



Western HVAC Performance Alliance

Commercial Quality Maintenance Committee
ANSI/ASHRAE/ACCA Standard 180
Section 4 Working Group Report

A WHPA Report dated September 19, 2014

Prepared on behalf of the Section 4 Working Group
By Mike Gallagher, Western Allied Corporation

3. DEFINITIONS

Revise the Following:

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.

Add the Following:

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

Add text in red.

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.

INFORMATIVE APPENDIX B— IDENTIFYING INDICATORS OF UNACCEPTABLE CONDITIONS

Modify the existing performance-related example (add text in red):

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 in red 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.

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.

WHPA Work Product Summary

DATE: September 19, 2014

INITIATING BODY: CQM Standard 180 Section 4 Working Group

WORK PRODUCT NAME: CQM Section 4 Working Group Standard 180 Proposed Revisions

TYPE OF ACTION REQUESTED: **VOTE** **GUIDANCE** **OTHER:** The Initiating Body requests that the WHPA Commercial Quality Maintenance Committee (CQM) review the referenced Work Product and vote to (1) approve it and (2) escalate it to the WHPA Executive Committee (EC) for review, validation as a WHPA work product, and distribution to the ANSI/ASHRAE/ACCA Standard 180 Committee.

APPROVAL HISTORY

WORKING GROUP: WHPA Commercial Quality Maintenance Standard 180 Section 4 Working Group

BY CONSENSUS **BY VOTE**

TALLY: All five voting members present at the meeting at the time of the vote voted "aye" with no nay or abstention votes. Three additional voting members provided "aye" votes following the meeting via email. Those eight voting members who responded with an "aye" vote included: ACCA; Aire Rite AC & Refrigeration; ASHRAE; FDSI; Honeywell ECC; Honeywell Smart Grid Solutions; PECI; Western Allied Corporation. Those who did not vote were Integrity Mechanical Systems Corp., Tre' Laine Associates, and Sheet Metal Workers (SMW) Local # 104.

DATE: September 19, 2014, meeting and follow-on email votes.

COMMITTEE: WHPA Commercial Quality Maintenance Committee (CQM)

BY CONSENSUS **BY VOTE**

TALLY: Ten of fourteen committee voting members responded to the email vote. Nine voted aye: ACCA, Aire Rite AC & Refrigeration, ASHRAE, Conservation Services Group, Field Diagnostic Services Inc., Honeywell ECC, Honeywell Smart Goal Solutions, Marina Mechanical, and Western Allied Corporation. There were no nay votes. PECI abstained.

DATE: The Committee vote was conducted via email between September 25 and October 6 in order to provide the Executive Committee with results at their next meeting on October 8, which would precede the next CQM Committee monthly meeting on October 14. The vote passed to elevate the Working Group report to the Executive Committee for consideration with a recommendation that it be approved/adopted as a WHPA work product, posted to the WHPA website, and forwarded onto the ANSI/ASHRAE/ACCA Standard 180 Committee.

WHPA Work Product Summary

WORK PRODUCT OBJECTIVES: 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. This draft report is intended to inform the ASHRAE/ACCA/ANSI Standard 180 Committee of current suggested revisions to the standard prepared by a group of WHPA subject matter experts. 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. Output of this working group will also be considered by California utilities as they work to refine and improve their quality maintenance programs. 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. This report and future reports are intended to be fully considered in the context of the ANSI review process for future updates of Standard 180 and/or the preparation of other materials, such as user guides, that support improved implementation of Standard 180.

Section 3. Definitions

Term Revisions:

1. Maintenance Program

Term Additions:

1. Inventory
2. Maintenance Plan

Section 4. Implementation

Revisions:

- 4.2.1 Inventory of Items
- 4.2.2 Maintenance Plan Development
 - 4.2.2.a Performance Objectives
 - 4.2.2.c Inspection and Maintenance Tasks
 - 4.2.2.d Inspection and Maintenance Task Frequencies
- 4.4 Revision of the Maintenance Program

Informative Appendix B—Identifying Indicators of Unacceptable Conditions

Modify existing performance-related condition indicators and suggest additional ones specifically related to packaged AC rooftop units.

Propose a new appendix intended to provide examples of performance objectives. Informative Appendix A provided suggested sources for performance objectives but did not provide any concrete examples for building owners and their service providers to conveniently consider.

Future reports are anticipated to address the above sections in greater detail as well as Section 4.2.2.3 Documentation. The Working Group members considered that it was critically important to expand the standard beyond service provider "documentation" of unit/system condition to provide better direction on how critical information should be conveyed to the building owners or their designated representatives. The original standard and 2012 revision did not directly address the common dynamic where any service, repair, corrective, or installation tasks beyond what was defined as "maintenance tasks" would require informing owners of the need for attention, proposed costs for those services and the need to establish an approval process.

WHPA Work Product Summary

This Working Group also intends to address a very difficult part of the CEESP HVAC Goal Strategies—how to better communicate the energy efficiency value and "performance benefits" of quality installation and maintenance to the marketplace. This would involve recommendations to the Standard which would attempt to quantify those benefits, provide references to research which evaluated occupant comfort as well as energy efficiency improvement, reduced HVAC related energy costs, reduced service/repair costs, and improved reliability.

CA ENERGY EFFICIENCY PLAN STRATEGIC GOAL ALIGNMENT:

GOAL 1 GOAL 2 GOAL 3 GOAL 4

CEESP HVAC GOAL STRATEGIES:

- Strategic Plan Goal 2: Quality HVAC installation and maintenance becomes the norm. The marketplace understands and values the performance benefits of quality installation and maintenance.
- Strategy 2.1: Create a statewide quality installation and maintenance (QI/QM) brand that will be attached to systems/installation/contactors that meet quality standards.

BENEFITS: Clearer definitions and improved descriptions regarding maintenance program implementation should improve having owners and their service provider develop better maintenance agreements: agreements which spell out in sufficient detail what equipment/components are to be maintained, how the equipment will be serviced, which specific tasks would be considered "maintenance," and which would require further authorization. Those improved agreements would also spell out in far greater detail what goals and their metrics have been agreed to so that the service being delivered can be evaluated from a common, agreed understanding.

OUTSTANDING ISSUES / DEBATES / MINORITY VIEWS: There is virtually no industry agreement or agreement between public utility commissions, IOUs, and industry participants as to the quantified benefits of improved maintenance practices. Maintenance is a "process" and not just the performance of a single task at one point in time. It would benefit California utility programs as well as program implementers if there could be established a common, agreed method of system performance evaluation so that systems could be benchmarked at the beginning of a program in a consistent, vetted manner and then measured at intervals. This would help establish the means for more objective evaluation of the benefits derived from improved maintenance practices.

POTENTIAL AUDIENCE: WHPA CQM Committee, WHPA Executive Committee, WHPA Council of Advisors, ANSI/ASHRAE/ACCA Standard 180 Committee, Contractors, Technicians, IOUs, CEC, and CPUC.

MOTION to the Executive Committee: That the "CQM Section 4 Working Group Standard 180 Proposed Revisions" dated September 19, 2014, be adopted as an official WHPA Report.

VOTE TALLY: On October 8, 2014, the following 13 EC member organizations or their designated proxies voted as follows to adopt the presented report and the above detailed motion: aye votes from ACCA, AHRI, ASHRAE, CEC, HARDI, IHACI, JCEEP, PG&E, SDG&E, SCE, UA; abstention from CPUC; SoCalGas was not present.

FURTHER ACTIONS REQUIRED: WHPA Staff will ensure the required motion steps are completed for finalization and posting of the report, plus the drafted letter of appreciation.

NEXT STEPS: CQM Committee Chair Don Langston to forward Report to the Chair of ASHRAE Standard 180 Committee when that recently re-formed group begins to meet. Expected timeframe: after October 1, 2014, and no later than January 25, 2015.