NU-S125 Class II, Type A2 AutoLabGard **E**nergy **S**aver Biological Safety Cabinet Performance Evaluation

Background

With more use of automation in today's life science laboratories, NuAire has developed a line of Biological Safety Cabinets to house high volume automation systems, i.e. flow cytometry, fermentation equipment, liquid handling or any large device requiring class II containment performance. Being a class II primary engineering control, any aerosols and particulates generated within the cabinet will be contained through HEPA filtration. If vapors and odors are generated in the process, the cabinet may be canopy connected to a facility exhaust to facilitate removal.

The NU-S125 AutoLabGard ES is designed and constructed with an interior stainless steel floor and wall panels that are gasketed and bolted together. Painted exterior Cold Rolled Steel (CRS) cover panels are gasketed and bolted to the stainless wall panels that make up the negative pressure plenum. Painted CRS blower modules are mounted on top of the wall panels and contain both the supply and exhaust HEPA filters along with the energy efficient DC ECM motor/blowers. Stainless steel doors complete the cabinet enclosure with a hinged window assembly mounted on each door providing an 8 inch (203mm) access opening. If additional access is needed to the interior for user or system interfaces (i.e. power/computer cables, process tubing, etc.), negative pressure pass-through ports may be added to the sides or rear of the enclosure that maintain enclosure containment.

The airflow pattern of the NU-S125 AutoLabGard ES is identical to any class II, type A2 BSC. Room air is pulled into the cabinet through the work access opening at an average velocity of 105 fpm (.53 m/s) to provide an air barrier. The airflow is then pulled at a negative pressure through the side walls and up the rear plenum into the DC ECM motor/blowers. The airflow is then pushed out of the DC ECM motor/blower and into the supply plenum at a positive pressure then spilt between the exhaust HEPA filter (30%) and the supply HEPA filter (70%). The exhaust airflow is then either pushed back into the room or into an exhaust canopy connected to a facility exhaust system. The supply airflow is then pushed down into the work zone through a supply diffuser providing uniform HEPA filtered airflow over the entire area within the cabinet. The supply airflow then enters the front and rear grills to mix with the inflow and recirculate back up to the DC ECM motor/blower. An illustration of the airflow pattern may be reviewed on drawing BCD-14671.

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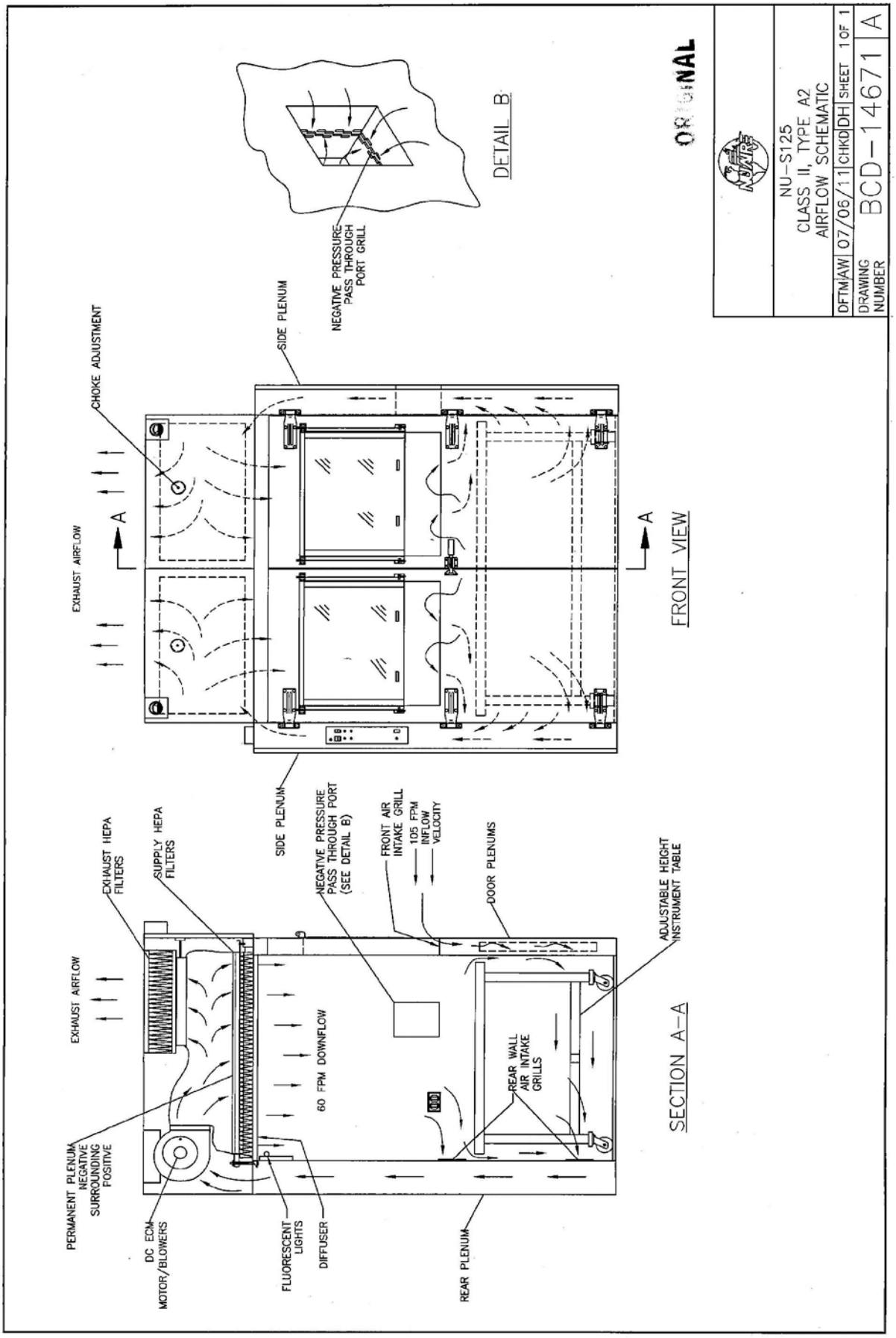

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The NU-S125 performance evaluation was conducted by NuAire for the factory evaluation and with the aid of B & V testing for the field evaluation to quantify the cabinet's ability to provide personnel and product protection. Two different test methods were used to measure the containment performance properties the BSC. The Test methods used for each of the above was the following:

1) Biological - NSF/ANSI 49 (static, as manufactured)
2) Tracer gas – ASHRAE 110 (dynamic, as installed)

Test Result Summary

Testing was conducted on a representative NU-S125-648 model size (72" interior width and 48" interior depth) for both factory and field testing being the most commonly used model size for Flow Cytometry. In both locations, airflow was adjusted as needed (inflow and downflow) for challenge testing. Additional testing information is provided in the attachments.

1) Biological Testing (static)
   The NU-S125 cabinet was set up and exhausted back into the room. Tests were performed per NSF/ANSI 49 on each door window access opening (right and left). Cabinet airflows were adjusted for both product and personnel protection at nominal and tolerance set points. All tests passed using NSF/ANSI 49 test criteria of 5 or less Colony Forming Units (CFU's) total for the slit samplers and 10 or less CFU's for the Impingers as shown in the table below.

Test	Velocity (fpm) test points		Test locations/results	
	Inflow	Downflow	Right side	Left side
Personnel	105	60	pass	pass
Product	105	60	pass	pass
Personnel	115	52	pass	pass
Product	96	69	pass	pass
Personnel	95	51	pass	pass
Product	95	51	pass	pass

2) Tracer Gas Testing (Dynamic)
   The NU-S125 cabinet was set up with a BD FACSAria installed on the interior table and operating during the test. The cabinet was exhausted with a canopy into the facility exhaust system, so all the exhausted tracer gas would be removed from the room. The test set up was similar to the NSF/ANSI 49 using a nebulizer supplied with 4 Liters per minute (Lpm) of tracer gas (SF_6) and monitored at the cabinet face with a gas detector. All the tracer gas measured below 0.10 ppm at the cabinet face.

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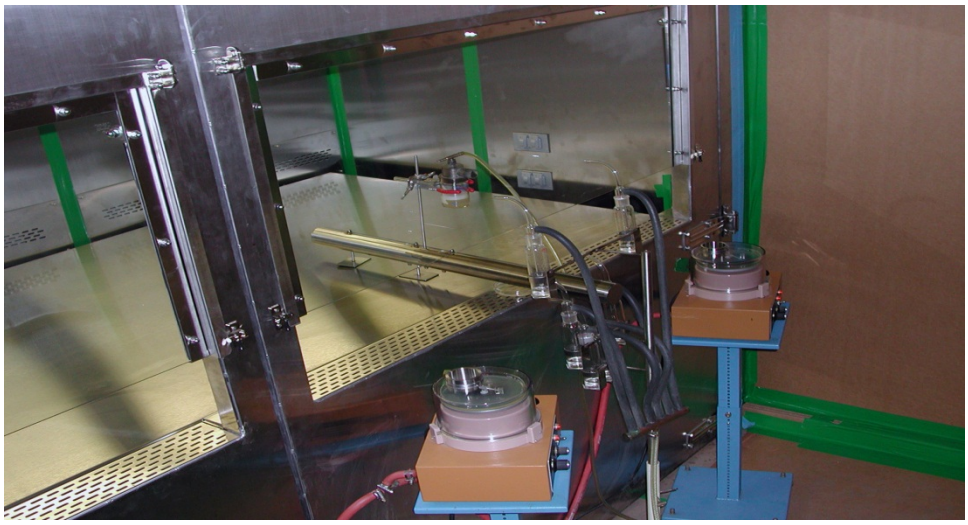
Biological Testing (Static)
to NSF/ANSI 49 for
Personnel/Product Protection

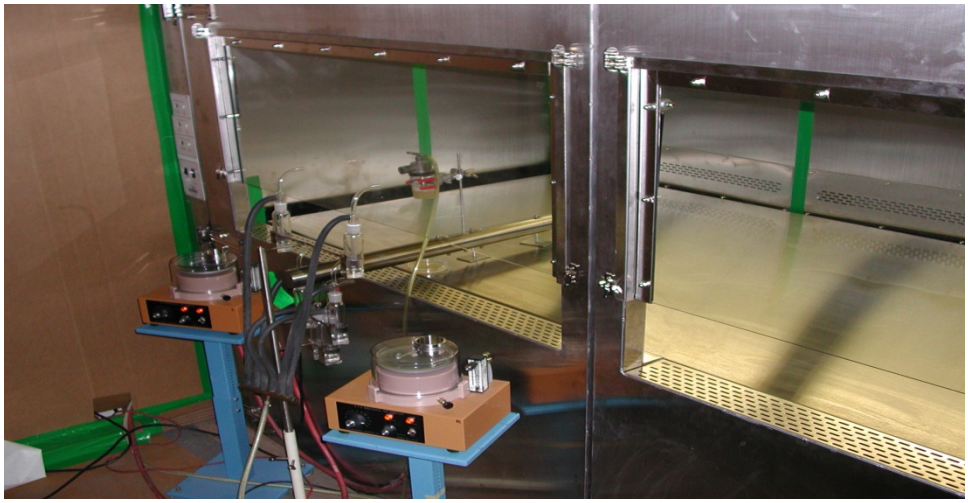
Background

Testing was conducted on a representative NU-S125-648 model size. After being factory assembled and tested, a temporary room was constructed using cardboard around the cabinet to minimize factory airflow currents and achieve static conditions per the requirements of the standard.

Before each test run, the cabinet airflow was adjusted to achieve the inflow and downflow required for each personnel or product test. The test setup (as shown below for personnel protection) was compliant to NSF/ANSI 49 and performed in triplicate.



NSF/ANSI 49 Personnel Protection test setup for cabinet right side



NSF/ANSI 49 Personnel Protection test setup for cabinet left side

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Tracer Gas Testing (Dynamic) to ASHRAE 110 (modified) for Personnel Protection

Background

Testing was conducted on a representative NU-S125-648 model size as installed and operating within an active laboratory. The cabinet was installed with an exhaust canopy connected to the facility exhaust system, so all tracer gas was exhausted and not recirculated into the laboratory. The cabinet airflow was calibrated to the nominal operational setpoints velocities of 60 fpm (.30 m/s) downflow and 105 fpm (.53 m/s) inflow. The exhaust canopy was checked to assure the canopy slots were at a negative pressure drawing in sufficient room air to provide containment.

The tracer gas test was conducted using a Collison nebulizer (same device used for the biological test) to inject the gas. The sulfur hexafluoride (SF_6) gas was flowing to the nebulizer at a rate of 4 Liters per minute (Lpm). The nebulizer position was 4 inches from the window, 14 inches above the work surface (level to the front grill) centered in each of the work access openings. A 2-1/2 inch diameter stainless steel cylinder was added from the cabinet interior extending out the work access opening centered under the nebulizer to simulate a technicians arm. The detector was an ITI Qualitek Leakmeter model 200, calibrated per manufacturer's instructions. The detector was used to scan the around the face of the cabinet no closer than 2 inches for the 5 minute time duration that the SF_6 gas was flowing. The test was repeated twice, once for each window access opening.

Conclusions

The NU-S125 AutoLabGard provides both personnel and product protection for containment of biological aerosols and particulates generated by laboratory automation equipment. Further testing may be required for unique applications and/or material transfer into and out of the cabinet.

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April 9, 2010

Mr. Bill Peters
NuAire, Inc.
2100 Fernbrook Lane
Plymouth, MN 55447

Model: NU-S125-648
Serial: 123884061608

Dear Bill,

The above unit was tested and certified per manufacturer's testing procedures. The cabinet airflows were set within the range specified by the manufacturer. Quantifiable containment testing was performed in accordance with ASHRAE/ANSI 110-1995.

Sulfahexafluoride (tracer gas) was released within the cabinet at a rate of 4 litres per minute. Tracer gas measured at the cabinet face was less than 0.10 ppm.

Yours truly,

Nick

Nick Flynn
Director of Technical Services

NTF:jc