



EXPANDING PART 9 BUILDING HVAC PERMITTING PRACTICES

Presentation

Prepared by:

Ecolighten Energy Solutions / Birch Consulting

AGENDA

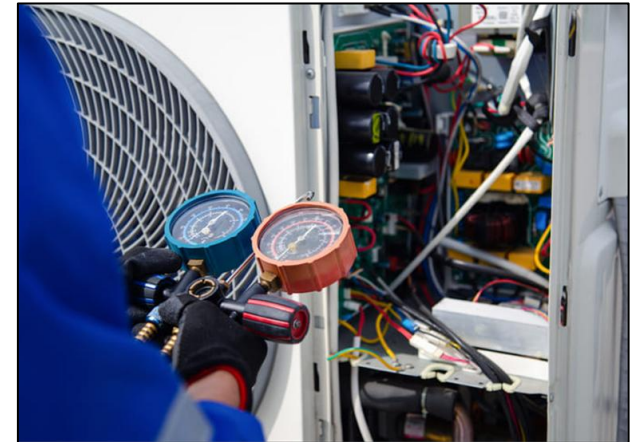
1. Existing Industry Conditions

- Conventional Standards of Practice
- BC Building Code and HVAC Systems for Part 9 Buildings

2. Quality Approach Fundamentals

- Design, Installation, and Performance Verification
- Field Experience with HVAC System Installations

3. Discussion



Section 1:

EXISTING INDUSTRY CONDITIONS



CONVENTIONAL STANDARDS OF PRACTICE

- Too often an HVAC system installation (new constructions and retrofits) does not include adequate consideration to upfront planning, optimized installation, and documented performance. This often leads to frustrated homeowners and poor performing equipment.

“50% to 70% of HVAC systems are improperly installed, causing them to be 10 to 50% less efficient than if they received quality design, specification, and installation.”
- ACEEE

HVAC SYSTEM INSTALLATIONS GO WRONG....TOO OFTEN.



CONVENTIONAL STANDARDS OF PRACTICE

- As homes become more energy-efficient, improperly sized HVAC equipment is emerging as one of the more serious issues in residential construction.



LOAD CALCULATIONS:

Too often 'Rule of Thumb'



HVAC DESIGN:

More coincidental than coordinated



VERIFICATION:

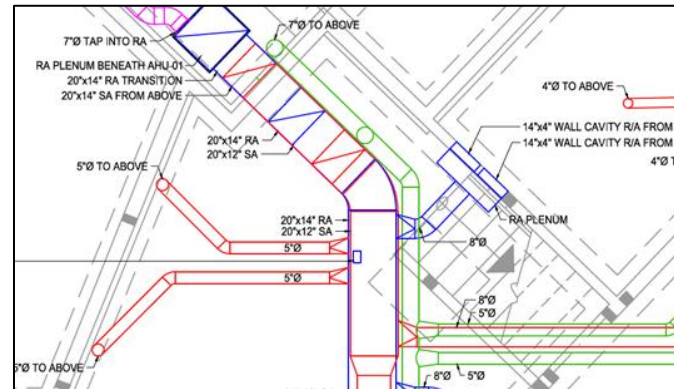
System commissioning is infrequent

BETTER STANDARDS OF PRACTICE

- Best practices in HVAC system design and installation starts with code compliant F280-12 load calculations as the foundation on which all other HVAC decisions are dependent.
- Integrated and coordinated design between builders, architects/designers, mechanical designers and contractors will optimize the HVAC system performance within changes in housing form, style, design and construction that have impacted the mechanical needs of today's housing.



LOAD CALCULATIONS:
CSA F280-12 compliant



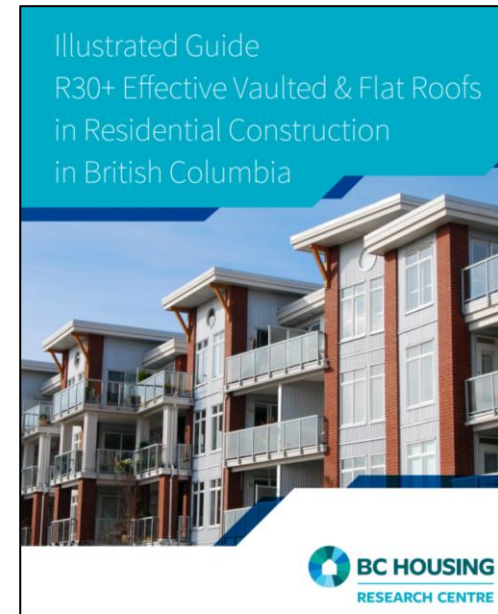
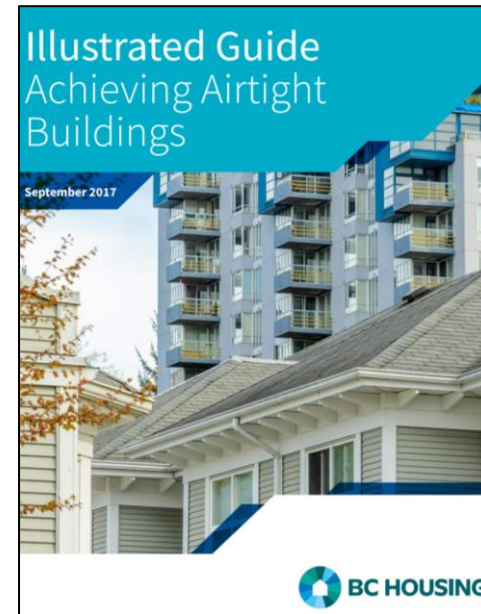
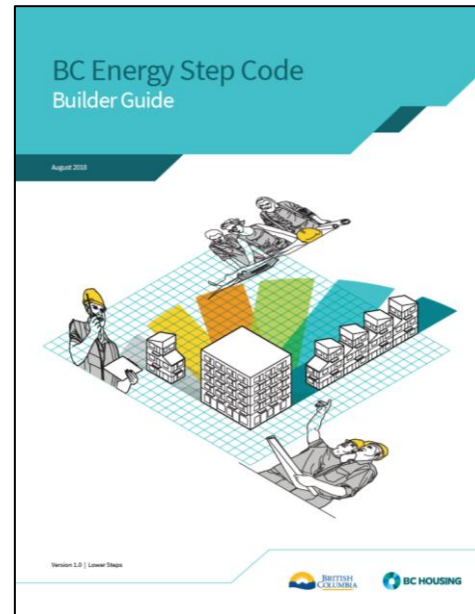
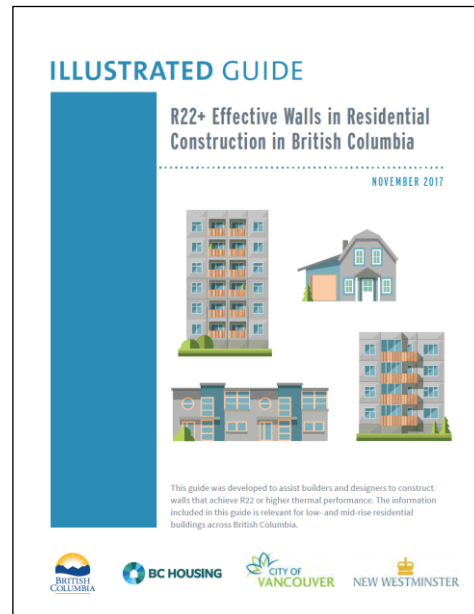
HVAC DESIGN:
Integrated design practices



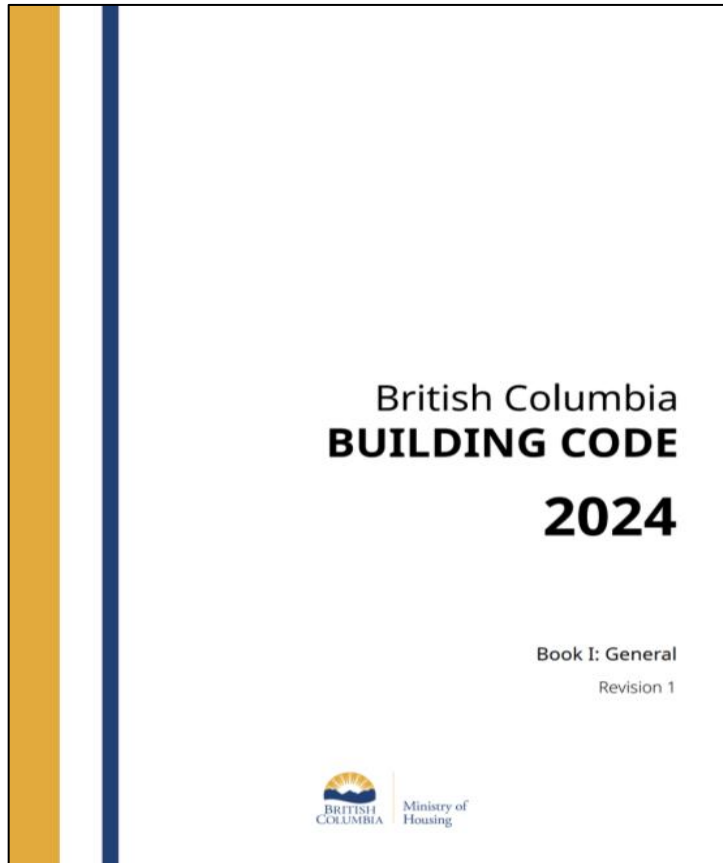
VERIFICATION:
Start-up performance documented

BETTER STANDARDS OF PRACTICE

- Efforts to date have been primarily focused on building envelopes and energy modeling. Opportunity exists to channel similar efforts to increase building industry knowledge and adoption of better standards of practice in HVAC design, installation and verification.



BC BUILDING CODE & LOAD CALCULATIONS



- BC Building Code requires heating and cooling equipment to be sized using CSA F280-12 standard.
- Major HVAC sections in Part 9 of BCBC:
 - Section 9.32 – Ventilation
 - **Section 9.33 – Heating & Air Conditioning**
 - Section 9.36 – Energy Efficiency
 - Section 9.37 – Greenhouse Gas Emissions

9.33.5.1 Capacity of Heating and Cooling Appliances

The **required capacity of heating and cooling appliances** located in a dwelling unit servicing only that dwelling unit, shall be determined in accordance with **CSA F280**, “Determining the required capacity of residential space heating and cooling appliances” except that design temperatures shall conform to Subsection 9.33.3.

BC BUILDING CODE & OVERHEATING PROTECTION



BRITISH COLUMBIA
www.gov.bc.ca

Information Bulletin
Building and Safety Standards Branch
PO Box 9844 Stn Prov Govt
Victoria BC V8W 9T2
Email: building.safety@gov.bc.ca
Website: www.gov.bc.ca/buildingcodes

No. B24-08
April 19, 2024

Protection from Overheating in Dwelling Units

This bulletin provides information about new provisions in the British Columbia Building Code (Building Code) 2024 related to minimizing the risks to health and safety due to overheating in dwelling units. These new Building Code 2024 requirements apply to projects for which a building permit is applied for on or after March 8, 2024. These changes apply to new dwelling units in all large (Part 3) and smaller (Part 9) residential occupancies.

Background

Recent extreme heat events in the summer of 2021 in British Columbia had devastating impacts, attributing to 619 deaths. Similar weather episodes are projected to become hotter, longer, and more frequent as B.C.'s climate changes.

In the Report to the Chief Coroner of British Columbia, titled "Extreme Heat and Human Mortality: A Review of Heat-Related Deaths in B.C. in Summer 2021" a recommendation was made to "...ensure that the 2024 release of the BC Building Code incorporates both passive and active cooling requirements in new housing construction...".

In response, the Building Code 2024 introduced a maximum design temperature limit for a single living space in each dwelling unit to minimize the risk to health and safety from overheating. Maintaining a safe temperature in a living space in each dwelling unit can involve a combination of mechanical cooling systems and passive design measures. The designated living space provides a place of reprieve for occupants of the dwelling unit from elevated temperatures, helping increase community resiliency and saving lives. The designer can designate a living space that makes sense for the circumstances of the dwelling unit (climate, configuration, building systems, etcetera), but it must be a living space that is designated. Unfinished basements, service rooms, and crawlspaces are not living spaces¹.

In addition, designers must coordinate the specification of space-conditioning equipment (as necessary) with energy efficiency requirements of the BC Energy Step Code. In some cases, mechanical equipment such as heat-recovery ventilators and heat pumps can be used to help maintain indoor design temperatures while also helping to meet energy efficiency targets.

¹ Article 9.33.3.1. of Division B describes living spaces distinctly from other spaces in residential buildings.

The contents of this Bulletin are not intended to be provided as legal advice and should not be relied upon as legal advice. The Building and Safety Standards Branch does not enforce compliance with the British Columbia Building Code. Local authorities are authorized to enforce the British Columbia Building Code through the Local Government Act and the Community Charter.

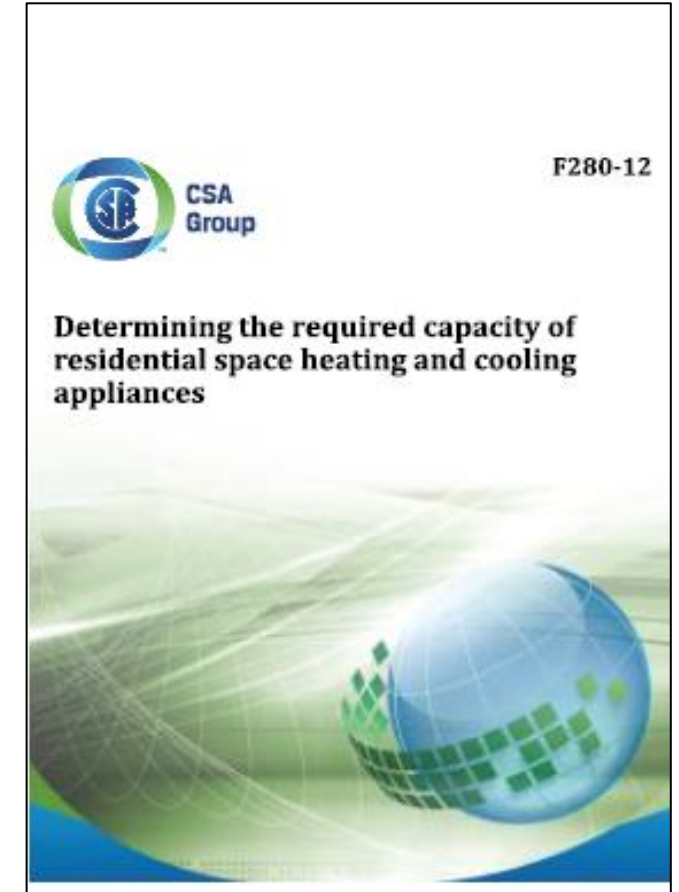
- In April 2024, BSSB released Information Bulletin No. B24-08 that provides information on new provisions in the BC Building Code 2024 related to **minimizing the risks to health and safety** due to overheating in dwelling units.
- Bulletin introduced a **maximum design temperature limit of 26°C for a single living space** in each dwelling unit to minimize the risk to health and safety from overheating

9.33.3.1 Indoor Design Temperatures

At the outside summer design temperature, **required cooling facilities** shall be capable of maintaining an indoor air temperature of not more than 26°C in **at least one living space in each dwelling unit**.

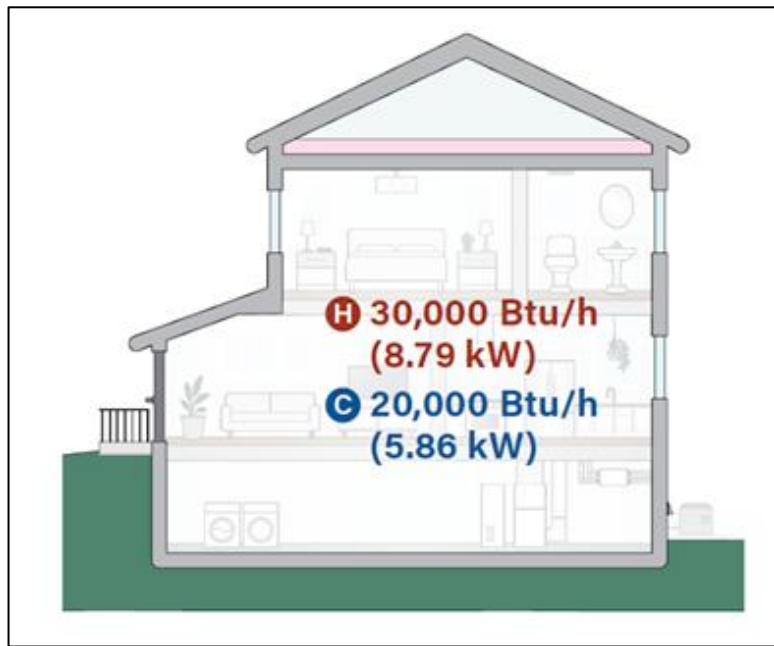
RIGHT SIZING WITH CSA F280-12

- Meeting BCBC requirements with HVAC system design and installation starts with code compliant load calculations.
- CAN/CSA F280-12: Canadian Standards Association (CSA) standard on how to properly size residential space heating and cooling equipment that is nationally recognized and referenced in BC's Building Code.
- Making sure this standard is used can:
 - ✓ Ensure comfort
 - ✓ Reduce installed HVAC system costs
 - ✓ Ensure you comply with code
 - ✓ Reduce liability risks

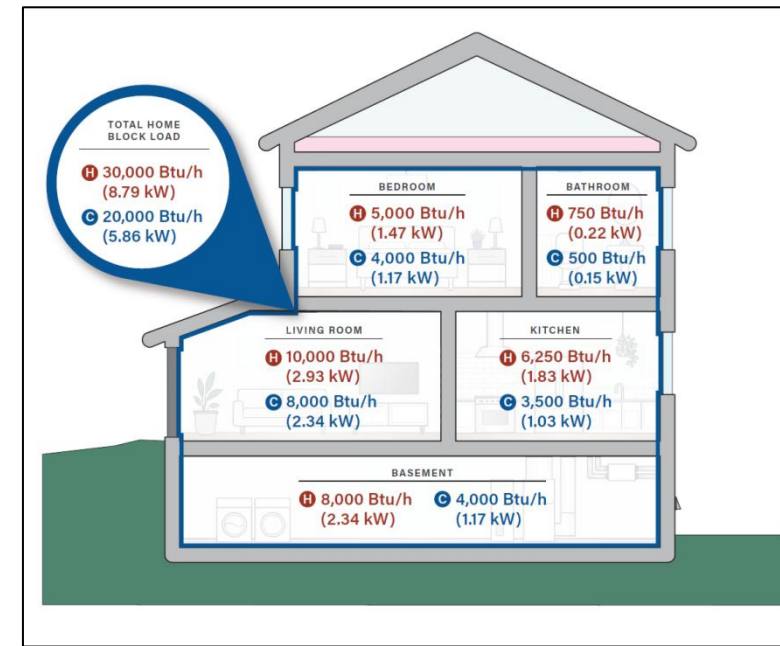


BLOCK LOADS VS. ROOM-BY-ROOM CALCULATIONS

- A block load calculates the heat loss/gain of the entire house as a single space. It is used for energy modelling and is typically used for retrofits on existing homes. A room-by-room is required for new construction and is the only approach that can adequately inform an HVAC system design.



VS



F280-12 VERIFIED SOFTWARE

- HVAC Designers of Canada has published a list of verified software tools that are compliant with CSA F280-12.
- Using verified software gives both the HVAC contractor, and those who rely on the outputs from the software, confidence that the tool can generate correct results in line with the CSA standard.



Verified F280 software tools are available at: <https://hvacdc.ca/f280-12-software/>

Section 2:

QUALITY FUNDAMENTALS



CONSUMER PERSPECTIVES

- **Consumers are vulnerable.** HVAC systems are a significant investment that is technically natured, and informed decision-making by consumers with well-intentioned contractors are needed to mitigate performance risks.



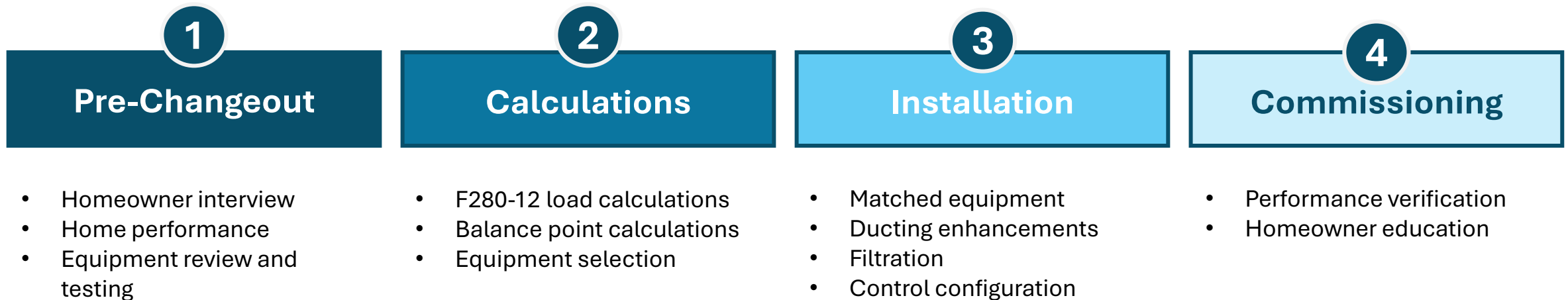
- What is a heat pump?
- How much is it going to cost?
- Who can I trust for installation?
- What should I ask the contractor?
- Is there an incentive for upgrade?
- What the heck is a COP?
- Etc. etc.



Unlike plug-in appliances and lighting which are consumer installed, a heat pump requires a professional installation by an HVAC contractor. Proper design and installation dictates the heat pump's performance, reliability and longevity, and safety of the new system.

QUALITY APPROACH FUNDAMENTALS

- **Good process leads to good results.** A sophisticated process is necessary to fully understand the opportunities and limitations with HVAC systems.



QUALITY APPROACH BENEFITS

- **Get it done right!** The importance of quality HVAC design and installation is underscored by the multiple benefits enjoyed by all stakeholders involved home retrofits.



CONSUMERS

Improved comfort and energy savings with a better performing home.



CONTRACTORS

Reduced call backs, improved relationship with homeowners, and better finished product.



UTILITIES / GOVERNMENT

Confidence that equipment should operate closer to rated performance with increased persistence of savings.

ACHIEVING A QUALITY HVAC SYSTEM INSTALLATION

“The most important day of an HVAC system is the day it is installed. Proper commissioning of the system is the only way to achieve the efficiency and long life for which the system was designed. It can also be the key to effective troubleshooting later.”

Product Manager
Johnson Controls Inc.



- Quality installations provide substantial non-energy related benefits - improved occupant comfort, lower maintenance costs and longer equipment life-cycles.

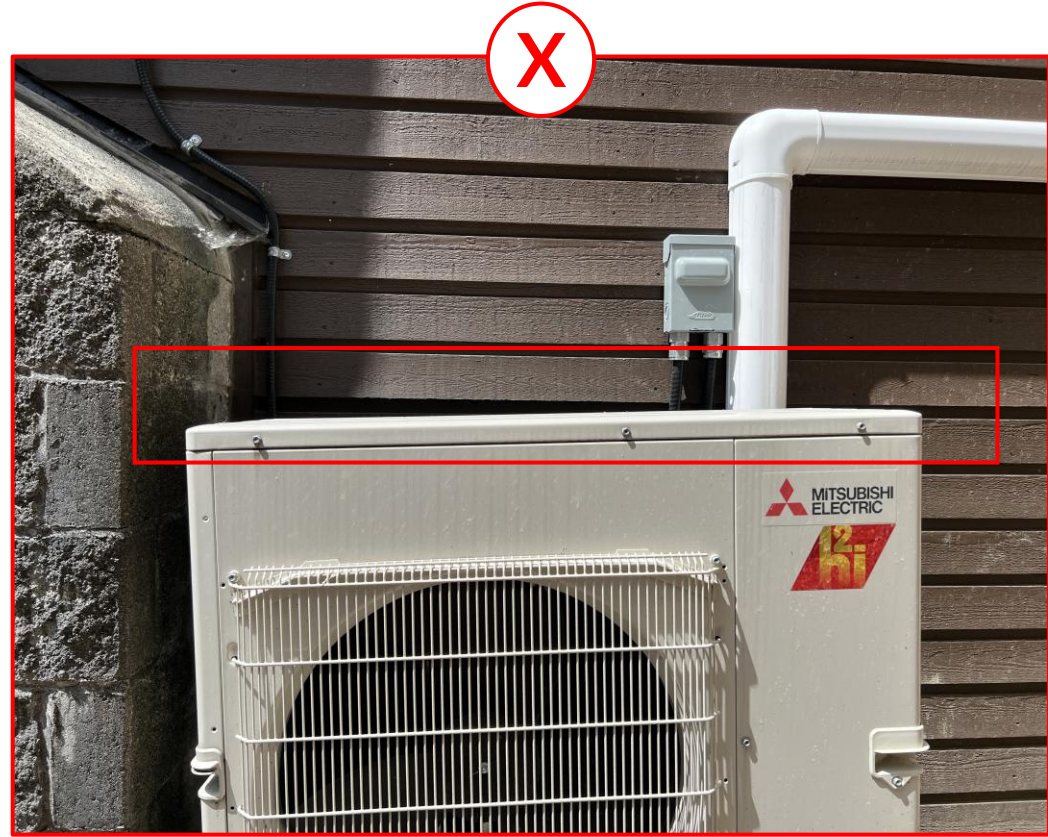
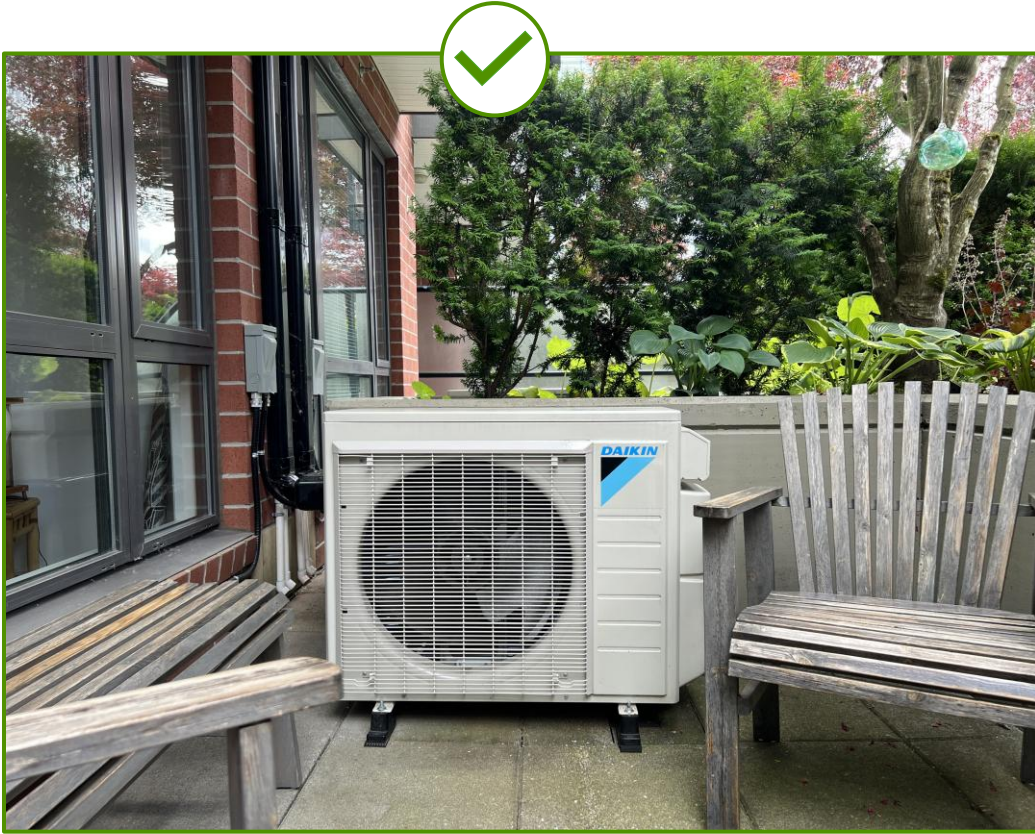
ACHIEVING A QUALITY INSTALLATION



Attributes of Quality Installation:

- Fully matched system
- Matching controls wired correctly
- Good filtration (e.g. 4" or 5" pleated filters)
- Duct enhancements and proper duct sealing
- Equipment vibration isolation (e.g. waffle pads)
- Sealed building penetrations
- Proper commissioning

OUTDOOR UNITS (Placement)



Outdoor units not level

OUTDOOR UNITS (Placement)



Limited clearance and restricted access for service

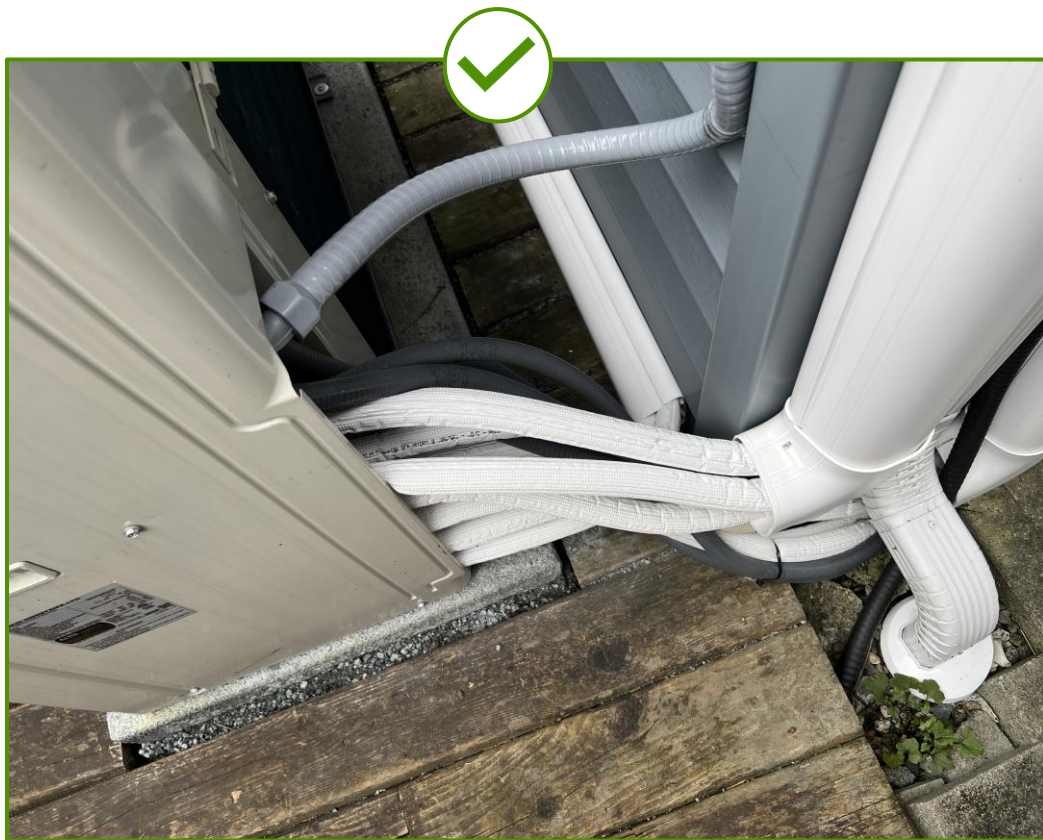


Heat pump stand on dirt with no pad and unlevel.

OUTDOOR UNITS (Noise Mitigation)



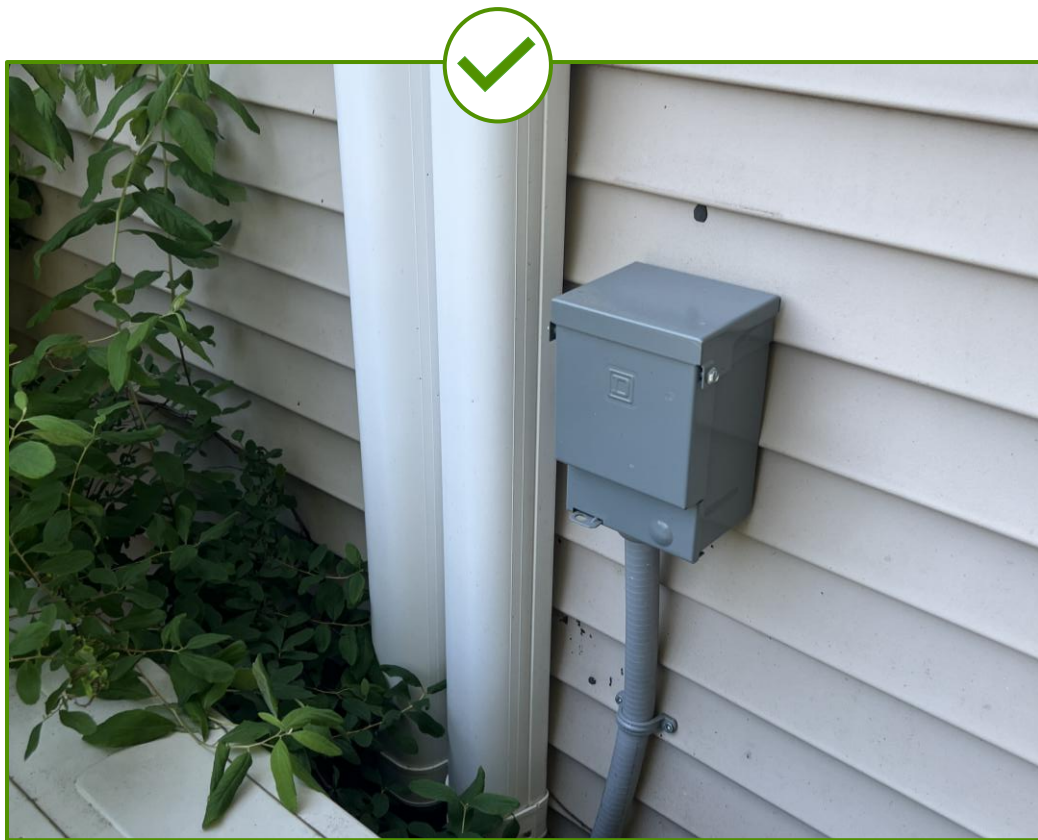
REFRIGERANT LINES (UV Protected & Insulated)



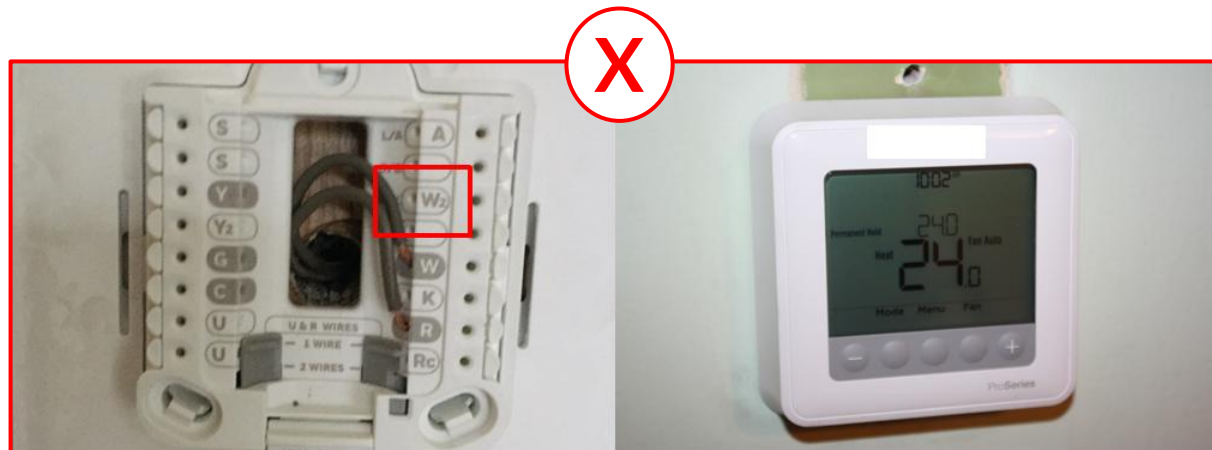
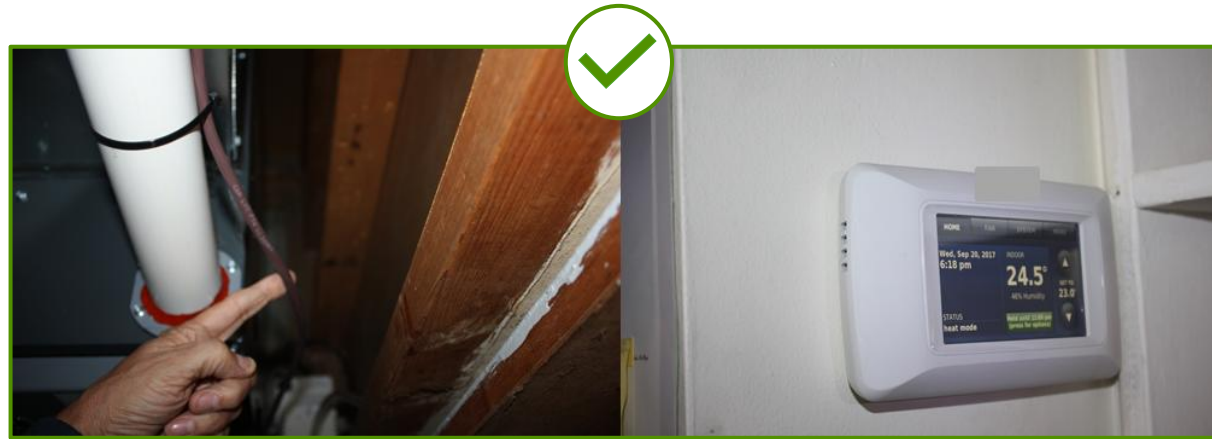
REFRIGERANT LINES (Use of Conduit)



ELECTRICAL (Wiring & Disconnect)



THERMOSTATS (Compatible & Wired Correctly)



FILTRATION



Sealed filter cabinet

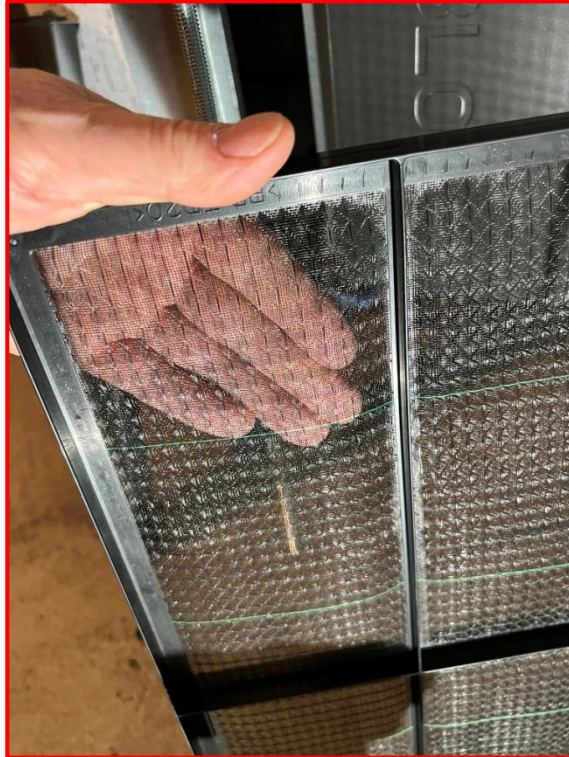


5" pleated high-efficiency filter



Accessible filter cabinet with 5" pleated high-efficiency filter

FILTRATION



Plastic screen “filter” installed



Plastic screen “filter” installed in
1” filter rack

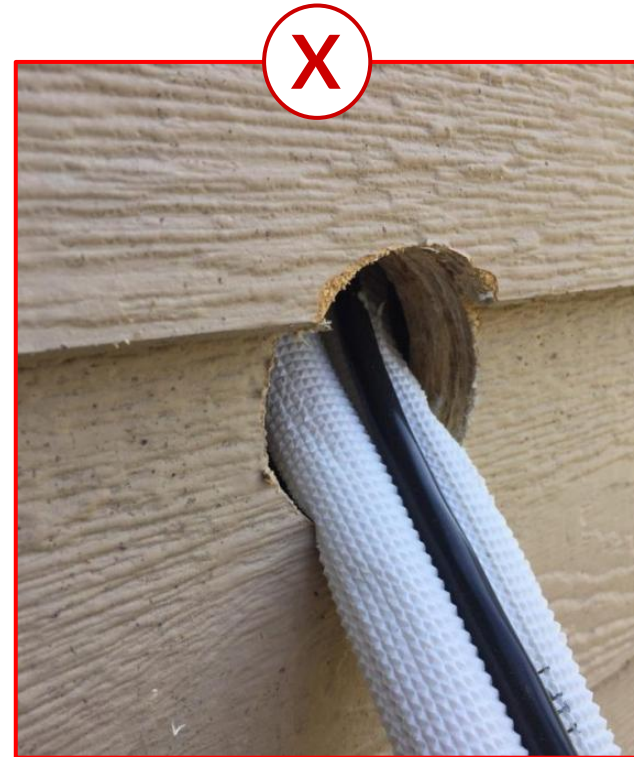


Metal screen “filter” installed

DUCT SEALING



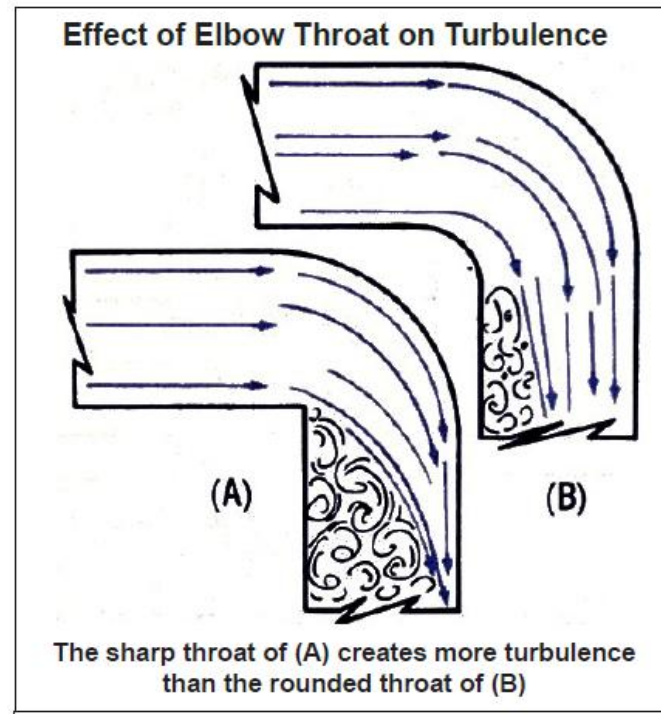
BUILDING PENETRATIONS



DUCTING DESIGN & AIRFLOW

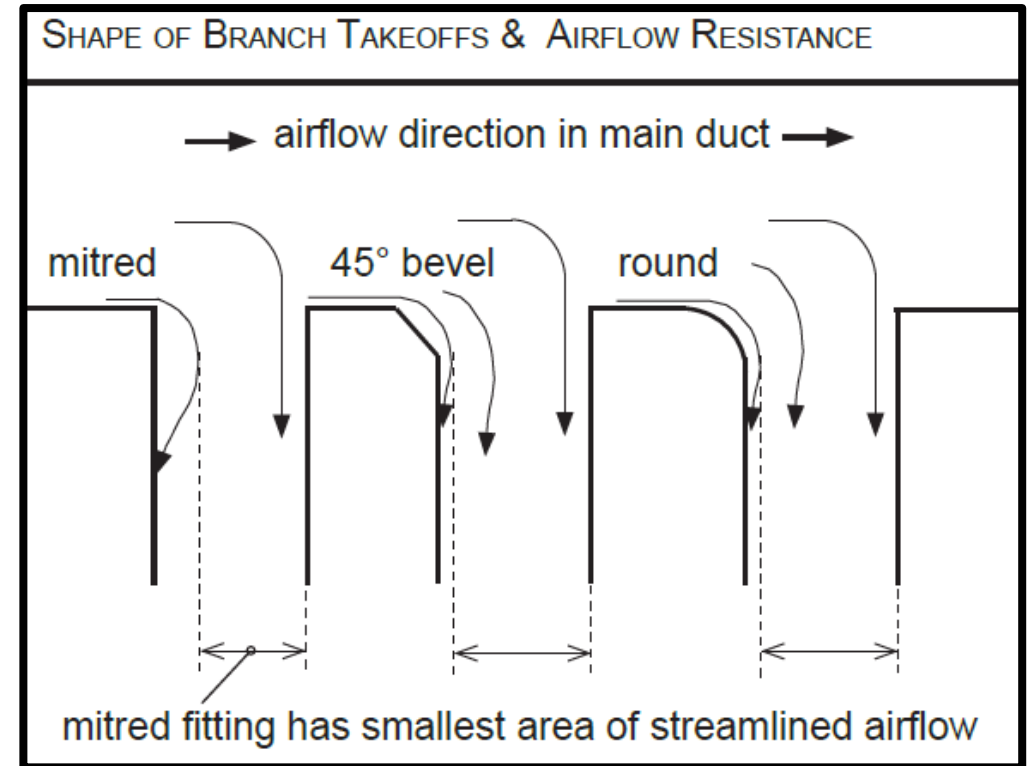
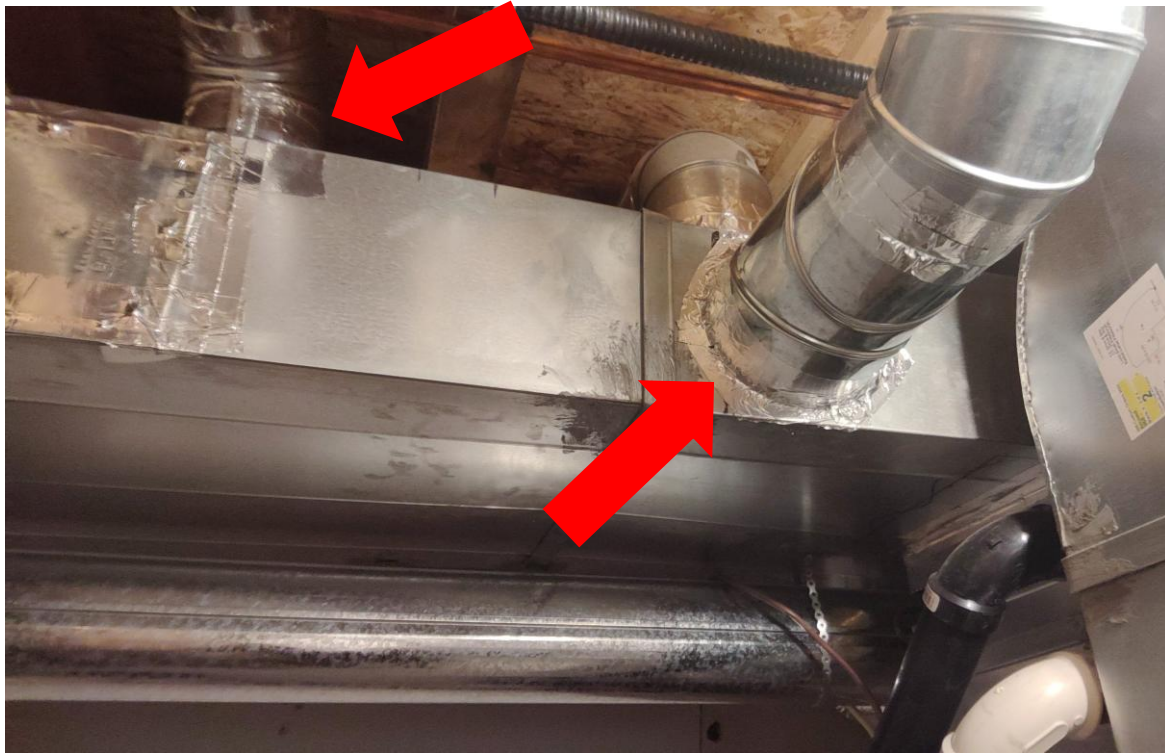


Elbows anywhere on the ducting should not have square throats or heels.



DUCTING DESIGN & AIRFLOW

- ❌** Branch run pipes that are dove-tailed into main trunks do not perform well.
Air flow doesn't like hard left or right turns.



DUCTING DESIGN & AIRFLOW



- A typical issue with flexible piping is the tendency to make sharp turns and choke airflow.
- All flexible piping must have long sweeping elbows, or use hard elbows that are then insulated.
- Also notice the HRV does not have a – trap.

KEY LEARNING

1

Guesstimation methods lead to poor unintended outcomes with HVAC system design.

A sophisticated process is necessary to achieve a quality installation.

2

F280-12 is a BC Building Code requirement and fundamental to right-sizing equipment.

Understanding the heat loss and gain for the home is critical for managing life safety with cooling and achieving high performance outcomes.

3

Installation standards of practice vary. Lack of oversight contributes to poor performing HVAC systems

Quality assurance and inspections can support better installations while protecting consumers and achieving energy-savings and environmental benefits for government and utilities.

Thank you!