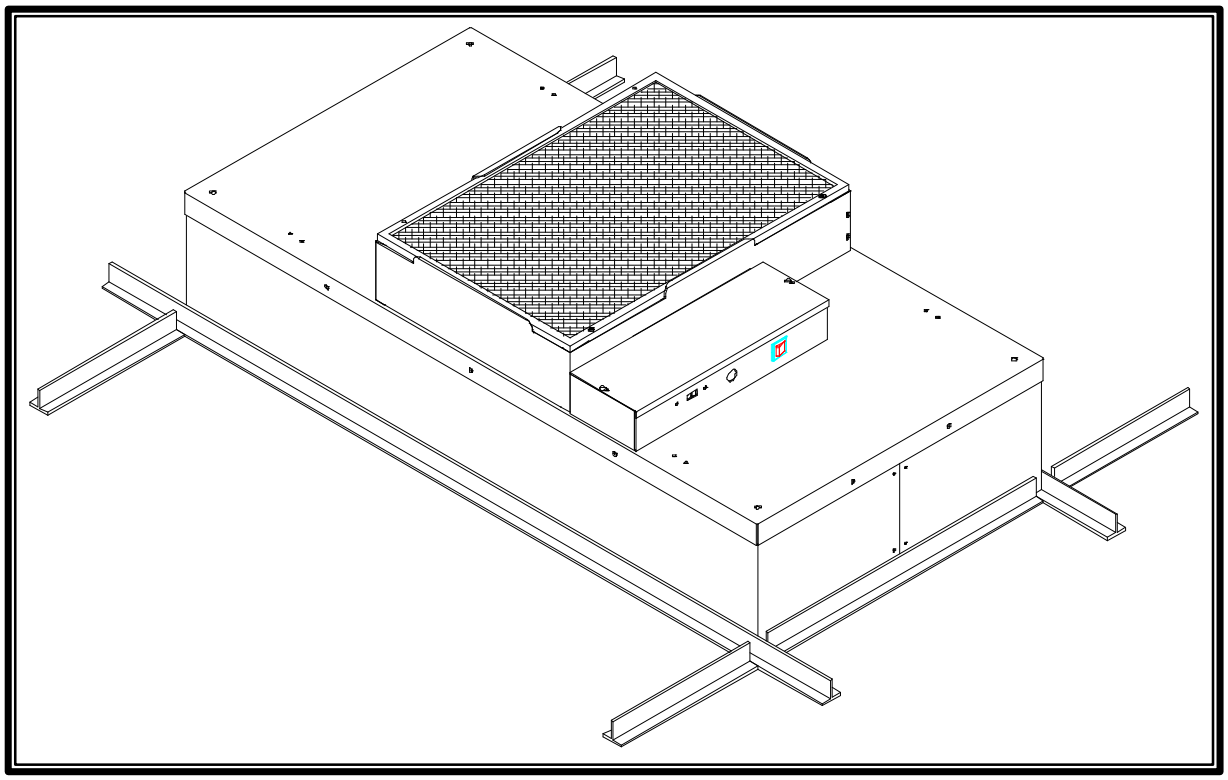
*** READ AND SAVE THESE INSTRUCTIONS ***

MAC 10® *IQ* VE5® FAN FILTER MODULE INSTALLATION AND SERVICE MANUAL

STANDARD, RSR, RSRE MODELS



ENVIRCO CORPORATION
Innovators in clean air technology

Updated 09/09

Critical operation conditions of the MAC 10

1. Touching of the HEPA filter could damage it, voiding the warranty on the filter. The screen is only to protect against an accidental 'touch' of the filter. Never place a hand or tool on the filter. Never lie filter face flat down on a surface always have filter on its side or back to protect from damage.
2. Prior to powering the unit, verify that the unit has been plugged into the correct voltage. The serial number label on the top of the Mac 10 unit has the required voltage.
3. For reorder prepossess the Mac 10 part number and serial number should be recorded. This information is located on the serial number label, located adjacent to the electrical box. If you can't located the Sales Order Number please contact Envirco for this information.

Part Numbers Covered by this Manual

11111-XXX	Mac 10 Original 2x4 Standard Filter
11112-XXX	Mac 10 Original 2x3 ½ Standard Filter
11113-XXX	Mac 10 Original 2x3 Standard Filter
11114-XXX	Mac 10 Original 2x2 Standard Filter
11115-XXX	Mac 10 Original 2x4 RSR Filter Sheet Metal Housing
11116-XXX	Mac 10 Original 2x3 ½ RSR Filter Sheet Metal Housing
11117-XXX	Mac 10 Original 2x3 RSR Filter Sheet Metal Housing
11118-XXX	Mac 10 Original 2x2 RSR Filter Sheet Metal Housing
11157-XXX	Mac 10 Original 2x4 RSR Filter Extrusion Housing
11171-XXX	Mac 10 Original 2x3 ½ RSR Filter Extrusion Housing
11169-XXX	Mac 10 Original 2x3 RSR Filter Extrusion Housing
11170-XXX	Mac 10 Original 2x2 RSR Filter Extrusion Housing

Note: A 'Z' in the part number indicates that the unit is special. This may indicate a size change from standard or a special filter. Please contact the factory for part numbers if this is the situation.

READ AND SAVE THESE INSTRUCTIONS

WARNING!

TO REDUCE THE RISK OF FIRE, ELECTRICAL SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING :

A. Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.

B. When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.

C. If this unit is to be installed over a tub or shower, it must be marked as appropriate for the application.

D. Use this unit only in the manner intended by the manufacturer. If you have any questions, contact the manufacturer:

ENVIRCO
101 McNeill Road
Sanford, NC 27330
Tel: (919) 775-2201
Tel: (800) 884-0002
Fax: (800) 458-2379
Email: info@envirco.com

ASIAN SALES
Building #1
200 Middle Suhong Road
Suzhou, Jiangsu
PRC 215021
Tel: (86) 512 6258 0031
Fax:(86) 512 6258 7180

Europe, Middle East & Africa (EMEA)
TRION Div of Ruskin Air Management Ltd
European Operations
The Cavendish Center Winnall Close
Winchester Hampshire
S023 OLB, UK
Tel: +44 (0) 1962 840465
Fax: +44 (0) 1962 828619

E. Before servicing or cleaning unit, switch power off at service panel and lock service panel to prevent power from being switched on accidentally.

Table of Contents

1 INSTALLATION

Note: The MAC 10 3- SpeedVE5 Fan Filter Unit is completely assembled at the factory with the exception of the optional ¼" (0.64 cm)-20 eyebolts, which can be used when hanging the unit from an overhead structure.

Step 1. Carefully remove the unit from the shipping carton and inspect for any damage that may have occurred during transportation. (See Figure 1)

Step 2. Wipe down plastic bag and move unit into clean room. (Double bagging is available upon request.)

Step 3. If using rigidly supported grid (usually 2" or wider), raise unit through ceiling and lower onto the gasketed grid. If using a flexible grid (typically supported with wires) the unit must be secured to an overhead structure with eyebolts, s-hooks and chain. A roll of high-density gasket has been provided for use with ungasketed grids. Note: special size units are available to fit specific clean room grid systems.

Step 4. Have an electrician wire the unit to the appropriate voltage (115V, 220V, 277V AC), according to the wiring diagram in section IX and local electric codes. If optional power cord was purchased, plug unit into a grounded receptacle

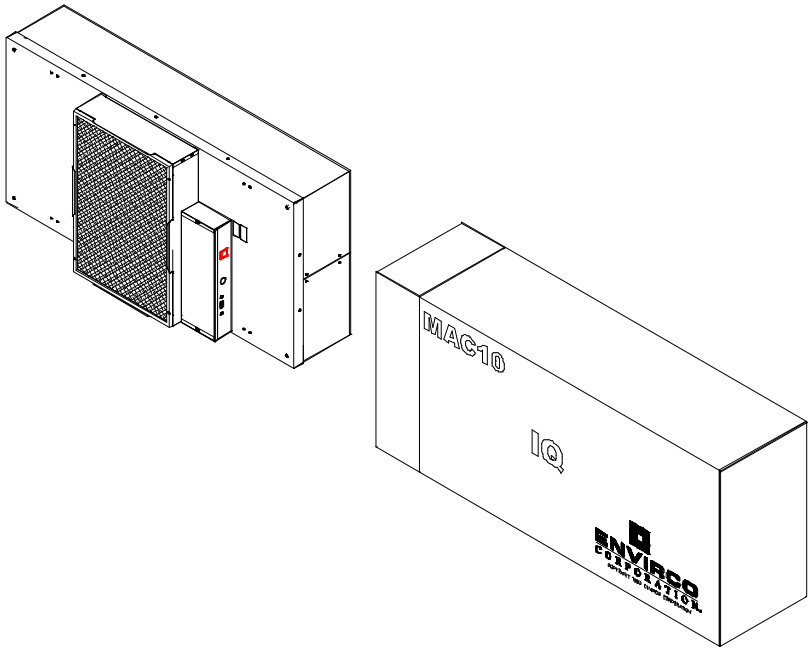


Figure 1 – Unit Uncrating

2 SERVICE: Cleaning the MAC 10 VE5 Prefilter

WARNING!
Disconnect the unit from the electrical power source before attempting any service.

Tools Required: None

Note: *To keep the filter in top operating condition, washing the foam prefilter is recommended every three to six months.*

Step 1. To gain access to the prefilter, remove the ceiling panel next to the unit, if applicable.

Step 2. Switch the ON-OFF switch to the off position.

Step 3. Remove the prefilter from the snap-in frame. (See Figure 2)

Step 4. Clean the prefilter by hand washing in water with a mild detergent or by using a vacuum cleaner. Allow prefilter to dry completely before replacing.

Step 5. Reassemble by reversing the above steps.

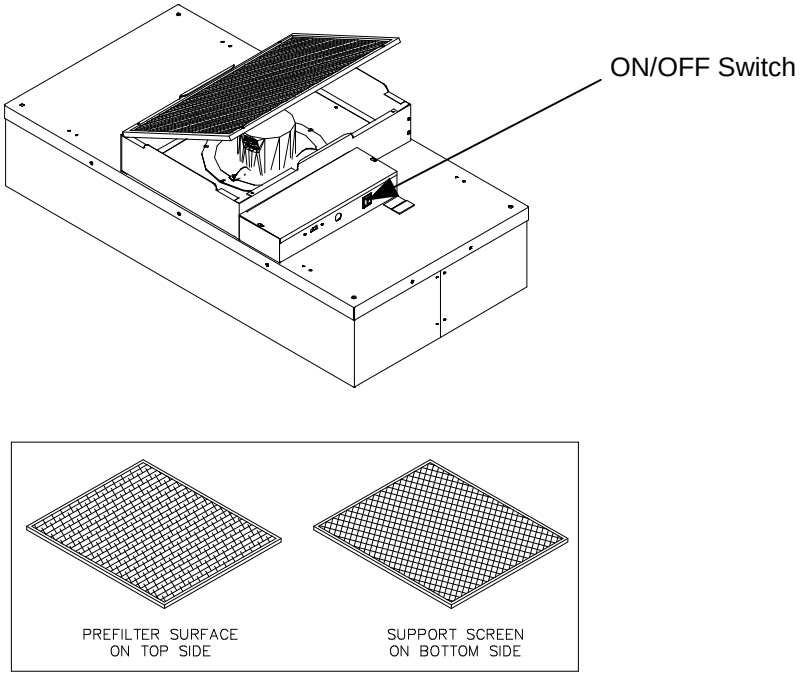


Figure 2 – Prefilter Cleaning

3 SERVICE: Removal and Replacement of the HEPA/ULPA Filter (Standard Unit)

WARNING!
Disconnect the unit from the electrical power source before attempting any service.
WARNING!
The Standard Filter is protected with an expanded metal face screen. This is never to be used to handle the filter. It is only for protection against an accidental touch of the filter. Only handle the filter by the frame.

Tools Required: Phillips Head Driver

Step 1. Remove unit from ceiling.

Step 2. Remove the 10 screws holding the HEPA/ULPA filter to the lid assembly.

Step 3. Lift the lid assembly off the HEPA/ULPA filter (see Figure 3). Discard the used filter as per requirements of the applicable regulations.

Note: *Before replacing with a new HEPA/ULPA filter, carefully inspect the new filter for any visible damage. Also inspect the gasket in the "tee" bar to insure a tight seal. Replace as necessary.*

Step 4. Replace with the new HEPA/ULPA filter and assemble by reversing the above steps.

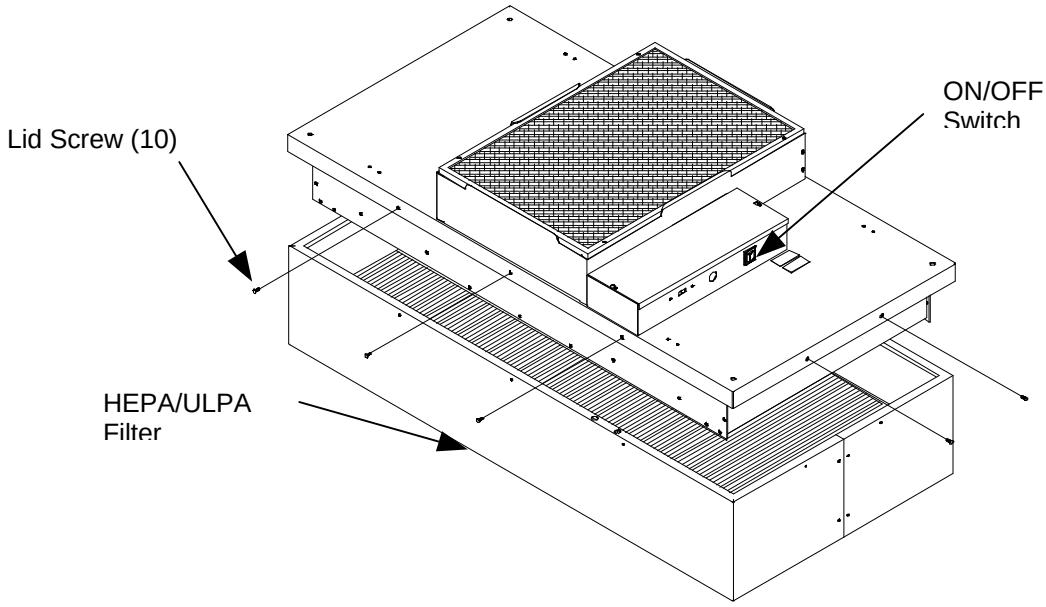


Figure 3 – Standard Filter Replacement

4 SERVICE: Removal and Installation of the Room Side Replaceable Gel Seal Filter – Extrusion Housing (RSR/RSRE)

WARNING!
Disconnect the unit from the electrical power source before attempting any service.

WARNING!
The RSR Filter is protected with an expanded metal face screen. This is never to be used to handle the filter. It is only for protection against an accidental touch of the filter. Only handle the filter by the frame.

Tools Required: **5/32" hex head wrench**
Manpower Required: **2**

Step 1. Remove the diffuser screen by removing the four M5x35 socket head screws securing the screen to the filter. (Figure 4)

Step 2. Loosen the six M5x16 socket head screws far enough to rotate the filter clip 180°. The filter will not drop during this operation. Using the clips as handles, slowly pull the filter away from the knife-edge seal. It is important to pull the filter slowly away from the seal, so that the gel remains in the filter gel track.

Step 3. Inspect filter for visible damage, if damaged set aside for replacement or repair.

Step 4. Inspect the gel seal, if reinstalling the removed filter. Determine if the gel has lost its ability to seal, if so repair the gel.

Step 5. Place the filter against the filter-sealing surface of the RSR unit. Install filter clips and screws. The clips can be rotated and angled into place. Using the clips as a lever the filter can be seated. It is recommended to work either clockwise or counter clock wise around the filter, raise the filter into the gel.

Step 6. Reinstall screen.

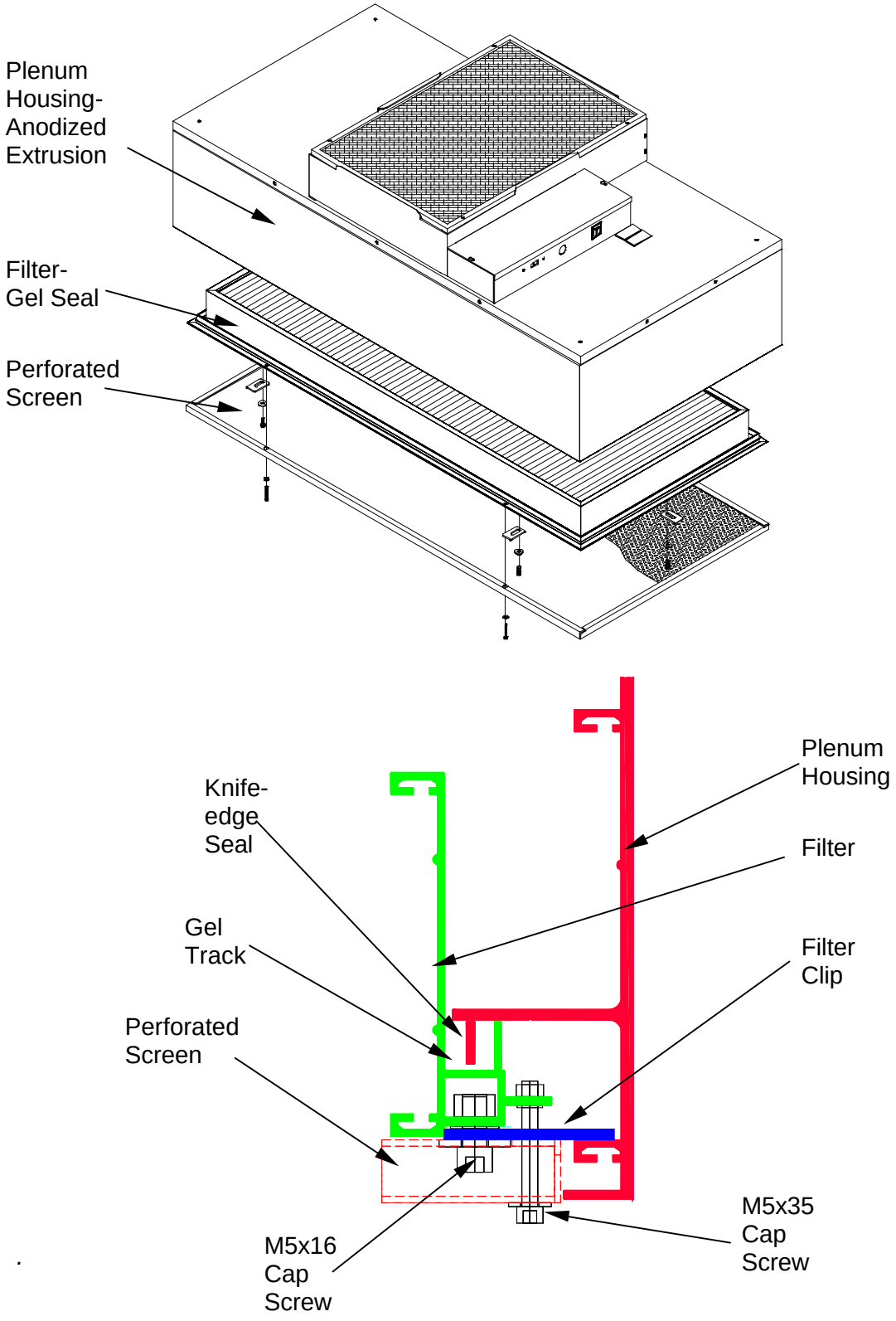


Figure 4 – RSR Extrusion Filter Replacement

5 SERVICE: Removal and Installation of the Room Side Replaceable Gel Seal Filter – Sheet Metal Housing (RSR/RSRE)

WARNING!
Disconnect the unit from the electrical power source before attempting any service.

WARNING!
The RSR Filter is protected with an expanded metal face screen. This is never to be used to handle the filter. It is only for protection against an accidental touch of the filter. Only handle the filter by the frame.

Step 1. Remove the diffuser screen by shifting it to one side and lowering it out of the housing.

Step 2. Loosen the six M5x16 socket head screws far enough to rotate the filter clip 180°. The filter will not drop during this operation. Using the clips as handles, slowly pull the filter away from the knife-edge seal. It is important to pull the filter slowly away from the seal, so that the gel remains in the filter gel track.

Step 3. Inspect filter for visible damage, if damaged set aside for replacement or repair.

Step 4. Inspect the gel seal, if reinstalling the removed filter. Determine if the gel has lost its ability to seal, if so repair the gel.

Step 5. Place the filter against the filter-sealing surface of the RSR unit. Install filter clips and screws. The clips can be rotated and angled into place. Using the clips as a lever the filter can be seated. It is recommended to work either clockwise or counter clock wise around the filter, raise the filter into the gel.

Step 6. Reinstall screen.

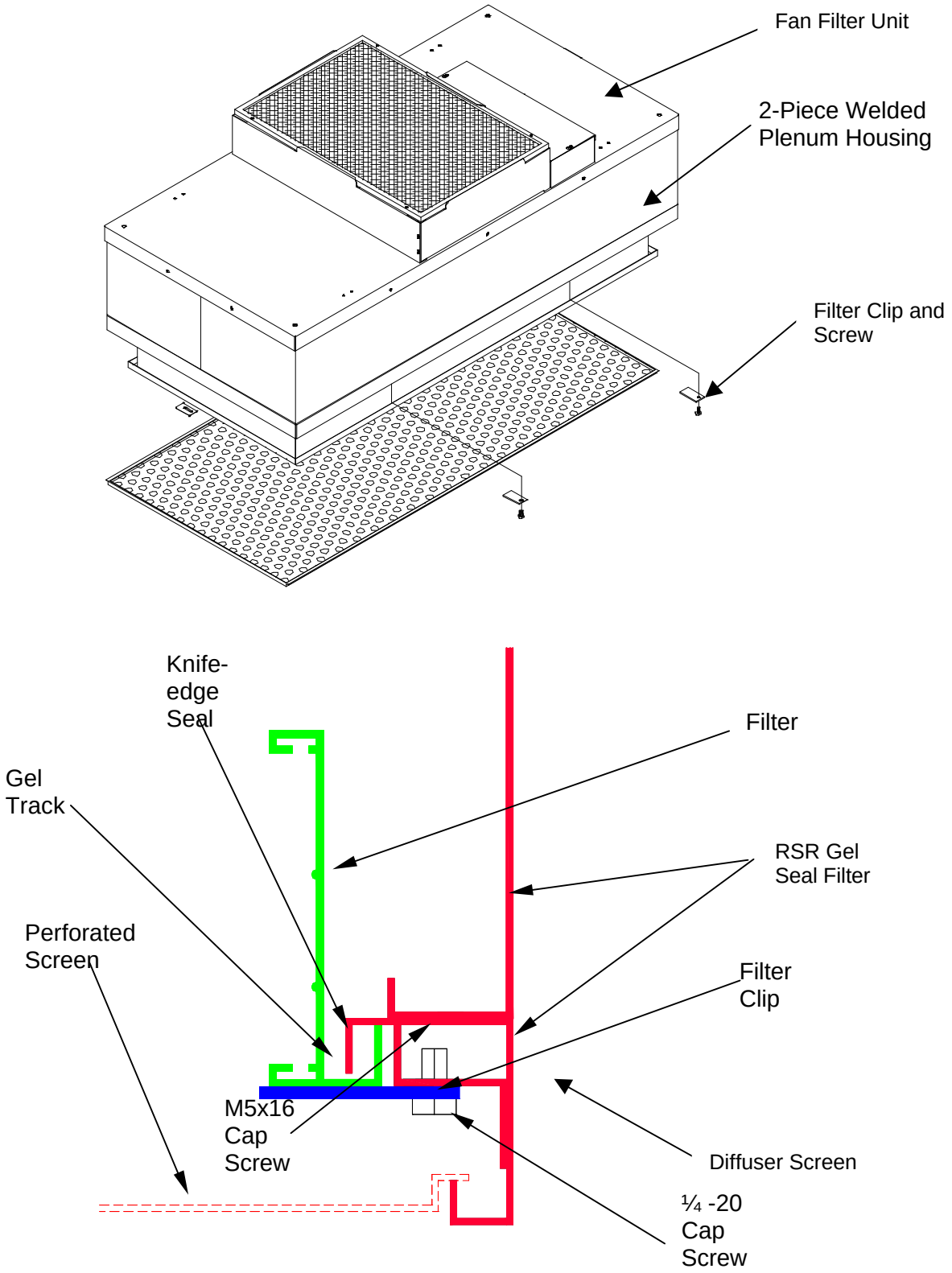


Figure 5 – RSR Sheet Metal Filter Replacement

6 SERVICE: Removal and Installation of the Motor (Standard and RSR models)

WARNING!
Disconnect the unit from the electrical power source before attempting any service.

WARNING!
Electrical service should be performed by licensed electricians or authorized ENVIRCO service technicians.

Tools Required: **Phillips Head Driver**
3/8" (10mm) Hex Head Wrench
Pliers
5/32"(0.40 cm) Allen wrench

Step 1. To gain access to the motor, remove the ceiling panel next to the unit, if applicable.
Step 2. Switch the ON-OFF switch to the off position.
Step 3. Remove the prefilter off the prefilter frame. (See Section II)
Step 4. Loosen the electrical box cover screws (2), and slide/lift off cover. (Figure 6)
Step 5. Make note of all wire locations for reinstallation later.
Step 6. Disconnect 5-pin and 16-pin wire harnesses from the motor.
Step 7. Remove the six screws to free the venturi ring and remove the motor/blower assembly from the lid assembly. If using power drivers, set the unit to a low torque setting to avoid stripping the sheet metal screws. (See Figure 6)
Step 8. Using a 5/32"(0.40 cm) Allen wrench remove the blower wheel from the motor shaft. Remove motor from the venturi ring using a hex wrench.
Step 9. Replace with the new motor and reassemble by reversing the above steps. Set the spacing between the venturi ring and the blower wheel at 0.06"(0.15 cm) clearance.

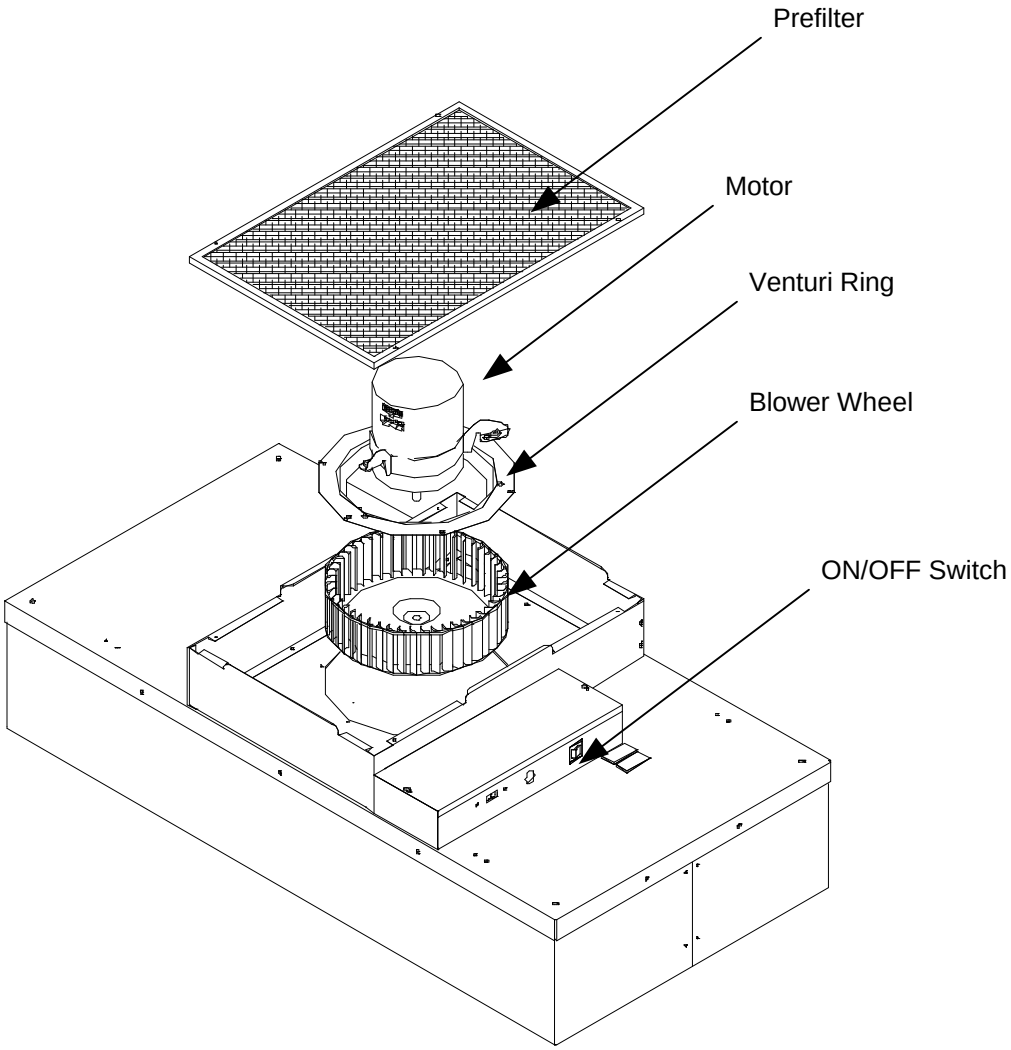


Figure 6 – Motor Replacement

7 SERVICE: Removal and Installation of the RSRE Motor

WARNING!
Disconnect the unit from the electrical power source before attempting any service.

WARNING!
Electrical service should be performed by licensed electricians or authorized ENVIRCO service technicians.

Step 1. To gain access to the motor, remove the gel seal filter (see Section III).

Step 2. While supporting the baffle assembly from below, remove the four corner screws on the baffle assembly and lower the assembly. (See Figure 7)

Step 3. Prior to removing motor/blower assembly, remove electrical box cover (located underneath the lid panel) to expose motor connectors. Disconnect the four and three pin connectors from its mate in the prefilter bracket.

Step 4. While supporting the motor/blower assembly from below, remove the six machine screws that secure the venturi ring to the bottom face of the lid.

Step 5. Using a 5/32”(0.40 cm) Allen wrench, remove the blower wheel from the motor shaft. Remove motor from the venturi ring by removing the three # 10 bolts.

Step 6. Before removal of the motor mount bracket, measure the precise location of the bracket on the motor. Remove the bracket.

Step 7. Replace with the new motor and reassemble by reversing the above steps. Set the location of the motor mount bracket as measured (see above Step 6). Set the spacing between the venturi ring and the blower wheel at 0.06”(0.15 cm) clearance. When reinstalling the motor plate, align the plate to insure that the leads will reach the electrical box.

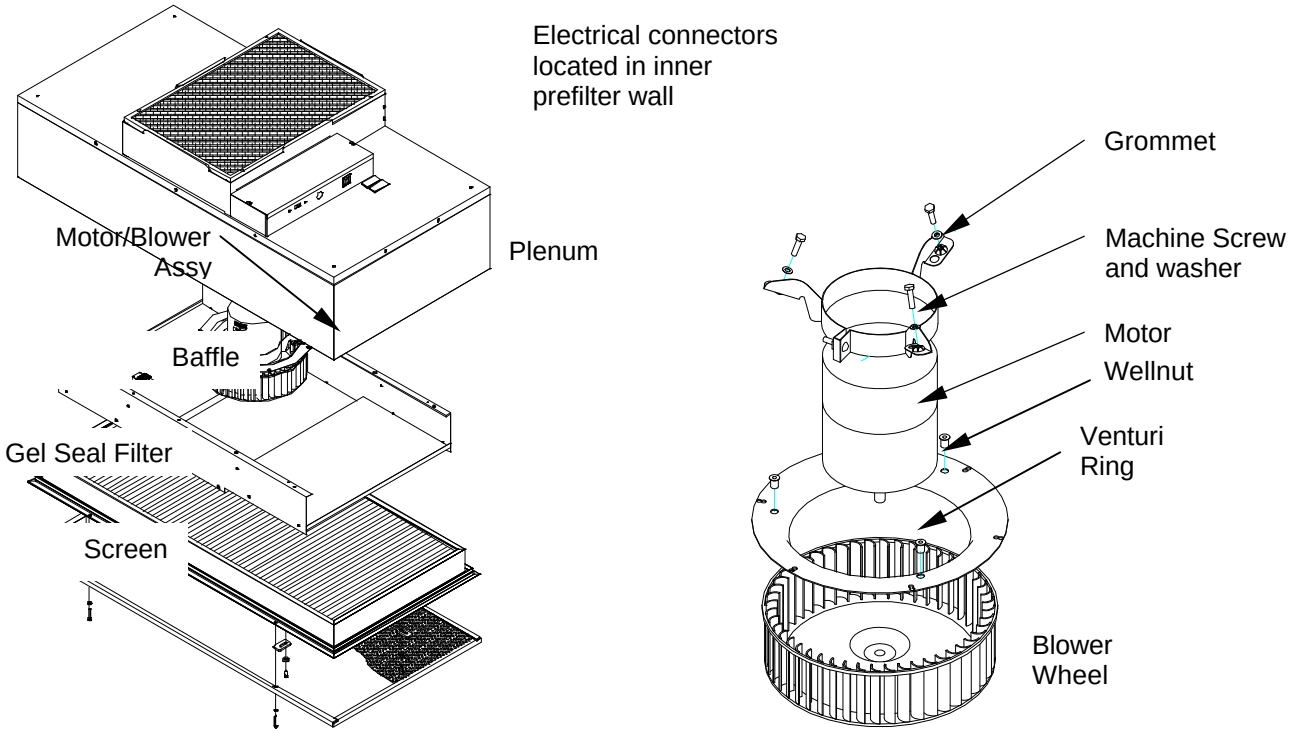


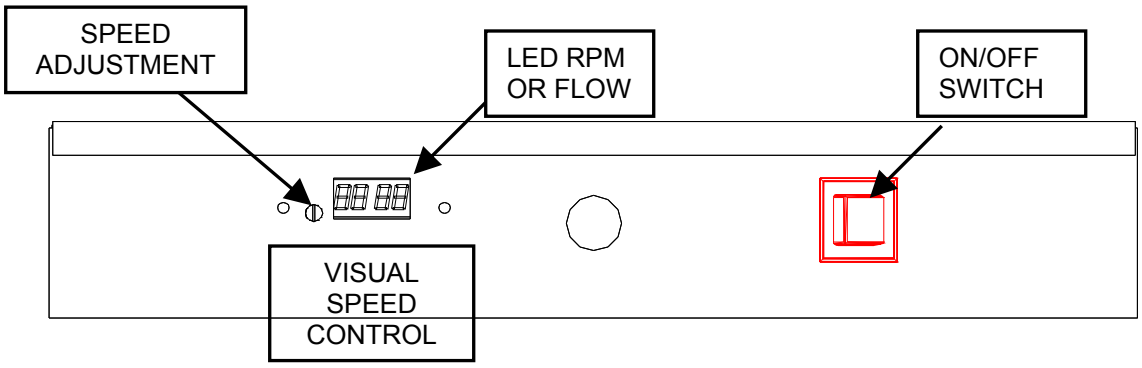
Figure 7 – RSRE Motor Replacement

8 ON/OFF Switch - Speed/Airflow Adjustment

All MAC 10 *IQ* units are equipped with a two-position rocker switch (ON/OFF), which is located on the side of the electrical box, on top of the unit. All units are furnished with the digital speed control to enable adjustment of airflow at any setting within the recommended performance range. The digital control speed is mounted on the electric control box and can be adjusted without opening the box (see figure 8).

8.1 Visual Speed Control

The Mac 10 / IQ is provided with the standard Visual Speed Control board a single screw driver is required to adjust the unit airflow. Just to the left of the LED readout is a recessed blue slotted stem which when turned clockwise will increase the airflow and if turned counter clockwise will decrease the airflow. The LED readout alternates between outputting the selected flow index (%) and the actual motor RPM.



8.2 Infrared Remote Control (Optional)

The Flow-Set is a handheld infrared remote control configured to adjust the Envirco Mac 10 IQ unit.

An EVO/ECM-IRC control sends the IQ motors a FLOW INDEX and a GO signal. The motor sends back a status signal that is connected to a red lamp. The control includes an infrared remote receiver.

The Flow-Set handheld remote sends infrared remote commands to the EVO/ECM-IRC control, allowing remote adjustment of the IQ motor. Using the Flow-Set, you can turn the motor on/off, adjust the flow index from 1-100 and read the current settings.

Point the Flow-Set at the Flow-Set target (red lamp if the motor is on) on the equipment. Operate the on/off button or any of the four ↑/↓ buttons. The green lamp near the Flow-Set target lights, indicating you are in an adjustment session. Continue to operate the on/off button or any of the four ↑/↓ buttons to achieve the desired settings. Press the Enter button to save your new settings and exit the adjustment session. Press the Clear button to delete your new settings, revert to the IQ settings and exit the adjustment session. If you enter an adjustment session and do not make any adjustments for 15 minutes, the adjustment session automatically clears.

Use the Clear button to read the current settings. Point the Flow-Set at the Flow-Set target and press the Clear button. A green lamp begins to flash indicating the signal was received. The flash sequence indicates the current flow index. The sequence occurs in two sets. The tens (1st) set uses long flashes to indicate the tens digit. The units (2nd) set uses short flashes to indicate the units digit. An extra long flash in the tens set or the units set indicates the value of the corresponding digit is zero.

- A flow index of 24 flashes two longs, then 4 shorts.
- A flow index of 89 flashes 8 longs, then 9 shorts.
- A flow index of 30 flashes 3 longs, then an extra long.
- A flow index of 04 flashes an extra long, then 4 short.
- A flow index of 100 flashes 10 longs, then an extra long.

Use the On/Off button to turn the motor on or off. Point the Flow-Set at the Flow-Set target on the equipment and press the on/off button. If you press Enter while the motor is off, the motor stays off, even through a power on/off cycle.

Adjust the flow index using the ↑/↓ buttons. The ↑/↓ button pair on the left adjusts the index ↑/↓ 10. The ↑/↓button pair on the right adjusts the flow index ↑/↓1. Using the ↑/↓10 pair, you can quickly move the index up and down. Using the ↑/↓1 pair, you can precisely set the index to achieve the desired flow. During an adjustment session, the

green lamp blinks each time you make a valid entry. If the flow index is already 100, and you try to increase the flow index, the green lamp does not blink, and the increase does not occur. If the flow index is at 91 and you press the ↑10 buttons, the green lamp does not blink and the increase does not occur because your entry would take the index above 100. When the flow index is greater than 90, use the ↑1 button to increase the index. The ↓1 and ↓10 keys respond in a like manner when you try to set the flow index below 1. (Zero is not a valid flow index).

Batteries

Two AA batteries power the EVO/IRC-Master$_{fs}$. Remove the sliding door on the back of the unit to expose the battery compartment. Remove the old batteries. Insert the new batteries in the position indicated by the battery pictures molded into the bottom of the battery compartment. The battery spring clips are difficult, so you may need to use a small screwdriver to "shoehorn" the batteries into place.

For maximum battery life, store the EVO/IRC-Master$_{fs}$ so the buttons are not pressed. While current drain is minimum when the unit is not sending infrared signals, some battery current is drawn to sense the pressed key.

8.3 Automation Control Unit

The Automation Control Unit (ACU) is controlled by the customers Building Management System. An ACU control requires industry standard 0-10Vdc to adjust and monitor the IQ motor. 2-10Vdc controls the motor between 0% to 100% of the flow index and 0 or 1Vdc turns the unit off. RPM feed back is provides the Building Management System with a unit operation signal. 0 -10 Vdc give a linear response to 0-2000 RPM.

8.4 Modbus Control System

This information is available in the Modbus Manual for either the Air Fiddler or the Console Control System.

8.5 Digital I/O Control

The Mac 10 IQ is provided with the standard Digital Speed Control board, but a Building Management System Digital Output is required to provide the 24 VAC power to the board. This allows the Building Management System to control the ON/OFF function of the MAC 10 IQ, while the Digital Control Board adjusts the unit speed per section 8.1.

9 Trouble Shooting:

Low Air Velocity

Step 1. Check prefilter media; replace or clean as necessary.

Step 2. Adjust digital speed control for higher blower output.

Step 3. Check power supply for proper voltage, amperage and distribution frequency.

Step 4. Replace HEPA filter if the air velocity remains low.

High Air Velocity

Step 1. Adjust digital speed control for lower blower output.

Non-Laminar Flow and/or Excessive Contamination

Step 1. Insure that no large obstructions are upstream of airflow pattern.

Step 2. Determine that no other air-moving devices are operating in or around clean room which disrupt room's airflow pattern.

Step 3. Check air velocity and if low, conduct the "Low Air Velocity" procedure outlined above.

Step 4. Conduct smoke and photometer test on HEPA filter. Seal or replace HEPA filter as necessary.

10 MAC 10 *IQ* Wiring Diagrams

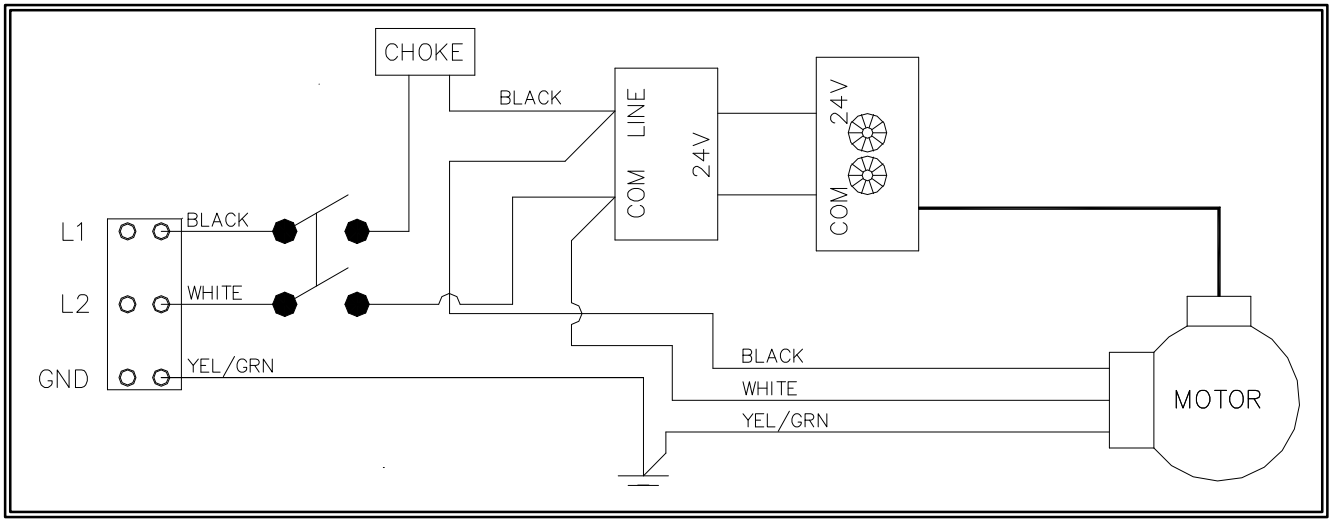


Figure 9 – Digital Speed Control Wiring Diagram

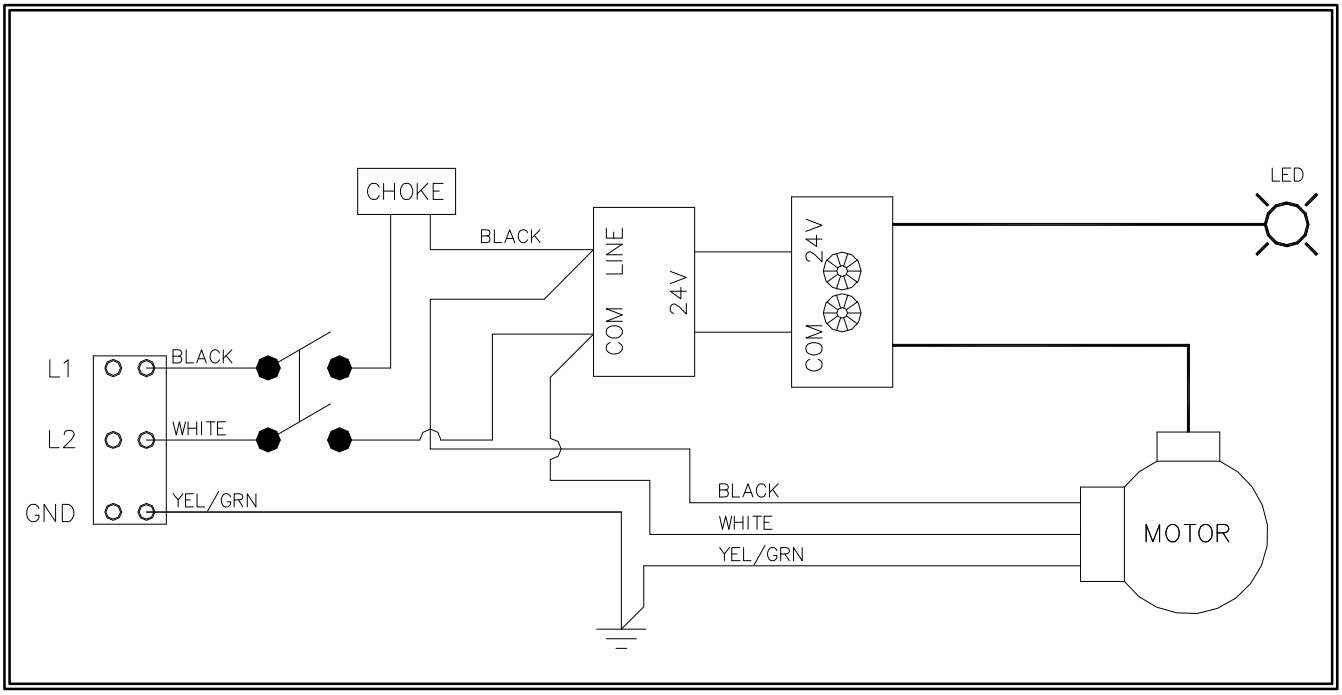


Figure 10 Digital Speed Control w/ Indicator Light

MAC 10 IQ Wiring Diagrams *(continued)*

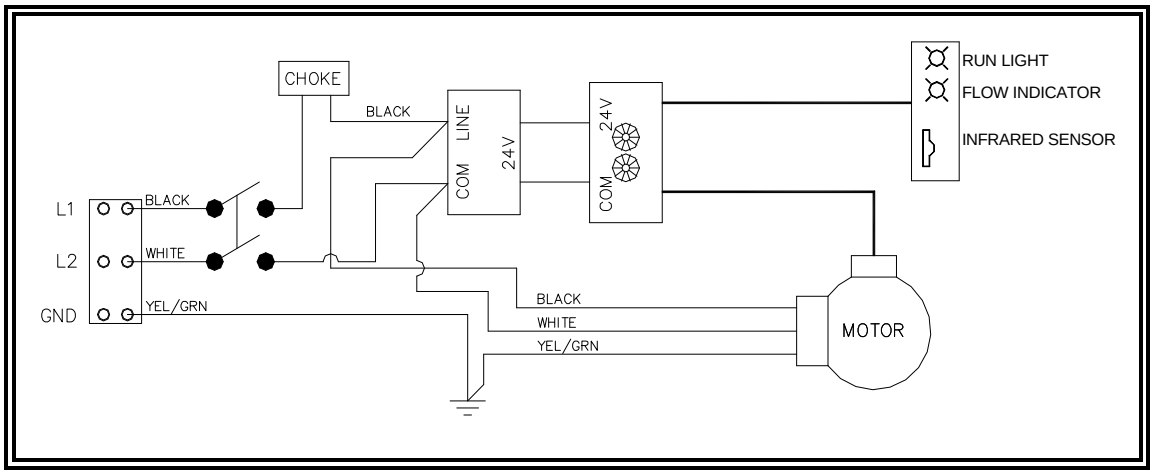


Figure 11 Infrared Control

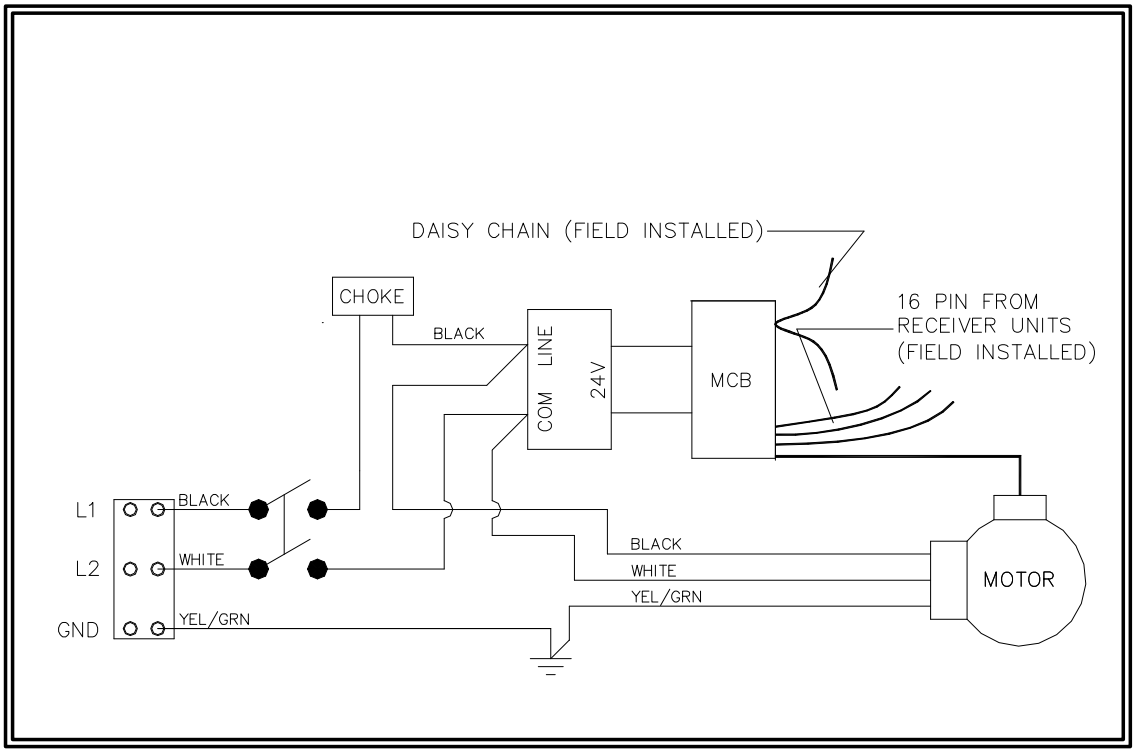


Figure 12 Modbus Control – Controller

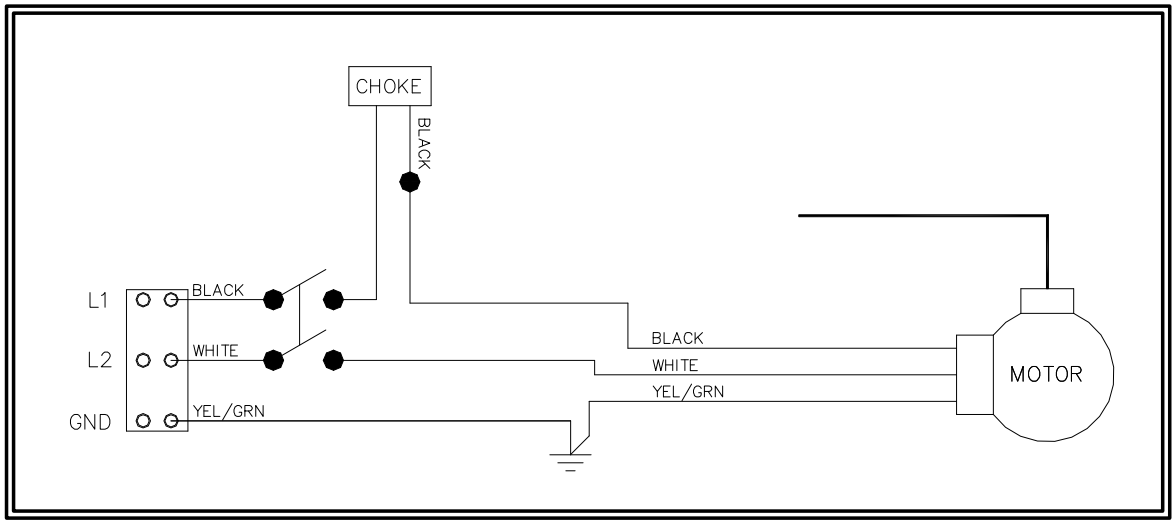


Figure 13 Modbus Control - Receiver

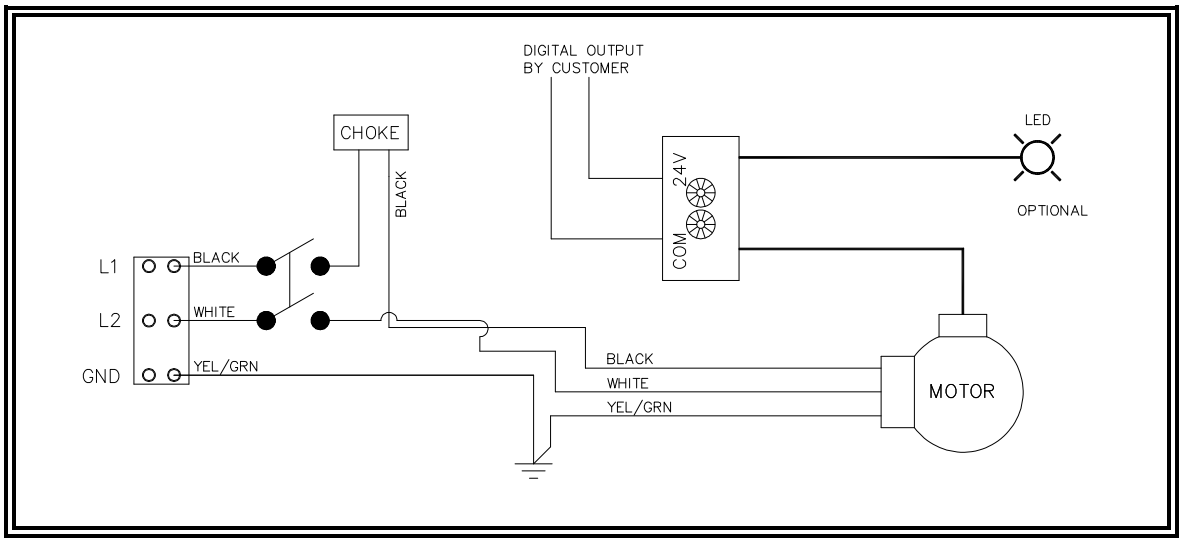


Figure 14 Digital IO (Remote ON/OFF)

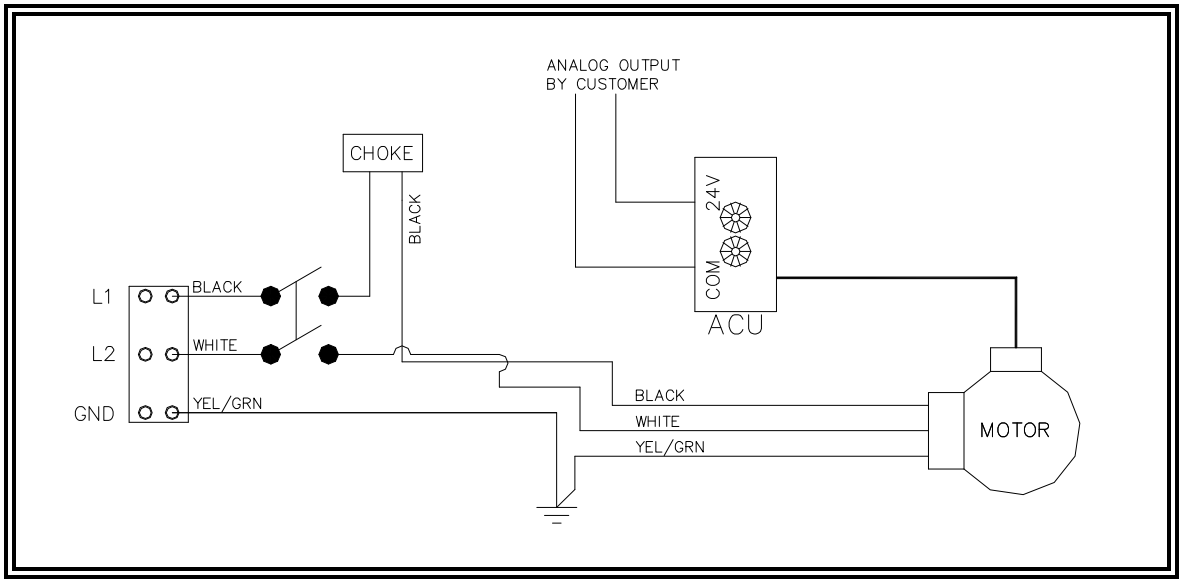


Figure 15 Automation Control Unit

11 MAC 10 IQ VE5 Replacement Parts List:

Description	Quantity per unit	ENVIRCO Part Number 115V 60 Hz	220V 50 - 60 Hz	277V 60 Hz
Prefilter	1	62981-001	62981-001	62981-001
Motor	1	63589	63589	63655-001
ON/OFF Switch	1	63739	63739	63739
Digital Speed Control	1	63672	63672	63672
Modbus (Fiddler)	1	63631	63631	63631
Modbus (Console)	1	63970	63970	63970
ACU	1	64014-001	64014-001	64014-001
Pressure Switch (Optional)		63415	63415	63415
Transformer		63667	63666	63665
Power cord (Optional)		63042-001	63042-004	63042-013
Standard Filter:[1]		HEPA	ULPA (Optional)	Actual Filter Dim
2' x 2'	1	69514-004	69514-018	23.63x23.63x9.125
2' x 3'	1	69514-019	69514-012	23.63x35.63x9.125
2' x 3.5'	1	69514-020	69514-021	23.63x41.63x9.125
2' x 4'	1	69514-006	69514-007	23.63x47.63x9.125
RSR Filter – Extrusion Housing:[1]		HEPA	ULPA (Optional)	Actual Filter Dim
2' x 2'	1	69563-005	69563-004	22.00x22.00x3.63
2' x 3'	1	69563-006	69563-007	22.00x34.00x3.63
2' x 3.5'	1	69563-008	69563-009	22.00x40.00x3.63
2' x 4'	1	69563-001	69563-003	22.00x46.00x3.63
RSR Filter – Sheet Metal Housing:[1]		HEPA	ULPA (Optional)	Actual Filter Dim
2' x 2'	1	93997-005	93997-004	21.00x21.00x3.55
2' x 3'	1	93997-006	93997-007	21.00x33.00x3.55
2' x 3.5'	1	93997-008	93997-009	21.00x39.00x3.55
2' x 4'	1	93997-001	93997-003	21.00x45.00x3.55

1: All filter part numbers are based on the standard Mac 10 sizes (2x4 – 23.63x47.63, 2x3 ½ -23.63x 41.63, 2x3 – 23.63x35.63, and 2x2 – 23.63x23.63). If the unit in question is not this size or the part number includes a "Z" contact the factory for replacement filter information.

Optional Accessories:
Fluorescent lighting
Ionizing bar
12”(30.48 cm) diameter A/C intake collar
Gasket Seal Filter (RSR unit only)
ULPA Filter (Standard and RSR)

Replacement parts are available through your authorized ENVIRCO representative. If you cannot locate a representative in your area, contact our Parts Department at:

ENVIRCO
101 McNeill Road
Sanford, NC 27330
Tel: (919) 775-2201
Tel: (800) 884-0002
Fax: (800) 458-2379
Email: info@envirco.com

12 Warranty

LIMITED WARRANTY: Unless otherwise expressly stated in Envirco's published specifications for the Goods, Envirco warrants that that Goods are free from defects in material and workmanship, except for services which are warranted to be performed in a competent and diligent manner in accordance with any mutually agreed specifications. The foregoing warranty shall apply for eighteen (18) months from the date of shipment from Envirco's facility, except for services for which the warranty shall apply for ninety (90) days from the date of performance (the "Warranty Period"). Provided Buyer informs Envirco in writing of any breach of warranty prior to the expiration of the applicable Warranty Period, Envirco shall, as its sole obligation and Buyer's sole and exclusive remedy for any breach of this warranty, repair or replace/reperform the Goods which gave rise to the breach or, at Envirco' option, refund the amounts paid by Buyer for the Goods which gave rise to the breach. Any repair, replacement or reperformance by Envirco hereunder shall not extend the applicable Warranty Period. The parties shall mutually agree on the specifications of any test to determine the presence of a defect. Unless otherwise agreed upon by Envirco in writing, Buyer shall bear the costs of access, de-installation, re-installation and transportation of Goods to Envirco and back to Buyer. These warranties and remedies are conditioned upon (a) the proper storage, installation, operation, and maintenance of the Goods and conformance with the proper operation instruction manuals provided by Envirco or its suppliers or subcontractors, (b) Buyer keeping proper records of operation and maintenance during the applicable Warranty Period and providing Envirco access to those records, and (c) modification or repair of the Goods only as authorized by Envirco. Envirco does not warrant the Goods or any repaired or replacement parts against normal wear and tear or damage caused by misuse, accident, or use against the instructions of Envirco. Any modification or repair of any of the Goods not authorized by Envirco shall render the warranty null and void. EXCEPT AS EXPRESSLY SET FORTH HEREIN, ENVIRCO MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT OR FITNESS FOR A PARTICULAR PURPOSE WHICH ARE HEREBY DISCLAIMED TO THE EXTENT PERMITTED BY APPLICABLE LAW.

13 TESTING

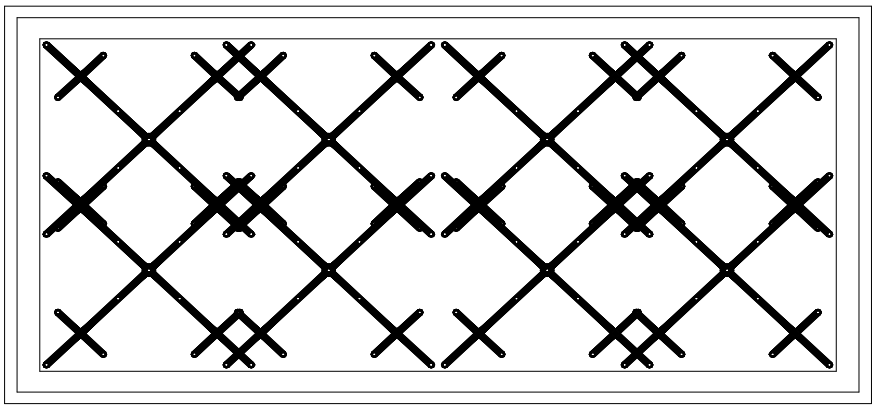
Each MAC 10 VE5 filter unit is thoroughly tested at the factory before shipment. However, because of the "rigors" of shipping, ENVIRCO encourages its re-test after installation.

ENVIRCO recommends that the customer contact an independent organization, with technicians trained and experienced in performance evaluation and maintenance of clean air equipment.

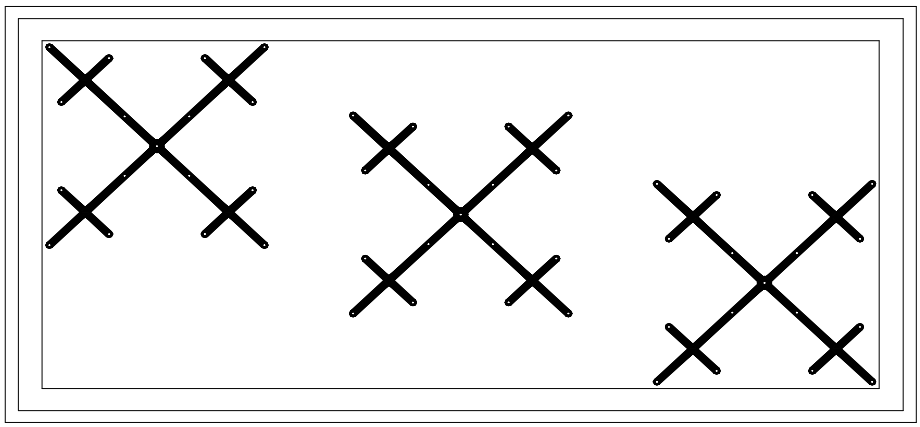
Some of the testing procedures performed on the MAC 10 VE5 include PSL challenge of HEPA/ULPA filters to assure specified performance, along with air velocity measurement and adjustment tests. No DOP is used on Mac 10 Filters, unless requested.

Recommended Testing

All units that are airflow tested at Envirco are tested using a Shortridge *Airdata Multimeter 800 series* with a Velgrid head. The recommended method of reading is to place one corner of the Velgrid head 1-1/4" from the corner of the filter face and then take four reading evenly spaced along the four foot side, then repeat these reads for the other long side. This gives a total of eight reading to test the unit. All advertised data is based on using the Velgrid with eight readings (128 velocity points). Envirco recognized using eight reading during a cleanroom start-up may be time consuming and recommends using three Velgrid readings taken on a diagonal, as shown below.



Recommended Testing – 8 readings with a Velgrid



Factory Approved Testing – 3 readings with a Velgrid

Figure 12 Velgrid Testing