Grease Extraction System
GREASE-X-TRACTOR™ Centrifugal Filtration
GREASE GRABBER™ Multi-Stage Filtration System

GX Filter U.S. Patent Number: 6,251,153
GG Filter U.S. Patent Number: 6,797,041 & 6,994,743

GREENHECK
Building Value in Air.

April 2006
What’s in my kitchen exhaust?

- Total kitchen exhaust includes all grease particulate sizes as well as grease vapors.
- Grease is the by-product of commercial cooking processes that must be extracted from the effluent air stream via the kitchen ventilation system.

*Grease can be broken down into three different categories.*

**Sub-micron**
Sub-micron particles are produced when a drop of grease or water comes in contact with a hot surface and immediately burns off. Particle sizes range from .03 to .55 microns (Smoke)

**Steam**
Steam is grease covered moisture and air mixture and is produced by the long burning of cold or frozen food on a hot cooking surface. Particle sizes range from .55 to 6.2 microns

**Spatter**
Spatter is the larger more visible effluent that is produced during the cooking process. Particle sizes range from 6.2 to 150 microns

Research and testing has uncovered that a significant concentration of grease particulates can be found in sub-micron and aerosol phase. Most currently applied grease extraction devices remove the very large grease particulates 10 to 150 microns in size (spatter phase) but, have very little effect at removing the fine particulates that are found in the sub-micron and aerosol phases.

How can I tell what we’re extracting?

The chart below shows the typical amount of grease produced during cooking on an appliance. The line represents the amount of grease produced at that size of particle. During the cooking process high amounts of grease in the .29 to 10 micron range are produced.

The US Navy Specification NBSIR 74-505 has been used for many years. It was designed to test the efficiency of a grease extractor using a paint spray gun to create particles in the range of 15 to 150 microns. Filters that are tested using this method often yield results in the 90 percentile. The Navy method of test does not effectively portray the full range of particles produced during the cooking operation. Recognition of this problem by the industry lead to the creation of an ad-hoc committee of companies to develop a standardized method of testing or ASTM F2519-2005.

Testing of Grease Extraction Devices

ASTM F2519-2005 Standard Test Method for Grease Particle Capture Efficiency of Commercial Kitchen Filters and Extractors is the first universally accepted test method in the commercial kitchen ventilation industry that covers efficiency testing of both removable filters and fixed extractors such as water wash hoods.

ASTM F2519-2005 test generates a controlled quantity of particles in size ranges from .3 to 10 microns that are released into a kitchen hood to represent the cooking effluent. The particles are then sampled and counted downstream in the ductwork with an optical particle counter with and without the extractor in place. The counts, with and without, are used to calculate the fractional efficiency graphed versus particle size.

ASHRAE research has shown that cooking emissions contain particles ranging in size from 0.1 to 100 microns. Previous efficiency tests used particles near 10 microns in size, all filters capture particles larger than 10 microns, and that is why the old tests were flawed. A single percentage number cannot express filter efficiency, it must be expressed as a graph similar to a fan curve.

The efficiency graphs that Greenheck uses reflects the test methods used in ASTM F2519-2005.
Comparison of Existing Grease Extraction Technology vs. Initial Cost

The graph below displays the efficiency of grease extraction devices that are currently available and the estimated initial cost of installation.

Greenheck focused on an area that had high grease removal efficiency yet was low cost. After five years of testing Greenheck introduced our series of high performance filters.

The Grease-X-Tractor™ filter (model GX) is twice as efficient as a standard Baffle filter and is still inexpensive. Once the GX filter was developed Greenheck continued development to higher levels of grease removal.

The Grease Grabber™ (model GG) was then introduced. The dual stage filter removes an amazing 80% of the grease out of the airstream at a low cost compared to the existing technology.

Grease Extraction by Cooking Equipment Type

The chart shows that the amount of grease produced changes with the type of cooking equipment. Greenheck understands that different appliances and types of food will produce different amounts of grease. There is a need for different types of grease extraction.

The chart lists the filters Greenheck recommends for each type of cooking equipment. If there is a diverse cooking lineup use the worst case for the entire hood.
Why does so much grease get through my filter?

Grease is the by-product of commercial cooking processes that must be extracted from the effluent air stream via the kitchen ventilation system. Total kitchen exhaust includes grease particulate as well as grease vapors. Grease particulate is made up of a range of particle sizes from sub-micron (smoke) to 150 micron (spatter).

Traditional filtration misses smaller grease particles

Traditional filtration removes grease particulate in the 10 micron to 150 micron range, however much of the grease particulate falls into the sub-micron range. These smaller particles flow through the traditional filter and collect in the ductwork, fan, and on the roof. The Grease Grabber™ utilizes a dual grease filtration system to collect 80% of the total grease particulate from kitchen exhaust.

Traditional Baffle Filter vs. Grease Grabber™ Two-Stage Filtration System

Figure 1 depicts how a traditional baffle filter collects only the largest spatter grease particles. Figure 2 depicts the Grease Grabber™ utilizing the Grease-X-Tractor™ as a primary filter improves on traditional filtration and in combination with the secondary filtration system removes 100% of particulate larger than 9 microns, and 80% of the grease particulate larger than 1 micron.
**Grease-X-Tractor™**
The filter consists of individual vortex chambers having air inlets at the top and bottom front of the filter. Air travels in a helical or corkscrew path through the filter chambers, subjecting the grease particulate to centrifugal force. Grease collects on the interior walls of the filter, where it drains into the hood grease trough and grease cup. The design of the filter gives the filter great strength and makes it the best fire barrier in the industry. The GX filter has been tested and approved in accordance with UL 1046 and NSF.

![Inside of GX filter showing grease marks](image1.jpg)

**Grease Grabber™**
The Grease Grabber™ dual stage filtration system uses Greenheck's Grease-X-Tractor™ (GX) along with the Grease Grabber™ filter to remove 80% of the grease out of the airstream. The Grease-X-Tractor™ (GX) is the primary filter and takes the brunt of the grease and heat. The GX removes large grease particles using centrifugal force as described above.

The secondary filter, the Grease Grabber™, uses a ½ inch packed bead bed to remove small particles. The beads remove the small particles of grease that are not removed by the GX filter.

It is recommended that the GG filters be cleaned twice weekly by placing in a standard commercial dishwasher or jet sink. Different cooking styles and volume will vary the frequency of cleaning needed.

![Grease Grabber™ filter](image2.jpg)

The GG filters have been tested in accordance to UL 1046 and UL 300 and have been approved for use in kitchens by NSF.
High Velocity Cartridge

The graph to the left compares the relative efficiency of grease extraction devices that are currently available and their estimated operating costs. Because traditional filters are less efficient, cleaning and maintenance costs of ducts and fan are much higher than with a Grease Grabber™ system. High end filtration systems require larger exhaust fans which contribute to higher operating costs. The Grease Grabber™ system keeps operating costs low while maintaining a high degree of grease extraction efficiency.

**Third Party Grease Extraction Efficiency Verification**

The following charts show the amount of grease that is extracted by a baffle filter, Greenheck Grease-X-Tractor™ and Greenheck Grease Grabber™. The charts also show the amount of grease that passes through the filter and into your exhaust duct, exhaust fan and on your roof.

This data was gathered by a third party testing agency while cooking beef patties on a griddle. The cooking of beef patties on a griddle yields the largest mass of grease particles at ~18 microns in size and the smallest at ~.2 microns in size (Human hair ~100 microns).

The yellow area represents the amount of grease that passes through the filter. The purple area represents the amount of grease extracted by the filter. The more purple area the more grease is extracted at the filter. The blue efficiency line shows the efficiency of the filter for a specific particle size. Follow a point on the blue line over to the efficiency axis and that is the filter’s efficiency at that particle size.

**Mass & Efficiency vs Particle Size**

**Baffle Over Griddle with Hamburger**

- **System Efficiency is 31%**
- **69% of particulate is exhausted into duct**
System Efficiency is 73%
27% of particulate is exhausted into duct

System Efficiency is 99%
1% of particulate is exhausted into duct
Provide Greenheck Grease Grabber Exhaust Hood, that includes a Multi-Stage Filtration System using centrifugal impingement and packed bead technology to remove grease from the airstream, as shown on plans and in accordance with the following specification:

Kitchen Ventilation hood(s) shall incorporate Grease Grabber Technology to remove grease by centrifugal force and interception. This dual stage system shall incorporate Greenheck Grease-X-Tractor as the primary filter to remove 60% of the grease particles that are larger than 5 microns. The Grease-X-Tractor high efficiency stainless steel filters shall be UL 1046 Classified and NSF Certified as manufactured by Greenheck, in sufficient number and sizes to ensure optimum performance. The secondary filter shall be a packed bead bed filter designed to remove 80% of the grease particles larger than 1 micron and 100% of the grease particles 9 microns and larger, as tested to ASTM F2519-2005. This grease extraction process must be accomplished at a static pressure loss of not more than 1.5 inches of water column at 330 cfm. Filtration systems having higher static requirements are not acceptable. The secondary filter must be shaped to provide maximum filter area. Flat style filters are not acceptable. The dual filtration system shall consist of individual filters for ease in removal and cleaning. The cleaning of these filters shall be in a standard commercial dishwasher. All filter efficiencies must be verified by independent third party testing organization.

Kitchen Ventilation hood(s) shall be of the Type I, suitable for all types of cooking applications. The hood(s) shall be UL Listed without (with) fire damper for 400°F, 600°F, or 700°F rated cooking appliances.

The hood(s) exterior shall be constructed of a minimum of 18 gauge stainless steel with a #4 finish. The hood(s) shall be constructed using the standing seam method for optimum strength. Front panels shall have stamped vertical ribs, evenly spaced, to add additional strength and rigidity. An integral 3 inch air space is provided to meet NFPA 96 clearance requirements against limited combustible walls. All seams, joints and penetrations of the hood enclosure shall be welded and/or liquid tight. Lighter material gauges, alternate material types and finishes are not acceptable. All unexposed interior surfaces shall be constructed of a minimum 18 gauge corrosion resistant steel including, but not limited to ducts, plenum, and brackets. The hood(s) shall include a filter housing constructed of the same material as the hood. The filter housing shall terminate in a pitched, full-length grease trough, which shall drain into a removable grease container.

Vaporproof, UL Listed incandescent light fixtures shall be prewired to a junction box situated at the top of the hood for field connection. Wiring shall conform to the requirements of the National Electrical Code (NFPA #70- Latest Edition).

The hood(s) shall be constructed by Greenheck of Schofield, Wisconsin. They shall be built in accordance with National Fire Protection Association (NFPA) Bulletin #96, International Mechanical Code (IMC), International Conference of Building Officials (ICBO), Building Officials and Code Administrators (BOCA), Southern Building Code Congress International (SBCCI), and bear the National Sanitation Foundation (NSF) Seal of Approval. The hood manufacturer shall provide, on request, the necessary data that confirms compliance with the code authorities listed above. The hood volume shall be calculated utilizing a computerized thermal updraft velocity method.

Due to continuous research Greenheck reserves the right to change specifications without notice.

Our Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid. Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs. As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.