UNIVERSITY OF WISCONSIN-MADISON
SPECIFICATION UW-MDN-10-CAD-2020
GENERAL PURPOSE CLEAN AIR DEVICE

A STAND ALONE WORK ENCLOSURE DESIGNED FOR ISO CLASS 5 PRODUCT PROTECTION WORKZONE AIRFLOW IS PARTIALLY RECIRCULATED AND THE REMAINING PORTION SIMULTANEOUSLY DISCHARGED INTO THE ROOM ATMOSPHERE

AIRFLOW RECIRCULATED

SPECIFICATION OUTLINE

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1.0 SCOPE, OBJECTIVE, CLASSIFICATION, INNOVATIVE DESIGN, DEFINITIONS

1.1 Scope This performance and hardware specification covers clean air devices designed with internal fan/motor systems in which a portion of the airflow is re-circulated within the cabinet workspace. Integral with the fan/motor system is a high efficiency particulate air filtration system designed with efficiency such that particulate-free air is produced in the work zone and simultaneously discharged to the surrounding atmosphere. This device does not provide occupational or environmental protection. Therefore, only non-hazardous work where the product must be manipulated in a particle free zone shall be done. An optional germicidal fixture is available under restricted use conditions. Please consult the University Agent or Industrial Hygienist before purchase for additional information on allowable practices in this device are required. It is recommended that the cabinet user develop a Standard Operating Practice (SOP) to ensure compliance to non-hazardous practices and appropriate practices to be followed.

1.2 Objective The objective of this document is to provide University specifications for the procurement of clean air devices designed with a contaminated positive pressure plenum which is contiguous to the ambient environment via a sealed metal barrier. The complete unit shall be listed as certified by Canadian Standards Association (CSA) and/or Underwriters Laboratories (UL) for electrical safety and integrity.

1.2.1 Noncompliance Clean air devices which have been selected from the competitive bidding process and delivered to the University shall conform to the specifications and standards cited in this document. In the event that the delivered cabinet does not conform to these requirements, the supplier shall be contacted by the university agent to arrange for rectification of any identified non-compliance requirement either in performance and/or construction specification not agreed to by the owner and supplier.

1.3 Classification The clean air devices covered by the specification shall be of the following sizes:

1.3.1 Sizes

1.3.1.1 Two foot cabinet

1.3.1.2 Three foot cabinet

1.3.1.3 Four foot cabinet

1.3.1.4 Five foot cabinet

1.3.1.5 Six foot cabinet

1.3.1.6 Eight foot cabinet

1.3.2 Style The Clean Air Devices covered by the specification may be specified in a console (floor standing) or bench top model.

1.3.2.1 Console unit is a free standing unit which will rest directly on the floor, the blower system is below the work surface.

1.3.2.2 Bench unit is a unit which may be located on a laboratory bench or requires an under structure to rest upon.

1.4 Innovative Design It is the intent of this specification to limit the purchase of Clean Air to units with a demonstrated record of safety, performance, and maintainability at the time of this writing. The University recognizes that these specifications may limit new technology development in the future and is prepared to review design changes which would be outside the boundaries of the following specifications as currently written. If a selected supplier chooses to revise a clean air device during the duration of the contract and the University is convinced that an innovative design is acceptable via impartial testing results and/or review, a written variance to these specifications may be granted and specifications revised. Therefore, a selected supplier contemplating changes in the clean air devices which will conflict with the specifications as written is

invited to submit documentation to the University for “innovative designs” consideration. Changes in cabinet design will be reviewed and an approval issued prior to fabrication of University clean air devices.

1.4.1 Any conflict with the specifications contained herein during the competitive bidding process, using innovative design(s), shall be identified by each bid proposal per each subsection of the specification with a justification of the innovative design(s) in terms of better safety, performance and maintainability. The University may review said changes, but expeditious approval within the bidding process period can not be guaranteed. Each bidder is encouraged to adhere to the specifications contained here in to be considered for competitive selection.

1.4.2 The cabinet design shall include ergonomic considerations in the use, maintenance and certification of clean air devices. Those suppliers that display the greatest level of human engineering mechanics and safety, sound control, ease of testing and maintenance and conformance with this specification and conservative economic product shall be considered in the bidding process.

1.5 Definitions

1.5.1 Clean Air Device, a device providing product protection for work requiring a particulate free zone, for example in electronic assembly, plant tissue culturing, pharmaceutical preparation and intravenous preparations. The work zone atmosphere shall control particles to within ISO Class 5 conditions (Class 100 per F.S. 209E). A clean air device is not a biological safety cabinet.

1.5.2 RPM, revolutions per minute

1.5.3 VAC, voltage - alternating current

1.5.4 CFM, cubic feet per minute

1.5.5 WC, water column

1.5.6 QT, total fan airflow

1.5.7 R, filter resistance, Filter resistance is the pressure drop in inches water column across a HEPA filter

1.5.8 ID, inside diameter

1.5.9 OD, outside diameter

1.5.10 Fail safe mechanism, a mechanical device which requires operator assistance to place mechanism into service and to disconnect mechanism from service.

1.5.11 PAO-4, the default aerosol challenge and test agent of choice

1.5.11.1 DOP, dioctylphthalate, acceptable alternative aerosol challenge, agent of second choice

1.5.11.2 Mineral Oil, acceptable alternative aerosol challenge, agent of third choice

1.5.12 AMCA, Air Moving and Conditioning Association

1.5.13 LFPM, linear feet per minute

1.5.13.1 SLFPM, Standard linear feet per minute, corrected to 29.92”Hg, 70 degrees F

1.5.13.2 ALFPM, Actual linear feet per minute, non-standard density

1.5.14 PEP, Positive Pressure Plenum shall be defined as any plenum which has been designed to be maintained at a pressure greater than a surrounding exterior atmosphere in order to insure the satisfactory operation of the clean air device.

1.5.15 NEP, Negative Exterior Plenum shall be defined as any plenum which has been designed to be maintained at a pressure less than a surrounding exterior atmosphere in order to insure the satisfactory operation of the clean air device.

1.5.16 NPT, national pipe thread

1.5.17 Filter velocity, the air velocity measured in the media section of the HEPA filter, in a plane projection parallel with and four inches perpendicular from the media. The perimeter of the plane projection must be offset at least three inches from any filter media obstructions.

1.5.18 Average filter velocity, the average air velocity associated with clean air devices designed with a uniform velocity distribution in the work zone.

1.5.19 HEPA (High Efficiency Particulate Air filter), a throw-away extended-media dry-type filter in a rigid frame having a maximum clean filter pressure drop of 1.0 inch water gauge at a rated airflow capacity of 180 cubic feet per minute (CFM) per square foot (SF) of media for a 5.875-inch deep filter, 35-42 pleats per lineal foot (LF), 225 CFM/SF of media for a 5.875-inch deep filter (high capacity).

1.5.20 Supplier, the supplier of the clean air device. A supplier can be the manufacturer, vender, contractor or bidder.

1.5.21 SF, square foot

1.5.22 Closure panel, the barrier between a positive or negative pressure plenum in the cabinet and the ambient environment.

1.5.23 HP, horsepower

1.5.24 Performance envelope, the range of airflow velocities in which a clean air device will produce product protection as defined at 0.5 micron particles at 100 particles per cubic foot of air sampled.

1.5.25 Barometric Pressure, BP. Local atmospheric pressure. BP unit as inches mercury.

1.5.26 Port, a resealable mechanical penetration into the cabinet interior to provide a service entrance for aerosol testing and pressure measurement

1.5.27 University Agent: One designated individual with an engineering degree, formal training in the certification of clean air devices, recommended Active Professional Engineering Registration, and recent listing as an Accredited NSF Field Certifier. This individual shall be the final judge of compliance to these specifications and will act as the University technical representative in any requests or legal proceedings involving disputes and interpretation.

1.5.28 NSF, National Sanitation Foundation

1.5.29 SOP, Standard Operating Practice, A written operating practice containing protocols on the operation of an experiment or piece of equipment. The SOP shall be reviewed and approved by the Principle Investigator (PI) in consultation with the University Agent or Biological Safety Officer.

2.0 APPLICABLE DOCUMENTS

2.1 Specifications and Standards The following documents, of the issues in effect on the date of the invitation for bids or requests for proposal form a part of this specification to the extent specified herein:

International Standards

ISO 14644-1 Clean Rooms and Associated Controlled Environments

National Standards

National Sanitation Standard No. 49, the current edition in effect

National Sanitation Standard Listing, the current edition in effect

Federal Specifications

J-C-145 Cable, Power, Electrical and Wire, Electrical; (Weather Resistant)

W-C-00596 Connector, Plug, Electrical: Connector Receptacle, Electrical

W-S-00896 Switch, Toggle

W-S-893 Switch, Toggle, and Mounting Strap, (Interchangeable)

CC-M-636 Motor, Alternating current, (Fractional Horsepower)

DD-G-1403 Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened and Fully Tempered)

QQ-S-698 Steel, Sheet and Strip, Low-carbon

QQ-S-766 Steel Plates, Sheets, and Strip-corrosion Resisting

TT-C-490 Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings

TT-C-535 Coating, Epoxy, Two Component for Interior and Exterior Use of Metal, Concrete and Masonry

TT-C-001224 Coating System, Epoxy, Glaze for Interior Surfaces

TT-C-001227 Coating System, Polyurethane Glaze for Interior Surfaces M

PPP-B-601 Boxes, Wood, Cleated plywood

PPP-B-621 Boxes, Wood, Nailed and Lock-corner

PPP-B-640 Boxes, Fiberboard, Corrugated, Triple Wall

PPP-C-650 Crates, Wood, Open and Covered

PPP-C-843 Cushioning Material, Cellulose

PPP-T-60 Tape, Packaging, Waterproof

Federal Standards

Federal Standard No. 102, Preservation, Packaging and Packing Levels

Federal Standard No. 123, Marking for Domestic Shipment

Federal Standard No. 209E, Airborne Particulate Cleanliness Classes

Military Specifications

MIL-C-104 Crates, Wood; Lumber and Plywood Sheathed Nailed and Bolted

MIL-C-132 Crates, Wood, Open; Maximum Capacity 2,500 pounds

MIL-C-3774 Crates, Wood, Open; 12,000 and 16,000 Pound Capacity

MIL-F-51079B Filters, Particulate, High Efficiency, Fire Resistant, Biological Use

MIL-L-10547 Liners, Case and Sheet Overwrap, Water vapor-proof or Waterproof, Flexible

MIL-P-116 Preservation, Methods of

MIL-R-3065 Rubber, Fabricated Products - Gaskets, Synthetic Rubber

MIL-S-8802 Sealing Compound, Temperature resistant, Aircraft High Adhesion

Military Standards

MIL-STD-282 Filter Units, protective clothing, gas mask components, and related products.

2.2 Other Publications

Air Moving and Conditioning Association (AMCA)

AMCA 99-76 Standards Handbook

AMCA 210-74 Test Code for Air Moving Devices

AMCA AS-2406-66 Fans, Designation of Direction of Rotation and Discharge

AMCA 211-80 Fans, Labeling Requirements

AMCA 401-66 Classifications for Spark Resistant Construction

American National Standards Institute, Inc. (ANSI)

A11.1-120083 Industrial Lighting RP-7

N101.1-120082 Efficiency Testing of Air Cleaning Systems Containing Devices for Removal of Particles

S1.2-1962 (R120081) Method for the Physical Measurement of Sound

S1.4-120081 Specification for Sound Level Meters

S2.2-1959 (R2011) Methods for the Calibration of Shock and Vibration Pick-ups

Z97.1-2009 Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings

American Society Mechanical Engineers (ASME)

AG-1 Code on Nuclear Air And Gas Treatment

Illuminating Engineering Society (IES)

IES Lighting Handbook

National Electrical Code (NEC)

Electrical Component and Wiring Specification

National Electrical Manufacturer's Association (NEMA)

Underwriters Laboratories (UL)

UL Standards

UL-817 Cord Sets and Power Supply Cords

UL-62 Flexible Cord and Cables

UL-586 High Efficiency Particulate Air Filter Units

UL-900 Safety Standards for Air Filter Units

UL-2701-1 Electrical Safety and Integrity

UL-61010-1 Safety Requirement for Electrical Equipment for Measurement, Control, and Laboratory Use

United States Atomic Energy Commission (AEC)

ORNL-NSIC-65 (1/70) Design, Construction, and Testing of High-Efficiency Air Filtration Systems for Nuclear Applications

Canadian Standards Association (CSA)

C22.2 No. 151 Laboratory Equipment

Institute of Environmental Sciences and Technology (IEST)

IEST-RP-CC-001.5 HEPA and ULPA Filters

IEST-RP-CC007.2 Testing ULPA Filters

IEST-RP-CC-013.3 Calibration Procedures and Guidelines for Select Equipment Used in Testing Cleanrooms and Other Controlled Environments

IEST-RP-CC-002.3 Unidirectional Flow-Clean Air Devices

American Society for Microbiology

"Evaluation of the Edgegard Laminar Flow Hood" Lewis J. Coriell and Gerard J. McGarrity, Institute for Medical Research, Copyright, 1970

3.0 REQUIREMENTS

3.1 Bid Submittal Requirements The following requirements apply to clean air devices bid on an individual basis. For clean air devices procured via a purchasing contract, the selected supplier need only comply with Sections 3.1.1, 3.1.2 and 3.1.3 for the initial bid, unless the cabinet fan/motor system is changed during the contract period. In this event, revised motor and fan graphs must be resubmitted and approved by the University prior to

construction of any modified cabinet as represented in the original contract. Sections 3.1.4, 3.1.5 and 3.1.6 shall apply to all clean air devices received by the University.

3.1.1 Motor and Fan Graphs Detailed motor and fan graphs for each clean air devices shall be submitted with each bid to the Purchasing Department. The graphs shall include sufficient detail to permit the University to determine if the selected fan/motor combination will comply with requirements in Section 3 of this specification. Sample graphs detailing the required format are included in Appendix A, Graphs 1 and 2.

3.1.1.1 Motor Performance Graph(s) Submitted bid(s) shall contain motor performance graph(s) selected by the supplier for the equipment to be used in the clean air devices proposed under bid. Each graph shall list the motor supplier, model number, horsepower and capacitor size. The ordinate of each graph shall contain units for motor RPM. The abscissa of each graph shall contain units for torque, voltage and amperes with applicable multipliers. At least three curves shall appear on the graph:

1. Motor torque versus RPM.
2. Motor voltage versus RPM.
3. Motor amperes versus RPM.

3.1.1.2 Fan/Motor Performance Graph(s) Submitted bid(s) shall contain fan/motor performance graph(s) for the equipment selected by the supplier to be used in the clean air devices proposed under bid. Each graph shall detail the fan supplier, fan model number, motor supplier and motor model number. The ordinate of each graph shall contain units for static pressure in inches water gauge. The abscissa of each graph shall contain units for cubic feet per minute of air at standard conditions. The following elements shall appear on each graph.

3.1.1.2.1 A series of constant fan wheel speed curves in RPM's.

3.1.1.2.2 A series of constant fan wheel torque curves in ounce feet.

3.1.1.2.3 A discrete motor/fan torque curve with the motor speed control(s) at full line voltage - 115 VAC. The curve points shall be obtained from the motor performance graph.

3.1.1.2.4 The fan design curve shall be such that the loaded and unloaded system resistance curves intersect the fan characteristic curve in the negative sloped portion of the fan curve. Fan/motor designed to operate at the specified airflows on either the broad or flat portion of the fan curve(s) - i.e., positive slope - may be rejected depending on how the performance characteristics of the exhaust and supply air velocities are effected when the filters have been loaded in accordance with specification 3.1.1.2.5.5

3.1.1.2.5 A discrete fan/motor torque curve with the motor speed control adjusted to the operational airflow in CFM's associated with required air velocities detailed under Paragraph 3.6.1. The curve points for reduced voltage operation may be approximated from the following formula: torque 1/torque 2 = (voltage 1/voltage 2) squared, or with actual motor performance data. The supplier shall indicate on the fan/motor performance graph how the curve points for reduced voltage operation have been derived and submit motor performance data for reduced voltage operation if used as curve points.

3.1.1.2.5.1 The curve generated under Paragraph 3.1.1.2.5 shall detail a representative initial fan static pressure using clean filters and a representative operational motor voltage.

3.1.1.2.5.2 The curve generated under Paragraph 3.1.1.2.5 shall detail the fan static pressure associated with a 100 percent increase in filter static pressure. One hundred percent increase in filter static pressure shall be determined by multiplying the clean filter static pressure, exhaust or supply filter static pressure, whichever is greater, by 2.0. The static pressure across each filter is that pressure necessary to develop the design mass filter airflow rate per filter such that the air velocity requirements specified in Paragraph 3.6.1 are achieved.

3.1.1.2.5.3 The curve generated under Paragraph 3.1.1.2.5 shall detail the fan airflow rate associated with a 10 percent drop in operational total airflow rate.

3.1.1.2.5.4 The supplier shall detail on the fan/motor performance graph a representative initial filter pressure drop at the total fan airflow associated with average downflow velocities required under Paragraph 3.6.1. This requirement shall be fulfilled by actual testing of the biological clean air devices offered for purchase or testing of a prototype clean air devices with clean HEPA filters with resistance and flow characteristics which are within ± 5 percent of those HEPA filters offered in the production biological clean air devices. The total airflow in CFM, the motor speed in RPM and filter static pressure in inches W.C. at this set point shall be stated. This detail shall appear on the motor/fan performance graph using the following format:

Clean Filters with Cabinet Air Velocities at Factory Set Point
QT CFM, Motor Speed RPM's, Filter R "W.C.

3.1.1.2.5.5 With the supply filter(s) evenly loaded to produce a 10 percent reduction in the clean filter total airflow delivery detailed in Paragraph 3.1.1.2.5.4 the supplier shall detail the resultant airflow in CFM, motor speed in RPM's and filter static pressure in inches W.C. This detail shall appear on the motor/fan performance graph using the following format:

Loaded Filters with 10 Percent Reduction in Total Airflow
QT = CFM, Motor Speed RPM's, Filter R " W.C.

3.1.2 Fabrication Drawings and Performance Data

3.1.2.1 Fabrication Drawings One set of detailed fabrication drawings shall be submitted with each bid to the University Purchasing Department. Drawings shall include sufficient detail to permit the University of Wisconsin to determine if all physical construction, mechanical, electrical and dimensional requirements in Section 3 have been included in the fabrication plans. Sample figures with dimensional requirements are included in Appendix B, Figure 1.

3.1.2.2 Performance Data The submitted bid shall contain performance data detailing the cabinet's ability to effectively handle controlled particle challenge under ISO Class 5 conditions. The data should provide a statistical graph plotting average work zone air velocity in feet per minute on the ordinate of the graph and aerosol/particle concentration/count per cubic foot of air sampled on the abscissa. The supplier is requested to develop a graph since performance data may become mandatory in the future. A suggested format is represented below:

3.1.2.2.1 At least 20 data points should be displayed on this graph.

3.1.2.2.2 The supplier’s model number should be displayed on this graph.

3.1.2.2.3 The graph should show failure and passing of ISO Class 5 conditions.

3.1.2.2.4 A statistical average and upper and lower ninety-five percent confidence limits should be displayed on the graph.

3.1.2.2.5 The data shall be reviewed by the University Agent to ensure that the cabinet under bid can safely perform under ISO Class 5 conditions.

3.1.2.2.6 Failure to submit performance data as called for in paragraph 3.1.2 shall result in bid rejection.

3.1.3 Submitted Bids Submitted bids will be reviewed within 60 days of receipt and the successful bidder notified accordingly by the University.

3.1.3.1 Any bid which does not comply with the specifications and performance standards contained herein shall be rejected.

3.1.3.2 Any bid which does not format requested data within the requirements of Paragraph 3.1 shall be rejected.

3.1.3.3 Any bid containing proposed fan/motor systems sized and rated such that the operational air delivery required under Paragraph 3.5.6.3 cannot be obtained shall be rejected.

3.1.4 Selected Supplier The vendor selected to construct a clean air device may be required if called upon to submit one set of detailed final fabrication drawings to the University. The drawings shall include sufficient detail to permit the University to determine if all physical construction, mechanical, electrical and dimensional requirements in Section 3 have been included in the fabrication plans. Electronic drawing submittal shall be the preferred method for submission to comply with this requirement.

3.1.4.1 Any optional equipment specified by the University for a particular bid shall be detailed on the final fabrication drawings.

3.1.4.2 The selected vendor shall commence cabinet fabrication after receiving approval to proceed from the UW Environment, Health & Safety –Biological Safety Cabinet Program. The default approval authority shall be the UW Environment, Health & Safety –Biological Safety Cabinet Programattention University Agent.

3.1.4.3 Once approval for final fabrication drawings has been given, no variance in the construction shall be permitted without prior re-approval by the University.

3.1.5 Field Fan/Motor Performance Test The clean air devices selected for purchase may be subjected to a field fan/motor performance test during performance testing of the cabinet. If this test demonstrates a failure of the fan/motor system to comply with the operational air delivery required under Paragraph 3.5.6.3, the cabinet supplier shall be contacted in order to arrange for replacement of the cabinet or purchase cancellation. Those clean air devices returned to the supplier shall be at the supplier's expense (FOB - clean air devices field location). Arrangements and costs for packaging of the cabinet for shipment will be the responsibility of the supplier.

3.1.6 Field Specification Compliance Inspection The clean air devices selected for purchase may be subjected to a field compliance inspection to determine whether the supplier has complied with the construction specifications contained here in. The cabinet may be completely dismantled and any contract conflicts with the construction brought to the attention of the supplier, as detailed in Paragraph 1.2.1.

3.2 General Description

3.2.1 Definition The cabinet shall be a complete unit, free standing, fabricated with materials of construction as required and contain all items of equipment as necessary to be functional and to operate fully within the intent of this document.

3.2.1.1 The cabinet may be either a console (floor standing unit) or bench top (unit which may be mounted on a platform). Specific requirements for the particular cabinet under bid will indicate whether a console or bench model is required.

3.2.2 Independent Operation The cabinet, when connected to external source of electrical power, shall be completely independent of all other sources for successful operation and performance, excluding plumbing services.

3.2.3 Unobstructed Work Opening The working face of the unit shall be an unobstructed opening.

3.2.4 Unidirectional Airflow The cabinet shall consist of a partially enclosed workspace into which air, which has been filtered by a HEPA filter, is supplied in a unidirectional horizontal manner through the work space.

3.2.5 Work Area The work area shall consist of the following items going from front to back: the work access opening the airfoil and scavenger slots, stainless steel sheet area. The free open area of the front perforated areas shall permit the supply air to pass through, with a minimum amount of turbulence, into the negative air zone created by the perimeter slots, which are connected to the suction side of the fan. The bottom of the work area shall consist of the airfoil and lower removable panel below the work zone entrance. The lower horizontal workzone shall extend from the front slotted entrance to the rear perforated area of the work zone. It shall be flat and level.

3.2.6 Scavenger Slots Air shall leave the workspace via the horizontal slots in the entrance of the work zone and vertical scavenger slots extending the full length of the vertical entrance plane on the left and right operator sides. This work zone air will be recycled back into the blower inlet. The remaining air will leave the clean air cabinet and enter the occupied space.

3.2.7 Stainless Lip A stainless steel lip shall be located below the filter guard so arranged as to stop any spillage in the working area from entering the filter zone. Permanent supporting structures for the work surface and front perforated area shall not cover more than a 10 percent projection of the horizontal surface of the work zone.

3.2.7.1 Supply Filter Stainless Guard and Lifting Handle On console and bench clean air devices, a removable stainless steel guard shall be provided over the open horizontal airflow area. The guard shall have uniform openings no greater than one quarter square inch. The guard should be removable. Ergonomic consideration shall be given to the ease of removal of this guard to reduce the risk of filter damage during service. The guard should be provided with a permanent lifting handle to facilitate safe removal from the work zone.

3.2.8 Fan Inlet Panel Fan intake opening shall be provided with a painted metal inlet panel. The panel shall have protective louvers or intake grill. The panel shall be a rigid metal frame with a half inch turned lip on the entire perimeter. The panel shall easily be removed without the need to use hand tools after the retaining fasteners have been released.

3.2.8.1 The panel shall be taped to the cabinet assembly to prevent damage during shipment.

3.2.8.2 The cabinet shall be provided with a pre-filter system upstream of the supply fan(s). The fan access panel to the pre-filters shall be ergonomically designed to facilitate easy access to the pre-filters without damaging the access panel fasteners.

3.2.9 Supply Filter Access Panel Hinged Closure panel shall be provided to allow top access to the supply filter. The panel shall be gasket.

3.2.10 Unobstructed Panel Removal. All panels to the filters and fan/motor(s) shall be designed so that each panel can be removed from the cabinet without obstruction from adjacent structures and associated fasteners.

3.2.11 Construction and Fabrication Requirements

3.2.11.1 The cabinet shall be constructed with the strength, rigidity and finish to meet noise and vibration levels and glove tear resistance specified in Paragraph 3.5.2.4.2.

3.2.11.2 The cabinet shall be constructed in a manner making it easy to clean and service. The cabinet shall be provided with a removable lower scavenger slot access panel. Cracks or crevices which provide reservoirs for access of contamination shall not be accepted. There shall be no sharp edges on any service or edge that may come into contact with the hands or fingers of the laboratorian and all certification and maintenance personnel. The work zone shall be a one piece stainless liner stainless steel.

3.2.11.2.1 All nuts, bolts, screws, stud screws, stud bolts, etc., shall be stainless steel. All screws and electric welded studs, etc., shall be 0.25 inch in diameter, twenty threads per inch. The method in mounting the multi-section clean air devices together shall be the use of electric welded stainless steel studs or the current method of choice in use by the manufacturer. These studs shall be used to attach all service panels and all sections of the multi-section clean air devices. The bolting unit shall be a stainless steel cap nut, a stainless steel lock washer, and a stainless steel flat washer where the stud protrudes through to the outside of the cabinet. Where two flanges meet inside the cabinet, stainless steel nuts and bolts shall be used. The holes in the service panels and closure plates and sections of the cabinet shall be at least 40 percent larger in diameter than the stud diameters.

3.2.11.2.2 Phillips head screws and plastic molded fasteners will not be allowed on gasket closure plates used to provide access to the negative and/or positive pressure plenums of the cabinet. Use of said construction will result in a 1.2.1 notification.

3.2.11.2.3 The console and bench clean air devices provided with a support frame shall have adjustable gliders installed in the base of the cabinet. The gliders shall be heavy enough to support the weight of the cabinet during shipment, moving and set-up at the use point. Glider construction shall be stainless steel and the glider foot shall be rounded to reduce floor tile damage on movement. Glider feet with sharp corners at the floor contact point that damages the floor, may result in a 1.2.1 notification and the supplier required to replace the parts. The supplier must pay close attention to glider construction since many floors in facilities are now being provided with sealed soft floor coverings.

3.2.11.3 Dimensional tolerances shall be as follows:

3.2.11.3.1 Linear dimensions shall be within + 0.125 inch of the specified dimension.

3.2.11.3.2 The squareness of the cabinet shall have the overall outside and inside surfaces perpendicular within the following limits: the maximum offset from 90 degrees shall be 0.125 inch or 0.0625 in/ft, whichever is greater.

3.2.11.3.3 The flatness of the outside surfaces which can be mated to other equipment and/or furniture shall be flat within 0.125 inch maximum offset over 50 inches.

3.2.12 Fabrication Welding Requirements

3.2.12.1 Prior to welding, work shall be degreased, buffed, and brushed as necessary to remove all dirt, scale corrosion, dust, grease, oil, water or other foreign material. All buffing shall be done with a stainless steel brush. In no case shall a carbon steel brush be used.

3.2.12.2 Weld surfaces as deposited shall be smooth and uniform in appearance without abrupt changes in contour.

3.2.12.3 Weld metal and base metal shall be free of excessive splatter due to too high a welding current, too large an electrode, wrong electrode angle, etc., when using the base metal consumable electrode with inert gas shielding for the welding method.

3.2.12.4 Weld surfaces, root or face, shall not show oxidation. Oxidation, as here defined, shall mean granulation (sugary) or scaling of the metal that cannot be removed or restored to a bright metal

surface by wire brushing. Heat discoloration or blackening by flux residue is not considered oxidation.

3.2.12.5 A crevice on any weld surface in any weld joining (other than between "skip" welds on lap joints) is not acceptable. (A crevice is defined as a space or depression which will retain liquid by capillary attraction, generally having a depth greater than its smallest surface dimension.)

3.2.12.6 Arc burns on the base material are not acceptable. (Arc burns are defined as scars left where the welding arc has been struck on or dragged across the base metal surface.)

3.2.12.7 Welds shall be entirely free of evidence of lack of fusion or cold lap, pinholes, cracks and weld craters, and shall be free of porosity, slag inclusion, and other imperfections as, in the opinion of the University, is obtainable by exercise of the high skills of the art.

3.2.12.8 Suck-back on the root face of welds made from one side only shall not exceed five percent of the base metal thickness. (Suck-back is defined as a minor depression in the center of the weld-metal surface, as measured from the base metal surface, caused by metal solidification, shrinkage and/or action of gravitational forces on the molten metal.)

3.2.12.9 All welds welded from one side only (except lap joints) shall have 100 percent penetration with melt-through. For butt joints, the weld metal on the front surface shall in no place be lower than the adjacent base metal surfaces; for butt, corner and tee joints, the weld metal on the back side shall in no place show a depression lower than the adjacent base metal thickness. Weld metal protrusion on the back side of welds made from one side shall not exceed 20 percent of the adjacent base metal thickness or 0.09375 inch, whichever is less. Joints detailed to be welded from one side only may, at the option of thesupplier, be welded from both sides to obtain 100 percent penetration, provided that no excessive warping in the sections being joined is caused thereby. All tolerance requirements shall be met as previously mentioned in Paragraphs 3.2.11.3, 3.2.11.3.1, 3.2.11.3.2, and 3.2.11.3.3.

3.2.12.10 All welds shall develop the full strength of the lighter of the sections being joined, except where only a "tack" or "seal" weld are required.

3.2.12.11 All interior work area welds shall be finished flush with adjacent surfaces and shall be no rougher than adjacent surfaces. Exterior weld area shall be ground smooth and flush with adjacent surfaces where necessary to provide gasket seating surfaces. Finishes made for this or other reasons shall be no rougher than the finish on adjacent surfaces. All interior air plenum welds shall be buffed.

3.2.12.12 Permanent joints in the sheet metal comprising the boundaries of the air passages should have continuous welds. Permanent joints in the sheet metal comprising the boundaries of the air passages made by tack welding and sealant bonding should be minimized.

3.2.12.13 Only the following welding methods may be used for welding of stainless steel. The method chosen shall take into account all other requirements of this specification.

3.2.12.13.1 Tungsten non-consumable electrode with inert gas shielding, using direct current and straight polarity (work positive). This method is commonly known as "TIG" or "HELIARC."

3.2.12.13.2 Base metal consumable electrode with inert gas shielding, using direct current and straight polarity (work positive). This method is commonly known as "MIG" or, when straight polarity is used, "SIGMA."

3.2.13 Services in Air Passages

3.2.13.1 Wires, tubing, cables, conduits, pipes, etc., shall not be located or routed within the air passages of the cabinet with the exception of fan electrical connections.

3.2.13.2 Exception construction shall have connectors installed between the interior and exterior sections of the cabinet.

3.2.13.3 Exception construction shall be routed in plenums and low velocity air passages. Routing in sections of the air passages with design air velocities in excess of 1000 LFPM shall not be allowed.

3.2.13.4 Exception construction shall be designed to minimize the build-up of contamination. Wiring to the fan motor shall either be via a power cord to a junction box or by insulated spade connectors located near the fan. Individual wires from the control center to the fan shall not be allowed. The wiring from the junction box or spade connectors to the fan motor shall be insulated cable or individual shielded wires sealed in an insulated tube.

3.2.13.5 Internal perforated metal diffusers in the fan discharge plenum are prohibited.

3.2.14 Service Areas

3.2.14.1 Accessories, such as lamp ballasts/drivers, pressure gauges, switches, relays, motor controllers, ground fault circuit interrupter, etc, shall be housed in the cabinet in an organized fashion. The service areas shall be in ventilated compartment(s) which are apart of the main structure of the cabinet. One electric power cord shall originate from the service area.

3.2.14.2 The blower switch shall be rated for 15 ampere service and a red pilot light provided to indicate that the blower motor has been energized. All blower switches for ½ horsepower application shall be rated for 20 ampere service. The 20 ampere switch shall be UL rated and shall be provided with a pilot lamp. The recommended switch should be a hospital grade type as manufactured by Hubbel with UL listing, CSA Certification and meet Federal Standard WS 000896. If the cabinet control switches are low voltage this requirement shall not apply.

3.2.14.3 Wiring in the service control center shall be orderly and systematically laid out using wire terminal blocks, plastic ties on wiring runs of two or more wires, and C-clip wiring connectors.

3.2.14.4 If printed circuit boards are used, the boards shall be secured the cabinet electrical system with re-useable fasteners to facilitate field replacement of these components. No soldered terminal connectors between the circuit board and the cabinet interconnecting wiring shall be allowed.

3.3 Dimensions

3.3.1 Overall Dimensions These shall include all protrusions through and/or from the outside walls of the cabinet such as pipe nipples, side door assemblies, electrical connection boxes, cabinet seams, etc. Sample figures with dimension requirements are included in Appendix B.

3.3.1.1 **Two foot, clean air devices, bench only**

3.3.1.1.1 Overall Length bench 28 inches (±1")

3.3.1.1.2 Overall Depth bench 27 inches (±1")

3.3.1.1.3 Overall Height-bench bench 43 inches (±1")

3.3.1.2 **Three foot, clean air devices – Console Only**

3.3.1.2.1 Overall Length-console 38 inches (±1")

3.3.1.2.2 Overall Depth-console 34 inches (±1")

3.3.1.2.3 Overall Height-Console 64 inches (-1", +3")

3.3.1.3 **Four foot, clean air devices – Console Only**

3.3.1.3.1 Overall Length-console 50 inches (±1")

3.3.1.3.2 Overall Depth-console 34 inches (±1")

3.3.1.3.3 Overall Height-Console 64-72 inches (±1")

3.3.1.4 **Five foot, clean air devices – Console Only**

3.3.1.4.1 Overall Length-console 62 inches (±1")

3.3.1.4.2 Overall Depth-console 34 inches (±1")

3.3.1.4.3 Overall Height-Console 64-72 inches (±1")

3.3.1.5 **Six foot, clean air devices – Console Only**

3.3.1.5.1 Overall Length-console 74 inches (±1")

3.3.1.5.2 Overall Depth-console 34 inches (±1")

3.3.1.5.3 Overall Height-Console 64-72 inches (±1")

3.3.1.6 **Eight foot, clean air devices-Console Only**

3.3.1.6.1 Overall Length-console 98 inches (±1")

3.3.1.6.2 Overall Depth-console 34 inches (±1")

3.3.1.6.3 Overall Height-Console 64-72 inches (±1")

3.3.2 Inner Dimensions of Work Area

3.3.2.1 **Two foot, clean air devices**

3.3.2.1.1 Inside wall to inside wall length shall be 22 inches, (±1")

3.3.2.1.2 Outer sidewall to inner sidewall length shall be no more than 3 inches.

3.3.2.1.3 Depth (front edge to back wall) 17 inches (±1")

3.3.2.1.4 Height (work surface to diffuser) 22 inches (±1")

3.3.2.1.5 Height (floor elevation to work surface) Not applicable

3.3.2.2 **Three foot, clean air devices**

3.3.2.2.1 Inside wall to inside wall length shall be 35 inches, (±1")

3.3.2.2.2 Outer sidewall to inner sidewall length shall be no more than 3 inches.

3.3.2.2.3 Depth (front edge to back wall) 22 inches (±1")

3.3.2.2.4 Height (work surface to diffuser) 28 inches (±1")

3.3.2.2.5 Height (floor elevation to work surface) 30 inches (±1")

3.3.2.3 **Four foot, clean air devices**

3.3.2.3.1 Inside wall to inside wall length shall be 46 inches, (±1")

3.3.2.3.2 Outer sidewall to inner sidewall length shall be no more than 3 inches.

3.3.2.3.3 Depth (front edge to back wall) 22 inches (±1")

3.3.2.3.4 Height (work surface to diffuser) 28-34 inches (±1")

3.3.2.3.5 Height (floor elevation to work surface) 30 inches (±1")

3.3.2.4 **Five foot, clean air devices**

3.3.2.4.1 Inside wall to inside wall length shall be 58 inches, (±1")

3.3.2.4.2 Outer sidewall to inner sidewall length shall be no more than 3 inches.

3.3.2.4.3 Depth (front edge to back wall) 22 inches (±1")

3.3.2.4.4 Height (work surface to diffuser) 28 inches (±1")

3.3.2.4.5 Height (floor elevation to work surface) 30 inches (±1")

3.3.2.5 **Six foot, clean air devices**

3.3.2.5.1 Inside wall to inside wall length shall be 70 inches, (±1")

3.3.2.5.2 Outer sidewall to inner sidewall length shall be no more than 3 inches.

3.3.2.5.3 Depth (front edge to back wall) 22 inches (±1")

3.3.2.5.4 Height (work surface to diffuser) 28-34 inches (±1")

3.3.2.5.5 Height (floor elevation to work surface) 30 inches (±1")

3.3.2.6 **Eight foot, clean air devices**

3.3.2.6.1 Inside wall to inside wall length shall be 94 inches (±1")

3.3.2.6.2 Outer sidewall to inner sidewall length shall be no more than 3 inches.

3.3.2.6.3 Depth (front edge to back wall) 22 inches (±1")

3.3.2.6.4 Height (work surface to diffuser) 28 inches (±1")

3.3.2.6.5 Height (floor elevation to work surface) 30 inches (±1")

3.4 Assembly

3.4.1 The cabinet shall be capable of being moved through a doorway nominally 6'7" high, 35" wide using only equipment commonly available for furniture moving such as jacks and dollies, and it shall not be turned over on end. Clean air devices assembled from upper and lower sections connected by gasket joints shall be acceptable. Clean air devices having a separate supporting base shall be acceptable and the supporting base shall be included in the overall height listed in Paragraphs 3.3.1 under console dimensions.

3.4.2 The work zone and lower section of the clean air device shall be bolted together to form a structural unit.

3.4.4 On console models, the solid work tray surface height from floor shall be 30 inches, ± 1.0 inch. Optional 36 inch work tray shall be offered in the console and bench tubular frame.

3.4.5 The work access opening height shall be 22 inches for two foot cabinet and 28 inches (±0.25 inches) for the remaining sizes.

3.4.6 The cabinet shall have a knee space at least 10 inches deep (+5", -0") horizontally, and 27 inches (+1", -1") high. Optional work zone depths may be specified on an individual purchase.

3.4.7 Under Work Zone Access Panel: A hinged panel shall be provided underneath the work surface directly under the exhaust slots on the leading edge of the work surface for cleaning in the event of spills and debris. The fasteners used to attach the panel shall be stainless steel with stainless steel rivet nuts or welded stud construction. The thread size shall be at least 1/4x 20 inches. All fasteners shall be thumb screw type to facilitate cleaning in case of spill. The manufacturer shall design a spill control drain pan routed to the exterior of the cabinet. Spillage can not be routed to the inside of the cabinet.

3.4.7.1 Spring clip galvanized fasters are prohibited as they have been found to fail in use.

3.5 Materials and Components

3.5.1 All cabinet surfaces, interior and exterior, shall be constructed of, or finished with, materials which are corrosion, flame and moisture resistant.

3.5.1.1 Exception: The interior pre-filter shall be fire retardant and UL approved material.

3.5.2 Sheet Metal and Finishes

3.5.2.1 The thickness of metals used for cabinet stainless steel liner shall not be a lesser thickness than U.S.S. Gauge No. 16. The exterior panels shall not be a lesser thickness than U.S.S. Gauge No. 18.

3.5.2.1.1 The use of non-ferrous materials in the cabinet walls, filter plenums and blower plenums is prohibited and will result in purchase cancellation. The use of non-stainless work surfaces is prohibited. Only type 304 stainless work surfaces are allowed. Therefore laminated surfaces are prohibited.

3.5.2.2 Stainless Steel Finish: All cabinet interior work surfaces shall be fabricated with corrosion-resistant steel that shall conform to Federal Specification QQ-S-766, Class 304, No. 4 satin finish.

3.5.2.2.1 Recommendation: The cabinet interior work zone sidewalls, work surface and inlet flanges should be fabricated from a single sheet of stainless steel. The horizontal work zone corners should have at least 0.4375-inch radius corners.

3.5.2.2.2 Exhaust Scavenger slots: Both the left and right inlet vertical sides of the work zone and lower work zone horizontal entrance shall be provided with continuous exhaust scavenger slots at the vertical and horizontal inlet work zone entry corners. At least 1.3 slots shall be provided per lineal inch in the vertical direction and 2.5 slots per lineal inch in the horizontal direction. The requirement for slots is based on experimental determination of the efficacy for preventing the backwash of contamination into the work zone. See confirming documentation in Section 2.2.

3.5.2.2.3 The work zone scavenger slots shall be fabricated from punched metal stock. The manufacturing process shall ensure that the work zone side of this construction is tear resistant to laboratory gloves.

3.5.2.3 Steel sheet used in the cabinet fabrication shall be prime grade, cold rolled carbon steel. Carbon steel sheet shall be used where Paragraph 3.5.2.2 does not apply.

3.5.2.4 Carbon Steel Finish Before painting, surfaces shall be cleaned of dirt, oil, and grease. The carbon steel shall be given a phosphate coating treatment in accordance with Federal Specification TT-C-490. Enamel finish shall be a uniform satin luster white. Prime and finish coats shall be applied by spraying or dipping, and baked after each coat for a minimum of 15 minutes at 300 degrees Fahrenheit. A total thickness of not less than one mil shall be achieved. Concealed surfaces or hollow metal sections shall be protected by the finish previously specified, by a suitable method, after welding, but before assembly. Epoxy coatings can be used to coat all carbon steel surfaces and they shall conform to TT-C-001224 and shall be a uniform satin luster white. A polyurethane coating can be used to coat all carbon steel surfaces and it shall conform to TT-C-001227 and shall be a uniform satin luster white.

3.5.2.4.1 All interior plenums shall be free of fabrication debris. Fabrication debris shall be defined as detached particles such as metal filings and wiring greater than 0.0625 inch in size.

3.5.2.4.2 All exterior metal plates, all interior work zone metal surfaces, all metal diffusers, the hinged metal spill panel, all interior metal surfaces within six inches of each HEPA filter, and the fan/motor assembly(s) and compartment shall have no exposed metal edges, seams or corners that will puncture or tear a vinyl examining glove when advanced across these surfaces with a maximum force not to exceed one pound per square inch of glove surface area. The vinyl glove cited in this requirement shall be Fisher Scientific brand, number 19-050-550C, marketed by Fisher Scientific 2000 Park Lane Drive, Pittsburgh, PA 1-800-772-6733. Punctures and tears will be deemed as poor workmanship and result in a 1.2.1 notification and field repair as specified in Paragraph 6.3.4. More than five areas in the cabinet having tear and puncture will result in cabinet rejection and request for a replacement.

3.5.2.4.3 All exterior surfaces shall have a flat finish application. A flat finished surface shall be defined as a continuous surface in either the horizontal or vertical plane with no surface distortion in excess of ± .001 inches.

3.5.2.4.3.1 All electric welded stud construction shall be protected from paint over spray. The method of protection shall be a rubberized cap fitted over each stud prior to painting.

3.5.2.4.5 Finish Color: White All University clean air devices shall be finished white. Alternate color perma white.

3.5.2.5 Internal Air Balancing Damper. No internal damper has been required in this specification.

3.5.2.6 Transitions: No transitions are required in this specification.

3.5.2.7 Supply Air Grill (SAG) used to protect the HEPA filter.

3.5.2.7.1 The SAG shall be stainless steel.

3.5.2.7.2 The SAG shall be mounted approximately 1 to 1.5 inches from the filter media. The SAG shall fit flush to all of the interior work zone sides.

3.5.2.7.3 The SAG shall be easily removed from the attachment points with the fastener holes in the diffuser at least 40 percent larger than the fastener shaft.

3.5.2.7.3.1 The supplier shall design the SAG with ergonomic consideration for the repair and maintenance of the filter surfaces and gasket. The SAG shall be easily removable. Consideration should be given to the provision of handles on the SAG for easy removal in the event filter repairs are needed.

3.5.2.7.4 No open cell foam shall be allowed on the SAG or within the vicinity of the cabinet work zone (work surface to upstream face of the supply HEPA filter).

3.5.2.7.5 The space between the SAG and HEPA filter shall be a smooth, stainless side wall contiguous with the filter gasket. No cavities or structural reinforcement in this critical area shall be allowed, due to the necessity for field filter repairs and prevention of contamination by induction.

3.5.2.7.6 The edges on the SAG shall be smooth and will not tear or puncture a laboratory vinyl glove as detailed in paragraph 3.5.2.4.2.

3.5.2.7.7 Provide a 0.5-inch stainless continuous lip in the permanent work surface to prevent liquid spills from entering the filter.

3.5.3 Glass. No glass windows shall be allowed on clean air devices.

3.5.4 Filters and Clamps

3.5.4.1 High Efficiency Particulate Air (HEPA) filters zero probed, 99.99 percent efficiency, shall be required for both supply and exhaust air systems of all clean air devices. Refer to USAEC, ORNL-NSIC-65. Higher filter efficiencies, greater than 99.99 percent (ULPA), may be specified on an individual procurement basis.

3.5.4.2 The supply filter(s) shall be high efficiency, fire resistant, particulate air filters, in conformance with MIL-F-51079B, with fire retardant frames, self-extinguishing type adhesives and sealant, and glass fiber media with or without aluminum separators. No filter shall have factory test patching greater than one percent of the open face area. Filter sizes not listed in MIL-F-51079B shall be acceptable. Paragraph 3.4.7 of the IL-F-51079B covering the environmental testing shall not apply. Galvanized metal frame or aluminum frame filters are an acceptable alternate.

3.5.4.3 The supply filters shall conform to IEST Standard IEST-RP-CC-001.5. Each filter shall be construction Grade 3 or 4, performance Type C or J. A label shall be affixed to each filter frame detailing testing requirements, ratings, manufacturer's test results, date tested and name of the factory test agent. The test results shall indicate aerosol scan leak rate, airflow in CFM and pressure drop across the filter during filter testing.

3.5.4.4 Filter mounting(s) tolerances shall be for openings up to 20 inches: +0.0625, -0 inch, and for openings over 20 inches: +0.125, -0 inch. The squareness of the filter mountings shall have diagonals within 0.0625 inch total allowance. Width of the gasket seating area shall be 0.75 inch (±0.25, -0 inch).

3.5.4.4.1 Filter mountings which provide a knife-edge seal between the gasket face of the filter and the sealing edge of the frame are prohibited and will result in purchase cancellation.

3.5.4.5 ULPA Filters: Individual clean air devices may be specified with optional ULPA filtration (+99.999%).

3.5.4.6 Clamps: Filter clamps shall be metal, constant pressure type. Filter clamps shall create uniform gasket compression to 50 percent of the new gasket depth or that pressure that results in no aerosol leaks upon challenge. For clamps requiring special extended reach with hand tools, a variable pressure clamp may be used. If a T bar clamp tool is required in order to remove the supply filter, the supplier shall attach the tool to the cabinet frame with a fastening system that holds the tool in place between filter changes. The tool shall be attached in such a manner that removal of the tool can be done by hand without the need for additional hand tools.

3.5.4.6.1 The use of wood clamps, screws, flexible plenums, adhesives to seal the cabinet filter to the blower system are prohibited and will result in contract termination.

3.5.5 Gaskets and Seals

3.5.5.1 HEPA filter seals using fluid seal systems are prohibited.

3.5.5.2 HEPA filters using permanently attached assemblies which are screwed or cemented to the filters are prohibited.

3.5.5.3 The HEPA filter gasket materials shall be cellular sheet or molded rubber or closed cell expanded neoprene gasket materials, as described in MIL-F-51068, Paragraph 3.2.2, Gasket Material; and shall be mounted in the manner described in MIL-F-51068, Paragraph 3.3.3, Gasket Assembly.

3.5.5.3.1 All HEPA filters shall be clamped to the cabinet frame. Clamps shall be designed with sufficient rigidity to compress the filter gasket material. The method of choice for filter clamps will be constant pressure filter clamps used to clamp supply HEPA filters in place. The clamping mechanism shall be designed to apply a minimum of 10 pounds of pressure per lineal inch of filter frame.

3.5.5.4 Neoprene gasket or solid silicone gasket shall be used in cabinet joints, seams, and on the facing of all air panels of the cabinet. The structural strength of the joints and connections of the service panels should be independent of the seal produced by the gasket.

3.5.5.4.1 Gasketing shall have a minimum width of 0.50 inch and be 0.125 inch thick on all joints and panels which form a barrier between contaminated areas of the cabinet and ambient environment.

3.5.5.4.2 The use of open cell gasketing and/or sheeting shall be prohibited in the air passages of the cabinet plenum systems.

3.5.5.5 All exterior, noncontaminated joints or assemblies made with sealant bonding shall be made by one of the following methods. The structural strength of the joints or assemblies shall be independent of sealants.

3.5.5.5.1 Two-part accelerated synthetic rubber (polysulfide type) sealing compound, temperature resistant, high adhesion aircraft specification grade, MIL-S-8802 or PR-1422 Class B-2, Products Research Company or equal shall be acceptable.

3.5.5.5.2 One part silicone-base sealant compound, such as Dow Corning RTV 732 Adhesive Sealant, Dow Corning RTV 781 Building Sealant or equal shall be acceptable.

3.5.5.6 All joints formed using bolted studs and gasket made to conform to leak tight construction shall seal because of gasket compression and exterior silicone sealant if necessary.

3.5.6 Fan(s)

3.5.6.1 The cabinet shall have one or more motor driven fan systems for both the re-circulated and discharged work zone air.

3.5.6.2 The fan(s) shall be labeled in accordance with Bulletin 211 of the Air Moving and Conditioning Association. Supplier's name and nameplate data shall be labeled on each fan scroll and in the operations manual. Fan housing and blades shall be fabricated of or protected with corrosion resistant materials and as specified in Paragraph 3.5.1.

3.5.6.3 Total fan delivery shall fall off no more than 10 percent as a result of 100 percent increase in the pressure drop or 0.3-inches water column which ever is greater, across the filters without readjusting the fan speed control. The fan curve shall intersect the system resistance curve, loaded and unloaded, only on that portion of the fan curve with a negative, neutral or slightly positive slope, as detailed in specification 3.1.1.2.4.

3.5.6.3.1 Fan airflow with the speed control turned to the maximum position the blower motor system should handle a 200 percent increase in static pressure load with a reduction of 10 percent in airflow or less.

3.5.6.4 The fan shall be direct connected forward curved centrifugal fan in conformance with AMCA standards.

3.5.6.5 The fan should be spark resistant construction in accordance with Air Moving and Conditioning Standard AS-401-66.

3.5.6.6 Each fan installed shall be balanced within the following vibration limits.

3.5.6.6.1 The maximum displacement of the work tray of the cabinet shall not exceed 200 micro-inches, R.M.S., in any direction.

3.5.6.6.2 The maximum field vibration limits for the centrifugal fan shall not exceed the following specified limits:

RPM	MILS DEFLECTION
900	1.00
1200	0.75
1800	0.50

3.5.6.6.3 These limits in section 3.5.6.6.2 shall apply to the top and side of the motor shaft/fan wheel connection and the fan scroll.

3.5.6.7 The fan/motor assembly shall be mechanically isolated from the cabinet by means of energy absorbing motor struts and isolating bonded rubber plate form mounts or equivalent. The fan shall be bolted to the rubber plates riveted to metal channels which are bolted to the cabinet frame. Air connections to the fan/cabinet interface shall be by means of sleeves of neoprenase or neoprene impregnated fabric, with vulcanized or cemented seals. Sleeves shall be designed to be secured to the cabinet frame and fan scroll without the need for cement or sealant. Sleeves shall be bolted in place. Bolts and associated metal materials shall be stainless steel. The fan/sleeve connection to the cabinet shall be such that air leakage is less than 0.5 percent of the total airflow. All sheet metal screws used to attach the blower boot to the blower scroll outlet shall have blunt tips to prevent glove puncture.

3.5.6.7.1 A flexible fan/cabinet sleeve greater than 12 inches of air stream length is prohibited.

3.5.6.7.2 Metal clamps and glued sleeve construction at the sleeve/cabinet and sleeve/fan interfaces are prohibited.

3.5.6.8 The fan wheel shall contain provisions for attaching a wheel puller in the event that the fan and motor must be separated for maintenance.

3.5.6.9 The fan wheel and scroll shall be designed to be separated without the need to cut welds in the scroll.

3.5.6.10 Cabinet/Fan/Sleeve FRONT MOUNT: The supplier shall design the fan motor assembly to facilitate removal of the fan/motor assemblies to reduce the need for close contact of maintenance personnel to the cabinet interior surfaces. The fan(s) shall be attached to the cabinet by front mount. Alternative mount by approval of the University Agent only.

3.5.7 Electrical Components The cabinet electrical systems when connected to the owner supplied 115VAC/20Ampere wall outlet shall have a ground circuit resistance not to exceed 0.15 ohms, an electrical leakage no more than 3,500 milli-amperes, correct wiring polarity and ground fault circuit interrupter that will trip at 5.0 milli-amperes. If these minimal electrical conditions cannot be achieved, the supplier shall be contacted and the components repaired or replaced. This shall include all components contained under paragraph 3.5.7.

3.5.7.1 Motor(s) and Speed Control(s)

3.5.7.1.1 The motor(s) that shall be used in the fan system shall be permanent split capacitor (PSC) and so designed that the motor winding temperature shall not exceed a temperature of 105 degrees centigrade in a maximum ambient temperature of 48 degrees centigrade (120 degrees Fahrenheit) under any maximum load condition. The thermal protector shall not trip at 115 percent of the rated voltage under maximum load and ambient temperature conditions. The motor shall be rated for 24 hour continuous operation. Nuisance trips shall not be allowed. The motor shall conform to Federal Specification CC-M-636.

3.5.7.1.1.1 The motor capacitor shall contain no derivatives of polychlorinated biphenyls (PCBs).

3.5.7.1.1.2 The motor performance curve should be provided with each cabinet in the operations manual with a format as detailed in 3.1.1.1.

3.5.7.1.1.3 The motor should be rated by the motor supplier for a continuous running time of 50000 hours (5.7 years).

3.5.7.1.2 The motor shall be sized to operate the fan at airflow sufficient to maintain airflow and face velocity in accordance with Paragraph 3.6.1 with a total fan delivery requirement as specified in Paragraph 3.5.6.3.

3.5.7.1.3 Electrical Requirements The motor shall be equal to or less than 0.5 HP and shall be 115 volts, 1-phase, 60 hertz A.C. A dual rated voltage motor shall not be acceptable. The motor shall have a power factor of 0.85 or greater at a full load condition. Full load is defined as that condition associated with the fan operating at a static pressure condition necessary to overcome at least a 100 percent increase in filter static pressure with up to a maximum of a 10 percent drop in total airflow in CFM, Paragraph 3.5.6.3.

3.5.7.1.4 Speed Control An adjustable voltage compensating fan motor control(s) (triac/potentiometer) shall be provided, with a span adjustment that allows for at least 270 degrees of adjustment in the potentiometer. The potentiometer must have at least 90 degrees of sweep with clean filters and allow no more than a 15-volt increase in motor voltage for 45-degree advancement. The fan motor control shall be adjusted and fixed in place by lock-nut by the cabinet supplier.

3.5.7.1.4.1 Service Entrance A permanent designated service entrance into the speed control circuit to allow measurement of the motor running voltage shall be considered by the supplier to allow certification personnel a method to safely measure voltage. The service entrance, if installed, shall be indicated on the electrical circuit diagram.

3.5.7.1.4.2 Speed Control Potentiometer Location: The potentiometer(s) shall be accessible without having to remove service panels. The potentiometers shall be located directly behind a three quarter inch stainless cap plug(s) which is located in the cabinet switch control panel. The panel cap plugs shall be labeled “Speed Control”.

3.5.7.1.5 Motor and lights shall be separately protected from the receptacles. Circuit breakers shall be provided and shall comply with the National Electrical Code.

3.5.7.1.5.1 GFCI A ground fault circuit interrupter shall be provided on the duplex outlet circuit and be designed for a maximum threshold leakage of five milliamperes. All workzone outlets shall be GFCI protected and labeled as such by the supplier.

3.5.7.1.5.2 All outlets specified shall be on a separate circuit from the motor(s) and lights, protected by a fused circuit. The fuse shall trip at 5 amperes. The fuse type shall be a reusable circuit breaker type.

3.5.7.1.6 The cabinet flexible power cord shall be at least a fourteen foot (-5', +4') length three wire with ground wire for single phase power unless otherwise specified, and the minimum size in accordance with the National Electrical Code for the specified design load. The plug shall be 20 ampere design except for the two foot cabinet that can be 15 ampere, NEMA 5-15 plug. It shall be labeled in accordance with UL Standard(s) UL 817 and/or UL 62. Six foot and eight foot cabinets shall be provided with an interior junction box and two power cord sets and 30 ampere plugs. Cord sets shall not have common neutral circuits.

3.5.7.1.7 The motor shaft shall terminate at the open face of the fan wheel. The motor shaft end shall be chamfered, and the longitudinal section shall be chamfered to at least 0.3125 inches for that portion of the shaft which the fan wheel attaches.

3.5.7.2 Electrical Wiring, Switches, etc.

3.5.7.2.1 Cable and wire shall conform to Federal Specification Cable Power, Electrical and Wire (Weather Resistant) J-C-145. The power cord shall be at least three wire 12 gauge, with a 20 ampere cap plug. At least ten feet of exterior power cord shall be provided on three, four, five, six and eight foot clean air devices.

3.5.7.2.2 Switches should conform to Federal Specifications W-S-000893 and W-S-00896.

3.5.7.2.3 Receptacles and plugs should conform to Federal Specification W-C-00596.

3.5.7.2.4 Ballasts/drivers shall be UL and/or CSA approved. Each unit shall be designed to satisfactorily start and operate the type of fluorescent/LED lamp in the particular fixture and shall meet the current practice and requirements of the "Certified Ballast Supplier." Ballast/driver design voltage shall suit the circuit voltage from which the fixtures are to be operated. Two lamp ballasts for operation of rapid start types of fluorescent lamps may be series-sequence type. Ballasts/drivers shall be securely fastened in place with the mounting surface of the ballast/driver making a complete contact with the surface of the ballast/driver mounting plate of the fixture as practical. All ballasts operating lamp sizes 40 watt or larger shall be protected against overheating by a built-in, thermally activated, automatic reclosing device, sensitive to winding temperatures and current, which will prevent winding temperatures from exceeding 120 degrees centigrade, with the exception that the peak temperatures in the first few operating cycles may exceed this. The protector must allow the winding temperature to reach 105 degrees centigrade ambient environment without opening the circuit to the primary windings and after opening shall reclose at a cast temperature less than 85 degrees centigrade.

3.5.7.2.4.1 No ballast(s) shall contain any derivative of polychlorinated biphenyls (PCB's).

3.5.7.2.4.2 All wiring insulation must be in excellent condition with no damage to the insulation or any conductor strands or solder touching other connectors. Poor wiring fabrication shall result in either a 1.2.1 notice or 6.3.4 penalty.

3.5.7.2.5 All electrical components and wiring shall conform to the latest edition of the National Electrical Code and the National Electrical Supplier's Association (NEMA). The entire cabinet must be listed as certified by Underwriters' Laboratories or the Canadian Standards Association.

3.5.7.2.6 Separate metal parts of the cabinet shall be inter-connected (jumpered) and grounded to the common ground with the electrical components. These jumpered inter-connections shall be made on the inside of the cabinet.

3.5.7.2.7 Electrical parts may be located in the air passage from the work surface to the filters

3.5.7.2.8 A 115 volt, 60 hertz, AC, three prong convenience duplex receptacle for grounded plugs may be provided in the middle of a sidewall (left or right) just above the work zone floor or on an exterior frontal panel. The receptacle shall cause minimal disruption of the airflow pattern and shall allow at least a 2.0-inch vertical clearance between the uppermost section of the work zone and the lower edge of the face plate to the receptacle. Specific bid requirements may require more than one receptacle. All receptacles shall be protected by a ground fault circuit interrupter as detailed in paragraph 3.5.7.1.5.1.

3.5.7.2.9 Two up-to-date wiring diagrams showing connection of all electrical components shall be provided. One legible diagram permanently attached to the cabinet at the service control center compartment access door and the other provided in the service manual.

3.5.7.3 Fluorescent Lighting

3.5.7.3.1 The light source shall be obscured from direct view of the operator.

3.5.7.3.2 The fluorescent/LED lamps shall be cool white (CW), rapid start type. Lamps shall be located outside the workspace and their reflection shall not interfere with visibility. The lamp assembly shall be removable from the cabinet interior.

3.5.8 Plumbing

3.5.8.1 Side Wall Hose Cock Assembly

3.5.8.1.1 0.375-inch IPS stainless steel nipples or couplings with inside pipe threads shall be welded into the end panels and fitted with hose cocks and tapered hose connections. Two unlabeled connections in each sidewall shall be provided, unless different numbers and labeling are specified. The two connections in each sidewall shall be located toward the rear of the work area, shall be stacked one above the other with the top connection approximately 10 to 12 inches off of the work surface. The lower hose connections shall be at least two inches above the uppermost section of the work tray to facilitate ease in removal of the work tray. This shall be an option, not required.

3.5.8.1.2 The lower hose connections shall be at least two inches above the uppermost section of the work zone. The upper petcock shall be marked for gas and the lower petcock assembly marked for vacuum.

3.5.8.1.3 Two additional petcocks may be specified at additional cost. The supplier shall consult the individual University purchase order and/or purchase agent.

3.5.8.2 Aerosol Sampling Port Assembly

3.5.8.2.1 An external port connected to the positive interior plenum shall be provided upstream of the recirculation HEPA filter(s) for aerosol testing.

3.5.8.2.2 The port shall be located on the upper horizontal metal plate of the cabinet.

3.5.8.2.3 The port connection into the positive exterior plenum shall be located such that a uniformly mixed air sample can be withdrawn for testing. Uniformly mixed shall mean that sample which produces no more than a 10 percent variance in 100 percent aerosol measurement when the aerosol is introduced into the cabinet work zone.

3.6 Required Performance And Acceptance Criteria The following tests shall be performed on the prototype and unit being supplied.

3.6.1 Airflow Velocity

3.6.1.1 To establish velocity levels in a clean air device provided with clean HEPA/ULPA filters and pre-filters using a calibrated hot wire thermal anemometer.

3.6.1.2 The velocity grid shall be per the manufacturer's test method, but no more than twelve inch by twelve inch.

3.6.1.3 The average measured velocity shall be 100 fpm ±10 percent. Individual readings shall fall within ±20% of the average.

3.6.2 Filter Leak Test

3.6.2.1 HEPA and ULPA filters shall be scan tested to ensure that these filters are free of defects and pinhole leaks using cold generated aerosol at an upstream concentration of greater than or equal to 20 ug/l and a calibrated aerosol photometer.

3.6.2.2 The filter(s) and cabinet seals shall show no leak greater than 0.01% of the specified upstream challenge concentration.

3.6.3 Induction Leak and Back Streaming Test-Prototype Performance

3.6.3.1 The supplier shall run the test for verification of compliance with IEST-RP-CC-002. The results shall be submitted with the original bidding and be available on request during the contract period.

3.6.3.2 The measured leak rate shall not exceed 0.01 % of the of the specified upstream challenge concentration from paragraph 3.14.2.

3.6.4 Motor/Fan Design Capacity with Loaded Filters

3.6.4.1 The supplier shall preload the HEPA/ULPA filters on a selected prototype unit (all model sizes) to determine reserve capacity in the selected motor/fan equipment. Unless the system design is changed and increases the system resistance curve or the motor/fan equipment is changed, no further initial testing will be required for compliance with this specification.

3.6.4.2 The filter(s) shall be preloaded to at least 100 percent of the initial HEPA/ULPA filter pressure drop at the required airflow velocity, paragraph 3.6.1. The average airflow velocity shall not be less than 90 percent of the average airflow velocity prior to loading.

3.6.5 Temperature Rise

3.6.5.1 The supplier shall determine the maximum rise in temperature in the clean air device workzone due to motor/fan(s) and cabinet fluorescent lamps.

3.6.5.2 The temperature rise shall not exceed 10 degrees F after four hours of continuos operation of the motor/fan(s) and fluorescent lights.

3.6.6 Lighting

3.6.6.1 The supplier shall test the illumination level of the work surface using a calibrated photoelectric meter.

3.6.6.2 A uniform light intensity of 200-foot candles average shall be provided at the work surface provided that no individual readings are less than 80-foot candles.

3.6.7 Structural Stability

3.6.7.1 The supplier shall test the clean air device for resistance to overturning, distortion, deflection of the work surface, and tipping per Section 10 of IEST-RP-CC-002. Assuming no cabinet modifications are made to the dimensions and weight of each cabinet size, the test shall be run once per size and the results made available to the University by written request.

3.6.8 Noise Level

3.6.8.1 The overall noise level one foot in front of the work opening of the cabinet shall not exceed 67 dBA, at a reference sound-pressure value of 20 micronewtons per meter squared (re: 0.0002 dynes per centimeter squared) when measured with the background not over 57 dBA. In addition, there shall be no objectionable pure tone noise component present during the operation of the cabinet. The overall noise level for the six foot and eight foot models can not exceed 75-dbA new filters and 78-dbA with loaded filters.

3.6.8.2 The noise level of the cabinet with the blower motor running at a filter loaded condition shall be no more than 70 dbA. The supplier shall verify this level and be prepared to present this information on demand by the University agent.

3.6.8.3 The supplier shall research the control of sound to achieve a sound pressure level of less than 60 dbA 12 inches in front of the working opening and 15 inches above the work surface of the cabinet for all models covered in this specification.

3.6.9 Vibration

3.6.9.1 The supplier shall run a vibration analysis of all clean air devices at the geometric center of the work surface using a calibrated vibration analyzer according to IEST-RP-CC-002.

3.6.9.2 The clean air device shall not exceed 200 micro-inches RMS amplitude at 10 to 200 Hertz when the cabinet is operated at the set point air velocity.

3.6.10 Electrical Leakage and Ground Fault Resistance

3.6.10.1 The supplier should consult NSF-49, Annex A, Test Method XIV before running this required performance test. The supplier shall run electrical leakage and ground fault resistance to cabinet ground connection on all models. The cabinet under test shall be set to operational air velocity as specified in section 3.6.1 using a calibrated electrical safety tester with 1 K input impedance.

3.6.10.2 The electrical leakage shall not exceed 500 microamperes on and off, normal and reverse polarity and the ground circuit resistance shall not exceed 0.15 ohms. Ground fault circuit interrupters shall also be tested for correct polarity and tripping at 5.0 milliamperes.

3.6.11 Filter Pressure Drop

3.6.11.1 The Supplier shall measure and record the supply filter pressure drop as inches water column.

3.6.11.2 The supply filter pressure drop shall be recorded at the airflow velocity as required in section 3.6.1. The value shall be reported in the factory certification report, section 4.2.

3.6.12 Particle Test

3.6.12.1 The supplier may be called upon to test the cabinet for particle concentration. The test shall be run according to IEST-RP-006, Testing Cleanrooms.

3.6.12.2 The cabinet particle count can not exceed ISO 5 conditions and may be required to comply with more stringent particle containment.

3.7 Labels

3.7.1 Restricted Substances Label: The cabinet shall have a permanently affixed (cemented) label. The label shall have the following phrase: "DO NOT USE TOXIC, EXPLOSIVE, OR FLAMMABLE SUBSTANCES IN THIS CABINET." This label shall be affixed directly above the work zone.

3.7.1.1 The supplier shall provide at least quarter-inch lettering using white lettering on a red background.

3.7.1.2 The exterior face of the sign shall have a plastic coating overlay to protect the sign from cleaning agents.

3.7.2 Manufacturer Label: The supplier shall install a supplier's label, permanently affixed to the front of the cabinet. The label shall be located on the operator's right side. The label shall contain:

(1) The supplier's name and address

(2) Cabinet type: Clean Air Device

(3) The cabinet model number

(4) The cabinet serial number

(5) Velocity range in LFPM and recommended grid in inches

(6) Supply HEPA filter size, rating, and quantity

(7) Factory Certification/Manufacture Date

3.7.3 Certification Plate: The cabinet shall have a permanently affixed stainless steel, Class 304, No. 4 satin finish plate, minimum U.S.S. Gauge No. 26, four inches vertical by five inches horizontal. This plate shall be installed at eye level (60-70 inches above floor elevation) or left in the work area for attachment by the certifier of the day at the initial certification. This plate shall be used to affix subsequent field certification labels.

3.7.4 UL and/or CSA Label

3.7.5 GFCI Label: Ground Fault Circuit Interrupter (GFCI) label.

3.7.5.1 All electrical outlets provided on or inside the clean air devices shall be labeled with ground fault circuit interrupter (GFCI) stickers.

3.7.6 Operator Instruction Label

3.7.6.1 The supplier shall affix an abbreviated set of operator instructions to the cabinet detailing instructions on the startup, use and shut down of the cabinet.

3.7.6.2 The operator instructions sign shall be plastic laminated and located 60 to 70 inches above floor elevation on the front panel of the cabinet.

3.8 Operations Manual

3.8.1 One copy of the operations manual containing the following information shall be furnished with each clean air devices. The manual shall be in a sealed container and taped to the work surface. If an electronic version of this information is to be provided, instructions as to its location and how to access it shall be provided.

(a) Unpacking procedure, purpose, location within the laboratory, cabinet function and description.

(b) Instructions for installing, operating and performing preventive maintenance on the cabinet. A detailed set of operating instructions shall also be included concerning the startup, operation and shut down procedure.

(c) Trouble shooting procedures.

(d) List of service parts (identified by supplier's part number) and quantity required for preventive maintenance purposes.

(e) HEPA and ULPA Filter - definitions, chemical effects, filter life, procedure for HEPA/ULPA filter replacement.

(f) An up-to-date wiring diagram of all electrical components shall be provided in the service manual.

(g) The fan/motor and motor performance curves should be provided with each cabinet as an attachment to the operations manual.

(h) A hard copy of the factory test results for all of the Production Quality Control Tests listed in Section 4.2 should be provided with each cabinet to be included in the operations manual.

(i) List of Tools and instruments required for Field Tests. Tool and instrument manufacturer addresses and phone numbers should be listed.

3.8.2 One copy of the manufacturer's operations manual for the clean air devices shall be submitted to the University Biological Safety Officer or the University Agent.

3.9 Pressure Gauge for Monitoring Filter Pressure Drop

3.9.1 Each Clean Air Device shall be equipped with one front mounted diaphragm activated air filter gauge rated for ±2 percent full scale accuracy. The gauge shall measure plenum pressure relative to the atmospheric pressure surrounding the cabinet. The gauge scale shall read at least 200 percent of the initial filter plenum pressure.

3.9.2 The gauge shall be prominently displayed in the front upper section of the cabinet at 60-70 inch elevation. The gauge can be mounted above the lamp assembly or below the worksurface near controls as an alternate to flush mounting.

3.9.3 The gauge shall have a front adjustable screw to adjust the needle to zero without disassembly of the gauge or removal of any cabinet assemblies to access this adjustment screw.

3.9.4 The gauge shall have a four inch diameter face to facilitate taking readings and calibration.

3.10 Parts List

3.10.1 The supplier shall provide a parts list by part name, part number and current price for the contract year. The parts list shall be provided to the University Purchasing Department and the University Agent in electronic format.

3.10.2 The parts list should be listed alphabetically and numerically.

3.10.3 The supplier shall have available, parts for each cabinet sold under the contract for at least ten years from the last production date of the cabinet model.

3.11 Options for Workstations

3.11.1 Option: Reinforce work surface: The supplier shall off a reinforced work surface rated to 200 pound loading

3.11.2 Option: Adjustable Leg Risers: The supplier shall offer adjustable leg risers to work surface height of 36 inches.

3.11.3 Option: Service Petcocks: The supplier shall offer left and right sidewall petcocks.

3.11.4 Option: Stainless steel IV Bar, Hangers, and plastic storage bins

3.11.5 Option: Tubular steel stand for bench models

3.11.6 Option: Five inch diameter casters with rubber tread, front and rear stainless push handles

3.11.7 Option: Second Duplex service outlet

3.11.8 Option: Isolated Blower(s) for low vibration work surface.

3.11.9 Option: 36-inch work surface elevation on console using optional leg risers

3.12 Drawings

3.12.1 Upon request the supplier shall provide drawings of this workstation detailing the entire front face of this workstation.

3.12.2 Upon request the supplier shall provide a plan view of this workstation. PDF files of same maybe sent as fulfilling this requirement, however the supplier shall provide “CAD” drawings if formally requested by the university agent

3.12.3 Drawings shall be provided in electronic format and will be used in the evaluation of the product or for the design and location of this product within the University Laboratory.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Qualifications

4.1.1 Procedure for Obtaining Qualification Applicants submitting bids shall submit to the University of Wisconsin a statement on the applicant's willingness to furnish clean air devices in conformance with this specification. As proof of compliance with the above statements the applicant must agree to submit test results, if called upon, for all prototype models. If corrections and/or modifications have been made since the prototype tests these changes shall be listed and detailed along with the test results.

4.1.1.1 UL and CSA Seals In the event that an individual purchase calls for an option that invalidates the UL or CSA Seal, the supplier shall note this in the drawing submittal in half inch block letters directly on the drawing, black on white: This design if approved shall not be listed under UL and/or CSA seal because of user requirements.

4.1.2 Prototype Tests The supplier shall conduct test procedures according to IEST-RP-CC0-02 Unidirectional-Flow Clean Air Devices, at the manufacturing facility for prototype models. This shall include electric tests outlined in section 3.6.10. If requested, the test results shall be provided in written form for review by the University Agent.

4.2 Production Quality Control Tests Each production clean air device unit shall meet the following required tests performed by the supplier on the unit at the factory. One signed factory test report, hard copy, shall accompany the operators manual for that cabinet. Approved Alternative: A digital copy of the factory test report can be provided with each device. Additional tests may be specified under specific specifications for a particular cabinet.

4.2.1 HEPA Filter Leak Test, IEST-RP-CC002 Unidirectional-Flow Clean Air Devices

4.2.2 Airflow Velocity, IEST-RP-CC002 Unidirectional-Flow Clean Air Devices

4.2.3 Temperature Rise, IEST-RP-CC002 Unidirectional-Flow Clean Air Devices

4.2.4 Lighting Intensity, IEST-RP-CC002 Unidirectional-Flow Clean Air Devices

4.2.5 Noise Level, IEST-RP-CC002 Unidirectional-Flow Clean Air Devices

4.2.6 Vibration, IEST-RP-CC002 Unidirectional-Flow Clean Air Devices

4.2.7 Structural Stability, IEST-RP-CC002 Unidirectional-Flow Clean Air Devices

4.2.8 Electrical Leakage and Ground Circuit Resistance and Polarity, Per NSF-49 1992 Edition

4.2.9 Filter Pressure Drop, Per Section 3.6.11 of this specification

4.2.10 Particle Test, Per Section 3.6.12

5.0 PREPARATION FOR DELIVERY

5.1 Packaging

5.1.1 All indicators, gauges and dials shall be covered with cushioning material conforming to PPP-C-843 and the cushioning material shall be secured in place with the tape conforming to PPP-T-60, Type II, Class 1.

5.1.2 All switch boxes, outlets, connections and drain line openings shall be sealed with the tape specified in Paragraph 5.1.1.

5.1.3 Instruction books, a copy of the test report, and parts lists shall be packaged together in accordance with MIL-P-116, method IC-1, and secured to the clean air devices in a protected location.

5.1.4 The work tray, front perforated area, air and/or light diffuser, fluorescent/LED light tube(s) shall be secured in position by taping, tying, blocking or bracing to prevent movement during transit.

5.2 Packing

5.2.1 Each clean air devices shall be packed in a container conforming to PPP-B-621, Class 2, style optional; or to PPP-B-601, overseas type; or PPP-B-640, Class 2, Grade A, Style optional. Except when a Class II, Type A-PEP clean air devices exceeds 1000 pounds net weight, it shall be packed in a crate conforming to MIL-C-3744; nailed assembly, skid type base. The contents of the crate shall be blocked, braced and anchored in accordance with MIL-C-104, and waterproofed with a shroud extending to the base of the crate in accordance with the appendix to MIL-C-132. Strapping shall be in accordance with the appendix to the applicable container specification. Approved Alternative: The cabinet shall be alternatively packed on a wooden skid rated for the shipping load, protected with cardboard walls and top with reinforcement members to face protect the front of the cabinet. The manufacturer shall be responsible for taping all moveable, unsecured cabinet components to insure against movement during transport. The shipping container shall be marked on all four sides with warning labels not to drop the contents.

5.2.2 Building Name and Room Number: The cabinet shall be tagged with the building name and room number of the campus laboratory where the unit is going to be installed.

6.0 NOTES

6.1 Guarantee The supplier guarantees the clean air devices against defective material, workmanship and performance for three years, said guarantee to run from the date of delivery. The supplier agrees to furnish, without cost to the University, replacement of all parts which are found to be defective during the guarantee period. Cost of installation (labor and decontamination if necessary) of replacement parts and material shall be borne by the supplier, exclusive of transportation charges on returned parts.

6.1.1 Extended Limited Warrantee The supplier warranties the clean air devices against defective parts for three years from the date of delivery.

6.1.2 Filters and lamp bulbs are perishable and may not be covered under 6.1.1 in the second and third years. The University Agent in conjunction with certification personnel will investigate filter and lamp parts to determine responsibility for replacement. The University will be the sole judge on requiring the guarantee on defective filters and lamp bulbs in the three year period, the supplier shall be consulted.

6.2 Qualification With respect to products requiring UL/CSA certification, awards will be made only for such products as have, prior to the bid opening date, been tested and approved for inclusion in the respective Products List, whether or not such products have actually been so listed by that date. The attention of suppliers is called to this requirement, and suppliers are urged to arrange to have products that they propose to offer to the University tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products covered by this specification may be obtained from the University Agent, UW-Environment, Health & Safety Department, University of Wisconsin-Madison, 30 East Campus Mall, Madison, Wisconsin 53715.

6.3 Inspection and Certification of Cabinet Delivered FOB Site

6.3.1 Notification of Delivery Supplier shall notify the University of Wisconsin-Madison – Environment, Health & Safety –Biological Safety Cabinet Program , 30 East Campus Mall, Madison, Wisconsin 53715, telephone: 608-262-1809, 10 days prior to date of expected delivery at designated FOB site Madison, Wisconsin.

6.3.2 Room Number Label: Attached to the safety cabinet underneath the packing plastic or written on cardboard will be a paper label attached with a string. The label shall have the room number and building or address that the cabinet is being delivered to assist university loading dock personnel, certifiers and moving and transfer personnel in the final resting location of the safety cabinet. Current program needs for data management require that the location of the safety cabinet be identified by the manufacturer PRIOR to shipment.

6.3.2.1 Direct Delivery to the Laboratory: Alternative shipment: FOB Room: The supplier upon request shall arrange delivery of the safety cabinet to the lab space of the designated room at the University. The supplier shall therefore list as an option direct delivery cost to the laboratory and assume all delivery and moving liability. This cost shall not be changed during the term of the contract unless prior approval has been received from the University Agent or Biological Safety Cabinet Program. A 90 day notice of intent to change shall be provided.

6.3.3 Dock Inspection User/Purchaser will notify the UW Environment, Health & Safety –Biological SAfeyt Cabinet Program of the cabinet's arrival. Gross inspection will be made for punctures, breakage or other signs of damage to packaging material and/or cabinet. Notation will be made of defects observed. Suppliers will be promptly notified of any defects or deficiencies in the cabinet. Following disassembly of outer packing and further inspection for damages, completeness of cabinet and options, authorization (by the Environment, Health & Safety –Biological Safety CAbient Program) will be given to the user to arrange for transfer to the designated laboratory. The user, supplier's representative, and the Biological Safety Cabinet Program will have previously arranged the site, utility proximity and other installation considerations for the cabinet.

6.3.3.1 Hidden Damage The University shall not be liable for hidden damage. It will be the responsibility of the supplier, shipper and/or moving and transfer agent to correct any hidden/undisclosed damages. The University shall notify the interested party(s) of any damage that is discovered. The cabinet supplier shall have the primary liability for resolving hidden damages with all parties concerned including replacing parts, the costs for labor or the cabinet itself.

6.3.3.2 Replacement Parts or Cabinet The cabinet is a custom made unit manufactured to controlled University specifications. Therefore if standard replacement parts are called for the supplier shall have 14 days to ship the parts to the University. If custom made parts or the entire cabinet is damaged the supplier has 60 days in order to replace these parts or cabinet.

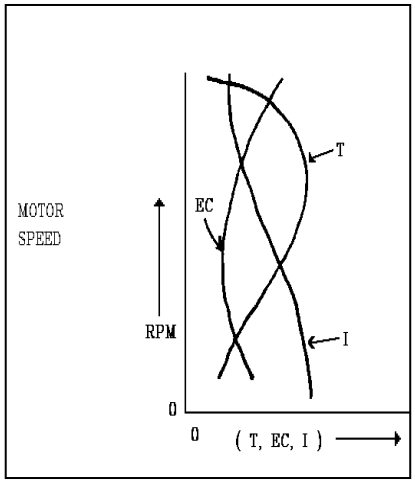
6.3.3.3 Certification Tests Upon installation, cabinet certification tests (paid by user) will be performed on the installed cabinet. These tests will follow those outlined in Paragraph 4.2, both in scope and method of performance. In addition, a filter-load test to determine fulfillment of the "10/100" requirement as stipulated in Paragraph 3.5.6.3 may be made by the Biological Safety Cabinet Program on selected clean air devices if there is some question of the fan/motor performance graphs cited in Paragraph 3.1.1. Cabinet site tests will be compared to results of factory control tests, which accompany the operator's manual for the cabinet supplied.

6.3.4 Penalties for Noncompliance Labor for minor corrections needed to achieve certification beyond one hour normally allotted will be charged to the supplier at the rate of $200.00 per hour. Failure of the cabinet to meet any of the tests specified (unless only minor correction suffices) or structural material requirements shall constitute grounds for rejection. The cabinet will be returned at the supplier's expense unless remedial action (including parts and labor) is provided within 30 days. This corrective action must be appropriate and satisfactory in the opinion of the Biological Safety Cabinet Program and purchaser and enable the cabinet to pass the specified certification tests. At the option of the supplier corrective labor necessary to satisfy the performance can be performed by the Biological Safety Cabinet Program group at the rate stipulated above ($200.00/hour).

6.4 Fabrication and Delivery Time Once drawing approval is given on a cabinet, the supplier shall commence fabrication within thirty days. Shipment shall be made within sixty days of drawing approval. The supplier shall complete an individual cabinet order no later than three months from the time the drawing approval is issued. Three months from the time of approval to shipment from the supplier’s loading dock is considered the maximum time and shall not occur more than three times per twelve month rolling period. The supplier shall contact the University Agent in order to clarify any conflicts in shipping and specification compliance to ensure acceptable delivery time.

6.4.1 Inspection and Certification of Cabinet Delivered FOB Laboratory: The University requests that the supplier prepare an optional cost for delivery FOB laboratory room. This cost shall not be changed during the term of the contract unless prior approval has been received from the University Agent or Biological Safety Cabinet Program. A 90 day notice of intent to change shall be provided. Shipping Inspection will be during certification in the final “AS IS” location.

APPENDIX A
GRAPH 1
Example Motor Performance Graph (Specification 3.1.1.1)



MOTOR MANUFACTURER:
MOTOR MODEL NUMBER:
MOTOR HORSEPOWER:_____(HP)
CAPACITOR SIZE:_____(MFD)

T= MOTOR TORQUE OUNCE FEET
EC= VOLTAGE ACROSS CAPACITOR
I= MOTOR AMPERES
RPM= REVOLUTIONS PER MINUTE
MFD= MICROFARAD

T - OUNCE FEET x MULT. _____
EC - x MULT. _____
I - x MULT. _____

APPENDIX A
GRAPH 2
Example Fan Motor Performance Graph (Specification 3.1.1.2)

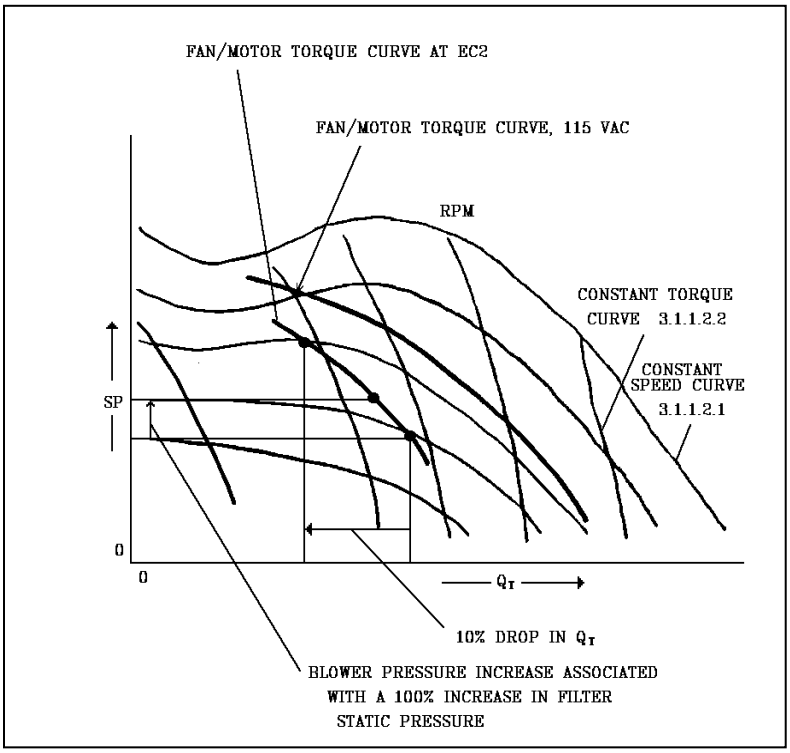
3.1.1.2.4.4 Clean filters with cabinet air velocities required under Paragraph 3.6.1.
QT = ___ CFM, Motor Speed = ___ RPM, Filter Pressure Drop = ___ IWC

3.1.1.2.4.5 Loaded filters to produce a 10 percent reduction in total airflow.
QT = ___ CFM, Motor Speed = ___ RPM, Filter Pressure Drop = ___ IWC

FAN MANUFACTURER:
FAN MODEL NUMBER:
MOTOR MANUFACTURER:
MOTOR MODEL NUMBER:

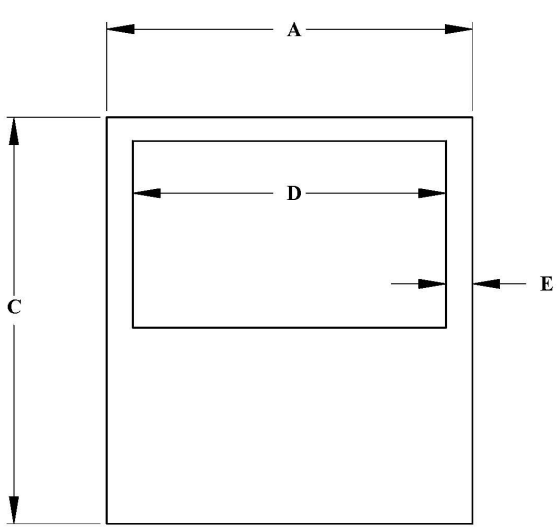
OPERATIONAL TORQUE DEFINED BY
THE EXPRESSION:

T2 = T1/(EC1/EC2)e2
T2 = OPERATIONAL TORQUE - OUNCE FEET
T1 = TORQUE AT 115 VOLTS AC-OUNCE FEET
EC1 = 115 VOLTS AC
EC2 = OPERATIONAL VOLTAGE

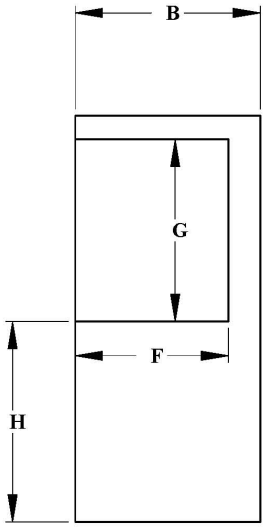


QT=FAN AIRFLOW-CFM-STANDARD AIR
SP=FAN STATIC PRESSURE-IWC
IWC=INCHES WATER COLUMN

Required minimum load factor is 100% as reported in graph & paragraph 3.5.6.3



FRONT VIEW



SIDE VIEW

NOT TO SCALE

DIMENSIONAL REQUIREMENTS IN INCHES

	A (RANGE)	B (RANGE)	C (RANGE)	D (RANGE)	E (RANGE)	F (RANGE)	G (RANGE)	H (RANGE)
BENCH TOP	28 (27-29)	27 (26-28)	43 (42-44)	22 (21-23)	3 (1-3)	17 (16-18)	22 (21-23)	NA
3ft Bench	38 (37-39)	34 (33-35)	64 (63-67)	35 (34-36)	3 (1-3)	22 (21-23)	28 (27-29)	30 (29-33)
4 ft Bench	50 (49-51)	34 (33-35)	64 (63-73)	46 (45-47)	3 (1-3)	22 (21-23)	28 (27-34)	30 (29-33)
5 ft Bench	62 (61-63)	34 (33-35)	64 (63-73)	58 (57-59)	3 (1-3)	22 (21-23)	28 (27-29)	30 (29-33)
6 ft Bench	74 (73-75)	34 (33-35)	64 (63-73)	70 (69-71)	3 (1-3)	22 (21-23)	28 (27-34)	30 (29-33)
8 ft Bench	98 (97-99)	34 (33-35)	64 (63-73)	94 (93-95)	3 (1-3)	22 (21-23)	28 (27-29)	30 (29-33)