

TO: Board of Education
FROM: Chuck Morris, Director of Facilities
RE: HVAC and VENTILATION
DATE: November 9, 2020

Background:

Facilities Services has been upgrading Heating Ventilation for years in our facilities, including lowering greenhouse gas emissions at the same time.

Below is a brief synopsis covering the past 4 years to highlight some of the upgrades in heating and ventilation work completed. Following that is a report on what we have been doing to help schools during COVID.

Year 2016:

- Facilities Building replaced the 1956 boiler with new condensing boilers and DDC controls.
- Monterey Middle School we upgraded the 1970 boiler with new condensing boilers and added DDC controls. We also replaced all classroom unit ventilators with new energy efficient units.
- Doncaster original single pane windows in the 1945/1963 and 1964 wings with new energy efficient double pane glazing.
- Rockheights Middle School had the single pane windows upgraded in the 1966 wing with new double pane glazing.

Year 2017:

- Sir James Douglas boiler replacement with new condensing boiler and new DDC building controls.
- Macaulay Elementary DDC building controls were upgraded with new technology
- Glanford Middle School the old boiler was replaced with a new condensing boiler
- Frank Hobbs had a complete window replacement with new double glazed windows

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Year 2018:

- Mount Douglas Secondary replaced two original 1960 boilers with two new energy efficient condensing boilers.
- Willows Elementary replacement of two original 1960 boilers with four energy efficient condensing boilers.
- Colquitz, Glanford, Northridge, Oaklands, Torquay and View Royal schools had all DDC system upgrades to Reliable DDC systems (Reliable is a make of DDC control).
- Mount Doug 15% of the existing single pane windows (Phase 1) were replaced with new energy efficient double pane windows.

Year 2019:

- Richmond Elementary saw a replacement of the 2 original 1960 boilers with 2 new energy efficient condensing boilers. All the classroom unit ventilators in Richmond were also replaced.

What are We Doing with Ventilations During COVID

Prior to June and through a good portion of the month staff:

- increased the volume of fresh air into the HVAC system
- unstuck opening windows
- increased slightly the restricted opening of certain windows on floors above the first floor.

The increased opening of windows was done at the time to allow for greater air movement because of the smoke from forest fires that drifted into the region and stayed for a number of weeks.

Some windows with factory hinges that cannot be opened farther are restricted to that size opening (3-4 inches). Speaking with one of our Mechanical Engineers, it is understood that a window opening of 4-6 inches on minimum three windows in a classroom is enough to allow good exchange.

With fresh air dampers open, pulling into the HVAC system, the air would be moved and into classrooms. With the exterior windows open, the air will usually exhaust through the open windows. This will allow quicker exchange of fresh air because the system is continually pulling fresh air in and distributing it throughout the school.

Buildings are designed to maintain a slightly pressurized atmosphere within itself. Volume of intake air and air relief are designed together based on building designs. High ceiling areas of most facilities use a gravity relief damper high up to allow release of built up warm air, allowing cooler air to enter the building (free cooling). All district HVAC filters are changed every 3 months. We have a staff member who starts at one school and by the time he is finished he starts over again.

Air handling units are checked to ensure drain pans are kept clean, any P-trap on the drain pan is functioning as designed, fan systems are lubed and belts checked to ensure they are not broken or cracked while the filters are being replaced.

During cold weather in the winter, outside air will be reduced down from 100% to allow the system to be able to heat the facility. The percent amount will vary from site to site depending on the systems in place for each facility. Where the balancing act is more difficult to maintain, we will do what we can to help. Typically outside air is reduced significantly during unoccupied hours, but the system will start

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up again around 6 am on school days with maximum possible fresh air. *This is new to everyone and being outside of 'normal', it is our intent to monitor all and work on adjustments as required as we move through the season.*

We use Merv 8 filters on our HVAC systems. Merv 13 and up are a different width which negates direct replacement of the Merv 8. The filters are replaced on a regular interval.

Most Air Handling (HVAC systems) contain 4 to 8 filters. Merv 13 and up demands a higher rpm electric motor to force the air through the filters because of the much greater resistance.

How much resistance depends on the type of filter material and the amount of area. The standard fiberglass filter doesn't resist the air flow much, at least not when the filter is clean. As the filter loads up with the stuff it catches, the resistance increases.

If you want to remove more stuff from the air, you can use a filter with a different material. The pores in these filters are much smaller, allowing the filter to catch more pollutants from the airstream but also adding more resistance.

The higher MERV filters have higher resistance. When you add more resistance, you can get a bigger pressure drop across the filter.

The blower in the furnace or air handler is rated for a certain amount of pressure drop. If you use a lot of it up just to get the air through the filter, there's not much left to move the air through the rest of the system.

This can lead to reduced air flow. If your system is rated for a total pressure drop of 0.5 inches of water column (I.W.C.) and you use up half of it just at the filter, you're not likely to get the amount of air flow the system was designed to deliver.

One consequence of low air flow is reduced comfort. In the hottest and coldest weather, your system may not be able to deliver enough heating or cooling to the building. Or it may just be one or two rooms that get uncomfortable.

Low air flow means the furnace heat exchanger gets hotter. It could even crack. If that happens, your duct system can become a carbon monoxide distribution system.

A high-MERV filter can:

- Add resistance to the air flow
- Increase the pressure in the duct system
- Increase the energy use of the system
- Reduce the air flow
- Cause comfort problems
- Crack the heat exchanger
- Put carbon monoxide in your home

For the district, if we went with Merv 13, the cost of the filters, huge increase in energy consumption and the time and material to retro fit filters into larger sleeves would amount to \$900,000 to well over a million dollars, conservatively speaking. Merv 13 filters range in cost from around 60 dollars each and up depending on size and system requirements.

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These may load much quicker therefore requiring replacement every month and a half or so, instead of the 3 month change rate we currently undergo. The other drawback is the amount of time required to obtain materials and make the physical changes to the HVAC systems.

All heat is back on throughout the district. Teaching staff may open or close their windows as desired. As weather gets colder we will see the outdoor air dampers begin to close, depending on the outdoor air temperature. I have encouraged schools to contact Facilities if they have heating/cool concerns.

We continue to identify heating and ventilation systems that need to be upgraded or replaced. All we identify is included with our 5-year Capital Plan submitted to the Ministry each year. We also use AFG funding to do some of the upgrades as well.

Staff are always sourcing and Vendors are always providing new and better products utilizing up to date technologies.

Recommendation:

None. Information only.

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