Number 14

MAINTENANCE MATTERS

BC HOUSING RESEARCH CENTRE

Avoiding Exhaust Duct Problems

Exhaust ducts help regulate indoor humidity by removing moist air from the home or suite to the outside. However, ducts that are not well maintained can lead to interior damage from condensation build up. As a homeowner, how can you identify if there are problems with your ducting, and what can be done to avoid or fix the problems?

What are the issues with ducting?

Exhaust vents in homes or suites are installed around locations of high humidity, such as dryers, showers or stoves. Moist air caused by these items is removed through the ducting and expelled to the exterior by fans. This keeps the interior humidity lower and decreases the risk of condensation and mould growth in the living space. The formation of small amounts of condensation in a duct is considered part of normal operation. It is important that the exhaust system is adequate to dry out this condensation to prevent prolonged wet periods and/or condensation build up.

If the removal of the moist air is restricted by a blockage or damaged ducts, or by an inadequately designed system, condensation can build up within the ducts. This can cause rusting, staining around the vents and damage to the ceilings or walls if the condensation leaks out of the ducts. The inability to effectively remove moisture and reduce interior humidity can allow condensation to form more easily on other interior surfaces, such as windows or corners, which can cause further damage.

Issues related to exhaust ducts that present the most challenges typically relate to high-rise and mid-rise multi-unit residential buildings that contain in-slab ducts. These ducts are cast into the concrete during building construction. This makes it difficult to inspect or fix problems since the ducts are encased in the concrete.

In-slab ducting cast into concrete during building construction.

Maintenance Matters

This series of bulletins and companion videos is designed to provide practical information on maintaining residential buildings. Produced by BC Housing, this bulletin was prepared by Morrison Hershfield Ltd in collaboration with the Condominium Home Owners' Association (CHOA).

How to Identify Duct Problems?

Staining and damage resulting from condensation build up in ducts do not suddenly appear. The conditions develop gradually. It is important to recognize the signs of condensation build up early in order to deal with it sooner, before it becomes a larger and more expensive problem.

First Signs and Symptoms

There are several clues that can indicate there are issues with condensation build up in ducts:

- Dripping water from bathroom fans or other interior vent covers.
- Large amounts of lint and dirt being expelled from or blocking the exterior vent covers.
- Longer than usual machine drying times for laundry, or dryers running hotter during operation.
- Increasingly higher humidity levels in the suite for long periods after laundry, cooking or showers.
- Slow forming water staining or discolouration around vents or ceiling cracks. This should not be confused with immediate water damage from a burst pipe or water leakage from the exterior during rain.

Self-Inspection

Occupants are the most likely to observe problems and a simple inspection can go a long way towards maintaining your ducts. Depending on the building, simple inspections may be the responsibility of the strata (e.g. building maintenance staff) or you can start your own self-inspection by looking at the exhaust grilles or vent intakes in the suite for lint, dirt or the build up of any other obstruction. If safe access is possible (do not lean over balconies or climb on ladders close to balcony railings) you can also remove the grille and look into the duct. The best time to do this is after doing laundry or having a shower, depending on what ducts you have access to. Reaching into the duct with a camera and taking a picture can also help reveal what is going on.

Poorly designed or unmaintained ducts can lead to damaged finishes from condensation build up.

Things to look for include:

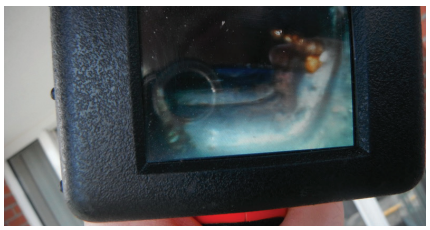
- Severe build up of lint or dirt
- Pooling of water
- Dips or damage to the ducts

Condensation at the duct outlet.

Further Investigation

Getting access to see inside in-slab ducts can be difficult. If the self-inspection does not reveal enough information or the problems are widespread to multiple units in your building, a more thorough investigation would be a good idea. This requires hiring a contractor or consultant who will use more advanced ways to find out what is happening within the ducting. If you are in a strata complex, you will first need to determine who is responsible for hiring these consultants.

The consultants may review the mechanical drawings for the duct system (if available) to see if there are issues with the design and correlate the problem locations within the duct. Most often, the investigation will involve the use of scoped cameras that can be extended into the ducts. These cameras give a much better view of the interior of the ducts and make it easier to determine where the problem areas are. Airflow tests may also be used. This will show whether the current duct and fan system in your home/suite is able to adequately move the air through the ducts.



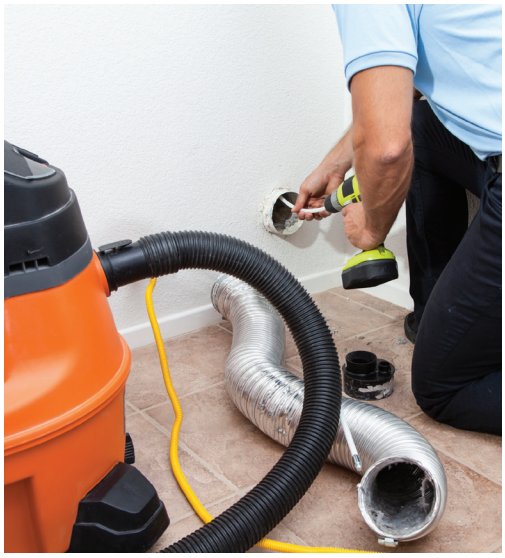
Scoped cameras provide views of duct interiors.

Major Causes of Duct Condensation Problems

The investigations should attempt to reveal where and why condensation build up in the ducts is occurring. Some of the major causes of duct problems are:

- **Dirt and Lint Build Up**
  Dryer ducts can accumulate a large amount of lint and dirt if not regularly cleaned. This is a fire hazard, and can also create large blockages that prevent airflow, trapping the moist air in the ducts.
- **Unprotected or Damaged Vent Covers**
  In-slab ducts typically vent out of the walls, or out the underside of concrete balconies. Sometimes these are directly incorporated into the framing of window-wall systems. If not properly covered and protected, wind-driven rain and snow can get into the ducting, which not only brings in more moisture, but also cools down the ducts, allowing for more condensation to build up. Ice formation on vent covers is a clear indicator. The other risks are damaged covers that can allow birds or insects to get in and nest, creating large blockages within the ducts.
- **Duct Lengths or Insufficient Fan Power**
  Some floor plans require long lengths of ducting installed to reach the exterior. The longer and more turns there are in the duct, the more fan power that is required to push out the air. If the fan is insufficient, the moist air can stay in the ducts and condensation can build up.
- **Damaged or Poorly Sealed Ducts**
  During construction, ducts can sometimes become punctured or the joints are not well sealed, creating holes where condensation can leak out and create damage to the structure, the interior space and/or the finishes.
- **Poorly Sloped Ducts**
  Ideally, ducts should be sloped to the exterior so that if any condensation forms, it will be directed out of the system. While this can be done relatively easily near the end of the ducts, it can be difficult to accurately slope the entire in-slab duct system during construction, especially if there are several turns or there are long runs of ducts where inlets are far from the exterior.
- **Collapsed Ducts**
  On occasion, ducts can be crushed by construction activities and, for in-slab ducts, replacement can be prohibitive if not fixed before they are encased in concrete. Crushed ducts can severely limit or completely block airflow through the ducts, making the system useless.
- **Occupancy Behavior**
  In some cases, interior humidity levels can be quite high in a suite or building due to occupant behaviour. Inappropriate or ineffective use of exhaust fans limits the ability of the condensate in the ducts to dry out.

Indications of condensation build up.



Condensation build up is caused by lint and dirt accumulation in ducts or vent covers and by restrictions in ducts.

Accumulation of dryer lint is a fire hazard.

Prevention Through Regular Maintenance

As with most things in life, it is better to stop the problem before it happens. More often than not, the main culprit for condensation build up is lint and dirt accumulation in the duct or at the vent covers. The best way to prevent these types of condensation problems is to ensure the ducts and vents are clear of debris. This first starts with routinely cleaning lint filters in the dryer. Dryer manufacturers recommend to check and clean dryer filters after each use. After that, the dryer ducts themselves should be cleaned annually as part of a regular building maintenance plan (grilles can be cleaned more often if necessary). This will not only help prevent condensation build up, but also help with fire prevention. Accumulation of dryer lint is a fire hazard.

Sometimes, the dirt build up may be caused by birds and insects getting into the ducts and building nests. Certain types of vent covers (some louvered or open vents) make it easier for pests to get inside. These should be replaced with pest proof covers and repaired when damaged.

Identifying Problems and Solutions

There are many construction and design issues for which regular cleaning alone may not be able to prevent condensation from building in ducts. The solutions to fixing duct problems can vary in complexity, depending on the cause of the issue. Some simple solutions may not require involvement with the building strata, while more complicated issues may require consulting an engineer or hiring a contractor.

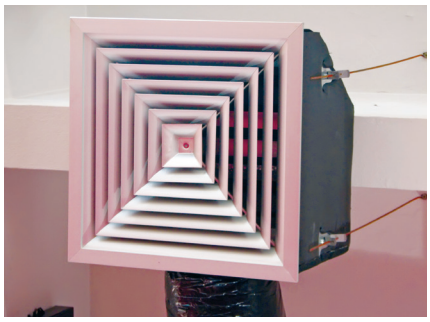
The checklist on the next page can be used by building residents to be aware of the most common requirements to fix condensation problems in in-slab ducting. For wood-frame structures, please see the last page of this bulletin.

Home Warranty Insurance Tip

Make sure you understand the extent and limitations of your new home warranty coverage. Construction or design related problems discovered within the first year or two of the home being built may be covered under the strata or unit policy of home warranty insurance. Check your warranty insurance policies for details.

Common Duct Problems and Solutions

WHO IS INVOLVED	PROBLEM	POTENTIAL SOLUTION
Homeowner	Dirt and Lint Build up	Clean dryer filters after each use and clear exhaust vent covers regularly
Strata	Dirt and Lint Build up	Have vents and dryer ducts in the building cleaned annually as part of regular maintenance to prevent debris accumulation.
	Unprotected Vents	Vent covers should be covers replaced or protected to prevent water, snow, insects, rodents or birds from getting inside the ducts.
	Insufficient Fan Power	Upgrade fans or install a booster fan. Ducting fans can be purchased from most home building supply stores, however, they may require a consultant or electrician to help install.
	Damaged/ Poorly	A contractor can identify gaps and holes in the ducts and apply a rubberized sealant to repair those sections. Please see page 7 for more information.
	Improperly Sloped Ducts	This construction problem is difficult to deal with after the fact. An in-slab Ducts ducting system cannot be resloped. While a self-levelling sealant could be used, it may be easier to install a ductless dryer or kitchen fan. Alternatively, a new dropped duct could be installed to replace the in-slab duct. Please see page 6 for more information.
	Collapsed Ducts	This is caused by the concrete pour during construction. The only solutions are to install a ductless dryer or kitchen fan system or have a new dropped duct installed. Please see pages 6 and 7 for more information.
Occupants	High Interior Humidity	It is important for occupants to use exhaust fans to remove high levels of humidity and allow the exhaust duct to dry out. Simple rules of thumb are: • Run the bathroom fan during a shower and for 20 minutes afterwards. • Run the range hood exhaust fan during cooking, especially when boiling water, and for 10 minutes afterwards. • Ensure that clothes coming out of the dryer are completely dry. If not, run the dryer for five minutes without clothes in it to dry out the duct.



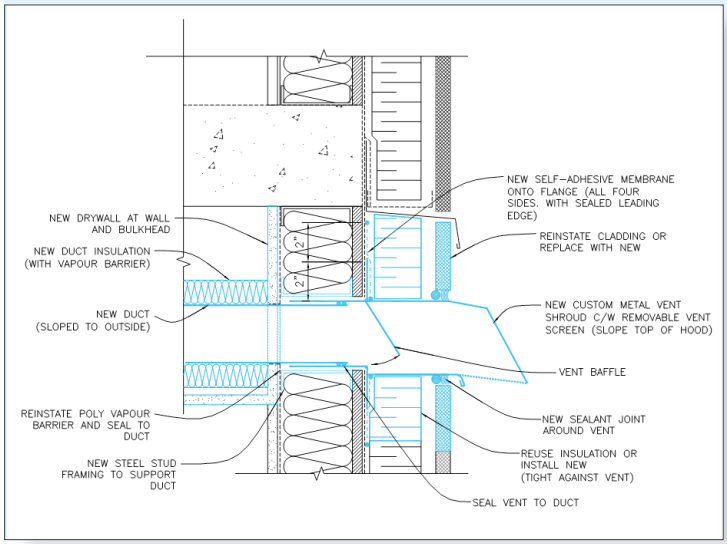
Installing a New Duct

There are several things to consider in the event that it is necessary to install a new duct system. To replace a collapsed in-slab duct, a new ducting system would have to be run across the underside of the ceiling of the unit. A new penetration through the envelope would also have to be made to connect the duct to the exterior.

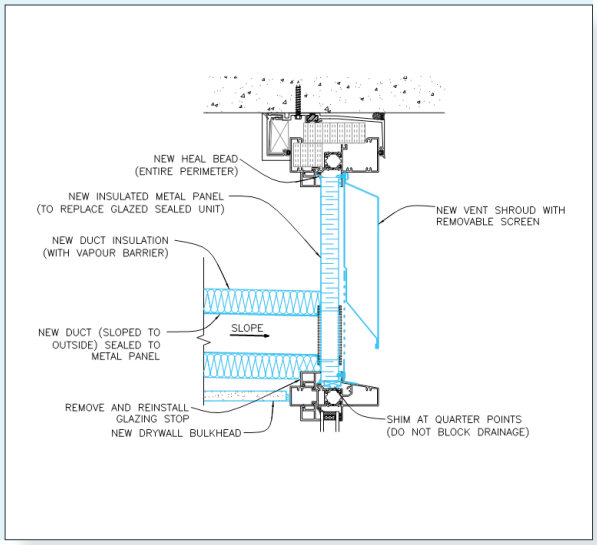
A consultant can assess whether or not this can be done practically. They must take into account the length of run, the slope, sealing and covering of the new duct. The penetration through the envelope would also have to be designed to ensure all of the critical air, water and moisture barriers are maintained.

The closer the vent intake (dryer, kitchen hood, or bathroom fan) is to an exterior wall, the easier and less obtrusive installing a new dropped duct will be. A new duct may not be reasonable if the runs are too long, ceiling space is limited or the new penetration has to be through a window (though options are available). In those cases, consider the use of ductless appliances. The two images below show general details for the installation of a new dryer duct penetration. However, due to the wide variety of building constructions, this detail can become much more complex when it comes to maintaining air, vapour and water barriers across your building envelope.

Details for installation of new dryer duct penetration



New Duct Detail Through a Steel Stud Wall.



New Duct Detail Through a Glazing System.

Ductless Appliances

A more straight forward option would be to use a ventless system, however these also come with some considerations. Condensing dryers recirculate air through the dryer and condense any water vapour through a heat exchanger. This water will either drain through a pipe or be collected in a tank to be manually drained. Since there is no duct, the hot air from the dryer cycle can significantly increase the interior room temperatures. Similarly, ductless range hoods recirculate kitchen air through a filter, which can remove grease, particles and smoke from the air, but not moisture. This can increase the indoor humidity and temperature.

Duct Sealing

Once potential causes of moisture build up have been addressed, you can consider duct sealing. Sealing in-slab ducts from the inside may be a cheaper solution than installing a new duct, however applications for this solution may be limited. To seal the duct from the inside, a rubberized material is often used to coat the ducts in order to fill any holes, dips or valleys in the system. This can be done through a pressurization system or by remote control sprayers placed within the ducts. This is a relatively new procedure and has not been extensively used in British Columbia to date. Selecting the right material for the application and finding someone who can do the procedure may be challenging.

Duct sealing from the outside.

What Your Strata Corporation Needs to Know

What steps should be taken before repairs or renewals of a ducting system are undertaken?

Every strata corporation has different allocations and designations of property and access to strata lots and common areas. Ducting may be common property if within the floor or wall of a boundary between two strata lots or a strata lot and common property, and the obligation to maintain and repair the ducting may be the responsibility of the strata corporation. Ducting and venting, with the exception of an exhaust vent, may be completely contained within a strata lot and the responsibility of the strata lot owner. It is important to understand the designation of the property, the application of the strata bylaws, and whether or not permission is required from the strata corporation, the strata lot owner, or if there are any impacts on warranty of the building or building products under warranty. The following documents are important and should be reviewed by the strata lot owner, the strata council and legal service before undertaking any construction, repairs or retrofits:

- The registered strata plan of the strata corporation which shows property designations.
- The bylaws of the strata corporation that identify responsibility for common property, limited common property and parts of the strata lot.
- Any agreements where an owner has assumed responsibility for any costs relating to an alteration or will take responsibility for any obligations.
- Any warranty materials relating to the building envelope systems.

Wood-Frame Considerations

While this bulletin mainly focuses on concrete buildings, similar issues can also occur with ducting in low-rise wood-frame structures. The causes of duct condensation are the same regardless of the type of buildings, however, the consequences in wood-frame buildings can be more critical, especially if left unattended. A consistent and heavy amount of condensation and moisture in the wood can eventually lead to rot, or a consistent build-up of lint can make the home more susceptible to fires.

Fortunately, condensation problems in ducts are often easier to deal with in low-rise wood structures. Problems show themselves sooner and the ducts can typically be accessed much easier than with in-slab ducts. In most cases, once the issue is identified, the duct can be repaired directly by access through an attic space, or through the drywall, without the need for more complicated investigations or repairs. Improperly sloped ducts can be rerouted and collapsed or damaged ducts can be replaced or resealed.

Action Plan Tips

- ☐ Keep dryer lint traps clean.
- ☐ Consider adding a line item to your operating budget for annual dryer vent cleaning if it is not already part of the regular maintenance plan.
- ☐ Monitor ceilings and vents around ducts for water stains or other initial signs of duct problems.
- ☐ If stains are noticed, determine responsibility for inspections, whether individual or strata.
- ☐ Inspect ends of exhaust vents for blockage if easily accessible. Take pictures within the duct if possible.
- ☐ If the source of the condensation problem is difficult to determine, engage an engineering consultant or contractor to perform a thorough investigation. This includes video scoping to see if there are any blockages, damaged/crushed vents, or specific areas where condensation is pooling. This may also include airflow tests to determine if there is adequate movement of air through the ducts.
- ☐ Depending on the investigation results, implement one of the recommended solutions quickly to prevent further damage to unit interiors.

More Information

1. Subscribe to receive *Maintenance Matters* bulletins at www.bchousing.org
2. *Maintenance Matters* Bulletin No.3 – Avoiding Condensation Problems, available at www.bchousing.org
3. *Building & Design – Are Dirty Vents a Fire Hazard?*, available at www. cmhc.ca
4. *Moisture and Air: Householder's Guide – Problems and Remedies*, available at cmhc.ca

Notice to Readers

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The regulations under the Homeowner Protection Act contain specific provisions requiring owners to mitigate and restrict damage to their homes and permitting warranty providers to exclude coverage for damage caused or made worse by negligent or improper maintenance. These apply to both new and building envelope renovated homes covered by home warranty insurance. Failure to carry out proper maintenance or carrying out improper maintenance either yourself or through qualified or unqualified personnel may negatively affect your warranty coverage. It is important for the property owner to read and review their warranty documents to understand how to file any claims and correspondence in the proper written form directly with the warranty company. Refer to your home warranty insurance documentation or contact your warranty insurance provider for more information.

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