National Manual of Assets and Facilities Management

Volume 5, Chapter 4

HVAC Systems Operations – Schools and Universities Procedure

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1.0 PURPOSE

Heating Ventilation & Air Conditioning (HVAC) is used extensively in all types of education premises to provide a safe and comfortable environment for occupants. The aim of air conditioning is to control the thermal environment, largely through simple adjustments to air temperatures. The method by which air temperature is adjusted, and the effect that this has on overall comfort control, will depend on the form of air conditioning employed and its ability to provide a uniform thermal environment.

The introduction to HVAC systems provides a generic overview of the types of systems that are likely to be found within an education facility, but is not as comprehensive, as the requirements of each facility will differ according to its particular function.

The Operations Management for HVAC systems document has been compiled utilizing the latest references available for inclusion within the manual but may be subject to change throughout the lifetime of the National Manual of Assets and Facilities Management.

The purpose of this document is to provide the Entity in the Kingdom of Saudi Arabia (KSA) the procedural guidelines for Operations Management of HVAC systems in schools and universities. Its application is mandated by Royal Decree passed by the Saudi Council of Ministers which dictates that HVAC systems for schools and universities be operated in a safe, efficient, and compliant manner. These guidelines contain operational expectations consistent with the Expro approach, using best practice developed through industry experience.

The intention of this document is to provide adequate reference and methodology to Entities, Facility Managers, and service providers to assist with the creation of their own documents and processes and to serve as an aid for engaging with external parties for service delivery.

References have been provided within the document to direct users to the ‘specific’ requirements of any decree or regulation as a point of reference. Where only a summary is provided within the guidelines, the actual reference should always be the standard that shall be employed.

2.0 SCOPE

The Operations Management Guidelines establish the uniform practical criteria and standards for HVAC systems and equipment, to enable quality, and cost-effective facilities maintenance that meets the needs and expectations of the Entity.

The Entity will need specific operational procedures for schools and universities the conditions of which may dictate the need to exceed the minimum requirements outlined within these guidelines.

The provision of these guidelines is not intended to prohibit the use of alternative systems, and methods, not specifically described. However, the use of alternative systems, and methods, can only be considered after receiving approval from the Entity.

This chapter should contribute to a schools or universities operational policy that may cover various aspects of HVAC systems. Staff responsible for the safe use of a HVAC system should receive specific training before being permitted to handle a system or associated equipment. This document shall outline the key personnel involved in the operation, and general use of the system.

For the purpose of this document “Schools and Universities” has been defined as a place of education and learning, such as but not limited to:

- Schools and Colleges
- Academies and University campus
- Teaching Faculties

This document provides the minimum technical requirements to be adopted by the Entity and/or contractors to enable safety, quality, and cost effectiveness in the operations of new and existing HVAC systems that meet the needs and expectations of the relevant Entity.

Using this document, the Entity shall establish and develop set procedures ensuring the continuous operation of HVAC systems for new and existing schools and universities. This may dictate the need to exceed the minimum requirements outlined within these guidelines.

3.0 DEFINITIONS

A universal list of terms and their associated definitions as they apply to the Entity are outlined in Volume 6, Chapter 3 of the National Manual of Assets and Facilities Management – EOM-ZM0-PR-000002 – Descriptions and Definitions.

Definitions specific to this particular section of the National Manual of Assets and Facilities are listed below:

Term	Definition
Atmosphere	The gaseous envelope surrounding the earth (outside conditions)
Concealed Exterior	Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures
Concealed Interior	Concealed from view and protected from physical contact by building occupants
Conditioned	Spaces directly provided with heating and cooling
Exposed Interior	Exposed to view indoors (not concealed)
Exposed, Exterior	Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions
Finished Space	Space other than mechanical rooms, electrical rooms, furred spaces, pipe chases, unheated spaces immediately below roof, space above ceilings, unexcavated spaces, crawl spaces, tunnels, and interstitial spaces
Indoors	Located inside the exterior walls and roof of the building
Outdoors	Located outside the exterior walls and roof of the building
Abbreviations	
ACH	Air Change per Hour
ACOP	Approved Code Of Practice
AE (V)	Authorized Engineer (Ventilation)
AHJ	Authority Having Jurisdiction
AHRI	Air Conditioning Heating and Refrigeration Institute
AHU	Air Handling Units
ANSI	American National Standards Institute
AMS	Asset Management System
AP (V)	Authorized person (Ventilation)
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
BAS	Building Automation System
BIM	Building Information Modelling
BMS	Building Management System
CAV	Constant Air Volume
CMMS	Computerized Maintenance Management System
CP (V)	Competent Person (Ventilation)
CRAC	Computer Room Air-conditioning Unit
CRAH	Computer Room Air Handling Unit
DOAS	Dedicated Outside Air System
DPS/T	Differential Pressure Sensor/Transmitter
DSP	District Service Provider
DX	Direct Expansion cooling unit
EMCS	Energy Management and Control System
EMP	Emergency Management Plan
EPA	Environmental Protection Agency
ETS	Energy Transfer Station

FCU	Fan Coil Units
FLS	Fire and Life Safety system
HEPA Filter	High Efficiency Particulate Air Filter
HSE	Health & Safety Executive
HSSE	Health, Safety, Security and Environment
HVAC	Heating, Ventilating, and Air Conditioning
IBC	International Building Code
IEC	International Electric Code
IMC	International Mechanical Code
KPI	Key Performance Indicators
KSA	Kingdom of Saudi Arabia
LEV	Local Exhaust Ventilation
NFPA	National Fire Protection Association
O&M	Operation & Maintenance
OSHA	Occupational Safety and Health Administration
PTAC	Packaged Terminal Air Conditioning unit
RCA	Root Cause Analysis
RCL	Refrigerant Concentration Limit
RH	Relative Humidity
RTU	Roof Top Units
SBC	Saudi Building Code
ULPA Filter	Ultra-Low Particulate Air Filter
UMC	Uniform Mechanical Code
UPS	Uninterruptible Power Supply
VAV	Variable Air Volume
VFD	Variable Frequency Drive
VNI	Virtual Network Interface
VRF	Variable Refrigerant Flow
ZSCS	Zoned Smoke Control System

Table 1: Definitions

4.0 REFERENCES

- National Manual of Assets and Facilities Management – Volume 6, Chapter 3 – EOM-ZM0-PR-000002 Descriptions and Definitions Procedure
- National Manual of Assets and Facilities Management – Volume 5, Chapter 5 – EOM-ZO0-PR-000018 Building Management System (BMS) Operations – Offices
- National Manual of Assets and Facilities Management – EOM-ZO0-TP-000035 Emergency Response Action Checklist - HVAC Systems - Schools & Universities
- National Manual of Assets and Facilities Management – EOM-ZO0-TP-000032 Start-up Checklist – HVAC Systems – Schools & Universities
- National Manual of Assets and Facilities Management – EOM-ZO0-TP-000033 Shutdown Checklist – HVAC Systems – Schools & Universities
- National Manual of Assets and Facilities Management – EOM-ZO0-TP-000034 Systems Monitoring/Daily Rounds Checklist – HVAC Systems – Schools & Universities
- Saudi Building Code (SBC)
- SBC 201 Building Code - General
- SBC 401 Electrical Code
- SBC 501 Mechanical Code
- SBC 601 Energy Conservation
- Expro Projects White Book Mechanical Design Guidelines
- Expro Projects White Book, Volume 11, HSSE Introduction
- Chartered Institution of Building Services Engineers (CIBSE) Guide M
- HSE Approved Code of Practice (ACOPs) L8 & HSG274

- ASHRAE Handbook – Fundamentals
- ASHRAE Handbook – Refrigeration
- ASHRAE Handbook – HVAC Applications
- ASHRAE Handbook – HVAC Systems and Equipment
- ASHRAE Standard 15 – Safety Standard for Mechanical Refrigeration
- ASHRAE Standard 34 – Designation and Safety Classification of Refrigerants
- ASHRAE Standard 62 – Ventilation for Acceptable Indoor Air Quality
- ASHRAE Laboratory Design Guide (2nd Edition)
- National Fire Protection Association (NFPA) 70 – National Electrical Code
- NFPA 90A – Standard for Installation of Air Conditioning and Ventilation Systems
- NFPA 92 – Standard for Smoke Control Systems
- NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- NFPA 101 – Life Safety Code

Note: Based upon the requirements on international best practices and standards. These shall be from Saudi Building code (SBC), the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Health Technical Memorandum (HTM), National Fire Protection Association (NFPA), American National Standards Institute (ANSI).

These standards shall be selectively applied based on the evaluation of individual requirements. Where the standards stipulated conditions conflict, the most stringent shall govern, unless otherwise noted herein. When there is any conflict with the Saudi Building Code (SBC), only the Saudi Building Code will be applied.

5.0 RESPONSIBILITIES

The Entity is the final Authority Having Jurisdiction (AHJ) unless specifically stated otherwise in other sections of the National Manual of Assets and Facilities Management. If a conflict is discovered between these guidelines and other operations management documents, it shall be brought to the attention of the Entity who will provide a resolution or direction to evaluate if all HVAC goals and requirements have been met.

Descriptions of these responsibilities are outlined below and depicted in the organizational structure in Figure 1.

5.1 Organizational Structure

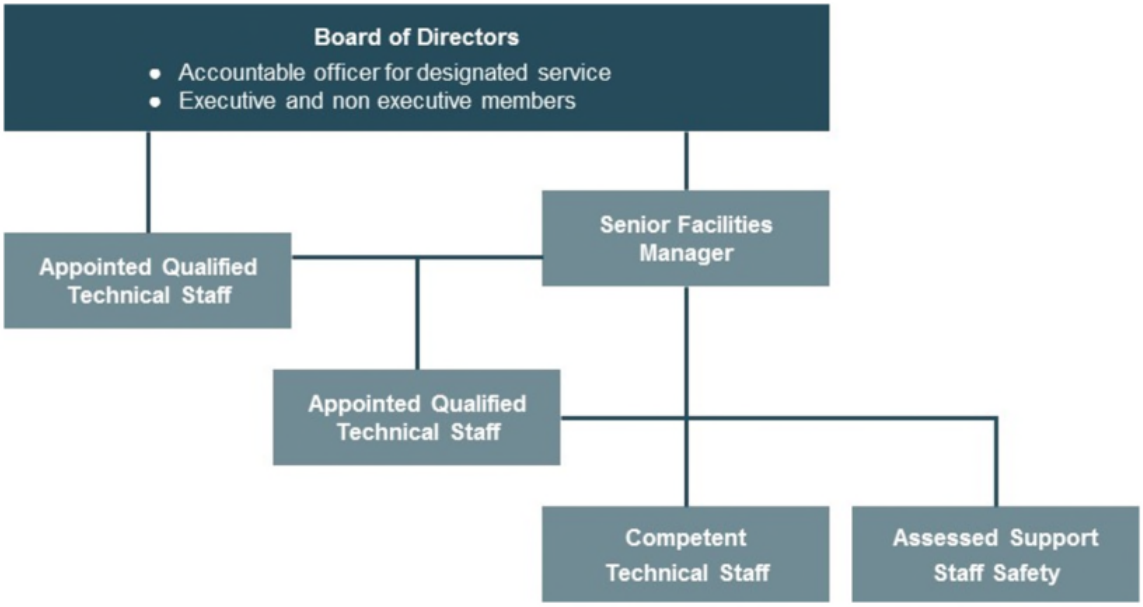

Figure 1: Organizational Structure

5.2 Management Responsibilities

It is the responsibility of management to ensure that inspection, service, and maintenance activities are carried out safely without hazard to staff, students or members of the public. Clear lines of managerial responsibility should be in place so that no doubt exists as to who is responsible for the safe operation and maintenance of the equipment. A periodic review of management systems should take place in order to ensure that the agreed standards are being maintained.

Management is also responsible for maintaining records of the asset's condition and systems being maintained and for taking on operational ownership of the repaired, replaced, altered or extended assets or systems.

5.3 Designated Person

This person provides the essential senior management link between the organization and professional support. The Designated Person should also hold an informed position at board level.

5.4 Authorized Engineer (Ventilation) (AE (V))

The AE (V) is defined as a person designated by Management to provide independent auditing and advice on ventilation systems and to review and witness documentation on validation.

5.5 Authorized Person (Ventilation) (AP (V))

The AP(V) is an individual possessing adequate technical knowledge and having received appropriate training, appointed in writing by the Designated Person (in conjunction with the advice provided by the AE(V)), who is responsible for the practical implementation and operation of Management's safety policy and procedures relating to the engineering aspects of ventilation systems.

5.6 Competent Person (Ventilation) (CP (V))

The CP (V) is defined as a person designated by Management to carry out maintenance, validation, and periodic testing of ventilation systems.

5.7 Plant Operator

The Plant Operator is any person who operates a ventilation installation.

5.8 End User

The End User is the person responsible for the management of the unit in which the ventilation system is installed (e.g., Head of Department, Operations Manager, Head of Research or another responsible person).

5.9 Contractor

The Contractor is the person or organization responsible for the supply of the ventilation equipment, its installation, commissioning, or validation. This person may be a representative of a specialist ventilation organization or a member of the General Manager/Chief Executive's staff.

6.0 PROCESS

6.1 Operations Management

6.1.1 Operational Policy

The Entity Organization's Board of Directors shall be responsible for setting overall operational policies and it is the responsibility of the Designated Person (DP), as the senior executive, to implement these policies.

The main recommendations for operational policy are that all ventilation plants should meet a minimum requirement in terms of the control of Legionella and safe access for inspection and maintenance. All ventilation plants should be inspected annually and the performance of all critical ventilation systems (such as those servicing operating rooms) should be verified annually.

6.1.2 Monitoring of the Operational Policy

The Designated Person (DP) is responsible for monitoring the operational policy to ensure that it is being properly implemented. This should be carried out on a regular basis and the procedure for such monitoring should be set out in the operational policy.

6.2 Risk Management

Critical pieces of equipment (assets) within an education facility have a greater impact on overall performance. Hence, it is crucial to identify any equipment that is critical in ensuring the safety, comfort, and amenity of a facility, particularly in laboratories or computer server rooms. The Entity should plan for major plant failure by procuring critical assets such as portable air conditioning units and developing a Risk Management Plan to minimize downtime and inconvenience to end users.

The loss of service of these areas would seriously degrade the ability of the premises to deliver optimal service. In order to ensure reliable service provisions, it is essential to inspect, verify, and maintain these HVAC systems at appropriate intervals. For many of these systems, a permit-to-work will need to be completed to ensure that taking the ventilation system out of service does not compromise the activities of the user department. In any event, it will be necessary to liaise with the user department when switching the system off to carry out routine inspection and maintenance.

6.3 Emergency Management

Emergency procedures are intended to highlight the key issues that may arise at the departmental level in the event of HVAC systems failure. Good practice in emergency management should include development of an Emergency Management Plan (EMP) which outlines responsibilities, identifies high risk areas and appropriate responses, and clearly identifies safe areas during an emergency and an evacuation plan for disabled persons.

6.4 Operational Considerations

6.4.1 Health, Safety, Security, and Environment (HSSE)

HVAC systems Operations Management shall be completed in full accordance to the respective Health, Safety, Security and Environment requirement (Refer to National Manual of Assets and Facilities Management Volume 10, Chapter 2 – Health, Safety, Security, and Environment (HSSE).

All safety aspects of operation associated with plant or equipment should be clearly understood by operational staff. End-users and other key staff should be aware of the purpose of any alarm systems and of the course of action to be taken in the event of an emergency occurring.

In order to prevent unwanted interference with plant and controls, all means of service isolation, regulation and control should be located and secured in such a way that they can be fixed in the "normal" position and be free from unauthorized adjustments. All plant rooms should be kept locked, signed and under access control. Signage should be displayed to alert individuals that they are entering a restricted area.

6.4.2 Environmental

It is important to achieve a balance between economy in capital and energy costs while creating appropriate levels of comfort through mechanical ventilation/comfort cooling. Natural ventilation is always the preferred solution for a space, provided that the quantity and quality of air required and consistency of control to suit the requirements of the space are achievable. If this is not the case, a mechanical ventilation system will be required.

6.4.3 Records/Drawings

The Entity should have accurate and up-to-date records and/or drawings. Where possible, these should be backed up electronically. They should be readily available on site in an appropriate format for use by any AP/V responsible for engineering services and CP/V inspecting or maintaining them. Facilities Management should also be aware of the increasing use of Building Information Modelling (BIM) and have the provisions to access BIM information where possible.

6.4.4 Training

All personnel employed in the operation and management of HVAC engineering services should receive adequate documented training. Personnel should not commence their duties until this training has been completed, competency has been validated and detailed operating instructions have been provided.

It is essential that practical training be given to all operational staff to ensure that work routines, operational procedures (including permit-to-work systems), and correct application of the safety procedures and rules are implemented.

6.5 HVAC Fundamentals

A central heating system provides thermal comfort to the whole interior of a building (or portion of a building) from one point to multiple rooms. When combined with a cooling system, in order to control the building climate, the whole system may be considered as HVAC.

HVAC in schools and universities are also used for quality conditioned air supplied to areas like computer server rooms, laboratories and kitchens. The air quality within a building is influenced by external and internal factors. The ability to maintain satisfactory air quality depends on identifying the factors that affect air quality in a particular application, controlling or eliminating detrimental factors, and promoting beneficial ones.

External factors include, but are not limited to:

- Vehicle traffic, including parking facilities
- Building geography: urban or rural

Internal factors include, but are not limited to:

- Internal building works and refurbishments
- Local processes generating fumes or vapors

Precautionary measures that can be implemented to prevent the repercussions caused by the contaminants above include, but are not limited to:

- Eliminating contaminants by preventing the use of volatile solvents and sprays.
- Diluting dust and odors through the introduction of fresh, filtered air.

Ventilation systems with terminal re-circulatory facilities may act as secondary contaminant sources, as internally generated dust and microbes will, unless removed by regular filter replacement and cleaning, accumulate and be ejected back into the workplace.

Specific guidelines related to elements of central heating and cooling equipment can be found in the ASHRAE standards cited in the References section of this document.

HVAC takes into consideration the following operating parameters

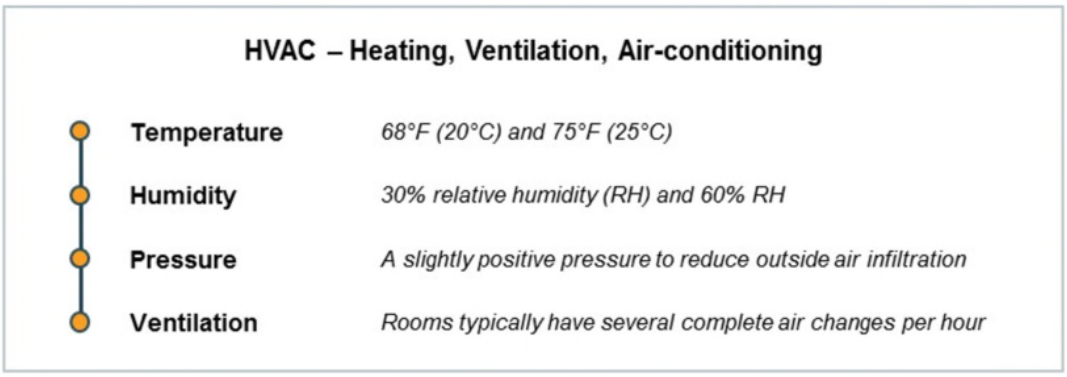

Figure 2: HVAC Heating, Ventilation, and Air-conditioning Operating Parameters

6.6 Systems Overview

6.6.1 HVAC Plant & Equipment

Users of HVAC plant and equipment similarly need to be aware of the system fundamentals in order to participate in the safe operation of the systems and to understand the purpose of warning alarms. They should be familiar with its arrangement and be able to start, stop, and isolate these systems in the event of an emergency. Service providers should also be aware of current operational techniques to increase equipment efficiency, and reliability in relation to improving the HVAC utilization in existing and new buildings with the added benefits of:

- Increased equipment life to meet with design life cycle
- Reduced downtime of plant and services through effective and targeted maintenance
- Utilization of best in class maintenance services
- Visibility of plant condition through effective reporting
- Increased performance and reduced utility costs

6.7 Building Management Systems (BMS)

All HVAC plant and equipment associated with the internal environment should, where possible, be monitored and controlled by a BMS. Effective systems should be in place for both off-site and on-site response to alarms.

The maintenance of HVAC systems requires integration with other disciplines such as, but not limited to, the fire alarm system and related to smoke control dampers. For most applications, sensors, and actuators are linked into outstations which gather data and act to provide the form of control, thereby, remotely transmitting information to the operator for real time optimization of the HVAC plant.

6.8 Example of the Subsystem found within HVAC

- Central Heating and Cooling
- Air Distribution System
- In-Room Terminal Systems
- Applied Heat Pump and Heat Recovery Systems
- Forced Air Heating and DX Cooling Systems
- Steam Systems
- Hydronic Heating and Cooling
- Condenser Water Systems
- Variable-Refrigerant Flow Systems

- Dust Collection Systems
- Hydronic Heating and Cooling
- Condenser Water Systems
- Specialist Systems
- Emergency Systems

6.9 Sample of Equipment found within System

- Direct Expansion (DX)
- Variable-Refrigerant Flow (VRF)
- Variable Air volume (VAV)
- Computer Room Air Conditioning (CRAC)
- Constant Air Volume (CAV)
- Roof Top Units (RTU)
- Air Handling Units (AHU)
- Fan Coil Units (FCU)
- Hybrid Heat Pump
- Chilled beams
- Local Exhaust Ventilation (LEV)

7.0 START-UP PROCEDURE

A start-up procedure is a reference document to be used while preparing a process to operate a system from an offline position. The actions within the procedure are intended to ensure that a methodological approach is taken to restore or commence a potentially dangerous system or a piece of equipment back online. Start-up procedures for HVAC shall include the following, but not limited to:

- Health and Safety
- Pre- Approvals
- System Readiness
- Pre- Start Checks
- Start Checks
- Notifications

8.0 SHUTDOWN PROCEDURE

A shutdown procedure is a reference document for a planned activity to take a system or a piece of equipment offline. The shutdown procedure should be clear, prescriptive and well understood. The specific steps often mirror those taken with a startup procedure but include additional consideration for the effect on utilities and other active building services connected to the process. HVAC shutdown procedures shall include the following, but are not limited to:

- Health and Safety
- Pre- Approvals
- Standby System Condition
- Pre-Shutdown Checks
- Routine Stop
- Post Stop Checks
- Notifications

9.0 SYSTEMS MONITORING/DAILY ROUNDS

9.1 Monitoring

Facilities Management/Service Providers should consider the following items that need to be monitored:

- Key Performance Indicators (KPI) – normally agreed between the facilities management company and the Entity
- The primary sources of supply supporting a HVAC system should be monitored for any outages and their reasons recorded. In some cases, the District Service Provider (DSP) will need to be contacted directly for an explanation in the event of a prolonged power outage.
- Work Orders under the Computer (or paper) Maintenance Management System (CMMS) should be actioned in accordance with the agreed contract requirements based on priorities and urgency levels such as routine, urgent and emergency work orders
- Assets listed in the Computerized Maintenance Management System (CMMS) should be audited and kept up to date as per the agreed contract requirements. This is to prevent the accumulation of unregistered assets not visible on the CMMS system and hence, be at risk from lack of maintenance
- Suitable trained staff shall be employed by the service provider for the purpose of monitoring plant and equipment. If the staff is not suitably qualified, competent, or available, the service provider should arrange for the appointment of an approved/authorized contractor to provide this service or support.
- Energy usage should be monitored and recorded in relation to site volume, floor area, occupant numbers, and specialism i.e.; computer rooms (due to high energy usage). Seasonal variations in energy usage should also be monitored to assist in highlighting anomalies in temperature, humidity, pressure and ventilation across the sites

10.0 EMERGENCY RESPONSE ACTIONS

The aim of this emergency procedure is to provide guidance and a structured approach to the management response in case of a major failure of a HVAC system, and to safeguard users/occupants from any such failure.

The following procedures are designed to instruct and advise on the operational requirements for dealing with such a compromised ventilation system. It is not considered a definitive guide on emergencies as the specific circumstances of the incident will ultimately determine the course of action taken.

10.1 Airborne Contamination

10.1.1 Causes

HVAC ventilation may become compromised by contamination in a number of ways including:

- Contamination of the incoming air supply to the facility
- Contamination caused by the corrosion or decay of materials in contact with the ventilation ductwork (e.g., rusting metal and vermin)
- Cross-contamination of ventilation supply because of a process not carried out correctly on site by staff or contractors where the safety protocols are inadequate or nonexistent (e.g., cross-contamination due to an unauthorized plant shutdown and loss of pressure)

10.1.2 Effects

The possible effects of a compromised system are varied and will depend on the severity and degree of the contamination. However, further investigation should be carried out if:

- Users complain about the air supply quality or if it is discolored
- The supply air has a distinctive odor. This could be the result of chemicals (e.g., chlorine) or decaying matter
- The air supply appears normal but people using it have become sick/infected

10.1.3 Response Actions

- Staff should safely complete or suspend any work being undertaken and prioritize their attention on the most critical equipment. Local standby supplies and equipment-based systems should be checked. Wherever necessary, manual intervention should be made to ensure the safety of users.

- When supply is restored, the AP (V) should ensure that all essential equipment is functioning correctly and, where necessary, transfer equipment onto essential supplies. On restoration of the primary supply, the AP should check that all systems and equipment have been reset to normal.

10.1.4 Investigation

- The size of the affected area must first be ascertained. This will give some indication of the extent of the problem and may help to identify the source of the contamination. Further actions may or may not be required, depending on whether part of or the whole ventilation system has been compromised.

- Inform the senior management of affected departments to cease using the system. Once the extent has been determined, an assessment should be undertaken as to identify the nature of the contamination. It is advised that the infection control officer is involved.

10.1.5 Damage Control

- The cause and result of the damage to the system should be investigated by the Authorized Engineer/Authorized Person AP/V and drawings and schematics should be made readily available.

- Measures should be taken to limit the amount of disruption, and temporary backup systems should be protected by sealing off damaged areas during repairs. Following damage limitation, lock off tag out (LOTO) the damaged section where possible, and ensure back-up support is functioning.

10.1.6 Debriefing

- Following return to normal, a team debriefing should be held to review the emergency procedure and update or correct any apparent weaknesses.

10.1.7 Review Procedure

- This procedure will be reviewed following any change in personnel, equipment, materials and environment. It shall be reviewed at regular intervals not exceeding 12 months.

- Where deemed necessary a Root Cause Analysis (RCA) should be undertaken to understand the event or sequence of events leading to a failure and allow a review of current practices to be undertaken. Implementing improvement or change where this may be found as necessary.

10.1.8 Training and Information

All staff involved will receive adequate training and instruction to enable them to carry out these procedures with confidence during an emergency. This training will be recorded in a formal training log, and updated on a regular basis.

10.1.9 Examples of Template Procedures and Checklists

The following procedures and checklists have been prepared for facilities management and service provider personnel to meet the needs of their own organizations during failure of a system.

They are not intended to be applicable or definitive for all facilities, but they give an indication of the types of format that may be used and the different levels of technical content that may be appropriate on different sites.

Further procedures may be required within an educational Entity, and it is recommended that a regular review be undertaken to ensure that directives for staff and equipment remain current.

11.0 ATTACHMENTS

1. Attachment 1 - EOM-ZO0-TP-000032 Start Up Checklist - HVAC Systems - Schools & Universities
2. Attachment 2 - EOM-ZO0-TP-000033 Shutdown Checklist - HVAC Systems - Schools & Universities
3. Attachment 3 - EOM-ZO0-TP-000034 Systems Monitoring/Daily Rounds Checklist - HVAC Systems - Schools & Universities
4. Attachment 4 - EOM-ZO0-TP-000035 Emergency Response Action Checklist - HVAC Systems - Schools & Universities

Attachment 1 – EOM-ZO0-TP-000032 – Start-Up Checklist - HVAC Systems - Schools & Universities

Building NAME:		Reference No.	REV-001		
Vol.5 Operations Management Chapter 4					
No.	**Start-Up Procedure**	**CHECKED SATISFACTORY**			
		N/A	YES	NO	
	HVAC Systems– Schools & Universities				
	Health and Safety				
1	Required Personal Protective Equipment (PPE) available	☐	☐	☐	
2	Risk Assessments Method Statement (RAMS) available	☐	☐	☐	
3	Chemical Material Safety Data Sheets (MSDS) & Product Data Sheets (PDS) checks available	☐	☐	☐	
4	Location of first aid instructions and supplies available	☐	☐	☐	
5	Emergency eyewash and showers available	☐	☐	☐	
6	Emergency evacuation plan reviewed	☐	☐	☐	
7	Emergency contact details of the authorized person and the contractors	☐	☐	☐	
8	Life Safety Systems (fire extinguishers, sprinklers, gas suppressors & fire-alarm)	☐	☐	☐	
9	Ventilation	☐	☐	☐	
	Pre-approvals				
10	System owner/Manager/Engineering team's approvals available	☐	☐	☐	
11	End-user/Department Head's approval available	☐	☐	☐	
12	Quality, Health, Safety, Environment Management (QHSE) approval available	☐	☐	☐	
13	Specialist contractor's schedule of work	☐	☐	☐	
14	Approved Permit To Work (PTW)	☐	☐	☐	
	System Readiness				
15	System pressure checks	☐	☐	☐	
16	System temperature checks	☐	☐	☐	
17	Humidity levels checks	☐	☐	☐	
18	System is hazard free and no leakage checks	☐	☐	☐	
19	Condense test kit checks	☐	☐	☐	
20	Filters' stock & expiry checks	☐	☐	☐	
21	Required tools checks	☐	☐	☐	
22	Lock Off Tags Out (LOTO) checks	☐	☐	☐	
23	Confirm with schematic and Building Management system (BMS)	☐	☐	☐	
24	Areas are cleaned and egress checks	☐	☐	☐	
	Pre-Start Checks				
25	System fault free/alarm free check	☐	☐	☐	
26	Original Equipment Manufacturers' (OEM) start up procedure available	☐	☐	☐	
27	Automatic controller checks	☐	☐	☐	
28	Parameters set point checks	☐	☐	☐	
29	Magnahelic gauge checks	☐	☐	☐	
30	Frost coil checks	☐	☐	☐	
31	Heater batteries' visual inspection checks	☐	☐	☐	
32	Previous services reports checks (3rdparty specialist)	☐	☐	☐	
33	Primary supplies systems/plants checks	☐	☐	☐	
34	Grease levels checks	☐	☐	☐	

Attachment 2 – EOM-ZO0-TP-000033 – Shutdown Checklist - HVAC Systems - Schools & Universities

Building NAME:		Reference No.	REV- 001		
Vol. 5 Operations Management Chapter 4					
No.	**Shutdown Procedure**	**CHECKED SATISFACTORY**			
		N/A	**YES**	**NO**	
	HVAC Systems – Schools & Universities				
	Health and Safety				
1	Required Personal Protective Equipment (PPE) available	☐	☐	☐	
2	Risk Assessments Method Statement (RAMS) available	☐	☐	☐	
3	Chemical Material Safety Data Sheets (MSDS) & Product Data sheets (PDS) checks available	☐	☐	☐	
4	Location of first-aid instructions and supplies available	☐	☐	☐	
5	Emergency eyewash and showers available	☐	☐	☐	
6	Emergency evacuation plan reviewed	☐	☐	☐	
7	Emergency contact details of the responsible person and the contractors	☐	☐	☐	
8	Life Safety Systems (fire extinguishers, sprinklers, gas suppression & fire alarm)	☐	☐	☐	
9	Ventilation	☐	☐	☐	
	Pre-approvals				
10	System Owner/ Manager /Engineering team's approvals available	☐	☐	☐	
11	End-user/ Department head's approvals available	☐	☐	☐	
12	Quality, Health, Safety and Environment Management (QHSE) approvals available	☐	☐	☐	
13	Specialist contractor's schedule of work	☐	☐	☐	
14	Approved Permit To Work (PTW)	☐	☐	☐	
	Stand by System Condition				
15	System's operating condition checks	☐	☐	☐	
16	System is leakage free	☐	☐	☐	
17	System faults/alarm free checks	☐	☐	☐	
18	Water flow checks	☐	☐	☐	
19	Systems' parameters checks	☐	☐	☐	
	Pre-Shutdown Checks				
20	System is alarm free checks	☐	☐	☐	
21	Automatic control panel parameters checks	☐	☐	☐	
22	Set points checks	☐	☐	☐	
23	Pressure gauges checks	☐	☐	☐	
24	Magnahelic / gauges	☐	☐	☐	
25	Heat recovery checks	☐	☐	☐	
26	All related valves open /closed checks	☐	☐	☐	
	Routine Stop				
27	Lock out, Tag Out (LOTO) removed checks	☐	☐	☐	
28	Stop fan from Building Management System (BMS)	☐	☐	☐	
29	Stop water supply	☐	☐	☐	

Attachment 3 – EOM-ZO0-TP-000034 – Systems Monitoring/Daily Rounds Checklist - HVAC Systems - Schools & Universities

Building NAME:	Reference No.	REV- 001
Vol. 5 Operations Management Chapter 4		

No.	Systems Monitoring / Daily Rounds	CHECKED SATISFACTORY		
		N/A	YES	NO
	HVAC Systems – Schools & Universities			
	This monitoring checklist is intended to highlight key issues that may arise day to day at local level. The procedures and any supporting information should be reviewed and amended as necessary to ensure that the document remains up-to-date and definitive for the facility.			
1	System inspection and checking: is the plant running?	☐	☐	☐
2	System assessment checks: Is the unit and its associated plant secured from unauthorized access?	☐	☐	☐
3	Remote monitoring of ventilation and air conditioning systems and equipment checks Building Management System (BMS)	☐	☐	☐
4	Identifying maintenance risks on equipment and raising work orders	☐	☐	☐
5	Investigating fault /alarms for HVAC systems checks	☐	☐	☐
6	Cleaning, adjustment of system	☐	☐	☐
7	Performing prompt emergency repairs and post efficiency checks	☐	☐	☐
8	Providing technical directions to ensure system is maintained returned to service	☐	☐	☐
9	Keeping daily logs and records of all the maintenance functions	☐	☐	☐
10	Ensuring compliance with applicable standards and with Occupational Health and Safety checks	☐	☐	☐
11	Complying with service standards, work instructions and users' requirements	☐	☐	☐

No.	Reviewer's Comments	Resolution

Originator's Name / Signature and Date:	Checker's Name / Signature and Date:

Attachment 4 – EOM-ZO0-TP-000035 – Emergency Response Action Checklist - HVAC Systems - Schools & Universities

Building NAME:	Reference No.	REV- 000
Vol. 5 Operations Management Chapter 4		

No.	Emergency Response Actions	CHECKED SATISFACTORY		
		N/A	YES	NO
	HVAC Systems – Schools & Universities			
	Introduction			
	This emergency procedure is intended to highlight the key issues that may arise at departmental level in the event of HVAC systems' failure. It is appreciated that this may be a result of a full site system's failure, but it may also be the result of a local failure for which notification from the Entity maybe necessary. The main aim is to provide a structured approach to safety of employees, students , and the general public for minimizing the risks associated with an HVAC systems' failure			
Priority 1	Life safety (Evacuation Plan)	☐	☐	☐
Priority 2	Stabilization of incident	☐	☐	☐
Priority 3	Minimize potential damage	☐	☐	☐
Priority 4	Containment of incident (Example: contamination of the incoming air supply)	☐	☐	☐
Priority 5	Damage Assessment	☐	☐	☐
Priority 6	Clean-up after the incident (Post-Incidents Plans)	☐	☐	☐
Priority 7	Designated Person to monitor weather sources for updated emergency instructions and broadcast warnings if any, issued by the weather services	☐	☐	☐
Priority 8	Building lockdown Plan/Plant lockdown plan	☐	☐	☐
1	The Designated Person shall conduct an initial and ongoing situational assessment of the incident.	☐	☐	☐
2	The Designated Person shall establish an effective communications plan	☐	☐	☐
3	The Designated Person shall deploy available resources and request additional resources based on the needs of the incident.	☐	☐	☐
4	The Designated Person shall develop an incident organization for the management of the incident	☐	☐	☐
5	The Designated Person shall review, evaluate, and revise the strategy and tactics based on the needs of the incident.	☐	☐	☐
6	The Designated Person shall provide for continuity, transfer, or termination of commands	☐	☐	☐
7	The procedures shall provide for a routine process of escalation as additional resources are required / utilized.	☐	☐	☐
8	The Designated Person shall determine what levels and elements of the incident management system are to be implemented in each case and shall develop the command structure for each incident by assigning supervisory responsibilities according to standard operating procedures (SOPs)	☐	☐	☐
9	The Incident Management Plan shall define standardized supervisory assignments	☐	☐	☐
10	The Person designated for incidence shall be responsible for controlling communications on the tactics, commands, and designated emergency traffic channels for the incident	☐	☐	☐
11	The Person designated for incident shall be responsible for overall responder's accountability for the incident	☐	☐	☐
12	The Person designated for incidence shall be responsible for developing and/or approving an incident action plan (IAP)	☐	☐	☐
13	The Person designated for incidence shall keep the safety officer informed of strategic and tactical plans and any change in situations	☐	☐	☐
14	The Person designated for incidence shall evaluate the risks to responders with respect to, the purpose and potential results of their actions in every situation	☐	☐	☐
15	The communication system shall provide a standard methods to prioritize the transmission of emergency messages and notification of imminent hazards over that of routine communications, to all levels of the incident commands structure	☐	☐	☐