HOWORTH EXFLOW 90-5

howorth-usa

Technical Data - Integral Fan Unit

Unit Size -	147 ¼ x 147 ¼ x 24 in.
Total Weight -	3800 lbs.
Extended Clean Zone -	14’ x 14”
Power Consumption -	4.5 KW Operating speed 2.2 KW Standby speed
Diffuser Height Range -	From 96 in. to 114 in. from FFL
Partial Walls -	Clear acrylic cut to establish bottom edge at 78 in. from FFL
Fans -	Four (4), forward curved, variable speed DWDI.
Minimum Dimension from FFL to Bottom of Transverse Beam -	124 in.
Air Velocity -	100 fpm central zone 80 fpm mid-zone 60 fpm perimeter Average velocity measured 78 in. FFL
Air Velocity measured at 40 in. FFL -	39 fpm (minimum) in critical zone
Air Diffuser -	Baked powder coat finish
Return Inlets -	Baked powder coat finish
Prefilters -	85% Efficiency
Primary Filters -	99.997% HEPA
Supply Air Requirements -	800 cfm (minimum) 2000 cfm (optimum)

HOWORTH EXFLOW 90-5

Supply Air Temperature -	Refer to Heat Gain Formula
Sound Pressure - (@ 3 ft. above FFL)	50-55 dBa
Electrical Requirements	
Fans & Power Dist. Panel -	220 or 208v/l phase/60 Hz 45 amps
Control Panels -	24 volts AC (internally generated)
Power -	7 KW
Integral Lighting Intensity -	500 LUX at 39 in. from FFL
Sprinkler Head -	Within canopy frame

SECTION 1 GENERAL

1.01 Description of Work

A. This section describes the design, supply and erection of one (1) Ultra Clean Ventilation (U.C.V.) System designed with ***EXPONENTIAL AIRFLOW***.

1.02 Related Work Pertaining To Other Specifications

A. Testing and Inspection Services
B. Facility Access and Protection
C. Ductwork
D. Chilled Water Piping
E. Electrical Wiring (208V)
F. Control Wiring (24V)

1.03 Submittals

A. The following information is to be submitted to the design professional prior to the release of any equipment for fabrication.

1. Product performance data for fans, filters, lighting, exponential airflow distribution.
2. Detail drawings of electrical, piping, ductwork and control requirements.

B. Proposed certification and testing agency for approval with qualifications listed.

1.04 References, Codes and Standards

A. HTM 2025
B. American Federal Standard 209e - Class 100
C. National Electrical Code
D. Underwriters Laboratory Standard 867
E. National Fire Protection Association
F. ISO 9001

1.05 References, Codes and Standards

A. The U.C.V. system shall be a product of an established manufacturer with installations in successful operation for a minimum of 10 years.

B. A representative from the manufacturer must be available to review installation of the U.C.V. to ensure the product is being installed in accordance with manufacturers' recommendations.

C. The services of a qualified party shall certify the velocity profile and filtration performance of the system.

SECTION 2 PRODUCTS

2.01 Design and Performance Criteria

A. GRADED VELOCITY EXPONENTIAL AIR FLOW

The performance of the U.C.V. system shall operate with exponential airflow characteristics. The unique graded airflow pattern shall have greater velocity in the central zone reducing concentrically to the perimeter.

The outward curving airflow generated by the Exflow shall provide protection to prevent entrainment in the Ultra Clean Zone (U.C.Z.) (110 x 110") and provide additional protection over instrument tables up to 30" beyond the U.C.Z., which is 7' – 1" from the center line of the table.

B. AIR VELOCITY PROFILE

1. Average air velocities measured 78" from Finished Floor Level (F.F.L.) shall be as follows:

	(APPROXIMATE) OPERATIONAL SPEED
Center of U.C.Z.	100 fpm)
Perimeter of U.C.Z.	60 fpm)
Between Center/Perimeter	80 fpm)

2. Measured 40" from F.F.L., the air velocity will not be less than 39 fpm within the central operating (clean zone) zone 78 x 78".

C. TEMPERATURE AND HUMIDITY PERFORMANCE

Desired operating room temperatures must be factored into the Heat Gain Formula (page 11) in order to achieve the optimum setting for surgery.

2.02 Mechanical Requirements

A. A schematic representation of the self-contained Exponential Ultra Clean Air System to be installed is indicated on the drawings.

Each system shall include the supply fans, sound attenuated supply air plenums, exponential stainless steel diffuser, return air plenums, prefilter housing, HEPA filter housing, background lighting assembly and cooling coils (optional).

B. INTEGRAL FAN UNIT SPECIFICATIONS

1. The self contained U.C.V. model shall have four integral fans housed in the ceiling mounted unit with sound attenuation in each air inlet and outlet. Each self-contained fan shall be factory installed, wired and mounted.

2. Fans shall be doubled inlet, forward curved impellers and built-in external rotor, variable speed motor (single phase).

3. Electrical Characteristics:
Full load current 7.3 amps per fan
Running current 6.8 amps per fan.

4. Noise level measured in Ultra Clean Zone at 36 in. from F.F.L. 50-55 dBa dependent upon background noise level.

5. Fan horsepower is 2.4 at 208Vac, but it runs at a reduced voltage for speed control (maximum 160Vac).

2.03 Filtration Requirements

The supply air shall be filtered to the following conditions:

Primary or re-circulated air from the room shall have an average efficiency of 85% in accordance with ASHRAE standard 52-76. The pre-filters shall be located in the integral air return grilles on the U.C.V. unit for ease of replacement.

Final filtration shall include 99.997% H.E.P.A. (high efficiency particulate air) filters. The final filters are to be installed in the U.C.V. unit immediately above the outlet diffusers.

A flush mounted magnahelic pressure gauge shall be installed in the U.C.V. unit to monitor the condition of the H.E.P.A. filtration section.

2.04 Air Diffuser

A. A multi-stage, graded air flow diffuser, constructed from perforated, matte finish stainless steel panels, is to be suspended directly below the final

H.E.P.A. filters. The diffuser shall be secured by quick release catches for easy removal of filters for change outs and cleaning.

B. The diffuser shall provide exponential airflow, which creates a concentrically graded airflow profile.

2.05 Return Air Inlets

Two inlet grilles shall be installed in the return air inlets of each quadrant of the U.C.V. unit. The grilles shall hinge downward for access to the prefilters.

2.06 Unit Construction

The U.C.V. unit shall be constructed from welded, mild steel sheets in four separate sections to fit around the operating room light stem. The four sections shall be bolted together and secured to the mounting frame on site. Support the U.C.V. by threaded rod or bolt directly to the slab or steelwork.

2.07 Finish

Polyester powder coated. Standard color RAL 9010 60% gloss.

2.08 Outside Air Inlets

Four openings shall be provided into the fan mixing chambers for the introduction of climate controlled outside air. The openings shall be located on the top or the sides of the unit depending on primary air inlet configuration.

2.09 Perimeter Lighting

Eight (8) integral color corrected fluorescent light fixtures shall be recessed into the U.C.V. unit perimeter. Each shall contain two (2) 48'' bulbs for a total of sixteen (16) bulbs. A lighting level of 500 LUX within the ultra clean zone, 39 in. from F.F.L., will be provided. Lighting controls are located in the Exflow Theatre Control Panel.

2.10 Plumbing Requirements

(See Medical Gas and Sprinkler Plans)

2.11 Control Requirements

The U.C.V. unit control panel (24 volt) shall be flush mounted into a prepared opening in the operating room wall. This shall contain the standard user controls i.e. standby/operational speed button, emergency stop button, system fault warning light, perimeter light switch and lamp test switch.

Additional options include body exhaust system controls, audio system controls, operating lamp controls as required.

2.12 Electrical Requirements

Power distribution cabinet for the U.C.V. unit and associated optional equipment shall contain all fuses, terminals, contactors, relays, transformers, etc. with external malfunction warning lights. It shall be surface mounted to the wall in the most convenient location within 50 feet of the operating room as located by the owner. Integral fan model shall include four speed control switches for the four integral fans operational/standby speed indicator, individual fan fail warning lights and dirty filter indicator.

220V or 208V/ I phase/ 60 Hz/ 45 amp. Coordinate all voltages with electrical contractor.

2.13 Unit Construction Details

A. The overall U.C.V. unit size shall be 147 x 147 x 24 in. deep. The unit can be surface mounted or recessed into the ceiling void. Reference mechanical and architectural drawings for ceiling detail.

B. The clear, partial acrylic walls (0.3936” thick) suspended from the underside of the U.C.V. unit shall terminate 78 in. from Finished Floor Level (F.F.L.).

C. Discharge area within the clear partial walls size shall be 110 x 110 in.

C. Diffuser height measured from its underside must be located between 96” and 114” from F.F.L., subject to local conditions and the operating lamp selected. Reference architectural and mechanical drawings.

2.14 Optional Accessories

A. HOWORTH BODY EXHAUST FAN SYSTEM

Provide a remote fan unit containing the exhaust fan motor in a sound attenuated mild steel casing to be located in accordance with the mechanical

drawings. The unit shall have a factory installed volume control damper for air pressure regulation.

B. BODY EXHAUST PENDANTS

Two BEX pendants shall be furnished, manufactured in mild steel, powder coated to match the U.C.V. unit mounted at opposing left and right side mid-points of the Exflow return air grille networks. Each pendant shall contain, mounted within its underside plate, three (3) spring loaded bayonet valves for connection (via flexible tubes) to surgical helmets and body exhaust shoulder loops, worn under surgical gowns. Five (5) lightweight flexible tubes will be supplied with connectors at both ends.

C. HOWORTH BODY EXHAUST AUDIO INTERCOM SYSTEM

The system shall consist of one eight-channel amplifier wired to sockets on the BEX pendants into which individual helmet tubes are plugged. The system shall be pre-wired.

Two loudspeakers shall be installed within the U.C.V. unit for general communication. This audio system is recommended when using the Charnley helmet BEX system.

D. MEDICAL GAS PENDANTS

Internally mount pendants at mid-way along opposing sides of the U.C.V. unit within the return air grille networks at the head and foot of the operating table according to the operating table orientation.

All medical gas pendants shall be manufactured in mild steel, powder coated to match the U.C.V. unit, having as standard four twin socket, 13 amp switched power outlets, satin chrome finish, all wired to terminals at the top of the pendant housing, internal mounting plate with fixings to accept up to six gas/vacuum outlet valves. Provide pendant pre-piped to terminate 12 inches above the unit. Underside cover plate shall be brushed stainless terminating at customer specified height from F.F.L.

E. OPERATING LAMPS

The manufacturer shall be consulted prior to selection of an operating lamp to be mounted beneath the U.C.V. unit to ensure compatibility and optimization of the airflow. Lamp controls are optional.

PART 3 - EXECUTION

3.01 Assembly and Installation

A. Installation must be completed in accordance with manufacturers' recommendations and installation manual.

B. All interconnecting wiring, conduit and integral power wiring shall be done by the mechanical installing contractor. Single point of power connection will be completed by the electrical contractor.

C. All work shall be assembled in a substantial workmanship manner in accordance with the specifications submitted and by the satisfaction of the owner, architect and engineer.

D. Final cleaning and sterilization shall be done by the contractor. The installation contractor assumes responsibility to meet clean air requirements in accordance with component cleaning instructions as outlined in the Installation, Operation and Maintenance Manual.

E. Filters should be stored in a clean environment prior to installation.

3.02 Testing

A. The installation contractor will ensure that the U.C.V. system passes the following tests:

1. Velocity profile test. Achieve all velocities as outlined in this specification.
2. Airborne particulate clean class test. Exceed Class 100 of the Federal Standard 209E.
3. Air balancing.
4. Noise level test.
5. Temperature and humidity uniformity test.
6. Check for excessive vibration.
7. Verify all electrical components and controls are functioning properly.
8. Body Exhaust System negative pressure test.

3.03 Training

A. Provide training by a factory authorized representative
B. Provide six operating and maintenance manuals.

EXFLOW HEAT GAIN FORMULA

1. The Exflow clean zone system generates **3.5Kw** of heat. This is given up into the theater room and must be removed by providing conditioned supply air into the Exflow from the main air-handling unit.

2. We normally supply about **2000 CFM at 10^{0}C (50^{0}F)** to remove heat generated by the Exflow and other sources in the theater (lights, people, equipment etc.).

   The quantity of supply air and its temperature may be varied such that, if you reduce air volume, you must reduce its temperature and vice versa.

   The following equation may be used.

$$\mathbf{V\ (CFM)} = \frac{\mathbf{Q}}{\mathbf{(Tr - Ts)}} \times \frac{\mathbf{273 + Ts}}{\mathbf{358}} \times \mathbf{2119}$$

   Where
   V = Supply Air in CFM
   Q = Heat gain in theater expressed in Kilowatts (Exflow @ 3.5Kw + lights + people + equipment + walls, floors and ceilings)
   Tr = Room temperature °C must **be determined by surgical staff**
   Ts = Supply air temperature °C

3. The quantity of air you need to supply to your theater depends on how much heat is generated in the theater, but generally the Exflow must receive at least **1600 CFM**. Use the above equation to determine an acceptable supply CFM and supply temperature.

   For example:

   Use a maximum figure for heat gain in the OR theater during procedures to be **5.0 kW** (i.e. heat from people, walls, roof, floor, windows, lights, equipment).

   Add to this, heat gain from Exflow @ **3.5Kw** making total of **8.5Kw**.

   Assuming air conditioning plant can cool supply air down to 10°C (i.e. Ts = 10°C).

   Assuming room temperature required by surgical staff = **Tr = 17°C**.

   Then air volume required:

$$\mathbf{V} = \frac{\mathbf{8.5}}{\mathbf{17 - 10}} \times \frac{\mathbf{273 + 10}}{\mathbf{358}} \times \mathbf{2119} = \mathbf{2034CFM}$$