

ASHRAE Guideline 1.1-2007
(Supersedes ASHRAE Guideline 1-1996)



ASHRAE GUIDELINE

HVAC&R Technical Requirements for The Commissioning Process

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NOTE

When addenda, interpretations, or errata to this guideline have been approved, they can be downloaded free of charge from the ASHRAE Web site at <http://www.ashrae.org>.

(This foreword is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

FOREWORD

The commissioning process is a quality-oriented process for verifying and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria. The Commissioning Team uses a variety of methods and tools to verify that a project is achieving the Owner's Project Requirements throughout the delivery of the project.

Commissioning process procedures and requirements for the Commissioning Team are fully covered in ASHRAE/NIBS Guideline 0-2005, The Commissioning Process. That document provides adequate guidance for implementing the commissioning process for all building assemblies and systems—and for both new and existing buildings.

To further assist owners, design teams, commissioning process teams, contractors, and building/facility engineering, operations, and maintenance teams or staff, a number of supporting commissioning process technical guidelines have been developed or are under development. This particular guideline provides specific guidance on applying the commissioning process to HVAC&R systems in buildings and facilities.

The following is a brief overview of the commissioning process as described in ASHRAE/NIBS Guideline 0-2005, The Commissioning Process. Guideline 0 was developed in a cooperative effort between ASHRAE and NIBS (the National Institute of Building Sciences). For simplicity, this guideline will be referred to as ASHRAE Guideline 0-2005 or Guideline 0-2005 in this document.

The commissioning process assumes that owners, facility programmers, designers, contractors, and building engineering, operations and maintenance (EOM) entities are fully accountable for the quality of their work. For example, the contractor is responsible for fully constructing, testing, and ensuring that his/her employees' work has provided the level of quality expected. The Commissioning Authority then randomly samples the contractor's work to verify that it is achieving the Owner's Project Requirements. If systemic issues of concern are identified, then the contractor is expected to recheck all of his/her work and correct any deficiencies. This quality-oriented commissioning process will provide improved quality and greater cost effectiveness compared to commissioning as currently practiced by many commissioning providers. One of the problems with current practice is that 100% checking is performed during the construction phase of the project delivery process and this checking usually focuses upon limited or targeted systems or assemblies. Quality-based sampling is not used and the current-practice approach has limited quality-based random inspection procedures.

Ideally, the commissioning process begins at project inception (during the Pre-Design Phase) and continues for the life of a facility (through the Occupancy and Operations Phase). The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meet the Owner's Project Requirements. This guideline focuses upon the implementation of the commissioning process to HVAC&R systems and assemblies.

It describes the specific tasks necessary to successfully implement the commissioning process for HVAC&R systems and assemblies. Because this guideline details a general process, it can be applied to both new and renovation projects and to the commissioning of existing buildings and systems.

Development of formal guidelines for HVAC&R commissioning began in 1982 when the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) established a committee to document best practices to achieve facilities that performed according to an owner's needs and requirements. ASHRAE published its original commissioning guideline in 1989, and published an updated version in 1996. In 2005 ASHRAE Guideline 0-2005, The Commissioning Process, was published to address the underlying quality-based commissioning process without reference to a specific discipline. Guideline 1.1-2007 presented herein represents a revision of ASHRAE Guideline 1-1996, which contained both general commissioning process requirements and HVAC technical requirements in one document. The technical commissioning process requirements for different building systems are now being developed in individual discipline technical guidelines, separate from the commissioning process requirements that are defined in Guideline 0-2005.

Guideline 1.1-2007 follows the format of Annex A in Guideline 0-2005 and incorporates committee experience on completed projects where systems and assemblies were expected to work from the day the project was turned over to the owner while meeting the requirements of owners, occupants, users of processes, and facility operating-maintenance-service organizations at a high level of satisfaction and where overall cost to deliver the project was reduced.

Guideline 0 and Guideline 1.1 are integral parts of the National Institute of Building Sciences (NIBS) total building commissioning process guideline series. The relationship of these two guidelines to other technical commissioning process guidelines is shown in the foreword of Guideline 0-2005.

In all of these guidelines, emphasis is placed upon documentation of the Owner's Project Requirements at the inception of a project and the proper transfer of this information from one party to the next throughout the life of a project. The commissioning process has been structured to coincide with the phases of a generic project with Pre-Design, Design, Construction, and Occupancy and Operations phases. Beginning the commissioning process at project inception will achieve the maximum benefits. If circumstances require owners to adopt the commissioning process during the Design Phase, during the Construction Phase, or during the first year of the Occupancy and Operations Phase of a project, such later implementation must capture the information that would have been developed had the commissioning process begun at project inception or during Pre-Design Phase. This is required for successful Occupancy and Operations Phase documentation and continuous or ongoing commissioning of the HVAC&R systems and assemblies for the life of the facility.

Due to the integration and interdependency of most systems in a facility, a performance deficiency in one system can result in less than optimal performance by other systems. Although Guideline 1.1 focuses upon HVAC&R systems, a successful total building commissioning process will carefully

validate interfaces and possible interferences between all building systems. Even when HVAC&R is the primary focus of the commissioning process, coordination among disciplines is essential for success.

Annexes are included in this guideline to assist in the implementation of the commissioning process to HVAC&R systems and assemblies. The annexes are based upon actual project experience, with details based upon current practice, and they illustrate application of the commissioning process to a variety of HVAC&R systems and equipment. The annexes should be viewed as examples of how to develop and define ongoing communications and planning tools: the Owner's Project Requirements, Basis of Design, and Commissioning Plan documents, and the verification, testing and training requirements.

A fictitious new headquarters office for ASHRAE has been used in some of the annexes to illustrate the application of the commissioning process to HVAC&R systems in buildings and facilities. These are not to be taken as illustrations of the commissioning process for an actual building, in that they were developed from several other actual projects and projected to what might be required by ASHRAE as the owner of a new building for their headquarters. They reflect what commissioning process documents and procedures that comply with this guideline might look like.

1. PURPOSE

1.1 The purpose of this guideline is to describe the technical requirements for the application of the commissioning process described in ASHRAE Guideline 0-2005 that will verify that the heating, ventilating, air-conditioning, and refrigerating (HVAC&R) systems achieve the Owner's Project Requirements.

2. SCOPE

2.1 The procedures, methods, and documentation requirements in this guideline describe the application of the commissioning process for each project delivery phase from Pre-Design through Owner Occupancy and Operations for all types and sizes of HVAC&R systems to support the commissioning process activities described in ASHRAE Guideline 0-2005, *The Commissioning Process* (also to be published by NIBS as Guideline 0-2005, *The Total Building Commissioning Process*). This includes requirements for:

- a. HVAC&R systems to fully support the commissioning process activities,
- b. Verification during each phase of the commissioning process,
- c. Acceptance during each phase,
- d. Documentation during each phase,
- e. Systems Manual, and
- f. Training for operations and maintenance personnel and occupants.

2.2 The procedures, methods, and documentation requirements apply to new construction and ongoing commissioning process activities or requirements of all or portions of build-

ings and facilities. They also can be applied to rehab, retro-commissioning, or re-commissioning projects.

3. UTILIZATION

3.1 The application of this guideline will depend upon the Owner's Project Requirements and how the project will be designed, built, and operated. This guideline is supplemental to the commissioning process detailed in Guideline 0-2005. This guideline must be used in conjunction with Guideline 0-2005; it is not intended to be a stand-alone document.

3.2 This guideline describes specific details required to properly implement the commissioning process relative to HVAC&R systems. This includes documentation, test procedures, and checklists.

4. DEFINITIONS

Definitions for general commissioning process terms are found in Guideline 0-2005, *The Commissioning Process*. No additional HVAC&R related terms have been identified for definition herein.

5. PRE-DESIGN PHASE

5.1 Introduction

5.1.1 Predesign is a preparatory phase of the project delivery process in which the Owner's Project Requirements are developed and defined. Information about the project is gathered, including:

- a. Program requirements (e.g., facility interior conditions),
- b. Community context (e.g., noise from cooling towers),
- c. Codes and regulations (e.g., ASHRAE Standards 62 and 90),
- d. Site and climate (e.g., outdoor air design conditions),
- e. Facility context and function (e.g., office, hospital, refrigerated warehouse),
- f. Facility technology (e.g., heat recovery, cool storage, automation system),
- g. Sustainability (e.g., recycled material content, energy use),
- h. Cost,
- i. Schedule, and
- j. Needs and capabilities of client (owner, occupants, operators, and maintenance personnel).

5.1.2 Pre-Design Phase commissioning process objectives relative to HVAC&R systems include the following:

- a. Developing the Owner's Project Requirements,
- b. Identifying a scope and budget for the commissioning process,
- c. Developing the initial Commissioning Plan,
- d. Acceptance of Pre-Design Phase commissioning process activities.

5.2 Pre-Design Commissioning Process Activities

5.2.1 Commissioning Team Members. In addition to those team members detailed in Guideline 0-2005 (5.2.1.3),