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                                        *NOT MEASUREMENT*
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                                        MIL-STD-2203A
                                        10 June 1994
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                                        SUPERSEDING
                                        MIL-STD-2203
                                        29 May 1987
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MILITARY STANDARD

ENERGY MONITORING AND CONTROL SYSTEMS,
PERFORMANCE VERIFICATION AND ENDURANCE TESTS

AMSC N6992   AREA ATTS
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FOREWORD

1. This military standard is approved for use by all Departments and
Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any
pertinent data which may be of use in improving this document should be
addressed to: Commanding Officer (Code 156), Naval Construction Battalion
Center, 1000 23rd Avenue, Port Hueneme, CA 93043-4301, by using the
Standardization Document Improvement Proposal (DD Form 1426) appearing at the
end of this document or by letter.

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1. SCOPE

1.1 Scope. The purpose of this Military Standard is to define generic Performance Verification and Endurance Tests for Energy Monitoring and Control Systems (EMCS), Utility Monitor and Control Systems (UMCS) and Utility Control Systems (UCS). These tests are to be used to assure that the physical and performance requirements of guide specifications for EMCS are tested, and that the test results are adequately documented. The Government shall base certain contractual decisions on the results of these tests. The EMCS, UMCS or UCS systems will typically have different names for the various devices used. For example, computer based devices used in the field are referred to as FIDs, smart field panels, RTUs, RCUs, or other names. Regardless of what the devices are named, the appropriate tests should be performed.

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2. APPLICABLE DOCUMENTS

2.1 Government documents. This paragraph is not applicable.

2.2 Non-Government publications. The following document(s) form a part of this standard to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS (ASHRAE)

    ASHRAE Handbook of Fundamentals.

(Application for copies should be addressed to the American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305.)

(Non-Government standards and other publications are normally available from the organizations that prepare or that distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this standard and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this standard shall take precedence. Nothing in this standard, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

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3. DEFINITIONS

3.1 Algorithm. An algorithm is a set of well-defined rules or procedures for solving a problem or providing an output from a specific set of inputs.

3.2 Analog. An analog is a continuously varying signal value temperature, current pressure, etc.

3.3 Analog to digital (A/D) converter. An A/D converter is a circuit or device whose input is information in analog form and whose output is the same information in digital form.

3.4 Architecture. Architecture is the general organization and structure of hardware and software.

3.5 American Standard Code for Information Interchange (ASCII). ASCII is an 8-bit coded character set to be used for the general interchange of data among information processing systems, communications systems, process control systems, and associated equipment.

3.6 Assembler. An assembler is a utility program which translates assembly language source code into the machine executable object code.

3.7 Assembly language. Assembly language is a low-level computer language used to program and manage the operations of a computer.

3.8 Asynchronous computer. An asynchronous computer is an automatic digital computer in which each operation starts as a result of a signal generated by the completion of the previous event or operation, or by the availability of the parts of the computer required by the next event or operation.

3.9 Asynchronous transmission. Asynchronous transmission is data transmission in which each character contains its own start and stop bits.

3.10 Automatic temperature control (ATC). ATC is a local loop network of pneumatic or electric/electronic devices which are interconnected to control temperature.

3.11 Auxiliary Control Unit (ACU). An ACU is a microcomputer based device that connects field sensors and control devices to a RCU.

3.12 Background programming. Background programming is a feature of computer hardware to provide a means of writing, testing, and debugging a software program on the computer at the same time the computer is performing other "Real Time" programs.

3.13 BASIC. BASIC is an acronym for Beginners All-Purpose Symbolic Instruction Code, a high-level, English-like programming language used for general applications.

3.14 Baud. A baud is a unit of signaling speed equal to the number of discrete conditions, or signal events, per second.

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3.15 Bit. Bit is an acronym for binary digit, the smallest unit of information which can be represented. A bit may be in one of two states, represented by the binary digits 0 and 1.

3.16 Bit error rate. The bit error rate is the number of incorrect or erroneous bits divided by the total number (correct plus incorrect) over some stipulated period of time.

3.17 Bootstrap. A bootstrap is a technique or device designed to bring a computer into a desired state by means of its own action.

3.18 Break point. A break point is a point in a program where an instruction or other condition enables a programmer to interrupt the running of a program by external intervention or a monitor routine. Break point is used in debugging.

3.19 Buffer. A buffer is a temporary data storage device used to compensate for a difference in data flow rate or event times, when transmitting data from one device to another.

3.20 Bus. A bus is a circuit path (or parallel paths) over which data instructions are transferred to all points in the computer system. Computers have several separate busses: the data, address, and control busses are those of greatest importance.

3.21 Byte. One byte is equal to eight bits.

3.22 Call. Call is a term used to designate the software procedure by which software control is transferred to a callable subroutine.

3.23 Callable. Callable is a subroutine module to which software control can be transferred.

3.24 Central control unit (CCU). The CCU is a process control digital computer that includes a CPU, central memory, and I/O bus.

3.25 Central operator station (COS). The COS is typically made up of a computer, monitor, disk drives, printers, and communication devices. The COS allows an operator to control the EMCS, UMCS, or UCS.

3.26 Central processing unit (CPU). The CPU is the portion of a computer that performs the interpretation and execution of instructions. It does not include memory or I/O.

3.27 Character. A character is one of a set of elementary symbols which normally include both alpha and numeric codes plus punctuation marks and any other symbol which may be read, stored, or written.

3.28 Clock. A clock is a device or a part of a device that generates all the timing pulses for the coordination of a digital system. System clocks usually generate two or more clock phases. Each phase is a separate, square wave pulse train output.

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3.29 Communications link terminations (CLT). The CLT is an independent piece of hardware that provides an interface point between the CCU and the Data Transmission Media.

3.30 Compiler. The compiler is a language translator which converts source statements written in a high level language into multiple machine instructions. A compiler translates the entire program before it is executed.

3.31 Control point adjustment (CPA). CPA is the procedure of changing the operating point of a local loop controller from a relocation.

3.32 Control sequence. The control sequence is an equipment operating order established upon a correlated set of data environment conditions.

3.33 Memory resident. The memory resident specifies a program which currently resides in central memory (and may thus be considered active) as opposed to programs residing on the disk which must be loaded into central memory for execution.

3.34 Cycle time. The cycle time, in microseconds/word for central memory, is the minimum time interval that must elapse between the starts of two successive accesses to any one storage location.

3.35 Data communications equipment. The data communications equipment is a device for transmitting digital information to and from any other system.

3.36 Data environment (DE). DE are the sensors and control devices connected to a single FID/MUX from the equipment and systems sampled or controlled.

3.37 Data terminal cabinet (DTC). The DTC is an independent metallic enclosure that provides an interface point between the FID/MUX Field Wiring Terminals and the Data Environment.

3.38 Data transmission media (DTM). DTM is transmission equipment including cables and interface modules (excluding MODEMs) permitting transmission of digital and analog information.

3.39 dbm. dbm is a measure of absolute power values. Zero dbm equals one milliwatt.

3.40 Debugging. Debugging is the procedure for detecting and correcting errors in a program.

3.41 Decibel (dB). A decibel is the standard unit for expressing transmission gain or loss utilizing logarithmic power and voltage ratios.

3.42 Deck. In HVAC terminology, the deck is the air discharge of the hot or cold coil in a duct serving a conditioned space.

3.43 Demand. Demand is the term used to describe the maximum rate of use of electrical energy averaged over a specific interval of time and usually expressed in kW.

3.44   Demultiplexer. A demultiplexer is a device used to separate two or more signals previously combined by compatible multiplexer for transmission over a single circuit.

3.45   Diagnostic program. A diagnostic program is machine-executable instructions used to detect and isolate malfunctions.

3.46   Digital signal. A digital signal is a discontinuous signal, the various states of which are discrete intervals apart. In some systems, the signal is either on or off (zero or one) and is referred to as binary.

3.47   Digital to analog (D/A) converter. The D/A converter is a hardware device which converts a digital signal into a voltage or current proportional to the digital input.

3.48   Direct digital control (DDC). The DDC is the sensing and control of processes directly with digital control electronics.

3.49   Direct memory access (DMA). The DMA is a provision for transfer of data blocks directly between memory and an external device interface.

3.50   Disk storage. The disk storage is a bulk storage, random access device for storing digital information. Usually consists of a thin rotating circular plate having a magnetizable coating, a read/write head with associated control equipment.

3.51   Distributed processing system. A distributed processing system is a system of multiple processors each performing its own task, yet working together a complete system under the supervision of a central computer, to perform multiple associated tasks.

3.52   Download. The download is the transfer of digital data or programs from a host computer to another data processing system such as central computer to microcomputer.

3.53   Driver/handler. The driver/handler is software which manages input/output to and from a given peripheral device.

3.54   Duplex. Duplex is a method of operation of a communications line in which each terminal can simultaneously transmit and receive.

3.55   Energy monitoring control system (EMCS). EMCS is a distributed processing system used to monitor and control energy usage.

   a.   A medium EMCS consists of the following major components.
        Distributed processing architecture is required.

        (1)   Minicomputer based CCU or COS (16 bit minimum).
        (2)   Color graphics monitor based operator's console.
        (3)   Alphanumeric monitor based system terminal.
        (4)   Alarm printer.
        (5)   Logging printer.
        (6)   Rigid disk systems.
        (7)   Bulk software loading device.

(8) System RTC.
(9) FID and MUX panels.
(10) Magnetic tape system.
(11) CLT.

b. A large EMCS, is identical to a medium EMCS except for a second CCU or COS and associated failover controller. Distributed processing architecture is required.

c. A micro EMCS, less than 125 points, consists of the following major components. Distributed processing architecture is not utilized. Portable device(s) utilized for programming, bulk loading, and diagnostics. Continuous operator interaction is not required. Alarm reporting or data display is accomplished via digital or analog I/O.

(1) Microcomputer based CCU or COS.
(2) System RTC.
(3) RCU panels.
(4) Programming and service panel (removable).
(5) CLT.

3.56 Executive program. The executive program is the main system program designed to establish priorities and to process and control other programs.

3.57 Failover controller. The failover controller is a hardware device or software to transfer functions from one CCU or COS to another CCU or COS in the event of CCU or COS failure.

3.58 Fall-back mode. The fall-back mode is the pre-selected operating mode of a FID when communications cease with the MCR or the operating sequence of each local control loop when the FID or RTU to which it is connected ceases to function.

3.59 Field interface device or remote terminal unit (FID or RTU). The FID or RTU is a small, intelligent hardware device containing software which implements the distributed processing aspects of operation with the central computer as well as maintaining effective control of field control loops in the absence of higher level influence. Operating constants are changed by down-line loading from the CCU or COS as well as from within the FID or RTU.

3.60 Firmware. Firmware is a procedure for accomplishing arithmetic operations where the instruction set is resident in ROM or PROM.

3.61 FORTRAN. FORTRAN is an acronym for FORmula TRANslation, a high-level, English-like programming language used for technical applications.

3.62 Function keys. Function keys are keys which, when depressed, send more than one character and are interpreted by the computer as a specific command.

3.63 Half duplex. Half duplex is a method of operation of a communications line in which each terminal can transmit and receive, but not simultaneously.

3.64 Hardware. Hardware is equipment, such as a CPU, memory, peripherals, sensors, and relays.

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3.65 Hardware vectored interrupts. Hardware vectored interrupts is a hardware feature which allows the CPU to directly determine the identity of an interrupting device and to automatically transfer control to a program which will service the interrupt.

3.66 Heating, ventilating, and air conditioning. Equipment used to heat, cool or circulate air in building or equipment.

3.67 Initialization (of the system). Initialization is the process of loading the operating system with the computer. Initialization is required to start normal operation of the computer after the computer has been out of service.

3.68 Input/output bus. The input/output bus is the connection through which data is transmitted and received from peripheral devices interacting with the processor. Heating, ventilating, and air conditioning (HVAC) equipment used to heat, cool or circulate air in buildings or equipment.

3.69 Input/output (I/O) device. The I/O device is digital hardware that transmits or receives data.

3.70 Interactive. Interactive functions are functions performed by an operator with the machine prompting or otherwise assisting these endeavors, while continuing to perform all other tasks as scheduled.

3.71 Interpreter. An interpreter is a language translator which converts individual source statements into machine instructions by translating and executing each statement as it is encountered.

3.72 Interrupt. An interrupt is an external or internal signal requesting that current operations be suspended to perform more important tasks.

3.73 Large scale integration (LSI). LSI is the technology of manufacturing integrated circuits (IC) capable of performing complex functions. Devices of this class contain 100 or more logic gates of a single chip.

3.74 Line conditioning. Line conditioning is electronic modification of the characteristic response of a line to meet certain standards. The characteristics include frequency response, signal levels, noise suppression impedance, and time delay.

3.75 Line driver. A line driver is a hardware element which enables signals to be directly transmitted over circuits to other devices some distance away.

3.76 Loader. A loader is a program used to prepare the computer and store other programs into memory location preparation for machine execution.

3.77 Local loop control. The local loop control is the control for any system or subsystem which existed prior to the installation of an EMCS and which will continue to function when the EMCS is non-operative.

3.78 Macro. Macro is a single programming symbolic instruction that generates multiple assembly language instructions.

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3.79 Machine language. Machine language is the binary code corresponding to the instruction set of the CPU.

3.80 Master control room (MCR). The MCR is the central facility containing the operator console, CCU, and related equipment for control and supervision of the complete EMCS.

3.81 Medium scale integration (MSI). An MSI is the same as an LSI but to a lesser degree.

3.82 Memory. A memory is any device that can store logic 1 and logic 0 bits in such a manner that a single bit or group of bits can be accessed and retrieved.

3.83 Memory address. A memory address is a binary number that specifies the precise memory location of a stored word.

3.84 Microcomputer. A microcomputer is a computer system based on a microprocessor and containing all the memory and interface hardware necessary to perform calculations and specified transformations.

3.85 Microprocessor. A microprocessor is a central processing unit fabricated as one integrated circuit.

3.86 Mnemonic. A mnemonic is a symbolic representation or abbreviation to help operators remember and understand.

3.87 MODEM. MODEM, an acronym for MOdulator/DEModulater, is a hardware device used for changing digital information to and from an analog form to allow transmission over voice grade circuits.

3.88 Monitor. A screen on which graphics and alphanumeric data can be displayed.

3.89 Multiplexer (MUX). An MUX is a device which combines multiple signals on one transmission media.

3.90 Multi-tasking. Multi-tasking is the procedure allowing a computer to perform a number of programs simultaneously under the management of the operating system.

3.91 Non-volatile memory. Non-volatile memory is memory which retains information in the absence of applied power (i.e., magnetic core, ROM, and PROM).

3.92 Normal mode operation. Normal mode operation describes equipment operating and performing its assigned tasks.

3.93 Object code. An object code is a term used to describe machine language.

3.94 Operating system. The operating system is a complex software system which manages the computer and its components and allows human interaction.

3.95 Optical isolation. Optical isolation is the electrical isolation of a portion of an electronic circuit by using an optical semiconductor and modulated light to carry the signal.

3.96 Parameter. A parameter is a variable that is given a constant value for a specific purpose or process.

3.97 Parity. Parity is a checking code within a binary word used to help identify errors.

3.98 PASCAL. PASCAL is a "structured programming" high level computer language.

3.99 Peripheral equipment. Peripheral equipment is equipment used for man-machine communications and further support of a processor.

3.100 Point. A point is an individual connected monitor or control devices (i.e., relay, temperature sensor).

3.101 Prediction program. A prediction program is applications software which allows continuous prediction of a future value and subsequent correction based on actual measurements.

3.102 Process automation. Process automation is process control without human intervention.

3.103 Process control. Process control is the collective functions performed by the equipment which is to control a variable.

3.104 Program. A program is a sequence of instructions causing the computer to perform a specified function.

3.105 Prompt/response sequence. Prompt/response sequence is man-machine dialogue by which the computer asks questions and requests responses from the operator.

3.106 Protocol. Protocol is a formal set of conventions governing the format and relative timing of message exchange between two terminals.

3.107 Random access memory (RAM). RAM is a volatile semiconductor data storage device in which data may be stored or retrieved. Access time is effectively independent of data location.

3.108 ROM, PROM, EPROM, and EEPROM. ROM, PROM, EPROM, and EEPROM are acronyms for Read-Only-Memory, Programmable ROM, Erasable PROM, Electrically Erasable PROM; a non-volatile semiconductor memory.

3.109 Real time. Real time is a situation in which a computer monitors, evaluates, reaches decisions, and effects controls within the response time of the fastest phenomenon.

3.110 Real time clock (RTC). A real time clock is a device which maintains accurate time of day, day of week, and date information for the computer. The RTC may be updated by hardware.

3.111 Register. A register is a digital device capable of retaining information.

3.112 Reinitialization. Refer to initialization.

3.113 Remote control unit (RCU). The RCU is an intelligent hardware device containing software which implements the distribution process aspects of operating with the central computer as well as maintaining effective control of field control loops.

3.114 Remote operator station (ROS). Identical to a COS except remotely located.

3.115 Resistance temperature detector (RTD). An RTD is a device where resistance changes linearly as a function of temperature.

3.116 Selective generation. Selective generation is where the management of input/output is restricted to selected peripherals.

3.117 Sensors. Sensors are devices used to detect or measure physical phenomena.

3.118 Single stepping. Single stepping is the procedure by which the next statement in a memory resident program is executed by depressing a switch.

3.119 Snapshot. A snapshot is a picture of the instantaneous status and state of a system.

3.120 Software. Software is a term used to describe all programs whether in machine, assembly, or high-level language.

3.121 Source code. Source code is a term used to describe assembler and high-level programmer developed code.

3.122 Stand-alone. Stand-alone is a term used to designate a device or system which can perform its function totally independent of any other device or system.

3.123 Standard panel. A control panel developed by the U.S. Army Corps of Engineers to control heating, ventilating, and air conditioning equipment.

3.124 Supervisory control. Supervisory control is a separate (and usually remote) control and monitoring of local control loops. (See Direct digital control.)

3.125 System normal heavy. System normal heavy load conditions are defined as the occurrence throughout the system of a total of three status changes, three digital alarms, three analog high or low limit alarms, and three analog quantity changes within the high and low limits during a single 1-second interval. This number of similar occurrences shall repeat on a continuous basis during successive 1 second intervals for up to 30 seconds. The system normal heavy load conditions shall have 50 percent of the changes and alarms, including no less than one of each type, occurring at a single FID or MUX with the remaining changes and alarms distributed among the remaining

FID/MUX. No DTM link shall be more than 65 percent loaded during this normal heavy load condition and the alarm printer shall continue to print out all occurrences.

3.126 Throughput. Throughput is the total capability of equipment to process or transmit data during a specified time period.

3.127 Time base generator (TBG). See Clock.

3.128 Time tag. A time tag is the date and time of occurrence of an event.

3.129 True digital. A true digital is a representation of any value by symmetric digits, used to form fixed length words.

3.130 Unitary control unit (UCU). UCU is a microprocessor based, dedicated purpose device designed and programmed to control air distribution system mixing boxes, terminal units or variable air volume (VAV) boxes.

3.131 Utility control system (UCS). A computer based system for monitoring and for controlling utility systems. A typical system would include a COS, DTM and RTSs/ACUs.

3.132 Utility monitoring and control systems (UMCS). A computer based system for monitoring and controlling utility systems and energy usage. A typical system would include COSs, DTM, and RCUs/ACUs.

3.133 Volatile memory. A volatile memory is a semiconductor device in which the stored digital data is lost when power is removed.

3.134 Word. A word is a set of binary bits handled by the computer as the primary unit of information.

3.135 Zone. A zone is an area composed of a building, a portion of a building, or a group of buildings affected by a single device or piece of equipment.

3.136 Definitions of acronyms used in this standard. The following acronyms listed in this Military Standard are defined as follows:

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A/D     - Analog to digital.
AA      - Analog alarm.
AC      - Alternating current.
ACU     - Auxiliary control unit.
AHU     - Air handling unit.
AI      - Analog input.
AO      - Analog output.
ASCII   - American standard code for information interchange.
ATC     - Automatic temperature control.
B/C     - Benefit to cost ratio.
BASIC   - Beginners all-purpose symbolic instruction code.
BCD     - Binary coded decimal.
bit     - Binary digit.
bps     - Bits per second.
Btu/hr  - British thermal unit per hour.
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CCU      - Central control unit.
CHW      - Chilled water.
CLT      - Communications link termination.
COS      - Central operator station.
CPA      - Control point adjustment.
cps      - Characters per second.
CPU      - Central processing unit.
CT       - Current transformer.
D/A      - Digital to analog.
dB       - Decibel.
DC       - Direct current.
DDC      - Direct digital control.
DE       - Data environment.
DI       - Digital input.
DMA      - Direct memory access.
DO       - Digital output.
DPS      - Differential pressure switch.
DTC      - Data terminal cabinet.
DTM      - Data transmission media.
DX       - Direct expansion.
E/C      - Energy to cost ratio.
EEPROM   - Electrically erasable PROM.
EMCS     - Energy monitoring and control system.
EMI      - Electromagnetic interference.
EPROM    - Erasable PROM.
FCB      - Failover control board.
FID      - Field interface device.
FORTRAN  - Formula translation.
FS       - Flow switch.
FSK      - Frequency shift keying.
H/C      - Hot/cold.
HOA      - Hand-off-automatic.
hp       - Horsepower.
HVAC     - Heating, ventilating, and air conditioning.
HW       - Hot water.
Hz       - Hertz.
I&C      - Instrumentation and control.
I/O      - Input/output.
IC       - Integrated circuit.
IMUX     - Intelligent multiplexer.
kHz      - Kilohertz.
kW       - Kilowatt.
kWh      - Kilowatt-hour.
lpm      - Lines per minute.
LSI      - Large scale integration.
mA       - Milliamp.
MBtu     - Btu (millions).
MCR      - Master control room.
MHz      - Megahertz.
MODEM    - Modulator/demodulator.
MSI      - Medium scale integration.
MUX      - Multiplexer.
Mb       - Megabyte.
OA       - Outside air.
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PROM    - Programmable ROM.
PS      - Pressure switch.
psi     - Pound-force per square inch.
psia    - Pound-force per square inch, absolute.
psid    - Pound-force per square inch, differential.
psig    - Pound-force per square inch, gage.
PT      - Potential transformer.
RA      - Return air.
RAM     - Random access memory.
RCU     - Remote control unit.
RF      - Radio frequency.
RFI     - Radio frequency interference.
RH      - Relative humidity.
RHT     - Reheat.
RMS     - Root mean square.
ROM     - Read only memory.
RT      - Run-time.
RTC     - Real time clock.
RTD     - Resistance temperature detector.
RTU     - Remote terminal unit
S/N     - Signal to noise ratio.
S/S     - Start/stop.
TBG     - Time base generator.
TTL     - Transistor-transistor logic.
UCS     - Utility control system.
UMCS    - Utility monitoring and control system.
VAC     - Volt, alternating current.
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4. GENERAL REQUIREMENTS

4.1 General. Performance Verification and Endurance Tests shall be
conducted under normal mode operation unless otherwise indicated in initial
conditions description for each test. System normal mode describes a condition
in which the system is performing its assigned tasks in accordance with the
contract requirements.

Performance Verification and Endurance Tests shall be conducted on hardware and
software installed at the job site to assure that the physical and performance
requirements of guide specifications are met. Tests on data transmission media
(DTM) shall include all contractor furnished DTM. Tests on FID or RTU and MUX
or ACU operation shall include at least one FID or RTU and MUX or ACU on each
DTM. Tests on I/O functions shall include each type of installed I/O function
and failure mode in each DTM.

Micro EMCS shall use a portable diagnostic programming, and bulk loading device
for operator interface for display and control of digital and analog points, and
for display of memory locations. For large/medium EMCS, UMCS, and UCS these
tasks shall be accomplished at the operator's console.

4.2 Test plans. Prior to the scheduling of the tests, the contractor shall
provide the Government with a Performance Verification and Endurance Test Plan
(see 6.3), including the following:

   . Installed system block diagram.
   . System hardware description.
   . System software description.
   . Operator's commands.
   . I/O summary tables with failure modes for test points.
   . Required passwords for each operator access level.
   . Description of each type of digital I/O and analog I/O to be used in
      the test.
   . List of test equipment.

For each application program shown in the I/O summary table, the contractor
shall provide:

   . Inputs required for each program (I/O point values and status) and
      corresponding expected results for each set of input values.
   . Default values for the program inputs not implemented or provided for
      in the contract documents for the application programs to be tested.
   . Failure modes for each I/O function to be tested.

4.2.1 Data requirements for test plans. EMCS Performance Verification and
Endurance Test Plans (see 6.3), applies to this requirement. Deliverable data
identified on the DD Form 1423 shall be prepared in accordance with instructions
specified in the DID.

4.3 Test procedures. The Contractor shall provide the approved EMCS
Performance Verification and Endurance Test Procedures (see 6.3). Test
procedures shall be developed from the test plans. The test procedures shall
consist of detailed instructions for test setup, execution, and evaluation of
test results.

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4.3.1 Data requirements for test procedures. EMCS Performance Verification and Endurance Test Procedures (see 6.3), applies to this requirement. Deliverable data identified on the DD Form 1423 shall be prepared in accordance with instructions specified in the DID.

4.4 Test reports. The Contractor shall provide EMCS Performance Verification and Endurance Test Reports (see 6.3). The test reports shall document the results of the tests.

4.4.1 Data requirements for test reports. EMCS Performance Verification and Endurance Test Reports (see 6.3), applies to this requirement. Deliverable data identified on the DD Form 1423 shall be prepared in accordance with instructions specified in the DID.

4.5 Test equipment and set up. All test equipment calibrations shall be traceable to NBS Standards or verified against a primary standard. The accuracy of the test equipment and overall test method shall be at least twice the maximum accuracy required for the test. For example, if the temperature sensor has an accuracy of +/-1oF over the executed range, the test instrument used shall have an accuracy of at least +/-0.5oF. All test equipment shall be provided by the contractor unless otherwise noted in the contract documents.

Test equipment for the Performance Verification and Endurance Tests shall include the following:

- . Surge Generator.
- . 480 VAC, RMS, at 60 Hz power source.
- . 180 VAC, peak, at 60 Hz power source.
- . Storage oscilloscope.
- . AC Signal Generator.
- . DC Signal Source.
- . Portable diagnostic programming and bulk loading device.
- . Test set.
- . Equipment that can generate 10 dry contact closures per second and indicate the number of pulses transmitted.
- . Equipment to test system accuracy - certified standard traceable to NBS. Accuracy should be at least twice the accuracy of the most accurate sensor to be tested.
- . Stop watch with 0.1 second time intervals.
- . White noise generator or communication error generator.

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5. DETAILED REQUIREMENTS

5.1 General. This section presents the generic EMCS Performance Verification and Endurance Test Procedures (see 4.3 and 6.3) with the following information:

. Test identification number.
. Test title.
. Objective.
. Generic EMCS configuration to be tested (large & medium).
. Initial conditions (if applicable).
. Test equipment (if required).
. Sequence of events.
. Expected results.

A space has been left open for the project specification paragraph number since the project specifications will vary for each job. The label has been included as a reminder that each Performance Verification and Endurance Test shall refer to the appropriate project specification paragraph(s).

5.2 Performance verification tests. The following are the Performance Verification Tests to be conducted on the EMCS.

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TEST NO: PVT-1A Page 1 of 1   OBJECTIVE: To verify that the
TITLE: Initial System Equipment   hardware components of the system
              Verification   provided by the contractor are in
APPLIES TO: Large/Medium EMCS, UMCS,   accordance with the contract plans
              and UCS   and specifications and all approved
REFERENCE: Proj. Spec. Paragraph ------ submittals.

INITIAL CONDITIONS

1. The contractor provides a list of approved system hardware components,
including the name of the component, manufacturer, and model number. This list
is based on the contract plans, specifications, change orders (if any) and
approved submittals which must be available for reference purposes during the
test.

              EVENT   EXPECTED RESULTS

1. The model numbers of each hardware   1. Model numbers of equipment
    component should be examined and   provided must match the model
    checked against the model numbers   numbers of the equipment on the
    of the equipment provided by the   approved submittals and which was
    contractor.   successfully tested at the factory
                                             test.

Test No: PVT-1A
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TEST NO: PVT-2A   Page 1 of 1   OBJECTIVE: To demonstrate that the
TITLE: System Startup   system normal startup procedures can
APPLIES TO: Large/Medium EMCS, UMCS,   initiate operation including
              and UCS   initializing CCU/COS and FIDs/RCUs.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. All equipment is off.

2. The contractor provides the EMCS performance verification test software and
    data points to be loaded into the system.

            EVENT   EXPECTED RESULTS

1. Energize the equipment (CCU or COS, 1. The equipment is ready for
    FID/MUX or RCU/ACU and peripherals).   operation.

2. Initiate system startup using   2. System loads CCU or COS, and FIDs
    procedures (bootstrap) specified   or RTUs with required software.
    by the computer manufacturer.

3. Load and run all software, which   3. System loads software and begins
    includes all data points required   execution of performance
    for the complete performance   verification test.
    verification test.

4. Using system terminal, display or   4. Memory map shows amount of memory
    print memory map.   installed and programs loaded.

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TEST NO: PVT-3A Page 1 of 1   OBJECTIVE: To demonstrate the system
TITLE: System Accuracy and   accuracy and resolution from analog
              Resolution   inputs to the operator's monitor
APPLIES TO: Large/Medium EMCS, UMCS,   display is within the specified
              and UCS   limits.
REFERENCE: Proj. Spec. Paragraph -------

TEST EQUIPMENT

1.   A currently certified standard traceable to the National Bureau of Standards
     for each type analog signal to be tested.

2.   The accuracy of the test equipment and overall test method is at least twice
     the accuracy of the most accurate sensor to be tested.

          EVENT   EXPECTED RESULTS

1.   Place certified standard at the   1.   The system displays analog values
     terminals of each type of AI to be   within 0.5 percent of the standard
     used in the system. Command the   test equipment readout across the
     system to display analog values.   entire range of analog input (zero,
                                              mid range size and full range).

2.   Vary the output of a calibrated   2.   The system displays a new analog
     test device connected to each type   value that is within 0.5 percent
     of analog I/O to be installed so   of the standard test equipment
     the output change in value is   readout.
     one-half the specified accuracy of
     the measured variable.

3.   Connect one of each type of analog 3.   Select each analog input
     sensor and transmitter configuration   configuration for display, the
     required by the Contract   accuracy should be
     specification into analog inputs. $(AI)2 + (Sensor)2 + (Transmitter)2$.
     Demonstrate the accuracy of each   For a calibrated temperature sensor
     analog sensor configuration over   (RTD), the accuracy should be the
     their respective spans in five equal $(.5)2 + (.1)2 + (.1)2 = .52\%$
     steps.   of temperature span.

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TEST NO:      PVT-4A  Page 1 of 1        OBJECTIVE:  To demonstrate that the
TITLE:        FID or RTU Memory and      FIDs/RCUs have the specified amount
              FID/MUX or RCU/ACU Spare   of memory and the specified spare
              I/O Capacity               I/O capacity.
APPLIES TO:   Large/Medium EMCS, UMCS,
              and UCS
REFERENCE:    Proj. Spec. Paragraph ------
```

TEST EQUIPMENT

1.   A FID or RTU portable tester.

EVENT	EXPECTED RESULTS
1. Command the FID or RTU to display memory size.	1. FID or RTU should have at least the specified amount of memory.
2. Count spare I/Os in selected FID/MUX or RCU/ACU.	2. Verify the number of spare I/Os corresponds with the maximum number of active and spare I/Os required by the approved shop drawings for FIDs and MUXs or RCUs and ACUs.

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TEST NO: PVT-5A   Page 1 of 2   OBJECTIVE: To demonstrate that the
TITLE: FID or RTU Startup and   FID or RTU can start operation
             Functions   automatically without human
APPLIES TO: Large/Medium EMCS, UMCS,   intervention. To demonstrate FID or
             and UCS   RCU monitoring and control functions
REFERENCE: Proj. Spec. Paragraph ------ in normal operational mode and in
                                           stand-alone mode.

INITIAL CONDITIONS

1. The FID or RTU power switch is off. Battery backup is disabled. There is
    no data stored in the FID or RTU RAM. The DTM line to the CCU or COS is
    disconnected.

TEST EQUIPMENT

1. A portable test set.

        EVENT   EXPECTED RESULTS

1. Power up the FID or RTU.   1. Visually verify "POWER ON" lamps
                                          are lit. FID or RTU automatically
                                          performs self-test diagnostics and
                                          displays NO GO condition. All FID
                                          or RTU and associated MUX or ACU
                                          outputs in the predetermined
                                          failure mode defined in the I/O
                                          tables.

2. Enable the DTM to CCU or COS.   2. FID or RTU establishes
                                          communication with CCU or COS.
                                          The CCU or COS automatically sets
                                          the FID or RTU time clock, and
                                          downloads all parameters: alarms,
                                          constraints, and application
                                          programs. The FID or RTU indicates
                                          that it is on-line.

3. Verify operation of the following 3. Operator console display matches DE
    FID/MUX or RCU/ACU monitoring   conditions.
    functions:

    . Scanning of inputs.
    . Control of outputs.
    . Report to CCU or COS of DE
        changes only.
    . Report to CCU or COS of DE status.
    . Averaging or filtering of all
        analog inputs.

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TEST NO: PVT-5A Page 2 of 2   OBJECTIVE: To demonstrate that the
TITLE: FID or RTU Startup and   FID or RTU can start operation
             Functions   automatically with human
APPLIES TO: Large/Medium EMCS, UMCS,   intervention. To demonstrate FID or
             and UCS   RTU monitoring and control functions
REFERENCE: Proj. Spec. Paragraph ------ in normal operational mode and in
                                        stand-alone mode.

                EVENT   EXPECTED RESULTS

4. Enter commands to operate the   4. Operator command matches DE status.
    following FID/MUX or RCU/ACU
    control functions:

    . Constraints checks (prior to
      command issuance).
    . Control functions: digital output.
    . Control functions: analog output.

5. Initiate a change in an analog   5. FID or RTU rejects value and sends
    point so that its value exceeds a   an alarm message to the CCU or COS.
    high or low reasonableness value.
    Select a point that provides input
    into an application program.

6. Disconnect DTM to FID or RTU.   6. The system reports an alarm
    Connect FID or RTU portable tester   indicating loss of communication.
    and reset FID or RTU real time   Verify FID or RTU RTC and CCU or
    clock (RTC) to be out of   COS time base generator are not
    synchronization.   synchronized.

7. Reconnect the DTM to the FID or 7. System automatically corrects the
    RTU.   FID or RTU RTC so that it agrees
                                         with the CCU or COS RTC (minutes
                                         and seconds and issues an alarm
                                         for FID or RTU accuracy error.

8. Connect FID or RTU portable tester 8. Verify FID or RTU RTC and CCU or
    and read FID or RTU RTC.   COS are synchronized.

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TEST NO: PVT-6A   Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: FID or RTU RTC and RAM   ability of the FID or RTU RTC and RAM
             Battery Backup   to continue to operate and the RAM to
APPLIES TO: Large/Medium EMCS, UMCS,   maintain memory contents during power
             and UCS   failures.
REFERENCE: Proj. Spec. Paragraph ------

                        TEST EQUIPMENT

1. Portable diagnostic tester.

           EVENT   EXPECTED RESULTS

1. Remove the 120 VAC service from the 1. FID or RTU RTC continues to operate
    FID or RTU for the duration of the   and RAM contents are not lost.
    RTC and RAM battery backup period   Alarm printer indicates last of
    minus 30 minutes for the FID or RTU   communication with FID or RTU.
    RTC and RAM as specified in the
    contract documents. Disconnect FID
    or RTU from DTM.

2. At the end of the specified battery 2. Verify the FID or RTU time clock is
    backup period, minus 30 minutes,   operational with the correct time,
    repower FID or RTU with 120 VAC   and the FID or RTU RAM contents are
    and read RTC and selected RAM   maintained for the period of time
    locations with portable tester.   specified.

3. Reconnect FID or RTU to DTM.   3. Alarm printer indicates
    Operator issue command to establish   communication with FID or RTU
    communication with FID or RTU.   established.

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TEST NO:      PVT-7A   Page 1 of 1    OBJECTIVE:  To demonstrate the
TITLE:        FID/MUX or RCU/ACU Battery   ability of designated complete
              Backup                       FID/MUX or RCU/ACU to operate under
APPLIES TO:   Large/Medium EMCS, UMCS,     battery backup during power failures
              and UCS                      and to demonstrate recharging
REFERENCE:    Proj. Spec. Paragraph ------ capabilities.
-------------------------------------------------------------------------
```

| EVENT | EXPECTED RESULTS |

1. Remove the 120 VAC from the FID/MUX   1. The FID/MUX or RCU/ACU continues to
    or RCU/ACU power source and operate   operate normally for the specified
    the FID/MUX or RCU/ACU for the time   period under battery backup without
    period required in the contract   degradation. An alarm is printed
    documents. Exercise FID/MUX or   and displayed at the operator's
    RCU/ACU by performing monitoring   console to indicate the FID/MUX or
    and control functions.   RCU/ACU is operating under battery
                                               backup.

2. Reconnect the 120 VAC to the   2. The FID/MUX or RCU/ACU continues to
    FID/MUX or RCU/ACU power source.   operate normally and printer prints
                                               return to normal operation.

3. Manually change status of selected   3. Displayed status of I/O points
    I/O points. Request I/O status.   corresponds to new status.

4. Measure charging current to backup   4. Verify batteries are being charged.
    battery.

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TEST NO:     PVT-8A  Page 1 of 2      OBJECTIVE:  Demonstrate the
TITLE:       Portable Tester          capability of the device to perform
APPLIES TO:  Large/Medium EMCS, UMCS, diagnostics, debug, exercise all
              and UCS                 points in FID/MUX or RCU/ACU, and
REFERENCE:   Proj. Spec. Paragraph ------  load all information for complete
                                      FID/MUX or RCU/ACU operation.
```

INITIAL CONDITIONS

1. The contractor provides the set of commands and inputs required to execute
    the test, including:

    . Listing of operator alphanumeric and decimal interface with diagnostic
      device.
    . Expected output from FID/MUX or RCU/ACU diagnostics.
    . Listing of a program that is not PROM-ROM resident in the FID or RTU,
      plus the input and predicted output.
    . Analog/digital point identification (with known values). Select points
      such that input for point control requires alphanumeric and decimal
      operation interface.
    . Display of a specific memory location.
    . Input for modification of a specific RAM location.
    . Input application programs that are not PROM-ROM resident in the FID or
      RTU, all field points (I/Os) and data-base parameters for complete FID or
      RTU stand-alone operation.

2. Portable tester loaded from CCU or COS with FID or RTU information.

3. The portable tester is connected to the FID/MUX or RCU/ACU.

4. FID/MUX or RCU/ACU are set up to contain known diagnosable errors.

EVENT	EXPECTED RESULTS
1. Portable tester connected to CCU or COS, command issued to load specified FID or RTU information.	1. Information loaded from CCU or COS to FID or RTU portable tester.
2. Run FID or RTU diagnostics using the FID or RTU self-test switch.	2. Displayed results of diagnostics agree with the predicted results.

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TEST NO: PVT-8A Page 2 of 2   OBJECTIVE: Demonstrate the
TITLE: Portable Tester   capability of the device to perform
APPLIES TO: Large/Medium EMCS, UMCS,   diagnostics, debug, exercise all
             and UCS   points in FID/MUX or RCU/ACU, and
REFERENCE: Proj. Spec. Paragraph ------ load all information for complete
                                        FID or RTU operation.

               EVENT   EXPECTED RESULTS

3. Run MUX or ACU diagnostics.   3. Displayed results of diagnostics
                                           agree with the predicted results.

4. Command the system to display the 4. Displayed results of diagnostics
    contents of a specific memory   agree with the predicted results.

5. Enter command to bulk load all   5. Displayed contents contain the
    programs into memory. Command   selected program(s) and that
    the system to display specified   program listing matches contractor
    memory location which contains a   supplied program listing.
    selected program. Command the
    system to display program listing
    in the specified memory location.

6. Enter command to display digital   6. Displayed status of analog and
    and analog inputs.   digital input corresponds with
                                           predicted results.

7. Enter command to control analog   7. Analog and digital commands are
    and digital outputs.   executed. Status of analog and
                                           digital outputs match the DE
                                           status.

8. Enter command to modify specific   8. System enters modification.
    RAM location.

9. Enter command to display the   9. Displayed contents of RAM include
    contents of modified RAM location.   the modification.

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TEST NO: PVT-9A Page 1 of 1   OBJECTIVE: To verify the
TITLE: Test Set   capabilities of the FID or RTU and
APPLIES TO: Large/Medium EMCS, UMCS,   associated DE simulator.
                and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The test set is connected via MODEM in the CLT to the CCU or COS.
    DE simulator input and outputs are part of the system data base.

          EVENT   EXPECTED RESULTS

1. Exercise the Digital Outputs (DOs)   1. DE simulator displays the DO
    from the operator's console.   signals received.

2. Exercise the Analog Outputs (AOs)   2. DE simulator displays the AO signal
    from the operator's console.   received.

3. Exercise the Digital Inputs (DIs)   3. Change of status is displayed at
    from the test set.   operator's console.

4. Exercise the Analog Inputs (AIs)   4. Change of status is displayed at
    from the test set.   operator's console.

5. Exercise the pulse accumulator   5. Change of value is displayed at
    inputs from the test set.   operator's console.

6. Execute in the test set a FID or   6. Verify output of program executed
    RTU resident application program.   at test set matches output of
                                             program executed at FID or RTU.

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TEST NO: PVT-10A Page 1 of 2   OBJECTIVE: To demonstrate the
TITLE: Analog and Digital I/O   ability of the FID or RTU to execute
              Functions   commands from central control and
APPLIES TO: Large/Medium EMCS, UMCS,   monitor analog and digital functions.
              and UCS
REFERENCE: Proj. Spec. Paragraph ------

TEST EQUIPMENT

1. A device that can generate 10 dry contact closures per second and can
    indicate the number of pulses transmitted.

2. Test set.

         EVENT   EXPECTED RESULTS

1. Change the state of two DE digital   1. System displays change of status of
    points (for example, from on to off   designated points.
    or from open to close) at selected
    FIDs or RTUs, MUXs or ACUs.

2. Connect a 24 VAC, 60 Hz source to   2. Visually verify digital output
    a digital output of a FID/MUX or   operates as commanded.
    RCU/ACU. Connect a load to this
    digital output that draws 1 ampere.

3. Connect a pulse generator to a   3. The number the engineering units
    pulse accumulator input function.   displayed at the operator's
    Generate contact closure at a rate   console agrees with the converted
    of 10 pulses per second. Convert   number of total number of pulses
    the total number of pulses generated,   generated.
    as shown on the pulse total indicator
    of the test equipment, into
    engineering units.

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TEST NO: PVT-10A Page 2 of 2   OBJECTIVE: To demonstrate the
TITLE: Analog and Digital I/O   ability of the FID or RTU to execute
                Functions   commands and monitor analog and
APPLIES TO: Large/Medium EMCS, UMCS,   digital functions.
                and UCS
REFERENCE: Proj. Spec. Paragraph ------

               EVENT   EXPECTED RESULTS

4. Connect a known analog signal to   4. The analog signal displayed at the
    an analog input function of a   operator's console agrees with the
    FID/MUX or RCU/ACU. Provide   engineering unit conversion of the
    engineering unit conversion.   known analog signal input.

5. Connect an analog dual input CPA   5. Visually verify that controller
    controller with remote reset   setpoints agree with operator's
    capabilities to an analog output   console setpoint commands, and
    function of a FID or RTU, MUX or   system provides a feedback status
    ACU. Provide engineering unit   on the controller setpoint.
    conversion. From the operator's
    console, command analog output
    to increase and decrease controller
    setpoint.

6. Disconnect control device from   6. Visually verify control device
    analog control device output   operates in accordance with
    (voltage source) for one minute.   command.
    Reconnect control device and
    exercise analog output from the
    central system. Command the system
    to operate the control device.

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TEST NO: PVT-11A Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: Analog Input Function Noise ability of differential analog
              Protection (Common Mode)   input hardware to withstand noise on
APPLIES TO: Large/Medium EMCS, UMCS,   the wiring connected to the analog
              and UCS   input. The common mode voltage
REFERENCE: Proj. Spec. Paragraph ------ appears as a voltage signal common to
                                           both inputs of a differential
                                           amplifier referenced to the signal
                                           common of the system.

INITIAL CONDITIONS

1.   At least two of each type of analog input hardware to be installed is
     selected for testing.

TEST EQUIPMENT

1.   AC Signal Generator (0 - 120 Hz).

2.   DC Signal Source.

          EVENT   EXPECTED RESULTS

1.   Connect a DC Signal Source between 1. Visually verify system display
     the analog input and system ground.   matches values of analog input
     Adjust the source for 50 percent of   in the DE.
     full scale. Command the system to
     display the values of each tested
     analog input.

2.   Remove the ground connection from   2. The rejection to the AC common mode
     the DC Signal Source and connect   signal should be at a dB level that
     an AC Signal between the point where   is in accordance with contract
     the system ground was connected and   requirements.
     system ground. Adjust the value of
     the AC voltage source to the maximum
     allowable common mode voltage. The
     AC signal frequency should be equal
     to the nominal power line frequency.

3.   Repeat Event 2 for a frequency   3. The rejection to the AC signal
     range of 0-120 Hz.   should be at a dB level that is in
                                              accordance with the contract
                                              requirements.

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TEST NO: PVT-12A   Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: Analog Input Function Noise   ability of the single ended analog
                Protection (Normal Mode)   input hardware to withstand noise on
APPLIES TO: Large/Medium EMCS, UMCS,   the wiring connected to the analog
                and UCS   input. The noise appears as an AC
REFERENCE: Proj. Spec. Paragraph ------   voltage in series with the signal
                                          source.

INITIAL CONDITIONS

1. At least two of each type of analog input hardware to be installed is
    selected for testing.

TEST EQUIPMENT

1. 60 Cycle AC Signal Generator.

2. DC Signal Source.

            EVENT   EXPECTED RESULTS

1. Connect a DC Signal Source between   1. Visually verify system display
    the input and system ground.   matches values of analog input in
    Command the system to display values   the DE.
    of each tested analog input.

2. Connect the DC Signal Source in   2. The rejection to the AC signal
    series with the 60 Cycle AC Signal   should be at a dB level that is in
    Generator. Connect these sources   accordance with the contract
    between the analog input and signal   requirements.
    ground. Turn on the generators and
    adjust the DC level for 50 percent
    of the maximum input signal value.
    Read the output with the AC signal
    at zero. Adjust the AC signal level
    so that the sum of the DC and peak
    AC values do not exceed the maximum
    allowable input signal amplitude.
    The AC signal frequency should be
    equal to the nominal power line
    frequency. Request display of
    tested analog signal and verify
    display against actual DE values.

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TEST NO: PVT-13A   Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: Digital Input and Output   ability of the digital input and
              Function Isolation and   output function hardware to withstand
              Protection   a steady-state voltage on the control
APPLIES TO: Large/Medium EMCS, UMCS,   wiring connected to the digital
              and UCS   input/output function hardware.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. At least one of each type of digital I/O function hardware (DI, DO, and
    pulse accumulator) to be installed is randomly selected for testing.

TEST EQUIPMENT

1. The test equipment is a 180 VAC, peak, 60 Hz single phase source.

         EVENT   EXPECTED RESULTS

1. Command the system to display   1. System display matches status of
    status of each selected digital   the I/O points in the DE.

2. Connect the test equipment across   2. After the application of the test
    the digital input/output terminals   waveform, the digital input/output
    at the FID/MUX or RCU/ACU, and   equipment does not exhibit any
    apply the test voltage for a period   malfunctions, degradation of
    of at least five minutes across   performance, or deviation from its
    the input of each type of digital   normal mode of operation.
    input/output function hardware.

3. Command the system to display   3. System display matches status of
    status of each tested digital I/O   the I/O points in the DE.
    function.

4. Change status of digital I/O   4. System display matches new status
    function.   of I/O points in the DE.

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TEST NO: PVT-14A   Page 1 of 2   OBJECTIVE: To demonstrate CCU or
TITLE: System Power Failure/Restart COS and FID or RTU response to power
APPLIES TO: Large/Medium EMCS, UMCS,   failures and to restoration of power.
                and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. Selected I/O points are set up to change status during the test.

2. The contractor provides I/O summary tables for each type of analog and
    digital point used in the test. The I/O summary table identifies the
    failure mode for each point such that the failure mode is easily
    distinguished from normal mode.

3. FIDs or RTUs and MUXs or ACUs have the necessary I/O and associated
    instrumentation and control (I&C) required documents to demonstrate for each
    type of I/O and I&C combination failure modes required.

            EVENT   EXPECTED RESULTS

1. Enter command to display status of   1. System displays I/O status.
    selected I/O points.

2. Initiate a power failure to the   2. System initiates shutdown of
    CCU or COS, but maintain power   CCU or COS. The FIDs or RTUs
    to the FIDs or RTUs.   operate in stand-alone mode.

3. Restore power to CCU or COS after   3. The system automatically obtains
    two minutes.   the current time-of-day from RTC,
                                             performs a warm start of CCU or
                                             COS operation without human
                                             intervention, and is in full
                                             operation within the specified time
                                             period.

4. Enter command for display of the   4. System displays I/O status which
    previously selected I/O status.   corresponds with I/O status prior
                                             to power failure.

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TEST NO: PVT-14A   Page 2 of 2   OBJECTIVE: To demonstrate CCU or
TITLE: System Power Failure/Restart COS and FID or RTU response to power
APPLIES TO: Large/Medium EMCS, UMCS,   failures and to restoration of power.
              and UCS
REFERENCE: Proj. Spec. Paragraph ------

          EVENT   EXPECTED RESULTS

5. Initiate a power failure to the   5. System initiates an orderly
    entire system.   shutdown of CCU or COS and
                                              without loss of contents of memory,
                                              registers, or machine status.
                                              Verify FID/MUX or RCU/ACU I/O and
                                              I&C combinations go into failure
                                              modes as defined in the I/O summary
                                              tables. Verify that I&C work in
                                              combination with I/O to perform the
                                              failure mode required by the
                                              contract documents.

6. After five minutes, restore all   6. The system is automatically
    power and perform system startup   reinitialized before the EMCS
    using procedures specified by the   functions are restarted. The
    computer manufacturer.   entire system is placed in
                                              operation within the time period
                                              specified. Visually verify
                                              resumption of normal mode
                                              operation.

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TEST NO: PVT-15A   Page 1 of 1   OBJECTIVE: To demonstrate that the
TITLE: CCU or COS Programmer   CCU or COS contains the required
                Control Function   programmer control functions.
APPLIES TO: Large/Medium EMCS, UMCS,
                and UCS
REFERENCE: Proj. Spec. Paragraph ------

                         INITIAL CONDITIONS

1.   The contractor provides a listing of location and contents of selected
     memory locations on the CCU or COS.

2.   The contractor provides a listing of CCU or COS instructions to execute a
     set of tasks that can be visually verified.

          EVENT   EXPECTED RESULTS

1.   Command the system to load software 1.   System loads software.
     required for system operation.

2.   Command the system to display   2.   System displays contents of
     contents of a specified main   designated main memory location.
     memory location.   Visually verify that the display
                                                agrees with contractor supplied
                                                listing.

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TEST NO: PVT-16A Page 1 of 1   OBJECTIVE: To demonstrate that the
TITLE: CCU or COS Time Base   difference between the CCU or COS
              Generator (TBG)   time base generator (TBG) and the
APPLIES TO: Large/Medium EMCS, UMCS,   system RTC is within specified
              and UCS   limits of error.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. RTC and CCU or COS TBG are synchronized.

            EVENT   EXPECTED RESULTS

1. Manually reset the RTC so that it   1. At the next scan cycle, the system
    differs from the CCU or COS TBG.   interrogates the RTC automatically
    Read the RTC at the next scan cycle.   and corrects the CCU or COS TBG so
                                            that it agrees with the RTC (to
                                            within one second). Alarm printer
                                            indicates a time error.

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TEST NO: PVT-17A Page 1 of 1   OBJECTIVE: To demonstrate error
TITLE: CCU or COS/FID or RTU Error detection and retransmission
              Detection and   capabilities between the FID or RTU
              Retransmission   and CCU or COS. This test also
APPLIES TO: Large/Medium EMCS, UMCS,   shutdown of the DTM link when
              and UCS   retransmission attempts exceed an
REFERENCE: Proj. Spec. Paragraph ------ operator assigned maximum.

INITIAL CONDITIONS

1. A maximum number of transmission errors are assigned for each of the DTM.

TEST EQUIPMENT

1. White noise generator on communication error generator.

            EVENT   EXPECTED RESULTS

1. Generate and superimpose a white   1. CCU or COS closes down transmission
    noise or communication error on   on DTM originating errors and
    each DTM.   prints an alarm message after the
                                            maximum number of transmission
                                            errors is reached.

2. Operator reopens closed down DTM   2. CCU or COS reopens communications
    circuits after white noise generator   to the shutdown device or DTM.
    or communication error generator
    are removed.

3. Initiate a DTM circuit report.   3. System displays the DTM circuit
                                            report.

4. Enable the DTM to CCU or COS.   4. FID or RTU establishes
                                            communications with CCU or COS.
                                            The CCU or COS automatically sets
                                            the FID or RTU time clock, clock,
                                            and downloads all parameters, if
                                            necessary, such as: constraints,
                                            and application programs. The FID
                                            or RTU indicates that it is
                                            on-line.

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TEST NO: PVT-18A Page 1 of 3   OBJECTIVE: To demonstrate the
TITLE: Backup Mode for CCU Failure software that detects failure of the
APPLIES TO: Large EMCS Only   CCU causing the CCU to begin backup
REFERENCE: Proj. Spec. Paragraph ------ operation of the EMCS. This test
                                           also demonstrates CCU programmer
                                           control functions and CCU time base
                                           generator accuracy.

INITIAL CONDITIONS

1.   Selected points in the DE are set up to initiate alarms during the test and
     to indicate the status of equipment to be used in the power demand limiting
     function.

2.   The contractor provides the list of operator's commands. The contractor
     provides an explanation of each operator command, including expected system
     response to the command.

3.   The electrical demand is set up to exceed allowed limits for peak demand.

4.   The contractor provides a description of power demand limiting functions.

5.   The system is programmed to execute the power demand limiting function.

6.   The contractor provides the location and a listing of contents of selected
     memory locations on the CCU.

7.   The contractor must provide a listing of CPU instructions to execute a set
     of tasks that can be visually verified by the operator.

8.   RTC and CCU TBG are synchronized.

            EVENT   EXPECTED RESULTS

1.   Select one of the CCUs and   1.   The system controller immediately,
     initiate a CCU failure.   and automatically switches CLT
                                             datalines, the logging and alarm
                                             printers to the other CCU.

2.   Initiate DE alarms.   2.   The other CCU takes over all
                                             functions.

3.   Command the system to display the 3.   Verify displayed list corresponds
     list of available operator's   to contract requirements.
     commands from the CCU during the
     CCU failure.

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TEST NO:      PVT-18A  Page 2 of 3      OBJECTIVE:  To demonstrate the
TITLE:        Backup Mode for CCU Failure  software that detects failure of the
APPLIES TO:   Large EMCS Only           CCU causing the CCU to begin backup
REFERENCE:    Proj. Spec. Paragraph ------  operation of the EMCS.  This test
                                        also demonstrates CCU programmer
                                        control functions and CCU time base
                                        generator accuracy.
```

<table>
<tr><td align="center">EVENT</td><td align="center">EXPECTED RESULTS</td></tr>
<tr><td>4. Command the system to perform each of the operator's commands listed by the system, including:</td><td>4. The system responds to each operator command in accordance with responses provided by the contractor, including:</td></tr>
<tr><td>(a) Command for status of specified points.</td><td>(a) System displays point status.</td></tr>
<tr><td>(b) Command the system to display the parameters of specific points.</td><td>(b) System displays point identification and associated parameters.</td></tr>
<tr><td>(c) Command the system to change specified point parameter(s) and input the new parameters.</td><td>(c) System acknowledges input.</td></tr>
<tr><td>(d) Command the system to display the modified parameters of the points.</td><td>(d) System displays point identification and associated parameters, including those which were modified.</td></tr>
<tr><td>(e) Command the system to control analog and digital output points.</td><td>(e) Commands are executed.</td></tr>
<tr><td>(f) Command the system to change limits on specified points which will bring them out of alarm condition.</td><td>(f) Verify designated alarms with new limits are no longer in alarm condition.</td></tr>
<tr><td>5. Initiate conditions for power demand limiting function. Command the system to display equipment status.</td><td>5. System executes power demand limiting function and causes equipment to be controlled in accordance with the power demand limiting function sequence. System displays equipment status that corresponds to shutdown requirements for power demand limiting function. Verify equipment status corresponds to predicted results.</td></tr>
</table>

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TEST NO: PVT-18A Page 3 of 3   OBJECTIVE: To demonstrate the
TITLE: Backup Mode for CCU Failure   software that detects failure of the
APPLIES TO: Large EMCS Only   CCU causing the CCU to begin backup
REFERENCE: Proj. Spec. Paragraph ------ operation of the EMCS. This test
                                            also demonstrates CCU programmer
                                            control functions and CCU time base
                                            generator accuracy.

                    EVENT   EXPECTED RESULTS

6. Erase all memory resident programs   6. No memory resident programs are
    in CCU. Command the system to   displayed.
    display directory of programs.

7. Reload all memory resident CCU   7. Verify system performs according to
    programs using the bulk loader.   results.
    Repeat operator interface events.

8. Command the system to load CCU   8. System loads required software.
    software.

9. Command the system to display   9. System displays contents of
    contents of a specified main memory   designated main memory location.
    location.   Verify that display agrees with
                                               contractor supplied listing.

10. Manually reset the RTC so that it   10. At the next scan cycle, the system
    differs from the CCU TBG. Read the   interrogates the RTC automatically
    RTC at the next scan cycle.   and corrects the CCU TBG so that it
                                               agrees with the RTC (to within one
                                               second).

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TEST NO: PVT-19A Page 1 of 1   OBJECTIVE: To demonstrate that a
TITLE: CLT Device and DTM Failure single failure of any CLT device will
APPLIES TO: Large/Medium EMCS, UMCS,   result in the loss of no more than
              and UCS   one DTM link.
REFERENCE: Proj. Spec. Paragraph ------

                EVENT   EXPECTED RESULTS

1. Command the system to display data   1. System displays status of FIDs or
    from selected FIDs or RTUs.   RTUs not responding, which
    Initiate failure of a CLT device in   corresponds to the contract
    in each DTM link. Command the   drawings for the CLT/DTM
    system to display FIDs or RTUs not   arrangement. Data from FIDs or
    responding.   RTUs not responding is highlighted
                                             as not current.

2. Initiate alarms at I/Os associated   2. System displays alarms.
    with the DTMs in service.

3. Initiate a failure of one DTM link   3. System displays status of FIDs or
    between CLT and CCU or COS.   RTUs not responding, which
    Command the system to display FIDs   corresponds to the FID/MUX or
    or RTUs not responding.   RCU/ACU associated with the
                                             failed DTM link. FIDs/MUXs or
                                             RCUs/ACUs associated with each DTM
                                             must be as shown in the contract
                                             requirements.

4. Initiate alarms at the I/Os   4. System displays alarms.
    associated with the DTMs in service.

5. Repeat Events 3 and 4 for each DTM   5. System responds as in Events 3
    link.   and 4.

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TEST NO: PVT-20A Page 1 of 1   OBJECTIVE: To demonstrate
TITLE: Backup to Disk Storage   performance of the duplicate disk
                System Failure   system in the event of primary disk
APPLIES TO: Large/Medium EMCS Only   system failure.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. Selected points in the DE are set up to change status during the test
    period.

        EVENT   EXPECTED RESULTS

1. Initiate a failure in the primary   1. System will not respond to any
    disk system.   commands.

2. Bring the second disk system   2. System updates the data base
    "on-line" by use of the programmer's   automatically and is fully panel or
    a pre-programmed bootstrap   operational within 15 minutes after
    routine (rewiring or reconnecting   placing the backup disk system
    is not permissible). Institute   on-line.
    change of status for selected DE
    points.

3. Within fifteen minutes after   3. Verify that the system display of
    second disk is brought on-line,   selected point status corresponds
    command the system to display the   to the DE status.
    status of the selected points in
    DE that changed status during the
    disk failure.

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TEST NO:      PVT-21A   Page 1 of 1      OBJECTIVE:  To demonstrate that
TITLE:        Magnetic Tape Validation     files can be successfully
APPLIES TO:   Large/Medium EMCS, UMCS,     transferred from disk to magnetic
                and UCS                     tape and from magnetic tape to disk.
REFERENCE:    Proj. Spec. Paragraph ------
```

INITIAL CONDITIONS

1. The contractor provides a directory of disk files containing the CCU or COS
    software required in the contract documents.

| EVENT | EXPECTED RESULTS |

1. Command the system to display the   1. System displays directory of the
    directory of all files (name and   disk files which corresponds to
    size) containing EMCS, UMCS, or   contractor supplied list.
    UCS software.

2. Transfer files from disk to   2. The list of those files that were
    magnetic tape. Clear directory on   transferred is not displayed.
    disk and command the system to
    display directory of files.

3. Transfer files from magnetic tape   3. System displays directory of files
    to disk. Command the system to   that corresponds to contractor
    display directory of files.   supplied list.

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TEST NO: PVT-22A Page 1 of 1   OBJECTIVE: To demonstrate that the
TITLE: Software Validation   EMCS system contains all system
APPLIES TO: Large/Medium EMCS, UMCS, software and disk capacity required
                and UCS   in the contract documents to manage
REFERENCE: Proj. Spec. Paragraph ------ the CCU or COS and associated
                                        peripherals as well as supporting
                                        command software and application
                                        programs.

INITIAL CONDITIONS

1.   The contractor provides a directory of disk files containing the CCU or COS
     software required in the contract documents.

2.   Written description of system software must be provided by the manufacturer
     of the EMCS, UMCS, or UCS software. The system software description can be
     augmented by the EMCS, UMCS, or UCS manufacturers for those items that are
     EMCS, UMCS, UCS specific.

          EVENT   EXPECTED RESULTS

1.   Command the system to display the   1.   System displays directory of the
     directory of all files (name and   disk files. Name of the files and
     size) containing EMCS, UMCS, UCS   size must match the written
     software.   description of the files required
                                               in each of the system programs
                                               specified in the contract
                                               documents. Verify the total disk
                                               capacity (used plus spare)
                                               corresponds with contract
                                               requirements.

2.   Command the system to print the   2.   System prints out the programs
     randomly selected application   which are written in a high-level
     software program files.   language. Verify printouts agree
                                              with the contractor furnished
                                              documentation.

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TEST NO: PVT-23A Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: Program Development   operation of the program development
APPLIES TO: Large/Medium EMCS, UMCS,   and debugging of control programs
                and UCS   while running the system in the
REFERENCE: Proj. Spec. Paragraph ------ on-line mode.

INITIAL CONDITIONS

1.   The contractor provides a source program written in a high-level language
     with known errors that perform a verifiable operation in the DE. (For
     example, provide a program that starts and stops equipment based on time and
     indoor/outdoor temperatures.) The contractor also provides input data and
     expected results.

2.   The system is performing on-line monitoring and control functions throughout
     the test.

3.   Operator is logged onto system at a level that enables operator access to
     the custom programming capabilities.

               EVENT   EXPECTED RESULTS

1.   Enter source program with name of   1.   System loads and compiles program
     file via the editor. (This program   into object code. Verify a hard
     will be called the "test program"   copy listing matches contractor
     hereafter.) Command the system to   supplied listing, and that system
     generate hard copy output.   displays error messages on known
                                                 errors.

2.   Correct errors via the editor   2.   System loads and compiles corrected
     program. Command the system to   program. Verify hard copy printout
     generate hard copy output.   corresponds to contractor supplied
                                                 document without errors.

3.   Command the system to save the   3.   System saves test program on disk
     test program on designated disk file.   file.

4.   Initiate the debugging software to   4.   System provides necessary check
     program logic. Check output   information for the operator to
     of program against expected results   follow, line by line, the execution
     using FID or RTU test set and its   of the program. Verify program
     associated DE.   output agrees with expected results
                                                 using the FID or RTU test set.

5.   Command the system to actuate the   5.   System transfers the program to the
     program in the CCU or COS using a   CCU or COS on-line mode status
     FID/MUX or RTU/ACU and its associated   using a FID/MUX or RCU/ACU.
     DE.

6.   Command the system to display the   6.   Verify system display of active
     directory programs active in the   programs includes the test program.
     CCU or COS.
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TEST NO:     PVT-24A  Page 1 of 1      OBJECTIVE:  To demonstrate capability
TITLE:       Diagnostics               of the diagnostic programs to detect
APPLIES TO:  Large/Medium EMCS, UMCS,   hardware and software problems and
               and UCS                  display the corresponding error
REFERENCE:   Proj. Spec. Paragraph ------  messages.
```

                  EVENT   EXPECTED RESULTS

1. Initiate diagnostic program to   1. System initiates diagnostic
    test the CCU or COS as designated   programs and displays the status
    in the contract documents.   of each diagnostic routine
                                            performed.

2. Initiate diagnostic program for   2. System displays status for each
    each peripheral device as designated   diagnostic routine performed.
    in the contract.

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TEST NO: PVT-25A Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: System Access Control   ability of the system to control
APPLIES TO: Large/Medium EMCS, UMCS,   operator access to software based
              and UCS   on selectable passwords.
REFERENCE: Proj. Spec. Paragraph ------

                        INITIAL CONDITIONS

1. The contractor provides a list of passwords for each access level and a list
    of software and commands accessible at each access level. All access levels
    required in the contract documents are tested.

            EVENT   EXPECTED RESULTS

1. Log on with the password that   1. System acknowledges log on and
    corresponds to an access level and   displays software accessible at the
    command the system to display   given access level. Visually
    software available at the given   verify the display matches the
    access level. Repeat for each   contractor's list.
    access level.

2. For all but the highest access   2. System indicates command cannot be
    level, command the system to perform   executed at the current access
    a function that cannot be performed   level.
    at the current access level.

3. Log on with a password to access 3. Command is executed. (For example,
    software for performing a specific   observe change in high/low limit
    function. (For example, command the   in a designated analog point.)
    system to set up high/low limits on
    analog point.)

4. Log on with a higher access   4. Command is executed.
    password and repeat software command
    in Event 3.

5. Log on with a lower access password 5. System indicates command cannot be
    (that prevents access to software in   executed at current access level.
    Event 3) and repeat software command
    in Event 3.

6. Repeat Events 3, 4, and 5 for every 6. Commands are executed only when the
    remaining level.   software and/or command is
                                            accessible at the given access
                                            level.

7. Change an existing password to a   7. Commands are executed only when the
    new password with a higher access   software and/or command is
    level and repeat Events 2 and 3.   accessible at the given access
                                           level.

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TEST NO: PVT-26A Page 1 of 6   OBJECTIVE: To demonstrate the
TITLE: Operator Commands   software which enables the operator
APPLIES TO: Large/Medium EMCS, UMCS,   to interface with the system for all
              and UCS   functions associated with daily
REFERENCE: Proj. Spec. Paragraph ------ operation of the system.

INITIAL CONDITIONS

1. The contractor must provide a list of Operator Commands and an explanation
    of the expected response to each command.

2. The DE contains disabled points not in communication with the System.

3. Operable points in the DE include one of each type of I/O points to be
    installed.

4. The contractor provides a listing of the I/O points to be addressed during
    the test.

SPECIAL COMMENTS

After entering an operator command, the system responds with a request for
operator verification that the command is to be executed. In the following
events which command the system to execute an operator command, it is
assumed, in each case, the system will request operator verification and the
operator will confirm the request prior to execution. It is assumed that
the system will acknowledge the command and commence processing within five
seconds of command entry. Operator commands can be entered using English
words, acronyms and either special function keys, light pen, or touch
screen. All commands must be issued using both full English command and
specified enhancements.

        EVENT   EXPECTED RESULTS

1. Log on to the system with an   1. The system indicates the password
    incorrect password.   is not valid and does not allow the
                                          operator to log on.

2. Log on to the system with a   2. System acknowledges log on and
    password that allows total operator   displays operator's name or
    access to all operator commands.   initials in the operator's console
                                          first field. The password should
                                          not be displayed or printed. The
                                          operator's name, the action, date
                                          and time of log-on is printed on
                                          the logging printer.

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TEST NO: PVT-26A Page 2 of 6   OBJECTIVE: To demonstrate the
TITLE: Operator Commands   software which enables the operator
APPLIES TO: Large/Medium EMCS, UMCS,   to interface with the system for all
               and UCS   functions associated with daily
REFERENCE: Proj. Spec. Paragraph ------ operation of the system.

                  EVENT   EXPECTED RESULTS

3. Enter the operator command for the   3. System displays all operator
    help function.   commands available to the operator
                                              at the password access level. The
                                              list must match the list of
                                              commands provided by the
                                              contractor.

4. Enter the help command followed by   4. System displays the purpose, use,
    a specific operator command.   and expected system reaction to the
                                              command. This explanation must
                                              agree with the contractor supplied
                                              documentation.

5. Command the system to print   5. System prints all succeeding
    operator's commands at logging   operator inputs on the logging
    printer.   printer.

6. Enter an abbreviated mode operator   6. Visually verify the system executes
    command.   the command.

7. Enter an operator command without   7. System requests operator
    operator confirming action.   verification.

8. Enter the cancel action.   8. Command is canceled.

9. Enter a command not listed in   9. System indicates command is
    the set of operator commands.   incorrect and does not request
                                              operator verification for
                                              execution.

10. Enter command for display of I/O   10. System displays requested I/O
    functions defined in the data base,   function data on the selected
    in accordance with the following   output device.
    address levels:

    . Installation.
    . Area.
    . Building.
    . Unit.
    . Point.

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TEST NO:      PVT-26A  Page 3 of 6      OBJECTIVE:  To demonstrate the
TITLE:        Operator Commands         software which enables the operator
APPLIES TO:   Large/Medium EMCS, UMCS,  to interface with the system for all
              and UCS                   functions associated with daily
REFERENCE:    Proj. Spec. Paragraph ------ operation of the system.
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EVENT	EXPECTED RESULTS
11. Command the system to display status of selected digital points and analog points.	11. System commences display of data within 10 seconds from command entry.
12. Command the system to shut down specified equipment at a designated FID/MUX or RCU/ACU by entering the STOP/DISABLE command.	12. Designated equipment commences shutdown at the specified location within 10 seconds from command entry.
13. Command the system to start up a device at a designated FID/MUX or RCU/ACU by entering the START/ENABLE command.	13. Designated equipment commences start up at the designated location within 10 seconds from command entry. System displays change in equipment status within 20 seconds from command entry, plus response time for the start up of controlled equipment.
14. Command the system to change the limits of a designated analog function. (For example, command a change in the high/low limit. Then change the DE condition to exceed the high or low analog set points.)	14. The system modifies the limit of each analog function within 10 seconds from command entry. Visually verify system displays analog point in alarm.
15. Command the system to adjust the set points of designated controllers by entering the set points/limits command.	15. Visually verify the system commences to adjust the set points of the designated controllers within 10 seconds of command entry. The system commences to display a change in point status within 20 seconds from command entry, plus response time for the shutdown of controlled equipment.
16. Command the system to convert designated control functions from automatic mode (under program control) to manual control (from the operator's console).	16. Visually verify change in control mode from automatic to manual.

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TEST NO: PVT-26A Page 4 of 6   OBJECTIVE: To demonstrate the
TITLE   Operator Commands   operation of the software which
APPLIES TO: Large/Medium EMCS, UMCS,   enables the operator to interface
             and UCS   with the system for all functions
REFERENCE: Proj. Spec. Paragraph ------   associated with daily operation of
                                              the system.

                EVENT   EXPECTED RESULTS

17. Command the system to initiate a   17. Visually verify the system
    change in the DE via the designated   commences to initiate a change in
    command function. (For example,   the DE within 10 seconds of command
    command the system to shut down   entry. The system commences to
    equipment.)   display a change in point status
                                             within 20 seconds from command
                                             entry, plus response time for the
                                             shutdown of controlled equipment.

18. Command the system to change   18. Visually verify change in control
    equipment control modes currently   from manual to automatic mode.
    in manual control to automatic
    control. Reset the time to initiate
    automatic control of equipment.
    (For example, reset the equipment
    stop time so that equipment will
    automatically shut down in five
    minutes.)

19. Command the system to disable   19. Visually verify specified inputs
    selected I/O points in a FID or   are disabled (in failure mode)
    RTU.   within 10 seconds of command entry.

20. Command the system to disable   20. System disables selected I/O
    selected I/O points in a MUX or   points.
    ACU.

21. Command the system to address the   21. System indicates command addresses
    disabled point identified in initial   a point which is disabled.
    conditions.

22. Command the system to enable the   22. Visually verify each designated
    points that were just disabled.   point is enabled (in normal mode)
                                             within 10 seconds from command
                                             entry.

23. Command the system to disable a   23. Visually verify that the I/O
    designated FID or RTU.   functions of disabled FID are in
                                             the failure mode within 10 seconds
                                             from command entry.

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TEST NO: PVT-26A   Page 5 of 6   OBJECTIVE: To demonstrate
TITLE   Operator Commands   the operation of the software which
APPLIES TO: Large/Medium EMCS, UMCS,   enables the operator to interface
              and UCS   with the system for all functions
REFERENCE: Proj. Spec. Paragraph ------ associated with daily operation of
                                            the system.

             EVENT   EXPECTED RESULTS

24. Command the system to enable the   24. Visually verify the FID or RTU is
    disabled FID or RTU.   enabled within 10 seconds from
                                             command entry. Visually verify
                                             change of status for the FID or RTU
                                             I/O functions to be the same as
                                             prior to disabling FID or RTU.

25. Command the system to disable the   25. Visually verify that the MUX or ACU
    designated MUX or ACU.   functions are in the failure mode
                                             within 10 seconds from command
                                             entry.

26. Command the system to enable the   26. Visually verify each MUX or ACU is
    disabled MUX or ACU.   enabled within 10 seconds from
                                             command entry. Visually verify
                                             change of status for the MUX or ACU
                                             I/O functions to be the same as
                                             prior to disabling outputs within
                                             10 seconds from command entry

27. Command the system to modify the   27. Visually verify equipment schedule
    automatic schedule of operation for   has been altered.
    selected equipment.

28. Command the system to execute a   28. System indicates that the command
    task on an analog point that contains   would violate constraints.
    a value outside the given point
    parameter definition.

29. Command the system to execute a   29. System indicates that the command
    task without providing sufficient   used is incorrect or incomplete.
    information for execution.

30. Command the system to execute a   30. System indicates that the point
    task on an existing point that is   addressed is out of service.
    currently not in communication with
    the system.

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TEST NO: PVT-26A Page 6 of 6   OBJECTIVE: To demonstrate
TITLE   Operator Commands   the operation of the software which
APPLIES TO: Large/Medium EMCS, UMCS,   enables the operator to interface
                 and UCS   with the system for all functions
REFERENCE: Proj. Spec. Paragraph ------ associated with daily operation of
                                         the system.

                EVENT   EXPECTED RESULTS

31. Command the system to execute a   31. System indicates that the command
    task on a nonexistent point.   addressed a point which does not
                                           exist.

32. Command the system to execute any 32. System displays the purpose, use,
    operator commands displayed in   and expected system reaction to the
    response to the help command but not   command. This explanation must
    yet tested in the preceding events.   agree with the contractor supplied
    Include any data necessary to   documentation.
    execute the command.

33. Log off the system.   33. System acknowledges log off and
                                           displays operator's name or
                                           initials in the operator's console
                                           first field. Operator's name, date
                                           and log-on time are printed on the
                                           logging printer.

34. Log on to the system with a   34. System acknowledges log on and
    password that allows minimum   displays operator's name or
    operator access to commands.   initials in the operator's console
                                           first field.

35. Enter a command that requires a   35. System indicates the operator is
    higher level password for   restricted from using that command.
    for execution.

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TEST NO: PVT-27A Page 1 of 3   OBJECTIVE: To verify that point(s)
TITLE   Data Environment (DE)   in the data base can be defined by
             Definition Process   the operator from the operator's
APPLIES TO: Large/Medium EMCS, UMCS, console with its own set of
             and UCS   parameters, definitions and
REFERENCE: Proj. Spec. Paragraph ------ constraints.

INITIAL CONDITIONS

1. The contractor provides the necessary input data for an operator to define
    selected analog and digital point(s) using English language commands and
    environments. The points selected for the test must include at least one of
    each type of I/O points to be installed, and at least one pulse accumulation
    point.

2. An allowed range of input has been assigned to each tested I/O point.

SPECIAL COMMENTS

    After entering an operator command, the system responds with a request for
    operator verification that the command is to be executed. In the following
    events which command the system to execute an operator command, it is
    assumed, in each case, the system will request operator verification and the
    operator will confirm the request prior to execution. It is assumed that
    the system will acknowledge the command and commence processing within five
    seconds of command entry.

         EVENT   EXPECTED RESULTS

1. Log on to the system with a   1. System acknowledges log on,
    password that allows operator access   displays and prints data in
    to the DE definition process.   accordance with contract documents.

2. Command the system to accept input 2. System request inputs.
    for point definition.

3. Input data for each point.   3. System acknowledges input for each
                                            point. At each step of the
    . Name   process, inputs outside the
    . Device or sensor type (i.e.,   predefined system ranges shall be
      sensor, control relay, motors).   rejected with a reason stated.
    . Building unit and point.
    . Area and installation.
    . FID or RTU number and channel.
    . MUX or ACU number and channel address.
    . kW (starting).
    . kW (running) (digital kW demand
      function).
    . Range (analog functions only).
    . Span (analog functions only).

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TEST NO:     PVT-27A  Page 2 of 3      OBJECTIVE:  To verify that point(s)
TITLE        Data Environment (DE)     in the data base can be defined by
             Definition Process        the operator from the operator's
APPLIES TO:  Large/Medium EMCS, UMCS,  console with its own set of
             and UCS                   parameters, definitions and
REFERENCE:   Proj. Spec. Paragraph ------ constraints.
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<table>
<tr><td align="center">EVENT</td><td align="center">EXPECTED RESULTS</td></tr>
</table>

3.   (continued)

    . Engineering units conversion
      (scale factor).
    . Low limit alarm (value in
      engineering units) (analog alarm
      functions only).
    . High limit alarm (value in
      engineering units) (analog alarm
      functions only).
    . Alarm class and associated message
      text.
    . Run-time target (digital functions
      with run-time targets).
    . Failure modes as specified in the
      I/O summary tables.
    . High reasonableness value (analog
      function).
    . Low reasonableness value (analog
      function).
    . High limit alarm differential
      (analog).
    . Low limit alarm differential
      (analog).
    . Analog value change differential.
    . Other data required by the system
      as specified in the contract
      documents.

4.   Command the system to modify   4.   System requests input for modified
    several but not all previously   values.
    entered data.

5.   Command the system to display   5.   Verify displayed data includes
    data for points.   modified values.

6.   Command the system to accept the 6.   System acknowledges input for each
    following FID or RTU resident   point.
    constraints:

    . Maximum starts (cycles) per hour
      (digital control functions only).

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TEST NO: PVT-27A Page 3 of 3   OBJECTIVE: To verify that point(s)
TITLE   Data Environment (DE)   in the data base can be defined by
               Definition Process   the operator from the operator's
APPLIES TO: Large/Medium EMCS, UMCS,   console with its own set of
               and UCS   parameters, definitions and
REFERENCE: Proj. Spec. Paragraph ------ constraints.

                EVENT   EXPECTED RESULTS

6. (continued)

    . Minimum off time (digital control
      functions only).
    . Minimum on time (digital control
      functions only).
    . Maximum off time (digital control
      functions only).
    . High constraint limit (value in
      engineering units) (analog control
      functions only).
    . Low constraint limit (value in
      engineering units) (analog control
      functions only).

7. Command the system to schedule   7. System indicates that command
    equipment operations that exceed the   cannot be executed because the FID
    FID or RTU resident constraints   or RTU memory resident constraints
    defined for each I/O control function   have been exceeded.
    in the test.

    . For example, for the digital
      control point, command the system
      to schedule:

      - More than the maximum allowed
        starts per hour.
      - An off time that is shorter than
        the allowed minimum.
      - An on time that is shorter than
        the allowed minimum.

    . For example, for analog control
      point, assign limits that exceed:

      - High limit.
      - Low limit.

8. Command the system to display the   8. Visually verify system display of
    point definition of each point   data for each point in the test
    defined in the test.   corresponds to initial input.

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TEST NO: PVT-28A Page 1 of 12   OBJECTIVE: To demonstrate the
TITLE: Report Generator   software which generates reports in a
APPLIES TO: Large/Medium EMCS, UMCS,   fixed format either by operator
               and UCS   request or in periodic automatic
REFERENCE: Proj. Spec. Paragraph ------ mode.

INITIAL CONDITIONS

1. The DE is set up to generate at least 64 alarm conditions. Each alarm must
    have correlated dependent parameters. (For example, a start/stop alarm on a
    fan would also result in temperature alarms.) At least one alarm must have
    32 dependent parameters.

2. The DE must provide the necessary input data to the system for the required
    reports to be generated.

3. The contractor must indicate how much storage is allocated for each type of
    report and relate this value to the size and quantity of profile reports
    required by the contract documents as well as the disk storage system sizing
    requirements.

4. The system is programmed to generate hourly, daily, and monthly values for
    each type of report. The data for the reports is stored concurrently and
    automatically.

5. The preselected points to be included in the reports must include the
    following address levels:

    . Point.
    . Equipment unit.
    . Building.
    . Area.
    . Installation.

6. Preselected output points for each specified report type are set up to
    become disabled during the test period.

7. Preselected output points for each specified report type are set up to be in
    alarm condition during the test period. Select alarm points so that each
    alarm class is represented.

8. Electric demand intervals are defined in the system software.

9. Target run-times have been established for each selected equipment item via
    the DE definition process.

10. Selected equipment run-time totals are set up to be 9,999 hours. Other
    selected equipment are set up to have reached their target.

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TEST NO:     PVT-28A  Page 2 of 12     OBJECTIVE:  To demonstrate the
TITLE:       Report Generator          software which generates reports in a
APPLIES TO:  Large/Medium EMCS, UMCS,  fixed format either by operator
              and UCS                  request or in periodic automatic
REFERENCE:   Proj. Spec. Paragraph ------  mode.
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INITIAL CONDITIONS (continued)

11. The system is set up to have chiller utilization data for at least 10
    discrete loading levels, including run-time for each load level and total
    run-time.

12. Selected building indoor temperature points are set up to maintain
    temperature levels below required occupancy temperatures throughout test
    period.

SPECIAL COMMENTS

1. Each report must indicate the date and time the data was obtained and the
    date and time the report was generated.

EVENT	EXPECTED RESULTS
1. Command the system to automatically collect data for all the reports to be generated. Command the system to generate all the reports automatically without operator interaction at different times of the day.	1. System requests information to collect data for all reports to be generated automatically.
2. Command the system to generate and display a status report of a list of equipment, sensors or control devices by each of the following categories:	2. System displays status of equipment, sensors, or control devices in the selected category.

. Building.
. Point.
. Unit.
. Area.
. Installation.

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TEST NO: PVT-28A Page 3 of 12   OBJECTIVE: To demonstrate the
TITLE: Report Generator   software which generates reports in a
APPLIES TO: Large/Medium EMCS, UMCS,   fixed format either by operator
             and UCS   request or in periodic automatic
REFERENCE: Proj. Spec. Paragraph ------ mode.

              EVENT   EXPECTED RESULTS

3. Command the system to generate a   3. System requests a time, the time
    status report automatically at fixed   interval between reports, and
    intervals. (For example, report on   device on which report will be
    status of selected temperature   displayed.
    sensors.)

    . Enter desired time intervals. (At   . System acknowledges input.
      least four reports must be
      generated during the test period.)

    . Specify the printer as the output   . Automatic report is generated at
      device.   specified time(s) and displayed
                                                on the printer in fixed format.

    . Command the system to cancel the   . System acknowledges command.
      report.   Visually verify the periodic
                                                automatic report is not generated
                                                at the programmed time.

    . Command the system to change the   . System acknowledges the change.
      generation mode for a specified   Report that was formally periodic
      report - from periodic automatic to   automatic will be generated as
      request mode.   requested by the operator.

    . Command the system to generate an   . System generates and displays the
      immediate printout of the latest   status report that was previously
      report using the PRINT REPORT   generated automatically.
      enhancement function.

    . Command the system to change the   . System generates and displays
      time interval.   status report with new time
                                                interval.

4. Command the system to store the   4. System stores data by type of
    data from the latest status report.   report, date and time.

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TEST NO:      PVT-28A  Page 4 of 12        OBJECTIVE:  To demonstrate the
TITLE:        Report Generator             software which generates reports in a
APPLIES TO:   Large/Medium EMCS, UMCS,     fixed format either by operator
               and UCS                     request or in periodic automatic
REFERENCE:    Proj. Spec. Paragraph ------ mode.
```

EVENT	EXPECTED RESULTS

5. Generate the maximum number of alarm conditions in the DE that are specified in the contract documents for correlated alarm reports.

5. System generates correlated alarm reports which contain at least the following:

    . Date and time of alarm.
    . Identification of the initiating alarm.
    . Identification of correlated dependent parameters.

6. Command the system to generate profile reports. Specify at least one of each type of the following profile reports:

    . Power consumption (value vs time).
    . Power demand (value vs time).
    . Temperatures (value vs time).
    . Equipment subsystem profiles (value vs value, value vs time).

    The total number of profile reports requested must be equal to the maximum number specified in the contract documents and must contain the maximum number of samples and parameters.

    Specify output device to be the printer.

6. System requests report data. Systems requests time interval between reports. System acknowledges input.

    The system generates requested profile reports on the printer.

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TEST NO:      PVT-28A  Page 5 of 12     OBJECTIVE:  To demonstrate the
TITLE:        Report Generator          software which generates reports in a
APPLIES TO:   Large/Medium EMCS, UMCS,  fixed format either by operator
              and UCS                   request or in periodic automatic
REFERENCE:    Proj. Spec. Paragraph ------  mode.
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| EVENT | EXPECTED RESULTS |

7. Command the system to display the   7. Verify that sufficient storage
    system to display the storage   space is allocated on disk to store
    space allocated for each report.   the number of profiles for each of
                                            the number of samples in accordance
                                            with the contractor's method of
                                            storing input parameters.

8. Command the system to terminate   8. System terminates profile report
    reports.   generation.

ELECTRICAL POWER UTILIZATION SUMMARY:

1. Command the system to generate the 1. System requests meter
    Electrical Power Utilization Summary.   identification and time period.

2. Enter meter identification(s).   2. System generates the following data
    Request daily and monthly totals.   for each meter:
    Specify the date of beginning day
    of the month.
                                            . Total daily consumption.
                                            . Total monthly consumption for the
                                              specified period.
                                            . Peak electric demand interval for
                                              the month and day, with time of
                                              occurrence.
                                            . Consumption over each demand
                                              interval for the month.
                                            . OA temperature for each demand
                                              interval.
                                            . OA relative humidity (RH) for
                                              each demand interval.
                                            . Calculated heating and cooling
                                              degree days.

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TEST NO: PVT-28A Page 6 of 12   OBJECTIVE: To demonstrate the
TITLE: Report Generator   software which generates reports in a
APPLIES TO: Large/Medium EMCS, UMCS,   fixed format either by operator
             and UCS   request or in periodic automatic
REFERENCE: Proj. Spec. Paragraph ------ mode.

              EVENT   EXPECTED RESULTS

ENERGY UTILIZATION SUMMARY:

1. Command the system to generate the   1. System requests identification of
    Energy Utilization Summary.   the point, unit, building, area,
                                              and/or [installation]. System
                                              requests beginning and ending times
                                              for sampling intervals.

2. Enter identification of desired   2. System generates a report for each
    I/O points according to each of the   addresss level. Each report must
    following address levels: contain:

    . A specific point in each DTM.   . Beginning and ending dates and
    . A unit in each DTM.   times.
    . A building in each DTM.   . Total energy usage for the
    . An area.   current and previous day.
    . [Installation.]   . Total energy usage for the
    . The entire EMCS.   current and previous month.
                                              . Maximum rate of consumption for
                                                the current and previous day.
                                              . Maximum rate of consumption for
                                                the current and previous month.
                                              . OA temperature and relative
                                                humidity (RH) for the sampling
                                                period (high, low, average).
                                              . Calculated heating and cooling
                                                degree days.

ALARM REPORT:

1. Command the system to generate the   1. System generates a report listing
    Alarm Report.   all outstanding alarms by class,
                                              including time of occurrence.

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TITLE:       Report Generator           software which generates reports in a
APPLIES TO:  Large/Medium EMCS, UMCS,   fixed format either by operator
               and UCS                  request or in periodic automatic
REFERENCE:   Proj. Spec. Paragraph ------  mode.
```

EVENT   EXPECTED RESULTS

LOCKOUT REPORT:

1. Command the system to generate the   1. System generates a report listing
    Lockout Report.   all points currently disabled,
                                                including time disabled, and
                                                identification of operator
                                                disabling the point.

ANALOG LIMIT REPORT:

1. Command the system to generate the   1. System generates a report with the
    Analog Limit Report.   following data for each analog
                                                point including those with
                                                suppressed alarm functions.

                                                . Identification.
                                                . Current analog value.
                                                . Engineering units.
                                                . High and low limits.
                                                . High and low limit differentials.
                                                . High and low reasonableness
                                                  limit.
                                                . Value change differentials.

2. Command the system to generate the   2. System generates a report with the
    Analog Limit Summary by building and   following data for each analog
    by unit.   point including those with
                                                suppressed alarm functions.

                                                . Identification.
                                                . Current analog value.
                                                . Engineering units.
                                                . High and low limits.
                                                . High and low limit differentials.
                                                . High and low reasonableness
                                                  limit.
                                                . Value change differentials.

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TEST NO:      PVT-28A  Page 8 of 12    OBJECTIVE:  To demonstrate the
TITLE:        Report Generator         software which generates reports in a
APPLIES TO:   Large/Medium EMCS, UMCS,  fixed format either by operator
              and UCS                   request or in periodic automatic
REFERENCE:    Proj. Spec. Paragraph ------  mode.
```

| EVENT | EXPECTED RESULTS |

RUN-TIME REPORTS:

1. Command the system to generate the   1. System requests identification of
    Run-Time Report.   equipment.

2. Enter identification of desired   2. System generates a report that
    equipment according to each of the   provides the total run-time for
    following address levels: each equipment unit in each address
                                        level.

    . Individual equipment items (for
      example, fan unit A in Building 1).
    . An equipment type (for example,
      all air handling units (AHUs)).
    . An equipment type and size (for
      example, all AHUs over 10 hp).
    . Equipment by physical grouping
      (for example, HVAC System I).
      Equipment must have run-times of
      9,999 hours (as established in
      initial conditions). Include
      equipment which has reached their
      respective run-time target (as
      established in initial conditions).
    . All equipment.

3. Manually reset run-time to zero for   3. System generates a Run-Time Report
    selected equipment and request   based on new time origin.
    Run-Time Report for the equipment.

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TEST NO: PVT-28A Page 9 of 12   OBJECTIVE: To demonstrate the
TITLE: Report Generator   software which generates reports in a
APPLIES TO: Large/Medium EMCS, UMCS,   fixed format either by operator
              and UCS   request or in periodic automatic
REFERENCE: Proj. Spec. Paragraph ------ mode.

                    EVENT   EXPECTED RESULTS

COOLING TOWER PROFILES:

1. Command the system to generate the   1. System requests cooling tower
    Cooling Tower Profile.   identification.

2. Enter cooling tower identification. 2. System acknowledges input and
                                             generates a report that provides:

                                             . Total daily and monthly on-time
                                               (each fan).
                                             . Number of ON and OFF transitions
                                               (each fan).
                                             . Maximum and minimum daily
                                               condenser water temperature at
                                               the time the cooling tower was
                                               turned on, and the time of
                                               occurrence.
                                             . Maximum and minimum daily
                                               condenser water temperature for
                                               the current month.

ELECTRICAL PEAK DEMAND PREDICTION REPORT:

1. Command the system to generate the   1. System requests meter
    Electrical Peak Demand Prediction   identification.
    Report.

2. Enter definition for individual   2. System acknowledges input and
    meter or groups of meters to be   generates a report for each meter
    totalized.   that provides:

                                             . Target.
                                             . Actual peak and predicted peak
                                               for each demand interval for that
                                               day.
                                             . Predicted demand for the next
                                               demand interval.

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TITLE:       Report Generator          software which generates reports in a
APPLIES TO:  Large/Medium EMCS, UMCS,  fixed format either by operator
              and UCS                  request or in periodic automatic
REFERENCE:   Proj. Spec. Paragraph ------  mode.
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EVENT	EXPECTED RESULTS

CHILLER UTILIZATION SUMMARY:

1. Command the system to generate the
    Chiller Utilization Summary.

    1. System requests chiller identification.

2. Enter chiller identification.

    2. System generates the chiller utilization summary report that provides:

      . Daily run-time in each one of at least 10 discrete loading levels.
      . Daily run-time average for the above discrete loading levels.
      . Total on-time for each level for the current month.
      . Run-time monthly average expressed in kWh and Btu/hr for the total on-time at each level.

OPTIMUM START/STOP REPORT:

1. Command the system to generate the
    Optimum Start Report for all systems
    and buildings.

    1. System generates report that lists the systems or buildings not meeting occupancy temperature requirements within plus or minus 20 minutes of designated time, updated daily or upon request. The report provides:

      . System and building identification.
      . Building occupancy schedule.
      . Actual start time.
      . Calculated start time.
      . Space temperature at beginning of occupancy.
      . OA temperature at beginning of occupancy.

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TEST NO: PVT-28A Page 11 of 12   OBJECTIVE: To demonstrate the
TITLE: Report Generator   software which generates reports in a
APPLIES TO: Large/Medium EMCS, UMCS,   fixed format either by operator
                and UCS   request or in periodic automatic
REFERENCE: Proj. Spec. Paragraph ------ mode.

                    EVENT   EXPECTED RESULTS

2. Command the system to generate the   2. System generates report that lists
    Optimum Stop Report for all systems   the systems or buildings not
    and buildings.   maintaining occupancy temperature
                                                 within 20 minutes of designated
                                                 time, updated daily or upon
                                                 request. The report provides:

                                                 . System and building
                                                   identification.
                                                 . Building occupancy schedule.
                                                 . Actual stop time.
                                                 . Calculated stop time.
                                                 . Space temperature at end of
                                                   occupancy.
                                                 . OA temperature at end of
                                                   occupancy.

OUT OF SERVICE REPORT:

1. Command the system to generate the   1. System requests report schedule and
    Out-of-Service Report.   locations to be reported.

2. Enter requests for reports on   2. System generates out of service
    equipment at each of the following   reports for each location. The
    locations: reports list all disabled points.

    . MCR.
    . DTM link.
    . FID or RTU panel.
    . MUX or ACU panel.

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TITLE: Report Generator   software which generates reports in a
APPLIES TO: Large/Medium EMCS, UMCS,   fixed format either by operator
             and UCS   request or in periodic automatic
REFERENCE: Proj. Spec. Paragraph ------ mode.

              EVENT   EXPECTED RESULTS

STATIC DATA BASE REPORT:

1. Command the system to generate a   1. System generates a list of the
    Static Data Base Report by building,   the active data base in categories
    zone, FID or RTU, and all points.   of building, zone, FID or RTU and
                                             all. The points have fixed
                                             parameters and constraints.

REAL-TIME DATA BASE REPORT:

1. Command the system to generate a   1. System generates a list of the
    Real-Time Data Base Report by   real-time data base. The list will
    building, zone, FID or RTU and all   include analog input, digital input
    points.   and calculated points. The points
                                             shall be concurrent by the year,
                                             month, day, hour, and minute.

DTM CIRCUIT REPORT:

1. Command the system to generate a   1. System generates the DTM circuit
    DTM circuit report on all   report.
    communication circuits with the
    following information:

    . Operator selected number (1-99)
      retransmission attempts.
    . Total number of transmissions
      attempted (0-128,000 - minimum).
    . Present consecutive retries (in
      progress) (1-99).
    . Total number of retries (cumulative
      to 32,000).
    . Status of DTM circuit (enabled or
      disabled).

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TEST NO: PVT-29A Page 1 of 5   OBJECTIVE: To demonstrate the
TITLE: Operator's Console Color   software that operates the operator's
               Display   console and generates graphic
APPLIES TO: Large/Medium EMCS, UMCS,   displays.
               and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The contractor provides an I/O summary of the DE list associated with each
    graphic display requested during the test.

2. The DE is set up to generate an event (such as an alarm) to test the
    software for displaying a graphic after a specified event.

3. The contractor provides a sample new graphic to be developed during the
    test.

4. The contractor provides a list of standard graphic symbols required in the
    contract documents, plus some additional graphic symbols to be added to the
    system during the test.

5. Second operator's console is being used to monitor a graphic display.

EVENT   EXPECTED RESULTS

ALPHANUMERIC DISPLAY

1. Enter operator password to access   1. System acknowledges password.
    the highest operator level.

2. Command the system to generate an   2. Visually verify that the system
    alphanumeric monitor display of I/O   displays the following data in
    points by system or individual I/O   fixed format:
    points. (For example, request a
    monitor display of an air handling   . Time of day (first field)
    unit (AHU).)   (hours, minutes, seconds).
                                              . Date (first field) (month, day,
                                                year: i.e., 10/25/86).
                                              . Value of two analog points (first
                                                field).
                                              . Operator name or initials (first
                                                field).
                                              . Alarm display and operator
                                                commands (second field). System
                                                displays, in varying format, the
                                                requested data (third field).

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TEST NO:      PVT-29A  Page 2 of 5      OBJECTIVE:  To demonstrate the
TITLE:        Operator's Console Color  software that operates the operator's
              Display                    console and generates graphic
APPLIES TO:   Large/Medium EMCS, UMCS,  display.
              and UCS
REFERENCE:    Proj. Spec. Paragraph ------
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EVENT   EXPECTED RESULTS

GRAPHIC DISPLAY

</div>

3. Command the system to list the   3. System displays a list of graphic
    the graphic displays in the system.   displays available to the operator.
                                              Verify list corresponds to contract
                                              documents.

4. Command the system to display a   4. Operator console displays fixed
    graphic from the prior list   format information plus graphic
    generated by the system.   display with associated live data.

5. Command the system to display all   5. Visually verify the system displays
    standard graphic symbols in the   all symbols required in the
    system library.   contract documents. These symbols
                                              conform to the ASHRAE Handbook of
                                              Fundamentals and include:

. Pump: Right hand (RH), left hand
  (LH), upflow (U), downflow (D).
. Valve, two-way: horizontal (H),
  vertical (V).
. Valve, three-way: H, V.
. Flow element: H, V.
. Temperature sensor: H, V.
. Pressure sensor: H, V.
. Humidity sensor: H, V.
. AHU, single deck.
. AHU, double deck.
. Fan: RH, LH, U, D.
. Chiller.
. Boiler.
. Vertical piping.
. Horizontal piping.
. Unit heater.
. Pressure reducing valve: H, V.
. Damper: H, V.
. Electric meter.
. Limit switch: H, V.
. Flow switch (FS): H, V.

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TEST NO: PVT-29A Page 3 of 5   OBJECTIVE: To demonstrate the
TITLE: Operator's Console Color   software that operates the operator's
             Display   console and generates graphic
APPLIES TO: Large/Medium EMCS, UMCS,   displays.
             and UCS
REFERENCE: Proj. Spec. Paragraph ------

            EVENT   EXPECTED RESULTS

            GRAPHIC DISPLAY

5. (continued)
                                            . Temperature switch: H, V.
                                            . Pressure switch (PS).
                                            . Coil: H, V.
                                            . Solenoid valve.
                                            . Filter.
                                            . Air-cooled condensing unit.
                                            . Cooling tower.

6. Command the system to add custom   6. System requests input.
    symbols to the Library.

7. Enter custom symbols.   7. System accepts input.

8. Command the system to display all   8. Visually verify that all symbols,
    graphic symbols.   including custom symbols, are
                                             displayed.

9. Enter command to define a graphic   9. System executes commands as
    display: follows:

    . Define the background color.   . Visually verify system displays
                                               requested background color.

    . Define the foreground color.   . Visually verify system displays
                                               requested foreground color.

    . Command the system to position   . System requests locations of I/O
       the I/O function Alphanumeric   function and executes command.
       descriptors at selected locations   Visually verify descriptors are
       on the graphic.   located.

    . Command the system to display new   . Visually verify system displays
       connecting lines between designated   lines between designated points
       points.   on the graphic display.

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TEST NO: PVT-29A Page 4 of 5   OBJECTIVE: To demonstrate the
TITLE: Operator's Console Color   software that operates the operator's
             Display   console and generates graphic
APPLIES TO: Large/Medium EMCS, UMCS,   displays.
             and UCS
REFERENCE: Proj. Spec. Paragraph ------

              EVENT   EXPECTED RESULTS

                         GRAPHIC DISPLAY

9.   (continued.)

     . Command the system to position   . Visually verify system positions
       standard graphic symbols from system   of graphic symbols at selected
       library at selected locations on the   locations.
       graphics.

     . Command the system to save the   . System acknowledges command and
       display.   saves the display.

     . Initiate an alarm in the DE, not   . Alarm appears on the second field
       associated with the generated   (color monitor) and prints on the
       graphic.   alarm printer.

10. Modify a portion of the display   10. Visually verify system overlays new
     previously stored. (For example,   alphanumeric and graphics on the
     add a new value, a controller or   existing display. Display is saved
     sensor.) Identify sources of live   under the new name.
     data and location of their readouts.
     Command the system to save the
     display under a new name and graphic
     designation.

11. Call up a Graphic Display with the 11. Visually verify system displays
     latest data on a specific system.   latest data as called for by the
     (For example, request the latest   I/O Summary Tables, fully
     data on an air handling unit (AHU).)   integrated with graphic display to
                                              at least 3 significant figures.
                                              Verify completeness of output
                                              against the I/O summary table
                                              provided by the contractor.

12. Initiate alarm condition(s) on a   12. Verify system displays red blinking
     designated graphic.   alarm(s) on the designated graphic.

13. Acknowledge alarm.   13. Verify system displays steady red
                                              alarms on the graphic.

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TEST NO:      PVT-29A  Page 5 of 5      OBJECTIVE:  To demonstrate the
TITLE:        Operator's Console Color   software that operates the operator's
              Display                    console and generates graphic
APPLIES TO:   Large/Medium EMCS, UMCS,   displays.
              and UCS
REFERENCE:    Proj. Spec. Paragraph ------
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| EVENT | EXPECTED RESULTS |

GRAPHIC DISPLAY

EVENT	EXPECTED RESULTS
14. Eliminate alarm condition.	14. Verify steady red alarms are no longer displayed.
15. Disconnect DTM associated with the graphic display.	15. System displays data by highlighting or flagging.
16. Command the system to cancel the display of a graphic picture. Reconnect DTM.	16. System removes display from monitor.
17. Command the system to display the graphic previously canceled.	17. System recalls graphic from library and displays on monitor.
18. Assign conditions which automatically initiate the display. (For example, display after an alarm condition for the graphic.)	18. Graphic will be displayed automatically by events established in initial conditions.
19. Command the system to duplicate the graphic, assign it a new name and save it.	19. System duplicates the graphic, assigned it a new name, and saves it.
20. Delete the original graphic.	20. System deletes original graphic from library and cancels display on monitor.
21. Call up the original deleted graphic.	21. System does not display graphic and indicates graphic is not in library.
22. Log off the system.	22. System performs according to expected results.

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TEST NO: PVT-30A Page 1 of 2   OBJECTIVE: To demonstrate the
TITLE: Control Sequences   software that permits the creation
APPLIES TO: Large/Medium EMCS, UMCS,   and execution of control sequences
              and UCS   for automated control of equipment
REFERENCE: Proj. Spec. Paragraph ------ based on operational parameters,
                                          including those defined in the
                                          data base.

INITIAL CONDITIONS

1.   The contractor provides a control sequence with at least ---- terms and
     known errors that utilize the mathematic package functions stored in the
     system. The contractor also provides input values for the control sequences
     with appropriate output.

2.   The contractor indicates total storage allocated for algorithmic control
     sequences and method of storage.

3.   The system contains the number of control sequences, each with the number of
     terms required by the contract documents. Contractor provides list of
     sequences stored, the number of terms in each sequence, and the amount of
     storage allocated to the sequence.

4.   The system is performing on-line monitoring and control functions throughout
     the test.

5.   Operator is logged onto system at a level that enables operator access to
     control sequences.

           EVENT   EXPECTED RESULTS

1.   Enter the control sequence via the   1.   CCU or COS loads and compiles
     designated terminal.   program. System generates a hard
                                               copy listing with error messages.

2.   Correct error via editor program.   2.   CCU or COS loads and compiles
     Verify hard copy output against   corrected program. System
     contractor supplied document.   generates a hard copy listing.

3.   Command the system to save the test 3.   CCU or COS saves test program.
     program.

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TEST NO: PVT-30A Page 2 of 2   OBJECTIVE: To demonstrate the
TITLE: Control Sequences   software that permits the creation
APPLIES TO: Large/Medium EMCS, UMCS,   and execution of control sequences
              and UCS   for automated control of equipment
REFERENCE: Proj. Spec. Paragraph ------ based on operational parameters,
                                           including those defined in the data
                                           base.

                    EVENT   EXPECTED RESULTS

4. Command the system to execute test   4. System executes sequence and
    sequence using FID or RTU test set.   displays output in the FID or RTU
                                              test set. Verify output against
                                              predicted results.

5. Command the system to change the   5. System requests modification.
    sequence.

6. Enter modification. Command the   6. CCU or COS loads and compiles
    system to print out new sequence.   program with modification. Verify
                                              the hard copy listing contains the
                                              modifications.

7. Command the system to delete test   7. System executes command.
    control sequence.

8. Command the system to execute test   8. System indicates command cannot be
    sequence.   executed because the sequence does
                                              not exist.

9. Command the system to display the   9. System displays the storage space.

    storage space allocated for all   Verify sufficient storage is
    control sequences stored in the   allocated by using the contractor's
    system.   method of storing control sequences
                                              to determine storage space
                                              required.

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TEST NO: PVT-31A Page 1 of 4   OBJECTIVE: To demonstrate the
TITLE: Alarm Reporting   operation of the software which
APPLIES TO: Large/Medium EMCS, UMCS, reports the alarm conditions with
             and UCS   associated messages.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The FID or RTU Test Set and DE is set up to initiate 1,000 alarms, including
    at least one of each of the following alarm conditions:

    . FID or RTU or MUX or ACU not responding.
    . FID or RTU or MUX or ACU responding (return to normal).
    . FID-CCU or RTU-COS DTM high error rate.
    . FID/MUX or RCU/ACU DTM Link high error rate.
    . FID-CCU or RTU-COS Real Time Clock error greater than 15 seconds
      (adjustable).
    . FID/MUX or RCU/ACU Door Intrusion Alarm.
    . FID/MUX or RCU/ACU OFF-LINE - control panel activated.
    . FID/MUX or RCU/ACU ON-LINE - control panel activated.
    . FID/MUX or RCU/ACU OUTPUTS DISABLED - control panel activated.
    . FID or RTU FAILURE - self diagnostics activated.
    . Point not responding to command.
    . Point change of state without command.

2. Each type of the DE alarm is assigned an alarm class. Both alarm classes
    must be represented.

3. At least one alarm in each class must have an associated message 60
    characters long.

4. The contractor provides a priority list for each reporting alarm condition
    when all classes of alarms are initiated simultaneously.

EVENT	EXPECTED RESULTS
1. Log on to the system at a password	1. System acknowledges log on.
level that does not allow operator	
to enact automatic alarm silencing.	

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TEST NO:      PVT-31A  Page 2 of 4      OBJECTIVE:  To demonstrate the
TITLE:        Alarm Reporting           operation of the software which
APPLIES TO:   Large/Medium EMCS, UMCS,  reports the alarm conditions with
                and UMCS                associated messages.
REFERENCE:    Proj. Spec. Paragraph ------
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              EVENT   EXPECTED RESULTS

2. Initiate Class 1 and Class 2   2. System sounds audible alarm,
    alarms. Each class of alarms   displays Class 2 alarms on
    tested shall include a minimum of   operator's console and prints Class
    two operational alarms and two I/O   1 and 2 alarms with the following
    functions for selected FID/MUX or   data for each alarm:
    RCU/ACU. At random times
    throughout the test, initiate an   . Alarm identification.
    alarm that can be easily distinguished . Alarm class.
    (such as varying the pulse rate to   . Date and time of occurrence.
    cause an alarm on the pulse   . Device or sensor type.
    accumulator). Request Secondary   . Limit exceeded (if analog
    alarm messages for selected alarms.   functions).
                                          . Engineering units.
                                          . Current value or status.
                                          . Primary alarm message with a 60
                                            character field.
                                          . Secondary messages with a 60
                                            character field for requested
                                            alarms.

3. Request secondary messages for each 3. System displays and prints
    selected alarm. Secondary messages   secondary messages with a 60
    shall be assigned by the operator   character field for selected
    for printing.   alarms.

4. Acknowledge Class 2 alarms.   4. System returns to normal operating
                                          mode.

5. Eliminate all alarm conditions.   5. System is in a normal operating
                                          mode.

6. Initiate Class 1 alarms.   6. System prints alarm report with the
                                          following data for each alarm in
                                          order of occurrence:

                                          . Alarm identification.
                                          . Time of occurrence.

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TEST NO: PVT-31A Page 3 of 4   OBJECTIVE: To demonstrate the
TITLE: Alarm Reporting   operation of the software which
APPLIES TO: Large/Medium EMCS, UMCS,   reports the alarm conditions with
             and UCS   associated messages.
REFERENCE: Proj. Spec. Paragraph ------

          EVENT   EXPECTED RESULTS

6. (continued)   . Device or sensor type.
                                            . Limit exceeded (if analog
                                              functions).
                                            . Engineering units.
                                            . Current value or status.
                                            . Primary alarm message with a 60
                                              character field.

7. Eliminate conditions causing Class   7. System prints updated status report
    1 alarms.   and returns to normal operating
                                            mode.

8. Initiate Class 2 alarms.   8. System sounds an audible alarm,
                                            prints and displays the following
                                            data for each alarm in order of
                                            occurrence:

                                            . Identification of alarm
                                              occurrence.
                                            . Time of alarm condition.
                                            . Device or sensor type.
                                            . Limit exceeded (for analog
                                              functions).
                                            . Engineering units.
                                            . Current value or status.
                                            . Primary alarm message with a 60
                                              character field.

9. Acknowledge alarm(s).   9. Upon operator acknowledgement,
                                            system turns off audible alarm,
                                            displays alarm data for the alarms.
                                            Visually verify the system display
                                            indicates that the alarm(s) have
                                            been acknowledged.

10. Eliminate conditions causing Class   10. System displays and prints updated
    2 alarms.   status report and returns to normal
                                            operating mode.

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TEST NO: PVT-31A Page 4 of 4   OBJECTIVE: To demonstrate the
TITLE: Alarm Reporting   operation of the software which
APPLIES TO: Large/Medium EMCS, UMCS,   reports the alarm conditions with
             and UCS   associated messages.
REFERENCE: Proj. Spec. Paragraph ------

                EVENT   EXPECTED RESULTS

11. Command the system to enable   11. System will indicate that command
    automatic silencing of a specified   cannot be executed at the present
    alarm.   operator access level.

12. Log off the system.   12. System acknowledges log off.

13. Log on with a password for an   13. System acknowledges log on.
    access level that enables the
    operator to activate automatic alarm
    silencing and/or initiate automatic
    acknowledgement of alarms.

14. Command the system to enable   14. System acknowledges and executes
    automatic audible alarm silencing of   command.
    alarms.

15. Command the system to enable   15. System acknowledges and executes
    automatic acknowledgement of alarms.   command.

16. Initiate alarm conditions.   16. System automatically acknowledges
                                           alarms.

17. Acknowledge Class 2 alarms   17. Audible alarm ceases.
    requiring such acknowledgement.

18. Eliminate Class 2 alarm conditions. 18. System prints return to normal.

19. Request display of primary and   19. Verify that sufficient storage
    secondary alarm messages.   space is allocated on disk to store
                                           a 60 character primary alarm
                                           message for every DE point with a
                                           possible alarm and 100 secondary
                                           messages with a field of 4 lines of
                                           60 characters each.

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TEST NO: PVT-32A Page 1 of 1   OBJECTIVE: To determine the ability
TITLE   Static Data Base Update   of the CCU or COS during normal
APPLIES TO: Large/Medium EMCS, UMCS,   operation to update the DE parameters
              and UCS   and the constraints to the static
REFERENCE: Proj. Spec. Paragraph ------ data base file automatically whenever
                                         a change occurs.

TEST EQUIPMENT

1. A certified stopwatch with time intervals of 0.1 seconds.

EVENT	EXPECTED RESULTS
1. Command the system to store new parameter definitions for selected analog/digital (A/D) points in the DE. (For example, select analog high and low limit alarms and select start-stop times for digital output points.)	1. System requests data. System acknowledges input and stores data in memory.
2. Command the system to display new parameters and constraints from static data base after new values are entered.	2. Visually verify system displays static data files with revised parameter and constraints.

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TEST NO: PVT-33A Page 1 of 2   OBJECTIVE: To demonstrate that the
TITLE: FID or RTU Software   FID or RTU executes FID or RTU
             Programming   software programs and/or FID or RTU
APPLIES TO: Large/Medium EMCS, UMCS, programs downloaded from the CCU or
             and UCS   COS without CCU or COS intervention.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The contractor provides a source program with a known error that performs a
    visually verifiable operation in the DE. The contractor also provides input
    data and expected results.

2. The system is performing on-line monitoring and control functions throughout
    the test.

3. Operator is logged onto system at a level that enables operator to perform
    FID or RTU software programming.

4. The contractor provides written descriptions of the FID or RTU resident
    programs to be downloaded with the expected results.

EVENT	EXPECTED RESULTS
1. Develop in the CCU or COS a custom FID or RTU program. (For example, start and stop all HVAC equipment connected to the FID or RTU and associated MUX or ACU at the same time every one-half hour with a time delay between successive starts.)	1. System accepts inputs.
2. Enter source program with name of file via the editor. (This program will be called the test program hereafter.) Command the system to generate hard copy output of program.	2. System generates output. Verify a hard copy listing matches contractor supplied listing, and that system displays error messages on known errors.
3. Correct errors via the editor program. Command the system to generate hard copy output.	3. System generates output. Verify hard copy printout corresponds to contractor supplied document without errors.
4. Command the system to save the test program on designated disk file.	4. System saves test program on disk file.

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TEST NO:      PVT-33A  Page 2 of 2      OBJECTIVE:  To demonstrate that the
TITLE:        FID or RTU Software       FID or RTU executes FID or RTU
APPLIES TO:   Large/Medium EMCS, UMCS,  software programs and/or FID or RTU
               and UCS                  programs downloaded from the CCU or
REFERENCE:    Proj. Spec. Paragraph ------  COS without CCU or COS intervention.
-----------------------------------------------------------------------------
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| EVENT | EXPECTED RESULTS |

5. Command the system to transfer
    software to the designated PROM
    programmer or alternately download
    RAM based software from the CCU
    or COS to the test set.

5. System transfers the FID or RTU RAM
    based software from the CCU or COS
    to the FID or RTU test set or PROMS
    are installed in the FID test set.

6. Initiate the debugging software
    to check program logic. Check
    output of program against expected
    results using the test set.

6. System provides necessary
    information for the operator to
    follow the execution of the
    program. Verify program output
    agrees with expected results.

7. Command the system to list and
    store the object code generated for
    the debugged program.

7. System generates a hard copy
    listing of the test program and
    stores program on disk.

8. Command the system to download
    software to selected FID or RTU
    command the system to create a
    new PROM.

8. System downloads software to
    selected FID or RTU or PROM and
    software installed in the selected
    FID or RTU.

9. Command the system to start
    execution of software at a selected
    FID or RTU using the local DE at a
    designated time.

9. Visually verify FID or RTU
    correctly executes program software
    with the DE points assigned to the
    program.

10. Inhibit communication between the
    CCU or COS and FID or RTU.

10. Visually verify FID or RTU executes
    custom programs without
    communication with CCU or COS as
    described in contractor furnished
    descriptions.

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TEST NO: PVT-34A Page 1 of 3   OBJECTIVE: To verify the system uses
TITLE: Command Priorities   priority levels to prevent
APPLIES TO: Large/Medium EMCS, UMCS,   interaction of a command of low
             and UCS   priority with a command of higher
REFERENCE: Proj. Spec. Paragraph ------ priority.

                        INITIAL CONDITIONS

1. Prior to the test, the contractor provides a schedule of commands for
    testing command priorities. In the test, command priorities are assigned to
    specific applications programs. For example:

    . Command Priority 1 - a routine operation such as scheduled start/stop and
      operator inputs.
    . Command Priority 2 - a modifying program to the command priority
      requirement, such as duty cycling.
    . Command Priority 3 - a modifying program to the Command Priority 1 and
      Command Priority 2 requirements, such as demand limiting.
    . Command Priority 4 - an override by access to a high-level password.

2. Each program priority must cause unique and identifiable change in equipment
    operation relative to the other program, and DE conditions must be designed
    so that changes in operation take place as soon as higher priority programs
    are executed. For example, establish unique but overlapping time periods
    for equipment start-up and duty cycling where duty cycling occurs after
    equipment start-up. Also, prescribe a demand limit that will be exceeded by
    demand during duty cycling period so that equipment cycling under a lower
    priority command will be interrupted.

3. Establish an equipment operating constraint or environmental constraint that
    visibly modifies or prevents a desired change in equipment operation. For
    example, establish a condition that will decrease and increase the duty
    cycling periods, establish conditions that will cause the duty cycle period
    to be exceeded during high demand periods.

             EVENT   EXPECTED RESULTS

1. Log onto system with an operator   1. System acknowledges log-on.
    password that permits access to
    all command priorities, except
    Priority 4.

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TEST NO: PVT-34A Page 2 of 3   OBJECTIVE: To verify the system uses
TITLE: Command Priorities   priority levels to prevent
APPLIES TO: Large/Medium EMCS, UMCS,   interaction of a command of low
             and UCS   priority with a command of higher
REFERENCE: Proj. Spec. Paragraph ------   priority.

                  EVENT   EXPECTED RESULTS

2. Command the system to execute a   2. System executes the command.
    Priority 1 command (for example,   Visually examine DE status changes.
    scheduled start/stop) on selected
    equipment.

3. Command the system to execute a   3. System executes the command.
    Priority 2 command that will   Equipment formally controlled by
    interrupt the execution of the   the Priority 1 command is
    Priority 1 command (for example,   controlled by the Priority 2
    duty cycling).   command. Visually verify the
                                             change in the operation of the
                                             equipment formally controlled by
                                             the Priority 1 command (for
                                             example, executed duty cycling on
                                             equipment currently under scheduled
                                             start/stop).

4. Command the system to execute a   4. System executes the command.
    Priority 3 command (for example,   Equipment formally controlled by
    demand limiting).   the Priority 2 command is
                                             controlled by the Priority 3
                                             command. Visually verify the
                                             change in the operation of
                                             equipment formally controlled by
                                             the Priority 2 command. (For
                                             example, execute a demand limiting
                                             program on equipment currently in
                                             the duty cycling mode.)

5. Command the system to execute a   5. System indicates command cannot be
    Priority 1 command.   executed because current command
                                             has a higher command priority.

6. Command the system to execute a   6. System indicates command cannot be
    Priority 2 command.   executed because current program
                                             has a higher command priority.

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TEST NO: PVT-34A   Page 3 of 3   OBJECTIVE: To verify the system uses
TITLE: Command Priorities   priority levels to prevent
APPLIES TO: Large/Medium EMCS, UMCS,   interaction of a command of low
                and UCS   priority with a command of higher
REFERENCE: Proj. Spec. Paragraph ------ priority.

                 EVENT   EXPECTED RESULTS

7. Command the system to execute a   7. System indicates command cannot be
    Priority 4 command. (For example,   executed at current operator access
    command the system to keep equipment   level.
    in operation regardless of demand
    limit program.)

8. Command the system to decrease   8. Verify that temperatures in all
    demand limiting target to a level   areas deviate equally from the
    that will require the implementation   established operating setpoints.
    of the "Fairness Doctrine" in the
    demand limiting program.

9. Log off the system.   9. System acknowledges log-off.

10. Log on the system using an operator 10. System acknowledges log-on.
    password that permits access to
    all commands.

11. Command the system to execute a   11. System acknowledges and executes
    Priority 4 command. (For example,   command. Visually verify the
    cause equipment to operate even   changes the operation of equipment
    though current peak demand conditions   currently controlled by the
    would cause equipment shutdown under   Priority 3 command.
    the Priority 3 command.)

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TEST NO: PVT-35A Page 1 of 1   OBJECTIVE: To demonstrate software
TITLE: Calculated Point   that creates new point values by
APPLIES TO: Large/Medium EMCS, UMCS,   performing mathematical operations on
             and UCS   any values available in the system
REFERENCE: Proj. Spec. Paragraph ------ data base.

INITIAL CONDITIONS

1. Specified DE points, from different communication circuits, are set up to
    generate known analog, digital and constant values required for the
    computation of point values. Input values are selected so that calculated
    values can be predicted.

2. The contractor provides a schedule of data base values of calculated points
    to be used in the test with the expected results.

            EVENT   EXPECTED RESULTS

1. Command the system to display   1. System displays point
    calculated point values based on   identification and values which
    predetermined data base values and   correspond with predicted values.
    mathematical operations such as   Display format is the same as any
    square roots and exponents).   analog print format.

2. Command the system to change   2. System acknowledges input.
    specified constants for computation
    of point values. Enter the new
    constant(s).

3. Command the system to display   3. System displays new values for
    revised calculated point values.   calculated points along with point
                                           identification. New values
                                           correspond with predicted results
                                           using the new constant(s).

4. Command the system to stop   4. System generates alarms. The DE
    communication with one of the DE   point and calculated point shows
    points used in calculating the   not current data status.
    calculated point.

5. Return the system to a normal   5. The system returns to a normal
    operating mode.   operating mode.

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TEST NO: PVT-36A   Page 1 of 1   OBJECTIVE: To demonstrate system
TITLE: Analog Monitoring   capability to monitor all analog
APPLIES TO: Large/Medium EMCS, UMCS,   values, including calculated analog
                 and UCS   points.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The contractor provides a list of analog points including calculated points.

               EVENT   EXPECTED RESULTS

1. Command the system to display analog   1. System acknowledges command and
    points, including calculated analog   displays the analog points with
    points.   their descriptors and alphanumeric
                                               values.

2. Command the system to change high   2. System acknowledges data input.
    limits alarm values for selected
    analog points.

3. Initiate a change of value of   3. System displays value of new value
    selected analog points at the   of preselected points without alarm
    FID/MUX or RCU/ACU within the high   indication.
    and low limits.

4. Initiate a change of value for   4. System displays value of selected
    selected analog points at the   points and generates an alarm for
    FID/MUX or RCU/ACU that will   each analog point in alarm.
    generate alarms, including an alarm
    for a calculated point.

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TEST NO: PVT-37A Page 1 of 2   OBJECTIVE: To demonstrate operation
TITLE: Analog Totalization   of software that transmits, displays,
APPLIES TO: Large/Medium EMCS, UMCS,   and totalizes analog values over a
             and UCS   given time period.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The contractor provides a list of analog points with known analog values so
    that totalization over at least three predetermined time periods for each
    point can be computed as a check against the system totalization for each
    point.

2. The selected analog points include calculated analog points.

3. The totalization values for each point must be unique for each time period.
    Time periods for each point must be different.

            EVENT   EXPECTED RESULTS

1. Command the system to display and   1. System acknowledges command and
    monitor selected designated analog   displays alphanumeric values.
    points.   Verify system display against known
                                             values.

2. Enter the point identification and   2. System executes analog totalization
    time period for totalizing each   program at designated time periods
    point. Select different time   for each point. For each
    period and time intervals so that   designated point system
    at least three outputs occur in   displays:
    the course of the test. Request
    system display of totalized values.   . Peak value in current time
                                               period.
                                             . Total value in current time
                                               period.
                                             . Peak value in previous time
                                               period.
                                             . Total value in previous time
                                               period.

                                             Verify system output against
                                             predetermined values.

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TEST NO:      PVT-37A  Page 2 of 2      OBJECTIVE:  To demonstrate operation
TITLE:        Analog Totalization        of software that transmits, displays,
APPLIES TO:   Large/Medium EMCS, UMCS,   and totalizes analog values over a
              and UCS                     given time period.
REFERENCE:    Proj. Spec. Paragraph ------
-------------------------------------------------------------------------
```

<table>
<tr><th>EVENT</th><th>EXPECTED RESULTS</th></tr>
<tr>
<td>3. Command the system to change end of time period for each totalized point. Request system display of totalized values.</td>
<td>3. System executes command and displays:

. Peak value in current time period.
. Total value in current time period.
. Peak value in previous time period.
. Total value in previous time period.

Verify system display matches expected results.</td>
</tr>
<tr>
<td>4. Enter command for system display of analog totals for each time period.</td>
<td>4. Verify system display of analog totals matches expected results.</td>
</tr>
</table>

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TEST NO: PVT-38A Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: Energy Totalization   operation of software that totalizes
APPLIES TO: Large/Medium EMCS, UMCS,   heating energy consumption for each
              and UCS   energy source.
REFERENCE: Proj. Spec. Paragraph ------

                          INITIAL CONDITIONS

1. The contractor provides a list of points with known values so that
    totalization over at least three distinct predetermining time periods for
    each point can be computed as a check against the system totalization for
    each point.

2. Selected points required for totalization are set up to fail during the
    totalization period.

                EVENT   EXPECTED RESULTS

1. Command the system to initiate   1. System acknowledges command, and
    energy totalization for selected   requests point identification and
    points.   time period for totalization for
                                           each point.

2. Enter system identification and   2. System executes energy totalization
    time period for totalization.   program at designated time periods
    Select a different time period so   for each system.
    that totalization occurs at least
    3 times in the course of the test
    period.

3. At the end of the second time   3. System displays the heat energy (in
    period, command the system to   thousand Btu) consumed during the
    display totalization values for   time period and the values for each
    each point.   instantaneous rate in Btu/hr for
                                           each point. Verify system output
                                           against known values.

4. At a predetermined time during the 4. System acknowledges command and
    third time period, command the   terminates totalization for the
    system to change the end of period   third time period.
    time for each totalized point.

5. Enter command for energy   5. System displays energy totalization
    totalization data for the third   values for the shortened time
    time period.   period.

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TEST NO:      PVT-39A  Page 1 of 1      OBJECTIVE:  To demonstrate software
TITLE:        Prediction Software        that performs an extrapolation on
APPLIES TO:   Large/Medium EMCS, UMCS,   data into future of analog values
              and UCS                    based on past analog values.
REFERENCE:    Proj. Spec. Paragraph ------
```

INITIAL CONDITIONS

1. The contractor provides a curve of known characteristics with at least eight
    analog values and expected output based on the curve. (At least two sets of
    input/output data provided. Each input set is spaced over a different time
    scale.)

2. The Government provides a curve of known characteristics with at least eight
    analog values and expected output based on the curve. (At least two sets of
    input/output data provided. Each input set is spaced over a different time
    scale.)

3. The system is programmed to use the known curve in the prediction program.

EVENT	EXPECTED RESULTS
1. Initiate the prediction program for the curve defined in initial conditions. Command the system to display predicted values.	1. System requests input data and time spacing of values to be extrapolated, and calculates predicted value into future for each point in the curve. Verify system display of predicted value corresponds to expected value.
2. Enter command to vary (increase or decrease) time spacing of values used in the prediction program. Command the system to display the predicted value.	2. System calculates predicted value. Verify system display of predicted value corresponds for each point in the curve to the expected value.
3. Enter Government furnished curve. Command the system to identify the predicted value.	3. System calculates predicted value. Verify system display of predicted value corresponds for each point in the curve to the expected value.

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TEST NO: PVT-40A Page 1 of 1   OBJECTIVE: To demonstrate operation
TITLE: Extended Service Program   of software that allows one-time
APPLIES TO: Large/Medium EMCS, UMCS,   extensions of timed equipment
             and UCS   schedules.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. All equipment affected by the extended service programs is set up to start
    up and shut down at specified times.

2. The contractor identifies the input commands for requesting extended service
    for a given schedule.

3. All selected equipment is initially off.

        EVENT   EXPECTED RESULTS

1. Command the system to execute time   1. Visually verify equipment starts up
    scheduled programs for all equipment   according to the scheduled start
    selected for the extended service   times.
    program.

2. Prior to the scheduled stop time,   2. Visually verify equipment shuts
    initiate appropriate inputs to   down for schedules without extended
    request extended service on some but   service request, while equipment
    not all of the equipment schedules.   under extended service schedules
                                              remains in operation.

3. Command the system to modify the   3. System requests identification of
    extended service program.   equipment and schedule.

4. Enter modified extended service   4. System acknowledges input of all
    programs for selected pieces of   schedules and equipment. Visually
    equipment.   verify service change in the
                                              operation of equipment as a result
                                              of the modified programs.

5. Command the system to display the   5. System displays start/stop schedule
    start/stop schedule for the equipment   which shows that the extended
    with the extended service program.   service was a one time only
                                              extended schedule.

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TEST NO:      PVT-41A  Page 1 of 1      OBJECTIVE:  To demonstrate software
TITLE:        Scheduled Start/Stop Program  to start and stop equipment based on
              - Summer Operation          time of day and day of week,
APPLIES TO:  Large/Medium EMCS, UMCS,     including holidays.
              and UCS
REFERENCE:   Proj. Spec. Paragraph ------
```

INITIAL CONDITIONS

1. Select points in the DE with status indication to have scheduled for
    start/stop activity every day of the week and holidays, during the summer.
    The contractor provides the following information for the units to be
    tested:

    . Summer period - cause cooling equipment operation.
    . Equipment schedules - to start and stop equipment during the test period.
    . Equipment status - (for example, to be off initially).

2. Select three points having electrical loads that are over 20 hp or 50 kW.

3. The system is programmed to execute the scheduled start/stop program with
    distinct operator adjustable time delay of loads over 20 hp and 50 kW.

EVENT	EXPECTED RESULTS
1. Compare list of program inputs and outputs required in the contract documents against the contractor supplied input/output.	1. Contractor supplied program inputs/outputs may include all those inputs/outputs in the contract documents. Contractor furnished software that requires input/output points not included in the contract documents must operate with default values.
2. Command the system to execute the scheduled start/stop program for all equipment selected for the test.	2. System executes start/stop program with time delay between starts of equipment over 20 hp and 50 kW.
3. Start up and stop equipment manually at the unit by overriding the system controls.	3. Visually verify the system generates an alarm to indicate unauthorized starting or stopping of equipment.

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TEST NO: PVT-42A Page 1 of 1   OBJECTIVE: To demonstrate software
TITLE: Scheduled Start/Stop Program to start and stop equipment based on
              - Winter Operation   time of day and day of week,
APPLIES TO: Large/Medium EMCS, UMCS,   including holidays.
              and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. Select points in the DE with status indication to have scheduled for
    start/stop activity every day of the week and holidays, during the winter.
    The contractor provides the following information for the units to be
    tested:

    . Winter period - cause heating equipment operation.
    . Equipment schedules - to start and stop equipment during the test period.
    . Equipment status - (for example, to be off initially).

2. Select three points having electrical loads that are over 20 hp or 50 kW.

3. The system is programmed to execute the scheduled start/stop program with
    distinct operator adjustable time delay of loads over 20 hp and 50 kW.

            EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract the contractor supplied
                                             documents. Contractor furnished
                                             software that requires input/output
                                             points not included in the contract
                                             documents must operate with default
                                             values.

2. Command the system to execute the   2. System executes start/stop program
    scheduled start/stop program for   with time delay between starts of
    all equipment selected for the test.   equipment over 20 hp and 50 kW.

3. Start up and stop equipment   3. Visually verify the system
    manually at the unit by overriding   generates an alarm to indicate
    the system controls.   unauthorized starting or stopping
                                             of equipment.

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TEST NO: PVT-43A Page 1 of 2   OBJECTIVE: To demonstrate software
TITLE: Optimum Start/Stop Program   to start and stop equipment on a
                - Summer Operation   sliding schedule based on indoor and
APPLIES TO: Large/Medium EMCS, UMCS,   outdoor air conditions.
                and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. Select points in the DE with status indication to have scheduled start/stop
    activity every day of the week and holidays during the summer.

2. The contractor provides equipment schedules that coincide with the test
    period.

3. The values must be selected so that the software for cooling units is
    tested.

4. The contractor provides the formulas and explanation for predicting optimum
    start/stop times.

5. The contractor provides the predicted values for optimum start/stop times
    based on input data on outside air temperature on building characteristics
    (occupancy, temperature, and thermal factors) and on equipment operating
    characteristics with distinct operator adjustable time delay of loads over
    20 hp and 50 kW.

             EVENT   EXPECTED RESULTS

1. Compare list of program inputs   1. Contractor supplied program
    and outputs required in the contract   inputs/outputs may include all
    documents against the contractor   inputs/outputs in the contract
    supplied input/output.   documents. Contractor furnished
                                             software that requires input/output
                                             points not included in the contract
                                             documents must operate with default
                                             values.

2. Command the system to execute the   2. System executes the optimum
    optimum start/stop program. Command   start/stop program. Visually
    the system to display optimum   verify the system displays start
    start/stop report.   and stop times that match the
                                             predicted optimum start/stop times.

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TEST NO:     PVT-43A  Page 2 of 2     OBJECTIVE:  To demonstrate software
TITLE:       Optimum Start/Stop Program  to start and stop equipment on a
               - Summer Operation       sliding schedule based on indoor and
APPLIES TO:  Large/Medium EMCS, UMCS,   outdoor air conditions.
               and UCS
REFERENCE:   Proj. Spec. Paragraph ------
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EVENT	EXPECTED RESULTS

3. Manually attempt to change point   3. System generates alarms and
    status from start to stop by   indicates unauthorized start or
    overriding the system controls.   stop of equipment.

4. Change (decrease) space temperature 4. Verify the system displays start
    setpoint (for cooling systems) for   times that match predicted results
    start-up and command the system to   (earlier start times than previous
    display equipment status.   start times).

5. Request printout of optimum   5. Verify output of optimum start/stop
    start/stop report.   report corresponds with actual
                                             results.

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TEST NO: PVT-44A Page 1 of 2   OBJECTIVE: To demonstrate software
TITLE: Optimum Start/Stop Program   to start and stop equipment on a
              - Winter Operation   sliding schedule based on indoor and
APPLIES TO: Large/Medium EMCS, UMCS,   outdoor air conditions.
              and UCS
REFERENCE: Proj. Spec. Paragraph ------

                      INITIAL CONDITIONS

1. Select points in the DE with status indication to have scheduled start/stop
    activity every day of the week and holidays during the winter schedule.

2. The contractor provides equipment schedules that coincide with the test
    period.

3. The values must be selected so that the software for heating units is
    tested.

4. The contractor provides the formulas and explanation for predicting optimum
    start/stop times.

5. The contractor provides the predicted values for optimum start/stop times
    based on input data on outside air temperature on building characteristics
    (occupancy, temperature, and thermal factors) and on equipment operating
    characteristics with distinct operator adjustable time delay of loads over
    20 hp and 50 kW.

              EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                              furnished software that requires
                                              input/output points not included in
                                              the contract documents must operate
                                              with default values.

2. Command the system to execute the   2. System executes the optimum
    optimum start/stop program. Command   start/stop program. Visually
    the system to display optimum   verify the system displays start
    start/stop report.   and stop times that match the
                                              predicted optimum start/stop times.

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TEST NO: PVT-44A Page 2 of 2   OBJECTIVE: To demonstrate software
TITLE: Optimum Start/Stop Program to start and stop equipment on a
              - Winter Operation   sliding schedule based on indoor and
APPLIES TO: Large/Medium EMCS, UMCS,   outdoor air conditions.
              and UCS
REFERENCE: Proj. Spec. Paragraph ------

               EVENT   EXPECTED RESULTS

3. Manually attempt to change   3. System generates alarms and
    point status from start to stop by   indicates unauthorized start or
    overriding the system controls.   stop of equipment.

4. Change (increase) space temperature 4. Verify the system displays start
    setpoint (for heating systems) for   times that match predicted results
    start-up and command the system to   (earlier start times than previous
    display equipment status.   start times).

5. Request printout of optimum   5. Verify output of optimum start/stop
    start/stop report.   report corresponds with actual
                                         results.

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TEST NO: PVT-45A Page 1 of 2   OBJECTIVE: To demonstrate the
TITLE: Duty Cycling Program -   software that causes equipment
              Summer Operation   shutdown for predetermined periods of
APPLIES TO: Large/Medium EMCS, UMCS,   time during building occupied hours
              and UCS   in accordance with satisfying space
REFERENCE: Proj. Spec. Paragraph ------ conditions.

                          INITIAL CONDITIONS

1.   Select points in the DE with status indication to have scheduled start and
     stop activity every day of the week and holidays, during the summer
     schedule.

2.   The contractor provides equipment schedules that coincide with the test
     period.

3.   The values must be selected so that the software for cooling units is
     tested.

4.   The contractor provides an explanation of how the system increases or
     decreases the cycling intervals relative to space temperature conditions.
     The contractor provides the predicted values for a change in the cycling for
     interval based on input data on space temperature changes.

                 EVENT   EXPECTED RESULTS

1.   Compare list of program inputs and   1.   Contractor supplied program
     outputs required in the contract   inputs/outputs may include all
     documents against the contractor   those inputs/outputs in the
     supplied input/output.   contract documents. Contractor
                                                furnished software that requires
                                                input/output points not included in
                                                the contract documents must operate
                                                with default values.

2.   Command the system to execute the   2.   System executes the duty cycling
     duty cycling program. Command the   program. Visually verify the DE
     system to display equipment status.   point status corresponds to the
                                                predicted on-off cycle intervals.
                                                The system displays the change of
                                                status and a start or stop signal
                                                for each unit. Check units for
                                                time delay between successive
                                                starts of equipment.

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TEST NO:     PVT-45A  Page 2 of 2        OBJECTIVE:  To demonstrate the
TITLE:       Duty Cycling Program -      software that causes equipment
               Summer Operation          shutdown for predetermined periods of
APPLIES TO:  Large/Medium EMCS, UMCS,    time during building occupied hours
               and UCS                   in accordance with satisfying space
REFERENCE:   Proj. Spec. Paragraph ----- conditions.
```

EVENT	EXPECTED RESULTS

3. Initiate a change in space
    temperature to cause a visible
    change in the duty cycling of
    selected equipment. (For example,
    initiate a higher space temperature,
    resulting in shorter "off" times for
    cooling equipment.)

3. Visually verify a change in cycling
    times of selected equipment and in
    system display of point status.

4. Enter command to change equipment
    duty cycle duration.

4. System requests equipment
    identification and new cycling
    time.

5. Enter point identification and
    new cycling interval.

5. System executes command. New
    cycling interval replaces old
    cycling interval for selected
    equipment. Visually verify changes
    in cycling intervals for selected
    equipment.

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TEST NO: PVT-46A Page 1 of 2   OBJECTIVE: To demonstrate the
TITLE: Duty Cycling Program –   software that causes equipment
                Winter Operation   shutdown for predetermined periods of
APPLIES TO: Large/Medium EMCS, UMCS,   time during building occupied hours
                and UCS   in accordance with satisfying space
REFERENCE: Proj. Spec. Paragraph ------ conditions.

INITIAL CONDITIONS

1. Select points in the DE with status indication to have scheduled start and
    stop activity every day of the week and holidays, during the winter
    schedule.

2. The contractor provides equipment schedules that coincide with the test
    period.

3. The values must be selected so that the software for heating units is
    tested.

4. The contractor provides an explanation of how the system increases or
    decreases the cycling intervals relative to space temperature conditions.
    The contractor provides the predicted values for a change in the cycling for
    interval based on input data on space temperature changes.

           EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                              furnished software that requires
                                              input/output points not included in
                                              the contract documents must operate
                                              with default values.

2. Command the system to execute the   2. System executes the duty cycling
    duty cycling program. Command the   program. Visually verify the DE
    system to display equipment status.   point status corresponds to the
                                              predicted on-off cycle intervals.
                                              The system displays the change of
                                              status and a start or stop signal
                                              for each unit. Check units for
                                              time delay between successive
                                              starts of equipment.

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TEST NO: PVT-46A Page 2 of 2   OBJECTIVE: To demonstrate the
TITLE: Duty Cycling Program -   software that causes equipment
               Winter Operation   shutdown for predetermined periods of
APPLIES TO: Large/Medium EMCS, UMCS,   time during building occupied hours
               and UCS   in accordance with satisfying space
REFERENCE: Proj. Spec. Paragraph ------ conditions.

              EVENT   EXPECTED RESULTS

3. Initiate a change in space   3. Visually verify a change in cycling
    temperature to cause a visible   times of selected equipment and in
    change in the duty cycling of   system display of point status.
    selected equipment. (For example,
    initiate a higher space temperature,
    resulting in longer "off" times for
    heating equipment.)

4. Enter command to change equipment 4. System requests equipment
    duty cycle duration.   identification and new cycling
                                           time.

5. Enter point identification and   5. System executes command. New
    new cycling interval.   cycling interval replaces old
                                           cycling interval for selected
                                           equipment. Visually verify changes
                                           in cycling intervals for selected
                                           equipment.

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TEST NO: PVT-47A Page 1 of 3   OBJECTIVE: To demonstrate the
TITLE: Demand Limiting Program   software that sheds electrical loads
APPLIES TO: Large/Medium EMCS, UMCS,   for peak demand control using
               and UCS   prediction techniques to avoid
REFERENCE: Proj. Spec. Paragraph ------ exceeding preestablished peak demand
                                           values.

INITIAL CONDITIONS

1. Select points in the DE with status indication for inclusion in the demand
    limiting program.

2. Equipment schedules coincide with the test period.

3. The contractor provides the necessary information per equipment unit (as
    required in the contract documents) such that the operation of the unit can
    be predicted during the test period.

4. Each equipment unit is assigned a priority class. All priority classes must
    contain at least two units.

5. Selected equipment is assigned constraints that will prevent a desired
    change in equipment operation.

6. The contractor provides data for determining power demand from fixed demand
    interval meters with and without end of interval signal, from "sliding
    window" intervals, and for time of day metering.

7. The test period demand levels are set up to exceed the peak demand target at
    least two times such that all equipment assigned to demand limiting program
    will be shut down and started up at least two times during the test period.

8. The system is programmed to generate the electrical peak demand report for
    each day in the test period.

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TEST NO: PVT-47A Page 2 of 3   OBJECTIVE: To demonstrate the
TITLE: Demand Limiting Program   software that sheds electrical loads
APPLIES TO: Large/Medium EMCS, UMCS,   for peak demand control using
             and UCS   prediction techniques to avoid
REFERENCE: Proj. Spec. Paragraph ------ exceeding preestablished peak demand
                                         values.

                EVENT   EXPECTED RESULTS

1. Compare list of program inputs   1. Contractor supplied program
    and outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                             furnished software that requires
                                             input/output points not included in
                                             the contract documents must operate
                                             with default values.

2. Initiate power demand levels which 2. System executes demand limit
    are predicted to exceed peak demand   program which sheds electrical
    target.   loads in order of assigned
                                             priority, from lowest to highest
                                             priority, until the predicted
                                             demand falls below the target.
                                             Visually verify system displays
                                             change of status signals for
                                             equipment that is shutdown.

3. Program demand levels to fall   3. System begins to restore shed
    below target limit such that some,   equipment. Verify the points
    but not all loads, are restored.   representing the highest priority
    Assign equipment constraints to some   shed are restored before units of
    equipment in the DE so that the   lower priority. Verify units with
    units cannot be shed at the time the   equipment constraints assigned in
    next demand target is exceeded.   Event 3 are not shed.

4. Decrease target and inhibit the   4. System initiates load shed on units
    "end-of-interval" signal from the   with the lowest priority that are
    system so that demand is computed   still operating as in Result 2.
    by the "sliding window" method.   Verify units with equipment
                                             constraints assigned to Event 3 are
                                             not shed. System displays change
                                             of status for equipment that is
                                             restored to the system.

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TEST NO: PVT-47A Page 3 of 3   OBJECTIVE: To demonstrate the
TITLE: Demand Limiting Program   software that sheds electrical loads
APPLIES TO: Large/Medium EMCS, UMCS,   for peak demand control using
              and UCS   prediction techniques to avoid
REFERENCE: Proj. Spec. Paragraph ------ exceeding preestablished peak demand
                                          values.

              EVENT   EXPECTED RESULTS

5. Change the target in the demand   5. System executes demand limiting
    limiting program operation from   program for time of day metering.
    sliding window to time of day
    metering.

6. Repeat Events 2 through 4 above   6. System initiates control on points
    for each time of day target. Each   representing loads as per Results 2
    time of day program has the number   through 4 for each of the different
    of different priority levels and   priority levels, for each time of
    targets required by the contract   the day target.
    requirements.

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TEST NO: PVT-48A Page 1 of 3   OBJECTIVE: To demonstrate the
TITLE: Day-Night Setback Program   software that reduces the heating
APPLIES TO: Large/Medium EMCS, UMCS,   space temperature setpoint during
             and UCS   unoccupied hours or raises the
REFERENCE: Proj. Spec. Paragraph ------ cooling space temperature setpoint
                                           during unoccupied hours.

INITIAL CONDITIONS

1. Select points in the DE for inclusion in the day-night setback program.

2. The contractor provides specific data for each required input and provides
    the predicted output with an explanation of how the output is determined.

4. Equipment operation coincides with the test period.

5. Program specified points to represent the value of space temperatures.

                EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                                furnished software that requires
                                                input/output points not included in
                                                the contract documents must operate
                                                with default values.

2. Initiate conditions causing heating   2. Verify displayed status of
    equipment to be in the night setback   equipment operation and space
    mode during winter season unoccupied   temperature match predicted
    period (heating mode).   results.

    Command the system to display
    equipment status and space
    temperatures.

3. Initiate conditions causing heating   3. Verify displayed status of
    equipment to be in the daytime mode   equipment operation and space
    of operation during winter season   temperatures match predicted
    occupied time period (heating mode).   results (equipment is started and
                                                space temperatures increase to
                                                setpoint).

    Command the system to display
    equipment status and space
    temperatures.

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TEST NO: PVT-48A Page 2 of 3   OBJECTIVE: To demonstrate the
TITLE: Day-Night Setback Program   software that reduces the heating
APPLIES TO: Large/Medium EMCS, UMCS,   space temperature setpoint during
               and UCS   unoccupied hours or raises the
REFERENCE: Proj. Spec. Paragraph ------ cooling space temperature setpoint
                                          during unoccupied hours.

                EVENT   EXPECTED RESULTS

4. Command the system to modify   4. System requests equipment
    day-night setback program.   identification and input.

5. Enter equipment identification and 5. System acknowledges input and
    new input (for example, modify   executes program in accordance with
    minimum occupied temperature).   modified input. Selected equipment
    Command the system to place equipment operation follows new program
    with new input in the occupied   inputs.
    mode.

6. Initiate conditions causing heating 6. Verify displayed status of
    equipment to be in the night setback   equipment operation and space
    mode during heating equipment   temperatures match predicted
    unoccupied period (heating mode).   results.

    Command the system to display
    equipment status and space
    temperatures.

7. Initiate conditions which will   7. Verify displayed status of
    cause night setback for cooling   equipment matches predicted results
    equipment during the summer season   (equipment is started and space
    unoccupied period (cooling mode).   temperatures are increased to
                                          unoccupied period setpoints).
    Command the system to display
    equipment status and space
    temperature.

8. Initiate conditions causing cooling 8. Visually verify equipment is
    equipment to be in daytime mode of   started and space temperatures are
    operation during summer season   decreased to occupied period
    occupied period (cooling mode).   setpoints. Verify displayed status
    of equipment matches predicted results. of equipment matches predicted results.

    Command the system to display
    equipment status and space
    temperature.

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TEST NO: PVT-48A Page 3 of 3   OBJECTIVE: To demonstrate the
TITLE: Day-Night Setback Program   software that reduces the heating
APPLIES TO: Large/Medium EMCS, UMCS,   space temperature setpoint during
              and UCS   unoccupied hours or raises the
REFERENCE: Proj. Spec. Paragraph ------ cooling space temperature setpoint
                                            during unoccupied hours.

EVENT	EXPECTED RESULTS
9. Command the system to modify day-night setback program.	9. System requests equipment identification and input.
10. Enter equipment identification and new input (for example, modify occupied temperature). Place equipment with new input in the unoccupied mode.	10. System acknowledges input and executes program in accordance with modified input. Verify selected equipment operation follows new program inputs.
11. Initiate conditions which will cause night setback for cooling equipment during the summer season unoccupied period (cooling mode). Command the system to display equipment status and space temperature.	11. Verify displayed status of equipment matches predicted results (equipment is started and space temperature are increased to unoccupied period setpoints).

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TEST NO: PVT-49A Page 1 of 1   OBJECTIVE: To demonstrate software
TITLE: Economizer Program   that reduces HVAC system cooling
APPLIES TO: Large/Medium EMCS, UMCS,   requirements when the outside air
             and UCS   (OA) dry bulb temperature is less
REFERENCE: Proj. Spec. Paragraph ------   than the required mixed air
                                         temperature of HVAC System.

INITIAL CONDITIONS

1. Select points in the DE for inclusion in the economizer program.

2. The contractor provides an explanation of how OA dampers are affected by OA
    dry bulb, return air (RA) dry bulb, and the changeover temperature. The
    contractor also provides at least two different predicted positions of
    outside air dampers (fully open, under local loop control) based on two
    different sets of input values on outside air and return air dry bulb
    temperatures.

           EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                              furnished software that requires
                                              input/output points not included in
                                              the contract documents must operate
                                              with default values.

2. Initiate conditions which will   2. System commands OA damper to be in
    cause outside air (OA) dampers to be   closed or minimum position. Verify
    fully closed or in minimum position   system display of status of OA
    (for example, when OA dry bulb is   dampers agrees with predicted
    greater than the specified changeover   results.
    temperature).

3. Initiate conditions which will   3. System commands outside air dampers
    cause outside air (OA) dampers to be   to be under local loop control to
    under local control (for example,   maintain mixed air temperature
    when OA dry bulb is less than the   status of the OA dampers (open).
    specified changeover temperature   Visually verify point output on
    and return air temperature).   damper position agrees with
                                              predicted results.

4. Modify changeover temperature   4. System commands OA as in Events 2
    setpoint and repeat Events 2 and 3.   and 3 at the new changeover
                                              temperature.

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TEST NO: PVT-50A Page 1 of 1   OBJECTIVE: To demonstrate software
TITLE: Enthalpy Program   that reduces HVAC system cooling
APPLIES TO: Large/Medium EMCS, UMCS,   requirements when the enthalpy of the
              and UCS   outside air (OA) is less than that of
REFERENCE: Proj. Spec. Paragraph ------   the return air.

                          INITIAL CONDITIONS

1. Select points in the DE for inclusion in the Enthalpy Program.

2. The contractor provides an explanation of how OA dampers are affected by OA,
    and also provides at least two different predicted positions of outside air
    dampers (fully open, under local loop control) based on two different sets
    of input values on outside air and return air enthalpy conditions.

              EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                                furnished software that requires
                                                input/output points not included in
                                                the contract documents must operate
                                                with default values.

2. Initiate conditions which will   2. System commands OA dampers to be
    cause outside air (OA) dampers to be   closed. Verify system display of
    at minimum position (for example,   status of OA dampers agrees with
    when OA enthalpy exceeds return air   predicted results.
    enthalpy).

3. Initiate conditions which will   3. Outside air dampers are placed
    cause outside air (OA) dampers to be   under local loop control. Verify
    under local loop control (for   system display of status of OA
    example, when OA enthalpy is less   dampers agrees with predicted
    than return air enthalpy).   results.

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TEST NO: PVT-51A Page 1 of 3   OBJECTIVE: To demonstrate the
TITLE: Ventilation - Recirculation   software that reduces the HVAC system
              Program   thermal load during warm-up or
APPLIES TO: Large/Medium EMCS, UMCS,   cool-down cycles prior to occupancy
              and UCS   of the building and unoccupied
REFERENCE: Proj. Spec. Paragraph ------   periods.

INITIAL CONDITIONS

1. Select points in the DE for inclusion in the ventilation - recirculation
    program.

2. The system is programmed to execute the ventilation - recirculation program.

3. The contractor provides an explanation of how OA temperature, RA temperature
    and space temperature affect heating/cooling equipment operation. The
    contractor also provides a set of conditions which will cause predictable
    equipment operation based on specified input values used during the test
    period.

4. Simulated OA dampers and relief dampers are set up to change position during
    the test periods.

           EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                                furnished software that requires
                                                input/output points not included in
                                                the contract documents must operate
                                                with default values.

2. Initiate conditions causing a   2. Visually verify OA dampers remain
    warm-up cycle: closed when HVAC equipment is
                                                started. Verify system displays
    . Winter season.   the status of the dampers to be
    . Unoccupied period.   closed and status of fans to be on.
    . OA temperature is below a
      predetermined value that would
      initiate the starting of equipment
      to meet the space temperature
      setpoints at the time of occupancy.

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TEST NO: PVT-51A Page 2 of 3   OBJECTIVE: To demonstrate the
TITLE: Ventilation - Recirculation software that reduces the HVAC system
             Program   thermal load during warm-up or
APPLIES TO: Large/Medium EMCS, UMCS,   cool-down cycles prior to occupancy
             and UCS   of the building and unoccupied
REFERENCE: Proj. Spec. Paragraph ------ periods.

                    EVENT   EXPECTED RESULTS

3. Initiate conditions causing   3. Verify OA air dampers and HVAC
    occupied space temperature to reach   equipment are placed under local
    desired levels prior to occupancy   loop control. Verify system
    time.   displays status of dampers to be
                                            under local loop control.
    . Cooling season.
    . Unoccupied period.
    . OA temperature is below a
      predetermined value that would
      initiate the starting of equipment
      to meet the space temperature
      setpoints at the time of occupancy.

4. Initiate conditions causing a   4. Verify OA air dampers are closed
    cool-down cycle during period prior   and HVAC equipment is started.
    to occupied period: Verify system displays status of
                                           OA relief air dampers to be closed
    . Cooling season.   and status of fans to be on.
    . Unoccupied period.
    . OA temperature is below a
      predetermined value that would
      initiate the starting of equipment
      to meet the space temperature
      setpoints at the time of occupancy.

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TEST NO:      PVT-51A  Page 3 of 3      OBJECTIVE:  To demonstrate the
TITLE:        Ventilation - Recirculation   software that reduces the HVAC system
              Program                        thermal load during warm-up or
APPLIES TO:   Large/Medium EMCS, UMCS,       cool-down cycles prior to occupancy
              and UCS                        of the building and unoccupied
REFERENCE:    Proj. Spec. Paragraph ------   periods.
```

<table>
<tr><td align="center">EVENT</td><td align="center">EXPECTED RESULTS</td></tr>
<tr>
<td valign="top">5. Initiate conditions that will require the OA damper to be placed under local loop control during the period prior to the occupied time.

. Winter season.
. Unoccupied period.
. OA temperature is below a predetermined value that would initiate the starting of equipment to meet the space temperature setpoints at the time of occupancy.</td>
<td valign="top">5. Verify OA dampers and HVAC equipment are placed under local loop control. Verify system displays status of dampers to be under local loop control.</td>
</tr>
<tr>
<td valign="top">6. Initiate conditions that will require the OA damper to be closed during the unoccupied period prior to cool-down or warm-up cycle.

. Winter/Cooling season.
. Unoccupied period (prior to a cool-down or warm-up cycle).</td>
<td valign="top">6. Verify OA dampers are closed and HVAC equipment is off. Verify system displays status of dampers to be closed and status of fans to be off.</td>
</tr>
</table>

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TEST NO: PVT-52A   Page 1 of 2   OBJECTIVE: To demonstrate the
TITLE: Hot Deck - Cold Deck   software that resets the hot deck -
              Temperature Reset Program   cold deck temperatures in dual duct
APPLIES TO: Large/Medium EMCS, UMCS,   and differential between the hot and
              and UCS   cold deck temperature.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1.   Select points in the DE for inclusion in the hot deck - cold deck program.

2.   The system is programmed to execute the hot deck - cold deck temperature
     reset program.

3.   The contractor provides an explanation of how space temperature and humidity
     requirements affect hot deck - cold deck temperature reset. The contractor
     also provides the test input data with expected zone hot and cold deck
     temperatures.

            EVENT   EXPECTED RESULTS

1.   Compare list of program inputs and   1.   Contractor supplied program
     outputs required in the contract   inputs/outputs may include all
     documents against the contractor   those inputs/outputs in the
     supplied input/output.   contract documents. Contractor
                                                 furnished software that requires
                                                 input/output points not included in
                                                 the contract documents must operate
                                                 with default values.

2.   Initiate an increase in space   2.   System executes the hot and cold
     temperature dry bulb setpoints for   deck temperature reset program to
     each zone so that the hot deck and   maintain zone space dry bulb
     cold deck temperature reset is   setpoints. Visually verify
     required. Command the system to   hot deck and cold deck discharge
     display hot deck and cold deck   temperatures are reset upwards in
     temperatures.   accordance with expected results.

3.   Initiate a change in space dry bulb   3.   Visually verify hot deck and cold
     temperature downwards for each zone   deck discharge temperatures
     so that hot and cold deck temperature   decrease in accordance with
     reset is required. Command the   expected results.
     system to display hot deck and cold
     deck temperatures.

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TEST NO:      PVT-52A  Page 2 of 2      OBJECTIVE:  To demonstrate the
TITLE:        Hot Deck - Cold Deck      software that resets the hot deck -
              Temperature Reset Program cold deck temperatures in dual duct
APPLIES TO:  Large/Medium EMCS, UMCS,   and differential between the hot and
              and UCS                   cold deck temperature.
REFERENCE:   Proj. Spec. Paragraph ------
```

| EVENT | EXPECTED RESULTS |

4. Initiate an increase in space dry   4. Visually verify hot deck
    bulb temperature and humidity   temperature is reset upwards in
    setpoints for the zone with the   accordance with expected results.
    maximum heating requirements.   Visually verify cold deck
                                               temperature is not reset.

5. Initiate a decrease in space dry   5. Visually verify cold deck
    bulb and humidity setpoints for the   temperature is reset downwards in
    zone with the maximum cooling   accordance with expected results.
    requirements.   Visually verify hot deck
                                               temperature is not reset.

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TEST NO: PVT-53A   Page 1 of 2   OBJECTIVE: To demonstrate the
TITLE: Reheat (RHT) Coil Reset   software that selects the zone
              Program   requiring the least amount of reheat
APPLIES TO: Large/Medium EMCS, UMCS,   and resets the cold deck discharge
              and UCS   temperature of the zone with the
REFERENCE: Proj. Spec. Paragraph ------ lowest reheat demand.

                        INITIAL CONDITIONS

1. Select points in the DE for inclusion in the reheat coil reset program.

2. The contractor provides an explanation of how the zone temperature and
    humidity requirements affect the cold deck discharge temperatures.

3. The contractor provides input data on zone temperatures and humidity
    requirements with expected cold deck discharge temperatures for the test.

            EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                              furnished software that requires
                                              input/output points not included
                                              in the contract documents must
                                              operate with default values.

2. Initiate dry bulb temperature   2. System executes the reheat coil
    setpoints in all zones to be above   discharge program to reset cold
    the initial cold deck discharge   deck discharge temperature
    temperature setpoint so that reheat   upwards until a reheat coil in
    is required in all zones.   the zone with lowest space
                                              temperature setpoint is fully
                                              closed. In other zones with
                                              higher reheat requirements,
                                              reheat coil valves are partially
                                              open.

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TEST NO: PVT-53A   Page 2 of 2   OBJECTIVE: To demonstrate the
TITLE: Reheat (RHT) Coil Reset   software that selects the zone
              Program   requiring the least amount of reheat
APPLIES TO: Large/Medium EMCS, UMCS,   and resets the cold deck discharge
              and UCS   temperature of the zone with the
REFERENCE: Proj. Spec. Paragraph ------ lowest reheat demand.

               EVENT   EXPECTED RESULTS

3. Initiate a change in the space   3. Verify that the cold deck discharge
    temperature setpoint upwards for   temperature is further increased
    the zone with reheat coil that is   until the reheat coil valve for the
    fully closed, so that the setpoint   zone with the current lowest space
    is higher than all other zones.   temperature setpoint is fully
    Command the system to display   closed. Visually verify sequence
    equipment status.   of equipment operation, and verify
                                            system display of final status
                                            agrees with predicted results.

4. Initiate a change in the space   4. Verify that the cold deck discharge
    temperature setpoint downwards to   temperature is reduced until the
    the zone with the reheat coil that   cold deck discharge temperature
    is fully closed so that the   equals the discharge temperature of
    temperature setpoint is below all   the zone with the lowest reheat
    other zones. Command the system to   demand. Visually verify sequence
    display equipment status.   of equipment operation, and verify
                                            system display of final status
                                            agrees with predicted results.

5. Repeat Events 2, 3, and 4 with dry 5. Visually verify that the cold deck
    bulb and humidity setpoints.   reset program resets the cold deck
    Command the system to display   discharge temperature until the
    equipment status.   zone(s) with the highest reheat
                                            demand is satisfied. Visually
                                            verify that reheat valve for the
                                            zone(s) with the lowest reheat
                                            demand is fully closed. Verify
                                            system display of final status
                                            agrees with predicted results.

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TEST NO: PVT-54A Page 1 of 2   OBJECTIVE: To demonstrate software
TITLE: Steam Boiler Selection   that selects the most efficient
             Program   boiler operating data to satisfy the
APPLIES TO: Large/Medium EMCS, UMCS,   heating load.
             and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. Select points in the DE for inclusion in the boiler selection program.

2. The contractor provides an explanation of how the program selects boiler
    plant operation to meet at least three levels of heating demand (low,
    average, maximum) representative of the size of boilers installed. The
    contractor also provides input data for establishing heating demand, such as
    OA temperature trends, and indicates the sequence and timing of boiler
    operation to satisfy various demands.

3. Boilers are to be either shut down or at minimum load at the beginning of
    the test.

4. The system is programmed to execute the steam boiler plant selection
    program.

            EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                              furnished software that requires
                                              input/output points not included in
                                              the contract documents must operate
                                              with default values.

2. Initiate conditions for minimum   2. System executes steam boiler
    heating requirements. Command the   selection program for minimum
    system to display boiler status and   heating requirements using the
    operating efficiency.   available boilers. The boilers
                                              that most efficiently satisfy
                                              minimum heating requirements are
                                              enabled or loaded. Visually verify
                                              system display of status on boilers
                                              and operating efficiency agrees
                                              with predicted results.

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TEST NO:      PVT-54A  Page 2 of 2        OBJECTIVE:  To demonstrate software
TITLE:        Steam Boiler Selection       that selects the most efficient
              Program                      boiler operating data to satisfy the
APPLIES TO:   Large/Medium EMCS, UMCS,     heating load.
              and UCS
REFERENCE:    Proj. Spec. Paragraph ------
-----------------------------------------------------------------------------
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                EVENT   EXPECTED RESULTS

3. Input a revised set of analog   3. Boilers that most efficiently
    values that establish a trend   satisfy higher heating requirements
    towards higher, but not maximum,   are enabled and/or loaded. Verify
    steam output requirements,   the system display of status on
    requiring multiple boiler operation.   boilers and operating efficiency
    Command the system to display boiler   corresponds with predicted results.
    status and operating efficiency.

4. Input revised analog values that   4. Boilers that most efficiently
    show a trend towards maximum steam   satisfy maximum heating
    requirements.   requirements are enabled and/or
                                             loaded. Verify system display of
                                             status on boilers and operating
                                             efficiency corresponds with
                                             predicted results.

5. Input analog values that predict   5. Verify system display of status on
    lower steam plant output.   boilers and operating efficiency
                                             corresponds with predicted results.
                                             System discontinues the operation
                                             of boilers not required to meet
                                             load.

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TEST NO: PVT-55A Page 1 of 2   OBJECTIVE: To demonstrate
TITLE: Hot Water (HW) Boiler   software that select the most
              Selection Program   efficient boiler or combination of
APPLIES TO: Large/Medium EMCS, UMCS,   boilers based on boiler operating
              and UCS   data to satisfy the heating load.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1.   Select points in the DE for inclusion in the boiler selection program.

2.   The contractor provides an explanation of how the program selects boiler
     plant operation to meet at least three levels of heating demand (low,
     average, maximum) representative of the size of boilers installed. The
     contractor also provides input data for establishing heating demand, such as
     OA temperature trends, and indicates the sequence and timing of boiler
     operation to satisfy various demands.

3.   Boilers are to be either shut down or at minimum load at the beginning of
     the test.

4.   The system is programmed to execute the HW boiler plant selection program.

              EVENT   EXPECTED RESULTS

1.   Compare list of program inputs and   1.   Contractor supplied program
     outputs required in the contract   inputs/outputs may include all
     documents against the contractor   those inputs/outputs in the
     supplied input/output.   contract documents. Contractor
                                                furnished software that requires
                                                input/output points not included in
                                                the contract documents must operate
                                                with default values.

2.   Initiate conditions for minimum   2.   System executes HW boiler selection
     heating requirements. Command the   program for minimum heating
     system to display boiler status and   requirements using the available
     operating efficiency.   boilers. The boilers that most
                                                efficiently satisfy minimum heating
                                                requirements are enabled and/or
                                                loaded. Visually verify system
                                                display of status on boilers and
                                                operating efficiency agrees with
                                                predicted results.

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TEST NO:     PVT-55A  Page 2 of 2      OBJECTIVE:  To demonstrate
TITLE:       Hot Water (HW) Boiler     software that select the most
             Selection Program         efficient boiler or combination of
APPLIES TO:  Large/Medium EMCS, UMCS,  boilers based on boiler operating
             and UCS                   data to satisfy the heating load.
REFERENCE:   Proj. Spec. Paragraph ------
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| EVENT | EXPECTED RESULTS |

3. Input a revised set of analog   3. Boilers that most efficiently
    values that establish a trend   satisfy higher heating requirements
    towards higher HW output   are enabled and/or loaded. Verify
    requirements, requiring multiple   the system display of status on
    operation. Command the system to   boilers and operating efficiency
    display boiler status and operating   corresponds with predicted results.
    efficiency.

4. Input revised analog values that   4. Boilers that most efficiently
    show a trend towards maximum HW   satisfy maximum heating
    requirements.   requirements are enabled and/or
                                            loaded. Verify system display of
                                            status on boilers and operating
                                            efficiency corresponds with
                                            predicted results.

5. Input analog values that predict   5. Verify system display of status on
    lower steam plant output.   boiler and operating efficiency
                                            corresponds with predicted results.
                                            System discontinues the operation
                                            of boilers not required to meet
                                            load.

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TEST NO: PVT-56A Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: Hot Water (HW) OA Reset   software that resets the HW
              Program   temperature supplied by the boiler or
APPLIES TO: Large/Medium EMCS, UMCS,   convertor in accordance with the
              and UCS   outside air (OA) temperature.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. Select points in the DE for inclusion in the hot water OA reset program.

2. The contractor provides an explanation of how the outside air temperature
    affects the HW supply temperature. The contractor also provides input data
    on outside air temperatures with corresponding expected HW supply
    temperature.

3. The system is programmed to execute the hot water OA reset program.

               EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                                furnished software that requires
                                                input/output points not included in
                                                the contract documents must operate
                                                with default values.

2. Initiate conditions causing   2. System executes the hot water OA
    reduction and increases in the   reset program which calculates HW
    outside air temperature. Command   reset temperature in accordance
    the system to display HW supply   with reset schedule. Verify system
    temperature and outside air   display of HW supply temperature in
    temperature for different OA   the corresponding OA temperature
    temperatures.   agrees with predicted results.

3. Initiate condition causing minimum   3. System executes the OA reset
    and maximum OA conditions.   program. Verify system display for
                                                maximum and minimum HW temperatures
                                                match those in the reset schedule.

4. Change OA reset schedule and   4. Verify that the results correspond
    repeat Events 2 and 3.   to Results 2 and 3.

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TEST NO: PVT-57A Page 1 of 3   OBJECTIVE: To demonstrate software
TITLE: Chiller Selection Program   that selects the most efficient
APPLIES TO: Large/Medium EMCS, UMCS,   chiller or combination of chillers
                 and UCS   based on chiller operating profile
REFERENCE: Proj. Spec. Paragraph ------ data to satisfy the cooling load
                                             using prediction techniques to match
                                             chiller capacity with the predicted
                                             load.

                         INITIAL CONDITIONS

1.   Select points in the DE that indicate chiller status, chilled water (CHW)
     pump status and condenser water pump operation for inclusion in the chiller
     selection program.

2.   The contractor provides an explanation of how the program selects chiller
     plant operation to meet at least three levels of cooling demand (low,
     average, maximum) representative of the size of chiller controlled. The
     contractor provides input data for establishing cooling demand, such as OA
     temperature trends, and indicates the sequence and timing of chiller
     operation to satisfy various demands, including lag time for chiller
     response to change in cooling demand.

3.   The chiller(s) are set up to be either shut down or at a minimum load at the
     beginning of the test.

4.   The system is programmed to execute the chiller plant selection program.

              EVENT   EXPECTED RESULTS

1.   Compare list of program inputs and   1.   Contractor supplied program
     outputs required in the contract   inputs/outputs may include all
     documents against the contractor   those inputs/outputs in the
     supplied input/output.   contract documents. Contractor
                                               furnished software that requires
                                               input/output points not included in
                                               the contract documents must operate
                                               with default values.

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TEST NO:     PVT-57A  Page 2 of 3      OBJECTIVE:  To demonstrate software
TITLE:       Chiller Selection Program  that selects the most efficient
APPLIES TO:  Large/Medium EMCS, UMCS,   chiller or combination of chillers
               and UCS                  based on chiller operating profile
REFERENCE:   Proj. Spec. Paragraph ------  data to satisfy the cooling load
                                        using prediction techniques to match
                                        chiller capacity with the predicted
                                        load.
```

<table>
<tr><td>EVENT</td><td>EXPECTED RESULTS</td></tr>
<tr>
<td>2. Initiate conditions causing a demand for minimum cooling requirements. Command the system to display status of chillers, CHW and condenser water pumps.</td>
<td>2. System executes the chiller selection program for minimum cooling requirements of the available chillers. The chillers that most efficiently satisfy minimum cooling requirements are started up. Verify system display of status on chillers and pumps agrees with predicted results. Verify the chiller(s) are started up in accordance with the chiller manufacturer's startup sequence requirements.</td>
</tr>
<tr>
<td>3. Input a revised set of analog values that establish a trend towards higher CHW plant output requirements.</td>
<td>3. Chillers that most efficiently satisfy higher cooling requirements are started up and/or loaded to meet the expected load. Verify system display of status on chillers and pumps agrees with predicted results. Verify the chiller(s) are started up in accordance with the chiller manufacturer's startup sequence requirements.</td>
</tr>
</table>

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TEST NO: PVT-57A Page 3 of 3   OBJECTIVE: To demonstrate software
TITLE: Chiller Selection Program   that selects the most efficient
APPLIES TO: Large/Medium EMCS, UMCS,   chiller or combination of chillers
               and UCS   based on chiller operating profile
REFERENCE: Proj. Spec. Paragraph ------ data to satisfy the cooling load
                                          using prediction techniques to match
                                          chiller capacity with the predicted
                                          load.

                    EVENT   EXPECTED RESULTS

4. Input analog values that show a   4. Chillers that most efficiently
    trend towards maximum CHW plant   satisfy maximum cooling
    output requirements. Command the   requirements are started up and/or
    system to display chiller and   loaded to meet the expected load.
    associated pump status.   Verify system display of status on
                                             chillers and pumps agrees with
                                             predicted results. Verify the
                                             chiller(s) are started up in
                                             accordance with the chiller
                                             manufacturer's startup sequence
                                             requirements. Verify there is a
                                             predetermined time lag between
                                             initiation of cooling demand
                                             requiring full load operation and
                                             initiation of full load operation
                                             at the chiller.

5. Input analog values that predict   5. Verify system display of status on
    lower CHW plant output. Command the   chillers and pumps agree with
    system to display chiller and   predicted results. If chiller(s)
    associated pump status.   are shut down, verify shutdown
                                             procedure is in accordance with the
                                             chiller manufacturer's
                                             requirements.

6. Input analog values that predict   6. Verify system display of status on
    minimum CHW plant output. Command   chillers and pumps agrees with
    the system to display chiller and   predicted results. If chiller(s)
    associated pump status.   are shut down, verify shutdown
                                             procedure is in accordance with the
                                             chiller manufacturer's
                                             requirements. System unloads and
                                             shuts down chillers not required to
                                             meet load.

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TEST NO: PVT-58A Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: Chilled Water (CHW)   software that resets the CHW
             Temperature Reset Program   temperature supplied by a water
APPLIES TO: Large/Medium EMCS, UMCS,   chiller in accordance with space
             and UCS   temperature and humidity
REFERENCE: Proj. Spec. Paragraph ------ requirements.

INITIAL CONDITIONS

1. Select points in the DE that indicate CHW temperatures, dry bulb
    temperature, and relative humidity (RH) of spaces for inclusion in the reset
    program.

2. The contractor provides an explanation of how space temperature/humidity
    requirements affect CHW temperatures. The contractor also provides input
    data on space temperature and humidity requirements with corresponding
    expected CHW supply temperatures.

3. The system is programmed to execute the CHW temperature reset program.

            EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                               furnished software that requires
                                               input/output points not included in
                                               the contract documents must operate
                                               with default values.

2. Initiate decreases in zone space   2. System executes the CHW reset
    temperatures (or CHW valve   program. The CHW supply
    position) and relative humidity (RH)   temperature is reset to the minimum
    setpoints that require the lowest   level. Verify the system display
    CHW supply temperature. Command   of CHW temperature agrees with
    the system to display CHW supply   predicted results.
    temperature.

3. Initiate increases in zone space   3. CHW supply temperature is reset
    relative humidity (RH) and space   upwards to satisfy new space
    temperature (or CHW valve position).   temperature and relative humidity
    Command the system to display CHW   (RH) setpoints. Verify system
    supply temperature.   display of CHW temperature agrees
                                               with predicted results.

4. Initiate an increase in all space   4. CHW supply temperature is reset to
    temperature (or CHW valve position)   its maximum value. Verify system
    and humidity setpoints that require   display of CHW temperature agrees
    the maximum CHW supply temperatures.   with predicted results.
    Command the system to display CHW
    supply temperature.

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TEST NO: PVT-59A Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: Condenser Water Temperature   software that resets the operating
              Reset Program   chiller condenser water temperature
APPLIES TO: Large/Medium EMCS, UMCS,   downward when the OA wet bulb
              and UCS   temperature will produce a lower
REFERENCE: Proj. Spec. Paragraph ------   condenser water temperature.

                        INITIAL CONDITIONS

1.   Select points in the DE that indicate condenser water temperatures and
     outside air wet bulb temperatures for inclusion in the reset program.

2.   The contractor provides an explanation of how changes in OA wet bulb affect
     condenser water temperatures. The contractor also provides input data on OA
     wet bulb with corresponding condenser water temperature levels.

3.   The system is programmed to execute the condenser water temperature reset
     program.

            EVENT   EXPECTED RESULTS

1.   Compare list of program inputs and   1.   Contractor supplied program
     outputs required in the contract   inputs/outputs may include all
     documents against the contractor   those inputs/outputs in the
     supplied input/output.   contract documents. Contractor
                                                furnished software that requires
                                                input/output points not included in
                                                the contract documents must operate
                                                with default values.

2.   Initiate an OA wet bulb temperature 2.   System executes the condenser water
     that will produce a lower condenser   supply temperature reset program.
     water temperature. Command the   The program compares OA wet bulb
     system to display the condenser   with condenser water supply
     water temperature.   temperature. The condenser water
                                                controller setpoint is reset
                                                downwards to match the temperature
                                                of condenser water that the OA wet
                                                bulb temperature can produce.
                                                Verify system display of condenser
                                                water temperature matches predicted
                                                results.

3.   Initiate OA wet bulb to fall to a   3.   Program resets condenser water
     a value that will produce a   controller setpoint to a minimum
     temperature below the minimum   allowable value and no lower.
     allowable condenser water   Verify the system display of
     temperature.   condenser water temperature agrees
                                                with predicted results.

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TEST NO: PVT-60A Page 1 of 2   OBJECTIVE: To demonstrate software
TITLE: Chiller Demand Limit   that limits the maximum available
            Program   chiller capacity when commanded by the
APPLIES TO: Large/Medium EMCS, UMCS,   demand limiting program.
            and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. Select points in the DE that indicate chiller status demand for inclusion in
    the demand limit program.

2. The system is programmed to execute the chiller demand limit program.

3. The contractor assigns each step of chiller capacity control to a different
    priority level of the demand limit program (for example, assign lowest
    priority to first step below full capacity and highest priority to minimum
    load). The chiller cooling capacity is set at maximum.

4. The contractor provides an explanation of how the chiller demand limit
    program fixed steps of chiller capacity control are interfaced with the
    demand limiting program for each assigned priority level.

            EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                             furnished software that requires
                                             input/output points not included in
                                             the contract documents must operate
                                             with default values.

2. Initiate conditions causing the   2. Verify the maximum cooling capacity
    system to execute the chiller   of chiller is reduced to the
    demand limit program (for example,   preassigned fixed step. Verify
    cause demand to exceed peak demand   system display of status of
    target).   available chiller capacity agrees
                                             with predicted results.

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TEST NO: PVT-60A   Page 2 of 2   OBJECTIVE: To demonstrate software
TITLE: Chiller Demand Limit   that limits the maximum available
              Program   chiller capacity when commanded by the
APPLIES TO: Large/Medium EMCS, UMCS,   demand limiting program.
              and UCS
REFERENCE: Proj. Spec. Paragraph ------

                EVENT   EXPECTED RESULTS

3. Initiate conditions causing the   3. Verify that the available maximum
    highest demand limit priority step   cooling capacity is reduced for
    of chiller fixed capacity to be   each additional fixed step
    activated (for example, continue to   reduction.
    increase demand until highest
    priority step of chiller fixed
    capacity is shed).

4. Initiate conditions causing chiller 4. Verify the maximum cooling capacity
    fixed capacity to be restored   of the total system is restored.
    on-line when the demand is reduced.   Verify system display of status of
                                            available chiller capacity agrees
                                            with predicted results.

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TEST NO:     PVT-61A  Page 1 of 1      OBJECTIVE:  To demonstrate software
TITLE:       Lighting Control Program  that turns equipment on and off based
APPLIES TO:  Large/Medium EMCS, UMCS,  on the time of day and the day of
             and UCS                   week, including holidays.
REFERENCE:   Proj. Spec. Paragraph ------
```

INITIAL CONDITIONS

1. Select points in the DE with status indication for inclusion in the lighting
    control program.

2. The test period includes time periods that correspond to each unique
    lighting schedule.

3. Establish an initial status on all systems (for example, off).

4. The system is programmed to execute the lighting control program.

EVENT	EXPECTED RESULTS
1. Compare list of program inputs and outputs required in the contract documents against the contractor supplied input/output.	1. Contractor supplied program inputs/outputs may include all those inputs/outputs in the contract documents. Contractor furnished software that requires input/output points not included in the contract documents must operate with default values.
2. Initiate a time period for lights to be turned on. Command the system to display status of lighting systems.	2. System executes lighting control program. Lighting systems start up in accordance with the equipment schedule. Verify system indicates which lighting systems are off.
3. Manually disable selected points to simulate the activity of turning off lights locally.	3. System displays alarms for each simulated lighting system locally turned off.

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TEST NO: PVT-62A   Page 1 of 1   OBJECTIVE: To demonstrate software
TITLE: Remote Boiler Monitoring   that monitors boiler operation and
              and Control Program   discontinues boiler operation if any
APPLIES TO: Large/Medium EMCS, UMCS,   monitored point exceeds a
              and UCS   predetermined value of change status.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1.   Select points in the DE for inclusion in the remote boiler monitoring and
     control program.

2.   The contractor provides an explanation of how the program remotely monitors
     and controls boiler plant operation.

3.   Boilers have been manually started and are operational at the beginning of
     the test.

4.   The system is programmed to execute the remote boiler monitoring and control
     program.

             EVENT   EXPECTED RESULTS

1.   Compare list of program inputs and   1.   Contractor supplied program
     outputs required in the contract   inputs/outputs may include all
     documents against the contractor   those inputs/outputs in the
     supplied input/output.   contract documents. Contractor
                                                 furnished software that requires
                                                 input/output points not included in
                                                 the contract documents must operate
                                                 with default values.

2.   Initiate conditions causing at   2.   Visually verify system discontinues
     least one of the inputs to exceed   boiler operation.
     the maximum or minimum allowed value
     (such as water level) and one of
     the digital inputs to change status
     (such as flame failure).

3.   Delete all analog inputs which   3.   Points are deleted from display.
     caused the system to discontinue   System indicates boiler is in
     boiler operation. Manually   operation.
     restart boiler.

4.   Add a new analog input whose value   4.   System accepts new value. Verify
     will cause the system to discontinue   system discontinues boiler
     boiler operation.   operation.

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TEST NO: PVT-63A Page 1 of 1   OBJECTIVE: To demonstrate custom
TITLE: *Custom Programs   program software performs in
APPLIES TO: Large/Medium EMCS, UMCS,   accordance with the contract
                 and UCS   requirements.
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The contractor provides an explanation of each program, provides necessary
    input data for each program and indicates the expected results.

            EVENT   EXPECTED RESULTS

1. Compare list of program inputs and   1. Contractor supplied program
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract documents. Contractor
                                               furnished software that requires
                                               input/output points not included in
                                               the contract documents must operate
                                               with default values.

2. Command the system to execute each   2. Verify program output corresponds
    custom program.   with expected results.

     *This test is used for programs that are added to the programs listed in
      the guide specification.

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TEST NO: PVT-64A Page 1 of 2   OBJECTIVE: To demonstrate the
TITLE: FID or RTU Stand-Alone Mode   software that performs FID or RTU
APPLIES TO: Large/Medium EMCS, UMCS,   functions and FID or RTU resident
              and UCS   applications programs using data
REFERENCE: Proj. Spec. Paragraph ------   obtained from the DE and based upon
                                             the FID or RTU RTC.

INITIAL CONDITIONS

1. The contractor provides a separate FID or RTU (stand-alone only) with a list
    of applications programs resident to the FID or RTU.

2. The contractor provides the default parameters for weekdays, holidays and
    weekends to be stored in the FID or RTU. (For example, initiate start-stop
    times for digital points and temperature setpoints for analog points.)

3. The contractor provides input data and expected output on the applications
    programs to be tested prior to and after the FID or RTU non-communicating
    mode. (Expected results from applications programs with and without FID or
    RTU - control system or communication are different.)

4. The contractor provides expected results on operational data that will be
    stored in the FID.

5. Selected points in the DE indicate the status of equipment included in the
    tests.

6. Demonstrate all FID or RTU stand-alone applications programs individually
    using different DE points for each program.

7. Demonstrate all FID or RTU stand-alone applications programs sharing the
    same set of DE points. (This will demonstrate the priority assigned to each
    applications program.)

            EVENT   EXPECTED RESULTS

1. Compare the contractor furnished   1. Verify the contractor's supplied
    list of application programs   list matches the list in the
    resident in the FID or RTU against   contract documents.
    the required list on the contract
    documents.

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TEST NO: PVT-64A Page 2 of 2   OBJECTIVE: To demonstrate the
TITLE: FID or RTU Stand-Alone Mode software that performs FID or RTU
APPLIES TO: Large/Medium EMCS, UMCS,   functions and FID or RTU resident
                and UCS   applications programs using data
REFERENCE: Proj. Spec. Paragraph ------   obtained from the DE and based upon
                                            the FID or RTU RTC.

               EVENT   EXPECTED RESULTS

2. Initiate operation of each of the   2. System requests input parameters
    FID or RTU resident application   appropriate to the application
    programs at the operator's console.   program. Verify equipment operates
    (Select a period of time for load   in accordance with expected results
    rolling to demonstrate all FID/RCU   when FID or RTU is in communication
    resident programs as specified.)   with the central system.

3. Initiate a communication failure   3. Application programs resident in
    between the central system and the   the FID or RTU operate in the
    selected FIDs or RTUs. Allow   stand-alone mode. Visually verify
    stand-alone mode to continue for at   equipment operates in accordance
    least six week days, one holiday   with stand-alone application
    and one weekend of a continuous   programs.
    period (simulate the remaining
    schedule by changing the FID or RTU
    time-clock time and date). Exercise
    operation of each FID or RTU
    resident program listed in Event 2.

4. At the end of the eight day period   4. Verify equipment operates in
    re-initiate communication between   accordance with expected results
    the FID or RTU and CCU or COS.   when FID or RTU is in communication
                                               with the central system.

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TEST NO: PVT-65A Page 1 of 1   OBJECTIVE: To demonstrate the
TITLE: FID or RTU Stand-Alone Load stand-alone software that implements
              Rolling Function   a load-rolling sequence at each FID
APPLIES TO: Large/Medium EMCS, UMCS,   or RTU including associated MUX or
             and UCS   ACU panels in the FID or RTU
REFERENCE: Proj. Spec. Paragraph ------ non-communication mode with the CCU
                                           or COS out of service.

                        INITIAL CONDITIONS

1.   The contractor provides a sequence of load control for the demand control
     programs initiated at the CCU or COS and for the stand-alone demand control
     program to be executed under a communication failure between the FID or RTU
     and CCU or COS. The sequences of control should be different between the
     two programs.

2.   Select points in the DE to represent status of equipment start/stop in the
     test.

            EVENT   EXPECTED RESULTS

1.   Initiate a communication failure   1.   FID or RTU resident load rolling
     between the FID or RTU and CCU or   function controls equipment.
     COS.   Visually verify equipment status
                                              corresponds to expected results of
                                              FID or RTU stand-alone load rolling
                                              function with a communication
                                              failure between FID or RTU and CCU
                                              or COS.

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TEST NO: PVT-66A Page 1 of 1   OBJECTIVE: To demonstrate that the
TITLE: Telephone Modem   modem is interfaced to the CCU or COS
APPLIES TO: Large/Medium EMCS, UMCS, and phone system.
                 and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The system is operating normally.

2. The modem and phone line are not busy.

3. A second monitor and modem connected to the telephone system is available.

                EVENT   EXPECTED RESULTS

1. Using a remote monitor and modem   1. System does not allow log on.
    (not connected to the system) call
    the system and log on using an
    unauthorized password.

2. Repeat Event 1, using an authorized 2. System allows log on through dial
    password.   up modem.

3. Issue typical commands suitable   3. System executes commands.
    for type of monitor and password.

4. Log off system.   4. System logs off monitor.

5. Manual originates call from system   5. System opens communication with
    to remote terminal.   remote terminal.

6. Send a report to remote terminal.   6. Report is displayed on remote
                                             terminal.

7. Log off remote terminal.   7. System logs off monitor.

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TEST NO: PVT-67A Page 1 of 1   OBJECTIVE: To demonstrate special tests
TITLE: *Special Tests   in accordance with the contract
APPLIES TO: Large/Medium EMCS, UMCS,   requirements.
                 and UCS
REFERENCE: Proj. Spec. Paragraph ------

INITIAL CONDITIONS

1. The contractor provides an explanation of each test, provides necessary
    input data for each test and indicates the expected results.

           EVENT   EXPECTED RESULTS

1. Compare list of data inputs and   1. Contractor supplied test
    outputs required in the contract   inputs/outputs may include all
    documents against the contractor   those inputs/outputs in the
    supplied input/output.   contract document. Contractor
                                             furnished data that requires
                                             input/output not included in the
                                             contract documents must operate
                                             with default values.

2. Command the system to execute each   2. Verify test output corresponds with
    special test.   expected results.

* This test is used for tests that are added to the tests listed in the guide
   specification.

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TEST NO: PVT-68A Page 1 of 1   OBJECTIVE: To verify that the
TITLE: Final System Equipment   hardware components of the system
               Verification   provided by the contractor are in
APPLIES TO: Large/Medium EMCS, UMCS,   accordance with the contract plans
               and UCS   and specifications and all approved
REFERENCE: Proj. Spec. Paragraph ------ submittals after all tests are
                                         completed.

INITIAL CONDITIONS

1. The contractor provides a list of approved system hardware components,
    including the name of the component, manufacturer, and model number. This
    list is based on the contract plans, specifications, change orders (if any)
    and approved submittals which must be available for reference purposes
    during the test.

                 EVENT   EXPECTED RESULTS

1. The model numbers of each hardware   1. Model numbers of equipment provided
    component should be examined and   shall match the model numbers of
    checked against the model numbers of   approved equipment on the approved
    the equipment provided by the   submittals.
    contractor.

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    5.3 Endurance Test, END-1A. The Endurance Test, END-1A, shall be designed to demonstrate the specified overall system reliability requirement of the completed system. The Endurance Test, END-1A, shall be conducted in four phases as described below. The Endurance Test, END-1A, shall not be started until the Government notifies the Contractor, in writing, that the Performance Verification Tests have been satisfactorily completed, training as specified has been completed, correction of all outstanding deficiencies has been satisfactorily completed, and that the Contractor has permission to start the Endurance Test, END-1A. The Contractor shall provide an operator to man the system eight hours per day during first shift operations, including weekends and holidays, during Phase I and Phase III Endurance testing, in addition to any Government personnel that may be made available. The Government may terminate testing at any time if the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II and Phase IV. Upon successful completion of the Endurance Test, END-1A, the Contractor shall deliver test reports (see 4.4 and 6.3) to the Government prior to acceptance of the system. The Contractor shall keep a record of the time and cause of each outage that takes place during the test period.

During the Phase I testing, the system shall be operated as specified for 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays. The Contractor shall not make repairs during this phase of testing unless authorized by the Government, in writing. If the system experiences no failures during the Phase I test, the Contractor may proceed directly to Phase III testing, after the Contractor receives written permission from the Government.

In Phase II, which occurs after the conclusion of Phase I, the Contractor shall identify all failures, shall determine the causes of all failures, repair all failures, and submit a test failure report (see 5.3.1 and 6.3) to the Government. After submitting the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall be scheduled no earlier than five business days after receipt of the report by the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate Performance Verification Tests. Based on the Contractor's report, the test review meeting, and the Contractor's recommendation, the Government shall independently determine the restart point and may require that the Phase I test be totally or partially rerun. The Contractor shall not commence any required retesting until after receipt of written notification by the Government.

After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed. If the retest is completed without any failures, the Contractor may proceed directly to Phase III testing, after the Contractor receives written permission from the Government.

During Phase III testing, the system shall be operated as specified for 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays. The Contractor shall not make repairs during this phase of testing unless authorized by the Government, in writing.

In Phase IV, which occurs after the conclusion of Phase III, the Contractor shall identify all failures, determine the causes of all failures, repair all failures, and submit a test failure report (see 5.3.1 and 6.3) to the Government. After submitting the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall not be scheduled earlier than five business days after receipt of the report by the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate Performance Verification Tests. Based on the Contractor's report, the test review meeting, and the Contractor's recommendation, the Government shall independently determine the restart point and may require that the Phase III test be totally or partially rerun. The Contractor shall not commence any required retesting until after receipt of written notification by the Government. After the conclusion of any retesting which the Government may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.

The Contractor shall not be held responsible for failures resulting from the following:

a. An outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the EMCS performed as specified.

b. Failure of a Government furnished communications link, provided that the FID or RTU automatically and correctly operates in the stand-alone mode as specified, and that the failure was not due to contractor furnished equipment, installation, or software.

c. Failure of existing Government owned equipment, provided that the failure was not due to contractor furnished equipment, installation, or software.

5.3.1 Failure reports. The Contractor shall provide EMCS Endurance Test Failure Reports (see 6.3). EMCS Test Failure Reports shall explain in detail the nature of each failure, corrective action taken, results of tests performed. If any failures occur during Phase I or Phase III testing, the Contractor shall recommend the point at which the Phase I or Phase III testing, as applicable, should be resumed.

5.3.2 Data requirements for failure reports. EMCS Endurance Test Failure Reports (see 6.3), applies to this requirement. Deliverable data identified on the DD Form 1423 shall be prepared in accordance with instructions specified in the DID.

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TEST NO:     END-1A  Page 1 of 4    OBJECTIVE:  To demonstrate system
TITLE:       Endurance Test - Phase I  normal mode operation 24 hours a day
APPLIES TO:  Large/Medium EMCS, UMCS,  for 15 consecutive calendar days in
             and UCS                 accordance with contract
REFERENCE:   Proj. Spec. Paragraph ------  requirements.
```

INITIAL CONDITIONS

1. All other performance verification tests have been successfully completed.

2. In addition to Government personnel present at the test, contractor
    operators are to man the system a minimum of 8 hours per day including
    weekends, for the duration of the Endurance Test.

EVENT	EXPECTED RESULTS
1. Operate the system in normal mode so that the system performs its assigned tasks in accordance with the contract requirements for 15 consecutive calendar days, 24 hours a day.	1. Verify the system performs its assigned tasks in accordance with the contract requirements. Verify the contractor makes no repairs on the system unless authorized by the Government, in writing.
2. Place at least one FID or RTU in stand-alone mode for 5 days minimum.	2. Verify FID or RTU performs its assigned tasks in stand-alone mode in accordance with contract requirements.
3. Place balance of FIDs or RTUs in stand-alone mode for at least one day.	3. Verify FIDs or RTUs perform their assigned tasks in stand-alone mode in accordance with contract requirements.
4. Record failures and provide Government with data as specified.	4. Verify contractor records data on any failures as specified.

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TEST NO: END-1A Page 2 of 4   OBJECTIVE: To demonstrate system
TITLE: Endurance Test - Phase II   normal mode operation 24 hours a day
APPLIES TO: Large/Medium EMCS, UMCS,   for 15 consecutive calendar days in
               and UCS   accordance with contract
REFERENCE: Proj. Spec. Paragraph ------ requirements.

              EVENT   EXPECTED RESULTS

5. Identify all failures, determine   5. Verify contractor repairs all
    causes of all failures and repair   failures and submits written
    all failures. Submit a written   reports on all failures as
    report to the Government on all   specified.
    failures as specified.

6. Meet with the Government to review   6. Determine the restart point for
    results of Phase I tests and   Phase I testing or determine that
    demonstrate that all failures have   the Contractor can commence Phase
    been corrected by submitting   III testing. Provide written
    results of appropriate Performance   notification for the Contractor.
    Verification Tests. Based on the
    results of Phase I, either recommend
    the point at which Phase I retesting
    should begin or recommend that the
    Government should proceed into
    Phase III testing.

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TEST NO: END-1A Page 3 of 4   OBJECTIVE: To demonstrate system
TITLE: Endurance Test - Phase III   normal mode operation 24 hours a day
APPLIES TO: Large/Medium EMCS, UMCS,   for 15 consecutive calendar days in
             and UCS   accordance with contract
REFERENCE: Proj. Spec. Paragraph ------ requirements.

         EVENT   EXPECTED RESULTS

7. Operate the system in normal mode   7. Verify the system performs its
    so that the system performs its   assigned tasks in accordance with
    assigned tasks in accordance with   the contract requirements. Verify
    the contract requirements for 15   the contractor makes no repairs on
    consecutive calendar days, 24 hours   the system unless authorized by the
    a day, including a weekend.   Government, in writing.

8. Place at least one FID or RTU in   8. Verify FID or RTU performs its
    stand-alone mode for 5 days   assigned tasks in stand-alone mode
    minimum (different FID or RTU from   in accordance with contract
    Phase I, END-1A, Event 3).   requirements.

9. Place balance of FIDs or RTUs in   9. Verify FIDs or RTUs perform their
    stand-alone mode for at least one   assigned tasks in stand-alone mode
    day.   in accordance with contract
                                               requirements.

10. Record failures and provide   10. Verify contractor records data on
    Government with data as specified.   any failures as specified.

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TEST NO:     END-1A  Page 4 of 4        OBJECTIVE:  To demonstrate system
TITLE:       Endurance Test - Phase IV  normal mode operation 24 hours a day
APPLIES TO:  Large/Medium EMCS, UMCS,   for 15 consecutive calendar days in
             and UCS                    accordance with contract
REFERENCE:   Proj. Spec. Paragraph ------ requirements.
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| EVENT | EXPECTED RESULTS |

11. Identify all failures, determine
    causes of all failures and repair
    all failures. Submit a written
    report to the Government on all
    failures as specified.

11. Verify contractor repairs all
    failures and submits written
    reports on all failures as
    specified.

12. Meet with the Government to review
    results of Phase III Tests and
    demonstrate that all failures have
    been corrected by submitting results
    of appropriate Performance
    Verification Tests. Based on the
    results of Phase III, either
    recommend the point at which Phase
    III retesting should begin or
    recommend that the EMCS has
    successfully completed the Endurance
    Test.

12. Determine the restart point for
    Phase III testing or determine that
    the EMCS has successfully completed
    the Endurance Test. If Phase III
    retesting is required, provide
    written notification for the
    contractor to recommence testing.

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5.4 Seasonal Endurance Test, END-2A. The Seasonal Endurance Test, END-2A, as specified shall be designed to demonstrate the specified overall system reliability requirement of the complete system. The Seasonal Endurance Test, END-2A, shall be conducted in four phases as described below. The Seasonal Endurance Test, END-2A, shall not be started until the Government notifies the Contractor, in writing, that the Performance Verification Tests have been satisfactorily completed, training as specified has been completed, correction of all outstanding deficiencies has been satisfactorily completed, and that the Contractor has permission to start the Seasonal Endurance Test, END-2A. The Contractor shall provide an operator to man the system eight hours per day during first shift operations, including weekends and holidays, during Phase I and Phase III Endurance Testing, in addition to any Government personnel that may be made available. The Government may terminate testing at any time if the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II and Phase IV. Upon successful completion of the Seasonal Endurance Test, END-2A, the Contractor shall deliver test reports (see 4.4 and 6.3) to the Government prior to acceptance of the system. The Contractor shall keep a record of the time and cause of each outage that takes place during the test period.

During the Phase I testing, the system shall be operated as specified for 24 hours per day, for 5 consecutive calendar days, including weekends and holidays. The Contractor shall not make repairs during this phase of testing unless authorized by the Government, in writing. If the system experiences no failures during the Phase I test, the Contractor may proceed directly to Phase III testing after the Contractor receives written permission from the Government.

In Phase II, which occurs after the conclusion of Phase I, the Contractor shall identify all failures, determine the causes of all failures, repair all failures, and submit a test failure report (see 5.3.1 and 6.3) to the Government. After submitting the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall be scheduled no earlier than five business days after receipt of the report by the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate Performance Verification Tests. Based on the Contractor's report, the test review meeting, and the Contractor's recommendation, the Government shall independently determine the restart point and may require that the Phase I test be totally or partially rerun. The Contractor shall not commence any required retesting until after receipt of written notification by the Government.

After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed. If the retest is completed without any failures, the Contractor may proceed directly to Phase III testing after the Contractor receives written permission from the Government.

During Phase III testing, the system shall be operated as specified for 24 hours per day, for 5 consecutive calendar days, including weekends and holidays. The Contractor shall not make repairs during this phase of testing unless authorized by the Government, in writing.

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In Phase IV, which occurs after the conclusion of Phase III, the Contractor shall identify all failures, determine the causes of all failures, repair all failures, and submit a test failure report (see 5.3.1 and 6.3) to the Government. After submitting the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall not be scheduled earlier than five business days after receipt of the reports by the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate Performance Verification Tests. Based on the Contractor's recommendation, the Government shall independently determine the restart point and may require that the Phase III test be totally or partially rerun. The Contractor cannot commence any required retesting until after receipt of written notification by the Government. After the conclusion of any retesting which the Government may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.

The Contractor shall not be held responsible for failures resulting from the following:

a. An outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the EMCS performed as specified.

b. Failure of a Government furnished communications link, provided that the FID or RTU automatically and correctly operates in the stand-alone mode as specified, and that the failure was not due to contractor furnished equipment, installation, or software.

c. Failure of existing Government owned equipment, provided that the failure was not due to contractor furnished equipment, installation, or software.

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TEST NO:     END-2A  Page 1 of 4      OBJECTIVE:  To demonstrate system
TITLE:       Seasonal Endurance Test    normal mode operation 24 hours a day
               - Phase I                 for five consecutive calendar days in
APPLIES TO:  Large/Medium EMCS, UMCS,    accordance with contract
               and UCS                   requirements.
REFERENCE:   Proj. Spec. Paragraph ------
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INITIAL CONDITIONS

1. All other performance verification tests have been successfully completed.

2. The Endurance Test END-1A is successfully completed.

3. In addition to Government personnel present at the test, contractor
    operators are to man the system a minimum of 8 hours per day including
    weekends, for the duration of the Seasonal Endurance Test.

EVENT	EXPECTED RESULTS
1. Operate the system in normal mode so that the system performs its assigned tasks in accordance with the contract requirements for 5 consecutive calendar days, 24 hours a day, including a weekend.	1. Verify the system performs its assigned tasks in accordance with the contract requirements. Verify the contractor makes no repairs on the system unless authorized by the Government, in writing.
2. Place at least one FID or RTU in stand-alone mode for 5 days minimum.	2. Verify FID or RTU performs its assigned tasks in stand-alone mode in accordance with contract requirements.
3. Place balance of FIDs or RTUs in stand-alone mode for at least one day.	3. Verify FIDs or RTUs perform their assigned tasks in stand-alone mode in accordance with contract requirements.
4. Record failures and provide Government with data as specified.	4. Verify contractor records data on any failures as specified.

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TEST NO:     END-2A  Page 2 of 4      OBJECTIVE:  To demonstrate system
TITLE:       Seasonal Endurance Test   normal mode operation 24 hours a day
               - Phase II               for five consecutive calendar days in
APPLIES TO:  Large/Medium EMCS, UMCS,   accordance with contract
               and UCS                  requirements.
REFERENCE:   Proj. Spec. Paragraph ------
```

EVENT	EXPECTED RESULTS
5. Identify all failures, determine causes of all failures and repair all failures. Submit a written report to the Government on all failures as specified.	5. Verify contractor repairs all failures and submits written reports on all failures as specified.
6. Meet with the Government to review results of Phase I tests and demonstrate that all failures have been corrected by submitting results of appropriate Seasonal Endurance Tests. Based on the results of Phase I, either recommend the point at which Phase I retesting should begin or recommend that the Government should proceed into Phase III testing.	6. Determine the restart point for Phase I testing or determine that the Contractor can commence Phase III testing. Provide written notification for the Contractor to recommence testing.

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TEST NO: END-2A Page 3 of 4   OBJECTIVE: To demonstrate system
TITLE: Seasonal Endurance Test   normal mode operation 24 hours a day
                - Phase III   for five consecutive calendar days in
APPLIES TO: Large/Medium EMCS, UMCS,   accordance with contract
                and UCS   requirements.
REFERENCE: Proj. Spec. Paragraph ------

                EVENT   EXPECTED RESULTS

7.   Operate the EMCS in normal mode so   7.   Verify the system performs its
     that the system performs its   assigned tasks in accordance with
     assigned tasks in accordance with   the contract requirements. Verify
     the contract requirements for 5   the contractor makes no repairs on
     consecutive calendar days, 24 hours   the system unless authorized by the
     a day, including a weekend.   Government, in writing.

8.   Place at least one FID or RTU in   8.   Verify FID or RTU performs its
     stand-alone mode for 5 days minimum.   assigned tasks in stand-alone mode
                                               in accordance with contract
                                               requirements.

9.   Place balance of FIDs or RTUs in   9.   Verify FIDs or RTUs perform their
     stand-alone mode for at least   assigned tasks in stand-alone mode
     one day.   in accordance with contract
                                               requirements.

10. Record failures and provide   10. Verify contractor records data on
     Government with data as specified.   any failures as specified.

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TEST NO:    END-2A  Page 4 of 4      OBJECTIVE:  To demonstrate system
TITLE:      Seasonal Endurance Test    normal mode operation 24 hours a day
              - Phase IV                for five consecutive calendar days in
APPLIES TO: Large/Medium EMCS, UMCS,    accordance with contract
              and UCS                   requirements.
REFERENCE:  Proj. Spec. Paragraph ------
----------------------------------------------------------------------
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EVENT	EXPECTED RESULTS
11. Identify all failures, determine causes of all failures and repair all failures. Submit a written report to the Government on all failures as specified.	11. Verify contractor repairs all failures and submits written reports on all failures as specified.
12. Meet with the Government to review results of Phase III Tests and demonstrate that all failures have been corrected by submitting results of appropriate Seasonal Endurance Tests. Based on the results of Phase III, either recommend the point at which Phase III retesting should begin or recommend that the EMCS has successfully completed the Seasonal Endurance Test.	12. Determine the restart point for Phase III Testing or determine that the EMCS has successfully completed the Seasonal Endurance Test. If Phase III retesting is required, provide written notification for the contractor to recommence testing.

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6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This standard provides generic performance verification and endurance tests for EMCS. These tests are to be used to assure that the physical and performance requirements of guide specifications for EMCS are tested, and that the test results are adequately documented.

6.2 Issue of DODISS. When this standard is used in acquisition, the applicable issue of the DODISS must be cited in the solicitation (see 2.2).

6.3 Data requirements. The following DIDs must be listed, as applicable, on the Contract Data Requirements List (DD Form 1423) when this standard is applied on a contract, in order to obtain the data, except where DoD FAR Supplement 227.405-70 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
4.2 and 4.2.1	DI-ATTS-80363A	EMCS Performance Verification and Endurance Test Plans	----
4.3, 4.3.1, and 5.1	DI-ATTS-80364A	EMCS Performance Verification and Endurance Test Procedures	----
4.4, 4.4.1, 5.3, and 5.4	DI-ATTS-80365A	EMCS Performance Verification and Endurance Test Reports	----
5.3, 5.3.1, 5.3.2, and 5.4	DI-ATTS-80366A	EMCS Endurance Test Failure Reports	----

The above DIDs were those cleared as of the date of this standard. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD Form 1423.

6.4 Subject term (key word) listing.

    Computer regulation unit
    Digital data display
    Digital electronics unit
    Execution validation and durability examination
    Unitary unit
    Utility computer command unit

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6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians: Preparing Activity:

  Army - CE   Navy - YD1
  Navy - YD1
  Air Force - 04   (Project ATTS-0026)