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Standard Guide for Evaluating Computerized Systems[1]

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1. Scope

1.1 This guide covers the evaluation of a computerized system that has been installed and accepted from the supplier. It deals with that system, as a whole, and how that system meets the needs for which it was acquired. Evaluations within other phases of system development and construction are covered in the documents describing those phases, or in separate documents.

1.2 This guide is not meant to describe an acceptance testing procedure; however, it does recognize and emphasize the need for acceptance testing in other phases.

1.3 *This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 622 Generic Guide for Computerized Systems[2]
E 623 Guide for Developing Functional Requirements for Computerized Systems[2]
E 624 Guide for Developing Implementation Designs for Computerized Systems[2]
E 625 Guide for Training Users of Computerized Systems
E 627 Guide for Documenting Computerized Systems[2]
E 730 Guide for Developing Functional Designs for Computerized Systems[2]
E 731 Guide for the Selection and Acquisition of Commercially Available Computerized Systems[2]
E 919 Specification for Software Documentation for a Computerized System
E 1013 Terminology Relating to Computerized Systems
E 1113 Guide for Project Definition for Computerized Systems

3. Terminology

3.1 *Description of Terms Specific to this Standard:*

3.1.1 *project definition*—a phase in the development of computerized systems in which a brief statement is developed as to what is to be accomplished and why (see Guides E 622, E 731 and E 1113).

3.1.2 *functional requirements*—a phase in the development of computerized systems in which all inputs to and outputs from the system, and transfer functions that produce the outputs from the inputs, are identified and described in detail (see Guide E 623).

3.1.3 *functional design*—a phase in the development of computerized systems which produces detailed descriptions of the system that are independent of particular hardware and software. This includes all flows of information, timing diagrams, and state transition diagrams (see Guide E 730).

3.1.4 *implementation design*—a phase in the development of computerized systems in which hardware and software components are selected, and implementation, operation and maintenance procedures are developed (see Guide E 624).

3.1.5 *system assembly, installation, and testing*—a phase in the development of computerized systems in which components are acquired, built, programmed, assembled, installed, and placed in operation (see Guides E 622 and E 625).

3.1.6 *system evaluation*—a phase in the development of computerized systems in which the system is compared with its requirements to determine how well the requirements are met, to determine possibilities for growth and improvement, and to preserve the lessons of this project in preparation for the next one.

3.1.7 *system documentation*—the accumulated documents relating to a computerized system that are prepared as the project proceeds. System documentation is not a separate phase. An important product of each of the previous phases is documentation (see Guides E 627 and E 919).

3.2 *Definitions:*

3.2.1 For additional terminology, see Terminology E 1013.

4. Significance and Use

4.1 The formal system evaluation process enables users to design better systems in the future.

4.1.1 The primary purposes of this document are to:

4.1.1.1 Determine if the installed system meets the needs specified in the functional requirements.

4.1.1.2 Determine if any necessary requirements were omitted from the functional requirements. If omitted, document whether they were assumed or left out of the implementation.

4.1.1.3 Evaluate if the design concept used is the proper one for this facility.

4.1.1.4 Ascertain if the system supplied fills the needs of the operation.

4.1.2 For future consideration:

4.1.2.1 Determine if compromises made during design and testing resulted in a less capable system than alternates.

4.1.2.2 Evaluate if this same design concept is appropriate for future systems.

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[2] *Annual Book of ASTM Standards*, Vol 14.01.

4.1.2.3 Find if the system has capabilities and potential beyond the functional requirements, or if the implementation leaves no room for expansion.

4.2 Requirements may change during the long process of planning and implementation. These changes must be dealt with. However, this guide covers only those changes that have been documented. Undocumented items must be dealt with elsewhere.

4.3 It is most important that the evaluation of a system be done promptly. If evaluation is delayed, it may be difficult to make a true evaluation because of changes in use, modification, or the like.

4.3.1 At least two further evaluations will be performed on the system. One should be scheduled after the system has been in operation a year or more. This can be considered a mid-life evaluation. The second is to be done when thoughts of replacement become persistent. See Section 11.

4.4 All of the discrepancies mentioned in 4.1, 4.2, and 4.3 must be considered, and well documented, since they should be considered in the planning of other systems.

4.5 The success of this guide depends on the engineering insight and experience of those performing the evaluation. The combination of insight, experience, and factual items presented in this evaluation provide a powerful tool for evaluating systems.

5. System Tests

5.1 Inasmuch as the system has already been accepted, the detailed evaluation of components should have been done in the design and implementation phases. The important determination in this phase is total system performance. The system, as a whole, must be evaluated to determine if it is functioning according to the specifications. It may be desirable to make some partial system tests by simply disconnecting certain components, or by testing them in other systems.

5.2 *Mechanical and Electrical Interfaces*—Evaluation of these interfaces may be done in several ways. Examination of the parts is among the quickest and easiest of ways. The evaluator's personal knowledge of the components is one of the surest ways to know how good they are and how well they will perform. Check the mechanical and electrical interfaces to determine that:

5.2.1 All interfaces are strong enough to provide the required connections and secure enough to stay in place,

5.2.2 Electrical interfaces make good contact without producing electrical noise that interferes with system operation, and that they will remain in good condition, not corrode, or otherwise deteriorate, and

5.2.3 Physical arrangement of components is such that undue strain is not produced by ordinary operation, handling, or servicing.

5.3 *Human Interfaces*—The person most often thought of as interfacing with the system is the operator. This person is only one of several that will need to interface with the system.

5.3.1 *Operator Interface*—Determine that:

5.3.1.1 Controls are well marked, accessible, and easy to operate,

5.3.1.2 There is no reasonable risk that controls, if accidently disturbed, will cause a disaster, and

5.3.1.3 Commands are designed so that routine use will not be laborious. It is desirable to have a set of commands that can be used for training or demonstrations; however, the commands used in routine operation must be executable with a minimum of entries and effort, and be quite clear and concise as to function.

5.3.2 *Servicing*—Determine if the system allows ease of servicing and repair. Document any shortcomings in this area.

5.3.3 *Maintenance*—Maintenance personnel may also be operators. An evaluation must be made of the ease with which maintenance can be performed. Routine maintenance should follow a logical pattern so that no item is likely to be overlooked. Maintenance documentation should be evaluated for completeness.

5.3.4 *Output for users*—Determine that the output is the same as the specified functional requirements.

5.3.5 *Output for Managers and Supervisors*—The functional requirements may specify output for managers and supervisors that is different from output for the principal users. If not, the output for users should fulfill the needs of management. If so, document the differences for users and evaluate the output to determine if it is adequate.

5.3.6 Evaluate the degree and sufficiency of training, preparation, and performance of the staff. Determine:

5.3.6.1 If the functional requirements provide any specifications for a staff,

5.3.6.2 If the staff is adequate to perform the required functions, and

5.3.6.3 If the staff has been properly trained.

5.4 *Electrical Distribution and Performance*—Determine:

5.4.1 If suitable electrical power is available to all components,

5.4.2 That all components have proper grounding, and

5.4.3 That the placement and shielding of electrical components is such that no part is adversely affected by the operation of another component.

5.5 *Software*—Determine that the software is functioning as specified.

5.5.1 *Timing*—Determine if timing studies were performed, and if the timing meets the specifications.

5.5.2 *Interactions*—Evaluate interactions among the subsets of programs. Determine if any subprogram is causing a deterioration of system performance.

5.5.3 For a complete evaluation, evaluate 5.5.1 and 5.5.2 at the same time. The areas discussed in 5.5.1 and 5.5.2 are only two examples of the numerous evaluations that should be performed. This guide is not intended to be a complete list of evaluations and procedures.

5.5.4 Verify that the system is designed to allow for change and maintainability.

5.6 Although environmental parameters should have been considered in the design phase of each module, these parameters are extremely important to the performance of the overall integrated system. Determine how closely the system compares to the environmental parameters set forth in the specifications. Determine further if the specifications are sufficient.

5.6.1 Determine if these environmental specifications have been adhered to. If there is any doubt, perform