HLA
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ARCHITECTS LLC

PM design
Architectural Engineering

Architectural & Engineering (A&E) assessment process for evaluating immediate and long-term solutions for constructing Airborne Infection Isolation Rooms (AIIRs) with Negative Pressure measures for existing medical facilities.

Hoffman Leakey Architects, LLC along with PM Design A&E has developed the following process outline.

General Installation Guidance for Airborne Infection Isolation Rooms (AIIRs)

Outpatient assessment of those infected with COVID-19 in a safe manner ensures maximum use of outpatient resources to minimize hospital admissions and readmissions. Evaluating and building the capacity now to perform this function safely in the outpatient setting has never been more important.

- Ultimately the preferred method is to install dedicated building systems ventilated to outside air to create permanent on demand AIIRs.

- When permanent or long-term construction methods are not practically achievable due to time constraints, creating expedient AIIRs is achievable through careful Temporary Negative Pressure Isolation. In every case, temporary or permanent, installed systems should be commissioned and tested by a certified Testing and Balancing Agency.

- Following installation the Architects, Engineers and Contractors should provide detailed Operation & Maintenance (O&M) Manuals to ensure proper system, testing and maintenance for extended operation.

- All installations must comply with State , Local Medical and Building Code Guidelines including NFPA Life Safety Code for Temporary Structures

Objectives

- To provide options for the installation, operation and maintenance of engineering and environmental controls in addition to recommended procedural measures by providers for the mitigation and elimination of potential airborne infectious disease contamination in healthcare facilities.
- Protection of Healthcare Administrators Personnel & Property
- Safe Patient Isolation

Options for AIIR Installation

Interior HEPA filtration balanced for Negative Pressure with discharge to outside air is preferred

- Interior Negative Pressure Isolation in existing rooms with discharge to outside air
  - Portable Medical Grade HEPA Filtration Units – See Example Products
  - Medical Grade HEPA Fan Filtration Units – See Example Products
- Interior Temporary Negative Pressure Isolation (TNPI)
  - Curtain Walls, Tents in combination with HEPA filtration measures
  - Must Observe NFPA Life Safety Code
- Exterior TNPI with discharge to outside air
  - Trailers or Tents in in combination with HEPA filtration measures
  - Must Observe NFPA Life Safety Code
- New Construction with dedicated HEPA filtration and advanced on-demand room by room Building Automation System (BAS) Controls

Assessment Report

Hoffman Leakey Architects, LLC (HLA) conducted a facility assessment of the medical office on March 25, 2020. HLA was requested to specifically evaluate three rooms as well as the entire facility envelope and site for recommendations for expedient and long term AIIR installations.

Assessment Report – Room Volume and required CFM findings

- Facility is a single story structure with sloped shingle roof that presently contains multiple HVAC units and has ample attic space for additional units and ducting as required for upgrades.
- The majority of the facility has zoned controls with a smaller suite area having individual room controls
- Given the building type the suggested application of interior construction is using Ceiling Mounted FFU with HEPA filtration discharged to outside air via attic ducting with roof penetration
- The site contains a large parking area and surrounding grass covered space that can accommodate temporary structures (tents or trailers) provided the required utilities (e.g. electric) can be extended from the existing building systems or provided by field generators.

Volume Calculations

Room Air Volumes

Room	*Length (ft.)*	*Width (ft.)*	*Height (ft.)*	*Floor Plan (SF)*	*Cubic Feet (CU^3)*	*Comments*
1	9	9.92	8	89	**714**	Outside Wall
2	8.67	9.92	7.92	86	**681**	Window, Outside Wall
5	10.58	12.42	7.75	131	**1018**	Inside Wall
Waiting Room	27.92	25.92	21.5	724	**15559**	Ceiling Height Variable TNPI, Curtain Walls, Tents
Interior Suite	4 rooms not considered in this study					Dedicated System Isolated to Suite w/Individual Rm
Outside Areas	Site Assessment indicates ample area for exterior TNPI					TNPI using Tents & Trailers

Required ACH for Various Rates

Air Changes Per Hour

Calculation of total required Airflow at various Air Change Rates (ACH)						
	Cubic Feet	***Required Exhaust Air (CFM)***				
Room	***(CU³)***	***6 (ACH)***	***8 (ACH)***	***10 (ACH)***	***12 (ACH)***	***Comments***
1	714	71	95	119	143	Portable in-room or FFU Units
2	681	68	91	114	136	
5	1018	102	136	170	204	

Note: These calculations are exclusive of current supply/return air measurements. Depending on manufacturer's suggetions a safety factor should be added to the measured ACH requirements to ensure

Recommendations for Interior Construction

- **Room 1, 2 & 5**
- Replace existing doors using CDC Standards for AIIR
- Replace existing drop ceiling panels (optional) with solid (e.g. drywall) ceiling system with ducting through ceiling to attic space with roof penetration to outside air
- Seal or replace existing return grilles with airtight louvered devices so they can be closed during AIIR application
- Install portable Medical Grade HEPA Machine with controls in room with discharge to outside air via temporary ducting through window, wall or installed ceiling duct adapter
- Install ceiling mounted HEPA Fan Filter Unit vented to outside air via attic dedicated duct with roof penetration

Recommendations for Interior Construction - continued

Equipment Advantages & Disadvantages

Equipment	Advantages	Disadvantages
Portable HEPA Filtration Units	Low Cost	Floor Space
	Highly portable and easilly deployed can be removed for servicing or when not in use	Noise
	Some Variable Controls	Electrical service
	Strategically placed exhaust for directing Airflow away from service provider	Requires extended ducting in room
HEPA Fan Filter Unit	Low Cost	Noise (Reduced)
	Wall Mounted Variable Controls w/Webserver Integration	Electrical service
	Ceiling Mounted - Permanent	

Product Samples – Option # 1
Temporary Solution

SPECIFICATIONS

Airflow - 350-900 cfm (Airflows are based on blower manufacturer curves. Different HEPA filters may cause the flow to vary.)
Weight - 75 lbs
Dimensions - 18" wide 21" high 32" long
Filtration -

- Primary/Secondary Filter - Dual-ply Dustlok polyester pad
- Medical Grade HEPA Filter - Metal Frame 99.99% Efficiency .3 micron individually certified
- Optional - Carbon Filter for odor control

Power Requirement - 115 VAC/ 50-60 Hz 5.8 amps
Cabinet - Aircraft grade aluminum, closed end rivet construction. All seams are silicone sealed before riveting. 4 hospital grade non-marking 3" casters for ease of movement.
Controls - Speed Selector Switch - HIGH/SPEED CONTROL Variable Speed Controller Pressure Gauge - 0" to 3" Digital Hour Meter Outlet Ring Size - 10" diameter

The 8' X 2' Edge-Guard Dust Free Barrier Systems has been engineered to provide simple, tough and reusable construction containment. It offers modular panels that fasten together without the use of tools. The panels are constructed of flame resistant polycarbonate and extruded aluminum. They are lightweight and allow light to pass through. The adjustable panels are designed to be used in areas that have a suspended grid type ceiling. They're compatable with ceilings that range in height from 7'-10" to 10'-0".

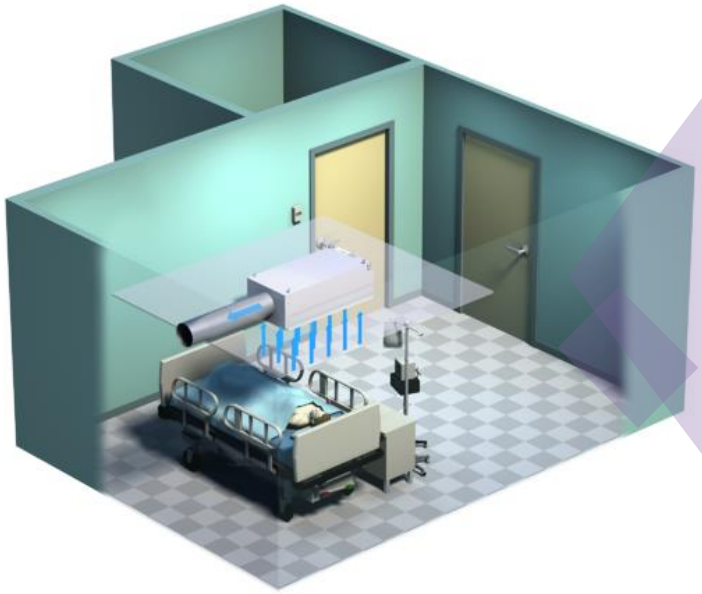
Custom engineered clips secure the panels to the ceiling grid and to each other very quickly without the use of tools creating an anteroom type entrance to construction areas, or sectioning off an area of a room or corridor.

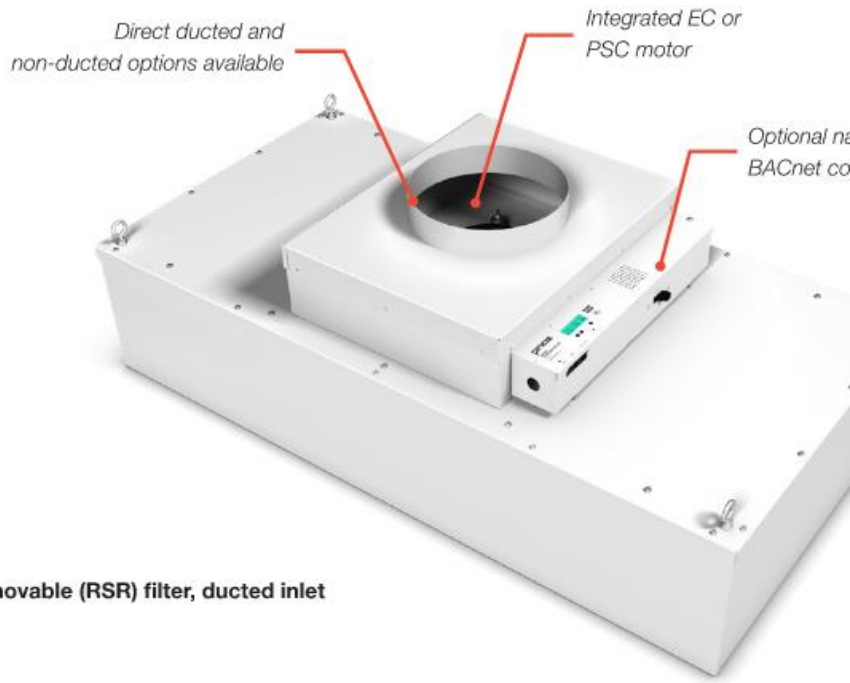
Product Samples – Option #2 Permanent Solution

- Fan Filter Units (FFU)

Ceiling Mounted Exhaust Flow FFU In this, the most permanent and involved application, an exhaust flow FFU is installed in the ceiling near the patient. Air is drawn from the room, HEPA filtered, and then exhausted through existing exhaust/return ductwork or directly outside.

Ceiling Mounted Exhaust Flow FFU





e Removable (RSR) filter, ducted inlet

Probable Schedule

- Schedule will vary depending on Scope of Work and **Equipment Lead Times**
- Option #1- Temporary solution for 3 rooms with portable HEPA Unit
- Option #2 – Permanent solution using FFU with design, testing & balancing, etc.

Option #1 - Probable Schedule for Design & Construction

Activity	Duration (Calendar Days)
Site Visit Scheduled	0
Site Visit Completed	1
Design	N/A
Review w/Client & Facility Engineers	1
Bid or Sole Source Contractor	
Bid or Sole Source Testing & Balancing (As Required)	N/A
Order Equipment	
Construction -place HEPA Unit & install Temporary duct to existing return air duct	2
Testing, Balancing & Commissioning	N/A
Total	**4**

Option #2 - Probable Schedule for Design & Construction

Activity	Duration (Calendar Days)
Site Visit Scheduled	0
Site Visit Completed	5
Design	7
Review w/Client & Facility Engineers	3
Bid or Sole Source Contractor	
Bid or Sole Source Testing & Balancing (As Required)	7
Order Equipment	
Construction	20
Testing, Balancing & Commissioning	5
Total	**47**

Estimated Cost of Construction –Option #1

- Costs can vary depending on equipment selection and supporting utility requirements
- Does not Include Design, Testing & Balancing & Permitting Fees
- Costs reflect installation portable HEPA Filtration Unit and connection to existing return air duct - assumes existing electrical service capacity is adequate for extension to equipment

SQ FT Costs by CSI Division

Division Name	Estimated SQFT Costs (2020)
Division 1: General Requirements	$ -
Division 2: Site Construction	$ 8.75
Division 3: Concrete	$ -
Division 4: Masonry	$ -
Division 5: Metals	$ -
Division 6: Wood, Plastics and Composites	$ -
Division 7: Thermal and Moisture Protection	$ -
Division 8: Openings (Door & Windows)	$ -
Division 9: Finishes (interior finishes)	$ -
Division 10: Specialties	$ -
Division 11: Equipment	$ 7.79
Division 12: Furnishings	$ -
Division 13: Special Construction	$ -
Division 14: Conveying Systems	$ -
Division 15: Mechanical	$ 69.58
Division 16: Electrical	$ -
Estimated Total SF Costs	**$ 86.12**

Cost per Room

Room	SF	Estimated Costs
Room 1	89	$ 7,664.68
Room 2	86	$ 7,406.32
Room 5	131	$ 11,281.72
Total		**$ 26,352.72**

Estimated Cost of Construction –Option #2

- Costs can vary depending on equipment selection and supporting utility requirements
- Includes Design, Testing & Balancing & Permitting Fees
- Costs reflect installation HEPA Filtration Unit (FFU) w/attic ducting through roof, room & door system upgrades and - assumes existing electrical service capacity is adequate for extension to equipment

SQ FT Costs by CSI Division

Division Name	Estimated SQFT Costs (2020)
Division 1: General Requirements including engineering design & testing & balancing	$ 42.00
Division 2: Site Construction	$ 8.75
Division 3: Concrete	$ -
Division 4: Masonry	$ 5.75
Division 5: Metals	$ 11.52
Division 6: Wood, Plastics and Composites	$ 8.92
Division 7: Thermal and Moisture Protection	$ 21.79
Division 8: Openings (Door & Windows)	$ 32.34
Division 9: Finishes (interior finishes)	$ 24.89
Division 10: Specialties	$ 5.25
Division 11: Equipment	$ 7.79
Division 12: Furnishings	$ -
Division 13: Special Construction	$ 4.93
Division 14: Conveying Systems	$ -
Division 15: Mechanical	$ 69.58
Division 16: Electrical	$ 34.50
Estimated Total SF Costs	**$ 278.01**

Cost per Room

Room	SF	Estimated Costs
Room 1	89	$ 24,742.00
Room 2	86	$ 23,908.00
Room 5	131	$ 36,418.00
Total		**$ 85,068.00**