



# VENTED M.I.C.E.<sup>®</sup> CAGING SYSTEM Installation and Operating Manual

## TABLE OF CONTENTS

System Description.....	1
System Operation .....	1
System Inventory.....	2
Moving Your Rack.....	2
Hooking Your Rack to Room Exhaust.....	3
Ventilation.....	5
Measuring Rack Airflow .....	6
Maintaining System Performance .....	7
Airflow Troubleshooting.....	7
Feeder Installation.....	8
Ventilation Mode.....	8
Emergency Conditions .....	9

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# Installation and Operating Manual for VENTED M.I.C.E.<sup>®</sup> CAGING SYSTEM

## System Description

The Vented M.I.C.E. Caging System is an exhaust-vented closed system for housing rodents. It uses modular construction to allow the customer to tailor the system size to individual site needs. Animal Care Systems supplies cage racks to suit any room size and any size of animal care needs. Modular rack systems start at the 14-cage size, and are available up to 140-cage racks. Every rack system is based on the same 14-cage base module.

Each base module consists of the following components:

- Module plenum, a sealed stainless steel tower that supports cage trays and provides the internal air passages for cage ventilation. Each plenum contains 14 self-closing, oval doors in its front face to receive cages.
- Seven cage trays that install easily into slots in the front face of the module plenum. Cage trays incorporate an angled front lip to secure the cage.
- A leg assembly, either single or double, depending on the desired rack configuration. Double leg assemblies support back-to-back modules in a double configuration. Each leg assembly supports the entire system and rolls on stainless steel high-temperature casters.
- 14 cage assemblies using patented technology to assure uniform, one-pass airflow through the cage. Each cage assembly consists of a cage, cage top, filter assemblies, feeder and lid, and water bottle.
- Rat cage assemblies using the same patented technology are available. Each occupies the space of two mouse cages.
- Plenum cap, manifold, and exhaust hose that positively attach to the top of the plenum and provide a means for the room ventilation system to draw air through the cages and then exhaust it out of the room.

## System Operation

Each individual rack assembly, regardless of size, ventilates its cages with active airflow provided by the room exhaust system. The unique cage design uses passive convective airflow to assist in cage ventilation. The operation is as follows:

- Room exhaust draws air through the flexible exhaust hose that is attached to the top of the module plenum.
- The air is pulled through the filtered air intake at the bottom front of each cage.
- The air is heated by the animals in the cage and naturally rises as it is drawn towards the filtered air outlet at the top rear of each cage.

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- The warm exhaust air passes through the cage nozzle, which is plugged into the spring-loaded door leading to the tapered internal air passage in the module plenum.
- Exhaust air is drawn up through the module plenum to the manifold mounted at the top, and then into the flexible exhaust hose.

## System Inventory

Your Vented M.I.C.E Caging System has been shipped to you assembled. After removing the system from its shipping container and removing the packing materials, take an inventory of all components of the system.

Visually inspect the entire system. Ensure that no damage has been incurred in shipping. Check cages, cage trays, caster wheels, module plenum, top caps and manifolds, and water bottles or watering system, if included.

Each cage should include cage, cage top, stainless steel feeder, feeder lid, filter assemblies front and rear, exhaust nozzle, and water bottle with seal, cap and sipper tube. Figure 1 shows a complete cage assembly. The white tunnel trough shown below the feeder is an optional accessory for animal enrichment.

Exhaust hoses and the accompanying ceiling flanges are normally shipped boxed along with the crated M.I.C.E. racks.



Figure 1

## Moving Your Rack

Every rack of cages rolls on four casters and is provided with one handle on each end. Two of the casters have integral brakes to allow the rack to be fixed into any desired position.

All racks, up to and including the D10 140-cage rack can be moved on their casters as necessary. When moving racks, check the following items to ensure that your move is successful.

- Door width. Generally, single-sided racks of cages do not have clearance problems in doorways. However, double-sided racks with the cages installed may not fit through a 36" (91.5 cm) wide doorway. In some cases, the cages may need to be removed to clear the doorway.
- Door height. Larger double-sided racks are approximately 78" (198 cm) high WITHOUT exhaust plenums and hoses installed. Make sure your doorways are high enough to clear the tops of the racks before beginning a move.

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- Always remove exhaust manifolds and hoses before moving racks from room to room. When adjusting location within a room, visually ensure that hoses are not damaged or tangled in the move.
- Door sills, dips, thresholds, and other uneven surfaces. Your racks may be moved with the cages installed over relatively smooth surfaces. If your path is uneven or if the rack must be rolled over thresholds, make sure that cages are secure and are not jarred out of place.
- Populated racks of cages should NOT be moved from room to room.

## Hooking Your Rack to Room Exhaust

Your Vented M.I.C.E Caging System exhaust hose/s and fittings have been shipped uninstalled. The exhaust manifolds may also need installation. After removing the system from its shipping container, removing the packing materials, and checking for damage, follow the checklist below to ensure that your system delivers maximum performance.

1. Position the cage rack in the room adjacent to the exhaust register or port and lock the caster wheel brakes.
2. Verify that the cage trays are all securely installed in the rack module. Trays install similarly to shelf brackets by pushing in and down.
3. Verify that all cages are securely pushed into the exhaust apertures on the rack. See Figure 2.



Figure 2

4. If the exhaust manifold or manifolds are not installed on the top of the rack, install them and the flex hose fitting now using the included plastic thumbscrews. See Figure 3.
5. Ideally, your room exhaust should be configured for the rack hoses, with either 3” diameter ports in exhaust ducting or 3” diameter duct ceiling drops near the chosen rack locations. If ports are provided, attach flex hose fittings to the ports using sheet metal screws.
6. Quick connect the hose to the top of the rack and to the flex hose fitting on the room exhaust ducting. Figure 4 shows installation of the vent hose on the exhaust fitting on the top of the rack.



Figure 3



Figure 4

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Figure 5 shows a typical preferred attachment to room exhaust ductwork. Figure 6 shows a soft-coupled attachment to a typical exhaust register when the room has sufficient positive pressure to assist in forcing room air through the cages and then to the exhaust. The installation shown in Figure 6 is less effective in exhausting cages in a rack than the direct connection shown in Figure 5. Figure 7 shows a typical attachment of two larger M.I.C.E. racks to overhead exhaust ducting.



Figure 5

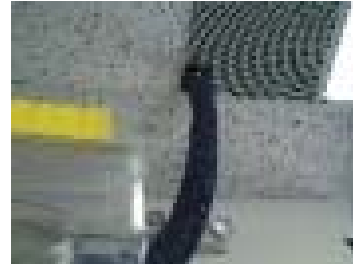


Figure 6



Figure 7

- Exhaust hose requirements vary depending on rack size. The following tables show the typical factory recommendations for the number of hoses required for each rack size. Rooms with marginal ventilation may require more than the standard number of flexible exhaust hoses on larger rack sizes.

**Hose Requirements vs Rack Size  
Single Sided Racks**

<b>Rack Designation</b>	<b>Description</b>	<b>Std. Hose Qty &amp; Location</b>
S1	Single 14-cage module, single sided	1
S2	Two 14-cage modules, single sided	1, either module
S3	Three 14-cage modules, single sided	1, center module
S4	Four 14-cage modules, single sided	2, on end modules
S5	Five 14-cage modules, single sided	2, on #2 and #4 module

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**Hose Requirements vs Rack Size  
Double Sided Racks**

<b>Rack Designation</b>	<b>Description</b>	<b>Std. Hose Qty &amp; Location</b>
D2	Single 14-cage module, single sided	1
D4	Two 14-cage modules, single sided	1, on either module pair
D6	Three 14-cage modules, single sided	2, on end module pairs
D8	Four 14-cage modules, single sided	2, on end module pairs
D10	Five 14-cage modules, single sided	2, on #2 and #4 module pairs, or 3, center & end module pairs

## Ventilation

Animal welfare depends on the cages receiving proper active exhaust ventilation. Regardless of how the room exhaust is configured, at least six cubic feet per minute (6 CFM) of air should be pulled from each 14-cage rack module continuously to provide the animals with sufficient fresh air and to prevent condensation from building up inside the cages. This will provide between 15 and 20 Air Changes per Hour (ACH) in the cages.

Adequate ventilation will ensure that cage changing intervals are a minimum of two weeks.

### Example 1

You have two D8 racks (double-sided, 8 14-cage modules in each rack) in your animal room. Each rack has two hoses connecting to room exhaust.

**8 modules per rack X 6 CFM per module = 48 CFM per rack**

**48 CFM per rack ÷ 2 hoses per rack = 24 CFM per hose**

**48 CFM per rack X 2 racks per room = 96 total CFM exhausted from cages in the room.**

### Example 2

You have three S4 racks (single-sided, 4 14-cage modules in each rack) in your animal room. Each rack has one hose connecting to room exhaust.

**4 modules per rack X 6 CFM per module = 24 CFM per rack**

**24 CFM per rack ÷ 1 hose per rack = 24 CFM per hose**

**24 CFM per rack X 3 racks per room = 72 total CFM exhausted from cages in the room.**

### Example 3

You have one S2 rack (single-sided, 2 14-cage modules in each rack) and two D4 racks (double sided, 4 14-cage modules in each rack) in your animal room. Each rack has one hose connecting to room exhaust.

**2 modules per S2 rack X 6 CFM per module = 12 CFM per S2 rack and hose**

**4 modules per D4 rack X 6 CFM per module = 24 CFM per D4 rack and hose**

**(24 CFM per D4 rack X 2 racks) + (12 CFM per S2 rack X 1 rack) = 60 total CFM exhausted from cages in the room.**

**48 CFM per rack ÷ 2 hoses per rack = 24 CFM per hose**

**48 CFM per rack X 2 racks per room = 96 total CFM exhausted from cages in the room.**

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## Measuring Rack Airflow

Each modular M.I.C.E. System rack size requires differing airflow velocities through the flexible exhaust hose or hoses to achieve adequate ventilation performance. Animal Care Systems recommends using our specially adapted anemometers to accurately measure rack airflow. These instruments quickly snap in place on the exhaust manifold of the rack and directly measure air velocity.

Use the table below to evaluate the performance of any M.I.C.E. rack while installed and operating.

### Single-Sided M.I.C.E. Racks Required Ventilation

<b>Rack Part No. &amp; Description</b>	<b>Number of Exhaust Hoses</b>	<b>Minimum CFM Required</b>	<b>Equivalent Measured Air Velocity per Hose, FPS (M/S)</b>
M85010S1 14-cage single sided	1	6	3.8 (1.16)
M85010S2 28-cage single sided	1	12	7.6 (2.32)
M85010S3 42-cage single sided	1	18	11.4 (3.48)
M85010S4 56-cage single sided	2	24	7.6 (2.32)
M85010S5 70-cage single sided	2	30	9.5 (2.9)

### Double-Sided M.I.C.E. Racks Required Ventilation

<b>Rack Part No. &amp; Description</b>	<b>Number of Exhaust Hoses</b>	<b>Minimum CFM Required</b>	<b>Equivalent Measured Air Velocity per Hose, FPS (M/S)</b>
M85015D2 28-cage double sided	1	12	7.6 (2.32)
M85015D4 56-cage double sided	2	24	7.6 (2.32)
M85015D6 84-cage double sided	2	36	11.4 (3.48)
M85015D8 112-cage double sided	2	48	15.2 (4.64)
M85015D10 140-cage single sided	2	60	19.0 (5.8)
	3		12.7 (3.9)

Please note that the Measured Air Velocity in the tables above must be measured with the Animal Care Systems anemometer provided by the factory. Air velocities measured with a hot-wire anemometer inserted into the exhaust hose airflow will read approximately 70% of the table values for the same ventilation performance.

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## Maintaining System Performance

Your Vented M.I.C.E. Caging System is a closed, sealed system. Optimum airflow depends on maintaining the sealed integrity of this environment.

Remember that if a cage is installed in the rack, it opens the rack door and airflow is allowed through the cage. So, when the cage is installed, it **MUST** be covered and have either the water bottle installed or a Sipper Tube Closure installed.

The following checklist will aid you in keeping the cage and rack environment sealed.

1. **Module Top Covers** – In place and latched. Gaskets must be undamaged.
2. **Module Cleanout Doors** – Located on the bottom of each module, they must all be closed and snapped shut.
3. **Rubber End Caps/Top Caps** – Undamaged and securely snapped in place.
4. **Cages**
  - All cages installed in rack and pushed securely into oval module doors.
  - All cage tops installed correctly on cages
  - All water bottles installed correctly (see Figure 7) **OR**
  - All snap-in Sipper Tube Closures installed (for systems with automatic watering).
  - Cage filters installed as necessary.
  - Cage filters are clean and unclogged. If room environment is dusty, filters may need replacing more often.
  - All cage exhaust nozzles installed
  - All feeder caps installed correctly over feeders.
5. **Exhaust Manifolds** – In place and securely screwed down. Gaskets must be undamaged.
6. **Exhaust Hose/s**
  - Hoses securely installed to rack and room exhaust
  - Hoses free of cracks, cuts, or other damage

## Airflow Troubleshooting

The first indication that insufficient air is flowing through occupied cages is when condensation and/or water droplets form on the inside of the occupied cage or cages.

First, follow the checklist in the Maintaining System Performance section.

If condensation or fogging persists, the exhaust is inadequate for the rack of cages, and the exhaust airflow must be increased. This sometimes requires changes to the HVAC system for that room.

If airflow must be increased immediately, or before changes can be made to the HVAC system, two options are available.

1. Increase the number of flexible exhaust hoses to the rack. Each module or pair of back-to-back modules is capable of having an exhaust manifold and hose attached. A D8 rack that normally uses two flexible exhaust hoses, is capable of handling a maximum of four. Contact the factory to obtain additional exhaust manifolds and hoses.
2. If animal care conditions and/or test conditions allow, the rear cage filter may be removed temporarily to increase airflow through the cage until alternate methods of increasing airflow can be implemented.

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Note: Removal of rear cage air filters will allow animal dander, dust, and airborne cage residue to be drawn into the exhaust system. Long-term use without rear filters may result in deposits in rack interior, exhaust hose, and HVAC exhaust ducting. More frequent cleaning may be necessary.

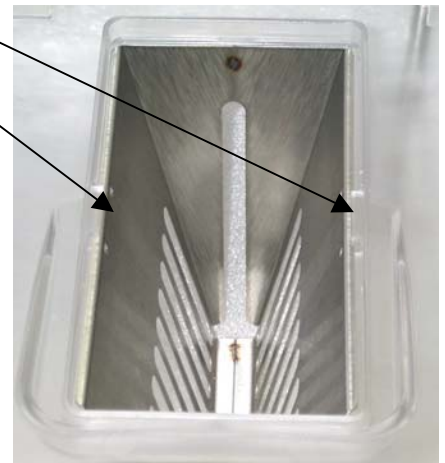
3. Make sure that the air balance and flow to the animal room/s is not affected by open doors, dirty exhaust filters, or closed dampers.

## Feeder Installation

The feeder is securely attached to the cage top and should remain in the cage top during all washing and autoclaving operations. If it becomes free of the cage top, use the following instructions to reinstall it.

Install feeder by inserting one top edge of feeder into a slot on the cage top

Squeeze feeder and insert the other side into opposite slot. The feeder will lock in place.



## Ventilation Mode

The M.I.C.E. System is a negative pressure, vented closed-system of isolation containers for rodents, i.e. a true barrier at cage level.

This system functions by convective passive ventilation and active exhaust venting—NO blowers.

When connected, convection and HVAC-assist draw filtered room air into each cage through high efficiency polyester air filters, across the cage to the opposite exhaust end, to the rack's plenum and out of the room. This not only prevents cage to cage and rack to rack cross-contamination, but also it eliminates animal allergens, odors, and contaminants in the room. Filtered air circulates through the cage with total-volume-air-change ventilation at low velocity. Air velocity can be adjusted to provide high dilution factor at 10 to 30 air changes per hour (ACH).

Set at 15 ACH with ~350 ml of Aspen shaving bedding, cage-changing period extends up to three weeks with 6 mice (25g) or 2 rats (300g) per cage. There is NO noise, vibration, or ultrasound induced in the cage BUT good air quality and stable conditions. There are NO odors and animal/equipment heat loads, so animal population density can be increased.

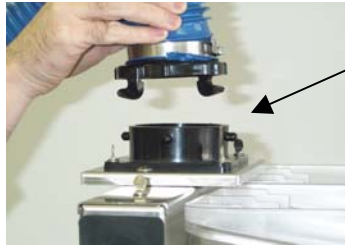
In case of building's power failure, convection created by the animal heat loads ventilates the cages adequately.

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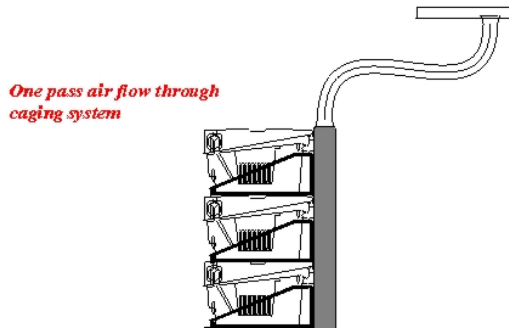
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## Emergency Conditions

In case of building power failure, convection created by the animal heat loads ventilates the cages adequately for survival. In case extended of power failure, remove the vent hose and let the rack exhaust directly in the animal room. This will allow maximum passive air flow through the cages.



Disconnect Vent  
Hose after 24  
hours  
of Power Failure



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