Number 19

MAINTENANCE MATTERS

BC HOUSING RESEARCH CENTRE

Make-Up Air Units and Corridor Pressurization

All buildings need fresh outdoor air to help control odours, humidity, and the build-up of other potentially harmful gases. In multi-unit residential buildings, fresh air, or make-up air for hallways and corridors is typically provided by a corridor pressurization system.

It is important for building owners and stratas to learn how to identify and address ventilation problems and how to maintain make-up air units that deliver fresh air through the ductwork.

This bulletin provides information on operating, maintaining, and replacing make-up air units (MUAs) and corridor pressurization systems. The MUA and corridor pressurization units are part of a multi-unit residential building's overall ventilation system. Alongside exterior windows and doors, exhaust fans, air handling units, and other pieces of equipment, MUAs keep spaces within the building healthy and comfortable for occupants.

The MUA and corridor pressurization units provide two key functions:

- Ventilate and pressurize the corridors, limiting migration of odours and pollutants from suites to other spaces.
- Maintain a positive pressure in parkade vestibules (typically elevator lobbies) and prevent carbon monoxide from entering into the living spaces. If the system in your building provides ventilation to parkade vestibules, fans must operate continuously (24/7).

Figure 1: MUA with fire exhaust.

Maintenance Matters

This series of bulletins and companion videos is designed to provide practical information on the maintenance of residential buildings. Produced by BC Housing, this bulletin was prepared by RDH Building Science Inc. in collaboration with the Condominium Home Owners Association (CHOA).

What are MUAs?

MUAs are a type of air-handling unit that delivers outdoor air to interior spaces. These units are most commonly located on the roof. However, they may also be located inside the building, such as within an attic space or in a parking garage. The air intake opening for an MUA should be located away from contaminated air sources such as exhaust fans, sanitary vents or combustion exhaust.

In most buildings, MUAs are likely to be part of a corridor pressurization system. This is a system of corridor pressurization ducts, grilles, and dampers that distribute fresh air to corridors throughout the building. The system is primarily intended to keep the air pressure within hallways slightly higher than the suites and other adjoining spaces, such as parkades. The higher air pressure limits odours and potentially harmful pollutants from circulating between areas of the building. In some buildings, the system may provide fresh air into suites.

Most MUAs include the following basic components:

1. Cabinet and casing at the exterior
2. Filter section
3. Fan section
4. Heating section (where applicable)
5. Connection to ductwork

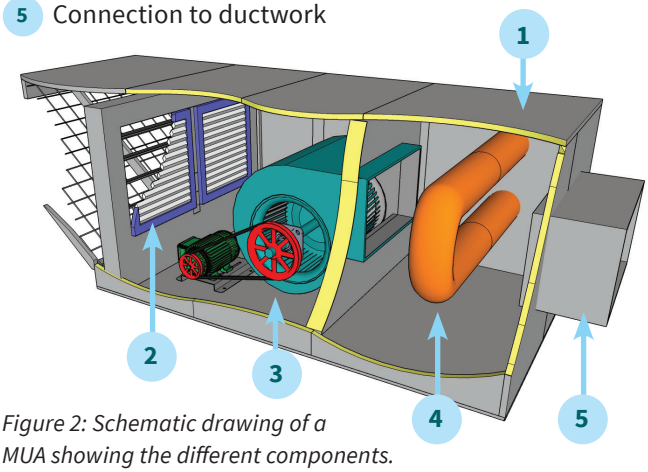

Figure 2: Schematic drawing of a MUA showing the different components.

MUAs will also have a control panel and a power connection and other utilities as appropriate. Some MUAs may have a cooling section.

Figure 3: Gas-fired MUA, including the electrical connections.

What are the common types of MUAs?

The most common types of MUAs have the basic components listed previously, including a heating section, and are used in most wood-frame buildings or mid-rise buildings. For older, smaller, wood-frame buildings, the MUA will often be a fan and filter assembly without a heating or cooling section. The casing, filter section, fan section, and heating section vary in sizes and capacities depending on the size and occupancy of the building. The heating section can also vary in type. The four basic heating section types are:

1. Electric: An electric coil heats the air passing through it.
2. Indirect gas-fired: A gas-fired burner is contained in a chamber that heats a heat exchanger. Air is heated when passing through or around the exchanger. The flame is separated from the incoming outdoor air, and combustion gases are prevented from entering the building.
3. Hydronic: Hot water circulates from a central heating source through a heating coil. Heat is transferred to the incoming outdoor air passing through the coil.
4. Heat pump: Heat is extracted from the ambient air around the MUA and transferred to the incoming outdoor air by a refrigeration loop. The heat pump type can also be used for cooling.

How long does an MUA last?

A properly maintained make-up air unit typically lasts up to 20 to 30 years. Most require replacement at around 20 years of service. Equipment approaching the end of its service life is less reliable and is more likely to breakdown and operate inefficiently, costing the strata or building owner more money to keep in service. Common issues include:

- Heating component failure. In indirect gas-fired MUAs, the heat exchanger may perforate or rupture, resulting in combustion gases being drawn into the building. In other types of MUAs, electric coils may corrode or short out. In the case of a hydronic coil, piping may leak or rupture.
- Holes in the cabinet housing form because of corrosion (rust). Water may get into the cabinet and potentially leak into the building.
- Failure of controls, particularly in gas-fired MUAs.
- Existing older equipment is less energy-efficient, in particular gas-fired units.

By planning ahead, a strata or building owner has time to optimize the replacement, including looking at what options they may have for new, more energy efficient equipment.

Why must MUAs be maintained?

Carrying out regular maintenance such as replacing filters, cleaning and lubricating fan assemblies, and cleaning and testing combustion equipment will help ensure your equipment operates at its most energy-efficient level.

Maintenance of MUAs is essential for four key reasons:

1. Safety: Poorly maintained systems may lead to carbon monoxide poisoning. In some systems (commonly high-rises), a poorly maintained system may not operate correctly in a fire.
2. Lifespan: All MUAs have moving parts, and many may have combustion components. Failing to maintain these components will shorten the lifespan of the equipment and lead to expensive repairs or unplanned replacement.
3. Air Quality: Good indoor air quality depends on clean filters and sufficient air being supplied into the building.
4. Energy: Poorly maintained or poorly balanced equipment may use more energy to operate.

Can we turn our MUA off permanently?

Where the MUA also provides ventilation to a vestibule, fans must operate continuously.

In a high-rise building, the MUA is likely integrated into a smoke control system. Therefore, it's a key part of the building safety so cannot be switched off.

MUAs should run continuously when the building is occupied to provide the required quantity of outdoor air.

What maintenance must be performed?

A combination of preventative and as-needed condition-based maintenance is required. Preventative maintenance includes periodic inspections, testing, and calibration of equipment, as well as regularly scheduled cleaning, lubrication, adjustments, and the scheduled replacement of specific parts such as filters.

Condition-based maintenance is done as a result of inspections or testing. This might include small repairs or replacement of some components that are showing wear, such as drive belts or bearings. Regardless of how well a MUA is maintained, it will still eventually need to be replaced.

Figure 4: MUA product model and serial number information tag.

Roof Access During Maintenance

Most MUAs are located on the roof. Maintaining MUAs may require accessing and walking across the roof surface.

- Protect your roof: Add a protective surface such as pavers on pedestals or an additional layer of waterproof membrane.
- Keep people safe: Check that access ladders and railings are securely fastened and roof hatches can easily open and close.

Figure 5: Sacrificial layer of waterproof membrane leading from the roof hatch to the MUA.

Odours: The smell of gas or exhaust fumes from burning natural gas or propane being brought into the building can indicate the heat exchanger in a gas-fired MUA has failed or ruptured.

This is an urgent safety hazard so you must call a certified service provider.

Figure 6: Roof access via hatch.

Who should perform the maintenance?

Maintenance must only be done by certified mechanical contractors or technicians. Possible risks include:

- Removing the cover or opening the door into the MUA may result in injuries if the equipment is not correctly shut down.
- Improper maintenance may cause a safety hazard or shorten the life of your equipment and may affect the warranty.
- Maintenance by non-certified personnel may be a violation of B.C.'s Safety Standards Act. Gas-fired appliances must be maintained and serviced by a certified service provider or gas appliance technician who is employed by a Technical Safety BC licensed gas contractor. Visit www.technicalsafetybc.ca for more information.

How do you identify and address ventilation problems?

A variety of symptoms might indicate a problem with ventilation systems, including the MUA and the corridor pressurization system. The list below is not exhaustive, but provides a general indication of typical symptoms that could be related to the ventilation system.

- Gas or combustion odour (burned or unburned gas smell)
- Build up of carbon dioxide (CO_2) or carbon monoxide (CO). It is recommended that CO_2 and CO sensors be installed in the building
- The persistent smell of car exhaust in corridors, elevators or vestibules
- Weak airflow or no airflow from grilles (unit shutdown)
- Unpleasant odours or "stuffiness" in corridors
- Perceptibly different temperatures in different corridors
- Unusually hot or cold temperatures in all corridors
- New or worsening vibration or noise

When symptoms of ventilation problems occur, follow these steps:

Action	Who does it?
☐ Check maintenance records to confirm maintenance has been completed as recommended. ☐ Record when issues come up and keep a record of symptoms, repairs, and repair costs. ☐ Monitor the record for repetition of similar issues and the total amount spent on unforeseen repairs.	Strata council or maintenance program administrator
☐ Inspect and confirm equipment and settings (including dampers, MUA, and controls) are operating as designed.	Certified tradesperson
☐ Rebalance or recommission the system to account for changes to the building over time.	Balancing and commissioning consultant
☐ Commission an investigation, particularly if issues cannot be identified and resolved.	Mechanical engineer

What are the options for improving energy efficiency?

Arrange for a mechanical engineer to evaluate the building and provide options for energy efficiency, including:

- Decreasing the size of the equipment. Smaller equipment might be adequate.
- Changing to more efficient equipment. Depending on the current heat source, a more energy-efficient heating section may be available.
- Changing to a different heat source. In some cases, gas-fired heaters may be replaced with a heat pump.
- Choosing a variable frequency drive (VFD) fan and controls. The fan speed may be programmed to change depending on the season and time of day. Reducing the fan speed (and thus power) reduces energy demands.

Should the MUA be replaced at the same time as the roof?

Many different types of roofing have a similar service life to a MUA (about 20 years). MUAs also have penetrations that go through the roof, such as ducts, electrical cables, or gas piping. Owners could consider:

- Replacing both the roof and the MUA together.
- Replacing the area of roof surrounding the MUA.
- Designing the reroofing with the future replacement of the MUA in mind. This might include roughing in for a new curb. The curb design would need to accommodate proposed new equipment.

Make sure repairs at electrical and other penetrations are properly designed and don't void any roof warranties.

Rebuild or replace?

When the cabinet is in good condition and access to the MUA is difficult, rebuilding the equipment may be a feasible, economical option.

The cabinet is left in place and the components, typically the heating section, are replaced. Tradespeople may be able to use the elevator to move components into place, instead of hiring a crane.

This option can be explored while planning the MUA replacement.

What will it cost to get a new MUA?

Depending on size and configuration, MUA equipment can range in cost from $10,000 to $50,000 for a wood-frame building. Supply and installation of a new, small MUA typically starts at $15,000. Several factors may increase the installation cost:

- Equipment size, capacity, location, and configuration
- Roof repairs or replacement
- Upgrades for energy efficiency may require a variety of additional work, including:
  - Structural upgrades if new equipment is heavier
  - New utility connections or upgrades
  - Replacement of some or all ductwork at the roof level
- Access costs, because a crane will likely be required to lift new equipment in place and remove old equipment for anything but the smallest units. The building height and surrounding streetscape will determine the type of crane required. Buildings located in densely populated areas may require special permits to close streets. Extremely tall buildings may have additional requirements.
- Commissioning and testing: depending on the complexity of the system, commissioning, testing, and balancing is highly recommended or may be required, which will add to the installation cost.

Action Plan Tips

- ☐ Reduce energy consumption during operation by turning down the temperature and maintaining your equipment.
- ☐ Keep records of preventative maintenance, inspections, and repairs.
- ☐ Plan for and hire qualified and certified tradespeople for inspections, maintenance, and repairs.
- ☐ Hire a qualified and certified technician to inspect and test fire dampers periodically.
- ☐ Begin planning for replacement at least one fiscal year ahead of when replacement is likely to be required.
- ☐ Think about improving energy efficiency.
- ☐ If the MUA is roof mounted, consider protecting your roof membrane or planning for future roof renewals.
- ☐ Keep the manufacturer's operation, maintenance, and warranty documents, and ensure your maintenance program covers the recommended preventative maintenance activities.

Maintenance Checklist

While there are many similarities between different manufacturers and types of MUAs, each building and piece of equipment is unique. Use the following checklist below as a guide or a starting point. The maintenance manual will include recommendations for your specific equipment. The information tag on your equipment will identify the brand, model, and serial number (see Figure 4 on page 3).

MAINTENANCE ACTIVITY	MAINTENANCE DETAILS	FREQUENCY	WHO DOES IT?
Maintenance service contract	Review contract and confirm all equipment and required maintenance is addressed appropriately.	Annually	Strata council or maintenance program administrator
Maintenance records	Review records for the previous year, including recommendations from tradespeople. Update checklists, including the frequency and timing of maintenance.	Annually	Strata council or building caretaker
Maintenance records	Record and track breakdowns, unforeseen repairs, and problems reported.	Ongoing	Strata council or building caretaker
Metal housing (cabinet)	Check for corrosion or damage. Touch up paint or arrange for repairs as appropriate.	Semi-annually	Strata council or building caretaker
Motor, drives, fan, and fan blades	Clean and inspect for damage, including pulleys, motors, belts, and vibration isolation. Lubricate the motor if it is supplied with grease fittings. Adjust or repair if required.	Quarterly	Qualified tradesperson
Filters	Clean or replace filters.	Quarterly	Qualified tradesperson
Fan belts	Check belts for alignment, tension, and wear. Replace if necessary. If there are multiple belts, replace all belts at the same time.	Quarterly	Qualified tradesperson
Fan shaft and motor bearings	Check for alignment, wear, overheating, noise or vibration.	Quarterly	Qualified tradesperson
Condensate drains	Check and confirm free flow. Replace neutralizing medium where applicable.	Quarterly	Qualified tradesperson
Heat pump section (if applicable)	Inspect and verify refrigeration components.	Quarterly (at the start of every season)	Qualified refrigeration technician
Controls	Check that all controls are properly calibrated and functioning.	Semi-annually	Qualified tradesperson
Temperature settings	Adjust thermostat or ductstat settings as required to the lowest comfortable setting.	Semi-annually	Qualified tradesperson
Outdoor air dampers	Check operation of dampers if applicable and lubricate as required.	Semi-annually	Qualified tradesperson
Electrical connections	Check components for proper mounting and tightness.	Annually	Qualified tradesperson
Mounts: Motor and fan	Inspect for damage, cracks, or corrosion. Repair as required.	Annually	Qualified tradesperson
Combustion equipment	Complete annual cleaning, inspection and testing of combustion equipment, as recommended by the manufacturer. Make adjustments or repairs as required.	Annually	Qualified tradesperson
Heat exchanger	Check the heat exchanger for cracks. Replace cracked equipment immediately.	Annually	Qualified tradesperson
Flue	Check the flue to ensure it is clear and free of debris.	Annually	Qualified tradesperson
Combustion equipment	Open and remove drip leg on gas line and clean.	Annually	Qualified tradesperson
Fire dampers	Inspect and test fire dampers at each level.	Five years	Qualified tradesperson
	Replace fire dampers.	As required	Qualified tradesperson
	Replace pulleys, motors, and vibration isolation.	As required	Qualified tradesperson
MUAs	Rebuild or replace MUAs.	20 to 30 years	Mechanical engineer or contractor

Figure 7: An unheated MUA.

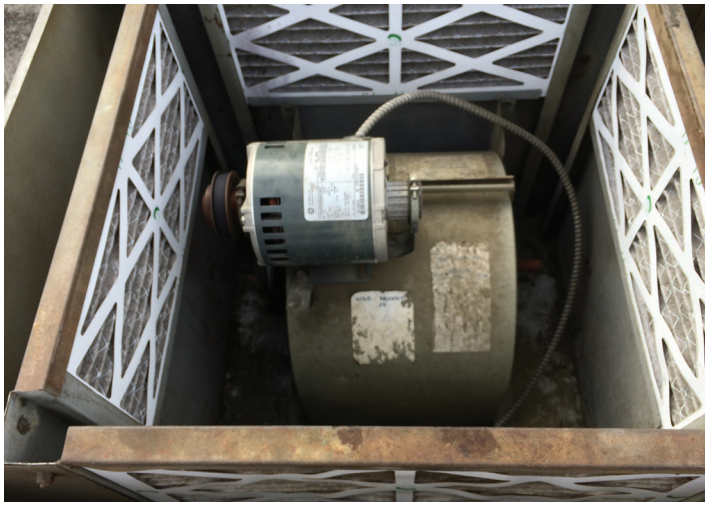

Figure 8: Inside an unheated MUA.

More information:

Maintaining Your Roof,
Maintenance Matters 2, available at www.bchousing.org

Avoiding Condensation Problems,
Maintenance Matters 3, available at www.bchousing.org

Maintaining Your Heat Recovery Ventilation System,
Maintenance Matters 16, available at www.bchousing.org

Energy Use in Mid- to High-Rise Multi-Unit Residential Buildings,
Builder Insight 12, available at www.bchousing.org

What is a Heat Pump and How Does it Work?,
available at www.nrcan.gc.ca

In multi-unit residential buildings, fresh air, or make-up air for hallways and corridors is typically provided by a corridor pressurization system.

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