**Explanation**

* **Code Documents:**
  + **National Building Code of Canada (NBC):** The overarching national model code.
  + **Alberta Building Code (ABC):** Alberta's provincial code, based on the NBC.
  + **British Columbia Building Code (BCBC):** BC's provincial code, based on the NBC.
  + **CSA B149.1 (Natural Gas and Propane Installation Code):** The national standard for gas appliance installation, including venting and combustion air.
  + **Canadian Electrical Code (CEC), Part I (Safety Standard for Electrical Installations):** The national standard for electrical installations.
  + **National Plumbing Code of Canada (NPC):** The national model plumbing code.
  + **SMACNA Standards:** Industry best practices for sheet metal work (not technically codes, but widely accepted).
* **Referenced Sections/Standards:** The specific sections and standards I mentioned (e.g., NBC Section 6, CSA B149.1 Section 7, ULC S636, etc.) are the *most relevant* parts of those documents for the type of work we're discussing. They are the places you would go to find the *detailed* requirements for:
  + Ductwork sizing, materials, installation, support, sealing, and insulation.
  + Venting system design, materials, installation, clearances, and termination (for *both* natural draft and high-efficiency appliances).
  + Combustion air requirements.
  + Gas piping installation.
  + Electrical connections to HVAC equipment.
  + Condensate drainage.
  + Firestopping of penetrations.
  + General safety requirements.
* **Not Exhaustive:** My list is *not* necessarily an *exhaustive* list of *every* code section that *might* apply in *every* situation. There could be other, more specific requirements depending on the particular details of a job, local amendments, or unique circumstances. That's why it's *essential* to consult the *actual code documents* and, when in doubt, to check with the local building authority.
* **Local Amendments:** I've said it before, but it's worth repeating: *Always* check with the local building department (the Authority Having Jurisdiction, or AHJ) for any local amendments or variations to the national and provincial codes. They have the final say.

**High-Efficient**

**How the Codes Apply to High-Efficiency Furnaces:**

1. **General Building Codes (NBC, ABC, BCBC):**
   * **Load Calculations:** Apply to *all* furnaces, regardless of efficiency. The furnace must be properly sized for the building's heating load.
   * **Ductwork Sizing & Installation:** Apply to *all* furnaces. Ductwork must be properly sized, supported, sealed, and insulated, regardless of furnace efficiency.
   * **Ventilation:** Apply to the *entire dwelling*, not specifically tied to furnace efficiency. Ventilation requirements are about overall air quality.
   * **Combustion Air:** Apply to *all* gas-fired appliances. *However*, the *method* of providing combustion air might differ depending on the furnace type and installation location. High-efficiency furnaces *often* draw combustion air directly from outside (through a dedicated pipe or concentric vent), which simplifies things. But the *principle* of providing adequate combustion air remains the same.
   * **Fire Protection:** Applies universally.
   * **Accessibility:** Applies universally.
2. **Gas Code (CSA B149.1):**
   * **This is where the biggest differences lie.**
   * **Venting Systems (Section 7):** This section is *crucial*. It distinguishes between different *types* of venting systems based on the appliance category.
     + **Category I:** Natural draft appliances (typically older, mid-efficiency furnaces). These use B-vent or chimney liners.
     + **Category IV:** Condensing appliances (high-efficiency furnaces). These use *special gas vent* systems, typically PVC, CPVC, or polypropylene, certified to ULC S636.
   * The code spells out the specific requirements for *each* type of venting system: materials, sizing, slope, support, clearances, termination, etc.
   * **Combustion Air (Section 7):** The principles are the same for all gas appliances, but the *implementation* might differ. High-efficiency furnaces often have a direct vent system that brings in combustion air from outside, simplifying the combustion air requirements.
   * **Gas Piping (Section 4):** Applies to *all* gas appliances. The rules for pipe sizing, materials, pressure testing, etc., are the same regardless of furnace efficiency.
3. **Electrical Code (CEC):**
   * Applies universally. The requirements for disconnect switches, wiring, grounding, etc., are the same regardless of furnace efficiency.
4. **Plumbing Code (NPC):**
   * Applies primarily to the *condensate drain*. High-efficiency furnaces produce *much more* condensate than mid-efficiency furnaces, so proper condensate drainage is even more critical. The plumbing code governs the materials, slope, and termination of the condensate drain line.
5. **SMACNA Standards:**
   * Apply to the *ductwork*, not the furnace itself. The principles of duct construction, support, sealing, and insulation are the same regardless of furnace efficiency.

**In Summary:**

* Most of the building, electrical, and plumbing codes apply *generally* to all HVAC installations, regardless of furnace efficiency.
* The *gas code (CSA B149.1)* is where the major differences lie, *specifically in the venting requirements*. High-efficiency furnaces have *very different* venting requirements than older, mid-efficiency furnaces. You *must* use the correct venting materials (System 636 certified plastic pipe) and follow the specific installation instructions for Category IV appliances.
* High-Efficiency furnaces also must follow instructions that are outlined by the manufacturer.

**Important codes**

**Important Codes for Residential HVAC Installation (Alberta & BC Focus)**

We're focusing on a typical residential install, including:

* Bathroom exhaust fans
* HRV
* Kitchen exhaust
* Natural gas forced-air furnace with ductwork
* Air conditioning (assuming a split system)
* Penetrations through walls, floors, and ceilings

We'll be referencing the major codes, but *always remember*:

* **Local Amendments:** Local jurisdictions (cities, municipalities) often have *amendments* or *variations* to the national and provincial codes. *Always* check with your local building department for the *specific* requirements in your area.
* **Code Updates:** Codes are updated periodically. Make sure you're working with the *current* edition of the relevant codes.
* **This is NOT a Substitute for Reading the Codes:** This is a *summary* of key points, designed to give you a general understanding. It is *not* a substitute for reading and understanding the actual code documents. You are *responsible* for knowing and following all applicable codes.

Here we go, broken down by category:

**I. General Building Codes (NBC & Provincial Variations):**

* **National Building Code of Canada (NBC):** This is the foundation. Alberta and BC (and most other provinces) base their provincial building codes on the NBC, with some modifications.
* **Alberta Building Code (ABC):**
* **British Columbia Building Code (BCBC):**
* **Key Sections (Relevant to HVAC):**
  + **Section 6: HVAC:** This section covers the design and installation of HVAC systems, including ductwork, ventilation, and combustion air requirements.
  + **Section 9: Housing and Small Buildings:** This section covers requirements for residential construction, including fire protection, insulation, and ventilation.
  + **Part 5: Environmental Seperation**
  + **Part 10: Permits**
  + **Section 5: Referenced Documents**
* **Key Requirements:**
  + **Load Calculations:** HVAC systems must be sized based on proper load calculations (Manual J or equivalent). This is usually covered in Section 6 or in referenced standards like CSA F280.
  + **Ductwork Sizing & Installation:** Ductwork must be sized and installed according to accepted engineering practices (Manual D or equivalent). This includes requirements for materials, support, sealing, and insulation. *Specific references within Section 6 and Section 9 will cover these details.*
  + **Ventilation:** Minimum ventilation requirements for dwellings (overall ventilation rates and local exhaust requirements for bathrooms and kitchens). This is often covered in Section 9 and in referenced standards like ASHRAE 62.2.
  + **Combustion Air:** Requirements for providing adequate combustion air to gas appliances. This is covered in Section 6 and in the gas code (B149.1).
  + **Fire Protection:** Requirements for firestopping penetrations through walls, floors, and ceilings. This is covered in Section 9.
  + **Accessibility:** Requirements for access to equipment for service and maintenance. This is usually covered in Section 6.

**II. Gas Code (CSA B149.1):**

* **CSA B149.1 (Natural Gas and Propane Installation Code):** This is the *bible* for gas appliance installation, including furnaces, water heaters, and fireplaces.
* **Key Sections (Relevant to HVAC):**
  + **Section 4: General Requirements:** Covers things like gas piping materials, pressure testing, and purging.
  + **Section 7: Venting Systems and Air Supply for Appliances:** This is the *big one* for HVAC installers. It covers *all* aspects of venting, including:
    - **Vent Types:** B-vent, special gas vent (System 636), etc.
    - **Vent Sizing:** How to determine the correct vent size based on appliance BTU input, vent length, and configuration.
    - **Vent Installation:** Requirements for slope, support, clearances, termination, and materials.
    - **Combustion Air:** Requirements for providing adequate combustion air to gas appliances.
  + **Section 8: Specific Appliance Requirements**
* **Key Requirements:**
  + **Venting Materials:** Use *only* approved venting materials for each type of appliance.
  + **Venting Sizing:** Properly size the vent system according to the code tables and the appliance manufacturer's instructions.
  + **Venting Slope:** Maintain the correct slope (typically 1/4" per foot upward for natural draft vents, and as specified by the manufacturer for high-efficiency furnace vents).
  + **Venting Support:** Properly support the vent system at the required intervals.
  + **Venting Clearances:** Maintain the required clearances between the vent pipe and combustible materials.
  + **Venting Termination:** Terminate the vent in a safe and approved location, with proper clearances from windows, doors, air intakes, property lines, etc.
  + **Combustion Air:** Provide adequate combustion air to all gas appliances.
  + **Gas Piping Pressure Testing:** All gas piping must be pressure-tested before being put into service.
  + **Appliance Installation:** Follow the manufacturer's installation instructions for *all* gas appliances.

**III. Electrical Code (CEC):**

* **Canadian Electrical Code (CEC):** While you're not (typically) doing the main electrical wiring for the house, you *will* be dealing with electrical connections to the furnace, air handler, HRV, and thermostat.
* **Key Sections (Relevant to HVAC):**
  + **Section 26:** General rules.
  + **Section 4:** Conductors
  + **Section 62:** Fixed electric heating and HVAC
  + **Section 10:** Grounding and Bonding.
* **Key Requirements:**
  + **Disconnect Switch:** A disconnect switch must be installed within sight of the furnace and air handler.
  + **Proper Wiring:** Use the correct type and size of wire for the load.
  + **Grounding:** Ensure all equipment is properly grounded.
  + **GFCI Protection:** GFCI protection may be required for certain circuits (e.g., condensate pumps).
  + **Junction Boxes:** All electrical connections must be made inside approved junction boxes.
  + **Overcurrent protection**
  + **Wiring Methods**

**IV. Plumbing Code (NPC):**

* **National Plumbing Code of Canada (NPC):** You'll primarily be dealing with the plumbing code in relation to condensate drains.
* **Key Sections (Relevant to HVAC):**
  + **Section 2.2: Drainage Systems:** Covers requirements for drain pipes, including materials, sizing, slope, and traps.
  + **Section 2.4: Installation of Drainage systems**
  + **Section 7: Potable Water systems**
* **Key Requirements:**
  + **Condensate Drain Slope:** Condensate drain lines must be sloped downward (typically 1/4" per foot) to ensure proper drainage.
  + **Condensate Drain Traps:** A P-trap may be required in the condensate drain line (check local codes and the manufacturer's instructions).
  + **Condensate Drain Termination:** Condensate drain lines must terminate in an approved location (e.g., a floor drain, a condensate pump, or an indirect waste receptor). *Not* directly into the sanitary sewer system without an air gap.

**V. Sheet Metal Specific Standards (SMACNA):**

* **SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) Standards:** While not technically "codes," SMACNA standards are widely accepted as industry best practices for sheet metal work.
* **Key Standards (Relevant to HVAC):**
  + **HVAC Duct Construction Standards:** Covers the fabrication and installation of sheet metal ductwork.
  + **Fibrous Glass Duct Construction Standards:** Covers the fabrication and installation of fiberglass duct board.
  + **Flexible Duct Performance & Installation Standards:** Covers the installation of flexible ductwork.
* **Key Requirements:**
  + **Duct Construction:** Proper methods for fabricating and assembling sheet metal ductwork (seams, joints, connections).
  + **Duct Support:** Proper methods for supporting ductwork.
  + **Duct Sealing:** Proper methods for sealing ductwork to prevent air leakage.
  + **Duct Insulation:** Proper methods for insulating ductwork.

**VI. Specific Considerations for This Project:**

* **Rim Joist Penetrations:**
  + **Sealing:** All penetrations through the rim joist (for venting) must be *thoroughly* sealed to prevent air and water infiltration. Use appropriate sealant (silicone, butyl rubber) and flashing.
  + **Firestopping:** If the penetrations pass through a fire-rated assembly (e.g., a wall between the house and an attached garage), you *must* use approved firestopping materials and methods.
* **HRV Installation:**
  + **Follow Manufacturer's Instructions:** *Always* follow the HRV manufacturer's installation instructions *carefully*. They often have specific requirements that go beyond the general building code.
  + **Intake/Exhaust Separation:** Ensure adequate separation between the HRV intake and exhaust vents to prevent cross-contamination.
  + **Insulation:** Properly insulate the HRV intake duct (and potentially the exhaust duct) to prevent condensation.
* **Bathroom and kitchen Fans:**
  + Ensure they are installed and vented according to code.
* **Wall Stacks:**
  + **Support:** Securely strap wall stacks to the studs.
  + **Alignment:** Ensure wall stacks are plumb and aligned with the register boot openings.
  + **Sealing:** Seal all connections between the wall stacks and the main ductwork, and between the wall stacks and the register boots.