ADDENDA

**ASHRAE Addendum f to**
**ASHRAE Guideline 36-2018**

# High Performance Sequences of Operation for HVAC Systems

Approved by ASHRAE on January 27, 2020.

This addendum was approved by a Standing Guideline Project Committee (SGPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the guideline. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

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 ISSN 1049-894X

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This Guideline was developed under the auspices of ASHRAE. ASHRAE Guidelines are developed under a review process, identifying a Guideline for the design, testing, application, or evaluation of a specific product, concept, or practice. As a Guideline it is not definitive but encompasses areas where there may be a variety of approaches, none of which must be precisely correct. ASHRAE Guidelines are written to assist professionals in the area of concern and expertise of ASHRAE's Technical Committees and Task Groups.

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Development of ASHRAE Guidelines follows procedures similar to those for ASHRAE Standards except that (a) committee balance is desired but not required, (b) an effort is made to achieve consensus but consensus is not required, (c) Guidelines are not appealable, and (d) Guidelines are not submitted to ANSI for approval.

The Senior Manager of Standards of ASHRAE should be contacted for

a. interpretation of the contents of this Guideline,
b. participation in the next review of the Guideline,
c. offering constructive criticism for improving the Guideline, or
d. permission to reprint portions of the Guideline.

**(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)**

## FOREWORD

*In Section 3.2.1.5, the designer is required to provide set point S-R-DIFF, which is the airflow differential between supply air and return air fans required to maintain building pressure at desired pressure when using the Return Fan Tracking control option. In Section 5.16.11.2, the AHU return fan speed is controlled so that return airflow rate tracks the supply airflow rate less S-R-DIFF. Issues with this logic:*

a. *This maintains a fixed offset even when the AHU is not in occupied mode, i.e., when minimum ventilation outdoor air is zero. This causes excess outdoor air during warm-up, setback, cooldown, and setup to make up this differential. The differential can also be caused if the return air fan is smaller in size than the supply air fan, which is common. Because VAV zones can operate at cooling-maximum during these modes, the supply air fan is often at full speed, and its airflow can exceed the return fan's capabilities, again resulting in excess outdoor air.*
b. *The offset is the same regardless of how many Zone Groups are in occupied mode. Clearly, the amount of air needed for pressurization will be lower when not all zones are being supplied.*

*This addendum addresses both issues by assuming the amount of air needed for pressurization is proportional to the area-component of the ventilation rate. This was deemed to be the variable the control system knows that is likely to be most indicative of the airflow needed for pressurization. If no zones are in occupied mode, the offset set point would be zero.*

*Note that Figures 5.16.2.3-2 and 5.16.2.3-3, which apply to AHUs with return fans using either airflow tracking or direct building pressure control, call for the outdoor air damper to be wide open during all operating modes, including warm-up, setback, cooldown, and setup. This has the advantage of decoupling the return fan and supply fan when the S-R-DIFF is set to zero—if the outdoor air damper were closed, the fans would be in series and airflow tracking would be unstable, as the action of one fan affects the other. But having the outdoor air damper open can cause excess outdoor air intake if there are airflow calibration differences between the return fan and supply fan, e.g., if the return fan airflow reading is higher than actual return airflow, causing return airflow to be less than supply airflow, with the remainder being nonzero outdoor airflow. Another issue with Figures 5.16.2.3-2 and 5.16.2.3-3 is that they effectively only work if the minimum outdoor air control scheme uses a single airflow measuring station, as opposed to separate minimum outdoor air and economizer outdoor air dampers. These issues will be addressed by future addenda.*

***Note:*** In this addendum, changes to the current standard are indicated in the text by <u>underlining</u> (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

## Addendum f to Guideline 36-2018

***Revise Section 3.2.1.5 as shown (I-P and SI).***

**3.2.1.5 Return-Fan Airflow ~~Differential~~ <u>Tracking Set Points</u>.** (For return-fan airflow tracking control, see (Section 5.16.11.)

a. **S-R-DIFF.** The airflow differential between supply air and return air fans required to maintain building pressure at desired pressure (e.g., 12 Pa [0.05 in. of water]) using a handheld sensor if a permanent sensor is not provided. All exhaust fans that normally operate with the air handler should be on.
b. <u>**Vrf-max.** The maximum return fan airflow rate, typically the scheduled design airflow rate.</u>

***Revise Section 5.16.11 as shown (I-P and SI).***

**5.16.11 Return-Fan Control—Airflow Tracking**

**5.16.11.1** Return fan operates whenever associated supply fan is proven ON.

**5.16.11.2** The active differential airflow set point S-R-DIFF* shall be S-R-DIFF for the entire system (see Section 3.2.1.5) adjusted by the sum of the area component of the breathing zone outdoor airflow rate of zones in Zone Groups that are in occupied mode relative to that in all zones served by the system.

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*The equations below will result in S-R-DIFF set to zero if no zones are in occupied mode, e.g., during warm-up, cooldown, setback, and setup modes.*

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**If the project is to comply with California Title 24 ventilation requirements, keep (b) and delete (a).**

**If the project is to comply with ASHRAE Standard 62.1 ventilation requirements, keep (a) and delete (b).**

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a. $$S-R-DIFF^{*} = S-R-DIFF \frac{\sum \text{All occupied zones } (V_{bz-A})}{\text{All zones } (V_{bz-A})}$$

b. $$S-R-DIFF^{*} = S-R-DIFF \frac{\sum \text{All occupied zones } (V_{area-min})}{\text{All zones } (V_{area-min})}$$

**5.16.11.~~2~~3** Return-fan speed shall be controlled to maintain return airflow equal to supply airflow less differential S-R-DIFF*~~, as determined per Section 3.2.1.5~~.

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*The following logic will keep supply airflow from exceeding the capability of the return fan, which is often designed to be smaller than the supply fan, which can result in excess outdoor air intake. This becomes an issue when S-R-DIFF* is zero during warm-up, cooldown, setback, and setup modes, because the supply air fan can be at full speed due to VAV boxes operating at Vcool-max during these modes.*

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**5.16.11.4** Supply fan airflow shall be limited by a reverse-acting P-only loop whose set point is (Vrf-max + S-R-DIFF*) and whose output is maximum supply fan speed ranging from 0% to 100%.

**5.16.11.~~3~~5** Relief/exhaust dampers shall be enabled when the associated supply and return fans are proven ON and closed otherwise. Exhaust dampers shall modulate as the inverse of the return air damper per Section 5.16.2.3.4.

# POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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