

ADDENDA

**ANSI/ASHRAE/IES Addendum az to
ANSI/ASHRAE/IES Standard 90.1-2019**

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by ASHRAE and the American National Standards Institute on January 21, 2022, and by the Illuminating Engineering Society on January 18, 2022.

This addendum was approved by a Standing Standard Project Committee (SSPC) 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 standard. Instructions for how to submit a change can be found on the ASHRAE® website (<https://www.ashrae.org/continuous-maintenance>).

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

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FOREWORD

Addendum az provides language and justification for compressed air system coverage in ASHRAE Standard 90.1. Including compressed air system requirements in Standard 90.1 ensures best energy management and design practices in a widespread, high-impact end-use category that remains underserved by codes and standards.

This addendum includes five measures for compressed air systems, each of which addresses separate common sources of energy waste:

- a. *Trim compressors and storage*
- b. *Advanced controls*
- c. *Leak testing*
- d. *Monitoring*
- e. *Pipe sizing*

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

Addendum az to Standard 90.1-2019

Modify Section 3 as shown (I-P and SI).

[...]

trim compressor: a compressor that is designated for part-load operation, handling the short-term variable trim load of end uses in addition to the fully loaded base compressors.

[...]

Modify Section 10 as shown (I-P and SI) and renumber existing sections.

10.4.6 Compressed Air Systems. All compressed air *systems* in factory industrial occupancies shall meet the requirements of Sections 10.4.6.1 through 10.4.6.5. These requirements apply to the compressors, related *pipng systems*, and *controls* that provide compressed air. This section does not apply to any *equipment* or *controls* that use or process the compressed air.

Exception to 10.4.6: Medical air *systems*.

10.4.6.1 Part-Load Controls and Efficiency. Compressed air *systems* where the total motor power is 25 hp (18 kW) or more shall be equipped with appropriately sized *trim compressor(s)* and primary storage. The compressed air *system* shall comply with either of the following:

- a. The compressed air *system* shall include one or more variable speed drive (VSD) compressors. For *systems* with more than one compressor, the total combined capacity of the VSD compressor(s) acting as *trim compressors* must be at least 1.25 times the largest net capacity increment between combinations of compressors. The compressed air *system* shall include primary storage of at least three (3) gallons per actual cubic feet per minute (acfm) (8 litres per L/s) of the largest *trim compressor*.
- b. The total effective trim capacity of a compressor system is the size of the continuous operational range where the specific power of the compressor(s) (kW/100 acfm) (kW/50 L/s) is within 15% of the specific power at their most efficient operating point. The total effective trim capacity of the system is the sum of the effective trim capacity of the *trim compressors*.

Systems shall include primary storage of at least four (4) gallons per acfm (8 litres per L/s) of the largest trim compressor and meet (1) or (2) as follows:

1. *Systems* with more than one compressor, not including backup compressors, shall include a compressor or set of compressors with total effective trim capacity at least the size of the largest net capacity increment between combinations of compressors, or the size of the smallest compressor, whichever is larger.

2. For systems with one compressor, not including backup compressors, the total effective trim capacity shall include the range from 70% to 100% of rated capacity.

Exceptions to 10.4.6.1:

1. Alterations where the total combined added or replaced compressor motor power is less than the average per-compressor power of all compressors in the system.
2. Alterations where all added or replaced compressors are VSD compressors and the compressed air system includes primary storage of at least three (3) gallons per actual cubic feet per minute (acfm) (8 litres per L/s) of the largest trim compressor.
3. Compressed air systems that have been approved by the authority having jurisdiction as having demonstrated that the system serves loads for which typical air demand fluctuates less than 10%.
4. Alterations of existing compressed air systems that include one or more centrifugal compressors.

10.4.6.2 Controls. Compressed air systems with three or more compressors, including backup compressors, with a combined input power of more than 150 hp (112 kW) shall operate with controls that are able to choose the most energy-efficient combination and loading of compressors in the system based on the current compressed air demand.

10.4.6.3 Monitoring. Compressed air systems having a combined input power rating equal to or greater than 150 hp (112 kW) shall have an energy and air demand monitoring system with the following minimum requirements:

- a. Measurement of system pressure
- b. Measurement or calculation of current or power of each compressor
- c. Measurement or determination of total airflow from all compressors in acfm (L/s or m³/h)
- d. Data logging of pressure, power in kW, airflow in acfm (L/s or m³/h), and compressed air system specific power in kW/100 acfm (kW/50 L/s) at intervals of five (5) minutes or less
- e. The equipment shall be configured to record not less than six (6) months of data and shall be capable of exporting the data.
- f. Visual trending display of each recorded point, load, and specific power.

10.4.6.4 Leak Testing of Compressed Air Piping. Compressed air system piping shall be pressure tested after being isolated from the compressed air supply, storage tanks, and end uses. The piping shall be pressurized to the design operating pressure and the pressure allowed to stabilize. Test pressures shall be held for no less than 30 minutes, with no loss of pressure greater than 1.0%.

For piping less than or equal to 50 adjoining feet (16 adjoining metres) in length, connections shall optionally be tested with a noncorrosive leak-detecting fluid or other leak detecting methods at the discretion of the authority having jurisdiction.

10.4.6.5 Pipe Sizing. For new systems and additions to systems with operating pressures above 50 psig (350 kPa [gage]), compressed air piping greater than 50 adjoining feet (16 adjoining metres) in length shall be designed and installed to minimize frictional losses in the distribution network.

Service line piping that delivers compressed air from distribution piping to end uses shall have inner diameters greater than or equal to 1 in. (25 mm).

Added or replaced piping in existing systems shall meet the requirements of 10.4.6.5(a). New systems shall meet the requirements of either 10.4.6.5(a) or (b).

- a. **Piping section average velocity.** Compressor room interconnection and main header piping shall be sized so that at coincident peak flow conditions the average velocity in the segment of pipe is no greater than 20 ft/s (6 m/s). Compressor room interconnection and main header piping are the pipes that deliver compressed air from the compressor outlets to the inlet to the distribution piping. Each segment of distribution and service piping shall be sized so that at coincident peak flow conditions the average velocity in the segment of pipe is no greater than 30 ft/s (9 m/s). Distribution piping is pipes that deliver compressed air from the compressor room interconnection piping or main header piping to the service line piping.
- b. **Piping total pressure drop.** Piping shall be designed such that piping frictional pressure loss at coincident peak loads are less than 5% of operating pressure between the compressor and connection at point of use, prior to any end-use regulators.

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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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