ADDENDA

ASHRAE Addendum b to
ASHRAE Guideline 36-2018

High-Performance Sequences of Operation for HVAC Systems

Approved by ASHRAE on August 16, 2019.

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 (https://www.ashrae.org/continuous-maintenance).

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FOREWORD

Guideline 36 includes Section 5.1.14, "Trim & Respond (T&R) Set-Point Reset Logic," under Section 5, "Sequences of Operation."

This addendum proposes to replace the current version of control for Trim & Respond so that trimming does not occur each time step—basically, the logic is Trim or Respond, although the name is not changed given its common use in practice and in the literature. The logic requires that SPres be unequal to SPtrim, or a stall (no set point change) occurs where the two cancel out. This revision eliminates that problem because the equation prevents trimming and responding in the same time step.

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

Addendum b to Guideline 36-2018

Delete the first sentence of the informative note below Table 5.1.14.3.

Table 5.1.14.3 Trim & Respond Variables

Variable	Definition
Device	Associated device (e.g., fan, pump)
SP0	Initial set point
SPmin	Minimum set point
SPmax	Maximum set point
Td	Delay timer
T	Time step
I	Number of ignored requests
R	Number of requests from zones/systems
SPtrim	Trim amount
SPres	Respond amount (must be opposite in sign to SPtrim)
SPres-max	Maximum response per time interval (must be same sign as SPres)

Informative Note: ~~Note that it is recommended that |SPres| > |SPtrim| so that the reset logic does not become stuck at a value, as can happen if SPres and SPtrim are equal in absolute value.~~ The number of ignored requests (I) should be set to zero for critical zones or air handlers.

Revise 5.1.14.4 as shown.

Trim & Respond logic shall reset setpoint within the range SPmin to SPmax. When the associated device is off, the setpoint shall be SP0. The reset logic shall be active while the associated device is proven on, starting Td after initial device start command. When active, after every time step T, if R ≤ I, trim the setpoint by SPtrim. If there are more than I Requests, respond by changing the setpoint by SPres * (R-I), (i.e., the number of Requests minus the number of Ignored Requests), but no more than SPres-max. In other words, every time step T:

If R ≤ I, ~~C~~change setpoint by SPtrim.

If R > I, ~~also~~ change setpoint by $(R - I)*SP_{res}$ but no larger than SPres-max.

Revise the informative example as shown. Delete Informative Figure 5.1.14.4 and replace with the new version shown.

The following is an example of a sequence that uses T&R to control the static pressure set point of a VAV AHU serving multiple downstream zones. This sequence defines the T&R variables as shown in Informative Table 5.1.14.4.

Description of General Operation:

Starting 5 minutes after the fan status indicates the supply fan is ON, the sequence will slowly reduce the AHUs static pressure set point by 10 Pa (0.04 in. of water) every 2 minutes if R ≤ I. As static pressure drops, downstream VAV box dampers will open further for a given load. When the combination of reduced static pressure and changes in load drives more than two VAV boxes more than 95% open, the system will respond by increasing static pressure set point by 15 Pa (0.06 in. of water) for every request but no more than a maximum of 37 Pa (0.15 in. of water), regardless of the number of requests. The set point will continue to increase every 2 minutes until all but 2 VAV boxes (for Ignored Request value of 2) are satisfied (damper position < 85%). Subsequently, the set point will continue to decrease by 10 Pa (0.04 in. of water) every 2 minutes.

Example:

(Note: For the example below, the net result for each time step is separately calculated using the variables in Pascal units and in units of inches of water column, in order to facilitate following the example in either units. Thus, the unit conversion of the net result is not exact at each time step.)

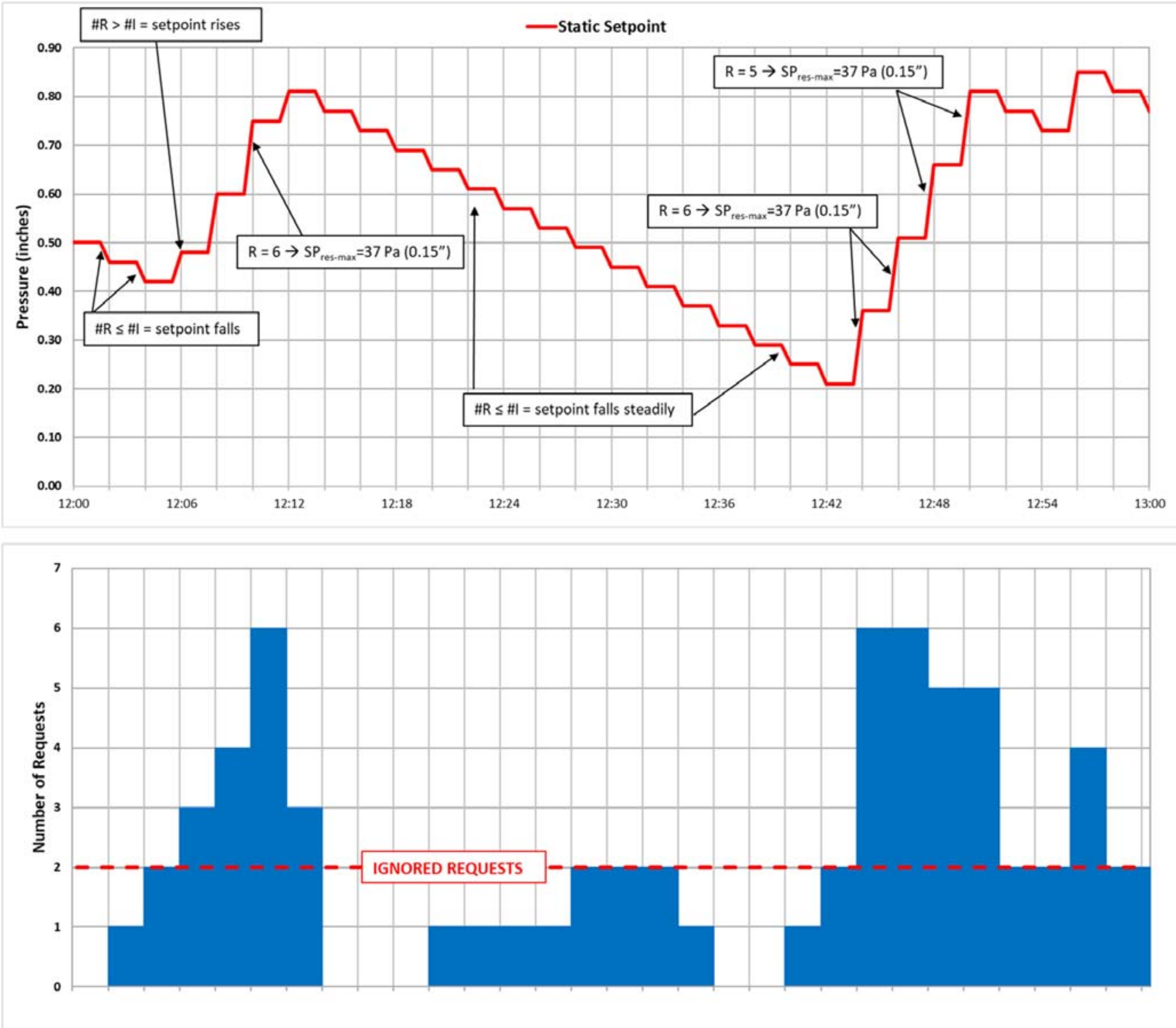
- *System starts at 11:55. Initial set point is 120 Pa (0.5 in. of water). At 12:00 (Td after start time), the reset begins.*
- *At 12:02 (i.e., 1*T after reset begins), there is one request (i.e., R = 1). Because R < I, ~~T~~trim component reduces set point by SPtrim, which is 10 Pa (0.04 in. of water)~~; because R – I < 0, there is no response component. Net result: set point is 110 Pa (0.46 in. of water)~~.*
- *At 12:04 (i.e., 2*T), there are two requests (i.e., R = 2). Because R = I, ~~T~~trim component reduces set point by 10 Pa (0.04 in. of water)~~; because R – I = 0, there is no response component.~~ Net result: set point is 100 Pa (0.42 in. of water).*
- *At 12:06 (i.e., 3*T), there are three requests (i.e., R = 3): ~~Trim component reduces set point by 10 Pa (0.04 in. of~~*

~~water);~~ ~~b~~Because R – I = 1, response component increases set point by 15 Pa (0.06 in. of water) (i.e., 1*SPres). Net result: set point is ~~105~~115 Pa (~~0.44~~0.48 in. of water)~~ (i.e., +5.0 Pa [+0.02 in. of water] net change)~~.

- At 12:08 (i.e., 4*T), there are four requests (i.e., R = 4). ~~Trim component reduces set point by 10 Pa (0.04 in. of water);~~ ~~b~~Because R – I = 2, response component increases set point by 30 Pa (0.12 in. of water) (i.e., 2*SPres). Net result: set point is ~~125~~145 Pa (~~0.52~~0.60 in. of water)~~ (i.e., +20 Pa [+0.08 in. of water] net change)~~.
- At 12:10 (i.e., 5*T), there are six requests (i.e., R = 6). ~~Trim component reduces set point by 10 Pa (0.04 in. of water);~~ ~~b~~Because R – I = 4, but SPres-max = 37 Pa (0.15 in. of water), response component increases set point by the maximum of 37 Pa (0.15 in. of water) (i.e., not 4*SPres = 60 Pa [0.24 in. of water]). Net result: set point is ~~152~~182 Pa (~~0.63~~0.75 in. of water)~~ (i.e., 37 Pa [+0.15 in. of water] net change)~~.
- At 12:12 (i.e., 6*T), there are three requests (i.e., R = 3). ~~Trim component reduces set point by 10 Pa (0.04 in. of water);~~ ~~b~~Because R – I = 1, response component increases set point by 15 Pa (0.06 in. of water) (i.e., 1*SPres). Net result: set point is ~~157~~197 Pa (~~0.65~~0.81 in. of water).
- At 12:14 (i.e., 7*T), there are zero requests (i.e., R = 0). Because R < I, t~~T~~rim component reduces set point by 10 Pa (0.04 in. of water)~~; because R – I < 0, there is no response component.~~ Net result: set point is ~~147~~187 Pa (~~0.61~~0.77 in. of water).

Informative Figure 5.1.14.4 shows a trend graph of the example above, continued for a period of an hour.

The system will tend toward minimum static pressure (thus saving energy) but respond rapidly to increasing demand from the terminal units. A cyclic pattern is characteristic of a robust T&R loop—the set point is not expected to remain static except at its minimum and maximum values. Note that Informative Figure 5.1.14.4 was created to illustrate how requests are used to reset the set point and does not necessarily represent the expected behavior of an actual T&R loop, although the long, slow cycling of the set point value is typical of T&R control.



Informative Figure 5.1.14.4 Example sequence trend graph.

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