

THE WORLD LEADER IN CLEAN AIR SOLUTIONS



Kitchen Ecology Unit

POLLUTION CONTROL SYSTEM FOR KITCHEN EXHAUST AIR

AAF[®]
INTERNATIONAL

Bringing clean air to life:

AAF - Your Clean Air Partner

Founded in 1921, AAF is a name recognized globally for quality, expertise, and innovation in Air Filtration. It is headquartered in Louisville, Kentucky, USA and has operations in 23 countries, 6 R&D centers and has 260 sales offices worldwide. It is a Daikin group company which is a diversified international manufacturing company and a global leader in air-conditioning with the group annual revenue of \$23 billion.

The broad product and service portfolio covers a versatile range of both particulate and gas-phase filtration solutions that offer the customer the answer to each air quality challenge, tailored to the specific application needs. All products are designed and tested to meet the latest filtration standards, such as EN779:2012 and EN1822:2009.

The region EEMEA, CIS & SAARC countries has 3 manufacturing units 1 of them in Middle-East (Saudi Arabia) and 2 in India (Bengaluru and Noida). The company has dedicated inside free and outside free trade zones to re-export to CIS and African countries.

In 1995, AAF established its unit in Riyadh, Saudi Arabia. It was the first MNC air filter company of the region. The unit is ISO 9001 certified and Recent investments in manufacturing and supply chain have resulted in further improved quality assurance and smooth logistics. AAF has occupied an advantageous position in the region and has maintained the leading position in the filtration industry.

By 2006, the company entered Indian market by setting up its first manufacturing unit in Bengaluru, India. It is India's first and the only filtration company who installed auto scan test facility to test HEPA and ULPA filters as per EN 1822 international standards. The unit also has a cleanroom of ISO Class 100000.

AAF provides of solutions for:

- IAQ to protect people at healthcare facilities, airports, and commercial complexes
- Cleanroom filtration to protect processes
- Gas-phase products for gaseous contaminants like VOCs and corrosive/toxic gases
- Air Pollution Control – Dust collectors and smoke collectors
- Gas Turbines – Auxiliary equipment, filters, repairs, refurbishment, retrofit and upgrades

AAF is a company with an outstanding industry record. The company is providing clean air solutions for 100 years now. Superior industry knowledge and an outstanding team of air filtration professionals mean the customers receive top quality products and services at a competitive price. From inexpensive disposable panel filters to high efficiency extended surface filters with antimicrobial media, AAF markets the widest range of air filters available. AAF has developed and introduced most of the filter designs throughout the industry, including the mini-pleats, extended surface bag filters and PerfectPleat.

Air Treatment

Kitchen exhaust systems provide a means to remove heat and contaminants (smoke, grease aerosols, and water vapor) generated during cooking operations. While exhausting these items provides a better indoor environment, it can cause problems outdoors to neighboring facilities due to the associated odors and particulates emitted.



The amount and type of contaminants generated from a kitchen exhaust application will depend on the cooking operations taking place inside. The contaminants include gases, vapors, aerosols, and particulates. Therefore, kitchen exhaust filtration must incorporate a wide range of filtration types and be versatile to provide an adequate solution.

Commercial kitchens typically include grease and moisture capture devices at the cooking locations. These may be in the form of hoods with baffles or other equipment to remove the initial amount of grease aerosols and particulate. The exhaust air stream will have carry over of contaminants that are not removed by these devices, or from cooking operations that do not use removal devices at the cooking location.



Relative Size of Common Contaminants

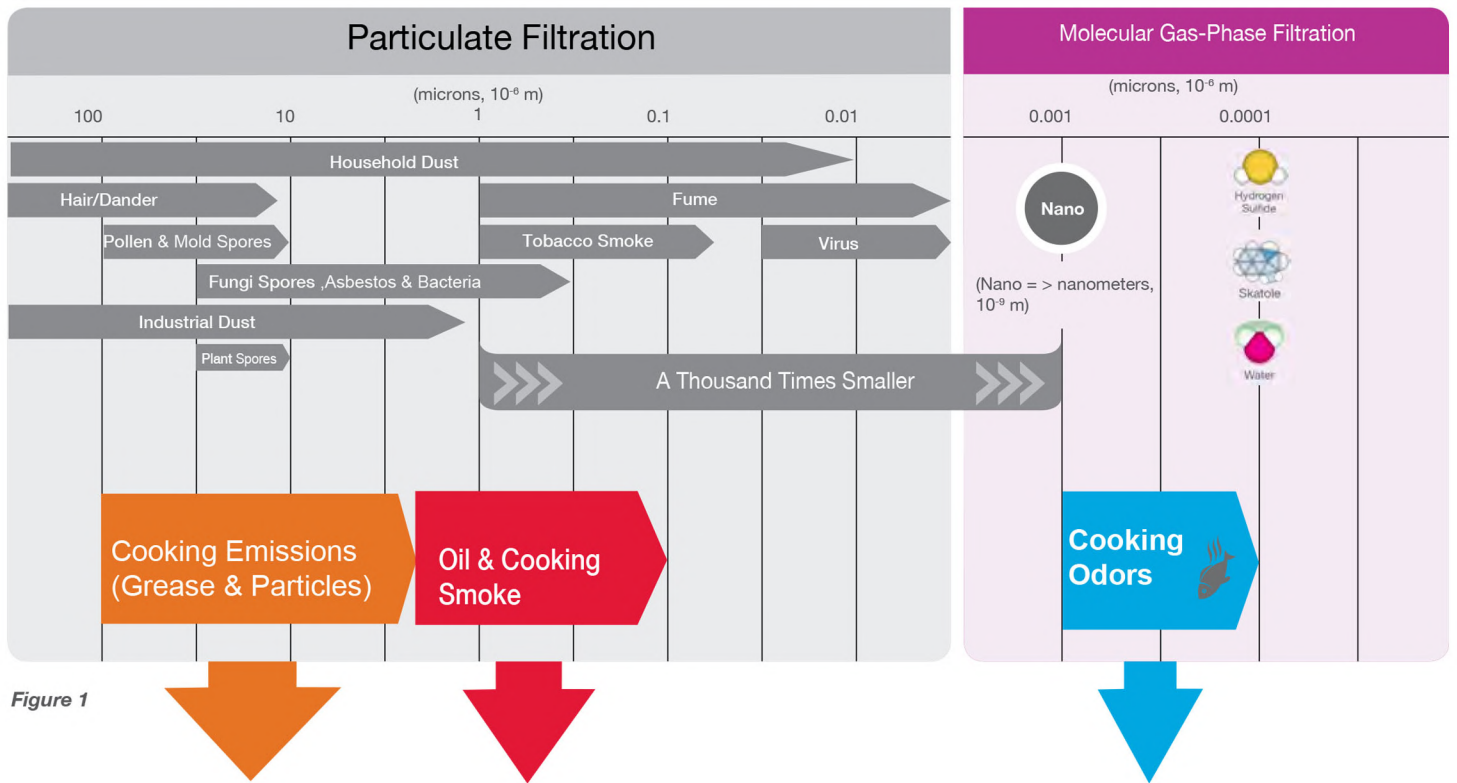


Figure 1

Grease and Smoke (Particulates)

Cooking operations produce grease and smoke covering a wide range of particle sizes (see figure above). The best filtration solutions employ several stages, typically starting with washable filters followed by multiple stages of increasing efficiency. In many cases, washable electrostatic precipitators are used to provide high overall efficiency and allow washing. Whatever filtration arrangement is used, proper maintenance schedules are key to ensure safety by removing build up of grease from the system. The NFPA Standard 96 dictates the following inspection and as needed cleaning schedule for exhaust systems.

Table - The NFPA Standard 96 Exhaust System Inspection Schedule

Type of Cooking	Inspection Schedule
Systems serving solid fuel cooking operations	Monthly
Systems serving high-volume cooking operations, such as 24-hour cooking, charbroiling, or work cooking	Quarterly
Systems serving low-volume cooking operations	Semiannually
Systems serving low-volume cooking operations, such as churches, day camps, seasonal businesses, or senior centers.	Annually

Odors (Gases)

Cooking emissions produce odors (gases), typically classified as volatile organic compounds (VOC's). Particulate filters are not effective against these gases, partly because of their small diameter (see figure above). Odor removal requires the use of gasphase filtration media such as activated carbon, which utilizes pore structure and surface area to adsorb the odors. Because surface area and pore structure are critical, filtration solutions must remove all grease and mists before the exhaust air contacts the gas-phase media. Otherwise, the media will be rendered useless and can become a fire hazard. Keeping proper maintenance schedules for exhausts ducts and filtration systems promotes their long term performance and safety.

Housing

AAF Kitchen Ecology Unit – Pollution Control unit comprises of robust design to encounter the most intense kitchen exhaust treatment. The various filter elements and techniques are added in order to suit the requirement per applications.



Product standard sizing details

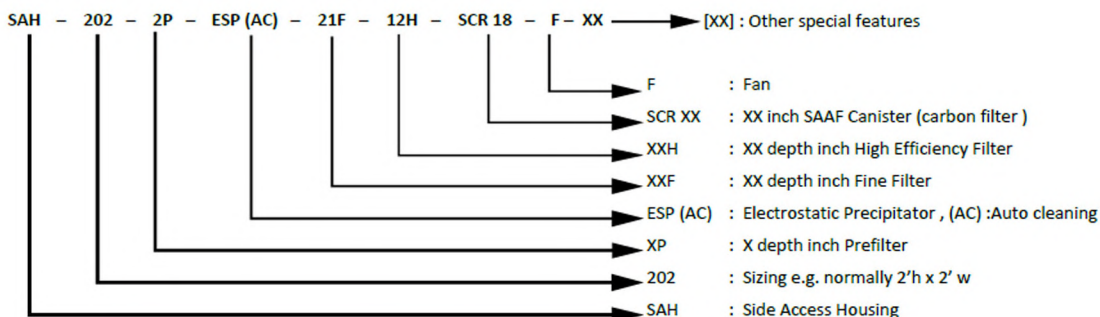
Nominal Dimension		Maximum Airflow at 500 FPM velocity (CFM)
H (ft)	W (ft)	
1	2	1000
2	2	2000
2	3	3000
2	4	4000
2	5	5000
3	4	6000
3	5	7000
4	4	8000
3	6	9000
4	5	10000
4	6	12000
5	5	13000
4	7	14000
5	6	15000
4	8	16000
5	7	17000
5	8	20000
6	7	21000
6	8	24000
7	8	28000
8	8	32000
7	10	35000
8	10	40000

Housing assembled with double skin panel for maximum acoustic and thermal insulation , self supporting modular design with an integrated base frame .

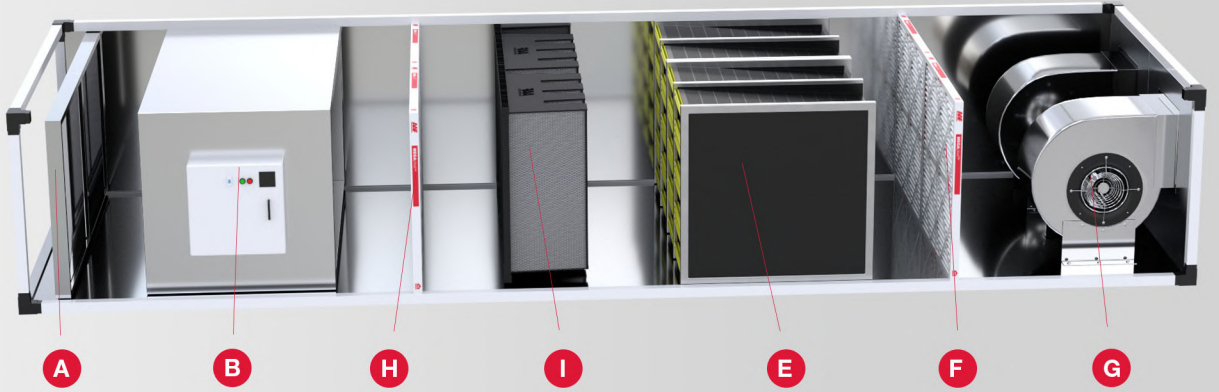
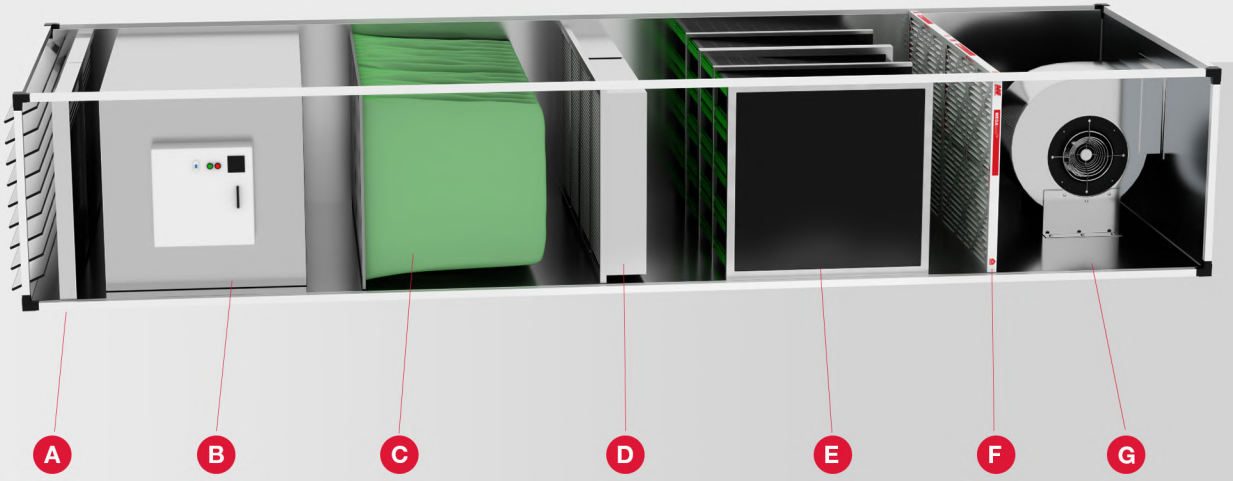
Features:

- Double wall construction, duly insulated.
- Hinged door with handle.
- Spring isolators for fan motor assembly .
- 4 inch galvanized base frame .
- Wide range of product customization .

Product Model Designations SAAF SAH : e.g



Kitchen Ecology Units



<p>A</p> <p>MetaNet (Pre Filter)</p>	<p>B</p> <p>Electrostatic Precipitators</p>	<p>C</p> <p>DriPak® GF (Bag Filter)</p>	<p>D</p> <p>BioCel® I (High Efficiency Filter)</p>	<p>E</p> <p>MD Cassette (Gas-Phase Filter)</p>
<p>F</p> <p>MEGApleat® M8 (De-dusting Filter)</p>	<p>G</p> <p>Fan Section</p>	<p>H</p> <p>MEGApleat® M8 (Pleated Disposable Filter)</p>	<p>I</p> <p>VariCel VXLE (V-Bank Fine Filter)</p>	<p>J</p> <p>Canister (Gas-Phase Filter)</p>

Choosing System Components

Grease and Smoke (Particulates)

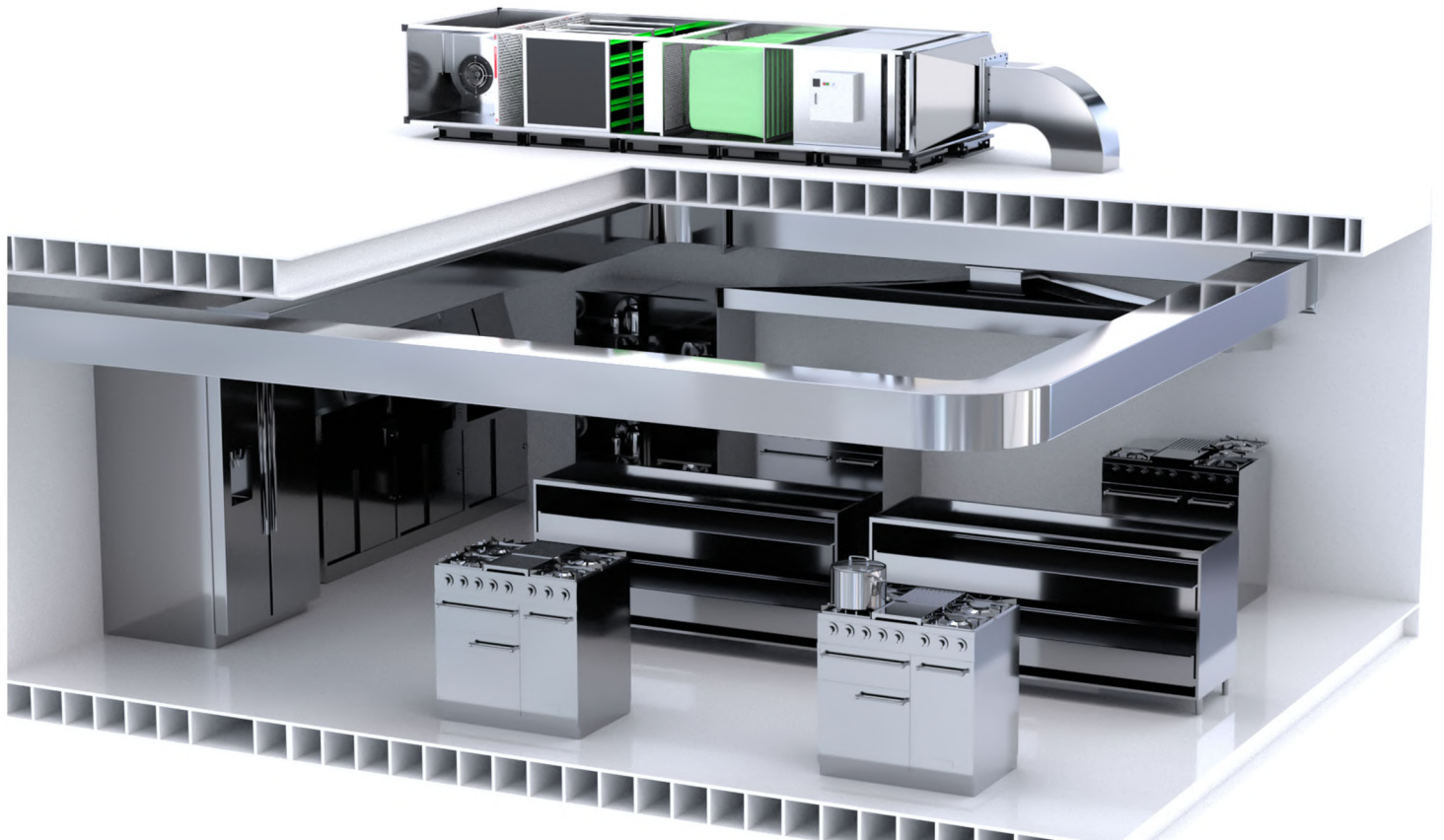
AAF removes the particulate contaminants (grease aerosols, moisture, other particulate) that are carried over into the exhaust air stream using electrostatic precipitators in combination with the appropriate stages of particulate filters. These include metal washable filters, high capacity bag filters, and high efficiency (MERV 16) pleated filters. In applications with lighter loading of particulates, solutions may solely use stages of particulate filters. In both cases, it is critical to performance and safety that proper maintenance, cleaning, and replacement are performed as required for the application.

Odors (Gases)

Odors result from the release of volatile organic compounds during cooking operations. These volatile organic compounds are in the gas -phase; they are not removed by the particulate contaminant solutions mentioned above. The most widespread solution to remove these compounds is activated carbon applied in filtration cells such as metal cassettes or canisters. In some instances, applications have used a blend of activated carbon and other media. The filtration cells are commonly designed to achieve at least 0.1 seconds of residence time, however, the actual configuration and associated residence time will depend on the cooking operations taking place inside the kitchen.

Exhaust of plume at the same level:

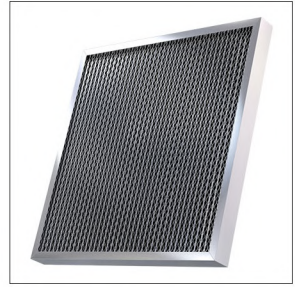
The kitchen exhaust hood design provides optimum performance and energy efficiency in commercial kitchen ventilation systems by properly selecting and sizing exhaust hoods. Plume raised will be captured by the hood and removed by the suction of the exhaust fan at the same level.



Grease / Particulate Filtration

Pre- Filters (MetaNet)

Permanent Metal Filters - MetaNet are ideal for high-moisture situations. They are durable, easy to clean. They are especially suited for applications requiring permanent, washable or high temperature filters with rust resistance.



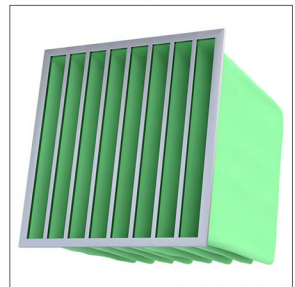
Pre- Filters (MEGApleat M8)

MEGApleat M8 is the long-lasting MERV 8 pleated panel filter in the market. Manufactured with a heavy-duty, galvanized expanded metal support grid and moisture-resistant adhesive, the MEGApleat M8 filter is the strongest MERV 8 pleated filter available. The MEGApleat M8 filter's low initial resistance requires less energy consumption, resulting in lower operating costs and energy savings.



Bag Filter (DriPak® GF)

DriPak® Base GF microfibre glass media has a proven reputation for high quality air filtration performance. It displays excellent dust holding capacity and has a long service life. The DriPak® Base GF range of fibreglass filters is available in five efficiency classes from M5 to F9.



Fine Filter (VariCel VXLE)

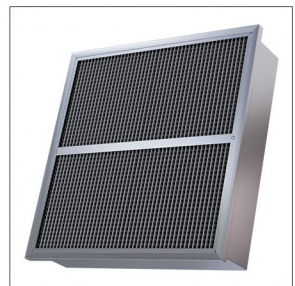
Permanent Metal Filters - MetaNet are ideal for high-moisture situations. They are durable, easy to clean. They are especially suited for applications requiring permanent, washable or high temperature filters with rust resistance.



Oil / Smoke Cooking Filtration

High Efficiency Filter (BioCel I)

BioCel I is rated at 95% efficiency on 0.3 micrometer challenge aerosol and a MERV 16 per ASHRAE Standard 52.2. It has the advantage of much lower pressure drop than a typical HEPA filter. BioCel I filters fill the gap between ASHRAE grade high efficiency filters and ultrahigh efficiency HEPAs at half the weight and pressure drop. It is able to withstand operating temperatures to 350 F.



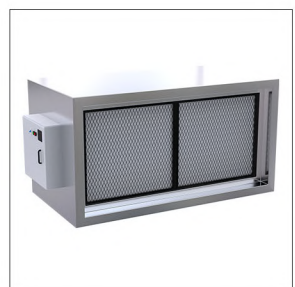
Electrostatic Precipitators

Electrostatic precipitators collect particulate matter such as smoke, grease, and moisture by imparting a charge to the particles and collecting them on negatively charged aluminum plates (manual washable).



Option

– Self-washing : includes a programmable controller option and features a multi jet wash manifold that rotates and traverses the collector cells to insure complete coverage.



Cooking Odor Control

Gas-Phase Filters (Canisters/Cassettes)

Gas-phase filters provide high efficiency filtration for effective removal of kitchen exhaust gas-phase contaminants. One to three passes of the following types can be chosen.



- 18" Canisters/Cassettes
- 24" Canisters (optional)



Normal
Cooking

Oily
Cooking

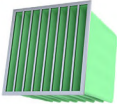
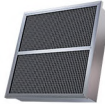

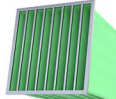


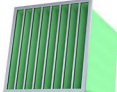
Recommended Filter selection For Grease Filtration

Type of Cooking	Filter
Normal Cooking .	 ChevroNet
Heavy Grease ,Oily Food.	 Permanent Metal Filters

Light
Smoke

Heavy Oily
Smoke

Recommended Stages and Filter selection For Smoke Filtration

Type of Cooking	1 st Stage	2 nd Stage	3 rd Stage
Normal Cooking .	 DriPak GF	 BIOCEL I	
Grill Restaurant , Barbecue . & Wide Range of Cooking.	 Electrostatic	 DriPak GF	
Frying Restaurant ,Heavy Oily Food.	 Electrostatic	 Electrostatic	 DriPak GF

VOC Smell

Fishy
Smell

Recommended Stages and media selection For Odor Filtration

Type of Cooking	1 st Stage	2 nd Stage
Continental , Western , Grill , Arabic & Frying Restaurant . (Rice ,Chicken ,beef and Lamb)	 Media : SAAFCarb [®]	
Indian Restaurant (vegetarian - Strong Spices) & International Restaurant (Very Wide Range of Cooking -Not Focused)	 Media : SAAFCarb [®]	 Media : SAAFBlend GP [™]
Sea Food and Asian Restaurant . (Fish & Egg)	 Media : SAAFBlend GP [™]	 Media : SAAFBlend GP [™]

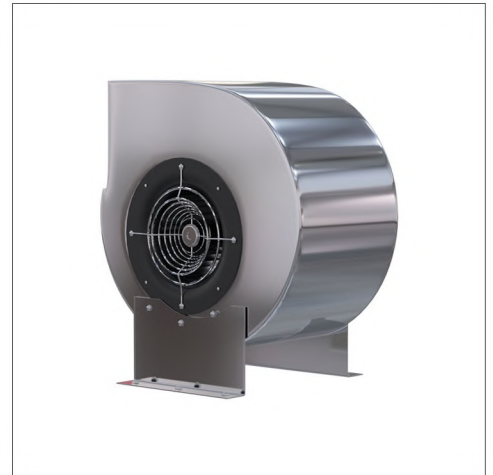
Fan

Fans are chosen to provide the correct amount of airflow and pressure in each application.

- Backward /Forward curved centrifugal fan .
- Double Inlet Double Width (DIDW) fans
- Motor : TEFC, class F insulation & temperature rise B .
- Deflection spring isolators

Fan Options

- Single Inlet Single Width (SISW) fans.
- Plug Fan .
- UL Listed Fan.
- Variable frequency drive (VFD)
- Explosion proof motor .



Optional Features

Dampers :

- Fire damper .
- Motorized damper.

Other filtration devices :

- UV Filtration (Smoke Filtration).
- Air neutralizer spray system (Odor Control).

Pressure measuring devices :

- Pressure measuring ports.
- Pressure switches.
- Pressure gauge (Magnehelic).

Others :

- Doors for both side .
- Sight glass .
- Bulkhead light .
- Rain Louver.
- Weatherproof canopy (outdoor installation).
- Fire suppression system.
- UL listed components .

Controller :

- Local Controller with monitoring panel .
- BMS interference .
- Remote panel .
- Starter motor .



Specification

Ecology Unit

1. General

1.1 The ecology units shall be sized and selected at a face velocity as following table in according to duty time of cooking; to a higher velocity is not acceptable.

Duty Time	Maximum Face Velocity
Heavy Duty (12-18 H/Day) :	< 350 FPM
Medium Duty (6-12 H/Day) :	< 400 FPM
Light Duty (3-6 H/Day) :	< 450 FPM
Very Light Duty (< 3 H/Day) :	< 500 FPM

1.2 The complete unit casing and the filtration elements shall be supplied by a specialized and reputed filter manufacturer.

1.3 The unit construction shall meet or exceed the following specifications:

2. Housing

2.1 The housing construction shall be qualified and tested in accordance with the requirements of and certified to have a minimum rating of L1 at 400 Pa negative pressure (- 400 Pa) and a minimum rating of L2 at 700 Pa pressure. (as per EN 1886)

2.2 Filter By-Pass Leakage for the housing shall be Class F9, as per EN 1886.

2.3 Housing: SAH shall have a corrosion resistant casing consisting of a rigid coated steel and structural frame and 50 mm thick, insulated, double wall panels.

2.4 The Walls (outer & inner) shall be 0.8 mm Pre-Coated External & Internal Finish (Standard Whitish Grey Colour) having Rock Wool insulation.

2.5 The filter enclosure shall include side-access extruded aluminium tracks to support the filters & odour control sections.

2.6 Access doors shall be provided on the filter sections to allow ease of access to, and installation and removal of, all the filter stages.

2.7 Weather Proof Roof Top, shall be provided in case the units are installed outdoors.

3. Filter Sections

3.1 The Ecology Unit, shall consist of the following filtration stages/sections :

- a) Electro Static Precipitator Section
- b) Pre-Filtration Section
- c) Fine Filtration Section
- d) Odor Removal Section
- e) Super Fine / HEPA Filtration Section

3.2 Pre-Filter (MetaNet)

Shall be 2" Thick, MetaNet, Heavy Duty Industrial Grade, Suitable for Grease Filtration in Kitchen Extract, Class MERV-3 , Washable Type, Stainless steel media; multiple layers in SS frames. The unit shall have a stainless steel drain tray with appropriate drain size, below this section, to drain the collected grease , It shall be able to withstand operating temperatures to 930 F.

3.3 Pre- Filters (ChevroNet)

Shall be 2" Thick , Class MERV-3 , ChevroNet is a lightweight panel filter with a reusable aluminum or steel frame and synthetic fiber media, Class MERV-7 , and have a large dust holding capacity. It can be cleaned with a solution of water and detergent on a limited basis.

3.4 Electrostatic Precipitator

3.4.1 Industrial grade Electronic Cell meant for kitchen smoke control, skid base, modular design having electrostatic precipitator housed inside double wall weatherproof Ecology unit.

3.4.2 Electrostatic precipitator shall have two sections, a charging section and a collection section. The charging section using ionizer wires to impart a positive charge to the incoming smoke fume and dust particles. The charged particles are then drawn into a secondary electric field where they need to collect on a series of metal plates. Access door shall be provided with safety disconnect switch, shall meet or exceed the following points:

1. The Pre-Filter Permanent Metal Filters or AmWash shall be installed upstream of Electrostatic Precipitator Section.
2. The Electrostatic system shall be requiring minimum and easy maintenance. The unit shall have control panel mounted on the unit or remote.
3. The units are all fitted with a drip tray and an oil drain point to allow collected waste grease and oil to be drained away
4. Neoprene seals shall be provided all around.
5. This section shall be installed upstream of (prior to) to the Bag Filter (DRIPAK GF), and shall be designed and selected to have a minimum 95% efficiency.
6. Face Velocity to be selected to meet the efficiency required, for this section.
7. Unit shall comply with UL 867 Standard for Electrostatic Air Cleaners and UL 710 Standard for Exhaust Hoods for Commercial Cooking Equipment or equivalent standards. The units shall be in complete accordance with ASHRAE Standard 52.2-2007 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

3.4.3 Option : Auto Wash option

1. High cleaning efficiency is using multi-jet wash manifold covering the entire span of ESP. The wash system should be complete with wash detergent pump, solenoid valve, spray nozzles in brass and SS drain pan. The wash detergent liquid container to be included within the ESP section.
2. Sequence Controller: The ESP along with the Ecology unit should be provided with timer based sequence controller allowing to program the shutdown, operation time, rinse and wash cycle. The controller to be in weather proof box with necessary push button to start / off the unit.
3. Five gallon liquid wash detergent should be supplied along with each unit.

3.5 Bag Filter (DriPak GF)

This shall be a UL Listed, 21" Deep, Type Fine Filter, with Glass Fiber Media Construction, Confirming to MERV-14 , 90-95% efficiency.

3.6 High Efficiency Filter (BioCel I)

This shall be a UL Listed, 12" Deep, Compact Rigid Box (Galvanized, Metallic Cell sides) Type Fine Filter, with Glass Fiber Media, Mini Pleated Construction and Confirming to Efficiency 95% @ 0.03 microns), Each Filter shall be factory tested, and test certificate provided for each filter. The media shall have a non-boron outgassing characteristic.

3.7 Activated Carbon /chemical filter (Canisters with media)

3.7.1 The Canister to be in galvanized steel finish having refillable cylindrical design, initial chemical media to be pre-filled by factory. The individual canister seals and holds in the frame with fully secure bayonet clamp sealing with cap gasket.

3.7.2 The Canisters and the Media should be supplied by a single source supply i.e. from same manufacturer who is providing the Housing and All other filter stages.

3.7.3 The unit shall house a media odor control section consisting of 24"x24"x18" and/or 12"x24"x18" refillable GI canisters delivery system.

3.7.4 The sizing/selection of the canister delivery system shall be done to ensure a minimum dwell time of 0.12 seconds.

3.7.6 The selected media shall be UL Listed as following

- SAAFCarb[®] :

SAAFCarb[®] Media to be used for effectively removing food odors carried down to the air stream prior to discharge. Media Shall be opened wide range of VOC Odors Included but not only following typical gases Media Capacity (minimum value of media capacity for following typical gases) :

- Meat (VOC eg. Toluene) : 3 Kg Gas / 1 Ft3 Media

- SAAFBlend GP[™] :

SAAFBlend GP[™] Media to be used for effectively removing food odors carried down to the air stream prior to discharge. Media Shall be opened wide range of Sulfur compounds and amine Odors Included but not only following typical gases

Media Capacity (minimum value of media capacity for following typical gases) :

- Garlic (diallyl sulfide) : 0.48 Kg Gas / 1 Ft3 Media
- Fishy, egg (Dimethylamine) : 1.8 Kg Gas / 1 Ft3 Media

4. Blower Section

- 4.1 The Fan shall be industrial quality, heavy-duty fan, with one duty and one standby motor. The fan impeller shall be with backward curved vanes, DIDW, Type.
- 4.2 The fan assembly shall be belt driven with fixed motor sheave. Fan shall be sized for the designed airflow, including total internal static pressure and external static pressure drop, as stated in the equipment schedule.
- 4.3 Fan assemblies are easy to service provided with Adjustable motor bases to allow for proper tensioning of the belts at all times.
- 4.4 25mm deflection spring isolators to be used under fan .

5. Differential Pressure Gauges/ Switches:

- 5.1 Dwyer Make, Industrial Type, rugged Differential Pressure Gauges/Switches, selected for purpose of sensing kitchen extract, shall be installed for each of the following sections, and shall be used to monitor the operation of the unit :
 - 1) Pre-Filters -1 (0-250 Pa)
 - 2) Pre Filter 3 (0-250 Pa)
 - 3) Fine Filter 1 (0-500Pa)
 - 4) Super Fine Filter – 1 (0-750 Pa)
 - 5) Fan Section (0 - 1500 Pa) (Optional Requirement)

6. Control Panel:

- 6.1 A Remotely installed, Starter/Control/Monitoring Panel shall be constructed for remote mounting with front locking screws, shall be provide along with the unit.
- 6.2 The panel shall be supplied with an Alarm Silence Button.
- 6.3 Control circuits to operate of 24 VAC.
- 6.4 The Starter cum Control panel shall allow for Remote Start / Stop from the BMS.
- 6.5 Following Monitoring points shall also be available :
 - 1) The panel shall be complete with lamps for system running status and alarm condition of :
 - a. Power On,
 - b. Fan On / Off / Trip,
 - c. Dirty Pre-Filter-1,
 - d. Dirty Pre-Filter-3,
 - e. Dirty Fine Filter 1,
 - f. Dirty Super Fine Filter 1,
 - 2) The panel shall be able to give the following trip signals separately.
 - a. ELR Fault Status
 - b. MCB Trip Status
 - c. OLR Trip Status.

Other Solution

RotoClone™ W

Wet Dust Collector

Removal of airborne contaminants resulting from the processing of sugars, candies, seasonings, grains, cereals, cheese and other food grade materials are often best handled by wet dust collectors. Engineered to handle a variety of dust types and applications, the one of a kind RotoClone® W is ideal for most food and beverage industry processes, including those that produce wet and sticky residue with proven installations.

1. Fire Barrier

The RotoClone® W is Factory Mutual (FM) approved to prevent fires originating in the kitchen or exhaust ductwork passing beyond its outlet, therefore preventing costly damage and shutdowns. The water curtain in the unit serves as a fire barrier and prevents the spread of fire to the exhaust duct, even in the event of a fire in the duct from the kitchen exhaust canopy to the unit. Water consumption is minimal.

2. Grease Vapor Collector

The RotoClone® W offers high efficiency in coalescing and capturing grease vapors. The vapors condense in the unit where they congeal on the water surface of the irrigated impeller blades prior to being sluiced to drain. Contamination of downstream ductwork is virtually eliminated.

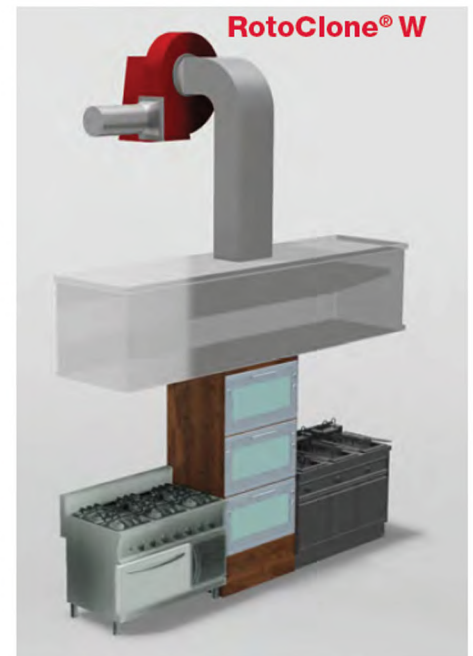
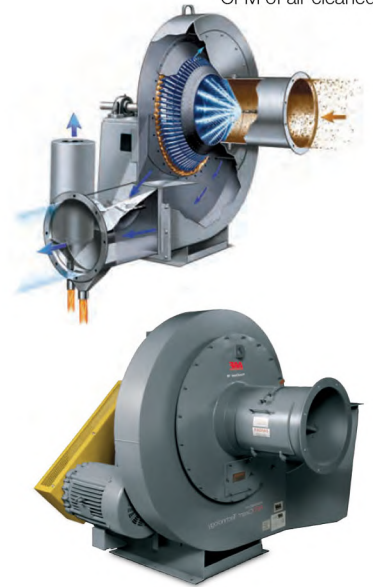
3. Exhaust Fan

The RotoClone® W is also the prime air mover for the kitchen range exhaust, replacing the conventional fan. Unlike a conventional fan, routine cleaning of the impeller is unnecessary. The RotoClone® W is quiet and can run 24 hours a day for extended periods without maintenance.

4. Odor Control

Independent tests have shown collection efficiencies approaching and exceeding 99% for most odor causing contaminants. The result is a significant reduction in the odor concentration carried in the kitchen exhaust. Complete elimination of odor is notoriously difficult to achieve without expensive additional treatment, nevertheless the RotoClone® W alone reduces odor and removes virtually all the fats, greases and oils that cause much of the odor problem.

Minimum water requirements :
✓ ½-1 GPM per 1000
CFM of air cleaned



Proven Expertise of AAF

AAF offers the most comprehensive air filtration portfolio in the industry, including particulate and gas-phase filters, to provide a customized clean air solution. Each product is carefully designed, manufactured, and tested in full compliance with all applicable standards to meet the most challenging demands with the lowest Total Cost of Ownership.

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AAF has a policy of continuous product research and improvement and reserves the right to change design and specifications without notice.

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