11611 – CUSTOM LABORATORY VENTILATED ENCLOSURES AND FUME HOODS

PART 1: DESCRIPTION OF WORK

1.00 SUMMARY AND SCOPE

A. Section Includes:
Based on New-Tech, Midland, Michigan Ventilated Enclosure design, furnish and install all Ventilated Enclosures. All further references of a Licensed Engineer shall be a Licensed Engineer from the State in which the Ventilated Enclosures is manufactured.

B. Scope:

Design and construction of Ventilated Enclosures is covered by this specification. Ventilation related issues are not covered here, but are in "Design for Ventilated Enclosure Installation"

C. Accessorization:

Furnishing and delivering all service outlets, accessory fittings, electrical receptacles, switches, and internal baffling as listed in these specifications, equipment schedules or as shown on drawings. The final on-site plumbing, electrical and sheet metal connections are the responsibility of the Sub-Contractors.

1. Plumbing fittings mounted on the Ventilated Enclosure shall be preplumbed by the Manufacture per section 2.01.I. The Plumbing Services design shall be approved and inspected by a Licensed Mechanical Engineer.

2. Electrical fixtures shall be prewired by the Manufacture per section 2.01.J. The Electrical Services design shall be approved and inspected by a Licensed Electrical Engineer.

3. Sheet Metal connections shall be mounted on the Ventilated Enclosure by the Manufacture per section 2.01.F.

4. If the Ventilated Enclosure requires internal baffles, the baffle size, location and configurations shall be designed and approved by a Licensed Mechanical Engineer. These internal baffles shall be installed by the Manufacture per section 2.01.E.

D. Removal of all debris, dirt and rubbish accumulated as a result of the installation of the Ventilated Enclosure to an on-site container provided by others, leaving the premises clean and orderly.

E. Related Publications:
1. ANSI/ASHRAE 110.1995 - Method of Testing Performance of Laboratory Fume Hoods
2. NSF STD#49 - Photometric Method of Testing
3. NIH03-112C - National Institute of Health Specification
4. UL - Underwriters Laboratories
5. ASTM D552 - Bending Test
6. NFPA-45 - National Fire Protection Association
7. ANSI/AIHA Z9.5-2003 Laboratory Ventilation
8. OSHA – 29CFR1910.1450 Occupational Exposures to Hazardous Chemicals in Laboratories

1.01 BASIS OF WORK

A. It is the intent of this specification to use New-Tech, Midland, Michigan as the standard of construction for laboratory ventilated enclosures. The construction standards of the Ventilated Enclosure shall provide the basis for quality and functional installation.

B. Supply all equipment in accordance with this specification. The offering of a product differing in materials and construction from this specification requires written approval by a OWNER or Owners Representative. This approval must be obtained in writing seven (7) days before the proposal deadline.

C. General Contractors should secure a list of approved Ventilated Enclosure manufacturers from the ARCHITECT or OWNER as a protection against non-conformance to these specifications.

D. OWNER reserves the right to reject qualified or alternate proposals and to award based on product value where such action assures greater integrity of product.

E. Submittals:

1. Samples:
   Samples if called for will be reviewed for color, texture, and pattern only. Submit the following:
   a. Enclosure interior lining, 6 by 6 inches.
   b. Enclosure exterior, 6 by 6 inches, of color selected.
   c. Operation sign(s).

2. Shop Drawings:
   a. Submit shop drawings for Ventilated Enclosures showing plans, elevations, ends, cross-sections, service run spaces, location and type of service fittings:
   b. Coordinate shop drawings with other work involved.
   c. Provide roughing-in drawings for mechanical and electrical services when required.
   d. Provide face working opening for sash, air volume, and static pressure drop data.
   e. Shop/Submittal Drawings should be approved and stamped by individual discipline Licensed Professional Engineers in the Plumbing/Mechanical, Electrical and Structural Disciplines.

3. The OWNER requires that a prototype Ventilated Enclosure be constructed for all projects. The prototype, at a minimum of 75% completion, shall be made available for review within four (4) weeks from approved submittal drawings. This prototype shall be constructed to allow for ARCHITECT and OWNER to inspect the prototype at the manufacturing facility to give written approval or notice of modifications. ARCHITECT and OWNER require two week notification of prototype readiness to coordinate inspection. If OWNER chooses not to perform a manufacturer site inspection, detailed photographs shall be produced for OWNER to provide the written approval or notice of modifications.

1.02 STANDARD VENTILATED ENCLOSURE PERFORMANCE REQUIREMENTS

A. Ventilated Enclosures shall be designed to ensure maximum operating efficiency. Sash and air entry framework of the enclosure shall minimize eddying of air currents at the enclosure face. Rear baffle system shall minimize turbulence and vortexes in all portions of the Ventilated Enclosure interior.

B. Designed Airflow Criteria shall be according to G5D-5032-02 (Choose Item(s) listed below):
1. Constant Airflow (By-Pass) Ventilated Enclosure designed to yield 100 FPM face velocity at 18” sash opening (+/- 20%)
2. Variable Air Volume (VAV) Ventilated Enclosure designed to yield 100 FPM face velocity at 18” sash opening (+/- 20%)
3. Constant Airflow (By-Pass) Ventilated Enclosure designed to yield 25 CFM per Square Foot of interior floor space
4. Two Stage Airflow with Low Flow Setting Designed to Yield 120 AC/HR in within Enclosure.

C. Containment:

1. At their option, OWNER may require an airflow performance test of the Ventilated Enclosures before delivery of product. OWNER or their representative shall witness the tests. Failure to meet the performance specified shall be cause for cancellation without penalty of the contract.
   a. The performance test criteria are contained in the ASHRAE 110 standard.

PART 2 - PRODUCTS

2.00 MANUFACTURERS

A. The basis of this specification is New-Tech, Midland, Michigan, Ventilated Enclosure design, furnish and install all Ventilated Enclosures.

B. All laboratory equipment covered by the specification shall be the product of one manufacturer and be fabricated at one geographic location to assure shipping continuity and single-source responsibility.

C. The selected manufacturer must warrant for a period of one-year starting (date of acceptance or occupancy, whichever comes first) that all products sold under the contract referenced above shall be free from defects in material and workmanship. Purchaser shall notify the manufacturer's representative immediately of any defective product. The manufacturer shall have a reasonable opportunity to inspect the goods. The purchaser shall return no product until receipt by purchaser of written shipping instructions from the manufacturer.

2.01 MATERIALS AND CONSTRUCTION

A. Ventilated Enclosure Superstructure Frame:
The Superstructure Frame of the Ventilated Enclosure shall be made from a minimum of 2” x 2” - 14 Gauge Hot Rolled EWS steel. This superstructure frame shall be fully welded by a Certified Welder. The Superstructure Frame shall be designed to support a minimum of 50 lbs per square foot of ceiling on all enclosures deeper than 24” of exterior depth. This design is to allow other trades to be able to stand on and work from the ceiling of the Ventilated Enclosure. The design of the superstructure shall be approved by and inspected by a Licensed Professional Structural Engineer, licensed in the state at which the Ventilated Enclosure is to be installed. The structure of steel support members shall be provided to support exterior panels and interior liner and baffle panels. To allow for maintenance and replacements, the baffle panels shall be removable without disassembly of the frame structure and outer steel panels. Likewise, the exterior steel panels shall be removable without disassembly of the frame structure and inner liner panels.

B. Ventilated Enclosure Interior Walls:
Double wall ends, not more than 4.5" wide on ends and 6.0” wide on common walls, shall be provided to maximize interior working area. The area between the double wall ends shall be closed to house the remote control valves.

C. Ventilated Enclosure Exterior Panels: All Exterior Enclosure Panels shall be 16 Gauge Furniture Grade Cold Rolled Steel Panels. All exterior side wall finished panels will be removable without disassembly of the frame structure and inner liner panels. All Exterior Enclosure Panels will have a finish applied per Section 2.01.N and Section 2.02.A.

D. Ventilated Enclosure Top Panel:
Ventilated Enclosure top panel shall incorporate a bypass providing a clean air stream behind the sash plane.

E. Ventilated Enclosure Baffles:
The Ventilated Enclosure baffles shall be constructed of the same material as the interior lining. They shall consist of multiple sections with vertical slots and a continuous horizontal slot at the worksurface. Each baffle panel shall be easily removable from the interior, without requiring liner disassembly. The

baffle size, location and configurations shall be designed and approved by a Licensed Mechanical Engineer.

F. Ventilated Enclosure Duct Collar:
Each Ventilated Enclosure up to six feet in length shall contain one (1) polyethylene or stainless steel bell-mouthed duct collar in the hood roof for exhausting the hood. Ventilated Enclosures over six feet in length shall contain two (2). Size of the duct collars shall be determined by airflow design. Rectangular duct collars are also acceptable if the design calls for it.
1. Outlet Velocity of Collar to have a 1600-1800 FPM target velocity.

G. Ventilated Enclosure Lighting:
A two-tube energy-efficient T-8 fluorescent light fixture of the size given below shall be provided in the enclosure roof. Illumination at the worksurface shall be at least 100 foot-candles, provide lighting calculation certified by a Licensed Professional Electrical Engineer. The light fixture shall be isolated from the enclosure interior by a 1/4" thick laminated safety glass panel sealed from the enclosure cavity. Fixture shall be UL listed.

H. Ventilated Enclosure Vertical Sash or Horizontal Doors (Per Design):
Vertical Sashes: A vertically moving sash shall be movable throughout its travel by application of no more than five pounds of force and shall remain stationary when force is removed. The sash shall be a fully framed sash constructed from Hot Rolled EWS tubular steel or Type # 316 Stainless Steel tubing. These sash frames shall be fully welded by a Certified. The sashes will have ¼" laminated safety glass panels set into a Neoprene gasket. These glass panels shall be removable without having to remove the sash frames. The vertical sash shall ride on Polypropylene glides within Type # 316 Stainless Steel tracks to provide a smooth none metal-to-metal contact.

These Vertical Sashes will be connected to a counterweight by 7X19 - 3/32" OD Vinyl Coated Stainless Steel Aircraft cables. These cables will roll over 2-7/16" Dia. Nylon Pulleys with Stainless Steel Ball Bearing Rollers. These Nylon Pulleys shall be attached to the tubular steel superstructure not the liner materials.

If a combination sash is requested, the combination sash will follow the Vertical Sash specifications along with the following additions. The height, width and configurations of these horizontally sliding doors will be determined by the Owner/User and properly designed by the Manufacture and approved by the Owner on the Submittal Drawings. The horizontal sliding doors will be constructed of ¼" Laminated Safety Glass with a 5/16" Stainless Steel U-Channel edging on the top and both sides. The top track of the combination frames will be an anodized aluminum track with plastic lining for ease of horizontal sliding door movement. The bottom track of each door will be an anodized aluminum H-Channel with Heavy-Duty Nylon Ball Bearing Wheels that will ride on an anodized aluminum shoe track. Each pair of rollers is designed to support 15 sqft of glass. Each horizontally sliding door will have two (2) stick on plastic finger pulls.

Or

Horizontal Sliding Doors: A vertically moving sash shall be movable throughout its travel by application of no more than five pounds of force and shall remain stationary when force is removed. The horizontal sliding door height, width and configurations shall be determined by the Owner/User and properly designed by the Manufacture and approved by the Owner on the Submittal Drawings. The horizontally sliding doors shall be designed so that they cannot fall out of or into the Ventilated Enclosure. The horizontal sliding doors will be constructed of ¼" Laminated Safety Glass. These doors shall be top hung doors (bottom rolling doors or double action ball bearing tracks are NOT acceptable). The top hung door track will be an anodized aluminum overhead track system. The horizontal sliding doors will have a hanging rail attached to the top of the doors constructed from anodized aluminum with Nylon Rollers with Stainless Steel ball bearings. These Nylon Rollers will roll in the top hung hanging track. The horizontal sliding doors will have a full length anodized aluminum finger pull on both side edges. The bottom edge of the horizontal sliding doors will have an anodized aluminum U-channel. These horizontal sliding doors will be guided at the bottom by a Type # 316 Stainless Steel track that will be

mounted and sealed to the floor. The Manufacture will provide aType # 316 Stainless Steel Ramp assembly (width of one door) that will set into the bottom track so that the Owner/User can roll items into and out of the Ventilated Enclosure. One ramp is required per four (4) horizontally sliding doors. Each ramp shall be constructed of 11 Gauge Type # 316 Stainless Steel, designed to support 500 lbs of weight being rolled over these ramps.

I. Ventilated Enclosure Services:
Rod Type Remote Control Fittings:
Service fitting valves shall be mounted to the enclosure interior sidewall liner with extension rods to the front vertical facia. Valves shall be furnished with chrome plated brass four-arm handles with color-coded index buttons and chrome plated brass panel flanges with removable hose barb fittings (chrome plated brass with clear epoxy coatings are available).

All plumbing piping shall meet the requirements specified on approved Engineering Project Bid Documents. The service piping shall be furnished and installed by the Ventilated Enclosure Manufacture. All plumbing fittings shall be factory installed and piped from the valve to a point 6" above the enclosure roof. These service pipes shall meet specification DE42. All fittings shall be Swage Type Nut & Ferrule three piece construction. Final plumbing connections shall be by the Plumbing Subcontractor.

J. Ventilated Enclosure Electrical Fixtures:
All electrical services shall meet the requirements specified on approved Engineering Project Bid Documents. The Ventilated Enclosure superstructure shall be pre-wired by the Manufacture. The Electrical Services design should be approved and inspected by a Licensed Electrical Engineer. Electrical fixtures shall consist of GFCI duplex receptacles and a light switch. The GFCI duplex receptacles shall be 20 Amp, 125 volt AC, and 3-wire polarized grounded with ground fault interruption. The receptacles shall be specification grade. The light switch shall be 20 Amp, 125 volt AC, and 3-wire polarized grounded. Wiring shall terminate in one common junction box per side wall. Final wiring and circuit dedication shall be by the Electrical Subcontractor.

K. Access Openings:
The interior end liner panels shall be furnished with a rectangular shaped opening that provides access to the service piping and valves to facilitate installation and maintenance. The openings shall be covered with a removable panel made from enclosure liner material.
    1. Owner specified locations shall be equipped with electrical cable pass-through duct to the interior of enclosure from the front.

L. Ventilated Enclosure Dimensions:
Double wall end panel thickness shall not exceed 4.5". Interior clear working height shall be not less than 96" at the ceiling of the enclosure. Interior depth from the back of the sash, or horizontal sliding doors, to the front of the rear baffle shall not be less than 24”. These measurements are guidelines for standard units. Custom units can have other measurements if specified.

M. Ventilated Enclosure Liners (Base on Drawings):
Polyply Composites ChemBlok CR-900 glass reinforced liner. CR-900 has a flame spread of 20.2 which meets the ASTM E-84 Class A and UL 723 flame spread rating (25 or less). CR-900 is a Self-Extinguishing Material. All interior liner panels shall be fastened with Stainless Steel screws. Nylon, Polypropylene or Plastic fasteners are NOT acceptable.

And/Or

Stainless Steel Lining:
Interior liner panels shall be 16 gauge Type # 316 Stainless Steel. Interior liner panels shall be fastened using stainless steel screws. Nylon, Polypropylene or Plastic fasteners are NOT acceptable.

N. Ventilated Enclosure Finish:
After the component parts have been completely welded together and before finishing, they shall be

given a pre-paint treatment to provide excellent adhesion of the finish system to the steel and to aid in the prevention of corrosion. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine grained crystalline phosphate surface that shall provide both an excellent bond for the finish and enhance the protection provided by the finish against humidity and corrosive chemicals.

After forming, all cold rolled steel parts shall be sanded to remove weld marks and other surface imperfections. These parts shall then be chemically cleaned, washed, rinsed, and then given a final phosphate treatment that is dried at elevated temperatures prior to paint application. All metal panels shall receive a prime and finish coat of enamel applied and baked. The baked-on enamel finish shall have the following chemical resistant performance, based on the following test procedure.

The completed finish in standard colors shall meet the performance test requirements specified under Section 2.02 A. Steel Paint Finish Performance Test Results.

O. Ventilated Enclosure Accessories:
   1. Furnish and install Dwyer Magnehelic Model 2000-0 recessed flush into face panel of hood for easy viewing by laboratory personnel. If gauge is mounted above eight foot above finished floor the gauge mounting shall be tilted to ensure easy viewing by laboratory personnel standing in front of Ventilated Enclosure. Low pressure port shall be piped using ¼" Poly-Tubing into the Ventilated Enclosure Duct Collar using a Dwyer A-308 Static Pressure Tip.
   2. Based on the requirements of the Mechanical drawings, install the Laboratory VAV Controller including but not limited to Display, Thru-the-wall Velocity Sensors, Sash area measurement sensors, associated cables and wire per manufacturer instructions. Components are furnished by Mechanical Contractor as needed by project.

2.02 PERFORMANCE REQUIREMENTS

A. The spot tests were made by placing a watch glass in a 5 drop puddle of each reagent solution on the test areas. After one hour, the test was thoroughly rinsed and wiped dry prior to examination. The following test reagents were used as specified:

REAGENT	TIME IN MINUTES	TEST RATINGS
SULFURIC ACID, 85%	60	EXCELLENT
SULFURIC ACID, 25%	60	EXCELLENT
HYDROCHLORIC ACID, 37%	60	EXCELLENT
NITRIC ACID	60	EXCELLENT
PHOSPHORIC ACID, 75%	60	EXCELLENT
CHROMIC ACID	60	EXCELLENT
ACETIC ACID, GLACIAL	60	EXCELLENT
SODIUM HYDROXIDE, 25%	60	EXCELLENT
SODIUM HYDROXIDE, 10%	60	EXCELLENT
AMMONIUM HYDROXIDE, 28%	60	EXCELLENT
HYDROGEN PEROXIDE, 5%	60	EXCELLENT
ETHER	60	EXCELLENT
ETHYL ACETATE	60	EXCELLENT
XYLENE	60	EXCELLENT
ACETONE	60	EXCELLENT
PHENOL, 85%	60	EXCELLENT
FORMALDEHYDE, 37%	60	EXCELLENT
CARBON TETRACHLORIDE	60	EXCELLENT
METHYL ETHYL KETONE	60	EXCELLENT

Ventilated Enclosure Liner Performance:

1. Chemical Spot Tests - 24 Hours:
   Chemical spot test shall be made by applying 10 drops (approximately 1/2 cc) of each reagent to

the surface to be tested. Each reagent (except those marked **) shall be covered with a 1-1/2" diameter watch glass, convex side down to confine the reagent. Spot tests of volatile solvents marked ** shall be tested as follows: A 1" or larger ball of cotton shall be saturated with the solvent and placed on the surfaces to be tested. The cotton ball shall then be covered by an inverted 2-ounce, wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire 24-hour test period and at a temperature of 77 degrees F. + 3 degrees F. At the end of the test period, the reagents shall be flushed from the surfaces with water and the surface scrubbed with a soft bristle brush under running water, rinsed, and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Spots where dyes have dried shall be cleaned with a cotton swab soaked in alcohol to remove the surface dye. The test panel shall then be evaluated immediately after drying.

2. Legend / Ratings:

1 –ChemBlok CR-900
2 - Stainless Steel 304
3 - Stainless Steel 316

A = No effect or slight change in gloss
B = Slight change in gloss or color
C = Slight etching or severe staining
D = Swelling, pitting, or severe etching

3. RESULTS:

		1	2	3
1.	Acetic Acid 98%	A	B	B
2.	Acetone **	A	A	A
3.	Ammonium Hydroxide ** 28%	A	B	B
4.	Benzene **	A	A	A
5.	Butyl Alcohol **	A	A	A
6.	Carbon Tetrachloride **	A	A	A
7.	Chloroform **	A	A	A
8.	Dimethylformamide	A	A	A
9.	Ethyl Acetate **	A	A	A
10.	Ethyl Ether **	A	A	A
11.	Ethyl Alcohol **	A	A	A
12.	Formaldehyde	A	A	A
13.	Gasoline **	A	A	A
14.	Hydrochloric Acid 37%	A	B	B
15.	Hydrofluoric Acid 48%	A	D	D
16.	Hydrogen Peroxide 30%	A	A	A
17.	Methyl Ethyl Ketone **	A	A	A
18.	Methyl Alcohol **	A	A	A
19.	Methylene Chloride **	A	A	A
20.	Naphthalene **	B	A	A
21.	Nitric Acid 20%	A	B	A
22.	Nitric Acid 30%	A	B	A
23.	Nitric Acid 70%	A	B	A
24.	Phenol ** 85%	B	A	A
25.	Phosphoric Acid 85%	A	B	A
26.	Sodium Hydroxide 40%	A	A	A
27.	Sodium Hydroxide 20%	A	A	A
28.	Sodium Hydroxide 10%	A	A	A
29.	Sulfuric Acid 77%	B	C	A
30.	Sulfuric Acid 96%	B	C	A
31.	Sulfuric Acid 33%	B	C	A
32.	Tincture of Iodine	B	B	B
33.	Toluene **	A	A	A
34.	Xylene **	A	A	A
35.	Nitric 70%/Sulfuric Acid 77%*	A	B	A

* Equal parts of Nitric Acid 70% and Sulfuric Acid 77%.
** Indicates these solvents tested with cotton and jar method.

PART 3 - EXECUTION –VENTILATED ENCLOSURES

3.00 SITE EXAMINATION

A. The owner and/or his representative shall certify building conditions conducive to the installation of a finished goods product, including all critical dimensions.

3.01 INSTALLATION

A. All Manufacturing Representatives, Sales Representatives and Installation Crews must be current in all Required Trainings such as but not limited to the following: Security Clearances and all Site Specific Building Training.

B. Preparation:
Prior to beginning installation of enclosure, check and verify that no irregularities exist that would affect quality of execution of work specified.

C. Coordination:
Coordinate the work of the Section with the schedule and other requirements of other work being performed in the area at the same time both with regard to mechanical and electrical connections to and in the enclosure and the general construction work.

D. Performance:
Install enclosure, plumb, level, rigid, securely anchored to building and adjacent furniture in proper location, in accordance with manufacturer's instructions and the approved shop drawings. Provide filler panels between top of enclosure and ceiling where required. Securely attach access panels but provide for easy removal and secure reattachment. Do not install any damaged units. Demonstrate that the sashes and doors are movable throughout there travel by application of no more than five pounds of force and that they remain stationary when force is removed.

E. Adjust and Clean:
1. After installations are complete, adjust all moving parts for smooth operation.
2. Remove all packing materials and debris resulting from this work, and turn over the enclosure to the Owner clean and polished both inside and out.
3. Repair or remove and replace defective work, as directed by owner and/or his representative upon completion of installation.

F. Protection:
1. Provide reasonable protective measures to prevent enclosure and equipment from being exposed to other construction activity.
2. Advise owner and/or his representative of procedures and precautions for protection of material, installed enclosure and fixtures from damage by work of other trades.