STANDARD

ANSI/ASHRAE/ACCA Standard 180-2018
(Supersedes ANSI/ASHRAE/ACCA Standard 180-2012)

Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems

Approved by ASHRAE on June 11, 2018; by the Air Conditioning Contractors of America on May 13, 2018; and by the American National Standards Institute on June 11, 2018.

 ISSN 1041-2336

ASHRAE Standard Project Committee 180
Lead Cognizant TC: 7.3, Operation and Maintenance Management
Co-Cognizant TCs: 2.4, Particulate Air Contaminants and Particulate Contaminant Removal Equipment; and
TC 9.8, Large Building Air-Conditioning Applications
SPLS Liaison: R. Lee Millies, Jr.

Thomas L. Paxson*, *Chair*
Donald R. Langston*, *Vice-Chair*
Richard A. Danks*, *Secretary*
Hywel Davies
Bill R. Benito*
Michael Blazey
Glenn Friedman*
Michael W. Gallagher
Kristin H. Heinemeier*
Donald C. Herrmann
Peter C. Jacobs*
Michael J. Lawing*
Benjamin E. Lipscomb
Phil London*
Phil Maybee*
Marc Newman*
Heather L. Platt*
Donald Prather*
Gregg A. Ray*
George Rodriguez*
Dale T. Rossi*
Robert J. Roth
Jeff O. Sturgeon*
John Warfield

** Denotes members of voting status when the document was approved for publication*

ACCA–EI Standards Task Team 2018–2019

Phil Forner, *Chair*
Dave Galbreath, *Vice-Chair*
Danny Halel, *Secretary*
Tom Jackson
Warren Lupson
Raymond Granderson
Timothy Offord
Joe Pacella
Matt Todd
Brent Ursenbach

ASHRAE STANDARDS COMMITTEE 2017–2018

Steven J. Emmerich, *Chair*
Donald M. Brundage, *Vice-Chair*
Niels Bidstrup
Michael D. Corbat
Drury B. Crawley
Julie M. Ferguson
Michael W. Gallagher
Walter T. Grondzik
Vinod P. Gupta
Susanna S. Hanson
Roger L. Hedrick
Rick M. Heiden
Jonathan Humble
Srinivas Katipamula
Kwang Woo Kim
Larry Kouma
Arsen K. Melikov
R. Lee Millies, Jr.
Karl L. Peterman
Erick A. Phelps
David Robin
Peter Simmonds
Dennis A. Stanke
Wayne H. Stoppelmoor, Jr.
Richard T. Swierczyna
Jack H. Zarour
Lawrence C. Markel, *BOD ExO*
M. Ginger Scoggins, *CO*

Steven C. Ferguson, *Senior Manager of Standards*

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

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

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for

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

CONTENTS

ANSI/ASHRAE/ACCA Standard 180-2018
Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems

NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

(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

2018 Revision

This 2018 edition of ANSI/ASHRAE/ACCA Standard 180 represents a complete revision of the standard. A thorough review of the 2012 edition of the standard using the continuing maintenance process resulted in improvements, revisions, and updates to the tables in Section 5. These changes were necessary to eliminate duplication, add additional tasks, list equipment tables in alphabetical order for easier reference, and consolidate similar equipment.

After publication of the 2012 edition, on recommendation of the committee, the standard was removed from continuous maintenance, and the Project Committee became inactive. In 2014, the committee received, along with requests for a user's manual, a request for clarification of how the standard might be used in conjunction with utility maintenance incentives. Subsequently, the ASHRAE Standards Committee reactivated the SPC 180 Project Committee to perform a full review of the document.

Specific effort was expended to make the standard easier to implement, with the understanding that many of the responsible parties would be contracting out their maintenance. Definitions were added to differentiate between inspection, maintenance, service, and repair tasks. The process section of the standard was modified to eliminate ambiguity and to clarify how a maintenance program was to be initiated and implemented. The nonnormative language in the 2012 edition was moved to the appendix. Tables were improved by adding columns to clarify which actions were required inspections, which were required maintenance, and which were recommendations. Lastly, the appendices were updated for clarity.

With these improvements the committee felt that a user's manual would not be required for the time being. They also agreed that continuous maintenance would not be required but that funds should be reserved for the development of a user's manual if later evidence warranted.

About Standard 180

Standard 180 was created in a collaborative effort between ASHRAE and Air Conditioning Contractors of America (ACCA). Its intent is to address the often inconsistent practices for inspecting and maintaining HVAC systems in commercial, institutional, and other buildings where the public may be exposed to the indoor environment. Current practices in such buildings vary widely. Many facilities choose to follow rigorous policies that maintain the system in new or nearly new condition. Others either lack policy in this area or have adopted a run-to-failure approach, where the system or components of the system are only attended to when there is a failure.

To provide consistency and improve the thermal comfort, energy efficiency, and indoor air quality of commercial HVAC systems, a standard practice for their inspection and maintenance is needed. When there is no routine inspection and subsequent adjustment or maintenance of system components, the system is typically found operating outside its optimum performance parameters. When systems are not maintained, they do not continue to provide the level of performance for which they were designed.

A standard practice is also needed to guide maintenance of HVAC systems, because often the maintenance information supplied by manufacturers applies only to the discrete components that they provide rather than to the entire system. This document considers the integration of those components and the way they interact, as well as each component separately.

For the public good, it is essential that the HVAC systems in all buildings where people work, visit, or reside support a high-quality indoor environment. In addition, sustainability mandates that those conditions be maintained in a manner as energy efficient as possible.

This document describes the minimum acceptable level of maintenance for commercial building HVAC systems. Other standards or guidance documents may establish more specific or rigorous requirements that apply to certain buildings. Where applicable, those requirements should be followed or considered (if guidelines). This document is not intended to limit the level of service provided or recommendations made by a service provider. Those delivering HVAC maintenance are encouraged to consider and recommend energy conservation measures or technology improvements that would help maintain or increase thermal comfort, the energy efficiency of the HVAC system, and indoor air quality.

Much of the information that will be required to prepare the maintenance program that is mandated by this standard can most conveniently be obtained from the building commissioning (recommissioning or retrocommissioning) documents. Although recommissioning is not a requirement of this standard, it should be considered where the commissioning data are either unavailable or outdated. Additionally, ASHRAE Guideline 4, Preparation of Operating and Maintenance Documentation for Building Systems*, and ASHRAE Guideline 32,* Sustainable, High-Performance Operations and Maintenance*, may be helpful to practitioners seeking to develop or expand maintenance programs. ASHRAE continues to provide industry reference documents and is in the process of preparing other guidelines on commissioning and training. Refer also to this standard's Informative Appendix C, "Bibliography," which lists many reference documents by ASHRAE and other organizations as well as industry technical papers and publications. Some of these documents include ideas regarding best practices or reliability-centered maintenance or other means and methods above the minimum standard.*

This standard is written in code-intended language so it may be referenced or adopted by enforcement authorities as the minimum acceptable level of performance within their jurisdictions.

Note that this standard is specifically focused on the impacts of maintenance on occupant thermal comfort, energy efficiency, and indoor air quality. Additional maintenance program considerations related to equipment reliability, equipment robustness, and minimizing overall maintenance costs are also appropriate in order to support sustainability efforts, protect the HVAC capital investment, and/or minimize system downtime. These considerations, however, fall outside the scope of this standard.

Dedication

This edition of ANSI/ASHRAE/ACCA Standard 180 is dedicated to the memory of Robert G. Baker, F-ASHRAE, the visionary who recognized and championed the need for an ANSI/ASHRAE/ACCA maintenance standard. Mr. Baker served as Chairman of the committee that developed the first version of this standard in 2008.

1. PURPOSE

The purpose of this standard is to establish minimum HVAC inspection and maintenance requirements that preserve a system's ability to achieve acceptable thermal comfort, energy efficiency, and indoor air quality in *commercial buildings*.

2. SCOPE

2.1 This standard provides minimum requirements for the HVAC system inspection and maintenance practice in new and existing buildings. Where specifically noted in this standard, different requirements apply.

2.2 The provisions of this standard do not apply to

a. single-family houses or multifamily structures of three or fewer stories above grade;
b. HVAC *equipment* and portions of building systems that primarily provide for industrial, manufacturing, or *commercial processes*; or
c. other building HVAC systems or elements of building HVAC systems that this standard specifically identifies.

2.3 This standard shall not be used to circumvent any safety, health, or environmental requirements.

3. DEFINITIONS

Many of the terms used in this standard are defined in *ASHRAE Terminology of Heating, Ventilation, Air-Conditioning, and Refrigeration*. Additional terms used in this standard are defined below.

Basis of Design (BoD): a guidance document that stipulates or lists the desired or intended function and *performance* of the HVAC system. It lists the needs, requirements, flexibility, efficiency, limits, *performance*, desired condition, etc., of the space served by the HVAC systems, and it is intended to communicate this information from the HVAC system designer to the HVAC systems owner to the operator or to subsequent owners and operators.

building management system (BMS): an energy management system relating to the overall operation of the building in which it is installed. It often has additional capabilities, such as *equipment* monitoring, protection of *equipment* against power failure, and building security. It may also be a direct digital control (DDC) system (programmable computer or microprocessor *equipment* executing the HVAC system operation) where the mode of control uses digital outputs to control processes or elements directly.

commercial building: includes but is not limited to governmental and educational facilities, health care and hospitality facilities, institutional buildings, offices, places of assembly, restaurants, and buildings for retail and wholesale businesses.

commercial HVAC: any nonresidential or nonprocess or manufacturing-related HVAC application, including, but not limited to, applications for governmental and educational facilities, health care and hospitality facilities, institutional buildings, offices, places of assembly, restaurants, and retail and wholesale businesses.

commercial process: a process used primarily to produce, manipulate, or hold material goods or works, such as cold food storage, painting, *equipment* assembly or repair, clothing assembly or cleaning, etc. It is used in manufacturing, assembly, repair, conditioned storage, and treatment systems.

condition: the assessed physical characteristics of *equipment*, such as visual appearance and working order (noise, odor, vibration, or fluid leaks), as compared to a desired state or standard. *Condition* is also the measurement of the delivery of the intended output capacities of the *equipment* that are compared to agreed-upon *condition* standards. These assessments and measurements shall be documented. (***Informative Note:*** Unacceptable *condition* is determined by comparing the findings to the agreed-upon baseline *condition indicator* values.)

condition history: the documentation over time of the assessments and measurements of *equipment* and systems inspections. Changes in *condition*, and rate of change in *equipment condition*, may require further investigation to determine proper response, such as revised *task* frequencies, revised *task* procedures, or scheduled replacement.

condition indicators: descriptions and measures of the physical characteristics and delivery *performance* of *equipment*. The described characteristics and *performance* are outcomes of operation and maintenance work. Actual outcomes, when compared to the desired standard, serve to measure the effectiveness of the systems and *equipment condition* and *performance*, and the effectiveness of the *maintenance program*. These are developed by responsible party (owner) in collaboration with the maintenance providing party. (***Informative Note:*** For example, the amount of rust on interior surfaces of an air handler is a measure of a physical characteristic, and when compared to a desired standard, such as new *condition*, establishes the *condition* of the asset. The air volume flow rate of the air handler compared to design rate is an indicator of a *performance* characteristic.)

corrective action: work required to restore systems or *equipment* to an acceptable *condition*.

equipment: the assembly of machines and devices in a logical manner that work systematically to provide an intended, conditioned environment for the facility.

inspection frequency: time period or interval in which occurrences of inspections are to be made. The period of *inspection frequency* may be based on timed intervals (i.e., weekly, monthly, quarterly, or annually) or on hours of use (run time), or system *condition*, as established in the *maintenance plan*.

inventory: the orderly documentation of system and *equipment* data that are used to provide detailed identification of

what is operated, inspected, and maintained. Each inventoried piece of *equipment* shall be uniquely identified.

inspection task: a work item to observe the *condition* of a piece of *equipment* or component and assess its normalcy.

maintenance plan: is a document that defines the level of effort for performing inspection and maintenance work required to support the facility's requirements for a given time period. The *maintenance plan* systematically establishes planning, organizing, and control for the inspection and maintenance work to be accomplished within resource limits. The *maintenance plan* includes the list of inspection and *maintenance tasks*, schedule for performing these *tasks*, method and measures for evaluating work *performance*, and desired results for the systems and *equipment* and *maintenance program*.

maintenance program: the overarching philosophy, management, and organization structure required to achieve the goals and requirements established for the facility and its occupants. The program explains how maintenance will be executed and managed to preserve the *condition* and capability of the HVAC systems and *equipment* to enable delivery of the intended thermal comfort, energy efficiency, and indoor air quality required for the facility. The program shall include an *inventory* of *equipment* to be inspected and maintained, a *maintenance plan* for executing the work, minimum documentation, requirements for authorizing and executing the work, a process to revise the program in an orderly manner, and a process for periodic program review and evaluation.

maintenance program objectives: the standards or desired end states that define desired outcomes of the *maintenance program* for HVAC systems. These include documentation of the desired measurable goals for the facility in terms of energy efficiency, thermal comfort, and indoor air quality, as well as any other goals of the *maintenance program* as defined by the responsible party and agreed to by the implementing party.

maintenance task: a work item requiring a minimum of tools to adjust components and restore expendable materials (such as fluids and filters) to their agreed upon *condition*. (Informative Note: Typical examples of such *tasks* include cleaning, adjusting, tightening, calibration, measurement, and lubrication.)

performance: a quantifiable measure of *equipment* or system delivery capacity.

repair task: a work item requiring substantial tools, parts, *equipment* and material to return a system that is not functioning properly back to its normative state.

replacement task: a work item required when a *repair task* is impossible, impractical and/or is not cost effective.

run to failure: a status conferred to certain devices and *equipment* where maintenance compliant with this standard is not practical or cost effective. Such *equipment* shall continue to be inspected to verify operation.

service task: a work item indicated to be required by an inspection or *maintenance task* or as determined to be required on a routine basis by the *maintenance plan*.

task: a well-defined unit of work that can be described by a sequence of instructions.

work request: a written or oral request for maintenance or repair work in response to an observed deficiency or as scheduled by the *maintenance plan*. The *work request* must be evaluated and authorized to initiate the proper *task*. For work required beyond the scope of the *maintenance plan*, a funding source may need to be identified.

4. IMPLEMENTATION

4.1 Introduction. This standard is intended to serve all segments of *commercial building* HVAC systems ownership and all methods of delivering inspection and maintenance work. This standard applies to facilities with no *maintenance program* as well as facilities with state-of-the-art *maintenance programs*. Requirements are described in terms consistent with a minimum standard. Implementation methods chosen to achieve compliance with this standard are left to the responsible party and/or an authorized implementation party. All parties may exceed these standard requirements as they see fit.

This standard is implemented by defining the party responsible for compliance and then defining a minimum *maintenance program* and the elements of the program. These program elements are described and defined to allow compliance to be achieved across the widest spectrum of owners and maintenance delivery systems as reasonably possible.

4.2 Responsible Party. The building owner shall be responsible for meeting the requirements of this standard. The owner may designate other parties that shall be authorized and contractually obligated to fulfill the owner's responsibility.

4.3 Maintenance Program. There shall be a *maintenance program* that preserves the *condition* and capability of the HVAC systems and *equipment* to enable the system to provide the intended thermal comfort, energy efficiency, and indoor air quality required for the facility.

At a minimum, the *maintenance program* shall contain the elements in Section 4.3.1 through Section 4.6.

4.3.1 Inventory of Items to be Inspected and Maintained. HVAC systems and *equipment* that impact thermal comfort, energy efficiency, and indoor air quality shall be listed in an *equipment inventory* of items to be inspected and maintained. This list shall include manufacturers' information, location, capacity, *maintenance program* identifier, and other data agreed upon by the responsible party and implementing party.

4.3.2 Maintenance Plan. A plan of inspection and maintenance work shall be developed. The *maintenance plan* shall document the work to be accomplished at scheduled intervals on the *inventory* of *equipment* to be maintained. The *maintenance plan* shall be developed specifically for the size, design, scope, criticality, and complexity of the systems and *equipment* serving the facility. The plan shall describe each required *task*, the frequency of each *task*, and *task* schedule; identify the party responsible for performing the *task*; and specify the authorizing party, *task* completion documentation procedure, plan monitoring procedures, and procedures for evaluation and feedback.

The plan shall include the information described in Sections 4.3.2.1 through 4.3.2.4.

4.3.2.1 Minimum Required Inspection and Maintenance Tasks. The required *inspection* and *maintenance tasks* are listed by *equipment* type in Section 5. All of the *tasks* in Section 5 that apply to the *equipment* in the *maintenance program* shall be included in the list of required *inspection* and *maintenance tasks* to comply with this standard.

4.3.2.2 Inspection and Maintenance Task Frequencies. The baseline frequencies of inspection and *maintenance tasks* for *equipment* and systems are listed in the tables in Section 5. These frequencies are the minimum required for compliance.

Refer to Section 4.6 for requirements for revising inspection and *maintenance task* frequencies.

Informative Note: Inspection serves to monitor and document the *condition* of *equipment* and components over time regarding appearance, functionality and *performance*. Maintenance serves to preserve *equipment condition* and *performance* as required by the facility.

4.3.2.3 Condition Indicators. *Condition indicators* for systems and *equipment* shall be developed. These indicators are measurements or observations of physical *condition* and delivery of thermal comfort, indoor air quality, and energy efficiency that are learned during the *performance* of the related *inspection tasks* and compared to the *condition* standard. The comparisons serve to determine the level of degradation and subsequent responsive action. The responsible party and the *maintenance program* implementer shall mutually agree on the *condition indicators* and standards used in the *maintenance program*.

Informative Notes:

1. The intent of this standard is to (a) monitor changes in the *condition indicators* over time as a measure of the efficacy of the *maintenance program* in meeting *performance* objectives and (2) provide advance indication of pending *equipment* failures. Unacceptable *condition indicators* could lead to *equipment* failure or *performance* degradation. When *condition indicators* reach unacceptable levels, additional preservative or restorative action is required.
2. Informative Appendix A lists examples of unacceptable system *condition indicators*.

4.3.2.4 Maintenance Program Objectives. Program objectives shall be established to define desired outcomes for the *maintenance program* for HVAC systems and *equipment* delivering required thermal comfort, energy efficiency, and indoor air quality. Program objectives shall be measurable quantities that can be trended over time, and shall, when achieved, define *maintenance program* success. Program objectives shall be based on responsible party requirements and operating procedures. The responsible party and the implementing party shall mutually agree on the program objectives. The program objectives shall be documented. Status of program objectives shall be reviewed periodically.

Informative Note: Informative Appendix B lists sources for establishing program objectives and example program objectives.

4.4 Maintenance Plan Authorization and Execution. The *maintenance plan* shall be approved by the responsible party with concurrence by the implementing party. Approval shall authorize performing the work included in the plan.

4.4.1 Inspection and *maintenance tasks* shall be performed on the established frequency or upon documented observance of unacceptable *condition*. Whether or not authorized by written or verbal instructions, execution of the *task* shall be documented and archived for future reference.

Informative Notes:

1. The *maintenance plan* shall include provisions for responding to unplanned inspection and maintenance events.
2. Response to discovery of unacceptable conditions found between *task* intervals shall require authorization to perform the required work with proper documentation. Good practice, once unacceptable conditions are found, is to take action to return the *equipment* to its required *condition* or *performance* capability. The responsible party and the implementing party must agree on the resource requirements for the work.
3. Unplanned events where additional work beyond the scope of this standard is required, such as repair or replacement, may require additional approval, funding, or authorization action by the responsible party and the implementing party for the work to proceed.

4.5 Revision of the Maintenance Program and Maintenance Plan. The *maintenance program* shall be capable of continuous improvement. Improvement in this context shall be manifest when changes in *equipment condition* or status, changes to the facility, or acquisition of new maintenance technology warrant review and revision of the *maintenance plan*. The intent of the standard is to enable *tasks* and/or frequencies to be changed in order to deliver proper preservative action in response to actual conditions.

Informative Note: Informative Appendix C lists situations that result in a review of the *maintenance plan*.

4.5.1 Degradation of Condition and Performance. Degradation of *equipment condition* or *performance* that is observed while performing scheduled inspection and *maintenance tasks* or on other occasions shall be documented.

4.5.2 Response to Changes. Upon initial discovery or observation of the degraded state, the situation shall be resolved through appropriate corrective or preservative action. If preservative action cannot resolve the degraded status, then further action outside the scope of this standard may be required.

4.5.3 If unacceptable *condition indicators* or unacceptable *performance* are found on a system or component during two successive inspections, the *maintenance plan* and *condition history* of the system or component shall be reviewed to determine if the *inspection frequency* or the *maintenance task* frequency should be increased. Further, *maintenance tasks* should also be reviewed for improvement opportunities. Results of the review, and revisions to the *maintenance plan*, shall be documented and implemented.

4.5.4 If acceptable *condition indicators* or acceptable *performance* are observed during three successive inspections, the *maintenance plan* shall be reviewed for opportunities to reduce *task* frequencies or work procedures without compromising *condition* or *performance*. Revisions to *task* frequencies and work procedures shall be documented.

4.5.5 Climate-related or facility operational requirements may impact execution of the *maintenance plan*. These circumstances shall be reviewed along with the *maintenance plan* for opportunities to revise *task* frequencies or work procedures. Revisions to *task* frequencies and work procedures shall be documented.

Informative Note: Informative Appendix D lists climate-related and operational situations that create a need to revise inspection and *maintenance task* frequencies.

4.5.6 Equipment Warranty. This standard's requirements shall not supersede *equipment* manufacturers' warranty terms and conditions and other guidance that may require different *tasks* and/or *task* frequencies.

Informative Note: In cases where manufacturer recommendations or warranty terms require more frequent *tasks* (or more *tasks*) than the Section 5 tables show, this standard does not require users to perform the additional maintenance to comply with the standard.

4.6 Program Review. The responsible party and the implementing party shall periodically review the *maintenance program*. There shall be at least two formal review meetings between the responsible party and the implementing party, one at the beginning of the *performance* period and one at the end of the *performance* period.

4.6.1 Beginning Review. The responsible party and implementing party shall define scope, expectations, and desired outcomes for the *maintenance program*. Initial review shall consist of developing program objectives, *condition* standards, and measures to be used to evaluate program *performance* that are mutually acceptable to the responsible party and the implementing party. These factors shall be established before the work commences. Creating *performance* objectives and *condition* standards ahead of implementation, both authorizing party and implementing party align expectations based on knowledge of the goals and evaluation measures established for the program and *maintenance plan*.

4.6.2 End Review. The end review shall consist of comparing *maintenance program* results with the program objectives and *condition* standards. The responsible party and the implementing party shall review the measurements and observations collected during the evaluation period. The actual results shall be compared to the program requirements, desired outcomes, and HVAC systems *performance*. The comparison shall serve to evaluate the *maintenance program performance*. This information shall be used to develop a plan for improving the *maintenance program*. Program improvement actions shall be mutually agreeable between the responsible party and the implementing party.

4.7 Transition to Required Tasks—Section 5. Section 4 covers the process and procedural requirements of this standard. Section 5 presents common types of HVAC *equipment* in tabular form listing *tasks* and frequencies that describe the minimum standard requirements for inspection and maintenance for most common HVAC systems and *equipment*.

All of the *tasks* in Section 5 that apply to the *equipment* in the *inventory* are required in order to comply with this standard.

5. REQUIRED INSPECTION AND MAINTENANCE TASKS

This section lists the required minimum inspection and *maintenance tasks* for any facility to which this standard applies. The *maintenance program* for the facility shall include at a minimum all of the listed inspection and *maintenance tasks* that apply to the HVAC systems and related *equipment* in the facility. The types of *equipment* and systems for which *tasks* are listed are as follows:

Table Number	*Equipment*/System
5-1	Air Distribution Systems
5-2	Air Handlers
5-3	Boilers
5-4	Chillers—Absorption
5-5	Chillers—Air-Cooled
5-6	Chillers—Water-Cooled
5-7	Coils and Radiators
5-8	Condensing Units
5-9	Control Systems
5-10	Cooling Towers and Evaporative-Cooled Devices
5-11	Dehumidification and Humidification Devices
5-12	Economizers—Air-Side
5-13	Engines—Microturbines
5-14	Fans (e.g., Exhaust, Supply, Transfer, Return)
5-15	Fan Coils—Hot-Water and Steam Unit Heaters
5-16	Furnaces—Combustion Unit Heaters
5-17	HVAC Water Distribution Systems
5-18	Indoor Section Duct-Free Splits
5-19	Outdoor-Air Heat-Exchanging Systems
5-20	Package Terminal Air Conditioners/ Heat Pumps (PTAC/PTHP)
5-21	Pumps
5-22	Rooftop Units
5-23	Steam Distribution Systems
5-24	Terminal and Control Boxes (e.g., VAV, Fan-Powered, Bypass)
5-25	Water-Source Heat Pumps

To determine the required inspection and *maintenance tasks* for each subsystem or piece of *equipment* in a building, use the following procedure:

a. Referring to the HVAC *equipment* and systems *inventory* prepared as required in Section 4.3.1 of this standard, prepare a list of the different *equipment* or subsystem types that exist in the building.
b. Using this list, identify from Tables 5-1 through 5-25 those that apply to the HVAC systems and *equipment* in the building. If the HVAC system for the facility contains subsystems or *equipment* that are not found in the tables in this section, use inspection and maintenance items from tables for similar subsystems or *equipment* or create a new list of appropriate items.
c. At a minimum, the *maintenance plan* for the building shall include each of the inspection and *maintenance tasks* from all of the applicable tables.
d. The *maintenance program* may include other inspection and *maintenance tasks* to preserve the ability of the subsystem or *equipment* to achieve acceptable thermal comfort, energy efficiency, and indoor air quality.
e. This standard shall not supersede *equipment* manufacturers' instructions and guidelines that may require more frequent or increased *tasks*.
f. In cases where manufacturers require more frequent *tasks* (or more *tasks*) than these tables show, this standard does not require its users to perform the additional maintenance to comply with the standard.

The tables include the following columns:

a. Sequence letter
b. *Inspection tasks* required for all systems and *equipment* in the *inventory*
c. *Maintenance tasks* required for all systems and *equipment* in the *inventory*
d. Minimum frequencies allowed for all systems and *equipment* in the *inventory*
e. Recommended *corrective actions* that are not requirements of this standard

Table 5-1 Air Distribution Systems

	Normative	Normative	Normative	Informative
	Inspection Task	***Maintenance Task***	**Frequency***	**Recommended *Corrective Action***
a	Check control system and devices for evidence of improper operation.	Clean, lubricate, repair, adjust.	Semiannually	Replace components to ensure proper operation.
b	Inspect grilles, registers, and diffusers for dirt accumulation.	Clean as needed to remove dirt build up.	Semiannually	Replace if missing or damaged.
c	Check damper for *condition*, setting, and operation.	Clean, lubricate, repair, replace, or adjust as needed to ensure proper operation.	Semiannually	Replace if missing or damaged.
d	Inspect areas of moisture accumulation for biological growth.	If present, clean.	Annually	Disinfect as needed.
e	Inspect exposed ductwork for insulation and vapor barrier integrity.	Record damage locations.	Annually	Replace or repair if needed.
f	Inspect internally lined ductwork until the first turn or up to 20 ft (6.1 m) from a potential moisture source, such as a supply plenum, from air handler, outdoor air damper, humidifier, etc. for water damage and/or biological contamination.	Determine and record source of moisture.	Annually	Eliminate moisture source. Repair/replace wet insulation. Remove biological contamination and disinfect surfaces.

*Refer to Section 4.3.2.2 for procedure to modify frequency.

Table 5-2 Air Handlers

	Normative	Normative	Normative	Informative
	Inspection Task	***Maintenance Task***	**Frequency***	**Recommended *Corrective Action***
a	Check for particulate accumulation on filters.	Clean or replace as needed to ensure proper operation.	Quarterly	Evaluate frequency of change requirement.
b	Check ultraviolet lamp.	Clean and verify that it is functioning.	Quarterly	Replace as needed to ensure proper operation.
c	Check P-trap.	Prime as needed to ensure proper operation.	Quarterly	Replace damaged P-trap.
d	Check drain pan, drain line, coil, and other areas of moisture accumulation for visible signs of biological growth.	Clean, and verify proper operation.	Quarterly	Disinfect as needed.
e	Check steam system traps, pumps, strainers, and controls.	Clean, and verify proper operation.	Semiannually	Repair or replace as needed to ensure proper operation.
f	Check control system and devices for evidence of improper operation.	Clean, lubricate, adjust.	Semiannually	Repair or replace components as needed to ensure proper operation.
g	Check fan-belt tension, check for belt wear, and check sheaves for evidence of improper alignment or evidence of wear.	Correct tension and sheave alignment.	Semiannually	Replace belts and sheaves as needed to ensure proper operation.
h	Check variable-frequency drive for proper operation.	Correct as needed. Clean housing, and tighten connections as needed. Clean or replace air filter.	Semiannually	Repair, replace, or restore as needed to ensure proper operation.

*Refer to Section 4.3.2.2 for procedure to modify frequency.