

Ductless (Split System) Installation Guide for Lincoln School

Version 1.01
Jan 20, 2020

Revision History:

- V0.95 Beta Roll-out, fee update, Oct. 2017
- V1.0 Contractor approval process, LSCOA inspection and infrastructure fee pass-through, flexible connector to condensate drain

Attachments:

- .zip file containing:
 - o Roof plan w/condenser unit locations
 - o 1st floor w/condensate drain plan
 - o 2nd floor w/condensate drain plan
 - o 1st floor w/quadrant chases plan
 - o 2nd floor w/quadrant chases plan
- Product example cut sheets (.pdf packet)
- Job Form

Important Contacts:

- LSC Ductless inspector contact info: Zach Erdmann at Premium Efficiency 541-343-0699, zach@premiumefficiency.com website: www.premiumefficiency.com
- Property Manager for access to building and contractor approval status BMC contact info: Aaron Solbeck, 541-485-6991 ext 108, asolbeck@bmc-llc.com
- Scheduling for initial walk through for contractor approval: Brian Bailey, bb17660@yahoo.com

1 Audience and Purpose of this document

The intended audience for this document is licensed, bonded and insured HVAC contractors wishing to provide unit owners accurate and compliant bids.

2 Contractor Approval

Only contractors approved by the LSCOA will be permitted to install a split-system at Lincoln School. To become an approved contractor, the following three steps must be completed:

1. Read this Installation Guide and review associated attachments
2. Schedule and complete a walk through of the Lincoln School split-system infrastructure (see Contacts above).
3. Provide the property manager current proof of bonding and insurance.

A contractor's approval may be revoked at any time by the LSCOA or the Lincoln School property manager for due cause which may include but is not limited to

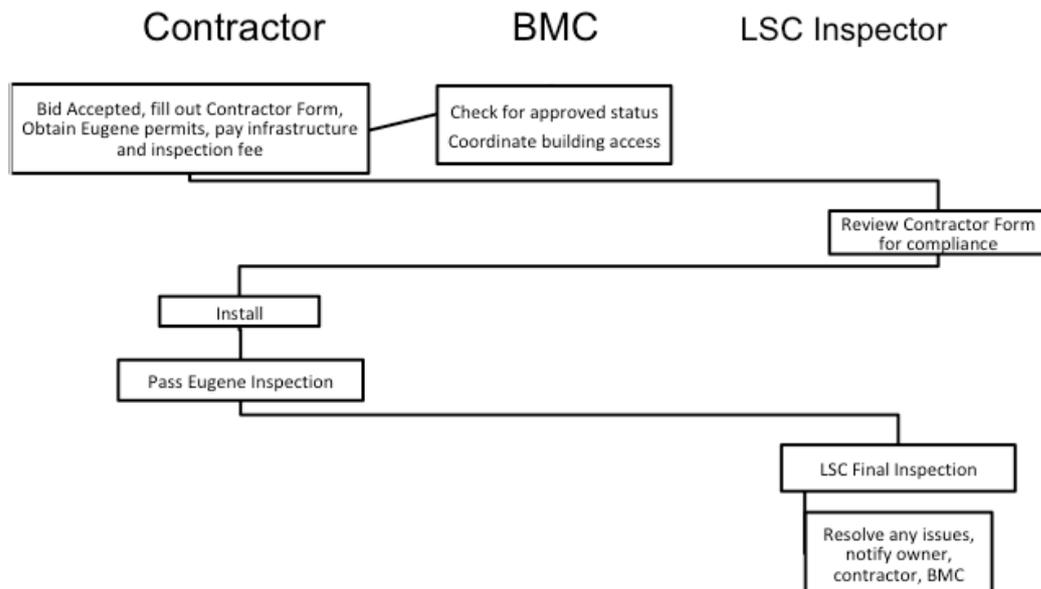
failure to remedy inspection failures, property damage, owner satisfaction or other resident disturbance issues.

3 Procedure overview

Once a contractor is approved, below is an overview for the procedure for installing a ductless system for a Lincoln School apartment.

1. Contractor prepares bid and makes agreement with owner
2. Contractor provides a filled out 'Job Form' to LSC's property manager along with payment for Infrastructure fee.
3. Contractor provides same Job Form to LSC's Ductless Inspector along with payment for LSCOA inspection. Any issues discovered by the inspector's review of this form must be resolved.
4. Contractor obtains necessary mechanical and electrical permits from city of Eugene.
5. Contractor installs, with building access coordinated with LSC property manager, then passes final inspection from City of Eugene, then coordinates with LSC Ductless inspector for post-install inspection
6. LSC Ductless inspector does walkthrough inspection with contractor. Contractor to provide proof of passed city and mechanical inspections, LSC Ductless inspector and Contractor coordinate remedies if any needed.
7. LSC Ductless inspector provides final approval Notifies owner, contractor, board & BMC of "final pass".

Installation Procedure Overview



3.1 Bidding requirements

For transparency, all bids received by the prospective unit owner should include:

- A line item for the Lincoln School infrastructure fee. This fee is a pass through and is paid by the contractor on the owner's behalf to LSCOA through the property manager (BMI).
- A line item for the additional inspection and fee required by LSCOA. This fee is a pass through and is paid by the contractor on the owner's behalf to the inspection company.

See the Fees section below for additional explanation.

4 Fees

There are two one-time fees payable to LSC that are paid when applying for an installation.

4.1 Infrastructure

The first is intended to repay the association for a portion of the infrastructure and engineering costs that were incurred as part of making the installation feasible at Lincoln School. At the time of this writing, it is set to: \$200

This fee is paid as a pass-through by the Contractor to BMC, but is ultimately the responsibility of the owner.

4.2 Inspection

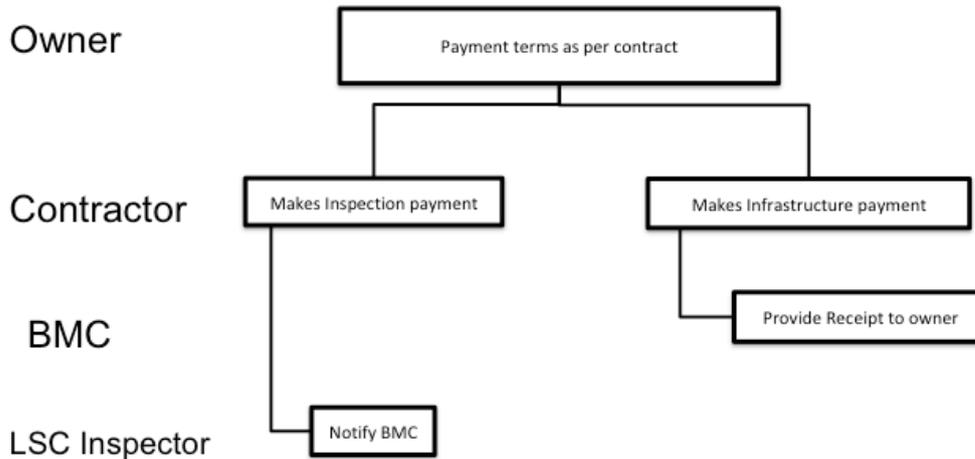
The second is a fee associated with pre and post technical inspection of the installation to ensure the installation meets these guidelines and will do no harm to the Lincoln School building. This fee is paid indirectly as a pass through from the contractor to the board-designated inspection firm. At the time of this writing, the fees set by the designated Inspector are as follows:

- Pre and Post inspection fees, including report with photos is: \$175.
- If a problem/non-compliance is found with contractor's install and can be verified (e.g. photo) easily without a visit, there will be no extra charge.
- If a site visit to re-inspect is necessary, a fee of \$125/hr. will be charged.

All inspection fees are ultimately the responsibility of the owner. In the case of re-inspection, we suggest the owner attempt recouping fees associated with non-compliance to this guide from the contractor.

If the non-compliance issues are not addressed in a timely fashion, the Board maintains the right to have the problem remedied. Costs associated with bringing the installation into compliance will be passed to the owner.

LSC Infrastructure and Inspection Fees



5 Building Access

Owner's are responsible for coordinating a contractor's access to the building, and their unit. Roof access is coordinated through BMC.

6 Mechanical Overview

Below is a brief overview of the mechanical requirements necessary for Ductless installations at Lincoln School:

- All 59 condos are permitted to install the outdoor unit (heat pump) at unit-specific reserved locations on the roof top raised area exterior side wall by way of installing a manufacture approved wall support bracket system plus anti-vibration mounts between bracket and side wall. Please see plans for location for each condo number outdoor unit. The location for each condo outdoor unit must be in the designated location to minimize total line length from indoor unit to outdoor unit for all units in the building. Design max length of this project for any one unit shall not exceed 150 ft. from indoor unit to outdoor unit.
- The design process provides that there shall be NO penetrations to the existing roof membrane.
- For 1st floor units, all refrigeration lines and electrical lines from each condo to rooftop shall be installed through one of four interior chases located in each quadrant. NW & NE quadrants to use existing light wells and SE & SW quadrants to use interior chases with access doors. See plans for location. Later in this document we detail which condos are to use which interior chase or designated interior cavity to run new piping, and how these lines are to be installed, secured, and sealed to the building structure.
- All lower and upper level condos will install their own condensate drain line to an already installed main drain line with stubs for unit attachment

that ultimately feeds into existing sump pump wells in the crawlspace. This is also be detailed on the plans.

- 2nd story condos must use condensate pumps located within their interior space (usually a purchase option with the interior unit) and pumped up to attic into existing main condensate drain line. Lower level condos may use an approved interior mounted condensate pump or gravity drain to existing main drain line in crawlspace.
- Sidewall penetrations on rooftop side wall must use a gasketed fixture designed for this application and be sealed properly to avoid moisture intrusion into the building. An example cut sheet for such a fixture is included in this packet.
- Each condo will be responsible for every aspect of their installation project. Including permits, electrical costs, installation, equipment manufacturer choice, interior air handler location, infrastructure and inspection fees, and logistics with BMC or LSC association.

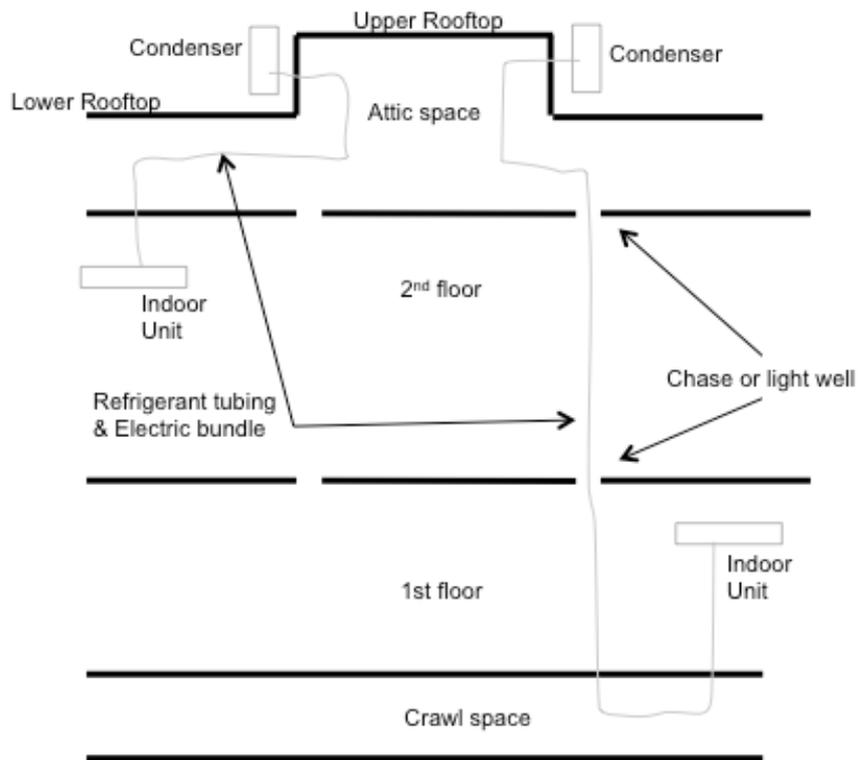
7 Provided Infrastructure

The following infrastructure will be provided to facilitate the installation of Ductless systems for Lincoln School:

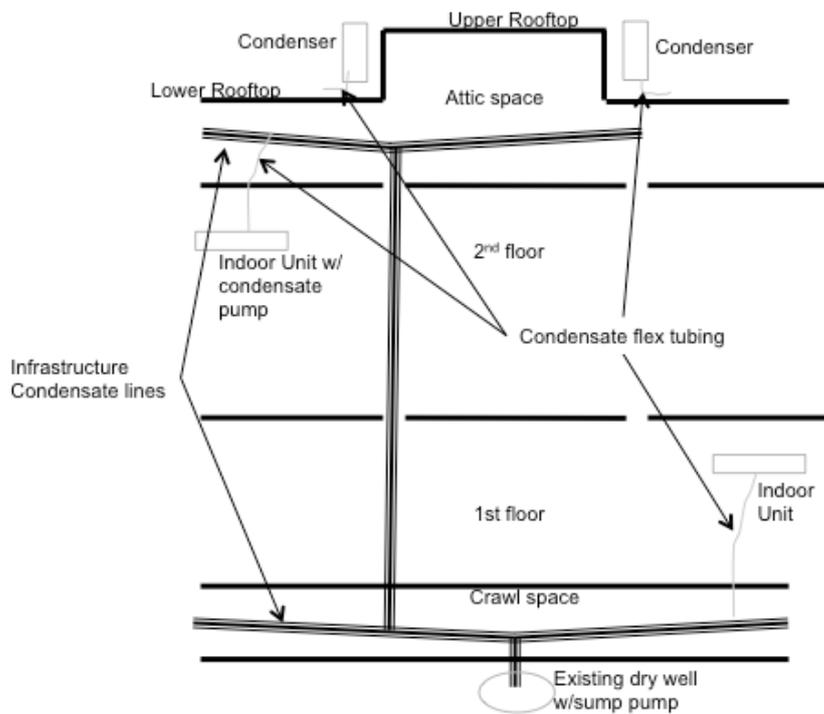
- Provide properly sloped main condensate drain lines in crawlspace and attic to existing sump pump wells in crawlspace. Main lines are sized to accommodate max. cooling BTU condensation for entire building.
- Provide fire rated access doors on SW & SE quadrant interior chases at approximately 18 inches from both the floor level and ceiling level at each floor and quadrant.
- Provide access to light wells from 1st floor corridor on NW and NE corners to act as interior chases.
- GFI receptacles with weather proof covers are provided on rooftop half walls to facilitate condenser installation.

The drawings below depict a lateral view of a (highly) conceptualized example of the plan for Refrigerant Tubing routing and Condensate Line routing for a 2nd and 1st floor installation (Please refer to provided drawings for actual details and locations):

Refrigerant Tubing Plan - conceptual view



Condensate Plan - conceptual view



8 Installation Requirements

8.1 General Requirements and Limitations

All job-related details and installation methods are to be followed by these guidelines. Under no circumstances may these requirements be deviated from or substituted for any other location or method.

1. At no time shall any owner or contractor representing the owner change the exterior appearance of the building by any means.
2. All questions, concerns, or alternatives must be brought to the LSC Association for approval unless otherwise stated in these guidelines.
3. If any deviations or alterations that are not approved by this plan are performed, it will be at the owner's expense to correct them to proper approved methods and locations.
4. All owners are required to get pre-approval from the LSC Ductless inspector, BMC for building access, and city of Eugene building and planning before performing any scope of this project.
5. All work performed as part of this project shall be executed by a licensed, bonded, and insured contractor in the State or Oregon. Owners to verify prior to hiring contractor and Contractor to provide proof in pre-installation submittal packet.
6. All mechanical and electrical work associated with this project requires building permits from the city of Eugene building and planning dept. Additionally a final inspection of work is required from the city and is the responsibility of the contractor.
7. Upon completion of any ductless heat pump or associated work, final inspection and approval is required by the city of Eugene building department, then by the LSC Ductless inspector. Issues found for either City of Eugene or the LSC Ductless inspectors are the responsibility of the Contractor to remedy.
8. The Owner and by extension, their Contractor is responsible for any damage or nuisance caused to residents, premises or structure during or after installation of the Ductless system.
9. LSCOA is responsible for the provided Ductless infrastructure, though Owner's and by extension their Contractor's are responsible for proper use of the infrastructure. Misuse of the infrastructure is the responsibility of the Owner and by extension, the Contractor.

8.2 Interior Components, Equipment and installation

1. Owners may choose to install any type of indoor air handler as long as air handler does not protrude into other condo spaces, hallways, common areas, attic spaces, or crawlspaces. Ducted or recessed air handlers that require the air handler to use attic or crawlspaces to accommodate the installation of the equipment are not allowed. Attic and crawlspaces are only to be used to route refrigeration, electrical, and condensate drain lines to the outdoor equipment. Air handlers are to be entirely contained within the conditioned space of the condo.
2. Owners may choose to have more than one indoor unit installed with a maximum of two indoor air handlers per condo. All other requirements

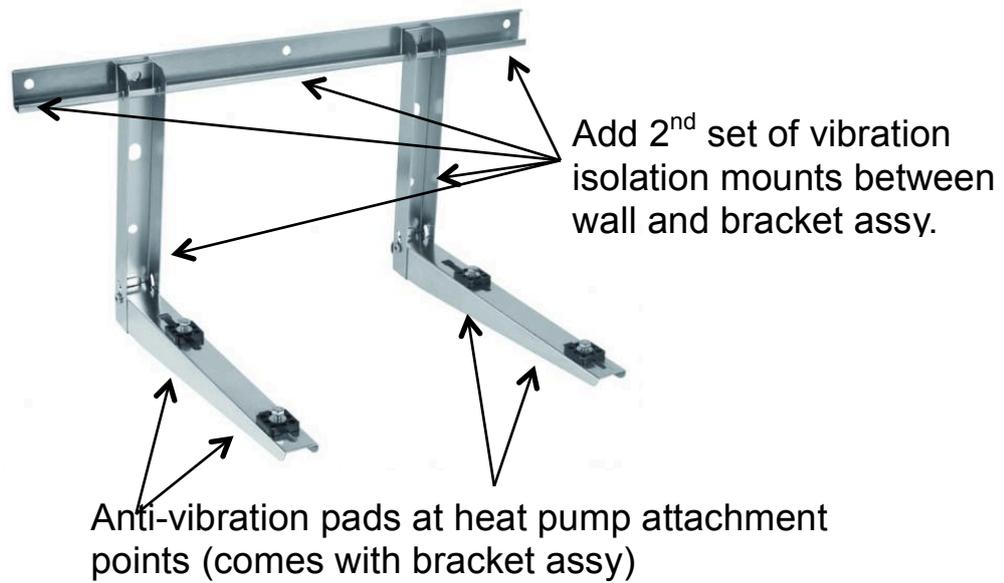
and limitations set in this section are to be followed for both indoor air handlers and associated piping / installation components.

3. Owners may choose to install indoor air handlers, refrigerant, electrical, condensation pump and drain lines at their discretion and direction within their interior conditioned space. This allows owners to choose locations and piping installation methods within their interior space. Refer to LSC Association if piping is to be installed inside a wall cavity that is shared by an adjacent condo. Pre-approval may be required with adjacent condo owner. If piping is installed on interior side of sheetrock or finished wall covering, no pre-approval is necessary.
4. To mitigate sound and vibration transmission to adjoining units, choosing a wall mount location for the interior unit that is **not adjacent** to an adjoining unit is encouraged, but not required.
5. The maximum allowed sound level pressure allowed for the interior unit is 50 dbA.
6. 2nd Level owners are required to use interior installed condensation pumps for drainage. Attic in-line or Attic installed condensate pumps are not allowed. Condensate drainage may also be obtained by direct or indirect connection to plumbing waste system if the connection point is within the interior space. Pre-approval from city of Eugene building department, Oregon mechanical & plumbing code division is required. 1st level owners may choose to use gravity drain method or condensation pump method. All requirements in the section apply to any owner that chooses to use condensation pumps.
7. Refer to other sections for further requirements and limitations related to the interior components of this project.

8.3 Exterior Rooftop Components, Equipment, and Installation.

1. All condos are numbered per plans and specified on roof plan drawing specific location of each condo outdoor heat pump unit. Follow plans to scale to ensure proper clearances to building structure and other designated condo heat pump locations.
2. Outdoor compressor unit is to be installed on raised section side wall, between lower and upper roof levels. Outdoor mechanical equipment shall maintain at least 12 inches above lower roof level for electrical components. See plans for details.
3. Outdoor compressor AND disconnect cover MUST be labeled with the UNIT # so as to immediately identify the corresponding Unit #.
4. Only a manufacturer approved or LSC Association approved wall mounting bracket is to be used. Please see attachments for examples of approved wall brackets. All wall brackets shall be fastened into at least two wall studs behind siding material for rigidity and support. If no wall studs are available within designated space, additional wall blocking behind siding is required for proper support. Wall brackets are to be installed in accordance with local building codes, wall bracket manufacturer installation guides, and this section. All outdoor units shall be bolted to wall bracket for seismic and vibration restraint.
5. Additionally, the wall mounting bracket shall have a **two sets of anti-vibration mounts**, One set between the condenser unit and the wall

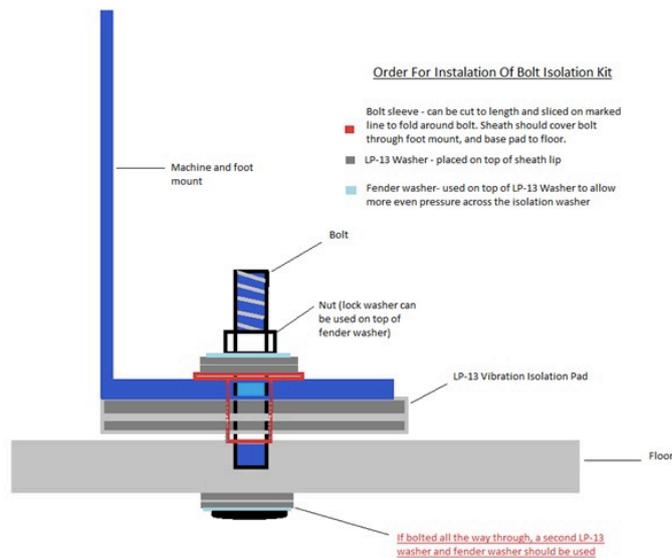
mount bracket (usually provided with the wall mount bracket assembly) and the second set between the wall mount bracket and the building wall. The second set of isolation mounts must be procured separately. These must support the vertical load of the heat pump and have complete mechanical isolation between wall and bracket assembly. WHY: The attic framing utilizes 'balloon framing' down through the attic into the second floor. Vibrations from the compressor mounts could travel to these understory apartment units. See depiction below:



Examples of wall mount vibration isolation pads:



Example of anti-vibration pad + bolt isolation kit:



Bolt isolation kit:



6. All screws, bolts, mounting hardware that penetrate siding shall be sealed properly with polyurethane or silicone sealants to prevent moisture intrusion into the building.
7. All electrical service lines and refrigerant lines that penetrate the side wall structure to any one outdoor unit shall be at least 12 inches above lower roof level and sealed properly to the siding material to ensure no moisture or air intrusion into the building. All refrigerant lines that penetrate the building wall must be covered and sealed by means of a manufacture or LSC Association approved wall penetration weather tight cover / gasket. See attachments for examples. All electrical wiring and refrigerant lines must penetrate side wall to outdoor unit within 12 inches of that systems outdoor unit.
8. Only one outdoor heat pump is allowed per condo space. Multi zone outdoor heat pumps are allowed if they meet the physical limitations set below.
9. All outdoor heat pumps are to be 200 lbs. or less and no larger than 40 inches wide, no larger than 45 inches tall, and no larger than 24 inches deep.
10. The maximum acceptable rated noise level pressure of the outdoor heat pump/condenser is 60 dbA.

11. Outdoor heat pump installations and locations are to follow this section and scaled plans in detail and according to manufacturer's installation guidelines.
12. A minimum of 24 inches of clearance shall be maintained to either side of any outdoor heat pump. A minimum of 12 inches must be maintained to any one side of outdoor unit against an exterior wall. A minimum of 6 inches must be maintained at rear of outdoor unit and side wall. A minimum of 84 inches clearance must be maintained in front of outdoor unit. All manufacturers clearance requirements are to be met and must fall within this section clearance requirements.
13. At no time shall any equipment, installation component or material penetrate or cause damage to the existing roofing material.
14. NOTE: Access to the roof area through the attic is extremely limited in space and therefore likely require a crane or lift for installing the outdoor compressor. Particular attention should be paid to avoid damage to the exterior of the historical façade of the building.

8.4 Refrigerant Piping, Electrical wiring and Condensate drain piping

1. ALL refrigerant piping bundles AND individual condensate lines MUST be labeled with the UNIT # every 12 ft. so as to be immediately visible.
2. All lower level condos are permitted to route any refrigerant lines and electrical wiring through crawlspace to access quadrant interior chases for access to upper attic. All lower level condos are required to route refrigeration lines and electrical wiring through designated interior chases as listed in this section below. All lower level condos are required to install condensate drain lines into crawl space directly from condo space and connect to existing main condensate drain line.
3. All upper level condos are permitted to route any refrigerant lines, electrical wiring, and condensation lines through attic space as needed to access side wall penetration to outdoor unit in attic space.
4. All electrical wiring, refrigerant piping, and condensation drain lines are to be installed in designated areas listed in this section and secured to the building structure at least every 6 ft. from indoor unit to outdoor unit. All penetration holes in building structures used to route piping as listed above must be properly sealed. All penetrations through interior chases must be sealed with one hour rated material and sealants at crawl space, 1st floor to 2nd floor sub floor, attic levels, and fire rated sheet rock at light wells in NW & NE quadrants.
5. The interior chases to be used for piping is designated based on location, The table below provides, by condo unit number, the route and condensate plan to be used: (see plans for quadrant chase location)

Floor/ Quadrant	Tubing route	Condensate from interior units	Units
1/NW	From inside unit to crawl space, then up into NW corridor light well, then attic, then indicated location of. See drawing	From inside unit to crawl space then attach to shared condensate drain in crawl space. See	#101 - #108

		drawing	
1/NE	From inside unit to crawl space, then up into NE corridor light well, then attic, then indicated location of condenser. See drawing	From inside unit to crawl space then attach to shared condensate drain in crawl space. See drawing	#123 - #130
1/SE	From inside unit to crawl space, then up into SE drain chase using access panels on 1 st and 2 nd floor, then attic, then indicated location of condenser. See drawing	From inside unit to crawl space then attach to shared condensate drain in crawl space. See drawing	#117 - #122
1/SW	From inside unit to crawl space, then up into SW drain chase using access panels on 1 st and 2 nd floor, then attic, then indicated location of condenser. See drawing	From inside unit to crawl space then attach to shared condensate drain in crawl space. See drawing	#109 - #115
2/NW	From inside unit to ceiling/attic space, then to indicated location of condenser. See drawing	Condensate pump required on internal unit. Connect to shared condensate drain in attic space. See drawing.	#201 - #208
2/NE	From inside unit to ceiling/attic space, then to indicated location of condenser. See drawing	Condensate pump required on internal unit. Connect to shared condensate drain in attic space. See drawing.	#223 - #230
2/SE	From inside unit to ceiling/attic space, then to indicated location of condenser. See drawing	Condensate pump required on internal unit. Connect to shared condensate drain in attic space. See drawing.	#216 - #222
2/SW	From inside unit to ceiling/attic space, then to indicated location of condenser. See drawing	Condensate pump required on internal unit. Connect to shared condensate drain in attic space. See drawing.	#209 - #215

6. 1st and 2nd story units that have heat pump capabilities will generate condensate at the outside heat pump/condenser. These will then be piped down to the roof surface. Condensate piping for outside heat pump must be secured to the stem wall, with the last attachment no less than 12" above the roof surface. Any stem wall penetrations must be water-proofed (i.e. use silicon sealant).

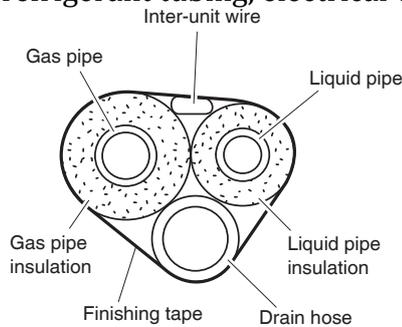
To avoid unnecessary drip wear on the roof surface, the fixed or flexible pipe termination will exit horizontally, parallel with the roof plane. Fixed pipe to be at approximately 1-2" above the roof surface; flexible pipe could lay directly on the roof surface. The termination must allow for new roofing material to be easily slid under by providing adequate clearance in the case of fixed pipe or by lifting in the case of flexible pipe. The piping or its securing mechanism must never penetrate the roof membrane and must not impede the natural flow of rainwater.

7. Condensate piping from interior unit shall always utilize rigid piping over flexible piping whenever possible. Attachment of the interior unit to the provided condensate infrastructure should make use of a removable flexible coupling, such as Fernco-type adaptor. This is to provide an easy ability to isolate and clear individual unit condensate lines with air

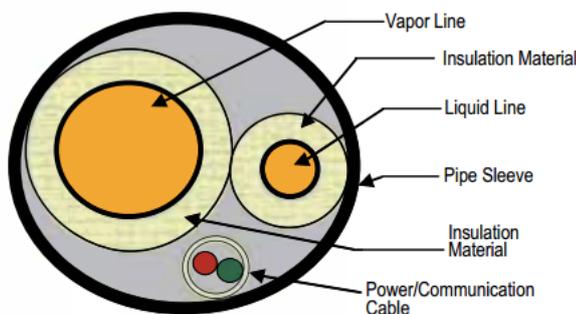


- pressure without putting reverse pressure on other connected drains.
8. Labeling of the inside condensate drain with the corresponding unit number must occur immediately at the connection point to the larger shared drain system.
 9. Access to interior quadrant chases is achieved by access through NE & NW quadrant interior windows on first floor and access panels for SW & SE quadrant interior chases on both 1st and 2nd floors.
 10. All electrical wiring is to be isolated to and sourced from each condominium's electrical service panel and no shared or common power is to be used to provide power to any piece of the heat pump system.
 11. No ductless system shall require more than a 25 amp, 220V dedicated service sourced at the condominium's electrical service panel. Most units appear to have a 125 amp service panel appear with sufficient capacity for the addition. However, in instances where necessary or desired, the licensed electrical contractor may properly disconnect one or more of the (typically) 30 amp 220 V breakers dedicated for electrical resistant heat wall heaters. This strategy would disable some or all of the resistant electrical heat in favor of the more efficient ductless heating while reducing the overall amperage requirements of the unit's service panel

12. Lower level condos must use main condensate drain line in crawl space at closest open port to condo. If port isn't available, contractor may add one at their discretion without impacting other units' condensation drain function.
13. Upper level condos must use main condensate drain line in attic space at closest open port to condo. If port isn't available, contractor may add one at their discretion without impacting other units' condensation drain function.
14. The Lincoln School Ductless System is designed to support piping lengths for refrigeration lines that do not exceed 150 ft. per system from any indoor unit to outdoor unit. Actual piping length calculations are the responsibility of the HVAC contractor.
15. All electrical wiring, condensate piping, and refrigerant lines are to be installed and secured to floor joist in crawl space a minimum of every 4 ft. and not to impede on crawl space access openings.
16. All electrical wiring, condensate piping, and refrigerant lines are to be installed and secured to roof trusses in attic space a minimum of every 4 ft. and not to impede on attic space access openings. All piping as listed above in attic space is not permitted to impede on walk ways and standing platforms in attic space.
17. All wall and ceiling penetrations must have required fire stop and/or waterproofing
18. Cable bundle must be *clearly labeled with the unit number* at least every 8 ft. and immediately before/after any wall or ceiling penetrations outside the actual apartment.
19. Wherever possible, tubing from inside units must bundle insulated refrigerant tubing, electrical wiring and the condensate drain hose:



20. In all other locations, tubing and cabling must use a combined bundle to carry all tubing and electrical/communications line:



Typical Piping, Insulation, Power Wire and Communications Cable Arrangement in a Conduit

21. Each refrigeration line must be independently insulated within the bundle, with no exposed tubing that can produce condensate.
22. Utilize hangers as per code, both vertically and horizontally (every 4'?)
23. Observe bend radius as per manufacturer.
24. Must have straight, professional looking lines that don't sag or wander.

8.5 Proper Sizing and Other Cost Considerations

There are some unique considerations to units installed in Lincoln School worthy of your attention when bidding and installing. Some of these are:

- The attic and roof access hatch from inside the building is quite limited space wise. You'll probably need to crane/hoist units onto the roof from the outside.
- All units will require extra time than may be typical for running tubing through crawlspace and/or attic access.
- To avoid callbacks due to LSCOA inspection, PLEASE don't forget to bring a fat Sharpie to mark the disconnect box, condensate and refer lines with the unit # and to bring lots of appropriate interior and exterior sealant for weather/rat-proofing tubing access holes. We'll be watching for this!
- Units on the first floor have long tubing runs with a good amount of vertical as well. Choose your condenser unit accordingly.
- Units on second floor require a condensate pump
- Many units have very large square footage of single pane glass which represent big energy losses or solar gains.
- All units have 11' ceilings, increasing the cubic area to heat/cool.
- Don't forget to include the inspection and infrastructure fees in your bid!

9 Installation checklists

These checklists will be used by the LSC Ductless inspector in evaluating both pre and post installation. These are provided for guidance only and are not the exhaustive, definitive criteria for installation.

9.1 Pre-installation

1. Has the contractor been designated an approved contractor by LSCOA?
2. Does the listed outside equipment selected meet the Installation Guidelines? This includes outside heat pump (weight, dimensions, noise limits). Also, bracket, vibration isolation pads, wall penetration gaskets etc.
3. Has the contractor calculated distance requirements between indoor and outdoor units, and does system meet these requirements?
4. What is the specific condensate plan used for this interior unit? Does it meet requirements for
5. Does interior unit piping path require any permissions or notifications from an adjacent unit? (e.g. a shared wall)
6. Were the fees paid and waiver included? Infrastructure fee to BMC, Inspector fee to Inspector and waiver signed by owner included in packet.

9.2 Post-installation Checklist

Overall general inspection of rooftop, attic space, crawl space, and interior chases to ensure guidelines set above are met and accepted by LSC Association, City building officials.

1. Is rooftop equipment installed in specified location and have proper clearances?
2. Is the exterior wall bracket installed according to manufacturer's guidelines. Is the 2nd set of vibration isolation pads installed?
3. Are all penetrations into interior chases, sub-floors, attic spaces, crawl spaces, exterior siding, and light wells sealed and fire-sealed according to instructions?
4. Is all electrical wiring, condensate drain piping, and refrigeration lines bundled, secured to building structure and labeled properly?
5. Is all electrical wiring, condensate drain piping, and refrigeration lines installed in specified locations listed in above sections.
6. Are condensate drains using fixed over flexible pipe wherever possible and properly connected to main condensate drain lines in attic or crawl space using flexible Fernco type coupling? Is there proper labeling of the individual unit's condensate drain line with the corresponding unit number at the connection point to the shared condensate drain system?
7. Does rooftop condensate drain from condenser exit onto rooftop as per specification? (Attached/sealed properly >12" above roof, Horizontal exit onto rooftop that allows roof maintenance, no impedance of rainwater flow, etc.).
8. Have all electrical and mechanical permits been final approved with city building department.
9. Is all garbage and debris from installation cleaned and disposed of.