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T5J 1S6  
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**SOLICITATION AMENDMENT  
MODIFICATION DE L'INVITATION**

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

**Comments - Commentaires**

**Vendor/Firm Name and Address  
Raison sociale et adresse du  
fournisseur/de l'entrepreneur**

**Issuing Office - Bureau de distribution**  
Public Works and Government Services Canada  
ATB Place North Tower  
10025 Jasper Ave./10025 ave Jasper  
5th floor/5e étage  
Edmonton  
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T5J 1S6

<b>Title - Sujet</b> Rooftop Units and Boiler Replacemen	
<b>Solicitation No. - N° de l'invitation</b> EW038-181808/A	<b>Amendment No. - N° modif.</b> 007
<b>Client Reference No. - N° de référence du client</b> CSC EW038-181808	<b>Date</b> 2018-01-04
<b>GETS Reference No. - N° de référence de SEAG</b> PW-\$PWU-183-11262	
<b>File No. - N° de dossier</b> PWU-7-40185 (183)	<b>CCC No./N° CCC - FMS No./N° VME</b>
<b>Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2018-01-09</b>	<b>Time Zone Fuseau horaire Mountain Standard Time MST</b>
<b>F.O.B. - F.A.B.</b> <b>Plant-Usine:</b> <input type="checkbox"/> <b>Destination:</b> <input type="checkbox"/> <b>Other-Autre:</b> <input type="checkbox"/>	
<b>Address Enquiries to: - Adresser toutes questions à:</b> Tikhonovitch (RPC), Alex	<b>Buyer Id - Id de l'acheteur</b> pwu183
<b>Telephone No. - N° de téléphone</b> (780) 901-7940 ( )	<b>FAX No. - N° de FAX</b> (780) 497-3510
<b>Destination - of Goods, Services, and Construction: Destination - des biens, services et construction:</b>	

**Instructions: See Herein**

**Instructions: Voir aux présentes**

<b>Delivery Required - Livraison exigée</b>	<b>Delivery Offered - Livraison proposée</b>
<b>Vendor/Firm Name and Address Raison sociale et adresse du fournisseur/de l'entrepreneur</b>	
<b>Telephone No. - N° de téléphone Facsimile No. - N° de télécopieur</b>	
<b>Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)</b>	
<b>Signature</b>	<b>Date</b>

**MECHANICAL ADDENDUM NO. THREE**

**PROJECT:**

**Pe Sakastew AHU & Boilers Upgrade**

**JOB #217-13**

**ENGINEER:**

**BACZ ENGINEERING INC.**

January 03, 2018

**1.0 GENERAL**

- 1.1 The following information shall constitute an Addendum to the Specifications and Drawings for the "Pe Sakastew Rooftop AHU & Boilers Replacement"
- 1.2 This construction shall conform to the original Drawings and Specifications, unless otherwise stated herein to be revised or deleted.
- 1.3 This addendum shall become part of the original Contract documents and all items listed below shall be carried out as part of the construction required to complete the project.

**2.0 RESPONSES TO CONTRACTOR QUESTIONS AND REVISION TO DRAWINGS SPECIFICATIONS:**

1. Mechanical Section 235200:

Delete Part 1.2.2.1.10.

Stack emission monitoring system is not required for any boiler plants.

2. *Q: Please provide testing and balancing specifications?*

Delete Specification Section **230593 - Testing, Adjusting and Balancing for HVAC** and replace with Section **230883 Balancing and Adjusting of Mechanical Equipment and Systems**

3. Q: Is testing and balancing required for new equipment only or for the entire system?

Balancing will be required on all new air outlets and all new equipment. Balancing is not required on existing outlets connected to new equipment.

4. Q: Is the intent to have the round ductwork in the ceremonial areas lined acoustically?

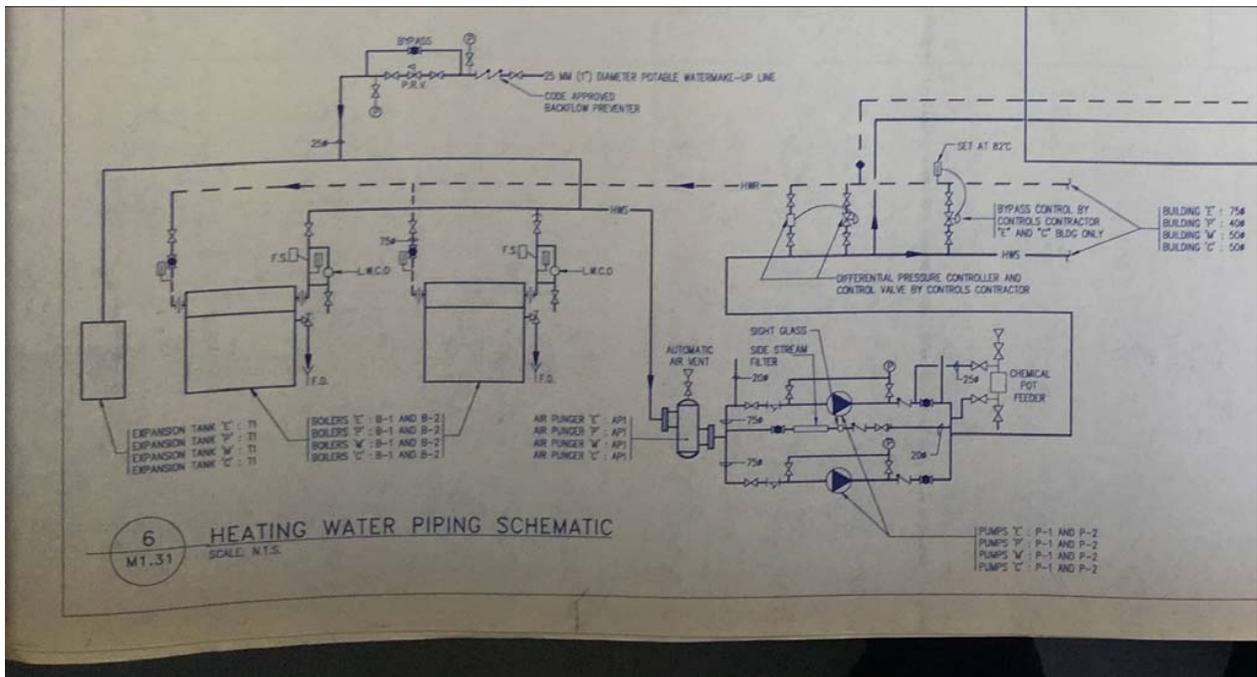
Exposed round ductwork to be complete with acoustic insulation. Concealed rectangular ductwork to be complete with thermal insulation.

5. Q: Is the intent to have a spring isolated curb for CRTU 1-2?

Air Handling Units to be complete with internal vibration isolation.

6. Q: Can a typical Boiler piping detail be provided?

See below for typical boiler schematic from original building tender drawing M1.31 .



END OF MECHANICAL ADDENDUM NO. THREE

**1. General**

**1.1 INTENT**

- .1 Test, adjust and balance mechanical equipment and systems so that entire system produces the results for which it was designed.
- .2 Air and water balancing performed by the same firm.

**1.2 TESTING/ADJUSTING/BALANCING REPORT DATA**

- .1 Organize balancing data in accordance with AABC - Associated Air Balancing Council, report format. Report data in SI units.
- .2 Air Systems: Include both specified and measured data.
  - .1 Air Handling Equipment:
    - .1 Maximum air flow volume.
    - .2 Fan total pressure.
    - .3 Motor volts, amps and power.
    - .4 Minimum outside air volume.
    - .5 Fan rotational speed.
    - .6 Fan Power, calculate fan efficiency.
    - .7 Inlet and outlet dry and wet bulb temperatures.
    - .8 Equipment static pressure profile.
  - .2 Duct Air Quantities - Mains and Branches:
    - .1 Duct size.
    - .2 Number of pressure/velocity readings per traverse.
    - .3 Sum of velocity measurements.
    - .4 Average velocity.
    - .5 Duct air flow volume.
    - .6 Barometric pressure and duct air temperature.
  - .3 Air Outlets:
    - .1 Outlet location and designation.
    - .2 Manufacturers catalogue identification and type.
    - .3 Air outlet flow factors. Use 1.0 when flowhood is used.
    - .4 Air flow volumes.
    - .5 Deflector vane or diffuser cone settings.

- .3 Hydronic Systems: Include both specified and measured data.
  - .1 Pumps:
    - .1 Discharge and suction pressures, at design flow and no flow.
    - .2 Fluid flow rate. Calculate from pump curves if metering not provided.
    - .3 Motor volts, amps, power.
  - .2 Heating Equipment:
    - .1 Equipment type, location and designation.
    - .2 Fluid used. Identify fluid used; water, % water/ethylene glycol mixes, steam, etc.
    - .3 Fluid flow rate.
    - .4 Fluid Specific Heat, at mean temperature.
    - .5 Fluid Specific Gravity, at mean temperature.
    - .6 Fluid entering and leaving temperatures and pressures.
    - .7 Heat transfer rate.
  - .3 Air Heating and Cooling Coils:
    - .1 Coil type and identification, location and designation.
    - .2 Entering and leaving air dry and wet bulb temperatures.
    - .3 Air static pressure drop.
    - .4 Air flow volume.
    - .5 Barometric pressure.
    - .6 Air side heat transfer rate.
    - .7 Fluid used. Identify fluid used; water, % water/ethylene glycol mixes, steam, etc.
    - .8 Fluid flow rate.
    - .9 Fluid Specific Heat, at mean temperature.
    - .10 Fluid Specific Gravity, at mean temperature.
    - .11 Fluid side heat transfer rate.
- .4 Sound Pressure Level Data:
  - .1 Overall A-weighted Sound Pressure Level readings.
  - .2 For outdoor equipment or community noise measurements provide a diagram or description of relationship of sound source to measuring instrument.

### **3. Execution**

#### **3.1 BALANCING AND ADJUSTING PREPARATION**

- .1 Perform testing, adjusting and balancing work after equipment and systems starting procedures have been completed.
- .2 Perform balancing during heating and cooling season of first year of operation, and at times when directed by Engineer, to ensure proper settings of controls under both summer and winter peak load conditions.
- .3 Vary load to verify operation of system under partial load conditions. Test start-up, shut-down, emergency conditions, safety controls operation and automatic and manual resets and interlocks.

#### **3.2 GENERAL PROCEDURES**

- .1 Perform balancing to following accuracy:
  - .1 Air - terminal outlets ± 10%
  - .2 Air - central equipment ± 5%
  - .3 Hydronic - terminal outlets ± 10%
  - .4 Hydronic - pumps and central equipment ± 5%
- .2 Permanently mark settings on splitters, valves, dampers or other adjustment devices.
- .3 Subsequent to correcting work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.
- .4 As a prerequisite to the Engineer's acceptance of balance report demonstrate random points in balance selected by the Engineer. The Engineer will witness these checks.

#### **3.3 FIRE DAMPER/FIRE STOP FLAP VERIFICATION**

- .1 Visually inspect all fire dampers/fire stop flaps to verify that:
  - .1 Installation is straight and level.
  - .2 Wall angles are properly installed.
  - .3 Duct has break away connection.
  - .4 Fire stopping material, where used, is properly installed.
  - .5 Access is adequate.
  - .6 Adequate clearance exists between sleeve and wall.
  - .7 ULC label is visible.
  - .8 Blades are out of air stream.
  - .9 Temperature rating of linkages are correct.
- .2 Inspect and clean all fire damper blades and tracks prior to function test.

- .3 Function test each damper, by detaching fusible link chain. Verify that damper blade drops properly and is tightly sealed within frame. Reset each damper.
- .4 If fire damper does not close properly, repair installation and retest.
- .5 All fire damper tests shall be witnessed by two parties, certified by Contractor and endorsed by testing personnel.
- .6 Write to authority having jurisdiction prior to testing dampers. Invite authority to witness tests as required.

### **3.4 AIR SYSTEM PROCEDURE**

- .1 Perform testing, adjusting and balancing only after all suspended ceilings and partitions are complete, with doors and windows in place and closed.
- .2 In consultation with the Engineer select duct traverse locations acceptable to all parties.
- .3 Adopt following procedures for central systems:
  - .1 Test drop and reset all fire dampers.
  - .2 Verify that dampers and volume control devices are in fully open position.
  - .3 Initially balance central plant to  $\pm 10\%$  air flow.
  - .4 Balance mains and branches to  $\pm 10\%$  air flow.
  - .5 Recheck central plant.
  - .6 Balance all terminal air outlets to  $\pm 10\%$ .
  - .7 Rebalance central plant to  $\pm 5\%$ .
  - .8 Recheck all air outlets.
  - .9 Measure performance of coils and humidifier.
  - .10 Measure air pressure change across each component of central plant.
  - .11 Take sound pressure level readings.
- .4 Take air flow measurements in ducts by "Pitot Tube" traverse of entire cross sectional area. Take the number of readings as set out in ASHRAE Fundamentals Chapter 13 "Measurement and Instruments". If readings are inconsistent across duct, relocate by two duct diameters / widths and redo traverse.
- .6 Following precedence applies to air flow measuring devices and methodology:
  - .1 Pitot tube traverses in straight sections of duct have precedence over anemometer or velometer traverses of filters, coils, ducts, etc.
  - .2 Micromanometer flowhood measurements at air outlets have precedence over anemometer or velometer readings at air outlets.
  - .3 A pitot tube traverse in a straight duct section at inlet to a variable volume box has precedence over a box air flow sensor reading.

- .4 Variable volume box air flow sensor may be used to set up box maximum and minimum air volumes but, unless otherwise agreed with the Engineer, the sum of micromanometer flowhood readings at all air outlets has precedence over a box flow sensor reading.
- .7 Use volume control devices at air outlets to regulate air quantities only to extent that adjustments do not create objectionable air motion or noise. Effect volume control primarily by duct internal devices such as dampers and splitters.
- .8 Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.
- .9 Balance air systems at design minimum supply air temperature.
- .10 When balancing constant volume systems:
  - .1 Rough balance furthest outlet and then balance sequentially back to source,
  - .2 Fine balance furthest outlet back to source.
- .11 Upon completion of balancing, recheck and record data from central Air Handling Unit including following:
  - .1 Motor data.
  - .2 Coil, filter, humidifier data.
  - .3 Static pressure profile across all components.
  - .4 Damper controls.
- .12 Final balanced condition of each area shall include testing and adjusting of pressure conditions. Test, adjust and record building and zone pressurization levels. For variable volume systems check pressurization throughout full range of fan delivery for both heating and cooling conditions. For multi-story buildings test pressure conditions at ground, intermediate and upper levels. Check front doors, exits and elevator shafts for air flow so that exterior conditions do not cause excessive or abnormal pressures. Document abnormal building leakage conditions noted.
- .13 Complete balancing to achieve positive building pressure unless otherwise instructed.

### **3.6 MISCELLANEOUS AIR HANDLING DEVICES**

- .1 Motorized Smoke and Gravity/Barometric Dampers:
  - .1 Review installation to ensure:
    - .1 No cracks around damper frame.
    - .2 Blades close and seals engage completely.
    - .3 Damper strokes fully open to fully closed with no binding of blades at any part of stroke.
    - .4 Suitable access and identification.
  - .2 Air Outlets:
    - .1 Review installation to ensure:
      - .1 Air outlet is clean.
      - .2 Air outlet is located as shown on drawings.
  - .3 Balancing Dampers:
    - .1 Check installation to ensure:
      - .1 Damper can open and close fully.
      - .2 Access is clearly marked.
      - .3 Damper is not located in a turbulent air stream.

### **3.7 COMBUSTION AIR**

- .1 With all heating appliances, within the boiler room, operating on high fire, measure:
  - .1 Combustion air volume entering boiler room from outside.
  - .2 Differential pressure to:
    - .1 Outside
    - .2 Adjacent areas of the building.
- .2 With all heating appliances on high fire, check each natural draft appliance diverter for any back draft.

### **3.8 ACOUSTIC MEASUREMENTS**

- .1 Acoustic Measurement Procedure:
  - .1 Use Sound Level Meter as specified in Section 23 08 13.
  - .2 Calibrate microphone and sound level meter before use.

- .3 Hold Sound Level Meter in front of body of observer and as far away as is practicable or attach instrument to a tripod stand.
  - .4 Height of measuring microphone from floor shall be 1200 mm  $\pm$ 50 mm unless otherwise noted.
  - .5 Measurement locations shall be minimum of one metre away from any large vertical or horizontal surface, ie. walls, columns, floors.
  - .6 Take measurements with meter on "SLOW" response or follow manufacturer's instructions for  $L_{eq}$  "equivalent energy level" averaging.
  - .7 Do not take readings until noise created by extraneous equipment, people or other sources, which would interfere with specific acoustic measurements, have ceased.
- .2 HVAC Noise Inside Building:
- .1 The objective is to measure Sound Pressure Level within each **occupied** room created by entire HVAC system and to evaluate these in terms of the recommended maximum background noise levels for each type or area. Investigate areas found to be in excess of recommended maximum levels and take corrective action.
  - .2 Follow testing procedures specified under "Acoustic Measurement Procedure".
  - .3 Measure overall A-weighted Sound Pressure Level
  - .4 Take minimum of one reading per 30 m<sup>2</sup> of floor area, but no less than one reading in any one enclosed room or open area which will be occupied.
  - .5 Take measurements with system operating in its loudest normal condition which is typically the summer mode.
  - .6 Take measurements in rooms equipped with exhaust fans or unit heaters or cabinet heaters with fan "on" and fan "off" conditions.
  - .7 Measure sound pressure levels in rooms directly beneath roof top towers, condensers, furnaces, etc. with units running at maximum speed or capacity.

- .8 Compare results with following maximum noise criteria:
  - .1 Conference Room, Observation/Therapy Suite, First Aid Room, Classroom, Lecture Halls, Executive Office: 37 dB(A)
  - .2 Private Office, Library, Open Plan Office, Gymnasium: 42 dB(A)
  - .3 Cafeteria, Washrooms, Circulation/Waiting Areas: 47 dB(A)
  - .4 Computer Equipment Room, Kitchen, Laboratory: 52 dB(A)
- .3 Community Noise:
  - .1 Community noise measurements are taken to ensure compliance with local noise by-laws and to minimize annoyance to nearby residents.
  - .2 Follow testing procedures specified under "Acoustic Measurement Procedure".
  - .3 Measure overall, A-weighted Sound Pressure Level.
  - .4 Take measurements when ambient noise is at lowest, typically at nighttime, 23:00 - 6:00. Do not take measurements when there is significant interference due to wind, rain, etc.
  - .5 Measure at adjoining property boundaries closest to mechanical equipment on all sides of building.
  - .6 Take following measurements at every position:
    - .1 Measure ambient noise level with no relevant mechanical equipment in building operating.
    - .2 Measure noise in the summer with all appropriate seasonal equipment at their nighttime maximum outputs.
  - .7 Measurements shall not exceed 45 dB(A) or they shall not increase existing ambient level by more than 2 dB(A) whichever is greatest.
  - .8 Documentation:
    - .1 Provide a site plan indicating buildings, adjacent properties, and test locations.
    - .2 Provide night time ambient noise levels with equipment on and off in the summer. Submit data in tabular format.

- .3 Provide a list of mechanical equipment operating in these conditions as well as their operating levels.
- .4 Provide any subjective comments that may be useful.
- .4 Outdoor Equipment Noise:
  - .1 This equipment includes Air-Cooled Condenser Units, Cooling Towers, Rooftop Chillers and Packaged Rooftop Heating/Cooling Units.
  - .2 Follow testing procedures specified under "Acoustic Measurement Procedure".
  - .3 Measure Sound Pressure levels in a manner consistent with manufacturer's data. If no such data is available then measure overall, A-weighted Sound Pressure Level.
  - .4 Orient observer and measuring microphone sideways to source.
  - .5 Note distance between measuring microphone and equipment. Choose a distance coinciding with closest measurements published by equipment manufacturer whenever possible. When this is not possible, take measurement 1500 mm from sides of equipment or from intake and exhaust louvers.
  - .6 Perform Sound Pressure Level measurements on all accessible sides of equipment and note measurement distance.
  - .7 Provide a plan indicating equipment location and measurement locations.
  - .8 Compare measurements with manufacturer's published data.

### **3.9 BALANCING OF HYDRONIC SYSTEMS**

- .1 Fully open all valves, except the pressure bypass valve which must be closed, including balancing valves, isolation valves and control valves.
- .2 Measure and record pump flows.
- .3 Adjust flows through each boiler or chiller to ensure equal flow.
- .4 Install pressure gauges across each coil or use balancing valve pressure tappings if provided. Read pressure drop through coil or balancing valve and set flow rate for full flow through coil. Set pressure drop across bypass valve at full flow to bypass to match coil full flow pressure drop.
- .5 Distribute flow through radiation using circuit balancing valve pressure drop to apportion flow to each zone, and temperature drop to apportion flow through each run of radiation.

- .6 Terminal reheat coils of constant or variable volume systems can not be hydronically balanced, by the method of air side temperature rise across the coil, until after air balance has been completed.
- .7 Position and lock all balancing valves and mark all hand valves for design flow through all coils, coil by-passes, branch circuits, heat exchangers, chiller evaporators, etc. Record flow measurement data for all major circuits and each terminal device.
- .8 After making all coil and terminal unit adjustments remeasure flow and head for each pump, for both single and parallel operation. Check flows through boilers, chillers, heat exchangers, etc. under following situations:
  - .1 With two pumps operating.
    - .1 Controls demanding maximum heating or cooling.
    - .2 Controls demanding no heating or cooling.
  - .2 With one pump operating - repeat for each pump:
    - .1 Controls demanding maximum heating or cooling.
    - .2 Controls demanding no heating or cooling.
- .9 For each pump, plot maximum and minimum flows on curve for both single and parallel operation.
- .10 Verify pressure drops and flows through pressure control by-pass valves over full operating range.
- .11 Calibrate all pressure and temperature gauges.

### **3.10 BALANCING REPORT**

- .1 Submit draft copies of final reports prior to Interim Acceptance of the Work. Provide four copies of final report for inclusion in Operation and Maintenance Manual.
- .2 Include types, serial number and dates of calibration of instruments.
- .3 Submit with report, fan and pump curves with operating conditions plotted. Submit grille and diffuser shop drawings and manufacturer's flow factors.

.4 Organize report as follows:

**Air Systems**

- .1 Summary
- .2 Procedure
- .3 Instrumentation
- .4 Drawings
- .5 Equipment Summary
- .6 Fan Data Sheets
- .7 Fan Curves
- .8 Air Handling Unit Profile Data
- .9 Air Flow Measuring Station Data
- .10 Traverse Data and Schedule
- .11 Terminal Unit Summary
- .12 Outlet Data Summary and Schematic, per system
- .13 Building Pressurization Data
- .14 Diagnostic

**Hydronic Systems**

- .1 Summary
- .2 Procedure
- .3 Instrumentation
- .4 Drawings
- .5 Equipment Summary
- .6 Pump Data Sheets
- .7 Pump Curves
- .8 Pump Profile Data
- .9 Terminal Unit Summary
- .10 Diagnostic

**Acoustics**

- .1 Summary
- .2 Procedure
- .3 Instrumentation
- .4 Drawings
- .5 Sound Pressure Level Data

**END OF SECTION**