



**INVITATION TO TENDER**

**OCEANSIDE PLACE – AHU REPLACEMENT – 2017**

**FOR THE REGIONAL DISTRICT OF NANAIMO,**

**Tender Closing Date: August 1, 2017**

## TABLE OF CONTENTS

Part I: General Instruction & Requirements of Bidding Process	3
A.    Scope of Work:	3
B.    Bid Call Instructions	3
C.    Bid Ineligibility	5
D.    Mandatory Site Meeting	5
E.    Tender Bid Opening	6
F.    Contract/Bid Documents	6
G.    Bid Submission	7
H.    Award Criteria	8
I.    Insurance	9
J.    Offer Acceptance/Rejection	9
K.    Workers' Compensation	10
L.    Business License	10
M.    Indemnity	10
N.    Patent Infringement	10
O.    Purchasing Statement	11
P.    Proposed Timelines	11
Q.    Warranties	11
Part II: General Specifications	11

## **Part I: General Instruction & Requirements of Bidding Process**

### **A. Scope of Work:**

The Regional District of Nanaimo is seeking tenders from qualified mechanical contractors to replace the existing Air Handling Units - AHU 1 + 2, located at 830 West Island Highway in the City of Parksville.

### **B. Bid Call Instructions:**

1. Sealed Tenders signed, executed and dated will be received up until **2:00 pm PDT August 1, 2017** and should be delivered to:

John Marcellus - Superintendent of Arena Services  
Oceanside Place

830 West Island Highway

Parksville, B.C.

V9P-2X4

2. It is the sole responsibility of each Bidder to deliver their tender to the Oceanside Place Office before the closing time. The Regional District of Nanaimo will not accept any responsibility for bid documents delivered to other RDN facilities and at the discretion of the RDN may be rejected.
3. Faxed tenders will not be accepted.
4. Bidders shall submit three (3) original hard copies and one (1) electronic version in MS Word/PDF format in the form of a CD/DVD or flash drive of the executed offer and the Bid Form provided, signed and in a sealed envelope, clearly identified with the bidder's name, project name and the Regional District of Nanaimo's name on the outside.
5. Tenders submitted may be withdrawn before the deadline upon written notice to the Superintendent of Arena Services at the address above or by fax to 250-248-3294.
6. Tenders may be amended if received 24 hours prior to bid closing and if endorsed by the same party or parties who signed the tender. Amendments submitted must be delivered in writing to the Superintendent of Arena Services at the address above or by fax to 250-248-3294.

7. Submitted tenders must remain valid for 90 days following the closing time and date. Tenders are irrevocable after the closing time and date.
8. Bidders must respond to all specifications in order to be considered a valid tender. Tenders having significant obvious errors will be rejected.
9. All prices shall be submitted in Canadian funds only and no authorization to pay in any foreign currency will be permitted.
10. Attached Part III, Form of Tender, must be completed properly in order to be considered.
11. Throughout this Request for Tender, the following terminology shall be used:
  - a) "Contract" means the written agreement resulting from this Request for Tender executed by the Regional District of Nanaimo and the Contractor;
  - b) "Contractor" means the successful bidder to the Request for Tender who enters into a written contract with the Regional District of Nanaimo;
  - c) "Will", "shall", "must", "mandatory", or "required" means a requirement that must be met in order to be considered;
  - d) "Bidder" means an individual or a company that submits, or intends to submit, a bid in response to this Request for Tender;
  - e) "Should", "desirable", or "ask" means a requirement having a significant degree of importance to the objectives of this Request for Tender.
12. The Regional District of Nanaimo reserves the right to reject any and all tenders for any reason or to accept any tender received which the Regional District, in its sole unrestricted discretion deems most advantageous to itself. The lowest or any tender may not necessarily be accepted. The bidder acknowledges the Regional District's rights under this clause and absolutely waives any right of action against the Regional District for the Regional District's failure to accept its' tender whether such right of action arises in agreement, negligence, bad faith or any other cause of action. The acceptance of any tender is subject to approval by the Board of the Regional District or the officer or employee of the Regional District having authority to accept the tender.
13. Unless otherwise requested in writing by the herein designated Regional District employee, a bidder must not contact or communicate with any elected or appointed officer or employee of the Regional District of Nanaimo other than the designated employee in relation to the proposal prior to the award of such tender by the Regional Board (or alternatively the officer or employee of the Regional District of Nanaimo having authority to accept the proposal). Any such communication will result in disqualification of the tender from further consideration.

14. The Regional District of Nanaimo is subject to the provisions of *The Freedom of Information and Protection of Privacy Act*. As a result, while Section 20 of the *Act* does offer some protection for third party business interests, the Regional District cannot guarantee that any information provided to the Regional District can or will be held in confidence.
15. Further information regarding the specifications in this solicitation/tender may be obtained from:

John Marcellus-Superintendent of Arena Services  
Tel 250-248-3252  
Fax 250-248-3294  
E-mail: [jmarcellus@rdn.bc.ca](mailto:jmarcellus@rdn.bc.ca)

16. In the Superintendent's absence, proponents may contact:

Dean Banman, Manager of Recreation Services  
Tel 250-248-3252  
Fax 250-248-3294  
Email: [dbanman@rdn.bc.ca](mailto:dbanman@rdn.bc.ca)

**C. Bid Ineligibility**

1. Bids that are unsigned, improperly signed, conditional, illegible, obscure, contain mathematical errors, erasures, alterations, or irregularities of any kind may, at the discretion of the Regional District of Nanaimo, be rejected.
2. Bid forms and enclosures, which are improperly prepared, may at the discretion of the Regional District of Nanaimo, be rejected.
3. Tenders submitted after the closing date and time shall be returned to the bidder unopened.

**D. Mandatory Site Meeting**

1. The mandatory site meeting for this project will commence at **10:00am on Tuesday July 25, 2017** at Oceanside Place Arena, 830 West Island Highway, Parksville, BC. Bidders are to meet in the main lobby of Oceanside Place. Only those Bidders attending the mandatory site meeting will be eligible to submit a Tender.
2. The Bidder attending the mandatory site meetings must be a principal of the Contractor or an estimator employed by the Contractor, indicative of competency in mechanical systems installation and an understand of the project requirements described in this RFT document.

3. As the project primarily involves mechanical work, Mechanical Contractors are invited to bid as Prime Contractors. In the event Contractors who are not qualified to carry out the mechanical installation work intent to bid as Prime Contractors, they shall be accompanied on the site meeting by the Mechanical Contractor they intent to carry as a sub-contractor.
4. Bidders must sign the Sign-In sheet providing proof of Bidder attendance. Tenders received by "closing date and time" will be compared to sign-in sheets. Failure by Bidders to attend and sign the sign-in sheet will exclude your company's Tender.
5. The purpose of the mandatory site meetings is for Bidders to determine the existing conditions, critical dimensions, and any other information relevant to providing a Tender.
6. Questions posted by Bidders and answered at the site meeting may not be further documented or disseminated. Questions which are taken under advisement at the meeting will be documented and the response shall be and distributed to the Bidders recorded as attending the meeting and posted on the Regional District of Nanaimo website
7. The site tour is not mandatory for other sub-contractors.

#### **E. Tender Bid Opening**

1. Bidders are advised that Tender Bid opening will be conducted at Oceanside Place at **2:15 pm PDT on August 1, 2017** at which time all bids received will be opened.

#### **F. Contract/Bid Documents**

1. Bid documents are available only for the purpose of obtaining offers for this project and their use does not confer a license or grant for other purposes.
2. If discrepancies or omissions are found, or clarification required within the Bid Documents, immediately notify the Superintendent of Arena Services.
3. Addenda may be issued during the bidding period. All addenda shall become part of the contract documents.
4. The Regional District of Nanaimo reserves the right to modify the terms on this Invitation to Tender at any time at its sole discretion. Such modifications shall be communicated to all bidders through formal addendums.
5. Bidders should be advised that the Regional District of Nanaimo posts all competitive bids and any resulting addendums on the Regional District of Nanaimo website at [www.rdn.bc.ca](http://www.rdn.bc.ca). Where in its sole discretion it considers it to be necessary, the Regional District of Nanaimo will issue Addenda to amend any portion of this Invitation to Tender by posting them on the RDN website. Such Addenda will become a part of the Tender document, and will supersede prior information. Addenda issued after the pre-tender meeting will also be supplied.

6. For those bidders who download any competitive bid directly from the RDN website and who have not contacted the Regional District of Nanaimo, it is their sole responsibility to access the RDN website to determine if any addendums have been posted, and to download them. The Regional District of Nanaimo does not maintain a bidder's registry for documents downloaded from the RDN website, and as a result, are unable to provide addendums in this situation.
7. For those bidders who obtained bid documents from the Regional District of Nanaimo, and not through the RDN website, the Regional District of Nanaimo will formally provide the bidders with the addendum through e-mail or fax transmission.
8. If a bidder finds, during examination of the contract documents, any errors, discrepancies, omissions, ambiguities, or conflicts in or among the Tender documents, or is in doubt as to their meaning, the bidder shall bring them to the attention of the Superintendent of Arenas Services, not later than three (3) days prior to the tender closing date. Such questions shall be forwarded in writing by hand deliver<sup>4</sup>y, courier, mail, facsimile, or e-mail. At the discretion of the Regional District of Nanaimo, it may be determined to respond by clarifying existing Tender documents to the inquirer only, by issuing an addendum to advise all bidders of additional information, conditions, or essential clarifications, or may elect to decline to respond.

#### **G. Bid Submission**

1. The tender must be accompanied by either a Bid Bond in an amount of ten (10) percent (%) of the tender price or in the form of a certified cheque made payable to the regional District of Nanaimo in the amount of ten (10) percent (%) of the tender price. The Bid Bonds submitted by unsuccessful bidders will be returned to them, without interest, as soon as the successful bidder has delivered to the Regional District of Nanaimo, a fully executed contract for the work, or the period for which tenders are irrevocable has elapsed, whichever shall occur first.
2. The Bid Bond must be issued by a Surety Company licensed to conduct business in the province of B.C. If the successful bidder fails, for any reason, to execute the Contract Agreement, the portion of this Bid Bond will be forfeited to, and retained by the Regional District of Nanaimo for which the Regional District of Nanaimo may legally contract with another party to perform the work, if the latter amount be in excess of the former.
3. The certified cheque submitted by the successful bidder will be retained by the Regional District of Nanaimo and will be returned to the unsuccessful bidders, without interest, as soon as the successful bidder has delivered to the Regional District of Nanaimo, a fully executed contract for the work, or the period for which tenders are irrevocable has elapsed, whichever shall occur first.

4. Any bidder submitting a Letter of Credit as a form of Performance Security agree that the successful bidder should renew the Letter of Credit at least two (2) weeks prior to the expiry date. If possible, an extension clause should be included within the Letter of Credit, such as follows: *“ This Letter of Credit shall be deemed to automatically extend, without amendment from year to year, from the present or any future expiration date herein, unless notice is given at least thirty (30) days prior to the present or any future expiration dates”*.

#### **H. Award Criteria**

1. The Regional District of Nanaimo intends to award this tender contract to the bidder that submits the most favorable priced Tender, to the Regional District of Nanaimo, as indicated in Section 00020, Form of Tender, and that complies with all of the requirements in this tender. However, the lowest or any tender submitted may not necessarily be accepted by the Regional District of Nanaimo, which at its sole discretion, reserves the right to reject any or all tenders. If the Regional District of Nanaimo elects to reject all Tenders, the Regional District of Nanaimo will not be liable to any bidder for any claims, whether for costs, damages incurred by any Bidder in preparing the Tender, loss of anticipated profit in connection with the Contract, or any other matter whatsoever.
2. If the Regional District of Nanaimo elects to reject all tenders, or declines to proceed with project due to funding issues as stated in Section G-3, then the Regional District of Nanaimo will not be liable to any bidder for any claims, whether for costs, damages incurred by any bidder in preparing the tender, loss of anticipated profit in connection with the Contract, or any other matter whatsoever.
3. This project is contingent upon funding from various sources which includes, but may not be limited to, grants, incentives and project budget. The successful bidder shall be expected to submit documentation to Fortis for potential incentives or funding that are eligible from Fortis for the project. In the event that funding from all sources does not cover the project amount tendered, then the Regional District of Nanaimo reserves the right to decline proceeding with the project. The execution of the Contract agreement with the successful bidder will occur upon written confirmation of funding for the entire tendered price of the project.



**I. Insurance**

1. The successful bidder shall provide and maintain Comprehensive General Liability Insurance, acceptable to the Regional District of Nanaimo and subject to the limits of not less than three million dollars (\$3,000,000) inclusive, per occurrence for bodily injury, death, damage to property including the loss of use thereof. Prior to commencement of the work for the project, the successful bidder shall provide the Regional District of Nanaimo with a certified true copy of the Comprehensive General Liability Insurance Policy as described in Section H-4 below.
2. All liability insurance policies shall contain an endorsement to provide prior notice of changes and cancellations. Such endorsement shall be in the following form" *it is understood that and agreed that the coverage by this policy will not be changed or amended in any way, nor cancelled, until thirty (30) days after written notice of such change or cancellation has been given to the Regional District of Nanaimo*".
3. With the exception of Automobile Liability Insurance, the insurance shall include the Regional District of Nanaimo as an additional insured. Proof of same shall be provided to the Regional District of Nanaimo for verification prior to commencing work on the project.
4. The Comprehensive General Liability Insurance shall have coverage for:
  - a) Premises and Operations Liability
  - b) Products or completed Operations Liability
  - c) Blanket Contractual Liability
  - d) Cross Liability
  - e) Equipment liability ( i.e.: man lifts, crane)
  - f) Contingent Employer's Liability
  - g) Personal injury liability arising out of false arrest, a detention or imprisonment, malicious prosecution, libel, slander or defamation of character, invasion of privacy, wrongful eviction or wrongful entry.
5. The successful bidder shall provide and maintain liability insurance in respect to owned and licensed vehicles subject to limits of not less than three million dollars (\$3,000,000).

**J. Offer Acceptance/Rejection**

1. Upon acceptance by the Regional District of Nanaimo, a written award notice will be issued to the successful bidder.
2. The Regional District of Nanaimo shall not be obligated in any manner to any bidder until a written agreement has been duly executed relating to an approved tender.

**K. Workers' Compensation**

1. The successful Contractor shall abide by all provisions of the Worker's Compensation Act of B.C. and upon request from the Regional District of Nanaimo, supply proof that all assessments have been paid and are current.
2. The successful Contractor shall be required to attend a meeting regarding workplace orientation and the applicable Safe Work Practices and Procedures of the Regional District of Nanaimo.
3. The successful Contractor shall ensure that all workers are trained and supervised in accordance with the Workers' Compensation Act, Division 3, Section 115, and are oriented to the applicable Safe Work Procedures of the Regional District of Nanaimo that pertain to the work being performed.
4. The successful bidder is required to supply a written Occupational Health and Safety Program, in respect to WSBC Part 3 Rights and Responsibilities of the Regulation, which includes safe work procedures, safety inspection procedures, and procedures for transporting injured workers. The Contractor shall comply with, but not limited to, all regulations that apply to the work being done. This program must identify and provide safety instructions for the work being performed as outlined in the Tender documents.

**L. Business License**

1. The successful Contractor shall be required to provide a copy of their business license for the City of Parksville.

**M. Indemnity**

1. Notwithstanding the providing of insurance coverage by the Contractor, the Contractor hereby agrees to indemnify and save harmless the Regional District of Nanaimo, its officers, servants, employees and each of them from and against claims, demands, losses, costs, damages, actions, suits or proceedings by whomever made, brought or prosecuted and in any manner based upon, arising out of, related to or occasioned by, or attributable to the negligent activities of the Contractor, its servants, agents, employees, or sub-contractors, in providing the services and performing the work of this Contract, excepting always the liability arising solely out of the negligent act or omission of the Regional District of Nanaimo.

**N. Patent Infringement**

1. Bidders may be required to demonstrate to the Regional District of Nanaimo that the products, materials, or processes in their bid do not infringe upon any patent, and that if, for any reason, a claim is subsequently made by anyone suggesting that a patent has been infringed upon and that the Regional District of Nanaimo may be liable, such bidder shall indemnify the Regional District of Nanaimo in every respect regarding the claim.

**O. Purchasing Statement**

1. The Regional District of Nanaimo encourages and promotes bidders to submit bids on Goods and Services that may contain elements that may reduce damage to the environment. The Regional District of Nanaimo supports purchasing decisions that achieve the best or favorable value for the District by seeking arrangements that provide the optimum combination of quality, suitability, and sustainability considerations into the contract award process.

**P. Proposed Timelines**

The following dates and activities are proposed for the project by the Regional District of Nanaimo.

<b><u>Activity</u></b>	<b><u>Proposed Date</u></b>
Tender Notification	July 11, 2017
Mandatory Site Meeting	July 25, 2017
Tender Closing/Bid Opening	August 1, 2017
Proposed Substantial Completion	October 20, 2017
Proposed Total Contract Completion	November 3, 2017

**Q. Warranties**

1. Bidders shall provide warranties on all mechanical components and workmanship. Warranties that are underwritten by third party insurers are preferred wherever applicable.

## **Part II: General Specifications**

### **Scope of Work**

1. The location of the work to be performed is at Oceanside Place, 830 West Island Highway, in the City of Parksville, B.C.
2. The project shall include the removal of the existing air handling units – AHU 1 + AHU 2 and supply and install new energy efficient air handling units.
3. All work to be performed by the Contractor shall be undertaken in a manner to minimize the impact on the facility user schedule and to the public that enjoy the use of the facility. The Contractor is expected to ensure that work areas are cleaned up and ready for public use after each work period or session. Work shall be coordinated through the Contractor and the Superintendent of Arena Services to ensure that this expectation is achieved. This may result in evening or weekend work to complete the project.
4. The Contractor shall ensure that all work performed is in accordance to industry standards and regulations. The installation shall be performed by qualified trade persons experienced in mechanical retrofits.
5. The Contractor shall supply a written Occupational Health and Safety Program, in respect to WSBC Part 3 Rights and Responsibilities of the Regulation, which includes safe work procedures, safety inspection procedures, and procedures for transporting injured workers.
6. The Contractor shall provide notice to Work Safe BC a minimum of 24 hours prior to the commencement of work as per WSBC Part 20.2 “Notice of Project” (NOP).
7. The Regional District of Nanaimo will provide an orientation for the Contractor and workers for the facility and on the Regional District of Nanaimo Operational and Safe Work Procedures that are applicable to the work to be performed. Due to the nature and timing of the work to be performed, the Regional District of Nanaimo shall provide staff to be on site whenever the Contractor is performing work for the project.
8. The Contractor shall supply the equipment required to perform the work. This shall include but not be limited to man lifts, ladders, scaffolding, tools, safety equipment and protection materials, signage and disposal containers.
9. Refer to the following mechanical specifications and drawings for specific details on the scope of work.

**PART 1.2 - STIPULATED PRICE BID FORM**

**Project/Contract:** Oceanside Place –  
AHU Replacement - 2017

**Project/Contract No.:** XXXX

**From (Bidder):** \_\_\_\_\_  
*company name*

\_\_\_\_\_  
*street address or postal box number*

\_\_\_\_\_  
*city/town, province and postal code*

**Bidders Ph.** \_\_\_\_\_ **Bidders Fax.** \_\_\_\_\_

**To (Owner):** REGIONAL DISTRICT OF NANAIMO

We, the undersigned, having examined the Request for Tender Documents for the above named project/contract, including Addendum Number(s) \_\_\_\_\_, and having visited the Place of the Work, hereby offer to perform the Work in accordance with the Request for Tender Documents, for the stipulated bid price of:

\$ \_\_\_\_\_  
*amount in writing*  
\_\_\_\_\_ in Canadian dollars, excluding GST.

\$ \_\_\_\_\_  
*amount in figures*  
\_\_\_\_\_ in Canadian dollars, GST.

We, the undersigned, declare that:

- (a) we agree to attain Substantial Performance of the Work within \_\_\_\_\_ weeks after receiving notice of contract award, and acknowledge that the construction duration may be considered by the *Owner* in evaluating the Tender and determining contract award. The date of contract award shall be the date the letter of award is sent to the bidder.
- (b) we have arrived at this bid without collusion with any competitor, and
- (c) this bid is open to acceptance by the *Owner* for a period [60] days from the date of Tender closing, and
- (d) all bid form supplements called for by the Request for Tender Documents form an integral part of this Tender.

**Signatures:**

Signed and submitted by:

---

*Company name*

---

*Name and title of authorized signing officer*

---

*Signature of authorized signing officer*

---

*Name of witness*

---

*Signature of witness*

---

*Name and title of authorized signing officer*

---

*Signature of authorized signing officer*

---

*Name of witness*

---

*Signature of witness*

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

**Appendix 'A' – LIST OF SUBCONTRACTORS**

**Project/Contract:** Oceanside Place –  
AHU Replacement - 2017

**Project/Contract No.:** XXXX

**From (Bidder):** \_\_\_\_\_  
*Company name*

We, the above named bidder, propose to use for the above named project/contract, the Subcontractors named below:

Item of Work

Name of Subcontractor

**Bid Depository Subcontractors**

NOT APPLICABLE

**Subcontractors and Suppliers Not Bid Through Bid Depository**

PIPING	_____
SHEET METAL	_____
ELECTRICAL	_____
GENERAL TRADES	_____
CONTROLS	_____
REFRIGERATION TECH	_____

## Appendix 'B' – ALTERNATIVE PRICES

**Project/Contract:** Oceanside Place –  
AHU Replacement - 2017

**Project/Contract No.:** XXXX

**From (Bidder):** \_\_\_\_\_

*Company name*

We, the above named bidder, offer the alternative prices requested below. The amount to be added to, or deducted from, our bid price (as entered in the Bid Form) is entered for each alternative requested. These prices do **NOT** include GST. If there is no change to the bid price for an alternative, we have so indicated. It is understood that:

- (a) the *Owner* may accept any of the alternatives and corresponding alternative prices in any order of combination, including all or none,
- (b) alternatives and alternative prices are open for acceptance by the *Owner* for the same period of time as the bid price, notwithstanding the award of the Contract.
- (c) the Work of the Contract and the Contract Price will reflect the alternatives and alternative prices, if any, accepted by the *Owner* at the time of contract award, and
- (d) acceptance of any alternatives will not affect the bid price contract completion time, unless we have specifically indicated an increase or decrease in time, in number of days, on account of a particular alternative.

<u>Description of Alternative</u>	<u>Effect on Bid Price</u>	
	<u>Add</u>	<u>Deduct</u>
Alternate Price No. 1 Work associated with supplying and installing condensing high efficiency gas fired make up air units instead of non-condensing gas fired make up air units.	\$ _____	\$ _____
	Time (in Days) _____	_____



**Appendix 'E' – LIST OF CASH ALLOWANCES**

**Project/Contract:** Oceanside Place –  
AHU Replacement - 2017

**Project/Contract No.:** XXXX

**From (Bidder):** \_\_\_\_\_

*Company name*

We, the above named bidder, have approved the Cash Allowance(s) included in our bid price (as entered in the Stipulated Price Bid Form) as requested below. These prices do **NOT** include GST.

**Description of Cash Allowance**

**Amount**

(NOT APPLICABLE)

**END OF SECTION 00020**

**THIS PAGE REPRESENTS THE  
CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE  
STIPULATED PRICE CONTRACT CCDC-2 (2008)**

**END OF STIPULATED PRICE CONTRACT  
SECTION 00700**

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<b>DIVISION</b>	<b>01</b>	<b>GENERAL CONDITIONS</b>
<b>Division</b>	<b>01000</b>	<b><u>GENERAL REQUIREMENTS</u></b>
<b>Section</b>	<b>01050</b>	<b>DESCRIPTION OF THE WORK</b>
<b>Section</b>	<b>01150</b>	<b>SCHEDULING AND COORDINATION</b>
<b>Section</b>	<b>01200</b>	<b>QUALITY CONTROL</b>
<b>Section</b>	<b>01250</b>	<b>SUBMITTAL REQUIREMENTS</b>
<b>Section</b>	<b>01300</b>	<b>CLEANING, SAFETY AND STORAGE REQUIREMENTS</b>
<b>Section</b>	<b>01400</b>	<b>SITE ACCESS AND PARKING</b>
<b>Section</b>	<b>01450</b>	<b>CONTRACT CLOSEOUT</b>
<b>Section</b>	<b>01500</b>	<b>GENERAL TRADES REQUIREMENTS</b>

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<b>DIVISION</b>	<b>15</b>	<b>MECHANICAL</b>
<b>Division</b>	<b>15000</b>	<b><u>MECHANICAL GENERAL REQUIREMENTS</u></b>
<b>Section</b>	<b>15010</b>	<b>SCOPE OF MECHANICAL WORK</b>
<b>Section</b>	<b>15020</b>	<b>MATERIALS AND EQUIPMENT</b>
<b>Division</b>	<b>15100</b>	<b><u>TESTING, ADJUSTING AND BALANCING (TAB)</u></b>
<b>Section</b>	<b>15120</b>	<b>AIR AND WATER BALANCING</b>
<b>Section</b>	<b>15130</b>	<b>MECHANICAL SYSTEMS VERIFICATION</b>
<b>Division</b>	<b>15200</b>	<b><u>NOISE, VIBRATION AND SEISMIC CONTROL</u></b>
<b>Section</b>	<b>15220</b>	<b>VIBRATION CONTROL</b>
<b>Section</b>	<b>15230</b>	<b>SEISMIC CONTROL</b>
<b>Division</b>	<b>15300</b>	<b><u>INSULATION AND FIRESTOPPING</u></b>
<b>Section</b>	<b>15320</b>	<b>DUCT INSULATION</b>
<b>Division</b>	<b>15400</b>	<b><u>PLUMBING AND DRAINAGE</u></b>
<b>Section</b>	<b>15420</b>	<b>SANITARY DRAIN AND VENT PIPING AND ACCESSORIES</b>
<b>Section</b>	<b>15440</b>	<b>NATURAL GAS PIPING AND ACCESSORIES</b>
<b>Division</b>	<b>15800</b>	<b><u>VENTILATION SYSTEMS AND EQUIPMENT</u></b>
<b>Section</b>	<b>15820</b>	<b>COMMERCIAL AIR HANDLING UNITS</b>
<b>Section</b>	<b>15880</b>	<b>DUCTWORK, HOODS AND DUCT ACCESSORIES</b>

**END OF SPECIFICATION  
TABLE OF CONTENTS**

**1 SCOPE OF WORK**

- .1 Provide new, complete, operational and tested mechanical systems for heating, ventilation, air conditioning, controls, plumbing and fire protection systems, as described herein, indicated on the drawings and in full conformance with applicable codes, standards and ordinances.
- .2 Provide all labour, materials and products as specified, as required to accomplish this work.
- .3 The scope of the mechanical work for this project generally includes:
  - .1 Roof mounted make up air units
  - .2 Supply air ductwork
  - .3 Internal acoustic duct lining and external duct insulation
  - .4 Controls
  - .5 Air systems balancing
  - .6 Verification of systems operation and controls
- .4 Plumbing work will include the following:
  - .1 Natural gas piping
- .5 Demolition and builder's work will include the following:
  - .1 Removal of existing equipment and disposal.
  - .2 Other demolition, painting, remediation, etc, as described in the specifications and on the drawings, to accommodate the Work.
  - .3 Removal and disposal of existing roof curbs
  - .4 Non-structural seismic protection
- .6 Envelope and Structural work will include the following:
  - .1 Refer to drawings S101.
- .7 Electrical work will require the following:
  - .1 Electrical power supply to mechanical equipment (AHU-1 and AHU-2)
  - .2 Removal and replacement of miscellaneous electrical devices, including some new equipment

- .8 The mechanical contractor shall act as the Prime Contractor for this project, responsible for the coordination of all trades required to carry out the work as described herein.

**3 ALTERNATE PRICES**

- .1 An Alternate Price No. 1 is also to be identified as an ADD-ON price to the Contractor's base tender, for work associated with supplying and installing condensing high efficiency gas fired make up air units instead of non-condensing gas fired make up air units, as indicated on the drawings.

**END OF SECTION 01050**

**1 SCHEDULING OF THE WORK**

- .1 Within seven working days of award of contract provide to the Consultant a detailed schedule describing the sequence and timing of the work.
- .2 All work described in contact documents must be performed in a manner which allows the building to function without interruption.

**2 COORDINATION OF THE WORK**

- .1 Coordinate all mechanical work with the work of other sections to avoid conflict.
- .2 Locate distribution systems, equipment and materials to eliminate interference, conserve headroom and leave maximum usable space.
- .3 The drawings are approximately to scale. They establish a scope of work only and are not intended as detailed installation instructions. Methods of construction required to attain the scope of work indicated on the drawings, confirmation of site measurements and attaining a level of quality as described in the specification are the responsibility of the Contractor
- .4 Route piping and ductwork in an orderly manner. Generally, follow routes parallel and perpendicular to building structure.
- .5 If interference should occur the Consultant will review relocation of equipment and materials regardless of installation order. No installation shall proceed without complete coordination between all trades.
- .6 Make any necessary minor changes or additions to runs of ducts or pipes, etc., to accommodate structural conditions without additional charge or expense to the Owner.
- .7 Alter location of ducts or pipes at the direction of the Consultant without charge to the Owner, so long as the change is made before installation and does not necessitate additional materials.

**3 CONTRACTOR'S RESPONSIBILITIES**

- .1 It shall be the General Contractor's responsibility to plan, schedule and perform the work and to coordinate the work of all sub-trades. The General Contractor shall be responsible for any damage caused to the Owner or other Contractors by failure to perform these duties.
- .2 Protect work performed and areas of the existing building from damage caused by carrying out of work. Pay particular attention to protection of building vapour barriers, waterproof membranes and existing interior and exterior surfaces. Where necessary to protect building surfaces using tarpaulins, plastic sheet, drop-cloths, etc. Repair any damage caused by the work to the satisfaction of the Owner and the Consultant.

- .3 Be responsible for the condition of all materials and equipment supplied to the site.
- .4 Obtain copies of the following Owner's policies and procedures, and ensure adherence to the requirements of these by all employees of the Contractor and sub-Contractors working on the site.
  - .1 Harassment
  - .2 Smoking
  - .3 Parking
  - .4 Security
  - .5 Safety
  - .6 Criminal Record
- .5 Be responsible for security of the property and equipment within the building, where that property or equipment can be impacted by the contractor's negligence or failure to secure the building.
- .6 Coordinate with the Owner any requirement to shut down mechanical systems or utility services to accommodate service connections. Do not shut down any such services without written consent from the Owner.
- .7 Any work that will generate excessive noise, odour or dust, or that may set off building fire detection equipment or alarms must also be scheduled with the School District Maintenance Department to ensure a minimal impact to all ongoing school activities.

#### **4 SEQUENCING OF THE WORK**

- .1 The required sequence of changeover from existing to new heating and ventilation equipment is as follows:
  - .1 Complete demolition of all systems as noted on plans
  - .2 Install all new mechanical equipment, ductwork, piping, etc. During this phase of the work none of the new equipment will be operational.
  - .3 Perform system start-up, balancing and commissioning.
  - .4 Remove all redundant equipment, piping and ductwork.
  - .5 Where existing materials are required to be removed earlier in the described sequence, to allow installation of new materials and equipment, contact the consultant to discuss a strategy for removal from service of existing equipment.

**END OF SECTION 01150**

**1 CODES, STANDARDS AND PERMITS**

- .1 Obtain and pay for any permits required for the work to be carried out.
- .2 The work shall be in performed in accordance with the regulations of the following authorities:
  - .1 2012 British Columbia Building Code
  - .2 Canadian Standards Association
  - .3 Provincial Electrical Inspector. Electrical work to the requirements of the Canadian Electrical Code and the Provincial Electrical Inspector. Electrical equipment shall bear CSA and ULC labels attesting that equipment meets the testing standards of these agencies.
  - .4 Provincial Gas Inspector.
  - .5 Natural Gas and/or Propane installations shall conform to the requirements of CAN/CSA-B149.1-00, "Natural Gas and Propane Installation Code. "
  - .6 Worksafe BC (WCB)
- .3 Ventilation systems and equipment shall be installed and conform to the followings standards.
  - .1 ASHRAE
  - .2 SMACNA
  - .3 Equipment manufacturers and suppliers recommendations.
- .4 Installation and equipment shall conform to the requirements of the plans and specifications.

**2 INSTALLATION REQUIREMENTS**

- .1 Installation and equipment shall conform to the requirements of the plans and specifications.
- .2 Install equipment in locations shown with minimum interference with other services or free space.
- .3 All HVAC equipment except for Condensers a shall be fully enclosed within Mechanical Service rooms, and all shop HVAC equipment should be in inside the applicable space, located in a mezzanine or service room with full service height. Remove and replace improperly installed equipment to satisfaction of the consultant at no extra cost.



- .4 Piping and ductwork shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel or perpendicular to building lines. All duct and pipes at ceiling level shall be kept as tight as possible to beams or other limiting structural members. All pipes and ducts shall be coordinated in elevation to ensure that they are concealed in the ceiling space.
- .5 Provide seismic restraints for all equipment, piping and ductwork when required by code.
- .6 The Mechanical Contractor shall coordinate with the General Contractor locations of pipe trenches, roof openings and wall openings to accommodate ducts and pipes, cutting and patching of beams, walls, floor slabs and masonry work necessary for hanger rods, brackets and sleeves.
- .7 Relocate improperly located holes and sleeves.
- .8 Drill for expansion bolts, hanger rods, brackets, and supports.
- .9 Obtain written approval from Consultant before cutting or burning structural members. This work shall be carried out by the specialist trade only.
- .10 Provide openings and holes required in precast members for mechanical work. Cast holes larger than 100 mm in diameter tight to columns shall not exceed 200 mm in diameter. Cast or field cut holes smaller than 100 mm.
- .11 Repair building where damaged from equipment installation, improperly located holes etc. by this section of the work. This repair work shall be carried out by the specialist trade at the expense of this section of work. Use matching materials as specified in the respective sections.
- .12 HVAC and plumbing systems shall be of institutional quality

### **3 INSPECTIONS OF THE WORK**

- .1 Do not conceal any installation prior to review by the consultant or the appropriate inspection authority. Ensure 72 hours written notice is provided to each of these parties prior to requirement for an inspection of the work. This includes any pressure tests of piping, ductwork or safety devices.
- .2 Provide certificates and inspection reports received from applicable authorities with jurisdiction, verifying that work installed conforms to necessary codes and standards.

### **4 GUARANTEE-WARRANTY**

- .1 The Contractor shall furnish a written warranty stating that all work executed will be free from defects of material and workmanship for a period of one year from the date of total performance.

- .2 The warranty shall include any part of equipment, units or structures furnished hereunder that show defects in the works under normal operating conditions and/or for the purpose of which they were intended.
- .3 The Contractor further agrees that they will, at their own expense, promptly investigate any mechanical or control malfunction, and repair or replace all such defective work, and all other damages thereby which becomes defective during the time of the guarantee-warranty.

## **5 TRADE QUALIFICATIONS**

- .1 Installation must be carried out by skilled tradesman holding a valid TQ license, or apprentices working under the supervision of a licensed tradesman. When apprentices are working, the licensed tradesman for each discipline must be on the site. These requirements apply to the installation of the following components of the project:
  - .1 Pipefitting for plumbing systems
  - .2 Gasfitting
  - .3 Sheet Metal
  - .4 Welding
  - .5 Electrical
- .2 Should the Contractor opt to use apprentices on the project a minimum level of supervision of one Journeyman for each two Apprentices must be maintained.
- .3 The Journeyman must be on site at all times. The Apprentices must not work without the direct supervision of a Journeyman.
- .4 The Contractor shall submit names and qualifications of all personal (including sub-trades) intended for this project within twenty one (21) days of contract award. The Owner reserves the right to accept or reject any individual proposed for the project, on the basis of qualifications.
- .5 All welding carried out at the project must be done by welders whose certificates are current. Welding certificates must be submitted within 21 days of contract award indicating the following minimum qualifications.
  - .1 Piping ASME Certification - MCABC 1A.
  - .2 Welding Code B52.1.
  - .3 All field welding to be in accordance with CSA B31.1.

- .6 Contractor to submit gas installation qualifications. The minimum requirement is for a Type 'A' licence.
  
- .7 A quality assurance programme shall be submitted by the Contractor within 21 days of contract award. The programme shall be reviewed by the Consultant. Upon acceptance, the programme shall be implemented for the duration of the contract.

**END OF SECTION 01200**

**1 SHOP DRAWINGS**

- .1 Provide PDF copies of shop drawings for the equipment listed below, in accordance with MCA-BC standards.
- .2 Shop drawings shall indicate all aspects of the construction and operating performance of the product proposed.
- .2 Identify materials and equipment by manufacturer trade name and model number. Include copies of applicable brochure or catalog material.
- .3 Clearly mark submittal material using arrows, underlining or circling to show specific model numbers if equipment sheets are generic, differences from specified products, ratings, capabilities and options being proposed. Cross out non-applicable materials.
- .4 Specifically note on the submittal specified features such as special tank linings, pumps, seals, material, or painting.
- .5 Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, and service connection data and motor sizes.
- .6 Shop drawings shall be endorsed by the General Contractor and Mechanical Sub-contractor indicating that the shop drawings have been reviewed and submitted without qualifications.
- .7 Provide for:
  - .1 Gas Fired Air Handling Units
  - .2 Controls

**2 OPERATING AND MAINTENANCE MANUALS**

**2.1 CONTRACTUAL RELATIONSHIP**

- .1 The work of this section will be performed by a Testing, Adjusting and Balancing (TAB) Agency retained by the contractor.
- .2 The Contractor's obligation for manuals is to provide the following documentation to the TAB agency:
  - .1 TWO clean paper, and PDF copies of
    - .1 A copy of all Shop Drawings. Version included is to be the version given "Reviewed" status by the Consultant.
    - .2 "Record" controls shop drawings

- .3 Manufacturer representatives' equipment start-up reports for:
  - .1 Gas Fired Air Handling Units
- .2 A digital copy in Microsoft Word format of
  - .1 Controls end-to-end check verification lists provided by Controls Contractor
  - .2 Hydrostatic tests performed on new;
    - .1 Natural gas piping
  - .3 Inspection certificates for
    - .1 Natural gas piping
  - .4 Certificate of Guarantee
  - .5 List of equipment manufacturers and suppliers and sub-contractors used on the project.
  - .6 A valve schedule. Refer also to Section 15020.

## **2.2 REQUIRED CONTENT OF OPERATION AND MAINTENANCE MANUALS**

- .1 The Operating and Maintenance manuals are to be submitted in hard cover three ring binders) The front cover and spine of the binders are to be labeled with the text  
***“MECHANICAL SYSTEMS OPERATING AND MAINTENANCE MANUAL – OCEANSIDE PLACE – AHU REPLACEMENT AND ROOFING UPGRADE - 2017”***
- .2 The TAB Agency is to provide two hard copies and two digital (CD-ROM) copies in PDF format of then Operating and Maintenance Manual for the completed installation.
- .3 Organize the manuals into sections as described below, with each section labeled with celluloid covered tabs. For shop drawings organize into sub-sections mirroring numbering of the mechanical specification. Indicate the appropriate specification section in the main index and put the shop drawings into the manuals in this order.

### **Part 1 – Description of Systems:**

- .1 Title page indicating project title and the names, addresses, telephone and fax numbers of the Owner, Mechanical Engineer, General Contractor, Mechanical Contractor and the agency preparing the manuals.

- .2 Description of systems, including description of system operation and components comprising the system. Describe systems operation and sequence of control operation, including start-up, shutdown and intended response of system components to controlling devices.

## **Part 2 – Maintenance and Test Information**

- .1 Maintenance procedures and lubrication requirements, including preventative maintenance procedures, lubrication schedules and a belt schedule.
- .2 List of equipment manufacturers and suppliers and sub-contractors used on the project.
- .3 Copies of hydrostatic tests performed on new;
  - .1 Natural gas piping
- .4 Copies of Inspection Certificates for
  - .1 Natural gas piping
- .5 Balancing reports for air systems
- .6 Equipment verification checklists. Checklists are to be provided for:
  - .1 Gas Fired Air Handling Units
  - .2 Controls
- .7 Controls end-to-end check verification lists provided by Controls Contractor
- .8 Equipment start-up reports.
- .9 Contractor's Certificate of Guarantee

## **Part 3 - Shop Drawings**

- .1 Include a copy of all Mechanical Shop Drawings. Version included is to be the version given "Reviewed" status by the Consultant.
- .2 Control shop drawings to be "As-Built" version, and include all system schematics, points lists and sequence of operations

## **3 RECORD DRAWINGS**

- .1 Maintain a set of record drawings at the site. Record drawings shall be neatly maintained on a set of prints provided to the Contractor by the Mechanical Consultant.

- .2 Drawings are to be maintained in an up to date condition at all times, recording all changes and deviations to the installation from those indicated on the construction issue drawings. The "record drawings shall include, but not be limited to, the following changes and shall be recorded daily.
  - .1 Size, location, arrangement, route and extent of ductwork, piping, conduit, terminal units, equipment, fixtures, cleanouts, valves, rough-in, etc., Above and below grade inside the building, including locations of buried piping.
  - .2 Include all revision drawings, supplementary drawings, change orders, addenda and site revisions, etc. on the as-built drawings.
- .3 At the time of Substantial Completion the Contractor shall engage and pay for services of either a competent drafting service or the Consultant to transfer the changes from the site record drawings to electronic drawing files. The Consultant will provide electronic files of the construction issue drawings to the alternate drafting service if required.
- .4 When the electronic drawing files are revised with the changes previously recorded on site by the Contractor, the Contractor will have a set "ARCH D" prints of the electronic drawings plotted, add the notation "Certified Record Drawings", and date and sign the drawings. Alternatively, the contractor may "digitally sign" the PDF copy of the Record drawings in lieu of providing hard copy signed drawings. The hard copy set (ARCH D) and the electronic drawing files in both AutoCAD DWG format and ADOBE PDF format are to be submitted for the Consultants review before turning over to the Owner.

**END OF SECTION 01250**

**1 EQUIPMENT STORAGE AND PROTECTION**

- .1 The Owner will designate storage areas for tools and equipment. The Contractor shall assign and coordinate storage facilities for sub-Contractors within these designated areas.
- .2 Prevent damage of material and equipment during delivery, handling, storage and after installation, until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .3 All mechanical materials and equipment stored on site shall be kept in a dry storage area and stored in accordance with supplier's instructions.
- .4 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.
- .5 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.
- .6 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .7 Provide temporary filters on all return air grilles and in all ventilation systems if the units must be run before the building is in a clean, operating condition.
- .8 Prior to the owners demonstration, provide written certification that all ductwork is clean and that all temporary filters have been replaced with new filters.
- .9 Touch-up damaged factory finished surfaces using primer or enamel to match original. Do not paint over nameplates under any circumstances.

**2 PROJECT CLEANLINESS**

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times dispose of as directed by RDN. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Provide and use marked separate bins for recycling.
- .6 Dispose of waste materials and debris off site.



- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surface nor contaminate building systems.
- .12 All work described in contract documents must be performed in a manner which allows the building to function without interruption.
- .13 If in the opinion of the Owner or the Consultant adequate clean up is not maintained, cleaning will be performed by Owner's forces and the Contractor will be back charged at a rate of \$50.00 per hour plus supplies and equipment for all such cleaning required.

### **3 FINAL CLEANING**

- .1 When work is substantially performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by owner or other contractors.
- .5 Remove waste materials from site at regularly scheduled times, do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fittings, walls and floors.

- .9 Clean lighting reflectors, lenses and other lighting fixtures impacted by this project
- .10 Vacuum clean and dust building interiors, behind grilles, louvers and screens.
- .11 Inspect finishes fitments and equipment and ensure specified workmanship and operation.
- .12 Broom clean and power wash exterior walks, steps and surfaces; rake clean other surfaces of grounds as impacted by this project.
- .13 Remove dirt and other disfiguration from exterior surfaces.
- .14 Sweep and power wash paved areas.
- .15 Clean equipment and fixtures to sanitary condition; replace filters of mechanical equipment.
- .16 Remove debris and surplus materials from crawl area and other accessible concealed spaces.

#### **4 SITE SAFETY**

- .1 All work shall be carried out in a safe and orderly manner, consistent with applicable Worksafe BC (WCB) safety regulations.
- .2 Provide any required scaffolds, hoists and ladders require to safely carry out the work.
- .3 The Contractor shall provide and keep up to date a Fire Safety Plan in accordance with Part 8 of the 2012 British Columbia Building Code, Worksafe BC and to satisfy the requirements of the local Authorities.
- .5 Provide first aid facilities to the requirements of the Workers Compensation Board for all employees and authorized visitors to the construction site.

#### **5 REDUNDANT EQUIPMENT**

- .1 The Owner retains right of first refusal for any old equipment indicated as being removed.
- .2 The materials and equipment are to be formally turned over to the Owner's designated site representative. The Contractor is to prepare a letter for countersigning by the Owner's representative that the equipment has been turned over in a condition acceptable to the Owner.
- .3 All other redundant materials and equipment are to be removed from the site and disposed of in a manner conforming to Worksafe BC and any applicable environmental codes and standards.

**END OF SECTION 01300**

**1 CONTRACTOR'S ACCESS TO BUILDINGS**

- .1 Access to the building shall be co-ordinated through John Marcellus, the Superintendent of Arena Services. (Telephone (250) 248-3252).
- .2 Keys are available to be signed out for inside access only. Master outdoor keys will not be issued.
- .3 Any keys which are given and registered by the Contractor must be returned at completion of the project. Lost keys will require the facility be re-keyed at the Contractors expense.
- .4 All work described in contact documents must be performed in a manner which allows the building to function without interruption.
- .5 All Contractors are required to wear photo ID, bearing the logo of the employer and the employees name and photograph, at all times when working while the school is occupied.

**2 CONTRACTOR'S USE OF THE BUILDING**

- .1 Sanitary Facilities: The washrooms within the buildings may be used by the Contractor, but must be maintained in a clean and orderly manner. If the Owner deems that maintenance of the washrooms is unacceptable, the Contractor will be required to provide temporary washroom facilities for the duration of the project. Be responsible for all damages thereto.
- .2 Water Supply: The water supply may be used by the Contractor provided damage to piping or valves does not occur. Be responsible for all damages thereto.
- .3 Temporary Power and Light: The permanent power and lighting system of the building or portions thereof may be used subject to approval of the Owner and the Consultant. Be responsible for all damages thereto.
- .4 Telephone and Fax: The Contractor shall make provision for his own hook-ups for any required telephone or fax service required for the duration of the contract. Permanent telephone and fax equipment in the building are for occupant use only.
- .5 Noise Control
  - .1 Conform to Municipal Noise Control Bylaws including hours of work.
  - .2 Workers shall refrain from use of loud and vulgar language. Non-compliance to this policy will result in the specific worker(s) involved being required to immediately leave the site and to be permanently removed from any subsequent involvement on this project by the Contractor.
  - .3 Use of loud radios shall be prohibited.

- .6 Smoking Policy
  - .1 The Owner has a no-smoking policy anywhere on the property, including in service and mechanical rooms, attics, crawlspaces, basements and the school fields.
  - .2 All construction personnel will be required to conform to this policy.
  - .3 The Contractor shall be responsible for enforcement of this requirement.

**END OF SECTION 01400**

**1 SUBMITTALS**

.1 Operation and Maintenance Manuals

- .1 Operation and Maintenance Manuals will be supplied by the TAB Agency retained by the Contractor
- .2 Final O+M manuals, including final commissioning reports, letters of warranty and all required inspection certificates are to be submitted at or before the time of Total Completion. Total Completion will not be granted without this requirement being met.
- .3 Refer to section 01250 for further details

.2 Record Drawings

- .1 Provide marked-up copies of record drawings for the Consultant's review at the time Substantial Completion is requested. Substantial Completion will not be granted without this requirement being met.
- .2 Provide digital copies of record drawings and a hardcopy set authorized by the Contractor as "Record" at the time Total Completion is requested. Total Completion will not be granted without this requirement being met.
- .3 Refer to section 01250 for further details

**2 SUBSTANTIAL PERFORMANCE INSPECTION**

.1 Prior to requesting an inspection for Substantial Performance, the Contractor shall verify in writing that all the following items have been provided and that beneficial use of the building is available to the Owner.

- .1 All systems shall be certified in writing as complete and fully operational.
- .2 A complete list of items that are not finished, or are deficient shall be provided. If, in the opinion of the Consultant, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.
- .3 The Contractor shall be fully responsible to accumulate all necessary data from this Sub-trades and suppliers and present it in the specified format for the approval by the Consultant.

.2 If the Contractor requests an inspection for Substantial Completion and it is deemed by the Owner and/or Consultant that items not identified on the Contractor supplied list are not complete, the Contractor shall bear the Consultant's cost for subsequent site inspections.

**3 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT**

- .1 Installed mechanical equipment whose performance is questioned by the Consultant, may be subject to performance verification as specified herein.
- .2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.
- .3 The Consultant will determine by whom testing shall be carried out. When requested, the contractor shall arrange for services of an independent testing agency.
- .4 Testing procedures shall be approved by the Consultant.
- .5 Maintain building comfort conditions when equipment is removed from service for testing purposes.
- .6 Promptly provide the Consultant with all test reports.
- .7 Should test results reveal that equipment does not meet specified performance requirements, equipment will be rejected and the following shall apply:
  - .1 Remove rejected equipment. Replace with equipment which meets requirements of Contract Documents including specified performance requirements.
  - .2 Replacement equipment will be subject to performance verification as well, using same testing procedures on originally installed equipment.
  - .3 Contractor shall pay all costs resulting from performance verification procedure.

**4 INSTRUCTION OF OPERATING STAFF**

- .1 The TAB Agency will coordinate and run a training and instruction session for facility operating and maintenance personnel. Training time to be a minimum of four hours and include instruction on complete start-up sequence of all systems and equipment and review of all modes of operation, as indicated in the control sequence of operations.
- .2 Instruction to be during regular work hours.
- .3 The following sub-Contractors are required to participate and assist with the demonstration and training session
  - .1 Controls
  - .2 Balancing
  - .3 Manufacturers representative for gas-fired rooftop units
- .4 The Contractor shall submit to the Consultant a document signed by Owner or his representative, stating:

- .1 The Owner has received satisfactory instruction in operation and maintenance of all equipment and systems.
- .2 Operation and maintenance manuals have been reviewed with Owner.
- .3 Specified spare parts of components, keys, removable handles and the like, have been turned over to the Owner.

**5            TURNOVER OF EQUIPMENT**

- .1 The Owner retains right of first refusal for any old equipment indicated as being removed.
- .2 The materials and equipment are to be formally turned over to the Owner's designated site representative. The Contractor is to prepare a letter for countersigning by the Owner's representative that the equipment has been turned over in a condition acceptable to the Owner.
- .3 All other redundant materials and equipment are to be removed from the site and disposed of in a manner conforming to Worksafe BC and any applicable environmental codes and standards.

**6            KEYS AND SECURITY ITEMS**

- .1 Return all keys to the Owner

**END OF SECTION 01450**

**1 QUALITY ASSURANCE**

- .1 The general trades work described below is to be performed by skilled tradesmen holding valid TQ licenses, or apprentices working under the supervision of a licensed tradesman.
- .2 When apprentices are working, the licensed tradesman for each discipline must be on the site.

**2 PAINTING**

- .1 All painting work shall conform to the standards of the Master Painters and Decorators Association. (MPDA).
- .2 Solvents to be odour free.
- .3 Paint materials shall meet the flame spread and smoke developed ratings indicated in Part 3 of the British Columbia Building Code, latest edition.
- .4 Paint products shall comply with CGSB standards.
- .5 Touch-up damaged finished equipment surfaces.
- .6 Surfaces shall be prepared as recommended in Chapter 2 and Chapter 3 of the Architectural Standards Manual of the MPDA.
- .7 Exterior ductwork shall be painted with weatherproof coating as described in Section 15320, Clause 5.
- .8 Natural gas piping shall be painted where exposed with solvent based primer and finish coat.
  - .1 Colour to be yellow, to CGSB 505-101
  - .2 Exposed natural gas pipe installed on the roof, in attics, crawl spaces and within ceiling plenums does not require painting, but is to be clearly identified with markers and banding, every 25 metres maximum spacing and in accordance with clause 14.1 above

**3 ROOFING**

- .1 Refer to building envelope drawings S101.

**4 REMOVAL AND REPLACEMENT OF CEILINGS**

- .1 In most areas of the schools new piping and ductwork is intended to run exposed to minimize disruption to ceilings. Some removal of ceilings of GWB will be required, as indicated on the drawings.



- .2 Replacement of drywall ceilings to include 16-mm (5/8-inch) gypsum wallboard, mudding, taping, sanding and painting to the Owner's and the Consultants satisfaction.
- .3 Painting to match existing, surrounding building finishes.

**6 FIRESTOPPING**

- .1 Refer to Section 15340

**END OF SECTION 01500**

## **1 SCOPE OF WORK**

- .1 Provide new, complete, operational and tested mechanical systems for heating, ventilation, air conditioning, controls, plumbing and fire protection systems, as described herein, indicated on the drawings and in full conformance with applicable codes, standards and ordinances.
- .2 Provide all labour, materials and products as specified and as required to accomplish this work.
- .3 The following general Divisions of the specification comprise the mechanical work of this project. The mechanical systems shall meet the performance guidelines of the following specifications.
  - .1 15000 Mechanical General Requirements
  - .2 15100 Testing, Adjusting and Balancing
  - .3 15200 Noise, Vibration and Seismic Control
  - .4 15300 Insulation
  - .5 15400 Plumbing Systems and Equipment
  - .6 15800 Air Distribution Systems and Equipment
- .2 Refer to the Table of Contents, Section 15001, for reference to specific specification sections included under each of the general Divisions noted above.

## **2 SUBMITTAL REQUIREMENTS**

### **2.1 Shop Drawings**

- .1 Refer to Division 01 for requirements of shop drawing submission.

### **2.2 Operating and Maintenance Manuals**

- .1 Refer to Division 01 for requirements of Operations and Maintenance Manuals

### **2.3 Record Drawings**

- .1 Refer to Division 01 for requirements of record drawings.

## **3 FALL RESTRAINT FOR ROOF MOUNTED MECHANICAL EQUIPMENT**

- .1 Where possible locate any roof mounted mechanical equipment or access hatches at least two metres from the edge of any roof three metres or higher above surrounding grade.

- .2 Where equipment or hatches are located within two metres of the edge of a roof three metres or higher above surrounding grade, provide anchors (at least two per piece of equipment) to which fall restraint equipment can be secured by maintenance workers. Refer also to Part 11 of the Worksafe BC Occupational Health and Safety Regulation.
- .3 The anchors must be capable of withstanding a load of 800 lbs in any direction. The Mechanical Contractor is to retain the services of a Professional Engineer, registered in the Province of British Columbia to ascertain that all fall restraint anchors installed under this contract are of adequately capacity.
- .4 At the completion of the project obtain a letter bearing the seal of the Engineer stating that the fall restraint anchors are of adequate capacity and correctly installed.

#### **4 ALTERATION WORKS**

- .1 Where utilities are removed, relocated, or abandoned, cap, valve, plug or bypass to make complete and working installation.
- .2 "Making good" is defined as providing new surfaces identical to the ones removed or disturbed and matching adjacent surfaces with no visible difference between new and existing. Where re-painting of a surface is required, paint to the entire surface between the nearest adjacent corners, ie: the entire plane of the surface containing the disturbed area.
- .3 Where concealed conditions differ from those indicated on the drawings the Contractor shall immediately inform the Consultant.

#### **5 INSTRUCTION OF OWNER'S OPERATING STAFF**

- .1 Refer to Division 01 for requirements of Operations and Maintenance Manuals

#### **6 LAWS, NOTICES, PERMITS AND FEES**

- .1 Give all necessary notices, obtain all necessary permits and pay all fees in order that the work specified may be carried out.
- .2 Furnish any certificates necessary as evidence that the work installed conforms with the law and regulations of all authorities having jurisdiction.

**END OF SECTION 15010**

**1 PRODUCTS – CONDITIONS FOR ACCEPTANCE**

- .1 Base Bid means an item is specified by manufacturer and model number meets the specifications in all respects regarding performance, quality of material and workmanship and is acceptable to the Consultant without qualification. Base Bid equipment is as listed in the Specification and Mechanical Equipment Schedules and on the Drawings.
- .2 Approved Equal means the Consultant has deemed the manufacturer capable of producing material, fixture or equipment of comparable quality. Products supplied by an approved equal must match the specified product in performance, approximate dimensions, quality of material and quality of workmanship. If in the opinion of the Consultant material submitted for review does not meet these criteria, satisfactory material from the equal manufacturer shall be provided, or the Contractor will revert to the Base Bid product.
- .3 Alternate means the Consultant may deem a manufacturer capable of producing substitute material, fixture, or equipment which will fulfill project requirements but may differ in material, quality, performance, characteristics, methods of construction or mode of operation. Alternate equipment suggested by bidders will be indicated as a separate item, with applicable cost differences from the specified product(s). The bidders tender will include a product supplied by a manufacturer indicated in the approved equals list as a part of the bidders base tender price.
- .4 The use of an equal or alternate products shall in no way relieve Division 15 from the responsibility of furnishing all work that may be required by reason of different space, weight or electrical requirements from that of the specified manufacturer. If, in the opinion of the Consultant, such work is necessary and is not carried out in a manner, which will ensure satisfactory operation and performance of the equipment, then the specified manufacturer shall be used.
- .5 Request for review from manufacturers of materials, fixtures and equipment who are not listed as equal and wish to be accorded "equal" status, shall be made at least seven (7) days prior to close of tender. Such material, fixtures, and equipment shall meet the requirements for an equal as described in the Standard of Acceptance. All information required by the Consultant to evaluate proposed manufacturer shall furnish the proposal at the time of the request.
- .6 Mechanical systems have been designed based on equipment from the Base Bid manufacturer. The onus shall be on the Mechanical Contractor in conjunction with the equal or alternate supplier(s) to ensure that their equipment will meet the required performance characteristics, electrical characteristics, as well as fit properly into allotted space including allowing for the required access and service spaces. Any additional costs incurred as a result of modifications to the system or room layout, or modifications required by other trades shall be borne by the Mechanical Contractor.
- .7 Provide within 24 hours a list of equipment and manufacturers to be used on this project. This list shall not be deviated from unless delivery, performance, or dimension issues require a change to be reviewed by the Consultant.

- .8 If shop drawings of any product submitted are rejected on technical reasons after three submissions, the Contractor at no additional expense to the Owner shall revert the specified product and manufacturer for this project.

**2 PRODUCTS – BASE BID AND APPROVED EQUAL MANUFACTURERS**

Air Handling Unit – Outdoor Gas Fired	Engineered Air, Sterling, Lennox, ICE
Automatic Air Vent	Hoffman, Braukman, Sarco, Armstrong, Maid-O-Mist
Control Dampers - Low Leakage	American Warming, Tamco, Ruskin
Dampers – Fire and Smoke	Canadian Advanced Air, Maxam, Ruskin, Controlled Air, Nailor Industries, Pottoroff
Duct Cleaning	Enviro-vac, Ace Mobile, Power Suction Services
Ductwork – Flexible	Thermafex, Wiremold, Flexmaster, Canaflex
Ductwork – Round and Oval Spiral	Spiro-Lock, Ecco
Ductwork – Canvas Flexible Connectors	Durodyne, Ventlan
Filters	Farr, Continental, Cambridge, AAF
Firestopping and Smoke Seals	3M, Tremco, Hilti
Flow and Pressure Switches	Potter, System Sensor
Gas Pressure Regulating Valves	Fisher, Rockwell
Identification – Pipe and Duct	3M, SMS, Duramark, Bradley
Insulation – Piping and Duct	3M, Dow, Fibrex, Knauf, Johns-Manville, Owens Corning, Pittsburgh Corning, Manson, Roxul, Fibreglass Canada, Certainteed
Insulation Jacketing	Childers, Fiberglas, Johns-Manville
Pipe Couplings - Grooved	Victaulic, Grinnell, Shur Joint
Pipe Couplings - Di-Electric	Watts, AG Specialties
Pipe Couplings - Flexible	Mason, Flexonics, Hyspan, Goodall, Victaulic, Proco

Pipe Fittings and Flanges	Crane, Grinnell, Jenkins
Pipe Supports and Hangers	Crane, Unistrut, Myatt, Grinnell, Sarco, Hunt, Taylor
Pressure Gauges	Weiss, Ashcroft, Terrice, Marsh, Winter, Miljoco
Pressure Reducing Valves	Watts, Singer
Pressure Relief Valves	Watts, Singer, Braukmann, Conbraco, Sarco
Slack Cable Restraints	Square M, Vibra Sonic, VMC-Korfund
Strainers	Red & White, Sarco, Armstrong, Mueller, Watts, Conbraco
Testing, Adjusting and Balancing Agencies	MDT Systems, Scott Technical, Arrow Flow, Flotech, Honey's Technical, Western Mechanical, KD Engineering, BC Tech Engineering, Airmec
Thermometers	Weiss, Ashcroft, Terrice, Marsh, Winter, Miljoco
Valves (Ball, Gate, Globe, Check)	Red & White/Toyo, Grinnell, Watts, Kitz, Crane, Milwaukee, Conbraco
Variable Frequency Drives	Danfoss/Graham, Baldor, Hitachi, ABB
Vibration Isolation	Mason, Vibron, VMC-Korfund, Mason, LoRez

### **3 TEMPORARY USE OF EQUIPMENT**

- .1 Permanent systems and equipment are not to be used during construction period without prior written consent from the Owner.
- .2 Heating systems may be used for temporary heating within the limitations specified below.
- .3 Equipment used during the construction period is to be thoroughly cleaned and overhauled. Replace worn or damaged parts so equipment is in perfect condition, to the satisfaction of the Owner and the Consultant.

- .4 Provide proper care, attention and maintenance for equipment while in temporary operation. If in the opinion of the Consultant sufficient care and maintenance is not being given to equipment and systems, the Consultant reserves right to forbid further use.
- .5 Temporary use of systems and equipment shall in no way affect the guarantee-warranty period on all mechanical systems installed, which comes into effect from the date of Substantial Performance.
- .6 Replace all filters in air systems and seals in pumps used during temporary operation just prior to turnover to the Owner.

#### **4 ELECTRIC WIRING AND MOTORS**

- .1 All electrical equipment supplied by the Mechanical contractor shall bear CSA label. Obtain special inspection labels required by Provincial Authority having jurisdiction for equipment that does not have a CSA label and/or a ULC label.
- .2 All electrical equipment and wiring shall conform to requirements of Canadian Electrical Code, the Provincial Electrical Inspector and specified standards.
- .3 All electrical motors shall conform to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40 deg C for open housing and 50 deg C for drip proof housing, and operate 1200 or 1800 RPM unless otherwise specified. Do not use air over ratings.
- .4 Motors shall have ball or roller type bearings with grease lubrication fittings.
- .5 All belt-driven motors shall be mounted on adjustable bases with adjusting screws so that proper belt tension can be obtained.
- .6 Motors of 15 KW and greater shall have capacitor and thermistor over heat protection.
- .7 Motor noise criteria shall not exceed NC-60.
- .8 Motors shall meet or exceed BC Hydro Power Smart High Efficiency standards.
- .9 All motors shall meet or exceed requirement necessary for variable frequency drive applications when this technology is used.
- .10 It shall be the responsibility of Division 15 to supply high efficiency motors with proper voltage characteristics to suit electrical distribution systems and suitable construction such as explosion-proof, dust-proof, part wind starting, etc., as required to suit operating conditions. Division 15 is responsible of complete working installation and must coordinate all electrical and control work.
- .11 Division 16 will provide and install all power wiring and connection of such to motor driven mechanical equipment.

- .12 Division 16 will provide and install motor starters for electric motors except where equipment is furnished with integral starters.
- .13 Division 15 shall provide and install all control wiring required to operate the mechanical systems, whether line or low voltage.

## **5 IDENTIFICATION**

### **5.1 Piping**

- .1 Identify fluids in piping with markers showing name, pipe size and service, including temperature and pressure where relevant, and with arrows to indicate flow direction.
- .2 Use CGSB 23-GP-3a and CSA B53 color codings and identification systems, using CGSB 1-GP-12c Color Coding System Schedule.
- .3 Standard of Acceptance: WH Brady identification tapes, bands, and markers.
- .4 For retrofit projects match existing identification system present in building.

### **5.2 Ductwork**

- .1 On ductwork use black 50 mm high stenciled letters to indicate duct size, duct function (ie: "Supply", "Exhaust") and air handling unit or fan (ie: AHU-1, EF-1, SF-1) to which the duct is connected. Use arrow to indicate air flow direction.
- .2 Identify duct runs at least once in every room and maximum 50 ft. between markings.
- .3 Identify fume exhaust ductwork in fan rooms and on roof as fume, radioactive perchloric, etc.
- .4 The nomenclature for identification of equipment shall be consistent with the designations in the plans and specifications.

### **5.3 Valves and Controllers**

- .1 Provide aluminum or lamacoid tags with stamped code lettering and numbers filled with black paint and secured to items.
- .2 Provide for all operable valves on all piping systems.
- .3 Provide a valve list showing the tag number, the location of the valve and its use, for inclusion in the Operation and Maintenance Manuals.

### **5.4 Equipment**

- .1 Provide factory supplied and installed nameplate on each piece of equipment.



- .2 Provide registration/approval nameplates (ie. CSA, ULC, ASME) in accordance with the requirements of authorities having jurisdiction.

**6 START UP OF MECHANICAL SYSTEMS AND EQUIPMENT**

- .1 Give the Consultant 72 hours written notice of date of start-up or commissioning of equipment or systems.
- .2 From the time of equipment or systems commissioning there shall be a three week stabilization period during which the Contractor shall ensure that all systems are functioning as intended. After the three week stabilization period, provide written confirmation that systems are fully compliant with requirements of the contract documents. This will be a requirement of Substantial Performance of the work.

**END OF SECTION 15020**

**1 CONTRACTUAL RELATIONSHIP**

- .1 The work of this section will be performed by a Testing, Adjusting and Balancing (TAB) Agency retained by the contractor.

**2 SCOPE OF BALANCING WORK**

- .1 Balancing of supply air systems
- .2 Submission of air balance report
- .3 Cooperation with the building verification agency if different than this balancing agency. Refer to Section 15130.

**3 REFERENCE STANDARDS AND QUALITY ASSURANCE**

- .1 Air and water systems balancing will be performed by an agency that has demonstrated experience in balancing mechanical systems of this scope. Refer to Section 15020 for listing of agencies approved to perform this work.
- .2 Air systems balancing shall be in general accordance with the AABC "National Standards for Field Measurement and Instrumentation" and ASHRAE standards.
- .3 All measuring instruments utilized by the balancing agency shall be accurate, with recent documented calibration test results. Supply such test results if requested by the Consultant.
- .4 The balancing agency shall include for two eight-hour days of time on site following occupancy of the building to perform spot checks and make adjustments requested by the Owner or Consultant.

**4 SUBMITTAL REQUIREMENTS**

- .1 The TAB agent will provide a report, in both hard copy and PDF digital format, for inclusion in the Operating and Maintenance Manuals, describing the final balanced operating conditions of the mechanical systems outlined below.
- .2 A preliminary copy of the report is to be submitted for the Consultant's review two weeks prior to Substantial Performance, and the final version submitted at the time of Substantial Performance. Submission of the final report will be a requirement of declaration of Substantial Performance.

**5 AIR SYSTEMS BALANCING**

- .1 Systems Requiring Air Balancing
  - .1 AHU-1 and AHU-2

- .2 Indicate in the balance report:
  - .1 Operating performance (design vs actual) of all fans and air systems.
  - .2 Air flow from each overall fan system
  - .3 Outdoor air flow from each air handling unit, with outdoor air damper at minimum position.
  - .4 Inlet and outlet pressure of each air handling unit. (Total system pressure drop)
  - .5 Motor HP draw, lock rotor amperage, running load amperage and fan and motor RPM of each air handling unit and unit ventilator.
- .3 Procedures
  - .1 Measure air flow in ducts by velocity traverse of entire cross section of duct.
  - .2 Ensure all test holes are properly sealed after use with rubber grommet type plugs.
  - .3 Balance air quantities to between 100% and 105% of design requirements
  - .4 Use the following sequence to adjust air volumes to design amounts in individual systems
    - .1 Adjust fan speed or blade angle where possible as the first step towards balancing. When the design target is outside the range of the sheave provided install a replacement sheave of the required size.
    - .2 Second, provide major volume control in main and branch ducts only by use of duct balancing dampers, not by throttling of terminal grilles, registers or diffusers.
    - .3 Finally provide minor adjustment at terminal inlet and outlets may be by throttling of individual dampers or grille blades.
  - .5 Adjust discharge pattern controllers on diffusers and registers to attain draft-free air distribution.
  - .6 Permanently mark the positions of balancing dampers.

**END OF SECTION 15120**

## **1 CONTRACTUAL RELATIONSHIP**

- .1 The work of this section will be performed by a Testing, Adjusting and Balancing (TAB) Agency retained by the contractor.
- .2 The Contractor's responsibility will be to coordinate the timing for the TAB work when it is required, and to cooperate with the TAB processes. This will include assistance with:
  - .1 The Controls Contractor will provide documentation confirming physical end-to-end checks all control points have been performed.
  - .2 When requested the Controls Contractor will assist the TAB agency in verifying software programming language.
  - .3 When requested the Controls Contractor will assist the TAB agency in simulating system operation by opening and closing control valves and dampers and enabling motor driven mechanical equipment
  - .4 Coordinate and supervise the start-up of the various pieces of equipment and systems. Utilize the start-up services of the manufacturer's representatives listed in Section 15100.
  - .5 Ensure that all the equipment is operating in a satisfactory manner.
  - .6 Resolve inter-contractor co-ordination problems. Where problems become apparent during the commissioning process, work at the identification and resolution of these problems.

## **2 SCOPE OF VERIFICATION WORK**

- .1 The TAB agency shall provide the following scope of services to review, inspect and verify all mechanical systems installed under this contract are operating in conformance to the design intent.
  - .1 Review of the drawings and specifications as issued for construction, and confirmation to the Owner and Consultant that the TAB agent understands the intended and design intent and specified sequence of operations. The TAB agent shall allow adequate time to review with the Owner and Consultant the design intent of the project and the intended operation.
  - .2 Verification of condition and operation of installed equipment and reporting on such as indicated below.
  - .3 Review of the air balance report, and coordination with the balancing agent to ensure that all systems are functioning as intended.
  - .4 Participating in end-to-end checks on all specified sequence of operations, working in conjunction with the DDC contractor. Initial each device listed on the Control system checkout sheets provided under section 15910 to verify these end to end checks were carried out.

- .5 Co-ordinate and supervise the start-up of equipment and systems as specified below. Utilize the start-up services of the manufacturers representative where specified. Ensure that the equipment is operating in a satisfactory manner.
- .6 Resolve inter-contractor coordination problems. Where problems become apparent during the TAB process, work at the identification and resolution of these problems.
- .2 Organize and conduct the demonstration to the Owner of all mechanical equipment and systems supplied under this contract. The demonstrations shall occur only after the operation and testing has been successfully completed. Equipment suppliers and the balancing agent shall participate in the demonstration as required. The DDC contractor must attend the systems demonstration.
- .3 The TAB agent bears the responsibility to ensure the mechanical installation functions as intended, or to indicate if certain components of the systems cannot operate as intended, why such is the case and what is recommended to rectify the problems.
- .4 The TAB agent will coordinate the work of the mechanical contractor, electrical contractor, balancing agent and controls contractor, including organization and chairing of any meetings required between these parties to resolve and coordinate the TAB process. The co-operation of all trades is essential for an efficient and planned process. A team comprising the above parties is recommended along with an owner's representative.
- .5 The TAB agent will be responsible for verification of the performance and operation of all equipment supplied under the Division 15 contract, as well as the building fire protection and life safety systems (joint Division 15 and 16).
- .6 The TAB agency shall possess computers, cables, and software needed to operate the building control system. This requires the TAB agency to be properly licensed and/or trained to run the Control contractor's software.

### **3 QUALITY ASSURANCE**

- .1 The TAB process shall be consistent with the "Code of Practice for Commissioning Mechanical Systems in Buildings".
- .2 Within seven days of tender closing provide the name, qualifications, and experience of the TAB coordinator to the Owner and Consultant.
- .3 At the time of the schedule submittal, also submit proposed testing recording sheets and procedures for review.
- .4 Hold regular meetings during the TAB process and provide minutes of such meetings within seven days. Minutes of the meeting shall be issued to all Contractors involved, the Consultant, and the Owners representative.

- .5 The TAB Agency shall include for TWO eight-hour days of time on site following occupancy of the building to perform checks and recommend adjustments if requested by the Owner or Consultant.

#### **4 DOCUMENTATION**

- .1 The TAB agent will provide a report, in both hard copy and PDF digital format, for inclusion in the Operating and Maintenance Manuals, verifying correct operation of all mechanical systems in the building, including trend logs of system operating conditions.
- .2 The report will include a statement that all systems are operational and functioning as intended, checklists indicating tests and control checks carried out on each system, and that control operation of each system is operating as intended. Or if this is not the case, why such is not the case and suggested procedures to rectify the situation.
- .3 A preliminary copy of the report is to be submitted for the Consultant's review two weeks prior to Substantial Performance, and the final version submitted at the time of Substantial Performance. Submission of the final report will be a requirement of declaration of Substantial Performance.
- .4 Submission of the final report will be a requirement of declaration of Substantial Performance.

#### **5 SYSTEMS**

##### **5.1 Supply Air Systems (AHU-1 and AHU-2)**

- .1 Verify the physical completion of the installation.
- .2 Verify pressure tests are completed and check for any leaks in the installation.
- .3 Verify installation of all required control equipment, including temperature and pressure sensors, required wells, sail switches, etc.
- .4 Verify positioning and marking of correct position of all balance dampers by the balancing agent
- .5 Verify all fire dampers are in the open position and are functional.
- .6 Verify filters are installed and sealed in place.
- .7 Verify correct direction of rotation of all fans.
- .8 Verify all systems are operating quietly.
- .9 Verify alignment of fan drives
- .10 Review the air balance report and verify that adequate airflow is attained throughout each system.

- .11 Verify correct sequencing of all control functions, including coordination of such with the DDC contractor.

**END OF SECTION 15130**

**1 SCOPE OF WORK**

- .1 Vibration spring isolators for motor driven fans and pumps with electric motors 1/2 HP and greater and on associated piping and ductwork.
- .2 Canvas flexible connections for ductwork

**2 VIBRATION ISOLATION - GENERAL**

- .1 Coordinate with Division 15800 for flexible connections on ductwork connections to fans or plenums.
- .2 Do not bridge isolation elements.
- .3 For isolated equipment provide vibration isolation to withstand without failure or yielding a static load of 2g minimum, acting through the centre of gravity.
- .4 For all equipment mounted on vibration isolators, provide a minimum clearance of 50-mm (2 inches) to other structures, piping, equipment, etc.
- .5 Factory installed isolators for packaged air handling units must comply with the requirements of this section.
- .6 Supply all of the vibration isolation equipment by one approved supplier. The vibration isolation supplier shall provide assistance to the contractor as necessary during the course of installation of isolation equipment
- .7 Vibration isolator housings are considered a safety guard with respect to isolated equipment and any contained compressed springs. Include "Fail Safe" seismic restraint in all vibration isolation designed to hold mechanical equipment and springs in place
- .8 Isolators shall be of the following types, as required, supplied by the manufacturers named, or other acceptable manufacturers listed or approved.

**3 PAD ISOLATORS**

- .1 Neoprene/steel/neoprene pad isolators, manufactured from "Bridge bearing quality neoprene", as defined by CSA Standard CAN3-S6-M78 Section 11.10. Select type 1 pads for a 2.5 mm (0.1") static deflection or greater. Bolt down equipment mounted on neoprene pad isolators using neoprene grommets. Design is based on Vibron Vibropad VSV or Mason WMW.

**4 FLEXIBLE DUCT CONNECTIONS**

- .1 Provide flexible duct connectors of Durodyne with Durolon fabric or approved equal.
- .2 Install 75-mm (3-inch) flexible duct connections with a minimum 40-mm (1 ½ inches) metal to metal gap.



- .3 Flexible duct connections shall be installed so that duct size is not reduced by the deflection of the flexible connector.

**END OF SECTION 15220**

**1 SCOPE OF WORK**

- .1 Seismic restraint of piping systems
- .2 Seismic restraint of duct systems
- .3 Seismic restraint of motor driven equipment
- .4 Seismic restraint of non-motor driven equipment

**2 SEISMIC RESTRAINT - GENERAL**

- .1 Provide restraints on all ceiling hung isolated equipment, piping and ductwork in accordance with National Building Code of Canada and SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems."
- .2 Retain the services of a Professional Engineer, registered in the Province of British Columbia, and specializing in the design of seismic restraint systems or structural engineering to ascertain that all mechanical equipment installed under this contract are adequately seismically restrained.
- .3 Design seismic restraints to meet the structural requirements of the British Columbia Building Code
- .4 It is the responsibility of the Contractor's Seismic Engineer to ascertain that an appropriate size restraint device is selected for each piece of equipment.
- .5 At the completion of the project obtain a letter bearing the seal of the Engineer, for inclusion in the Operation and Maintenance Manuals, stating that the mechanical installation is seismically restrained in accordance with Building Code and SMACNA requirements.

**3 SEISMIC RESTRAINT OF PIPING SYSTEMS**

- .1 Provide seismic restraint for all piping systems installed under this contract with the following exceptions:
  - .1 Natural gas piping less than 25 mm (NPS 1) diameter.
  - .2 Water piping in mechanical equipment rooms of 32 mm (NPS 1-1/4) diameter and smaller.
  - .3 All other piping of 65 mm (NPS 2-1/2) diameter and smaller.
  - .4 All piping suspended by individual hangers 300 mm (12 inches) or less in length from the top of pipe to the bottom of the support for the hanger.
  - .5 All piping suspended by hangers 300 mm (12 inches) or less in length from the top of the duct to the bottom of the support for the hanger.

**4 SEISMIC RESTRAINT OF DUCT SYSTEMS**

- .1 Provide seismic restraint for all ductwork systems installed under this contract with the following exceptions:
  - .1 All rectangular air handling ducts less than 0.56 sq. meters (6 sq. ft.) in cross sectional area.
  - .2 All round air handling ducts less than 710 mm (28 inches) in diameter.
  - .3 All ducts suspended by hangers 300 mm (12 inches) or less in length from the top of the duct to the bottom of the support for the hanger.

**5 SEISMIC RESTRAINT OF MOTOR DRIVEN EQUIPMENT**

- .1 Connect slack cable restraints to ceiling hung or in-line pumps in such a way that the axial projection of the wires passes through the centre of gravity of the equipment. Orient the restraint wires at approximately 90 degrees to each other (in plan), and tie back to the ceiling or structure above at an angle not exceeding 45 degrees.
- .2 Connect slack cable restraints to ceiling hung fans in such a way that the axial projection of the wires passes through the centre of gravity of the equipment. Orient the restraint wires at approximately 90 degrees to each other (in plan), and tie back to the ceiling or structure above at an angle not exceeding 45 degrees.
- .3 Provide seismically rated spring mount isolators for fans installed on floor structures or inside air handling unit casings. Refer to the requirements of Section 15220, Clause 5.
- .4 Rooftop air handling units AHU-1 and AHU-2 will be supplied with seismically rated roof curbs. The Contractor's Seismic Engineer will determine appropriate methods of seismic attachment of the curbs to the roof structure.

**END OF SECTION 15230**

**1 SCOPE OF WORK**

- .1 Flexible Acoustic Duct Liner for Exterior Supply Air Ductwork

**2 QUALITY ASSURANCE**

- .1 Install insulation to the requirements of the latest edition of the British Columbia Insulation Contractors Association Standards Manual for Mechanical Insulation. Code numbers quoted refer to this specification for installation standards. Code numbers quoted refer to this specification for installation standards.
- .2 Provide materials conforming to British Columbia Building Code requirements for maximum smoke developed rating of 50 and flame spread rating of 25.

**3 SUPPLY AIR DUCT INSULATION**

**3.1 Flexible Acoustic Duct Liner for Exterior Supply Air Ductwork**

- .1 Where acoustic duct liner is indicated on the drawings provide 50-mm (2-inch) thick, closed-cell, moisture resistant, elastomeric acoustic duct liner with washable surface, Nomaco K-Flex Gray Duct Liner, Rubatex Insul-sheet R-1800 FS Elastomeric Insulation, AP Armaflex or approved equal.
- .2 Apply to the following ductwork where indicated on the drawings.
  - .1 Supply air ductwork on roof from AHU-1 and Dehumidifier.
- .3 Application
  - .1 Attach duct liner to pins at 300-mm (12-inches) on centre. Pins to be spot welded to inside surface of duct. Do NOT use pressure sensitive adhesives.
  - .2 In round ductwork, to anchor duct liner material in place provide 38-mm (1.5-inch) wide, 24-gauge steel bands on inside surface of duct liner at each joint of liner material.
- .4 Acoustic duct liner to meet the following standards
  - .1 NFPA 90A For materials used in air distribution Systems
  - .2 UL 181 For air erosion (No break-up or delamination of interior surface at air velocities up to 2500 FPM.
  - .3 ASTM C-1071 For fungal and bacterial growth
  - .4 ASTM C-209 For water absorption (Maximum 0.2% by volume)
  - .5 Thermal conductivity  $k = 0.277 \text{ BTU / hour-ft-deg F}$

**4 FASTENINGS, ADHESIVES, COATINGS**

**4.1 External Ductwork**

- .1 Externally coat ductwork exposed on the roof with polyurethane coating to create a waterproof seal on the exterior of the ductwork.
- .2 Apply to dry, clean surfaces.
- .3 Brush on a first coat onto all joints, rivets, bolts, etc. Brush or spray a second coat over the entire surface of exposed ductwork. Take care to protect surrounding roof surfaces from overspray or drips.
- .4 Product: Tremco Vulkern 640 / 642.

**4.2 Internal Ductwork**

- .1 Provide all wire insulation fastenings, staples, adhesive tapes, contact adhesives and barrier coatings as required for a complete, neat insulation installation and finish.

**5 EXECUTION**

- .1 No insulation is to be applied prior to confirmation from the Consultant and Building Inspector that ductwork is installed in conformance with code and specification requirements.
- .2 Ensure that insulation is clean and dry during installation and application of all finishes.
- .3 Install insulation with smooth and even surfaces.
- .4 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.
- .5 Sagging of duct insulation will not be acceptable.
- .6 Stagger both longitudinal and horizontal joints, on duct insulation of multi-layered construction.

**END OF SECTION 15320**

**1 SCOPE OF WORK**

- .1 Make up air unit condensate piping

**2 CODES, STANDARDS AND APPROVALS**

- .1 The installation shall conform to Part 7 of the 2012 British Columbia Building Code.
- .2 Route piping installation in an orderly manner, as indicated on the drawings. Generally follow routes parallel and perpendicular to building structure.

**3 BASE BID AND APPROVED EQUAL MANUFACTURERS**

Pipe Cleanouts Jay R. Smith, Ancon, Zurn, Mifab

**4 SANITARY DRAIN AND VENT PIPING**

**4.1 Sanitary Drain and Vent Piping Inside Building**

<u>MATERIAL</u>	<u>CODE REF</u>	<u>CONFORM TO</u>	<u>FITTINGS</u>
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Use piping system supplied by boiler manufacturer. Install as per manufacturers recommendations along with condensate neutralizer.

**5 INSTALLATION OF SANITARY DRAIN AND VENT PIPING**

**5.1 General Requirements**

- .1 Grade sanitary piping as indicated on the drawings.
- .3 Install neoprene pads under clamps where sanitary piping rests on floor systems.
- .4 Ensure no joints of dissimilar metals are provided. Install dielectrically isolated fittings where dissimilar metallic materials meet.
- .5 Install condensate pipe in accordance with manufacturers recommendations.

**5.2 Cleanouts**

**5.2.1 General Requirements**

- .1 Provide cleanouts in the following locations for sanitary drainage systems:
  - .1 At changes of direction of more than 45 degrees.
  - .2 At the end of all horizontal drainage lines.
  - .3 Where required by the 2012 British Columbia Plumbing Code.
- .2 Cleanouts shall be full size for pipe up to 100mm (4 inch).

- .3 Make cleanouts with Barrett type fitting that has a threaded plug, or a cleanout ferrule that is installed in a "Y" or extended "Y".

**END OF SECTION 15420**

**1 SCOPE OF WORK**

- .1 Natural gas piping to roof mounted air handling units AHU-1 to AHU-2

**2 CODES, STANDARDS AND APPROVALS**

- .1 Natural (Propane) gas installation shall conform to the requirements of CAN/CSA-B149.1, "Natural Gas and Propane Installation Code."
- .2 Route piping installation in an orderly manner, as indicated on the drawings. Generally follow routes parallel and perpendicular to building structure.

**3 NATURAL GAS PIPE**

- .1 Pipe: Schedule 40 black steel
- .2 Joints
  - .1 50-mm (2-inch) and smaller: Threaded.
  - .2 65-mm (2.5-inch) and larger: Continuously welded
- .3 Steel fittings
  - .1 Malleable iron: screwed, banded, class 150 to ANSI/ASME-B16.3
  - .2 Welding: Butt-welding to ANSI/ASME-B16.9
  - .3 Unions: Malleable iron, brass to iron. Ground Seat. Screwed to ASTM A47M.
  - .4 Nipples: Schedule 40, to ASTM A53.

**4 PIPE HANGERS**

- .1 Install hangers for steel pipe with a maximum separation as indicated in table below and where required elsewhere to avoid sag in pipe installation. Provide sheet metal shields to protect insulation from being crushed at hanger locations on cold water installations.

<u>Pipe diameter</u>	<u>Rod diameter</u>	<u>Steel</u>	<u>Copper</u>
Up to 19mm	10mm	1.8m	1.8m
25mm to 32mm	10mm	2.4m	1.8m
38mm to 50mm	10mm	3.0m	2.4m
65mm to 75mm	13mm	3.6m	2.4m
100mm to 130mm	16mm	3.6m	2.4m
150mm	19mm	3.6m	

- .2 Provide galvanized steel, continuous threaded hanger rods.



.3 Inserts

- .1 Insert shall be malleable iron case or galvanized steel shell with expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.
- .2 Size inserts to suit threaded hanger rods.
- .3 Cast-in-place concrete insert shall be galvanized malleable iron or steel Grinnell Fig 281 or Fig 282 or Unistrut.
- .4 Drilled concrete insert shall be Hilti Model HSL or HVA.
- .5 All inserts shall be ICBO approved. Use only ICBO design load ratings.

**5 TESTING**

- .1 Tests on natural gas systems shall consist of a hydraulic test of 1050 kPa (150 PSIG) for 8 hours with no loss of pressure.

**END OF SECTION 15440**

**1 QUALITY ASSURANCE**

- .1 Air Handling Units shall be built to the level of quality as herein specified and to the description of the Air Handling Unit Schedule, Drawings M-2.
- .2 Substitution of any product other than that specified, must assure no deviation below the stated capacities, air flow rate, heat transfer rate, filtration efficiency and air mixing quality. Power requirements must not be exceeded, and where specifically defined, sound power levels must not be exceeded.
- .3 Unless stated otherwise, air handling units are to be shipped to the job in one piece, factory assembled. All equipment shall be factory tested prior to shipment.
- .4 The air handling units and major components shall be products of manufacturers regularly engaged in the production of such equipment.
- .5 Fans and air handling equipment shall meet the requirements of AMCA performance standards.
- .6 Equipment supplied shall be constructed to meet the requirements of CSA/NRTL, ULC or ETL approvals.
- .7 Gas-fired equipment supplied shall be CGA, C-ETL or CSA certified.
- .8 Provide industry standard size filters only in all air handling equipment

**3 OUTDOOR MAKE-UP AIR UNITS (GAS-FIRED HEATING)**

- .1 Provide packaged air handling unit as indicated in the mechanical equipment schedules. The unit shall be assembled and installed to provide free, clear and unencumbered access to all components that require routine servicing. This includes all motors, bearings, dampers, damper actuators, coils, and control devices. Unit shall consist of exterior plenum construction and internal components as follows:
  - .1 Forward type supply air fans and motors
  - .2 Gas fired heat exchangers
  - .3 Filter sections
  - .4 Factory installed safety, interlock and control wiring
- .2 Casing: Constructed of 18 gauge satin-coated steel panels with a maximum panel width of 525 mm. Seams gasketed and caulked and turned inward for flush exterior surface. All openings required in casing for controls, electrical and piping shall be grommetted to ensure airtight seals. Ensure no air bypass between the various sections of the unit. Exterior finish of casing to be etch bond primer and finish paint with alkyd enamel.

- .3 Acoustic Attenuation: Inside of exterior casing to be completely lined with fiberglass plenum liner, Manville Permacote Linacoustic R-300 or approved equal, minimum 50-mm (2-inch) thick, neoprene coated on the air side and held in place by 22-gauge perforated metal liner.
- .4 Base: Perimeter channel iron frame with intermediate channel and angle iron supports. Channels sized with adequate strength to prevent distortion and with a depth to accommodate traps for drains. Insulate underside of base with 25-mm (1-inch) thick 1.5 lb per sq.ft. density acoustic insulation
- .5 Access doors: Provide hinged access doors for each equipment section to facilitate service and removal of internal components. Doors shall be insulated double wall construction with interior perforated metal liner, airtight gaskets around perimeter of doors and lockable heavy duty hinges and handles.
- .6 Fan: Forward Curved centrifugal fans, belt driven with adjustable sheaves with bell mouth duct inlet connection. Fan shall conform to AMCA Bulletins regarding construction and testing. Mount fan and motor assembly on a steel channel base, and mount the base on seismically rated spring vibration isolation mounts, sized for 25-mm (1-inch) static deflection. Refer also to Section 15200. Fan bearings shall be self-aligning, regreaseable ball type.
- .7 Heat Exchangers: Titanium stainless steel, blow through heat exchanger, with 15:1 turndown burner. Burner and gas train to be contained in a separate enclosure.
- .8 Filters: 50 mm pleated filters in a holding frame that allows slide-out removal of filter panels. Minimum 30% efficiency and 92% arrestance, in accordance with ASHRAE Standard 52.1, and with a rated clean pressure drop not exceeding 0.28 inches at 500 FPM face velocity. Farr 30/30 or equivalent product from approved manufacturers list. Provide standard sizes only unless indicated otherwise on drawings or in equipment schedules.
- .9 Outdoor air section: With parallel blade outdoor air damper of aluminum construction with gasketed blade edges to provide positive shut-off when closed. Standard of acceptance: Tamco or Ruskin. Stainless steel or aluminum linkage rods, of sufficient thickness to move the dampers between the full open and full closed positions with no distortion to the damper frames or blades, or the actuator rods.
- .10 Full perimeter, seismically rated roof curb, 300-mm (12-inch) high, constructed of heavy gauge metal and with field applied 50-mm (2-inch) rigid thermal insulation on the four interior surfaces. Provide, 25-mm (1-inch) deep by 50-mm (2-inch) wide neoprene gasket on top of curb, to provide vibration isolation between the unit casing from the roof curb. Supply curb with wood nailer, neoprene sealing strip and welded Z-bar with 25-mm (1-inch) upturn on the inner perimeter to provide a complete watertight seal.
- .11 For sound attenuation place inside the roof curb 4 layers of 16-mm (5/8-inch) GWB on the roof deck and a layer of R20 batt insulation on top of the GWB, prior to placing of unit. Place the layers of GWB and insulation tight to all sides of the curb.

- .12 Units to be provided with outdoor ambient discharge air temperature controller, to control modulating gas valve.
- .14 Electrical: The air handling unit is to be factory pre-wired as follows.
  - .1 Starter and contactors provided. Conduit also to be provided within casing wall, terminating at exterior of casing to allow electrical Contractor to provide weatherproof installation of exterior mounted disconnect.
  - .2 The air handling unit is to have the following electrical circuitry factory installed and routed in conduit to connection points at the base of the unit for connection by Division 16.
    - .1 3-phase power connection for supply fan
- .15 For performance data refer to the mechanical equipment schedules on the mechanical plans

**END OF SECTION 15820**

## **1 QUALITY ASSURANCE**

- .1 Fabricated sheet metal ductwork shall conform to SMACNA standards for materials used and fabrication methods.
- .2 Ductwork specialties shall conform to applicable CSA, UL and ULC standards
- .3 Ductwork, fittings and supports for the woodshop dust extraction system shall conform to “SMACNA – Industrial Duct Construction” Guidelines, Class 2 Classification.
- .4 Ductwork, fittings, sup-ports and hoods for other exhaust systems in the Technical Shops shall be designed and fabricated to meet the requirements of “The Industrial Ventilation Manual” published by the American Conference of Governmental Industrial Hygienists.
- .5 Ductwork for grease exhaust systems shall conform to the requirements of the latest version of NFPA-96.

## **2 DUCTWORK**

### **2.1 General and Quality Assurance**

- .1 Construct all ductwork to the appropriate sections of SMACNA standards for the specified classifications of ductwork.
- .2 All ductwork used on this project shall be clean and free of scale.
- .3 All outdoor, supply, return, relief and exhaust air ductwork on this project is classified as low pressure. Sheet metal screws may be used for fastening joints in low pressure ductwork.
- .4 Woodshop dust extraction, welding fume, soldering fume and science lab fume hood exhaust ducts are classified as medium pressure construction.
- .5 Prior to fabrication of ductwork, check all ceiling spaces and heights and conflict with other trades. Include and provide necessary offset to maintain ceiling height, headroom etc.

### **2.2 Low Pressure Galvanized Sheet Metal Ductwork**

- .1 Galvanized steel lock forming ductwork, with galvanized coating conforming to ASTM A525 G90, fabricated to the requirements of SMACNA standards
- .2 Wrap all joints with fire and water resistive duct tape and sealant. Sealant shall be water resistant, Robson’s Duct Seal or Duro Dyne S-2 with FT-2 tape Flexmaster duct band.

## **2.7 Exterior Mounted, Internally Insulated Ductwork**

- .1 Galvanized steel spiral-lock ductwork, with galvanized coating conforming to ASTM A525 G90, fabricated to the requirements of SMACNA standards for the specified classifications.
- .2 Insulation: 50-mm (2-inch) thick internal acoustic duct liner, as described in Section 15320, Clause 4.1
- .3 To anchor duct liner material in place provide 38-mm (1.5-inch) wide, 24-gauge steel bands on inside surface of duct liner at each joint of liner material.
- .4 Paint exterior surface of ducts with weatherproof coating as described in Section 15320, Clause 5.1.

## **4 DUCTWORK SPECIALTIES**

### **4.1 Acoustic Duct Lining**

- .1 Where acoustic duct lining is indicated, duct dimensions on the drawings designate the clear inside dimensions required. Make allowance in the overall sheet metal dimensions to accommodate this requirement.
- .2 This requirement does NOT apply to ductwork associated with classroom unit ventilators.
- .3 Refer to Section 15320 for installation requirements.

### **4.2 Flexible Ductwork**

- .1 Flexible duct runouts to diffusers shall be of aluminum or corrugated construction, supported by helically wound steel. Length of flexible runouts shall not exceed 900-mm (36-inches).
- .2 On air conditioning systems provide flexible duct wrapped with flexible fibrous glass insulation, enclosed by seamless aluminum plastic vapour barrier jacket.

### **4.3 Flexible Connections**

- .1 Install canvas flexible connections on inlet and outlet of all exhaust fans, and inlet and outlet of roof mounted air handling units.
- .2 Ensure that flex does not impede airflow and allows movement of equipment without transmitting vibration into the ductwork.

### **4.4 Turning Vanes**

- .1 Airfoil type with runner channels.
- .2 Provide for all square or rectangular duct elbows.

**5 DUCT CLEANING**

- .1 Maintain all new ductwork installed on this project clean and free from dust and other workplace debris.
- .2 If in the Consultant's opinion any new ductwork installed has not been maintained in a clean condition the Contractor shall retain the services of a certified duct cleaning company to thoroughly vacuum and clean ALL outdoor, supply and return air ductwork installed.
- .3 For all existing ductwork on the systems indicated below retain the services of a certified duct cleaning company to thoroughly vacuum and clean ALL outdoor, supply and return air ductwork

**6 COUNTERFLASHINGS FOR ROOF CURBS**

- .1 Galvanized sheet steel of 0.8 mm minimum thickness.
- .2 Counterflashings are attached to mechanical equipment and lap the base flashings on the roof curbs.
- .3 All joints in counterflashings shall be flattened and solder double seam. Storm collars shall be adjustable to draw tight to pie with bolts. Caulk around the top edge. Storm collars shall be used above all roof jacks.
- .4 Vertical flange section of roof jacks shall be screwed to face of curb.
- .5 Install in accordance with latest RCABC Standards.

**END OF SECTION 15880**