



**BSR/ASHRAE/IES Addendum d
to ANSI/ASHRAE/IES Standard 90.1-2019**

Public Review Draft

Proposed Addendum d to Standard 90.1-2019, Energy Standard for Buildings Except Low-Rise Residential Buildings

**First Public Review (March 2020)
(Draft Shows Proposed Changes to Current Standard)**

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FOREWORD

The current requirements for garage ventilation are fairly lax:

- *Fan systems are only required to reduce exhaust rates down to 50%. Thus a large garage could meet the requirement with two fans, on one 2-speed fan. Currently Standard 62.1 (and model codes based on this Standard) require 0.75 cfm/ft² which is much higher than is needed to meet ventilation requirements even under peak conditions for modern garages with a typical mix of gasoline, hybrid, and electric vehicles. Moreover these peak conditions seldom if ever occur, generally only when many vehicles simultaneously experience cold starts, e.g. at around 6pm for an office building garage. So improved low capacity operation is readily justified.*
- *Provided the system does not have mechanical cooling or heating capability, the exceptions exempt garages smaller than 30000 ft², which would require a 22,500 cfm exhaust system, a relatively large system to run constant volume for the long periods a garage may be open and operational.*
- *Similarly, systems with more than 1500 ft²/HP is exempted. This roughly equates to a static pressure of 2.5" which is very high for garage exhaust systems. This exception exempts also all garage exhaust systems.*

This addendum proposes the following changes:

- *Garages that have separate sections separated by solid walls must have separate exhaust systems and controls. This is so that vehicle activity in one section does not result in unnecessary exhaust in other sections, and it improves safety by ensuring controls are provided in each section. There is no limit to the size of a section; many very large garages have only one section, e.g. all floors of a multi-story garage are often open to one another. Mandating separate systems and controls for each floor or for a certain maximum floor area may not be justified depending on the ventilation system design. For example unducted "Sweep Garage Exhaust Systems" per Taylor, ASHRAE Journal July 2016 can very efficiently serve a large garage. With "sweep" systems, ventilation in one section also ventilates the upstream sections at no added cost. Requiring small sections would disallow the system and essentially mandate much less efficient ducted systems.*
- *Controls must be able to reduce airflow down to 20% or less, reduced from 50% in the current standard. This minimum is readily provided by multiple stages fans or fans with variable speed drives. The 20% value matches the requirements of California's Title 24 requirement of 0.15 cfm/ft² (20% of the 0.75 cfm/ft² design airflow requirement).*
- *The system must include variable speed drives or equivalent to reduce power as airflow is reduced. The language "30% of design wattage at 50% of the design airflow" is used throughout the standard to infer this performance. The 50% value may appear to conflict with the 20% value in the previous bullet but it does not; it is simply a rating point. Note that systems that include some low power constant volume destratification (aka "jet") fans can still meet this requirement provided the main*

exhaust fans are variable speed. These fans can also be readily made to be variable speed, e.g. with electronically commutated motors.

- *The first exception is revised to address motor size, not garage size, since the cost of variable speed drives is directly a function of motor size. The size of the garage is indirectly addressed because motor size is tied to airflow rate which in turn is tied to garage size. The 5 HP limit is the same as that used for fan power in other sections and previously shown to be life cycle cost effective.*
- *The second exception is eliminated because, as noted above, it exempts too many systems and not relevant given the 5 HP limit is included.*
- *The last exception is eliminated because safety codes and authorities having jurisdiction always supercede Standard 90.1 requirements per Section 2.4 and need not be repeated here.*

Note that, consistent with the current Standard 90.1 requirements for demand-control ventilation in garages (as well as densely occupied spaces and kitchen exhaust hoods), the contaminants required to be monitored and their setpoints are not addressed. These must be addressed by the designer based on their application (e.g. vehicle engine type) and health codes and standards.

Cost Impact: Costs will increase for pollutant sensors and fan variable speed drives. Cost effectiveness is assured by the LCCA done for VAV systems, variable flow chilled water pumps, and cooling tower fans which have the same 5 hp threshold yet operate fewer hours and/or much less turndown than garage ventilation fans.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum d to 90.1-2019

Modify the standard as follows (IP and SI Units)

6.4.3.4.5 Enclosed Parking Garage Ventilation

Enclosed parking garage ventilation systems shall meet all of the following:

- Separate ventilation systems and control systems shall be provided for each garage section that is separated from other sections by solid walls effectively restricting airflow from one section to another.
- Control systems for each garage section shall automatically detect contaminant levels and stage fans or modulate reduce fan airflow rates to 50% 20% or less of design capacity, provided acceptable contaminant levels are maintained.
- The ventilation system for each garage section shall have controls and/or devices, such as variable speed drives, that result in fan motor demand of no more than 30% of design wattage at 50% of the design airflow.

Exceptions to 6.4.3.4.5

- ~~1. Garages ventilation systems serving a single garage section having a total ventilation system motor nameplate horsepower [kilowatt rating] not exceeding 5 hp [3.7 kW] at fan system design conditions less than 30,000 ft² with ventilation systems and that do not utilize mechanical cooling or mechanical heating.~~
- ~~2. Garages that have a garage area to ventilation system motor nameplate horsepower ratio that exceeds 1500 ft²/hp and do not utilize mechanical cooling or mechanical heating.~~
- ~~3. Where not permitted by the authority having jurisdiction.~~