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September 6, 2023

Maren Toohill
Town Planner
Littleton Planning Board
37 Shattuck Street
1st Floor
Littleton, MA 01460

Ref 4834

Re: Sanctuary Medicinals, Littleton, MA- Odor Control

Dear Maren Toohill:

This letter covers the odor control conceptual design package being submitted to the Town of Littleton Planning Board (PB) on behalf of Sanctuary Medicinals Inc. (Sanctuary). Included in this letter is a discussion conceptual design of the odor control system that is proposed for the new building. The figures and cutsheets for the design are included in the package sent to the BOH. They are attached here for the Planning Board's convenience.

Recently, to address concerns raised to the Board of Health (BOH), Sanctuary engaged Tech Environmental, Inc. (Tech) to perform a new odor audit around the time of late spring/early summer when odor complaints unexpectedly increased. Tech identified areas of concern and developed a three-step process to reduce the odor baseline and to maintain the lower odor baseline going forward. It included:

1. Immediate differed operations and maintenance items,
2. Short-term odor control capital improvements needed, and
3. Long-term capital improvements to be incorporated into the new building design and construction during the permitting phase.

The progress to date on the first two steps have returned the odor baseline to the original level achieved after the facility start-up and after incorporating some of the recommendations Tech made in 2019. Those recommendations were for high-speed doors and air curtains to better isolate the odor from the offices and loading dock areas. These same recommendations are proposed for the new building as well. Both Item 1 and Item 2 will be fully completed prior to the approval of the Planning Board Application for the new building. Item 2 includes recirculating odor control systems in the main building area to reduce the residual odor concentration, prior to the exhaust odor control system. These recirculating systems are proposed for the new building as well, which will further reduce the potential for fugitive emission release.

Although this permitting effort is for a single new building, the new building is proposed to support the existing building, with the sole of goal streamlining the entire operation. As noted at the first Planning Board meeting, the new building will not add any additional grow facilities, so the odor loading created at the facility will not increase. However, the design of the new building will provide the space and opportunity to further mitigate odor potential well beyond the existing building.

All of the odor potential is created in the grow rooms in the existing building. The odor potential reaches an equilibrium in the grow rooms via the condensate removal system. As condensate is collected and sent to water treatment, the odorants absorbed are removed prior to water reuse. To a much smaller degree, the remaining odor loading travels with the product through harvesting, drying, processing, purging during cleaning and disinfection of the grow room between grow cycles, and within the final product. While odor can be and is emitted into the main building during all of these activities, the important thing to remember is that from an odor loading perspective there is no more generation of odor, so in each step beyond growing, the odor loading decreases significantly, so the potential odor emission driving force is reduced as well. The new building will shift some of the processing odor from the main building into this new building, but it will not create any more odor loading, or odor potential and will be fully equipped to control that odor. With the shift of some processing from the main building to the new building, there is a need for odor control in the new building, and an opportunity to further improve odor control for the entire facility which has been built into the conceptual design provided here.

The driving force for fugitive emission in the main building is created by the pressure differential created by a positive pressure in the grow rooms and a negative pressure in the hallways to limit the ability of airborne contaminants to enter into the grow rooms during access. The new building will not have this same driving force. The new building will be designed and operated more like a traditional warehouse/laboratory/food service building. It will include HVAC units that will condition the air in the interior rooms for worker comfort and for the processing needs and also the air directed from the hallways in the existing building for further odor control.

In some warehouse settings, such as the loading dock area, there may be little to no conditioning. In the processing areas there will be some need to keep the workers and product conditioned. As is typical, up to 98+% of the conditioned air will be recirculated, and a small percentage of fresh will be added. The fresh air can be added in a controlled manner or an uncontrolled manner. In a controlled manner air would be added via vents to the building. In a situation like this, where there is a desire to maintain a negative pressure on the building, air is often allowed to enter in an uncontrolled manner (via building tightness inward leakage), or a combination of both controlled and uncontrolled. Whether the new building employ both controlled and uncontrolled will be determined by the HVAC engineer during design.

What the new building will do is allow the harvesting and processing areas to be separated from the storage areas for the equipment and supplies necessary for the grow operations. Currently, there is a lot of equipment and supplies in the hallways that must be moved multiple times to accommodate all the required grow activities during each grow cycle. The constant shuffling of equipment and materials is time consuming and requires that the doors to the grow rooms be open more than the absolute least amount of time desired. This new building will allow the hallways to be used only as staging areas right before grow room access, which will reduce the time the odor from growing would be released into the main building.

The new building will also provide dedicated space for the exhaust odor control system that will service both the new building and the existing building. Currently, the existing building exhaust system is hung under the roof over the grow rooms near the centerline roof peak. With the new building, there will be a dedicated space at ground level for the exhaust odor control system. The facility has committed to sizing the new odor control system for both the existing 3,600 cfm that is needed to address the positive-negative pressure requirements of the grow room/main building dynamic, and the new building. At the conceptual level, it is anticipated that the new odor control system will be sized for approximately 5,000 cfm total of continuous exhaust potential. The facility has committed to using carbon adsorption as the primary odor

control system going in the new building forward. The existing ozone system will continue to operate as a redundant system to treat odors from the existing building after the new building is fully functional. During design, a decision will be made to use the existing system as a supplemental system, or as a backup system.

While details of the odor control system will be made during the design process, this letter, and the attachments are provided today to demonstrate that there is sufficient commitment and conceptual design consideration to make the process work.

The carbon system would be either a deep bed style system, or a module type system. The recirculating carbon units employ open trays, but those will not work well in this exhaust system because of the pressure drop that must be supplied to overcome the head loss in ductwork from the existing building and also the ductwork from the new building to the centralized exhaust odor control system. The carbon adsorption unit itself could be located within the building or directly outdoors. It is more likely feasible to locate a deep bed system outdoors, or if a side access unit with carbon modules inside. Either way, the facility will be adding a dedicated odor control room for all of the exhaust air. The facility is committing to including a spare uninstalled fan onsite to satisfy redundancy concerns. The current exhaust system has no redundancy.

Figure 4 from the OMP shows a conceptual layout of the two buildings with a possible odor control room and ductwork shown in blue. The loading dock areas are shown in purple. The grow room and their HVAC systems are shown in green. The six recirculating carbon systems are shown as boxes in magenta. There will be an exhaust stack that penetrates the roof of the new building or runs up the side, if a deep bed system is considered, "as equal."

Although the odor control system cannot be fully designed until the special permit has been approved, Tech does provide cutsheets from a manufacturer Tech has used on different projects. Tech provided a cutsheet for a side-by-side module carbon system design. Tech considers this option the optimal choice with all things being equal. While they are both " as equal" from an odor control effectiveness standpoint, they are not equal for a site impact standpoint. A deep bed option will consume less building space, especially if the bed itself is located outdoors, but it will also likely require the hiring of a vactor truck to remove and replace the carbon. On-site personnel can exclusively manage the preferred side-by-side alternative, but again, it will take up more space. How much space can be determined during the design, and the facility can decide between the two as the interior of the building is formally designed. Unlike the recirculating carbon units that contain less than 100 pounds of carbon each, this unit will hold significantly more, so that the system need not be changed more than every three to six months.

As we all are aware, the growing, selling, and consuming of marijuana and marijuana infused products has evolved across the country over the last 10 or so years. Within Massachusetts, the legislature passed "An Act to Ensure Safe, The Cannabis Control Commission (CCC) was established, and it developed regulation under 935 CMR 500.000. Within this regulation, in Subsection 500.120: Additional Operational Requirements for Indoor and Outdoor Marijuana Cultivators, item (11) states:

> *(11) A Marijuana Cultivator shall satisfy minimum energy efficiency and equipment standards established by the Commission and meet all applicable environmental laws, regulations, permits and other applicable approvals including, but not limited to, those related to water quality and quantity, wastewater, solid and hazardous waste management, and air pollution control, including*

prevention of odor and noise pursuant to 310 CMR 7.00: Air Pollution Control as a condition of obtaining a final license under 935 CMR 500.103(2) and as a condition of renewal under 935 CMR 500.103(4).

As one can see from the regulation passed that the intent is to treat marijuana cultivating, harvesting, processing, and distribution facilities the same way other industrial activities are treated per the definition of air pollution in the air quality regulations, 310 CMR 7.00. As part of the new auxiliary building permitting and design, the following additional odor control features will be added to minimize odor and to meet the CCC and MassDEP requirements:

1. Currently there is processing and storage equipment, as well as growing ingredients in the hallways. This means that items must often be moved multiple times to get to the other items that are needed. This congestion makes entering and existing, and moving materials into and out of, the grow rooms inefficient. By increasing the space for ancillary activities, the new facility will reduce fugitive emissions from the grow room into the main building, and lower the potential for exterior fugitive emissions, simply through more efficient access.

2. The new building will have a dedicated carbon exhaust system mounted in the new building at ground level that will serve the hallways in the existing building and the new building. By installing this system for not just the new building, but the existing building as well, the ozone system can remain as a redundant or back up option.

3. The new building will include three more recirculating carbon units. The benefit of the recirculating units is that they need not be extremely effective on any single pass as the air within the building will be treated by the systems more than once. These systems also then improve the carbon life fand lower the loading ultimately to the new carbon exhaust system.

4. The new building will also include the same level of odor capture via high-speed garage doors and air curtains to be located as needed, as the design progresses.

5. An Odor Management Plan (OMP) was created as a working document for the facility to use to proactively monitor odor. If the facility simply follows the basic daily, weekly, monthly activities in the OMP they can identify any increase in the odor baseline quickly and address it.

A copy of the information sent to the BOH, including the OMP, are attached to this letter for your information. Tech looks forward to the PB approval, as soon as possible, so the facility can implement the third step of our recommendations to improve odor control at the facility. Please contact me if you have any questions.

Sincerely,

TECH ENVIRONMENTAL, INC.

Michael T. Lannan, P.E.
President

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MEMORANDUM

To: ***Files***
From: ***Michael Lannan and Patricia Rosa***
Subject: ***Odor Management Plan Overview– Sanctuary Medicinals Littleton***
Date: ***September 6, 2023*** **Ref 4834**

This memorandum and the attachments are provided to update the Board of Health (BOH) on the progress to date with Sanctuary Medicinal (Sanctuary) and its off-site odor potential. Based upon this memorandum, its attachments, and the items submitted to the Planning Board to further odor control improvements planned as part of the new ancillary building effort, Sanctuary believes that it has more than addressed the concerns of the BOH to date. Sanctuary engaged Tech Environmental (Tech) to reexamine the facility around the time of late spring/early summer of 2023 when odor complaints unexpectedly increased. Tech identified areas of concern and developed a three-step process to help the facility prioritize improvements to reduce the odor baseline and also to maintain the lower odor baseline going forward. It includes:

1. Immediately address operations and maintenance items,
2. Short-term odor control capital improvements needed, and
3. Long-term capital improvements to be incorporated into the new building design and construction during the permitting phase.

The immediate odor control needs related to maintenance activities identified by Tech. Tech worked with Sanctuary to develop a plan within a few weeks of being reengaged in 2023 that would (1) address these concerns immediately, and (2) prevent them from occurring again going forward. While there will always be the rare potential for operational upset conditions, and there will always be continual maintenance requirements, the difference going forward is that normal Operations and Maintenance (O&M) Activities will be identified proactively, and remedies will be implemented prior to the facility's average baseline odor level increasing. This is something that Tech stresses with all clients that have to keep their baseline odor potential in check in all industrial sectors, not just cannabis grow facilities.

As we all know, the growing, selling, and consuming of marijuana and marijuana infused products has evolved across the country over the last 10 or so years. Within Massachusetts, the legislature passed "An Act to Ensure Safe, The Cannabis Control Commission (CCC) was established, and it developed regulation 935 CMR 500.000. Within this regulation, in Subsection 500.120: Additional Operational Requirements for Indoor and Outdoor Marijuana Cultivators, item (11) states:

> *(11) A Marijuana Cultivator shall satisfy minimum energy efficiency and equipment standards established by the Commission and meet all applicable environmental laws, regulations, permits and other applicable approvals including, but not limited to, those related to water quality and quantity, wastewater, solid and hazardous waste management, and air pollution control, including prevention of odor and noise pursuant to 310 CMR 7.00: Air Pollution Control as a condition of obtaining a final license under 935 CMR 500.103(2) and as a condition of renewal under 935 CMR 500.103(4).*

It also important to note that as part of the development of the cannabis industry in Massachusetts, the legislature understood that this newly activated industry was not without controversy. And although the majority of the state approved of the legalization of marijuana, the state was smart to initiate the industry as an "opt-in" only process. This legalization process started will all towns beginning "outside" of the growing, cultivating, processing, and distributing marijuana system, and only by majority vote within an individual town, could a town "opt-in" and allow this budding industry under the terms established by the local voters.

As one can see from the regulation passed that the intent is to treat marijuana cultivating, harvesting, processing, and distribution facilities the same way other industrial activities are treated per the definition of air pollution in the air quality regulations, 310 CMR 7.00 which include odor. An update on the progress made with the current three-step process was requested by the BOH at the last meeting with Sanctuary and is therefore discussed further below within the context of the air quality regulation stated above.

Immediate Operations and Maintenance Items

As part of the original application process each proposed cannabis facility must submit an odor plan to the CCC. In many cases this "plan" is simply a statement of commitment that they understand that the facility cannot emit odor that will "cause a condition of air pollution" as per the air quality definition, and that they will address odor if complaints occur. It essentially acknowledges the overall facility "odor goal." For many facilities, depending on the circumstances, this simple statement is all that is needed formally to operate.

In other cases, a more formal approach to achieving the odor goal may be required. Again, this is the same across all kinds of industries, not just the cannabis industry. If an industrial facility is receiving formal complaints and they can be coupled to times of elevated odor, then there could be a benefit to formally managing the "odor goal." In these situations, Tech recommends a formal "Odor Management Plan" (OMP) be developed, so Tech and Sanctuary have has developed one for this facility. Sanctuary is formally submitting the OMP to the Planning Board (PB), so it can be included as supporting information for the Planning Board's third-party odor control review of the proposed facility with the new auxiliary building.

During an odor audit of the facility Tech identified some specific operations that need to be addressed, and some maintenance items that also need to be addressed. over the years Since Tech's first visit in 2019, the facility has ramped up production to its maximum capacity, As a consequence odor potential has increased during that time,. The purpose of the OMP is to make sure that the facility establishes a reasonable odor baseline and provides sufficient energy and resources to maintain the odor baseline over time, while still focusing on the business.

During the audit, Tech identified were some ventilations short-circuiting areas of concern.

One area of short-circuiting that was identified previously and was discussed at the last Board of Health meeting, is the seals on the outdoor HVAC units. Over time, these gaskets have dried in the sun and have lost some of their elasticity. This loss of elasticity resulted in untight seals and fugitive emissions. The seals were replaced before the last meeting, and Tech reported that these new seals provided a noticeable reduction in fugitive emission potential from the HVAC units. More importantly, the inspection of these units will occur on a regular basis going forward as outlined in the OMP, so that as they inevitably become

less elastic again, they can be identified and replaced when they first start to leak which will prevent an increase in the odor baseline.

Lastly, Tech noticed that there was an increased level of condensate in the HVAC systems when the grow cycle entered the last stage of cannabis growth prior to harvesting, when the plants are forced into a "drying growth" stage. Since removing, treating, and reusing this water is the prime way to minimize the odor potential from the recirculating system, Tech recommended that the facility install pumps in each HVAC unit, instead of every other unit. This process is still underway.

For those HVAC units with pumps already, prior to the last meeting with the BOH, it was reported that the flexible piping from the existing pumps back to the water treatment and reuse room, were cleaned when possible, and replaced when not. As reported at the last BOH meeting, clean pump lines have lowered the condensate level in all of the units with pumps that were cleaned. Checking and cleaning these lines is now part of the OMP.

Short-Term Odor Control Capital Improvements

The facility has been steadily implementing Tech's recommendations and has reach an odor level that was originally established back in 2019 as an acceptable level of odor . In addition to the maintenance items identified above, the following short-term capital improvements have been completed or are in process that have returned the odor baseline to its former levels and should continue to improve:

1. A recirculating carbon system has been placed in the breakroom/lobby that is 100% operational and working well at reducing the odor in these otherwise untreated, "non-odorous" areas.Since the original build-out, more employees have been hired and more lockers were installed in the hallways outside of the men's and women's locker rooms. Cannabis odor, especially the sulfur-based odorants of concern tend to stick to certain fabrics and can travel with the workers from the processing area to breakroom. As a result, Tech recommended that the facility install a recirculating carbon system in this area to prevent the short-circuiting of these adsorbed odors, from desorbing and being emitted as fugitive odors, as employees enter and exit the building, or thorough the office space's general HVAC equipment. This improvement has been made since the last BOH meeting attended, and Tech is happy to report that it is working well. Odors in the breakroom are noticeably less indoors, which translate to less potential for fugitives outdoors.

2. A recirculating carbon system has been placed in the loading dock area to assist with any fugitive odors that come from the processing areas into the loading dock area. This system is 100% operational and is working well at reducing the odor in this area.

3. A recirculating carbon system has been placed in the hallway outside of the grow rooms to assist with any odors that come from the processing areas and from the grow rooms. This system is 100% operational and is working well at reducing the odor in this area.

4. A ozone generator and residual monitoring system has been ordered and is being installed in the main HVAC ventilation system on the roof. It is likely that by the next BOH meeting Sanctuary attends that this task will be 100% complete, or nearly complete.

5. The condensate pump lines have been reamed or replaced, and temporary drain stems have been installed to allow the facility to manually drain off condensate to keep the condensate level is the HVAC units that do not have dedicated pumps but drain by gravity to the HVAC unit next to it for pumping currently. These drains will be replaced by dedicated pumps soon. They must be replaced by new pumps before the ground freezes solid or they will freeze. Even with these last remaining pump modifications, the effort to minimize condensate build-up is 80% to 90% complete.

Long-term Capital Improvements

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The new auxiliary building will only be one-third to one-half the size of the existing building and infrastructure. At the same time, it will nearly double the space for product and equipment processing and storage. It will not include any new grow areas, which have the highest odor potential. However, it affords the space and opportunity to further manage the ventilation from the existing building shell as well as the new addition, to further mitigate odor potential for the entire operation. Thus, as part of the new auxiliary building permitting and design, the following additional odor control features will be added:

1. Currently there is processing and storage equipment, as well as other ingredients stored in the hallways. This means that items must often be moved multiple times to get to the other items that are needed during different stages of the grow cycle. This congestion makes entering and existing, and moving materials into and out of, the grow rooms inefficient. By increasing the space for ancillary activities and storage, the facility will reduce fugitive emissions from the grow room into the main building, and lower the potential for exterior fugitive emissions, simply through more efficient and less frequent access.

2. The new building will have a dedicated carbon exhaust system mounted at ground level that will serve the air ventilated from inside the shell of the existing building, the hallways in the existing building and the new building. By installing this system for not just the new building, but the existing building as well, this will supplement the existing exhaust system.

3. The new building will include three more recirculating carbon units. The benefit of the recirculating units is that they need not be extremely effective on any single pass as the air within the building will be treated by the systems more than once. These systems also then improve the carbon life and lower the loading ultimately to the new carbon exhaust system.

4. The new building will also include the same level of odor capture via high-speed garage doors and air curtains to be located as needed, as the design progresses. A typical level of capture detail is proposed in the PB permitting documents.

5. The OMP is being written today to incorporate the conceptual design of new auxiliary building after permitting.

Current Odor Baseline

Tech has completed two more rounds of odor monitoring both inside and outside of the facility after the recirculating carbon system were installed. As one can imagine, the odor baseline within the building

dropped dramatically with the headspace being treated slowly and continuously. Attached are the summary sheets from our two rounds of external evaluations. At this point in time, Tech is happy to report that there is noticeable improvement now, from the levels noticed when Tech was first contacted by Sanctuary to complete an updated odor audit. The recirculating carbon systems in the building are noticeably reducing the residual odor level by a factor of 2 to 4. During the two recent rounds of odor monitoring the overall odor intensity was barely detectable (i.e., l or less than 1 on the n-butanol scale). The odor concentration was low enough that the odor experience was partially masked by natural summer background odor. The odor was marginally recognizable to the point that if one was not formally monitoring odor it likely would not be recognizable as cannabis to most people.

It is Tech's opinion that the BOH has met its obligation to explore the current situation and require improvements, and that Sanctuary need not be added to the BOH's busy schedule anymore going forward, at least until such time as the PB has rendered a decision on the new auxiliary building and future odor control upgrades proposed and/or there are significant additional confirmed complaints of excessive odor.

Based upon its review of the recent odor complaints Tech believes that the odor complaint process is currently broken and should be fixed as soon as possible

That is why Tech proposed and completed training for the facility to use the n-butanol scale for measuring ambient odor. It employs an objective monitoring approach that removes bias from all sides. Based upon the recent odor monitoring performed via the n-butanol scale by Tech and the facility, the recent odor complaints, logged by only a few distinct individuals, do not line up with what one would even remotely consider a potential nuisance. Tech recommends that the facility continue to perform and document its current regular odor monitoring rounds and that if the Board of Health desires to rectify the uncertainty and subjective nature of the complaints received by residents, the Board implement a similar system of odor monitoring.

Conclusion

At this time, after three to four BOH meetings and both O&M and short-term capital odor control improvements, the odor baseline has returned to a level at or below what it was later half of 2019 through 2022. Furthermore, the new axillary building and the holistic odor control improvements will allow the facility to reduce the odor baseline further and the have more than enough tools at the ready to maintain odor to levels that meet the CCC and MassDEP definitions of a condition of air pollution.

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MEMORANDUM

To: Files

From: Patricia

Subject: Field odor monitoring on August 31, 2023– Sanctuary Medicinals Littleton

Date: September 1, 2023 Ref 4834

This field odor monitoring memorandum was created based of field notes taken on Thursday August 31st, where odor potential was monitored at Sanctuary Medicinals Marijuana facility located at 234 Taylor Street Littleton, Massachusetts 01460 and quantified its intensity based on the modified n-butanol scale as per ASTM E-544. I have been screened and trained to perform odor monitoring onsite and have performed similar monitoring at other facilities. As protocol requires odor monitoring was conducted prior to entering the facility starting at 12:05 PM. The weather was sunny, with temperature in the high-60s, with calm to 10 miles per hour winds directly from the north.

The monitoring locations that were investigated on this day were 1 through 11. The monitoring locations 1 through 5 that were investigated on this day were the same locations monitored in 2019.

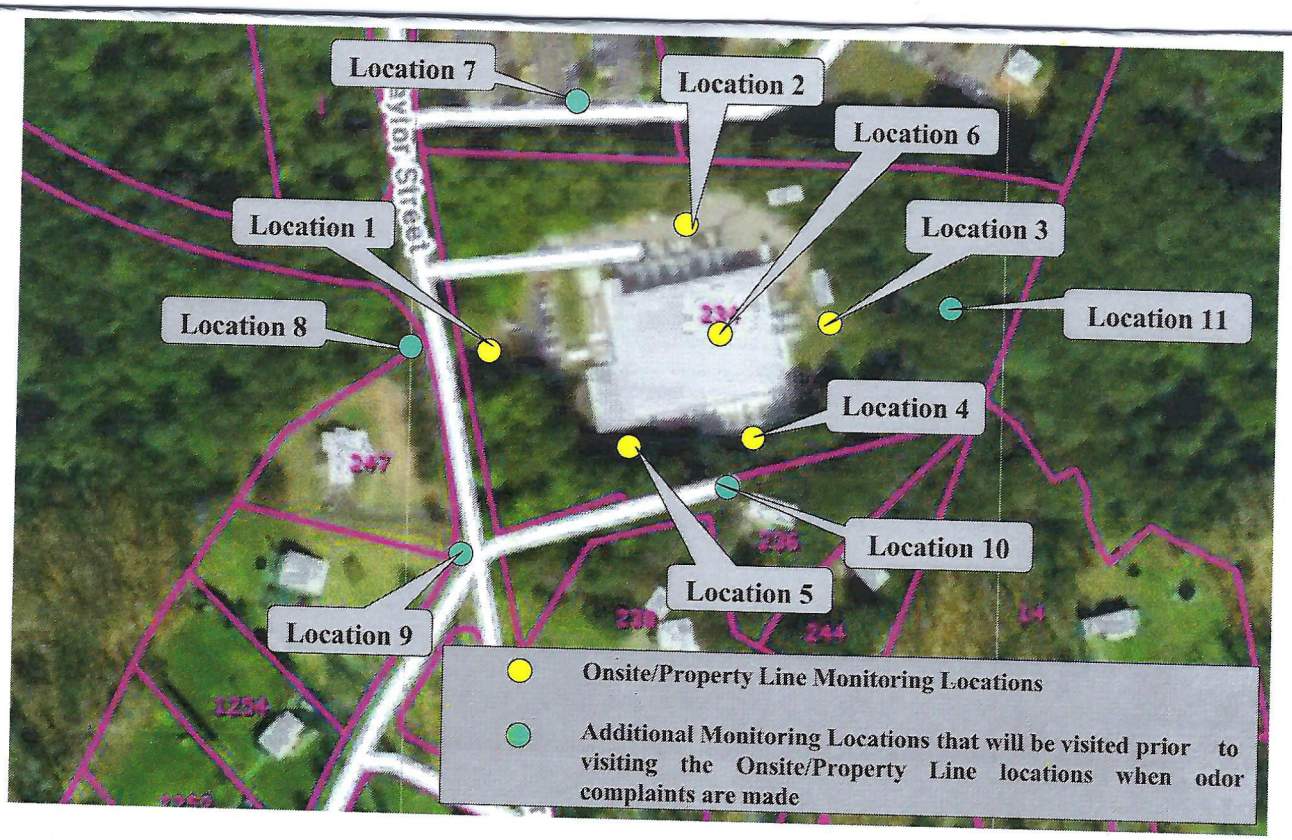
Monitoring began with location 2 and travelled counterclockwise around the facility. Odor from the facility was detected at locations 9, 5, 4, and 10. The odor intensity at these location were a 1 or less than 1. The odor intensity at locations 9, 5, 4, and 10 were less. This makes sense because the odor inside was less than it was before. The odor intensity of the grow room hallway and lobby was less than 4 and less than 2, respectively. The overall odor characteristic ranged from sour, fruity, earthy, floral, and skunky. The odor characteristic was consistent at all locations where facility odor was present but was not unpleasant compared to the existing odors of grassy, earthy and floral. See attached Odor Investigation Forms for more detail.

Sanctuary Medicinals
234 Taylor Street, Littleton, MA 01460
Odor Monitoring

Date, Time, Weather Conditions	Location	Facility Odor (Y/N)	Intensity (1 -> 5)	Odor Characteristic
12:05 PM 8/31/2023 69°F, sunny, winds: 0-10mph North	2	N	1	Grassy, earthy
	7	N	<1	earthy, plastic (med.)
	8	N	<1	earthy
	9	Y	<1	floral, skunky (last couple secs)
	1	N	<1	earthy
	5	Y	<1	floral, skunky (last couple sec)
	6	Y	<1	floral, skunky, sour, fruity
	10	Y	1	floral, skunky, sour, fruity
	3	N	<1	grassy, earthy
	11	N	<1	grassy, earthy
	Lobby	Y	<2	floral, skunky
	Holloway	Y	<4	floral, skunky

Investigator's Name: Patricia Rosa

Figure 1. Odor Monitoring Locations



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MEMORANDUM

To: Files

From: Patricia

Subject: Field odor monitoring on September 6, 2023– Sanctuary Medicinals Littleton

Date: September 6, 2023 Ref 4834

This field odor monitoring memorandum was created based of field notes taken on Wednesday September 6th, where odor potential was monitored at Sanctuary Medicinals Marijuana facility located at 234 Taylor Street Littleton, Massachusetts 01460 and quantified its intensity based on the modified n-butanol scale as per ASTM E-544. I have been screened and trained to perform odor monitoring onsite and have performed similar monitoring at other facilities. As protocol requires odor monitoring was conducted prior to entering the facility starting at 8:45 AM. The weather was sunny, with temperature in the high-70s, with calm to 4 miles per hour winds directly from the north.

The monitoring locations that were investigated on this day were 1 through 11. The monitoring locations 1 through 5 that were investigated on this day were the same locations monitored in 2019.

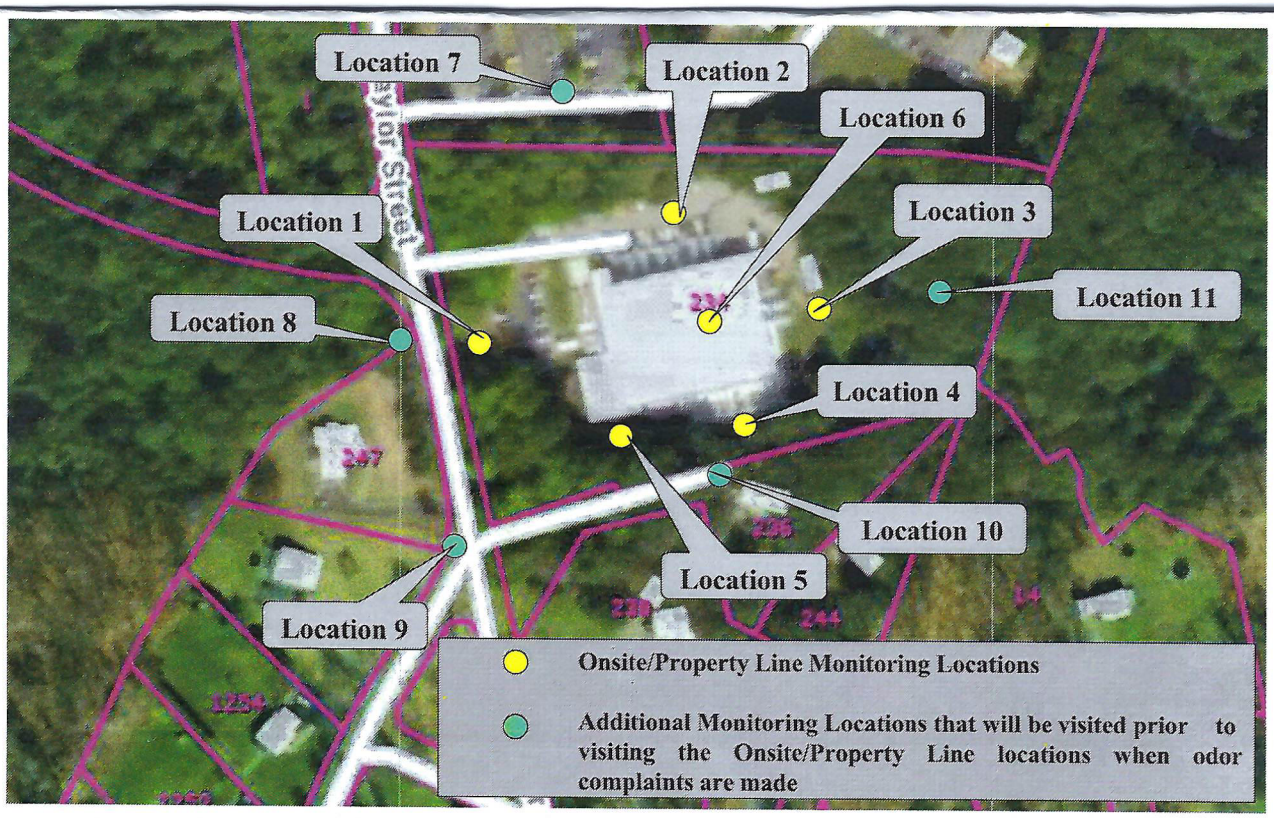
Monitoring began with location 2 and travelled counterclockwise around the facility. Odor from the facility was detected at locations 9, 1, 5, 4, 10, and 3. The odor intensity at these location were a 1 or less than 1. The odor intensity at locations 9, 1, 5, 4, 10, and 3 were less. This makes sense because the odor inside was less than it was before. The odor intensity of the grow room hallway and lobby was less than 4 and less than 2, respectively. The overall odor characteristic ranged from skunky, earthy, floral, and skunky. The odor characteristic was consistent at all locations where facility odor was present but was not unpleasant compared to the existing odors of earthy, woodsy, and floral. See attached Odor Investigation Forms for more detail.

Sanctuary Medicinals
234 Taylor Street, Littleton, MA 01460
Odor Monitoring

Date, Time, Weather Conditions	Location	Facility Odor (Y/N)	Intensity (1 -> 5)	Odor Characteristic
8:45 am 9/6/2023 76°F, sunny, Winds 0-4 mph North	2	N	<1	earthy
	7	N	<1	earthy
	8	N	<1	earthy, floral
	9	Y	<1	skunky, earthy (odor faint)
	1	Y	<1	skunky, earthy (odor faint)
	5	Y	1	skunky, earthy (odor faint)
	10	Y	<1	skunky, earthy, floral
	4	Y	<1	skunky, earthy, floral
	3	Y	<1	floral, earthy
	11	N	<1	earthy, woodsy
	Lobby	Y	<2	floral, earthy, skunky
	Hallway	Y	<4	floral, earthy, skunky

Investigator's Name: Patricia Rosa

Figure 1. Odor Monitoring Locations



Odor Management Plan

Sanctuary Medicinals
234 Taylor Street
Littleton, Massachusetts

Updated
August 4, 2023

Update Prepared By:

Tech Environmental, Inc.
303 Wyman Street, Suite 295
Waltham, MA 02451

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

In order for there to be sufficient odor control for a cannabis grow facility, in a mixed-use area with commercial and residential properties nearby, there must be odor containment, odor ventilation, odor control, and some dispersion of residual odor. The first odor control commitment for this location was made when the type of grow facility was selected for this site.

There are essentially three types of cannabis grow facilities with respect to odor capture and odor control. The first type is a greenhouse/outdoor facility, where cannabis starts growing indoors in the winter/spring, and then transplanted outdoors during the normal summer growing season. Unfortunately, there is no capture and therefore there can be no formal "odor control" in this type of grow operations. These facilities typically require a significant amount of land buffer so the odor can dissipate to some degree prior to traveling off-site and into any nearby neighborhood. If this type of outdoor grow facility were installed here, the odor potential would be substantially higher. By not selecting an open-grow operation, the facility made a commitment to odor control containment before initial construction.

The second type is the greenhouse style. In this type of grow facility, the entire grow operations take place in one or more greenhouses. There are typically greenhouses for storing the mother plants and others for growing the product. In this type of grow facility, the grow operations are occurring "indoors" and therefore there is an ability to capture or contain odor. There is also an opportunity to control odor sometimes but not all times. While odors can be contained in the greenhouses, during the warmer months, they must be constantly ventilated with fresh air for heat relief which can emit odor that has been contained. By not selecting a greenhouse operation, the facility made a commitment to odor control capture before initial construction.

The third type of grow facility is a completely enclosed and ventilated and conditioned building with individual grow rooms to isolate their power, light, and watering needs, to each grow room. This type of facility requires a significant air recirculating system to add/remove humidity and heat from the grow rooms, which have the highest odor potential from the growing plants. And since only a small fraction of the recirculating air is actually emitted, these facilities have the best ability to capture and treat the odor. This Sanctuary Medicinal facility employes this third type of grow facility, with the highest capture and odor control options available. Of course, even with the highest potential for control it is important to optimize that potential with the proper tools for odor control, and to supplement those tools as needed. This updated OMP includes odor control procedures and tools that exist today and those that will be added once the facility completes its footprint expansion in the near future. The plan is to add another building at the rear of the property that will support the existing operations.

Please note that the facility is not proposing to add any grow capacity to the facility in the planned expansion, but instead is planning more ancillary, support areas. With no added grow capacity, the basic odor potential will not increase, and with more space to systematically process and store product and equipment and to install additional odors controls, it will be easier for the facility to manage its existing odor potential. This grow facility was one of the first proposed in the area nearly five years ago.

This Odor Management Plan provides background, regulatory requirements, the site location, and facility contacts in Section 1.0. Section 2.0 provides background on odor at marijuana facilities, a summary of training provided to Sanctuary Medicinals staff, and a discussion of on-site odor surveys and off-site odor complaint response procedures. Section 3.0 includes a discussion of the odor control system and how it should be operated and maintained to minimize offsite odor impacts. And Section 4.0 provides details on the plan to monitor odor and record keeping.

1.1 Background and Odor Potential

Sanctuary Medicinals (Sanctuary) is located on the east side of Taylor Street (also known as State Route 31), at approximately less than a half mile south of I-495, in Littleton, Massachusetts. The total property is 6 plus acres, with commercial properties to the north and residential properties to the southwest and south. The location of Sanctuary is shown in Figure 1.

If one draws a box around this facility, a majority of the odor loading, or odor potential or odor loading is created in the grow rooms. The odor loading is then removed via the HVAC system condensate recovery process, in processing, or to a much much letter degree with the final product off-site. How is odor removed via the HVAC system? As air is continually recirculated in those rooms odorant dissolve in the humidity or become airborne. The odor loading within the grow rooms reaches an equilibrium when the level of production in the grow rooms is balanced by the odor removed via the condensate removal system. Condensate and other odorants is collected in the HVAC unit via impaction and pumping of the condensate out of the system and back to water reuse.

Since the primary odorants of concern are water soluble, the primary pathways for odor removal is via the two planned odor removal pathways: odor in the condensation and odor still in the moisture in the product upon harvest. The third "planned" pathway is via fugitive emissions. This emission is planned in the sense that the grow rooms are designed to be under a positive pressure and the hallways and space over the grow rooms is designed to be under a negative pressure.

This "push-pull" ventilation dynamic is planned to prevent contaminants from entering into the grow rooms from outside. Any biological grow operation, including cannabis, is susceptible to rapid spread of contamination, simply because there is a single crop being grown and harvested in a confined space and recirculating air system. A positive pressure grow room is the best way to limit the potential of a fungus or other concern spreading through a grow room.

Although the "plan" is for the rooms to leak outwards into the hallways, the potential for leakage can be minimized by rigorous Best Management Practices (BMPs), in this case by opening and closing the doors only when necessary. These BMPs will be improved when there is more room for storage and processing in the new building.

Even through minimization of door activity, there are discrete times that there will be more potential fugitive odor entering the hallways than other (think harvest time, cleaning between cycles, etc.), so it is important to treat the fugitive odors in the hallways (i.e. all areas in the building that are not the grow rooms or designated office spaces) prior to discharge.

Essentially the grow rooms act as small individually controlled air spaces, with their mechanical needs met for humidity control and temperature control, through ground mounted exterior HVAC systems. These units are fully enclosed with respect to the outdoors. The units have pressurized gaskets on all manways and access hatches, and all condensate is collected and sent back into the building's water treatment area for reuse to isolate them from the ambient environment.

Air is added to the grow rooms to create the positive pressure, and air is withdrawn from the main building processing area by ventilation through the roof. The original plans called for a carbon adsorption system on the two exhaust systems located in a crawl space above the grow rooms but beneath the main building structure that were to penetrate through the roof. The current approach is for ozone to treat these odors in an "or equal" manner. In the future, after the new axillary building and new odor control system is installed, an ozone odor control system that is mounted under the roof and above the grow rooms can be used a redundant or as another back-up odor control option. The final use decision will be made in conjunction with the new odor control system design.

The ozone generation system is being updated. Attached to this OMP are the generator cutsheets as well as some information on the residual monitoring system. The ozone generator, "or equal" if a different one is installed as part of the upgrade will provide up to 40 grams/hour, or 20 grams per hour per each of the two exhaust systems. The existing rooftop upblast fans, Greenheck CUE-131 provide approximately 1800 cubic feet per minute (cfm) of exhaust air. The duct to these fans is up to 30 feet long, 20 inches wide and 18 inches deepIt is noted that the injection location needs to be at least 25 feet prior to the exhaust point. At 25 feet, the ozone will have more than the minimum 2 second detention time needed for optimal reaction.

The residual monitoring location needs to be as close to the outlet on each stack as possible. The generation unit has a significant turndown ratio option to limit residual ozone, though most ozone will be consumed with the proper reaction or contact time since ozone is highly reactive and the reaction is not selective. The gas monitor(s) will measure and confirm that the outlet concentration, with reasonable dispersion assumptions, would not exceed the National Ambient Air Quality Standard of 70 ppb average over 8 hours beyond the fenceline. At maximum production, the zone generator could produce up to 3,000 ppb in the duct prior to reaction. At a 10 to 1 turndown this drops to 300 ppb. The ozone monitoring unit is an ATI F12 gas transmitter with calibration to ozone, or equal, with a setpoint of 100 ppb residual. This is a conservative setpoint with respect to ambient levels, since it would only require a dilution of 1.42 to get under an instantaneous reading of 70 ppb at any location and no dilution to get under that level, even with minimal wind direction changes over eight hours.

Prior to the ozone system, there are three recirculating carbon systems installed in the existing building as per Figure 2. These systems in combination with the existing three air curtains for the office and two loading dock areas will ensure that any fugitive emissions emitted from accessing the grow rooms, moving harvest material to processing, from processing areas, and from product storage areas will be reduced so that any air that escapes will have a lower average loading (again, see Figure 2).

The unit in the office space is included because it was noted that at full employee capacity, odor that can travel within the worker's clothing into the lobby, breakroom, and locker area will be reduced so that the normal odor loading is less as workers enter and exit through the front door.

Each carbon system was built to order and contains a two-speed Solar and Palau inline fan that is sized for recirculating up to 1050 cfm on high speed and 750 cfm on low speed with little to no pressure drop. The does have added pressure drop through trays of activated carbon, and the flow rate will drop based upon how thick the carbon layer is placed in each of the three trays, the trays are 4.5 inches deep and 21.5 inches by 21.5 inches wide. The facility should not fill all three of these trays up to the top as they will cause excessive pressure drop and limit the recirculation rate, and obviously be hard to handle. At 2 inches of carbon, each unit holds approximately 50 to 75 pounds of carbon, depending on the carbon density and pelletizing process.

The carbon trays should not be filled with too little carbon either. Obviously, the less the carbon thickness the more often it will need to be changed, but also if there is not a minimum thickness then any changes in thickness can create a pathway for short-circuiting. A minimum of just two inches is typically considered adequate, so long as it is evenly leveled.

With three trays and one directional flow, one could consider this potentially a "three stage" carbon system, though operating as a three-stage system is likely overkill. To operate it as a three stage system the layer closest to the inlet flow would be the oldest and the carbon trays would rotate so that the tray that receives the newest carbon is furthest from the inlet and the trays are rotated accordingly. As simpler and likely more the optimal configuration is that the lowest level (the first exposed) is removed. The top two trays are added to it, and the other two trays have fresh carbon added. This will allow for using the highest percentage of absorptive sites on the carbon prior to change out.

1.2 Regulatory Requirements

The Massachusetts Department of Environmental Protection (MassDEP) regulates nuisance through 310 CMR 7.00"Air Pollution Control" In these regulations "air contaminant" is defined to include odor and a condition of "air pollution" includes the presence of an air contaminant in such concentration and duration as to "cause a nuisance" or "unreasonably interfere with the comfortable enjoyment of life and property".

The Town of Littleton Chapter 217 under Division 1.5: Board of Health Enactments it states, upon which there is any substance or material, or any condition, which is or may become a source of danger to the public health or a nuisance, shall, when ordered by the Board of Health, in writing, remove or abate the same within the time specified in said order."

As one can see from this very basic qualitative condition, odor is not set at a numerical regulatory limit. There is no single event that causes a violation, just as there is no threshold for multiple, milder, events. Because there is a qualitative standard, a common mistake often made is to assume that all odor evaluations can only be subjective, because the standard is subjective. That is not the case. It is very possible to use an objective approach to monitor and track odor to minimize the potential for events that could be considered a nuisance.

It is very possible, as this OMP describes, to quantitatively assess odors, and to use these assessments to track quantifiable changes in odor patterns.

1.3 Facility Contacts

As of the drafting of this OMP, observations of changes in odor shall be addressed immediately to 978-301-6600. In addition, here is a list of general contacts, as of today.

Main Office: 234 Taylor Street Littleton, MA 01460
Facilities Manager: Kevin Coyne 800-666-8621
Corporate Offices: 800-666-8621
24-Hour Odor Complaint Hotline: 978-301-6600
Emergency Numbers: Fire: 911 or (978) 540-2302 Police: 911 or (978) 540-2300 Westminster Health Department: (978) 540-2430

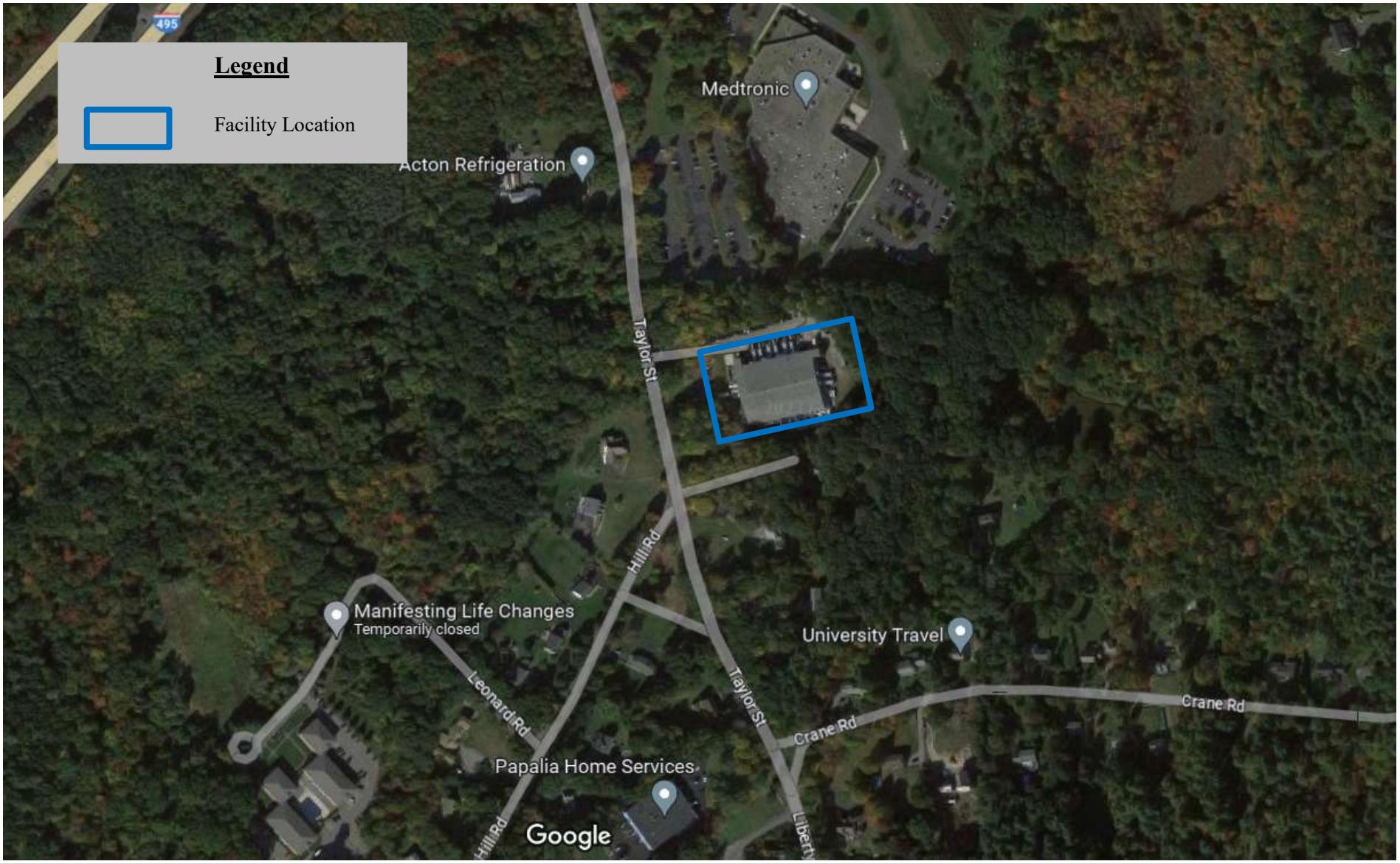


FIGURE 1.
Facility Location
Sanctuary Medicinals
Littleton, MA

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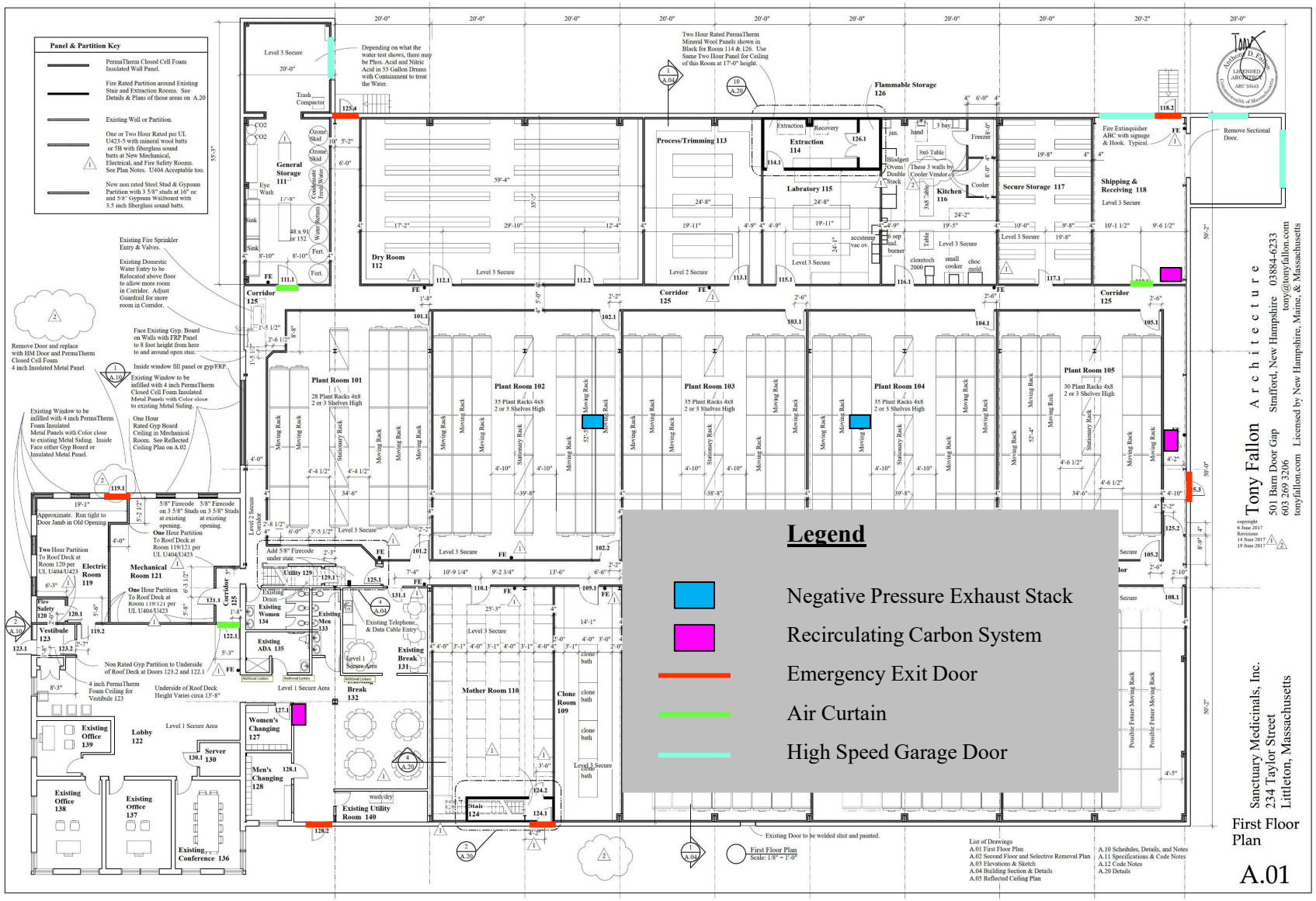

FIGURE 2.
Current: Existing Building
Sanctuary Medicinals
Littleton, MA

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2.0 ODOR BASELINE AND ODOR AWARENESS

It is human nature to react to odors that are unknown and not regularly experienced, and therefore could potentially be a health or safety problem. Typically, your average grow facility worker is not threated by the odor directly and therefore would not be aware of changes in the odor inside or outside of the facility because they are normal, non-threatening, and expected. This section is included to be shared with employees so that odor awareness can be a part of everyone's job. It is important that all employees look for increases in odor potential and point them out to the responsible contact, so that they can be addressed before they could reach a level that could cause an increase in odor outside of the facility, or beyond the property line.

However, before someone can understand potential changes in odor at the facility, the odor baseline must be fully understood. This section is included to help employees understand the basics of odor, how to continuously assess odor as part of their daily activities, and to understand the odor baseline and how odor varies.

2.1 Odor Primer

Sensitivity to odors varies among the population. An odor that is noticed by or is offensive to one person may not be noticed by or offensive to another. It has been estimated that the olfactory sensitivity for 1 in 20 people is outside of what is considered the "normal" range and oftentimes individuals who have a poor sense of smell are never aware of their desensitized olfactory system. Conversely, some individuals have an extremely keen sense of smell. Factors that affect one's sensitivity to odors include genetics, age, gender, experience, and environmental influences.

Since odor detection and sensitivity can vary among individuals, sensitivity screening can be conducted to determine whether someone is in the "normal" (average) range. Odor threshold screening should be conducted to determine whether those individuals who are formally charged with assessing the odor baseline and tracking its changes surveys possess an adequate olfactory threshold and are capable of conducting an accurate assessment of current odors. It can also be used to assess those individuals that are ideally suited to respond to odor complaints.

Four (4) attributes of the sense of smell have been defined to classify odors:

- Concentration/Intensity - strength of the odor;
- Pervasiveness - change in intensity upon dilution;
- Character - description of the odor; and
- Hedonic Tone - relative pleasantness of the odor.

The concentration, or intensity, of an odor describes its strength; the intensity of an odor is unrelated to its character or pleasantness. In general, more reactive compounds have higher odor intensities. Odor concentration is typically highest at the source and disperses as it travels away from the source. However, odors from like sources can be additive. The pervasiveness of an odor is its rate of change in intensity upon dilution. The intensity of some odors will quickly diminish when released, while other odors will show very little decrease in concentration with dilution. The character of an odor best describes the source of that odor and typifies the human reaction to it.

The hedonic tone of an odor describes its relative pleasantness to the human nose. Two odors may both be very strong with similar odor intensities, but one may be pleasing to the human nose (i.e., flowers, chocolate, coffee) having a highly positive hedonic tone, while the other may be very offensive to the human nose (i.e., skunk, sewage, garbage) and have a highly negative hedonic tone. The character and hedonic tone of cannabis are considered negative, and their degree of unpleasantness can contribute to community nuisance issues.

2.2 Cannabis Odor

Cannabis odor is not dominated by one compound or even one type of compound, it is a bouquet of odors, similar to odor experienced from a bouquet of flowers. It is complex, it varies at different parts or the process, and it is a desired effect. A good "skunky" can be the sign of a good product. It is also the sign of an odor that can be described as undesirable from other natural or manmade processes or industries where sulfur compounds are more prevalent than in the natural environment. It is important to remember that humans have been able to detect sulfur compounds for tens of thousands of years at very low levels, as a defense mechanism. If one thinks of "cavemen concerns," number three behind being eaten by a predator, or not finding enough food and water to survive, would be exposure to naturally occurring emissions in caves that could suffocate them. As a result, the first reaction by the general public, to the skunky and desirable marijuana odor associated with a fresh cannabis product, is that it smells like something that could be harmful, or in this day and age, simply unpleasant.

The simplest reduced sulfur compound is hydrogen sulfide ("H_2S"). H_2S is often used as a surrogate for total odor. The simplest mercaptan is methyl mercaptan ("MM") which consists of a single methane where one hydrogen "H" compound is replaced by a sulfur-hydrogen "SH" compound. There are other mercaptans as well that are longer chains with more methyl groups but the same basic "SH" structure. These compounds will vary from plant to plant, but also from the operations. If plants, especially after harvest, are starved of oxygen. They will begin to decay, and reduced sulfur compounds can increase. As this occurs, sulfur compounds can also "free-up" to attach to other compounds that are regularly associated with cannabis odor.

Furthermore, other compounds regularly associated with cannabis including terpenes and ketones, can breakdown into other compounds that are often less desirable and more persistent odorants. Terpenes are by far the most recognized cannabis-based odorants. The most common are myrcenes, beta-caryophyllene, limonene, linalool, pinene, to name a few. They offer earthy, spicy, citrus, flowery, piney flavors, respectively. There are many others, but the purpose of this description is not?? for one to recognize these desirable products, but to note that these products typically are much less persistent that the sulfur compounds or some of the compounds terpenes can break down into if the drying process is not optimized. Why is persistence important? Because if fugitive odor is emitted, the more persistent ones can still be present offsite, but the less persistent ones are below the recognizable level. It is therefore possible for all the pleasant local cannabis smell to be gone and the less pleasant ones remaining. This is how a cannabis facility can be confused with a landfill odor or "sewer gas" odor. It is important to monitor overall all odors and also the different components on-site and to report any drastic change from "normal" odors.

Normal is in quotes because it will also change with different products, so one must take all variables into account.

humans can detect mercaptans to the parts per trillion ("ppt") level. Although the threshold for odor nuisance is subject to great debate, the nuisance threshold for a single short-term event is below the single ppmv range of standard electrochemical sensors. Thus, a combination of the nose and other instruments are necessary.

2.3 Odor Nuisance Threshold

The odor from the facility will vary with the different stages of the growing process. Which leads to varying odor characteristics and odor intensity. So far capturing the odor has been achieved by a combination of airlocks, positive and negative pressure balancing, isolating the areas that generate odor from those that do not, and minimal access doors to the outside that cannot be used except in emergencies. However, it is not reasonable to expect "zero odors" from a cannabis cultivation facility.

It is important that Sanctuary staff realize that they may become desensitized to certain odors during the day and over time. The staff working in the grow rooms will experience the greatest amount of temporary olfactory fatigue, while those working in the office will experience the least amount of temporary olfactory fatigue. Thus, assessing off-site odor potential may not be as effective until after some time is spent away from the facility. It is not uncommon for someone from a facility that has been exposed to on-site odor to travel off-site to investigate an odor complaint and concluded that the odor is "not that bad."

In summary, Sanctuary should always be aware of the odor baseline on-site as they complete their normal daily tasks. If this baseline changes, it should be noted. If it increases dramatically, the nuisance potential off-site should be explored by someone that is not immediately desensitized. Sanctuary should not wait for an odor complaint to assess this off-site odor potential.

2.4 Odor Training

It is possible to train someone to better understand their olfactory senses. To properly analyze an odor event, individuals need to understand the basics of odor, including how and what we smell when exposed to odorous compounds in the air. The goal of odor training is to provide individuals with the information that they need to better understand odors and how to recognize and characterize them. This, in turn, will help the trained individuals to better manage and respond to odor events and/or complaints. This type of training usually includes:

- Instruction on the role of personal perception;
- The differences between typical odors and each of their potentials; and
- The methods to recognize various odors.

Individuals responding to odor complaints, and conducting odor surveys, can more accurately determine the source of any one odor if they are well-informed about the characteristics of common odors and the way in which odors are released and transported to off-site locations. In some cases,

odors initially believed to derive from a very proximate location are from other sources that are much further away or are a culmination of smaller sources that together produce a considerable odor. Many times, multiple sources may be added to the total odor dynamic in a neighborhood, while the local community assumes that all odor is from a single source. A trained odor investigator is typically able to determine where an odor is coming from, and if not, at least correlate the odor to its rightful source.

Training has been conducted for specific Sanctuary Medicinals staff so that they can better understand odor, human perception, the differences between cannabis odors and odor potential. This training will help the staff recognize and characterize odor increases more quickly, which will lead to a faster response. The training included information on what causes odors, the role of personal perception, recognizing odors, the conduct of on-site odor surveying and gathering of data, and appropriate operational adjustments to operating conditions to address any detected off-site odors. Since odor detection and sensitivity vary a great deal among individuals, staff were also screened for their odor sensitivity to confirm that the staff is in the "normal" range. It has been estimated that the olfactory sensitivity for 1 in 20 people is outside of what is considered a "normal" range. Staff members who were in the "normal" range are considered qualified to receive the training.

2.5 Fugitive Odor Potential

The growing of cannabis is not homogeneous. It is a mixture of many different odor characteristics. Odor characteristics range from typical very complex cannabis odor character to a simpler sulfur-type odor. This odor character shift indicates that many of the odorous compounds have reached their non-detectable level and only the more persistent compounds remain. A "top-tier" cannabis facility design with respect odor, the facility functions as designed with the exception of some bleed. The resultant bleed odor can work its way towards doors and "burp" as personnel and material are transferred. The bleed odor is much lower than the process odor and the burp releases are infrequent, so the overall average odor loading from these activities is low, and therefore the nuisance potential is low, but there is still potential to detect the odor.

2.6 Formal Odor Surveys

As part of this Odor Management Plan, Sanctuary will conduct a formal odor survey at least two (2) to three (3) times per week. The odor surveys, over time, will establish an "odor baseline" for Sanctuary. This odor baseline will allow staff to more quickly recognize and respond to an incident of increased odor on-site in the future, ideally before it becomes an off-site concern. Staff conducting the surveys have been, or will be, trained in odor monitoring and odor identification.

The formal survey should be conducted in the morning before the surveyor has become desensitized to odor. Monitoring in the morning is also beneficial from a meteorological perspective since odors can experience less dispersion after a still and clear night. The survey will initially be conducted at the onsite/property line locations (See Figure 3) so that different wind directions and different areas can be examined. As the surveyor traverses the perimeter, they should record any notable odors on the Odor Survey Log. A copy of the Odor Survey Log template

is included in Appendix A. This information will help establish the areas onsite that have a higher odor potential, based on both facility activity and meteorological conditions.

Sanctuary should record the following information on days when odor surveys are completed:

- Wind speed and direction (observed and documented from a weather station).
- Weather observations (cloud cover, precipitation, haze, etc.); and
- Facility activity.

When odors are detected during the odor survey, the following information should be recorded:

- Description of odor character and intensity;
- Weather observations (cloud cover, precipitation, haze, etc.);
- Wind speed and direction (from a weather station);
- Any outdoor activity occurring; and
- Any unusual release locations

The information from these surveys should be compiled in an electronic database to generate an odor baseline and to target areas onsite with greater odor potential.

Please note that this section is designed to formally observe and document the odor baseline and changes to it. It should also include informal odor observations made by all staff during all operations and maintenance activities.

Eventually, the formal odor surveys could be reduced to a weekly or monthly basis combined with formal surveys triggered by informal observations made by staff with the use of additional effective odor control systems have been applied. The key will be to maintain sufficient odor surveys, so that any change in odor can still be readily observed and explored.

2.7 Odor Complaint Program

Sanctuary will establish a toll-free hotline which operates 24-hours a day, 7 days a week, through which all odor complaints are to be channeled. The toll-free hotline number is (978) 301-6600. The hotline calls are forwarded to Sanctuary staff to assemble a report and to respond to odor complaints made by the public and to assemble a report. Sanctuary will respond to complaints within thirty (30) minutes during the operating hours, and within eight (8) hours during all other hours. A copy of the Odor Complaint Response Report forms to be completed by Sanctuary is included in Appendix B.

The two (2) most helpful items to any odor complaint response program (in addition to the dimensional factors such as location and time) are objective in-field intensity measurements as compared to a known scale, in this case the n-butanol scale, the odor descriptors of the odors in the area. All odors present should be observed and described. Whether the responder would consider them typical daily odors for the neighborhood (skunk-like, earthy, flowers, etc.), uncommon but possible (burnt wood, fresh bark mulch, wetlands, etc.), atypical odor (septic, garbage, or sewer) is not as important as the actual descriptors such as:

- Earthy, Musty, Moldy, Musk, Grassy, Woodsy, Dust
- Floral, Fragrant, Flowery, Pine
- Fruity, Sweet, Citrus, Vegetable
- Spicy, Garlic, Cabbage, Onion, Pepper, Cinnamon, Vanilla
- Sewage, Septic, Fecal, Manure
- Putrid, Rotten Egg, Rotten Vegetable, Skunk, Vinegar
- Fishy, Urine, Ammonia, Amine
- Medicinal, Alcohol, Chlorine, Chemical, Paint, Car Exhaust

The Supplemental Odor Complaint Response Form (See Appendix B). includes the incorporation of the Odor Intensity Referencing Scale[1] (OIRS) field jar kits, and more common odor descriptors to assist the responder. The proper completion of the Supplemental Odor Complaint Response Form requires the odor responder to identify the odor character, intensity, duration, and frequency. Odor intensity should be reported using the OIRS field jar kits to provide objective quantitative comparative odor intensity. All formal responders will be trained in the use of these jars first "theoretically" during the in odor training class and later in the field as part of the final field portion as the weather gets closer to the traditional odor season. Any future responders should be trained as staff turnover requires.

Word descriptors assigned to these concentrations are no odor, trace, noticeable, moderate, strong, and very strong. All members of the odor response team will be trained in this method to ensure accurate and consistent observations of odor. The complaint and response will be logged into a database created in Excel and maintained by the odor responders. The database will include the following information: date, time, name of complainant, brief description of the nature of complaint, and weather conditions. If an odor is determined to be attributed to the facility, Sanctuary should undertake corrective actions as necessary to address the cause of the odor.

[1] From 1) "Standard Practices for Referencing Suprathreshold Odor Intensify", ASTM E554 (Reapproved 1988, 1999.) and 2) McGinley, Charles M. and McGinley, Michael A. "Odor Intensity Scales for Enforcement, Monitoring, and Testing", Air and Waste Management Association, 2000 Conference.

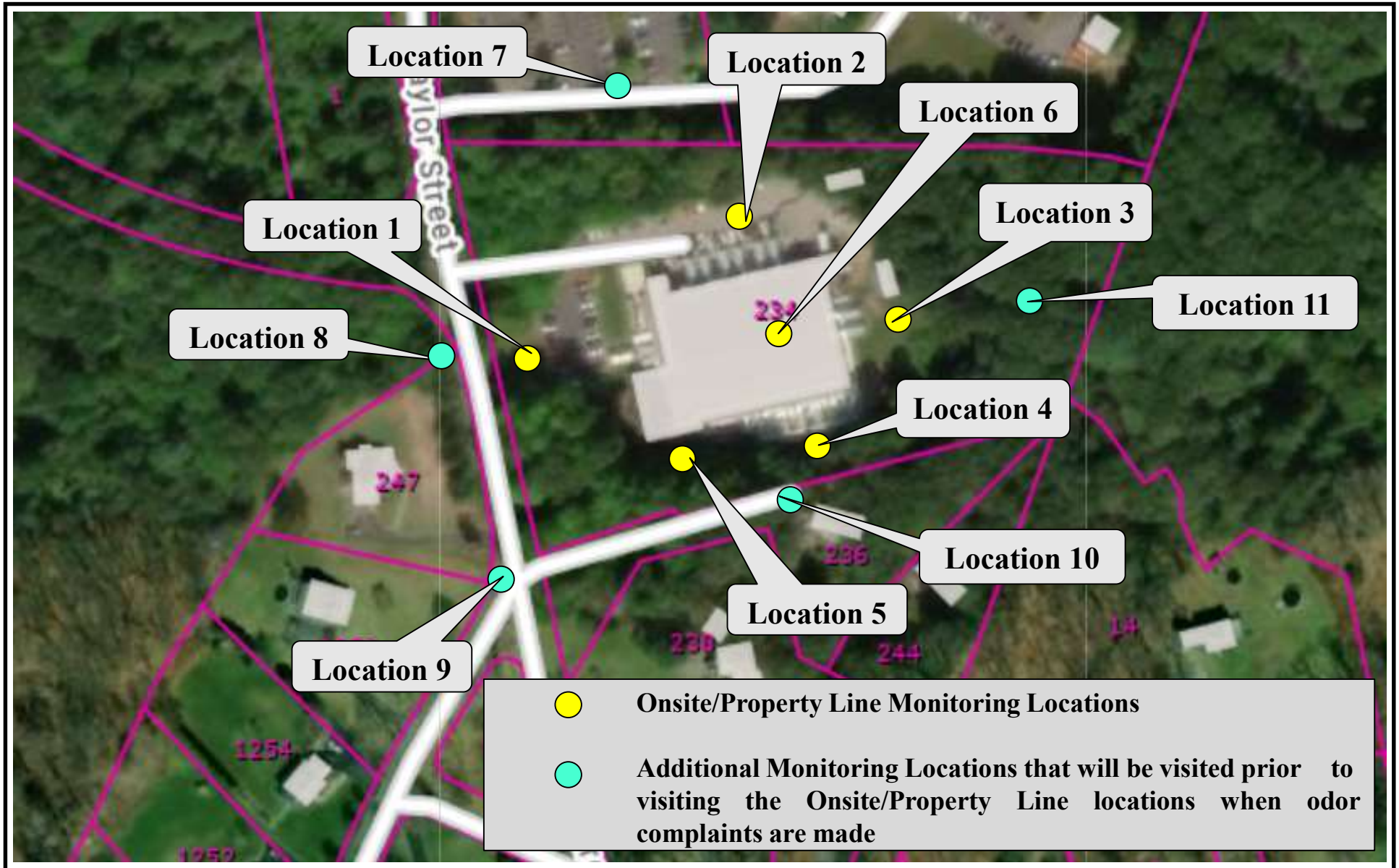

FIGURE 3.
Odor Monitoring Locations
Sanctuary Medicinals
Littleton, MA

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3.0 NEW BUILDING AND ODOR CONTROL EXHAUST SYSTEM

The new building will not create more odor. It will msnage the existing odor by creating new processing, storage, and shipping areas that are currently undertaken in the existing facility structure. As a result, there will be some "fugitive" odor that currently exists in the facility areas outside of the grow room today that will be transferred to this new building.

The new building also provides a new opportunity for odor control improvements that can best serve the more spread-out odor potential of the existing and new building, and also can provide redundancy. As part of the permitting for the future facility is committing in the future a new carbon system that will keep both the existing building and the new ancillary building negative, so that any ozone system can be considered a redundant, back-up, or extreme heat relief odor control system, as needed.

The new building will be built as a stand-alone structure that will be connected to the existing structure via a hallway (See Figure 4.). The headspace in the new hallway and the headspace in one of the existing hallways will be used to provide new ductwork to and from the odor control unit as shown on Figure 4. Please note that what is known at this time is that shipping and receiving will be separated. Shipping activities will occur in the new building and receiving will occur within the existing building shipping and receiving area. It is also known that the new building will provide more processing space. This will allow some of the existing processing space in the current building to be used for grow room storage and support.

The process room headspace in the existing structures is defined as the entire existing structure minus the grow rooms, the lavatories, the mechanical and electrical rooms, and the changing rooms and the offices which each have their own dedicated HVAC systems. The volume of this headspace is approximately 320,000 cubic feet. The new building will be considered all processing for the purpose of permitting, but could have spaces isolated during design, as the design progresses. The headspace of the new building will be approximately 270,000 cubic feet.

Three more similar recirculating carbon systems are proposed for the new building. One in the loading dock and two in other processing locations. With these new systems installed then the exhaust odor control system can be considered a "polishing unit," where the recirculating units knock down the odor within each building and the new combined system then polishes the odor, or treats it again, prior to discharge.

Currently, the main building has a maximum exhaust capacity of 3,600 cfm which is driven by the forced air into the building from the grow rooms. And since the new building will not add any new grow areas, there will be no forced air into the building, so the total airflow estimated to keep the building negative will be less. It is estimated at 1,000 to 1,500 cfm for the new building or approximately 5,000 cfm total will be withdrawn from two headspaces combined. A new carbon odor control system will be supplied to "polish" the exhaust.

At the permitting level it is reasonable to assume that the future building will also be a similar prefabricated steel structure building with no windows, and minimal door openings. There will be minimal personal doors and garage doors installed. Most of the personnel doors will be alarmed

and marked as emergency exit only. Any access to non-alarmed doors will be restricted to only the plant managers for the required security precautions. The security precautions will ensure that these doors are not potential fugitive emission locations.

There will be one or more garage doors installed in the new loading dock area. These doors will be operated similar to the current doors in a normally closed and locked position. Each garage door opening will also be fitted with a fast-moving interior door.

4.0 ODOR Operations and Maintenance Activities

This section is organized by frequency of required events to proactively manage odor control. Also included is the survey and monitoring activities:

4.1 Daily activities

Although employees may not consider daily odor observations part of their normal routine, each employee is still responsible on a daily basis to:

1. Observe odor coming to and from the building and report anything out of the ordinary
2. Report any equipment that may not be functioning properly and may result in increases to the odor baseline inside the building or outside
3. Follow required washdown and declutter procedures to keep areas clean and tidy to limit residual odor
4. The security guard should be made aware of potential areas of concern for added odor and to report to management if those areas are compromised
5. Monitor the operating instrumentation (SCADA) system for odor control system operation

4.2 Weekly activities

1. Inspect the odor control systems for changes in flow pattern and carbon distribution
2. Perform formal proactive odor surveys, with more than one activity per week needed if either it is warmer, and the odor baseline appears to be increasing or there have been confirmed odor complaints.
3. Examine the HVAC units outdoors for potential wind or storm damage and for potential leaks in gaskets

4.3 Monthly Activities

1. Measure the pressure drop in each condensate pump line and replace or clean as required.
2. Compile the odor survey and summarize them for quarterly reports
3. Examine the odor control system performance for the month and summarize down times and maintenance performed.
4. Compile any odor complaints received, reports completed, and action items taken.
5. Check carbon for breakthrough potential and rotate carbon as per the desired process to maximize carbon efficiency.
6. Test the odor control system monitoring and shutdown components and replace those that fail.

4.4 Odor Jar Kit

Odor intensity is also a measure of the odor strength, like the D/T concentration, but it has another purpose too. While concentration (i.e., how much additional dilution is necessary to get to an undetectable level) will help one understand the potential extent of an obvious odor, intensity will help define the potential for an immediate, frequent, or long-lasting odor condition. The intensity is a measure of how strong the odor is compared to a reference odor.

The selected approach to monitoring is based upon a modified version of the laboratory method ASTM E-544 (https://www.astm.org/Standards/E544.htm) for use in the field. The primary difference between the field and laboratory method is that the field method uses the diluted end of the n-butanol scale (for off-site versus on-site odors), and it has been modified for use in the field. Five jars of increasing n-butanol concentrations are used from one (1) to five (5). N-butanol is the reference odorant used in this test method because it has a unique odor that is not typically associated with natural odors, and also it has a neutral hedonic tone (relative pleasantness). It is not considered pleasant or unpleasant. Sanctuary has obtained an Odor Jar Kit from Tech, which will be used during each round of odor monitoring to be able to quantify the datable odor's intensity. The Odor Jar Kit last about 6 months which will then be replaced by purchasing another kit from Tech or creating one with instructions provided by Tech.

4.5 Odor Monitoring

Odor Jar Kit will be used to determine the odor intensity. Starting with the most diluted jar, the procedure for determining odor intensity is to sniff the odor in the air, sniff the odor in the jar, and then back to the air. If ambient intensity is higher than the jar intensity, then the process is repeated until the jar is stronger than the ambient odor. The intensity reading is then the highest jar equal to or below the odor. For comparison sake, most natural or typical odors are a one (1) or below on this scale; even the smell of low tide, wetlands, fresh cut grass, flowers, etc. Although these natural odors can be readily identified in nature, their intensities need not be typically overwhelming. Sanctuary will also summarize the collected data quarterly and report to the Littleton BOH as part of an evaluation of where the monitors have provided useful information.

4.6 Record Keeping & Reporting

Sanctuary will report to the Littleton BOH periodically, at a frequency agreed to with the BOH, on its efforts to address off-site odor complaints. At the request of the BOH, such reports will be provided either in writing or verbally through appearance at BOH meetings or directly to the BOH's Health Agent.

Sanctuary will meet with the Littleton BOH to review all aspects of this Odor Management Plan at a regularly scheduled meeting of the BOH, and at six (6) month intervals thereafter if requested by the BOH. If odor conditions at that time indicate that revisions are needed in the Odor Management Plan, Sanctuary and the BOH will work collaboratively to agree on modifying the odor management program, with consideration of additional best management practices for facility odor control, including adoption of alternative state of the art technology solutions in the event these are not already in use at Sanctuary.

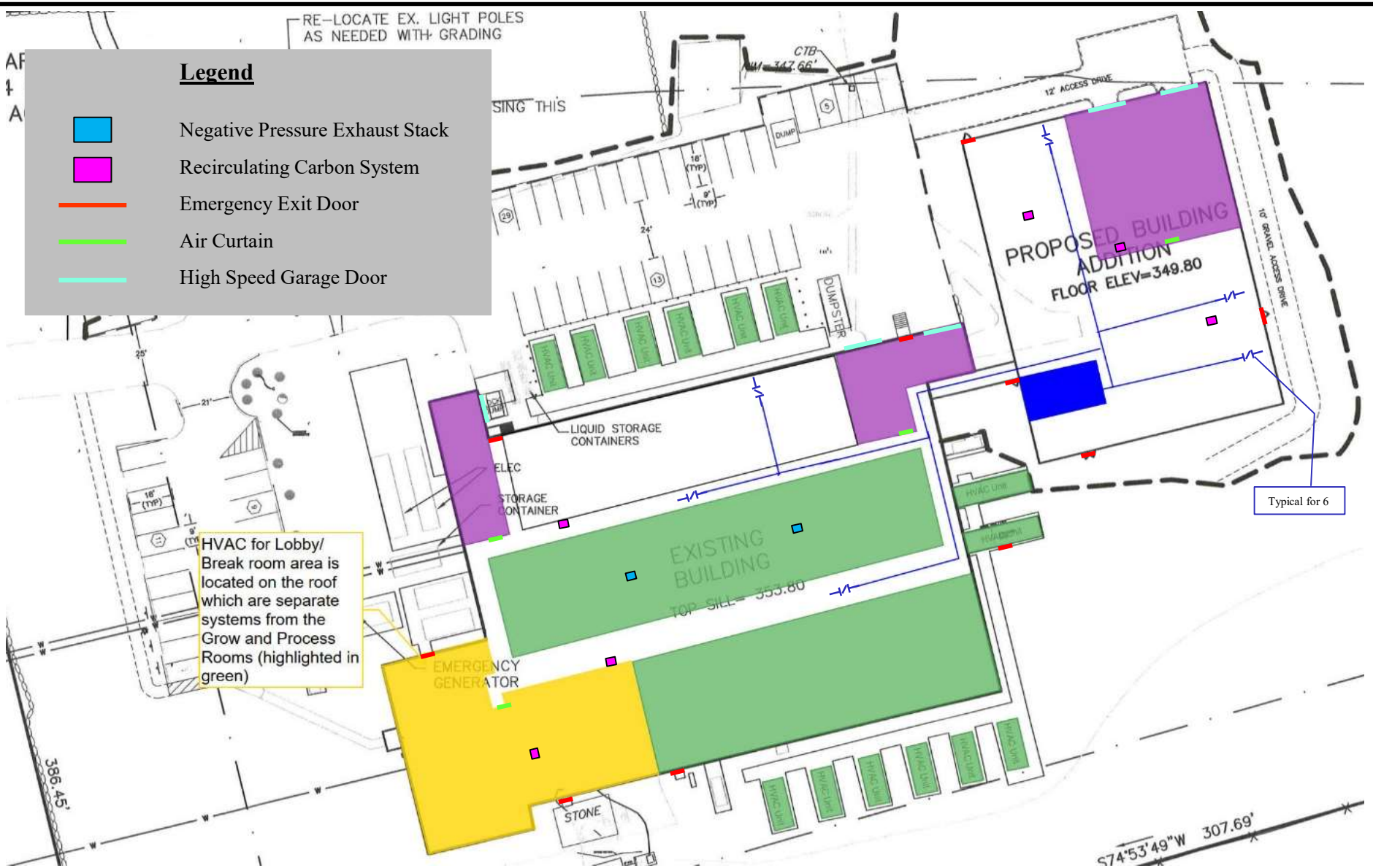


FIGURE 4.
Future: Existing and Proposed Building
Sanctuary Medicinals
Littleton, MA

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

APPENDIX A

ODOR SURVEY LOG

The following form is FOR INTERNAL USE ONLY.
Only trained investigators should fill out this form.

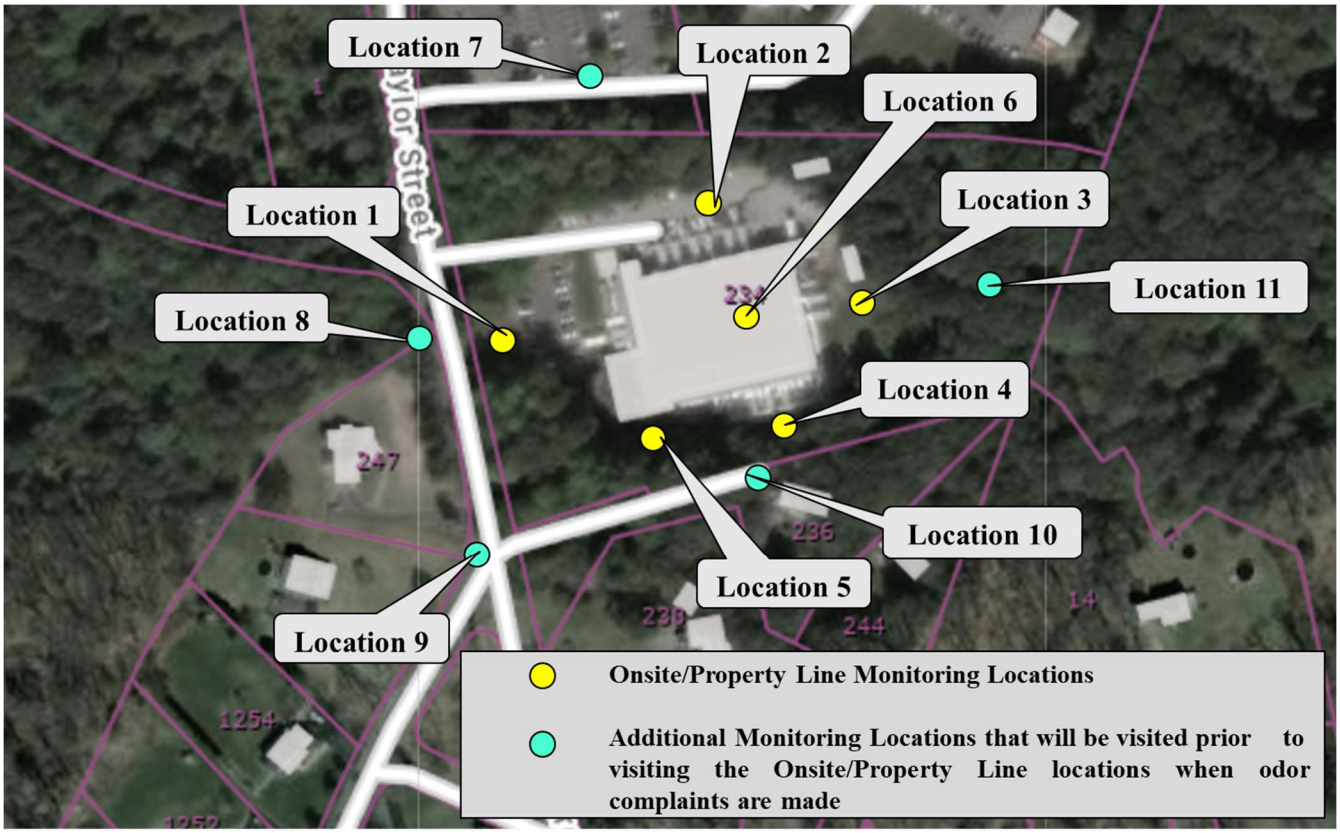
SANCTUARY MEDICINALS ODOR SURVEY LOG

Date: _____

Investigator's Name: _____ **Starting Time:** _____

Your best estimate of current weather conditions in field:	**Weather.com/ local met-station data:**
Wind Direction (wind coming from the): N NE E SE S SW W NW	Condition: _____
Average Wind Speed: None/Still Calm Low (5-10 mph) High (10+ mph)	Temp (ºF): _____ Pressure (in.): _____
Weather: Clear Skies Partly Cloudy Cloudy Light Rain Heavy Rain Snow	Wind from the: _____ Wind speed (mph): _____

Odor Monitoring Locations:



Notes:

_____

_____

_____

The following form is FOR INTERNAL USE ONLY.
Only trained investigators should fill out this form.

Fill out the table below:

MONITORING LOCATIONS	*WAS THERE ANY NOTICEABLE ODOR?*	*WHAT DID IT SMELL LIKE?[1]*	*HOW STRONG WAS THE ODOR?[2]*	*WHAT IS THE ODOR INTENSITY?[3]*	*FACILITY ACTIVITIES AT THE TIME OF MONITORING*
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

[1] *Common Odor Descriptors:*

- *Earthy, Musty, Moldy, Musk, Grassy, Woodsy, Dust*
- *Floral, Fragrant, Flowery, Pine*
- *Fruity, Sweet, Citrus, Vegetable*
- *Spicy, Garlic, Cabbage, Onion, Pepper, Cinnamon, Vanilla*
- *Sewage, Septic, Fecal, Manure*
- *Putrid, Rotten Egg, Rotten Vegetable, Skunk, Vinegar*
- *Fishy, Urine, Ammonia, Amine*
- *Medicinal, Alcohol, Chlorine, Chemical, Paint, Car Exhaust*

[2] *(1) Trace (2) Noticeable (3) Moderate (4) Strong (5) Very strong*

[3] *Based on Odor Jar Kit ranking of 1 through 5*

DOCUMENT ALL READINGS FROM THE ODOR PATROL IN THE ELECTRONIC DATABASE

APPENDIX B

ODOR COMPLAINT RESPONSE FORM

All intensity evaluations should use the jar kits.
Only trained investigators should fill out this form.

Date: _____

ODOR COMPLAINT RESPONSE FORM

Complainant's Name/Company:_____ **Time of Complaint:** _____

Location of Complainant:_____ **Time Odor was Detected:** _____

Investigator's Name: _____ **Response Starting Time:** _____

Your best estimate of current weather conditions in field:	**Weather.com/ local met-station data:**
Wind Direction (wind coming from the): N NE E SE S SW W NW	Condition: _____
Average Wind Speed: None/Still Calm Low (5-10 mph) High (10+ mph)	Temp (ºF): _____ Pressure (in.): _____
Weather: Clear Skies Partly Cloudy Cloudy Light Rain Heavy Rain Snow	Wind from the: _____ Wind speed (mph): _____

Mark(X) the Location of the Odor Event:

Common Odor Descriptors

- Earthy, Musty, Moldy, Musk, Grassy, Woodsy, Dust
- Floral, Fragrant, Flowery, Pine
- Fruity, Sweet, Citrus, Vegetable
- Spicy, Garlic, Cabbage, Onion, Pepper, Cinnamon, Vanilla
- Sewage, Septic, Fecal, Manure
- Putrid, Rotten Egg, Rotten Vegetable, Skunk, Vinegar
- Fishy, Urine, Ammonia, Amine
- Medicinal, Alcohol, Chlorine, Chemical, Paint, Car Exhaust

Did you notice the odor? *Yes* *No*

How strong was the odor? *(1) Trace* *(2) Noticeable* *(3) Moderate* *(4) Strong* *(5) Very strong*

What did it smell like? _____

Notes: _____

_____

_____

Response Back to Caller

Date & Time:_____ **Responder's Name:**_____

APPENDIX C

OZONE SYSTEM CUTSHEETS

OXG-Series Ozone Generators

The OXG Series are built with an Ozone Generation Cell and Oxygen Concentrator in one system. They can produce ozone from 10 to 150 g/hr from 4 to 30 LPM. These Ozone Generators are compact, efficient, and easy to use with a wide variety of options and features.

APPLICATIONS

- Water Treatment
- Bottled water
- Laundry applications
- Odor control
- Agricultural applications

OXG TECHNOLOGY

The OXG Ozone Generator line is a turnkey unit that houses both an ozone generation cell and oxygen concentrator. Simply plug into electrical power and produce both oxygen and ozone from one unit. The OXG units are easy to use and work for a variety of industrial applications.

SYSTEM FEATURES

- Turnkey Ozone Generator
- Integrated Oxygen Concentrator
- Efficient ozone generation – high concentration ozone
- Air cooled Ozone Generator – no cooling water necessary
- Visual Flow-meter (standard)
- Adjustable ozone output (standard)
- Easy to install and operate

Oxidation Technologies, LLC.
214 US Highway 18
Inwood, IA 51240

(515) 635-5854
Sales@oxidationtech.com
www.oxidationtech.com

Model	O3 Production	Oxygen Flow	O3 %	Dimensions (inches WxDxH)	Power Requirement	Compressed Air Requirement (compressor standard)
OXG-10	10 g/hr	4 LPM	3.5%	24” x 12” x 36”	120 VAC	4 CFM
OXG-20	20 g/hr	7 LPM	4%	26” x 12” x 36”	120 VAC	4 CFM
OXG-30	30 g/hr	10LPM	4%	26” x 12” x 38”	120 VAC	4 CFM
OXG-40	40 g/hr	10 LPM	4.7%	26” x 12” x 38”	120 VAC	4 CFM
OXG-60	60 g/hr	10 LPM	6%	26” x 12” x 38”	220 VAC	8 CFM
OXG-80	80 g/hr	20 LPM	4.7%	30” x 12” x 38”	220 VAC	8 CFM
OXG-100	100 g/hr	20 LPM	6%	30” x 12” x 38”	220 VAC	8 CFM
OXG-120	120 g/hr	30 LPM	4.7%	30” x 12” x 38”	220 VAC	12 CFM
OXG-150	150 g/hr	30 LPM	6 %	30” x 12” x 42”	220 VAC	12 CFM

OPTIONS

- **External Compressed Air** – the OXG-10 to OXG-40 units incorporate an oil-less compressor to provide compressed air for the Ozone Generator. If plant air is available, or in very humid/poor air quality environments the internal air compressor can be removed at a cost savings. We will remove the compressor and replace with air solenoid valve, pressure regulator, and 2-stage air filtration.
- **Internal Compressed Air** - the standard OXG-60 to OXG-100 require plant compressed air for operation. An optional internal air compressor is available. The OXG-120 & OXG-150 are not available with an internal compressed air option.
- **Stainless Steel Enclosure** – upgrade the enclosure to be stainless steel if required for your application, durability or look.
- **Ozone Analyzer** – this additional piece of equipment will provide readout of the output of the ozone generator

Oxidation Technologies, LLC.
214 US Highway 18
Inwood, IA 51240

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Sales@oxidationtech.com
www.oxidationtech.com

ATi
ANALYTICAL TECHNOLOGY, INC.

F12iS

INTRINSICALLY SAFE TOXIC GAS DETECTION

ATI's Series F12iS Toxic Gas Transmitter is the perfect choice for detection of gas leaks in explosion-hazard environments. While operating at intrinsically-safe power levels, the F12iS is still available with our Auto-Test system that verifies sensor function daily, virtually eliminating the need for manual "bump tests".

c UL us

Ex

IECEx

MODEL F12iS TOXIC GAS DETECTOR

- **Power:** Loop-powered 12-28 VDC
- **Interchangeable Sensors:** The F12iS accommodates 60 different sensor modules
- **Sensor Verification:** Auto-Test generator option provides a true gas response test. Test history is stored in sensor memory for user review at any time
- **LCD Graphic Display:** Allows clear gas concentration display plus complete menu-driven operator interface
- **Heated Sensor Option:** A heated sensor holder allows operation in high humidity to avoid condensation problems
- **Remote Sensor:** A junction box with digital output allows sensor location up to 500 ft. from the F12iS display unit
- **Internal Data Logger:** Gas values are stored at user defined intervals from 1 to 60 minutes. Stored data may be reviewed or graphed on the LCD display
- **Calibration History:** Sensor calibration adjustments of zero and span are stored in sensor memory and may be viewed on the F12iS display
- **Communication:** F12iS is available with optional Hart® output
- **Approvals:** CE and RoHS Compliant

INSTALLATION OPTIONS

The sensor holder in the F12iS is normally mounted to the transmitter enclosure. For applications where this configuration is not ideal, there are a number of different configurations for meeting specific requirements. These include a 6 ft. (1.9 m) cable extension, a remote junction box for longer sensor separation distances, and a duct mount sensor.

F12iS with integral sensor holder

F12iS with integral sensor holder & Auto-Test generator

6 ft. extended sensor holder

Insertion sensor assembly

Remote sensor holder & digital interface

FLOWCELL AND CALIBRATION ADAPTERS

Calibration adapters slide into the sensor holder for easy connection of calibration gas. A flowcell assembly is also available where pumped sampling systems are used.

An accessory device called a "sensor keeper" is available for storing standby spares. The keeper provides sensor bias circuitry that maintains spare sensors in a ready-to-use state without the need for stabilization time.

SMART SENSORS

The F12iS uses ATI **smart sensors** that allow easy interchangeability. Each sensor contains signal conditioning electronics and data memory. Sensors can be calibrated using a spare unit in the shop to avoid using calibration gases in the plant. Sensors may also be returned to ATI for factory calibration, which is useful for gases that are costly or difficult to obtain. Each sensor adjustment (zero or span) is stored in sensor memory and can be reviewed on the F12iS display. This data is very useful in assessing the sensor's condition and estimating remaining sensor life.

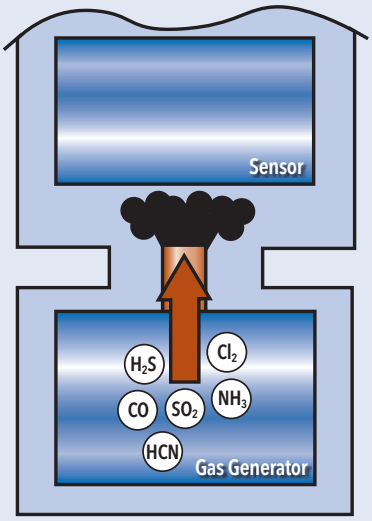
AVAILABLE SENSORS

00-1000*	Br_2, 0-1/5 ppm (00-1538)
00-1001*	Br_2, 0-5/200 ppm (00-1538, 20 max.)
00-1002*	Cl_2, 0-1/5 ppm (00-1538)
00-1003*	Cl_2, 0-5/200 ppm (00-1538, 20 max.)
00-1004*	ClO_2, 0-1/5 ppm (00-1538)
00-1005*	ClO_2, 0-5/200 ppm (00-1538, 20 max.)
00-1359	ClO_2, 200/1000 ppm
00-1425*	ClO_2, 0-1/5 ppm (low Cl_2) (00-1538)
00-1006*	F_2, 0-1/5 ppm (00-1538)
00-1007*	F_2, 0-5/200 (00-1538, 20 max.)
00-1008*	O_3, 0-1/5 ppm (00-1538)
00-1009*	O_3, 0-5/200 ppm (00-1538, 20 max.)
00-1358	O_3, 200/1000 ppm
00-1163	O_3, 500/2000 ppb (00-1538)
00-1010*	NH_3, 0-50/500 ppm (00-1539, 100 max.)
00-1011	NH_3, 0-500/2000 ppm
00-1012*	CO, 0-50/1000 ppm (00-1540, 100 max.)
00-1013	H_2, 0-1/10%
00-1041	H_2, 0-500/2000 ppm
00-1014	O_2, 0-5/25%
00-1015	$COCl_2$, 0-1/5 ppm
00-1016	$COCl_2$, 0-5/100 ppm
00-1017*	HCl, 0-10/200 ppm (00-1541, 20 max.)
00-1018*	HCN, 0-10/200 ppm (00-1611, 20 max.)
00-1019*	HF, 0-10/200 ppm (00-1538, 20 max.)
00-1020*	H_2S, 0-10/200 ppm (00-1541, 100 max.)
00-1469	H_2S, 200/1000 ppm
00-1021	NO, 0-50/500 ppm
00-1022*	NO_2, 0-10/200 ppm (00-1538, 20 max.)
00-1023*	SO_2, 0-10/500 ppm (00-1542, 20 max.)
00-1024	AsH_3, 0-500/2000 ppb
00-1025	AsH_3, 0-10/200 ppm
00-1026	B_2H_6, 0-500/2000 ppb
00-1027	B_2H_6, 0-10/200 ppm
00-1028	GeH_4, 0-500/2000 ppb
00-1029	GeH_4, 0-10/200 ppm
00-1030	H_2Se, 0-500/2000 ppb
00-1031	H_2Se, 0-10/200 ppm
00-1032	PH_3, 0-500/2000 ppb
00-1033	PH_3, 0-10/200 ppm
00-1034	PH_3, 0-200/2000 ppm
00-1035	SiH_4, 0-10/200 ppm
00-1036*	I_2, 0-1/5 ppm (00-1538)
00-1037*	I_2, 0-5/200 ppm (00-1538, 20 max.)
00-1038*	Acid Gas, 0-10/200 ppm (00-1538,20 max)
00-1039*	ETO, 0-20/200 ppm (00-1540, 20 max.)
00-1040	HCOH, 0-20/200 ppm (00-1540, 20 max.)
00-1349	HCOH, 500/2000 ppm
00-1042	H_2O_2, 0-10/100 ppm (00-1542)
00-1169	H_2O_2, 200/2000 ppm
00-1043	Alcohol, 0-50/500 ppm
00-1044	Alcohol, 0-500/2000 ppm
00-1057	C_2H_2, 0-200/2000 ppm
00-1181	NO_x, 0-50/500 ppm
00-1450*	DMA, 100/200 ppm (00-1539, 100 max.)
00-1455*	HBr, 10/200 ppm (00-1538, 20 max.)
00-1516	HC Sensor – Consult Factory)
00-1045	CH_3COOH, 100/500 ppm
00-1704	PAA Vapor, 1/5 ppm
00-1705	PAA Vapor, 10/100 ppm

Notes: X/XX for each sensor indicates minimum and maximum ranges for that sensor.
* indicates availability of Auto-Test. Generator part number shown in ( ).
Auto-Test not available for ranges above indicated maximum.

AUTOMATIC SENSOR VERIFICATION

With the F12iS, users can take advantage of ATI's unique Auto-Test sensor verification system. While other gas transmitters rely on less reliable electronic sensor tests, the Auto-Test system consists of an actual gas test. A test gas is generated right at the sensor and the response of the sensor is verified. Manual bump testing to verify response is eliminated, greatly reducing maintenance requirements.



AUTO-TEST GENERATORS

00-1538	E18-11 Chlorine gas generator
00-1539	E18-15 Ammonia gas generator
00-1540	E18-16 Carbon Monoxide gas generator
00-1541	E18-24 Hydrogen Sulfide gas generator
00-1542	E18-27 Sulfur Dioxide gas generator
00-1611	E18-22 HCN gas generator

ORDERING INFORMATION
MODEL F12IS - A-B-C-D

F12iS transmitters are designed to use electrochemical sensors only. Specify transmitter and then select sensors from page 3. Add the Auto-Test generator if that feature is desired.

SUFFIX A – POWER

1 - 24 VDC, loop-powered

SUFFIX B – SENSOR HOLDER STYLE

1 - Integral sensor holder

2 - Remote sensor holder with junction box (order 31-0185 interconnect cable below)

3 - Integral heated sensor holder

4 - Remote heated sensor holder with junction box (order 31-0068 interconnect cable below)

5 - Duct mount sensor holder with 25 ft. extension cable (requires 00-1388 Adapter)

6 - Sensor holder with 6 ft. cable

7 - Remote junction box plus 6 ft. cable with holder

8 - Remote junction box with close-coupled duct mount sensor (requires 00-1388 Adapter)

SUFFIX C – SENSOR AUTO-TEST

1 - No Auto-Test Generator Holder

2 - With Auto-Test Generator Holder

SUFFIX D – DIGITAL OUTPUT

1 - None

2 - HART® interface

ACCESSORIES

00-1056 Calibration adapter
00-1251 Flowcell assembly
03-0118 Flowcell with 03-0460 sensor cap
00-0981 Sensing module keeper for 4 sensors
00-1388 Duct sensor adapter, 1½" MNPT
31-0185 4-Conductor Interconnect Cable, specify length, max. 500 ft.
31-0068 6-Conductor Interconnect Cable, specify length, max. 500 ft.

Note: When ordering an F12iS unit with a flowcell, the 03-0460 sensor cap will be supplied in place of the standard sensor cap and does not need to be ordered separately. If a flowcell is being added to an existing F12iS, order the 03-0118 assembly which includes both the flowcell and sensor cap.

SPECIFICATIONS

Sensor Type	Electrochemical cell
Gas Type	Select sensor from listing on page 3
Range	User adjustable within limits of selected sensor
Response Time	Sensor dependent
Accuracy	Generally ±5-10% of value, limited by available calibration gas accuracy.
Repeatability	±1% (Electronic)
Linearity	±0.5% (Electronic)
Zero Drift	Less than 2% full scale per month, non-cumulative
Span Drift	Dependent on sensor environment but generally less than 3% per month
Analog Output	4-20 mA, 600 ohms max. at 24 VDC
Serial Interface	(Optional) HART® digital signaling over the 4-20mA current loop
Power Requirements	12-28 VDC, 25 mA Maximum 75 mA Maximum with heated sensor
Enclosure	IP 65, polycarbonate with stainless steel hardware. Weatherproof and corrosion resistant. Refer to F12iS Support Drawings for Dimensions
CE Mark	2014/35/EU – Low voltage directive 2014/30/EU – Electromagnetic compatibility
Certifications:	UL/CSA: I.S. for Class I, II, and III, Division 1 Locations ATEX: EX II 1 G Ex ia IIC T4 Ga, -30°C ≤ Ta ≤ 60°C; IP65 IEC: Ex ia IIC T4 Ga, -30°C ≤ Ta ≤ 60°C
Mounting	(Standard) Wall or pipe mount bracket. U-Bolts suitable for 1.5" or 2" I.D. (Optional) Panel mount kit available.
Auto-Test Option	Dependent on sensor gas type and full scale range
Display	96x32 Dot-matrix Graphic LCD, Backlit, Transflective
Controls	Four, dome-type push buttons; Remote alarm reset input (w/optional alarm relays only)
Temperature	-30°C to +60°C (Min. temp. for O_2 Sensor is –20°C)
Environment	10 to 95% RH (non-condensing)
Weight	1.5 lb (0.68 kg)

Visit Us on the Web: www.analyticaltechnology.com

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Fax 610.917.0992
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Analytical Technology
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Delph New Road, Delph
Saddleworth OL3 5DE
Phone 01457 873 318
Fax 01457 874 468
Email sales@atiuk.com

Represented by:

Centrifugal Upblast & Sidewall Exhaust

Models CUE, CUBE and USGF

- General Clean Air
- Restaurant Grease
- High Wind
- Seismic
- Smoke Control
- Contaminants

VARI-GREEN. *performance data included*

GREENHECK
Building Value in Air.

BUILDING VALUE IN AIR.

August 2023

GREENHECK
Building Value in Air.

Table of Contents

c UL US LISTED

- UL/cUL705 Listed Power Ventilators
  File E40001 (CUE and CUBE)
- UL/cUL 705 Supplement SC Power Ventilators for Restaurant Exhaust Appliances
  File MH11745 (CUE, CUBE and USGF sizes 099 and larger)
- UL/cUL Power Ventilators for Smoke Control Systems
  File MH17511 (CUBE and USGF models 500°F (260°C) for 4 hours and 1,000°F (538°C) for 15 minutes)

Note: UL/cUL is optional and must be specified

Model sizes CUBE-099, 160XP, 240XP, 300HP & 300XP are excluded from Power Ventilators for Smoke Control Systems

CE

Modes CUE, CUBE, and USGF meet CE (Conformité Européenne).

Greenheck Fan Corporation certifies that the Model CUE, CUBE, and USGF shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. The certified ratings for Model CUBE, CUE and USGF, are shown on pages 19-50.

Enjoy Greenheck's extraordinary service, before, during and after the sale.

Greenheck offers added value to our wide selection of top performing, energy-efficient products by providing several unique Greenheck service programs.

- Our Quick Delivery program ensures shipment of our in-stock products within 24 hours of placing your order. Our Quick Build made-to-order products can be produced in 1-3-5-10-15-20 or 25-day production cycles, depending upon their complexity.
- eCAPS® online selection guides you to choose the best value products for your building projects. eCAPS® includes fan, louver, make-up air, energy recovery preconditioner, and dedicated outdoor air system (DOAS) selections, as well as a damper guide and toolbox.
- Greenheck's free Computer Aided Product Selection (CAPS®) program, rated by many as the best in the industry, helps you conveniently and efficiently select the right products for the challenge at hand.
- Our 3D service allows you to download, at no charge, easy-to-use AutoDesk® Revit® 3D drawings for many of our ventilation products.

Find out more about these special Greenheck services at greenheck.com

Model Comparison

Model	Location		Mounting					Airflow				Application								Drive Type		Impeller Type			Performance	
	Outdoor	Indoor	Roof Curb	Base/Floor	Hanging	Wall	Ceiling Mounted	Exhaust	Supply	Reversible	Recirculate	General/Clean Air	Contaminated Air	Spark Resistant	Grease (UL 705 Supplement SC)	Smoke Control (UL 705 Supplement SD)	High Wind (150 mph)	High Temp (above 200°F)	Seismic Certification	Belt	Direct	Centrifugal	Propeller/Axial	Mixed Flow	Maximum Volume (cfm)	Maximum Static Pressure (in. wg)
CUE	✓		✓			✓		✓				✓	✓	✓	✓		✓	✓	✓		✓	✓			14,700	3
CUBE	✓		✓			✓		✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			30,000	5
USGF	✓		✓					✓				✓	✓		✓	✓	✓	✓		✓		✓			6,800	3.25

When you buy a Greenheck roof upblast or sidewall exhaust fan, you'll receive a fan with the industry's best performance and durability for general clean air, restaurant grease, smoke control, light contaminants, seismic, high wind, and hurricane applications. Both roof upblast and sidewall configurations are specifically designed to discharge air directly away from the mounting surface.

- Performance as cataloged is assured. All fan sizes are tested in our AMCA accredited laboratory and all models are licensed to bear the AMCA Sound, Air and FEI Performance seal.
- UL/cUL Listed for Power Ventilators, Restaurant Exhaust Appliances and Smoke Control Systems.
- Greenheck subjects these products to extensive life testing, ensuring the fans will provide many years of reliable performance.

LEED information

Greenheck became one of the first manufacturers in the air movement and control industry to join the LEED/green movement when they joined the United States Green Building Council (USGBC) in 2005. Greenheck has been actively researching qualification requirements for our products to meet LEED credits and prerequisites.

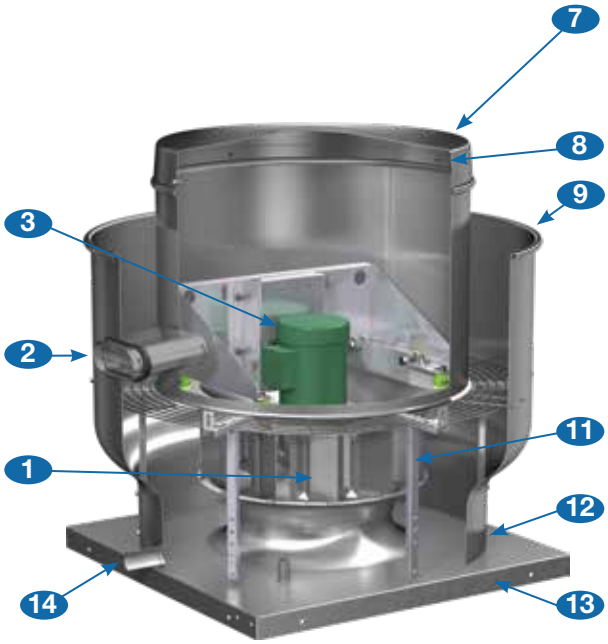
The Vari-Green® motor significantly helps qualification efforts for the Energy and Atmosphere credits and prerequisites, specifically credit one, Optimize Energy Performance and prerequisite two, Minimum Energy Performance.

Standard Construction Features

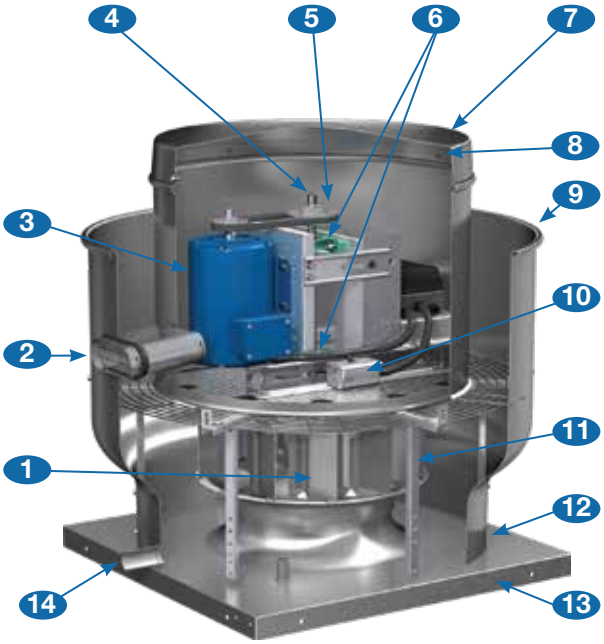
GREENHECK
Building Value in Air.

	Standard Construction Features	CUE CUBE	USGF
1	**Wheel** — A backward-inclined, non-overloading centrifugal wheel is utilized to generate high efficiency and minimal sound. Wheel cones are carefully matched to the venturi for maximum efficiency. Each wheel is statically and dynamically balanced for long life and quiet operation.	✓	✓ *Non-Stick, Steel
2	**Motor Cooling Tube** — Cooling fins located on top of the fan wheel draw outside air through a large breather tube directly into the motor compartment. Positive motor cooling with fresh air results in maximum motor life.	✓	✓
3	**Motor** — Carefully matched to the fan load and mounted out of the airstream.	✓	✓
4	**Fan Shaft** — Precisely sized, ground and polished so the first critical speed is at least 25% over the maximum operating speed. Where the shaft makes contact with bearings, close tolerances result in longer bearing life.	✓	✓
5	**Drive Assembly** — Belts, pulleys and keys are oversized 150% of driven horsepower. Machined-cast pulleys are adjustable for final system balancing. Belts are static-free and oil-resistant.	✓	✓
6	**Bearings** — 100% factory tested and designed specifically for air handling applications with a minimum L_{10} life in excess of 100,000 hours (L_{50} life in excess of 500,000 hours).	✓	✓
7	**Motor Cover** — Constructed of aluminum. Attached with stainless steel fasteners for easy removal and access to the motor compartment and drive assembly.	✓	✓ *Steel
8	**Stainless Steel Fasteners** — Allow easy removal and access to the motor compartment and drive assembly.	✓	✓
9	**Windband** — One-piece, heavy-gauge aluminum with a rolled bead for extra strength directs exhaust air away from the mounting surface.	✓	✓ *Steel
10	**Disconnect Switch** — NEMA-1 switch is factory-mounted and wiring is provided from the motor as standard (other switches are available). All wiring and electrical components comply with the National Electric Code (NEC) and are either UL/cUL Listed or Recognized.	✓	
	NEMA-3R switch is factory-mounted and wired as standard. All wiring and electrical components comply with the National Electric Code (NEC) and are either UL/cUL Listed or Recognized.		✓
11	**Internal Supports** — Heavy-gauge supports provide additional strength to withstand wind loads of 150 PSF and support motor and drives.	✓	✓
12	**Leakproof Construction** — One-piece windband is continuously welded to the curb cap for leakproof protection on models CUE, CUBE, and USGF through size 240 and all sizes with UL/cUL 705 Supplement SC (restaurant exhaust).	✓	✓
13	**Curb Cap with Mounting Holes** — One-piece for a weathertight fit. Constructed of aluminum with an integral deep spun venturi. Aluminum curb cap has prepunched mounting holes to ensure correct attachment to the roof.	✓	✓ *Steel
14	**Drain/Grease Trough** — Allows for one-point drainage of water, grease and other residues.	✓	✓
Not Shown	**Nameplate** — Permanent embossed aluminum nameplate for exact model and serial number identification.	✓	✓
Not Shown	**Internal Conduit Chase** — For easy internal electrical wiring in applications. Not available on UL 705 Supplement SC (restaurant exhaust) rated fans per NFPA 96.	✓	
15	**Dual Drives** — Oversized 150%, adjustable, static-free and oil-resistant.		✓
16	**Permatector™ Coating** — Typically used for applications that require corrosion resistance in indoor and outdoor environments.		✓
17	**Clean-Out Port** — Allows for easy cleaning of the entire centrifugal wheel through a 4-inch diameter hole on the outside of the fan windband. Meets NFPA 96 standard.		✓
18	**Hinged Curb Base with Cables** — Allows maintenance personnel to gain access to wheel and ductwork for regular inspection and cleaning by utilizing the factory assembled hinge.		✓
19	**Vibration Isolation** — True vibration isolators consist of two independent studs separated by a neoprene (rubber) center. Reduces vibration and noise transfer between the drive system and fan housing. (No metal-to-metal contact. Factory-mounted ground wire used to ground system).	✓	✓
20	**Lifting Points** — Various lifting points located on the drive frame and bearing plate.	✓	✓

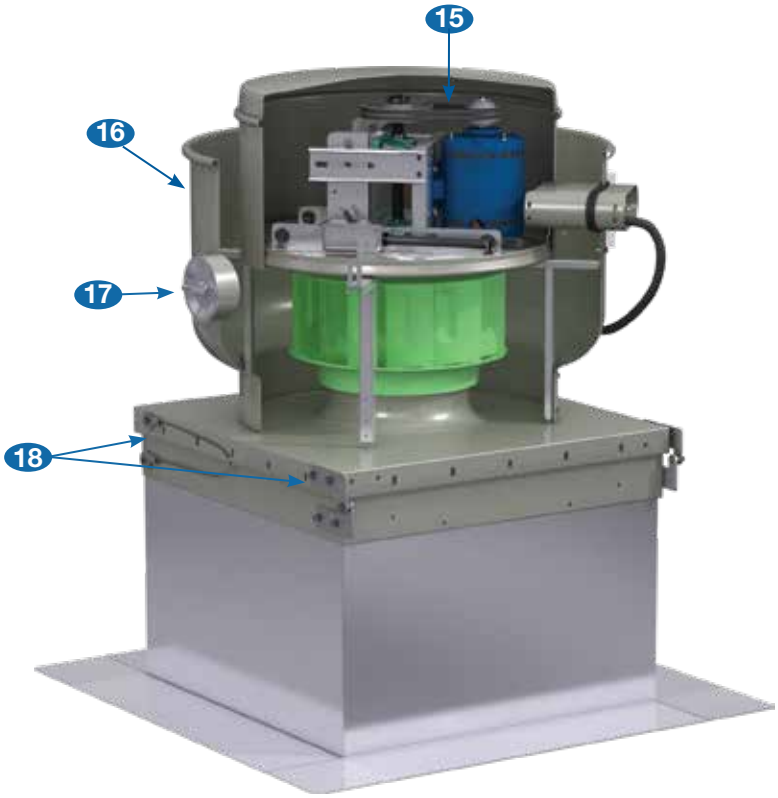
*Differences from the standard construction feature.



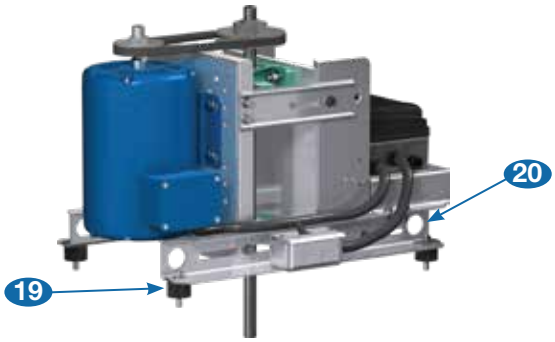
Model CUE



Model CUBE



Model USGF



Clean Air Applications

Models CUE and CUBE

These spun aluminum fans are designed specifically for roof or wall-mounted applications. General clean or lightly contaminated exhaust air can be discharged directly upward, away from the roof surface, or discharged out and away from building walls.

- Most advanced motor cooling of any fan in its class.
- One-piece windband, continuously welded to the curb cap, ensures leak-proof construction for the life of the fan.
- Performance as cataloged is ensured. All fan sizes are tested in our AMCA accredited laboratory and all models are licensed to bear the AMCA Sound, Air and FEI Performance seal.
- Greenheck subjects these products to extensive life testing, ensuring the fans will provide many years of reliable performance.

Restaurant and Grease Applications

Models CUE and CUBE

When you choose a Greenheck fan, you have selected a fan with the industry's best performance and durability for restaurant and grease applications. Spun aluminum exhaust fans, models CUE and CUBE sizes 099 and larger, are specifically designed for use in restaurant applications to discharge air directly away from the mounting surface.

- Most advanced motor cooling of any fan in its class.
- One-piece windband, continuously welded to the curb cap, ensures leakproof construction for the life of the fan.
- UL/cUL 705 Supplement SC Listed for exhausting restaurant grease exhaust.

Ultimate Steel Grease Fan for Heavy Grease Applications

Model USGF

Fan model USGF is the industry's best for performance and durability for heavy grease applications. This spun steel exhaust fan is specifically designed to remove large amounts of grease and/or contaminants associated with solid fuel cooking and discharge the air directly away from the mounting surface.

- Only spun steel fan in the industry.
- Withstands the most severe cleaning conditions.
- Most advanced motor cooling of any grease fan. Capable of continuously handling 400°F (204°C) airstream temperatures.
- UL/cUL 705 Supplement SC Listed for restaurant grease exhaust.

Emergency Smoke Control

Models CUBE and USGF

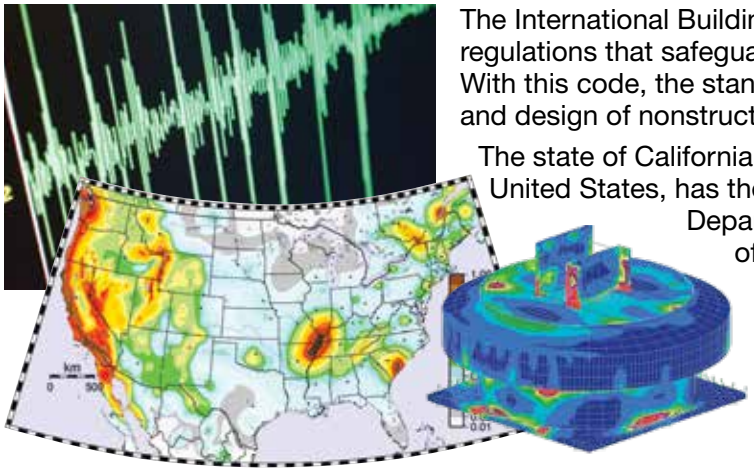
When you buy a Greenheck model CUBE or USGF with the smoke control option, you receive a fan with the industry's best performance and durability for smoke control applications (as found in emergency smoke control systems).

Note: Model sizes CUBE-099, 160XP, 240XP, 300HP & 300XP are excluded for Emergency Smoke Control.
Refer to page 18 for size chart.

- UL/cUL Listed for 500°F (260°C) for 4 hours and 1,000°F (538°C) for 15 minutes.
- Half the weight of traditional smoke control fans, an ideal choice for roof load concerns.
- Low profile, height is less than half of traditional smoke control fans, maximum of 48⅛ inches (1,334 mm) from curb cap to top of the fan.
- Multiple applications, capable of exhausting general clean air and satisfying emergency smoke control regulations.

Seismic

Models CUE and CUBE



With changes in building codes and standards, more equipment is being required to be seismically certified in areas of the country not commonly thought of as being in seismically active zones.

The International Building Code (IBC) is designed to provide model code regulations that safeguard public health and safety in all U.S. communities. With this code, the standards are intended to improve the performance and design of nonstructural systems subject to seismic events.

The state of California, one of the most active seismic areas in the United States, has the Health Care Access and Information (HCAI) Department. HCAI regulates the design and construction of health care facilities to ensure they are safe and capable of providing services to the public after a seismic event. HCAI developed their own unique certification process to incorporate the IBC and ASCE testing standards to ensure equipment remains operable after a seismic event.

Protocols designed for seismic standards:

Seismic Testing Criteria	All Greenheck seismically certified models have been tested using the most severe seismic event that is found on the Spectral Response Map per IBC Figures 1613.5 (1-2). Our testing is performed under the worst-case scenario using the highest mapped seismic load, highest level occupancy category, worst-case site class, and highest code mandated importance factor. This testing allows Greenheck seismically certified fans to be used anywhere in the United States under any conditions.
California HCAI Test Protocols	The California Department of Health Care Access and Information (HCAI) requires all certified models to be shake table tested in accordance with ICC ES AC-156, in which the fans are physically subjected to the same or greater forces than they will see during a seismic event. Subjecting models CUE and CUBE fans to this type of testing ensures the fans will operate without problems after a seismic event.
HCAI Certification	The HCAI certification numbers and supporting documents can be viewed on HCAI's website. This ensures that the fan has been subjected to and passed rigorous testing standards.

High Wind and Hurricane

Models CUE and CUBE

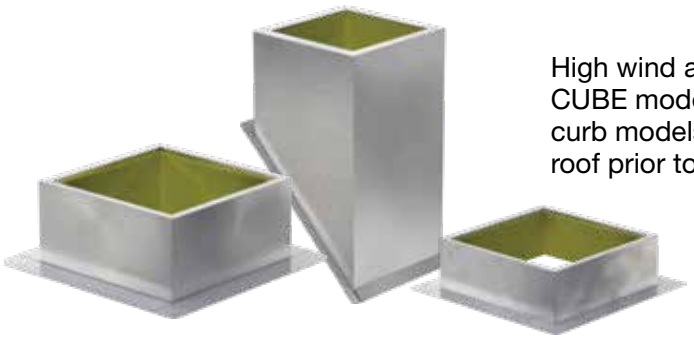
Greenheck is leading the High Wind Standard for rooftop fans and ventilators. Forceful winds are the cause of most hurricane damage. While forceful winds are not the only problem, wind-borne debris can also cause detrimental effects to objects and structures. High winds produce extreme forces on buildings and structures. By analyzing calculations, computer simulations, actual testing, and other standards—Greenheck developed the High Wind Standard.

Atlantic, Gulf and Pacific history of major hurricane tracks.

Protocols designed to protect against wind-borne debris and severe wind loads:

Structural Performance Load	A static load that is 1.5 times the design load (195 pounds per square foot pressure) is applied both positive and negative to simulate wind force loads in each direction. Structural Performance per Dade County Protocol TAS-202 (ASTM E-330).
Large Missile Impact Test	Large Missile Impact Testing is required when objects are 30 feet or less from the ground. The test is per Dade County Protocol TAS-201. The test unit is impacted three times with a piece of lumber (2 in. x 4 in. x 6 ft.) weighing approximately nine pounds and traveling at 34 mph. This simulates wind-borne debris striking the fan.
Miami-Dade NOA Numbers	View the certifications on the Miami-Dade County website. Models CUE and CUBE are the first upblast aluminum/steel fans in the industry that have received a Miami-Dade NOA for high wind (150 mph) and hurricane zones.
Certified Independent Third-Party Testing	Each Greenheck model has been subjected to extensive testing procedures. The CUE and CUBE have been certified by an independent third-party to the ASTM E-330 Static Pressure Difference Standard, Florida Building Code Test Protocols TAS-202 Static Pressure Difference and TAS-201 Large Missile Impact. All tests are videotaped for documentation of test method and results.

Large missile impact test



High wind and severe duty roof curbs are available on CUE and CUBE models with high wind certification. The severe duty roof curb models can ship separately to allow for final finishing of the roof prior to the fan arrival and installation.

Description	1 inch (25 mm) Insulation	Flashing Flange	Available Heights Inches (mm)
GPF for flat roofs Curbs are used for high wind/seismic applications. Fully formed on three sides with a single, fully welded seam when dimension (L+Wx2) <118 inches (2,997 mm). Larger sizes are a fully welded assembly.	✓	2 or 5 inches *(50.8 or 127 mm)*	8 to 42 *(203 to 1067)*
GPFHL for heavy load applications Curb construction is intended to support compression loads exceeding 1,000 pounds (454 kg). GPFHL is mounted directly to the roof deck structure. The roofing material is brought to the vertical surface and sealed to the flashing flange. Additional standard construction features include 14-gauge galvanized steel and internal vertical support members.	✓	5 inches *(127 mm)*	12 to 24 *(305 to 610)*
GPFHD for supporting heavy load equipment For severe duty, high wind and seismic applications. The double-thick flashing flange provides an extremely durable surface to secure the curb to the building structure. The roofing material is brought to the vertical surface and sealed to the flashing flange. Additional standard construction features include 12-gauge galvanized steel and internal vertical support members.	✓	Double Thick 5 inches *(127 mm)*	12 to 24 *(305 to 610)*

Model CUE

VARI-GREEN Motor

Greenheck's electronically commutated (EC) Vari-Green (VG) motor is the industry's first fully controllable motor. It combines motor technology, controllability and energy efficiency into a single low-maintenance unit. When combined with Greenheck fans, all the CFM and static pressure ranges of a belt drive can be attained with the benefits of a direct drive.

Motor Information

HP	Voltages	Phase	Enclosure
1/15	115, 208-230	1	TENV
1/10	115, 208-230, 277	1	TENV
1/10	115, 208-230, 277	1	ODP
1/6	115, 208-230, 277	1	ODP
1/4	115, 208-230, 277	1	ODP
1/2	115, 208-230, 277	1	ODP
1/2	115, 208-230, 277	1	TENV
3/4	115, 208-230, 277	1	ODP
1	115, 208-230, 277	1	ODP
1	115, 208-230, 277	1	TENV
1	115, 208-230	1	TEFC
1	208-240, 380-480	3	TEFC
2	208-230	1	TEFC
2	208-240, 380-480	3	TEFC
3	208-230	1	TEFC
3	208-240. 380-480	3	TEFC
5	208-240. 380-480	3	TEFC
7 1/2	380-480	3	TEFC
10	380-480	3	TEFC

Benefits

- The motor can attain up to IE5 efficiency ratings and reduce energy consumption.
- Watt savings of 30-70% depending on RPM. Note: As motor speed is turned down, efficiency stays high as compared to an AC motor, which decreases dramatically.
- Operates cooler than a standard AC motor at lower RPMs. A cooler motor has longer motor life and reduces energy consumption.
- 75% usable RPM turndown versus 30%, see Motor Turndown Comparison chart at right.
- CUE fans with Vari-Green motors can provide all the CFM and static pressure ranges of a comparable belt drive.
- Maintenance costs are reduced as there are no belts or bearings to replace and no pulleys to adjust.
- Direct drive fans are often preferred where maintenance access is difficult.
- Provides a solution for demand-controlled ventilation applications.

Features

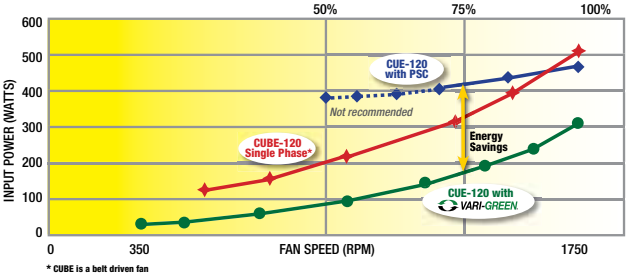
Dial on Motor Control - a potentiometer (dial on motor control) is mounted on the motor for easy speed adjustment for system balance. Simply turn the dial. There are no belts and pulleys to adjust.

Control Wire Inputs - the motor accepts a 0-10V DC signal from Building Automated Systems or other controls to adjust motor speed.

Vari-Green Advantages

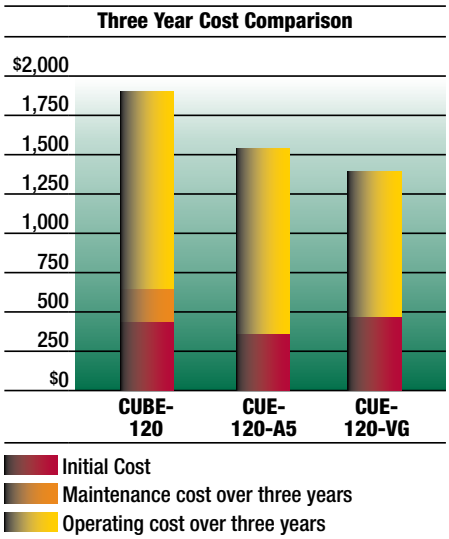
- Initial cost is similar to a belt drive
- Lower operating cost
- No maintenance: no belts, pulleys or bearings
- Easy RPM adjustment

Comparisons: Belt, Direct Drive with PSC and Direct Drive with Vari-Green



The length of each curve indicates the practical turndown range. Data is for 1/2 hp motors with load of 0.35 Bhp at full speed

Constant Volume Life Cycle Analysis



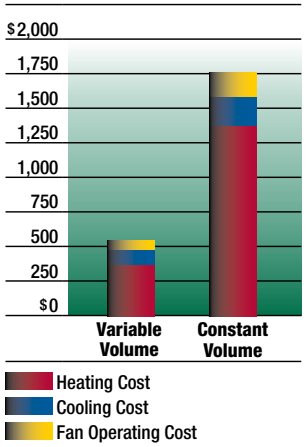
Analysis is based on operating costs for a period of three years where the fans operate continuously at 1725 rpm, 24/7, with an energy rate of $0.10/kWh. Maintenance on the CUBE-120 is estimated at $65/yr.

Note: Example is based on a relative cost. Use and installation variables may produce different results.

Demand Control Ventilation for Multistory Buildings

Applications requiring constant pressure or variable volume can utilize CUE fans with Vari-Green motors and Vari-Green controls. Demand control ventilation systems reduce the amount of energy used by decreasing the speed of the fan when demand is low. This lessens the amount of conditioned air exhausted, and in turn, reduces the total operating costs associated with air conditioning and heating in multistoried buildings including hotels, multifamily complexes, institutional facilities, and high-rise commercial buildings.

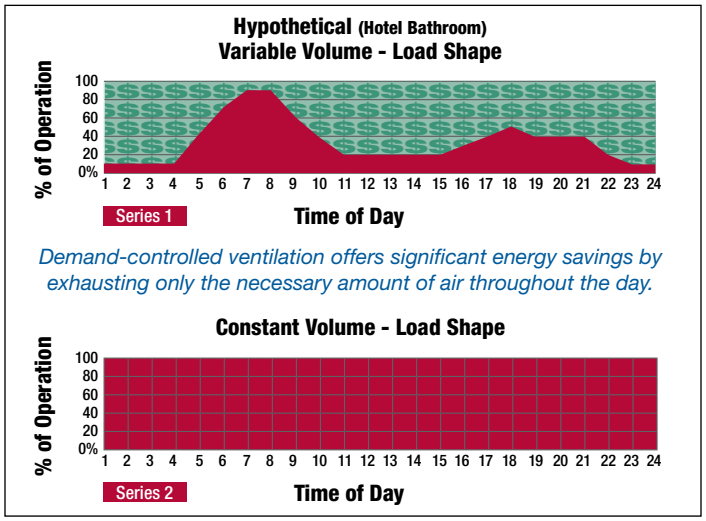
Variable Volume Operating Cost Analysis



Example of potential savings based on a northeast city in the USA using Vari-Green components for Variable Volume.

The Vari-Green constant pressure control is preprogrammed and easy to install for applications that include venting dryers, bathrooms, residential-type kitchen space, or industrial process exhaust.

Daily Operating Comparison: Variable Volume and Constant Volume



Demand-controlled ventilation offers significant energy savings by exhausting only the necessary amount of air throughout the day.

Note: A standard VFD compatible motor can also function within a Variable Volume system.

Vari-Green® Controls

Transformer - Provides 24V power from the existing line voltage at the fan to the Vari-Green motor and controls. Dual voltage primary (120/240V) transformer provided with the fan.

Hand/Off/Auto- Creates either a control or an accessory to other controls. Four modes are selectable. Hand mode: control of the motor at this device. Off mode: stops the motor. Auto-Local mode: select a speed at this control and toggle the fan on or off via voltage or dry inputs. Auto-Remote mode: accepts a speed reference signal from other devices and passes that to the motor when a voltage or dry input signal is received. Provides 24V power for other controls and an auxiliary contact for damper control.

Remote Dial - Allows for remote, manual airflow adjustments. Wall plate with dial may be mounted in a standard 2x4 inch electrical junction box.

Two-Speed Control - Control allows motor RPM to be set at two independent speeds (high or low). Meets minimum airflow requirements with the ability to bump up to high speed in an emergency or meet maximum airflow requirements, or reset down to low speed for energy conservation.

Constant Pressure Control - Control the Vari-Green® motor via static (variable volume) or velocity (constant CFM) pressure on the inlet or outlet side of the fan. Available with duct or room probes for use in:

- Multifamily structures including apartments, condos, hotels; residential kitchens and bathrooms
- Institutional facilities such as schools, prisons, multistory office buildings; bathrooms

Air Quality, Volatile Organic Compounds (VOC) - Control a Vari-Green motor via changes in VOCs. VOCs are gasses that are emitted from humans, building materials, perfumes, foods, and furniture off-gassing. Range is 0-2000 CO_2 PPM equivalent.

- Institutional facilities including schools, courthouses, hospital bathrooms, waiting rooms, cafeterias
- Commercial buildings including office space in conference rooms, bathrooms or breakrooms

Air Quality for Temperature and Humidity - Control the Vari-Green motor via changes in temperature, humidity, or both. Range is 32° to 120°F and 0% to 100% relative humidity.

- Multifamily structures including apartments, condos, hotels, with placement in bathrooms and utility rooms
- Commercial buildings such as office buildings for placement in general office space, conference rooms, utility rooms, and bathrooms

Greenheck's Vari-Green Drive is a factory-mounted, wired, and programmed variable frequency drive. Specifically designed for use in air handling applications, the Vari-Green Drive expands variable volume operation and simplifies speed adjustment to three phase applications.

Features

Vari-Green Drive model VGD-100+ is constructed with a NEMA-4X rated enclosure to ensure a long life operating under outdoor environmental conditions. Every Vari-Green Drive is compatible with all Vari-Green controls or any industry control sending a 0-10V signal. Model VGD-100+ is also equipped with Modbus/BACnet® communications allowing for seamless integration to building management systems.

	VGD-100+
Analog Input (0-10V, 4-20mA)	✓
Damper Actuator Output (24VDC)	✓
Control Voltage Output (24VDC)	✓
LED Indication Lights (3)	✓
Relay Output (2)	✓
Digital Input - Dry (2)	✓
Digital Input - Voltage (2)	✓
RS-485 (Modbus/BACnet®)	✓
Bluetooth/Smart Device Interface	✓
On-Board PID Control	✓
Optional Pressure Transducer	✓

Benefits

- Variable volume control from the factory on larger fan sizes where Vari-Green motors are not available.
- R^3 filtering and short leads mitigate harmonics.
- Quick start-up and simplistic commissioning as each drive comes preprogrammed and installed from the factory.
- Eliminate compatibility issues as the motor and drive are factory-matched.
- Induction motors are reliable, efficient and readily available if replacements are needed.

Vari-Green Drive 100+ App

VGD+ Available on the App Store GET IT ON Google Play

Vari-Green Drive model VGD-100+ features a smartphone companion app available for download from the app store. Manually control and monitor the drive from the app as well as access any advanced programming features. For more information about the companion app and its capabilities, reference the VGD-100+ Quick Start Guide located on greenheck.com and the documentation section of the app.

The following chart shows options and accessories available on Greenheck's roof upblast and sidewall exhaust fans.

Options and Accessories	CUE	CUBE	USGF
Sidewall Mount	✓	✓	
Roof Curbs	✓	✓	✓
Wall Bracket	✓	✓	
Curb Extensions	✓	✓	✓
Vented Curb Extensions	✓	✓	✓
Adapter/Reducer	✓	✓	
Curb Seal	✓	✓	std.
Windband Extension	✓	✓	✓
Hinged Curb Cap	✓	✓	✓
Hinged Base (Size 300-480)	✓	✓	std.
Tie-Down Points	✓	✓	✓
Grease Trap	✓	✓	✓
Grease Trap with Absorbent Material	✓	✓	✓
Grease Pan Kit	✓	✓	
Clean-Out Port	✓	✓	std.
Heat Baffle		✓	✓
Hood Hasps	✓	✓	✓
Birdscreen	✓	✓	
Wall Grille	✓	✓	
Non-Stick Aluminum Wheel	✓	✓	std.
Disconnect Switches	✓	✓	✓
Dampers	✓	✓	
Speed Controllers	✓		
Motor Starters	✓	✓	✓
UL 705	✓	✓	
UL 705 Supplement SC (Restaurant)	✓	✓	std.
UL 705 Supplement SD (Smoke)		✓	✓
Coatings	✓	✓	✓

Sidewall Mount — Allows for a horizontal discharge with a square mounting base, models CUE and CUBE.

Roof Curbs — Wide variety of roof curbs are available for mounting the fan to the roof including: vented, flanged, pitched and sound-absorbing. For more information on severe duty curbs refer to the information on page 9.

Wall Bracket — Available for our sidewall mounted CUE and CUBE fans for non-grease applications. This is a different option for wall mounting versus using a curb. Note: Your wall opening will be slightly different when using the wall bracket.

Curb Extensions — Mounts between roof curb and fan for additional height from roof top.

Vented Curb Extensions — Mounts between roof curb and roof-mounted fan to meet NFPA requirements of 40-inch (1016 mm) minimum discharge above the roof when mounted on a minimum 8-inch (203 mm) high roof curb.

Adapter/Reducer — This is used when you need to fit a fan to an existing curb. Use the adapter when the fan square size is smaller than the existing curb. The reducer is used when the fan square size is larger than the existing curb.

Curb Seal — Foam or high-temperature seal between fan and curb to assure proper sealing when attached to a curb.

Windband Extension — Aluminum tube raising the fan discharge height.

Hinged Curb Cap — The hinged curb cap allows the entire fan to swing open to allow maintenance personnel access to the wheel and ductwork for regular inspection and cleaning. Available as factory-mounted or shipped loose.

Hinged Base — Available on sizes 300 up to 480, allows for easy maintenance. Hinge and restraining cables are factory-mounted to a sub-base attached directly to the curb without additional height added.

Tie-Down Points — Four brackets located on the windband for securing the fan in heavy wind applications.

Grease Trap — Polypropylene trap designed to collect grease residue to avoid drainage onto roof surface. Only available with UL 705 Supplement SC (restaurant exhaust).

Shown on a CUBE-180

Grease Trap with Absorbent Material — Same as above with an absorbent material to collect grease residue for easy disposal.

Shown on a CUBE-360

Grease Pan Kit — Used for our sidewall-mounted CUE and CUBE fans.

Clean-Out Port — Patented removable plug allows for easy spray or steam cleaning of wheel through the windband. Available on select models.

Heat Baffle — The heat baffle is an insulation heat barrier mounted to the support pan. The heat baffle is designed to act as a shield against the high temperatures of grease exhaust applications.

Hood Hasp — Additional brackets attached to the motor compartment and vertical hoodband. This provides a location for security lock.

Birdscreen — Stainless rigid wire to protect the fan discharge from birds or small objects.

Wall Grille — Available on sidewall-mounted CUE or CUBE fans.

Non-Stick Aluminum Wheel — Patented coating helps prevent wheel imbalance in heavy grease applications and allows buildup on wheel to be easily removed.

Disconnect Switches — Assorted NEMA-rated switches are available for positive electrical shutoff and safety including: dust-tight, rainproof and corrosion-resistant.

Dampers — Designed to prevent outside air from entering back into the building when fan is off. Includes backdraft and motorized dampers. (Not available with UL/cUL 705 Supplement SC (restaurant exhaust) or USGF fans).

Speed Controllers— Available for use with shaded pole and permanent split capacitor motors on direct drive fans. They provide an economical means of system balancing.

Motor Starters — The fundamental function of a motor starter is to protect the motor from damage that can occur from overheating. With a Greenheck motor starter you will be provided with the best motor protection available.

Specific model components may include: SmartStart™ technology, physical interface, overload protection, disconnect, magnetic contractor, NEMA-1 or NEMA-3R steel enclosures and pre-engineered easy system integration. For complete information on specific Greenheck motor starter models, refer to greenheck.com, motor starters web page.

UL/cUL 705 — Models CUE and CUBE may be Listed for Power Ventilators (Electrical). CUBE for Power Ventilators for Smoke Control Systems comes standard with UL 705.

UL/cUL 705 Supplement SC (Formerly UL-762) — Models CUE and CUBE, sizes 099 and larger, may be Listed for Power Ventilators for Restaurant Exhaust Appliances. Model USGF comes standard with UL 705 Supplement SC.

UL/cUL Power Ventilators for Control Systems — Models CUBE and USGF may be Listed for Power Ventilators for Smoke Control Systems.

Note: Model sizes CUBE-099, 160XP, 240XP, 300HP & 300XP are excluded from Ventilators for Smoke Control Systems

Coatings – A variety of coatings and colors are available for decorative to protective applications.

Permatector™ is our standard coating on steel fans and is typically used for applications that require corrosion resistance in indoor and outdoor environments.

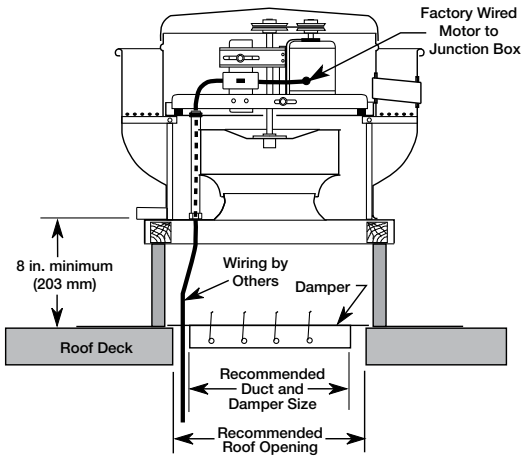
Hi-Pro Polyester is resistant to salt water, chemical fumes and moisture in more corrosive atmospheres. Typically used for applications that require superior chemical resistance, excellent abrasion and outdoor UV protection, this coating exceeds protective qualities of air dried Heresite and air dry phenolic. Customers can choose from seven standard decorative colors or color match any color.

Macropoxy with UV topcoat is a two-coat extreme duty coating system. The base coat of Macropoxy is designed specifically for harsh environments, while the topcoat is used for its chemical and UV resistance. Together this system offers the greatest protection in adverse environments, such as marine or chemical processing applications. Customers can choose from seven standard decorative colors.

Note: Colors are subject to change. See Performance Coatings for Commercial & Industrial Fans catalog for more details.

General Clean Air/Fume Hood (Non-Grease)

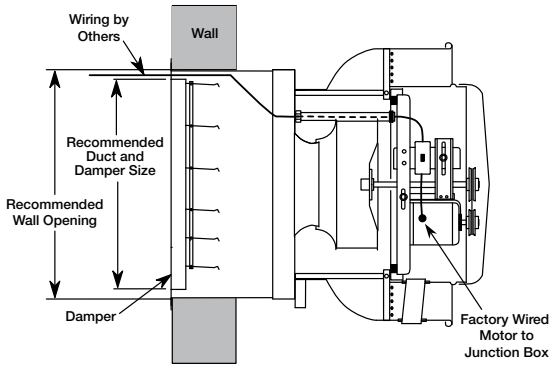
All CUE and CUBE exhaust fans are designed for applications ranging from clean air to contaminated air. A typical installation is shown.



Models CUE and CUBE Roof-Mounted

When roofing materials extend to the top of the curb, roof curbs should be 1½-inches (¾-inch on a side) less than the unit curb cap to allow for roofing and flashing.

- For recommended duct size, damper size and roof opening dimensions, refer to the performance data pages.
- Installation must include a means for inspecting, cleaning and servicing the exhaust fan.

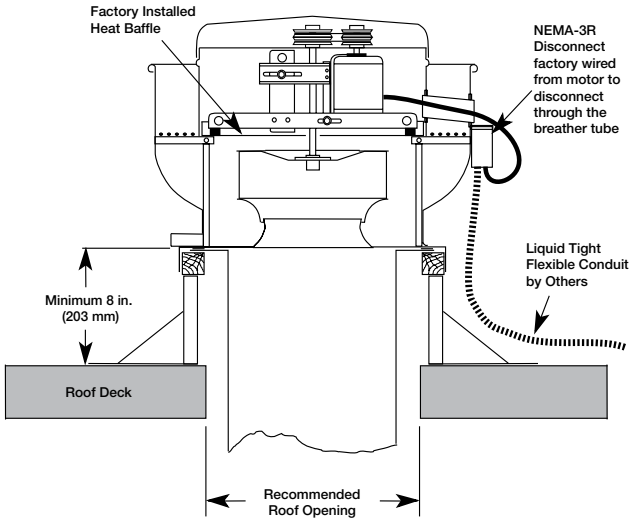


Models CUE and CUBE Wall-Mounted

Emergency Smoke Control

The CUBE with smoke option and the USGF are specifically designed for Emergency Smoke Control applications. These fans are UL/cUL Listed for Power Ventilators and Power Ventilators for Smoke Control Systems for 500°F (260°C) for 4 hours and 1,000°F (538°C) for 15 minutes.

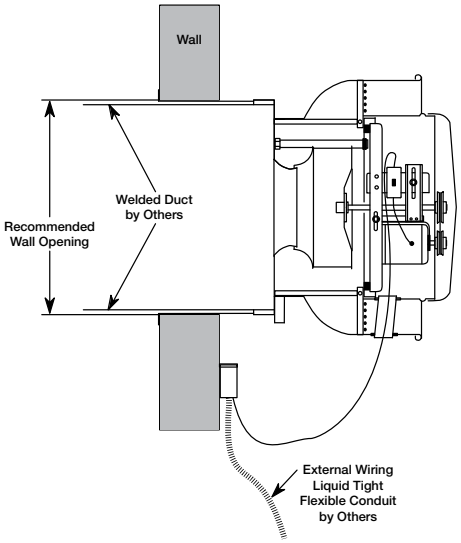
- Due to the varying airstreams encountered in commercial ventilation, system designers must be aware of national, state, and local codes and guidelines governing these installations. Consult with local code authorities before proceeding with any ventilation project.
- When roofing materials extend to the top of the curb, roof curbs should be 1½-inches (¾-inch on a side) less than the unit curb cap to allow for roofing and flashing.
- For recommended duct size, damper size and roof opening dimensions, refer to the performance data pages.
- Installation must include a means for inspecting, cleaning and servicing the exhaust fan.
- Exhaust fans used in emergency smoke applications must have external wiring. (Wiring must not be installed in the airstream).



Models CUBE and USGF

Commercial Kitchen (Grease)

Models CUBE, USGF and model CUE sizes 099 and larger, are designed to meet restaurant and food service applications. These fans are UL/cUL Listed Power Ventilators for Restaurant Exhaust Appliances and have been tested under high temperature [400°F (204°C)] and abnormal flare-up [600°F (316°C)] conditions.



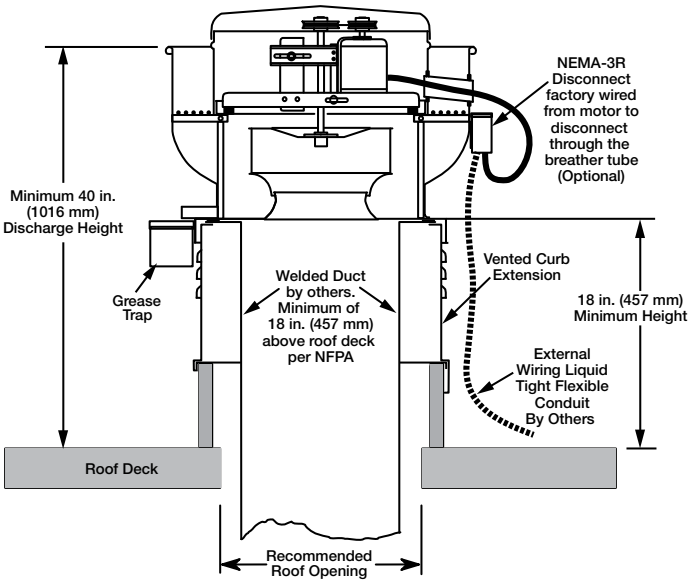
Models CUE and CUBE
Wall-Mounted

- Due to high temperatures and grease-laden airstreams in commercial kitchen ventilation, system designers must be aware of governing codes and guidelines. The National Fire Protection Association (NFPA) is the primary source which governs many codes for commercial kitchen ventilation. Selected information from NFPA 96 is shown below. Consult with local code authorities before proceeding with any kitchen ventilation project.
- Exhaust fans used in kitchen ventilation applications must have external wiring. (Wiring must not be installed in the airstream).
- Installation must include a means for inspecting, cleaning and servicing the exhaust fan. Greenheck offers a Hinged Curb Cap option for upblast exhaust fans.
- No dampers are to be installed in the system.

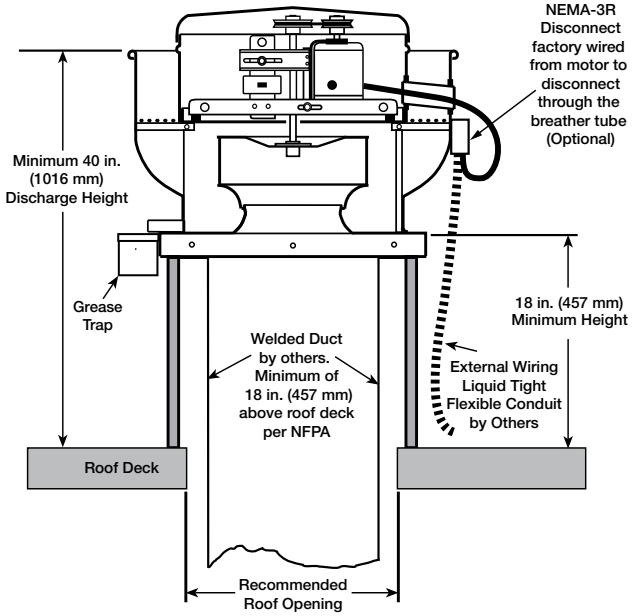
Note:

- *The typical installations shown on these two pages are recommendations based on national codes. Local authority may supersede these recommendations.*
- *Drawing shows NEMA-1 Standard, NEMA-3R is optional.*

c UL US LISTED



Models CUE and CUBE
Vented Installation



Models CUE and CUBE
Non-Vented Installation

GREENHECK
Building Value in Air.

Performance & Dimensions Quick Reference

Page Index					Material Thickness		
Model Size	CUBE	CUE	CUBE Smoke Option	USGF	Windband	Motor Cover	Curb Caps
060		19 •			0.051 *(1.3)*	0.051 *(1.3)*	0.051 *(1.3)*
070		20 •					
080		21 •			0.051 *(1.3)*	0.051 *(1.3)*	0.064 *(1.6)*
090		22 •					
095		23 •					
099	24 •				0.051 (1.3)	0.040 *(1.0)*	0.064 *(1.6)*
100	25 •		x				
100HP	26 •		x				
120	27 •		x				
130	28 •		x				
140	29 •		x	x			
140HP	30 •		x	x			
160	31 •		x	x			
160HP	32 •		x	x			
160XP	33 •			x			
180	34 •		x	x	0.064 *(1.6)*	0.040 *(1.0)*	0.064 *(1.6)*
180HP	35 •		x	x			
200	36 •		x	x			
200HP	37 •		x	x			
220	38 •		x		USGF 0.051 *(1.3)*		
220HP	39 •		x				
240	40 •		x				
240HP	41 •		x		0.064 *(1.6)*	0.051 *(1.3)*	0.064 *(1.6)*
240XP	42 •						
300	43 •		x		0.080 *(2.0)*	0.051 *(1.3)*	0.064 *(1.6)*
300HP	44 •						
300XP	45 •						
360	46 •		x		0.080 *(2.0)*	0.064 *(1.6)*	0.080 *(2.0)*
360HP	47 •		x				
360XP	48 •						
420	49 •		x		0.080 *(2.0)*	0.064 *(1.6)*	0.100 *(2.5)*
480	50 •		x				

• Vari-Green option available

The Model number system is designed to completely identify the fan. The correct code letters must be specified to designate belt or direct drive. The remainder of the model number is determined by the size and performance.

CUBE-240HP-A-5-VG/VGD-1-34-X

Configuration
CUE - Direct Drive Roof or Wall Mounted
CUBE - Belt Drive Roof or Wall Mounted
USGF - Belt Drive Roof Mounted

Fan Size
060 thru 480

Wheel Pressure Level
HP - High-Pressure
XP - Extended High-Pressure

60 Hz Motor RPM *(Direct Drive Only)*
A = 1725
B = 1140
C = 860
D = 1550
E = 1050
G = 1300

50 Hz Motor RPM *(Direct Drive Only)*
International *(See CAPS for performance)*
K = 950 RPM
L = 1290 RPM
J = 1425 RPM

Motor HP
4 = 1/4
3 = 1/3
5 = 1/2
7 = 3/4
10 = 1
15 = 1½
20 = 2
30 = 3
50 = 5
75 = 7½

VG = Vari-Green® Motor
VGD = Vari-Green® Drive

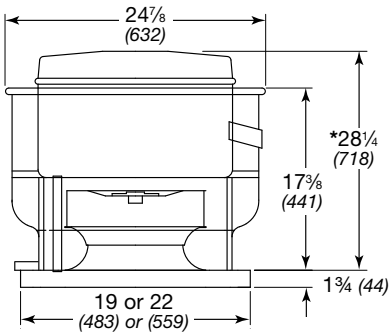
Performance Revision

Curb Cap Size (inches)

X = UL 705
F = UL 705 Supplement SD (Smoke)
G = UL 705 Supplement SC (Restaurant)

Roof Upblast/Sidewall Exhaust
Size-130: CUBE • CUE
Previously Size-131

GREENHECK
Building Value in Air.

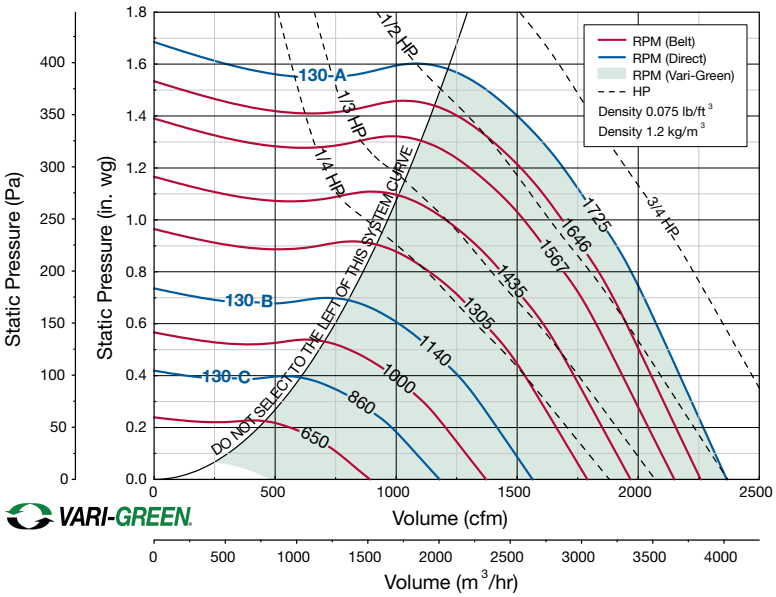


Direct Drive RPM

C-860 RPM
B-1140 RPM
A-1725 RPM
VG-1725 RPM

All dimensions in inches *(millimeters)*, weight in pounds *(kilograms)*.
* May be greater depending on motor.
^Weight shown is largest cataloged open drip-proof motor.

	CUBE	CUE
^Approximate Weight	66 *(30)*	64 *(29)*
Damper Size	12 x 12 *(305 x 305)*	
	16 x 16 *(406 x 406)*	
Roof/Wall (without wall bracket) Opening	15½ x 15½ *(394 x 394)*	
	18½ x 18½ *(470 x 470)*	
Wall Opening with Wall Bracket	15 x 15 *(381 x 381)*	
	18 x 18 *(457 x 457)*	
Wall Opening with a Curb Through Wall	19 x 19 *(483 x 483)*	
	22 x 22 *(559 x 559)*	



Motor HP			Fan		Static Pressure in Inches wg									
Belt	Direct		RPM		0	0.125	0.25	0.375	0.5	0.625	0.75	1	1.25	1.5
130														
1/4	VG-1/4		650	CFM	892	724								
				BHP	0.03	0.03								
				Sones	6.2	6.0								
			755	CFM	1036	895	697							
				BHP	0.04	0.05	0.05							
				Sones	7.2	7.0	6.3							
	VARI-GREEN.	C-1/8	860	CFM	1180	1057	914	675						
				BHP	0.06	0.07	0.07	0.07						
				Sones	8.5	8.3	7.7	6.9						
			1000	CFM	1372	1267	1158	1016	801					
				BHP	0.10	0.11	0.11	0.12	0.11					
				Sones	10.7	10.5	10.0	9.2	8.3					
		B-1/6	1140	CFM	1564	1471	1379	1280	1144	964				
				BHP	0.14	0.15	0.16	0.17	0.17	0.17				
				Sones	12.5	12.2	11.8	11.2	10.3	9.7				
	VG-1/2		1305	CFM	1790	1709	1629	1547	1458	1340	1201			
				BHP	0.22	0.23	0.24	0.25	0.26	0.26	0.26			
				Sones	14.6	14.3	13.9	13.5	13.0	12.0	11.5			
1/3			1435	CFM	1968	1895	1822	1749	1671	1586	1479	1198		
				BHP	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.33		
				Sones	15.7	15.5	15.1	14.8	14.3	13.8	13.1	11.9		
1/2	VG-3/4		1488	CFM	2041	1970	1900	1829	1756	1679	1580	1342		
				BHP	0.32	0.33	0.35	0.36	0.37	0.38	0.39	0.38		
				Sones	16.2	15.9	15.7	15.4	15.0	14.5	13.9	12.7		
			1567	CFM	2149	2082	2015	1948	1881	1808	1728	1527	1222	
				BHP	0.37	0.39	0.40	0.41	0.43	0.44	0.45	0.45	0.42	
				Sones	17.0	16.8	16.5	16.3	15.9	15.5	15.0	13.8	12.6	
			1646	CFM	2258	2194	2130	2066	2002	1935	1865	1686	1458	
				BHP	0.43	0.45	0.46	0.47	0.49	0.50	0.51	0.52	0.51	
				Sones	17.9	17.6	17.4	17.2	16.9	16.5	16.1	15.1	14.0	
		A-1/2	1725	CFM	2366	2305	2244	2183	2122	2061	1994	1838	1646	1365
				BHP	0.50	0.51	0.53	0.54	0.56	0.57	0.58	0.60	0.60	0.57
				Sones	18.8	18.6	18.4	18.2	18.0	17.6	17.2	16.4	15.3	14.1

MAXIMUM BHP AT A
GIVEN RPM = (RPM/2041)³
MAXIMUM RPM = 1725
TIP SPEED (ft/min) = RPM x 3.420
MAXIMUM MOTOR FRAME SIZE = 56
AVERAGE DISCHARGE VELOCITY
(FPM) = CFM/1.28

Performance certified is for installation type A: Free inlet, Free outlet. Power rating (Bhp) does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories). The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: Free inlet hemispherical sone levels.

APPENDIX D

RECIRCULATING CARBON SYSTEM

SORBAIRE

Is your neighbor's nose all up in your business? Or is your business all up in your neighbor's nose?

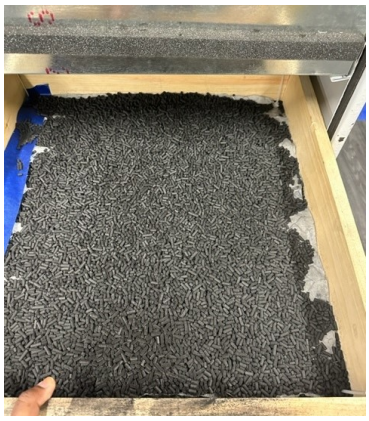
However you look at it, meet SorbAire. SorbAire is our own odor mitigation system that was designed and built by our team in Auburn, Maine.

SorbAire can be wall-mounted into a room, or you can take advantage of our mobile CIP (short for "Clean-In-Place") Cart.

Want to try SorbAire out for free to make sure it's a good fit for your organization? Send us an email at info@lifespringmc.com for more information.

Lifespring Microclimates
1400 Hotel Road
Auburn, ME 04210

info@lifespringmc.com
Tel : 1.877.351.9875
https://www.lifespringmc.com/



Inline Fans Options

Featuring TD-MIXVENT/TD-SILENT

The World's Leading Producer of Air Movement Products

Soler&Palau Ventilation Group

TD_0116
January 2016

Table of Contents

Overview TD-MIXVENT & TD-SILENT Series

Compact Size-TD Fans require minimum space

The S&P TD-MIXVENT & TD-SILENT series of in-line duct fans have been specially designed to maximize the airflow performance with minimal noise levels within the smallest and most compact of housing sizes. This makes the TD-MIXVENT & TD-SILENT series the ultimate solution for small to medium sized ventilation installations which require a high airflow to pressure ratio and occupy only the minimum space possible. Example: false ceiling voids, cabinets and many other limited space environments.

Easy to Install...fit and forget!

All the models in the TD-MIXVENT & TD-SILENT range have been designed with the professional contractor/ engineer in mind. All models include a “removable body” feature that enables the motor-impeller assembly to be completely removed or replaced without the need to interfere with the attached ducting.

Internal parts can be easily removed for mounting & servicing

Multitude of features-high specification

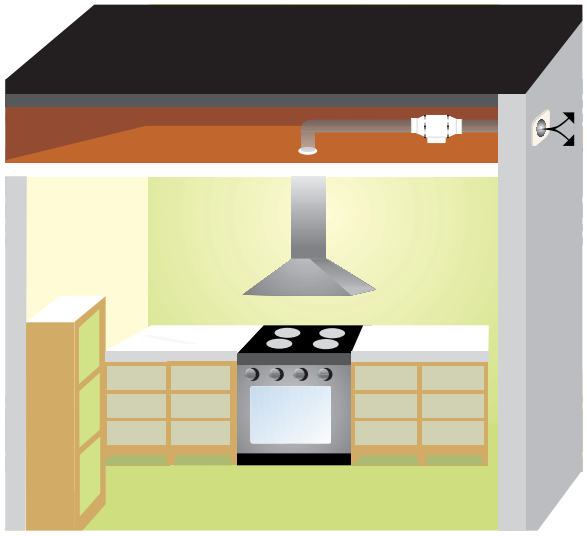
All models within the TD-MIXVENT & TD-SILENT range incorporate a powerful mixed flow impeller and internal air vanes located at the discharge end of the fan housing. This impeller and guide vane combination provides a smooth laminar air flow which in turn minimizes turbulence and noise, and generates an **excellent air flow to pressure performance ratio.**

Description

All of the TD-fans include the combination of a powerful motor, factory installed, to a mixed flow impeller. This motor and impeller combination enables the TD-fans to deliver high airflow performances with minimum noise generation against high static pressures typically found in ducted ventilation systems. The unique design of the support brackets, allows the motor and impeller assembly to be fitted or removed without dismantling the adjacent ducting and therefore, facilitating any installation or maintenance. The internal aerodynamic design of the TD-MIXVENT & TD-SILENT fans enable the units to generate large air volumes and pressures with the minimum of in-duct or radiated noise. The TD-fans offer the ideal in-line duct fan solution for a wide range of HVAC ventilation applications.

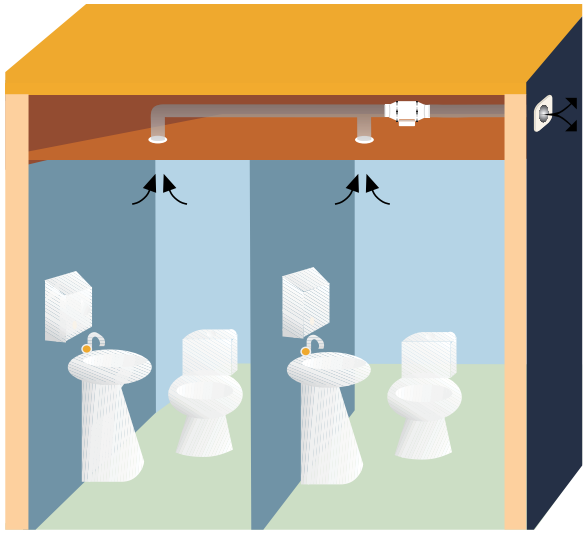
TD-MIXVENT & TD-SILENT Practical Installations

The TD-MIXVENT & TD-SILENT system offers the most versatile installation range on the market, as a result of its multiple combinations; it can be used in a large number of small and mid-range ventilation installations.

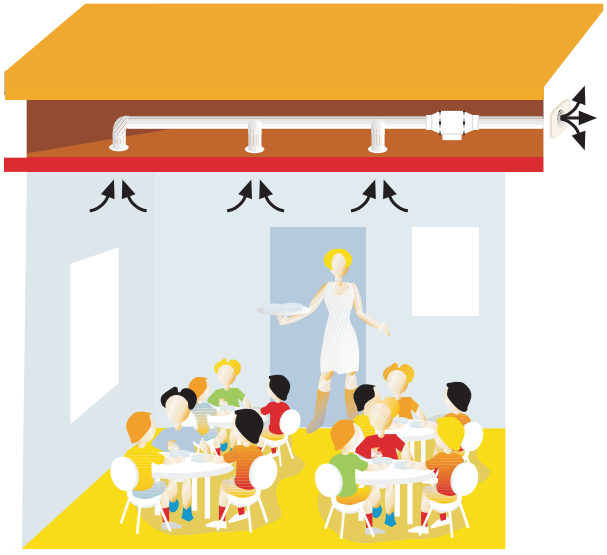


Domestic - Range Hood Exhaust

Commercial - Office

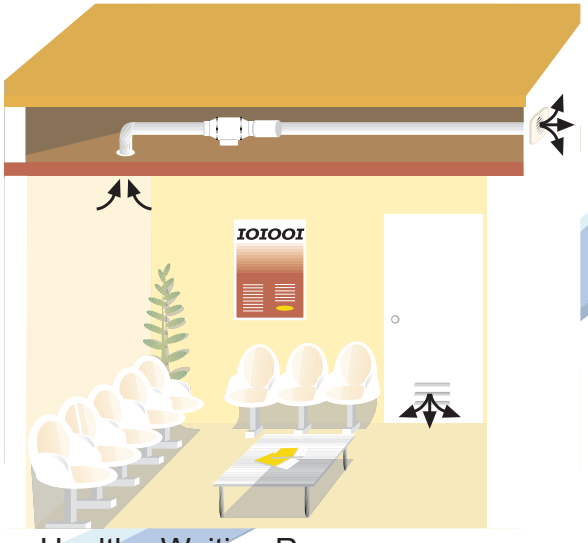


Industrial - Public Restroom



School - Dining Hall

Industrial - Locker Room



Health - Waiting Room

General Details of the TD-MIXVENT Range

S&P Exclusive Product

Low profile mixed flow fans, manufactured in plastic material (up to model 200) or in **galvanized steel** sheet protected with Epoxy paint (models 250, 315, 355, and 400), with external terminal box, removable motor-impeller assembly and adjustable single-phase motor, Class B, IP44.

Construction characteristics

	100	100x	125	150	200	250	315	355	400
Polypropylene housing	•	•	•	•	•				
Steel housing with epoxy coating						•	•	•	•
ABS fan blades	•	•	•	•	•				
Aluminum fan blades						•	•	•	•
Thermal link via fuse	•								
Thermal link with automatic reset		•	•	•	•	•	•	•	•
Permanently lubricated ball bearings	•	•	•	•	•	•	•	•	•

The extensive range of the TD-MIXVENT series makes it an effective solution for a wide range of residential and light commercial ventilation installations.

TD-MIXVENT Installation & Maintenance

Low Profile

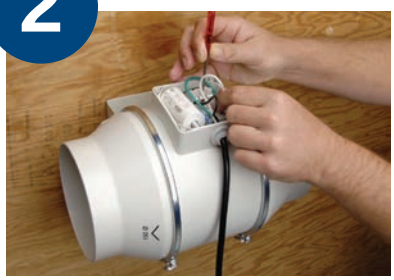
The low profile of the fans in the TD-MIXVENT range makes them the ideal product for installations with low height limits, such as the case of suspended ceilings.

Easy to Install

1

Secure the support.

2

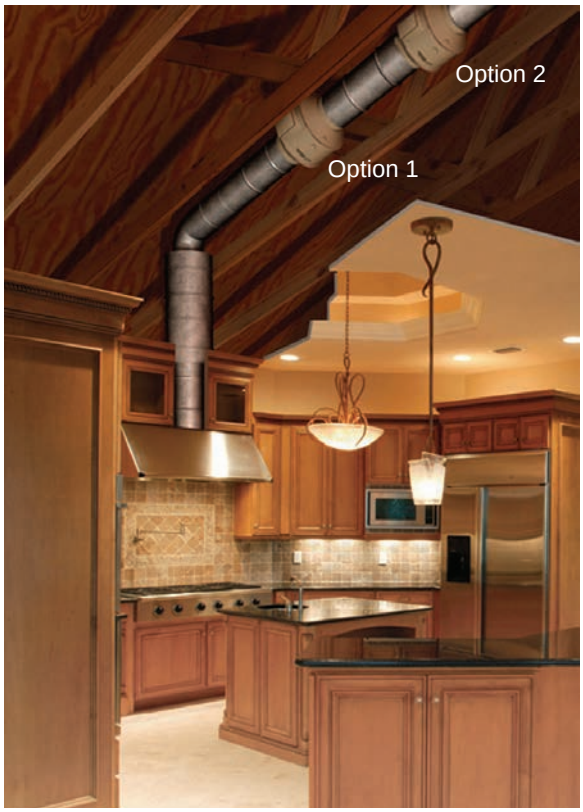


Make the connections.

3

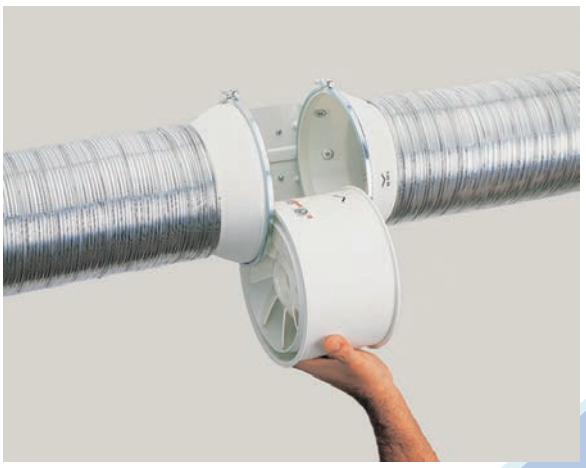
Connect the ducts.

Flexibility in Location



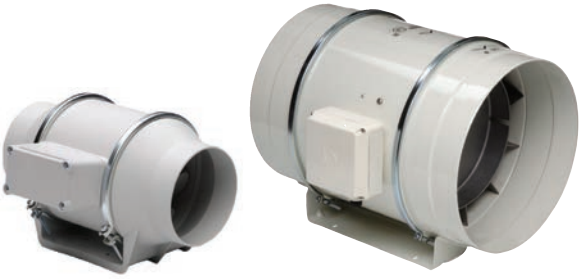
The fans can be connected at any point along the ventilation duct: along the duct or at the end.

Easy Maintenance



Removable body, for repair or cleaning, **without the need to touch the ducts.**

TD-MIXVENT Technical Specifications



Warranty
Five (5) year limited warranty.

Range
The TD-MIXVENT series consists of nine (9) nominal sized in-line fans. All models are specifically designed for direct connection in-line with industry standard diameter round ducting.

Construction
The TD-MIXVENT models 100, 100x, 125,150, and 200 are manufactured in tough reinforced plastic, models 250, 315, 355, and 400 have a metal casing and are finished in a tough epoxy-polyester paint coating. The TD fan duct connection flanges are manufactured from reinforced plastic, except for models 200, 250, 315, 355, and 400 which are constructed from epoxy-polyester coated metal.

Impellers
The impeller blades for models 100, 100x, 125, 150 and 200 are molded in tough ABS plastic. Models 250, 315, 355, and 400 are metal.

Motors
Models 100, 100x and 125 :
- Single-phase, 120V 60Hz, shaded pole induction asynchronous motor in die cast aluminum. All motors include direct single speed connection and are also suitable for voltage speed control.
- Class ll electrical insulation (model 100) & Class l (models 100x and 125)
- IP 44 Protection
- Class B Motor Insulation
- Safety auto reset Thermal Overload Protection (fuse type)
- Self-lubricating sleeve bearings.
- Suitable for working airstreams up to 104° F (40°C).

Models 150, 200, 250, 315, 355, and 400:
- Single-phase induction asynchronous motor, with permanent capacitor and external rotor constructed of die cast aluminum. Models 150, 200, 355 and 400 feature single speed, fully speed controllable motors. Models 250 and 315 include direct two speed connection motors and are also suitable for voltage speed control.
- Class l electrical insulation
- IP 44 Protection
- Thermal Overload Protection
- Class B Motor Insulation
- Sealed For Life, ball bearings
- Suitable for working airstreams up to 140° F (60°C).

Performance characteristics

Models 250 and 315 include a direct two speed motor connection.

Model	Nom. RPM	Volts	Max. Watts	Speed	CFM v Static Pressure (SP) Ins. WG							Max. SP	Max operating temp. (ºF)	Wgt. (lbs)	Duct Dia. Ins.
					0”	0.125”	0.25”	0.375”	0.5”	0.75”	1.0”				
TD-100	2516	120	26	-	101	85	57	-	-	-	-	.4	104	2	4”
TD-100x	2096	120	33	-	135	113	90	53	-	-	-	.55	104	4.4	4”
TD-125	2146	120	38	-	197	168	133	86	22	-	-	.55	104	4.4	5”
TD-150	2289	120	65	-	293	273	250	227	206	131	35	1.15	140	4.4	6”
TD-200	2781	120	184	-	538	495	458	418	367	190	10	1.625	140	8.8	8”
TD-250	2400	115	162	LS	541	475	418	355	295	218	170	2.03	140	19.8	10”
	3200	115	241	HS	754	715	680	640	600	520	405	2.53	140	19.8	10”
TD-315	2000	115	208	LS	751	670	545	420	285	190	130	1.62	140	30.9	12.4”
	2500	115	335	HS	1050	990	932	850	770	600	420	2.95	140	30.9	12.4”
TD-355	1536	115	522	-	2090	2013	1935	1856	1777	1616	1320	1.1	140	43	14”
TD-400	1559	115	916	-	3127	3034	2938	2836	2735	2542	2303	1.2	140	78	16”

Performance certified is for installation Type D: Ducted Inlet, Ducted Outlet. Performance ratings do not include the effects of appurtenances.

LS= Low Speed
HS = High Speed

S&P USA certifies that all TD fan sizes shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.

TD-100x, 125, 150, and 200 are ENERGY STAR® qualified.

COMPLIANT TITLE 24

The TD-MIXVENT Models 100, 100x and 150 are California Title 24 compliant and meet ASHRAE 62.2 when installed with a CVC and other TD models are compliant when installed with a 3 way switch and remotely mounted speed control.

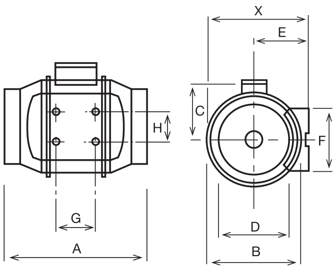
TD 250 & 315 are UL listed for outdoor use.

Sound characteristics

Fan sound levels are measured in sones. At this time there are no sone level test standards available through HVI due to the fact that remote mounted fan noise levels are in proportion to the following: type of duct, length of duct, fan distance from the intake source and other miscellaneous factors. However, it is generally accepted that remote mounted venting is usually quieter than standard (in room) venting.

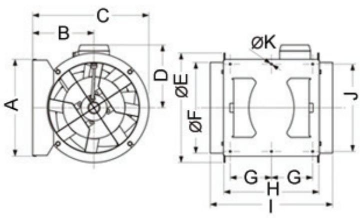
Dimensions (inches/mm)

Models 100-315



Model	X	A	B	C	D	E	F	G	H
TD-100	5 15/16 / 151	9 1/8 / 232	5 7/16 / 138	3 3/4 / 96	3 7/8 / 98	3 1/4 / 82	3 3/4 / 95	1 7/8 / 48	2 1/16 / 52
TD-100x	7 3/8 / 188	11 15/16 / 303	6 15/16 / 176	4 1/2 / 115	3 13/16 / 97	3 15/16 / 100	3 9/16 / 90	3 1/8 / 80	2 3/8 / 60
TD-125	7 3/8 / 188	10 3/16 / 258	6 15/16 / 176	4 1/2 / 115	4 13/16 / 123	3 15/16 / 100	3 9/16 / 90	3 1/8 / 80	2 3/8 / 60
TD-150	8 3/8 / 212	11 5/8 / 295	7 7/8 / 200	5 / 127	5 13/16 / 147	4 7/16 / 112	5 1/8 / 130	3 1/8 / 80	2 3/8 / 60
TD-200	9 3/16 / 233	11 7/8 / 302	8 9/16 / 217	5 9/16 / 141	7 13/16 / 198	4 7/8 / 124	5 1/2 / 140	3 15/16 / 100	3 11/16 / 94
TD-250	11 7/16 / 291	15 3/16 / 386	10 11/16 / 272	7 9/16 / 192	9 3/4 / 248	6 1/8 / 155	6 5/8 / 168	5 11/16 / 145	5 1/2 / 140
TD-315	14 / 356	17 11/16 / 450	13 1/4 / 336	8 13/16 / 224	12 5/16 / 312	7 3/8 / 188	8 1/4 / 210	7 3/16 / 182	7 / 178

Models 355 - 400



Model	A	B	C	D	E	F	G	H	I	J	K
TD-355	14 5/6 / 377	9 3/8 / 238	17 11/16 / 451	8 5/6 / 224	16 7/9 / 426	13 15/16 / 354	5 8/9 / 150	14 1/2 / 368	18 2/3 / 474	13 3/8 / 340	1/3 / 8.5
TD-400	16 / 407	9 4/5 / 249	19 3/8 / 492	10 1/2 / 267	19 1/6 / 487	15 5/7 / 399	6 2/7 / 160	16 3/4 / 425	21 5/9 / 547	14 4/7 / 370	1/3 / 8.5

TD-MIXVENT KIT Bathroom Kits

If the strongest, quietest, bathroom exhaust system is what you seek…look no further. S&P offers the perfect solution with the most options. The TD-MIXVENT fan kits provide all the hardware needed to complete a simple in-line ducted ventilation installation. The kit includes a powerful TD in-line fan and exterior and interior grilles (with or without lights). Available in both Standard Exhaust Kits, for venting a single location, and Deluxe Exhaust Kits, for venting multiple locations with one fan.

The TD-MIXVENT fan kit is the ideal solution for any simple in-line ducted fan installation.
All TD kits have standard 7-year warranty.

Standard Exhaust Kits

KIT-TD100
- 1 TD100 exhaust fan
- 1 plastic round grille (PG-100)
- 1 exterior louvered grille (PER-100W)
- Integral mounting bracket

KIT-TD100x
- 1 TD100x exhaust fan
- 1 plastic round grille (PG-100)
- 1 exterior louvered grille (PER-100W)
- Integral mounting bracket

KIT-TD150
- 1 TD150 exhaust fan
- 1 plastic round grille (PG-150)
- 1 exterior louvered grille (PER-150W)
- Integral mounting bracket

Deluxe Exhaust Kits

KIT-TD150-DV
- 1 TD150 exhaust fan
- 2 plastic round grilles (PG-150)
- 1 exterior louvered grille (PER-150W)
- 1 Y-fitting (SY-6)
- Integral mounting bracket

IMPORTANT: If venting in an non-insulated attic space, or in a cold climate, insulated flexible duct is strongly recommended for condensation issues.

Lighted Standard Exhaust Kits

KIT-TD100XL
- 1 TD100x exhaust fan
- 1 Vent Light with LED Bulb (VLED-100)
- Integral mounting bracket

KIT-TD100XH
- 1 TD100x exhaust fan
- 1 Vent Light with Halogen Bulb (VLH-100)
- Integral mounting bracket

KIT-TD100XF
- 1 TD100x exhaust fan
- 1 Vent Light with Fluorescent Bulb (VLF-100)
- Integral mounting bracket

Lighted Deluxe Exhaust Kits

KIT-TD150L
- 1 TD150 exhaust fan
- 2 Vent Lights with LED Bulb (VLED-100)
- 1 Y-fitting (SY44-6)
- Integral mounting bracket

KIT-TD150H
- 1 TD150 exhaust fan
- 2 Vent Lights with Halogen Bulb (VLH-100)
- 1 Y-fitting (SY44-6)
- Integral mounting bracket

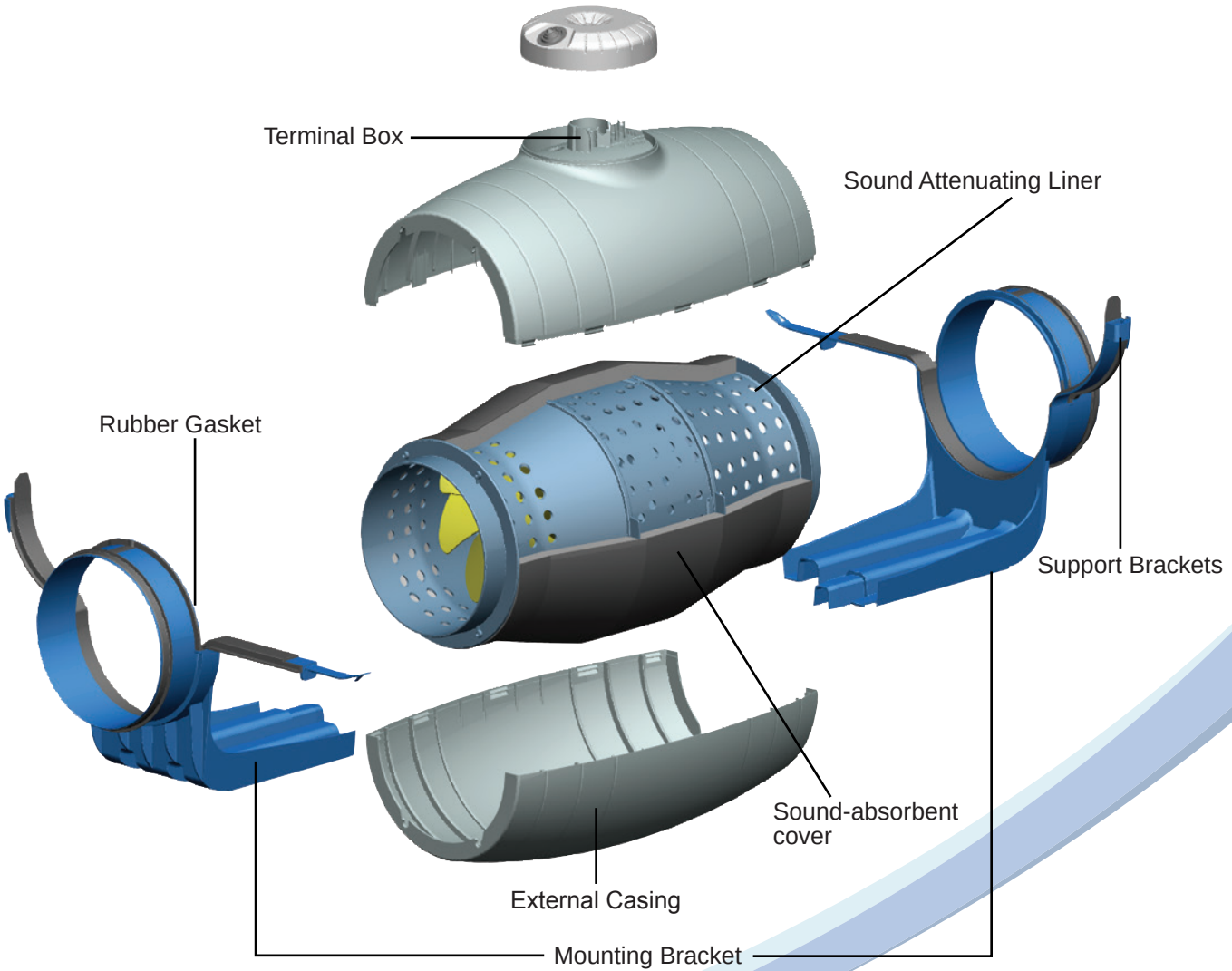
KIT-TD150F
- 1 TD150 exhaust fan
- 2 Vent Lights with Fluorescent Bulb (VLF-100)
- 1 Y-fitting (SY44-6)
- Integral mounting bracket

General Details of the TD-SILENT Range

As the name suggests these fans are extremely quiet, low profile “Mixed-flow” fans. Manufactured in plastic material with an external connection box, the body is easily dismantled with a full speed controllable, single speed motor. Sound waves are directed through the perforated inner skin and absorbed by a layer of sound-absorbent insulation. Plus the TD-SILENT is fitted with rubber gaskets on the inlet and outlet to absorb vibrations.

Construction characteristics

	125XS	150S	200S
Polypropylene housing	•	•	•
ABS fan blades	•	•	•
Thermal link with automatic reset	•	•	•
Permanently lubricated ball bearings	•	•	•



TD-SILENT Innovative Design Features

Low Profile

The low profile of the fans in the TD-SILENT range makes them the ideal product for installations with low height limits, such as the case of suspended ceilings.

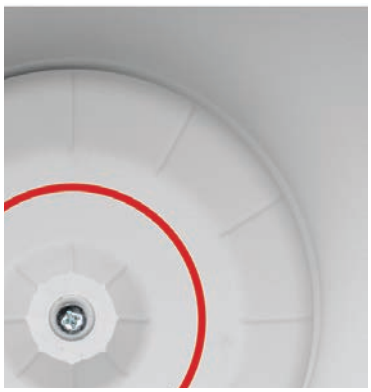
Low Noise Levels

Sound waves produced inside the TD, are directed through the perforated inner skin and absorbed by the layer of sound-absorbent material.

Easy Maintenance

Bi-material support brackets, which in addition to simplifying installation, serve as joint seals.

Connection Box Rotates 360°



Connection box can be rotated 360º, to facilitate easy connection of the power cable.

Duct Air-Seals

Bi-material inlet and outlet incorporating a flexible washer to facilitate installation, absorb vibrations and provide a virtually **air-tight** seal.

Integral Mounting Bracket

Mounting bracket for installing on a wall or ceiling, incorporating twin-material support brackets for the motor section that absorbs vibration.

TD-SILENT Easy Installation

1

Loosen the clamps.

2

Open the clamps on both ends.

3

Remove the fan body.

4

Remove the terminal box lid.

5

Connect electrical supply.

6

Re-mount fan body by tightening the clamps.

TD-SILENT Technical Specifications

Warranty
Five (5) year limited warranty.

Range
The TD-SILENT consists of three (3) nominal sized in-line fans. All models are specifically designed for direct connection in-line with industry standard diameter round ducting.

Construction
The TD-SILENT models 125XS, 150S and 200S are manufactured in tough reinforced plastic. Sound waves are directed through the perforated inner skin and absorbed by a layer of sound-absorbent insulation. Plus the TD-SILENT is fitted with rubber gaskets on the inlet and outlet to absorb vibrations.

Impellers
The impeller blades are molded in tough ABS plastic.

Motors
Models 125XS:
Single-phase, 120V 60Hz, shaded pole induction asynchronous motor in die cast aluminum. All motors include direct single speed connection and are also suitable for voltage speed control.

- Class I electrical insulation
- IP 44 Protection
- Class B Motor Insulation
- Safety auto reset Thermal Overload Protection (fuse type)
- Self-lubricating sleeve bearings.
- Suitable for working airstreams up to 104° F (40°C).

Models 150S and 200S:
Single-phase induction asynchronous motor, with permanent capacitor and external rotor in die cast aluminum. All models include direct single speed connection and are also suitable for voltage speed control.

- Suitable for working airstreams up to 140° F (60°C).
- Class I electrical insulation
- IP 44 Protection
- Thermal Overload Protection
- Class B Motor Insulation
- Sealed For Life, ball bearings

Code Approval

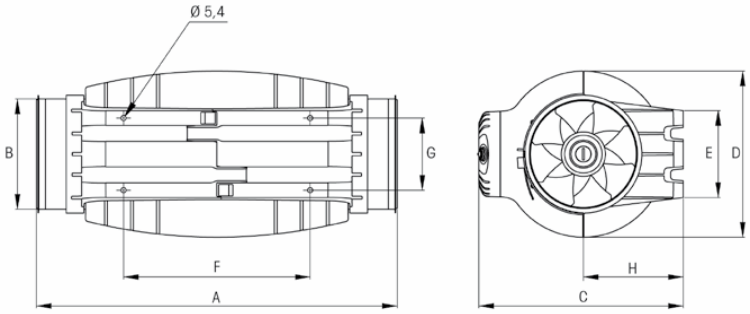
- All models have been independently safety tested by Underwriters Laboratories, Inc. and are UL and cUL Listed.
- Independently tested for Airflow Performance.
- The TD product range is certified by the Home Ventilating Institute (HVI) for Air Performance.
- All models are ENERGY STAR® qualified.

Air Performance

Model	Duct Dia. Ins.	Nom. RPM	Volts	Max. Watts	CFM v Static Pressure (SP) Ins. WG							Max. SP	Max operating temp. (°F)	Wgt. (lbs)
					0"	0.125"	0.25"	0.375"	0.5"	0.75"	1.0"			
TD-125XS	5"	2500	120	36	203	175	138	84	33	-	-	0.6	104	11.9
TD-150S	6"	2700	120	65	333	315	286	271	257	178	77	1.2	140	13.2
TD-200S	8"	2200	120	122	530	503	472	443	415	349	204	1.2	140	19.2

The TD-SILENT Models 125XS and 150S are California Title 24 compliant and meet ASHRAE 62.2 when installed with a CVC and other TD models are compliant when installed with a 3 way switch and remotely mounted speed control.

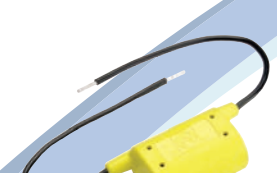
Dimensions (inches)



Model	A	B Ø	C	D Ø	E	F	G	H
TD-125XS	22 5/8	3 13/16	9 15/16	8 1/16	3 15/16	9 13/16	3 1/4	4 3/4
TD-150S	19 1/16	5 13/16	10 13/16	8 11/16	4 9/16	9 13/16	3 3/4	5 1/4
TD-200S	22 3/8	7 13/16	12 7/8	10 3/8	5 11/16	13 3/8	5 1/16	6 7/16

Bathroom Exhaust Controls - ASHRAE 62.2

CVC - Continuous Ventilation Control



S&P's CVC allow a new or existing bath fan to run continuously on a low speed. In conjunction with an S&P TD fan a CVC will immediately improve the air quality in the home and reduce the damaging effects of moisture and mold.

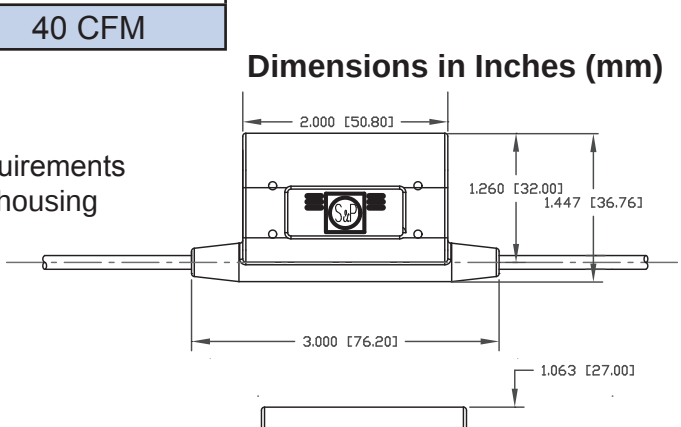
The CVCs are designed to meet the requirements of ASHRAE 62.2 and the International Residential Code. In areas where ASHRAE 62.2 is not a requirement the CVC is still an economical choice to improve indoor air quality.

CVC Model	Fan Size	Application	Max. Flow	Continuous Flow @ .25"SP
CVC-100	100	Single Inlet	101 CFM	20 CFM
CVC-100x	100x	Single Inlet	135 CFM	20 CFM
CVC-150	150	Single Inlet	218 CFM	20 CFM
		Dual Inlet	293 CFM	40 CFM

Features

- Reduces remodeling costs, helps meet ASHRAE 62.2 requirements
- Perfect for homes, apartments, dorms, hotels and elderly housing
- Economical and easy to install in your existing wall box
- Works with most fan controls, i.e. motion sensors, timers, speed controllers.
- Undetectable, efficient and effective
- Operates with any standard switch
- No programming required
- 120V, 60 Hz, 3A Maximum

Dimensions in Inches (mm)



Easy Installation. . .

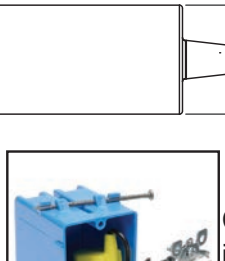
1

Attaches to any standard wall switch.

2

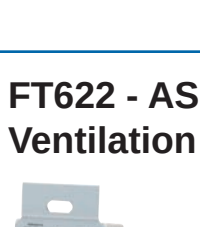
Simple 2 wire connection across the wall switch and fits into most standard wall/ junction boxes.

3



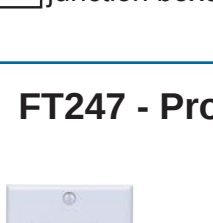
Completely installed in minutes!

FT622 - ASHRAE 62.2 Bath Fan Ventilation Control



The FT622 is designed to replace bathroom fan and light switches and provide both functions with one easy operation. The FT622 delivers a precise amount of ventilation, and is a simple solution to meet ASHRAE 62.2 in conjunction with an S&P fan.

FT247 - Programmable Fan Timer



S&P offers the FT247 with easy programming for your bathroom fan ventilation needs. Simply set what time you want the fan to turn on and off and what day or days you want the fan to run.

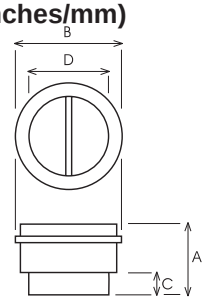
TD-MIXVENT & TD-SILENT Accessories

MCA

Backdraft dampers are installed at the fans' discharge. They prevent the entry of odors, air currents and prevent heat leaks when the exhauster is not in operation.

Model	Type TD
MCA-100	100
MCA-125	125
MCA-150	150
MCA-200	200
MCA-250	250
MCA-315	315

Dimensions (inches/mm)



MCA-100-315

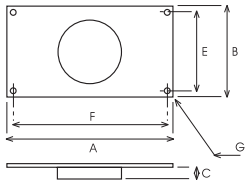
Model	A	B	C	D
MCA-100	4 3/16 / 107	4 3/8 / 111	1 1/4 / 31	3 11/16 / 94
MCA-125	4 3/16 / 107	5 3/8 / 136	1 1/4 / 31	4 11/16 / 119
MCA-150	4 3/4 / 121	6 7/16 / 163	1 3/8 / 35	5 13/16 / 147
MCA-200	5 3/16 / 131	8 7/16 / 214	1 3/8 / 35	7 3/4 / 197
MCA-250	6 3/16 / 164	10 3/8 / 264	1 5/8 / 42	9 3/4 / 248
MCA-315	8 1/16 / 205	13 / 330	1 15/16 / 50	12 5/16 / 312

MAR

Connections for rectangular ducts enable TD devices to be connected to a rectangular duct.

Model	Type TD	Nominal dim. of ducting L x H (in/mm)
MAR-100	100	9 x 6 / 224 x 140
MAR-125	125	9 x 6 / 224 x 140
MAR-150	150	11 x 7 / 280 x 180
MAR-200	200	12 x 8 / 315 x 200
MAR-250	250	16 x 10 / 400 x 250
MAR-315	315	20 x 12 / 500 x 315

Dimensions (inches/mm)



Model	A	B	C	E	F	G
MAR-100	10 3/8 / 264	7 1/16 / 180	1 5/16 / 33	6 5/16 / 160	9 5/8 / 244	3/8 / 9
MAR-125	10 3/8 / 264	7 1/16 / 180	1 5/16 / 33	6 5/16 / 160	9 5/8 / 244	3/8 / 9
MAR-150	12 5/8 / 320	8 11/16 / 220	1 7/16 / 37	7 7/8 / 200	11 13/16 / 300	3/8 / 9
MAR-200	14 / 355	9 7/16 / 240	1 7/16 / 37	8 11/16 / 220	13 3/16 / 335	3/8 / 9
MAR-250	17 5/16 / 440	11 7/16 / 290	1 5/8 / 42	10 5/8 / 270	16 9/16 / 420	3/8 / 9
MAR-315	21 1/4 / 540	14 / 355	2 1/16 / 52	14 / 355	20 1/2 / 520	3/8 / 9

MRJ

Grilles fit on the suction and the discharge sides of the installation. They prevent the entry of foreign bodies which could damage the fan.

Model	Type TD
MRJ100	100
MRJ125	125
MRJ150	150
MRJ200	200
MRJ250	250
MRJ315	315

MBR

Flanges enable TD devices to connect in a series.

Model	Type TD
MBR-125	125
MBR-150	150
MBR-200	200
MBR-250	250

TD Bathroom Exhaust Grilles

Featuring Vent Lights and Premium Grilles

S&P's Grille Options give you the choice of seven (7) aesthetically pleasing grilles designed to match any bathroom decor. You can choose from our Vent Lights, Premium Grilles or Adjustable Grilles to fit your needs.

These grilles are designed to be used exclusively with one of S&P's TD remotely mounted inline for virtually silent bathroom ventilation. Inline fans give you the option to mount your grille over the shower, toilet, tub, or in multiple locations (dual vent).

With S&P's Grille Options the choice is yours!

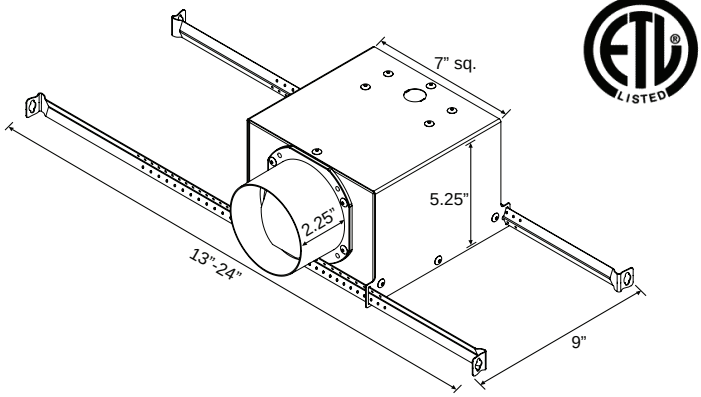
Vent Lights

Available with LED Bulbs

S&P's new Vent Lights give you ventilation that is *"Out-of-Sight and Out-of-Mind"!* The Vent Lights appear to be a regular can light, and when combined with a remotely mounted fan, the noise and unsightly look of the traditional bathroom fan are gone! The Vent Lights are aesthetically pleasing grilles with lights that will match any bathroom decor.

Model	Description
VLED-100	Vent Light with PAR30 LED Bulb
VLH-100	Vent Light with PAR30 Halogen Bulb
VLF-100	Vent Light with Energy Star Rated Compact Fluorescent Bulb

Dimensions (inches)



Features:

- Longer duct collar for 4" duct
- Extendable hanger bars up to 24"
- 7.5" grille
- Built-in backdraft damper
- 3 bulb options

Why Choose the Vent Light with LED Bulbs?

S&P's respect for the environment extends to its Vent Lights with the optional LED Bulb. The benefits to the LED Bulbs include:

- Built to last a minimum of 60,000 hours, plus the LED's use a fraction of the energy that a traditional incandescent or halogen lamp uses
- LED's contain no mercury so they are easy to dispose of, unlike other energy efficient bulbs
- The LED lamps run cool and are shock resistant, making them safer for use in your home

Premium Grilles

PG

S&P's premium grilles come standard with steel collars for easy mounting and installation.

Model	Description
PG-100	4" Plastic Grille with 4" Steel Collar
PG-150	6" Plastic Grille with 6" Steel Collar

Grille Dimensions (in inches)

Grille	Dia.	Height	Fits Duct Dia.	Fits Collars
PG-150G	8 1/8	1 5/8	6"	PG-150D
PG-100G	4 5/8	1 1/2	4"	PG-100D

Collar Dimensions (in inches)

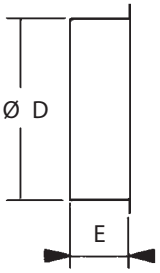
PG Collar

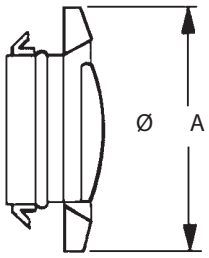
Collar	Diameter	Length
PG-100D	3 3/4	3 1/4
PG-150D	5 3/4	4 5/8

Adjustable Grilles

BOR/BOC

Exhaust grilles for bathrooms, toilets and other small rooms. All models offer an adjustable central valve to regulate the airflow.



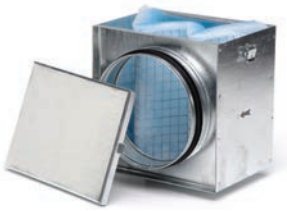


Model	A	D	E	Weight (lbs)
BOR/BOC-100	145	100	50	1
BOR/BOC-125	145	125	50	1
BOR/BOC-150	204	160	50	1
BOR/BOC-200	244	200	50	1

Additional general assembly accessories

BOR/BOC
Round plastic/metal adjustable grille

MBR
Connection Flanges



MFL
Filtering Box

PER-W
Plastic louver shutter

PER
High pressure aluminum louver shutter

GRA
Aluminum exterior fixed grilles

SR
Reducer

SY
Y sheet metal adapter

ID
Flexible round duct

SIL
Acoustic attenuators

Electrical accessories

EPBT
Electronic push button timer

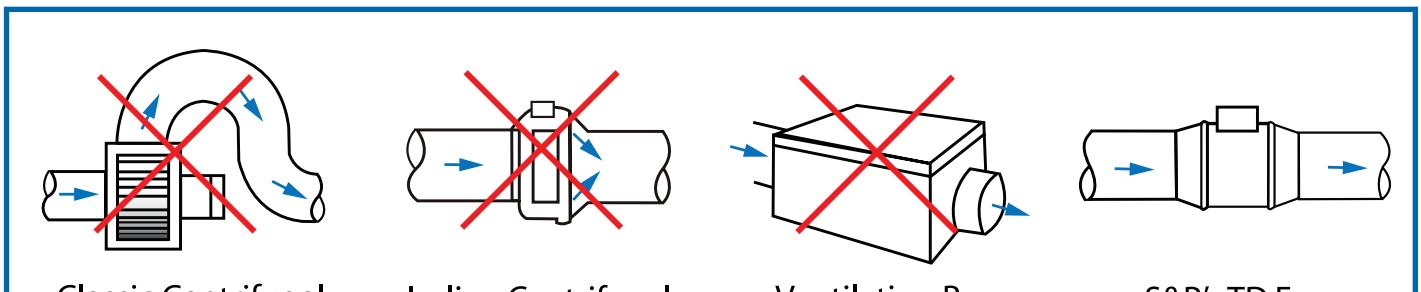
SCS
Speed control slide type

SC
Speed control

5685-2W
2-Speed White Rocker Wall Switch (High/Off/Low)

Mixed Flow Fans vs. Axial & Centrifugal Fans

	Noise Level	Air Volume	Static Pressure
Axial Fans • Low noise levels • High air volumes • Very little static pressure capability*			
Centrifugal Fans • Higher noise levels • Lower air volumes • Very high static pressure capability*			
Mixed Flow Fans** • Low noise levels • High air volumes • Significant static pressure capability*			



*Static pressure is the ability of the fan to overcome resistance such as long or complicated duct runs.

Mixed flow fans (TD series) offer the best of both axial and centrifugal fans and are suitable for most air movement applications. S&P's **TD-MIXVENT & TD-SILENT Series has all the benefits of a mixed flow fan, plus it requires minimal space and it is easy to install.

Also Available from S&P

PV-POWERVENT Fans

MODEL FEATURES

- Exhaust air up to 942 CFM with static pressure capabilities to 1.5” w.g.
- Galvanized steel casing with black backed enamel coating
- Pre-wired junction box
- Ideal for applications where space is limited
- Non-overloading backward inclined wheel for efficiency at higher static pressures
- AMCA Seal for Air Performance
- cULus Listed

Air Performance

Model No.	Nom. RPM	Volts	Max. Watts	CFM v Static Pressure (SP) Ins. WG									Max. SP	Duct Dia. Ins.
				0”	0.125”	0.25”	0.375”	0.5”	0.75”	1.0”	1.25”	1.5”		
PV-100	1400	115	57	108	100	92	85	78	66	52	33	18	1.70	4”
PV-100x	2880	115	84	153	142	130	120	111	96	80	63	34	1.85	4”
PV-125	2350	115	58	128	104	85	74	63	47	32	15	-	1.43	5”
PV-125x	2745	115	85	206	190	170	153	135	110	88	62	33	1.77	5”
PV-150	2750	115	78	245	205	177	157	129	93	59	-	-	1.20	6”
PV-150x	2700	115	130	390	367	340	312	285	233	193	153	110	2.05	6”
PV-200	3100	115	130	402	375	350	327	296	239	179	135	85	1.94	8”
PV-200x	2930	115	180	544	515	485	446	415	360	312	273	230	2.64	8”
PV-250	3000	115	170	568	533	502	471	440	370	312	263	221	2.61	10”
PV-250x	3045	115	214	618	595	570	540	510	450	390	340	297	2.80	10”
PV-315	2600	115	170	654	605	570	525	487	408	333	265	203	2.21	12.4”
PV-315x	2650	115	370	942	905	859	811	762	622	508	440	390	3.90	12.4”

Performance certified is for installation type D-Ducted inlet, Ducted outlet. Performance ratings do not include the effects of appurtenances (accessories). Speed (RPM or RPS) shown is nominal. Performance is based on actual speed of test.

S&P USA certifies that the PV range shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.

*PV 150x and larger ENERGY STAR® qualified

SWF-SIDEWALL Fan

MODEL FEATURES

- Exhaust air up to 416 CFM with static pressure capabilities to 1.5” w.g.
- Galvanized steel casing with black backed enamel coating
- Pre-wired junction box
- Ideal for applications where space is limited
- Non-overloading backward inclined wheel for efficiency at higher static pressures
- cULus Listed

Air Performance

Model	RPM	Volts	Fre-quency	Current	Watts	CFM vs. Static Pressure (SP) Ins. WG								
						0”	0.125”	0.25”	0.375”	0.5”	0.75”	1.0”	1.25”	1.5”
SWF-100	2200	120	60 Hz	0.52 A	57	119	106	92	78	64	44	26	-	-
SWF-100X	2600	120	60 Hz	0.8 A	90	171	162	152	142	118	90	66	46	28
SWF-150	2600	120	60 Hz	0.8 A	90	235	221	197	181	168	122	81	60	27
SWF-150X	2800	120	60 Hz	1.0 A	115	354	332	310	287	266	230	192	147	96
SWF-200	2800	120	60 Hz	1.0 A	115	416	395	368	341	324	287	233	184	132

S&P USA Ventilation Systems, LLC
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P. 904-731-4711 · F. 904-737-8322
www.spvg-northamerica.com

S&P Canada Ventilation Products, Inc.
5600 Ambler Drive
Mississauga, ON L4W 2K9 - Canada
Tel. 416-744-1217 · Fax 416-744-0887
www.solerpalaucanada.com

Soler&Palau Ventilation Group

APPENDIX E

PROPOSED NEW CARBON SYSTEM CUTSHEETS

PureAIR FILTRATION

EXPERTS IN ODOR ELIMINATION

CANNABIS ODOR CAN BE A NUISANCE
WE CAN HELP ELIMINATE IT...
AND THE COMPLAINTS

Side Access Housing (SAH)

- Horizontal airflow system
- Quick access, low maintenance

Packaged Filter Unit (PFU)

- Vertical airflow system
- Powerful & compact

+1 678.935.1431
Toll Free: 866.543.7479
www.PureAirFiltration.com
6050 Peachtree Pkwy Suite 240-187. Atlanta, GA, USA 30092

PureAIR FILTRATION

OUR PRODUCTS & SERVICES

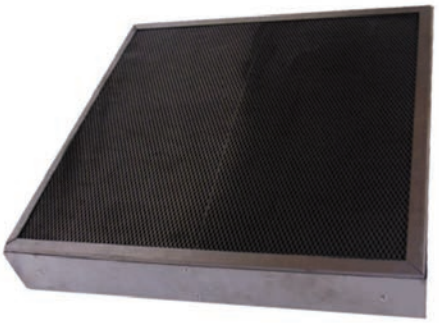
Custom Engineered Equipment

High Quality Chemical Absorbent Media

Air Quality Testing & Monitoring

Live Media Analysis Capacity

Competitive Prices & Top Customer Service



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Side Access Housing (SAH)

PureAir's Side Access Housing (SAH) system provides horizontal airflow with a compact footprint relative to airflow capacity. This system is known for its quick access doors that create a low maintenance profile when media and filter changeouts are needed. The SAH uses disposable PurePak Modules and Matrix™ Filters.

Designed to handle low to medium contaminant levels, PP18 Modules are used for low contaminant levels, but medium contaminant levels require PP12 Modules due to the higher media capacity.

The SAH is our most customizable system, offering up to three media passes, passive, single, or redundant blowers in an array of sizes, materials, and configurations.

PurePak 18 Half Module

PurePak 12 Half Module

Matrix™ Filter

Notable Customers:

- ATK Missile
- Bass Museum of Art
- Baylor University
- Boston Scientific
- CNN Center
- Cargill
- Conagra Foods, Inc.
- Dubai Airport UAE
- Gansen, Germany
- Harvard McKay Lab
- Houston Airport
- NESCop Technologies
- Nestle - Hartwell
- New York Public Library
- Shamrock Farms WWTP
- Under Armour

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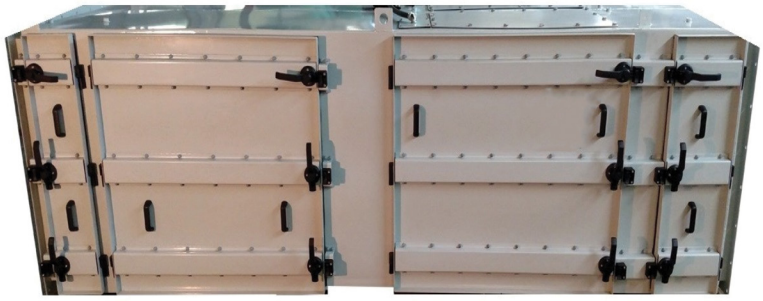
BENEFITS	FEATURES
Compact and Powerful	• Horizontal airflow system • 850 - 67,960 CMH (500 - 40,000 CFM)
Integral	• Connects with HVAC systems • Integrated particulate filter
High Filtration Efficiency	• Positive seal prevents air bypass
Quick Access	• Side doors for easy access to media, filter and blower sections
Low Maintenance	• Ease of replacing or disposing of media modules/filters • Magnehelic pressure gages to measure pressure drop across prefilter and final filter
Customizable	• Multiples sizes and configurations • Explosion proof • UL Rated • Material options: Aluminized CRS, Aluminum, 304 SST, 316 SST • Single or double wall • Lifting lugs • Rain louver • Damper • Weatherproofing
Multiple Applications	• Protect mission critical electronics • Improve indoor air quality • Commercial and industrial odor control

Need odor control for a commercial kitchen?

We have a specific SAH model, the EcoClean™ Kitchen Exhaust Ecology Unit



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