

RPS

Operating Manual

MAC-21 VFD

Portable Filtration Module

Part Number FM37VFD



Master Contract No. 215873

Certificate No. 2449861

Class 3812-81– Fans and Blowers

Class 3812-01– Fans and Blowers



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I. DESCRIPTION

The MAC-21 VFD is a variable speed modular HEPA Filtration unit capable of providing High Efficiency Particulate Air (HEPA) filtration with 99.97% efficiency @ 0.3 Microns, at flow rates ranging up to 500 CFM at 2" of static pressure to 390 CFM at 4" of static pressure. The MAC-21 VFD is an assembly of three (3) modules that include:

Power Module: direct drive blower/motor, VFD and base assembly,

Filter Module: pre & HEPA Filter housing assembly, prefilter and HEPA filter,

Quick Mount Cart: handling cart/mounting platform for the Power Module and Filter Module.

The **Power Module** has an integrally mounted motor directly driving a cast aluminum blower. The motor/blower are mounted to a stainless steel base. The Variable Frequency Drive (VFD) is mounted to a SS bracket adjacent to the motor. The Power Module base mounts to studs on the Quick Mount Cart. The Power Module blower inlet is a combination 8" flex duct connector/Female Docking Adapter (FDA). To use as a flex duct connector, slip the duct over the connector and clamp or tape in place. To use as a FDA, the rubber seal inside the adapter compresses against the mating sealing surface of the Male Docking Adapter on the Filter Module, coupling the two modules together without requiring an interconnecting hose, boot or other sealing device.

The **Filter Module** is a portable stainless steel housing that holds the prefilter, HEPA filter or adsorber element. It is a two-piece assembly consisting of a housing cover and housing body. The Filter Module accepts a slide in prefilter through a separate prefilter compartment door in the Filter Module housing cover. This separate prefilter compartment allows quick, easy prefilter change-out without disturbing the HEPA filter seal and may be performed without shutting the unit down. The Filter Module housing cover is also equipped with an "Accessory Track" that will accept a number of different flex duct inlet adapter, 8" flex duct x FDA or special attachments such as the Snorkel Arm or 55 Gallon Drum Capture Velocity Hood. The housing cover is equipped with the 8" flex duct x Female Docking Adapter inlet as standard equipment.

The Filter Module housing body will accept either a HEPA filter element or other elements such as carbon or gas phase adsorber elements. The HEPA filters and adsorber elements are nominally 12"x12" of various depths with a dual gasketed 14" x 14" sealing flange on the upstream face. A 0"-10" static pressure water differential pressure gage is installed in the Filter Module body, with the low pressure tap extended to an external tubing connector in the housing cover to permit measurement of the static pressure drop across an installed filter element. The Filter Module downstream outlet is a combination 8" flex duct connector/Male Docking Adapter. As a flex duct connector, duct is slipped over the nipple and clamped or taped in place. As a Male Docking Adapter, the sealing surface compresses the rubber gasket in a mating Female Docking Adapter, which may be installed on either the Power Module or on the inlet of another Filter Module, coupling the two modules together without requiring a hose, boot or other sealing device.

The **Quick Mount Cart** (QMC1) functions as the mounting platform and handling device for the Modular Air Cleaning system. Components are constructed from stainless steel tubing, resembling a "hand truck" in design.

II. COMPONENT SPECIFICATION

VFD Electrical Rating

120/230V, 16.6/8.3A, 1 phase, 60 Hz.

Blower Motor/VFD Assembly

VFD: 1 HP ACTech SMVector series programmed for 3/4 HP operation.

Motor: 3/4 HP, 230/460 VAC, 2.6A, 3 Phase, 3450 RPM, TEFC.

Wheel, 9.75" x 2.875" developing 550 CFM at 1" SP. Housing, 10" x 11" x 4.125", 5" inlet.

Discharge mounted stainless steel slide gate for flow control with a nipple for 8" dia. flex duct connection.

HEPA Filter

350 CFM @ 1.3" WG DP, Mil-Spec Grade.

Element nominal 12.5" x 12.5" x 8.5" with 3/4" flanged lip on inlet face.

Stainless steel case.

Closed cell neoprene gasket on each side of flange.

Steel mesh face guards on upstream and downstream side of media.

Prefilter

Multi-density polyester with internal support wire.

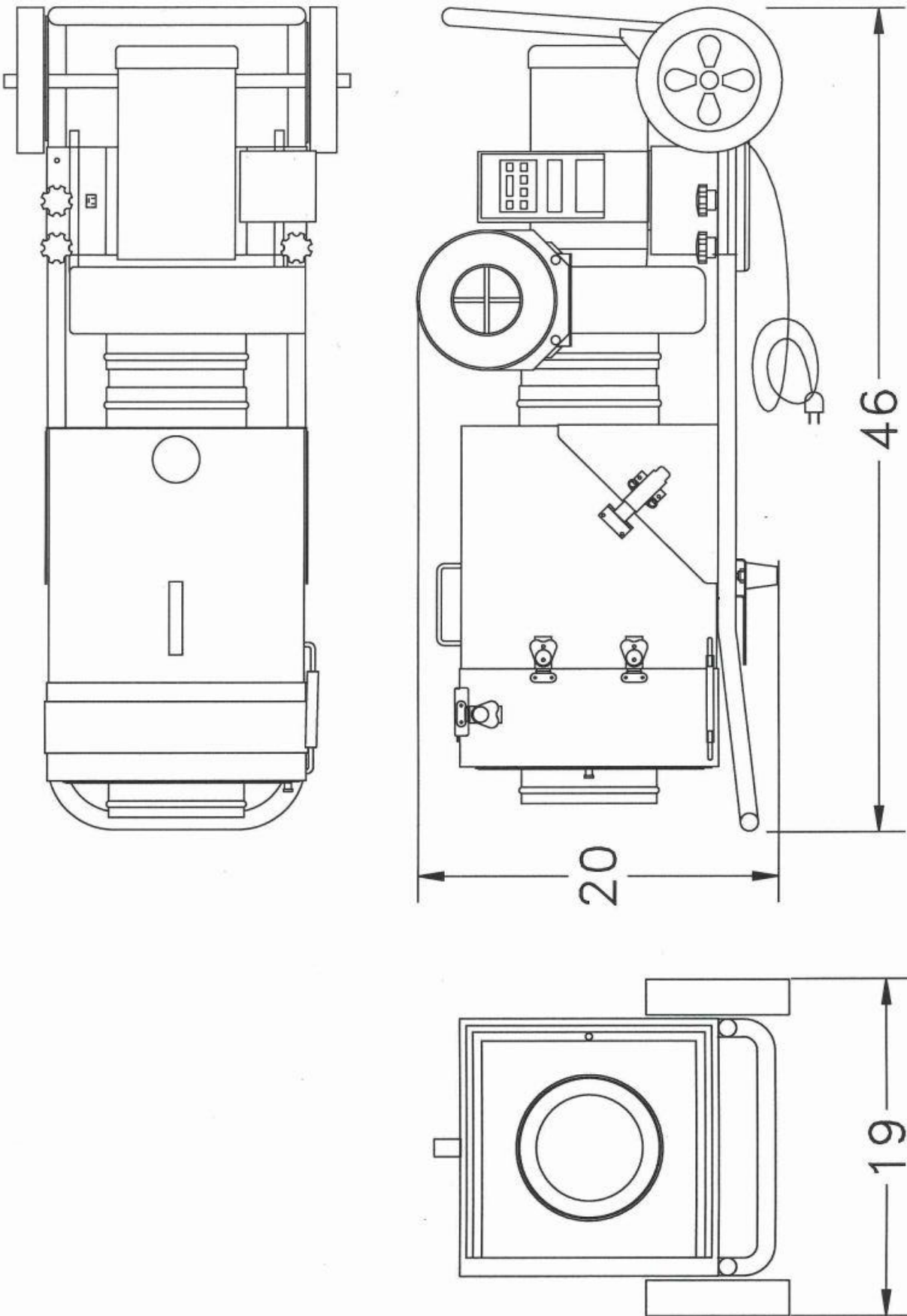
Merv 6, UL 900 Class 2.

14" x 14" x 1.5".

Differential Pressure Gage

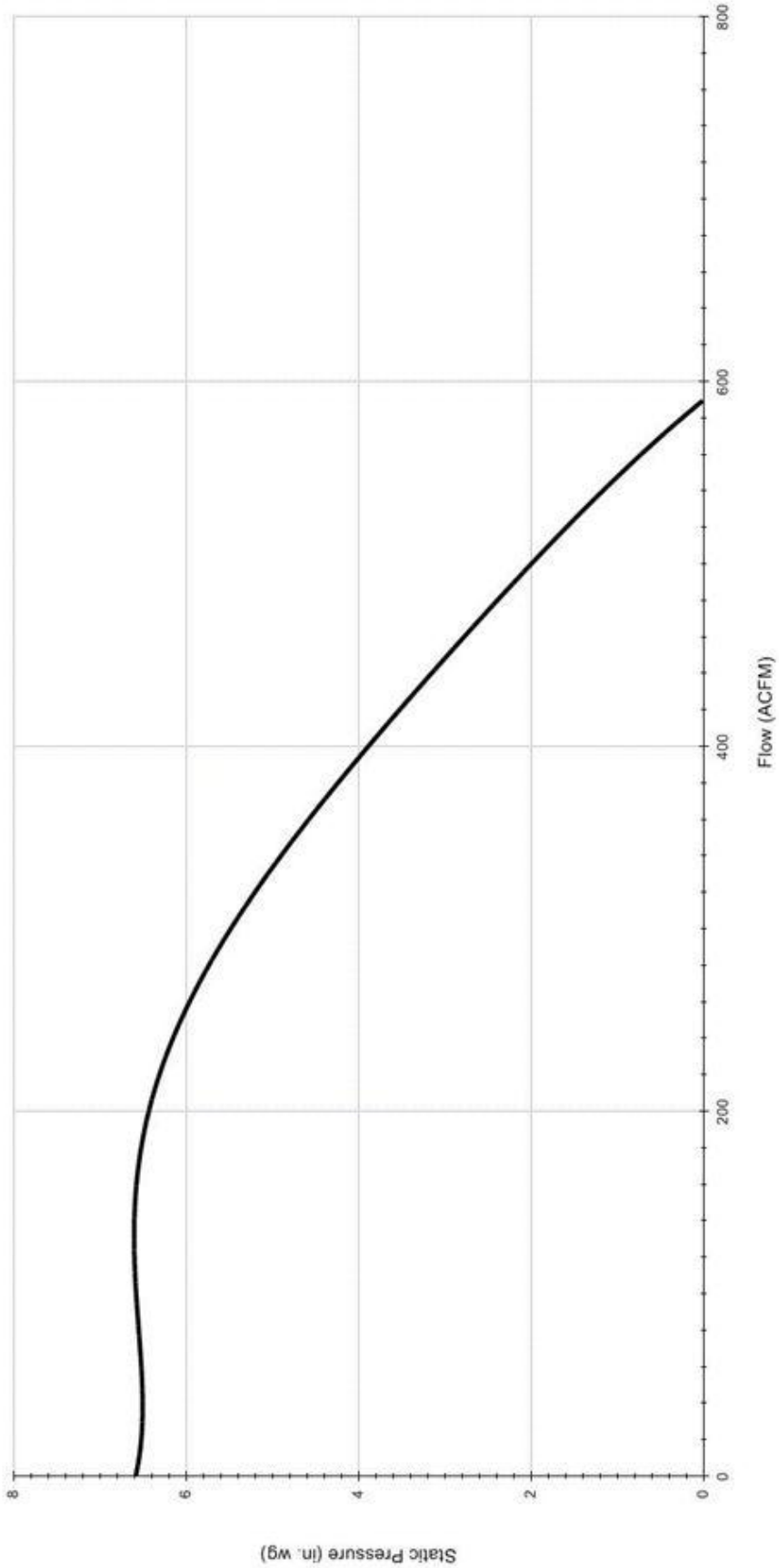
Dwyer Minihelic Differential Pressure Gage, 0- 10 inches W.C.

III. ARRANGEMENT DRAWING



IV. FAN CURVE

MAC-21VFD FAN CURVE



V. OPERATING INSTRUCTIONS

ATTENTION: IMPORTANT

SAFETY INSTRUCTIONS

READ AND SAVE THESE INSTRUCTIONS

WARNING – TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT USE THIS FAN WITH ANY SOLID-STATE SPEED CONTROL DEVICE.

WARNING – DO NOT OPERATE ANY FAN WITH A DAMAGED CORD OR PLUG. DISCARD OR OBTAIN SERVICES FROM A QUALIFIED ELECTRICIAN FOR REPLACEMENT OR REPAIR.

WARNING – TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING: Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.

DANGER



Hazardous voltage can cause electrical shock and death.



High speed rotating equipment can cause severe personal injury.



Avoid injury. NEVER operate without ALL required safety guards in place.



Lock out/Tag out to prevent personal injury BEFORE starting ANY service or inspection.

A. Prerequisites

1. Inspect all components/hardware for damage. Particular attention should be paid to the Power Module and Filter Module.
2. Check differential pressure gage for zero set point. If differential pressure gage does not indicate zero, re-zero gage by turning set screw on the face of the gage.
3. Check all electrical connections and cables for damage. Plug unit into 115VAC outlet and observe VFD display displays "STOP" after unit initializes.

B. Cautions

1. Ensure free rotation of the blower motor.
2. Perform frequent gamma surveys of filter housing(s), especially immediately following initial system start-up. Radiation dose rates may increase rapidly.
3. To provide optimal VFD cooling the unit should be operated in the horizontal position (VFD should be vertical).
4. Where bends in flexible ducting runs are required to suit working configurations, avoid sharp bends. The number of bends should be kept to a minimum in order to minimize pressure drops through the system. Replace kinked or collapsed ducting immediately.
5. Frequent replacement of the prefilter(s) will improve air flow rates and extend the life of the HEPA filters.
6. Do not stand in front of the blower discharge when operating the blower. Foreign objects could be ejected at dangerously high velocities.

C. Operation

1. Arrange unit in the configuration desired for ventilation supply.
2. Adjust dampers to provide the desired flow path during system operation.
3. Press the green "RUN" button on the VFD keypad to start the blower. Use the UP/DOWN arrow keys to adjust blower speed to desired flow. VFD displays speed setting in Hertz. Speed range is limited to 12 to 60 Hz or 690 to 3450 RPM. Press the red "Stop" button on the VFD keypad to stop the blower.
4. Check differential pressure gages frequently and change out the prefilter or HEPA filter if the pressure drop increases to 5" on gage or a decrease in flow is evident.

NOTE: Radiological conditions present may dictate change-out of filters prior to pressure drop restrictions. Follow site radiological guidelines as appropriate.

5. Readjust blower speed, via VFD keypad, as necessary to suit flow requirements.

VI. FILTER CHANGE

Filter change requirements are dictated by three conditions: radiation levels within the filter housing, ventilation flow requirements reduced by filter loading, or excessive differential pressure. Site radiological procedures will govern when radiological conditions warrant filter change-out. As the filters load with dirt, the system flow rate will begin to fall. Depending upon the application, the flow rate may fall below acceptable levels before the filters become fully loaded with dirt. Replacing the filters will reduce the system pressure losses and will return the flow rate to the initial level. In this case, the actual flow rate will dictate when the filters are changed. High differential pressure (DP) across the filters indicates that the filters are dirty. Filter change-out should be performed when (or before) the DP across the filters increases to approximately 7" - 8" wg pressure. The prefilter should be changed out more frequently to help preserve the HEPA filter. Applications with conditions of high amounts of dust and debris will require more frequent filter changes than low airborne dust conditions. At no time should the unit be allowed to operate for extended periods with a DP in excess of 10" wg.

NOTE: Prior to filter change, survey filter assembly to determine radiation and contamination levels. Results will indicate protective measures to be taken. Decontamination may be warranted.

A. Prefilter

1. The prefilter should be serviced with the unit in the horizontal position.
2. Unfasten latches securing prefilter chamber cover to the Filter Module cover. Raise prefilter cover. Attach poly bag around chamber opening and secure with tape. Leave sufficient room for attachment of a second poly bag.
3. Reach into the prefilter chamber through the poly bag and pull the prefilter out into the extended bag.
4. Seal the prefilter in the poly bag by gathering the bag at the attached end and securing with tape. Cut through the taped joint leaving the end of the poly bag taped to the prefilter chamber opening. Dispose of the used (bagged and sealed) prefilter in accordance with established radiological procedures.
5. Place a clean prefilter inside a new poly bag.
6. Attach the poly bag containing the clean prefilter around the prefilter chamber opening and secure with tape at a point below the first bag.
7. Remove the poly bag remnant from the prefilter chamber opening, leaving it inside the new bag. Slide the prefilter into the chamber, secure the cover and remove poly bag. Dispose of the bag containing the bag remnant in accordance with established radiological procedures. Check outside surfaces for loose surface contamination.

B. HEPA Filter

1. HEPA filter should be serviced with the unit in the vertical position. Move filtration module to an area controlled for contamination.
2. Unfasten the four quick release fasteners securing the prefilter housing to the filter housing. Pull the DP gage hose off of one of the 1/4" nipples. Remove the prefilter housing from the filter housing. Use appropriate measures to prevent the spread of contamination. Place the prefilter housing aside.
3. Place a plastic bag over the opening and tape it securely to the outside of the housing.
4. Withdraw the HEPA in to the plastic bag, lifting it by the bail wire.
5. Gather the plastic bag just beyond the filter housing and wrap an area about 4" long with tape. Perform an umbilical cut through the center of the tape. Place a piece of tape over the severed ends. Dispose of the HEPA appropriately.
6. Carefully remove the tape and the remnant from the filter housing, place in a plastic bag, and dispose of appropriately.
7. The inside edge of the filter housing (above the gasket sealing surface) is potentially contaminated and should now be wiped down.
8. Place a new HEPA into the filter housing, ensuring that it rests squarely on the gasket sealing surface.
9. Replace the prefilter housing onto the filter housing and secure the four quick release fasteners.
10. Replace the DP gage tube over the 1/4" nipple.

VII. TROUBLE SHOOTING GUIDE

The following table offers a guide for the most common problems that can be encountered. As with all machinery, disconnect the power before servicing or opening the electrical components.

SYMPTOM	CAUSE/ACTION
Unit won't start	<ol style="list-style-type: none"> 1. Make sure unit is electrically connected. 2. Check circuit breaker on circuit that powers the unit. 3. If unit has power and VFD display is dark unplug unit and check connections within VFD. 4. VFD fault—observe display for fault code and refer to VFD manual for instructions
DP gage not on zero when system is not running	<ol style="list-style-type: none"> 1. Re-zero gage by turning set screw on the face of gage. 2. If gage does not zero, replace.
DP gage does not move when machine is started	<ol style="list-style-type: none"> 1. Check to ensure that the "HI" side of the gage is plumbed to the upstream side of the HEPA. 2. Ensure the 1/4" clear Tygon D/P gage tube is connected at each end. 3. Make sure nothing is obstructing the inlet plenum, the unit is operating and air is flowing. 4. Replace the gage.
Lower than expected flow	<ol style="list-style-type: none"> 1. Verify correct motor rotation and correct if necessary. 2. Excessive resistance to flow caused by flow restrictions, added duct runs, or filter loading. 3. VFD speed setting too low.

VIII. PREVENTIVE MAINTENANCE

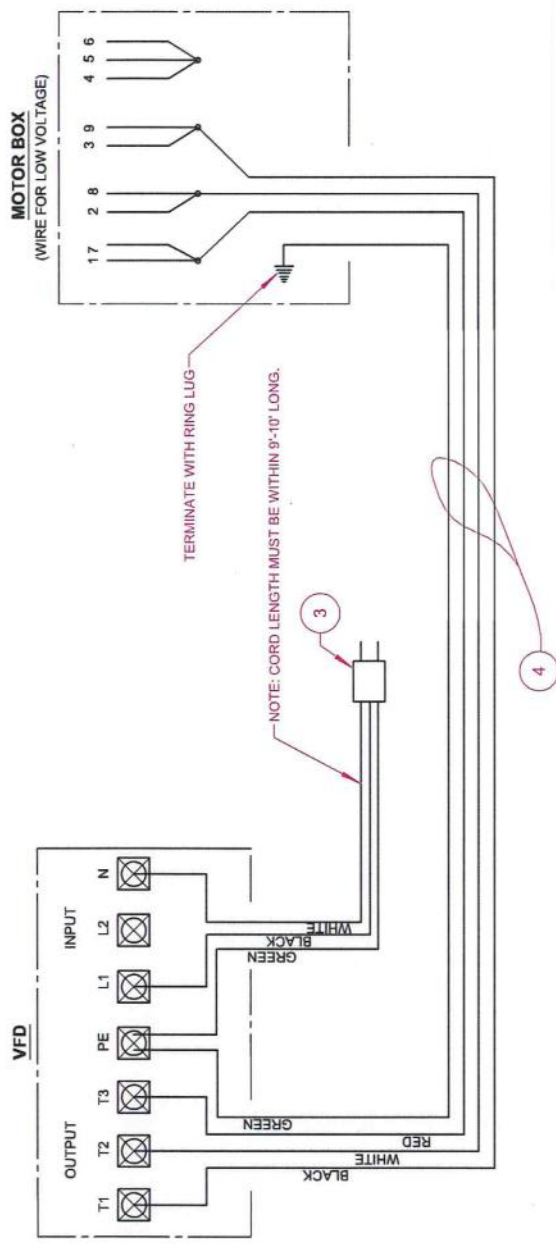
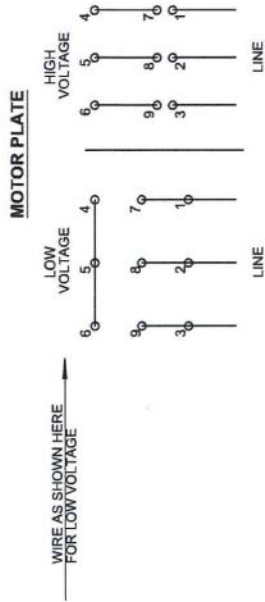
This portable filtration module requires very little preventive maintenance. The following table provides a list of those items that require checking as well as a recommended frequency.

MAINTENANCE ITEM	FREQUENCY
Verify proper motor rotation (blower should rotate counter clockwise as viewed from the motor end)	Upon wiring/rewiring motor connection
Check DP set point for zero set point	At start-up
Change filters	As stated in Sec. VI

IX. SPARE PARTS MATRIX

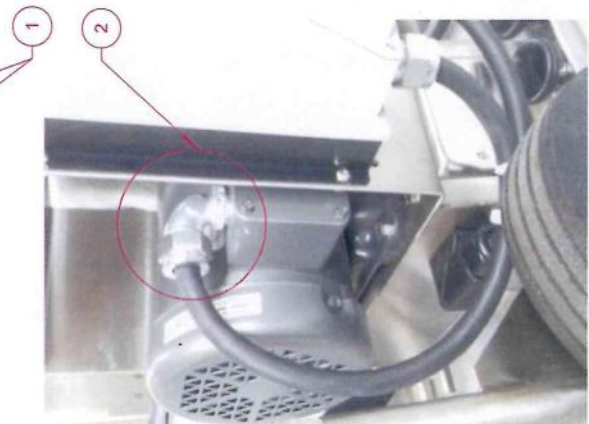
DESCRIPTION	PART NO.	REQ'D QTY	NOTES
Blower/Motor PB-9 Arrangement 4, 5" inlet CCW Rotation, TH Discharge, 9-3/4 x 2-7/8	C101868	1	Spare
HEPA Filter	AK78	1	Spare
Prefilter	AK66	1	Spare
Minihelic Differential Pressure Gage	AR13	1	Repair
Variable Speed Drive	C102122	1	Spare
Inlet Adapter, 6" Flex Duct. For BF13 Filter Module	CR25	1	Optional
Inlet Adapter, 4" Flex Duct. For BF13 Filter Module	CR26	1	Optional
Power Cord for Power Module (FM39)	C102333	1	Repair
Starter	C103631	1	Repair

X. ELECTRICAL WIRING DIAGRAM



BILL OF MATERIALS

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	C103647	CORD GRIP STRAIGHT 1/2 NPT, ZINC PLATED STEEL
2	1	C103648	CORD GRIP 90 DEGREE ELBOW 1/2 NPT, ZINC PLATED STEEL
3	1	C102333	CORD WITH NEMA 5-15P PLUG (MOLDED) 14/3 SOOW 90C BLACK
4	1	C102865	CORD, 14/4 SOOW



XI. VFD PROGRAMMING

All VFD parameters are the manufacturer's default settings except for the following:

P102 — 12 Hz.

P108 — 62%

P300 — 1

P302 — 230V

P303 — 2.6A

P305 — 3450

Refer to the operating instructions for more details on the VFD provided with this unit.

XII. WARRANTY

Radiation Protection Systems, Inc. (RPS) warrants that the supplies delivered hereunder will be free from defects in workmanship and materials and will conform to applicable specifications invoked in this agreement. Subject to the limitations set forth below, RPS agrees to replace or correct within a reasonable time frame and without expense to the Buyer any supplies not conforming to the foregoing requirements when notified by Buyer thereof during a period of 12 months after delivery, provided that if the supplies have become radiologically contaminated, the Buyer will perform at its own expense any decontamination which may reasonably be required by RPS so that repair or replacement can be effected. In no event will contaminated supplies be shipped back to RPS. All returns must be authorized by RPS prior to shipment back to RPS.

This warranty excludes consumable parts, such as filter elements, bulbs, fuses, etc. during the warranty period.

Failure of the Buyer to properly complete all installation requirements, system test requirements and maintenance procedures as required by RPS via technical, operational or maintenance manuals shall release RPS from all of its obligations as herein provided.

The foregoing warranties are exclusive and in lieu of all other warranties, whether express or implied, including any warranty of merchantability or fitness for a particular purpose. Failure of the Buyer to promptly notify RPS of any such non-conformity shall release RPS from all of its obligations as herein provided. Further, any repairs or alterations to the equipment by the Buyer not authorized by RPS in advance shall release RPS from its warranty obligations. Any defects or damage resulting from abnormal use, misuse, abuse, or normal wear and tear are not covered under this warranty and shall be the responsibility of the Buyer. This warranty applies only to the extent that any equipment or process furnished hereunder is in accordance with Seller's goods regularly sold and not (a) supplied according to Buyer's design or instructions; (b) modified to meet particular needs of Buyer; or (c) combined by Buyer with items not furnished hereunder, where such design, instruction, modification or combination is responsible for the warranty claim. The foregoing states the entire liability of Seller with respect to warranty.