

Regulation
No. 1110-345-723

31 July 1995

Engineering and Design
SYSTEMS COMMISSIONING PROCEDURES

1. Purpose. This regulation provides policy and guidance for developing systems commissioning procedures and executing systems commissioning acceptance testing to verify that the construction requirements are met and ensure that systems operate as indicated in the plans and specifications, especially regarding sequences of operation.

2. Applicability. This regulation applies to all HQUSACE/OCE elements, major subordinate commands, districts, and field operating activities (FOA) having military and/or support for others design and construction responsibilities.

3. References.

a. ANSI/ASHRAE GUIDELINE 1-1989, Guideline for Commissioning of HVAC Systems.

b. AR 415-15, Military Construction Army Program Development.

c. ER 5-7-1 (FR), Project Management

d. ER 25-345-1, Systems Operation and Maintenance Documentation.

e. ER 415-1-10, Contractor Submittal Procedures

f. ER 415-1-11, Biddability, Constructibility, Operability, and Environmental Review.

4. Background. Designers must effectively convey the design*s intended operation into the plans and specifications. Systems commissioning performed to verify the design intent, as expressed in the plans and specifications, is a necessary element for true beneficial use of any project. Several forms of testing, operation and demonstration are contained in the various technical sections of construction contract documents. These requirements evolve from guide specifications and national standards. Typically, operational testing is limited to individual equipment and/or small subsystems specified within the specific technical section. There is a lack of a concentrated requirement for large, interdisciplinary systems testing,

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operation and demonstration. Testing of system elements and interactions, beyond the individual technical sections, is often needed. Such a concentrated requirement to verify that systems operate as indicated in the plans and specifications, especially regarding sequences of operation is a significant contributor to customer satisfaction with the entire design and construction process. Operation and maintenance functions are enhanced when all of the responsible parties are cognizant of contract compliance, construction quality, and performance and operational parameters of the systems. The importance for a disciplined approach to systems commissioning is intensified as the cost, complexity, uniqueness, and magnitude of the project, system or process involved increases. The need is further intensified by the interdisciplinary interactions of the various systems comprising the entire project. The concept and practice of systems commissioning has long been recognized in the acceptance of industrial processes, nuclear technology, aviation technology, and similarly complex projects. The heating, ventilating, and air conditioning (HVAC) industry has recognized a need to formulate procedures for functional performance testing and documentation of HVAC systems. ANSI/ASHRAE GUIDELINE 1-1989, Guideline for Commissioning of HVAC Systems provides procedures and methods for verifying and documenting the actual performance of HVAC systems and evaluating their conformity with the design intent.

5. Guidance.

a. The need for systems commissioning, beyond normal construction contract requirements, must be established early in the planning/design process. The determination shall be made on a project specific basis. Early establishment of the need will allow the necessary planning and design resources to be identified and programmed. Systems commissioning represents a service which can be provided on projects. The service maximizes the opportunity for successful O&M. The value of the service to the using agency is proportional to the user's participation. The using agency's participation is presented herein so that appropriate Corps elements can fully understand when and how the user is to participate to maximize the value of the commissioning process. When systems commissioning is being executed, the using agency is to be notified, encouraged, and expected to participate. Occasions may arise when the using agency will not be available to participate. In these instances, the process of commissioning should continue without causing delays to contract performance. As a minimum, the using agency, design agent and construction agent will all actively participate in identifying and developing system commissioning requirements. Optimally, the need for systems commissioning shall be identified in the project's scope of work (SOW). In the event that systems

commissioning requirements materialize less than optimally, the procedures established in AR 415-15 shall be followed to properly identify and program the necessary planning and design resources and construction funding requirements.

(1) The using agency or other associated organizational elements (e.g., Installation, DEH, MACON, etc.) shall identify and substantiate any need for systems commissioning and the associated construction cost on the DD Form 1391, Military Construction Project Data, during project development. In the case of work for others, a Memorandum of Understanding (MOU) or the particular SOW governing the work shall describe the concept of systems commissioning.

(2) The design agent or other associated organizational element (e.g., HQUSACE, MSC) may identify, validate, and substantiate any need for systems commissioning and the associated construction cost during the review stage of the project development process, including review of DD Form 1391. This identification shall also occur where the design agent develops the 1391 as a support service to the using agency. In the case of work for others, the design agent shall ensure that the MOU or SOW requires that systems commissioning be identified on a project specific basis, and for the design agent to recommend systems commissioning during development of the design SOW.

(3) The construction agent or associated organizational element (e.g., HQUSACE, MSC) may identify and substantiate any need for systems commissioning during participation in the design process as described in ER 415-1-11.

(4) In the event a need for systems commissioning is identified by elements outside the using agency, its application and any cost or schedule implications must be coordinated and approved by the using agency.

b. Systems commissioning represents testing, operation and demonstration efforts to verify the intended design as reflected in the contract documents has been achieved in the installed construction. Systems commissioning extends beyond the testing, operation and demonstration associated with individual technical contract requirements typically identified in individual specification sections. Systems commissioning requirements as described herein are not appropriate for all projects or systems. Projects or systems exhibiting at least two of the following characteristics shall be considered as prime candidates for systems commissioning as described herein:

(1) Process oriented – The project or system involves a

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continuous operation or treatment beginning with an expected input or load condition and resulting in an established continuous output or condition.

(2) Large - The expected construction value of the project or system exceeds \$10 M if new construction is proposed, or \$5 M if renovation, rehabilitation, or alteration is proposed. In applying this characteristic, the extent to which similar, but smaller portions are essentially repeated, shall be considered.

(3) Complex - The project or system is expected to consist of intricately combined and interactive portions, the whole of which has difficult to understand, analyze, or evaluate performance characteristics.

(4) Unique - The project or system involves technology or specific equipment which is one of a kind and, excluding prototypes and pilot operations, not more than one other beneficially proven example exists.

(5) Significant consequential magnitude - The project or system is critical to life safety, the mission of the installation, or environmental quality. Failure of the project or system to function as designed will result in a profound degradation of these critical features.

(6) Requires systems operation and maintenance documentation - The project or system has been identified as described in ER 25-345-1 and requires systems operation and maintenance documentation, shared as a two-step operation by the designer and the construction contractor. Systems commissioning is a natural corollary to systems operation and maintenance documentation. It should be rare that the need for either would exist without the other.

6. Action to be taken. Whenever the need for systems commissioning is identified and the appropriate resources authorized, the using agency, design agent, and construction agent shall all actively participate as a team during the design and construction process as outlined below. The particular resources, processes, and responsibilities shall be documented in the Project Management Plan (PMP) that is specifically developed for that project. Minimum requirements of a PMP are described in ER 5-7-1 (FR). It is expected that the using agency will fund the participation of its own personnel in the commissioning activities. For Corps of Engineers costs associated with commissioning, funding shall be in accordance with the activities performed. For design activities occurring prior to award of the construction contract, appropriate Planning and Design (P&D)

funds shall be utilized. For activities occurring after construction contract award, design agent commissioning activities shall be related to extension of design and will therefore be funded by Engineering During Construction (EDC) resources. Construction agent activities shall be funded with Supervision and Administration (S&A) resources. Design agent quality assurance support shall be available to and under the control of the construction agent. QA support would be S&A funded. Construction contractor activities associated with executing the commissioning process during construction must be included as contract requirements and therefore would be funded with project construction funds.

a. The district, in its capacity as design agent, shall ensure that the design SOW requires the design services necessary to develop a contract specification section(s) using the guidelines in Appendix A and, as outlined in Appendix B. The district shall ensure that systems commissioning requirements included in the construction contract will result in verification of the design intent, as expressed in the plans and specifications with the installed construction. The designer will document the design intent for all systems requiring commissioning as part of the commissioning requirements of the contract. Districts shall ensure appropriate participation by the designer after award and during execution of the systems commissioning requirements. District Quality Management Programs shall document the assurance procedures to be used to verify compliance with these requirements. The district shall secure documentation indicating the satisfaction of the using agency and construction agent with the systems commissioning requirements developed prior to bid opening. The review and certification processes established by ER 415-1-11 will serve to document both the construction agent*s and the using agency*s satisfaction with the systems commissioning requirements developed prior to bid opening.

b. The district, in its capacity as construction agent, shall ensure that the construction contractor provides all necessary labor, services and materials to perform and document the systems commissioning requirements. District Quality Assurance Programs shall document the procedures to be used to verify compliance with these requirements. During construction, the Administrative Contracting Officer (ACO) will act as the chairperson of the Commissioning Team.

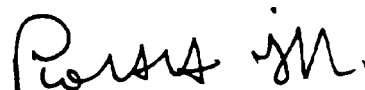
c. The using agency, in its capacity as user/owner/operator and ultimate customer, should make a continuous corporate commitment to the systems commissioning process. The using agency*s participation begins early in project development and requires continuous representation through the

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design/construction process. Appropriate resources and representation must be programmed and provided as required in the commissioning process. While the Corps of Engineers is ultimately responsible for a fully functional project, the using agency should convey their commissioning concerns and functional requirements clearly and early on a project specific basis, and participate in witnessing and determining acceptability of commissioning results. The design/construction elements and the using agency should work together in developing realistic and reasonable systems commissioning requirements to ensure adequate and complete results, and recognize the cost and schedule consequences associated with idealistic requirements.

d. Acceptance of the systems commissioning process, and the completed construction, may require extrapolation or interpretation of systems commissioning results to conditions other than those experienced during actual execution. Normally, an acceptable characteristic will be determined as a consensus of the commissioning team comprised of the using agency, design agent and construction agent. During construction, the ACO may need to facilitate and mediate to establish a consensus. If acceptable performance cannot be achieved, the necessary corrective measures should be carried out. The ACO will identify the construction deficiencies and/or design deficiencies causing problems and pursue a course of corrective action. The designer may be used to assist in diagnosing the cause of problems and should always provide recommended solutions to design deficiencies. The solutions to significant problems should be approved by the commissioning team, including the user. If the user cannot respond in a timely manner, decisions must be made without user input. Needless contract delays cannot be tolerated. The ACO must issue appropriate directions for corrective measures, through proper contractual channels. In cases of contractual disputes the appropriate contracting officer shall determine final direction.

FOR THE COMMANDER:



2 Appendices
APP A - Guidelines for the
Commissioning Process
APP B - Outline for the
Preparation of Systems
Commissioning Specification

ROBERT H. GRIFFIN
Colonel, Corps of Engineers
Chief of Staff