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MILITARY STANDARD

ENERGY MONITORING AND CONTROL SYSTEMS FACTORY TESTS

AMSC N6988 **AREA ATTS**

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, 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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FID or RTU Stand-Alone:

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1. SCOPE

1.1 Scope. The purpose of this Military Standard is to define generic Factory 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 functional requirements of the guide specifications are tested, and that the test results are adequately documented. The Government will 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.

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.

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.

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.

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 or RCU/ACU 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 or RCU/ACU 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 or RTU and MUX or ACU 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 or RTU 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.

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.

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 RTU or MUX or ACU with the remaining changes and alarms distributed among the remaining FID/MUX or RCU/ACU. 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 controlling utility systems. A typical system would include a COS, DTM and RTUs/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:

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.
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.
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.

4. GENERAL REQUIREMENTS

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

Factory Tests shall be conducted on EMCS hardware of the same model and software version to be installed at the job site to assure that the physical and functional requirements of guide specifications are met. The Factory Tests shall include at least one of each type of DTM to be used at the job site. Tests on FID or RTU and MUX or ACU operation shall include at least one FID/MUX or RCU/ACU in each DTM. Tests on I/O functions shall include each type of I/O function to be installed in each DTM.
Medium and large EMCS shall use the operator's console for operator interface, for display and control of digital and analog points, and for display of memory locations. UMCS and UCS shall use the COS.

4.2 Test plans. Prior to the initiation of the tests, the contractor shall provide the approved EMCS Factory Test Plans (see 6.3), including the following:

- Factory Test Equipment block diagram.
- EMCS hardware description.
- EMCS 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 data base.
- List of test equipment.
- Surge and overvoltage protection circuits diagrams.

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

- 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 Factory 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 Factory 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.

4.3.1 Data requirements for test procedures. EMCS Factory Test Procedures, 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 Factory Test Reports (see 6.3). The test reports shall document the results of the tests.

4.4.1 Data requirements for test reports. EMCS Factory 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 ± 1 degree Fahrenheit (^{o}F) over the executed range, the test instrument used shall have an accuracy of at least $\pm 0.5^{o}F$. All test equipment shall be provided by the contractor unless otherwise noted in the contract documents.

Test equipment for the Factory 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.
- Normal heavy load condition generator.

5. DETAILED REQUIREMENTS

5.1 General. This section presents the generic EMCS Factory 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 Factory Test should refer to the appropriate project specification paragraph(s).

5.2 Factory tests. The following are the Factory Tests to be conducted on the EMCS.

TEST NO: Factory-1A Page 1 of 1
TITLE: Initial System Equipment Verification
APPLIES TO: Large/Medium EMCS, UMCS, UCS
REFERENCE: Proj. Spec. Paragraph ______

OBJECTIVE: To verify that the hardware components of the system provided by the contractor are in accordance with the contract plans and specifications and all approved 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 component should be examined and checked against the model numbers the equipment provided by the contractor.	1. Model numbers of equipment provided must match the model numbers of the equipment on the approved submittals.

Test No: Factory-1A
10 June 1994

TEST NO: Factory-2A Page 1 of 1
TITLE: System Startup
TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _______

OBJECTIVE: To demonstrate that the system normal startup APPLIES procedures can initiate operation including initializing CCU/COS and FIDS/RTUs.

INITIAL CONDITIONS

1. All equipment is off.

2. The system has the specified memory installed.

EVENT	EXPECTED RESULTS
1. Energize the equipment CCU or COS FID/MUX or RCU/ACU and peripherals.	1. The equipment is ready for operation.
2. Initiate system startup using procedures (bootstrap) specified by the computer manufacturer.	2. System loads CCU or COS, and FIDs or RTUs with required software.
3. Load and run all software and data required for the complete factory test.	3. System loads software and data and begins execution of factory test.
4. Using system terminal, display memory or print memory map.	4. Memory map shows amount of installed and programs loaded.

Test No: Factory-2A
10 June 1994

TEST NO: Factory-3A Page 1 of 1
TITLE: System Accuracy and Resolution
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ______

OBJECTIVE: To demonstrate the system accuracy and resolution from analog inputs to the operator's monitor display is within the specified limits.

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 terminals of each type AI to be used in the system. Command the system to display analog values.	1. The system displays analog values within 0.5 percent of the standard test of equipment readout across the entire range of analog input (zero, mid-range size and full-range).
2. Vary the output of a calibrated test device connected to each type of analog I/0 to be installed so that the output change in value is one-half the specified accuracy of the measured variable.	2. The system displays a new analog value that is within 0.5 percent of the standard test equipment readout.
3. Connect one of each type of sensor and transmitter the configuration required by the contract specification into analog inputs. Demonstrate the accuracy of each analog sensor configuration over their respective spans in five equal steps.	3. Select each analog input configuration for display; the accuracy should be: $((AI)^2 + (sensor)^{2+} (transmitter)^2)^{\circ}$ For a calibrated temperature sensor (RTD), the accuracy should be

$((0.5)^2 + (0.1)^2 + (0.1)2)^{\circ} = .52\%$
of temperature span.

Test No: Factory-3A
10 June 1994

TEST NO: Factory-4A Page 1 of 1
TITLE: Power Line Surge Protection
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ______

OBJECTIVE: To demonstrate that all equipment connected to AC power circuits can meet the requirements of the contract.

INITIAL CONDITIONS

1. System power lines to each type of EMCS, UMCS, and UCS equipment to be installed are randomly selected for the test.

TEST EQUIPMENT

1. The test equipment shall generate AC power surges to meet the requirements of the contract.

EVENT	EXPECTED RESULTS
1. Connect the test equipment between each input line and ground for each piece of equipment to be tested, apply the required power surges accordance with the contract. their normal mode of operation. of	1. After the application and removal of the power surge, the tested equipment shall not exhibit any and malfunctions, degradation of in performance, or deviation from Visually verify equipment operation by manually initiating changes in the DE that require the operation the tested equipment. System displays required data.

Test No: Factory-4A
10 June 1994

TEST NO: Factory-5A Page 1 of 1
TITLE: Sensor and Control Wiring Surge Protection
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ______

OBJECTIVE: To demonstrate the ability of all digital and analog I/O devices to withstand surges induced on sensor and control wiring by the test defined in the contract.

INITIAL CONDITIONS

1. Wiring to each type of digital and analog input and output device is randomly selected for the test.

2. Surge protection is installed on circuits to be tested.

TEST EQUIPMENT

1. The test equipment shall generate the waveform described in the contract.

EVENT	EXPECTED RESULTS
1. Command the system to display status of input/output points for those I/O devices to be tested.	1. System displays I/O status.
2. Connect the test equipment at the I/O function input terminals to be tested, and generate the test waveform described in the contract, while system is in operation.	2. After the application and removal of the test waveform, the tested equipment shall not exhibit any malfunctions, the degradation of performance, or deviation from its normal mode of operation.
3. Manually initiate changes in the DE that require the operation of the tested equipment. System displays required data. Command the system to display status of I/O points.	3. System displays new I/O status.

Test No: Factory-5A
10 June 1994

TEST NO: Factory-6A Page 1 of 1
TITLE: Communications Links Surge Protection
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To test the ability of all contractor supplied communication equipment, except fiber optics, to withstand the test wave defined in the contract.

TEST EQUIPMENT

1. The test equipment generates the waveform described in the contract.

2. Disconnect the DTM and connect test wave generator to DTE terminals.

3. Surge protection is installed on circuits to be tested.

EVENT	EXPECTED RESULTS
1. Command the system to display status of I/O points.	1. System displays I/O status.
2. Connect the test equipment across each type of data transmission equipment to be used in the EMCS generate the test waveform described in the contract, while the EMCS is in operation.	2. After the application and removal of the waveform, the communication equipment shall not exhibit any and malfunctions, degradation of performance, or deviation from its normal mode of operation.
3. Manually initiate changes in the DE that require the operation of the tested equipment. Command the system to display status of I/O points.	3. System displays new I/O status.

Test No: Factory-6A
10 June 1994

TEST NO: Factory-7A Page 1 of 1
TITLE: Data Communications Links
Overvoltage Protection
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the the ability of all contractor supplied communication equipment, except fiber optics, to withstand a 480 VAC, RMS 60 Hz signal superimposed on any data communication line terminal.

INITIAL CONDITIONS

1. Overvoltage protection is installed on circuits to be tested.

TEST EQUIPMENT

1. The test equipment is a 480 VAC, RMS, 60 Hz single phase source.

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EVENT	EXPECTED RESULTS
1. Command the system to display status of I/O points.	1. System displays I/O status.
2. Connect the test equipment to each data communication equipment communication line terminal (one at a time) and apply the test voltage for a period of at least 1 minute while the system is in operation. its normal mode of operation.	2. After the application and removal of the test waveform, the equipment not connected to the test equipment does not exhibit any malfunctions, degradation of performance, or deviation from Only the fuse or fusible link shall be destroyed on

receiving

the 480 test voltage.

When these

components are replaced,

the

communication

equipment does not

exhibit any malfunctions, degradation of

performance, or

mode of deviation from its normal operation.

3. Manually initiate changes in the DE that require the operation of the tested equipment. Command the system to display status of I/O points.	3. System displays new I/O status.

Test No: Factory-7A
10 June 1994

TEST NO: Factory-8A Page 1 of 1
TITLE: FID or RTU Memory and FID/MUX or RCU/ACU Spare I/O Capacity
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate that the FIDs/RTUs have the specified amount of memory and the specified I/O capacity.

TEST EQUIPMENT

1. A FID or RTU portable tester.

EVENT	EXPECTED RESULTS
1. Command the FID/RTU to display memory size.	1. FID/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 or RTUs and MUXs or ACUs.

Test No: Factory-8A
10 June 1994

TEST NO: Factory-9A Page 1 of 2
TITLE: FID or RTU Startup and Functions
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ______

OBJECTIVE: To demonstrate that the FID or RTU can start operation automatically without human intervention. To demonstrate FID or RTU monitoring and control functions 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 FID/MUX monitoring functions:	3. Operator console or COS display matches DE conditions.

. 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.

Test No: Factory-9/1A
10 June 1994

TEST NO: Factory-9A Page 2 of 2
TITLE: FID or RTU Startup and Functions
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate that the FID or RTU can start operation automatically without human intervention. To demonstrate FID or RTU monitoring and control functions in normal operational mode and in stand-alone mode.

EVENT	EXPECTED RESULTS
4. Enter commands to operate the following FID/MUX or RCU/ACU control functions: . Constraints checks (prior to command issuance). . Control functions: digital output. . Control functions: analog output.	4. Operator command matches DE status.
5. Initiate a change in an analog point so that its value exceeds a or reasonableness value. Select a point that provides input into an application program.	5. FID or RTU rejects value and sends an alarm message to the CCU or high COS.
6. Disconnect DTM to FID or RTU. portable tester and reset FID or RTU real time clock (RTC) to be out of synchronization.	6. The system reports an alarm Connect indicating loss of communication. Verify FID or RTU RTC and CCU or COS time of base generator are not synchronized.
7. Reconnect the DTM to the FID or RTU.	7. System automatically corrects the 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 clock accuracy error.

8. Connect portable tester and read FID or RTU real time clock (RTC).	8. Verify FID or RTU RTC and CCU or COS TBG are synchronized.

Test No: Factory-9/2A
10 June 1994

TEST NO: Factory-10A Page 1 of 1
TITLE: FID or RTU and RAM Battery Backup
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the ability of the FID RTU RTC and RAM to continue to operate and the RAM to maintain memory contents during power failures.

TEST EQUIPMENT

1. Portable diagnostic tester.

EVENT	EXPECTED RESULTS
1. Remove the 120 VAC service from the FID or RTU for the duration of the RTC and RAM battery backup period 30 minutes for the FID or RCU RTC and RAM as specified in the contract documents. Disconnect FID or RCU from DTM.	1. FID or RTU RTC continues to operate and RAM contents are not lost. Alarm printer indicates minus loss of communication with FID or RCU.
2. At the end of the specified battery backup period, minus 30 minutes, repower FID or RTU with 120 VAC and read RTC and selected RAM locations with portable tester.	2. Verify the FID or RTU time clock is operational with the correct time, and the FID or RTU RAM contents are maintained for the period of time specified.
3. Reconnect FID or RTU to DTM. Operator issue command to establish communication with FID or RTU.	3. Alarm printer indicates communication with FID or RTU established.

Test No: Factory-10A
10 June 1994

TEST NO: Factory-11A Page 1 of 1
TITLE: FID/MUX or RCU/ACU Battery Backup
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the ability of designated complete FID/MUX or RTU/ACU to operate under battery backup during power failures and to demonstrate recharging capabilities.

EVENT	EXPECTED RESULTS
1. Remove the 120 VAC from the FID/MUX continues or RTU/ACU power source and operate FID/MUX or RCU/ACU for the time period required in the contract documents, minus 10 minutes. Exercise FID/MUX or RCU/ACU by performing monitoring and control RCU/ACU functions.	1. The FID/MUX or RCU/ACU to operate normally for the the specified period under battery backup without degradation. An alarm is printed and displayed at the operator's console to indicate the FID/MUX or is operating under battery backup.
2. Reconnect the 120 VAC to the FID/MUX continues or RCU/ACU power source.	2. The FID/MUX or RCU/ACU to operate normally and printer prints return to normal operation.
3. Manually change status of selected points. Request I/O status.	3. Displayed status of I/O points I/O corresponds to new status.
4. Measure charging current to backup	4. Verify batteries are being battery. charged.

Test No: Factory 11A
10 June 1994

TEST NO: Factory-12A Page 1 of 2
TITLE: Portable Tester
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: Demonstrate the capability of the device to perform diagnostics, debug, exercise all points in FID/MUX or RCU/ACU, and load all information for complete FID or RTU 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 portable tester.
2. Run FID or RTU diagnostics using the or RTU switch.	2. Displayed results of diagnostics FID agree with the predicted results.

Test No: Factory-12/1A
10 June 1994

TEST NO: Factory-12A Page 2 of 2
TITLE: Portable Tester
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: Demonstrate the capability of the device to perform diagnostics, debug, exercise all points in FID/MUX or RCU/ACU, and 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 contents of a specific memory location.	4. Displayed results of diagnostics agree with the predicted results.
5. Enter command to bulk load all programs into memory. Command the to display specified memory which contains a selected program. Command the system to display program listing in the specified memory location.	5. Displayed contents contain the selected program(s) and that system program listing matches location contractor supplied program listing.
6. Enter command to display analog	6. Displayed status of analog and inputs. digital input corresponds with predicted results.
7. Enter command to control analog digital outputs.	7. Analog and digital commands are and executed. Status of analog and digital outputs match the DE status.
8. Enter command to modify specific RAM location.	8. System enters modification.
9. Enter command to display the contents of modified RAM location.	9. Displayed contents of RAM include the modification.

Test No: Factory-12/2A
10 June 1994

TEST NO: Factory-13A Page 1 of 1
TITLE: FID or RTU Test Set
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To verify the capabilities of the FID or RTU and associated DE simulator.

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) the operator's console.	1. DE simulator displays the DO from signals received.
2. Exercise the eight Analog Outputs from the operator's console.	2. DE simulator displays the AO (AOs) signals received.
3. Exercise the Digital Inputs (DIs) the test set.	3. Change of status is displayed at from operator's console or COS.
4. Exercise the Analog Inputs (AIs) the test set.	4. Change of status is displayed at from console or COS.
5. Exercise the pulse accumulator the test set.	5. Change of value is displayed at from operator's console or COS.
6. Execute in the test set a FID or RTU resident application program.	6. Verify output of program executed at FID or RTU test set matches output of program executed at FID or RTU.

Test No: Factory-13A
10 June 1994

TEST NO: Factory-14A Page 1 of 2
TITLE: Analog and Digital I/O Functions
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the ability of the FID or RTU to execute commands from central control and monitor analog and digital functions.

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 points (for example, from on to off or from open to close) at selected FIDs/MUXs or RCUs/ACUs.	1. System displays change of status of designated points.
2. Connect a 24 VAC, 60 Hz source to a digital output of a FID/MUX or RCU/ACU. Connect a load to this digital output that draws 1 ampere.	2. Visually verify digital output operates as commanded.
3. Connect a pulse generator to a pulse accumulator input function. Generate contact closure at a rate 10 pulses per second. Convert the total number of pulses generated, as shown on the pulse total indicator of the test equipment, into engineering units.	3. The number the engineering units displayed at the operator's console agree with the converted of number of total number of pulses generated.

Test No: Factory-14/1A
10 June 1994

TEST NO: Factory-14A Page 2 of 2
TITLE: Analog and Digital I/O Functions
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the ability of the FID or RTU to execute commands from central control and monitor analog and digital functions.

EVENT	EXPECTED RESULTS
4. Connect a known analog signal to analog input function of a FID/MUX or RCU/ACU. Provide engineering unit conversion.	4. The analog signal displayed at the an operator's console agrees with the engineering unit conversion of the known analog signal input.
5. Connect an analog dual input CPA with remote reset capabilities to an analog output function of a FID/MUX or RCU/ACU. engineering unit conversion. From the operator's console, command analog output to increase and decrease controller setpoint.	5. Visually verify that controller controller setpoints agree with operator's console setpoint commands, and system provides a feedback status on the controller setpoint.
6. Disconnect control device from control device output source) for one minute. Reconnect control device and exercise analog output from the central system. Command the system to operate the control device.	6. Visually verify control device analog operates in accordance with (voltage command.

Test No: Factory-14/2A
10 June 1994

TEST NO: Factory-15A Page 1 of 1
TITLE: Analog Input Function Noise Protection (Common Mode)
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the ability of differential analog input hardware to withstand noise on the wiring connected to the analog input. The common mode voltage 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 analog input and system ground. Adjust the source for 50 percent of full scale. Command the system to display the values of each tested analog input.	1. Visually verify system display the matches values of analog input in the DE.
2. Remove the ground connection from the DC Signal Source and connect an signal between the point where system ground was connected and and 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.	2. The rejection to the AC common mode signal should be at a dB AC that is in accordance with the contract requirements.

3. Repeat Event 2 for a frequency range of 0-120Hz.

3. The rejection to the AC signal should be at a dB level that is in accordance with the contract requirements.

Test No: Factory-15A
10 June 1994

TEST NO: Factory-16A Page 1 of 1
TITLE: Analog Input Function Noise Protection (Normal Mode)
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the ability of the single ended analog input hardware to withstand noise on the wiring connected to the analog input. The noise appears as an AC 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 input and system ground. Command system to display values of each tested analog input.	1. Visually verify system display the matches values of analog input the in the DE.
2. Connect the DC Signal Source in with the 60 Cycle AC Signal Generator. Connect these sources between the analog input and signal 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	2. The rejection to the AC signal series should be at a dB level that is in accordance with the contract requirements.

verify display against actual DE values.

Test No: Factory-16A
<u>10 June 1994</u>

TEST NO: Factory-17A Page 1 of 1
TITLE: Digital Input and Output Function Isolation and Protection

APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the ability of the digital input and output function hardware to withstand a steady-state voltage on the control wiring connected to the digital input/output function hardware.

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 status of each selected digital I/O function.	1. System display matches status of the I/O points in the DE.
2. Connect the test equipment across the digital input/output terminals at the FID/MUX or RCU/ACU and apply the test voltage for a period of five minutes on each type of digital input and digital output.	2. After the application of the test waveform, the digital input/output equipment does not exhibit any malfunctions, degradation of performance, or deviation from its normal mode of operation.
3. Command the system to display status of each tested digital I/O function.	3. System display matches status of the I/O points in the DE.
4. Change status of digital I/O function.	4. System display matches new status of I/O points in the DE.

Test No: Factory-17A
10 June 1994

TEST NO: Factory-18A Page 1 of 2 TITLE: System Power Failure/Restart APPLIES TO Large/Medium EMCS/UMCS/UCS REFERENCE: Proj. Spec. Paragraph ____	OBJECTIVE: To demonstrate CCU or COS and FID or RTU response to power failures and to restoration of power.

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/MUXs or RCUs/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 selected I/O points.	1. System displays I/O status.
2. Initiate a power failure to the CCU or COS, but maintain power to the FIDs or RTUs.	2. System initiates shutdown of CCU or COS. The FIDs or RTUs operate in stand-alone mode.
3. Restore power to CCU or COS after two minutes.	3. The system automatically obtains 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 previously selected I/O status.	4. System displays I/O status which corresponds with I/O status prior to power failure.

Test No: Factory-18/1A
10 June 1994

TEST NO: Factory-18A Page 2 of 2
TITLE: System Power Failure/Restart
APPLIES TO Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate CCU or COS and FID or RTU response to power failures and to restoration of power.

EVENT	EXPECTED RESULTS
5. Initiate a power failure to the system in excess memory the and RTC battery backup capacity.	5. System initiates an orderly complete shutdown of CCU or COS and of peripherals without loss of contents of memory, registers, or machine status. Verify 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. Restore all power and perform startup using procedures specified by the computer manufacturer.	6. The system is automatically system reinitialized before the EMCS/ UMCS/UCS functions are restarted. The entire system is placed in operation within the time period specified. Visually verify resumption of normal mode operation.

Test No: Factory-18/2A
10 June 1994

TEST NO: Factory-19A Page 1 of 1
TITLE: CCU or COS Programmer Control Function
APPLIES TO: Large/Medium Small EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate that the CCU or COS contains the required programmer control functions.

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 required for system operation.	1. System loads software.
2. Command the system to display of a specified main memory location.	2. System displays contents of contents designated main memory location. Visually verify that the display agrees with contractor supplied listing.

Test No: Factory-19A
10 June 1994

TEST NO: Factory-20A Page 1 of 1 TITLE: CCU or COS Time Base Generator (TBG) APPLIES TO: Large/Medium EMCS/UMCS/UCS REFERENCE: Proj. Spec. Paragraph ____	OBJECTIVE: To demonstrate that the difference between the CCU or COS time base generator (TBG) and the system RTC is within specified limits of error.

INITIAL CONDITIONS

1. RTC and CCU or COS TBG are synchronized.

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

Test No: Factory-20A
10 June 1994

TEST NO: Factory-21A Page 1 of 1
TITLE: CCU or COS/FID or RTU Detection and Retransmission
APPLIES TO: Large/Medium EMCS/UMCS/UCS link REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate error detection and retransmission Error capabilities between the FID or RTU and CCUs or COSs. This test also verifies shutdown of the DTM when retransmission attempts exceed an 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 noise or communication error on DTM.	1. CCU or COS closes down transmission on DTM originating each errors and prints an alarm message after the maximum number of transmission errors are reached.
2. Operator reopens closed down DTM communications circuits after white noise generator or communication error generator are removed.	2. CCU or COS reopens to the shutdown device or DTM.
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 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.

Test No: Factory-21A
10 June 1994

TEST NO: Factory-22A Page 1 of 4
TITLE: Backup Mode for CCU Failure
APPLIES TO: Large EMCS only
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software that detects failure of the CCU causing the CCU to begin backup 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. Initiate a CCU failure.	1. The system controller immediately and automatically switches CLT data lines and the logging and alarm printers to the other CCU.

Test No: Factory 22/1A
10 June 1994

TEST NO: Factory-22A Page 2 of 4
TITLE: Backup Mode for CCU Failure
APPLIES TO: Large EMCS only
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software that detects failure of the CCU causing the CCU to begin backup operation of the EMCS. This test also demonstrates CCU programmer control functions and CCU time base generator accuracy.

EVENT	EXPECTED RESULTS
2. Initiate DE alarms.	2. The other CCU takes over all functions.
3. Command the system to display the list of available operator's commands from the CCU during the CCU failure.	3. Verify displayed list corresponds to contract requirements.
4. Command the system to perform each operator's commands listed by the system including:	4. The system responds to each of the operator command in accordance with responses provide by the contractor, including:
(a) Command for status of specified points.	(a) System displays point status.
(b) Command the system to display the parameters of specific points.	(b) System displays point identification and associated parameters.
(c) Command the system to change specified point parameter(s) and input the new parameters.	(c) System acknowledges input.
(d) Command the system to display the modified parameters of the points.	(d) System displays point identification and associated parameters, including those which were modified.
(e) Command the system to control analog and digital output points.	(e) Commands are executed.

Test No: Factory-22/2A
10 June 1994

TEST NO: Factory-22A Page 3 of 4
TITLE: Backup Mode for CCU Failure
APPLIES TO: Large EMCS only
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software that detects failure of the CCU causing the CCU to begin backup operation of the EMCS. This test also demonstrates CCU programmer control functions and CCU time base generator accuracy.

EVENT	EXPECTED RESULTS
(f) Command the system to change limits on specified points which which will bring them out of alarm condition.	(f) Verify designated alarms with new limits are no longer in alarm condition.
5. Initiate conditions for power demand limiting function. Command system to display equipment	5. System executes power demand limiting function and causes the equipment to be controlled in status. 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.
6. Erase all memory resident programs in CCU. Command the system to display directory of programs.	6. No memory resident programs are displayed.
7. Reload all memory resident CCU programs using the bulk loader. Repeat operator interface events.	7. Verify system performs according to expected results.
8. Command the system to load CCU software.	8. System loads required software.

9. Command the system to display of a specified main memory location.

9. System displays contents of contents designated main memory location. Verify that display agrees with contractor supplied listing.

Test No: Factory-22/3A
10 June 1994

TEST NO: Factory-22A Page 4 of 4
TITLE: Backup Mode for CCU Failure
APPLIES TO: Large EMCS only
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software that detects failure of the CCU causing the CCU to begin backup operation of the EMCS. This test also demonstrates CCU programmer control functions and CCU time base generator accuracy.

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

Test No: Factory 22/4A
10 June 1994

TEST NO: Factory-23A Page 1 of 1
TITLE: CLT Device and DTM Failure
TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate that a single failure of any CLT will APPLIES result in the loss of no more than one DTM link.

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EVENT	EXPECTED RESULTS
1. Command the system to display data from selected FIDs or RTUs. failure of a CLT device DTM link. Command the system to display FIDs or RTUs responding.	1. System displays status of FIDs or RTUs not responding, which Initiate corresponds to the contract in each drawings for the CLT/DTM arrangement. Data from FIDs or not RTUs not responding is highlighted as not current.
2. Initiate alarms at I/Os associated with the DTMs in service.	2. System displays alarms.
3. Initiate a failure of one DTM link between CLT and CCU. Command system to display FIDs or RTUs responding.	3. System displays status of FIDs or RTUs not responding, which the corresponds to the FID/MUX or not 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 associated with the DTMs in service.	4. System displays alarms.
5. Repeat Events 3 and 4 for each DTM	5. System responds as in Events 3 link. and 4.

Test No: Factory-23A
10 June 1994

TEST NO: Factory-24A Page 1 of 1
TITLE: Backup to Disk Storage System Failure
APPLIES TO: Large/Medium EMCS Only
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate performance of the duplicate disk system in the event of primary disk system failure.

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 system.	1. System will not respond to any disk commands.
2. Bring the second disk system line" by use of the programmer's pre-programmed bootstrap (rewiring or reconnecting of device is not permissible). Institute change of status for selected DE points.	2. System updates the data base "on- automatically and is fully panel or a operational within 15 minutes routine after placing the backup disk any system on line.
3. Within fifteen minutes after second is brought on line, command the system to display the status of the selected points in DE that changed status during the disk failure.	3. Verify that the system display of disk selected point status corresponds to the DE status.

Test No: Factory-24A
10 June 1994

TEST NO: Factory-25A Page 1 of 1
TITLE: Magnetic Tape Validation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate that files can be successfully transferred from disk to magnetic tape and from magnetic tape to disk.

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 directory of all files (name and size) containing EMCS, UMCS or UCS software.	1. System displays directory of the disk files which corresponds to contractor supplied list.
2. Transfer files from disk to magnetic tape. Clear directory on disk and command the system to display directory of files.	2. The list of those files that were transferred is not displayed.
3. Transfer files from magnetic tape to disk. Command the system to display directory of files.	3. System displays directory of files that corresponds to contractor supplied list.

Test No: Factory-25A
10 June 1994

TEST NO: Factory-26A Page 1 of 1
TITLE: Software Validation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate that the system contains all system software and disk capacity required in the contract documents to manage 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 computer system software description can be augmented by the EMCS, UMCS or UCS manufacturers for those items that are EMCS, UMCS or UCS specific.

EVENT	EXPECTED RESULTS
1. Command the system to display the directory of all files (name and containing EMCS, UMCS, UCS	1. System displays directory of the disk files. Name of the files and size) 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 randomly selected application software program files.	2. System prints out the programs which are written in a high level language. Verify printouts agree with the contractor furnished documentation.

Test No: Factory-26A
10 June 1994

TEST NO: Factory-27A Page 1 of 2
TITLE: Program Development
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the operation of the program development facility which allows the development and debugging of control programs while running the system in the 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 file via the editor. (This program be called the test program hereafter.) Command the system generate hard copy output.	1. System loads and compiles program into object code. Verify a hard will copy listing matches contractor supplied listing, and that system to displays error messages on known errors.
2. Correct errors via the editor Command the system to generate hard copy output.	2. System loads and compiles program. corrected program. Verify hard copy printout corresponds to contractor supplied document without errors.
3. Command the system to save the test program on designated disk file.	3. System saves test program on disk file.
4. Initiate the debugging software to program logic. Check output program against expected results	4. System provides necessary check information for the operator to of follow, line by line, the using FID

or RTU test set and its associated DE.

execution of the program. Verify program output agrees with expected results using the FID or RTU test set.

Test No: Factory-27/1A
10 June 1994

TEST NO: Factory-27A Page 2 of 2
TITLE: Program Development
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the operation of the program development facility which allows the development and debugging of control programs while running the system in the on-line mode.

EVENT	EXPECTED RESULTS
5. Command the system to actuate the program in the CCU or COS using a FID/MUX or RCU/ACU and its RCU/ACU associated DE.	5. System transfers the program to the CCU or COS on-line mode status using a FID/MUX or
6. Command the system to display the programs active in the CCU or COS.	6. Verify system display of active programs includes the test program.

Test No: Factory-27/2A
10 June 1994

TEST NO: Factory-28A Page 1 of 1
TITLE: Diagnostics
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate capability of the diagnostic programs to detect hardware and software problems and display the corresponding error messages.

EVENT	EXPECTED RESULTS
1. Initiate diagnostic program to CCU or COS as designated in the contract documents.	1. System initiates diagnostic test the programs and displays the status of each diagnostic routine performed.
2. Initiate diagnostic program for each peripheral device as designated in the contract.	2. System displays status for each diagnostic routine performed.

Test No: Factory-28A
10 June 1994

TEST NO: Factory-29A Page 1 of 2
TITLE: System Access Control
APPLIES TO: Large/Medium EMCS/UMCS/UCS based
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the ability of the system to control operator access to software selectable passwords.

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 corresponds to an access level and command the system to display software available at the given level. Repeat for each access level.	1. System acknowledges log on and displays software accessible at the given access level. Visually verify the display matches the access the contractor's list.
2. For all but the highest access command the system to perform a function that cannot be performed at the current access level.	2. System indicates command level, cannot be executed at the current access level.
3. Log on with a password to access for performing a specific function. (For example, command system to set up high/low limits on analog point.)	3. Command is executed. (For software example, observe change in high/low limit in a designated the analog point.)
4. Log on with a higher access password and repeat software command in Event 3.	4. Command is executed.
5. Log on with a lower access password (that prevents access to software in Event 3) and repeat software command in Event 3.	5. System indicates command cannot be executed at current access level

Test No: Factory-29/1A
10 June 1994

TEST NO: Factory-29A Page 2 of 2
TITLE: System Access Control
APPLIES TO: Large/Medium EMCS/UMCS/UCS based
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the ability of the system to control operator access to software selectable passwords.

EVENT	EXPECTED RESULTS
6. Repeat Events 3, 4, and 5 for every remaining level.	6. Commands are executed only when the software and/or command is accessible at the given access level.
7. Change an existing password to a new password with a higher access level and report Events 2 and 3.	7. Commands are executed only when the software and/or command is accessible at the given access level.

Test No: Factory-29/2A
10 June 1994

TEST NO: Factory-30A Page 1 of 7
TITLE: Operator Commands
APPLIES TO: Large/Medium EMCS/UMCS/UCS
all REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software which enables the operator to interface with the system for functions associated with daily 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 5 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 incorrect password.	1. The system indicates the password is not valid and does not allow the operator to log on.

Test No: Factory 30/1A
<u>10 June 1994</u>

TEST NO: Factory-30A Page 2 of 7
TITLE: Operator Commands
APPLIES TO: Large/Medium EMCS/UMCS/UCS
all REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software which enables the operator to interface with the system for functions associated with daily operation of the system.

EVENT	EXPECTED RESULTS
2. Log on to the system with a password that allows total operator access to all operator commands.	2. System acknowledges log on and displays operator's name or 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.
3. Enter the operator command for the function.	3. System displays all operator help 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 a specific operator command.	4. System displays the purpose, use and expected system reaction to the command. This explanation must agree with the contractor supplied documentation.
5. Command the system to print operator's commands at logging printer.	5. System prints all succeeding operator inputs on the logging printer.
6. Enter an abbreviated mode operator command.	6. Visually verify the system executes the command.
7. Enter an operator command without confirming action.	7. System requests operator operator verification.
8. Enter the cancel action.	8. Command is canceled.

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

Test No: Factory-30/2A
10 June 1994

TEST NO: Factory-30A Page 3 of 7
TITLE: Operator Commands
APPLIES TO: Large/Medium EMCS/UMCS/UCS
all REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software which enables the operator to interface with the system for functions associated with daily operation of the system.

EVENT	EXPECTED RESULTS
10. Enter command for display of I/O functions defined in the data base, in accordance with the following address levels: . Installation. . Area. . Building. . Unit. . Point.	10. System displays requested I/O function data on the selected output device.
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.

Test No: Factory-30/3A
10 June 1994

TEST NO: Factory-30A Page 4 of 7
TITLE: Operator Commands
APPLIES TO: Large/Medium EMCS/UMCS/UCS
all REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software which enables the operator to interface with the system for functions associated with daily operation of the system.

EVENT	EXPECTED RESULTS
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/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 setpoints 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.
17. Command the system to initiate a change in the DE via the in designated command function. example, command the system to shut down equipment.)	17. Visually verify the system commences to initiate a change the DE within 10 seconds of (For 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.

Test No: Factory-30/4A
10 June 1994

TEST NO: Factory-30A Page 5 of 7
TITLE: Operator Commands
APPLIES TO: Large/Medium EMCS/UMCS/UCS
all REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software which enables the operator to interface with the system for functions associated with daily operation of the system.

EVENT	EXPECTED RESULTS
18. Command the system to change equipment control modes currently 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 5 minutes.)	18. Visually verify change in control from manual to automatic code.
19. Command the system to disable selected I/O points in a FID or RTU.	19. Visually verify specified inputs (in failure mode) within 10 seconds of command entry.
20. Command the system to disable selected I/O points in a MUX or ACU.	20. System disables selected I/O points.
21. Command the system to address the point identified in initial conditions.	21. System indicates command disabled addresses a point which is Disabled.
22. Command the system to enable the points that were just disabled.	22. Visually verify each designated point is enabled (in normal mode) within 10 seconds from command entry.
23. Command the system to disable a designated FID or RTU.	23. Visually verify that the I/O functions of disabled FID or RTU are in the failure mode within 10 seconds from command entry.

Test No: Factory-30/5A
10 June 1994

TEST NO: Factory-30A Page 6 of 7
TITLE: Operator Commands
APPLIES TO: Large/Medium EMCS/UMCS/UCS
all REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software which enables the operator to interface with the system for functions associated with daily operation of the system.

EVENT	EXPECTED RESULTS
24. Command the system to enable the FID or RTU.	24. Visually verify the FID is disabled 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 designated MUX or ACU.	25. Visually verify that the MUX or ACU I/O functions are in the failure mode within 10 seconds from command entry.
26. Command the system to enable the disabled MUX or ACU.	26. Visually verify each MUX or ACU is enabled within 10 seconds 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 automatic schedule of operation for selected equipment.	27. Visually verify equipment schedule has been altered.
28. Command the system to execute a task on an analog point that contains a value outside the given point parameter definition.	28. System indicates that the command would violate constraints.
29. Command the system to execute a task without providing sufficient	29. System indicates that the command used is incorrect or

information for execution. incomplete.

Test No: Factory-30/6A
10 June 1994

TEST NO: Factory-30A Page 7 of 7
TITLE: Operator Commands
APPLIES TO: Large/Medium EMCS/UMCS/UCS all
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software which enables the operator to interface with the system for functions associated with daily operation of the system.

EVENT	EXPECTED RESULTS
30. Command the system to execute a an existing point that is currently not in communication with the system.	30. System indicates that the point task on addressed is out of service.
31. Command the system to execute a task on a nonexistent point.	31. System indicates that the command addresses a point which does not exist.
32. Command the system to execute any operator commands displayed in response to the help command but yet tested in the preceding events. Include any data necessary to execute the command.	32. System displays the purpose, use, and expected system reaction to the command. This explanation not must agree with the contractor supplied documentation.
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 password that allows minimum access to commands. field.	34. System acknowledges log on and displays operator's name or operator initials in the operator's console first
35. Enter a command that requires a higher level password for	35. System indicates the operator is restricted from using that execution. command.

Test No: Factory-30/7A
10 June 1994

TEST NO: Factory-31A Page 1 of 5
TITLE: Data Environment (DE) Definition Process
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To verify that point(s) in the data base can be defined by by the operator from the operator's console with its own set of parameters, definitions, and 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 password allows operator access to the definition process.	1. System acknowledges log on, that displays and prints data in DE accordance with contract documents.
2. Command the system to accept input for point definition.	2. System request inputs.

Test No: Factory-31/1A
10 June 1994

TEST NO: Factory-31A Page 2 of 5
TITLE: Data Environment (DE) Definition Process
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To verify that point(s) in the data base can be defined by by the operator from the operator's console with its own set of parameters, definitions, and constraints.

EVENT	EXPECTED RESULTS
3. Input data for each point. . Name . Device or sensor type (i.e., sensor, control relay, motors) . 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). . 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.	3. System acknowledges input for each point. At each step of the process, inputs outside the predefined system ranges shall be rejected with a reason stated

Test No: Factory-31/2A
10 June 1994

TEST NO: Factory-31A Page 3 of 5
TITLE: Data Environment (DE) Definition Process
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To verify that point(s) in the data base can be defined by by the operator from the operator's console with its own set of parameters, definitions, and constraints.

EVENT	EXPECTED RESULTS
3. (continued) . 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 several but not all previously entered data.	4. System requests input for modified values.
5. Command the system to display data points.	5. Verify displayed data includes for modified values.
6. Command the system to accept the following FID or RTU resident constraints: . Maximum starts (cycles) per hour (digital control functions only). . Minimum off time (digital control functions only). . Minimum on time (digital control functions only).	6. System acknowledges input for each point.

Test No: Factory-31/3A
10 June 1994

TEST NO: Factory-31A Page 4 of 5
TITLE: Data Environment (DE) Definition Process
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To verify that point(s) in the data base can be defined by by the operator from the operator's console with its own set of parameters, definitions, and constraints.

EVENT	EXPECTED RESULTS
6. (continued) . 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 equipment operations that exceed FID or RTU resident constraints defined for each I/O control function 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.	7. System indicates that command cannot be executed because the the FID or RTU memory resident constraints have been exceeded.

Test No: Factory-31/4A
10 June 1994

TEST NO: Factory-31A Page 5 of 5
TITLE: Data Environment (DE) Definition Process
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To verify that point(s) in the data base can be defined by by the operator from the operator's console with its own set of parameters, definitions, and constraints.

EVENT	EXPECTED RESULTS
7. (continued) . For example, for Analog control point, assign limits that exceed: - High limit. - Low limit.	
8. Command the system to display the definition of each point in the test.	8. Visually verify system display of point data for each point in the test defined corresponds to initial input.

Test No: Factory-31/5A
10 June 1994

TEST NO: Factory-32A Page 1 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic 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.

Test No: Factory-32/1A
10 June 1994

TEST NO: Factory-32A Page 2 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

INITIAL CONDITIONS (continued)

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.

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 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.

Test No: Factory-32/2A
10 June 1994

TEST NO: Factory-32A Page 3 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
2. Command the system to generate and status report of a list equipment, sensors or control devices by each of the following categories: . Building. . Point. . Unit. . Area. . Installation.	2. System displays status of display a equipment, sensors, or control of devices in the selected category.
3. Command the system to generate a status report automatically at fixed intervals. (For example, report on status of selected temperature sensors.)	3. System requests a time, the time interval between reports, and device on which report will be displayed.
. Enter desired time intervals. (At least four reports must be generated during the test period.)	System acknowledges input.
. Specify the printer as the output device.	Automatic report is generated at specified time(s) and displayed on the printer in fixed format.
. Command the system to cancel the report.	. System acknowledges command. Visually verify the periodic automatic report is not generated at the programmed time.

Test No: Factory-32/3A
10 June 1994

TEST NO: Factory-32A Page 4 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
3. (continued)	
. Command the system to change the generation mode for a specified report from periodic automatic to request mode.	. System acknowledges the change. Report that was formally periodic automatic will be generated as requested by the operator.
. Command the system to generate an immediate printout of the latest status report using the PRINT REPORT enhancement function.	.System generates and displays status report that was previously generated automatically.
. Command the system to change the time interval.	System generates and displays status report with new time interval.
4. Command the system to store the data from the latest status report.	4. System stores data by type of report, date and time.
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 reports. Specify at least	6. System requests report data. profile System requests time interval one of

each type of the following reports:	between reports. System profile acknowledges input.

Test No: Factory-32/4A
10 June 1994

TEST NO: Factory-32A Page 5 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
6. (continued)	
. 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.	The system generates requested profile reports on the printer.
7. Command the system to display the space allocated for each	7. Verify that sufficient storage storage space is allocated on disk to report. store 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 the profile reports.	8. System terminates profile report generation.

Test No: Factory-32/5A
10 June 1994

TEST NO: Factory-32A Page 6 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
ELECTRICAL POWER UTILIZATION SUMMARY:	
1. Command the system to generate the Electric Power Utilization Summary.	1. System requests meter identification and time period.
2. Enter meter identification(s). Request daily and monthly totals. Specify the date of beginning day of the month.	2. System generates the following data for each meter: . 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.

Test No: Factory-32/6A
10 June 1994

TEST NO: Factory-32A Page 7 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
ENERGY UTILIZATION SUMMARY:	
1. Command the system to generate the Energy Utilization Summary.	1. System requests identification of the point, unit, building, area, and/or [installation]. System requests beginning and ending times for sampling intervals.
2. Enter identification of desired I/O points according to each of the following address levels: levels: . A specific point in each DTM. . A unit in each DTM. . A unit in each DTM. . A building in each DTM. . An area. . [Installation.] . The entire EMCS.	2. System generates a report for each address level. Each report must contain: . Beginning and ending dates and times. . Total energy usage for the current and previous day. . Total energy usage for the 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 Alarm Report.	1. System generates a report listing all outstanding alarms by class,

including time of occurrence.

Test No: Factory-32/7A
10 June 1994

TEST NO: Factory-32A Page 8 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
LOCKOUT REPORT:	
1. Command the system to generate the Lockout Report.	1. System generates a report listing all points currently disabled, and identification of operator disabling the point.
ANALOG LIMIT REPORT:	
1. Command the system to generate the Analog Limit Report.	1. System generates a report with the 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 Analog Limit Summary by building unit.	2. System generates a report with the following data for each analog and by 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.

Test No: Factory-32/8A
10 June 1994

TEST NO: Factory-32A Page 9 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
RUN-TIME REPORTS:	
1. Command the system to generate the Time Report.	1. System requests identification Run- of equipment.
2. Enter identification of desired equipment according to each of the following address levels: . 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.	2. System generates a report that provides the total run-time for run-time for each equipment unit in each address level.
3. Manually reset run-time to zero for selected equipment and request Run-Time Report for the equipment.	3. System generates a Run-Time Report based on new time origin.

Test No: Factory-32/9A
10 June 1994

TEST NO: Factory-32A Page 10 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
COOLING TOWER PROFILES:	
1. Command the system to generate the Cooling Tower Profile.	1. System requests cooling tower 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 Peak Demand Prediction Report.	1. System requests meter Electrical identification.
2. Enter definition for individual meter or groups of meters to be totalized.	2. System acknowledges input and generates a report for each meter or groups of meters that provides:

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

Test No: Factory-32/10A
10 June 1994

TEST NO: Factory-32A Page 11 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
CHILLER UTILIZATION SUMMARY:	
1. Command the system to generate the Utilization Summary.	1. System requests chiller 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 buildings.	1. System generates report that lists the systems or buildings and and 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.

Test No: Factory-32/11A
10 June 1994

TEST NO: Factory-32A Page 12 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
2. Command the system to generate the Optimum Stop Report for all systems	2. System generates report that lists the systems or buildings not 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 Out-of-Service Report.	1. System requests report schedule the and locations to be reported.
2. Enter requests for reports on equipment at each of the following locations: . MCR. . DTM link. . FID or RTU panel. . MUX or ACU panel.	2. System generates out of service on reports for each location. The reports list all disabled points.

Test No: Factory-32/12A
10 June 1994

TEST NO: Factory-32A Page 13 of 13
TITLE: Report Generator
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software which generates reports in a fixed format either by operator request or in periodic automatic mode.

EVENT	EXPECTED RESULTS
STATIC DATA BASE REPORT:	
1. Command the system to generate a Data Base Report by building, or RTU, and all points.	1. System generates a list of the Static active data base in categories of zone, FID 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 Time Data Base Report by zone, FID or RTU and points.	1. System generates a list of the Real- real-time data base. The list building, will include analog input, digital all input 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 DTM circuit report on all communication circuits with the following information:	1. System generates the DTM circuit report.

. 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).

Test No: Factory-32/13A
10 June 1994

TEST NO: Factory-33A Page 1 of 6
TITLE: Operator's Console Color

APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that operates the Display operator's console and generates graphic displays.

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 the highest operator level.	1. System acknowledges password.
2. Command the system to generate alphanumeric monitor display of points by system or individual I/O points. (For example, request a monitoring display of an air handling unit (AHU).	2. Visually verify that the system an displays the following data in I/O fixed format: . Time of day (first field) unit (hours, minutes, seconds). . Date (first field) (month, day, year; i.e., 10/25/86).

Test No: Factory-33/1A
10 June 1994

TEST NO: Factory-33A Page 2 of 6
TITLE: Operator's Console Color

APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that operates the Display operator's console and generates graphic displays.

EVENT	EXPECTED RESULTS
GRAPHIC DISPLAY	
2. (continued)	
	. 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).
3. Command the system to list the graphic displays in the system.	3. System displays a list of graphic displays available to the operator. Verify list corresponds to contract documents.
4. Command the system to display a graphic from the prior list generated by the system.	4. Operator console displays fixed format information plus graphic display with associated live data.
5. Command the system to display all graphic symbols in the graphic symbols in the system library.	5. Visually verify the system standard displays all symbols required in the 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.

Test No: Factory-33/2A
10 June 1994

TEST NO: Factory-33A Page 3 of 6
TITLE: Operator's Console Color

APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that operates the Display operator's console and generates graphic displays.

EVENT	EXPECTED RESULTS
GRAPHIC DISPLAY	
5. (continued)	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. . 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 symbols to the Library.	6. System requests input.

Test No: Factory-33/3A
10 June 1994

TEST NO: Factory-33A Page 4 of 6
TITLE: Operator's Console Color

APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that operates the Display operator's console and generates graphic displays.

EVENT	EXPECTED RESULTS
GRAPHIC DISPLAY	
7. Enter custom symbols.	7. System accepts input.
8. Command the system to display all symbols.	8. Visually verify that all symbols, graphic 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 the I/O function Alphanumeric descriptors at selected locations on the graphic.	. System requests locations of I/O function and executes command. Visually verify descriptors are located.
. Command the system to display new connecting lines between designated points.	. Visually verify system displays lines between designated points on the graphic display.
. Command the system to position standard graphic symbols from system library at selected locations on the selected locations on the graphics.	. Visually verify system positions of graphic symbols at selected locations.
. Command the system to save the	. System acknowledges command and

display.	saves the display.

Test No: Factory-33/4A
10 June 1994

TEST NO: Factory-33A Page 5 of 6
TITLE: Operator's Console Color

APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that operates the Display operator's console and generates graphic displays.

EVENT	EXPECTED RESULTS
GRAPHIC DISPLAY	
9. (continued)	
. Initiate an alarm in the DE, not associated with the generated graphic.	. Alarm appears on the second field (color monitor) and prints on the alarm printer.
10. Modify a portion of the display previously stored. (For example, add a new value, a controller or sensor.) Identify sources of live data and location of their readouts. Command the system to save the display under a new name and graphic designation.	10. Visually verify system overlays new alphanumeric and graphics on the existing display. Display is saved under the new name.
11. Call up a Graphic Display with the latest data on a specific system. (For example, request the latest data on an air handling unit (AHU).	11. Visually verify system displays latest data as called for by the I/O Summary Tables, fully 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 designated graphic.	12. Verify system displays red blinking alarm(s) on the designated graphic.
13. Acknowledge alarm.	13. Verify system displays steady red alarms on the graphic.

14. Eliminate alarm condition.	14. Verify steady red alarms are no longer displayed.

Test No: Factory-33/5A
10 June 1994

TEST NO: Factory-33A Page 6 of 6
TITLE: Operator's Console Color
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that operates the Display operator's console and generates graphic displays.

EVENT	EXPECTED RESULTS
GRAPHIC DISPLAY	
15. Disconnect DTM associated with the display.	15. System displays data by graphic 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. example, display after an condition for the graphic.)	18. Graphic will be displayed automatically by events (For established in initial alarm conditions.
19. Command the system to duplicate the graphic, assign it a new name and save it.	19. System duplicates the graphic, assigns 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.

Test No: Factory-33/6A
10 June 1994

TEST NO: Factory-34A Page 1 of 2
TITLE: Control Sequences
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software that permits the creation and execution of control sequences for automated control of equipment 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 designated terminal.	1. CCU or COS loads and compiles program. System generates a hard copy listing with error messages.
2. Correct error via editor program. Verify hard copy output against contractor supplied document.	2. CCU or COS loads and compiles corrected program. System generates a hard copy listing.
3. Command the system to save the test program.	3. CCU or COS saves test program.

Test No: Factory-34/1A
10 June 1994

TEST NO: Factory-34A Page 2 of 2
TITLE: Control Sequences
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the software that permits the creation and execution of control sequences for automated control of equipment based on operational parameters, including those defined in the data base.

EVENT	EXPECTED RESULTS
4. Command the system to execute test sequence using FID or RTU test set. RTU test set.	4. System executes sequence and and displays output in the FID or Verify output against predicted results.
5. Command the system to change the sequence.	5. System requests modification.
6. Enter modification. Command the system to print out new sequence.	6. CCU or COS loads and compiles program with modification. Verify the hard copy listing contains the modifications.
7. Command the system to delete test control sequence.	7. System executes command.
8. Command the system to execute test sequence.	8. System indicates command cannot be executed because the sequence does not exist.
9. Command the system to display the space allocated for all sequences stored in the system.	9. System displays the storage storage space. Verify sufficient control storage is allocated by using the contractor's method of storing control sequences to determine storage space required.

Test No: Factory-34/2A
10 June 1994

TEST NO: Factory-35A Page 1 of 4
TITLE: Alarm Reporting
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the operation of the software which reports the alarm conditions with associated messages.

INITIAL CONDITIONS

1. The 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/MUX or ACU not responding.
   . FID or RTU/MUX or ACU responding (return to normal).
   . FID or RTU/CCU or COS DTM high error rate.
   . FID/MUX or RCU/ACU DTM Link high error rate.
. FID or RTU/CCU or 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 level that does not allow operator to enact automatic alarm silencing..	1. System acknowledges log on.

Test No: Factory-35/1A
10 June 1994

TEST NO: Factory-35A Page 2 of 4
TITLE: Alarm Reporting
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the operation of the software which reports the alarm conditions with associated messages.

EVENT	EXPECTED RESULTS
2. Initiate Class 1 and Class 2 alarms. alarms tested shall a minimum of two operational alarms and two I/O functions for selected FID/MUX or RCU/ACU. At random times throughout the test, initiate an alarm that can be easily distinguished (such as varying the pulse rate to cause an alarm on the pulse accumulator). Request secondary alarm messages for alarms.	2. System sounds audible alarm, Each class of displays Class 2 alarms on include operator's console and prints Class 1 and 2 alarms with the following data for each alarm: . Alarm identification. . Alarm class. . Date and time of occurrence. . Device or sensor type. . Limit exceeded (if analog selected 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 alarm. Secondary messages be assigned by the operator for printing.	3. System displays and prints selected secondary messages with a 60 shall character field for selected 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.

Test No: Factory-35/2A
10 June 1994

TEST NO: Factory-35A Page 3 of 4
TITLE: Alarm Reporting
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the operation of the software which reports the alarm conditions with associated messages.

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 alarms.	7. System prints updated status Class 1 report 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 updated Class 2 alarms.

10. System displays and prints status report and returns to normal operating mode.

Test No: Factory-35/3A
10 June 1994

TEST NO: Factory-35A Page 4 of 4
TITLE: Alarm Reporting
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the operation of the software which reports the alarm conditions with associated messages.

EVENT	EXPECTED RESULTS
11. Command the system to enable automatic silencing of a present specified alarm.	11. System will indicate that command cannot be executed at the operator access level.
12. Log off the system.	12. System acknowledges log off.
13. Log on with a password for an access level that enables the operator to activate automatic alarm silencing and/or initiate automatic acknowledgement of alarms.	13. System acknowledges log on.
14. Command the system to enable automatic audible alarm silencing of alarms.	14. System acknowledges and executes command.
15. Command the system to enable automatic acknowledgement of alarms.	15. System acknowledges and executes command.
16. Initiate alarm conditions.	16. System automatically acknowledges alarms.
17. Acknowledge Class 2 alarms requiring such acknowledgement.	17. Audible alarm ceases.
18. Eliminate Class 2 alarm conditions.	18. System prints return to normal.
19. Request display of primary and secondary alarm messages.	19. Verify that sufficient storage 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.

Test No: Factory-35/4A
10 June 1994

TEST NO: Factory-36A Page 1 of 4
TITLE: System Reaction to Commands, Real Time Data Base Updates and Alarms
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: to demonstrate that the system reaction time to changes of status, alarms reporting, and data base updates are within the specified limits.

INITIAL CONDITIONS

1. DE is set up to initiate a system of normal heavy load conditions as defined in the contract requirements (720 alarm conditions and 720 changes of state).

2. FIDs or RTUs and MUXs or ACUs are set up to initiate a system of normal heavy loads with all FIDs/MUXs or RCUs/ACUs and DTMs on line.
3. Test set is connected to a communications link.

4. Display the graphic with the points in which the alarms and response times are to be measured.

TEST EQUIPMENT

1. Stop watch with time intervals of 0.1 seconds.

EVENT	EXPECTED RESULTS
1. Command the system to display the digital and analog points normal heavy load conditions.	1. System displays status of status of selected points. selected to create
2. Initiate sufficient number of alarms changes to create successive occurrences of normal load conditions for a period time described in the for Events 3 and 4.	2. Verify the system displays the and status status changes and alarms which create normal heavy load heavy conditions. Verify FID or RTU of test set is connected to a specifications communications link.

Test No: Factory-36/1A
10 June 1994

TEST NO: Factory-36A Page 2 of 4
TITLE: System Reaction to Commands, Real Time Data Base Updates and Alarms
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: to demonstrate that the system reaction time to changes of status, alarms reporting, and data base updates are within the specified limits.

EVENT	EXPECTED RESULTS
2. (continued) (For example, normal heavy load conditions occur when there are three digital status changes, three digital alarms, three analog changes within the high and low limits, and three high or low limit analog alarms (AAs) per second and for successive one second intervals for up to 2 minutes. Fifty percent of the changes and alarms, including no less than one of each type, occur at a single FID/MUX or RCU/ACU, the remaining changes and alarms occur among the remaining FIDs/MUXs or RCUs/ACUs.)	
3. After the fifth second of the normal load conditions, initiate at least one analog alarm of each alarm class at a FIX/MUX or RCU/ACU not used in console the generation of the normal heavy load. Time the delay between the analog alarm occurrence at the FID/MUX or RCU/ACU and the display at the color monitor and observe that the time is printed with the occurrence of this alarm on the alarm printer.	3. The time delay between the initiation of the analog alarms and the initiation of the alarm display at the operator's console is no more than 10 seconds. Verify all alarms that occured during normal heavy load conditions are printed on the alarm printer. The total number of alarms printed will be 720 plus each each individual generated alarm. The time lagging from the first alarm printed to the last alarm printed will be 2

minutes. Verify data base update.

Test No: Factory-36/2A
10 June 1994

TEST NO: Factory-36A Page 3 of 4
TITLE: System Reaction to Commands, Real Time Data Base Updates and Alarms
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: to demonstrate that the system reaction time to changes of status, alarms reporting, and data base updates are within the specified limits.

EVENT	EXPECTED RESULTS
4. After the twentieth second of the heavy load conditions, initiate, at the FID/MUX or RCU/ACU, digital alarm not used in the generation of the normal heavy conditions on each type of DTM. the delays between the alarms occurrence and the display at the color monitor.	4. The time delay between the normal initiation of the digital alarm and initiation on the display at one the operator's console is no more than 10 seconds. Verify all load alarms are printed. Verify Time data base update.
5. After the fortieth second of the heavy load conditions, an analog alarm (AA) in a FID/MUX or RCU/ACU not used generation of the normal heavy each type of DTM link.	5. The time delay between the normal initiation of the analog alarm initiate and the display at the operators's console is no more in than 10 seconds. Verify all load on Alarms are printed. Verify data base update.
6. After the fifty-third second of the normal heavy load conditions, initiate a command to change the of a point in a FID/MUX or RCU/ACU not used in the generation of the normal heavy load. Time the delay between the issuance of the command to the FID/ no MUX or RCU/ACU in the DE and the processing, execution, and the the status change at the operator's console.	6. The system commences to process the operator's command within 5 seconds of command entry. status Visually verify that the time delay between the initiation of the command from the operator's console and the initiation of the command execution at the DE is more than 10 seconds. Visually verify that the time delay display of between the initiation of the command and display of status change at the operator's console is no more than 20

seconds, plus the response time
of the control device.

Test No: Factory-36/3A
10 June 1994

TEST NO: Factory-36A Page 4 of 4
TITLE: System Reaction to Commands, Real Time Data Base Updates and Alarms
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: to demonstrate that the system reaction time to changes of status, alarms reporting, and data base updates are within the specified limits.

EVENT	EXPECTED RESULTS
7. After the seventy-fifth second of the normal heavy load conditions, command the system to execute each of the following points not used in the generation of the normal heavy load. . Initiate reports. . Request graphic displays. . Modify time and event scheduling. . Modify analog limits. . Adjust setpoints of selected controllers. . Select manual or automatic control mode. . Enable and disable individual print; disabling shall take precedence over all other actions. . Enable and disable individual FID or RTU. . Enable and disable individual MUX or ACU. . Point definition.	7. The system commences to process operator's commands within 5 seconds of command entry. Verify all commands are executed.

Test No: Factory-36/4A
10 June 1994

TEST NO: Factory-37A Page 1 of 1
TITLE: Static Data Base Update
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To determine the ability of the CCU or COS during normal operation to update the DE parameters and the constraints to the static 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.

Test No: Factory-37A
10 June 1994

TEST NO: Factory-38A Page 1 of 3 TITLE: FID or RTU Software Programming APPLIES TO: Large/Medium EMCS/UMCS/UCS CCU REFERENCE: Proj. Spec. Paragraph ____	OBJECTIVE: To demonstrate that the FID or RTU executes FID or RTU software programs and/or FID or RTU programs downloaded from the or COS without CCU or COS intervention.

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 FID or RTU program. (For example, start and stop all HVAC equipment 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 via the editor. (This program called the test program hereafter.) Command the system generate hard copy output of program.	2. System generates output. Verify file a hard copy listing matches will be contractor supplied listing, and that system displays error to messages on known errors.

Test No: Factory-38/1A
10 June 1994

TEST NO: Factory-38A Page 2 of 3
TITLE: FID or RTU Software Programming
APPLIES TO: Large/Medium EMCS/UMCS/UCS
CCU REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate that the FID or RTU executes FID or RTU software programs and/or FID or RTU programs downloaded from the or COS without CCU or COS intervention.

EVENT	EXPECTED RESULTS
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 program on designated disk file.	4. System saves test program on disk test file.
5. Command the system to transfer software to the designated PROM or programmer or alternately download based software from the CCU or COS to the test set.	5. System transfers the FID or RTU RAM based software from the CCU COS to the FID or RTU test set or RAM PROMS are installed in the FID or RTU test set.
6. Initiate the debugging software to check program logic. Check output program against expected results test set.	6. System provides necessary information for the operator to of follow the execution of the using the program. Verify program output agrees with expected results.
7. Command the system to list and object code generated debugged program.	7. System generates a hard copy store the listing of the test program and for the stores program on disk.
8. Command the system to download to selected FID or RTU or the system to create a new PROM.	8. System downloads software to software selected FID or RTU or PROM and software installed in the selected FID or RTU.

Test No: Factory-38/2A
10 June 1994

TEST NO: Factory-38A Page 3 of 3
TITLE: FID or RTU Software Programming
APPLIES TO: Large/Medium EMCS/UMCS/UCS
CCU REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate that the FID or RTU executes FID or RTU software programs and/or FID or RTU programs downloaded from the or COS without CCU or COS intervention.

EVENT	EXPECTED RESULTS
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.

Test No: Factory-38/3A
10 June 1994

TEST NO: Factory-39A Page 1 of 3
TITLE: Command Priorities
TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To verify the system uses priority levels to prevent APPLIES interaction of a command of low priority with a command of higher 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 password that permits access to all command priorities, except Priority 4.	1. System acknowledges log-on.

Test No: Factory-39/1A
10 June 1994

TEST NO: Factory-39A Page 2 of 3
TITLE: Command Priorities
TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To verify the system uses priority levels to prevent APPLIES interaction of a command of low priority with a command of higher priority.

EVENT	EXPECTED RESULTS
2. Command the system to execute a 1 command (for example, start/stop) on selected equipment.	2. System executes the command. Priority Visually examine DE status scheduled changes.
3. Command the system to execute a 2 command that will interrupt the execution of the command (for example, cycling).	3. System executes the command. Priority Equipment formally controlled by the Priority 1 command is Priority 1 controlled by the Priority 2 duty 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 3 command (for example, demand limiting).	4. System executes the command. Priority Equipment formally controlled by 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 Priority 1 command.	5. System indicates command cannot be executed because current command has a higher command priority.

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

Test No: Factory 39/2A
10 June 1994

TEST NO: Factory-39A Page 3 of 3
TITLE: Command Priorities
TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To verify the system uses priority levels to prevent APPLIES interaction of a command of low priority with a command of higher priority.

EVENT	EXPECTED RESULTS
7. Command the system to execute a Priority 4 command. (For example, command the system to keep equipment in operation regardless of demand limit program.)	7. System indicates command cannot be executed at current operator access level.
8. Command the system to decrease limiting target to a level that will require the implementation of the "Fairness Doctrine" in the demand limiting program.	8. Verify that temperatures in all demand areas deviates equally from the level established operating setpoints.
9. Log off the system.	9. System acknowledges log-off.
10. Log on the system using an operator password that permits access to all commands.	10. System acknowledges log-on.
11. Command the system to execute a Priority 4 command. (For example, equipment to operate even current peak demand conditions would cause equipment shutdown under the Priority 3 command.)	11. System acknowledges and executes command. Visually verify the cause changes the operation of though equipment currently controlled by the Priority 3 command.

Test No: Factory-39/3A
10 June 1994

TEST NO: Factory-40A Page 1 of 2
TITLE: Calculated Point
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that creates new point values by performing mathematical operations on any values available in the system 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 point values based on predetermined data based values and mathematical operations (such as square roots and exponents).	1. System displays point calculated identification and values which correspond with predicted values. Display format is the same as any analog point format.
2. Command the system to change specified constants for computation of point values. Enter the new constant(s).	2. System acknowledges input.
3. Command the system to display revised calculated point values.	3. System displays new values for calculated points along with point identification. New values correspond with predicted results using the new constant(s).

Test No: Factory-40/1A
<u>10 June 1994</u>

TEST NO: Factory-40A Page 2 of 2
TITLE: Calculated Point
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that creates new point values by performing mathematical operations on any values available in the system data base.

EVENT	EXPECTED RESULTS
4. Command the system to stop communication with one of the DE points used in calculating the calculated point.	4. System generates alarms. The DE point and calculated point shows current data status.
5. Return the system to a normal operating mode.	5. The system returns to a normal operating mode.

Test No: Factory-40/2A
10 June 1994

TEST NO: Factory-41A Page 1 of 1
TITLE: Analog Monitoring
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate system capability to monitor all analog values, including calculated analog points.

INITIAL CONDITIONS

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

EVENT	EXPECTED RESULTS
1. Command the system to display analog points, including calculated points. values.	1. System acknowledges command and displays the analog points with analog their descriptors and alphanumeric
2. Command the system to change high and low limits alarm values for selected analog points.	2. System acknowledges data input.
3. Initiate a change of value of selected analog points at the FID/MUX or RCU/ACU within the high and low limits.	3. System displays value of new value of preselected points without alarm indication.
4. Initiate a change of value for selected analog points at the FID/MUX or RCU/ACU that will generate alarms, including an alarm for a calculated point.	4. System displays value of selected points and generates an alarm for each analog point in alarm.

Test No: Factory-41A
10 June 1994

TEST NO: Factory-42A Page 1 of 2 OBJECTIVE: To demonstrate
operation TITLE: Analog Totalization of software that transmits,
APPLIES TO: Large/Medium EMCS/UMCS/UCS displays, and totalizes analog
REFERENCE: Proj. Spec. Paragraph ____ values over a given time period.

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 and monitor selected designated analog points.	1. System acknowledges command displays alphanumeric values. Verify system display against known values.
2. Enter the point identification and time period for totalizing each Select different time period and time intervals so that at least three outputs occur in the the course of the test. Request system display of. totalized values	2. System executes analog totalization program at point. designated time periods for each point. For each designated point system 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 output against predetermined values.

Test No: Factory-42/1A
10 June 1994

TEST NO: Factory-42A Page 2 of 2
TITLE: Analog Totalization
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate operation of software that transmits, displays, and totalizes analog values over a given time period.

EVENT	EXPECTED RESULTS
3. Command the system to change end time period for each totalized point. Request system display of totalized values.	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.
4. Enter command for system display of analog totals for each time period.	4. Verify system display of analog totals matches expected results.

Test No: Factory-42/2A
10 June 1994

TEST NO: Factory-43A Page 1 of 2
TITLE: Energy Totalization
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the operation of software that totalizes eating energy consumption for each energy source.

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 energy totalization for selected points.	1. System acknowledges command, and requests point identification and time period for totalization for each point.
2. Enter system identification and time period for totalization. Select a different time period so totalization occurs at least three times in the course of the test period.	2. System executes energy totalization program at designated time periods for each that system.
3. At the end of the second time period, command the system to display totalization values for each point.	3. System displays the heat energy (in thousand Btu) consumed during the time period and the instantaneous rate in Btu/hr for each point. Verify system output against known values.

Test No: Factory-43/1A
10 June 1994

TEST NO: Factory-43A Page 2 of 2
TITLE: Energy Totalization
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ____

OBJECTIVE: To demonstrate the operation of software that totalizes eating energy consumption for each energy source.

EVENT	EXPECTED RESULTS
4. At a predetermined time during the third time period, command the system to change the end of period time for each totalized point.	4. System acknowledges command and terminates totalization for the third time period.
5. Enter command for energy data for the third period.	5. System displays energy totalization totalization values for the time shortened time period.

Test No: Factory-43/2A
10 June 1994

TEST NO: Factory-44A Page 1 of 1
TITLE: Prediction Software
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that performs an extrapolation on data into future of analog values based on past analog values.

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 curve defined in initial conditions. Command the system to predicted values.	1. System requests input data and for the time spacing of values to be extrapolated, and calculates display 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 the 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.

Test No: Factory-44A
10 June 1994

TEST NO: Factory-45A Page 1 of 1 OBJECTIVE: To demonstrate
operation TITLE: Extended Service Program of software that allows one-time
APPLIES TO: Large/Medium EMCS/UMCS/UCS extensions of timed equipment
REFERENCE: Proj. Spec. Paragraph _____ schedules.

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 programs for all equipment extended service program.	1. Visually verify equipment scheduled starts up according to the selected for the scheduled start times.
2. Prior to the scheduled stop time, appropriate inputs to extended service on some but not all of the equipment schedules.	2. Visually verify equipment shuts initiate down for schedules without request extended service request, while but equipment under extended service schedules remain in operation.
3. Command the system to modify the extended service program.	3. System requests identification of equipment and schedule.
4. Enter modified extended service programs for selected pieces of equipment.	4. System acknowledges input of all schedules and equipment. Visually of verify service change in the operation of equipment as a result of the modified programs.
5. Command the system to display the schedule for the equipment with the extended service program.	5. System displays start/stop start/stop schedule which shows that the extended service was a one time only extended schedule.

Test No: Factory-45A
10 June 1994

TEST NO: Factory-46A Page 1 of 1
TITLE: Scheduled Start/Stop Program Summer Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software to start and stop equipment based on time of day and day of week, including holidays.

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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 start/stop program for all equipment selected for the test.	2. System executes start/stop scheduled 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.

Test No: Factory-46A
10 June 1994

TEST NO: Factory-47A Page 1 of 1
TITLE: Scheduled Start/Stop Program Winter Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software to start and stop equipment based on time of day and day of week, including holidays.

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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 start/stop program for all equipment selected for the test.	2. System executes start/stop scheduled program with time delay between starts of equipment over 20 hp and 50 kW.
3. Start up and stop equipment manually unit by overriding the system controls.	3. Visually verify the system at the generates an alarm to indicate unauthorized starting or stopping of equipment.

Test No: Factory-47A
10 June 1994

TEST NO: Factory-48A Page 1 of 2
TITLE: Optimum Start/Stop Program - Summer Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software to start and stop equipment on a sliding schedule based on indoor and outdoor air conditions.

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 and required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 optimum start/stop program. Command system to display optimum start/stop report.	2. System executes the optimum start/stop program. Visually the verify the system displays start and stop times that match the predicted optimum start/stop times.

Test No: Factory-48/1A
10 June 1994

TEST NO: Factory-48A Page 2 of 2
TITLE: Optimum Start/Stop Program - Summer Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software to start and stop equipment on a sliding schedule based on indoor and outdoor air conditions.

EVENT	EXPECTED RESULTS
3. Manually attempt to change point from start to stop by the system controls.	3. System generates alarms and status indicates unauthorized overriding start or stop of equipment.
4. Change (decrease) space temperature setpoint (for cooling for start-up and command system to display equipment status.	4. Verify the system displays start times that match predicted systems) results (earlier start times than the previous start times).
5. Request printout of optimum report.	5. Verify output of optimum start/stop start/stop report corresponds with actual results.

Test No: Factory-48/2A
10 June 1994

TEST NO: Factory-49A Page 1 of 2
TITLE: Optimum Start/Stop Program - Winter Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software to start and stop equipment on a sliding schedule based on indoor and outdoor air conditions.

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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 optimum start/stop program. Command the system to display optimum start/stop report.	2. System executes the optimum start/stop program. Visually verify the system displays start and stop times that match the predicted optimum start/stop times.

Test No: Factory-49/1A
10 June 1994

TEST NO: Factory-49A Page 1 of 2
TITLE: Optimum Start/Stop Program - Winter Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software to start and stop equipment on a sliding schedule based on indoor and outdoor air conditions.

EVENT	EXPECTED RESULTS
3. Manually attempt to change point from start to stop by overriding the system controls.	3. System generates alarms and status indicates unauthorized start or stop of equipment.
4. Change (increase) space temperature setpoint (for heating systems) for start-up and command system to display equipment status.	4. Verify the system displays start times that match predicted results (earlier start times than previous the start times).
5. Request printout of optimum start/stop report.	5. Verify output of optimum start/stop report corresponds with actual results.

Test No: Factory-49/2A
10 June 1994

TEST NO: Factory-50A Page 1 of 2
TITLE: Duty Cycling Program - Summer Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that causes equipment shutdown for predetermined periods of time during building occupied hours in accordance with satisfying space 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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 duty cycling program. Command the system to display equipment status.	2. System executes the duty cycling program. Visually verify the DE 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.

Test No: Factory 50/1A
10 June 1994

TEST NO: Factory-50A Page 2 of 2
TITLE: Duty Cycling Program - Summer Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that causes equipment shutdown for predetermined periods of time during building occupied hours in accordance with satisfying space conditions.

EVENT	EXPECTED RESULTS
3. Initiate a change in space temperature to cause a visible 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 change in equipment and in system display of point status.
4. Enter command to change equipment cycle duration.	4. System requests equipment duty 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.

Test No: Factory-50/2A
10 June 1994

TEST NO: Factory-51A Page 1 of 2
TITLE: Duty Cycling Program - Winter Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that causes equipment shutdown for predetermined periods of time during building occupied hours in accordance with satisfying space 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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 duty cycling program. Command the system to display equipment status. display equipment status.	2. System executes the duty cycling program. Visually verify the DE 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.

Test No: Factory-51/1A
10 June 1994

TEST NO: Factory-51A Page 2 of 2
TITLE: Duty Cycling Program - Winter Operation
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that causes equipment shutdown for predetermined periods of time during building occupied hours in accordance with satisfying space conditions.

EVENT	EXPECTED RESULTS
3. Initiate a change in space temperature to cause a visible the duty cycling system selected equipment. (For example initiate a higher space temperature, resulting in longer "off" times for heating equipment.)	3. Visually verify a change in cycling times of selected change in equipment and in system display of of point status.
4. Enter command to change equipment cycle duration.	4. System requests equipment duty 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.

Test No: Factory-51/2A
10 June 1994

TEST NO: Factory-52A Page 1 of 3
TITLE: Demand Limiting Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that sheds electrical loads or peak demand control using prediction techniques to avoid 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.

Test No: Factory 52/1A
10 June 1994

TEST NO: Factory-52A Page 2 of 3
TITLE: Demand Limiting Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that sheds electrical loads or peak demand control using prediction techniques to avoid exceeding preestablished peak demand values.

EVENT	EXPECTED RESULTS
1. Compare list of program inputs and required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 are predicted to exceed peak demand target.	2. System executes demand limit program which sheds electrical 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 below limit such that some, but not all loads, are restored. Assign equipment constraints to some equipment in the DE so that the units be shed at the time the next target is exceeded.	3. System begins to restore shed target equipment. Verify the points representing the highest priority shed are restored before units of lower priority. Verify units cannot with equipment constraints demand assigned in Event 3 are not shed.
4. Decrease target and inhibit the interval" signal from the	4. System initiates load shed on "end-of- units with the lowest priority system

so that demand is computed by "sliding window" method.

that are still operating as in the Result 2. 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.

Test No: Factory-52/2A
10 June 1994

TEST NO: Factory-52A Page 3 of 3
TITLE: Demand Limiting Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that sheds electrical loads or peak demand control using prediction techniques to avoid exceeding preestablished peak demand values.

EVENT	EXPECTED RESULTS
5. Change the target in the demand limiting program operation from sliding window to time of day metering.	5. System executes demand limiting program for time of day metering.
6. Repeat Events 2 through 4 above each time of day target. Each of day program has the number different priority levels and required by the contract requirements.	6. System initiates control on points for representing loads as per Results time 2 through 4 for each of the of different priority levels, for targets each time of the day target.

Test No: Factory-52/3A
10 June 1994

TEST NO: Factory-53A Page 1 of 3
TITLE: Day-Night Setback Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that reduces the heating space temperature setpoint during unoccupied hours or raises the 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.

3. Equipment operation coincides with the test period.

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

EVENT	EXPECTED RESULTS
1. Compare list of program inputs and required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 to be in the night setback mode during winter season unoccupied period (heating mode).	2. Verify displayed status of equipment equipment operation and space temperatures match predicted results.

Command the system to display equipment status and space temperatures.

Test No: Factory-53/1A
10 June 1994

TEST NO: Factory-53A Page 2 of 3
TITLE: Day-Night Setback Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
during REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that reduces the heating space temperature setpoint unoccupied hours or raises the cooling space temperature setpoint during unoccupied hours.

EVENT	EXPECTED RESULTS
3. Initiate conditions causing heating to be in the daytime mode of operation during winter season occupied time period (heating mode). Command the system to display equipment status and space temperatures.	3. Verify displayed status of equipment equipment operation and space temperatures match predicted results (equipment is started and space temperatures increase to setpoint).
4. Command the system to modify day-night set-back program.	4. System requests equipment identification and input.
5. Enter equipment identification and input (for example, modify minimum occupied temperature). Command the system to place equipment with new input in the occupied mode.	5. System acknowledges input and new executes program in accordance with modified input. Selected equipment operation follows new program inputs.
6. Initiate conditions causing equipment to be in the setback mode during heating equipment unoccupied period (heating mode). Command the system to display equipment status and space temperatures.	6. Verify displayed status of heating equipment operation and space night temperatures match predicted results.
7. Initiate conditions which will cause night setback for cooling equipment during the summer	7. Verify displayed status of equipment matches predicted results (equipment is started and

season unoccupied period (cooling mode).	space temperatures are increased to unoccupied period setpoints).

Test No: Factory-53/2A
10 June 1994

TEST NO: Factory-53A Page 3 of 3
TITLE: Day-Night Setback Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that reduces the heating space temperature setpoint during unoccupied hours or raises the cooling space temperature setpoint during unoccupied hours.

EVENT	EXPECTED RESULTS
7. (continued) Command the system to display equipment status and space temperature.	
8. Initiate conditions causing cooling equipment to be in daytime mode of operation during summer season occupied period (cooling mode). Command the system to display status and space temperature.	8. Visually verify equipment is started and space temperatures are decreased to occupied period setpoints. Verify displayed status of equipment matches predicted results. equipment
9. Command the system to modify night setback program.	9. System requests equipment day-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 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 cause equipment matches predicted results (equipment is started and space temperatures are increased to unoccupied period setpoints).

Test No: Factory-53/3A
10 June 1994

TEST NO: Factory-54A Page 1 of 2
TITLE: Economizer Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that reduces HVAC system cooling equirements when the outside air (OA) dry bulb temperature is less 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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 cause outside air (OA) dampers to closed or in minimum position (for example, when OA dry bulb is greater than the specified changeover temperature).	2. System commands OA damper to be in closed or minimum position. be fully Verify system display of status of OA dampers agrees with predicted results.

Test No: Factory-54/1A
10 June 1994

TEST NO: Factory-54A Page 2 of 2
TITLE: Economizer Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that reduces HVAC system cooling equirements when the outside air (OA) dry bulb temperature is less than the required mixed air temperature of HVAC System.

EVENT	EXPECTED RESULTS
3. Initiate conditions which will outside air (OA) dampers to be control (for example, OA dry bulb is less than the changeover temperature return air temperature).	3. System commands outside air cause dampers to be under local loop under local control to maintain mixed air when temperature status of the OA specified dampers (open). Visually verify and point output on damper position agrees with predicted results.
4. Modify changeover temperature setpoint and repeat Events 2 and 3.	4. System commands OA as in Events 2 and 3 at the new changeover temperature.

Test No: Factory-54/2A
10 June 1994

TEST NO: Factory-55A Page 1 of 3
TITLE: Ventilation - Recirculation Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that reduces the HVAC system thermal load during warm-up or cool-down cycles prior to occupancy of the building and unoccupied 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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 warm-up cycle: . Winter season. . Unoccupied period.	2. Visually verify OA dampers remain closed when HVAC equipment is started. Verify system displays the status of the dampers to be closed and status of fans to be on.

Test No: Factory-55/1A
10 June 1994

TEST NO: Factory-55A Page 2 of 3
TITLE: Ventilation - Recirculation Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that reduces the HVAC system thermal load during warm-up or cool-down cycles prior to occupancy of the building and unoccupied periods.

EVENT	EXPECTED RESULTS
2. (continued) . 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.	
3. Initiate conditions causing occupied space temperature to reach desired levels prior to occupancy . 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.	3. Verify OA air dampers and HVAC equipment are placed under local loop control. Verify system time. displays status of dampers to be under local loop control.
4. Initiate conditions causing a cool-down cycle during period prior to occupied period. . Cooling season. Unoccupied period. . OA temperature is below a predetermined value that would initiate the starting of equipment	4. Verify OA air dampers are closed and HVAC equipment is started. Verify system displays status of OA relief air dampers to be closed and status of fans to be . on.

to meet the space temperature
setpoints at the time of occupancy.

Test No: Factory-55/2A
10 June 1994

TEST NO: Factory-55A Page 3 of 3
TITLE: Ventilation - Recirculation Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that reduces the HVAC system thermal load during warm-up or cool-down cycles prior to occupancy of the building and unoccupied periods.

EVENT	EXPECTED RESULTS
5. Initiate conditions that will require the OA damper to be placed under local loop control during the prior to the occupied time. under local loop control. . 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.	5. Verify OA dampers and HVAC equipment are placed under local loop control. Verify system period displays status of dampers to be
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).	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.

Test No: Factory-55/3A
10 June 1994

TEST NO: Factory-56A Page 1 of 2
TITLE: Hot Deck - Cold Deck Temperature Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that resets the hot deck-cold deck temperatures in dual duct and multizone HVAC systems to minimize the temperature differential between the hot and cold deck temperature.

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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 temperature dry bulb setpoints for each zone so that the hot deck and deck temperature reset is required. Command the system to hot deck and cold deck temperatures.	2. System executes the hot and cold deck temperature reset program to maintain zone space dry bulb cold setpoints. Visually verify hot deck and cold deck discharge display temperatures are reset upwards in accordance with expected results.
3. Initiate a change in space dry bulb temperature downwards for each zone	3. Visually verify hot deck and cold deck discharge temperatures so

that hot and cold deck temperature reset is required. Command the system to display hot deck and cold deck temperatures.

decrease in accordance with expected results.

Test No: Factory-56/1A
10 June 1994

TEST NO: Factory-56A Page 2 of 2
TITLE: Hot Deck - Cold Deck Temperature Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that resets the hot deck-cold deck temperatures in dual duct and multizone HVAC systems to minimize the temperature differential between the hot and cold deck temperature.

EVENT	EXPECTED RESULTS
4. Initiate an increase in space dry temperature and humidity setpoints for the zone with the maximum heating requirements.	4. Visually verify hot deck bulb temperature is reset upwards in accordance with expected results. Visually verify cold deck temperature is not reset.
5. Initiate a decrease in space dry and humidity setpoints for the zone with the maximum cooling requirements.	5. Visually verify cold deck bulb temperature is reset downwards in accordance with expected results. Visually verify hot deck temperature is not reset.

Test No: Factory-56/2A
10 June 1994

TEST NO: Factory-57A Page 1 of 2
TITLE: Reheat (RHT) Coil Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that selects the zone requiring the least amount of reheat and resets the cold deck discharge temperature to equal the discharge temperature of the zone with the 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 outputs required in the contract documents against the contractor contractor supplied input/output.	1. Contractor supplied program inputs/outputs may include all those inputs/outputs in the the 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 setpoints in all zones to be above initial cold deck discharge temperature setpoint so that reheat required in all zones.	2. System executes the reheat coil discharge program to reset cold the deck discharge temperature upwards until a reheat coil in the zone is with lowest space temperature setpoint is fully closed. In other zones with higher reheat requirements, reheat coil valves are partially open.

Test No: Factory-57/1A
10 June 1994

TEST NO: Factory-57A Page 2 of 2
TITLE: Reheat (RHT) Coil Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
discharge REFERENCE: Proj. Spec. Paragraph _____
discharge

OBJECTIVE: To demonstrate the software that selects the zone requiring the least amount of reheat and resets the cold deck temperature to equal the temperature of the zone with the lowest reheat demand.

EVENT	EXPECTED RESULTS
3. Initiate a change in the space setpoint upwards for the zone with the reheat coil that fully closed, so that the setpoint is higher than all other zones. Command the system to equipment status.	3. Verify that the cold deck temperature discharge temperature is further increased until the reheat is coil valve for the zone with the current lowest space temperature setpoint is fully closed. display Visually verify sequence of equipment operation, and verify system display of final status agrees with predicted results.
4. Initiate a change in the space setpoint downwards to zone with the reheat coil that is fully closed so that the temperature setpoint is below all zones. Command the system to equipment status.	4. Verify that the cold deck temperature discharge temperature is reduced the until the cold deck discharge temperature equals the discharge temperature of the zone with the other lowest reheat demand. Visually display verify sequence of equipment operation, and verify system display of final status agrees with predicted results.
5. Repeat Events 2, 3, and 4 with dry and humidity setpoints. Command the system to display equipment status.	5. Visually verify that the cold deck bulb reset program resets the cold deck discharge temperature until the 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.

Test No: Factory-57/2A
10 June 1994

TEST NO: Factory-58A Page 1 of 2
TITLE: Steam Boiler Selection Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that selects the most efficient boiler or combination of boilers based on boiler operating data to satisfy the heating load.

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 shutdown 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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 heating requirements. Command the system to display boiler status and operating efficiency.	2. System executes steam boiler selection program for minimum heating requirements using the and 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.

Test No: Factory-58/1A
10 June 1994

TEST NO: Factory-58A Page 2 of 2
TITLE: Steam Boiler Selection Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that selects the most efficient boiler or combination of boilers based on boiler operating data to satisfy the heating load.

EVENT	EXPECTED RESULTS
3. Input a revised set of analog establish a trend higher, but not maximum, output requirements, requiring boiler operation. Command system to display boiler status operating efficiency.	3. Boilers that most efficiently values that satisfy higher heating towards requirements are enabled and/or steam loaded. Verify the system display multiple of status on boilers and operating the efficiency corresponds with and predicted results.
4. Input revised analog values that show a trend towards maximum steam requirements.	4. Boilers that most efficiently satisfy maximum heating output 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 lower steam plant output.	5. Verify system display of status on boilers and operating efficiency corresponds with predicted results. System discontinues the operation of boilers not required to meet load.

Test No: Factory-58/2A
10 June 1994

TEST NO: Factory-59A Page 1 of 2
TITLE: Hot Water (HW) Boiler Selection Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that select the most efficient boiler or combination of boilers based on boiler operating data to satisfy the heating load.

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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 requirements. Command the system to display boiler status and operating efficiency.	2. System executes HW boiler heating selection program for minimum heating requirements using the available 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.

Test No: Factory-59/1A
10 June 1994

TEST NO: Factory-59A Page 2 of 2
TITLE: Hot Water (HW) Boiler Selection Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that select the most efficient boiler or combination of boilers based on boiler operating data to satisfy the heating load.

EVENT	EXPECTED RESULTS
3. Input a revised set of analog values establish a trend towards higher HW output requirements, requiring multiple boiler operation. Command the system to display boiler status and operating efficiency.	3. Boilers that most efficiently that satisfy higher heating requirements are enabled and/or loaded. Verify the system display of status on boilers and operating efficiency corresponds with predicted results.
4. Input revised analog values that trend towards higher HW requirements.	4. Boilers that most efficiently show a satisfy maximum heating output 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 lower steam plant output.	5. Verify system display of status on boiler and operating efficiency corresponds with predicted results. System discontinues the operation of boilers not required to meet load.

Test No: Factory-59/2A
10 June 1994

TEST NO: Factory-60A Page 1 of 2
TITLE: Hot Water (HW) OA Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that resets the HW temperature supplied by the boiler or converter in accordance with the outside air (OA) temperature.

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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 reduction and increases in the outside air temperature. Command system to display HW supply temperature and outside air temperature for different OA temperatures.	2. System executes the hot water OA reset program which calculates HW reset temperature in accordance the with reset schedule. Verify system display of HW supply temperature in the corresponding OA temperature agrees with predicted results.

Test No: Factory-60/1A
10 June 1994

TEST NO: Factory-60A Page 2 of 2
TITLE: Hot Water (HW) OA Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that resets the HW temperature supplied by the boiler or converter in accordance with the outside air (OA) temperature.

EVENT	EXPECTED RESULTS
3. Initiate condition causing minimum maximum OA conditions. match	3. System executes the OA reset and program. Verify system display for maximum and minimum HW temperatures those in the reset schedule.
4. Change OA reset schedule and repeat and 3.	4. Verify that the results Events 2 Corresponds to Results 2 and 3.

Test No: Factory-60/2A
10 June 1994

TEST NO: Factory-61A Page 1 of 3
TITLE: Chiller Selection Program
TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that selects the most efficient APPLIES chiller or combination of chillers based on chiller operating profile 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 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.

Test No: Factory-61/1A
10 June 1994

TEST NO: Factory-61A Page 2 of 3
TITLE: Chiller Selection Program
TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that selects the most efficient APPLIES chiller or combination of chillers based on chiller operating profile data to satisfy the cooling load using prediction techniques to match chiller capacity with the predicted load.

EVENT	EXPECTED RESULTS
2. Initiate conditions causing a for minimum cooling requirements. Command the system to of chillers, CHW and condenser water pumps.	2. System executes the chiller demand selection program for minimum cooling requirements of the display status 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.
3. Input a revised set of analog that establish a trend towards maximum CHW plant output output requirements.	3. Chillers that most efficiently values 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.
4. Input analog values that show a towards maximum CHW plant requirements. Command the system to display chiller and associated pump status.	4. Chillers that most efficiently trend satisfy maximum cooling output 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.
Verify there is a

Test No: Factory-61/2A
10 June 1994

TEST NO: Factory-61A Page 3 of 3
TITLE: Chiller Selection Program
TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that selects the most efficient APPLIES chiller or combination of chillers based on chiller operating profile data to satisfy the cooling load using prediction techniques to match chiller capacity with the predicted load.

EVENT	EXPECTED RESULTS
	4. (continued) 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 lower CHW plant output. Command the system to display chiller and associated pump status.	5. Verify system display of status on chillers and pumps agree with predicted results. If chiller(s) are shut down, verify shutdown procedure is in accordance with the chiller manufacturer's requirements.
6. Input analog values that predict minimum CHW plant output. Command the system to display chiller and associated pump status.	6. Verify system display of status on chillers and pumps agree with predicted results. If chiller(s) 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.

Test No: Factory 61/3A
10 June 1994

TEST NO: Factory-62A Page 1 of 2 TITLE: Chilled Water (CHW) Temperature Reset Program APPLIES TO: Large/Medium EMCS/UMCS/UCS REFERENCE: Proj. Spec. Paragraph _____	OBJECTIVE: To demonstrate the software that resets the CHW temperature supplied by a water chiller in accordance with space temperature and humidity 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 outputs required in the contract documents against the contractor supplied input/output.	1. Contractor supplied program and 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 decreases in zone space temperatures (or CHW valve position) and relative humidity (RH) setpoints require the lowest CHW supply temperature. Command the system to display CHW supply temperature.	2. System executes the CHW reset program. The CHW supply temperature is reset to the that minimum level. Verify the system display of CHW Temperature agrees with predicted results.

Test No: Factory-62/1A
10 June 1994

TEST NO: Factory-62A Page 2 of 2
TITLE: Chilled Water (CHW) Temperature Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that resets the CHW temperature supplied by a water chiller in accordance with space temperature and humidity requirements.

EVENT	EXPECTED RESULTS
3. Initiate increases in zone space relative humidity (RH) and space temperature (or CHW valve position). Command the system to display CHW temperature.	3. CHW supply temperature is reset upwards to satisfy new space temperature and relative humidity (RH) setpoints. Verify system supply display of CHW temperature agrees with predicted results.
4. Initiate an increase in all space temperature (or CHW valve position) and humidity setpoints that require the maximum CHW supply temperatures. Command the system to display CHW supply temperature.	4. CHW supply temperature is reset to its maximum value. Verify system display of CHW temperature agrees with predicted results.

Test No: Factory-62/2A
10 June 1994

TEST NO: Factory-63A Page 1 of 2
TITLE: Condenser Water Temperature Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that resets the operating chiller condenser water temperature from a fixed temperature downward when the OA wet bulb temperature will produce a lower 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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 will produce a lower condenser water temperature. Command the system to display the condenser water temperature.	2. System executes the condenser that water supply temperature reset program. The program compares OA wet bulb with condenser water supply 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.

Test No: Factory-63/1A
10 June 1994

TEST NO: Factory-63A Page 2 of 2
TITLE: Condenser Water Temperature Reset Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that resets the operating chiller condenser water temperature from a fixed temperature downward when the OA wet bulb temperature will produce a lower condenser water temperature.

EVENT	EXPECTED RESULTS
3. Initiate OA wet bulb to fall to a value that will produce a temperature below the minimum allowable condenser water temperature.	3. Program resets condenser water controller setpoint to a minimum allowable value and no lower. Verify the system display of condenser water temperature agrees with predicted results.

Test No: Factory-63/2A
10 June 1994

TEST NO: Factory-64A Page 1 of 2 OBJECTIVE: To demonstrate software TITLE: Chiller Demand Limit Program that limits the maximum available APPLIES TO: Large/Medium EMCS/UMCS/UCS chiller capacity when commanded by REFERENCE: Proj. Spec. Paragraph _____ the demand limiting program.

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 outputs required in the contract documents against the contractor supplied input/output.	1. Contractor supplied program and 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 conditions causing the system to execute the chiller demand limit program (for example, cause demand to exceed peak demand target).	2. Verify the maximum cooling capacity of chiller is reduced to the preassigned fixed step. Verify system display of status of available chiller capacity agrees with predicted results.

Test No: Factory-64/1A
10 June 1994

TEST NO: Factory-64A Page 2 of 2 OBJECTIVE: To demonstrate software TITLE: Chiller Demand Limit Program that limits the maximum available APPLIES TO: Large/Medium EMCS/UMCS/UCS chiller capacity when commanded by REFERENCE: Proj. Spec. Paragraph _____ the demand limiting program.

EVENT	EXPECTED RESULTS
3. Initiate conditions causing the highest demand limit priority step chiller fixed capacity to be (for example, continue to increase demand until highest priority step of chiller fixed capacity is shed).	3. Verify that the available maximum cooling capacity is reduced for of each additional fixed step activated reduction.
4. Initiate conditions causing chiller fixed capacity to be restored when the demand is reduced.	4. Verify the maximum cooling capacity of the total system is on-line restored. Verify system display of status of available chiller capacity agrees with predicted results.

Test No: Factory-64/2A
10 June 1994

TEST NO: Factory-65A Page 1 of 1
TITLE: Lighting Control Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that turns equipment on and off based on the time of day and the day of week, including holidays.

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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 be turned on. Command the system to display status of systems.	2. System executes lighting control to program. Lighting systems start up in accordance with the lighting equipment schedule. Verify system indicates which lighting systems are off.
3. Manually disable selected points simulate the activity of off lights locally.	3. System displays alarms for each to simulated lighting system turning locally turned off.

Test No: Factory-65A
10 June 1994

TEST NO: Factory-66A Page 1 of 2
TITLE: Remote Boiler Monitoring and Control Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that monitors boiler operation and discontinues boiler operation if any monitored point exceeds a predetermined value or change status.

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 required in the contract documents against the contractor input/output.	1. Contractor supplied program outputs inputs/outputs may include all those inputs/outputs in the supplied 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 least one of the inputs to exceed the maximum or minimum allowed value (such as water level) and one of the digital inputs to change status (such as flame failure).	2. Visually verify system discontinues boiler operation.

3. Delete all analog inputs which caused the system to discontinue operation. Manually restart boiler.	3. Points are deleted from display. System indicates boiler is in boiler operation.

Test No: Factory-66/1A
10 June 1994

TEST NO: Factory-66A Page 2 of 2
TITLE: Remote Boiler Monitoring and Control Program
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate software that monitors boiler operation and discontinues boiler operation if any monitored point exceeds a predetermined value or change status.

EVENT	EXPECTED RESULTS
4. Add a new analog input whose value will cause the system to discontinue operation.	4. System accepts new value. Verify system discontinues boiler boiler operation.

Test No: Factory-66/2A
10 June 1994

TEST NO: Factory-67A Page 1 of 1
TITLE: *Custom Programs
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate custom program software performs in accordance with the contract requirements.

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 required in the contract documents against the contractor supplied input/output.	1. Contractor supplied program outputs 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 each custom program.	2. Verify program output corresponds with expected results.

*This test is used for programs that are added to the programs listed in the guide specification.

Test No: Factory-67A
10 June 1994

TEST NO: Factory-68A Page 1 of 2
TITLE: FID or RTU Stand-Alone Mode
APPLIES TO: Large/Medium EMCS/UMCS/UCS
resident REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that performs FID or RTU functions and FID or RTU applications programs using data 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 or RTU.

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 application programs the FID or RTU against the required list on the contract documents.	1. Verify the contractor's supplied list of list matches the list in the resident in contract documents.

Test No: Factory-68/1A
10 June 1994

TEST NO: Factory-68A Page 2 of 2
TITLE: FID or RTU Stand-Alone Mode
APPLIES TO: Large/Medium EMCS/UMCS/UCS
resident REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the software that performs FID or RTU functions and FID or RTU applications programs using data obtained from the DE and based upon the FID or RTU RTC.

EVENT	EXPECTED RESULTS
2. Initiate operation of each of the or RTU resident application at the operator's console. period of time for load demonstrate all FID or RCU resident programs as specified.)	2. System requests input parameters FID appropriate to the application programs program. Verify equipment (Select a operates in accordance with rolling to expected results when FID or RTU is in communications with the communication with the central system.
3. Initiate a communication failure between the central system and the FIDs or RTUs. Allow stand-alone mode to continue for day, one holiday, and one of a continuous 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.	3. Application programs resident in the FID or RTU operate in the selected stand-alone mode. Visually verify simulated equipment operates in week accordance with stand-alone weekend application programs.
4. At the end of a simulated eight-day initiate communication between the FID or RTU and CCU or COS.	4. Verify equipment operates in period re-accordance with expected results when FID or RTU is in communication with the central system.

Test No: Factory-68/2A
10 June 1994

TEST NO: Factory-69A Page 1 of 1
TITLE: FID or RTU Stand-Alone Load Rolling Function
APPLIES TO: Large/Medium EMCS/UMCS/UCS
MUX or REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate the stand-alone software that implements a load-rolling sequence at each FID or RTU including associated ACU panels in the FID or RTU non-communication mode and 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 between the FID or RTU and CCU or COS.	1. FID or RTU resident load rolling function controls equipment. 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.

Test No: Factory-69A
10 June 1994

TEST NO: Factory-70A Page 1 of 1
TITLE: Telephone Modem
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To demonstrate that the modem is interfaced to the CCU or COS phone system.

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 (not connected to the system) call the system and log on using an unauthorized password.	1. System does not allow log on.
2. Repeat Event 1, using an authorized password.	2. System allows log on through dial up modem.
3. Issue typical commands suitable for type of monitor and password.	3. System executes commands.
4. Log off system.	4. System logs off monitor.
5. Manual originates call from system to remote terminal.	5. System opens communication with 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.

Test No: Factory-70A
10 June 1994

TEST NO: Factory-71A Page 1 of 1
TITLE: *Special Tests
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph ______

OBJECTIVE: To demonstrate special tests in accordance with the contract requirements.

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 outputs required in the contract documents against the contractor supplied input/output.	1. Contractor supplied test inputs/outputs may include all those inputs/outputs in the 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 special test.	2. Verify test output corresponds with expected results.

*This test is used for tests that are added to the tests listed in the guide specification.

Test No: Factory-71A
10 June 1994

TEST NO: Factory-72A Page 1 of 1
TITLE: Final System Equipment Verification
APPLIES TO: Large/Medium EMCS/UMCS/UCS
REFERENCE: Proj. Spec. Paragraph _____

OBJECTIVE: To verify that the hardware components of the system provided by the contractor are in accordance with the contract plans and specifications and all approved 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 component should be examined and checked against the model numbers of the equipment provided by the contractor.	1. Model numbers of equipment provided shall match the model numbers of approved equipment on the approved submittals.

Test No: Factory-72A
10 June 1994

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 factory tests for EMCS, UMCS, and UCS. These tests are to be used to assure that the physical and performance requirements of guide specifications for EMCS, UMCS, and UCS 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 Data Item Descriptions (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 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph Tailoring	DID Number	Suggested DID Title
4.2 and ---- 4.2.1	DI-ATTS-80360A	Energy Monitoring and Control Systems (EMCS) Factory Test Plans
4.3, 4.3.1 ----	DI-ATTS-80361A and 5.1	Energy Monitoring and Control Systems (EMCS) Factory Test Procedures
4.4 and ---- 4.4.1	DI-ATTS-80362A	Energy Monitoring and Control Systems (EMCS) Factory Test 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.

Analysis procedures

Verification plans and reports
Unitary command unit
Utility computer command unit

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-0025)