

## Summary

Study and proposed revisions to Section 4 (Implementation of packaged HVAC equipment) of ANSI/ASHRAE/ACCA Standard 180. Purpose is to inform utility programs and users of the Standard. Delivered to ASHRAE Std. 180 Committee January 2015.

**Finalized:** September 19, 2014

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## Use of this Document

*This document provides Standard 180 Section 4 Implementation.*

*It is based on an official [WHPA Work Product](#) of September 19<sup>th</sup>, 2014 titled “CQM Section 4 Working Group Standard 180 Proposed Revisions.” This Work Product was developed by the WHPA Commercial Quality Maintenance Committee.*

*This document, and also the WHPA Work Product, may be used in part or whole at no charge. Attribution to the Western HVAC Performance Alliance is requested.*

*We would also ask that you inform the WHPA through [info@performancealliance.org](mailto:info@performancealliance.org) if you have made use of either document, so that we can inform and encourage the hundreds of volunteers who donate their time to providing expert HVAC advice in order to support energy efficiency objectives.*

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## Standard 180 Section 4 Implementation

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## Background

This document consists only of revisions and comments on the then-current draft version of Section 4 (Implementation of packaged HVAC equipment) of ANSI/ASHRAE/ACCA Standard 180. It is not the complete Section 4 content.

This Working Group was formed to help operationalize and improve the understanding of Standard 180, especially in the area of Section 4 Implementation. The group was focused on packaged HVAC equipment, similar to the Standard 180 Maintenance Task Working Group, and intended to have the standard considered from the perspective of contracted service providers in addition to maintenance which would be performed by in-house staff. The report highlights topic and subject areas which the Working Group believed to need further clarification in order that Section 4 of the Standard be implemented in a more consistent manner and help both the building owners and their service providers share a common understanding of the standard terms and requirements. This is an initial report specifically focused on Section 3 Definitions, Section 4 Implementation, and the informative appendices. Future updated reports will also be submitted to the Standard 180 Committee and made available to California utilities.

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## 3. DEFINITIONS

Maintenance Program: Maintenance program is a maintenance concept or approach that defines how maintenance will be performed for a specific facility or group of facilities. The maintenance program consists of two components:

1. The inventory list of equipment and elements to be maintained, and
2. The maintenance plan.

Inventory: Inventory is a list of known HVAC equipment and related elements to be inspected and maintained under the maintenance plan. The purpose of an inventory list is to define the equipment and other elements (if any) to be inspected and/or maintained. Initially, sufficient information should be determined (i.e., quantity, equipment type, approximate age, general size range, etc.) to enable the development of the maintenance plan. When the maintenance plan is implemented, additional detailed information (such as model/serial numbers, electrical information, fan belt and filter size/type/quantity, etc.) shall be gathered to augment the inventory list. It should be clearly understood that after the inventory has been identified, the maintenance plan will then define the level of inspection, assessment, and maintenance tasks which will then be performed. An inventory list does not include assessment information such as equipment condition and performance evaluation.

Maintenance Plan: The maintenance plan documents the maintenance objectives establishes the criteria for evaluation and defines those responsible for maintenance. The maintenance plan includes basic goals of performance, such as prompt response to mechanical failure and maintenance tasks, frequencies, and specifications. The maintenance plan provides direction regarding time and resource allocation and defines the record keeping methods, fault communication methods, and reporting protocols to be utilized.

## 4. IMPLEMENTATION

**4.1 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.

**4.2 Maintenance Program:** Each HVAC system shall have a *maintenance program* that, at a minimum, preserves the condition of the HVAC system and its elements in a manner that enables the system to provide the intended thermal comfort, energy efficiency, and helps to achieve the intended indoor air quality required for the building. At a minimum, the *maintenance program* shall contain an inventory of equipment and systems to be inspected and maintained and a maintenance plan describing the goals, objectives, and execution of the HVAC systems *maintenance program*.

**4.2.1 Inventory of Items to be Inspected and Maintained.** Components of HVAC systems that impact the building's *performance* shall be inventoried as an initial step. A more detailed list shall then be used to establish unacceptable system condition indicators, *inspection frequencies*, and *maintenance tasks*.

**4.2.2 Maintenance Plan Development:** For any given facility, the maintenance plan shall be written and developed specifically to meet the size, design, scope, and complexity of the system(s) serving that facility as reflected in the inventory list. The plan shall describe each required task, identify the party responsible for performing the task, specify the authorizing party, document its completion, and subsequently monitor the results. The plan shall include all of the following information in 4.2.2.a through 4.2.2.e below.

**4.2.2.a Performance Objectives:** Performance objectives shall incorporate thermal comfort, energy efficiency, and indoor air quality metrics. Performance objectives shall be based on the basis of design and comparison to baseline operational criteria specific to a particular system. The source of the performance objectives shall be documented. Informative Appendix A lists some of the possible sources that can be used to establish performance objectives. See Informative Appendix C for specific examples of possible performance objectives.

**4.2.2.b Condition Indicators:** Indicators of unacceptable system and equipment conditions shall be established. These indicators are measurements or observations of conditions that could lead to failure or *performance* degradation. See Informative Appendix B for examples of unacceptable system condition indicators.

**4.2.2.c Inspection and Maintenance Tasks:** *Inspection and maintenance tasks* for inventoried equipment and systems shall be established. *Inspection* shall include the condition assessment of systems and/or their components by observation and/or measurement of operating parameters and may include data provided by sensors or a *building management system (BMS)*. *Maintenance Tasks* shall include adjustment, lubrication, and items covered in the maintenance agreement such as belt and filter replacement. Condition and performance assessment are both considered to be inspection and maintenance functions. Owner notification procedures for service or replacement of inventoried equipment and systems shall be included in the maintenance contract. See Section 5 for tables of required *inspection, service, replacement, and maintenance tasks* by equipment type. When Section 5 *inspection and maintenance* task tables are separated from service and/or replacement tasks contractually, *inspection and contracted maintenance* portions of contractual agreements shall designate Table 5 items to be *inspected and maintained* and a reporting procedure for submitting items in need of *service or replacement* to the owner's/operator's designated party.

**4.2.2.d Inspection and Maintenance Task Frequencies:** Frequency of *inspection* and *maintenance tasks* for inventoried equipment and systems shall be established. If unacceptable condition indicators or unacceptable *performance* for one or more pieces of equipment or related elements are found during two successive *inspections*, the owner or the owner's designated representative shall investigate and analyze possible causes. At a minimum, the following possible causes shall be investigated.

- Poor field practices—review inspection documentation and/or technician execution to ensure *maintenance tasks* are performed correctly.
- Insufficient time budgeted for tasks—review time budgeted to the technician to ensure that reasonable time has been given to perform the tasks.
- Component repairs noted/pending/not made—inspect documentation to determine that authorized repair or component replacement has been undertaken.
- Design issues—determine whether underlying design issues are causing successive failures.
- Obsolete equipment or components—determine whether the equipment or component is no longer available or has been in service beyond its useful life.
- Conditions outside of the HVAC system causing failure—investigate whether water leaks, vandalism, a problem in the building envelope, or some other external factor is causing the problem. Based on the analysis, the *inspection frequency* or the *maintenance task* shall be modified to resolve the deficiency. If acceptable condition indicators or acceptable *performance* is found during three successive inspections, then the *inspection frequency* for that task may be reduced from the existing frequency and/or the level of maintenance performed in the maintenance task may be reduced. The reduced frequency and/or maintenance shall be based on the specific findings and shall be documented.

Frequency may also be adjusted for climate-related or operational reasons. Examples would include the following:

- A cooling tower shutdown during the winter—inspection and maintenance may be suspended during the shutdown period.
- A new chiller is installed and the old chiller is retained as a backup—inspection and maintenance of the backup unit may be adjusted to reflect fewer operating hours. Each adjusted frequency shall be documented, including the reason for the adjustment.

**4.2.2.e Documentation:** A minimum inspection and maintenance documentation package shall consist of the following items:

- a) Listings of HVAC systems and system components with associated performance criteria pertinent to the facility,
- b) *Inspection* and *maintenance tasks* and the method of tracking (automated or manual), and
- c) Sufficient record detail and *verification* (written or electronic) to demonstrate implementation of the maintenance plan.

The inspection and maintenance document directory shall provide easy access and be well organized and clearly identified. Emergency information shall be immediately available and shall include emergency staff and/or agency notification procedures.

**4.3 Maintenance Plan Authorization and Execution:** *Inspection* and *maintenance tasks* shall be performed on an established frequency or upon a documented observance of unacceptable condition. Whether authorized by written or verbal instructions, execution of the task shall be documented and archived for future reference.

- 4.4 Revision of the Maintenance Program:** The *maintenance program* shall be reviewed, and revision shall be considered in any of the following situations:
1. Modifications to the building that impact HVAC *performance objectives* have occurred,
  2. The building function or its use has changed in a way that impacts HVAC *performance objectives*,
  3. HVAC component or HVAC system changes have occurred,
  4. One or more systems are found to be incapable of achieving their *performance objectives*,
  5. Governmental regulations regarding tasks and/or their frequency have changed, and/or
  6. Upon documented recommendation from the maintenance provider.

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### INFORMATIVE APPENDIX B IDENTIFYING INDICATORS OF UNACCEPTABLE CONDITIONS

3. Airflow from any air handler is not within design requirements. A possible indicator could be static pressure outside manufacturer's or design criteria.

**Add the following text (#7-10) to the existing list of 6 performance-related condition indicators:**

7. Abnormal system internal operating pressures or temperatures.
8. Abnormal temperature differentials across HVAC equipment.
9. Abnormal amperage or voltage readings.
10. Broken or inoperative controlled air dampers.

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### PROPOSED:

#### INFORMATIVE APPENDIX C EXAMPLES OF PERFORMANCE OBJECTIVES

Following is a list of example performance objectives that may be appropriate for inclusion in a maintenance plan:

1. A unit's supply air temperature differential produced in either cooling or heating mode.
2. Pressure drop across air filters.
3. Amperage draw from specific motors.
4. Measured heat exchanger approach compared to optimum efficiency approach.
5. Carbon dioxide ppm differential between occupied and outdoor ambient levels when in stable operation and not in airside economizer mode.
6. Frequency of condensate drain blockages resulting in service calls.
7. Frequency of temperature complaints.
8. Frequency of service calls impacting a specific area (i.e., a server room).
9. Frequency of fan belt breakage resulting in service calls.

Please note that acceptable performance metrics can vary within types of equipment, depending upon specific application and original design criteria. For this reason, it is useful to record baseline performance criteria for equipment that has been brought to good condition (clean heat exchangers, reasonable fan performance, etc.) and is operating under normal operating conditions. This baseline data can serve as a guideline for technicians and facilities' representatives in assessing comparative operating conditions over time.