

Restarting HVAC & hydraulics systems when reoccupying buildings

When all or part of a building has been shut down during a pandemic, care needs to be taken restarting heating, ventilation, and air conditioning (HVAC) and hydraulic systems.

There are occupant health and safety risks when re-entering a shut-down building. Elevated carbon dioxide levels, VOCs (Volatile Organic Compounds) and disagreeable odours can build up. Temperatures can be uncomfortably hot or cold. Hydraulic systems run the risk of legionella bacteria growth. Restarting essential systems early helps pre-purge the building, restore a comfortable temperature and reduce the risk of transmitting airborne infectious diseases.

All stakeholders in a building should be involved with planning the re-start procedure, including:

- Landlord or building manager
- Facilities manager
- Tenant representatives
- Mechanical maintenance contractor
- Plumbing maintenance contractor
- Electrical maintenance contractor
- Mechanical HVAC or hydraulics services engineers

Timing of building re-start

The building restart procedure should be completed before reoccupation. If earlier re-occupation is required, make tenants aware that some HVAC systems are not operating which may cause temporary discomfort or reduced productivity. Your start-up plan will be driven by:

- Potential health and safety risks to those working on the start-up
- Potential comfort issues if some plant cannot be started immediately
- Potential risks to building occupants if the plan is not followed.

As a minimum, HVAC and hydraulic systems must meet compliance requirements to ensure they are fully operational, compliant, and safe before the building is reoccupied. Systems that must be fully operational to allow for legal, healthy, and safe reoccupation include:

- Outdoor air systems
- Some exhaust air ventilation systems
- Cooling towers if chillers are required to operate from the beginning of occupancy
- Domestic water supplies (both hot and cold water).

Planning can occur early but remember that pandemic restrictions on personnel movement and business operations may apply — make sure you know what access and work is permitted.

Key plant items to be considered

Ventilation systems

Buildings relying solely on mechanical outdoor air supply and/or extract systems for ventilation are legally required to have them operational prior to reoccupation. If a building has both natural and mechanical ventilation systems or natural ventilation only, a mechanical/HVAC engineer can advise on what areas can be safely occupied.

Cooling towers

If a cooling tower has been idle for several weeks, it needs specific maintenance to recommission it and make it fit for normal operation. Requirements will partly depend on whether the tower was:

- simply switched off for the duration of the shutdown
- operated periodically to maintain chemical dosing levels
- shut down and drained for the duration of the shutdown.

Clean and/or decontaminate the cooling tower, including draining and chemical dosing, to minimise the risk of legionella. Poorly maintained cooling towers are a known source of legionella bacteria, which is spread by aerosol droplets and poses a significant risk to building occupants.

If a cooling tower has been switched off during the lockdown period, the following additional maintenance tasks should be undertaken, by maintenance contractors wearing appropriate PPE:

- Drain all water from the cooling tower and its connected condenser water system — it is a biological hazard and should be removed via the dedicated cooling tower drain ONLY.
- Clean the cooling tower as required.
- Refill the cooling tower with clean potable water.
- Kill any bacteria in the cooling tower with an approved chemical biocide ‘shock’ dose.
- Start pumps to circulate water through the cooling tower and condenser water system.
- DO NOT operate cooling tower fans or connected HVAC systems until finished.
- Resume normal dosing and testing procedures, including the addition of corrosion inhibitors etc. once complete.
- In cooler weather, operate crankcase heaters for chillers prior to restarting.

Domestic hot and cold-water systems

Domestic hot water (DHW) systems which have been switched off for a period pose a risk of legionella bacteria being present, especially at shower heads and basin/sink taps etc. When used, they can spread contaminated aerosol droplets which occupants might inhale (maintenance contractors should wear appropriate PPE to reduce risk).

The re-start process for these systems depends on the type of system installed:

- **Electric or gas fired storage cylinders** Switch on and allow to reach operating temperature for a period of 48 hours prior to use. The system should then be flushed by turning all hot water taps, mixers, and showers to full hot to purge the water in the pipes.
- **Circulating loop hot water systems** Switch on circulation pumps and hot water plant and allow water to circulate for 48 hours at the normal operating temperature. Do not consume or use water

in this period. The system should then be flushed by turning all hot water taps, mixers, and showers to full hot to purge the water in the system.

Domestic cold-water (DCW) systems also have a risk of Legionella growth, though it is reduced. Flush the system by turning on all taps, mixers and showers before any water is drawn off or used.

Considerations for different building types & sizes

General recommendations applicable to all building types

The same contractor and/or the personnel who shut the building down should put the building back into operation. This provides an increased level of efficiency and continuity, reducing the risk of damage or malfunction of any systems due to valves or dampers inadvertently being overlooked during the process of re-starting the building systems.

If the building control system or Building Management System (BMS) contains a self-learning optimum start/stop system, these should be checked and reset as part of the start-up procedure. If parts of the plant were switched off manually, this may upset the self-learning function.

Ideally, bring the annual HVAC plant service forward to when you've just re-started the systems. This will ensure all items of plant are physically checked for their operation and condition after the building has been re-started, providing early intervention of any potential problems.

All filters should be checked, cleaned, and replaced as necessary.

Pre-purge the building by operating the ventilation systems prior to occupancy.

Small to medium buildings

These buildings typically have low-complexity single split system heat pump units or small VRF/VRV systems, with local outdoor air and exhaust systems. Restarting them is simple and fast.

In cold weather, if the air conditioning units have been isolated, reconnect power to the outdoor units 24 hours before start-up to ensure all refrigerant is removed from the crankcase oil. Internal control systems will handle the start-up of the fans and compressors in each machine.

Consider staging the start-up of the systems so the electrical system is not overloaded by allowing sufficient time for each system to start-up and reach stable operation before starting the next one.

Operate outside air ventilation systems and exhaust air systems such as toilet and kitchen exhaust air systems for 48 hours prior to occupancy, to dilute odours and VOCs.

Medium to large buildings with air cooled chillers

These buildings will typically be served by larger VRF/VRV systems or chilled water systems with air cooled chillers, with electric or reverse cycle heating. Ventilation systems typically consist of individual fans or central air handling systems for outdoor air and exhaust systems. Restarting these systems is more involved and will take longer.

For HVAC plant start-up for this building type, we recommend the following:

- Operate chilled water and heating circulation pumps for 10 minutes to allow water to move through the system and for any sediment or air to be dealt with.
- Start each central plant item and stabilise its operation before starting the next system.
- Once the central plant is operating, stage the start-up of terminal units (FCUs, AHUs etc.). If FCUs operate with electric heating elements, start-up in a cold building will cause high electrical demand. Staged start-up will avoid overloading the building's electrical systems.
- Stage the start-up of AHUs as the electrical demand of these units from fans and/or high-capacity electric heating elements can also be significant.
- Start ventilation fans (outdoor air, general exhaust, and kitchen exhaust fans, etc.) at will.
- If it is currently cooler weather, or soon will be, consider bringing your annual boiler inspection and maintenance forward to coincide with the re-start.
- Run a pre-purge cycle, with outside air ventilation systems and exhaust air systems operating continuously for 48 hours prior to occupancy to dilute odours and VOCs.
- Where air handling units are fitted with economiser cycle dampers, fix them to full outside air/full exhaust air mode (with no recirculation) to maximise the effectiveness of the purge cycle. Note that temperature limits may apply during winter months.

Medium to large buildings with water cooled chillers

Buildings with water cooled plant have additional considerations for a condenser water system and cooling tower; restart will take longer due to the complexity of the HVAC system.

It is important to have the condenser water circuit and cooling tower fully operational, cleaned and fully maintained before starting any chillers. Maintenance includes chemical dosing (regular or shock) as determined by the cooling tower maintenance contractor.

Depending on the BMS or controls setup, it may be necessary to manually operate the condenser water system and cooling towers to allow them to run without the chiller/s being operated during the cooling tower cleaning and maintenance procedures.

Further Information

Please follow the links below for more information.

<https://www.health.govt.nz/system/files/documents/publications/prevention-of-legionellosis-in-new-zealand-jul19.pdf>

<https://worksafe.govt.nz/topic-and-industry/legionnaires-disease/legionnaires-disease-cooling-towers-and-evaporative-condensers/>

With respect to the current 2021 Coronavirus outbreak, advice is available from the [World Health Organisation](#), [Centers for Disease Control](#) and New Zealand government [COVID-19](#) websites.

This article has been condensed from the full article available [here](#):

The articles provide general strategies that apply to commonly used HVAC systems. We strongly recommend seeking professional advice on a building-by-building basis prior to implementing any of these strategies. For further information or specific advice for your situation, contact us at www.jacksons.co.nz

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