والماء.

على المقاول تزويد رقعة تبين اسم المقاول ورقم هوية لحيمي الكيبلات، وتكون تلك الرقعة مثبتة على نهاية الوصلة حسب تعليمات مهندس وزارة الكهرباء والماء.

وفي حال فشل المقاول في وضع هذه الرقعة سيتم تطبيق غرامة مناسبة عليه كما هو مبين في جدول الغرامة.

ويقوم المقاول بتوفير تلك الرقعة وتقديم نموذج أولى للاعتماد من قبل مهندس الوزارة.

وفي حالة إخفاق هذه الوصلة بسبب المهنية السيئة للحيمي الكيبلات (الجونترية) فسوف يتم تغريم المقاول بالإضافة إلى إدراجه ضمن القائمة السوداء للمناقصين.

18-5 نقل المواد

يتم استلام كل من الوصلات والسويتش جير ونهايات المحولات ووصلات نهاية الكيبل الخارجية وكيبلات الضغط المنخفض وكيبلات أحادية القلب وكيبلات القيادة والمحولات من مخازن وزارة الكهرباء والماء أو أي مواقع أخرى ونقلها للموقع وإعادة المواد التي بها عيوب إلى مخازن وزارة الكهرباء والماء.

19-5 استبدال المحولات المعطلة

في حال استبدال محولات معطوبة يتحمل المقاول مسئولية ترتيب وإحضار وسائل النقل الضرورية مثل الرافعات وشاحنات النقل والعمال (عدد 4 على الأقل) لإحضار المحول الجديد من مخازن وزارة الكهرباء والماء ونقله إلى الموقع وعلى أن يتم إرجاع المحول المعطوب إلى مخازن وزارة الكهرباء والماء أو بموجب تعليمات مهندس الوزارة. أيضا المقاول مسئول عن فصل وإعادة لحيم كيبلات الضغط العالي والضغط المنخفض طبقاً للجدول Q-1.

20-5 الرافعات

- يتطلب من المقاول تزويد الرافعات لأعمال التحميل والتفريغ للمعدات بموجب تعليمات مهندس وزارة الكهرباء والماء ويجب أن تكون الرافعة ذات قدرة لرفع 50 طن على الأقل مسافة 32 متر . أو حسب المسافة المطلوبة للعمل المكلف به ويجب أن تكون الرافعة مصحوبة بشهادة من جهة فحص معتمدة وصادرة من جهة معتمدة صادرة خلال مدة لا تزيد عن عام واحد قبل توقيع العقد.

- ويجب أن يكون مع الرافعة سائق / مشغل وأن يكون لديه تصريح للعمل في دولة الكويت.

- ويجب أن تكون الرافعة متوفرة في أي وقت بناء على طلب مهندس وزارة الكهرباء والماء.

21-5 قاطرة ومقطورة

- يتطلب من المقاول توريد شاحنات نقل (12 متر) حمولة 50 طن لنقل المعدات بمعرفة مهندس وزارة الكهرباء والماء ويجب أن تكون الشاحنة مصحوبة بشهادة من جهة فحص معتمدة وصادرة من جهة معتمدة وتكون صادرة خلال مدة لا تزيد عن عام واحد قبل توقيع العقد.

- ويجب أن يكون مع الشاحنة سائق لديه تصريح للعمل في دولة الكويت.

- ويجب أن تكون الشاحنة متوفرة في أي وقت بناء على طلب مهندس وزارة الكهرباء والماء.

22-5 إجراءات العمل

- على المقاول الإعداد لبدء تنفيذ الأعمال خلال فترة 60 يوماً بعد توقيع العقد.

- حيث أن طبيعة الأعمال طارئة ومرتبطة بأعطال الكيبلات، لذا فعلى المقاول أن مستعدا لنقل معداته خلال فترة زمنية قصيرة جداً ويكون فريق عمله ومعداته ووسائل نقله متاحة في جميع الأوقات. يجب على المقاول الانتهاء من العمل حسب الوقت المحدد من قبل مهندس الوزارة.

- على المقاول تقديم عشر نسخ من المواصفات مع نسخة من العقد لمهندس وزارة الكهرباء والماء، ويجب تعبئتها بصورة صحيحة وأن تكون مناسبة للاستخدام في الموقع كمرجع للأعمال.

- يجب على المقاول العمل جنباً إلى جنب مع الفريق الفني المختص بوزارة الكهرباء والماء وأن يلتزم بتعليماتهم فيما يتعلق بالإجراءات الفنية والتي لا تكون من ضمن اختصاصاته المباشرة.

- لن يتم أي عمل في الموقع حتى يقوم المهندس / المراقب التابع لوزارة الكهرباء والماء بتحديد الموقع وأن يصدر تصريحاً للمقاول بالعمل وهذا التصريح سوف يلغى عند استكمال العمل وتقديم المخالصة بذلك من المقاول، وسوف يقوم مهندس وزارة الكهرباء والماء بتقديم التعليمات الكتابية الخاصة بالموقع والتي تورد تفصيلاً العمل المطلوب تنفيذه للمقاول.

- وسوف يتم قياس العمل المنجز والموافقة عليه وتسجيله في النموذج المناسب ويكون معتمد من قبل مهندس وزارة الكهرباء والماء.

- بالنسبة لكل عمل يلتزم المقاول بتقديم برنامج العمل بهدف اعتماده من مهندس وزارة الكهرباء والماء.

- جميع الأعمال يجب أن تلقى الرضا التام لمهندس وزارة الكهرباء والماء، ويتحمل المقاول المسئولية عن أي أخطاء أو عيوب في العمل المنفذ من قبله.

- سوف يكون مطلوباً من المقاول العمل في أكثر من موقع في وقت واحد.

- خلال العمل يجب اتخاذ الحماية الكاملة لجميع معدات وخنادق وزارة الكهرباء والماء مع مراعاة قوانين ولوائح البلدية ولوائح المرور وكذلك قواعد السلامة والأمان في وزارة الكهرباء والماء.

- يجب أن يترك الموقع نظيفاً ومرتباً وفي حالة جيدة وكذلك التخلص من الأنقاض حسب متطلبات البلدية.

23-5 تزويد فريق طوارئ

يجب على المقاول تزويد فرق كما يرد في ، الجداول (جدول العمالة وجدول Q1) بالمستند رقم (7) بالترتيب مع مهندس الوزارة .

24-5 المستندات الواجب تقديمها من قبل المناقص

يجب على المناقص تقديم ثلاث نسخ من المستندات التالية مع عطاءه وذلك بعد تعبئتها بالكامل وتوقيعها وختمها ووضعها في مغلفات منفصلة ، وسوف يستبعد العطاء الذي لا يحتوي على المستندات المذكورة أدناه :

1- صيغة العطاء (مرفق).

2- بيان مفردات الوثائق (مرفق).

3- قوائم الأسعار وقوائم ملخص مجمل الأسعار كما جاء بجداول تحليل الأسعار مستند (5-2).

4- شهادة إستيفاء نسبة العمالة الوطنية الصادرة من الجهة المختصة وفقاً لنص المادة 6 من قانون رقم 19 لسنة 2000 في شأن دعم العمالة الوطنية وقرارات مجلس الوزراء ذات الصلة.

5- شهادات بنكية من البنوك المحلية التي تتعامل معها الشركة أو المؤسسة تبين وضعها المالي أو استعدادها لمنحها التسهيلات المالية.

6- تقديم شهادة أو شهادات إنجاز العقود المقدمة (استلام وقبول) لعقد لا يقل عن مليون دينار كويتي أو عقدين لا تقل قيمة كل منهما عن 500 ألف دينار كويتي مع جهات رسمية من الدولة التي تمت بها الأعمال لتنفيذ أعمال مماثلة لظروف مشابهة لدولة الكويت في صيانة وإصلاح كيبلات الضغط المتوسط 11 ك.ف وكيبلات القيادة والأعمال المدنية المتعلقة بهما.

25-5 المواصفات الفنية لسيارات فحص وتحديد الأعطال

The mobile cable test set is required for dielectric testing, pre-location of faults, cable tracing, pin pointing of cable faults and cable depth determination for 11 KV underground cables and pilot cables.

The cable test set shall have option for VLF-Testing. This shall be 0 – 70 KV 0.1 Hz cosine Rectangular wave, maximum capacity 5 ηF.

Various instruments required shall be assembled in a weatherproof enclosure and shall be fixed on a vehicle of approved model.

The mobile cable test set should comprise the following: -

5.25.1 **Control Unit**

The Control Unit is to Control all the Equipment Available in the Van: -

a) The unit shall accommodate an insulation transformer with input voltage switchable, selectable 240/220-volt, 50 HZ. All the system should accept an input voltage tolerance of +/- 10%. The control unit shall be provided with voltmeter 0-250 Volts, Ammeter to indicate the input currents of the van and frequency meter.

b) The On/Off control switches with indication and selection for mains operation or generator operation.

Safety installations such as control of door contacts, auxiliary ground control, earth loop control, emergency off control, mains breakdown control, automatic control of the discharge and grounding unit as well as the interlocking for instrument and phase selection are controlled centrally by the system.

A mains power supplies with integrated circuit breakers and built-in automatic battery charging system of **12/24 volt should be provided without connecting it to the vehicle's battery.**

c) A manually operated (3) three phase selection switches for 80 KV operated from control room, and an automatic discharge and grounding device positioned in the high voltage room should be provided.

d) All the voltmeters of high-tension units (DC testing, burning and impulse testing) and Milli-Ammeters.

e) The control unit shall accommodate a low voltage selection unit including (3) three-phase plug panel.

f) The control unit should be of simple design to minimize defects and faults.

5.25.2 High Voltage Testing Unit

a) DC Testing Equipment:

The unit shall give output voltage of (**0 - 80** KV DC).

The unit is to have a thermal indication and thermal tripping device in case of over heating or accidents and shall give a nominal output current of 22 MA (continuously) and a short circuit current of 90 MA for approximately (15) seconds. The analogue KV-meter should have (**2**) scales to indicate a voltage measuring range of **35 KV and 80 KV.**

The transformer shall be rated for (5.75) KVA nominal power consumption. This shall be suitable for the power consumption of the instruments.

5.25.3 Burning Unit

This is required to transform high resistance faults in to reflective low impedance fault, for application of pulse reflection techniques for pre location. The burning unit shall be rated at minimum 5.75 KVA.

The burning unit shall have stages of voltages from 60 volts to 2600 volts AC. Five (5) steps and 5000 volts to 15000 volts DC. Three (3) steps output voltage. it should be automatically discharged in case of system switching "OFF" the transformer, the high voltage rectifier and the high voltage commutator are to be fitted in aluminum housing in which oil is insulating and cooling media. **Instrument is to be equipped with a temperature warning with buzzer or lamp.**

Continuous output at full load to be provided for minimum 50 minutes, separate regulation of output current and output voltage is required. Automatic current limitation at fault break down is necessary, even during full load the burn down transformer can be switched over to the different voltage stages. Burning unit will have (4 Nos.) cooling fans.

5.25.4 Portable Instruments

5.25.4.1 Portable high-performance Testing

This shall be suitable for cable testing in compliance with standards. The test voltage shall be up to 40 KV rms and 60 KV DC. with automatic frequency 0.1 Hz cosine rectangular VLF voltage

The instrument shall have fastest possible results, user friendly, automatic discharge mechanism fully automatic programmable test sequences, high test capacitance digital control with professional, self explanatory multilingual software, data communication and saving via USB interface.

The instrument shall have battery and mains operation facility. This shall be kept in the carrying case with all accessories required for connection etc.

5.25.4.2 Portable Instrument for Partial Discharge Test and Fault Location.

These shall be suitable for PD measurement by means of DAC (Damped AC Voltage) and PD level measurement according to IEC 60270.

Other features shall be:

- Automatic adjustment of the band width of the measurement circuit for optimized signal detection.
- PC with WINDOWS and WLAN for system control.
- Statistical PD fault acquisition, online and offline processing.
- Menu driven unit to operate the test sequence.
- Automatic calibration mode with joint location features.
- This shall be complete with all accessories and carrying bag.

5.25.4.3 Sheath Fault Test and Location Set

This is required for sheath testing and sheath fault location in underground cables.

This must be supplied as loose units and shall comprise of the following instruments.

A) Sheath Fault Test Generator

This must be suitable for:

(I) Test voltage 0 – 10 KV

(II) Current indication 0 – 500 mA

(III) Provision of voltage regulator to prevent unacceptable voltage increase.

(IV) Provision of built-in discharge switch for operator safety

(V) Provision of pulse generator for pin pointing

This must be complete with HV connecting cable suitable up to 10KV, connector terminal, earth cable 5MTR. Length with suitable connectors, mains lead 5MTR. In length with suitable connectors, and battery connecting cable (minimum 25 MTR.)

b) **Percolation Unit:**

Percolation shall be done with an accurate high voltage bridge which can be used with a measuring voltage up to 10 KV supplied by an external supply unit.

The measuring bridge shall have an accuracy of +/- 1% and a portable power supply unit having a voltage output in steps up to 2500v will be supplied.

c) **Earth Fault Probe**

This is required for pin pointing the sheath fault and shall be suitable for
(i) pin pointing by tapping voltage difference in the ground
(ii) provision for high sensitivity (10 MV full deflection)
(iii) provision for high input resistance (0,5 M Ω)
(iv) provision for switching over of polarity of display to polarity of supply generator
(v) provision for low current consumption so as to achieve longer battery life

d) The sheath fault test and locating set must have an easy to use software which visualizes the recorded data on a PC.
Storage of the recorded data shall be done automatically to a suitable medium like a USB stick.
The software shall provide means to supplement the measurements with additional data about cable and measurement details.
Provision of printout and export of the data are required.

This must be complete with suitable connecting leads.

5.25.5 **High Voltage Impulse Generator (Type A)**

It shall consist of: -

A) High voltage capacitors bank to give a shock discharge of 3000 joules at 50KV and 80 KV.

B) A motorized high voltage spark gap for a spark over voltage of 0-50 KV and 0-80 KV. The automatic spark gap is to be controlled remotely and it should withstand the frequent operations without causing hazards.

C) **The unit shall provide suitable impulse rate which shall not be less than 20 impulses per minute.**

5.25.6 **High Voltage Impulse Generator (Type B)**

It shall consist of: -

A) High voltage capacitors bank to give a shock discharge of **3000** joules at 4, 8,16 and 32 KV or any other suitable voltage range.

B) The surge voltage shall be variable between each step from 0 to 100% and shall provide a continuous operation without overheating or hazard.

C) The unit shall provide a single HV impulse, and as well shall provide a train of high voltage impulses at the rate of 20, 30 and 120 impulses per minute.

5.25.7 System Coupling Unit

The unit shall offer the possibility of fault location according to SIM (Secondary Impulse Method) or equivalent in connection with the surge voltage generator.

5.25.8 Pulse Reflection Test Set Echo meter

Instrument shall be computer aided having cable fault locating system with pulse echo set with built-in 200 MHZ transient recorder. It shall be fully automatic and based on a industrial PC. The instrument shall be equipped with 12±1" TFT color display and based on latest version of operating system. The 3-phase input shall be voltage protected and CD-ROM will be included.

Provision shall be made for getting the report printed out with a suitable printer associated with the PC. The printer shall be available in the control cabin.

Further the industrial PC shall have provision for generating the CAD drawing which shall give the route of the cable.

A Mega-Ohm-meter with a maximum output voltage of 400 V and a measuring range up to 3 Giga-OHM shall be included in the software of the pulse reflection test set.

The Instrument Must Offer Following Measuring Methods: -

A) Arc reflection method (ARM) or Multiple Impulse Method (MIM)

B) Pulse reflection method (PRM)

C) Impulse current method (ICM)

D) Impulse current differential method (ICDM)

E) Decay method (DM)

F) Differential decay method (DDM)

5.25.9 Audio Frequency Unit

The instrument shall be used for cable tracing, depth determination, cable selection and pin-pointing.

The Unit Shall Comprise: -

A) Transmitter

I) It shall be suitable for use with 230 ±10 % volts AC. System with minimum 50 watts output and also with rechargeable batteries not less than 20 watts output for considerable time usage.

II) **Shall be transmit a frequency between 2 to 10 KHZ with two fixed selections with continuous and pulse mode.**

III) Shall be provided with automatic matching arrangement to match the different types and lengths of cables.

IV) It shall have a test meter to keep the batteries under supervision.

V) Transmitter is to be portable and shall have a proper storage place in the test van.

B) Transmitter

(I) It shall be suitable for use with 230 ±10 % volts AC system with minimum 50 watts output and also with rechargeable batteries not less than 20 watts output for considerable time usage.

(II) Shall transmit a frequency between 2 to 10 KHz with two fixed selections.

(III) Shall be provided with automatic matching arrangement to match the different types and lengths of cables.

(IV) It shall have test meter to keep the batteries under supervision.

(V) Transmitter is to be fixed in the control desk.

C) Receiver

I) It shall be battery operated (preferably rechargeable) with sufficient output and reasonable operating time.

II) It shall include an analogue display.

III) Shall have a test meter to indicate the strength of magnetic field.

IV) Shall be provided with headphones capable of efficient operation in noisy areas (rains, winds, traffic etc.).

V) Shall be provided with earth contact microphones or geo-phones for acoustic and magnetic detection, search coils probes. etc. which can be efficiently used in hard and soft sandy soils with the transmitters and impulse surge generators.

VI) The instrument shall include a time measurement for magnetic and acoustic signals for easy detection of faults in deep sand or cable layed in ducts.

VII) The headphones must have soft pads which can be used for long periods.

VIII) Following Accessories Are Needed: -

A) Detecting rod

B) Selecting coils 2 KHz and 10 Khz

C) Headphone.

D) Inductive pickup.

E) Ground microphone wind and noise protected light weight.

The receiver with its accessories shall be supplied in a carrying case.

5.25.10 Insulation Tester

Operation voltage is 400 volts. This instrument will be used to measure insulation resistance of the cable under test in mega ohms.

This instrument tester shall be integrated in the software of the pulse reflection test set.

5.25.11 Distance Measuring Roller

This equipment will be used to measure the fault distance in meters on the site.

5.25.12 Cables and Wires

a) High Tension Cable

Three (3) single core high tension cables armoured of 50 meters length and 110 KV. DC nominal working voltage. The cable is to be fitted with adequate sealing at one end (van) and a clamp at the remote end (cable under test).

The armouring of the cable is to be brought out with flexible copper wires or braids and terminated with clamps.

Metal drum to accommodate the high-tension cable is mounted into bearings, fitted with breaks and handles. Frame and axle must be supported from both sides.

b) Earthing Cable

A flexible insulated copper cable of 50 meters length and provided with metal ferrules to allow for usage of the required cable length (without drawing out all the cable).

It shall be terminated with a clamp or suitable terminal for earthing connection.

The cable to be mounted in a drum manually operated with brakes and handles for winding and rewinding efficiently.

c) Supply Cable

A Three (3) core insulated cable of 50 meters length. The other end is to be connected to an overload protecting inter connecting box with different connecting facilities. The cable shall be mounted on a metal drum manually operated and provided with handles for easy winding and rewinding purposes.

The high-tension cable and earthing cable are to be used for all the equipment in the van without the necessity of dis-connection or replacement.

d) Auxiliary Earth Cable

Auxiliary earth cable used must be minimum 25 meters long. It should be provided with a pin at the rear end connection and clip at the earth spike end connection. Earth spike also to be provided.

e) A **three**-core insulated cable of 50 meters in length shall be provided for emergency supply.

5.25.13 Auxiliary Supply

A 9 KVA 230 volts, 50 HZ. built in generator should be provided.

This is to be activated by the vehicle motor via a secondary power take off. Provision to be made for stabilizing voltage and frequency.

5.25.14 Manuals

The following manuals must be supplied along with each test van: -

a)	Operation manual for each unit	(in English)
b)	Service manual for each unit	(in English)
c)	Manufacturing manual showing circuit diagrams for reference	(in English)
d)	Trouble shooting manual for each unit	(in English)
e)	Lay out of all equipment and PCB	(in English)
f)	Lay out of all components of PCB	(in English)
g)	Spare parts manual	(in English)
h)	Service manual for the van	(in English)
i)	Maintenance schedule for the base vehicle. This must be authenticated by the local agent of vehicle manufacturer	(in English)

5.25.15 Fault Location System with Easy Go Operating Concept

5.25.15.1 Also a fault location system with Easy Go operating concept shall be given. This must have automatic data storage and logging, central control of all test van function and shall integrate the most innovative pre-location methods.

This system must be user friendly, fast and efficient, with Arc Reflection pre-location methods up to 80KV, Arc burning with burn takeover, provision for automatic analysis of the test data, reports in PDF format and online documentation and help.

The operation concept shall consist of a large monitor and a free positionable control panel, the control unit. This shall store all test and measurement data automatically. Also, the control unit shall evaluate and transmit the data easily. Suitable software shall be provided to carry out the function smoothly. Operational steps which occur frequently during operation shall automatically pre selected. The user then simply confirms the next operating step with the help of the software.

This shall be in the forms of a test van and shall consist of following instruments. Technical details of all offered instruments shall be given with supporting documents.

5.25.15.2 Test

This shall have an integrated test set using D.C, 0.1 Hz Cosine rectangular wave voltage or a sinusoidal wave from (0.1 Hz VLF). The DC tests shall be possible up to a maximum voltage of 40 or 80 KV and with test currents of maximum 600 mA and this shall enable direct burning without the use of external power burn units.

A fully integrated insulation tester up to 1 KV, capacitance measurement and sheath tests shall be provided. This shall enable additional applications for all necessary maintenance work on cables and accessories.

5.25.15.3 Pre - Location

This shall be through decay traveling wave method and the impulse current method (ICE). New version of Arc Reflection (ARM) method shall be available and this shall be with a choice of displaying up to 15 reflectograms out of one ARM short. Also, there shall be ARM burning technology which permits the monitoring of the fault location with a reflection measurement, during the burn process. The burning process shall be controlled and shall automatically provides a pre-location result. The burn duration shall be as short as possible.

Further there shall be provision for progressive methods of fault location like ARM Plus or Decay Plus double surge method for use on higher voltage levels and long cables.

There shall be IFL mode available for intermittent faults.

5.25.15.4 Pinpointing

Pin pointing of fault shall be by using Digi phone which shall be simple fast reliable and low weight. This shall have powerful surge modules with 1280, 1750 or 3000 joules at voltage levels 2 to 32 KV.

The pinpointing device shall include powerful, integrated 200 W audio frequency transmitter with signal select technology, as well as the direct and capacitive step voltage method with AC voltage.

5.25.16 Vehicle

The mobile cable test set must be complete in all respect and ready for use when handed over to the purchaser. The vehicle shall have built in GPS in order to track the vehicle locations, collecting data from the field and deliver it.

The GPS vehicle tracking system (VTS) consists of GPS/GPRS units and GPS software (A web-based solution that relies on internet access for possessing, viewing, storage).

In general, The VTS shall be capable but not limited to the following:

1. The vehicle tracking system should be based on GPS technology to determinate the vehicle location & GPRS technology to transfer the data to back office in real time.
2. The system provided should have the system server hosted in Kuwait.
3. 24/7 monitoring.
4. The hosted system should be built considering state-of-the art, high available and redundant design.
5. The system should provide secure communication, transmission and storage of data.
6. The provided GPRS service should be based on dedicated/private APN from the GSM provider in Kuwait.
7. The system maintains at least 3 years of historical data.
8. The software should be provided in both languages, Arabic & English

Hardware:

9. The tracking device should be capable of utilizing power from the vehicle's DC power system.
10. The hardware should have an internal temperature sensor to measure the internal temperature of the device and observe above threshold temperature.
11. Store and forward the recorded data/events in instances of cellular coverage outage or in areas where no cellular coverage exists. The tracking device should at least store the last 5000 events.
12. The tracking system should be installed totally hidden from the driver to avoid misuse.
13. The tracking device should have a backup battery to ensure continuing the tracking for at least 8 hours if the power source is weak or dismissed.
14. The tracking device should have the ability to switch between various power modes while maintaining the full functional ability. In this case, the device will reduce its power consumption allowing the vehicle to stand for weeks without being driven, while not excessively draining the vehicle battery.

15. The tracking device should have at least 5 inputs to connect to different sensors if needed (door sensor, panic button, fuel sensor, etc...).

16. The tracking device should have at least 4 outputs to be used to control any external sensor/device.

17. The device should have an internal 3-axis accelerometer to sense any harsh braking and acceleration events and send these violations in real time to back office.

18. The tracking device should be connected to the vehicle odometer to display the exact speed and distance as they are in the vehicle.

19. The tracking device should be connected to the vehicle RPM to allow the system displaying the RPM violations.

20. The tracking device should have "Accident Reconstruction" feature to ensure recording the last 20 seconds, at least, before the accident moment occurrence.

21. A push button should be connected to the tracking device allowing the driver to send alerts in case of any accident.

22. The tracking device should have a built-in GPS antenna sensor. This sensor will allow the system to display and alert the users any event of connecting or disconnecting the GPS antenna to detect any attempt to tamper the device.

23. The tracking device should have the ability to alert in case the main power cable/supply is disconnected.

24. The tracking device should be suitable to withstand and operate accurately, reliably and consistently under extreme climatic conditions of the Country (Kuwait).

25. The tracking device should have the capability to store at least 4000 hardware geofences with different shapes. The device will alert the predefined geofence entry/exit in real time.

26. The system user should be able to specify different speed limits for the uploaded hardware geofences.

27. The tracking device saving should accept all below geofences shapes:

- ⇨ Circle
- ⇨ Polygon
- ⇨ Rectangle

Software:

Tracking & Mapping module:

28. The application should be web-based, allowing users to connect from any internet connection via any of the famous web search engines (Internet Explorer, Firefox, etc...).

29. The application should have a digital map with multiple layers to provide address information (main streets, internal streets, blocks, and provinces).

30. The application should allow displaying the vehicle location & events on Google map.

31. The application map should have control tools (search, minimize, maximize, pan, etc…).

32. The system to track a single vehicle, or a group of vehicles simultaneously, in real time updating the speed, location, direction, and time every 30 seconds when the vehicle engine is running, and every 3600 seconds when the vehicle engine is off.

33. The system should be able to display multiple vehicle historical/past trips and show their movements on the map simultaneously with different colors.

34. The user should be able to increase and decrease the speed of the trip replay.

35. The user should be able to customize the vehicle labeling and colors.

36. The application should be able to display the vehicle/vehicles on the map in real time with the following status simultaneously, each with different icon:

- ⇨ Ignition status
- ⇨ Direction status
- ⇨ Last event type

37. Accurately capture, transmit, record & display specific information and events specified herein but not limited to:

- ⇨ Driver login
- ⇨ Driving Speed
- ⇨ Driving Direction
- ⇨ Seat Belt use of Driver
- ⇨ Seat belt use of front seat companion
- ⇨ Vehicle Location
- ⇨ Vehicle Start Point
- ⇨ Vehicle Stop Point
- ⇨ Vehicle Idling
- ⇨ Idle time
- ⇨ Vehicle off the designated route
- ⇨ Harsh Braking

38. The ability to display all created hardware geofences & software zones on the system map while monitoring the vehicles in real time.

39. The ability to assign different geofence groups to any vehicle group.

40. The application should be provided in IPhone/IPad and android versions.

Zone Management Module:

41. To allow the user to create unlimited number of software/map zones to define ministry locations, centers, offices, job sites, buildings, etc... these created zones should take any of the following shapes:

- ⇨ Circle
- ⇨ Polygon
- ⇨ Rectangle
- ⇨ Corridor — the user should determine the corridor width upon his need for each created

42. To allow the user to categorize the created zones into groups (centers group, contractors group, etc...).

43. To allow the user to create a circular zone with a specific radius around any selected vehicle or driver on the map.

44. To allow the user to specify different colors for the created software/map zones.

45. To allow the user to specify the speed limit for each created software/map zone.

Driver Management Module:

46. To enable the user of adding/editing/deleting any driver.

47. The user should be able to categorize the drivers into groups (contractor 1 group, contractor 2 group, etc...).

48. The system should identify and display the driver name responsible for each trip, event, and violation.

49. The system should lock the vehicle engine to work only in the allowed working hours/shifts and only for specific pre-assigned drivers.

50. The user should be able to create unlimited number of driver time profiles (working hours & shifts).

51. The user should be able to create & save unlimited number of driver rating profiles to be used in comparing & evaluating drivers' performance based on any of these created profiles. In each driver time profile, the user can specify the weight of each criterion (speeding, RPM, harsh braking, etc...).

52. The user should be able to generate different reports for any driver rating profile, define in the system by the user.

53. The system should display the trend in performance for each driver over certain time periods.

Planning & Scheduling Module:

54. The system should allow the user to create & save tasks/jobs

55. The system should allow the user to create & save job categories to be assigned for vehicle groups and for each created job to assure the compliance between the vehicle and the assigned job category.

56. The system should allow the user to specify and save the recurring tasks (daily basis, weekly basis, fortnightly, monthly, etc...).

57. The system should allow assigning vehicles to a specific center/ministry location.

58. The system should allow the user to assign a time profile (Ramadan shift, Normal days shift, etc...) for each ministry center, location, vehicle, etc...

59. The system should compare the number of hours each vehicle works inside and outside the pre-assigned duty shift.

60. The system should be capable to propose for each vehicle the best route/schedule and job assignments to be performed at different ministry locations. This proposed plan should be according to different criteria: shortest duration, shortest distance, maximum resource load, balanced resource load, job category, or mix of them. [Route Optimization].

61. The system should provide also the ability to assign manually resources (vehicle & driver) to perform job manually.

62. The system should check the compatibility between the job category and the vehicle type and notify the user in case of an incompatibility.

63. The system should be capable of notifying the user in case of any conflict between the duty hours/time profiles of ministry centers, locations, vehicles and drivers while making the schedule or job assignment plan, either automatically or manually.

64. The system should display the assigned jobs for all vehicles (schedule) in an easy to read interface [Gantt chart] showing the status of each job in a different color (late, early, etc...)

65. The system should be able to display the schedule/plan on the map with different colors.

66. The system should display the unassigned/pending tasks in a separate list.

67. The system should have charts (pie charts, or bar graphs, etc...) to analyze the tasks/jobs status (on time, early, late, etc...) per center, vehicle, etc...

Reporting Module:

68. The system should allow the user to view any report in any of the following format : Excel, PDF, Word, MHTML, CSV, XML, TIFF.

69. The system should allow the user to print any report from the system directly.

70. The system should allow the user to schedule any report to be send to unlimited number of email addresses on a daily, weekly or monthly basis (upon user choice) in Excel, PDF, CSV or XML format.

Conditions & Triggers Assignment:

71. The user should have the ability to define a custom event in the system, these custom events combine multiple sequenced events, for example but not limited to:

- ⇨ The user can define a custom event for a probable accident as following: If an over speeding event is generated by the device followed by harsh braking within a certain period, a custom trigger/event should be created to alert the user of a probable accident.
- ⇨ The user can define a custom event for a probable device tampering as following: If a GPS antenna event and low battery events are generated within a certain period, a custom trigger/event should be created to alert the user of a probable device removal/tampering.
- ⇨ The user can define a custom event for Start of Job On Site as following: If Zone Entry event, and one digital input indicated switching on one of the machines on board, a custom trigger/event should be created to alert the user of Start of Job on Site.

72. The system should provide the ability to configure these custom events at the hardware side, so events to be generated directly from the device.

Administration Functions:

73. The system shall allow allocating administrative authority levels by password protection and thereby allowing the following to be performed only by the authorized personnel:

- ⇨ Define and Edit locations on the map.
- ⇨ Define and Edit automated email report delivery.
- ⇨ Define and Edit saved locations.
- ⇨ Define and Edit Zones and sub-zones.
- ⇨ Define and Edit Vehicle Names and colors.
- ⇨ Define and Edit Driver ID and driver data.
- ⇨ Define and Edit vehicle drive route.
- ⇨ Define and Edit speed limits.
- ⇨ Define and Edit user account authority.
  - ➡ Roles: to control & limit the user ability of using the system functions, features & reports.
  - ➡ Rights: to control & limit the user ability of tracking & monitoring resources (vehicles & drivers).

74. The system should allow the administrative user to be able to stop/lock any vehicle engine in case of theft.

75. The system to record all violations for each vehicle (for example but not limited to :

Over speeding, idling, harsh braking, excessive acceleration, over speeding on turns & curves, specific locations entry/exit, weak vehicle battery, etc...).

76. The system should allow the user to configure any event to be an alert (system alert, email alert, and SMS alert upon user choice).

77. The system should give the administrative user the facility to manage user accounts (add user, edit user, user level, user roles, user group, etc...).

78. The system should alert system misuse events (antenna removal, vehicle battery disconnecting, device tampering, etc...).

79. The system should allow the user to schedule vehicles maintenance, to notify the user/operator when the maintenance should happen, based on odometer or predefined period for each vehicle model.

The base vehicle shall be diesel engine driven, heavy-duty four-wheel drive medium size.

This shall be with 6 – 8 cylinder or more, rpm 2200. Maximum torque shall not be less than 675 Nm at rpm 1200 – 1600 Transmission shall be automatic Permitted rear axle lead shall be 5000 Kg. It is preferred to have vehicle manufactured by European or American manufacturer.

* All trucks types / models should be approved and satisfied by MEW Engineer.

This must have all standard options compliance with legally prescribed emission limits featuring ABS drum brakes and break lining wear indicator in addition to the following.

a) Automatic engine protection RQV regulation to be provided.

b) Air conditioning facility to be provided for the driver`s cabin and the control room cabin. Air conditioning unit to be fitted on the top of the van and covered properly and should follow environmental safety rules.

c) The control equipment should be fixed in a separate cabin.

d) The high-tension instrument cabin and the control equipment cabin shall be separated by a plexiglass screen. This will protect the operator in case the equipment attain high voltage by accident and also the operator can check the required positions of the instruments in the high voltage cabin.

e) A safety interlocks system shall be provided on the rear door and the control cabin door.

f) A side cabinet with lock shall be provided for keeping the loose instruments in the control cabin.

The height of the cabinet should be such that the top can be used as a table top for any small writing works by the operator. In addition, a fixed folding table shall be provided in the control cabin.

g) A revolving chair shall be provided in the control cabin. Necessary arrangement to be provided to fix the chair firm during the movement of the vehicle.

h) Stairs shall be provided for entry in the control cabin.

i) Sliding windows with curtain in the control cabin to be provided.

j) A revolving warning light to be provided on top of the drivers' cabin.

k) Necessary warning light is to be provided at the rear of the vehicle when the testing is in progress.

l) Provision of water tank with minimum 25 Liter. Capacity. This shall have filling and drain valve. This shall be available at the chassis level so that the water can be used for cleaning and washing by the operator at site.

m) The fuel tank capacity shall be sufficient to cover a distance of 350 km.

n) The vehicle shall be painted with white and orange. This is subject to MEW approval.

5.25.17 Weatherproof Enclosure for Assembly of Instruments

The weather proof enclosure shall have:

i) Insulation of walls and roof for noise and heat.

ii) Shall have suitable covering for wall and roof.

iii) There shall be flap door at rear for cable outlet.

iv) Proper flooring shall be laid over whole area preferably with insulating material.

v) Proper lighting arrangement shall be available.

❖ **ملاحظة :** على المناقص الفائز توريد عدد (2) سيارات فحص وتحديد الأعطال، على أن تؤول ملكيتها إلى وزارة الكهرباء والماء حسب جهة الإختصاص المعتمدة بالوزارة.