

**SPOORMAKER  
& PARTNERS**

MECHANICAL & ELECTRICAL  
CONSULTING ENGINEERS



# AFTER LOCK DOWN RETURNING TO THE NEW NORMAL

A GUIDELINE FOR REOPENING YOUR  
WORKPLACE SPECIFIC TO HVAC SYSTEMS



EST | 1964

[www.spoormaker.co.uk](http://www.spoormaker.co.uk)

## Contents

---

THE FULL CONTEXT.....	3
SUPPORT SYSTEMS .....	4
HVAC SPECIFICALLY .....	4
1.1    It's function in your workplace.....	4
1.2    HVAC and COVID 19 .....	5
1.3    Preparation for reopening of workspace.....	6
1.4    Day one and after .....	7
INTO THE FUTURE .....	8
Annexure A Checklist: HVAC system changes for COVID .....	9
Annexure B Checklist: Routine Preparations for HVAC re-start.....	11



## THE FULL CONTEXT

---

As gradual easing of the lock-down implemented by government to slow the spread of the COVID 19 virus takes effect in South Africa, organizations will begin to bring workers back into the workplaces. This process will look different for every organization. The mix of returning employees will vary, and in some cases, a segment of the workforce may continue to work from home. One thing is clear, however—the management of the process is without precedent.

Depending on the work sector your company functions within, the questions that need answering would differ. For real estate owners, how to most effectively prepare their assets for the return of building occupants? For employers in general it is to ensure they are prepared to receive their workforce, that their employees are prepared for the return, and that the transition is safe, efficient, effective, and aligned to the needs of the organization and the needs of its people?

All however have the same essential considerations, which are:

- **Prepare the Building:** cleaning plans, pre-return inspections, HVAC & Mechanicals checks
- **Prepare the Workforce:** mitigating anxiety, policies for deciding who returns, employee communications
- **Control Access:** protocols for safety and health checks, building reception, shipping and receiving, elevators, visitor policies
- **Create a Social Distancing Plan:** decreasing density, schedule management, office traffic patterns
- **Reduce Touch Points and Increase Cleaning:** open doors, clean desk policy, food plan, cleaning common areas
- **Communicate for Confidence:** recognize the fear in returning, communicate transparently, listen and survey regularly

Whilst this guideline does not cover all of the above but rather focus on a specific service (HVAC) forming part of but one of the above considerations (Building preparation), it is important that the building owner and occupant attend to each of these six aspects within the context of their specific relevance to the organization.

In addressing and resolving these items, and in using this guideline on HVAC, three overriding things must be noted:

First, the World Health Organization (WHO), as well as the respective health organizations and government bodies, are the primary sources for guidance on COVID-19 and other health-related issues.

Second, while the practices and recommendations in this guide at times reference office environments, they are largely applicable to other types of workforce environments and properties.

Finally, the intention of this document is to establish the foundation of ideas and recommendations upon which all can build—in collaboration with clients and partners. We're certain the coming weeks and months will teach us new things, and we look forward to sharing more ideas and updates to help you move forward through unfamiliar territory.

In the meantime, we look forward to connecting with you to learn more about how we can help.

## SUPPORT SYSTEMS

---

Various systems support the occupants of a building in order to make the space usable and safe, and promote productivity for the workforce. These systems are all part of the preparatory works to enable the building to be ready for accepting back the occupants, and include:

- HVAC systems (applicable to this guideline)
- Electrical systems
- Fire systems
- IT systems
- Security and access control systems
- Vertical transportation systems
- Plumbing and wet services systems
- Food preparation systems (kitchens)

Guidelines for assisting with building preparation in terms of each of these services should be obtained and followed in consultation with specialist maintenance contractors and engineers.

## HVAC SPECIFICALLY

---

### 1.1 IT'S FUNCTION IN YOUR WORKPLACE

Heating, Ventilation and Air Conditioning (HVAC) system's primary functions in order of importance are:

- **Life support:**
  - Fresh Air provision at minimum required volumes for human occupation (SANS 10400 Part O),
  - Ventilation (supply and extraction) of areas where noxious and dangerous gasses can build up to avoid adverse effects on human health,
  - Fire related safety systems for protecting escape routes and removing heat and smoke which can kill occupants during fire conditions,'
- **Process support:**
  - Cooling of processes forming a key part of occupant activity and production, such as IT systems, manufacturing, etc
  - Extraction of smoke and heat from food preparation areas
- **Comfort:**
  - Air temperature control for best productivity of the workforce and clientele.
  - Relative humidity (if applicable) within the acceptable band where building health and occupant comfort is optimal.

The state of readiness of HVAC in a workplace or building should be viewed with this prioritization in mind – first safety, then process, then comfort. Whilst safety is a non-negotiable, process is subject to the needs of production, and the comfort remains an optional function which if need be is sacrificial to safety, and to a lesser extent production.

## 1.2 HVAC AND COVID 19

Contagious diseases can spread amongst occupants of a building in a number of ways, including direct contact with an infected person, contact with surfaces contaminated by an infected person, airborne droplets projected from an infected person when sneezing, coughing or talking, or via inhalation of airborne particles containing infectious microorganisms.

The potential for airborne transmission of disease is widely recognized, although there remains uncertainty concerning which diseases are spread primarily via which route, whether it be airborne, short range droplets, direct or indirect contact, or multimodal (a combination of mechanisms).

In accordance to the WHO, small droplet airborne contamination has not been proven with COVID 19, and hence opinions vary as to what extent COVID 19 can spread via Air Conditioning systems, if at all. What is well documented is the fact that the largest risk for contamination lies with direct contact, contact with surfaces contaminated and large droplets due to sneezing, coughing and talking. The following serve as guideline for building operators to further reduce the risk of contamination:

- **Source reduction:** The best way to avoid spread of contamination, is to remove any persons who potentially carry the disease. This should include persons who have been exposed to risky environments or contaminated persons, but have not yet been tested. Eliminating airborne particulate at the source is the golden rule in mitigating risk.
- **Dilution of airborne contamination:** If source reduction is the golden rule, dilution of the building air by introduction of larger fresh air rates is the silver bullet in mitigating risk of contagion. As a rule of thumb, an increase of fresh air proportionally reduces the risk of contamination by airborne particulate.
- **Protection of vulnerable individuals:** COVID 19 seem to have higher risk for immunosuppressed persons and the elderly. It is recommended that such persons be removed from exposure, and requested to work from home or be placed in separated spaces/areas where higher level of control and sterilization measures are in place.
- **Occupancy density reduction:** Reducing the density at which occupants are placed mitigates risk in three ways – (a) Larger physical distance between occupants lowers risk of droplet contamination, (b) Less people lowers load on fresh air system, and thus improves rate of dilution, which has a direct effect on reducing airborne particulate, and (c) Having less personnel in the space lowers probability of rapid and wide contamination.
- **Physical barriers and separation:** Introducing physical barriers, or separating groups of occupants avoids exposing larger clusters of people to a single contaminated person and the airborne particulate he might be generating.
- **Eliminate social interaction spaces within building:** As a temporary measure, steering occupants away from social interaction in central nodes within the building, will reduce large scale and simultaneous exposure to airborne particulate, especially droplets which has a reach of up to 5 meters when projected. If required, making such relaxation spaces outdoors would greatly reduce airborne particulate exposure due to the dilution which occurs outside.
- **HVAC system maintenance:** Ensuring that systems are functional and operating as per the design intent is key to avoiding increased risk caused when extract systems, fresh air systems, or filter systems fail. Make sure that the maintenance personnel do filter washing/replacement in the units, and when doing so switches fans and systems off to avoid the spread of particulate which becomes dislodged from filters when replacing it.

- **Sterilization of A/C equipment:** Introduce regular sterilization of air handling equipment coils, plenums and surfaces. Diffuser face plates, Air Handling Unit fan chambers, filter systems etc are all potential hiding places for airborne particulate with micro-organism. These should always be cleaned regularly, but during periods when high risk of contagious diseases exists, they should be sterilized as well.
- **Active sterilization systems:** Consider introduction of active, real time air sterilization by use of Ultra-Violet Germ Irradiation (UVGI) systems in space upper zones, or in the duct/air moving equipment. Whilst the efficiency of these systems is not quantifiable, it does mitigate risk and move the risk level down.

By implementing any or all off the above, the relative low risk of airborne contamination via the Air Conditioning systems is further reduced.

### 1.3 PREPARATION FOR REOPENING OF WORKSPACE

In most buildings the HVAC systems would have been switched off at the onset off lock-down, or in the very least set back to operate in a reduced or mothballed state. Whichever the case, it is imperative that these systems be prepared for full and safe functionality prior to the onset of normal occupation.

Two considerations would be governing the preparation of the systems, being (a) what system changes is required or recommended to better protect the occupants against COVID 19 spread, and (b) what routine maintenance need to be done to make sure the original HVAC system and equipment operates correctly and safely.

- **System changes for better COVID 19 protection:**

These changes are to be viewed as temporary, since most of the actions taken would, whilst reducing risk of contamination, increase energy consumption and reduce comfort levels of occupants. Being temporary, one would limit changes to those that does not materially replace equipment and concepts, but rather consist of adjustments and actions which are easily reversable.

Key objectives for reducing risk of virus spread via large-droplet airborne contamination, would be dilution of the contaminant, and avoiding stagnant spaces where the build-up and suspension of contaminant can increase over time. To this means, the following steps can be taken (refer to attached checklist in Annexure A for easy reference):

- Open all openable windows to the building.
- Central Systems with an Economy Cycle: Override in full economy cycle mode, to run on full fresh air. Enable 24 hours operation to flush the building at night.
- Central Systems without an “Economy Cycle” Manually open fresh air dampers to full open and reduce return air dampers to minimum. Enable 24 hours operation to flush the building at night.
- Unitary systems such as fan coil units, split units, VRF systems: Run the fresh air system at maximum capacity and 24 hours to flush the building.
- Where practical, building fire smoke extract systems can be run manually at night to assist in flushing the building with fresh air.

- **Routine preparations for HVAC re-start:**

These actions and routines would be similar to those typically implemented following the annual break during the festive season, when maintenance teams traverse the site and do systematic cleaning, testing and starting of the HVAC equipment and systems. We list a summary of the basic aspects which require the attention of the maintenance contractor, but each site and system would be specific in the detail actions needed. The following needs to be included in the scope of work for the maintenance teams (refer to attached checklist in Annexure B for easy reference):

- **Safety related:**
  - Fire protection systems (dampers, fans, interlocks etc)
  - OHSACT items (general safety for operators and occupants)
  - Fresh Air and ventilation / extraction in terms of UK Building Regulations Part F and CIBSE Part A4.
- **Process supporting:**
  - IT systems cooling (Servers, Patch rooms, Telco rooms)
  - Kitchen extraction and make-up
  - Electrical system cooling (UPS's, Generators, Battery rooms etc)
- **Comfort:**
  - Cooling / Heating source (chillers, condensers, cooling towers etc)
  - Air systems (AHU's, FCU's, Unitary equipment)
  - Terminal control (VAV diffusers, re-heaters, pressure control dampers)
- **Monitoring:**
  - Building Management System (where applicable)

It is recommended that all of the above systems, following the necessary preparatory testing and checks, be started up and run for a period of at least 48 hours (2 days) prior to building occupation, under observation, to ensure that systems are stable and safe prior to the start of partial or full occupation of the building.

#### 1.4 DAY ONE AND AFTER

The inherent perception of many that switching off the Air Conditioning and fresh air systems would eliminate risk of airborne spread, would be changed once the occupants understand the important role that these systems play in creating an occupiable space where not only temperatures are controlled within a band deemed healthy and comfortable, but contamination risk is reduced by dilution of foul air with fresh air, and by inducing airflow in to stagnant space which assist with local dilution of airborne droplets.

Human nature remains the largest contributing factor to increased risk when it comes to spread within Office Buildings. Whilst the WHO is clear in its guidelines for reducing person-to-person spread, and most employers have circulated these good practice guidelines to employees, the reflex of touching ones face with your unwashed hands is probably the most risky moment that an occupant would experience in a typical day at the office. Personal discipline remains the best method of reducing risk of contamination.

Clear and frequent communication of these facts will assist with reinstating calm and trust amongst the occupants.

## INTO THE FUTURE

---

It is our belief that lessons learnt due to the unexpected events of the past few months, would continue to have an influence on the HVAC industry, in that building owners and occupants would place a higher value in the capabilities of their HVAC systems to adapt and support their continued operations, should these kind of events occur again in future.

One such an aspect which has proven to be a clear advantage for some buildings, is the Economy (full fresh air) Cycle which is mostly installed in high-end HVAC central VAV systems. Buildings with these full fresh air Economy Cycle systems forming part of their standard HVAC, has a clear advantage in dealing with contamination risk, which can be activated or deactivated at the press of a button (via BMS).

Given the loss of income caused by the lock-down, and the further risk of similar losses when and if COVID positive employees are identified in a workplace, a simple cost and risk balance is likely to convince most future building owners and occupants to ask and even demand that their preferred HVAC systems are up specked to include Economy Cycle and the ability to change to full fresh air mode when so required by the occupants for highest contaminant dilution during events such as the current crisis.

Unfortunately, these advantageous features such as Economy Cycle (full fresh air mode) does not exist within the unitary (FCU / Split / VRF) type of HVAC systems, and hence could encourage future building developers to opt out of the lower cost, unitary systems for the added advantage and marketability of buildings with built in, user ready full fresh air capability.

Other technologies which is likely to make a comeback and enter in to the HVAC system concepts would be active real time air sterilization such as that provided by UV units and various other technologies currently only available for highly specialized use at high costs.

Human nature and the high cost the COVID experience has incurred for all industries and sectors, would dictate that all future building developers would be asking the simple question: How will the HVAC system proposed for my building make provision for the future risk of reoccurring COVID outbreaks or similar contagious events.

We invite such responsible developers and owners to approach us should they wish to widen their field of options and prepare for the inevitable pressure from the market to be more prepared for future risks such as COVID.



Annexure A

**Checklist: HVAC system changes for COVID**

---



**DILUTION OF PATHOGENS (VIRUS)**

	Yes	No	NA.		Yes	No	NA.
Set Economy Cycle to 100% fresh air (if available).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Open all openable windows which can be opened in a safe manner.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Set fresh air system timer to flush building after hours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Increase central fresh air systems to maximum volume by opening of dampers and speeding up of fans.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Run bathroom extraction systems 24/7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Open doors of rooms not occupied, such as unused boardrooms etc. This allows for better Air Change Rates.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use fire extract fans to flush the building after hours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Keeping lobby doors open can increase the building fresh air system volume by making pressure relieve easier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Do not put occupants in rooms of areas with no or slow air movement (avoid stagnated areas).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

**ELIMINATION OF PATHOGENS (VIRUS)**

	Yes	No	NA		Yes	No	NA.
Sterilize/sanitize air handling units (AHU's) internally as often as practically possible (weekly).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clean off terminal face plates with sanitizer fluid to eliminate surface attached pathogens.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Replace / clean filters on AHU's, FCU's, Split units etc at higher frequencies, also using sanitizing fluids.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Make sure the maintenance personnel doing these works are provided with PPE, and themselves are clear of any COVID symptoms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The option of introducing UV type sterilization in to AHU's and spaces does exist – but needs to be investigated by specialists since it does have limitations and risks.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clean off the wall mounted controllers for A/C systems regularly during the workday, and position hand sanitizer close to these for use by occupants.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



**Annexure B**

**Checklist: Routine Preparations for HVAC re-start**

---



AFTER LOCKDOWN

TECHNICIAN  BUILDING MANAGER  MAINTENANCE SUPERVISOR  MAINTENANCE WORKER

**Ventilation Systems**

	Yes	No	NA
Toilet Extract fan Operational 24hrs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kitchen Extract fans Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fresh Air Fan Operational 24hrs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No	NA
Fresh Air Fan Filters due for Replacement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fresh Air Fan Filters Clean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Airconditioning Systems – Large Equipment**

	Yes	No	NA
Chiller Pumps Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chilled Water Secondary Pumps Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chiller Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Condenser Pumps Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Condenser Water Secondary Pumps Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooling Tower Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No	NA
Primary Air handling Units Operational 24hrs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Primary Air handling Units Filters Clean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Roof Top Packaged Units Filters Clean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Roof Top Packaged Units Filters Clean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Units Filters due for Replacement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Airconditioning Systems – Small Equipment**

	Yes	No	NA
Ceiling Mounted Fan Coil Units Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Floor Mounted Fan Coil Units Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fan Coil Units Filters Clean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fan Coil Units Filters due for Replacement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air Handling Units Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air Handling Units Filters Clean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air Handling Units Filters due for Replacement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No	NA
Air Handling Units and Fan Coil Units Heaters operation and Air Flow Interlock and Safeties checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DX Split Units Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DX Split Units Filters Clean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DX Split Units Filters due for Replacement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VAV Diffusers Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VAV Diffusers Heaters operation and Air Flow Interlock and Safeties checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VAV PRD's Dampers Operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Building Management System For HVAC Systems (BMS)**

	Yes	No	NA
All equipment Operating as per Agreed Operating Times Checked (2hrs prior to building usage)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Faulty equipment alarms Checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fresh Air Units Operating 24hrs and at minimum speed after- hours Checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Toilet Extract Fans Operating 24hrs Checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DX Split Units in Computer/Patch Rooms Operating 24hrs Checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All equipment Operating as per Agreed Operating Times Checked (2hrs prior to building usage)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Faulty equipment alarms Checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No	NA
Air Handling Units on/off coil Temperatures Checked that they are as per design.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chillers on/off chilled water Temperatures Checked that they are as per design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooling Towers on/off chilled water Temperatures Checked that they are as per design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Roof Top Packaged Units on/off coil Temperatures Checked that they are as per design.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Calibration of all temperature sensors checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air Handling Units on/off coil Temperatures Checked that they are as per design.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chillers on/off chilled water Temperatures Checked that they are as per design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## PPE Requirements

	Yes	No	NA
Face Masks or Visors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hand Sanitizers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No	NA
2m Distancing between Personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fresh air Systems Disinfected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

