وزارة الإعلام

قطاع الشئون الهندسية

إدارة الخدمات والإنشاءات الهندسية

اعمال تجهيز موقع تصوير خاص بالقناة الإخبارية الجديدة بقرية يوم البحار

ترغب وزارة الاعلام بتوريد مبنى جاهز الصـنع يتكون من دورين يسـتخدم كمبنى للتصـوير الخارجي بنظام **تسليم المفتاح بمساحة 80 م² (8*10م) للدور الواحد**، وذلك حسب المواصفات التالية:

ملاحظات عامة:

1) يلتزم المقاول بالمواصفات الخاصة لأعمال المرافق العامة و أنظمة السلامة للأفراد والممتلكات وملحقاتها الصادرة عن وزارة الأشغال العامة، على أن تطبق هذه المواصفات دون الإخلال بأحكام المرسوم بقانون رقم(18) لسنة (1978) فى شأن أنظمة السلامة و حماية المرافق العامة و موارد الثروة العامة المعدلة بالقانون رقم (56) لسنة (1980) وكذلك بأحكام المرسوم بلائحة أنظمة السلامة للأفراد والممتلكات و المرافق العامة الصادرة في : 1980/07/05 و القرار رقم (83/94) والقرار رقم (84/95) المنشوران في الجريدة الرسمية بالعدد (1708) بتاريخ 1987/03/01 وجميع القرارات المنفذة له.
2) إن معنى كلمة (أو ما يماثله) حيثما وردت في أي مستند من مستندات العقد إنما المراد منها هو المماثلة من ناحية الجودة والسعر شريطة عدم توفر المادة المذكورة في السوق المحلي.
3) ما لم يرد ذكره بالمواصفات الخاصة لبنود الأعمال التي سيتم تنفيذها يطبق ما ورد ذكره بشأنها في المواصفات العامة للمباني والأشغال الهندسية لوزارة الأشغال العامة الصادرة سنة 1990 م وأية تعديلات طرأت عليها حتى تاريخه.
4) أينما ذكرت (المواصفات العامة) فالمقصود بها المواصفات العامة للمباني والأشغال الهندسية لوزارة الأشغال العامة طبعة سنة 1990 م وأي تعديلات طرأت عليها.
5) يلتزم المقاول بتطبيق جميع الشروط المعتمدة من الجهات المختصة بالدولة (الإطفاء/ البلدية / الكهرباء ...الخ) كما يلتزم بإصدار جميع التراخيص اللازمة من تلك الجهات.
6) على المقاول القيام بجميع ما هو لازم من اعمال مدنية وخدمات من اجل تحقيق الهدف المنشود من قيامه بأعمال المشروع لكافة العناصر والمباني داخل موقع المشروع.

7) يعد المشروع مشروع تسليم مفتاح، واي شرط لم يرد في بنود هذه المواصفات او جداول الكميات، ولكنه ضروري لإتمام الاعمال، فيجب على المقاول تضمينه وتسعيره، ولا يحق له المطالبة بأي زيادة اضافية بقيمة أو بمدة المشروع.
8) المقاول مسؤول عن الحصول على جميع الموافقات والاعتمادات والتراخيص ان لزمت وتوصيل الخدمات التابعة للجهات الحكومية ذات العلاقة الى المشروع.
9) مدة تنفيذ المشروع 90 يوم تبدأ من تاريخ استلام المقاول للموقع.
10) منسوب تشطيب المبنى 45 سم من منسوب أعلى نقطة محيطة بالمبنى.
11) يلتزم المقاول بتقديم مخطط تصميمي من بين 3 تصاميم للاعتماد من قبل وزارة الاعلام (للشكل المعماري والواجهات) وذلك بعد توقيع العقد مباشرة من اجل الدراسة والاعتماد (يستوجب الحصول على ختم المكتب الهندسي على أعمال الهيكل.
12) يجب على المقاول زيارة الموقع حتى يكون على بينة بطبيعة العمل، ويعد تقديم المقاول العطاء إقرارا ضمنيا بمعاينته للموقع معاينة نافيه للجهالة لكافة العناصر التي يجب أن يبني عليها عطائه وأن يضعها في اعتباره خلال مراحل التنفيذ المختلفة والتحقق من الخدمات المجاورة وعلاقتها بالمشروع الجديد وأيضا القيام بأعمال المسح الموقعي لمعرفة طبيعة الموقع الفعلية وأخذها بعين الاعتبار عند وضع أسعاره.
13) يتحمل المقاول كافة تكاليف نقل المعدات والآلات ومكونات المشروع ان وجدت من والى اي موقع اخر حسب تعليمات المهندس المشرف دون تحمل وزارة الاعلام اية تكلفه على العقد، كما يتحمل اخذ جميع الموافقات الامنية الخاصة بالوزارة ان لزمت.
14) يبدأ سريان مدة التنفيذ من تاريخ استلام المقاول للموقع وعليه أن يباشر العمل فوراً من هذا التاريخ.
15) يجب أن يرفق المقاول جداول كميات تفصيلية وتحليل أسعار لجميع البنود مع ذكر الكميات لكل بند.
16) يحق للمهندس المشرف إجراء أي اختبار للأعمال والمواد يراها ضرورية دون اعتراض من المقاول ويتحمل المقاول كافة المصاريف اللازمة لإجراء الاختبارات.
17) جميع المواد المستخدمة بالمشروع لكافة الأعمال يتقدم بها المقاول قبل موعد التشغيل والتوريد وذلك للاعتماد الخطي من قبل المهندس المشرف ولا يتم التوريد أو التشغيل بأية مادة الا بعد أخذ الموافقة الخطية من المهندس المشرف.

18) على المقاول أن يتأكد من كافة الخدمات العامة بمحيط الموقع من تمديدات كهربائية ومياه ومجاري صحية وأمطار وخطوط الهاتف وغير ذلك، ويتحمل المقاول كافة التكاليف المتعلقة بأي أضرار قد تحدث لهذه الخدمات نتيجة الاهمال أو سوء التنفيذ أو عدم أخذ الاحتياطات المناسبة حال استلام الموقع وحتى التسليم النهائي للأعمال.

19) على المقاول ازالة العوائق التي تعترض المنشآت موضوع هذا العقد الظاهر منها أو المخفي والتي لم تبين أو تذكر في مستندات العقد ونقلها للمقالب العمومية أو الأماكن التي يحددها المهندس دون المطالبة بأي مبالغ اضافية نظير ذلك.

20) للمهندس الحق في التأكد من مطابقة الأعمال المنفذة حسب ما جاء بالمواصفات وذلك قبل الاختبارات المقترحة والكشف عن الأعمال وهذا لا يعفي المقاول من مسئوليته عن هذا العمل إذا ثبت بعد ذلك وجود ما يخالف المذكور بالمواصفات، ولمهندس وزارة الاعلام والمشرف على الاعمال الحق أن يأمر بإزالة أية أعمال يراها معيبة او دون الجودة المطلوبة ويتوجب على المقاول أن يقوم بالعمل على ازالة هذه الأعمال فور صدور أمر المهندس الخطي له وعملها مره ثانية متحملا كافة نفقات الازالة واعادة العمل.

21) يلتزم المقاول الرئيسي بتوفير جميع وسائل الأمن والسلامة في الموقع من معدات حماية وعلامات تحذيرية وإرشادية حسب ما يلزم، مع تحديد منطقة العمل بحيث لا يشكل أي خطر على سير المرور في المناطق المحيطة بالموقع.

22) تجري الاختبارات المطلوبة ان لزمت في محطة الاختبارات وأبحاث البناء الحكومية التابعة لوزارة الأشغال العامة أو أي مختبر آخر غير حكومي معتمد لدى وزارة الاشغال العامة ويتحمل المقاول كافة التبعات والتكاليف المترتبة على هذه الفحوصات.

23) على المقاول الرئيسي الالتزام بإجراء أعمال نظافة دورية للمشروع وتوريد حاوية والتخلص من كل الأنقاض والمخلفات أولاً بأول وفور الانتهاء من كل مرحلة عمل كما يلتزم بالحفاظ على نظافة وسلامة جميع المنشآت والمرافق المحيطة بالموقع. هذا ويتم استكمال عمل النظافة الشاملة للموقع وفق الإجراءات المتبعة وذلك قبيل التسليم الابتدائي للمشروع.

24) تورد جميع المواد المطلوبة للأعمال سواء المحلية أو المستوردة من الخارج في أوعيتها الأصلية وبحيث تكون مقفلة ومحمية ضد الرطوبة وتأثير العوامل الجوية وغير مفتوحة وسليمة من أي ضربات خارجية، ويتم تخزينها بشكل مناسب في المواقع المتفق عليها مع اشراف الوزارة ونقلها متى ما لزم، والمقاول مسؤول على سلامة تلك المواد.

25) للوزارة الحق في إلغاء أي بند من بنود العقد لا يصب في مصلحة العمل أثناء التنفيذ دون إبداء للأسباب وبما يتماشى مع الشروط الحقوقية المعتمدة لسنة 1971 وتعديلاتها. وعلى المقاول الالتزام بتلك الشروط الحقوقية وتعديلاتها.

26) يجب على المتعهد تقديم قائمة بمقاولي الباطن في مدة أقصاها (14) يوم من توقيع العقد.

27) يجب على المقاول أن يقدم طلب تدقيق للأعمال قبل 24 ساعة من موعد التدقيق على نموذج يعتمده في بداية المشروع من الوزارة وللوزارة الحق في تدقيق الأعمال خلال 48 ساعة من تقديم هذا الطلب.

28) كافة أعمال الهدم والتكسير ان وجدت تتم بواسطة عمالة فنية متخصصة مع الاخذ بعين الاعتبار أن ترحيل مخلفات أعمال الهدم والبناء تتم أولا بأول مع توفير عدد (1) حاوية وعلى أن تكون الأنقاض وكافة التشوينات

29) يتحمل المقاول مسئولية نقل وفك الأدوات والأجهزة التي تم فكها وكانت بحالة سليمة وتعرضت لأي أضرار أثناء التنزيل أو الرفع أو التشوين أو النقل إلى الجهة المستفيدة.

30) في حال تعرض او اتلاف اية خدمات تابعة للإدارات المختلفة للوزارة قبل أو أثناء التنفيذ فان المقاول يتحمل مسؤولية اصلاح الاضرار او الاعطال من قبله ودون المطالبة بأية تعويضات سواء وقتية أو مالية.

31) أي شكوى من أي جهة بالوزارة من ضوضاء أو أتربة أو خلافه يتحمل المقاول كافة آثارها المادية والقانونية.

32) يلتزم المقاول بإصدار التصاريح الأمنية لدخول العمال والمعدات وذلك حسب تعليمات إدارة الامن والسلامة ، وبمدة 24 ساعة على الأكثر من موعد دخول العمال او المعدات.

33) جميع القياسات الواردة في هذه المواصفات تقديرية، لذا يلتزم المقاول بتنفيذ جميع الاعمال حسب القياسات الطبيعية بالموقع ودون أي زيادة في المبلغ.

34) الالتزام باشتراطات الامن وذلك بتقديم نسخ من هويات طاقم عمل المشروع وكذلك السيارات وذلك لإصدار تصريخ دخول.

أولا: أعمال الحفر والدفان:

1- الحفر حتى الوصول الى منسوب التأسيس المعتمد بالمخطط
2- أعمال الدفان تكون بأتربة نظيف موردة للموقع للأساسات مع الرش والدحل بالمعدات الخاصة.

ثانيا: أعمال الخرسانة المسلحة والهيكل الحديدي:

1- صافي ارتفاع الدور الأرضي 4.7 م والدور الأول 5م غير شامل الدراوي ان وجدت وحسب التصميم المعتمد.
2- توريد حديد التسليح والقوالب الخشبية وحديد التسليح حسب الأقطار بالمخططات التصميمية.
3- أعمال الخرسانة العادية أسفل الأساسات (k150) اسمنت مقاوم للأملاح والرطوبة.
4- أعمال الخرسانة المسلحة للقواعد (k350) اسمنت مقاوم للأملاح والعوامل البحرية.
5- تصميم وتصنيع وتوريد ودهان القطاعات الحديدية بالدهانات العازلة للرطوبة والملوحة مع وصل القطاعات الحديدية بالبراغي عالية الاجهاد وحسب التصميم المعتمد.
6- سقف الدور الأرضي من الخرسانة المسلحة سمك 10 سم (k350) مقاوم للأملاح محمل على قطاعات حديدية وحسب التصميم المعتمد.
7- سقف الدور الأول من Sandwich Panels سمك 15 سم من مصنع محلي معتمد له سابق أعمال بالمشاريع الحكومية.
8- توريد وتركيب درابزين للسلم الداخلي وحسب التصميم المقدم واعتماد المهندس المشرف.

ثالثا: أعمال الواجهات الخارجية والمباني والدهانات:

1- توريد وتركيب طابوق أبيض خفيف عازل للحرارة من مصنع محلي معتمد سمك 20 سم شامل اللواصق الخاصة للحوائط الخارجية.
2- توريد وتركيب طابوق اسمنتي سمك 10 سم لزوم القواطع الداخلية مع التنفيذ حسب أصول الصنعة من مونة اسمنتية وشرمات للتثبيت مع الهيكل الحديدي.
3- يتم تشطيب الحوائط الداخلية بألواح الاسمنت بورد المقاول للرطوبة شامل الزوايا والاكسسوارات وجميع ما يلزم حسب أصول الصنعة.
4- توريد وتركيب ألواح ملساء sandwich panelsلحوائط الدور الأول سمك 15 سم بكثافة 40 كجم/م^3.
5- يلتزم المقاول بتقديم تصميم عصري للواجهات الخارجية يتوافق مع الشكل العام للموقع والمباني المجاورة وتكون المواد مقاومة للحرارة والعوامل الجوية والملوحة.

6- توريد وعمل الصبغ الداخلي للمبنى نوع jotun فينوماستك أو ما يماثله 3 أوجه وحسب أصول الصنعة.
7- توريد ودهان الأسقف بدهان أسود مطفي وجهين بطريقة الرش.
8- يجب على المقاول الاخذ بالحسبان أعمال دروة السطح (ان وجدت) وحسب التصميم، حساب كمياتها ضمن العقد.
9- توريد وتنفيذ كسوة الواجهة الخارجية وفقاً للمواد المستخدمة في المباني التراثية (2 أو 3 مم) الصناعات الوطنية الكويتية أوKPC،Hempel . وحسب تعليمات المهندس المشرف.

رابعا: أعمال الصحي:

1- توريد وتركيب أنابيب صرف صحي داخلية بالأقطار المعتمدة حسب التصميم (العدساني).
2- توريد وتركيب الأطقم الصحية Duravet
3- توريد وتركيب خلاطات صحية GROHE للمغاسل والمراحيض.
4- توريد وتركيب اكسسوارات الحمام من فواطات وصبانات وعلاقات.

خامسا: أعمال الألمنيوم والزجاج:

1- توريد وتركيب قطاعات الالمنيوم للشبابيك (أوروبي) بالألوان المعتمدة سمك 2 مم – اكسسوارات إيطالي مع تقديم شركة مختصة لها سابق أعمال حكومية وذلك للدراسة والاعتماد.
2- توريد وتركيب زجاج مقسى Tempered safety glass **لثلاث واجهات** عاكس وعازل للحرارة والاشعة الفوق بنفسجية بتصنيف STC (فئة نقل الصوت) وبمقياس **لا يقل عن 36** ويلتزم المقاول بتقديم تفاصيل المادة Data sheet من مصنع أو شركة لتصنيع الزجاج له سابق أعمال بالمشاريع المختصة بالواجهات الزجاجية (استوديوهات-مطارات-مجمعات او ما شابه) وذلك للدراسة والاعتماد.

خامسا: أعمال الأبواب:

1- جميع الأبواب الداخلية تكون من مادة wpc مقاومة للحريق والرطوبة وحسب الأبعاد المعتمدة بالتصميم شامل جميع الاكسسوارات من مقابض وفصالات واقفال .... الخ.

2- توريد وتركيب بابين رئيسي خارجي وداخلي(مزودج بينهما 1.5م) للمبنى بالدور الأرضي بالأبعاد والسماكات المعتمدة بالتصميم من الخشب المقاوم للحريق (تقديم شهادة من قوة الإطفاء) وللعوامل الجوية والملوحة وعازل للصوت شامل جميع الاكسسوارات من مسكات وفصالات واقفال الكترونية وجميع ما يلزم.
3- توريد وتركيب باب للدور الأول بالسمك المعتمد حسب المخطط عازل للصوت ومقاوم للحريق حتى 30 دقيقة وحسب اشتراطات قوة الإطفاء.

سادسا: أعمال الزراعة.

1- توريد وزراعة عدد 6 أشجار واشنطونيا بارتفاع لا يقل عن 9 متر شامل شبكة الري.

سابعا: أعمال العزل الصوتي:

الأرضيات للدور الأول

Floor carpet using materials (Wool blend or nylon or polypropylene)

Durable, stain resistant loop carpet, with sound absorption

Complies with international fire safety standards (Class 1 Fire Rating, ASTM and EN standards for fire safety, low-emitting by CRI)

Installation by using adhesive or double-sided tape with details of installation approved by supervising engineer, with all seams sealed with heat sealing or glued together

Customization Options all under approval and guidance of supervising engineer
Fabric Choices in various colors and patterns.
Finishes Options for installation and fixing on floor.
Warranty: Manufacturer’s warranty

تكسيات حوائط الدور الأول

توريد وتركيب بلاطات فوم بشكل هرمي صديقة للبيئة عازلة للصوت والرطوبة ومقاومة للحريق سمك 5 سم باللون المعتمد من قبل المهندس لحوائط الدور الأول وحسب التصميم المعتمد.

ثامنا: الأرضيات

1. توريد وتركيب أرضيات بلاطات الجرانيت الصناعي بالمقاسات المعتمدة سمك 10 مم وحسب موافقة المهندس المشرف.
2. توريد وتركيب بلاطات من الجرانيت الطبيعي للسلم الخارجي للمدخل.
3. توريد وفرش مادة الأبوكسي 3 طبقات لأرضية الدور الأول وحسب التصميم المعتمد.

CIVIL WORKS BOQ

	DESCRIPTION	QTY	UNIT	UNIT PRICE		TOTAL PRICE	
				K.D	Fils	K.D	Fils
1	توريد مبنى جاهز الصنع حسب المواصفات المرفقة بمساحة 80 متر مربع، دورين	مقطوعية					

TOTAL AMOUNT (K.D / Fils)	

الأعمال الميكانيكية

Chapter 1
General Conditions

Ministry of Information invites specialized companies to participate in the following works as detailed in the scope of work of these specifications.

1. **General Conditions**:

Ministry of Information invites tenderers for supply, Installation, Commissioning and Handing over in good working condition with two years guarantee and maintenance of 3 Nos. Package Air-Cooled Air-Conditioning unit with power supply cables, controls, in weather proof box , and all duct works.

1.1 All tenderers wishing to participate in this tender must visit the site to have full idea about all works involved in this tender before submitting their offers as no variation claims shall be entertained. The attached site visit statements with the tender documents shall be filled and stamped by the tenderer's seal and signed by the Tenderer's representative and MOI Engineer.

Site visit can be arranged by calling to telephone no. 98554248 from 10.00 AM till 1.00 PM. Four days every week from Sundays to Wednesday, with A/C engineer site visit shall be carried out every Wednesday Morning only.

1.2 specifications described hereunder are brief and therefore the tenderer shall be include for all equipment material, labour and whatever is required for the entire project and to ensure best workmanship and operating conditions to the entire satisfaction of the MOI Engineer whether detailed under the specifications or not.

1.3 The Contractor shall take all necessary precautions not to damage any exiting services and shall make good any done by him during the course of installation of equipments, at no extra cost.

1.4 The Contractor shall ensure that all mechanical, electrical and civil works shall be supervised by qualified engineers of the respective specialization and experience and all installations shall be make with special companies working in the Air conditioning filed and approved from engineering services department before installation works start.

1.5 The contractor shall ensure cleanliness and safety of the site, all throughout the execution of the project and shall remove all waste materials. No scrape materials shall be carried out at short intervals to avoid mishap, accident or inconvenience to site users.

1.6 **Guarantee and maintenance**:-

The successful tendered shall be responsible for guarantee and maintenance of all the works for all period of two years included the spare parts, from the date commissioning and handing over of the project & five years for each compressor.

Chapter 2
Scope of Work

2.**Scope of Work**:

2.1 Contractor Shall Provide A Heat Load Calculation to determine the cooling capacity required for the project. The contractor shall keep into consideration that the second floor will be a studio and shall keep the noise level as low as possible when designing the HVAC System. The Heat load calculation needs to be submitted within a **WEEK** from signing the contract and approved by ministry engineer.

2.2 Supply, installation, testing, commissioning and handing over in perfect condition with two years guarantee and maintenance including on call service of the following:

Total of 3 package air cold DX units in YOUM AL BAHAR Site:

3 Package air cold DX unit of total capacity of the three package units to be not less than 18 TR complete with controls

Temperature control with cover box.

Condensate water pipe for All air package units.

Steel stand foundation support for the All air package units

All civil and electrical works necessary to complete the works.

Two years maintenance guarantee for all installations and five years for the compressors.

2.3 Design, supply and installation of Ducting layout with all duct work and accessories including insulation, acoustic lining, supports, cladding, dampers, air inlets and outlets and sound attenuator, according to layout plan and other necessary equipment to have an efficient air distribution system as specified.

2.4 Supply and Installation All necessary Insulation for Duct, connection duct

2.5 Design, Supply and Installation of Turbine ventilator system for two toilets with ductwork and all necessary accessories.

2.6 Supply and install 3 NOS Digital thermostat

Chapter 3
Detailed technical specification

Section 1 - PACKAGE DIRECT EXPANSION A/C UNITS
PART-1 GENERAL

1.01 Description

A. Scope: Supply and install Package D/X cooling units complete in accordance with the requirements of the Contract Documents. This Section relates to the supply and installation.

1.02 Quality Assurance

A firm regularly engaged in manufacture of air-cooled DX units, of type and capacities required, whose products have been successfully used in similar services for not less than 5 years.

1.03 Submittals

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, etc.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring for D/X cooling units.

D. Static pressures given in the DX-units Schedules are only for guidance. The Contractor shall calculate the external and internal static pressures for all DX units and shall obtain Engineer's approval before ordering the equipment's. The Contractor should provide the required fan and motor h.p. Without additional cost. (Minimum Static pressure shall not be less than 1.5 in.water)

1.04 Special Project Warranty

A. Warranty on Compressor: Provide written warranty, signed by the manufacturer and/or supplier, agreeing to replace/repair, within warranty period of five years, compressors with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provide manufacturer's instructions for handling installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is not limited to component replacement only, and it does include labour for removal and reinstallation.

B. D/X Cooling Units

PART 2 – PRODUCTS

2.01 MANUFACTURERS:

a) Except where specifically stated to the contrary, approved manufacturers for equipment and/or materials under this section are as follows:
b) All manufacturers will be approved, as subject to compliance will specifications.
c) Manufactured units will be considered if they are produced by, specialized manufacturers whose units are equal in every respect and have been in similar service for not less than five years.

Approval of the manufacturer does not necessarily constitute approval of its products as equal to the start of construction

2.02 Package D.X Units

C. General: Provide factory-assembled and tested for D.X units as indicated, designed for roof, slab or floor mounting, consisting of compressors, condensers, evaporator coils, refrigerant piping, condenser and evaporator fans, refrigeration and temperature controls, filters, and damper. Provide capacities and electrical characteristics as scheduled.

D. Casing: Provide manufacturer's standard weather proof casing slim line construction, corrosion protection coating, and exterior finish. Provide removable panels and/or access door for inspection and access to internal parts. Insulate casing with 1" thick minimum thermal insulation. Provide knockouts for electrical and piping connections. Provide condensate drain connection and lifting lugs.

E. The framework should be clad with minimum 50-mm thick, double skinned panel insulated with mineral wool / fiberglass / polyurethane insulation sandwiched having a density of not less than 48 kg/m³. Coefficient of heat transfer for the casing should not exceed 0.6 W/(m2K).

F. Evaporator Fans: Provide propeller-type, direct-driven Plug in fans with permanently lubricated bearings.

G. Coils: For evaporator and condenser, provide non-ferrous construction with aluminum plate fins mechanically bonded to seamless copper tubes; with brazed tubing joints. Circuit evaporator to provide full active face on minimum cooling step.

H. All DX units shall have all inverter driven Scroll compressor(s) electronically controlled and capable of changing speed to follow the variation in cooling or heating requirements, and from same manufacturer of main equipment.

1. Provide cylinder unloaders for capacity control, with minimum steps as scheduled.

2. Provide thermal expansion valves, filter dryers, sight glasses, compressor service valves, liquid line service valves; and provide minimum of 2 refrigerant circuits for units having 2 or more compressors. Provide fan-cycling control for low ambient control to 45°F (6°C).

I. Safety Controls: Provide the following controls:

1. Low pressure cutout, manual reset.

2. High pressure cutout, manual reset.

3. Compressor motor overload protection, manual reset.

4. Anti - recycling timing device.

5. Adjustable low-ambient lockout.

J. Provide filter section consisting of 2" (50mm) thick metallic aluminum filter in V-shape arrangement, with maximum face velocity of 300 fpm & fresh air filter with 4"(100mm) thick metallic aluminum filter.

K. Electrical: Provide 240 V convenience outlet, separately fused, for unit service. Provide means for unit power connection through unit cabinet.

L. Refrigerant: 410A/407C

M. Accessories: Provide the following accessories:

1. Anti-Recycling Control: Provide controls to automatically prevent compressor restart for 5 minutes after shutdown.

2. Time Guard: Provide time guard to prevent short cycling of compressors.

PART 3 – EXECUTION

3.01 Inspection

N. Examine areas and conditions under which D.X cooling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 Installation of Package D.X Cooling Units

A. General: Install D.X cooling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in approved locations, and maintain manufacturer's recommended clearances.

B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal.

3.03 Start - up

A. Start-up D.X cooling units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

B. Balance D.X unit systems to verify its capacity and balanced delivery of air for each space.

3.04 Grounding

A. Provide Positive equipment ground for D.X cooling unit components.

3.05 Spare Parts

A. General: Furnish to the Employer, with receipt, the following spare parts for each D.X cooling unit.

1. One set filters for each unit.

SECTION 2 - AIR-DISTRIBUTION

PART-1 GENERAL

1.01 SECTION:

A. Duct work
B. Duct work accessories

1.02 DESCRIPTION

A. Extent of ductwork and accessories is in the scope of work, and the requirements of this section.

B. Types of ductwork required include the following:
- Closed loop high speed, high pressure ducts.
- Air-conditioning supply and return air ducts.
- Outdoor air supply systems.
- Mechanical exhaust systems.

C. Types of duct accessories required include, but not limited, to the following:

- Dampers.
- Fire dampers.
- Elbows.
- Duct fittings.
- Duct access doors.
- Housing access doors.
- Casing or housing.
- Flexible connections.
- Hangers and supports.
- Sealants.
- Duct connection to equipment.
- Turning vane extractor.
- Duct hardware.

- Duct lining.

D. Classification:

The Duct Work shall be classified into two groups:

i. Low Pressure
ii. Medium and High Pressure

The following table shows pressure-velocity classification:

Duct Group	Duct Class	Static Pressure	Pressure	Velocity FPM.
Medium and High Pressure	High Pressure	10’	Positive	4000 & above
	Medium pressure	6”	Positive	4000 & above
	Medium Pressure	4”	Positive	4000 & above
	Medium Pressure	3”	Pos. or Negative	3999 & below
Low Pressure Duct	Low Pressure	2”	Pos. or Negative	2500 & below
	Low pressure	1”	Pos. or Negative	2500 & below
	Low pressure	1/2"	Pos. or Negative	2500 & below

1.03. QUALITY ASSURANCE

A. SMACNA Standards: Comply with SMACNA "Low Pressure Duct Construction Standards" and SMACNA "High Pressure Duct Construction Standards" for fabrication and installation of low and high pressure ductwork comply with SMACNA "Low Pressure Duct Construction Standards" and SMACNA "High Pressure Duct Construction Standards" for fabrication and installation of low medium and high pressure ductwork.

B. NFPA Compliance: Comply with ANSI/NFPA90 A "Standard for the Installation of Air-conditioning and Ventilating Systems" and APNSI/NFPA 90 B "Standard for the Installation of Warm Air Heating and Air-conditioning Systems.

C. Field Reference Manual: submit at project field office, copy of SMACNA "Low Pressure Duct Construction Standard and SMACNA "High Pressure Duct Construction Standards."

D. Frame-Smoke Ratings: Duct liner shall have flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84-75.

1.04. SUBMITTALS

A. Product Data Submit manufacturer's specifications on manufactured products and factory fabricated ductwork, used for work of this Clause.

B. Shop Drawings: Submit dimensions layouts of duct work showing both the accurately scaled ductwork with its accessories and its relation to space enclosure. show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets.

D. Maintenance Data: Submit manufacturer’s maintenance data including parts lists for each type of duct accessory, include this data in Maintenance Manual.

1.05. DELIVERY, STORAGE AND HANDLING

A. Protect shop-fabricated and factory-fabricated duct work, accessories and purchased products from damage during shipping, storage and handling. Prevent damage and prevent dirt and moisture from entering ducts and fittings.

B. Store ductwork and ductwork accessories inside and protect from weather. Where necessary to store outside, store above ground and enclose with waterproof wrapping.

PART - 2 PRODUCTS

2.01. DUCT MATERIAL:

A. Sheet Metal: All ducting shall be made of galvanized steel sheet to ASTM A525, Lock-forming quality, having zinc coating of 1.25 Oz. per sq. ft. (382 g/sq.m) for both sides in conformance with ASTM A90 of tensile strength in range of 28/33 tons per square inch.

B. Stainless Steel Sheet: Provide stainless steel complying with ANSI/ASTM A 167; ISI Type 316 with No. 4 directional polish where exposed to view in occupied spaces. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

2.02. FABRICATION

A. Shop fabricate ductwork in 1, 2, 3 or 4 meter lengths, unless otherwise required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field disassembled systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark actions for reassembly and coordinated installation.

B. Shop fabricate ductwork of gauges (thickness) and reinforcement complying with SMACNA "Low Pressure Duct Construction Standards" and SMACNA "High Pressure Duct Construction Standards".

C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with centre-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible.

E. Duct dimensions shall be clear inside dimensions.

F. Ductwork shall be fabricated from galvanized steel sheet metal having a thickness and appropriate joints and reinforcement as recommended by SMACNA STANDARDS and as listed hereunder:

i. Low Pressure Rectangular Duct Work:

Gauges of G.I. Sheeting, type of joints, bracing etc,. used for the manufacture of low pressure. Ducting shall be as per the following schedule:

Max. Side Inches	**US/Std. Gauge**	**Transverse Joints and bracing**
Up to 12”	24	¾” Pocket or slip Joint at 8 ft. center
13” – 18”	22	1” Pocket Joint at 4. ft. centers with cross breaking
19” – 30”	22	1” Pocket Joint at 4. ft. centers with cross breaking
31” – 42”	22	1 ½ Pocket Joint at 4 ft. centers with across breaking and ½” x ½” x 1/8” angle girth at 8 ft. centers bolted to the pocket joints.
43” – 54”	20	1 ½ Pocket Joint at 4 ft. centers with across breaking and 1½” x 1½” x 3/16” angle girth at 8 ft. centers bolted to the pocket joints
55” – 72”	20	1 ½ Pocket Joint at 4 ft. centers with across breaking and 1½” x 1½” x 3/16” angle girth at 8 ft. centers bolted to the pocket joints
73” and above	18	2 – 1 ½” x 1 ½” x 3/16 angles at 4 ft. centers bolted to the duct with 3/8” bolts at 1 ½” centers and fastened together with 3/8’ bolts at 2” centers with rubber gasket between the 2 angles and cross breaking.

All transformation pieces of ducting shall have slope of 1 in 7, where it is not possible to maintain this, a maximum slope of 1 in 4 shall not be exceeded.

All the side outlet take off (outlet collars) shall have a throat radius of not less than the width of the take off and to be fitted with fixed turning vanes.

All Tees, bends and elbows shall be constructed in such a way that the radius will not be less than 1-1/2 times width of duct on centerline. Where this is not possible turning Vanes shall be provided.

Duct sizes shall be increased gradually, not exceeding 15 Deg. wherever possible. Divergence upstream of equipment shall not exceed 30 degrees, convergence downstream shall not exceed 45 degrees.

ii. Low Pressure Round Duct

Low pressure Round Duct shall be constructed generally according to the following schedule:

Duct diameter in inches	**Negative Pressure**		**Positive Pressure**	
	Spiral Seam gauge US	**Longitude. Seam gauge US**	**Spiral Seam gauge US**	**Longitude. Seam gauge US**
3"thru 8”	28	24	30	28
9” thru 14”	26	24	28	26
15”thru 26”	24	22	26	24
27”thru 26”	22	20	24	22
27”thru 50”	20	18	22	20
61”thru 84”	-	16	-	16

1" W.G. Maximum Negative Pressure.

iii. Medium and High Pressure Duct Work:

Medium and High Pressure Duct shall be of round Construction.

Fabrication and Construction shall be in accordance with SMACNA high pressure duct construction Standards.

The Spiral Ducts shall be externally seamed so that the inside surface of the ducts is smooth.

Gauges of G.I. sheeting, type of joints, bracing etc. used for the manufacture of medium and high pressure round duct work shall be as per the schedule:

Duct Diameter mm	Galv. Steel Gauge (U.S.)			Girth Reinforcing		Girth Joints*
	Spiral lock Seam Duct	** Longitudinal Seam Duct	*** Sound Duct Fitting	Between Joint Angle Size & Max. Longitudinal Spacing		
Up thru 200				22	None Required	50 mm long
225 – 350	26	24	26	20		Slip Joint
375 – 650	24	22	24	20	None Required	50 mm. Ditto
675 – 900	22	20	22	20	None Required	50 mm. Ditto
925 – 1250	20	20	20	18	None Required	40x40 mm Angle flanged joint
1275 – 1500	18	18	18	18	None Required	*Ditto*
1525 - 2100			18	18	None Required	*Ditto*

* Recommended Joint Listed; However, 50 mm. Slip Joint or Draw Band is acceptable thru 1500 mm. size.

** Slip or Draw Band Joint.
*** Flanged Joint.

All Tees, Bends and Elbows shall be constructed with radius of not less than 11/2" times diameter of duct on centerline. Where not possible and where rectangular elbows are used, airfoil turning vanes shall be provided. Transformation of duct sizes shall be gradual, not exceeding 15 degrees divergence and 30 degrees convergence.
Round duct fittings shall be of welded type construction. For ducts of diameter up to and including 12”, one piece smooth 90 Deg. elbows shall be used. Over 12" 0 they shall be 5 pieces welded.

2.03. STAINLESS STEEL DUCTWORK:

Provide stainless steel ductwork for all kitchen hoods up to five (5) meters away from hood. Fabricate entire length of ductwork using stainless steel type 316, thickness 0.7 mm.

2.04. FLEXIBLE DUCTS:

For connections between branches, risers or mains to mixing units, air outlets and inlets or terminal units or for combination lighting air distribution units. Flexible ducts to be manufactured from vinyl or anisole bonded to glass fabric zinc-coated flexible metal or constructed of two-element spiral construction composed of a corrosion-resistant metal, supporting spiral and coated fabric approved equal materials with a mineral base.

2.05. DAMPERS

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA "Low Pressure Duct Standards". These dampers are for use in balancing air flow in duct systems.

B. Control Dampers: Provide dampers with parallel blades for 2-position control or opposed blades for modulating control. Construct blades of 1.6 mm thick steel to provide heavy-duty molded self-lubricating nylon bearings, 13mm diameter steel axles spaced on 230 mm centers. Construct frame of 50mm x 13mm x 3.2 mm steel channel for face areas 2.3 sq. meter and under; 100mm x 32mm x 1.6mm thick channel for face areas over 2.3 sq. meters. Provide galvanized steel finish with aluminum touch-up.

C. Counterbalanced Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 1.6mm thick aluminum, provide 13mm diameter ball bearings, 123 mm diameter steel axles spaced on 230 mm centers. Construct frame of 50 x 13 x 3.2 mm steel channel for face area 2.3 sq. meters and under; 100 x 32 x 1.6mm channel for face areas over 2.3 sq. meters. Provide galvanized steel finish or frame with aluminum touch-up.

2.06. TURNING VANES/AIR EXTRACTORS

A. **Turning Vanes**:

- Shall be fabricated in accordance with SMACNA Standards.
- Turning Vanes shall be as follows: Factory fabricated vane spacing rails. Turning Vanes shall be provided in all square elbows, take-off or extension collars to supply outlets and tap-in branch take-off connections.

B. Actuation Mechanism: Devices shall be equipped with both motorized and the fusible links. The fusible links shall be rated and marked for 72 degrees C. Fire dampers shall be suitable for horizontal or vertical mounting and shall be interlocked with fire alarm system.

C. Free Areas: Unless otherwise noted, fire dampers for use in ducted applications shall be constructed so that in the open position, the damper has a clear opening equal dimensionally to the duct size. Fire dampers for use in no ducted applications must have at least 75% free areas

D. Fire Rating: All dampers shall not permit the passage of flame when exposed to the time/temperature curve of BS 476, Part 8 for a period of two (2) hours. The damper blades, gearing, mechanism and inner casting shall be easily removable to facilitate maintenance, replacement or repair. To facilitate reset and manual resetting of the blades, a short extension spigot shall be fitted to the damper blade assembly with a manual lever fitted to the spigot and linked to the damper blade gearing assembly. Indication shall be provided when the damper is in the open or closed position. An internal rachet mechanism shall hold the damper in the open position. Fire damper assembly shall be tested by an approved authority and the contractor shall provide test certificates from the authority. An inspection hatch shall be provided on each side of the damper. Fire damper shall have provision for remote close or open signaling and shall be connected with fire alarm system.

2.08. ELBOWS

A. Rectangular Ducts:

i. Radius Elbows: Radius elbows shall be fabricated in accordance with Figure 2-1 of the SMACNA L.P Duct Manual. Wherever possible, the throat radius of the elbow shall be equal to duct width. Where throat radius must be less than duct width, elbow shall be constructed with one vane as shown in Figure 2-1.

ii. Square Elbows: Double thickness turning vanes as shown in Figure 2-3 of the L.P Duct Manual shall be used in square

Type	Space Between Vanes	Radius	Gauge
Small	1 ½”	2”	24
Large	3 ¼”	4 ½”	22

B. Air Extractors:

Provide air extractors in sub-branch supply ducts to control air flow quantity to branch. Construct extractors of Galva steel or aluminum in accordance with SMACNA "Low Pressure Duct Standards".

2.07. FIRE DAMPERS

A. Damper Frame: Frame shall be fabricated of no less than 1.7 mm thick (minimum galvanized steel, roll-formed for structural rigidity and equipped with slots or holes for mounting to wall sleeve. Damper frames designed to function as a wall sleeve are not acceptable. Separate wall sleeves must be furnished.

B. Damper Blades: Damper blades shall be mounted in the air stream and be opposed - blade arrangement. The blades shall be interlocking, be constructed from not less than 0.7 mm thick (minimum) galvanized steel, or not less than 0.5 mm thick stainless steel and have hollow section profile. The blades shall normally be parallel with the air stream and be closed by internal spring's operating rack and pinion mechanism, or gearing, to interlink the damper blades. The gearing shall have low torque characteristic and be constructed in zinc plated steel. The fire damper blades and holding casting shall be fitted in the fire wall or floor and be designed to accommodate thermal expansion during fire condition to prevent jamming and distortion of the blades and maintain integrity to the fire seal.

C. Wall Sleeves: Contractor-fabricated sleeves shall be furnished for all fire damper installations. Sleeves shall be fabricated of not less than 3mm thick, (minimum) galvanized steel and equipped with 38 mm x 38mm x 3.2mm (or larger) angle iron frames to secure the sleeve in the wall or floor. Angle iron frames shall be provided on both sides of the wall or floor and shall be welded or bolted to the wall sleeve along the entire perimeter of the sleeve.

B. Round and Oval Ducts:

Elbows for round ducts may be smooth, machine stamped elbows or mitred elbow, with throat radius equal to or greater than the duct diameter. All mitred elbows shall be fabricated according to the following schedule:

Elbow Angle	Number of Cores
Up through 35 degrees	2
36 degree thru 71 degree	3

2.09. DUCT FITTINGS

A. Rectangular Duct:
All changes in duct sizes or elevation, tee connections, connection for grilles, registers or diffusers, transitions for elbows, casings, etc. shall be in accordance with Figures 2-2, 2-7 through 2-10 of the L.P. Duct Manual, SMACNA. Unless otherwise noted, no mitred fittings will be allowed.

B. Round and Oval Ducts:

All changes in duct size or elevation, the connections and branch laterals shall be made with separate fittings of all welded construction. All 90 degrees tees and 45 degree branch laterals up to 300 mm diameter tap size shall have a radiused entrance into the tap, reduced by machine or press forming; field-made connections are not acceptable. For duct with tap sizes larger than 300 mm diameter, these fittings shall be of the conical design. Welded seams must be ground free of any weld build-up, burrs or irregularities and coated with a corrosion resistant aluminium paint.

2.10. ACCESS DOORS

A. General: Access doors are to be installed in ducts, casings and housing as specified below. Unless otherwise noted, access doors are to be made of the same material as ducts, casings, or housing in which they are installed. Insulate access doors with an equal ductwork or housings in which they are installed.

B. Access doors are to be installed in ducts at each vaned elbow or tee, splitter damper, volume damper, fire damper, duct-mounted coil, fan, humidifier, air flow measuring station and any duct mounted instrumentation.

C. Air tight access doors with rubber linings shall be installed in all ducts at fans, filters, heaters, fire dampers and volume dampers for inspection, cleaning and maintenance purposes.

C. The opening in the ductwork shall be properly stiffened at the edges, with frames riveted or welded to the duct. The access door shall be as follows:

All Access Doors mounted on insulated ducts shall be of sandwich type, having the same insulation thickness as that of duct, with Cam Lock Handles.

MSX DIM	NO. OF HINGES	NO.OF HANDLING	DOOR	GAUGE BACK	FRAME
12x12	2	1	26	26	24
16x20	2	2	24	26	22
24x24	2	2	22	26	22

2.11. FLEXIBLE CONNECTIONS

Flexible connections shall be fitted on all suction and discharge connections of fans and air conditioning units, for preventing transmission of vibration through the ducts to occupied spaces.

Flexible connections shall be flame proof factory fabricated from chemically impregnated canvas. Connections shall fit closely and be secured in an air-tight fashion to duct work, fans and apparatus by means of angle iron or flat iron frames. The un-clamped section of the flexible connection between the apparatus and the ductwork shall be not less than 6" in length. Flexible connections shall not be painted.

2.12. SUPPORTS AND HANGERS

Refer to "Supports and Anchors" spec’s in section “12”.
Installation of supports and hangers shall be as follows:

A. Supports and hangers shall be attached only to structural framing members and concrete slabs. They shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking.

B. Supports shall generally comprise galvanized steel sections, and where heavy item of equipment occur within ductwork additional supports shall be provided as necessary.

C. Duct work hung from inserts or from clip angles shall be secured with expansion bolts in shear.

D. Supports for horizontal ducts shall be as follows:

i. Rectangular Duct

LENGTH OF LONGER SIDE mm	**DROP ROD DIAMETER Mm**	**BEARING MEMBER Mm**	**MAXIMUM SPACING mm**
Up to 300 Over 300	8 8	20x3 FLAT 25x25x4 angle	3000 3000
Over 600	10	40x40x4 angle	2500
Over 1000	10	50x50x5 angle	2500
Over 1600	15	75x75x6 angle	2500

Design of Supports for vertical ducts will be dictated by site conditions and spacing may be greater than for horizontal ducts.

Supports for vertical ducts shall be angles and channels made of galvanized or painted black steel.
Vertical duct shall be fastened with a minimum of 2 supports at each floor.

ii. Hangers Sizes for Round Duct:

DUCT DIAMETER	**STRAP HANGERS**	**MAXIMUM SPACING**
Up thru 26”	One 1” x 22 ga.	12 ft
27” thru 36”	One 1” x 18 ga	12 ft
37” thru 50	One 1” x 16 ga	12 ft

51" thru 60"	Two 1"x 18 ga	12 ft
61" thru 84"	Two 1"x 16 ga	12 ft

2.13. SEALANTS:

A. All joints and seams in ductwork and casing are to be thoroughly sealed to prevent air leakage. This applies to all transverse joints between duct sections, duct taping, branch duct connections or access door installations. Longitudinal seams need not be sealed unless the duct or casing section contains more than two seams along its perimeter.
B. Sealant is to be a fast-setting, thixotropic paste that remains flexible after drying.

2.14. DUCT CONNECTIONS TO EQUIPMENT:

Duct connections to air conditioning equipment shall be angle reinforced, flanged connections secured by 6 mm dia. bolts on 200 mm centers (maximum). Joints are to be gasketed with red rubber or high-density neoprene and sealed airtight.

Ducts connection to transmitters shall be carried out to manufacturer recommendations and approved of the engineers.

2.15. DUCT HARDWARE:

A. General: Provide duct hardware, manufactured by one manufacturer for all items on product.

B. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as required, duct test holes, consisting of slot and cover, for instrument tests.

C. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and test holes, consisting of slot and cover, for instrument tests.

2.16. DUCT LINING:

Duct lining shall be 25 mm thick, 24 Kg/m3 density, coated with black-pigmented fire-resistant coating on the side towards the airstream.

PART - 3 EXECUTION

3.01 INSTALLATION OF DUCTWORK:

A. General:

Assemble and install ductwork in accordance with recognized industry practices which will achieve airtight (5% leakage) and noiseless (no objectional noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 3 mm misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and prevent buckling.

B. Seal ductwork, after installation, to seal class recommended and method prescribed in SMACNA "Low Pressure Duct Construction Standards - 5th Edition.

C. Install concrete inserts for supports of ductwork in coordination with formwork, as required to avoid delays in work.

D. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

E. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Or if not otherwise in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead constructions, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 13 mm furring where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 25 mm clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

F. Electrical Equipment Spaces: Unless otherwise indicated, do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.

G. Where ducts pass through interior partitions, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 38 mm.

H. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

Support ductwork in manner complying with SMACNA "Low Pressure Duct Construction Standards - 5th Edition" hangers and supports section.

J. Exposed Ductwork Materials: Where ductwork to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting, exposed duct color and finish shall be subject to M.O.I's engineers approval.

K. Duct Lining: All portions of duct designated to receive duct liner shall be completely covered with 2.5 mm thick duct liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. The black coated surface of the duct liner shall be adhered to the sheet metal with 100% coverage of adhesive, and all exposed leading edges and all transverse joints coasted with adhesive.

The duct liner shall be additionally secured with mechanical fasteners which shall compress the duct liner sufficiently to hold it firmly in place.
Duct Liner shall be cut to assure overlapped and compressed longitudinal corner joints.

Fasteners shall start within 70 mm of the upstream transverse edges of the duct liner and 70 mm from the longitudinal corner joints.

Fasteners shall start within 70 mm of the upstream transverse edges of the duct liner and 70 mm from the longitudinal joints and shall be spaced at a maximum of 300 mm around the perimeter of the duct, except that they may be a maximum of 300 mm from corner break. Elsewhere they shall be placed not more than 150 mm from a longitudinal joint of the liner nor 300 mm from a corner break.

3.02. INSTALLATION OF FLEXIBLE DUCTS:

Install flexible ductwork in accordance with SMACNA Flexible Duct Performance Standards and Flexible Duct Installation Standards - 15d".

3.03. INSTALLATION OF KITCHEN EXHAUST DUCTS:

A. General:

Fabricate joints and seams with continuous welds for watertight of ductwork through 1000 Deg. C temperature range. Install without dips or traps which may collect residues, except where traps have continuous or automatic residue removal. Provide access openings at each change in direction, located on sides of duct 38 mm minimum from bottom, and fitted with grease tight covers of same material as duct.

3.04. INSTALLATION OF DUCT ACCESSORIES:

A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install turning vanes in square or rectangular 90 degree in supply and exhaust air systems.

C. Install access doors larger than 400 mm x 400 mm to open against system air pressure.

D. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

E. Manual dampers shall be provided to all branches for air balancing.

F. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where duct work is to be painted, might interfere with painting or cause paint deterioration.

G. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

H. Temporary Closures: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris into unit at time connections are to be completed.

3.05. BALANCING:

Refer to "Testing, Adjusting and Balancing" for air distribution balancing of pressure ductwork. Seam and leaks in ductwork that become apparent in balancing process.

SECTION 3 - AIR OUTLETS AND INLETS

PART-1 GENERAL

1.1 DESCRIPTION:

A. Scope:

1. Supply and Install Air outlets and inlets compliance in accordance with the requirements of the Contract Documents. This Section relates to supply and installation of air outlets and inlets for the HVAC Installation.

2. Types of outlets and inlets required include the following:

   a. Ceiling air diffusers
   b. Registers and grilles.
   c. Louvers

B. Related Work Specified Elsewhere and Forming Part of This Contract: Refer to other Sections of the HVAC installation for Ductwork and Duct Accessories required in conjunction with outlets and inlets.

1.2 QUALITY ASSURANCE:

a) Except where specifically stated to the contrary, approved manufacturers for equipment and/or materials under this section are as follows:
b) All manufacturers will be approved as subject to compliance will specifications.
c) Manufactured units will be considered if they are produced by, specialized manufacturers whose units are equal in every respect and have been in similar service for not less than five years.
d) Approval of the manufacturer does not necessarily constitute approval of its products as equal to the start of construction submit to the engineer for a complete written summary of the manufacturer's proposed products

B. Regulatory Requirements

1. IDC Test Code: Test and rate air outlets and inlets in certified laboratory under the requirements of Air Diffusion Council (ADC) Equipment Test Code 1062 "Certification, Rating and Test Manual".

2. ANSI/NEPA Standards: Install air outlets and inlets in accordance with National Fire Protection Association (NFPA) Standard 90A "Installation of Air Conditioning and Ventilating System".

1.3 SUBMITTALS:

Product Data: Submit manufacturer's data on outlets and inlets including the following:

1. Schedule of outlets and inlets indicating drawing designation, room location, and number furnished, model number, size, and accessories furnished.

2. Data sheet for each type of outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

3. Performance data for each type of outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, static

pressure drop and noise criteria ratings at the required cfm. Indicate selections on data.

Samples: Submit samples of each type of finish required.

1.4 PRODUCTS DELIVERY, STORAGE AND HANDLING:

A. Delivery outlets wrapped in factory-fabricated fiberboard type containers. Identify on outside container type of outlet or inlet and location be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 – PRODUCTS

2.1 GENERAL:

All air inlets and outlets shall be made of extruded aluminum alloy, polyester powder coated, oven baked and with a suitable color to the satisfaction of the Engineer. All air inlets and outlets shall be tested by an approved laboratory and certified by ADC (Air Diffusion Council) or an approved equivalent Authority.

Air Velocities in Press Hall not exceed 0.5 m/sec and also pressure in the Press Hall must be controlled to be lower than pressure in the adjacent Rooms in order to avoid ink smell, which is spreading from Press Hall to rest of the other building.

2.2 GRILLES AND REGISTERS:

They shall be furnished with sponge rubber gaskets or foam tape behind the frame to eliminate air leakage and with nylon bushings or PVC at the blades connection to the frame to eliminate corrosion and vibration. Free cross-sectional area shall be at least 65 percent.

Supply air registers and grilles shall have individually adjustable horizontal front blades and vertical rear blades.

Supply air register shall be equipped with key operated, opposed blade volume control damper.

Return and exhaust air registers and grilles shall have fixed single deflection blades set at an angle 35°.

Return and exhaust air registers shall be with key operated, opposed blade volume control damper.

All opposed blade volume control dampers shall be polyester coated oven baked with black color finish.

2.3 DIFFUSERS:

Diffusers shall be suitable for ceiling installation and duct work application as shown on project drawings. They shall be provided with rubber gasket or foam tape at the outer edge of the frame to produce a positive air seal at the mounting surface. They shall be produced with removable core and provided with equalizing grids. Face plates shall be furnished with concealed hinges and clips. Duct collars connecting duct of diffuser shall be air tight and not interfere with the volume control damper. Supply air diffuser shall be equipped with opposed blade volume damper adjustable from the face of the diffuser without removing the core.

2.4 DOOR GRILLES:

The frame shall be separated from the blades by an extruded rigid PVC track which shall be an integral part of the frame. The blades shall be of V-shape; mounted in the PVC track and spaced 12.5mm on centers. Door grills shall be provided if necessary even not shown on drawings.

Note: All Toilet door are to be provided with DUC /Door grilles.

2.5 LOUVERS

Louvers shall be suitable for installation into masonry work or directly connected by duct work to air handling equipment and shall be as follows: -

Frame and blades shall be made of extruded aluminum alloy, polyester powder coated, oven baked with a suitable colour to the satisfaction of the Engineer.

Each blade shall be held to the frame by aluminum angle brackets, which slip into a groove on the interior blade face and riveted to the frame.

The blades shall be spaced 2 1/4" on center and set at 45 degree to the horizontal.

Edges of louver blades shall be baffled to exclude driving vain.

Louver shall be furnished with an expanded aluminum bird screen, attached to the interior face of the louver.

For fresh air intake, louver shall be provided with insect screen, filters and control damper. Control damper shall be manual or motor operated as required.

PART 3 – EXECUTION

3.1 GENERAL:

A. Provide all grilles, registers or diffusers which are suitable for installation in the ceiling, wall or floor finishes. Provide all required accessories to facilitate installation.

B. Provide all air distribution devices from one manufacturer unless otherwise noted.

3.2 INSPECTION:

Examine areas and conditions under which outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.3 INSTALLATION:

A. General: Install outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.4 SPARE PARTS:

Furnish to the Engineer, with receipt, 3 operating keys for each type of outlet and inlet that require them.

20% of special displacement outlets from Total quantity.

SECTION 4 - INSULATION

PART -1 GENERAL

1.01 DESCRIPTION

A. Extent of Work: The extent of insulation work is as per the requirements of this section.

B. Insulation material shall be applied to the following:

i. Chilled water piping, condensate water piping, valves and accessories.
ii. Supply & return ductwork.
iii. Cold surfaces of ACHV equipment

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of pipe and ductwork insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Code and Standards: Comply with applicable requirements of NFPA, ASTM and BS standards as follows:

i. BS British Standard - BS 542, BS 2972, BS 5970 and BS 476.

ii. ASTM American Society for Testing and Material, ASTM E-84.
iii. NFPANational Fire Protection Association, NFPZ - 225.

1.03 SUBMITTALS

A. Manufacturer’s Data: Submit manufacturer's data on all types of insulation specified hereinafter.

B. Certification: Provide certificates or other data as necessary to show compliance with these specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

1.04 PRODUCT DELIVERY, STORAGE & HANDLING

A. Product insulation against dirt, water and chemical and mechanical damage. Do not install damaged insulation; remove from project site.

B. Deliver insulation, coverings, cements, adhesives and coatings to the site in factory fabricated containers with the manufacture's stamps, or label, affixed showing fire hazard ratings of the products.

C. Store insulation in original wrappings and protect from weather and construction traffic.

PART - 2 PRODUCT

2.01. GENERAL REQUIREMENTS

A. Insulating materials shall be selected for use in accordance with, and comply with all applicable requirements of BS 5422 and BS 5970.

B. Thermal insulation shall be of an approved material with thermal conductivity no higher than 0.29 Btu/hr. Ft 2. Deg.F. inch measured at an average temperature of 100 F. The thermal insulation shall be non-corrosive to the metal, water repellent, fire retardant, sustenance to vermin and easily cut and fitted to shape during application.

The insulation shall be provided with approved fire retardant vapour barrier jacket to prevent moisture penetration to the insulation. Vapour barrier shall also be applied to all joints and edges.

The insulation shall be fixed into the material surface by means of an approved adhesive compound that has no corrosion effect on the metal, and thoroughly applied to the metal surface and insulation.

C. All materials, including fixing and finishing materials, shall be rated Grade "P" when tested for ignitability in accordance with BS 476; part.5.

D. Materials shall be rated "low flammability" as defined in BS 2972.

2.02 MANUFACTURERS:

1 Except where specifically stated to the contrary, approved manufacturers for equipment and/or materials under this section are as follows:
2 All manufacturers will be approved as subject to compliance with specifications and Engineer’s approval.
3 Manufactured units will be considered if they are produced by, specialized manufacturers whose units are equal in every respect and have been in similar service for not less than five years.
4 Approval of the manufacturer does not necessarily constitute approval of its products as equal to the start of construction submit to the Engineer for a complete written summary of the manufacturer’s proposed product.

2.03. PIPE WORK INSULATION

A. Chilled Water, Refrigerant Pipes, Valves, Strainers, etc., and fittings shall be insulated with rigid fibre glass of not less than 6 lb/ft3 density or equivalent, performed sectionally and split longitudinally into two valves with factory applied reinforced aluminium foil coating with following thickness.

PIPE SIZE SERVICE	Upto 2"	21/2" - 6"	8" & above
1. Chilled Water Pipes exposed to Sun.	1"	2"	3"
2. Chilled Water Pipes in non A/C Areas.	1"	11/2"	2"
3. Chilled Water Pipes in A/C areas	1/2"	1"	11/2"
4. Condensate Drain Pipe	1/2"	1/2"	
5. Refrigerant (Suction Pipe Only) inside building	1"	1"	
6. Refrigerant (Suction Pipe Only) exposed to Sun	11/2"	21/4"	

B. Insulation jacket to be white Kraft paper bonded to aluminum foil, reinforced with glass fiber yarn. The Kraft paper shall be permanently treated to assure permanent fire and smoke safety and to prevent corrosion of foil. An adhesive shall be used to seal the insulation jacket. The longitudinal lap of the jacket shall have pressure sensitive tape closure system. The tape shall be protected by a strip of release paper which is pulled off prior to application to pressure sensitive tape. Butt strips shall also be furnished in order to totally seal the system.

C. Chilled water pumps, valves, strainers and fittings requiring periodic maintenance shall be insulated with removal and replaceable covers of 1 mm. thick

galvanized sheet metal jacket lined with 2" thick rigid fiberglass insulation. All voids between insulation and cold equipment surfaces shall be filled with fiber glass blanket insulation.

Joints of the metal cover shall be vapour sealed with vapour barrier coating after the covers are in place.

D. On chilled and condensate pipes, longitudinal jacket laps shall be sealed with adhesive and butt joints and wrapped with 3 inch wide strip of jacket material and sealed with adhesive. Fitting cover edges to be sealed with vapor barrier adhesive and circumferential edges to be covered with vapor barrier tape over-lapping a minimum of 2 inch on each side of joint.

E. Runout to air handling units to be insulated with 1/2 inch thick flexible foamed plastic insulation, having an average thermal conductivity of 0.04Wm Deg.C. at a mean temperature of 24 Deg.C. When necessary to cut insulation and at all butt joints, joint insulation by sealing with waterproof vapor barrier adhesive.

F. All insulated pipes running inside A/C plant room or inside they are exposed to view, shall be cladded with anodized 0.4 mm. thick aluminum sheets neatly installed. No painting is required above the aluminum cladding. Colored arrows and indications shall be used as specified elsewhere.

All insulated pipes inside tunnels, shafts, and above false ceiling shall be cladded with 0.3 mm. thick smooth PVC sheet.

Pipes running underground or in trenches below ground level, whether back-filled or not, shall be specially treated for moisture and water-proofing. The whole insulation shall be tightly wrapped with 3/4" galvanized wire mesh and coated with approved bitumastic compound thickly applied to cover the mesh completely. Alternatively, the insulation may be wrapped completely with dense taps over-lapped or equal and approved moisture proofing material.

Un-insulated pipes burried underground shall protected against water and soil corrosion.

2.04 DUCT WORK INSULATION

Thermal insulation shall consist of an inorganic blanket of fiber glass or equivalent with reinforced aluminum foil external coating, factory applied with resin bonded internal layer to give flat and resilient surface. The insulation for all duct work exposed to outside and those in plant rooms shall be rigid slab type and for remaining ducting flexible blanket type.

The density of insulation shall be minimum 1.5 1b/cu.ft. for flexible blanket type and 3 1b/cu.ft. for rigid slab type and thickness as below:-

Supply air duct in non air-conditioned areas	2"
Supply air duct in air-conditioned areas	1"
Return air duct in non air-conditioned areas	1"
Return air duct in air-conditioned areas	Nil
Fresh air duct in air-conditioned areas	1"
Supply & Return air ducts exposed to outside ambient temperature.	3"

Insulation shall be secured to duct work 2" x 2" G.I. sheet metal strips of 22 gauge fixed to corners and tightened with wire 6" intervals. The strips may be suitably grooved to take the wire fasteners. Transfers duct connections such as pocket joints and flanges shall be additionally insulated with 4" wide, 1" thick insulation and covered with 8" wide, 8 OZ canvas equally overlapped on either side and finally coated with 2 coats of approved paint.

All duct work exposed to outside, shall be covered with 0.6 G.I. sheeting and shall be treated for water-proofing prior to cladding i.e. wrap the insulation with 0.5.mm. thick polyethylene sheet and secure with adhesive. All duct work insulation exposed to view shall be finished with 8 OZ canvas finished with 2 coats of fire retardent and water proof paint.

2.05. ACOUSTIC DUCT LINING

Internal duct lining for acoustic insulation where applicable shall not be less than 1" thick fibre glass mat faced, flexible blanket of fine fibres with securely bonded

surface mat coated with clean or black neoprene or approved equal. Lining to be applied with 100% coverage of fire resistive approved adhesive compound and mechanical fastenings according to the manufacturer's instructions. Acoustic lining shall be cleared 20cm. Duct lining density shall be 1.5 Lb/Ft.3.

PART -3 EXECUTION

3.01. INSPECTION

A. The Contractor shall examine the substrate and the conditions under which insulation is to be installed and correct any unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.02. INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with the manufacture's written instructions, and in accordance with recognized industry practices to ensure that the insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to testing and acceptable of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapour barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, flanges, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Contractor's option) except where a specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation.

I. In addition to the insulation specified above, pipes that are exposed in traffic areas such a mechanical rooms and pipes exposed to outdoor conditions such as those installed on roofs shall be cladded with aluminum sheet. Cladding shall be strapped at not more than 400 mm on centers.

J. Pipe Hanger Insulation Inserts: Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 75 mm wide vapor barrier tape or bank over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 75 mm wide vapor barrier tape or band.

3.03. INSTALLATION OF DUCTWORK INSULATION

A. Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that the insulation serves its intended purpose.
B. Install insulation materials with smooth and even surfaces
C. Clean and dry ductwork prior to insulating, Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
D. Maintain integrity of vapour-barrier on ductwork insulation and protect it to prevent puncture and other damage.
E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
F. Apply insulation with edges tightly butte. Impale insulation on pins welded to the duct and secure with speed clips. Cut the protruding ends of the pins flush after the speed clips have been applied. Seal the vapour barrier facing with a vapour barrier mastic or tape where the pins have pierced through. Space the pins as required to hold insulation firmly against duct surface but not less than 10 pins per square meter. Seal all joints with 75 mm wide pressure sensitive tape to match the facing.

3.04. INSTALLATION OF EQUIPMENT INSULATION

A. **General:** Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapour-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Aluminum sheet metal cladding shall be neatly cut, fixed with self-tapping aluminum metal screws and arranged for easy removal and reinstallation.

E. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

F. **Equipment Exposed to Weather:** Protect outdoor insulation from weather installation of weather-barrier mastic protective finish, or jacketing, as recommended by manufacturer.

Protection: The Contractor shall provide protection, as required for insulation work during remainder of construction period, to avoid damage and deterioration

3.05 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protect insulation work during the remainder of the Construction period, to avoid damage and deterioration.

SECTION 5 - CONTROL SYSTEMS

PART - I GENERAL

1.01 DESCRIPTION

A. Supply and install electrical/electronic control systems complete in accordance with the requirements of the Contract Documents. This Section relates to the supply and installation of automatic control systems for the ACHV Installation.

B. Control wiring including power necessary for electronic digital temperature control systems, 3 way valves dampers and actuators, etc, is including in this Section.

C. Automatic temperature control systems to be provided shall include all relays, switches, dampers, valves, thermostats, transformers, humidistats, controllers and all other control devices required to maintain the specified conditions. Control devices shall be connected complete so as to perform the functions in a required sequence. Thermometers, indicators and all other necessary accessories shall be included as required in related section.

D. All sensors, actuators and field items should be able to give and/or receive signals from building automation system.

1.02. QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of electric/ electronic controls equipment instrumentation of type and size as specified hereafter and who shall submit a list of at least five (5) similar installations provided by them in the Middle East area and which have been in satisfactory use for not less than 3 years.

B. The manufacturer shall have facilities in the Middle East area capable of providing locally, technical assistance and maintenance. The Contractor's trained staff shall be readily available and shall be fully capable of system engineering supervision, start-up commissioning, personnel training and emergency service.

C. Any components of the system related to fire or smoke control shall have been tested, and listed by Underwriters Laboratories Inc. (UL). The system shall be

supplied with all hardware and installed as to comply with all requirements of NFPA Standards for Local Protective Signaling System.

D. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems, and not custom designed especially for this project.

E. All systems and components shall have been thoroughly tested and proven in actual use.

F. The systems must be a standard with the manufacturer to ensure spare parts, availability and trained technical support.

G. Electrical Standards: Provide electrical products which have been tested, listed and labelled by Underwriter's Laboratories (UL) and comply with Kuwait regulation.

1.03. SUBMITTALS

A. **Engineering Submittal for approval**: The intention of the engineering submittal is to provide sufficient information to allow the Engineer to evaluate the manufacturer's compliance to specification, system capability and reliability in order to grant approval.

The engineering submittal shall include:-

- List of all system "local control loops" related to all mechanical installations independent of size of complexity.

- Complete detailed control diagrams for each of the listed "local control loop" accompanied by wiring/connection diagrams. All control equipment, system components or devices shall be identified by a reference number.
- Technical specification data sheets for each system component identified by the reference number given in the control diagrams.

-A proposed spare parts list to cover basic parts to be used by the Employer to provide a reliable and trouble-free operations.

B. **After installation the Contractor shall keep records of all changes and adjustments and shall incorporate them into his final submission. This submittal shall include:-**

- Complete "As-Built" drawings comprised of system diagrams, plans, etc.

- Complete system description.

-Manufacturer's catalogs with technical data for all devices and equipment.

- Operation instructions for each system.

- Maintenance instructions for each item.

-Parts list of submittal items.

- Required copies of all above submittals shall be provided in sets of book form with hard cover all as specified.

1.04 PRODUCT, DELIVERY, STORAGE AND HANDLING

A. Provide factory shipping cartons or crates for each piece of equipment. Maintain these through shipping, storage and handling as required to prevent equipment damage and to eliminate dirt and moisture from equipment.

B. Store equipment and materials inside and protect from weather. Where necessary to store outside, elevate well above ground and enclose with durable waterproof wrapping.

C. System component shall be capable of withstanding high ambient temperatures and adverse dust conditions during shipment and on site storage.

PART - 2 PRODUCTS

2.01. MANUFACTURERS

1 Except where specifically stated to the contrary, approved manufacturers for equipment and/or materials under this section are as follows:
2 All manufacturers will be approved as subject to compliance with specifications and Engineer's approval.
3 Manufactured units will be considered if they are produced by, specialized manufacturers whose units are equal in every respect and have been in similar service for not less than five years.
4 Approval of the manufacturer does not necessarily constitute approval of its products as equal to the start of construction submit to the Engineer for a complete written summary of the manufacturer's proposed products

2.02. CONTROL VALVES

A. **General:** Provide factory-fabricated electrical control valves of type, body material as specified hereinafter. Class of valves shall be based on maximum pressure and temperature rating of piping system. Unless otherwise indicated, provide valves which mate and match material of connecting piping. Equip valves with proper shut-off rating for each individual application.

B. **Electrical Characteristics:** All valves motors shall be suitable to work on low voltage. Motors must be suitable to receive 4-20 mA control signal.

C. Control valves of sizes 50 mm and below shall have threaded connection to BS.3643 complete with pipe coupling pieces. Valves 65 mm and above shall be flanged connections to BS 4504.

D. Valves shall be sized to have a full pressure drop equal or greater than the pressure drop of the water coils being controlled, but not more than 65 KPa.

E. Three port valves shall have a close off capability equal to or greater than the combined full flow pressure drops of the coil plus the valve itself.

F. Three port valves shall be piped for mixing service.
G. Valves shall be designed for pressure rating of 10 bars.

H. All valves shall be closed when the spindle is in the up position. Two port modulating valves(when used) shall have an equal percentage control characteristic. Three port modulating valves shall have an equal percentage characteristic on the through port and a Linear characteristic on the bypass port.

I. **Valve Construction:**

- Threaded valves shall be of brass or gunmetal body with bronze or stainless steel seats.

- Flanged valves shall be of cast iron body with bronze or stainless steel seats.

- Valves trim and stems shall be polished stainless steel.

- Valves shall have performed, spring loaded, self adjusting packing of teflon.

2.03 DAMPERS AND VALVE MOTORS

A. Size each motor to operate damper or valve with sufficient reserve power to provide smooth modulating action or 2-position action as specified.

B. Provide Permanent Split-Capacitor or shaded pole type motors with gear trains completely oil-immersed and sealed. Equip spring-return motors, in operational sequence, with integral spiral-spring mechanism. Furnish entire spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

C. Equip motors for outdoor locations and or outside air intakes with "O-Ring" gaskets designed to make motors completely weatherproof, and equip with internal heaters to permit normal operation at ambient condition in Kuwait.

D. Furnish non-spring return motors for dampers larger than 25 square metres for valves larger than 50 mm, sized for running torque rating of 150 inch-pounds, and break-away torque rating of 300 inch-pounds. Size spring-return motors for running torque rating of 150 inch- pounds, and breakaway torque rating of 150 inch-pounds.

E. Motors to be connected to BAS, should be suitable for 4-20 mA signal, if modulating type.

In case of the ON/OFF type motors should be suitable for 240V, 50Hz.

2.04. ROOM THERMOSTATS

Provide electronic room type thermostats for the control of the 3-way valves as necessary. The thermostat shall be of solid state integrated circuit construction with accessible set point adjustment. It shall also include an internal direct/reverse action selector switch and adjustable throttling range. It shall provide proportional control 3-way valves.

The room thermostats shall be complete with locking covers, and with concealed or readily accessible adjustment devices.

2.05 IONIZATION SMOKE DETECTORS

For each air handling unit, provide UL-listed ionization smoke detectors in main supply and return air ducts, and where indicated. connect detectors into control circuits to stop fans in event of presence of smoke.

2.06 ELECTRONIC SENSORS

Provide electronic temperature and or relative humidity sensors of supersensitive resistance type, which are vibration and corrosion-resistant, and of wall mounted immersion, duct mounting, averaging or bulb type as required for application including controllers.

2.07 WATER FLOW SWITCHES

Provide water flow switches of stainless steel paddle types. Where flow switches are used in chilled water applications, provide vapor-proof type to prevent condensation of electrical switch. Provide pressure-flow switches of bellows actuated mercury type or snap-acting type, with appropriate scale range and differential adjustment for service indicated.

مواصفات الأعمال الكهربائية

Electrical Works:

1. General Specifications:

1.1 Specifications described hereunder are brief and therefore the tenderer shall include all equipment, material, labour etc. for the complete installation to ensure best workmanship and operating conditions, whether detailed under this specifications or not.

1.2 The bidder shall ensure that the electrical subcontractor shall be authorized by CTC.

1.3 The electrical subcontractor shall be CTC grade 4 in minimum, and shall have at least 10 years experience in public sector projects and at least 5 year experience in private sector project in terms of electrical works and shall submit a profile with past projects.

1.4 Any amendments foreseen by the contractor shall be clearly stated upon submitting the technical and financial offer.

1.5 The electrical subcontractor shall be an established company with a physical presence including dedicated stores where spare parts are available upon the request.

1.6 The bidder shall submit electrical subcontractor papers for approval, moi engineer reserves the right to accept or reject if the electrical subcontractor does not meet the required standards, experience, etc.

1.7 The bidder is responsible for any authorization works such as MEW approvals, etc.

1.8 The bidder shall submit a time schedule with clear approximate dates of arrival of all equipment, presenting of all submittals and termination of all works; the time schedule shall either be approved by MOI engineer or resubmitted if MOI engineer states any remarks.

1.9 The bidder shall ensure the cleanliness of the site throughout and after the project.

1.10 The bidder shall ensure that all of the technicians operating on site are following safety regulations (helmets, insulation gloves, etc).

1.11 The bidder shall dismantle all items intended to be replaced and shall return them to MOI stores.

1.12 Approval of design, material, equipment's, systems, layout, etc. does not relieve the contractor from his contractual obligations, if later found that they do not comply with specifications requirements or equipment do not render the required performance.

1.13 The bidder shall submit a breakdown bill of quantity for all electrical works, all articles of the BOQ shall have a quantity except for wirings, cables and lights which can be submitted according to design later for approvals.

1.14 The contractor shall ensure that all laborers are to be under the residence of the subcontractor's company.

End of section

- All materials and works shall be carried out according to standards below:
- IEC
- BS
- Kuwait MEW rules and Regulations
- NEC

2. Scope of Work:

2.1. Distribution Boards:

The contractor shall supply and install distribution boards with their miniature circuit breakers and RCCBO's to feed studio equipment, lights, general socket outlets in addition to any HVAC works and plumbing.

2.2. Earthing system:

a. Supply and install a technical earthing system for the studio's equipment and control DB.
b. Supply and install an earthing system to the lights and sockets DB.

2.3. Sockets:

- Supply and install sockets and industrial sockets (male / female) as specified in technical specifications.

2.4. Lights:

- Supply and install lights for the studio's building. Lights shall include but not be limited to : magnetic track lights, double square downlights, exterior wall lights, cove lights, etc.

2.5. Emergency Lights:

- Supply and install emergency lights as per the requirements of the Kuwait fire department.

2.6. Cables and Cable works:

- Supply, install, terminate and commission all cables and cable works relevant to project.

2.7. Conduits:

- Supply and install all conduits to be used in electrical works.

2.8. Warranty:

- All electrical works shall have a warranty of 2 years.

End of section

3. Technical Specifications:

3.1. Distribution Boards:

3.2. The contractor shall design, supply and install distribution board with MCB's (RCCBO type) and earthing system to feed the power sockets, lights, control equipment.

3.3. The DB shall comply with the standards of IEC 61439-1 and BS EN 61439-1 & 2.

3.4. The DB shall have a degree of IP 65.

3.5. The board shall be made of galvanized steel and shall be powder coated to resist corrosion.

3.6. The enclosure shall be wall mounted and shall have a hinged door with lock and key or screw fixed cover providing easy access for maintenance.

3.7. The enclosure shall have an adequate ventilation.

3.8. The busbars shall be copper with 99.9 purity and shall have a current rating as per the total load.

3.9. The busbars shall have heat shrinkable sleeves.

3.10. The circuit breakers shall be RCCBO type

3.11. The electrical subcontractor shall design breaker size ratings according to load and initial design and shall be approved by MOI electrical engineer.

3.12. Breakers shall be from one of the following manufacturers:

a. Scneider Electric
b. Siemens

c. Abb

3.13. The circuit breakers shall by of type D for highly inductive loads and type C for medium conductive loads.
3.14. A surge protection device shall be installed to ensure protection.
3.15. Upon completion of installation and connections, the breakers shall be clearly labeled to indicate each breaker; no adhesives are permitted.
3.16. Neutral and earth bars shall be adequately rated and clearly labeled.
3.17. Breakers shall have a minimum short circuit capacity 10 kA.

End of section

4. Earthing System:

4.1. The DB feeding studio equipment shall be technically earthed according to IEC and BS standards.
4.2. DB's feeding lights, sockets and air conditioning units shall be earthed, and an initial design layout of the earthing system shall be submitted prior to installation for approval.

End of section

5. Sockets and Switches:

5.1. The contractor shall supply and install Light switches that comply with IEC 60669-1 from IEC and BS standards.
5.2. The switches shall be type 1 gang and 2- gang
5.3. The light switches materials shall be satin chrome finish with anti finger print coating.
5.4. The light switches shall be rated 10 A minimum
5.5. The light switches shall be operated with a toggle or a rocker switch
5.6. The light switches shall be wall mounted.
5.7. The back box depth of the light switches shall be minimum 35 mm.
5.8. The contractor shall supply and install general purpose sockets that comply with IEC 60884-1 standards.
5.9. The sockets shall be of type 13 A and 15 A socket outlets.

5.10. The sockets shall be satin chrome finish with anti fingerprint coating.
5.11. The sockets shall flush or floor mounted according to the studio
5.12. S design.
5.13. The back box depth shall be minimum 35 mm.
5.14. The contractor shall supply and install industrial sockets for the control of the studio and industrial sockets shall comply with IEC standard 60309-1.
5.15. The industrial sockets shall be type 16 A, 32 A , 63 A and 125 A.
5.16. The sockets shall be high impact resistant thermoplastic or metal clad.
5.17. The sockets shall have ratings of 16 A / 32 A / 63 A / 125 A + 3P+N+E (three phase+neutral+earth).
5.18. The sockets shall be surface or panel mounted.
5.19. The contractor shall supply and install industrial plugs and connectors for the theater's control room and stage, the industrial plugs shall comply with the IEC standard 60309-1
5.20. The industrial plugs and connectors shall be rated 16 A / 32 A / 63 A / 125 A + 3P + N + E
5.21. The contractor shall supply and install Isolators for the industrial sockets and shall comply with IEC standard 60947-3
5.22. The industrial socket Isolator shall be rotary isolator switch
5.23. The rating shall be 16 A / 32 A / 63 A / 125 A
5.24. The industrial socket shall be of high impact resistant thermoplastic or metal clad.
5.25. Industrial socket isolator shall surface mounted and shall operate with a padlockable in the off position for safety.
5.26. All of the switches and sockets and isolators above shall be CE tested.

End of section

6. Lights :

6.1. The contractor shall submit catalogues and designs for the lights intended to be used in all rooms and locations included in the project; submittals must be approved by MOI engineer.

6.2. The contractor shall supply, install and connect recessed magnetic track lights, each light shall not be less than 18 m.

6.3. Supply and install magnetic integrate LED driver.

6.4. Supply and install Magnetic LED track light, 12 W, 48 VDC, (3000 k or 4000 k) with CRI 90

6.5. Supply and install Magnetic LED grill Lamp, 18 W, 48VDC, (3000 k or 4000 k) CRI 90.

6.6. Supply and install Magnetic Direct Conductive module 48 VDC.

6.7. Supply and install double square (single square for WC) black colored downlights , with LED spot light 6 W , 3000K , CRI 90.

6.8. Supply and install waterproof exterior LED black wall lights (up and down type).

6.9. Supply and install strip cove light on edges in studio.

End of section

7. <u>Emergency Lights:</u>

7.1. Supply and install Emergency Light fitting, 1x8W, 3hrs backup.

End of section

8. <u>Cables and Cable Works:</u>

8.1. All cables and wires shall comply to the following standards:

a. IEC 60227
b. IEC 60228
c. BS 6004
d. BS 6346

8.2. Cables shall be insulated by PVC.
8.3. Conductors shall be pure copper with 99.9 % purity.
8.4. Cables shall withstand heat up to 90 ° C.
8.5. Cables shall have Low smoke, zero halogen properties and shall be fire resistant.
8.6. PVC used for core insulation , bedding and sheath shall be of hard type and shall be identified by different colors according to MEW regulations.
8.7. Flexible cords shall be 450/750 Volt, Three core.
8.8. Flexible cords shall be circular, silicon rubber insulated, glass fiber braided.
8.9. The conductors shall be tinned annealed copper.
8.10. M.I.C.C. cables of 1000 Volt grade shall be of copper solid conductors mineral insulated.
8.11. Seals for M.I.C.C. cables shall be of the cold screw-on pot type consisting of a brass pot complete with anchoring wedges and caps.

End of section

9. <u>Conduits and Cable trays:</u>

9.1. Conduits and conduit fittings shall comply to the following standards:

a. 4607
b. IEC 61386-1

9.2. Conduits shall be made from galvanized steel.
9.3. Steel conduits and fitting should be of heavy gauge, longitudinally welded type and comply with IEC/BS EN 60423, IEC/BS EN 61386 or equivalent.

9.4. The nominal minimum outside diameter of any rigid conduit to be used should be 16 mm with a minimum wall thickness of 1.4 mm. and the conduits shall be completed with all necessary threaded fittings, couplings and connecting devices having galvanised equivalent finish.

9.5. Conduits and fittings shall be manufactured specially for electric wiring purposes. When manufactured by a continuous weld process, weld heads both inside and outside the tube shall be completely removed prior to galvanising.

9.6. All conduits and fitting shall be free from rust or other defects on delivery to the site and shall be properly stored in covered racking so that it is protected from mechanical damage by weather and water whilst stored on the site.

9.7. All conduits shall be coupled to boxes and trunking wires using brass male bushes. All such bushes shall be hexagon headed, heavy duty long threaded type.

9.8. All conduit runs shall be fixed using spacer bar pattern saddles giving not less than 3mm clearance between the conduit and the surface to which it is fixed. Saddles shall have finish to match the conduit and saddle clips shall be secured to the bar by means of brass screws.

9.9. Steel cable trunking shall be made of painted zinc coated steel

9.10. The cable trunking shall have inward turned flanges on the body for strengthening, the cable trunking shall be complete with easily fitted covers which are locked in place by flush pattern turn button

9.11. Standard trunking accessories: Tees, angle tees, four way through boxes, off sets, etc., shall be used. These accessories shall be made by the same steel trunking manufacturers

9.12. Each length of the cable trunking and accessories shall be complete with coupling and earth copper links.

9.13. Cable trays shall generally consist of sheet metal or steel profiles being of the ladder or the perforated channel type with a maximum width of 600mm and a supporting distance not exceeding 1500mm.

9.14. Cable tray shall have a minimum carrying capacity of 200 Kg/m and under normal conditions the sag is not to exceed 3mm.

9.15. The cable trays shall be part of a module system having available all required accessories and transition pieces from one to another direction or elevation

9.16. All bolts and screws shall be cadmium-plated or electrolytically galvanized

9.17. Every cable tray shall be marked at both ends and at intervals of 20m.with the pertaining registration number the metal thickness of perforated channel cable tray shall not be less than 1.6 mm (6G) before being galvanizing and vertical stem shall have a minimum height of 45 mm with return flange.

9.18. Cable trays arranged one above the other shall have spacing in relation to their width not exceeding a ratio of 1:2 with a minimum distance of 150mm

9.19. All trays, supporting steel members, clamps and other accessories shall be of one manufacturer and shall be hot-dipped galvanized after fabrication.

End of section

10. Testing and commissioning:

- All materials and works shall be tested under the supervision of MOI engineer.

11. Warranty:

- All works and materials shall have a warranty of 2 years.

متطلبات النقل الخارجي

Ref.	Description	Qty	Unit Price	Total Price
1	Camera cable Lemo Fiber SMPTE311	8		
2	Camera Cable TRIAX FISCHER 1051	8		
3	Video Cable PNC	10		
4	Audio Cable XLR	12		
Total				

وهذه المتطلبات يتم تركيبها داخل لوحة حائطية عدد (2) يكون إحداهما بجانب سيارة النقل التلفزيوني والأخرى داخل الاستديو .