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Maximizing Furnace Performance

The ultimate performance of a high-efficiency furnace in a home often depends on the quality of the installation. In the U.S., the Department of Energy (DOE) claims that more than half of the HVAC systems installed in that country are not performing to their rated efficiency, and that improper installation can reduce performance by as much as 30 per cent.

Closer to home, FortisBC recently funded a report aimed at researching high efficiency furnace installation, with an aim of learning what can be done to maximize the performance of a system.

Based on that research, and given that properly sizing HVAC equipment, and installing these units according to industry-recognized procedures are critical to ensuring top-notch performance, we've compiled a list of some of the system and design considerations that can help optimize energy efficiency, while delivering comfort and maximizing equipment longevity, when installing a high-efficiency furnace in a retrofit up-flow application.



Before the Changeout

The first step when replacing existing equipment should be to gather insight from the homeowner about the existing system. How well does it function? Are there any cold spots, drafts or noise? Are there any areas where the existing ductwork may be failing?

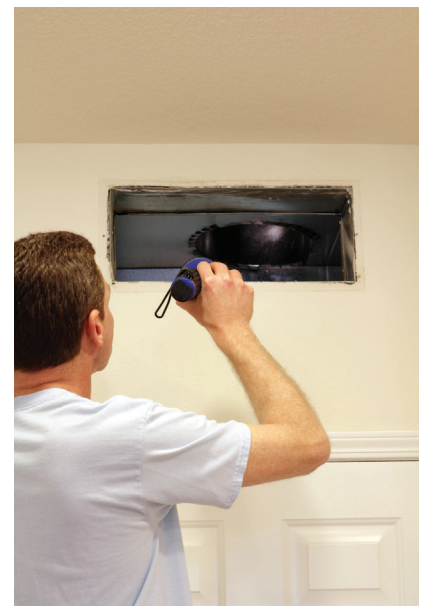
This qualification and information gathering is an article in itself however many, if not all, of these system challenges can be overcome with newer sophisticated equipment, and by following each of the steps below.

Quick Tip: The ductwork should be designed to deliver system performance with correct airflow and duct size at, or within, 0.10 to 0.15 ESP for the supply side and -0.10 to -0.15 ESP for the return air.

1 DO THE MATH: Since many older furnaces may not have been sized correctly and existing home conditions may have changed heating requirements, a trained HVAC contractor should complete a heat load calculation (room-by-room preferred or block load calculation) to right size the new equipment for the home.



2 ASSESS THE DUCTWORK: Since most HE furnaces produce slightly more cubic feet per minute (CFM) of airflow than the equipment that is being replaced, the condition of existing ducts should be assessed for proper sizing, balanced pressures and adequate airflow to each register, as well as adequate return to the furnace. HVAC contractors should complete an external static pressure test and ductulator calculation to determine whether the existing ductwork and fittings are optimized for system distribution, and to gather insight into whether the new furnace will have enough air flow to operate at peak efficiency.



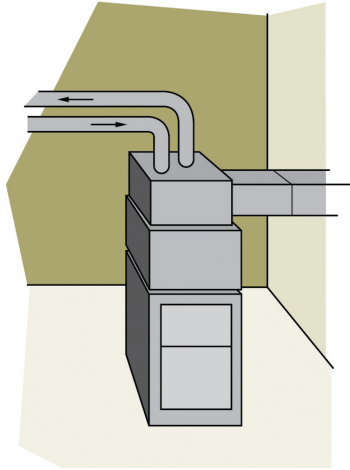
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At Installation

Once the existing furnace conditions are understood, attention can be directed to the installation phase to ensure the new equipment selected and installed will achieve the full energy-saving, comfort, equipment longevity and other benefits a homeowner is expecting from their new high-efficiency furnace.

3 DOUBLE PIPE IT: The venting should be double piped with combustion air taken from outside. By installing a double pipe system, overall energy-efficiency for the home will be improved since the furnace will not require outside combustion air to be taken from another hole in the home, which could create uncomfortable drafts and unnecessary air leakage in the building envelope.



4 BULK UP THE FILTER: A minimum 4" pleated filter should be installed. It should be sized to the new CFM, and be MERV 8 or better to deliver quieter operation, better equipment longevity and potential electrical savings resulting from lower static pressure. A pre-fabricated manufactured cabinet that provides a positive door seal for reduced air leakage and allows for easier access and servicing should also be considered.



5 SWAP THE THERMOSTAT: The new furnace should include a properly wired, matching or compatible thermostat. Most furnace manufacturers have a choice of two-stage, three-stage and/or variable-stage gas valves in their furnace offerings today, and this equipment must be "matched" to a proper thermostat to achieve the full system performance, comfort and the energy-savings.

6 TAPER IT: For an up-flow furnace, the return air should include a tapered transition at the top of the return air drop, with the return air drop duct sized to match the CFM requirements of the new furnace. This will reduce noise, thanks to less turbulence, and should lower electrical consumption associated with bad fittings since electronically commutated motors (ECM) will ramp up to deliver the necessary air through the heat exchanger to achieve correct temperature rise. Similar duct design principles should be applied to down-flow and horizontal applications.

7 SUPPLY AND DISTRIBUTION: The supply air plenum should include a tapered takeoff connecting to existing ductwork. In addition, all accessible joints in the furnace room ducting should be sealed. If air is lost due to leakage along the distribution network, there will not be enough static pressure or velocity for all return and supply air to get to its final destination as the air will fall out at its first and easiest path.

8 PLACEMENT AND CONDENSATE: The furnace placement should incorporate waffle pads or feet so that it is off the floor and can be tipped to drain if the manufacture requires this. The combustion process in high-efficiency furnaces produces an acidic condensate. When this is not drained and is left to build up inside the furnace for long periods, premature equipment failure may occur. Raising the furnace off the floor also mitigates potential corrosion possibilities to the metal base. In addition, equipment noise is reduced with waffle pads absorbing vibration. Separately, in the event of a minor flood or liquid spilling on the floor, the furnace is protected.

Startups and Checks

Commissioning is a critical quality assurance step that should not be overlooked to verify and document that the engineered performance of the furnace has been achieved.

9 USE A LIST To confirm that the furnace is operating to its designed intent, complete the commissioning requirements and use the checklist provided by most furnace manufacturers to collect installation performance data. Performance tests will include a combination of temperature rise, gas pressure checks, clocking-the-meter, ESP and others. The data collected at commissioning empirically confirms optimal system performance for homeowners, and may identify ductwork issues that can be addressed. It also provides HVAC contractors with a reference point for future service and maintenance.



10 COMMUNICATION AND CUSTOMER EDUCATION: Homeowners should be engaged throughout the pre-changeout, installation and commissioning process. Focus should be placed on understanding system operation, including the thermostat setup, equipment service options such as service contracts, and the maintenance required of the system.