REGIONAL DISTRICT of OKANAGAN-SIMILKAMEEN

REQUEST FOR QUOTATIONS

101 MARTIN STREET ROOFTOP UNIT REPLACEMENTS

6 October 2022

GENERAL

The Regional District of Okanagan-Similkameen (RDOS) is requesting submission of quotations and timelines for the supply of new dual fuel rooftop units x3 for our main office building at 101 Martin Street Penticton. The dual fuel units are set to come with a new control system and be optimized for low GHG operations. Specifications and design has been completed by our engineer consultants.

Selection will be based on the submitted quote, the time lines and demonstrated experience, expertise and previous quality performance for the work.

SPECIFICATIONS & WORK

The intent of this contract is the delivery and installation of Roof Top Units x3 and controls, including the supply of engineered stamped shop drawings and details for installation of any items designed and supplied by sub trades (including shop drawings)

The specifications must meet the exact criteria detailed in the attached supporting documentation.

The additional plans and energy reports provided are purely for reference to assist with creating accurate tender responses.

SUPPORITNG DOCUMENTATION

As attached in this particular order:

- 20220310 - RTU Replacement Specifications

- 20220310 - RTU Replacement Mechanical
- 20220310 - RTU Replacement Electrical
- 20140829 - RDOS Structural Assessment Drawing
- 20140831 - RDOS Report Structural Assessment
- FortisBC Commercial energy Assessment Program Report

ALTERNATIVES

No alternatives or equals to the specified products will be considered.

EXPECTED TIMELINES

For scheduling purposes, the intent of the RDOS is issue notice of award by **November 9th 2022**, and require a completion date of **September 15th 2023**. The Supplier shall use these dates when preparing the quotation.

PRE-QUOTATION MEETING (optional)

On **Monday October 17th @ 10am** there will be an optional Pre-Quotation Meeting held by the RDOS at 101 Martin St.

TAXES AND DUTIES

1. The Supplier shall include sales tax in accordance with current sales tax legislation taking into account any changes that have been made known by the Government and that will occur during the life of the Contract.
2. If sales taxes are increased or decreased, or other amendments are made in the legislation during the course of the Contract that alter tax amounts carried in the Contract price, an adjustment will be made accordingly to the Total Contract Price.
3. The Supplier shall keep records and invoices of accounts subject to Goods and Services Tax and Provincial Sales Tax for the purpose of establishing taxes paid and for substantiation in the event of changes to the tax legislation during the course of the Contract.
4. The Supplier shall contact the Sales Tax authorities and determine what the applicable taxes are and the procedures for tax exemption and/or refunding and include related administrative costs in the Tender.

TERMS OF PAYMENT

The payments will be made in 2 tranches the timing and % of which will be determined by RDOS.

The RDOS will reserve the right to pay at least 50% upon receipt that proof of the purchase of the agreed equipment has been made by the winning contractor.

The RDOS will reserve the right to pay at least 50% as a hold back until completion of the install and all testing is completed as per the terms of the agreement.

QUOTATION

Submissions shall include the following information:

- Qualifications, background and directly related experience;
- All key personnel and any sub-consultant(s);
- Detailed breakdown of effort by key personnel, hourly rates and disbursements;
- Details of tasks and timelines, including proposed date of delivery;
- Breakdown showing supply and delivery costs.

Ensure sufficient detail is provided to facilitate evaluation of level of effort by task and cost.

Fees and fee estimates must include all applicable taxes but show taxes as a separate item.

All respondents must, in addition to such other mandatory requirements as may be set out in the Request for Quotes:

- Provide shop drawings stamped by a Professional Engineer registered in British Columbia, Canada;
- Provide a certification with respect to safety.

All Ministry and WorkSafeBC safety policies will apply to the work. This includes policies regarding safety equipment, signs, traffic control and procedures.

The Specifications & Work list herein is a comprehensive list of the anticipated work. RDOS may negotiate with the prospective supplier to minimize some of the requested duties.

All technical inquiries shall be via email and directed to:

Jeremy Dresner
jdresner@rdos.bc.ca

Address Quotations to:

Jeremy Dresner
Community Services
Regional District of Okanagan-Similkameen
101 Martin Street, Penticton, B.C. V2A 5J9

Or email to: jdresner@rdos.bc.ca

Envelopes should be clearly marked

101 Martin Street Rooftop Unit Replacements

and will be received by the undersigned, up to and including the Closing Time of:

November 7th 2022.

The lowest or any Quotation will not necessarily be accepted. The Regional District reserves the right to waive formalities in or reject any or all Quotations, or accept the Quotation deemed most favourable in the interest of the Regional District, having regard to the price, timeline, capacity, equipment and qualifications offered. The Regional District reserves the sole and unfettered right to cancel and not proceed with this Quotation.

The Regional District shall not be obligated in any manner to any proponent whatsoever until a written agreement has been duly executed relating to an approved submission.

END

RDOS – 101 Martin Street

Rooftop Units Upgrade

Mechanical and Electrical Specifications

Issued for: Tender
Project No.: 2022310
Date: October 7, 2022

320 - 3605 Gilmore Way, Burnaby, BC V5G 4X5 main: 604 298 4858 toll free: 888 724 1715 prismengineering.com

Discipline	Responsibility	Seal
Mechanical	General, Mechanical, Controls	
Electrical	General, Electrical	

Index:

Part 1 General Specification

1. General

1.1. The General Conditions, Supplements and amendments shall govern this work.

2. Intent

2.1. Work shall be in accordance with the drawings and specifications and their intent, complete with all necessary components, including those not normally shown or specified, and shall be ready for operation before acceptance.

2.2. Any reference to the “Design Authority” or "Consultant" shall mean Prism Engineering Ltd.

2.3. Any reference to the “Owner” shall mean Regional District of Okanagan-Similkameen.

2.4. The word "provide" shall mean "supply and install" unless otherwise indicated.

2.5. The new installation shall meet the current building standards in all aspects.

3. Governing Regulations

3.1. The work under this contract shall conform, but not be limited to, the requirements of the following codes, regulations and standards:

By-Laws, Standards and Codes:

- Local building by-laws
- BC Building Code (2018) Part 1 to 11 inclusive.
- BC Plumbing Code (2018)
- BC Fire Code (2018)
- WorkSafe BC Standards
- ASHRAE 90.1-2016
- Canadian Electrical Code C22
- CSA B-149.1 Gas Code
- B-52 Mechanical Refrigeration Code
- ASME B30 Safety Standard for Cranes, Hoists and Rigging
- CSA Z150 Safety Code on Mobile Cranes
- SMACNA Publications:
    - HVAC Duct Construction Standards, Third Edition 2005
    - Guidelines for Seismic Restraints of Mechanical Systems and Piping Systems
- NFPA Standards

3.2. Letters of Assurance completed and stamped by a registered professional engineer, will be required to be submitted at the completion of the project for the installation of seismic restraint of new equipment installed. Paid and supplied by the mechanical contractor.

3.3. Comply with the Owner’s requirements for construction activities in the building.

4. Codes, Standards and Permits

4.1. Obtain all required permits, pay all fees therefore, and comply with all provincial, municipal and other legal regulations, codes and by-laws applicable to the work.

4.2. Provide certificates for inclusion in O&M documentation, as evidence that the work conforms with the laws and regulations of the Authorities having jurisdiction.

5. Examination of Site

5.1. Visit the site before tendering and examine all local and existing conditions on which the work is dependent.

5.2. No consideration will be granted for any misunderstanding of work to be done resulting from failure to visit the site.

5.3. When the contract documents do not contain sufficient information for the proper selection of equipment for bidding, notify the design authority during the tendering period. If clarification is not obtained, allow for the most expensive arrangement. Failure to do this shall not relieve the contractor of responsibility to supply the intended equipment.

5.4. Check drawings of all trades and survey the site to verify space availability for the installation. Co-ordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent without written approval.

5.5. Wall locations, layout and heights shall be verified on site. Failure to do this shall not relieve the contractor of the responsibility for correct location of mechanical systems and equipment.

5.6. The dimensions of existing work shown on the drawings are approximate and the contractor must take actual measurements before ordering materials, equipment and the like. Failure to comply with this requirement will make the contractor fully responsible for replacing such material or equipment at no extra cost to the contract.

6. Liability

6.1. Assume responsibility for laying out work and for damage caused by improper execution of work.

6.2. Protect finished and unfinished work fillings and occupant's furniture and equipment from damage.

6.3. Take responsibility for condition of materials and equipment supplied and protect until work is completed and accepted.

6.4. The Owner shall have recourse in tort for any negligent action by the contractor or his representatives.

7. Insurance

7.1. The contractor shall provide, at his expense, and show proof of, comprehensive general liability insurance of not less than $5,000,000.00 including non-owned car coverage, contractual liability and containing a cross liability clause. Coverage shall include loss or damage the contractor may cause to any works, building, equipment structural, on the owner's property. The insurance may contain a deductible clause not to exceed $500.00

7.2. The contractor shall carry full employee's liability insurance for the whole of the work in accordance with the workers' compensation act. Before the start of the project, the contractor shall submit a letter to the Owner that he is in good standing with the Worksafe BC.

8. Existing Services

8.1. Arrange work to avoid shutdowns of existing services. In order to maintain existing services in operation, temporary relocations and/or bypasses of ductwork and/or piping may be required. Shutdowns of systems are to be co-ordinated with the Senior Energy Specialist of the Owner.

8.2. Allow in tender for afterhours work for shutdown of services that affects the occupied operation of the building.

8.3. Protect all existing services, report damage and make good any damage occasioned by the work in this contract.

8.4. The plans show approximate locations of piping and equipment based upon existing record drawings. Be prepared to accommodate changes in location as may be found on site.

9. Cutting, Coring and Patching

9.1. Layout all cutting, patching, digging, canning and coring required to accommodate the mechanical services. The performance of actual cutting and patching is by the general contractor. Be responsible for all openings required under this contract, including duct openings. Allow oversized openings for fire dampers.

9.2. Verify the locations of existing service runs and structural reinforcement within existing concrete walls and floors prior to core drilling and cutting. Provide x-ray or penetrating radar (GPR) for each proposed opening in concrete floor/wall.

9.3. Coring and cutting of structural building components shall only take place upon the receipt of specific written approval of the base building structural engineer paid by the mechanical contractor.

10. Penetration of Fire Separations – Fire Stopping

10.1. Work included: furnish labour, material, equipment and services necessary to provide fire stopping and smoke seals around mechanical service piping and duct penetrations through fire rated wall and floor assemblies to CSA Standard CAN4-S115-M85 and authorities having jurisdiction.

10.2. Work shall be carried out by approved specialist firm, employing tradesmen experienced in fire stopping and smoke seals application. Installing contractors shall be certified by the British Columbia insulation contractor's association for work specified. Work shall be installed in accordance with manufacturer's recommended installation procedures.

10.3. Acceptable fire stopping systems for vertical penetrations: 3m fire barrier penetration sealing system, bio-fire protection ltd. Fire stopping and smoke seals, dow corning fire stop sealant; for horizontal and poke through penetrations: fyre sleeve and fyre flange as manufactured by fyre sleeve industries inc.

10.4. Contractor shall provide fire stopping shop drawings for review to the Consultant.

10.5. Location and extent of fire separations shall be confirmed on site.

11. Penetrations of Common Wall and Floors

11.1. Work included: furnish labour, material, equipment and services necessary to provide stopping and sealant around mechanical service piping and duct penetrations through all non-fire rated wall and floor assemblies.

11.2. Thermally seal around all pipe and duct penetrations through walls, ceilings and floors.

12. Scaffolding, rigging and hoisting

12.1. The Contractor is responsible for furnishing scaffolding, craning, rigging, hoisting and services necessary for erection and delivery into and onto the premises of any equipment and apparatus removed or furnished.

12.2. Remove same from premises when no longer required.

13. Workmanship

13.1. Workmanship shall be in accordance with established practice and standards accepted and recognized by design authorities and the trade.

13.2. Employ only tradesmen holding valid provincial trade qualification certificates. Tradesmen shall perform only work that their certificate permits.

13.3. All roofing work shall be carried out be a registered RACBC contractor.

14. Cleanup

14.1. Make good and clean all areas disrupted by this work. Spot checks may be made by the consultant during the cleaning process to verify that the required standard has been met at substantial completion.

14.2. The Contractor shall be responsible for damages caused to the building and tenant areas during the duration of the work.

14.3. The Contractor shall cleanup the work area at the end of each shift.

15. Material

15.1. Where two or more items of equipment and/or material, of the same type, are required, they shall be the products of a single manufacturer.

15.2. Material considered to satisfy the specification, but of a manufacturer other than those named, may be submitted to the design authority for consideration only during the tender phase. After contract award and during construction, specified equipment shall be provided.

15.3. All provided materials under this project shall be new, unused and of high quality standards.

16. Drawings and Measurements

16.1. Drawings are generally diagrammatic and are intended to indicate the scope, intent and general arrangement of work. Do not scale the drawings.

16.2. Take field measurements where equipment and material dimensions are dependent upon building dimensions.

17. Shop Drawings

17.1. Prior to ordering material, submit digital sets of shop drawings for all major mechanical equipment to the consultant for review by e-mail with a copy to the Owner. At a minimum, drawings should be provided for packaged dual-fuel rooftop units, controls and electrical.

17.2. Each shop drawings submittal shall be stamped by the Contractor verifying that the submitted shop drawings have been reviewed for conformance with the specifications.

17.3. Note each shop drawings with the following information:

- Manufacturers and suppliers' name
- Catalogue model number
- Name of trade supplying item
- Project identification number
- Number identifying item on contract drawing and/or in specifications
- Equipment size, performance, and electrical information

18. Record Drawings

18.1. Maintain one contract drawing white print on site, solely for the purpose of recording, in red, any change and/or deviation from the contract drawing as it occurs.

18.2. Submit a copy of as-installed drawings to the consultant upon substantial completion of this contract.

18.3. Mechanical Contractor and Electrical Contractor shall submit as-built markups to Prism Engineering Ltd. for review. After the as-built mark-ups are reviewed, the Contractor will then transfer all changes to produce the record drawings in AutoCAD. After a release form is signed, Prism Engineering can provide original design AutoCAD files to the Contractor for a fee of $750 for all drawings. The Contractor may use these to provide finished, record AutoCAD drawings.

18.4. Alternatively, for an approximate fee of $2000, Prism Engineering will transfer the hand mark-up changes to the AutoCAD format to produce the required cad record drawings. Fee to do AutoCAD work to be confirmed based on amount of CAD work required.

18.5. Include all details and revisions reflecting as-built conditions to the mechanical system. Label each drawing in the lower right corner in letters of at least 12mm (1/2") high as follows: "record drawing", Contractors name and date.

18.6. Deliver one set of AutoCAD files when Contractor has transferred the changes to CAD and insert one set plots/PDF files in the O&M manuals. When the consultant has transferred the changes to the CAD files, the Contractor will be provided with one set of plots/PDF files for the contractor to insert in the O&M manuals.

19. Operating & Maintenance Manuals

19.1. Upon completion of project, provide one (1) searchable electronic copy (soft copy) of the operating & maintenance manual on a USB thumb drive and one (1) hard copies (in 3-ring binder) shall be submitted. The manual shall consist of the following information:

- Title page with project name on front cover and on the spine of binders
- Description of systems and operation
- Shop drawings of all equipment
- One-year parts and labour warranty and extended warranties
- Maintenance and operation instructions
- List of manufacturer and trade names
- List of supply sources for maintenance
- Equipment start-up reports
- Balance report
- Name of Owner, Consultant and Mechanical and Electrical contractors
- Copies of Mechanical and Electrical as-built drawings
- Letters of assurance for seismic restraints
- Pressure test reports, where applicable
- Safety branch permits and inspection reports

20. Salvage

20.1. Unless otherwise specified, completely remove all equipment, which becomes redundant and is no longer required due to the work in this contract.

20.2. The Owner wishes to salvage the heat exchanger and combustion motor of existing rooftop unit xRTU-2. The contractor shall allow to transport the heat exchanger to a site in Penticton. Location and time shall be coordinated with the Owner and Contractor.

20.3. Salvage other than mentioned above, shall be coordinated with Owner and Contractor prior to construction.

20.4. Where noted on the drawings, the equipment/material shall be handed over to the owner. A receipt of the transfer shall be provided indicating where the material has been stored.

20.5. Disposal of all unused mechanical equipment is the responsibility of the Contractor.

20.6. The Owner will cooperate with the Contractor to allocate space for a waste bin and materials storage.

21. New products only

21.1. All products used in this installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of 1 year. This installation shall not be used as a test site for any new products unless explicitly directed by the Consultant in writing prior to bid date.

21.2. Spare parts shall be available for at least 5 years after completion of this contract.

22. Warranty

22.1. Provide a written and signed warranty in the name of the Client. The warranty is to include the necessary materials and labour to cover repair or replacement of specified work, as a result of faulty materials or workmanship.

22.2. The warranty is to cover a minimum of one year from the date of substantial completion.

22.3. Upon written notification from the client that a deficiency exists, promptly repair or replace the defective work at no cost to the client.

23. Coordination with Electrical Contractor

23.1. Contractor shall review all equipment requiring electrical power and accessories with the electrical contractor (retained by Contractor) and electrical drawings prior to ordering equipment. Ensure that correct electrical characteristics including controls are confirmed for the equipment.

23.2. Any work which is contracted or requires the City of Penticton Electrical Utility shall be at the Contractors risk and expense.

24. Seismic Restraints

24.1. Mechanical/electrical contractor shall employ the services of a qualified seismic/structural engineer registered in BC to submit letters of assurance for seismic work on new equipment.

24.2. Submit the sealed letter of assurance to Prism Engineering at the completion of the project.

24.3. Seismic services shall be paid by the Contractor.

25. Hazardous Materials

25.1. Definitions:

.1 Asbestos-Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.

.2 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.3 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.4 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

25.2. Reference Standards:

.5 Canadian Environmental Protection Act,1999 (CEPA 1999)

.6 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.7 Department of Justice Canada (Jus)

.8 Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).

.9 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

.10 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.11 Material Safety Data Sheets (MSDS).

.12 National Research Council Canada Institute for Research in Construction (NRC-IRC)

.13 National Fire Code of Canada-2005.

25.3. Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

25.4. Storage and Handling Requirements:

.14 Store and handle hazardous materials and waste in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.15 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.16 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.

.17 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

25.5. Hazardous material reports will be made available by Owner upon request and will be provided to Contractor.

25.6. Notify the Owner of material discovered during Work. Do not disturb such material. Testing and subsequent abatement as required will be carried at the owner's expense.

25.7. Where existing pipe, duct, plenum, insulation, equipment, etc., is removed from service, or where new connections are made into existing insulated piping, ductwork or plenum, the Contractor shall take particular note that this existing pipe, duct, plenum, insulation, or equipment may contain asbestos.

25.8. Where existing pipe, duct, plenum, insulation, equipment etc. is identified containing asbestos, clear signage in large letters strongly affixed to relevant equipment and materials stating 'CAUTION ASBESTOS', shall be provided.

25.9. Where asbestos insulation products are removed from service or disturbed, all asbestos materials, fibres, dust, etc., shall be handled and controlled in strict accordance with the standards laid down by the BC Workers Compensation Board.

25.10. Particular care shall be taken to assure that any asbestos materials, fibres, or dust does not circulate through the building.

25.11. All insulation and asbestos products shall be handled, cleaned up, contained, and disposed of in accordance with the requirements of the BC Workers Compensation Board.

25.12. Where any existing building materials contain asbestos (linoleum, wall plaster, drywall taping compound, etc.) then any cutting and patching required to accommodate new work shall be done in accordance with the requirements of the BC Workers' Compensation Board.

26. Final Site Review

26.1. The Contractor shall advise the Consultant 7 days before the planned final site review to arrange a mutually agreeable time and date to conduct the final site review.

26.2. The Contractor is to provide the required resources and staff to review the installation work and demonstrate the operation of equipment.

Part 2 Mechanical Specification

27. General

27.1. The General Conditions, Supplements and amendments shall govern this work.

28. Testing and Balancing

28.1. Mechanical Contractor shall retain services of a qualified and independent Balancing Agent and provide the Balancing Agent with a complete set of drawings and specifications for the work and shall make adjustments/corrections (sheave changes etc.), as required by the Balancing Agency for all new equipment supplied for under this contract.

28.2. The third party Balancing Agent shall be named prior to the start of the project.

28.3. Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting balancing including but not limited to:

- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.

28.4. Do TAB to following tolerances of design values:

- .1 All HVAC systems: plus 5%, minus 5%.

28.5. Air Systems:

- .1 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .2 Locations of equipment measurements: to include as appropriate:
- .3 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.
- .4 At controllers, controlled device.
- .5 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

28.6. All measurements and readings shall be taken using reliable testing instruments and procedures by workmen fully experienced and regularly employed in this type of work. Records shall be

taken of all readings and a detailed report submitted for review after balancing to the Consultant and the Owner.

28.7. The Balancing Agency shall carefully record the make, model, size, serial number, and characteristics of each piece of equipment and motor installed on the project. This data shall be recorded and included in the balancing reports.

28.8. Submit a complete balancing report on all air systems per the project scope of work and drawings to the Owner and Consultant. The balancing report shall indicate final flows obtained. The balancing report shall be included in the final O&M manual.

29. Commissioning and Demonstration

29.1. It shall be the Contractor's responsibility to furnish and install all required labour, equipment, instruments, and procedures to commission the complete mechanical system into operation. This shall include the following items:

29.2. Carry out initial start up of all new and existing systems, including the following:

- Check operation of all equipment, machinery, systems, correct fan rotation, etc.
- Check all drives and belts. Provide a millwright certificate certifying alignment where specified.
- Lubricate all motors and equipment where required.
- Check installation of all air filters.
- Provide three sets of all keys, operators, or special tools, etc., required for the operation and maintenance of all equipment and systems. These shall be turned over to the owner. Obtain a signed receipt.
- Balance all air systems as specified.
- Set up and calibrate all controls, operators and instruments. Place controls system in operation.
- Clean all ductwork as required.
- Check that all safety controls have been installed, wired, dry tested, and are fully operational.
- Check that permanent electrical connections have been made to all equipment and that power is available.
- Check all vibration isolators and seismic restraints. Adjust and shim as required.
- All Startup verification checks by manufacturer's representatives for rooftop units etc., have been carried out.
- Provide copies of all test certificates, inspection certificates, and operating permits to the Owner and Consultant. Copies of all documentation shall be included in the final O&M manual.
- Check that proper overload protection has been provided for all motors, controls, and control circuits.
- Check for any abnormal equipment vibration or noise. Determine cause and rectify.

29.3. Prior to request for final inspection and Substantial Performance of the work:

- Check out operation of the entire system as a whole.
- Set up all constant volume and variable volume fans. Adjust drive sheaves as required or change drive or driven sheaves as required to obtain correct fan speed.
- Set up and adjust all variable volume boxes and air valves.
- Set and adjust all air grilles, registers, and diffusers for proper throw and air distribution and draftless diffusion.
- Verify and certify all fire stopping and sealing of all penetrations through all rated and non-rated fire separations and sound separations where applicable.
- Test out and certify the operation of all alarms and protective devices.

- Complete all systems identification, labels, nameplates, pipe identification, colour coding, directional arrows, hydraulic data plates, etc. and include a clear guide to the colour coding in PDF and hard copy form.
- Fit all air filters with new filter media and provide spare filter media as specified. Mark and label with the date of installation.
- Check and prove out operation of all safety and operating devices, controls, time clocks, and interlocks.
- Re check operation and calibration of all controls, operators and instruments. Re-calibrate as required.
- Provide complete control system calibration report signed and certified by Controls Contractor.
- Provide air systems balancing reports.
- Provide complete Maintenance Manuals at least two weeks prior to request for inspection for review.
- Provide Project Record Drawings.
- Provide a letter to the Owners with a copy to the Consultant certifying that the work is complete and that all systems and controls have been checked and proven out and are in full operation.
- Draw up a proposed time schedule for the testing and demonstration phase of the inspection for review by the Consultant. This schedule shall be divided into days and daily time periods and shall list all the various systems, sub systems, controls, and equipment, and the estimated time period to be devoted to testing and proving out the operation of each item. The time schedule shall take into consideration the Owner's use of the building and facilities and shall not interfere with his operations.

29.4. All deficiencies shall be recorded and corrected prior to proceeding further.

29.5. If, in the opinion of the Consultant, field operations and testing indicates that any item of equipment or machinery does not meet the specifications, the Owner may request that testing of the equipment in question be carried out by an independent testing laboratory or testing agency. In the event that the tested equipment or machinery proves to meet the specification, the Owner shall pay for the independent lab testing. If the equipment or machinery does not meet the specification the Contractor will be responsible to pay the costs of all testing and the costs of all alterations to the equipment or machinery to bring it up to specifications, any subsequent testing, or the complete cost of replacing the equipment or machinery with new equipment or machinery that meets the specifications.

29.6. When all of the above have been completed and all systems are operating in a satisfactory manner the controls system shall be put through a process of fine tuning by the Contractor.

- Recheck operation and calibration of all controls, instruments, and operators. Recalibrate as required. All controls shall be fine tuned for accurate response, precise sequencing, and smooth operation.
- All setpoints and schedules shall be reviewed and adjusted as required.
- DDC Controls Systems and their hardware and software shall be debugged, reviewed, and reprogrammed as required.
- All problems or deficiencies revealed by the Balancing Agency shall be rectified. Fan speeds shall be altered as required and drive and driven sheaves shall be replaced as necessary.
- When all the above requirements have been carried out, the Consultant shall arrange a final inspection of the work for Substantial Performance. The Contractor and his specialist sub contractors shall be in attendance for this inspection. The Contractor and his sub contractors shall provide all necessary labour, tools, and equipment to carry out all required inspections and tests. They shall test and prove out the operation of all systems and related equipment to the satisfaction

of the Consultant. They shall test and prove out the operation and calibration of all controls, systems, electrical circuits, switches, safety devices and systems.

- Where existing systems are shut down in the course of the work, it shall be the Contractor's responsibility to replace all systems back in complete service. This shall include all required purging, cleaning, filling, chemical treating, appliance relighting, and system start-up. All existing systems shall be replaced in full operation as the schedule requires.
- All tests shall be carried out complete by the Contractor and his sub contractors. The Consultant and the Owner will act as observers only.
- All tests shall be arranged at a time to suit the Owner and operators.
- Acceptance of the mechanical systems is conditional upon performance and completion of every aspect of the foregoing. If Substantial Performance cannot be declared for reasons of incompletion, deficiencies, or non-performance, the Owner shall not be denied the use of the building spaces or operable systems and equipment. All operable systems and equipment shall be fully maintained by the Contractor until acceptance can be declared. The warranty period for the work shall commence only upon Substantial Performance.
- After placing all systems and equipment in full operation and fulfilling all Substantial Performance requirements, the Contractor along with all specialist sub-trades and manufacturers' representatives shall demonstrate and instruct the Owner's operating, maintenance, and custodial staff in the complete operations and maintenance of all systems, controls, and equipment. The Contractor shall allow at least 2 full working days for this demonstration. During this time, he shall demonstrate all start up procedures, operation of all systems, control functions, adjustment of systems, shutdown of systems, operation of all alarm and safety controls, and maintenance requirements of all systems and equipment. The training on all equipment must be provided to all relevant staff from the Owner. This shall be scheduled at least 2 weeks prior to completion.
- On completion of the demonstration and instruction period the Contractor shall obtain a signed Statement of Satisfaction from the Building Owner.
- Commissioning report to be inserted in the operating and maintenance manual.

30. Vibration Isolation

30.1. Provide vibration isolation on all motor driven equipment with motors of 0.37 kW (0.5 HP) and greater power output (as indicated on the motor nameplate) and on piping and ductwork, as specified herein. For equipment less than 0.37 kW, provide neoprene grommets at the support points. Where equipment is internally isolated by the manufacturer, it need not be externally isolated.

30.2. Submit shop drawings including details of attachment to the structure. Attachment details to the structure to be approved by a BC Registered Professional Engineer.

30.3. Space isolators under equipment so that the minimum distance between adjacent corner isolators is at least equal to the height of the centre of gravity of the equipment. Include height of centre of gravity on shop drawings. Otherwise, design for increased forces on the supports, and submit design calculations with shop drawings for approval. In particular, chillers shall meet this requirement.

30.4. For all electrical connections to isolated equipment, provide a minimum 90° bend of flexible conduit.

30.5. Ensure isolation systems have a vertical natural frequency no higher than one third of the lowest forcing frequency, unless otherwise specified. Use dynamic stiffness for elastomers and do not exceed 60 durometer.

30.6. Isolators and restraining devices which are factory supplied with equipment shall meet the requirements of this section.

30.7. Provide structural steel bases for all motor driven equipment unless the equipment manufacturer certified direct attachment capabilities.

30.8. Bolt all equipment to the structure. Do not bridge isolation elements.

30.9. Supply all isolators fully assembled and clearly labelled with full instructions for installation by the Contractor.

30.10. Supply all of the vibration isolation equipment by one approved supplier with the exception of isolators which are factory installed and are standard equipment with the machinery.

30.11. Execute the work in accordance with the specifications and, where applicable, in accordance with the manufacturer's instructions and only by workers experienced in this type of work.

30.12. Execute all work in accordance with the current editions of the S.M.A.C.N.A. - "Seismic Restraint Manual guidelines for Mechanical Systems", the C.A.L.S.M.A.C.N.A. and P.P.I.C. Manual "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems", and the "National Uniform Seismic Installation Guide".

30.13. For all equipment mounted on vibration isolators, provide a minimum clearance of 50 mm (2") to other structures, piping, equipment, etc.

30.14. Unless specifically noted otherwise in this specification, all fan equipment supplied shall not generate noise levels in excess of the levels calculated from the ASHRAE Guide (1987 Systems Edition, Chapter 52, Table 5) without specific approval.

30.15. Submit sound power levels with shop drawings, measured to AMCA Standard 300 (latest edition) and calculated to AMCA Standard 301 (latest edition). Provide test data if required.

30.16. All fan equipment shall be dynamically balanced, individually and after final assembly. All fan shafts shall have a critical speed of at least 1.5 times operational speed. Manufacturer shall guarantee that vibration displacement at full speed and load will not exceed 0.001 inch (0.025mm). All fan equipment shall have a maximum vibration velocity not exceeding 0.10 in/sec (2.54 mm/sec) as measured on the fan bearings.

30.17. All manufactured equipment shall be complete with manufacturers designed and rated seismic restraint anchor points and attachments so that they may be easily bolted down or restrained in the field. Equipment attachment anchor points shall be certified by the manufacturer. The equipment manufacturers of any mechanical equipment used on this project must design their equipment so that the strength and anchorage of the internal components of the equipment exceeds the force level used to restrain and anchor the equipment itself to the supporting structure.

30.18. Performance

.6 Install inertia bases of type and thickness as indicated on Isolation Schedule.

.7 Install isolators of type and deflection as indicated on the Isolation Schedule or according to the following table, whichever provides the greater deflection.

.8 The required static deflection of isolators for equipment exceeding 0.35 kW1/2 Hp is indicated below. Spring isolators shall be "open spring". Closed spring isolators shall only be used where specified.

Machine Speed r/min	**Basement**		**Upper Floor**	
	Under *15 kW20 Hp*	**Over *15 kW20 Hp***	**Normal**	**Critical**
Under 400	Special*	Special*	Special*	Special*

400 - 600	*25 mm**1 in***	*50 mm**2 in***	*90 mm* ***31/2 in.***	Special*
600 - 800	*12 mm**1/2 in***	*25 mm**1 in***	*50 mm**2 in***	*90 mm* ***31/2 in***
800 - 1100	*5 mm**3/16 in**.*	*12 mm**1/2 in***	*25 mm**1 in***	*50 mm**2 in***
1100 - 1500	*3 mm**1/8 in***	*4 mm**5/32 in***	*5 mm**3/16 in**.*	*12 mm**1/2 in.***

** "Special" indicates as directed by the acoustical consultant.*

30.19. Isolation schedule

Isolated Equipment	Base		Type of	Static	
Description	Type	Thickness	Isolation	Deflection	Remarks
RTU Curb	Steel Curb	-	Neoprene	-	Isolate RTU/Curb
RTU Fans	-	-	Mason BR	-	By Manufacturer

30.20. Vibration isolation static deflection requirements

Description	Minimum static deflection (in.) for 4" to 6" thick solid concrete floors				
	Ground Supported Slab or Basement	20 ft. Floor Span	30 ft. Floor Span	40 ft. Floor Span	50 ft. Floor Span
Factory Assembled HVAC Units	From blower minimum deflection guide.				
Centrifugal Fans	From blower minimum deflection guide.				
Fan Heads	From blower minimum deflection guide.				
Blower Minimum Deflection Guide					
500 rpm and up	0.50	0.75	1.5	2.5	3.5
375 to 499 rpm	0.50	1.5	2.5	3.5	3.5
300 to 374 rpm	0.50	2.5	2.5	3.5	3.5
225 to 299 rpm	0.50	3.5	3.5	3.5	3.5
175 to 224 rpm	0.50	3.5	4.5	4.5	4.5
For built up fan systems or factory built AH units, minimum deflections selected shall be the greater of the above table or, regardless of location, the following minimum's:	Up to 24 1/2" wheel dia. = 1.0" 27" to 36 1/2" dia. = 2.0" 40 1/4" dia. and over = 2.5"				

.9 Notes:

.1 Minimum deflections called for in this specification are to be certifiable minimum's, not nominal rating.

.2 Steel spring isolators shall be used for all deflections 0.50" and over.

.3 Neoprene isolators shall be used for all deflections 0.35" and smaller.

.4 Limit deflections for utility sets 18" wheel diameter and smaller to 1 1/2".

.5 Limit deflections for utility sets 1/4 hp and smaller to 0.25".

.6 Where equipment is internally isolated, it does not require additional external isolation.

.7 Refer also to major equipment specifications. Where isolator requirements are defined in two places, the most stringent requirement shall be provided.

31. Refrigerant Disposal

31.1. Removal of any refrigerant AC equipment requires refrigerant to be pumped out by a licensed refrigerant mechanic in accordance with the refrigerant code of practise. Provide certified report on refrigerant disposal or recycling to Consultant.

32. Rooftop Units

32.1. References:

.1 NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.

.2 ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

.3 ANSI/ASHRAE 37 - Testing Unitary Air Conditioning and Heat Pump Equipment.

.4 ANSI/ASHRAE/IESNA 90.1 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.

.5 ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.

.6 AHRI 210/240 - Unitary Air-Conditioning Equipment and Air- Source Heat Pump Equipment.

.7 AHRI 270 - Sound Rating of Outdoor Unitary Equipment.

.8 ANSI/NFPA 70-1995 - National Electric Code.

32.2. Submittals

.1 Submit unit performance data including: capacity, nominal and operating performance to the Owner and Consultant for review by e-mail.

.2 Submit Mechanical Specifications for unit and accessories describing construction, components and options.

.3 Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

.4 Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

32.3. Delivery, Storage and Handling

.1 Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

.2 Protect units from physical damage. Leave factory-shipping covers in place until installation.

32.4. Warranty

.1 Provide parts warranty (excluding refrigerant) for a minimum of one year from start-up or 18 months from shipment, whichever occurs first.

.2 Provide a minimum of five-year extended warranty for compressors.

.3 Provide a minimum of five-year heat exchanger limited warranty.

32.5. Regulatory Requirements

.1 Unit shall conform to ANSI Z21.47/UL1995 for construction of packaged air conditioner.

.2 Conform to Canadian Standards Association (CAN/CSA-2.3/CAN/CSA C22.2 #236) for construction of packaged air conditioner

32.6. The contractor shall provide package rooftop unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

32.7. General Unit Description

.1 Units furnished and installed shall be dual fuel packaged rooftops as scheduled on contract documents and these specifications. Units shall consist of insulated weather-tight casing with compressors, air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls.

.2 Units shall be 100% factory run tested and fully charged with R-410A refrigerant.

.3 Units shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

.4 Units shall be convertible airflow design as manufactured.

.5 Wiring internal to the unit shall be colored and numbered for identification.

32.8. Unit casing

.6 Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 18 gauge with access doors and removable panels of minimum 20 gauge.

.7 Units cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.

.8 Cabinet construction shall allow for all service/ maintenance from one side of the unit.

.9 Cabinet top cover shall be one piece construction or where seams exits, it shall be double-hemmed and gasket-sealed.

.10 Hinged Access Panels: Water- and air-tight hinged panels with handles shall provide access to filters, heating section, supply air fan section, evaporator coil section, and unit control section.

.11 Units base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.

.12 Insulation: Provide 1/2 inch thick fiberglass insulation with foil face on all exterior panels in contact with the return and conditioned air stream. All edges must be captured so that there is no insulation exposed in the air stream.

.13 Provide openings either on side of unit or through the base for power, control, condensate, and gas connections.

.14 The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.

32.9. Air filters

.1 Air Filters: Factory installed MERV-13 filters shall mount integral within the unit and shall be accessible through access panels. One-inch thick glass fiber

disposable media filters shall be provided with the provisions within the unit for 2 inch thick filters to be field- provided and installed.

32.10. Fans and motors

.1 Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.

.2 Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.

.3 Provide units with belt driven, supply fans with adjustable motor sheaves and multispeed blowers.

.4 Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.

.5 Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.

.6 Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

32.11. Gas fired heating section

.1 Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping.

.2 Heating section shall be factory run tested prior to shipment.

.3 Gas heating section shall operate as backup to heat pump operation.

.4 Induced draft combustion type with direct spark ignition system, redundant main gas valve, and 2-staged heat.

.5 Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Provide flame rollout switches.

.6 Induced draft blower shall have combustion air proving switches and built-in thermal overload protection on fan motor.

.7 Heat Exchanger: Provide tubular section type constructed from 18-gauge stainless steel.

.8 Burners: Burners shall be of the in-shot type constructed of stainless steel.

.9 Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

32.12. Evaporator coil

.1 Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

.2 Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.

.3 Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.

32.13. Condenser section

.1 Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

32.14. Refrigeration system

.1 Compressor(s): Provide scroll compressor with direct drive operating at 3600 rpm. Integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads.

.2 Units shall have cooling capabilities down to 0 degree F as standard.

.3 Provide each unit with factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.

.4 Provide reversing valve, discharge muffler, flow control check valve, and electronic adaptive demand defrost control on all units.

32.15. Exhaust/return section

.1 Provide a factory supplied field installed power exhaust assembly that shall assist the barometric relief damper in the economizer in relieving building pressurization.

32.16. Outdoor air section

.1 Provide 100% return air.

.2 Provide economizer with temperature based control

.3 Provide adjustable minimum position control located in the economizer section of the unit.

.4 Provide spring return motor for outside air damper closure during unit shutdown or power interruption.

32.17. Operating controls

.1 Provide microprocessor unit-mounted DDC control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling, and ventilating decisions through resident software logic.

.2 Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.

.3 Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.

.4 Economizer Preferred Cooling - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

.5 Provide programmable electronic microcomputer based zone control.

.6 Zone control shall incorporate:

.1 Automatic changeover from heating to cooling.

.2 Set-up for at least 2 - sets of separate heating and cooling temperatures per day.

.3 Instant override of setpoint for continuous or timed period from one hour to 31 days.

.4 Switch selection features including Fahrenheit display, 12 or 24-hour clock, keyboard disable, remote sensor, fan on-auto.

.5 Smart Fan Operation: Allows the unit fan operation to default to the Auto Mode during unoccupied periods, regardless of the Fan switch position.

.6 Economizer Minimum Position Override: Allows the unit controller to override and close the minimum position setting on the economizer damper during unoccupied time periods.

.7 Zone sensor display shall be capable of:

.1 Time of day.

.2 Actual room temperature.

.3 Programmed temperature.

.4 Programmed time.

.5 Duration of timed override.

.6 Day of week.

.7 System mode indication: heating, cooling, low battery, and fan on.

.8 Provide remote temperature sensor capability.

32.18. Roof curb

.9 Contractor shall provide factory supplied roof curb, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.

32.19. Convenient Outlet:

.10 The rooftop units shall be provided complete with factory installed convenient outlet. The roof top units shall be a single point of power and the convenient outlet shall be powered from the unit electrical distribution. The power supply to the outlet shall bypass the unit disconnect switch so the outlet is powered if the unit is electrically isolated (e.g., outlet not disconnected by switch).

32.20. Examination

.11 Contractor shall verify that roof is ready to receive work and opening dimensions are as detailed on supplier shop drawings.

.12 Contractor shall verify that proper power supply is available.

32.21. Installation

.13 Contractor shall install in accordance with manufacturer's instructions.

.14 Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

33. Ductwork – galvanized steel

33.1. Provide galvanized sheet metal ductwork in accordance with SMACNA Standards suitable for operating pressure of 500 Pa and less.

33.2. Balance dampers to be 0.76 mm thick, single blade with 0.4 mm shaft diameter and end bearings. Operator to be lockable quadrant type.

33.3. All joints shall be made up of airtight using Duro-Dyne S-2 duct sealer. Sealer shall be applied to all joints and seams of supply, return and exhaust ductwork.

33.4. All ducts having any size over 12" shall be reinforced by cross bracing.

33.5. All ducts shall be supported by 1" wide (16 ga.) galvanized vent hangers fastened to the side and bottom of the ducts by bolts, rivets, or metal screws. Duct hangers shall be suspended from structural bearings such as beams, top chords, or structural concrete slabs. Where structural bearings do not exist, the contractor shall provide angle or channel iron members from the nearest structural bearings to support hangers.

33.6. Contractor shall provide adequate protection of duct openings during construction and demolition to protect from construction dust & debris.

34. Ductwork – flexible

34.1. Flexible ductwork may be installed in concealed areas. Flexible ducts must be secured to solid duct.

34.2. Ducts shall conform to and be installed in accordance with NFPA Standard 90A.

34.3. Radius of bends shall be minimum one duct diameter centerline radius.

34.4. Ducts shall be non-metallic construction and insulated with 1" fibreglass insulation with integral vapour barrier, rated for 4"sp.

35. Ductwork insulation & Finish

35.1. "Concealed" insulated mechanical services in furred spaces, shafts and hung ceilings considered to be concealed.

35.2. "Exposed" will mean not concealed.

35.3. Install 2" acoustic insulation on supply and return duct within 5ft of air handling equipment.

35.4. Externally insulate all concealed rigid supply air ducts and plenums.

35.5. Flame spread ratings and smoke developed classifications shall comply with the current BC building code and NFPA 90A. Generally the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

35.6. Insulation thickness and insulating values shall be in accordance with current ASHRAE 90.1.

35.7. Apply external insulation to ductwork only after all tests have been made and systems accepted by the construction manager as airtight.

35.8. Apply insulation and insulation finish in a workmanlike manner so that the finished product is uniform, smooth in finish, pleasing to the eye and with longitudinal seams concealed from view.

Apply ductwork insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

35.9. Insulation and vapour barrier shall be continuous through all non-rated separations.

35.10. Terminate insulation short of all control, smoke and fire dampers so as not to interfere with their operation (where applicable).

35.11. Exposed duct insulation shall have a minimum density - 12 kg/cu.m. (3/4 lbs/cu. Ft.). Thermal conductivity at 24 deg.c. - 0.042 w/m/deg.c.

35.12. Insulation shall be adhered to the duct with 100 mm (4") wide strips of adhesive around the duct at approximately 300 mm (12") centres.

35.13. Insulation shall be wrapped around the duct with all edges butted. The jacket shall overlap 50 mm (2") at all joints and shall be stapled using flare type staples at maximum 150mm (6") centres.

35.14. All joints, seams, breaks, pinheads, staples, etc., in the jacket shall be sealed with 75 mm (3") wide vapour barrier RFFRK tape.

35.15. Insulation on exposed ductwork shall have rd/3 premium quality finish. Apply treated canvas jacket over insulation using fabric adhesive. Finish canvas jacket with one (1) coat of fabric coating.

35.16. Ducts exposed to weather, shall have watertight mechanical connections and receive exterior duct sealant treatment that is capable of bonding well to galvanized metal. Exterior duct sealant shall have a service temperature rating of -30°F (-34°C) to 175°F (79°C). Duct sealant shall be ultraviolet-ray and ozone resistant. Duct shall not be pressurized until sealant has time to cure.

35.17. Duct sealant is not limited to materials of adhesive or mastic nature, but is inclusive of tapes and combinations of woven fabric strips and mastics.

36. Internal Insulation

36.1. Internal duct insulation for acoustic or thermal properties shall be flexible fibreglass duct liner with air stream side faced with matte facing. Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Thickness 1”, (25) mm thick, or as shown, density: 24 kg/m3 minimum.

36.2. Acceptable material: Manson Acoustic-Liner coated duct liner; Knauf flexible coated Dual liner M.

36.3. Install in accordance with recommendations of SMACNA duct liner standards.

36.4. Duct dimensions, as indicated, are clear inside duct lining.

36.5. Fasten to interior sheet metal surface with 100% coverage of adhesive. In addition to adhesive, install weld pins not less than two rows per surface and not more than 425 mm on centres. Impale insulation on pens, coated side exposed to airstream and secure with holding washers cover washers with reinforcing membrane and insulation coating/sealer.

36.6. Seal butt joints, exposed edges; weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Seal longitudinal joints of insulation with coating sealer. Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

37. Natural Gas Piping

37.1. Natural gas piping shall be installed to CAN/CGA-N149.1 (current edition) and to Fortis gas standards.

37.2. Provide lockable shut-off at connection to gas fired equipment.

37.3. Provide new gas regulators for new rooftop units.

37.4. Provide approved flexible connectors at point of connection to RTU.

37.5. Install piping on roof using C-Port rubber bases, minimum 1.8 m on centre.

37.6. Pipe

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.

.2 Copper tube: to ASTM B837.

37.7. Jointing material

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Brazing: to ASTM B837.

37.8. Fittings

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ASME B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ASME B16.18.

.2 Wrought copper fittings: to ASME B16.22.

37.9. Valves

.1 Provincial Code approved, lubricated plug type.

37.10. Execution

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

.2 Install in accordance applicable Provincial/Territorial Codes, CAN/CSA B149.1, CAN/CSA B149.2.

.3 Provide gas piping for the new rooftop units as per rooftop unit manufacturer’s recommendation and up to the latest version of the BC Gas Code.

.4 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

.5 Install valves with stems upright or horizontal unless otherwise indicated.

.6 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

.7 Test system in accordance with CAN/CSA B149.1 CAN/CSA B149.2 and requirements of authorities having jurisdiction.

.8 Purging: purge after pressure test in accordance with CAN/CSA B149.1 CAN/CSA B149.2.

.9 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.10 Perform cleaning operations in accordance with manufacturer's recommendations.

.11 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

38. Equipment Labelling

38.1. Provide lamacoid labels on all new equipment and where noted on the drawings.

38.2. Provide lamacoid labels as a minimum, but not be limited to, on the rooftop units.

38.3. All lamacoid labels shall be minimum of 1”, (25 mm) high.

38.4. Identify contents by background colour marking, pictogram (as necessary), legend, direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

39. Manufacturer's Equipment Nameplates

39.1. Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

39.2. Lettering and numbers raised or recessed.

39.3. Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

40. Piping Labelling

40.1. Legend: Block capitals to sizes and colours listed in CAN/CGSB 24.3.

40.2. Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

40.3. Extent of background colour marking:

.4 To full circumference of pipe or insulation.

40.4. Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

40.5. Colours and Legends:

.1 Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Notes
Natural Gas	To Codes	Painted yellow in accordance with CSA requirements
Gas regulator vents	To Codes	

41. Controls Components Identification

41.1. Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

41.2. Inscriptions to include function and (where appropriate) fail-safe position.

42. Direct Digital Controls – General

42.1. Contractor shall upgrade the existing Delta Controls DDC System to monitor and control the three new dual fuel roof top units. The new DDC System shall include capability to access via a remote web based portal to monitor, review trends, adjust set points etc. This shall be specified and agreed with RDOS Information Services prior to project initiation.

42.2. The new DDC system shall allow for future expansion of connection from other buildings. The site shall act as a central DDC hub for DDC Controls of this site and future building connections. Contractor shall allow future design considerations for approximately 20 buildings.

42.3. The new DDC system shall be installed in the existing electrical room.

42.4. The new RTU's shall be configured for the heat-pump to provide first stage heating and cooling. 2nd stage heating will be provided by the gas fired section when the ambient conditions prevent the heat pump from operating. Existing equipment, controllers and field devices shall be reused where appropriate and replaced/upgraded as required.

42.5. The existing economizer module shall be disabled, and the economizer shall be controlled by the DDC system. Existing outdoor air damper actuator can be re-used if compatible with the DDC system.

42.6. RTU-1 rooftop unit serving the south and central areas will be replaced with a Dual Fuel RTU. Remove existing networked thermostat and replace the thermostat with a DDC controller. Existing space temperature sensors to be replaced with a new temperature sensor. Controller to be

installed in a control panel above the drop ceiling or inside the associated RTU. New space temperature sensor to be installed in the old location. DDC contractor shall re-wire all points to the new unit and revise existing program code as per sequences of operation in this specification.

42.7. RTU-2 rooftop unit serving the north and northwest areas will be replaced with a Dual Fuel RTU Remove existing networked thermostat and replace the thermostat with a DDC controller. Existing space temperature sensors to be replaced with a new temperature sensor. Controller to be installed in a control panel above the drop ceiling or inside the associated RTU. New space temperature sensor to be installed in the old location. DDC contractor shall re-wire all points to the new unit and revise existing program code as per sequences of operation in this specification.

42.8. RTU-3 rooftop unit serving the northeast and southeast areas will be replaced with a Dual Fuel RTU. Remove existing networked thermostat and replace the thermostat with a DDC controller. Existing space temperature sensors to be replaced with a new temperature sensor. Controller to be installed in a control panel above the drop ceiling or inside the associated RTU. New space temperature sensor to be installed in the old location. DDC contractor shall re-wire all points to the new unit and revise existing program code as per sequences of operation in this specification.

43. New Points list

RTU-1 DDC Controller

Point	Label	Point Description	Device	Comments
xx_IP1	RTU1_SAT	RTU-1 Supply Air Temperature	Duct Temperature Sensor	Replace
xx_IP2	RTU1_MAT	RTU-1 Mixing Air Temperature	Duct Temperature Sensor, averaging	Replace
xx_IP3	RTU1_RAT	RTU-1 Return Air Temperature	Duct Temperature Sensor	Replace
xx_IP4	RTU1_SF_S	RTU-1 Supply Fan Status	Current Transducer	Replace
Network	RTU1_RT	RTU-1 Room Temperature	Room Temperature Sensor	New
BACnet	RTU1_CLG_S	RTU-1 Cooling Status	-	
BACnet	RTU1_HTG_S	RTU-1 Heating Status	-	
BACnet	RTU1_ALM	RTU-1 Alarm	-	
BO1	RTU1_SF_C	RTU-1 Supply Fan Command	Control Relay	New
BO2	RTU1_CLG1_C	RTU-1 Compressor 1 Command	Control Relay	New
BO3	RTU1_HTG1_C	RTU-1 Heating Stage 1 Command	Control Relay	New
BO4	RTU1_HTG2_C	RTU-1 Heating Stage 2 Command	Control Relay	New
AO5	RTU1_MAD_C	RTU-1 Mixing Dampers Command	Damper Actuator 0-10VDC Signal	Existing

RTU-2 DDC Controller

Point	Label	Point Description	Device	Comments
xx_IP1	RTU2_SAT	RTU-2 Supply Air Temperature	Duct Temperature Sensor	New
xx_IP2	RTU2_MAT	RTU-2 Mixing Air Temperature	Duct Temperature Sensor, averaging	New
xx_IP3	RTU2_RAT	RTU-2 Return Air Temperature	Duct Temperature Sensor	New

xx_IP4	RTU2_SF_S	RTU-2 Supply Fan Status	Current Transducer	New
Network	RTU2_RT	RTU-2 Room Temperature	Room Temperature Sensor	New
BACnet	RTU2_CLG_S	RTU-2 Cooling Status	-	
BACnet	RTU2_HTG_S	RTU-2 Heating Status	-	
BACnet	RTU2_ALM	RTU-2 Alarm	-	
BO1	RTU2_SF_C	RTU-2 Supply Fan Command	Control Relay (Dry Contact)	New
BO2	RTU2_CLG1_C	RTU-2 Compressor 1 Command	Control Relay (Dry Contact)	New
BO3	RTU2_HTG1_C	RTU-2 Heating Stage 1 Command	Control Relay (Dry Contact)	New
BO4	RTU2_HTG2_C	RTU-2 Heating Stage 2 Command	Control Relay (Dry Contact)	New
AO5	RTU2_MAD_C	RTU-2 Mixing Dampers Command	Damper Actuator 0-10VDC Signal	Existing

RTU-3 DDC Controller

Point	Label	Point Description	Device	Comments
xx_IP1	RTU3_SAT	RTU-3 Supply Air Temperature	Duct Temperature Sensor	New
xx_IP2	RTU3_MAT	RTU-3 Mixing Air Temperature	Duct Temperature Sensor, averaging	New
xx_IP3	RTU3_RAT	RTU-3 Return Air Temperature	Duct Temperature Sensor	New
xx_IP4	RTU3_SF_S	RTU-3 Supply Fan Status	Current Transducer	New
Network	RTU3_RT	RTU-3 Room Temperature	Room Temperature Sensor	New
BACnet	RTU3_CLG_S	RTU-3 Cooling Status	-	
BACnet	RTU3_HTG_S	RTU-3 Heating Status	-	
BACnet	RTU3_ALM	RTU-3 Alarm	-	
BO1	RTU3_SF_C	RTU-3 Supply Fan Command	Control Relay (Dry Contact)	New
BO2	RTU3_CLG1_C	RTU-3 Compressor 1 Command	Control Relay (Dry Contact)	New
BO3	RTU3_HTG1_C	RTU-3 Heating Stage 1 Command	Control Relay (Dry Contact)	New
BO4	RTU3_HTG2_C	RTU-3 Heating Stage 2 Command	Control Relay (Dry Contact)	New
AO5	RTU3_MAD_C	RTU-3 Mixing Dampers Command	Damper Actuator 0-10VDC Signal	Existing

44. Sequences of Operation

44.1. Start-up:

.1 The rooftop units shall operate in occupied hours based on a system specific weekly schedule per unit subject to the global holiday calendar.

.2 Once supply fan operation is confirmed the outdoor air damper shall slowly ramp to its minimum position.

.3 If proper operation is not established after a timed delay an alarm shall be annunciated at the operator workstation. On a supply fan failure alarm, the mixing dampers shall be set to full recirculation.

.4 Cooling mode shall be locked-out when the outdoor air temperature is lower than 15°C (adjustable) for more than 30 minutes.

.5 Heating mode shall be locked-out when the outdoor air temperature is higher than 17°C (adjustable) for more than 30 minutes.

44.2. Morning Warm-up Mode / Optimum Start:

.1 Both a heating and cooling optimum start algorithm shall be applied to enable the heat pump at the latest possible time prior to weekly schedule start times so as to attain occupied space temperature (±1°C) at the weekly schedule start time (commencement of occupancy).

.2 The optimum start routine shall, at a minimum, be based on prevailing outdoor air temperature, average space temperature and the period of time since the prior weekly schedule stop time.

.3 The outdoor air damper shall be allowed to fully close during the warm-up period.

.4 The optimal start period shall be limited to a maximum of two hours.

.5 During morning warm-up mode, the main heating source shall be the roof top unit heat pump (subject to ambient lockout temperature). When the zone temperature is less than 3°C below setpoint, the auxiliary gas fired heating will be disabled. When the zone temperature is more than 3°C (adjustable) below than the setpoint, the gas fired heating shall be enabled to provide supplemental heating.

44.3. Occupied Mode:

.1 The supply fan shall run continuously during occupied periods.

.2 Temperature setpoints shall be set based on a nominal setpoint. Cooling setpoint shall be set as +1.5ºC and the heating setpoint as -1.5ºC of the nominal temperature setpoint (3ºC deadband)

.3 Economizer Control:

.4 The economizer shall be enabled on a call for cooling and when the outdoor air temperature is 2°C below the return air temperature. The mixing damper position shall be overridden to maintain a minimum mixed air temperature of 10°C. The economizer shall be disabled when the outdoor air temperature is equal to the return air temperature. When the economizer is disabled the mixing dampers shall move to the minimum outdoor air damper position.

.5 Mixing dampers shall be controlled based on system start-up ramp, mixed air low limit (freeze protection) and supply air temperature control (split range)

.6 Cooling Mode:

.7 On a call for cooling the DDC system shall modulate the mixing air dampers when the economizer is enabled to maintain a supply air temperature setpoint from 13ºC (low limit setpoint adjustable) to 22ºC (high limit setpoint adjustable) as reset by a room temperature control loop.

.8 The heat pump compressor shall start in cooling mode when the zone temperature rises 1.5°C above the occupied zone temperature setpoint (default 22.5°C).

.9 Subject to a 5-minute minimum run time, the compressor shall stop when the space temperature falls to the occupied zone temperature setpoint.

.10 When the mechanical cooling is enabled, the DDC system shall modulate the outdoor air damper to the minimum damper position.

.11 Heating Mode:

.12 The heat pump compressor shall start in heating mode when the zone temperature falls 1.5°C below the occupied zone temperature setpoint (default 22.5°C).

.13 Subject to a 5-minute minimum run time, the compressor shall stop when the space temperature rises to the occupied zone temperature setpoint.

.14 The heating shall be enabled only after the mixing dampers have moved to the minimum air damper position.

.15 The auxiliary gas fired heating shall be enabled if the ambient air temperature is outside the safe operating limits of the heat pump (-5°C, adjustable) or if the unit is in heating mode for more than 45 minutes (adjustable) and the room temperature is still 1.5ºC below the occupied temperature setpoint.

.16 The auxiliary heating shall be disabled when the room temperature reaches 0.5ºC below the occupied temperature setpoint.

.17 A 10-minute delay shall be applied before switching the unit from cooling mode to heating, and vice-versa.

44.4. Unoccupied Mode:

.1 During unoccupied mode the supply fan shall be off and the outdoor air damper closed.

.2 The rooftop unit shall start in full recirculation mode if the space temperature decreases below the unoccupied temperature initially set at 17ºC (adjustable). The rooftop unit shall stop when the space temperature increase 2ºC above the unoccupied temperature setpoint.

44.5. Pandemic Override Mode

.1 Pandemic mode shall be manually enabled and disabled through the DDC system. A ‘Pandemic Override Mode’ switch shall be incorporated on the system graphics.

.2 During ‘Pandemic Override Mode’, the supply fan shall run continuously as occupancy requirements dictate. The outdoor air damper shall be opened to maximum possible position, whilst still continuing to maintain zone temperature setpoint.

.3 Temperature setpoints shall be set based occupied mode and unoccupied modes as described above.

.4 During heating mode, while the auxiliary gas fired heating is in operation, and during cooling mode, when the space temperature deviates 2°C from the zone temperature setpoint, the outdoor air damper position will modulate to reduce the amount of outdoor air.

.5 The supply fan shall start 2 hours (adjustable) before scheduled occupancy to perform a morning building flush. The outdoor air damper shall maintain the minimum position for the duration of the building flush unless required as per the economizer control sequence above.

.6 The supply fan shall run on for 2 hours (adjustable) after scheduled occupancy periods to perform an evening building flush. The outdoor air damper shall maintain the minimum position for the duration of the building flush.

45. Alarms

45.1. The following alarms shall be enunciated at the DDC operators workstation:

Alarm	Alarm Source	High Limit	Low Limit
Space Temperature Extreme	Space Temp Sensor	SP + 3°C	SP - 3°C
Supply Temperature Extreme	Supply Temp Sensor	SP + 5°C	SP - 3°C
Low Mixed Air Temperature	MAT Sensor	-	< 4°C
Supply Fan failure	Fan Motor Status	-	-
Cooling failure (*)	Supply Air Temp	RMT - 4ºC	-
Heating Failure (**)	Supply Air Temp	RMT + 4ºC	-
CO_2 Concentration	CO_2 Sensor	1200 ppm	350 ppm

(*) Cooling failure alarm shall be generated if the unit has been operating in cooling mode for a period of 10 minutes continuous and the discharge air temperature is less than 4ºC below the room temperature.

(**) Heating failure alarm shall be generated if the heating has been operating in heating mode for a period of 10 minutes continuous and the discharge air temperature is less than 4ºC above the room temperature.

45.2. Applicable interlocks as well as adequate time delay shall be provided to avoid nuisance alarms caused by changes of state as well normal temperature recovery period.

46. Software and System Graphics

46.1. System graphic screen shall indicate the complete equipment layout with all inputs, outputs, setpoints, and alarms. Provide navigation buttons to main menu, associated trends and associated screens. All setpoints shall be adjustable at graphic screen.

46.2. Provide a floor plan indicating the rooftop air units; room temperature and setpoint; and mode of operation (heating /off/cooling). Blocks with temperature indication should change its colour as referenced to setpoint.

46.3. Provide a graphic screen with a table showing the heat pump fan command and status operating mode (heating /off/cooling), supply air temperature, room temperatures and setpoints. Table shall provide links to specific trend and to the heat pump system schematic screen.

47. Trends

47.1. Provide 300 sample trends, at 15-minute intervals as applicable, for the following points/variables:

Trend 1 (Cooling):

Point	Trend Type
Outdoor Air Temperature	Polling
Room Temperature	Polling
Mixed Air Temperature	Polling
Supply Air Temperature	Polling
Supply Air Temperature Setpoint	Polling
Mixing Damper Command	Polling
Cooling Command	Polling
Supply Fan Status	Polling

Trend 2 (Heating):

Point	Trend Type
Outdoor Air Temperature	Polling
Room Temperature	Polling
Mixed Air Temperature	Polling
Supply Air Temperature	Polling
Supply Air Temperature Setpoint	Polling
Mixing Damper Command	Polling
Heating Stage 1 Command	Polling
Heating Stage 2 Command	Polling
Supply Fan Status	Polling

48. Run Time Logs

48.1. Run time totalizers shall be provided as follows:

Supply Fan Status
Heating Command
Cooling Command

48.2. Totalizers shall be reset on an annual basis or by command by the building operator.

49. Direct Digital Controls – ALTERNATE PRICING

49.1. Contractor to provide alternate pricing for basic RTU control via programmable unit controllers.

49.2. Each Dual Fuel RTU shall be controlled locally by its onboard ReliaTel controller.

49.3. All units shall be equipped with economizer module, dry bulb sensor, onboard micro processor control and remote sensors as required.

49.4. The compatible programmable thermostat controllers shall be used as per manufactures requirements.

49.5. The supply fan shall operate as per schedule.

49.6. The heat pump shall operate as first stage heating and the gas burner shall operate as second stage heating.

49.7. Heating shall be enabled when the zone temperature is 2°C below the heating setpoint (recommended 18°C).

49.8. Heating shall be disabled when the zone temperature is 1°C above the heating setpoint.

49.9. Cooling shall be enabled when the zone temperature is 1°C above the cooling setpoint (recommended 24°C).

49.10. Cooling shall be disabled when the zone temperature is 2°C below the cooling setpoint.

49.11. The minimum outdoor air damper shall be set to 10%.

49.12. The outdoor air damper shall modulate to optimize free cooling when available.

Part 3 Electrical Specification

50. Governing regulations, codes and standards

50.1. The installation shall comply with the latest editions of the CEC and all applicable local Province of British Columbia codes and standards. Including:

.1	BCBC	British Columbia Building Code (2018)
.2	EIA	Electronic Industries Association
.3	IEEE	Institute of Electrical and Electronic Engineers
.4	Worksafe BC	The Workers' Compensation Board of BC
.5	EEMAC of Canada	Electrical and Electronic Equipment Manufacturers Association
.6	CSA	Canadian Standards Association
.7	NEMA	National Electrical Manufacturer's Association
.8	NFPA	National Fire Protection Association
.9	ULC	Underwriters Laboratory of Canada
.10	NBC-2018	National Building Code of Canada.

51. Quality assurance

51.1. Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold a valid Master Electrical Contractor license or are employed by such an entity. Apprentices may conduct Work under the supervision of a journeyman electrician in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

51.2. Employees registered in provincial apprentices' program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

51.3. Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

52. Examination of site

52.1. Carefully examine the site and conditions of the proposed Work together with the Work of all other trades and include in the tender price all costs for Work such as cutting and patching, rerouting and repositioning of electrical equipment and wiring, made necessary to accommodate any architectural renovations and electrical systems shown. Cutting and patching of new and existing building to accommodate the Work of this trade shall be done by workmen skilled in the appropriate trades.

52.2. No consideration will be granted for any misunderstanding of work to be done resulting from failure to visit the site.

52.3. When the contract documents do not contain sufficient information for the proper selection of equipment for bidding, notify the design authority during the tendering period. If clarification is not obtained, allow for the most expensive arrangement. Failure to do this shall not relieve the contractor of responsibility to supply the intended equipment.

52.4. Check drawings of all trades and survey the site to verify space availability for the installation. Co-ordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent without written approval.

52.5. The dimensions of existing work shown on the drawings are approximate and the contractor must take actual measurements before ordering materials, equipment and the like. Failure to comply with this requirement will make the contractor fully responsible for replacing such material or equipment at no extra cost to the contract.

53. Shop drawings

53.1. Prior to ordering materials, submit in the form of a PDF via email shop drawings for all major electrical equipment and fire proofing for review. All drawings shall be complete with following information:

.11 Manufacturers and Suppliers name

.12 Catalogue model number

.13 Project name

.14 Contractor stamp and signature that drawing has been reviewed

54. Penetrations

54.1. All services penetrating the floor slab and walls shall be in conduit unless specified otherwise. All existing or new penetrations through floor or walls for cables, conduits or services shall be sealed with an approved non-shrink, waterproof and fireproof sealant and reviewed by design consultant and building Owner prior to drilling. Floor slabs should be x-rayed prior to any drilling, Contractor must repair any damaged services.

55. Demolition

55.1. Include in the tender price for the removal and re-installation of luminaires, wiring devices and equipment made necessary due to installation of new equipment. Cut back and cap unused raceways and outlets and remove unused wiring back to panelboard in an approved manner to a concealed location so that the finished Work appears neat and clean.

55.2. Prior to disposal of any major equipment shown to be removed, coordinate with owner for any devices to be turned over to owner for future use. Devices shall be stored in dry conditions prior to turn over.

55.3. All devices may not be shown on drawings. Contractor shall be responsible to review the site for existing devices in the vicinity of the scope of work to ensure no interference with existing services.

56. Clean up

56.1. Remove and clean up any debris or material from the site throughout the duration of the contract and on completion of the Work as directed by Owner's Representative.

57. Shutdowns

57.1. Arrange with the building Owner for necessary shutdowns of systems and include overtime costs in the tender for tie-ins to be done on weekends and at other times suitable to the Owner and building Owner.

57.2. Protect Work of this and other trades, existing finishes, systems and services which must remain in operation. Replace and/or reinstall any existing services which are to remain that are improperly installed or create any interferences with new construction.

57.3. Schedule and co-ordinate all Work with other trades and Owner before installation of equipment to avoid conflict during or after installation.

58. Panelboards, splitters & safety switches

58.1. Upon completion of project, provide typed directory indicating description of each circuit for each new panelboard or in panelboards where modifications have occurred.

58.2. Fusible devices shall be of heavy duty type with fuse clips and English Electric or Gould Shawmut class "J" fuses.

59. Wiring devices

59.1. All wiring, devices, luminaires and equipment shall be new and CSA or suitably approved unless otherwise noted.

59.2. Generally, junction/terminal boxes located inside shall be rated to match existing.

59.3. Exposed coverplates shall be to match existing. Provide blank insert in unused portions of coverplates as required, colour to match devices. Install after final painting flush with the wall. Provide circuit identification on each receptacle coverplate, utilizing clear white adhesive tape with black lettering.

59.4. Existing holes not required shall be filled, flush with existing floor slab, with non-shrinking cement compound.

60. Conductors, wires and cables

60.1. All conductors are to be copper conductors sized as per CEC Table 16. All AWG sizes given in this specification and drawings refer to the copper AWG size.

60.2. All wiring shall be colour coded copper min. #12 AWG RW-90 X-link for runs up to 23 m (75'-0") and #10 AWG over 23 m (75'-0") unless otherwise noted. Wire shall be run concealed in EMT conduit.

60.3. Conduits as routed through concrete slabs on grade or at building exteriors shall be rigid conduit or PVC type. If PVC is utilized, include a code sized grounding conductor. PVC shall be increased in size indicated to allow for the additional ground wire.

60.4. Wiring shall be continuous from power source to equipment. Where splices are required, they shall be made only in approved fittings or junction boxes.

60.5. All wiring including spares shall be identified at each end and in pull boxes.

60.6. All power wire termination shall be crimp type, single or double bolt lug. All equipment that is furnished with setscrew type lugs for exterior connections shall be replaced with crimp type lugs except for equipment that is designed to accept setscrew type lugs only, such as circuit breakers and motor starter units.

61. Mechanical equipment

61.1. Supply and install all safety switches, starter switches, overloads, magnetic contactors and relays for the control and protection of circuits as shown on the drawings.

61.2. Fusible and non-fusible disconnect safety switch sizes shall Quick-make, Quick-break type and sized as indicated on drawings. Safety switches shall be complete fuse holders and mechanically interlocked door to prevent opening when handle is in ON position.

61.3. Provide "NEMA" rating enclosures for motor starters and safety switches to suit the horsepower rating of the motor they control and protect.

62. Sleeves

62.1. Maintain the integrity of the fire rating of the floors and walls around electrical raceways and/or cables passing through such floors and/or walls.

62.2. Materials used to maintain rating to have a minimum two (2) hour ULC listed rating or as required by room classification.

62.3. All services penetrating the floor slab, or any fire-rated surface shall be sealed with an approved non-shrink, waterproof and fireproof sealant, Hilti FS-ONE or accepted equivalent.

62.4. Provide sleeves of galvanized steel for conduit and cable runs passing through concrete walls, beams, slabs and floor.

63. Wiring methods

63.1. Cable that are routed through return air plenums must be FT-6 rated to suit local flame spread and smoke development requirements. (no jacket on cables).

63.2. All cables not installed in cable tray shall be adequately supported every 1m using cable clamping hardware (no ty-wraps).

63.3. Conduit is to be of sufficient size to permit easy removal of conductors at any time. Conduit sizes, where shown, are minimum and shall not be reduced. Do not bend conduit over sharp objects. Improperly formed bends and running threads will not be accepted. Do not use bends and fittings together.

63.4. Run conduits and cables in finished areas concealed, above finished ceilings, under floors, in walls and in partitions. Run conduit and cables in unfinished areas, exposed and install at right angles or parallel to building lines, accurate in line and level.

63.5. Install conduit and cables to avoid proximity to water and heating pipes. They are not to be run within 152.4 mm (6”) of such pipes except where crossings are unavoidable, in which case they are to be kept at least 25 mm (1”) from covering of pipe crossed.

63.6. Provide expansion joint sleeves with ground jumpers in conduit runs where they cross building expansion joints.

63.7. Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

63.8. Fasten exposed conduit or cables to building construction or support system using straps.

63.9. One hole steel straps to secure surface conduits and cables 50 mm and smaller.

63.10. Two hole steel straps for conduits and cables larger than 50 mm.

63.11. Beam clamps to secure conduit to exposed steel work.

63.12. Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

63.13. All 120/208V (3ph, 4w) conductors shall be identified as follows:

.15	Phase A	Red
.16	Phase B	Black
.17	Phase C	Blue
.18	Neutral Conductor	White
.19	Ground conductor	Green

63.14. Color coding shall be accomplished using pigmented or dyed insulation on conductors No. 8 and smaller. Paint shall not be used for color coding of conductors larger than No. 8.

63.15. Provide code sized ground line in each new service. Conduit cannot be used as ground.

63.16. Provide laminated plastic or lamacoid nameplates, black letters over white secured with stainless steel screws.

63.17. Install conduits and cables to provide maximum head room and to interfere as little as possible with free use of spaces through which they pass. They shall be installed as close to building structure as possible. Install conduit and cables to avoid proximity to water and heating pipes. They shall not be run within 6" (150mm) of such pipes except where crossing are unavoidable, in which case they shall be kept at least 1" (25mm) from covering of pipe crossed.

63.18. Carefully routes new conduits and other new services so that they do not interfere with existing installation. Arrange and pay for any necessary relocation of existing conduit, cable tray, bus duct or any other services required for the proper installation of new Work, regardless of whether the conduit, tray or duct to be moved is the work of trade doing new Work.

64. Inspection, tests and pre-commissioning

64.1. The Contractor shall perform inspection, testing, and calibration of electrical equipment and systems. Testing shall be carried out using trained and qualified staff or a sub-contracted specialist testing company. Manufacturer representatives shall be used for specialised equipment testing and commissioning to maintain the equipment warranty or where the Contractor of testing company lacks the specific training required to adequately and safely perform the task.

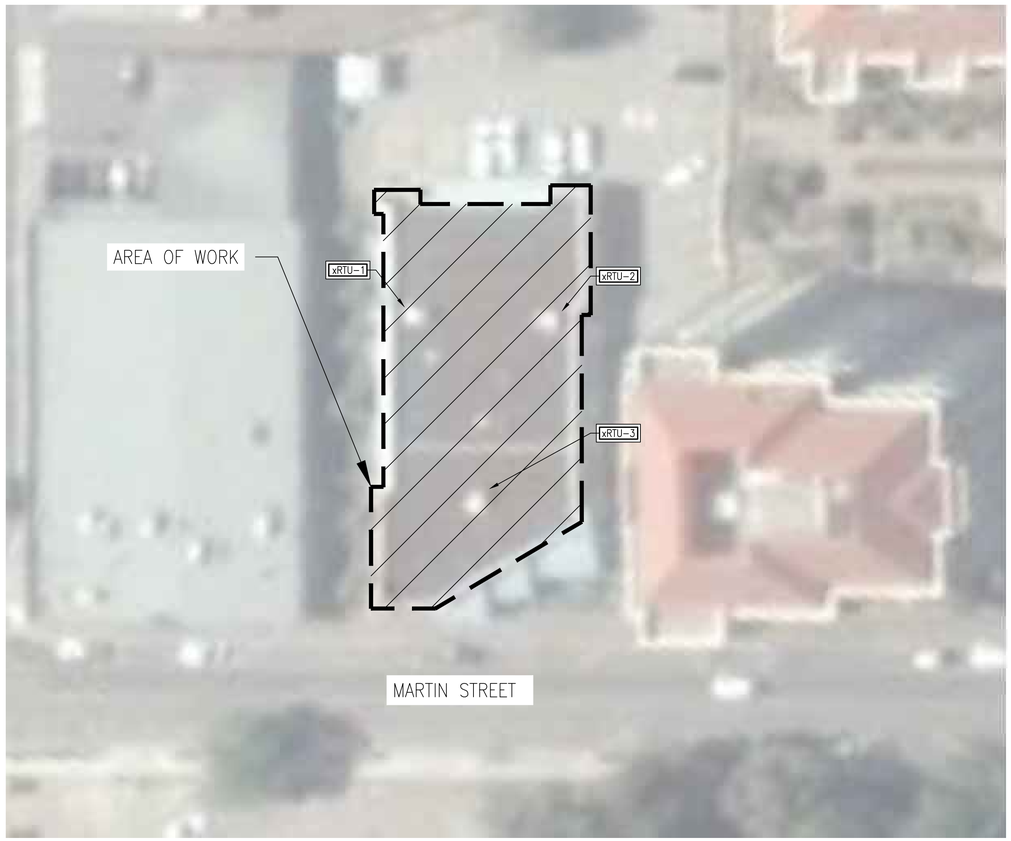
64.2. The Owner reserves the right to inspect and test any portion of the equipment and materials at any time during the installation process.

64.3. Before connecting fixtures or equipment to the wiring system, the Contractor shall first verify that all wiring and connections are free from short-circuits, open-circuits and unintentional grounds.

64.4. The Contractor shall work with the Mechanical trade to test the entire system including VFD's, relays and motors in the presence of the Owner or the Owner's representative and verify that the entire electrical system is properly installed before energizations of any portion of the electrical system. All equipment required to test the electrical system or system components shall be provided by and at the expense of the Contractor.

64.5. Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

End of Section



TRUE NORTH

PROJECT NORTH

1 M-1 SITE PLAN
SCALE: NTS

MECHANICAL LEGEND

SYMBOL	DESCRIPTION
X-X-X	EQUIPMENT TAG
#	DRAWING NOTE

PLUMBING LEGEND

SYMBOL	DESCRIPTION
GAS	GAS PIPING - NEW
GAS	GAS PIPING - EXIST.
	PRESSURE REDUCING VALVE
	ISOLATION/SHUT OFF VALVE
	TIE INTO EXISTING PIPING

DRAWING LIST

DWG NO.	DESCRIPTION	SCALE
M-1	GENERAL AND MECHANICAL SPECIFICATIONS, LEGENDS AND DRAWING LIST	NTS
M-2	ROOFTOP AND 1ST FLOOR PLAN - DEMO AND NEW	1/8" = 1'-0"
M-3	DETAILS AND SCHEDULES	NTS

PROJECT INFORMATION

CIVIC ADDRESS: 101 MARTIN STREET, PENTICTON, BC V2A 59J

GENERAL NOTES

GENERAL:

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS.
2. THE MECHANICAL SYSTEMS CONSIST OF ALL WORK INDICATED ON THE DRAWINGS, SCHEMATICS, DIAGRAMS, AND AS DESCRIBED IN THE SPECIFICATIONS.
3. THE MECHANICAL DRAWINGS ARE DIAGRAMMATIC IN NATURE AND DO NOT ATTEMPT TO SHOW ALL REQUIRED OFFSETS.
4. WHERE THERE IS A CONFLICT BETWEEN THE DRAWINGS AND THE SPECIFICATIONS, THE MOST STRINGENT REQUIREMENT SHALL APPLY.
5. COORDINATE ALL MECHANICAL WORK WITH OTHER TRADES TO ENSURE PROPER AND ADEQUATE INTERFACE WITH THE WORK OUTLINE FOR THIS PROJECT.
6. PROVIDE CANADIAN ELECTRICAL CODE (CEC) REQUIRED CLEARANCES FOR ALL INSTALLED EQUIPMENT. OFFSET MECHANICAL WORK AS REQUIRED TO SUIT THIS REQUIREMENT.
7. WHERE PIPING, DUCTWORK, CONTROLS, ETC. ARE TO BE REMOVED, CONTRACTOR SHALL VERIFY DETAILS ON SITE. ALL WALLS, CEILING AND FLOOR UNUSED OPENINGS ARE TO BE REPAIRED WITH THE SAME CONSTRUCTION MATERIAL AND ASSEMBLY DETAILS AND TO MATCH EXISTING FINISH WHERE NO LONGER REQUIRED.
8. ANY NEW OPENING OR CORING REQUIRED FOR NEW PIPING AND DUCTWORK SHALL BE APPROVED BY THE STRUCTURAL ENGINEER RETAINED BY CONTRACTOR. ALL NEW STRUCTURAL OPENINGS SHALL BE X-RAYED OR SCANNED PRIOR TO CORING/CUTTING.
9. WHERE NEW DUCTWORK OR PIPING IS ADDED OR EXTENDED FROM EXISTING DUCTWORK OR PIPING, CONTRACTOR SHALL VERIFY SIZE AND DETAILS ON SITE AND PROVIDED REQUIRED TRANSITIONS TO SUIT.

SEISMIC RESTRAINTS:

1. THE MECHANICAL CONTRACTOR SHALL RETAIN THE SERVICES OF A PROFESSIONAL ENGINEER, REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA, TO PROVIDE A COMPLETE DESIGN, SIZING AND DETAILING OF ALL ANCHORS, SUPPORTS AND SEISMIC RESTRAINT FOR ALL MECHANICAL, PLUMBING AND FIRE SUPPRESSION SYSTEMS. THE CONTRACTOR'S ENGINEER WILL BE THE "REGISTERED PROFESSIONAL OF RECORD" FOR THE SEISMIC RESTRAINT.
2. POST-INSTALLED DROP-IN OR POWER DRIVEN ANCHORS ARE NOT PERMITTED.

DUCTWORK:

1. REFER TO SPECIFICATION PARTS 2.33 AND 2.34 FOR DUCT PRESSURE CLASSIFICATIONS. WHERE DUCT PRESSURE CLASSIFICATIONS ARE NOT FOR A SPECIFIC APPLICATION, CONFIRM WITH THE MECHANICAL CONSULTANT DURING TENDER.
2. ALL DUCTWORK AND PLENUMS SHALL BE CONSTRUCTED TO SEAL CLASS A. REFER TO SPECIFICATIONS FOR DETAILS.

Revision	Date
1. ISSUED FOR TENDER	07/10/22
0. ISSUED FOR TENDER REVIEW	05/08/22

MOTOR LIST

UNIT TAG	QTY	UNIT DESCRIPTION	UNIT LOCATION	ELECTRICAL LOAD					VOLT	PH	EQUIPMENT			STARTER				SAFETY SWITCH				CONTROL				SIZING AND SOURCE				EMERGENCY PWR (YES/NO)	NOTES
				MCA	MOP	HP	FLA	kW			SUPPLIED BY	INSTALLED BY	ELECT CONNECTED	TYPE	SUPPLIED BY	INSTALLED BY	ELECT CONNECTED	SUPPLIED BY	INSTALLED BY	ELECT CONNECTED	SIZE	SUPPLIED BY	INSTALLED BY	ELECT CONNECTED	TYPE	PANEL	BREAKER	WIRE	CONDUIT		
EXISTING EQUIPMENT BEING REMOVED																															
xRTU-1	1	ROOF TOP UNIT	ROOF	42	50	-	-	-	208	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Panel B	50A-3P	-	-	NO	
xRTU-2	1	ROOF TOP UNIT	ROOF	42	50	-	-	-	208	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Panel B	50A-3P	-	-	NO	
xRTU-3	1	ROOF TOP UNIT	ROOF	42	50	-	-	-	208	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Panel B	50A-3P	-	-	NO	
NEW EQUIPMENT																															
RTU-1	1	ROOF TOP UNIT	ROOF	90	90				208	3	M	M	E	VSD	M	M	E	M	M	E	-	M	M	E	BMS	Panel B	90A-3P	3#3 + #8 GRN GND	1-1/4"(35mm)	NO	1, 2, 3
RTU-2	1	ROOF TOP UNIT	ROOF	90	90				208	3	M	M	E	VSD	M	M	E	M	M	E	-	M	M	E	BMS	Panel B	90A-3P	3#3 + #8 GRN GND	1-1/4"(35mm)	NO	1, 2, 3
RTU-3	1	ROOF TOP UNIT	ROOF	90	90				208	3	M	M	E	VSD	M	M	E	M	M	E	-	M	M	E	BMS	Panel B	90A-3P	3#3 + #8 GRN GND	1-1/4"(35mm)	NO	1, 2, 3

SUPPLIER / INSTALL / WIRE CODES:
M = BY MECHANICAL
E = BY ELECTRICAL
G = GENERAL CONTRACTOR
S = SUPPLIED BY
I = INSTALLED BY
C = CONNECTED/WIRED BY

STARTER CODES:
MAN = MANUAL STARTER

HOA = MAGNETIC STARTER W/ HAND/OFF/AUTO SWITCH W/ AUX. CONTACTS
MAG = MAGNETIC STARTER C/W AUX STATUS CONTACTS
MRR = MOTOR RATED RELAY, 24 VAC COIL & MOTOR PROTECTION SWITCH
PCS = PACKAGED CONTROL SYSTEM
VSD = VARIABLE SPEED DRIVE
RVS = REDUCED VOLTAGE STARTER
WS = WALL SWITCH
CP = CONTROL PANEL

CONTROL DEVICE CODES:
AQUA = PUMP CONTROLLED BY AQUASTAT
BMS = BLDG MANAGEMENT SYSTEM
ES = END SWITCH
ET = LINE VOLTAGE T'STAT
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H = HUMIDITY SENSOR
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I = INTERLOCK, SEE NOTES
LIGHT = WIRED TO LIGHT SWITCH
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OS = OCCUPANT SENSOR
PS = PRESSURE SWITCH
R. STAT = REVERSE ACTING THERMOSTAT
TC = TIME CLOCK
T = LOW VOLTAGE T'STAT OR SENSOR
TS = TAMPER SWITCH
VS = VARIABLE SPEED SWITCH
WS = WALL SWITCH

ELECTRICAL LOAD CODES
MCA= MINIMUM CIRCUIT AMPS
MOP= MAXIMUM OVERCURRENT PROTECTION
HP= HORSEPOWER
FLA= FULL LOAD AMP
kW= KILOWATT

NOTES:
1. CONDUIT OR TECK 90 CU COMPLETE WITH WATERPROOF FITTINGS
2. ALL BREAKERS TO MATCH FAULT LEVEL RATING OF EXISTING PANELBOARDS BEING INSTALLED
3. UNIT COMPLETE WITH FACTORY INSTALLED DISCONNECT SWITCH AND CONVENIENCE OUTLET

2 M-1 MECHANICAL EQUIPMENT ELECTRICAL MOTOR LIST
SCALE: NTS

CONSULTANT:
Project No. 2022310
Prism ENGINEERING
saving you energy
PTP Number: BC: 1000889
320 - 3605 Gilmore Way
Burnaby, B.C. V5G 4X5
Tel: 604-298-4858
Fax: 604-298-8143

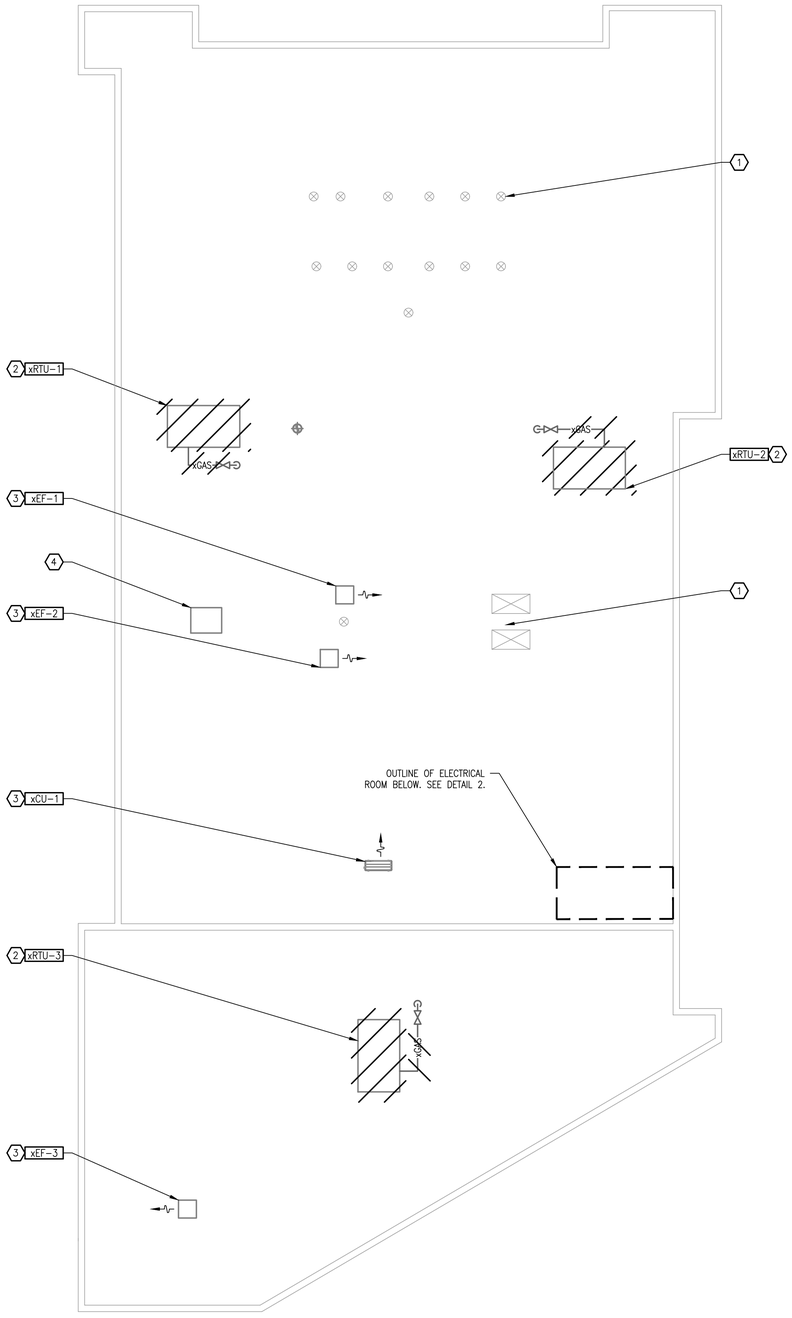
PROJECT:
RDOS ROOFTOP UNIT REPLACEMENT

101 MARTIN STREET
PENTICTON, BC V2A 5J9

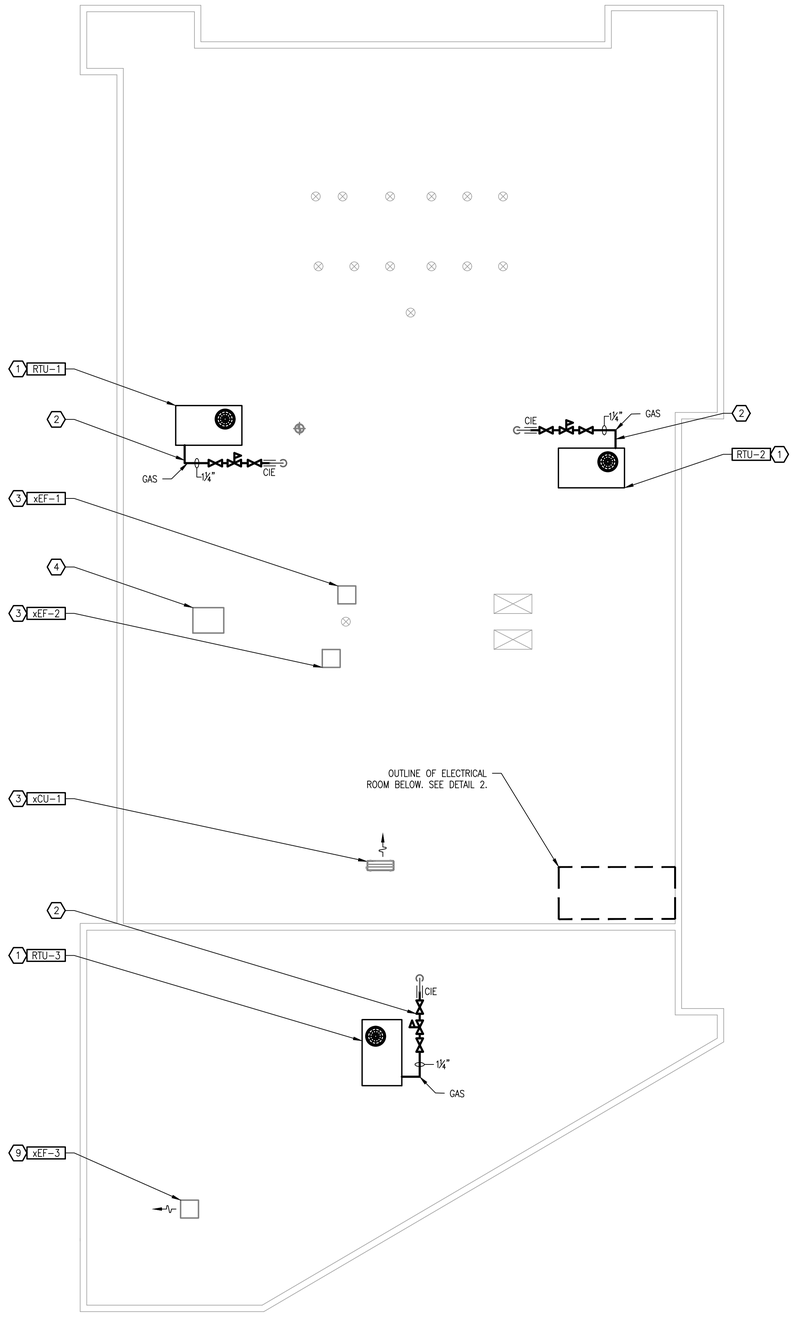
DRAWING TITLE:
SITE PLAN, LEGENDS, DRAWING LIST, GENERAL NOTES

DATE: JUNE, 2022		REV. NO.
DRAWN BY: PI	CHECKED BY: BK	1
SCALE: AS NOTED		

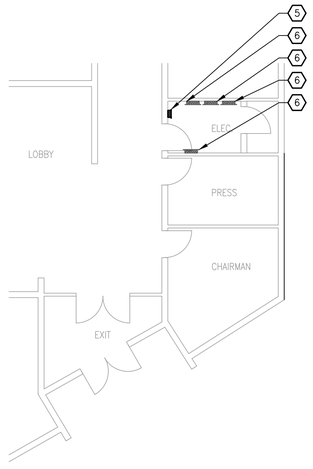
DRAWING NO.
M-1 of 3



1 M-2 ROOFTOP PLAN – DEMO
SCALE: 1/8" = 1'-0"



2 M-2 ROOFTOP PLAN – NEW
SCALE: 1/8" = 1'-0"



3 M-2 ELECTRICAL ROOM – NEW
SCALE: 1/8" = 1'-0"

GENERAL NOTES

1. ALTERNATE PRICING IS BEING REQUESTED. REFER TO CONTROLS SPECIFICATIONS FOR DETAILS.

(#) DEMO DRAWING NOTES

1. EXISTING SKY LIGHTS TO REMAIN.
2. REMOVE EXISTING ROOFTOP UNITS INCLUDING GAS CONNECTION UP TO EXISTING ISOLATION VALVE AND ELECTRICAL CONNECTIONS. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL SCOPE OF WORK. MEASURE AND NOTE THE MINIMUM O/A DAMPER POSITION AND AIR FLOW FOR NEW ROOFTOP UNIT SET UP. RETAIN EXISTING ROOF CURB FOR NEW EQUIPMENT INSTALLATION. REFER TO NEW PLANS FOR NEW EQUIPMENT SCOPE OF WORK.
3. EXISTING EXHAUST FANS AND CONDENSING UNIT TO REMAIN.
4. EXISTING 41"x34" ROOF ACCESS HATCH.

(#) NEW DRAWING NOTES

1. PROVIDE NEW DUAL-FUEL PACKAGED ROOFTOP UNITS AS PER SPECIFICATIONS AND EQUIPMENT SCHEDULES. PROVIDE NEW UNITS COMPLETE WITH ROOF CURB ADAPTER TO MATCH NEW EQUIPMENT FOOTPRINT TO EXISTING ROOF CURB DIMENSIONS. EXTEND EXISTING SUPPLY AND RETURN DUCTWORK AS REQUIRED FOR NEW EQUIPMENT CONNECTION, AND PROVIDE NEW FLEXIBLE DUCT CONNECTOR. PROVIDE NEW ELECTRICAL CONNECTIONS FOR ROOFTOP UNITS, REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL SCOPE OF WORK. CONTRACTOR SHALL VERIFY EXISTING ROOF CURB DIMENSIONS ON SITE AND SIZE THE CURB ADAPTOR TO SUIT. REPAIR ANY ROOFING AS REQUIRED TO MATCH EXISTING DETAILS AND FINISH TO HAVE A WATERTIGHT ASSEMBLY. SEISMICALLY RESTRAIN NEW EQUIPMENT. EXISTING THERMOSTAT AND REMOTE SENSORS (IF APPLICABLE) TO REMAIN WHERE POSSIBLE. FOR CONTROLS SCOPE OF WORK, REFER TO CONTROLS SPECIFICATION.
2. EXTEND EXISTING GAS CONNECTION TO NEW DUAL-FUEL PACKAGED ROOFTOP UNITS, COMPLETE WITH NEW GAS REGULATORS AND ISOLATION VALVES.
3. EXISTING EXHAUST FANS AND CONDENSING UNIT.
4. EXISTING 41"x34" ROOF ACCESS HATCH.
5. LOCATION OF EXISTING CONTROLS PANEL. UPGRADE CONTROLS SYSTEM AS PER CONTROLS SPECIFICATIONS FOR NEW DDC SYSTEM WITH WEB BASED ACCESS PORTAL, INCLUDING PROVISIONS FOR EXPANSIONS TO CONNECT FUTURE BUILDINGS.
6. LOCATION OF EXISTING ELECTRICAL PANELS TO REMAIN. REFER TO ELECTRICAL DRAWINGS FOR DETAILS.

Revision	Date
1. ISSUED FOR TENDER	07/10/22
0. ISSUED FOR TENDER REVIEW	05/06/22

CONSULTANT:
Project No: 2022310
Prism ENGINEERING
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320 – 3605 Gilmore Way
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Fax: 604-298-8143

PROJECT:
RDOS ROOFTOP UNIT REPLACEMENT

101 MARTIN STREET
PENTICTON, BC V2A 5J9

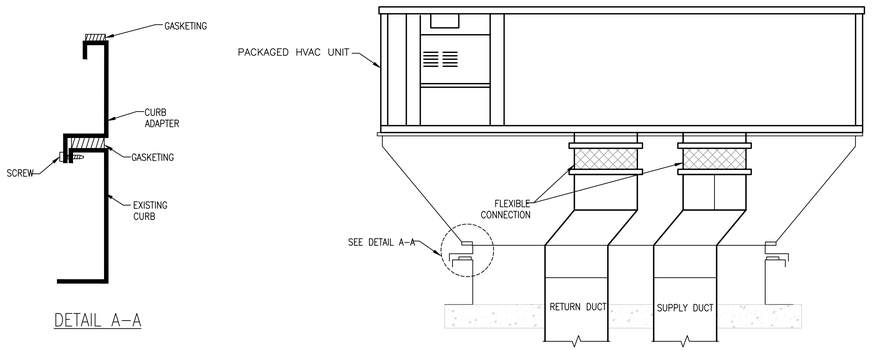
DRAWING TITLE:
ROOFTOP AND FIRST FLOOR PLAN - DEMO AND NEW

DATE: JUNE, 2022		REV. NO.
DRAWN BY: PI	CHECKED BY: BK	1
SCALE: AS NOTED		

DRAWING NO.
M-2 of 3

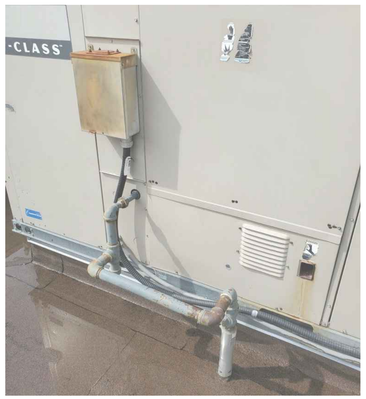
ROOFTOP PACKAGED UNIT SCHEDULE

ITEM	DESCRIPTION	LOCATION	SERVING	MAKE/MODEL	PERFORMANCE					NOTES
RTU-1, RTU-2, RTU-3	DUAL-FUEL ROOFTOP PACKAGED UNIT	ROOF	BUILDING OFFICE SPACE	TRANE / DHC092H3RZA	**SENSIBLE COOLING**	21.9	kW	74.7	MBH	C/W BACNET COMMUNICATIONS, FACTORY INSTALLED DISCONNECT SWITCH, FACTORY INSTALLED CONVENIENCE OUTLET, ECONOMIZER WITH BAROMETRIC RELIEF, HINGED PANEL WITH 2" PLATED FILTERS MERV-13, AND ROOF CURB ADAPTER.
					COOLING CAPACITY	28.2	kW	96.2	MBH	
					EDB / LDB	26.7 / 13.6	°C	80 / 56.4	°F	
					EWB / LWB	19.4 / 13.5	°C	67 / 56.3	°F	
					COOLING AMBIENT AIR TEMP.	35	°C	95.00	°F	
					HEATING CAPACITY (HEAT PUMP)	25.35	kW	86.5	MBH	
					EAT / LAT	10 / 24.6	°C	50 / 76.3	°F	
					HEATING AMBIENT AIR TEMP.	8.33	°C	47.00	°F	
					SECONDARY HEAT (GAS): OUTPUT	47.48	kW	162.0	MBH	
					EAT / LAT	10 / 37.8	°C	50 / 100	°F	
					FAN CFM	1416	L/S	3000	CFM	
					ESP (IN.W)	248.8	PA	1.00	(inW.C)	
					VOLTAGE/PHASE	REFER TO MOTOR LIST				
					UNIT DIMENSIONS (L X W X H)	88.7" X 53.3" X 46.9"				
					MAX. OPER. WEIGHT	587.40	KG	1295	LBS	



1 / M–3 CURB ADAPTER INSTALLATION DETAIL
SCALE: NTS

2 / M–3 EXISTING ROOFTOP UNIT DETAIL 1 (TYP.)
SCALE: NTS



3 / M–3 EXISTING ROOFTOP UNIT DETAIL 2 (TYP.)
SCALE: NTS

4 / M–3 EXISTING ROOFTOP UNIT DETAIL 3 (TYP.)
SCALE: NTS

NOTE:
PICTURES OF EXISTING EQUIPMENT, GAS PIPING AND ELECTRICAL CONNECTIONS ARE PROVIDED FOR CLARITY AND INFORMATION ONLY. EXTEND OF WORK WITHIN SCOPE IS INDICATED ON FLOOR PLAN DRAWINGS.

Revision	Date
1. ISSUED FOR TENDER	07/10/22
0. ISSUED FOR TENDER REVIEW	05/08/22

CONSULTANT:
Project No. 2022310
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PTP Number: BC: 1000889
320 – 3605 Gilmore Way
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Tel: 604-298-4858
Fax: 604-298-8143

PROJECT:
RDOS ROOFTOP UNIT REPLACEMENT

101 MARTIN STREET
PENTICTON, BC V2A 5J9

DRAWING TITLE:
DETAILS AND SCHEDULES

DATE: JUNE, 2022		REV. NO.
DRAWN BY: PI	CHECKED BY: BK	1
SCALE: AS NOTED		

DRAWING NO.
M-3 of 3

MOTOR LIST

UNIT TAG	QTY	UNIT DESCRIPTION	UNIT LOCATION	ELECTRICAL LOAD					VOLT	PH	EQUIPMENT			STARTER				SAFETY SWITCH				CONTROL				SIZING AND SOURCE				EMERGENCY PWR (YES/NO)	NOTES
				MCA	MOP	HP	FLA	kW			SUPPLIED BY	INSTALLED BY	ELECT CONNECTED	TYPE	SUPPLIED BY	INSTALLED BY	ELECT CONNECTED	SUPPLIED BY	INSTALLED BY	ELECT CONNECTED	SIZE	SUPPLIED BY	INSTALLED BY	ELECT CONNECTED	TYPE	PANEL	BREAKER	WIRE	CONDUIT		
EXISTING EQUIPMENT BEING REMOVED																															
xRTU-1	1	ROOF TOP UNIT	ROOF	42	50	-	-	-	208	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Panel B	50A-3P	-	-	NO	
xRTU-2	1	ROOF TOP UNIT	ROOF	42	50	-	-	-	208	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Panel B	50A-3P	-	-	NO	
xRTU-3	1	ROOF TOP UNIT	ROOF	42	50	-	-	-	208	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Panel B	50A-3P	-	-	NO	
NEW EQUIPMENT																															
RTU-1	1	ROOF TOP UNIT	ROOF	90	90				208	3	M	M	E	VSD	M	M	E	M	M	E	-	M	M	E	BMS	Panel B	90A-3P	3#3 + #8 GRN GND	1-1/4"(35mm)	NO	1, 2, 3
RTU-2	1	ROOF TOP UNIT	ROOF	90	90				208	3	M	M	E	VSD	M	M	E	M	M	E	-	M	M	E	BMS	Panel B	90A-3P	3#3 + #8 GRN GND	1-1/4"(35mm)	NO	1, 2, 3
RTU-3	1	ROOF TOP UNIT	ROOF	90	90				208	3	M	M	E	VSD	M	M	E	M	M	E	-	M	M	E	BMS	Panel B	90A-3P	3#3 + #8 GRN GND	1-1/4"(35mm)	NO	1, 2, 3

SUPPLIER / INSTALL / WIRE CODES:
M = BY MECHANICAL
E = BY ELECTRICAL
G = GENERAL CONTRACTOR
S = SUPPLIED BY
I = INSTALLED BY
C = CONNECTED/WIRED BY

STARTER CODES:
MAN = MANUAL STARTER

HOA = MAGNETIC STARTER W/ HAND/OFF/AUTO SWITCH W/ AUX. CONTACTS
MAG = MAGNETIC STARTER C/W AUX STATUS CONTACTS
MRR = MOTOR RATED RELAY, 24 VAC COIL & MOTOR PROTECTION SWITCH
PCS = PACKAGED CONTROL SYSTEM
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CONTROL DEVICE CODES:
AQUA = PUMP CONTROLLED BY AQUASTAT
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FA = FIRE ALARM
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DDC= DIRECT DIGITAL CONTROL
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LIGHT = WIRED TO LIGHT SWITCH
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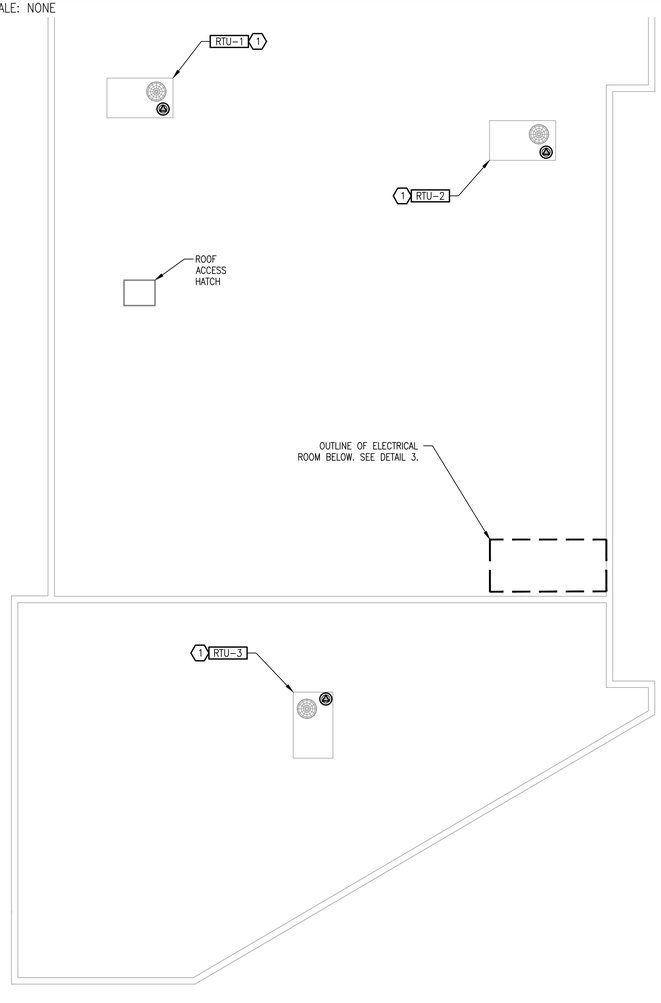
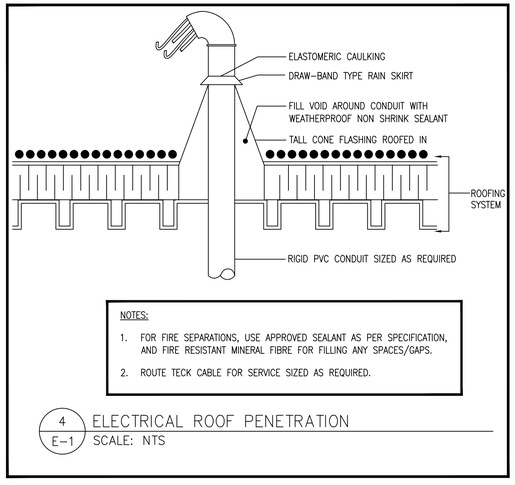
ELECTRICAL LOAD CODES
MCA= MINIMUM CIRCUIT AMPS
MOP= MAXIMUM OVERCURRENT PROTECTION
HP= HORSEPOWER
FLA= FULL LOAD AMP
kW= KILOWATT

NOTES:
1. CONDUIT OR TECK 90 CU COMPLETE WITH WATERPROOF FITTINGS
2. ALL BREAKERS TO MATCH FAULT LEVEL RATING OF EXISTING PANELBOARDS BEING INSTALLED
3. UNIT COMPLETE WITH FACTORY INSTALLED DISCONNECT SWITCH AND CONVENIENCE OUTLET

1 E-1 MOTOR LIST
SCALE: NONE

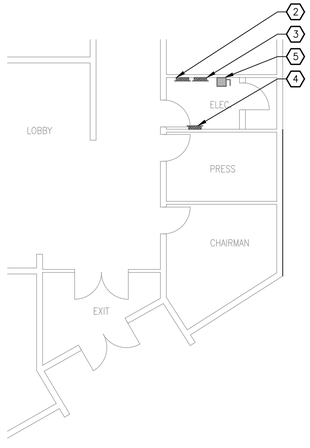


2 E-1 ROOFTOP PLAN – DEMO & NEW
SCALE: 1/8" = 1'-0"



NOTES:
1. FOR FIRE SEPARATIONS, USE APPROVED SEALANT AS PER SPECIFICATION, AND FIRE RESISTANT MINERAL FIBRE FOR FILLING ANY SPACES/GAPS.
2. ROUTE TECK CABLE FOR SERVICE SIZED AS REQUIRED.

4 E-1 ELECTRICAL ROOF PENETRATION
SCALE: NTS



3 E-1 ELECTRICAL ROOM
SCALE: 1/8" = 1'-0"

PROJECT INFORMATION

CIVIC ADDRESS: 101 MARTIN STREET, PENTICTON, BC V2A 5J9

POWER LEGEND

SYMBOL	DESCRIPTION
	5-20R DUPLEX RECEPTACLE
	120V SINGLE PHASE OUTLET
	208V 3 PHASE OUTLET
	FUSED ELECTRICAL DISCONNECT
	ELECTRICAL PANELBOARD

GENERAL NOTES

1. THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS.
2. WHERE THERE IS A CONFLICT BETWEEN THE DRAWINGS AND THE SPECIFICATIONS THE MOST STRINGENT REQUIREMENT SHALL APPLY.
3. COORDINATE ALL ELECTRICAL WORK WITH OTHER TRADES TO ENSURE PROPER AND ADEQUATE INTERFACE WITH THE WORK OUTLINED FOR THE PROJECT AND ENQUIRED EQUIPMENT ACCESS CLEARANCE ARE PROVIDED.
4. PROVIDE CANADIAN ELECTRICAL CODE (CEC) REQUIRED CLEARANCES FOR ALL INSTALLED EQUIPMENT AND REQUIRED EQUIPMENT ACCESS AS REQUIRED BY MANUFACTURER.
5. WHERE CABLING AND CONDUITS ARE TO BE REMOVED, CONTRACTOR SHALL VERIFY DETAILS ON SITE, ALL WAY, CEILING AND FLOOR UNUSED OPENINGS ARE TO BE REPAIRED WITH THE SAME CONSTRUCTION MATERIAL AND ASSEMBLY DETAILS AND TO MATCH EXISTING FINISH WHERE NO LONGER REQUIRED.
6. ANY NEW OPENING OR CORING REQUIRED FOR NEW CABLING AND CONDUITS SHALL BE APPROVED BY CONTRACTOR. ALL NEW STRUCTURAL OPENINGS SHALL BE X-RAYED OR SCANNED PRIOR TO CORING/CUTTING.
7. PROVIDE ALL REQUIRED CABLING SUPPORTS AND UNISTRUT SYSTEMS FOR CONDUITS/CABLING MOUNTED ON ROOF. CABLING/CONDUITS SHALL NOT SIT DIRECTLY ON ROOF SURFACE.
8. ALL CONDUITS AND CONNECTIONS ON THE EXTERIOR OF THE BUILDING SHALL USE LIQUID TIGHT CONNECTORS.

(#) NEW DRAWING NOTES

1. NEW REPLACEMENT RTU IN THE SAME LOCATION AS EXISTING. REPLACE EXISTING FEEDER TO THE RTU UNITS WITH NEW BREAKERS AND WIRING IN CONDUIT AS PER THE MOTOR LIST DETAIL 1. REUSE EXISTING ROOF PENETRATIONS WHERE POSSIBLE.
2. EXISTING 400A, 120/208V, 3ø, 4W, ELECTRICAL PANEL "A".
3. EXISTING 400A, 120/208V, 3ø, 4W, ELECTRICAL PANEL "B" CONTAINING BREAKER FOR EXISTING AND REPLACEMENT RTUS.
4. EXISTING 120/208V, 3ø, 4W, ELECTRICAL SUB-PANEL "C" FED FROM AN 100A BREAKER IN ELECTRICAL PANEL "B".
5. MAIN EXISTING 400A, 120/208V, 3ø, 4W, ELECTRICAL SERVICE.

Load Calculations –

CODE DEMAND – 1003m2 OFFICE (CEC TABLE 14 @ 50W/m2)	55KW
METERED MAXIMUM DEMAND OF BUILDING (AUG 2017)	48KW
NEW HVAC	97KW
REMOVED HVAC	45KW
TOTAL HVAC	52KW
TOTAL DEMAND	100KW
TOTAL DEMAND @208V X 0.85 LOAD FACTOR =	85KW
I @ 120/208V 3ø 4W = 85KW / 208V*1.732 X 1.25 =	357A

THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE CONSULTANT.
DO NOT SCALE THIS DRAWING.

Revision	Date
1. ISSUED FOR TENDER	07/10/22
0. ISSUED FOR TENDER REVIEW	05/08/22

CONSULTANT:
Project No. 2022310
Prism ENGINEERING
saving you energy
PTP Number: BC: 1000889
320 – 3605 Gilmore Way
Burnaby, B.C. V5G 4X5
Tel: 604-298-4858
Fax: 604-298-8143

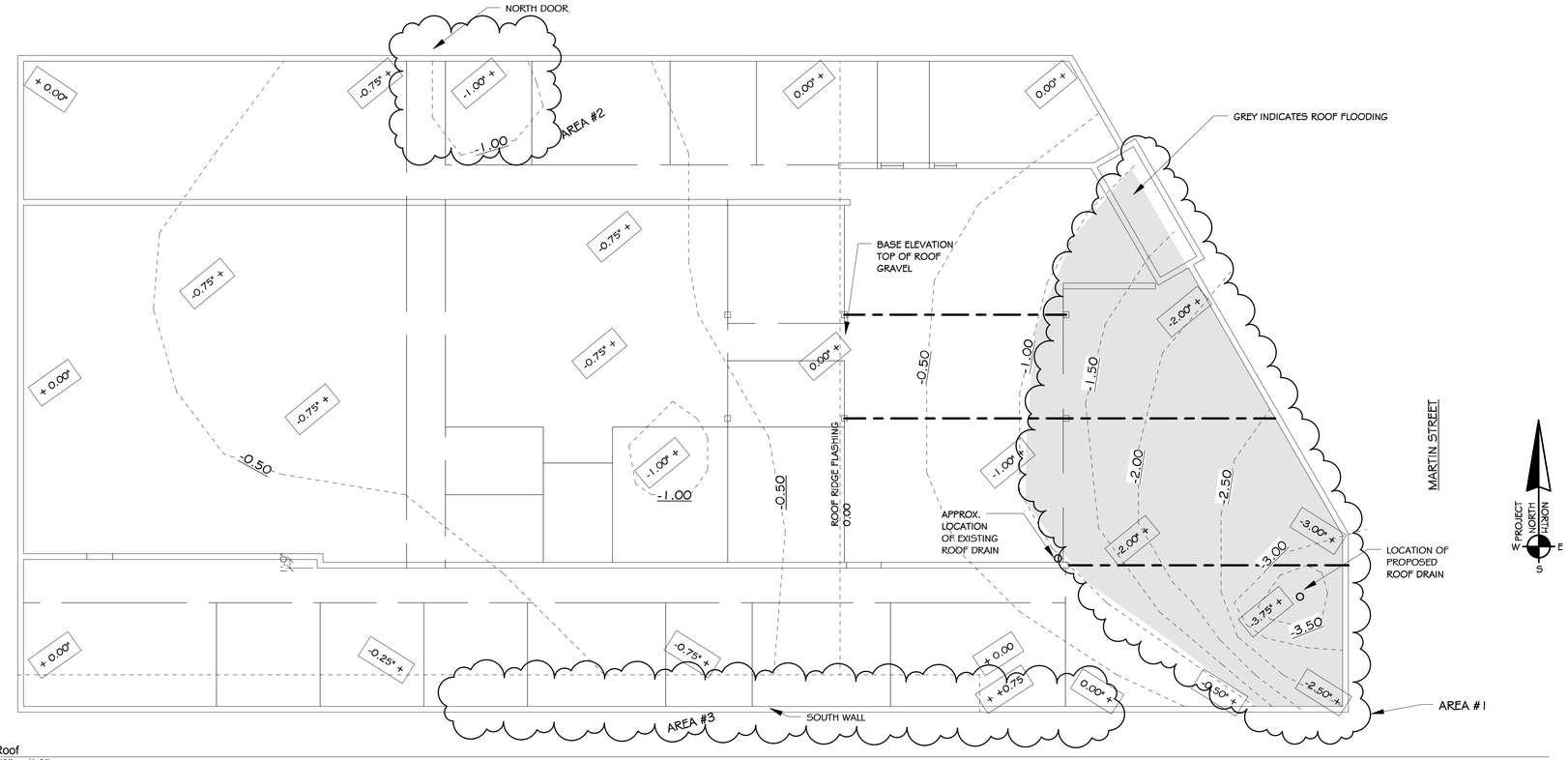
PROJECT:
RDOS ROOFTOP UNIT REPLACEMENT

101 MARTIN STREET
PENTICTON, BC V2A 5J9

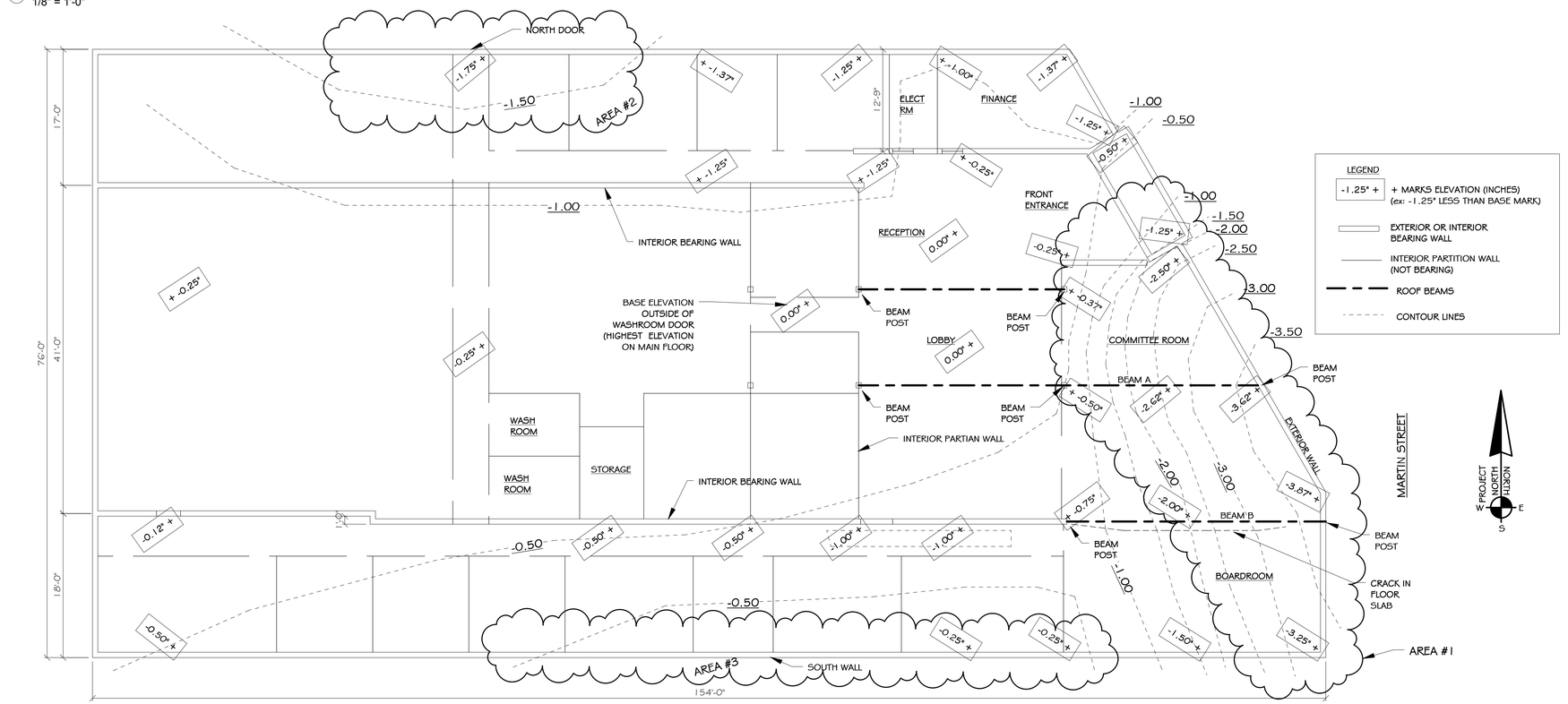
DRAWING TITLE:
ELECTRICAL POWER PLAN

DATE: JUNE, 2022		REV. NO.
DRAWN BY: AB	CHECKED BY: DJ	1
SCALE: AS NOTED		

DRAWING NO.
E-1 of 1



2 *Roof
1/8" = 1'-0"



1 *Main FLoor Plan
1/8" = 1'-0"

REVISIONS	ISSUE	DATE	BY	DESCRIPTION
	1	Aug 7/14	DMC	As-Built Elevations (Aug 6/14)
	2	Aug 29/14	DMC	Add Further Details

HILLSIDE ENGINEERING SERVICES LTD.

LAND PLANNING – ENGINEERING
PERMITTING – STRUCTURAL – CIVIL – CADD – DESIGN
COMMERCIAL – INDUSTRIAL – RESIDENTIAL
54 NANAIMO AVENUE EAST, PENTICTON, BC. V2A 1L9
PHONE (250) 490-4155

101 Martin Street
Penticton, B.C.
Figure #1

SCALE: 1/8" = 1'-0"		DRAWING NO. 5645
DRAWN BY: dmc	Aug 6/14	S.101
Approver		

Hillside Engineering Services Ltd.

54 Nanaimo Ave. East, Penticton, B.C., V2A 1L9, phone (250) 490-4155, fax (250) 490-4156
Structural & Municipal Engineering - Land Planning - Permitting - Wastewater Systems - CADD

August 31, 2014

Regional District of Okanagan – Similkameen (RDOS)
101 Martin Street
Penticton, BC
V2A 5J9

Attn: Liisa Bloomfield, P. Eng.

Re: Building Structural Assessment

Introduction

On July 31, 2014 the RDOS hired Hillside Engineering Services Ltd. (HES) to assess the condition of their building located at 101 Martin Street, Penticton. The floor in the boardroom had cracked and settled. The assessment was to determine if there were any structural or geotechnical problems with the building,

Background

The building was constructed in 1981. It is a one story, slab on grade building approximately 10,500 sq. ft. in area. It is 76' wide by 154' long. The longest side of the building runs in the direction of east-west. The building has gone through numerous renovations since 1981. A copy of the original permit drawings were supplied and examined.

The original roof trusses span north-south. The trusses are supported by the north and south exterior walls and 2 main internal bearing walls that run east-west for the entire length of the building except at the front entrance. The layout of some of the offices and interior non- bearing partition walls has changed from the original 1981 drawings.

The roof area at the main entrance and boardroom are supported by glulam beams instead of bearing walls. These beams are supported by posts and concrete pads inside the building and on the exterior building walls.

Observations

- HES took elevation measurements of the roof. The elevations were obtained with a Zip Level. This level measures the relative elevation differences between the base station and its handheld unit. It has an accuracy of 1/8". A 0.0" elevation for reference was taken at the highest point on the roof. Random elevations were then taken. These elevations were plotted on a map. See Fig#1

- It appeared that rain water was ponding at the SE corner of the roof. There was no roof drain at the center of this ponding area. The rest of the roof appears to be draining water as per the original design. No soft spots in the roof sheathing were detected.

- HES then took the elevations of the main floor which is a concrete slab-on-grade floor. Again a 0.0" elevation was set on the tile floor at the entrance to the front bathrooms. Relative elevation differences were recorded randomly throughout the building. These elevations were plotted on a map. See Fig #1

- A crack in the boardroom concrete floor was observed under Beam B, see Fig #1. This crack started at the beams support post on the west side of the boardroom and continued east to the exterior wall approximately 25' in length. The crack was not visible because carpet covered it.

- The concrete floor was also cracked in the reception and lobby area. This was clearly visible due to cracked tiles.

- There was slab movement at the door entrances of the electrical room and the finance area at the main building entrance located in the NE corner of the building. The mortar in between the floor tiles is cracked and separated.

- Some of the staff interviewed indicated that the cracks had been there for a long time. They were not sure if the cracking has stopped, slowed down or was ongoing.

- 4 test pits were dug on the exterior of the building by the geotechnical engineering company, Rock Glen Consulting Ltd. (RGC). The location of the pits and their findings are attached in RGC's report. Appendix #1.

- There was cracking in the stucco of the building immediately to the south of the RDOS building. This cracking and its pattern in the stucco shows signs that the building foundation is settling. This is not part of the RDOS building assessment, but HES felt it should be noted since it is located on the neighboring property.

Discussion

Some of the buildings footings have settled. There are 3 areas of concern;

1) The worst location Area # 1 is the east wall of the building.
    i) The roof should be fairly flat with some slope that will take the rain and melting snow to the roof drains. The foundation settlement has caused the roof to settle in this area. This has resulted in a 3.75" roof depression right beside the east wall of the boardroom. The nearest roof drain is about 25' away and 2.5" higher. This depression may not seem significant, but the water has been creating a pond that is approximately 50'x25'.
    ii) The east wall in the boardroom has settled 3.75". The load on this wall is the point load from the roof beams A and B, see Fig #1, a small load from the roof joists, the exterior wall, concrete foundation and footings. The calculated factored load is approx. 1,100#/sqft (51kPa).

2) Area # 2 is the north entrance door to the parking lot.
    i) The roof has settled in a small area. HES cannot determine if the water is ponding. If there is ponding, it does not last long or it is so small there is no indication of standing water.

    ii) The main floor north door area, has settled 1.75". HES cannot find any significant settlement signs. 1.75" of settlement should have cracked drywall and concrete. This area could have been built this way during original construction or cracks have been patched over the years.

3) Area # 3, the south wall.
    i) The roof shows no sign of settlement.
    ii) The south wall shows no sign of settlement except at the SE corner boardroom area. HES is only mentioning the south wall due to the adjacent building settlement. Whatever is causing the settlement on the adjacent property appears to not be affecting the RDOS building.

Discussions with some of the staff indicate that the building has been settling for a long time, at least 10-20 years. The building is currently 33 years old. The majority of this settlement could have happened over the first 10-20 years of the buildings life. If the building was currently settling at any significant rate the front windows would be cracked or out of alignment with the frames. The front entrance door and interior doors would be out of square and would start to bind when opening and closing the doors. HES does not see any of these indicators.

RGC report indicated that the water table is high on the east side of the building compared to low on the west side. The soils are prone to weakening with the introduction of water. The settling of the east wall is the most likely caused by the high water table.

Conclusion

HES and RGC have both come to the conclusion that the building does not appear to be settling at this current time. There is no direct evidence to suggest that the building will continue to settle. HES does not recommend any remedial work or repairs to the foundation. At this time, the building appears to be stable and structurally sound.

If the RDOS wishes to renovate, no extra load should be added to the existing footings as the building stands now. If an extra floor is desired, a structural and geotechnical engineer should go to the next level of exploring the soil under the footings with a drilling program. This program would better calculate the soil capacity to handle the new reconfigured building loads.

HES recommends hiring a legal surveyor to determine the elevation of the foundation and create a benchmark. Survey again in a month and repeat. If no movement is detected, resurvey at 6 months. If no movement is detected at that time, resurvey at 1 year. After a year, if no movement is detected and the rug in the board room needs replacing, use a concrete leveling compound to make the floor level before adding a finish to the floor.

Immediately install a roof drain at the lowest point of the roof above the boardroom. This will pick up the standing water and prolong the life of the roof.

Ground water has weakened the soils under the footings and slab. The water table is highest at the SE corner of the building were the majority of the settling has occurred. The RDOS should explore the following:

- Perform a water test on the domestic water line coming in from the street to determine if there is a leak.
- Perform a sewer test to determine if there is a leak.
- Turn off and permanently disconnect all exterior irrigation lines.

If you have any questions or concerns, please do not hesitate to call.

Hillside Engineering Services Ltd.

per David Craig, P.Eng.

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Regional District of Okanagan-Similkameen (RDOS) Office

101 Martin St, Penticton, BC V2A 5J9

Participant number CEAP_000144

June 14th, 2021

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www.bes-canada.com

TABLE OF CONTENTS

Note: This report outlines the findings of the site investigations and describes the equipment used at the facility, estimates the gas consumption and efficiency of systems & fixtures, and provides observations and recommendations which may cost-effectively reduce energy use. Please note that this report is based on visual observations and should be used only as the basis for further investigation. Verification of recommendations should include measurement and detailed assessment.

Please refer any questions about this report to:

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EXECUTIVE SUMMARY

The site audit was completed on May 20th, 2021, and the subsequent analysis of the building is provided in the following report.

From the 12-month period ending December 2019, Regional District of Okanagan-Similkameen (RDOS) Office consumed **985 GJ** of natural gas with an annual cost of **$8,415.00** and **128,238.00 kWh** of electricity with an annual cost of **$9,329.31** at the current rate**.**

This report includes recommendations that have potential to deliver the energy savings detailed in the following summary table. Please visit fortisbc.com for the most current information on rebates and energy savings.

Table 1: Recommended Saving from Implementing Energy Conservation Measures (ECM)

Recommended Energy Conservation Measure in order of priority[1]	Cost Benefit Analysis Based on Incremental Costs (Cost difference between standard efficiency equipment and high efficiency equipment)					*Estimated Total Project Capital, Design & Install Cost ($)*[2]
	Pre-incentive Estimated Incremental Capital Cost ($)[3]	Applicable Incentive ($)	Total Estimated Incremental Capital Cost ($)	Estimated Incremental Annual Gas / Electricity Cost Savings ($)	Simple Payback (yrs)	
Install High Efficiency Condensing Rooftop Units	$30,600.00	$10,500.00	$20,100.00	$1,555.03	12.9	$145,800.00
Repair and Replace Door Seals to Minimize Infiltration Heat loss	$200.00	$0.00	$200.00	$42.73	4.7	$200.00
Install Thermal Insulation on Domestic Hot Water Service Pipework	$120.00	$78.74	$41.26	$59.83	0.7	$41.26
Install Low Flow Plumbing Fixtures	$23.00	$0.00	$23.00	$15.67	1.5	$23.00
Install a New Direct Digital Controls (DDC) System to control HVAC	$12,000.00	$0.00	$12,000.00	$969.16	12.4	$12,000.00
LED Lighting Upgrade	$24,996.00	$1,870.00	$23,126.00	$2,002.50	11.5	$23,126.00
TOTAL SUM OF BUNDLED MEASURES	**$67,939**	**$12,449**	**$55,490**	**$4,645**	**11.9**	**$181,190**

[1] Note that the provided costs, savings, and associated paybacks are estimates, and should be investigated in further detail before proceeding with these measures. Readers are encouraged to read the report in its entirety for more detailed information.

[2] Project Capital Cost is the total estimated capital cost including design & install in which the client will incur for implementation of the measure.

[3] Incremental costs are shown (cost difference between a standard efficiency equipment and high efficiency equipment).

The following are the recommended "Next Steps" which should be considered by the Client:

- **Discuss the potential energy retrofits BES.**
- **Implement the low-cost measures as a priority.**
- **Engineering Support.**
- **Explore options for project financing.**

The illustrates the Greenhouse Gas Emissions Reduction by Implementing the Recommended Measures:

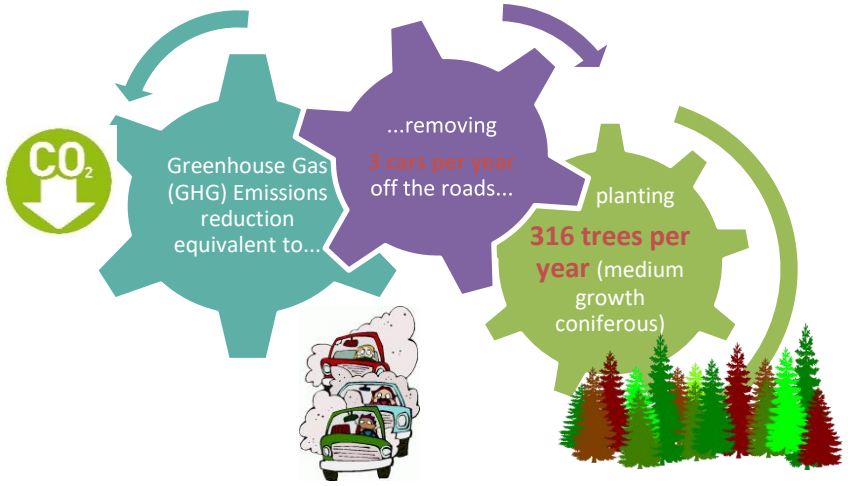

Figure 1: Greenhouse Gas Emissions Reduction by Implementing the Recommended Measures

DETAILED REPORT

Building Description

The Regional District of Okanagan-Similkameen (RDOS) Office is located at 101 Martin St, Penticton, BC V2A 5J9. The total floor area is approximately 10800 ft² (1003 m²) and the whole building is served by one central FortisBC gas meter. This building was built in 1981 and is a place for public engagements.

The building envelope is in poor condition for its age. Observed envelope deficiencies include high rates of outside air infiltration through poorly sealed windows, entrance and exits. Envelope upgrades could improve the building's overall R-Value.

Review of Current Natural Gas Energy Consumption

Natural gas for this account (#317471) is purchased by FortisBC and delivered under Rate Schedule 2 (A commercial, institutional, or small industrial operation with consumption of **less than 2,000 GJ annually**). Gas cost savings in this report are based on the current Rate 2 gas cost of approximately $8.5460 per GJ.

This account used **985 GJ** of natural gas during the 12-month period ending December 2019 which cost approximately **$8,415** at the current rate (excluding fixed monthly charges and taxes).

Visit How to Read your Gas / Electricity Bills for further information.

Review of Current Electrical Energy Consumption

Electricity to the Regional District of Okanagan-Similkameen (RDOS) Office is purchased from FortisBC. Electricity cost savings in this report are based on the current commercial services electricity cost of approximately $0.0728 per kWh.

The building used **128,238.00 kWh** during the 12-month period ending December 2019 which cost approximately **$9,329.31** at the current rate.

Year 2019 is used as the baseline for this report due to 2020 being an extraordinary year as a result of the COVID-19 pandemic.

Natural Gas

In order to best prioritize and discuss energy conservation opportunities at the facility, an estimated end-use breakdown has been developed. This breakdown represents the probable energy consumption by end-use based upon the limited historical annual utility records, detailed data on equipment and systems installed, and an understanding of facility operation strategies.

The following end-use breakdown is an order of magnitude estimate, based on the consulting teams' understanding of building systems, operation schedules, and existing utility records. Actual testing, measurement and verification, which would prove both difficult and costly, would need to be undertaken to provide a more accurate breakdown.

Table 2: Total Natural Gas End-Use Breakdown Estimate (2019)[4]

Period: Jan 2019 to Dec 2019	Space Heating	Total
Annual Consumption (GJ)	985	985
Annual Cost	$8,415	$8,415
Percentage of Consumption	100.0%	100.0%

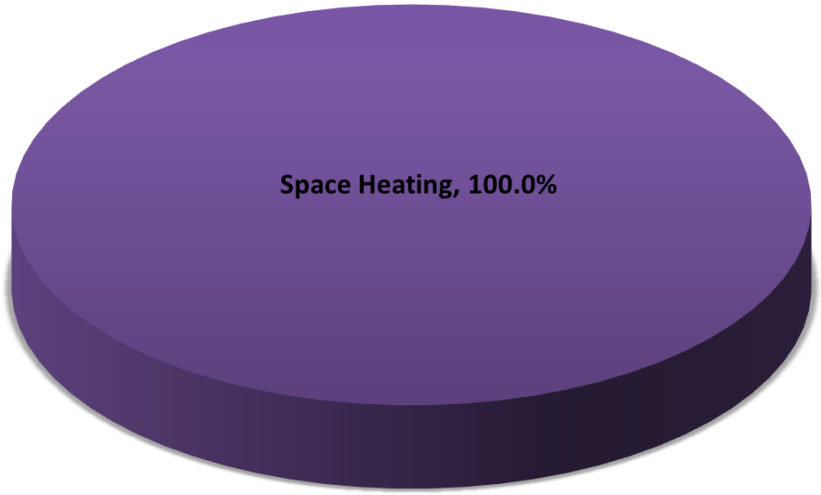

Figure 2: Total Natural Gas End-Use Breakdown Estimate

[4] Values are estimated based on available utility data (12 months) specified operating conditions and other factors.

Gas consumption in the building from 2018 to 2020 is represented graphically as follow:

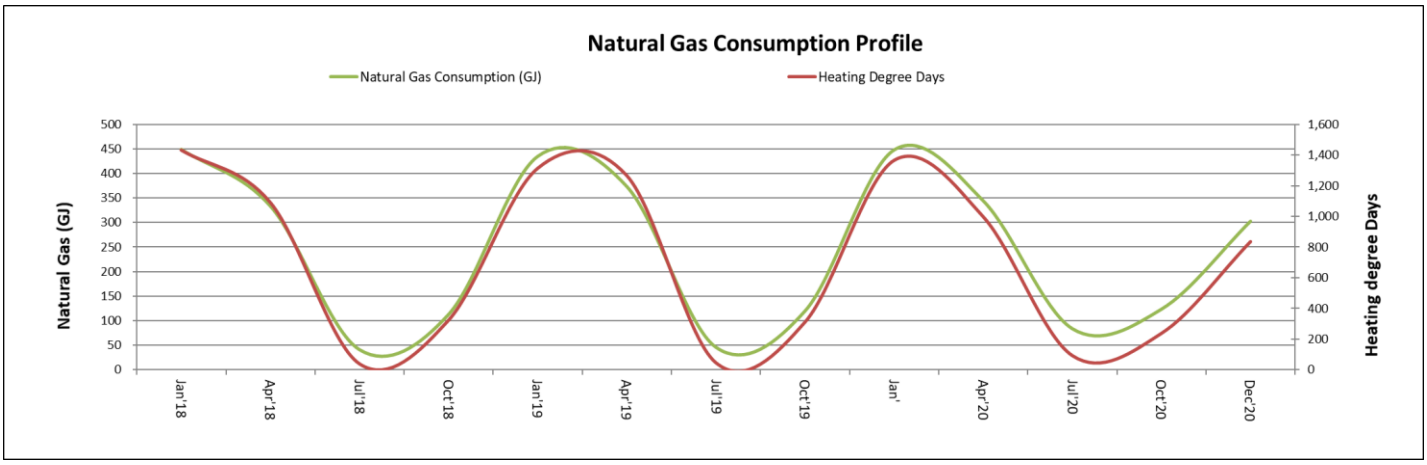

Figure 3: Annual Natural Gas Consumption Profile

As the graph shows, the gas consumption fluctuates relatively consistent with annual heating degree days. The gas consumption is therefore dependent on the heating demand of the facility.

Electricity

In order to best prioritize and discuss energy conservation opportunities at the facility, an estimated end-use breakdown has been developed. This breakdown represents the probable energy consumption by end-use based upon historical annual utility records, detailed data on equipment and systems installed, and an understanding of facility operation strategies.

The following end-use breakdown is an order of magnitude estimate, based on the consulting teams' understanding of building systems, operation schedules, and existing utility records. Actual testing, measurement and verification, which would prove both difficult and costly, would need to be undertaken to provide a more accurate breakdown.

Table 3: Total Electricity End-Use Breakdown Estimate (January 2019 to December 2019)

Period: Jan 2019 to Dec 2019	Lighting	DHW & Plug Loads (misc equipment, Heating)	Cooling	Total
Annual Consumption (kWh)	45,934.0	63,068.3	19,235.7	128,238.0
Annual Cost	$3,341.70	$4,588.22	$1,399.40	$9,329.31
Percentages	35.8%	49.2%	15.0%	100%

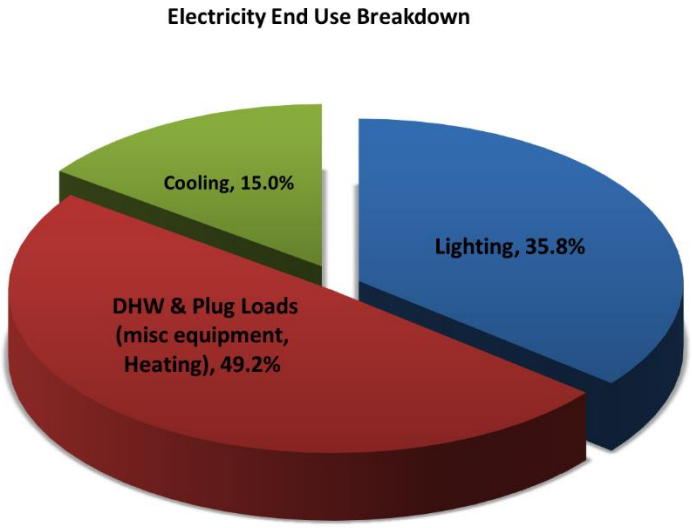

Figure 4: Total Electricity End-Use Breakdown Estimate (January 2019 to December 2019)

The subsequent plots show the electricity consumption of the building in 2019. The plots show the peak electricity consumption occurs over the winter and summer periods due to space heating and cooling demands.

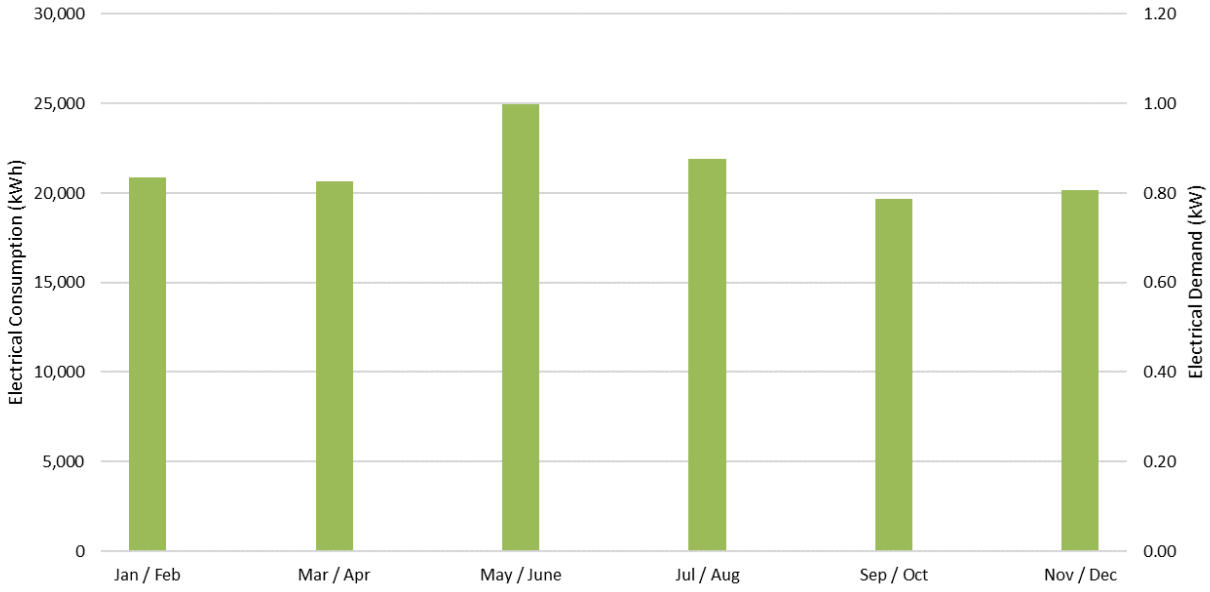

Figure 5: Electrical Consumption Profile

Proposed Energy Conservation Measures

Space HVAC Equipment

Heating, ventilation, and air-conditioning (HVAC) to the office space is provided by three (3) LENNOX gas fired packaged rooftop units (RTU-1 to RTU-3). Each standard efficiency packaged unit is installed with a gas fired heating module, DX cooling, supply air section, return air section, controls and filter section. Conditioned air is supplied by a network of distribution ductwork which terminates through supply air diffusers in the spaces. Name plate data was not available at the time of the audit.

The rooftop units appear to be original to the building and has reached the end of their useful economic life. Based on ASHRAE guidelines, the estimated life expectancy of a rooftop unit is 15 years. Incentives are available from FortisBC for installing high efficiency condensing rooftop units.

Figure 6: Typical Existing LENNOX Gas Fired Rooftop Units

Figure 7: Existing MITSUBISHI Split System – Condensing Unit on Roof

Primary cooling to the Server Room is provided by a dedicated self-contained air-cooled system (APC ACSC100) with supplementary cooling provided the Mitsubishi split system. Two (2) exhaust fans serving public washrooms and appear to be in good working order.

Figure 8: Existing Two (2) DELHI Exhaust Fans on Roof

The following table provides an inventory of existing space heating equipment:

Table 4: Details of Existing Space Heating System

Equipment Tag	Location	Type	Manufacturer	Model #	Input (BTU/HR)	Rated Efficiency
RTU-1	Rooftop	Gas Fired Rooftop Unit	LENNOX	T-Class	180,000	80%
RTU-2	Rooftop	Gas Fired Rooftop Unit	LENNOX	T-Class	180,000	80%
RTU-3	Rooftop	Gas Fired Rooftop Unit	LENNOX	T-Class	180,000	80%
AC-1 / CU-1	Rooftop	Split AC Unit	MITSUBISHI	PUY-A24NHA4	Not Available	80%
AC-2	Server Room	Energy Recovery Ventilator	APC	ACSC100	Not Available	80%

The following table provides a description of proposed Energy Conservation Measures (ECM):

Table 5: Space Heating – Description of Energy Conservation Measures

Recommended Energy Conservation Measure	Description
Install High Efficiency Condensing Rooftop Units	Three (3) existing "LENNOX" standard efficiency gas fired rooftop units (RTU-1, RTU-2, & RTU-3), which provide tempered air to the building's offices, are at the end of their rated economical lifespan. It is anticipated that it is possible to increase the overall efficiency of the heating system by replacing the existing gas fired RTUs with new high efficiency condensing RTUs. This measure will save energy by increasing the equipment's operational efficiency. Incentives are available from FortisBC for installing eligible high efficiency condensing RTUs as listed on the FortisBC website.
HVAC System Redesign - Installation of Variable Refrigerant Flow (VRF) System	Three (3) existing "LENNOX" standard efficiency gas fired rooftop units (RTU-1, RTU-2, & RTU-3), which provide tempered air to the building's offices, are at the end of their rated economical lifespan. The existing system provides limited zone control and poor heating and cooling capacity. It is proposed to replace the entire HVAC system (All RTUs) with new high efficiency variable refrigerant flow (VRF) system complete with air source heat pumps and full heat recovery. This analysis incudes for the installation of VRF indoor units to offset heating and cooling loads in all zones with heat recovery ventilators to provide the outdoor air requirement. The quantity of indoor units will be confirmed up on completion of a detailed engineering design. The proposed VRF system provides the ability for multiple indoor units or zones to operate on the same system. The new VRF systems provides simultaneous heating and cooling within the building without an energy penalty. This option allows for superior zone control of all offices. The outdoor units shall be installed on the roof of the building and controlled by the manufacturer's proprietary controller.

The following table provides a summary of savings, costs, and simple payback period associated with each proposed ECM:

Table 6: Space Heating – Summary of ECM Costs and Savings

Potential Energy Conservation Measure	Cost Benefit Analysis Based on Incremental Costs (Cost difference between standard efficiency equipment and high efficiency equipment)					*Estimated Total Project Capital, Design & Install Cost ($)*
	Pre-incentive Estimated Incremental Capital Cost ($)	Applicable Incentive ($)	Total Estimated Incremental Capital Cost ($)	Estimated Incremental Annual Gas / Electricity Cost Savings ($)	Simple Payback (yrs.)	
Install High Efficiency Condensing Rooftop Units	$30,600.00	$10,500.00	$20,100.00	$1,555.03	12.9	$145,800.00
HVAC Redesign - Installation of Variable Refrigerant Flow (VRF) System	$350,000.00	$0.00	$350,000.00	$7,287.84	48.0	$350,000.00

Domestic Hot Water Heating Systems

Domestic hot water (DHW) to the building's plumbing fixtures is provided by an electric storage water heater. There is limited thermal insulation installed, as shown in the figure below.

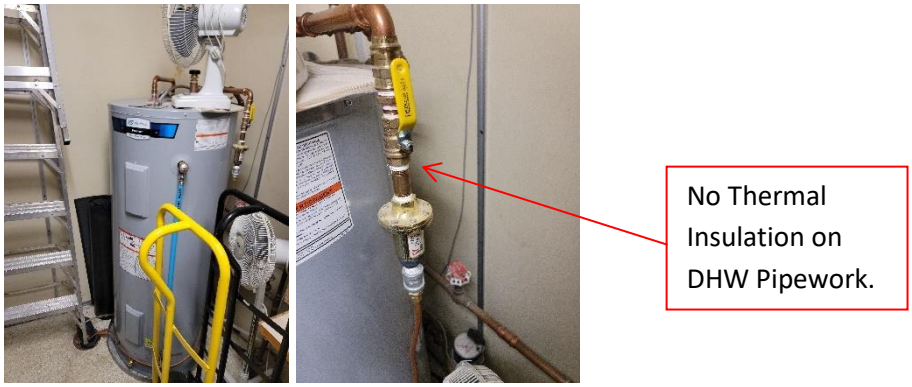

Figure 9: Existing GSW Electric DHW Storage Heater Tank

Equipment Tag	Location	Type	Manufacturer	Model #	Rated Input (kW)	Capacity
DWH-1	Janitor Room	Electric DHW Storage Heater	JOHN WOOD	E80TE-45240 250	6.0	287 L

The following table provides a description of proposed Energy Conservation Measures (ECM):

Table 7: Description of Energy Conservation Measures

Recommended Energy Conservation Measure	Description
Install Low Flow Plumbing Fixtures	Water use in the building can have a significant effect on energy use for domestic hot water heating. As such, high performance and low-flow fixtures are required to best manage energy. It is therefore recommended that faucets are fitted with low flow devices to reduce hot water consumption (and the associated gas for water heating). These devices are low cost and can reduce hot water use by 25-50% at these fixtures. Typically, 1.9 L/min aerators are most effective on high traffic taps used mainly for hand, while 5.7 L/min aerators are more common for general use taps. The antibacterial low flow devices addressing contamination concerns are typically available in 5.7 L/min and 3.8 L/min ratings.
Install Thermal Insulation on Domestic Hot Water Service Pipework	It was noted that there was limited thermal insulation on the majority of DHW pipework in the building. It is recommended that the pipework be insulated with suitable pipe insulation to prevent unnecessary heat loss, which will result in annual natural gas savings.

The following table provides a summary of savings, costs, and simple payback period associated with each proposed ECM:

Table 8: DHW – Summary of ECM Costs and Savings

Potential Energy Conservation Measure	Cost Benefit Analysis Based on Incremental Costs (Cost difference between standard efficiency equipment and high efficiency equipment)					***Estimated Total Project Capital, Design & Install Cost ($)***
	Pre-incentive Estimated Incremental Capital Cost ($)	Applicable Incentive ($)	Total Estimated Incremental Capital Cost ($)	Estimated Incremental Annual Gas / Electricity Cost Savings ($)	Simple Payback (yrs.)	
Install Low Flow Plumbing Fixtures	$23.00	$0.00	$23.00	$15.67	1.5	$23.00
Install Thermal Insulation on Domestic Hot Water Service Pipework	$120.00	$78.74	$41.26	$59.83	0.7	$41.26

Building Envelope Improvements

The envelope appeared to be in poor condition. High rates of outside air infiltration through poorly sealed entrances and exit doors was observed. Exit doors that are poorly sealed require additional heating to heat the building to the desired temperature. Envelope upgrades would improve the building's overall R-Value and save significant energy. Windows are single-glazed and are poorly sealed.

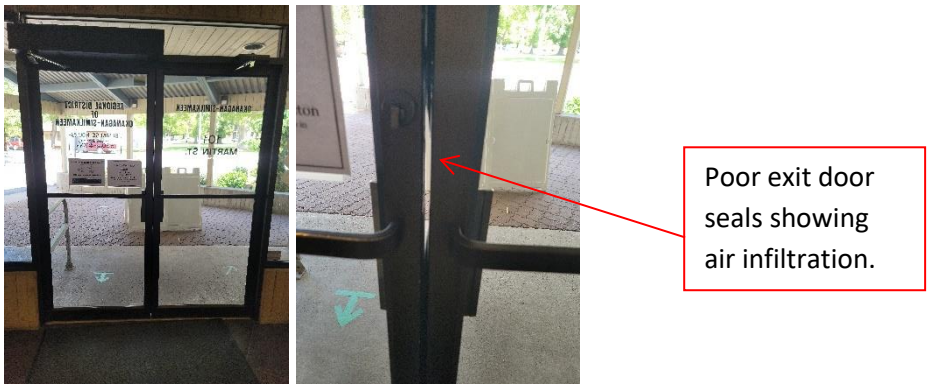

Figure 10: Existing Door Seals

The following table provides a description of proposed Energy Conservation Measures (ECM) found during the site investigation:

Table 9: Building Envelope – Description of Energy Conservation Measures

Potential Energy Conservation Measure	Description
Repair and Replace Door Seals to Minimize Infiltration Heat loss	During the site audit, it was noticed that the seals to the external doors in the facility were in poor condition. These should be repaired or replaced as soon as possible to prevent unnecessary heat loss and air infiltration.

The following table provides a summary of savings, costs, and simple payback period associated with the proposed ECM:

Table 10: Summary of ECM Costs and Savings

Potential Energy Conservation Measure in order of priority	Cost Benefit Analysis Based on Incremental Costs (Cost difference between standard efficiency equipment and high efficiency equipment)					***Estimated Total Project Capital, Design & Install Cost ($)***
	Pre-incentive Estimated Incremental Capital Cost ($)	Applicable Incentive ($)	Total Estimated Incremental Capital Cost ($)	Estimated Incremental Annual Gas / Electricity Cost Savings ($)	Simple Payback (yrs)	
Repair and Replace Door Seals to Minimize Infiltration Heat loss	$200.00	$0.00	$200.00	$42.73	4.7	$200.00

Controls

There is no automated direct digital control system (DDC) serving the HVAC equipment in the building. The majority of equipment is controlled via standalone thermostats. Rooftop units have programmable thermostats.

Figure 11: Typical Existing Wall Mounted Thermostat

The following table details the energy conservation measures found during the site investigation:

Table 11: Controls – Description of Energy Conservation Measures

Recommended Energy Conservation Measure	Description
Install a New Direct Digital Controls (DDC) System to control HVAC	A new DDC system has the potential to reduce HVAC energy consumption by programming the controls to optimize facility energy use. The following are advantages of installing a new DDC system: ▪ the ability to fine tune the operation of building HVAC equipment; ▪ the ability to monitor and schedule building HVAC equipment; ▪ the ability to verify savings from energy efficiency measures; ▪ the ability to understand loads (i.e. heating) to optimize operating efficiencies; ▪ the ability to assess savings from efficiency measures; ▪ the ability to verify performance of new renovations and additions; ▪ the ability to identify consumption anomalies as part of ongoing commissioning processes.

The following table provides a summary of savings, costs, and simple payback period associated with the proposed ECM:

Table 12: Summary of ECM Costs and Savings

Potential Energy Conservation Measure	Cost Benefit Analysis Based on Incremental Costs (Cost difference between standard efficiency equipment and high efficiency equipment)					*Estimated Total Project Capital, Design & Install Cost ($)*
	Pre-incentive Estimated Incremental Capital Cost ($)	Applicable Incentive ($)	Total Estimated Incremental Capital Cost ($)	Estimated Incremental Annual Gas / Electricity Cost Savings ($)	Simple Payback (yrs.)	
Install a New Direct Digital Controls (DDC) System to control HVAC	$12,000.00	$0.00	$12,000.00	$969.16	12.4	$12,000.00

Electrical & Lighting Systems

Electrical Power to the building is used for the buildings lighting, kitchen equipment, refrigeration, plug loads and mechanical equipment.

There is a good opportunity for energy conservation measures associated with the lighting technology in the facility. Lighting in the facility consists of LED, MH, CFL luminaires, and T8 linear fluorescent luminaires. The lighting in facility is controlled by combination of manually operated switches and photocells for external luminaires.

The primary non-mechanical loads are related to the lighting and plug loads.

Figure 12: Indoor Lighting in the RDOS Office

Figure 13: RDOS Office External Lighting

Note: Types and wattages of the luminaires are assumed based on visual observations and should be used only as the basis for further investigation. Verification of recommendations should include measurement and detailed assessment.

The following tables detail the energy conservation measures found during the site investigation:

Table 13: Electricity – Energy Conservation Measures

Potential Energy Conservation Measure	Affected End Use	Cost Benefit Analysis Based on Incremental Costs (Cost difference between standard efficiency equipment and high efficiency equipment)					*Estimated Total Project Capital, Design & Install Cost ($)*
		Pre-incentive Estimated Incremental Capital Cost ($)	Applicable Incentive ($)	Total Estimated Incremental Capital Cost ($)	Estimated Incremental Annual Electric Cost Savings ($)	Simple Payback (yrs)	
LED Lighting Upgrade	Lighting	$24,996.00	$1,870.00	$23,126.00	$2,002.50	11.5	$23,126.00

Table 14: Electricity – Description of Energy Conservation Measures

Recommended Energy Conservation Measure	
Internal spotlights: Replace Existing CFL-23W-1L Screw in with Energy Efficient LED PAR38-17W	
Offices Open & Closed: Replace Existing T8-32W-2L-4' with Energy Efficient 2x4 Flat Panel, 3800Lmns, 3500K UNV W/ Surface Mount Kit	
External: Replace Existing External MH-70W-Wallpack with Energy Efficient LED-8W-Wall Pack	
External: Replace Existing MH-250W-Pab with Energy Efficient LED-90W-Wall Pack	

Note: All proposed lighting fixtures must be listed and approved by FortisBC and Design Lights Consortium (DLC).

Summary

From the 12-month of 2019, the Regional District of Okanagan-Similkameen (RDOS) Office consumed **985 GJ** of natural gas with an annual cost of **$8,415.** For the 12-month period ending December 2019, the facility consumed **128,238.00 kWh** of electricity which cost approximately **$9,329.31** at the current rate**.**

Please visit fortisbc.com for the most current information on rebates and energy savings.

Based upon BES's professional opinion and knowledge of the building, a broader set of criteria have been used to select a bundle of recommended Conservation Measures. These include measures that should be implemented to improve operation, occupant comfort conditions, and facilitate the implementation of other ECMs but are also responsible for extending the simple payback period beyond 11.9 years.

These measures are detailed in the table below:

Table 15: Potential Saving from Implementing Recommended Energy Conservation Measures (ECM)

Recommended Energy Conservation Measure in order of priority		Total Sum of Bundled Measures
Cost Benefit Analysis Based on Incremental Costs	Pre-incentive Estimated Incremental Capital Cost ($)	$67,939.00
	Applicable Incentives ($)	$12,448.74
	Total Estimated Incremental Capital Cost ($)	$55,490.26
	Estimated Incremental Annual Gas Cost Savings ($)	$1,967.83
	Estimated Incremental Annual Electricity Cost Savings ($)	$2,677.10
	Simple Payback (yrs)	11.9
Estimated Total Project Capital, Design & Install Cost ($)		$181,190.26
GhG Emission Savings (Tonnes e-CO2/yr)		12.3

All costs are estimates of probable cost and should be used for budgetary purposes only. There are also some measures included in the body text which cannot be quantified and as such are not included in the summary table. In the event that energy conservation measures overlap and affect the same piece of equipment, these are identified as numbered options. In these cases, the Client will need to select the retrofit measure that best meets their financial and performance criteria.

NEXT STEPS

Contact BES to Discuss the Potential Energy Retrofits

- To learn more about the energy savings potential of the selected measures and the impact on the building's energy and thermal comfort performance.
- Ask if you qualify for additional funding for a more detailed study and additional customized incentives.

Implementation Support from BES (No Cost)

- Prepare guide specifications and schematic level diagrams (not detailed engineering specifications) meant to assist the contractor with a design-build solution (This provides the basis of design for the bidding process and typically results in contractors following the schematic level design.)
- Conduct the bidding processes with third party contractors; designs can be sent to multiple contractors of your choice or sole-sourced with your contractor of choice
- Review quotes from contractors and summarizing the results of the bid in-person review of the final installation of the upgrade applicable to the implementation support provided
- Provide assistance in applying for applicable rebates

Explore Options for Project Financing:

- Financing companies, credit unions and banks can provide low interest loans for energy efficiency upgrades. Energy savings ($) can be realised immediately upon implemenetation of proposed projects.

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