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Capability Guidelines for Computer Controlled Test
Equipment for Hydraulic Components

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

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1. SCOPE:

1.1 Scope:

This SAE Aerospace Recommended Practice (ARP) establishes software capability guidelines for computer controlled test equipment, hereinafter referred to as automatic test equipment (ATE), for testing hydraulic components. A typical ATE system is shown in Figure 1. The items herein have been selected as potential features which may or may not be applicable to a particular application. This document does not address software development requirements, qualification procedures, or hardware design requirements, but encourages users to refer to existing documents, defined in 2.1.1, for guidance on such issues.

1.2 Field of Application:

It is anticipated that this document will be used as an aid and/or guideline for aerospace support equipment engineers, who are either designing ATE for hydraulic components or preparing design/procurement specifications for such equipment. In this document, "shall" denotes a requirement while "may" denotes a typical implementation. Because of the interdependency between system software and hardware and software requirements, it is anticipated that users of this document will separately establish the ATE hardware requirements.

NOTE: Hardware specification should specify operator input/output (I/O) devices, such as, but not limited to, graphics compatible printer, plotter, high resolution monitor, touchscreen, sealed keypad, floppy disk drive, RS-232 or IEEE-488 I/O ports. Such hardware features affect software requirements.)

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this specification to the extent specified herein. The applicable issue shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this specification and references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained. Users of this document are encouraged to review and reference the appropriate sections of the following documents, as appropriate to the specific applications.

2.1.1 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-2165	Testability Program for Electronic Systems and Equipment
DOD-STD-2167	Defense Systems Software Development
DOD-STD-2168	Defense Software Quality Assurance
MIL-HDBK-287	Defense System Software Development Handbook

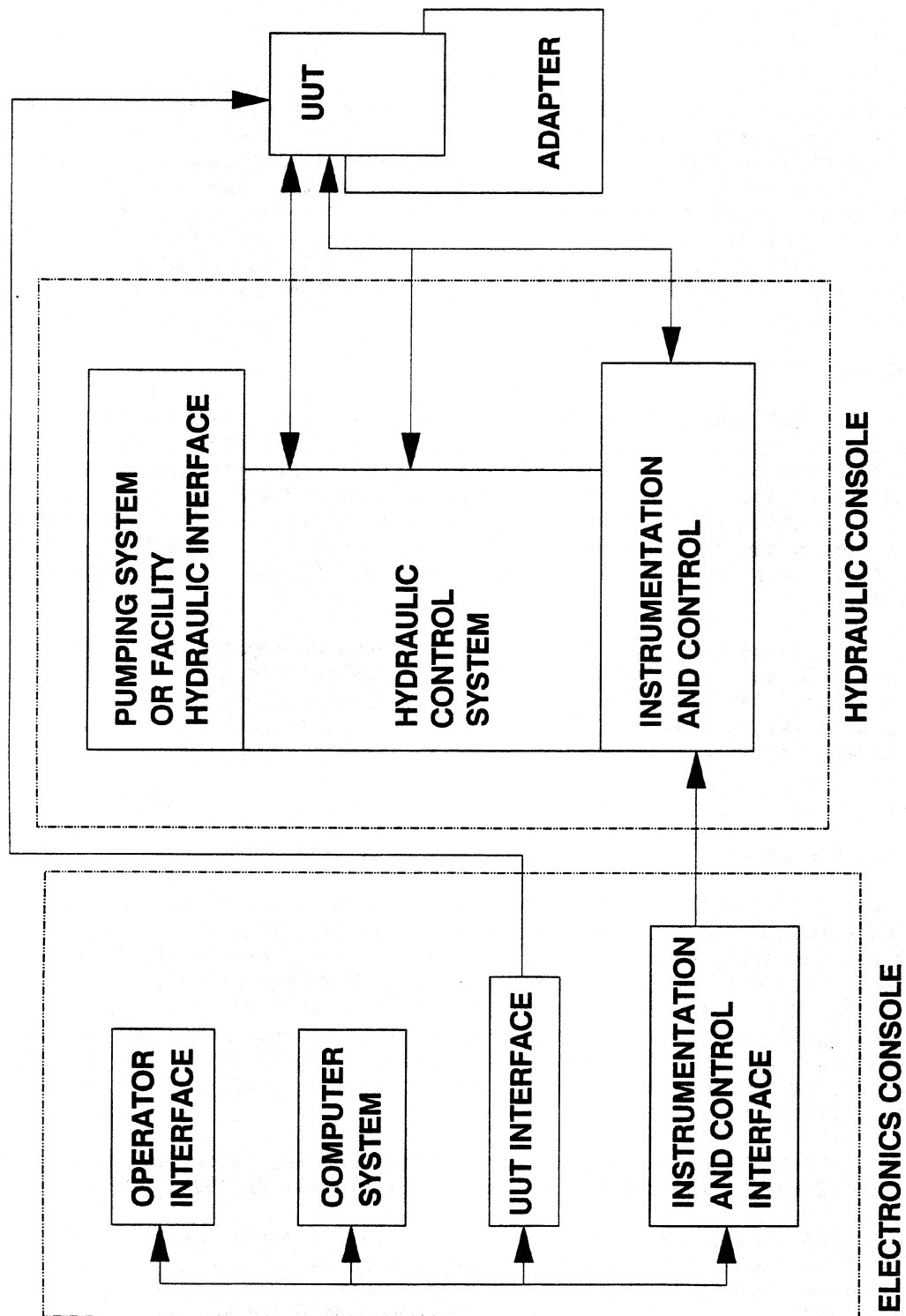


FIGURE 1 - Typical ATE System Diagram

2.2 Definitions:

- 2.2.1 **UNIT UNDER TEST (UUT):** UUT is defined as a component tested on the ATE. UUT testing may require the use of electrical, mechanical and/or hydraulic adapters in order to interface the UUT to the ATE.
- 2.2.2 **AUTOMATIC MODE:** The automatic mode is defined as that mode in which the operator can test a UUT from start to finish, by initiating a preprogrammed test sequence. Any interruptions in this mode, which require operator intervention (i.e., external leakage measurement, etc.), shall be minimized and should be approved by the customer.
- 2.2.3 **SEMIAUTOMATIC MODE:** The semiautomatic mode is defined as that mode in which the operator is able to select and initiate a subset of the automatic mode tests. The semiautomatic mode provides the operator with the flexibility to perform portions of the preprogrammed test sequences as desired by the user.
- 2.2.4 **MANUAL MODE:** Manual Mode is defined as that mode in which the operator is able to command, control, and communicate with the ATE system devices and the UUT, through the computer via an operator interface system. The manual mode enables the operator to directly control, configure and acquire data from any system device (i.e., transducers, solenoids, servovalves, latches, I/O devices, etc.), independent of the automatic or semiautomatic operation. Manual mode allows the creation of unique UUT test programs in which the operator may select various equipment configurations and test parameters.
- 2.2.5 **UUT PERFORMANCE VERIFICATION (PV) TEST:** Performance verification test is defined as the sequence of UUT individual tests, the results of which verify that the UUT is fully operational and meets all of its performance requirements.
- 2.2.6 **UUT INDIVIDUAL TEST:** An individual test is defined as a sequence of operations which verify either a single UUT performance requirement or a set of similar UUT performance requirements. To maximize utilization of acquired data and reduce test time, it may be advantageous to perform several UUT individual tests simultaneously. In such cases, tests can be combined into a single test module, which can be initiated by the operator. This type of module is also called an individual test. An example is a linear variable differential transformer (LVDT) test module, which performs specific individual tests to determine several performance parameters, including Null voltage, scalefactor, linearity and tracking, based on a single set of acquired data.
- 2.2.7 **UUT DIAGNOSTIC FAULT ISOLATION (DFI) TEST:** DFI test is defined as the sequence of UUT individual tests, the results of which identify failed component(s) in the UUT.
- 2.2.8 **APPLICATION SOFTWARE:** Application software is defined as those high-level software programs which accomplish ATE functional tasks. Examples include self-test, calibration, and UUT tests. In the scope of this document, the computer processor operating system is not considered application software.

- 2.2.9 **ON-LINE HELP:** On-line help is defined as a function, that is available to the operator during ATE operation, which provides the operator with additional informative and instructional messages to facilitate ATE operation and maintenance.
- 2.2.10 **USER-SELECTABLE:** User-selectable is defined as a function descriptor which requires that the system provide the operator with a predefined set of options, within the ATE hardware constraints, for that function. An example would be allowing the operator to select the state (ON/OFF) of a solenoid.
- 2.2.11 **USER-SPECIFIABLE:** User-specifiable is defined as a function descriptor which requires that the system allow the operator to specify a particular parameter, within the ATE hardware constraints, for that function. An example would be allowing the operator to specify the pressure regulation set point for a hydraulic port.
- 2.2.12 **OPERATOR:** Operator is defined as that individual who is selecting, initiating and executing ATE functions relating to UUT test.
- 2.2.13 **USER INTERFACE:** User Interface is defined as the means by which the operator communicates with the ATE and the UUT. User interface comprises both the hardware (including monitor, plasma tube, keypad, keyboard, function buttons, printer, plotter, touchscreen, audible alarms, and annunciator lights as appropriate for the application) and software (including software for prompting, selecting menus and displaying and formatting of test results).
- 2.2.14 **CONFIDENCE TEST:** Confidence test is defined as a brief ATE self-test performed during ATE initialization. Confidence test shall include a gross check of all ATE power supplies and digital/analog instrumentation for reasonable values and a verification that all I/O devices have been properly initialized. Specific conditions which may be checked during the confidence test include excessive analog instrumentation offsets, shorts, grounds, and opens. As a design goal, the system should be able to perform a confidence test with the UUT connected to the the test system.
- 2.2.15 **PRIMARY FAILURE:** Primary failure is defined as a failure, reported by the system software, that is related to a fault in the ATE which could result in damage to the ATE, UUT or operator.
- 2.2.16 **RUN-TIME FAILURE:** Run-time failure is defined as a software event which occurs during the execution of an application program whenever the program attempts to perform an operation which is outside the realm of anticipated operation. Examples of run-time failures include divide, case, arithmetic, heap and string overflows, and range errors. In many instances, such errors result from the processing of ill-conditioned or faulty test data.
- 2.2.17 **USER:** User is defined as that group who operates the ATE. Users include operators, maintainers, calibration technicians, and software development engineers. Specific users may be limited in terms of their ability to access certain ATE capabilities. For example, a UUT test operator may be unable to access calibration applications.