

# Vertical Laminar Flow Clean Air Wet Process Fume Hood

Model NU-156 Series  
Bench Model

Operation and Maintenance Manual



- BIOLOGICAL SAFETY CABINETS
- FUME HOODS
- ANIMAL FACILITY PRODUCTS
- CO<sub>2</sub> WATER-JACKETED INCUBATORS
- POLYPROPYLENE CASEWORK
- LAMINAR AIR FLOW EQUIPMENT
- TOTAL EXHAUST SYSTEMS
- ULTRA LOW FREEZERS
- CO<sub>2</sub> DIRECT-HEAT INCUBATORS
- CUSTOM FABRICATED PRODUCTS

# **Vertical Laminar Flow Clean Air Wet Process Fume Hood**

**Model NU-156 Series  
Bench Model**

**Operation and Maintenance Manual**

**November, 2004  
Revision 7**

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## NOTICE:

This Operation and Maintenance Manual has been prepared to reflect a standard version of NU-156 Vertical Laminar Flow Clean Air Fume Hood.

NuAire offers a wide variety of polypropylene fume hoods to fit individual requirements. The FumeGard series is flexible, designed for selection with the options that meet your specific needs.

Customer or shop drawings prepared for customer approval illustrating variety, plumbing fixtures' locations, -- work surface configurations and/or other modifications required are appended to this manual.

Errata sheets illustrating any changes to maintenance procedures and/or spare parts are also included.

Any optional equipment that requires instruction, calibration or preventative maintenance is covered by a separate Operation and Maintenance Supplement.

NU-156-OM-001

**VERTICAL LAMINAR FLOW CLEAN AIR WET PROCESS FUME HOOD  
MODEL NU-156 SERIES  
BENCH MODEL  
OPERATION AND MAINTENANCE MANUAL**

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## CONGRATULATIONS!

You have just purchased one of the finest all polypropylene Vertical Laminar Flow Clean Air Fume Hoods available. With proper care, maintenance (certification), and laboratory procedure, this cabinet will give you years of product and personnel protection from particulate contaminants as prescribed in National Sanitation Foundation (NSF) Standard No. 49, as well as ASHRAE Standard 110-1995, "Personnel Protection for Fume Hoods." Please read this manual carefully to familiarize yourself with proper installation, maintenance and operation of the cabinet.

## ACKNOWLEDGMENT

NuAire, Inc. acknowledges that some material in this manual reflects information supplied by the National Institutes of Health personnel both in verbal and written specifications. In particular, NuAire acknowledges that information in Section 8 was obtained from the following source:

Technical Report No. FPS 5650000001. Prepared by Dow Chemical Co., for the National Cancer Institute, May 1, 1972.

**1.1 Proven Field Performance Reliability**

NuAire equipment is designed to meet customer requirements completely. Notwithstanding that our equipment reliability is high, we feel highly responsible for providing excellent service when needed. This consideration starts with our design wherein all control electrical components are placed in modular packages, wired with quick-disconnects. All electrical control modules can be removed and replaced easily. We can air express a new module to your site and have a malfunctioned unit operating again within 24 hours of notification.

**1.2 High Efficiency Particulate Air (HEPA) Filtration** is utilized for the supply (internal downflow) air delivery system. The HEPA filter is rated at 99.99% efficiency on removal of all particulate matter 0.3 micron with greater efficiency on larger and/or smaller particles. Five 9's or six 9's HEPA filters are also available.

**1.3 Controlled Air Flow** establishes an optimum balance between the cabinet's internal downflow, work access opening inflow velocity and the exhaust air system while:

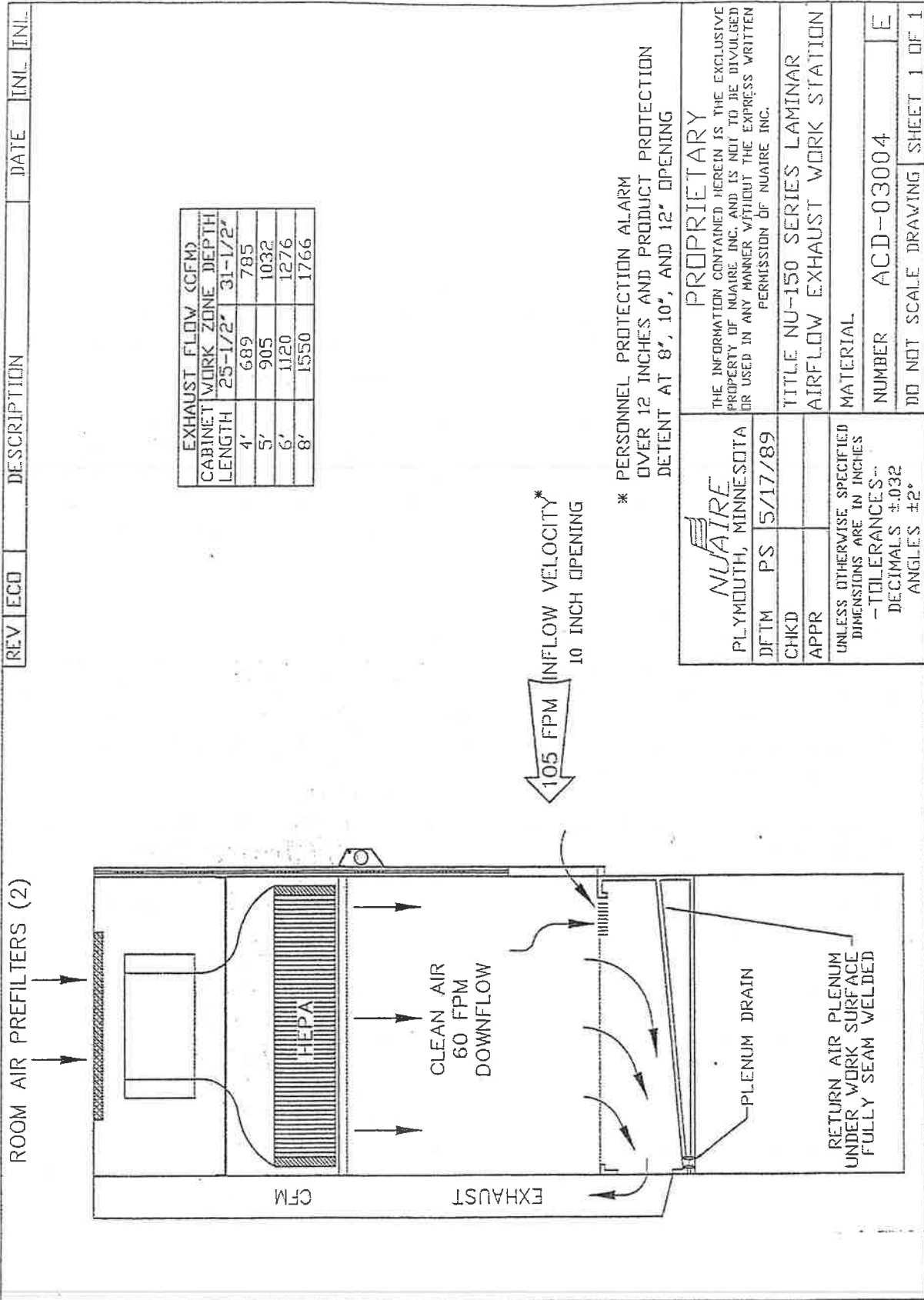
- a) Providing HEPA filtered air flowing in a unidirectional vertical downward manner through the workspace at an average velocity of 60 LFPM measured in the horizontal plane defined by the bottom edge of the viewing window frame.
- b) The work zone airflow is ducted such that the quantity of air leaving through the rear perforated area is half of the downflow air quantity. The remainder, that is the other half of the downflow air and the air entering through the work access opening flow into the front perforated area.
- c) The work access inflow velocity at 105 LFPM (.53 m/s) with a sash height of 10 inches (254mm) permits flexibility of operating sash heights from 8 to 12 inches (203 to 305mm) while maintaining the Performance Hood Rating.

**1.4 Seam Welded Polypropylene Construction** requires that the entire cabinet shell and all air ducts and plenums be leak-tight. Penetrations necessary for utilities, access panels, electrical, etc. are sealed in such a manner or contained within a negative pressure area to prevent escape of potentially contaminated air into the room.

**1.5 All Negative Pressure Interior** requires that all interior areas of the cabinet shell, under operating conditions, be maintained under negative pressure relative to the ambient room. Vents are provided for the cabinets under the work surface plenum, eliminating any buildup of fumes or vapors in the base cabinet.

**1.6 HEPEX Pressure Plenum** results in greater reliability for a continuing Class 10 Federal Standard 209d environment within the working zone of the cabinet. The air space between the HEPEX and the cabinet structure is always less than room ambient pressure which prevents any air outflow from the filter other than clean air.

The absolute filter is nested in non-flammable elastomeric foam in a manner which insures zero leak and preserves the Class 10 environment free from the rigors of shipping and moving.



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DFTM	PS	5/17/89	TITLE	NU-150 SERIES LAMINAR
CHKD				AIRFLOW EXHAUST WORK STATION
APPR			MATERIAL	
<p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES -TOLERANCES-- DECIMALS ±.032 ANGLES ±2°</p>		<p>NUMBER</p> <p>ACD-03004</p>		E
		<p>DO NOT SCALE DRAWING</p>		SHEET 1 OF 1

- 2.6 The prefilter located over the blower for the supply (downflow) air is one-inch thick, disposable, non-woven fiberglass media with a nominal efficiency of 40% by NB Test Method using atmospheric dust.
- 2.7 The fumegard uses a backward inclined motorized impeller controlled by a solid state motor speed control for the supply (internal downflow) air. The fan blades are plastic which is corrosion resistant to withstand normal laboratory or chemical fumes.

The blower/motor will automatically compensate for airflow as the filters load with particulate to achieve a fan delivery falloff of no more than 10% as a result of a 60% increase in pressure drop across the filters. With the use of the speed control, a greater than 150% increase in pressure drop across the filter is achievable.

- 2.8 The work area (see Airflow Schematic, Drawing ACD-03004) consists of the following items, going from front to back: the airfoil, the work access opening at 10 inches (254mm), the high density perforated inlet grill, the removable solid (reinforced) 1/4-inch (6mm) polypropylene work surface, high density perforated rear grill and drain spillage plenum below the work surface containing base cabinet vents. The top lip of the airfoil is 1 inch (25mm) above the removable work surface, which extends the full length and width of the work space.
- 2.9 Air is drawn through the prefilter on the top of the cabinet by the blower supplying clean HEPA filtered air down through the work space interior at 60 LFPM (.30 m/s). Fifty percent of the air leaves the work space via the perforated area in the rear and via a similar perforated area in the front along with the air drawn through the front work access opening at 105 LFPM (.53 m/s) average. All of the air is exhausted via the rear duct.
- 2.10 The motorized impeller requires 115 or 230 Vac, single phase, 50/60Hz power and will not exceed a temperature of 105°C. In a maximum ambient temperature of 48°C (120°F) under any maximum load condition. The thermal protector will not trip 115% of the rated voltage under maximum load and ambient temperature conditions. The motor is rated for 24-hour continuous operation and is lubricated for life.
- 2.11 Electrical power is supplied on two internal circuits: One for blower and lights and the other for duplex outlets from a single 20 Amp power source. All electrical components are grounded back to electrical source, to meet grounding continuity requirements for electrical safety.
- 2.12 Access panels are provided in both the interior and exterior sidewalls for access to plumbing fixtures. The panel is 1/4-inch (6mm) thick and mounted flush with the 1/2-inch (12mm) thick sidewall held in place with 8-32 polypropylene flat head screws.
- 2.13 The HEPA filter is of standard size, as a wood framed separatorless type, 99.99% efficient on all particulates, and replaceable from the front. It can be checked on site using D.O.P. smoke to establish integrity of the filter efficiency. D.O.P. is introduced into the blower compartment by removing the prefilter. A pressure probe (normally plugged at cabinet top) is used to measure the D.O.P. concentration within the HEPEX pressure plenum, if the measuring instrument requires an upstream count.



### 3.0 Model and Features

The NU-156 Vertical Laminar Flow Wet Process Fume Hood is manufactured in four standard widths: 4 ft., 5 ft., 6 ft. and 8 ft., with two standard work surface depths: 26" or 32". (See also Specification Drawing BCD-05043.)

<u>Dimensions</u>	<u>NU-156-4 ft.</u>	<u>NU-156-5 ft.</u>	<u>NU-156-6 ft.</u>	<u>NU-156-8 ft.</u>
<b>Overall Dimensions</b>				
Width (W)	48 1/2"(1232mm)	60 1/2"(1536mm)	72 1/2"(1842mm)	96 1/2"(2451mm)
Depth (D) includes duct and light	35"/41" (889mm)/(1041mm)	35"/41" (889mm)/(1041mm)	35"/41" (889mm)/(1041mm)	35"/41" (889mm)/(1041mm)
Height (H) includes prefilter grill	66-5/8" (1692mm)	66-5/8" (1692mm)	66-5/8" (1692mm)	66-5/8" (1692mm)
<b>Work Area Dimensions</b>				
Width	38 1/2"(978mm)	50 1/2"(1283mm)	62 1/2"(1588mm)	86 1/2"(2197mm)
Depth	25 1/2"(648mm) OR: 31 1/2"(800mm)	25 1/2"(648mm) OR: 31 1/2"(800mm)	25 1/2"(648mm) OR: 31 1/2"(800mm)	25 1/2"(648mm) OR: 31 1/2"(800mm)
Height	29"(737mm)	29"(737mm)	29"(737mm)	29"(737mm)

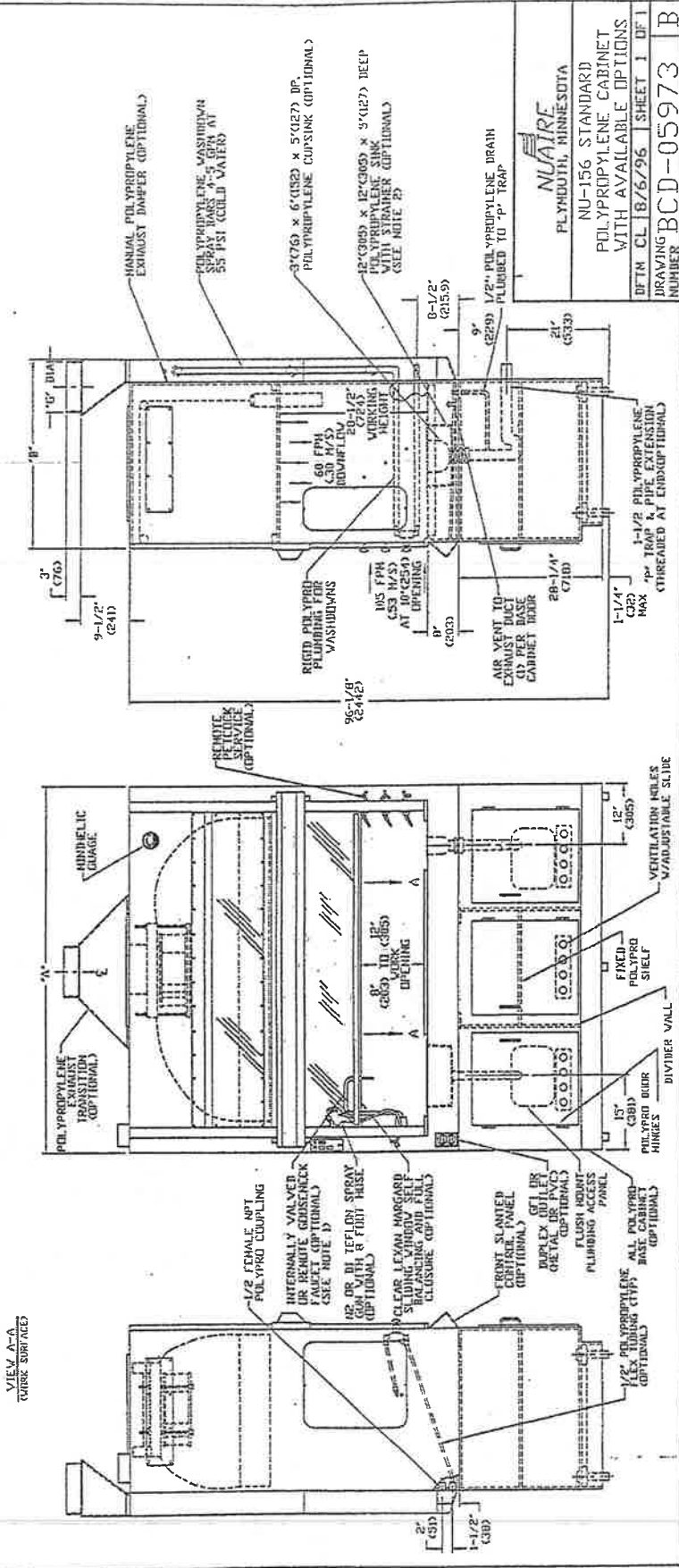
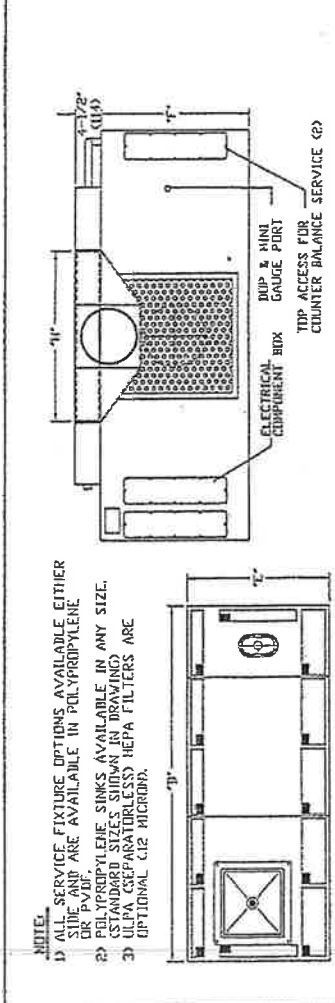
#### 3.1 Standard Features

- \*HEPEX Zero Leak Airflow System
- \*Standard HEPA Filter: Wood Frame Separatorless 99.99% Efficient on 0.3 Microns
- \*External Fluorescent Lighting
- \*Front Filter Removal
- \*Sliding View Screen: Fully Closing to 20" Open
- \*10-Inch (254mm) Work Access Opening at 100 LFPM (.51 m/s)
- \*Removable Solid Work Surface With Front and Rear Perforated Grills
- \*1/2-Inch Stress Relieved Seam Welded Polypropylene
- \*PVC Diffuser Over Supply HEPA Filter
- \*Spill Trough Plenum Under Work Surface
- \*Flush Mounted Interior and Exterior Plumbing Access Panels
- \*Plastic Motorized Impeller

#### 3.2 Optional Features

- \*Magnehelic Gauge: For Supply Pressure
- \*Remote Controlled Polypropylene/PVDF Service Fixtures
- \*Duplex Electrical Outlet, Externally or Internally Mounted
- \*12" X 12" x 5" Polypropylene Sink With Strainer and "P" Trap
- \*Ground Fault Circuit Interrupter
- \*Polypropylene or PBF Kynar Hi-Purity Plumbing
- \*Cascade Rinse Tanks, Single to Triple Tanks With Nitrogen Inlets For Improved Scrubbing Action
- \*DI, N2 Teflon Spray Guns
- \*Exhaust Monitor Alarm
- \*Exhaust Blower Interlock With Alarm
- \*Exhaust Transition 10" to 14" Round; 1/4-Inch Polypropylene
- \*99.999% Efficient HEPA Filter on 0.12 Micron (ULPA)
- \*Fully Perforated (10% Open) Work Surface
- \*Vented Base Storage Cabinet

MODEL	DIW 'A'	DIW 'B'	DIW 'C'	DIW 'D'	DIW 'E'	DIW 'F'	DIW 'G'	DIW 'H'	HEPA FILTER SIZE	TOTAL EXHAUST
NU-156-42	48-1/2" (1232)	31-1/2" (800)	30-1/2" (768)	24-3/4" (629)	25" (635)	10" (254)	24" (609)	24" X 36" X 6"	(609)X(914)X(152)	609 CFM
NU-156-43	48-1/2" (1232)	37-1/2" (953)	30-1/2" (768)	24-3/4" (629)	25" (635)	10" (254)	24" (609)	30" X 36" X 6"	(762)X(914)X(152)	705 CFM
NU-156-52	60-1/2" (1537)	31-1/2" (800)	30-1/2" (768)	24-3/4" (629)	25" (635)	10" (254)	30" (762)	24" X 48" X 6"	(609)X(1193)X(152)	905 CFM
NU-156-53	60-1/2" (1537)	37-1/2" (953)	30-1/2" (768)	24-3/4" (629)	25" (635)	10" (254)	30" (762)	30" X 48" X 6"	(609)X(1193)X(152)	1038 CFM
NU-156-62	72-1/2" (1842)	31-1/2" (800)	30-1/2" (768)	24-3/4" (629)	25" (635)	12" (305)	30" (762)	24" X 60" X 6"	(609)X(1193)X(152)	1193 CFM
NU-156-63	72-1/2" (1842)	37-1/2" (953)	30-1/2" (768)	24-3/4" (629)	25" (635)	12" (305)	30" (762)	30" X 60" X 6"	(762)X(1193)X(152)	1276 CFM
NU-156-82	96-1/2" (2451)	31-1/2" (800)	30-1/2" (768)	24-3/4" (629)	25" (635)	14" (356)	36" (914)	24" X 84" X 6"	(609)X(1193)X(152)	1593 CFM
NU-156-93	96-1/2" (2451)	37-1/2" (953)	30-1/2" (768)	24-3/4" (629)	25" (635)	14" (356)	36" (914)	30" X 84" X 6"	(762)X(1193)X(152)	1766 CFM
NU-156-93B	96-1/2" (2451)	37-1/2" (953)	30-1/2" (768)	24-3/4" (629)	25" (635)	14" (356)	36" (914)	30" X 84" X 6"	(762)X(1193)X(152)	1766 CFM



**NUAIRE**  
 PLYMOUTH, MINNESOTA  
 NU-156 STANDARD  
 POLYPROPYLENE CABINET  
 WITH AVAILABLE OPTIONS  
 DFTM CL 18/6/96 SHEET 1 OF 1  
 DRAWING NUMBER: **BCD-05973** B

## 4.0 Test Performance and Procedures

All equipment is thoroughly inspected at the NuAire factory at the time of shipment. Quality control is maintained by constant surveillance over the product, beginning at the receipt of purchased material and concluding with a final inspection which certifies cabinet performance to Federal Standard 209d, Class 10 for air quality conditions and the National Sanitation Foundation Standard No. 49 for personnel, product and cross-contamination performance as well as ASHRAE-110-1995 as it applies to personnel protection for fume hoods.

Testing procedures are derived from, and a combination of, NSF Std. #49, Institute of Environmental Sciences Standard IES-RP-CC-002-83T, "Laminar Flow Clean Air Devices", and UL Standard 1262, IEC 1010 for electrical integrity as well as any unique customer requirements. In all instances where product quality cannot be easily assessed on the end item, the product is inspected during subassembly fabrication. The following test procedures are conducted on each cabinet and a copy of the test report is included with each unit.

### 4.1 Inflow Air Velocity Measurement

(Direct Reading Instrument or Inflow Velocity Measurement)

Inflow air velocity must be calculated using the following equation:

$$\text{Inflow Air Velocity} = \frac{\text{Total Flow Volume} - \text{Downflow Volume}}{\text{Work Access Opening Area}}$$

Measure total flow volume through the work access opening using a direct reading instrument (Shortridge Flowhood ADM-870) or measured on a 4-inch (102mm) grid in two rows at 25% and 75% of the access opening height using an Anor 8500 or TSI 8355 Thermoanemometer. If using a grid measurement, the front grill should be covered to produce a more laminar airflow through the work access opening. Also, during the above procedures, the internal blower should be turned off and the inlet duct connection blocked off to assure all airflow is drawn through the work access opening. The inflow air volume quantify is sufficient to provide a calculated velocity of 105,  $\pm 5$  LFPM (.53  $\pm$  .025m/s) through the work access opening.

	<u>CFM</u>	<u>Downflow Velocity</u>	<u>Work Access Inflow Area</u>
NU-156-424	689 (1171 CMH)	60 FPM (.30 m/s)	2.67 Sq. Ft. (.248 m <sup>2</sup> )
NU-156-524	905 (1538 CMH)	60 FPM (.30 m/s)	3.51 Sq. Ft. (.326 m <sup>2</sup> )
NU-156-624	1120 (1903 CMH)	60 FPM (.30 m/s)	4.34 Sq. Ft. (.403 m <sup>2</sup> )
NU-156-824	1550 (2633 CMH)	60 FPM (.30 m/s)	6.01 Sq. Ft. (.558 m <sup>2</sup> )
NU-156-430	785 (1334 CMH)	60 FPM (.30 m/s)	2.67 Sq. Ft. (.248 m <sup>2</sup> )
NU-156-530	1032 (1753 CMH)	60 FPM (.30 m/s)	3.51 Sq. Ft. (.326 m <sup>2</sup> )
NU-156-630	1276 (2168 CMH)	60 FPM (.30 m/s)	4.34 Sq. Ft. (.403 m <sup>2</sup> )
NU-156-830	1766 (3000 CMH)	60 FPM (.30 m/s)	6.01 Sq. Ft. (.558 m <sup>2</sup> )

**NOTE 1:**

NuAire has conducted the two tests on a representative production cabinet in order to validate the design and containment properties of the design. NuAire will periodically conduct these tests as a Quality Assurance measure.

Cabinets so tested are labeled and decontaminated prior to shipment. These tests may also be conducted at customer request and expense.

All of the other above tests are conducted on each cabinet prior to shipment and a copy of the test report accompanies this Operation and Maintenance Manual.

## 7.0 Installation Instructions

### 7.1 Location

Within the laboratory, production process, etc., the ideal location for the Fumegard safety cabinet is away from personnel traffic lanes, air vents (in or out), doors and/or any other source of disruptive air currents.

If drafts or other disruptive air currents exceed the intake velocity of the cabinet through the access opening, the potential exists for contaminated air to exit or enter the work surface area of the cabinet. It depends on the severity of the air current. Remember, the Fumegard safety cabinet is no substitute for good laboratory technique. Supply makeup air should be evenly diffused into the room at a rate not to exceed 75 LFPM (.38 m/s), and never "blasted" directly at the floor.

Where space permits, it is recommended to provide a clear 12-inch (305mm) area on each side of the cabinet for maintenance purposes. The Fumegard, however, has been specifically designed to fit line to line with casework and still have access to necessary maintenance items.

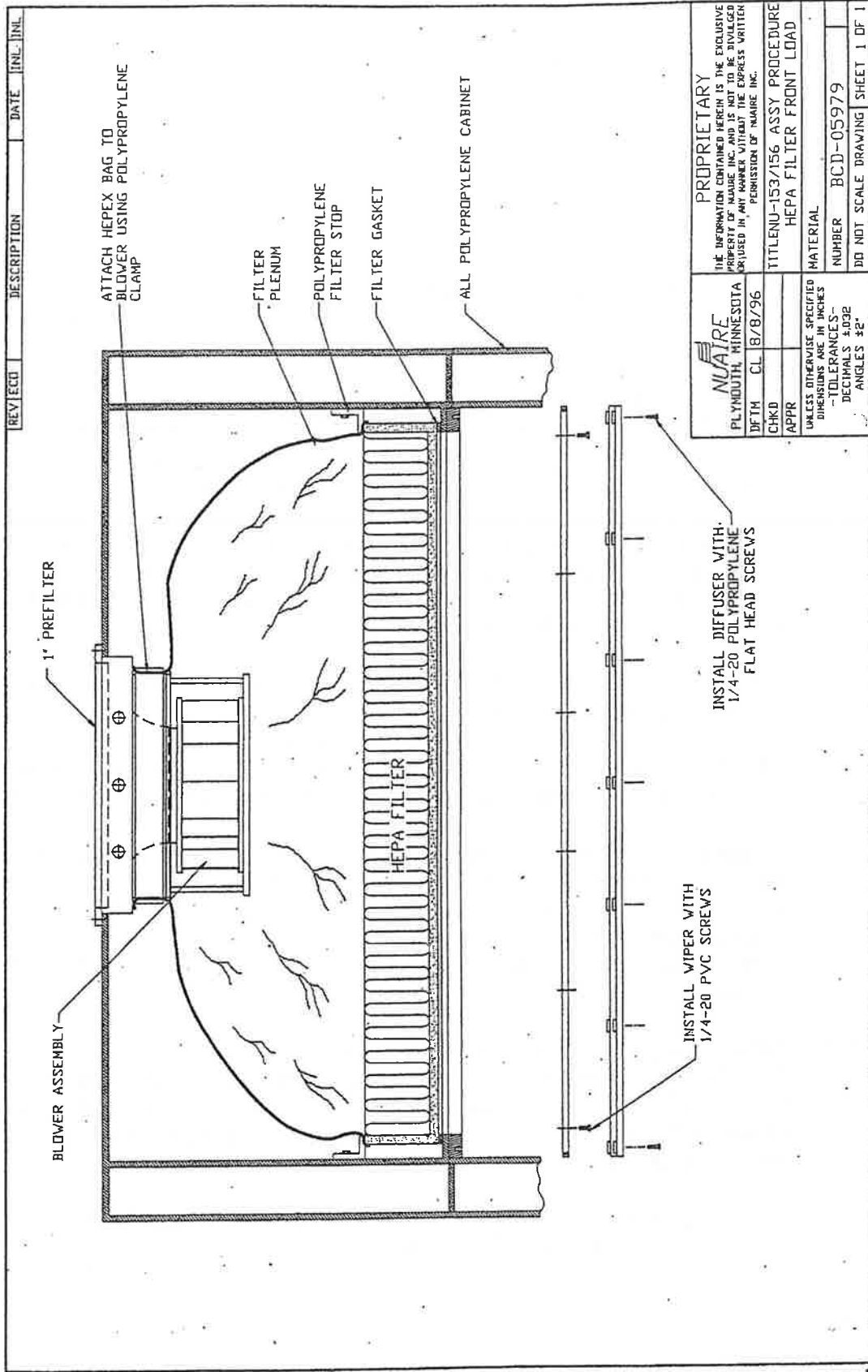
The electrical outlet into which the cabinet is connected should be readily accessible for maintenance purposes. If the outlet is inaccessible, such as a conduit (hardwired) connection, then an appropriate warning label should be applied near the cabinet's on/off switch to indicate the circuit breaker on the power distribution panel to be used.

More than any other type of safety cabinet, the NU-156 requires careful site planning and preparation, due to the total exhaust nature of the cabinet. Proper sizing of the exhaust and supply systems are critical to the successful installation of the cabinet. In addition, the cabinet provides for the choice of makeup air for the supply (downflow air). The following are airflow requirements:

	<u>Supply Air</u>	<u>Inflow</u>	<u>Exhaust Air*</u>
NU-156-424	409 CFM (695 CMH)	280 CFM (476 CMH)	689 CFM (1171 CMH)
NU-156-524	536 CFM (511 CMH)	369 CFM (627 CMH)	905 CFM (1538 CMH)
NU-156-624	664 CFM (1128 CMH)	456 CFM (775 CMH)	1120 CFM (1903 CMH)
NU-156-824	919 CFM (1561 CMH)	631 CFM (1072 CMH)	1550 CFM (2633 CMH)
NU-156-430	505 CFM (858 CMH)	280 CFM (476 CMH)	785 CFM (1334 CMH)
NU-156-530	663 CFM (1126 CMH)	369 CFM (627 CMH)	1032 CFM (1753 CMH)
NU-156-630	820 CFM (1393 CMH)	456 CFM (775 CMH)	1276 CFM (2168 CMH)
NU-156-830	1135 CFM (1928 CMH)	631 CFM (1072 CMH)	1766 CFM (3000 CMH)

\*CFM exhaust at 1.0 inches w.g. negative measured at the rectangular exhaust of the cabinet.

NuAire offers a complete selection of roof exhaust modules which have been specifically designed to support the installation of the NU-156. The module selected is dependent on the length and size of ductwork needed to connect the cabinet to the exhaust blower. Design guidelines are discussed in Section 7.2.5.



REV	ECO	DESCRIPTION	DATE	INL	INL

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DEPTH	CL	TITLE	NO.
8/8/96		NUAIRE-153/156 ASSY PROCEDURE	
CHKD		MATERIAL	
APPR		HEPA FILTER FRONT LOAD	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES -TOLERANCES- DECIMALS ±.002 ANGLES ±2°		NUMBER	BCD-05979
		DO NOT SCALE DRAWING	SHEET 1 OF 1

INSTALL DIFFUSER WITH  
1/4-20 POLYPROPYLENE  
FLAT HEAD SCREWS

INSTALL VIPER WITH  
1/4-20 PVC SCREWS

## MAKEUP AIR REQUIREMENTS

	<u>WITH SUPPLY DUCT</u>	<u>WITHOUT SUPPLY DUCT</u>
NU-156-424	280 CFM (476 CMH)	689 CFM (1171 CMH)
NU-156-524	369 CFM (627 CMH)	905 CFM (1538 CMH)
NU-156-624	456 CFM (775 CMH)	1120 CFM (1903 CMH)
NU-156-824	631 CFM (1072 CMH)	1550 CFM (2633 CMH)
NU-156-430	280 CFM (476 CMH)	785 CFM (1334 CMH)
NU-156-530	369 CFM (627 CMH)	1032 CFM (1753 CMH)
NU-156-630	456 CFM (775 CMH)	1276 CFM (2168 CMH)
NU-156-830	631 CFM (1072 CMH)	1766 CFM (3000 CMH)

- 2) Adequate plant exhaust system capability. The exhaust system is usually adequate if it can provide the rated exhaust flow at 1.0 inches water gauge negative.
- 3) Adequate supply air capability (if used). The supply air system is usually adequate if it can provide the rated supply air at 0.0 inches water gauge positive.
- 4) All duct losses must be considered in selecting the exhaust blower, for a new exhaust system (i.e. duct diameter, length and number of elbows.)
- 5) All duct work should be securely anchored to the building construction in a manner to be free from vibration and swaying under all conditions of operation.
- 6) Sheet metal gauges and seams should be in accordance with the current edition of the ASHRAE guide. A minimum of 24 gauge is required to prevent duct collapse due to high static pressure conditions, required.
- 7) All duct work should be maintained at a negative pressure within the building (i.e. externally located exhaust blower).
- 8) The exhaust blower and duct work should be a sealed system, properly vented to the atmosphere to disperse exhausted air.
- 9) The exhaust duct should be dampered. Dampers should be installed with a locking quadrant with markings to indicate damper position. A polypropylene damper system is available and is located in the upper duct extension.

### **7.2.6 Final Assembly**

The exterior surfaces and viewing window are easily cleaned with any mild household detergent using a soft cloth. Harsh chemicals, solvent-type cleansers and abrasive cleaners should not be used.

Do not attempt to clean the HEPA filter media. Cabinet interior walls or work surfaces are easily cleaned with any household detergent, using a soft cloth. The work surface is removable for access to the sloped drain plenum area for cleaning.

The interior should be thoroughly cleaned prior to use. A solution of 70% isopropyl alcohol is suitable.

## 8.0 Operating Guidelines

### 8.1 Operator Controls and Indicators

The following is a description of the controls and indicators on the instrument control panel.

#### 8.1.1 Blower Switch

The blower switch applies power to the internal blower when in the ON position.

#### 8.1.2 Indicator Light

A green neon indicator light is located above the Blower on/off switch and lights when power is applied to the blower. The lamp is rated for 20,000 hours continuous duty.

#### 8.1.3 Circuit Breaker - Blower

The blower is protected with a circuit breaker. The circuit breaker in conjunction with the blower's thermal protector is designed to open under locked rotor or half-wave power conditions. Should the circuit breaker open (pop-out button will appear), merely press to reset. If the circuit breaker continually opens, a failure has occurred in the motor or solid-state speed controller. Consult a qualified repair technician or NuAire, Inc. for replacement.

#### 8.1.4 Fluorescent/U.V. Light Switch (Optional UV Light)

This switch provides on/off control for the fluorescent light and/or the ultraviolet light (UV) if present (optional). With the UV light option, the switch provides for on center off/on operation so that both the fluorescent light and the UV light cannot be energized at the same time. When the UV light is on, proper care should be exercised.

#### 8.1.5 Outlet Switch (Optional)

This switch provides on/off control for the line power available in the outlet within the interior of the cabinet or located in either outside sidewall of the base cabinet.

#### 8.1.6 Circuit Breaker - Outlets (Optional)

The outlet located on the cabinet is protected with a separate circuit breaker. The circuit breaker may trip at 110% of load rating, but will trip at 145% of load rating in less than 2 hours. Should the circuit breaker open (pop-out button will appear), unplug the appliance plugged into the outlet and merely depress the pop-out button to reset.

#### NOTE:

If the outlet circuit breaker is not present in your model and the outlet circuit has been specifically wired as a separate circuit, the outlet rating is dependent on the branch circuit, circuit breaker at the power distribution panel.



### 8.2.2 Minimize Penetration of "Air Curtain"

The minimum number of items necessary should be placed into the cabinet to prevent overloading, but the work should also be planned to minimize the number of times an operator's hands and arms must enter and leave the air curtain at the open face. The ideal situation is to have everything needed for the complete procedure placed in the hood before starting, so that nothing need pass in or out through the air barrier at the face until the procedure is completed. This is especially important in working with moderate risk agents.

Unnecessary raising of the hands inside the cabinet above the level of the work opening should be avoided. This presents an inclined plane from hands to elbows along which the downflow of air may run, to and possibly out, the open face. When withdrawing hands from the cabinet, never use horizontal sweeping movements. Always use motions parallel to the inflow velocity - straight in, straight out.

#### NOTE:

When working with agents of lower risk, it is not as important for all materials to be placed in the cabinet before starting, or for the procedure to be completely finished before materials are removed. Also, the time period for a unit of work may be continued over a more extended period during which entries and withdrawals from the cabinet may be made.

### 8.2.3 Minimize Room Activity

Activity in the room itself should be held to a minimum. Unnecessary activity may create disruptive air currents as well as interfere with the work of the operator. A person walking past the front of a cabinet can cause draft velocities up to 175 FPM (.89 m/s), which are sufficient to disrupt the air balance of the laminar flow unit.

### 8.2.4 Utilize Unidirectional Air Flow

The operator must keep two important facts in mind: (1) The air, as supplied to the work area through filters from the top, is contaminant free and (2) airborne contamination generated in the work area is controlled by the unidirectional flow of parallel air streams in a top-to-bottom direction.

A solid object placed in a laminar air stream will disrupt the parallel flow and consequently, the capability of controlling lateral movement of airborne particulates. A cone of turbulence extends below the object and laminarity of the air stream is not regained until a point is reached downstream, approximately equal to three to six times the diameter of the object. Within the parameters of this cone, particles may be carried laterally by multidirectional eddy currents.

## 9.0 General Maintenance



191

ATTENTION ACCOMPANY'S  
INFORMATION OR IMPORTANT  
SYMBOL



188

POTENTIAL ELECTRICAL  
HAZARD ONLY QUALIFIED  
PERSON TO ACCESS

**CAUTION: All maintenance actions on this equipment must be performed by a qualified technician who is familiar with the proper maintenance procedures required for this equipment. This include both certification as well as repair.**

Normally no preventive maintenance is required on the interior of the cabinet (i.e. the area behind the access panels containing the HEPA filters and blower assembly). All required adjustments in order to maintain proper cabinet airflows are external to the cabinet interior. The blower is lubricated for life and is thermally protected with automatic reset.

The prefilter replacement interval depends on the contaminant (large particles or lint) in the room - a typical period is every three months. NuAire does, however, recommend that the Fumegard have the integrity of the HEPA filters verified by a qualified technician per Paragraph 4.3 after the unit has been initially installed. Thereafter, certification per Section 4.0 should be performed on an annual basis, or whenever the operator has reason to believe it necessary, especially if the cabinet has been moved to a new location, or the magnehelic gauge has increased by 0.1" w.g. (2.5mm w.g.), see Paragraph 8.1.8.

### 9.1 Lamp Replacement, Fluorescent

Two fluorescent slimline lamps are sealed external to the cabinet to aid maintenance and minimize heat buildup within the cabinet. The life rating of the lamp is 9000 hours based on three-hour burning cycles.

To replace a lamp it is necessary to remove the lamp fixture assembly supported by four front screws.

1. First, switch cabinet light switch off and remove the four front flat head screws.
2. With the help of another person to support the fixture, disconnect the fixture connector on the left end so the entire fixture can be laid on a bench. The bulbs are sealed behind a 1/8 inch (3mm) thick Lexan cover. Remove the 8-32 PVC screws that secure the cover to the fixture.
3. After the bulbs are replaced reverse the procedure for assembly.
4. When replacing the light fixture, be sure to tuck the electrical wiring back into the holes (i.e. cabinet interior), preventing unsightly wires from being exposed.

### 9.2 Supply Filter/Motor Replacement

The supply HEPA filter under normal usage and barring an accident (a puncture) do not need replacement until the supply volume cannot be maintained. This may permit the supply average velocity to be as low as 55 LFPM (.28 m/s), as long as no point falls below 20 percent of the average.

The supply filter for the Fumegard employs NuAire's HEPEX system.

### 9.3 Airflow Adjustments

The NU-156 airflow calibration consists of internal and external adjustments to balance the airflow within the cabinet and the calibration of the airflow monitor probes. **THIS WORK SHOULD BE DONE ONLY BY A QUALIFIED TECHNICIAN WHO CAN MEASURE THE AIRFLOW FROM THE FILTERS WITH A SUITABLE VELOMETER.** NuAire provides one internal adjustment to balance the supply airflow within the cabinet. This is:

- a. Blower speed adjustment via control system.

The blower speed control system adjusts the cabinet's supply volume of airflow while the customer supplied exhaust system controls the exhaust volume of airflow. Since it has been NuAire's experience that the filters may not "load" evenly, both adjustments are necessary for proper cabinet performance.

The cabinet is considered to be certifiable if the following airflow measurements are present:

- a. Downflow average: 60 LFPM  $\pm$ 5 LFPM (.30 m/s  $\pm$ .025 m/s).
- b. Inflow average: 105 LFPM  $\pm$ 5 LFPM (.53 m/s  $\pm$ .025 m/s) using the direct inflow measurement method or related value using the inflow velocity measurement method.

The following procedure should be used to measure the cabinet flow, in the order specified in the subsequent sections.

#### 9.3.1 Determine Total Flow

The first step is to determine the total flow available to the cabinet, in order to evaluate the proper installation (capability of the exhaust system.) The exhaust system is adequate if it can provide 1.0" w.g. (25mm w.g.) static pressure at the cabinet's rated maximum flow.

The total flow measurement procedure can be found in Table 9.1. If necessary, adjust the exhaust system to achieve the correct exhaust volume. Use Table 9.0 to relate downflow and inflow volumes and corresponding average airflow velocities. Note the internal motor/blower is turned off during the total flow measurement.

#### 9.3.2 Determine Downflow Average

The procedure for determining the downflow volume and average velocity (both quantities will have to be determined) is shown in Table 9.1, Item A. NuAire provides one adjustment to balance the downflow within the cabinet, the motor speed adjustment (see Section 8.1.7). The downflow is considered to be certifiable if the following measurements are present.

##### NOTE:

NuAire employs a permanent split capacitor motorized blower which, due to its physical properties, will automatically increase RPM as the applied load to the blower increases (i.e. the static pressure increases due to HEPA filter loading.) This results in the capacity to automatically handle a 60 percent increase in static pressure across the HEPA filter with no more than 10% drop in total flow (CFM). Therefore only a moderate motor speed adjustment may be required on an annual certification basis.

## 10.0 Electrical/Environmental Requirements

### 10.1 Electrical

NU-156-424/430, 115 VAC, 60 Hz, 1 Phase, 4 Amps  
NU-156-524/530, 115 VAC, 60 Hz, 1 Phase, 6 Amps  
NU-156-624/630, 115 VAC, 60 Hz, 1 Phase, 6 Amps  
NU-156-824/830, 115 VAC, 60 Hz, 1 Phase, 12 Amps  
NU-156-424E/430E, 230 VAC, 50 Hz, 1 Phase, 5 Amps  
NU-156-524E/530E, 230 VAC, 50 Hz, 1 Phase, 5 Amps  
NU-156-624E/630E, 230 VAC, 50 Hz, 1 Phase, 5 Amps  
NU-156-824E/830E, 230 VAC, 50 Hz, 1 Phase, 6 Amps

### 10.2 Operational Performance (for indoor use only)

Environment Temperature Range: 60°F-85°F (15°C - 30°C)  
Environment Humidity: 20% - 60% Relative Humidity  
Environment Altitude: 6562 Feet (2000M)

### 10.3 Light Exposure

Standard Fluorescent Lighting @ 150 ft. candles (1614 LUX) maximum intensity.

### 10.4 Installation Category: 2.0

Installation category (overvoltage category) defines the level of transient overvoltage, which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II, which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500 V for a 230 V supply and 1500 V for a 120 V supply.

### 10.5 Pollution Degree: 2.0

Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.

### 10.6 Chemical Exposure

Chemical exposure should be limited to antibacterial materials used for cleaning and disinfecting. Chamber decontamination can be accomplished by paraformaldehyde, vapor phased Hydrogen Peroxide or Ethylene Oxide without degradation of cabinet materials.

### 10.7 EMC Performance (classified for light industrial)

Conducted Emissions: CISPR 11, Class B & EN55011  
Radiated Emission: CISPR 11, Class B & EN55011  
Radiated Immunity: EN50082-1, IEC 801-3, Level 2  
ESD Immunity: EN50082-1, IEC 801-2, Level 2  
EFT/BURST Immunity: EN5082-1, IEC 801-4, Level 2

(Note: The EMC performance requirements are generated within the product enclosure. The enclosure will be all metal grounded to earth.

<u>Parameter</u>	<u>Minimum Acceptable Flow</u>	<u>Stated Average Flow</u>	<u>Maximum Acceptable Flow</u>
<u>NU-156-430</u>			
1. Inflow Avg. Velocity	100 FPM (.51 m/s)	105 FPM (.53 m/s)	110 FPM (.56 m/s)
2. Inflow Volume	270 CFM (459 CMH)	280 CFM (476 CMH)	294 CFM (500 CMH)
3. Down Avg. Velocity	55 FPM (.28 m/s)	60 FPM (.30 m/s)	65 FPM (.33 m/s)
4. Down Volume	463 CFM (787 CMH)	505 CFM (858 CMH)	547 CFM (929 CMH)
5. Total Volume	733 CFM (1245 CMH)	785 CFM (1334 CMH)	841 CFM (1429 CMH)
<u>NU-156-530</u>			
1. Inflow Avg. Velocity	100 FPM (.51 m/s)	105 FPM (.53 m/s)	110 FPM (.56 m/s)
2. Inflow Volume	355 CFM (603 CMH)	369 CFM (627 CMH)	386 CFM (656 CMH)
3. Down Avg. Velocity	55 FPM (.28 m/s)	60 FPM (.30 m/s)	65 FPM (.33 m/s)
4. Down Volume	608 CFM (1033 CMH)	663 CFM (1126 CMH)	718 CFM (1220 CMH)
5. Total Volume	959 CFM (1629 CMH)	1032 CFM (1753 CMH)	1104 CFM (1876 CMH)
<u>NU-156-630</u>			
1. Inflow Avg. Velocity	100 FPM (.51 m/s)	105 FPM (.53 m/s)	110 FPM (.56 m/s)
2. Inflow Volume	435 CFM (739 CMH)	456 CFM (775 CMH)	477 CFM (810 CMH)
3. Down Avg. Velocity	55 FPM (.28 m/s)	60 FPM (.30 m/s)	65 FPM (.33 m/s)
4. Down Volume	752 CFM (1278 CMH)	820 CFM (1393 CMH)	889 CFM (1510 CMH)
5. Total Volume	1187 CFM (2017 CMH)	1276 CFM (2168 CMH)	1366 CFM (2321 CMH)
<u>NU-156-830</u>			
1. Inflow Avg. Velocity	100 FPM (.51 m/s)	105 FPM (.53 m/s)	110 FPM (.56 m/s)
2. Inflow Volume	605 CFM (1028 CMH)	631 CFM (1072 CMH)	661 CFM (1123 CMH)
3. Down Avg. Velocity	55 FPM (.28 m/s)	60 FPM (.30 m/s)	65 FPM (.33 m/s)
4. Down Volume	1041 CFM (1769 CMH)	1135 CFM (1928 CMH)	1230 CFM (2090 CMH)
5. Total Volume	1646 CFM (2797 CMH)	1766 CFM (3000 CMH)	1891 CFM (3213 CMH)

**B. Inflow Measurement**

**a. Primary Procedure:**

The primary procedure to determine inflow velocity uses a Direct Inflow Measurement (DIM) Instrument (i.e. Shortridge Flowhood). The DIM Instrument can be used directly on the cabinet with NO CORRECTION FACTORS REQUIRED. The DIM Instrument should be equipped with a flowhood that is as close as possible to the width of the cabinet (i.e. NU-156-424 should use 1 x 4 foot flowhood). The DIM Instrument should also be duct taped to the cabinet to prevent any sneak air paths from occurring. The cabinet supply duct connection should also be blocked off to assure all airflow is directed through the window access opening.

The DIM Instrument will read exhaust volume (i.e. CFM). Use Tables 9.0 and 9.1 to calculate inflow velocity.

**b. Alternate Procedure:**

The alternate procedure to determine inflow velocity is as follows. The inflow velocity is measured on a grid scale in the plane of the access opening. Readings taken at least 4 inches (102mm) from sides of window access opening and in to rows at 25% and 75% of the access opening height. Also, the front grill should be removed and the work tray inverted and placed at the front of the work zone. So, the exhaust airflow will be taken from the rear of the work zone, thus producing a more laminar airflow through the window access opening.

4 ft	4 (102)	7.812 (198)	11.625 (295)	15.438 (392)	19.250 (489)	23.062 (586)	26.875 (683)	30.688 (779)	34.5 (876)				
5 ft	4 (102)	7.863 (200)	11.725 (298)	15.589 (396)	19.450 (494)	23.312 (592)	27.175 (690)	31.038 (788)	34.901 (886)	38.764 (985)	42.625 (1083)	46.500 (1181)	
6 ft	4 (102)	7.893 (200)	11.786 (299)	15.679 (398)	19.572 (497)	23.465 (596)	27.358 (695)	31.250 (794)	35.144 (893)	39.037 (992)	42.930 (1090)	46.823 (1189)	
8 ft	4 (102)	7.925 (201)	11.850 (301)	15.775 (401)	19.700 (500)	23.625 (600)	27.550 (700)	31.475 (800)	35.400 (900)	39.325 (998)	43.250 (1098)	47.175 (1198)	
2.5													
7.5													

6 ft (CONT)	50.716 (1288)	54.609 (1387)	58.500 (1486)										
8 ft (CONT)	51.100 (1298)	55.025 (1398)	58.950 (1497)	62.875 (1597)	66.800 (1697)	70.725 (1796)	74.650 (1896)	78.575 (1996)	82.5 (2096)				

**TABLE 9.1 CONTINUED**

**C. Work Access Inflow Velocity**

The horizontal vector of the inflow velocity (perpendicular to the access opening) is calculated as follows:

$$\text{Air Barrier Velocity} = \frac{\text{Exhaust CFM} - \text{downflow CFM}}{\text{Work Access Opening (sq. ft.)}}$$

**NOTE:**

The downflow CFM equals the work zone cross-sectional area times the average downflow velocity established by the performance test in Section 4.3.

## 11.0 Optional Equipment

### 11.1 Ground Fault Circuit Interrupter

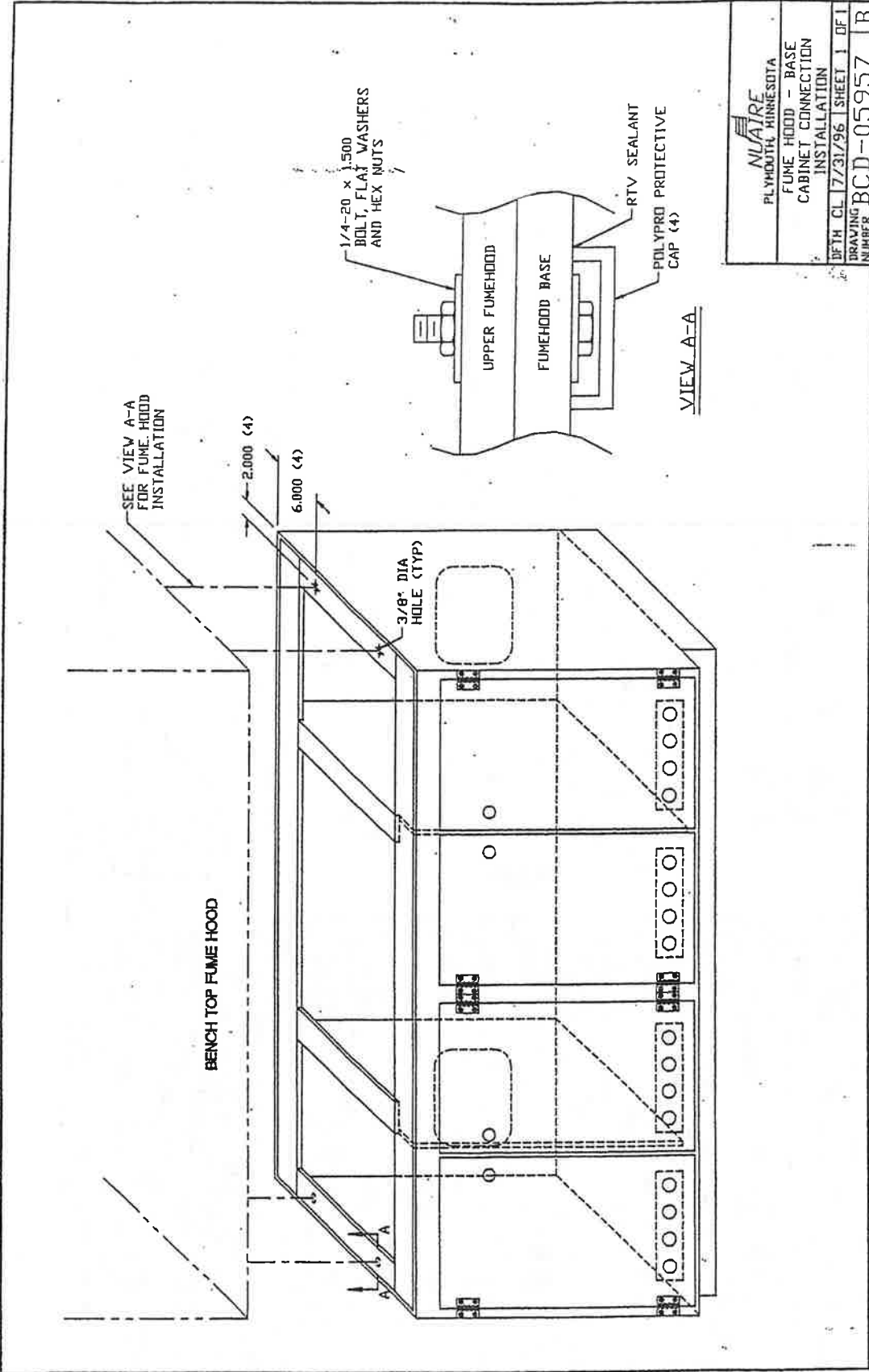
The duplex outlet may be wired with a Ground Fault Interrupting circuit (GFI). The GFI sensor detects a "leakage" of five milliamperes or greater between power and ground and interrupts current flow in 1/40 of a second; fast enough to prevent injury to personnel.

The GFI duplex contains a "reset" button that pops out, showing a red line which indicates that power to the protected circuit has been discontinued. The GFI circuit should be tested at least once a month for maximum protection against electrical shock hazard.

- To Test:
1. Push "test" button. The "reset" button should pop up, showing a red line which indicates that power to the protected circuit has been discontinued. The GFI circuit should be tested at least once a month for maximum protection against electrical shock hazard.
  2. If the "reset" button does not pop up when the test button is pushed, a loss of ground fault protection is indicated. Do not use, call a qualified electrician.
  3. To restore power, push the "reset" button.

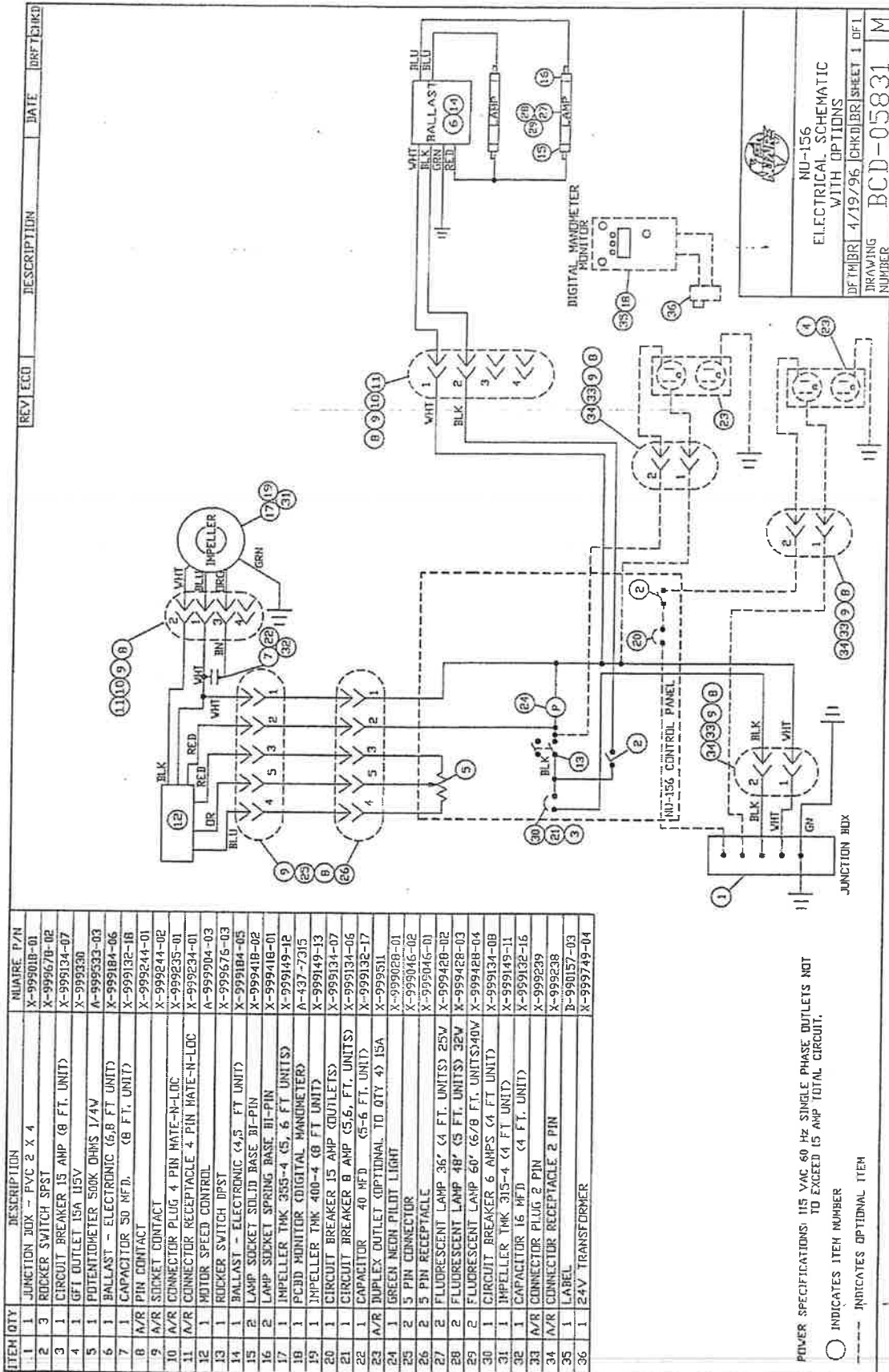
The GFI is so dependable that the Fumegard can be used to verify the integrity of electrical circuitry in any appliance simply by plugging it into a Fumegard electrical outlet.

Each GFI is thoroughly tested prior to shipment.



PLYMOUTH, MINNESOTA	
FUME HOOD - BASE	
CABINET CONNECTION	
INSTALLATION	
DFTH CL 7/31/96	SHEET 1 OF 1
DRAWING NUMBER	BCD-05957
	B





NU-156  
ELECTRICAL SCHEMATIC  
WITH OPTIONS

DATE: 4/19/96  
DRAWING NUMBER: BCD-05831

REV | ECO | DESCRIPTION | DATE | DRPT/CHKD



*NuAire Incorporated*  
2100 Fernbrook Lane, Plymouth MN 55447  
Tel: 800-328-3352 Fax: 763-553-0459

## **Warranty for Polypropylene Products**

NuAire, Inc. warrants that it will repair FOB its factory, or furnish without charge FOB its factory, a similar part to replace any material in its equipment within 12 months after the date of sale, if proved to the satisfaction of the company, to have been defective at the time it was sold, provided that all parts claimed defective shall be returned, properly identified to the company at its factory, charges prepaid.

Factory installed equipment or accessories are warranted only to the extent guaranteed by the original manufacturer, and this warranty shall not apply to any portion of the equipment modified by the user. Claims under this warranty should be directed to NuAire, Inc. setting forth in detail the nature of the defect, the date of the initial installation and the serial and model number of the equipment.

This warranty shall not apply to any NuAire product or part thereof which has been subject to misuse, abuse, accident, shipping damage, improper installation or service, damage by fire, flood, or acts of God. If the serial number of this product is altered, removed or defaced as to be illegible, the warranty shall be null and void in its entirety.

The warranty is for the sole benefit of the original purchaser and is not assignable or transferable.