

Policy No.	Policy issuer	Policy name	Alternative Policy No.
AST. MO - MAD -...	General Administration of Maintenance	Maintenance of negative-pressure isolation rooms	--
Issued date	Implemented date	Review date	Policy level
5 / 4 / 2021	6 / 4 / 2021	6 / 4 / 2022	Common policy

Title	Maintenance of negative-pressure isolation rooms
Description	Maintenance and monitoring of environmental conditions (pressure, temperature, humidity) and follow-up of periodic maintenance of low-pressure insulation rooms in all hospitals and specialized centers of the Ministry of Health.
Purpose	To determine the following responsibilities for the maintenance of negative-pressure isolation rooms : <ul style="list-style-type: none"> <li>- Monitoring environmental conditions (temperature, relative humidity RH%, Air Cycle Change per Hour - (ACH).</li> <li>- Room pressure in relation to the outer corridor.</li> <li>- Room maintenance and cleanliness.</li> </ul>
Applied by	Maintenance, operation, infection control and nursing officials in all hospitals and specialized centers of the Ministry of Health.
Apply to	Negative- Pressure isolation rooms in all hospitals and specialized centers of the Ministry of Health.
The policy	<p><u>All isolation room maintenance practices will follow the maintenance and operation contract</u></p> <p><b><u>First: Monitoring the environmental conditions of negative-pressure insulation rooms:</u></b></p> <p>All air conditioning systems (HVAC) in hospitals and medical centers must maintain the engineering specifications of air quality: temperature, relative humidity RH%, air change per hour (ACH) and negative room pressure as well as the air of the exhaust from the room to the outside of the building according to the ASHRAE standards and recommendations and CDC &amp; FGI guidelines which recommended maintaining these specific engineering specifications (setpoint) - (table no. 1).</p> <p><b>A. Temperature and humidity control:</b></p> <p>1- Temperature and humidity are monitored in the following ways:</p> <ul style="list-style-type: none"> <li>✓ <b><u>Through the building management system - BMS - (central):</u></b> It will be automatic by setting the specified engineering specifications (set point) from the control room of the building management system that performs the process of monitoring, informing nursing, maintenance and infection control each according to the specialty and responsibilities in the event that a warning is noticed or issued by the system that there is a deviation in the readings or there is a system of service that causes the spread of infection . (The responsibility of the maintenance department).</li> <li>✓ <b><u>Control panel (internal)</u></b> (Some sites do not have a building management system or that the system has not connected to all other systems): this is done from the control panel in the room or section which consists of: <ol style="list-style-type: none"> <li>1. Sensor installed in designated places inside the isolation room.</li> </ol> </li> </ul>

2. The control panel is in a clear place for everyone such as the nursing station and will issue an alarm sound as well as readings.

✓ **Mobile devices: In the event, that** in the event that there is no internal control panel, or one of the indicators is malfunctioning, or in the event of an examination of negative isolation rooms, they are used to measure temperature and relative humidity. (Pic 2)

- 2- (Temperature, humidity) is monitored and recorded in isolation rooms on a daily basis according to the form attached (Form#01)

**(Responsibility of the Nursing Department).**

- 3- In the event of deviation from the specified engineering specifications (set point), contact the maintenance department to request a correction.

**(Responsibility of the Nursing Department).**

#### **B- Monitor the pressure difference of the negative room:**

1. The negative pressured difference is monitored from the pressure meter:

- **Daily:** in the event of a having a patient, performing visual checks of the direction of airflow (using flap strips) in all rooms **(Responsibility of the Nursing Department).**
- **Weekly:** In the absence of a patient **(Maintenance department responsibility).**

**This is to maintain pressure and its readiness to receive any cases, according to the attached form (Form # 02).**

2. In the event of deviation from the specified engineering specifications (set point), a maintenance request should be submitted to the maintenance department. **(Responsibility of the Nursing Department).**
3. In the event of failure to maintain the negative pressure of the isolation rooms, an audible sound emits from the screen and flashing red lights appear: In the event of a patient, the hospitals evacuation plan is applied to transport the patient. Then a maintenance request is raised by Department's nursing, in the absence of a patient, a maintenance request shall be submitted to the maintenance department by the nursing staff.

#### **C- Ventilation:**

Control of air pollutants (for example, microorganisms, dust, chemicals, and smoke) at the source (air supply) is the most effective way to maintain clean air. The second most effective method for controlling indoor air pollution is ventilation. Ventilation is defined in terms of air volume per minute per person () and is based on the assumption that people and their activities are responsible for most of the pollutants in an air-conditioned space.

Most ventilation rates for healthcare facilities are expressed as (ACH: Air Cycle Change / Hour), air flow rate (12 ACH) air change per hour as a minimum (negative isolation room) and for each time flow rate the ventilation system needs to sterilize air (Table 2,) directing the exhaust air from the room to outside the building high-efficiency molecular airfilter (HEPA)is an air filter that removes 99.97% of the particles 0.3 micrometers at a specific airflow rate HEPA filters can be integrated into central air handling, the sensors of the ACH are connected to the air inlet (supply) and the main air outlet of the room with the building monitoring system or the departmental control panel.

**1) (ACH) is monitored and recorded from the control panel:**

- **Daily:** Each room every 24 hours by form #03.  
(Responsibility of the Nursing Department).
- **Monthly:** Once (maintenance department)
  - 1) In the event of deviation from the specified engineering specifications (set point), a maintenance request should be submitted to the maintenance department. (Responsibility of the Nursing Department).

**Second: Maintenance of passive-pressure insulation rooms:** (Liability of the maintenance department of the facility)

Their maintenance and securing their consumers are subject to a maintenance and operation contract between the Ministry and the contractor (**work is done in the sequence mentioned in the agreement between the supply and engineering affairs deputy and the public health deputy**), and isolation rooms such as some critical sections are given priority in the types of maintenance that are provided (emergency or preventive)

**A- Unit Package:**

1. Coordination with the head of the department for any preventive maintenance (PPM) workers to determine the appropriate time and duration of work.
2. Ensure that suitable spare parts and consumables are available.
3. Personal safety measures suitable for work are used.
4. After the completion of the work, there should be coordination with the cleaning supervisor to clean the site.
5. The department head supervise the completion of the works and the operation of the air-conditioning unit.

**B- AHU air handling unit filters:**



1. Coordination with the head of the department to determine a suitable time to change the filter.
2. The AHU is shut down
3. Use appropriate personal safety measures.
4. The paper or metal filter is removed (the metal filter can be washed or changed depending on visual inspection).
5. Wash the Cooling Coils
6. Place the new filter
7. Discard the old filter and coordinate with the cleaning supervisor to clean the site.
8. Informing the head of the department of the completion of the works and operating the AHU

**D- HEPA filters**

All HEPA filters are changed from 6 to 12 months, depending on the visual inspection or the manufacturer's recommendations, according to the attached form (**Form # 04**), and they can be changed in the same steps as changing the AHU filters with confirmation using Appropriate personal protective equipment measures **in coordination with the infection control department of the facility and disposal as medical waste.**

	<p><b>C- Electrical works:</b></p> <p>All measuring devices for temperature, humidity and pressure or measuring the rate of air change every hour should be calibrated annually or according to the manufacturer's recommendations. All lighting works are subject to maintenance according to the request of the concerned department.</p> <p><b><u>Third: cleanliness of negative pressure isolation rooms:</u></b></p> <ol style="list-style-type: none"> <li>1. Creating a daily cleaning schedule in coordination between infection control and site support services department.</li> <li>2. Providing approved materials and supplies for cleaning of the isolation room.</li> <li>3. Using proper personal protective equipment during work, in coordination with the nursing department</li> <li>4. Ensure that workers have cleansed their hands before entering the isolation rooms.</li> <li>5. The presence of a nursing staff during the cleaning process for guidance.</li> <li>6. After the completion of the work, ensure that the workers have cleansed their hands.</li> <li>7. The signature in the table mentioned in paragraph No. (1) of the department official.</li> </ol> <p><b><u>Fourth: Documents:</u></b></p> <p>Providing the facility's infection control department with a copy of all the daily, weekly and monthly follow-up records (Form # 1,2,3,4) by the departments nursing and the maintenance department, as well as the maintenance record for isolation rooms by the maintenance department.</p>
	Reference
	Attachments
	Number of pages (without attachments)
	<p>GHC-CIC manual 3<sup>rd</sup> Edition CDC, CBAHI standards 3<sup>rd</sup> Edition , ASHRAE</p> <p>Form #01 , Form #02 , Form #03, Form #04</p> <p><b>(04) page</b></p>

Approved by:

Name	Post	Signature	Date
Eng. Yasser Ibrahim Al-Matfi	Director General, General Directorate of Maintenance		5 / 4 / 2021
Dr. Khalid H. Alanazi	Director General, General Directorate of Infection Prevention and Control		5 / 4 / 2021

Temperature & Humidity (Form #01)

Department:

Month/Year :		Room No:	
Accepted Range	T (C°): 21 to 24		RH (%) > 30 - 60%

Date	Time	T (C°)	RH (%)	Remark	ID/sig.
1					
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31					

Negative Pressure Room Recording (Form #02)

Department:

Month/Year :	Room No:
Accepted Range	Pressure (Pa): < -2.5

Date	Time	P (pa)	Remark	ID/sig.
1				
2				
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ACH - Air Cycle Change per Hour Recording (Form #03)

Department:

Month/Year :	Room No:	Accepted Range : ACH $\geq 12$
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	Time / ACH																													
Date	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7						
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## HEPA Filter Monthly Physical Inspection (Form #04)

[illegible]

#### Abbreviations:

Abbreviation	Meaning
ACH	Air Cycle Change per Hour
RH	Relative Humidity
HVAC	Heating, ventilation, and air conditioning
Set point	Standard points or engineering specifications for optimum operation.
PPM	Planned Preventive Maintenance.
HEPA	High Efficiency Particulate Air
CBAHI	The Saudi Central Board for Accreditation of Healthcare Institutions
GHC-CIC	Gulf Health Council Centre for Infection Control
ASHRAE	The American Society of Heating, Refrigerating and Air-Conditioning Engineers.

**Table: (1) Negative Pressure Isolation Room Engineering Standards:**

> -2.5 Pa (0.01" water gauge)	(dp)
≥12 ACH	ACH
Supply: 90% (dust spot test) Return: 99.97% @ 0.3 μm DOP	Filtration efficiency
T (C°): 21 to 24	Temperature
RH (%) > 60%	Humidity RH %

**Table (2): Relation Between Air Change Per Hour and Time Needed for Indoor Air Filtration:**

Air changes per hour (ACH) and time required for airborne-contaminant removal by efficiency		
ACH	Time (min.) required for removal 99% efficiency	Time (min.) required for removal 99.9% efficiency
2	138	207
4	69	104
6	46	69
8	35	52
10	28	41
12	23	35
15	18	28
20	14	21
50	6	8

Source: Data from the Centers for Disease Control and Prevention<sup>3</sup>

**Image (1): Negative Pressure Room Design:**

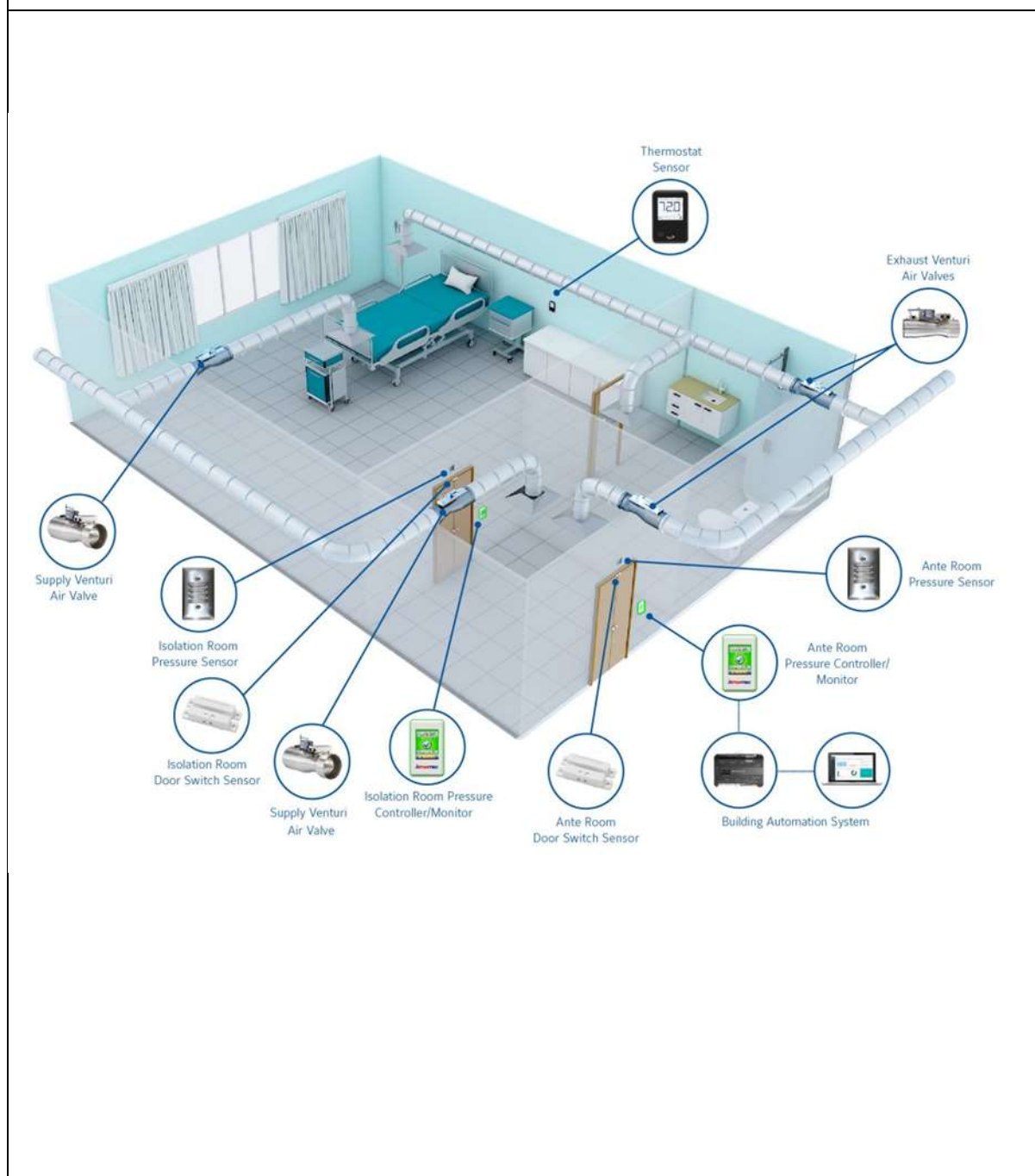


Image (2):

