7A Design Response to Appendix B, ABWR LRB Instrumentation and Controls

7A.1 Introduction

The instrumentation and control (I&C) systems of the ABWR use state-of-the-art fiber optic-based communication equipment and computer controls.

In Appendix B to the GE Advanced Boiling Water Reactor Licensing Review Bases (LRB), dated August, 1987, the NRC staff indicated that guidance in this area had not been developed. However, GE committed to address the standards and criteria currently specified in the SRP, and to use the documents and criteria identified in Appendix B.

The NRC requested considerable additional information specific to this equipment in Appendix B. The NRC requests, along with responses as revised, are provided in this appendix to Chapter 7.

A Failure Modes and Effects Analysis (FMEA) of the Essential Communication Functions (ECFs) is provided in Appendix 15B.

[*The following two Items must be addressed when any change is made in the commitments of the ECFs and Safety Systems Logic and Control (SSLC) systems designs:*

(1) *Table 10 of DCD/Introduction identifies the commitments for ECFs performance specifications and architecture which, if changed, requires NRC Staff review and approval prior to implementation. The applicable portions of the Tier 2 sections and tables, identified on Table 10 of DCD/Introduction for this restriction, are italicized on the sections and tables themselves.*

(2) *Table 11 of DCD/Introduction identifies the commitments for SSLC systems hardware and software qualification which, if changed, requires NRC Staff review and approval prior to implemtentation. The applicable portions of the Tier 2 sections and tables, identified on Table 11 of DCD/Introduction for this restricition, are italicized on the sections and tables themselves.*]*

7A.2 [*Multiplexing Systems*

NRC Request (1)—*Provide a complete list of components (pumps, valves, etc.) whose actuation, interlock, or status indication is dependent on the proper operation of each Class 1E multiplexer.*

Revised Response (1)—*Class 1E multiplexers are not used in more modern I&C systems. Safety-related data communication is performed as an integral function of the SSLC systems. A*

* See Section 3.5 of DCD/Introduction.

typical list of components whose actuation, interlock, or status indication depends on the proper operation of SSLC equipment implementing these essential communication functions (ECFs) is provided as Table 7A-1. It was obtained by extraction from an early version of the ABWR I/O database which reflects information available that was on the system P&ID and IBD drawings at the time of design certification. The inventory of components satisfying this criteria is subject to change as the detailed design is implemented.

NRC Request (2)—*For the components cited above, describe the means of remote or local control (other than by cutting wires or jumpering) that may be employed should the multiplexer fails.*

Revised Response (2)—*Class 1E multiplexers are not used. Safety-related data communication is performed as an integral function of the SSLC systems. All Class-1E SSLC hardware is designed to meet the single-failure criteria. Systems which employ such hardware have redundant divisions of equipment such that no single failure of any SSLC component, including those implementing the ECFs, could jeopardize any safety system action. In addition, local control is provided, via the Remote Shutdown System, to bring the reactor to shutdown conditions in event of multiple safety system failures or evacuation of the control room. The Remote Shutdown System is hard-wired and therefore provides diversity to the SSLC interfaces.*

NRC Request (3)—*Describe the multiplexer pre-operational test program.*

Revised Response (3)—*Multiplexers are not used. Safety-related data communication is performed as an integral function of the SSLC systems. Non-safety data communication is performed by the Plant Data Network (PDN) and dedicated system level communication links. The pre-operational test program will test the data communication functions (DCFs) concurrently with instrumentation and control functional loop checks. As each input to an input/output (I/O) device is simulated using a suitable input device, the required outputs shall be verified correct. In this manner, all hardware and software are confirmed concurrently.*

Equipment verifications of the individual I/O devices are performed at the factory and typically include detailed component level tests which require special test apparatus and technical expertise. Any malfunctioning not found during factory testing will be detected during pre-operational tests of instrument loops.

Preoperational testing includes instrument loop checks and calibration verification tests as described in ANSI/IEEE-338. Factory testing includes response time verification tests on the digital logic processing equipment.

In addition to the testing described above, tests shall be developed to verify system electrical independence (ITAAC Table 3.4 Item 3).

NRC Request (4)—*Describe the test and/or hardware features employed to demonstrate fault tolerance to electromagnetic interference.*

Revised Response (4)*—One major deterrence to electromagnetic interference (EMI) in the ECFs is the use of fiber optic data links as the transmission medium. Optical fiber, being a non-electrical medium, has the inherent properties of immunity to electrical noise (EMI, radio frequency interference (RFI), and lightning), point-to-point electrical isolation, and the absence of conventional transmission line effects. Fiber optic media is also unaffected by the radiated noise from high voltage conductors, by high frequency motor control drives, and by transient switching pulses from electromagnetic contactors or other switching devices.*

However, the electrical-to-optical interface at the transmitting and receiving ends must still be addressed to ensure complete immunity to EMI. The control equipment containing the electrical circuitry use standard techniques for shielding, grounding, and filtering and are mounted in grounded equipment panels provided with separate instrument ground buses. Panel location, particularly in local areas, is carefully chosen to minimize noise effects from adjacent sources. The use of fiber optic cables ensures that current-carrying ground loops will not exist between the control room and local areas.

The use of redundancy provides the other major deterrence to EMI effects. The divisions are independent and will run asynchronously with respect to each other with limited communication between divisions. This arrangement provides fault tolerance to EMI or other noise occurring in isolated locations.

During normal operation, data communication performance will be monitored by online diagnostic tests such as parity checks, checksum verification, or the reception of a keep-alive signal.

As part of the equipment qualification test program [see Request (3)], the equipment qualification type test specimen will be subjected to EMI testing. EMI and RFI test measurements will be developed using the guidelines described in ANSI/IEEE-C63.12, "American National Standard for Electromagnetic Compatibility Limits—Recommended Practice." For testing susceptibility to noise generation from portable radio transceivers, tests will be developed from ANSI/IEEE-C37.90.2, "IEEE Trial-Use Standard, Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers." Section 5.5.3 of this standard describes tests for digital equipment using clocked logic circuits.

The type test specimen will be required to demonstrate immunity to the defined conducted and radiated tests. Units shall also comply with standard surge withstand capability tests, as follows:

- *(a) ANSI/IEEE-C62.41—"Guide for Surge Voltages in Low-Voltage AC Power Circuits."*
- *(b) ANSI/IEEE-C62.45—"Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."*

The interconnecting fiber optic links of the SSLC systems are not subject to EMI effects.

For design guidance and additional test development guidance, the following military standards shall be used:

(a) MIL-STD-461E—"Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference."

(b) Not Used

Due to the comprehensive nature of these documents, their applicability to ground, airborne, and shipboard equipment, and the differences in requirements for the Army, Navy and Air Force, the use of these standards shall be limited to the susceptibility requirements and limits for class A3 equipment and subsystems (ground, fixed). Within these limits, the guidelines for Army procurements only shall be used. Tests for transmitting and receiving equipment, power generators, and special purpose military devices are not applicable.

[*To facilitate achieving electromagnetic compatibility (EMC) compliance, system and equipment grounding and shielding practices will follow the guidance of the standards listed below:*

(a) IEEE Std. 518, "Guide for the Installation of Electrical Equipemnt to Minimize Electrical Noise Inputs to Controllers from External Sources."

(b) IEEE Std. 1050, "Guide for Instrumentation and Control Equipment Grounding in Generating Stations."*]

***NRC Request (5)**—Describe the interconnection, if any, of any Class 1E multiplexer to non-Class 1E devices such as the plant computer.*

***Revised Response (5)**—Class 1E multiplexers are not used. Safety-related data communication is performed as an integral function of the SSLC systems. The interconnection of Class 1E communication devices to non-Class 1E devices is done using fiber optic cable. The fiber optic cable will provide the necessary isolation.*

Non-Class 1E devices are connected to a buffer module (memory storage module). Information is stored in this module by 1E communication interface equipment for access by the non-Class 1E devices, thus preventing any interruption by Non 1E devices on the 1E communication functions.

***NRC Request (6)**—Describe the online test and/or diagnostic features that may be employed, including any operator alarms/indicators and their locations.*

***Revised Response (6)**—Continuously operating diagnostics check all data transmissions and provide operators with fault information and fault location through alarms. The diagnostics operation or its failure cannot harm the operation of the safety systems.*

The test and diagnostic features including operator alarms and location are detailed as follows:

* See Section 7A.1(2) and 7A.1(1).

- *Self-diagnostics and periodic testing locates a fault down to the processing module level and provides positive local identification of the failed device.*
- *A periodic test feature verifies proper operation of the ECFs.*
- *Detection of fatal (affects signal transmission) and non-fatal (does not affect signal transmission) errors is annunciated. Operators are informed on the type of malfunction and its location.*
- *Self-diagnostics are continuous. System end-to-end test is initiated as an off-line test in one division at a time.*
- *Indication of test results (pass, fail) is provided.*
- *The diagnostic function does not degrade system reliability. The diagnostic function will not cause actuation of the driven equipment.*

NRC Request (7)—*Describe the multiplexer power sources.*

Revised Response (7)—*Multiplexers are not used. Safety-related data communication is performed as an integral function of the SSLC systems. The equipment implementing the ECFs receives its power from the four-divisional battery-backed 120 VAC buses (uninterruptible) for RTIS and 125 VDC buses for ELCS. These are discussed in Subsection 8.1.2.2 and illustrated in Figure 8.3-4.*

NRC Request (8)—*Describe the dynamic response of the multiplexers to momentary interruptions of AC power.*

Revised Response (8)—*Multiplexers are not used. Safety-related data communication is performed as an integral function of the SSLC systems. Each of the four divisions of the SSLC system is fed by the corresponding division of the 125 VDC battery. Therefore, the multiplexer system will not be affected by momentary interruption to the AC power. Extended losses of power in any division would not affect operations of safety functions because of multiplicity of divisional power (Figure 8.3-3).*

If there is a loss of power to the ELCS system, it will assume a predefined safe state. If there is a loss of power to the RTIS, it is designed to fail in a trip initiating state.

NRC Request (9)—*Describe the applicability of the plant Technical Specifications to multiplexer operability.*

Revised Response (9)—*Multiplexers are not used. Safety-related data communication is performed as an integral function of the SSLC systems. The applicability of the plant Technical Specifications to the SSLC systems operability will be a section in the specifications that will include limiting condition for operation, and surveillance requirements.*

The limiting condition is expected to be similar to that for a loss of a divisional electrical power supply.

NRC Request (10)—*Describe the hardware architecture of all multiplexer units.*

Revised Response (10)—*Multiplexers are not used. Safety-related data communication is performed as an integral function of the SSLC systems.*

System Configuration

For the RTIS, input and output signals are directly connected to the RTIS equipment for each protective division.

In each ELCS protection division, remote DLCs (RDLCs) are located in local plant areas to acquire sensor data and transmit it to the control room for processing. The RDLCs also receive processed signals from the control room for command of safety system actuators.

RDLC interconnections are fiber optic data links.

The safety-related equipment implementing the ECFs in each division are separated and independent.

ELCS Hardware Configuration

(1) RDLC

(a) Microprocessor-based, programmable controller with control program stored in non-volatile memory.

(b) Modular design: Plug-in modules or circuit boards with distinct functions on separate modules. Redundant low voltage power supplies are used for greater reliability.

(c) Input modules acquire safety-related analog and digital data from process transmitters and equipment status contact closures, respectively. Analog input modules perform signal conditioning and A/D conversion. Digital input modules perform signal conditioning (filtering, voltage level conversion).

(d) Output modules transmit processed control signals to equipment actuator circuits (output signals may be contact closures or voltage levels to drive relays or solid-state load drivers).

(e) Section 7.9 explains the methods used to communicate data between all DLCs.

(f) Controller modules coordinate I/O and communication functions and perform peripheral tasks such as self-test and calibration.

(g) A maintenance and test panel (MTP) is provided for each ELCS protective division. The MTP provides the interfaces for technician access to calibration and diagnostic functions.

[***The development of the SSLC systems shall assure that the ECFs are implemented using a deterministic design.***

]*Section 7.9 provides information on the design of the data communication functions.*

NRC Request (11)—*Describe the "firmware" architecture.*

Revised Response (11)—*The "firmware" (software contained in non-volatile memory) architecture depends upon knowledge of a specific hardware/software combination for the I/O devices. Since Tier 2 is to be independent of specific vendor's hardware and is, instead, based upon system level requirements, the exact configuration of software for the I/O devices is not specified. However, software development will follow a process consistent with the safety-related nature of the ELCS, including their ECFs. RTIS is not within the scope of this response because input and output signals are directly connected to the RTIS equipment for each protective division.*

The software must also support the following characteristics of the ELCS:

(1) The ELCS ECFs are implemented as real-time control applications configured as point to point, unidirectional data links.

(2) Because time response for some functions is critical to safety, system timing must be deterministic and not event-driven.

(3) The safety-critical system functions are analog and digital data acquisition, signal formatting, signal transmission, and control signal outputs to actuators. Peripheral functions are self-diagnostic features and system calibration.

(4) During system initialization or shutdown and after loss of power, control outputs to actuators must fail to a safe state (fail safe or fail-as-is, as appropriate for the affected safety system). System restart shall not cause inadvertent trip or initiation of safety-related equipment (i.e., system output shall depend only on sensed plant inputs).

(5) The system must be fault-tolerant to support the single-failure criterion. Multi-division duplication of the system will provide this feature.

High quality software is the most critical aspect of microprocessor-based designs for safety systems. The software must be of easily proven reliability so as not to degrade the reliability and availability of the overall system. When installed as "firmware", the software should become, in effect, another high quality hardware component of the control equipment.

Software development will, in general, follow Regulatory Guide 1.152, which endorses ANSI/IEEE ANS-7-4.3.2. These documents emphasize an orderly, structured, development approach and the use of independent verification and validation to provide traceable confirmation of the design. Validation must verify a predictable and safe response to abnormal as well as normal test cases. A software-based design must also support the testability, calibration and bypass requirements of IEEE-603.

* See Sections 7A.1(2) and 7A.1(1).

To meet the above requirements, the software will be developed as a structured set of simple modules. Each module will perform a prescribed task that can be independently verified and tested. The software requirements specification and design specification will define structures of external files used and interfaces with other programs. The integration of the modules into the control program will be another activity to be independently verified and validated.

The overall program structure will be a hierarchy of tasks. Separate modules will be created for safety-critical tasks, calibration functions, and self-test functions, with self-test running in the background at the lowest priority. Highest priority functions will always run to completion. The use of interrupts will be minimized to prevent interference with scheduled tasks.

On detection of communication faults, retry will be permitted within system time constraints. If the fault is permanent, the module shall fail to a predefined state and the operator shall be alerted. System level diagnostics verify memory is not changed after initial loading.

The software shall permit online calibration and testing consistent with the requirements of the Technical Specifications.

The software design shall prevent unauthorized access or modification.

Software development to achieve program operation as described above and to document and verify this operation shall conform to the following standards:

(1) [IEEE-828, "IEEE Standard for Software Configuration Management Plans"

(2) IEEE-829, "IEEE Standard for Software Test Documentation"

(3) IEEE-830, "IEEE Standard for Software Requirements Specifications"

(4) IEEE-1012, "IEEE Standard for Software Verification and Validation Plans"

(5) IEEE-1042, IEEE Guide to Software Configuration Managenent]*

NRC Request (12)*—Provide an explicit discussion of how the systems conform to the provisions of IEEE-279, Section 4.17.*

Revised Response (12)*—Also reference IEEE-603 Sections 5.1, 6.2, and 7.2. The ECFs for safety systems support the acquisition of data from plant sensors (pressure, level, flow, etc.) and equipment status contact closures (open, close, start, stop, etc.) that provide automatic trip or initiation functions for RPS and ESF equipment.*

Manual initiation inputs for protective action, such as reactor scram, are implemented by direct, hardwired or optical connections to the safety system logic. Manual initiation inputs for other protective actions (e.g., ECCS, containment isolation, except for MSIV isolation) depend

* See Sections 7A.1(2) and 7A.1(1).

on the ECFs for communication to the safety system logic. Initiation outputs for ECCS and isolation functions (except MSIV) are communicated to the actuators using the ECFs. Manual scram (reactor trip) is provided by breaking the power source to the scram pilot valve solenoids external to the equipment implementing the ECFs and safety system logic. Manual reactor trip and manual MSIV closure in each division are available even with failure of the ECFs, since these outputs are not communicated to the via the ECFs.

However, because the design is fault tolerant (replicated in four divisions and redundant within each division) [see the responses to Requests (4), (10), and (11)], a single failure will not degrade data communications in any division.

Therefore, the requirements of IEEE-279, Section 4.17 (IEEE-603 Section 5.1), are satisfied, since a single failure will not prevent initiation of protective action by manual or automatic means.

The last sentence of Section 4.17 states that "manual initiation should depend upon the operation of a minimum of equipment". The first paragraph has shown that manual initiation of reactor trip and MSIV isolation do not depend at all on the ECFs. Manual initiation of ECCS and isolation other than MSIV do depend on ECFs for sending inputs to the logic, but can tolerate the single failure of one division of ECFs. They depend on the operation of only one channel of ECFs in each division to send outputs to actuators.

***NRC Request (13)**—Provide an explicit discussion of how the systems conform to IEEE 279, Paragraph 4.7.2, as supplemented by Regulatory Guide 1.75 and IEEE 384.*

***Revised Response (13)**—The safety-related ECFs, which are part of the protection system, have no direct interaction with the control systems. Sensor and equipment status data are communicated only to protection system logic. However, signals are sent from the protection system logic to non-safety systems. The signals are transmitted via fiber optic data links or through qualified isolation devices.*

Fiber optic transmission lines are not subject to credible electrical faults such as short-circuit loading, hot shorts, grounds or application of high AC or DC voltages. Adjacent cables are not subject to induced fault currents or to being shorted together. The effects of cable damage are restricted to signal loss or data corruption at the receiving equipment. Cables and control equipment of different systems or assigned to different divisions are kept separated only to prevent simultaneous physical damage.

Thus, the SSLC systems ECFs design conforms to IEEE-279, paragraph 4.7.2 (IEEE-603 paragraph 5.6.3.1(2)), in that no credible failure at the output of an isolation device can "prevent the protection system from meeting minimum performance requirements specified in the design bases."

To meet the requirements of IEEE-384 and Regulatory Guide 1.75, the protective covering of the fiber optic cables are flame retardant. The cables are passed through physical, safety class barriers, where necessary, for separation of Class 1E circuits and equipment from other Class 1E equipment or from non-Class 1E equipment. The fiber optic data communication paths are independent in each protection division.Limiteddata communication does occur between divisions, for example, to provide signals needed for 2-out-of-4 voting logic. However, dedicated fiber optic cables are used for this purpose, thereby providing electrical isolation and preserving divisional independence. However, the equipment implementing the ECFs is otherwise kept physically separate to minimize the effects of design basis events.

NRC Request (14)*—Provide confirmation that system level failures of any multiplexer system detected by automated diagnostic techniques are indicated to the operators consistent with Regulatory Guide 1.47. (i.e., bypass and inoperable status indication)*

Revised Response (14)*—Multiplexers are not used, and there is no multiplexer system. Safety-related data communication is performed as an integral function of the SSLC systems. Each safety-related SSLC system contains online self-diagnostics that will monitor system performance, including its associated ECFs. As an example, for each ELCS controller, the following typical parameters are monitored: (1) status of the CPU, (2) Cyclic Redundancy Checks (CRC), (3) communication keep-alive signal, (4) watchdog timer status, (5) power supply status, (6) memory checks, and (7) data range and bounds checks. Self-diagnostics will indicate faults to the module board replacement level.*

The RDLC ECFs are implemented with dual communication channels for fault tolerance. A detected fault is automatically annunciated to the operator. Total shutdown of an RDLC ECF is indicated by a separate alarm.

The above actions indicate conformance to Regulation Guide 1.47, Section C.1 (Automatic system level indication of bypass or deliberately induced inoperability).

Power loss to any control station is separately monitored and annunciated to aid in troubleshooting and to alert the operator when power is removed from a unit when being serviced. Power loss will cause the fault or out-of-service alarms described previously to activate. This indicates conformance to Regulation Guide 1.47, Section C.2 [Automatic activation of indicating system of C.1 when auxiliary or supporting system (in this case, power source) is bypassed or deliberately rendered inoperable].

Bypassed or inoperable status of any one division of ECFs can not render inoperable any redundant portion of the protection system. Each division of ECFs is independent of ECFs in the other divisions. Inoperable status in one division will cause the appropriate safe-state trips in that division, but the other divisions will continue to operate normally. Faults in another division simultaneously will indicate according to the previous discussion. The resulting safe-state trips will result in the required protective action. Thus, the requirements of Regulation Guide 1.47, Section C.3, are satisfied.

During periodic surveillance, the system-level out-of-service indicators can be tested manually. This satisfies the requirement of Regulation Guide 1.47, Section C.4.

NRC Request (15)*—Provide an explicit discussion of the susceptibility of the multiplexer systems to electromagnetic interference.*

Revised Response (15)*—Multiplexers are not used, and there is no multiplexer system. Safety-related data communication is performed as an integral function of the SSLC systems. ELCS equipment is contained in EMI resistant enclosures. Proper grounding and shielding practices are used. The lack of susceptibility of ELCS equipment is verified during qualification testing. Fiber optics are used to communicate with equipment external to the cabinet. Fiber optics are not subject to induced electrical currents, eliminate ground loops, and also do not radiate electrical noise. Thus, the isolated and distributed nature of the system, which is also replicated in four divisions, tends to reduce EMI effects.*

Response (4) indicates several common techniques (shielding, grounding, etc.) used to minimize EMI in the electrical control circuitry. Proper physical placement, especially for the I/O devices, is essential to eliminate interference from high current or high voltage switching devices.

Self-diagnostics at the controllers monitor data transmission to ensure that faults do not propagate into the safety protection logic. Bad data transmission will cause a system alarm.

Response (4) also discusses various tests that the system will undergo to demonstrate immunity to EMI.

7A.3 Electrical Isolators

NRC Request (1)*—For each type of device used to accomplish electrical isolation, provide a description of the testing to be performed to demonstrate that the device is acceptable for its application(s). Describe the test configuration and how the maximum credible faults applied to the devices will be included in the test instructions.*

Revised Response (1)*—This response is limited to fiber optic data links, which are the only type of isolation device used for electrical isolation of logic level and analog signals between protection divisions and from protection divisions to non-safety-related equipment.*

Testing is of two types:

(1) Optical characteristics

(2) Signal transmission capability

Optical characteristics are checked by an optical power meter and a hand-held light source to determine the optical loss from one end of the fiber optic cable to the other. In an operational *system, an optical time domain reflectometer measures and displays optical loss along any continuous optical fiber path. Any abrupt disruption in the optical path such as a splice or connector is seen as a blip on the display. This technique is especially useful for troubleshooting long runs of cable such as those used to implement the DCFs. Cable terminations are visually inspected under magnification to determine if cracks and flaws have appeared in the optical fiber surfaces within the connector.*

Transmission characteristics are monitored in the system by the self diagnostics.

Maximum credible electrical faults applied at the outputs of isolation devices do not apply to fiber optic systems. The maximum credible fault is cable breakage causing loss of signal transmission. Faults cannot cause propagation of electrical voltages and currents into other electrical circuitry at the transmitting or receiving ends. Conversely, electrical faults originating at the input to the fiber optic transmitter can only damage the local circuitry and cause loss or corruption of data transmission; damaging voltages and currents will not propagate to the receiving end.

***NRC Request (2)**—Identify the data that will be used to verify that the maximum credible faults applied during the test are the maximum voltage/current to which the device could be exposed, and to define how the maximum voltage/current is determined.*

***Response (2)**—The response to Request (1) established that electrical faults are not credible at the output of a fiber optic isolating device. Therefore, Request (2) is not relevant.*

***NRC Request (3)**—Identify the data that will be used to verify that the maximum credible fault is applied to the output of the device in the transverse mode (between signal and return) and other faults are considered (i.e., open and short circuits).*

***Response (3)**—The response to Request (1) established that electrical faults are not credible at the output of a fiber optic isolating device. Open and short circuits of the fiber optic cable have no electrical effect on the input side electrical circuitry.*

***NRC Request (4)**—Define the pass/fail acceptance criteria for each type of device.*

***Response (4)**—Since electrical faults at the outputs are not credible, acceptance tests for fiber optic isolation devices need only verify optical characteristics and signal transmission characteristics as defined in Response (1).*

***NRC Request (5)**—Provide a commitment that the isolation devices will comply with all environmental qualification and seismic qualification requirements.*

***Revised Response (5)**—Fiber optic isolation devices are expected to have less difficulty than previous isolation devices in complying with all qualification requirements due to their small size, low mass, and simple electronic interfaces. The basic materials and components, except for the fiber optic cable itself, are the same as those used in existing, qualified isolation devices.*

A major advantage of fiber optics is that signals can be transmitted long distances and around curves through the isolating medium; thus, the physical, safety-class barrier required for separation of Class 1E devices may be provided by just the cable length if the protective covering and any fill materials of the cable are made properly flame-retardant. For short distances, the fiber optic cable can be fed through a standard safety class structure.

NRC Request (6)*—Describe the measures taken to protect the safety systems from electrical interference (i.e., electrostatic coupling, EMI, common mode, and crosstalk) that may be generated.*

Revised Response (6)*—Previous responses have described the specific measures that are employed to minimize electrical interference. Fiber optic isolating devices do not require metallic shielding and are immune from electrostatic coupling, EMI, common-mode effects, and crosstalk along their cable length; they also do not radiate electrical interference. The electrical circuitry used to transmit and receive the optical signals is susceptible to electrical interference in the same manner as other circuitry, but the isolating effects of the fiber optic cable will reduce propagation of interference. The local effects of EMI and other electrical noise are handled by standard filtering, shielding, and grounding techniques.*

See Reponse (4) of Section 7A.2 for tests that will be performed to verify the effectiveness of EMI preventive measures for safety systems. Additional tests to determine the susceptibility of safety system control equipment to electrostatic discharges shall be established using the test procedures included in IEC Publication 61000-4-2, Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test. The test procedures of Part 4-2 will be used to qualify electrical and electronic equipment subjected to static electricity discharges.

NRC Request (7)*—Provide information to verify that the Class 1E isolation devices are powered from a Class 1E power source(s).*

Revised Response (7)*—Fiber optic cable is used for Class 1E isolation and does not use any electrical power to accomplish that function.*

NRC Request (8)*—Provide a comparison of the design with the guidance in NUREG/CR-3453/EGG-2444, "Electronic Isolators Used in Safety Systems of U.S. Nuclear Power Plants," March 1986.*

Response (8)*—The isolating devices used for the ABWR are similar to the Group 1 types referred to in the NUREG. They are of the long fiber optic cable design, so transmitting and receiving ends are separated by a significant distance (typically several feet to several hundred feet). These types of designs had the best isolating characteristics of the various isolators compared in the NUREG study.*

Typically, the electrical-to-optical interfaces are part of the general logic processing equipment within a channel and do not reside in separate isolator units. The fiber optic interfaces receive the protection from EMI and surge currents designed into the logic equipment (for example, power supply decoupling, shielding, filtering, single-point signal common connection to chassis ground, and chassis ground connection to panel ground bus). The equipment will undergo EMI and surge testing to the standards identified in the NUREG or equivalent.

The results of the NUREG tests show that the fiber optic type of isolators exhibited no or very little effects from the major fault and lightning surge tests. Only surge and EMI tests applied to the isolator power supplies caused damage to the isolator input side, mainly because of the output and input supplies sharing a common, commercial AC power line. However, as noted in the NUREG BWRs do not directly use a commercial power source. For the ABWR, RPS and ESF functions are supplied from different plant power sources (120V Vital AC and 125 VDC, respectively). The low voltage DC supplies fed from these sources are highly regulated and filtered. Thus, isolator circuitry is isolated from most power source transients.

NRC Request (9)*—Provide a comparison of the design with the guidance in draft Regulatory Guide EE502-4, "Criteria for Electrical Isolation Devices Used in Safety Systems for Nuclear Power Plants".*

Response (9)*—(Draft RG EE502-4 was withdrawn by the NRC.)*]*

7A.4 Fiber Optic Cable

The staff is working with EG&G to develop comprehensive guidance on this subject. The guidance will be based on the existing IEEE cable standards, such as IEEE-323 and IEEE-384, on the ANSI standards for fiber optic cables (list provided), and the results of the EG&G work.

7A.5 [*Programmable Digital Computer Software*†

NRC Request*—Provide a comparison of the design with the following:*

(1) **[*ANSI/IEEE-ANS-7.4.3.2, "Application Criteria for Programmable Digital Computer Systems in Safety Systems of Nuclear Power Generating Stations."*]‡**

(2) Regulatory Guide 1.152, "Criteria for Programmable Digital Computer System Software in Safety-Related Systems of Nuclear Power Plants," November 1985

* See Section 7A.1(1).

† Responses to Sections 7A.5 and 7A.6 above are grouped in various combinations, as appropriate, in Subsection 7A.7

‡ See section 7A.1(2) and 7A.1(1).

(3) *NUREG-0308, "Safety Evaluation Report—Arkansas Nuclear 1, Unit 2," November 1977*

(4) *NUREG-0493, "A Defense-in-Depth and Diversity Assessment of the RESAR-414 Integrated Protection System," May 1985*

(5) *NUREG-0491, "Safety Evaluation Report of RESAR-414," February 1979*

7A.6 Programmable Digital Computer Hardware *

NRC Request*—Provide a comparison of the design with the following:*

(1) *IEEE-603, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations"*

(2) *NUREG-0308, "Safety Evaluation Report— Arkansas Nuclear 1, Unit 2," November 1977*

(3) *Regulatory Guide 1.153, "Criteria for Power, Instrumentation and Control Portions of Safety Systems"*

(4) *NUREG-0493, "A Defense-in-Depth and Diversity Assessment of the RESAR-414 Integrated Protection System," May 1985*

(5) *NUREG-0491, "Safety Evaluation Report of RESAR-414," February 1979*

7A.7 Revised Responses to Subsections 7A.5 & 7A.6; Computer Hardware and Software

Items 7A.5(1) and 7A.5(2)

Criteria and guidelines stated in ANSI/IEEE-ANS-7.4.3.2, as endorsed by Regulatory Guide 1.152, have been used as a basis for design procedures established for programmable digital equipment.

All programmable digital equipment utilized for safety-related functions are qualified in accordance with safety criteria and with the safety system design basis with which they interface.

Self-test or self-diagnostic features of this equipment, whether implemented in hardware or software, are considered an integral part of the design, and, as such, are qualified to Class 1E standards.

* Responses to Sections 7A.5 and 7A.6 above are grouped in various combinations, as appropriate, in Subsection 7A.7

A structured, engineered approach to the development of both hardware and software is implemented to assure that the design proceeds along the lines of the requirement specifications and has traceable documentation.

Verification and validation (V&V) includes the establishment of test and evaluation criteria, the development of test and evaluation procedures, the testing of the integrated hardware and software, and the installation of the hardware and software in the field.

In accordance with the step-by-step verification process, design reviews are performed at the system functional and performance requirements specification/task analysis and allocation of functions level, the hardware design and the software design level, the test and evaluation criteria and procedures level, and the personnel requirements and operating/maintenance plan level. Such reviews are conducted by knowledgeable and experienced system engineers, software engineers, hardware engineers, etc., who are not directly responsible for the design, but who may be from the same organization.

Figure 7A-2 illustrates the structure utilized for ABWR control and instrumentation system design which incorporates subject guidelines.

Items 7A.5(3) and 7A.6(2)

NUREG-0308, "Safety Evaluation Report—Arkansas Nuclear 1, Unit 2", was reviewed and generally found to be not applicable to the BWR/ABWR reactor design philosophy.

The NUREG discusses a "Core Protection Calculator System (CPCS)" which is designed to provide reactor protection for two conditions: (1) low local departure from nucleate boiling ratio (DNBR), and (2) high local linear power density.

For condition (1), "DNBR" is associated with PWRs and is not applicable to BWRs. For condition (2), power density is determined via the Neutron Monitoring System (NMS), similar to methods used in operating BWRs (see Subsection 7.6.1.1 for discussion of the NMS).

The ABWR design of the Reactor Protection System utilizes configurable logic technology for logic decisions based on analog input from various sensors.

The ABWR uses a modern form of digital device for the same reasons relays and solid-state devices were used in earlier designs (i.e., making simple logic decisions); not for making complex calculations for which protective action is dependent.

Items 7A.5(4) and 7A.6(4)

The guidelines of NUREG-0493 have been used to perform analysis of several possible different configurations of the Safety System Logic and Control (SSLC) network. Analyses have been performed at the system design level to assure adequate defense-in-depth and/or diversity principles were incorporated at acceptable cost. It is recognized that such requirements are in addition to positions on safety-related protection systems (such as the single failure criterion) taken previously in other Regulatory Guides.

In order to reduce plant construction costs and simplify maintenance operation, the ABWR protection sytems are designed with a partially "shared sensors" concept. The RTIS is the central processing mechanism that produces logic decisions for both RPS and MSIV isolation functions. The ELCS is the central processing mechanism that produces logic decisions for all ESF safety system functions. Redundancy and "single failure" requirements are enhanced by a full four-division modular design using two-out-of-four voting logic on inputs derived from LOCA signals which consist of diverse parameters (i.e., reactor low level and high drywell pressure). Many additional signals are provided, in groups of four or more, to initiate RPS scram (Table 7.2-2).

With its inherent advantages, it is also recognized that such design integration (i.e., shared sensors) theoretically escalates the effects of potential common-mode failures (CMF). Therefore, the architecture of the SSLC systems is designed to provide maximum separation of system functions by using separate digital trip functions (DTFs) and trip logic functions (TLFs) for RPS/MSIV logic processing and for LDS/ECCS logic processing within each of the four essential power divisions. Thus, setpoint comparisons within individual DTFs are associated with logically separate initiation tasks.

Sensor signals are sent to each DTF on separate or redundant data links such that distribution of DTF functions results in minimum interdependence between echelons of defense. For reactor level sensing, the RPS scram function utilizes narrow-range transmitters while the ECCS functions utilize the wide-range transmitters. The diverse high drywell signals are shared within the two-out-of-four voting logic. In addition, all automatic protective functions are backed up by manual controls.

As a general rule, shared sensors for protection systems are not used for control systems (i.e., feedwater, recirc, etc.). However, the end-of-cycle (EOC) recirc pump trip signals originate from the same turbine stop valve closure or turbine control valve fast closure sensors which contribute to scram. These are Class 1E sensors, but they are not shared with other protection systems and the interface with the recirc system is naturally isolated via fiber-optic cable.

Another use for some of the protection shared signals involves the ATWS trip which activates the Fine Motion Control Rod Drive (FMCRD) run-in and alternate rod insertion (ARI) as diverse backup to hydraulic scram. However, this Class-1E-to-non-Class-1E isolated interface is a special case for mitigation of ATWS and is not a control system interface.

The ABWR demonstrates strong multi-system diversity in its capability to shut down and cool the reactor core. There are four distinct systems for controlling reactivity and four distinct systems for cooling the core.

Reactor Shutdown Systems

(1) The RPS "failsafe" (i.e., scram on loss of power or data communications) hydraulic scram (Subsection 7.2.1.1.4).

(2) The ATWS-mitigating DC-power-actuated air header dump valves (alternate rod insertion [ARI]) scram (Subsection 7.2.1.1.4.5).

(3) The ATWS-mitigating rod run-in function utilizing fine-motion control rod drive (Subsection 7.7.1.2.2).

(4) The Standby Liquid Control System (Subsection 7.4.1.2).

Reactor Core Cooling Systems

(1) The Feedwater Control System (Subsection 7.7.1.4).

(2) The High Pressure Core Flooder System (Subsection 7.3.1.1.1.1).

(3) The turbine-driven Reactor Core Isolation Cooling System (Subsection 7.3.1.1.1.3).

(4) The low pressure flooder mode of RHR (Subsection 7.3.1.1.4).

The Remote Shutdown System (RSS) also provides an independent means of actuating core cooling functions diverse from the plant main control room.

In summary, the ABWR design has incorporated defense-in-depth principles through maintaining separation of control and protection functions even though sensors are shared within protection systems. In addition, the shared sensors are designed within a full four division architecture with two-out-of-four voting logic.

Diversity principles are incorporated at both the signal and system levels: (1) diverse parameters are monitored to automatically initiate protective actions which are also manually controllable; and, (2) multiple diverse systems are available to both shut down the reactor and to cool its core.

Therefore, the ABWR fully meets the intent of NUREG-0493.

Items 7A.5(5) and 7A.6(5)

NUREG-0491 has been reviewed and determined to be a precursor to NUREG-0493 for which GE has stated full compliance as detailed above. Therefore, the ABWR design is also consistent with the intent of NUREG-0491.

Items 6(1) and 6(3)

IEEE-603 has been reviewed, as has Regulatory Guide 1.153 which endorses IEEE-603.

The hardware and software which make up the Safety System Logic and Control (SSLC) systems is designed to make logic decisions which automatically initiate safety actions based on input from instrument monitored parameters for several nuclear safety systems. In that sense, the SSLC systems integrate the nuclear safety systems.

Most positions stated in IEEE-603 (as endorsed by RG 1.153) pertain to the nuclear safety systems, and are similar to those of IEEE-279, which are addressed for each system in the analysis sections of Chapter 7. Safety system design bases are described for all I&C systems in Section 7.1, beginning at Subsection 7.1.2.2. The methods for calculating setpoints and margins are described in Chapter 16.

The safety system criteria in Section 5 and the functional and design requirements in Section 6 of IEEE-603 are not compromised by the introduction of the SSLC. All positions regarding single-failure, completion of protective actions, etc., are designed into the protection systems. All SSLC components associated with the protection systems are Class 1E and are qualified to the same standards as the protection systems.

Independence of the four SSLC electrical divisions is retained by using fiber-optic cable for cross-divisional communication such as the two-out-of-four voting logic.

In summary, the hardware and software functions used in the SSLC comply with applicable portions of IEEE-603 and Regulatory Guide 1.153 (i.e., quality, qualification, testability, independence). The remaining portions, which apply to the nuclear safety systems, are not compromised by the SSLC design, but are in fact enhanced by self-test.]*

* See Section 7A.1(1).

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical)

Device	Div	Description
B21-F003A	1	AO CHECK VALVE
B21-F003B	2	AO CHECK VALVE
B21-F010A	1	SRV/ADS VALVE
B21-F010A	2	SRV/ADS VALVE
B21-F010A	3	SRV/ADS VALVE
B21-F010B	3	SAFETY RELIEF VALVE
B21-F010C	1	SRV/ADS VALVE
B21-F010C	2	SRV/ADS VALVE
B21-F010D	1	SAFETY RELIEF VALVE
B21-F010E	2	SAFETY RELIEF VALVE
B21-F010F	1	SRV/ADS VALVE
B21-F010F	2	SRV/ADS VALVE
B21-F010G	1	SAFETY RELIEF VALVE
B21-F010H	1	SRV/ADS VALVE
B21-F010H	2	SRV/ADS VALVE
B21-F010H	3	SRV/ADS VALVE
B21-F010J	2	SAFETY RELIEF VALVE
B21-F010K	1	SAFETY RELIEF VALVE
B21-F010L	1	SRV/ADS VALVE
B21-F010L	2	SRV/ADS VALVE
B21-F010L	3	SRV/ADS VALVE
B21-F010M	3	SAFETY RELIEF VALVE
B21-F010N	1	SRV/ADS VALVE
B21-F010N	2	SRV/ADS VALVE
B21-F010P	1	SAFETY RELIEF VALVE
B21-F010R	1	SRV/ADS VALVE
B21-F010R	2	SRV/ADS VALVE
B21-F010S	2	SAFETY RELIEF VALVE
B21-F010T	1	SRV/ADS VALVE
B21-F010T	2	SRV/ADS VALVE
B21-F010U	3	SAFETY RELIEF VALVE
B21-F011	1	MO GATE VALVE
B21-F012	2	MO GATE VALVE
B21-LT001A	1	LEVEL TRANSMITTER
B21-LT001B	2	LEVEL TRANSMITTER
B21-LT001C	3	LEVEL TRANSMITTER

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
B21-LT001D	4	LEVEL TRANSMITTER
B21-LT003A	1	LEVEL TRANSMITTER
B21-LT003B	2	LEVEL TRANSMITTER
B21-LT003C	3	LEVEL TRANSMITTER
B21-LT003D	4	LEVEL TRANSMITTER
B21-LT003E	1	LEVEL TRANSMITTER
B21-LT003F	2	LEVEL TRANSMITTER
B21-LT003G	3	LEVEL TRANSMITTER
B21-LT003H	4	LEVEL TRANSMITTER
B21-LT006A	1	LEVEL TRANSMITTER
B21-LT006B	2	LEVEL TRANSMITTER
B21-POSZ902A	3	POSITION SWITCH
B21-POSZ902B	3	POSITION SWITCH
B21-POSZ902C	2	POSITION SWITCH
B21-POSZ902D	1	POSITION SWITCH
B21-POSZ902E	2	POSITION SWITCH
B21-POSZ902F	1	POSITION SWITCH
B21-POSZ902G	1	POSITION SWITCH
B21-POSZ902H	3	POSITION SWITCH
B21-POSZ902J	2	POSITION SWITCH
B21-POSZ902K	1	POSITION SWITCH
B21-POSZ902L	3	POSITION SWITCH
B21-POSZ902M	3	POSITION SWITCH
B21-POSZ902N	2	POSITION SWITCH
B21-POSZ902P	1	POSITION SWITCH
B21-POSZ902R	2	POSITION SWITCH
B21-POSZ902S	2	POSITION SWITCH
B21-POSZ902T	1	POSITION SWITCH
B21-POSZ902U	3	POSITION SWITCH
B21-F010A	3	SRV POSITION TRANSMITTER
B21-F010B	3	SRV POSITION TRANSMITTER
B21-F010C	2	SRV POSITION TRANSMITTER
B21-F010D	1	SRV POSITION TRANSMITTER
B21-F010E	2	SRV POSITION TRANSMITTER
B21-F010F	1	SRV POSITION TRANSMITTER
B21-F010G	1	SRV POSITION TRANSMITTER

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
B21-F010H	3	SRV POSITION TRANSMITTER
B21-F010J	2	SRV POSITION TRANSMITTER
B21-F010K	1	SRV POSITION TRANSMITTER
B21-F010L	3	SRV POSITION TRANSMITTER
B21-F010M	3	SRV POSITION TRANSMITTER
B21-F010N	2	SRV POSITION TRANSMITTER
B21-F010P	1	SRV POSITION TRANSMITTER
B21-F010R	2	SRV POSITION TRANSMITTER
B21-F010S	2	SRV POSITION TRANSMITTER
B21-F010T	1	SRV POSITION TRANSMITTER
B21-F010U	3	SRV POSITION TRANSMITTER
B21-PT007A	1	PRESS TRANSMITTER
B21-PT007B	2	PRESS TRANSMITTER
B21-PT007C	3	PRESS TRANSMITTER
B21-PT007D	4	PRESS TRANSMITTER
B21-PT025A	1	PRESS TRANSMITTER
B21-PT025B	2	PRESS TRANSMITTER
B21-PT025C	3	PRESS TRANSMITTER
B21-PT025D	4	PRESS TRANSMITTER
B21-PT028A	1	PRESS TRANSMITTER
B21-PT028B	2	PRESS TRANSMITTER
B21-PT028C	3	PRESS TRANSMITTER
B21-PT028D	4	PRESS TRANSMITTER
B21-PT301A	1	PRESS TRANSMITTER
B21-PT301B	2	PRESS TRANSMITTER
B21-PT301C	3	PRESS TRANSMITTER
B21-PT301D	4	PRESS TRANSMITTER
B21-TE019A	1	TEMP ELEMENT
B21-TE019B	2	TEMP ELEMENT
B21-TE020A	1	TEMP ELEMENT
B21-TE020B	2	TEMP ELEMENT
B21-TE021A	1	TEMP ELEMENT
B21-TE021B	2	TEMP ELEMENT
B21-TE022A	1	TEMP ELEMENT
B21-TE022B	2	TEMP ELEMENT
B21-TE023A	1	TEMP ELEMENT

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
B21-TE023B	2	TEMP ELEMENT
B21-TE024A	1	TEMP ELEMENT
B21-TE024B	2	TEMP ELEMENT
C12-D005001	1	FMCRD 34-63 A QUAD
C12-D005001	2	FMCRD 34-63 A QUAD
C12-D005002	1	FMCRD 54-59 A QUAD
C12-D005002	2	FMCRD 54-59 A QUAD
C12-D005003	1	FMCRD 38-19 C QUAD
C12-D005003	2	FMCRD 38-19 C QUAD
C12-D005004	1	FMCRD 50-59 A QUAD
C12-D005004	2	FMCRD 50-59 A QUAD
C12-D005005	1	FMCRD 38-35 A QUAD
C12-D005005	2	FMCRD 38-35 A QUAD
C12-D005006	1	FMCRD 54-35 C QUAD
C12-D005006	2	FMCRD 54-35 C QUAD
C12-D005007	1	FMCRD 34-23 C QUAD
C12-D005007	2	FMCRD 34-23 C QUAD
C12-D005008	1	FMCRD 50-55 A QUAD
C12-D005008	2	FMCRD 50-55 A QUAD
C12-D005009	1	FMCRD 62-47 A QUAD
C12-D005009	2	FMCRD 62-47 A QUAD
C12-D005010	1	FMCRD 38-31 C QUAD
C12-D005010	2	FMCRD 38-31 C QUAD
C12-D005011	1	FMCRD 58-35 C QUAD
C12-D005011	2	FMCRD 58-35 C QUAD
C12-D005012	1	FMCRD 58-47 A QUAD
C12-D005012	2	FMCRD 58-47 A QUAD
C12-D005013	1	FMCRD 42-27 C QUAD
C12-D005013	2	FMCRD 42-27 C QUAD
C12-D005014	1	FMCRD 54-47 A QUAD
C12-D005014	2	FMCRD 54-47 A QUAD
C12-D005015	1	FMCRD 46-63 A QUAD
C12-D005015	2	FMCRD 46-63 A QUAD
C12-D005016	1	FMCRD 50-51 A QUAD
C12-D005016	2	FMCRD 50-51 A QUAD
C12-D005017	1	FMCRD 46-59 A QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005017	2	FMCRD 46-59 A QUAD
C12-D005018	1	FMCRD 42-23 C QUAD
C12-D005018	2	FMCRD 42-23 C QUAD
C12-D005019	1	FMCRD 38-27 C QUAD
C12-D005019	2	FMCRD 38-27 C QUAD
C12-D005020	1	FMCRD 38-55 A QUAD
C12-D005020	2	FMCRD 38-55 A QUAD
C12-D005021	1	FMCRD 34-67 A QUAD
C12-D005021	2	FMCRD 34-67 A QUAD
C12-D005022	1	FMCRD 26-07 B QUAD
C12-D005022	2	FMCRD 26-07 B QUAD
C12-D005023	1	FMCRD 38-03 C QUAD
C12-D005023	2	FMCRD 38-03 C QUAD
C12-D005024	1	FMCRD 10-43 D QUAD
C12-D005024	2	FMCRD 10-43 D QUAD
C12-D005025	1	FMCRD 42-35 A QUAD
C12-D005025	2	FMCRD 42-35 A QUAD
C12-D005026	1	FMCRD 14-11 B QUAD
C12-D005026	2	FMCRD 14-11 B QUAD
C12-D005027	1	FMCRD 54-51 A QUAD
C12-D005027	2	FMCRD 54-51 A QUAD
C12-D005028	1	FMCRD 34-39 D QUAD
C12-D005028	2	FMCRD 34-39 D QUAD
C12-D005029	1	FMCRD 34-19 C QUAD
C12-D005029	2	FMCRD 34-19 C QUAD
C12-D005030	1	FMCRD 10-19 B QUAD
C12-D005030	2	FMCRD 10-19 B QUAD
C12-D005031	1	FMCRD 30-23 B QUAD
C12-D005031	2	FMCRD 30-23 B QUAD
C12-D005032	1	FMCRD 22-47 D QUAD
C12-D005032	2	FMCRD 22-47 D QUAD
C12-D005033	1	FMCRD 54-31 C QUAD
C12-D005033	2	FMCRD 54-31 C QUAD
C12-D005034	1	FMCRD 06-47 D QUAD
C12-D005034	2	FMCRD 06-47 D QUAD
C12-D005035	1	FMCRD 22-19 B QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005035	2	FMCRD 22-19 B QUAD
C12-D005036	1	FMCRD 34-43 D QUAD
C12-D005036	2	FMCRD 34-43 D QUAD
C12-D005037	1	FMCRD 50-31 C QUAD
C12-D005037	2	FMCRD 50-31 C QUAD
C12-D005038	1	FMCRD 42-19 C QUAD
C12-D005038	2	FMCRD 42-19 C QUAD
C12-D005039	1	FMCRD 30-19 B QUAD
C12-D005039	2	FMCRD 30-19 B QUAD
C12-D005040	1	FMCRD 38-67 A QUAD
C12-D005040	2	FMCRD 38-67 A QUAD
C12-D005041	1	FMCRD 46-47 A QUAD
C12-D005041	2	FMCRD 46-47 A QUAD
C12-D005042	1	FMCRD 42-59 A QUAD
C12-D005042	2	FMCRD 42-59 A QUAD
C12-D005043	1	FMCRD 26-39 D QUAD
C12-D005043	2	FMCRD 26-39 D QUAD
C12-D005044	1	FMCRD 42-11 C QUAD
C12-D005044	2	FMCRD 42-11 C QUAD
C12-D005045	1	FMCRD 46-15 C QUAD
C12-D005045	2	FMCRD 46-15 C QUAD
C12-D005046	1	FMCRD 34-31 C QUAD
C12-D005046	2	FMCRD 34-31 C QUAD
C12-D005047	1	FMCRD 10-15 B QUAD
C12-D005047	2	FMCRD 10-15 B QUAD
C12-D005048	1	FMCRD 46-35 A QUAD
C12-D005048	2	FMCRD 46-35 A QUAD
C12-D005049	1	FMCRD 46-19 C QUAD
C12-D005049	2	FMCRD 46-19 C QUAD
C12-D005050	1	FMCRD 58-27 C QUAD
C12-D005050	2	FMCRD 58-27 C QUAD
C12-D005051	1	FMCRD 26-15 B QUAD
C12-D005051	2	FMCRD 26-15 B QUAD
C12-D005052	1	FMCRD 54-19 C QUAD
C12-D005052	2	FMCRD 54-19 C QUAD
C12-D005053	1	FMCRD 50-23 C QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005053	2	FMCRD 50-23 C QUAD
C12-D005054	1	FMCRD 66-35 C QUAD
C12-D005054	2	FMCRD 66-35 C QUAD
C12-D005055	1	FMCRD 06-39 D QUAD
C12-D005055	2	FMCRD 06-39 D QUAD
C12-D005056	1	FMCRD 66-39 A QUAD
C12-D005056	2	FMCRD 66-39 A QUAD
C12-D005057	1	FMCRD 06-31 B QUAD
C12-D005057	2	FMCRD 06-31 B QUAD
C12-D005058	1	FMCRD 58-51 A QUAD
C12-D005058	2	FMCRD 58-51 A QUAD
C12-D005059	1	FMCRD 58-23 C QUAD
C12-D005059	2	FMCRD 58-23 C QUAD
C12-D005060	1	FMCRD 34-27 C QUAD
C12-D005060	2	FMCRD 34-27 C QUAD
C12-D005061	1	FMCRD 22-27 B QUAD
C12-D005061	2	FMCRD 22-27 B QUAD
C12-D005062	1	FMCRD 50-43 A QUAD
C12-D005062	2	FMCRD 50-43 A QUAD
C12-D005063	1	FMCRD 38-51 A QUAD
C12-D005063	2	FMCRD 38-51 A QUAD
C12-D005064	1	FMCRD 58-31 C QUAD
C12-D005064	2	FMCRD 58-31 C QUAD
C12-D005065	1	FMCRD 14-27 B QUAD
C12-D005065	2	FMCRD 14-27 B QUAD
C12-D005066	1	FMCRD 50-47 A QUAD
C12-D005066	2	FMCRD 50-47 A QUAD
C12-D005067	1	FMCRD 38-47 A QUAD
C12-D005067	2	FMCRD 38-47 A QUAD
C12-D005068	1	FMCRD 46-55 A QUAD
C12-D005068	2	FMCRD 46-55 A QUAD
C12-D005069	1	FMCRD 26-27 B QUAD
C12-D005069	2	FMCRD 26-27 B QUAD
C12-D005070	1	FMCRD 58-55 A QUAD
C12-D005070	2	FMCRD 58-55 A QUAD
C12-D005071	1	FMCRD 58-39 A QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005071	2	FMCRD 58-39 A QUAD
C12-D005072	1	FMCRD 38-11 C QUAD
C12-D005072	2	FMCRD 38-11 C QUAD
C12-D005073	1	FMCRD 42-31 C QUAD
C12-D005073	2	FMCRD 42-31 C QUAD
C12-D005074	1	FMCRD 26-11 B QUAD
C12-D005074	2	FMCRD 26-11 B QUAD
C12-D005075	1	FMCRD 50-15 C QUAD
C12-D005075	2	FMCRD 50-15 C QUAD
C12-D005076	1	FMCRD 34-15 B QUAD
C12-D005076	2	FMCRD 34-15 B QUAD
C12-D005077	1	FMCRD 38-43 A QUAD
C12-D005077	2	FMCRD 38-43 A QUAD
C12-D005078	1	FMCRD 22-43 D QUAD
C12-D005078	2	FMCRD 22-43 D QUAD
C12-D005079	1	FMCRD 58-43 A QUAD
C12-D005079	2	FMCRD 58-43 A QUAD
C12-D005080	1	FMCRD 14-59 D QUAD
C12-D005080	2	FMCRD 14-59 D QUAD
C12-D005081	1	FMCRD 42-15 C QUAD
C12-D005081	2	FMCRD 42-15 C QUAD
C12-D005082	1	FMCRD 18-23 B QUAD
C12-D005082	2	FMCRD 18-23 B QUAD
C12-D005083	1	FMCRD 42-43 A QUAD
C12-D005083	2	FMCRD 42-43 A QUAD
C12-D005084	1	FMCRD 06-35 D QUAD
C12-D005084	2	FMCRD 06-35 D QUAD
C12-D005085	1	FMCRD 42-51 A QUAD
C12-D005085	2	FMCRD 42-51 A QUAD
C12-D005086	1	FMCRD 18-59 D QUAD
C12-D005086	2	FMCRD 18-59 D QUAD
C12-D005087	1	FMCRD 42-07 C QUAD
C12-D005087	2	FMCRD 42-07 C QUAD
C12-D005088	1	FMCRD 14-43 D QUAD
C12-D005088	2	FMCRD 14-43 D QUAD
C12-D005089	1	FMCRD 18-35 D QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005089	2	FMCRD 18-35 D QUAD
C12-D005090	1	FMCRD 26-31 B QUAD
C12-D005090	2	FMCRD 26-31 B QUAD
C12-D005091	1	FMCRD 46-51 A QUAD
C12-D005091	2	FMCRD 46-51 A QUAD
C12-D005092	1	FMCRD 22-11 B QUAD
C12-D005092	2	FMCRD 22-11 B QUAD
C12-D005093	1	FMCRD 22-55 D QUAD
C12-D005093	2	FMCRD 22-55 D QUAD
C12-D005094	1	FMCRD 22-59 D QUAD
C12-D005094	2	FMCRD 22-59 D QUAD
C12-D005095	1	FMCRD 26-63 D QUAD
C12-D005095	2	FMCRD 26-63 D QUAD
C12-D005096	1	FMCRD 14-23 B QUAD
C12-D005096	2	FMCRD 14-23 B QUAD
C12-D005097	1	FMCRD 22-35 B QUAD
C12-D005097	2	FMCRD 22-35 B QUAD
C12-D005098	1	FMCRD 30-27 B QUAD
C12-D005098	2	FMCRD 30-27 B QUAD
C12-D005099	1	FMCRD 34-11 B QUAD
C12-D005099	2	FMCRD 34-11 B QUAD
C12-D005100	1	FMCRD 18-47 D QUAD
C12-D005100	2	FMCRD 18-47 D QUAD
C12-D005101	1	FMCRD 62-23 C QUAD
C12-D005101	2	FMCRD 62-23 C QUAD
C12-D005102	1	FMCRD 10-51 D QUAD
C12-D005102	2	FMCRD 10-51 D QUAD
C12-D005103	1	FMCRD 34-51 D QUAD
C12-D005103	2	FMCRD 34-51 D QUAD
C12-D005104	1	FMCRD 14-47 D QUAD
C12-D005104	2	FMCRD 14-47 D QUAD
C12-D005105	1	FMCRD 62-27 C QUAD
C12-D005105	2	FMCRD 62-27 C QUAD
C12-D005106	1	FMCRD 26-55 D QUAD
C12-D005106	2	FMCRD 26-55 D QUAD
C12-D005107	1	FMCRD 30-03 B QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005107	2	FMCRD 30-03 B QUAD
C12-D005108	1	FMCRD 10-47 D QUAD
C12-D005108	2	FMCRD 10-47 D QUAD
C12-D005109	1	FMCRD 10-39 D QUAD
C12-D005109	2	FMCRD 10-39 D QUAD
C12-D005110	1	FMCRD 26-35 B QUAD
C12-D005110	2	FMCRD 26-35 B QUAD
C12-D005111	1	FMCRD 22-07 B QUAD
C12-D005111	2	FMCRD 22-07 B QUAD
C12-D005112	1	FMCRD 46-39 A QUAD
C12-D005112	2	FMCRD 46-39 A QUAD
C12-D005113	1	FMCRD 38-63 A QUAD
C12-D005113	2	FMCRD 38-63 A QUAD
C12-D005114	1	FMCRD 34-59 A QUAD
C12-D005114	2	FMCRD 34-59 A QUAD
C12-D005115	1	FMCRD 30-43 D QUAD
C12-D005115	2	FMCRD 30-43 D QUAD
C12-D005116	1	FMCRD 62-35 C QUAD
C12-D005116	2	FMCRD 62-35 C QUAD
C12-D005117	1	FMCRD 22-39 D QUAD
C12-D005117	2	FMCRD 22-39 D QUAD
C12-D005118	1	FMCRD 42-63 A QUAD
C12-D005118	2	FMCRD 42-63 A QUAD
C12-D005119	1	FMCRD 46-11 C QUAD
C12-D005119	2	FMCRD 46-11 C QUAD
C12-D005120	1	FMCRD 46-27 C QUAD
C12-D005120	2	FMCRD 46-27 C QUAD
C12-D005121	1	FMCRD 30-35 B QUAD
C12-D005121	2	FMCRD 30-35 B QUAD
C12-D005122	1	FMCRD 38-07 C QUAD
C12-D005122	2	FMCRD 38-07 C QUAD
C12-D005123	1	FMCRD 18-27 B QUAD
C12-D005123	2	FMCRD 18-27 B QUAD
C12-D005124	1	FMCRD 42-47 A QUAD
C12-D005124	2	FMCRD 42-47 A QUAD
C12-D005125	1	FMCRD 34-07 B QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005125	2	FMCRD 34-07 B QUAD
C12-D005126	1	FMCRD 62-31 C QUAD
C12-D005126	2	FMCRD 62-31 C QUAD
C12-D005127	1	FMCRD 06-23 B QUAD
C12-D005127	2	FMCRD 06-23 B QUAD
C12-D005128	1	FMCRD 46-31 C QUAD
C12-D005128	2	FMCRD 46-31 C QUAD
C12-D005129	1	FMCRD 10-31 B QUAD
C12-D005129	2	FMCRD 10-31 B QUAD
C12-D005130	1	FMCRD 62-43 A QUAD
C12-D005130	2	FMCRD 62-43 A QUAD
C12-D005131	1	FMCRD 30-55 D QUAD
C12-D005131	2	FMCRD 30-55 D QUAD
C12-D005132	1	FMCRD 26-43 D QUAD
C12-D005132	2	FMCRD 26-43 D QUAD
C12-D005133	1	FMCRD 14-35 D QUAD
C12-D005133	2	FMCRD 14-35 D QUAD
C12-D005134	1	FMCRD 30-47 D QUAD
C12-D005134	2	FMCRD 30-47 D QUAD
C12-D005135	1	FMCRD 14-15 B QUAD
C12-D005135	2	FMCRD 14-15 B QUAD
C12-D005136	1	FMCRD 18-31 B QUAD
C12-D005136	2	FMCRD 18-31 B QUAD
C12-D005137	1	FMCRD 30-51 D QUAD
C12-D005137	2	FMCRD 30-51 D QUAD
C12-D005138	1	FMCRD 66-31 C QUAD
C12-D005138	2	FMCRD 66-31 C QUAD
C12-D005139	1	FMCRD 30-15 B QUAD
C12-D005139	2	FMCRD 30-15 B QUAD
C12-D005140	1	FMCRD 50-19 C QUAD
C12-D005140	2	FMCRD 50-19 C QUAD
C12-D005141	1	FMCRD 02-35 D QUAD
C12-D005141	2	FMCRD 02-35 D QUAD
C12-D005142	1	FMCRD 46-43 A QUAD
C12-D005142	2	FMCRD 46-43 A QUAD
C12-D005143	1	FMCRD 26-19 B QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005143	2	FMCRD 26-19 B QUAD
C12-D005144	1	FMCRD 18-15 B QUAD
C12-D005144	2	FMCRD 18-15 B QUAD
C12-D005145	1	FMCRD 06-43 D QUAD
C12-D005145	2	FMCRD 06-43 D QUAD
C12-D005146	1	FMCRD 30-59 D QUAD
C12-D005146	2	FMCRD 30-59 D QUAD
C12-D005147	1	FMCRD 18-43 D QUAD
C12-D005147	2	FMCRD 18-43 D QUAD
C12-D005148	1	FMCRD 38-59 A QUAD
C12-D005148	2	FMCRD 38-59 A QUAD
C12-D005149	1	FMCRD 22-15 B QUAD
C12-D005149	2	FMCRD 22-15 B QUAD
C12-D005150	1	FMCRD 54-27 C QUAD
C12-D005150	2	FMCRD 54-27 C QUAD
C12-D005151	1	FMCRD 26-51 D QUAD
C12-D005151	2	FMCRD 26-51 D QUAD
C12-D005152	1	FMCRD 10-35 D QUAD
C12-D005152	2	FMCRD 10-35 D QUAD
C12-D005153	1	FMCRD 30-07 B QUAD
C12-D005153	2	FMCRD 30-07 B QUAD
C12-D005154	1	FMCRD 30-31 B QUAD
C12-D005154	2	FMCRD 30-31 B QUAD
C12-D005155	1	FMCRD 18-51 D QUAD
C12-D005155	2	FMCRD 18-51 D QUAD
C12-D005156	1	FMCRD 18-39 D QUAD
C12-D005156	2	FMCRD 18-39 D QUAD
C12-D005157	1	FMCRD 14-55 D QUAD
C12-D005157	2	FMCRD 14-55 D QUAD
C12-D005158	1	FMCRD 30-39 D QUAD
C12-D005158	2	FMCRD 30-39 D QUAD
C12-D005159	1	FMCRD 30-11 B QUAD
C12-D005159	2	FMCRD 30-11 B QUAD
C12-D005160	1	FMCRD 26-23 B QUAD
C12-D005160	2	FMCRD 26-23 B QUAD
C12-D005161	1	FMCRD 18-55 D QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005161	2	FMCRD 18-55 D QUAD
C12-D005162	1	FMCRD 18-11 B QUAD
C12-D005162	2	FMCRD 18-11 B QUAD
C12-D005163	1	FMCRD 14-51 D QUAD
C12-D005163	2	FMCRD 14-51 D QUAD
C12-D005164	1	FMCRD 18-19 B QUAD
C12-D005164	2	FMCRD 18-19 B QUAD
C12-D005165	1	FMCRD 10-23 B QUAD
C12-D005165	2	FMCRD 10-23 B QUAD
C12-D005166	1	FMCRD 02-31 B QUAD
C12-D005166	2	FMCRD 02-31 B QUAD
C12-D005167	1	FMCRD 34-35 B QUAD
C12-D005167	2	FMCRD 34-35 B QUAD
C12-D005168	1	FMCRD 54-43 A QUAD
C12-D005168	2	FMCRD 54-43 A QUAD
C12-D005169	1	FMCRD 06-27 B QUAD
C12-D005169	2	FMCRD 06-27 B QUAD
C12-D005170	1	FMCRD 54-39 A QUAD
C12-D005170	2	FMCRD 54-39 A QUAD
C12-D005171	1	FMCRD 10-55 D QUAD
C12-D005171	2	FMCRD 10-55 D QUAD
C12-D005172	1	FMCRD 38-23 C QUAD
C12-D005172	2	FMCRD 38-23 C QUAD
C12-D005173	1	FMCRD 22-63 D QUAD
C12-D005173	2	FMCRD 22-63 D QUAD
C12-D005174	1	FMCRD 42-39 A QUAD
C12-D005174	2	FMCRD 42-39 A QUAD
C12-D005175	1	FMCRD 34-03 B QUAD
C12-D005175	2	FMCRD 34-03 B QUAD
C12-D005176	1	FMCRD 10-27 B QUAD
C12-D005176	2	FMCRD 10-27 B QUAD
C12-D005177	1	FMCRD 30-67 D QUAD
C12-D005177	2	FMCRD 30-67 D QUAD
C12-D005178	1	FMCRD 46-23 C QUAD
C12-D005178	2	FMCRD 46-23 C QUAD
C12-D005179	1	FMCRD 02-39 D QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005179	2	FMCRD 02-39 D QUAD
C12-D005180	1	FMCRD 14-31 B QUAD
C12-D005180	2	FMCRD 14-31 B QUAD
C12-D005181	1	FMCRD 14-39 D QUAD
C12-D005181	2	FMCRD 14-39 D QUAD
C12-D005182	1	FMCRD 22-31 B QUAD
C12-D005182	2	FMCRD 22-31 B QUAD
C12-D005183	1	FMCRD 62-39 A QUAD
C12-D005183	2	FMCRD 62-39 A QUAD
C12-D005184	1	FMCRD 34-47 D QUAD
C12-D005184	2	FMCRD 34-47 D QUAD
C12-D005185	1	FMCRD 58-19 C QUAD
C12-D005185	2	FMCRD 58-19 C QUAD
C12-D005186	1	FMCRD 22-51 D QUAD
C12-D005186	2	FMCRD 22-51 D QUAD
C12-D005187	1	FMCRD 50-35 C QUAD
C12-D005187	2	FMCRD 50-35 C QUAD
C12-D005188	1	FMCRD 54-11 C QUAD
C12-D005188	2	FMCRD 54-11 C QUAD
C12-D005189	1	FMCRD 38-15 C QUAD
C12-D005189	2	FMCRD 38-15 C QUAD
C12-D005190	1	FMCRD 42-55 A QUAD
C12-D005190	2	FMCRD 42-55 A QUAD
C12-D005191	1	FMCRD 38-39 A QUAD
C12-D005191	2	FMCRD 38-39 A QUAD
C12-D005192	1	FMCRD 54-23 C QUAD
C12-D005192	2	FMCRD 54-23 C QUAD
C12-D005193	1	FMCRD 50-39 A QUAD
C12-D005193	2	FMCRD 50-39 A QUAD
C12-D005194	1	FMCRD 26-47 D QUAD
C12-D005194	2	FMCRD 26-47 D QUAD
C12-D005195	1	FMCRD 46-07 C QUAD
C12-D005195	2	FMCRD 46-07 C QUAD
C12-D005196	1	FMCRD 22-23 B QUAD
C12-D005196	2	FMCRD 22-23 B QUAD
C12-D005197	1	FMCRD 54-15 C QUAD

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
C12-D005197	2	FMCRD 54-15 C QUAD
C12-D005198	1	FMCRD 34-55 A QUAD
C12-D005198	2	FMCRD 34-55 A QUAD
C12-D005199	1	FMCRD 50-11 C QUAD
C12-D005199	2	FMCRD 50-11 C QUAD
C12-D005200	1	FMCRD 26-59 D QUAD
C12-D005200	2	FMCRD 26-59 D QUAD
C12-D005201	1	FMCRD 58-15 C QUAD
C12-D005201	2	FMCRD 58-15 C QUAD
C12-D005202	1	FMCRD 50-27 C QUAD
C12-D005202	2	FMCRD 50-27 C QUAD
C12-D005203	1	FMCRD 14-19 B QUAD
C12-D005203	2	FMCRD 14-19 B QUAD
C12-D005204	1	FMCRD 54-55 A QUAD
C12-D005204	2	FMCRD 54-55 A QUAD
C12-D005205	1	FMCRD 30-63 D QUAD
C12-D005205	2	FMCRD 30-63 D QUAD
C12-F041	1	SO VALVE
C12-F042	2	SO VALVE
C12-F043	2	AO VALVE
C12-F044	2	AO VALVE
C12-F047	1	AO VALVE
C12-F048A	1	AO VALVE
C12-F048B	2	AO VALVE
C12-F049A	1	AO VALVE
C12-F049B	2	AO VALVE
C12-PT011A	1	PRESS TRANSMITTER
C12-PT011B	2	PRESS TRANSMITTER
C12-PT011C	3	PRESS TRANSMITTER
C12-PT011D	4	PRESS TRANSMITTER
E11-C001A	1	RHR PUMP
E11-C001B	2	RHR PUMP
E11-C001C	3	RHR PUMP
E11-C002A	1	SEAL WATER PUMP
E11-C002B	2	SEAL WATER PUMP
E11-C002C	3	SEAL WATER PUMP

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E11-F001A	1	MO GATE VALVE
E11-F001B	2	MO GATE VALVE
E11-F001C	3	MO GATE VALVE
E11-F004A	1	MO GLOBE VALVE
E11-F004B	2	MO GLOBE VALVE
E11-F004C	3	MO GLOBE VALVE
E11-F005A	1	MO GATE VALVE
E11-F005B	2	MO GATE VALVE
E11-F005C	3	MO GATE VALVE
E11-F006A	1	AO CHECK VALVE
E11-F006B	2	AO CHECK VALVE
E11-F006C	3	AO CHECK VALVE
E11-F007B	2	MAN OPER GATE VALVE
E11-F007C	3	MAN OPER GATE VALVE
E11-F008A	1	MO GLOBE VALVE
E11-F008B	2	MO GLOBE VALVE
E11-F008C	3	MO GLOBE VALVE
E11-F009A	1	MAN OPER GATE VALVE
E11-F009B	2	MAN OPER GATE VALVE
E11-F009C	3	MAN OPER GATE VALVE
E11-F010A	1	MO GATE VALVE
E11-F010B	2	MO GATE VALVE
E11-F010C	3	MO GATE VALVE
E11-F011A	2	MO GATE VALVE (RHR ISOL)
E11-F011B	3	MO GATE VALVE (RHR ISOL)
E11-F011C	1	MO GATE VALVE (RHR ISOL)
E11-F012A	1	MO GATE VALVE
E11-F012B	2	MO GATE VALVE
E11-F012C	3	MO GATE VALVE
E11-F013A	1	MO GLOBE VALVE
E11-F013B	2	MO GLOBE VALVE
E11-F013C	3	MO GLOBE VALVE
E11-F014B	2	MO GATE VALVE
E11-F014C	3	MO GATE VALVE
E11-F015B	2	MO GATE VALVE
E11-F015C	3	MO GATE VALVE

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E11-F017B	2	MO GLOBE VALVE
E11-F017C	3	MO GLOBE VALVE
E11-F018B	2	MO GATE VALVE
E11-F018C	3	MO GATE VALVE
E11-F019B	2	MO GATE VALVE
E11-F019C	3	MO GATE VALVE
E11-F021A	1	MO GATE VALVE
E11-F021B	2	MO GATE VALVE
E11-F021C	3	MO GATE VALVE
E11-F029A	1	MO GATE VALVE
E11-F029B	2	MO GATE VALVE
E11-F029C	3	MO GATE VALVE
E11-F030A	1	MO GATE VALVE
E11-F030B	2	MO GATE VALVE
E11-F030C	3	MO GATE VALVE
E11-F031A	1	MO GLOBE VALVE
E11-F031B	2	MO GLOBE VALVE
E11-F031C	3	MO GLOBE VALVE
E11-F036A	1	AO GLOBE VALVE
E11-F036B	2	AO GLOBE VALVE
E11-F036C	3	AO GLOBE VALVE
E11-F043A	1	SO VALVE
E11-F043B	2	SO VALVE
E11-F043C	3	SO VALVE
E11-F044A	1	SO VALVE
E11-F044B	2	SO VALVE
E11-F044C	3	SO VALVE
E11-F045A	1	MO GLOBE VALVE
E11-F046A	1	MO GLOBE VALVE
E11-FT008A1	1	FLOW TRANSMITTER
E11-FT008A2	1	FLOW TRANSMITTER
E11-FT008B1	2	FLOW TRANSMITTER
E11-FT008B2	2	FLOW TRANSMITTER
E11-FT008C1	3	FLOW TRANSMITTER
E11-FT008C2	3	FLOW TRANSMITTER
E11-FT012B	2	FLOW TRANSMITTER

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E11-FT015B	2	FLOW TRANSMITTER
E11-FT015C	3	FLOW TRANSMITTER
E11-POT303A	1	POSITION TRANSMITTER
E11-POT303B	2	POSITION TRANSMITTER
E11-POT303C	3	POSITION TRANSMITTER
E11-PT004A	1	PRESS TRANSMITTER
E11-PT004B	2	PRESS TRANSMITTER
E11-PT004C	3	PRESS TRANSMITTER
E11-PT004E	1	PRESS TRANSMITTER
E11-PT004F	2	PRESS TRANSMITTER
E11-PT004G	3	PRESS TRANSMITTER
E11-PT005A	1	PRESS TRANSMITTER
E11-PT005B	2	PRESS TRANSMITTER
E11-PT005C	3	PRESS TRANSMITTER
E11-PT009A	1	PRESS TRANSMITTER
E11-PT009B	2	PRESS TRANSMITTER
E11-PT009C	3	PRESS TRANSMITTER
E22-C001B	2	PUMP
E22-C001C	3	PUMP
E22-F001B	2	MO GATE VALVE
E22-F001C	3	MO GATE VALVE
E22-F003B	2	MO GATE VALVE
E22-F003C	3	MO GATE VALVE
E22-F004B	2	AIR OP CHECK VALVE
E22-F004C	3	AIR OP CHECK VALVE
E22-F005B	2	MAN OPER GATE VALVE
E22-F005C	3	MAN OPER GATE VALVE
E22-F006B	2	MO GATE VALVE
E22-F006C	3	MO GATE VALVE
E22-F008B	2	MO GLOBE VALVE
E22-F008C	3	MO GLOBE VALVE
E22-F009B	2	MO GLOBE VALVE
E22-F009C	3	MO GLOBE VALVE
E22-F010B	2	MO GATE VALVE
E22-F010C	3	MO GATE VALVE
E22-F019B	2	EQUALIZING VALVE

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E22-F019C	3	EQUALIZING VALVE
E22-FT008B1	2	FLOW TRANSMITTER
E22-FT008B2	2	FLOW TRANSMITTER
E22-FT008C1	3	FLOW TRANSMITTER
E22-FT008C2	3	FLOW TRANSMITTER
E22-PT003B	2	PRESSURE TRANSMITTER
E22-PT003C	3	PRESSURE TRANSMITTER
E22-PT006B	2	PRESSURE TRANSMITTER
E22-PT006C	3	PRESSURE TRANSMITTER
E22-PT006F	2	PRESSURE TRANSMITTER
E22-PT006G	3	PRESSURE TRANSMITTER
E22-PT007B	2	PRESSURE TRANSMITTER
E22-PT007C	3	PRESSURE TRANSMITTER
E31-DPT006A	1	DIFF PRESS TRANSMITTER
E31-DPT006B	2	DIFF PRESS TRANSMITTER
E31-DPT006C	3	DIFF PRESS TRANSMITTER
E31-DPT006D	4	DIFF PRESS TRANSMITTER
E31-DPT013A	1	DIFF PRESS TRANSMITTER
E31-DPT013B	2	DIFF PRESS TRANSMITTER
E31-DPT013C	3	DIFF PRESS TRANSMITTER
E31-DPT013D	4	DIFF PRESS TRANSMITTER
E31-DPT014A	1	DIFF PRESS TRANSMITTER
E31-DPT014B	2	DIFF PRESS TRANSMITTER
E31-DPT014C	3	DIFF PRESS TRANSMITTER
E31-DPT014D	4	DIFF PRESS TRANSMITTER
E31-DPT015A	1	DIFF PRESS TRANSMITTER
E31-DPT015B	2	DIFF PRESS TRANSMITTER
E31-DPT015C	3	DIFF PRESS TRANSMITTER
E31-DPT015D	4	DIFF PRESS TRANSMITTER
E31-DPT016A	1	DIFF PRESS TRANS
E31-DPT016B	2	DIFF PRESS TRANS
E31-DPT016C	3	DIFF PRESS TRANS
E31-DPT016D	4	DIFF PRESS TRANS
E31-DPT016E	1	DIFF PRESS TRANS
E31-DPT016F	2	DIFF PRESS TRANS
E31-DPT016G	3	DIFF PRESS TRANS

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E31-DPT016H	4	DIFF PRESS TRANS
E31-DPT016J	1	DIFF PRESS TRANS
E31-DPT016K	2	DIFF PRESS TRANS
E31-DPT016L	3	DIFF PRESS TRANS
E31-DPT016M	4	DIFF PRESS TRANS
E31-DPT016N	1	DIFF PRESS TRANS
E31-DPT016P	2	DIFF PRESS TRANS
E31-DPT016R	3	DIFF PRESS TRANS
E31-DPT016S	4	DIFF PRESS TRANS
E31-F002	1	A O SOLENOID VALVE
E31-F003	2	A O SOLENOID VALVE
E31-F004	2	A O SOLENOID VALVE
E31-F005	1	A O SOLENOID VALVE
E31-PT007A	1	PRESS TRANSMITTER
E31-PT007D	4	PRESS TRANSMITTER
E31-TE005A	1	TEMP ELEMENT
E31-TE005B	2	TEMP ELEMENT
E31-TE005C	3	TEMP ELEMENT
E31-TE005D	4	TEMP ELEMENT
E31-TE008A	1	TEMP ELEMENT
E31-TE008B	2	TEMP ELEMENT
E31-TE008C	3	TEMP ELEMENT
E31-TE008D	4	TEMP ELEMENT
E31-TE008E	1	TEMP ELEMENT
E31-TE008F	2	TEMP ELEMENT
E31-TE008G	3	TEMP ELEMENT
E31-TE008H	4	TEMP ELEMENT
E31-TE008J	1	TEMP ELEMENT
E31-TE008K	2	TEMP ELEMENT
E31-TE008L	3	TEMP ELEMENT
E31-TE008M	4	TEMP ELEMENT
E31-TE009A	1	TEMP ELEMENT
E31-TE009B	2	TEMP ELEMENT
E31-TE009C	3	TEMP ELEMENT
E31-TE009D	4	TEMP ELEMENT
E31-TE009E	1	TEMP ELEMENT

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E31-TE009F	2	TEMP ELEMENT
E31-TE009G	3	TEMP ELEMENT
E31-TE009H	4	TEMP ELEMENT
E31-TE009J	1	TEMP ELEMENT
E31-TE009K	2	TEMP ELEMENT
E31-TE009L	3	TEMP ELEMENT
E31-TE009M	4	TEMP ELEMENT
E31-TE010A	1	TEMP ELEMENT
E31-TE010B	2	TEMP ELEMENT
E31-TE010C	3	TEMP ELEMENT
E31-TE010D	4	TEMP ELEMENT
E31-TE011A	1	TEMP ELEMENT
E31-TE011B	2	TEMP ELEMENT
E31-TE011C	3	TEMP ELEMENT
E31-TE011D	4	TEMP ELEMENT
E31-TE012A	1	TEMP ELEMENT
E31-TE012B	2	TEMP ELEMENT
E31-TE012C	3	TEMP ELEMENT
E31-TE012D	4	TEMP ELEMENT
E31-TE018A	1	TEMP ELEMENT
E31-TE019A	1	TEMP ELEMENT
E31-TE020A	1	TEMP ELEMENT
E31-TE020B	2	TEMP ELEMENT
E31-TE020C	3	TEMP ELEMENT
E31-TE020D	4	TEMP ELEMENT
E31-TE021A	1	MSL TEMP SENSORS
E31-TE021B	2	MSL TEMP SENSORS
E31-TE021C	3	MSL TEMP SENSORS
E31-TE021D	4	MSL TEMP SENSORS
E31-TE022A	1	TEMP ELEMENT
E31-TE022B	2	TEMP ELEMENT
E31-TE022C	3	TEMP ELEMENT
E31-TE022D	4	TEMP ELEMENT
E31-TE023A	1	TEMP ELEMENT
E31-TE023B	2	TEMP ELEMENT
E31-TE023C	3	TEMP ELEMENT

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E31-TE023D	4	TEMP ELEMENT
E31-TE024A	1	TEMP ELEMENT
E31-TE024B	2	TEMP ELEMENT
E31-TE024C	3	TEMP ELEMENT
E31-TE024D	4	TEMP ELEMENT
E31-TE025A	1	TEMP ELEMENT
E31-TE025B	2	TEMP ELEMENT
E31-TE025C	3	TEMP ELEMENT
E31-TE025D	4	TEMP ELEMENT
E31-TE026A	1	TEMP ELEMENT
E31-TE026B	2	TEMP ELEMENT
E31-TE026C	3	TEMP ELEMENT
E31-TE026D	4	TEMP ELEMENT
E31-TE027A	1	TEMP ELEMENT
E31-TE027B	2	TEMP ELEMENT
E31-TE027C	3	TEMP ELEMENT
E31-TE027D	4	TEMP ELEMENT
E31-TE028A	1	TEMP ELEMENT
E31-TE028B	2	TEMP ELEMENT
E31-TE028C	3	TEMP ELEMENT
E31-TE028D	4	TEMP ELEMENT
E31-TE029A	1	TEMP ELEMENT
E31-TE029B	2	TEMP ELEMENT
E31-TE029C	3	TEMP ELEMENT
E31-TE029D	4	TEMP ELEMENT
E31-TE031A	1	TEMP ELEMENT
E31-TE031E	1	TEMP ELEMENT
E31-TE031J	1	TEMP ELEMENT
E31-TE032A	1	TEMP ELEMENT
E31-TE032E	1	TEMP ELEMENT
E31-TE032J	1	TEMP ELEMENT
E31-TE033A	1	TEMP ELEMENT
E31-TE033E	1	TEMP ELEMENT
E31-TE033J	1	TEMP ELEMENT
E31-TE034A	1	TEMP ELEMENT
E31-TE034E	1	TEMP ELEMENT

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E31-TE034J	1	TEMP ELEMENT
E51-C002	1	TURBINE
E51-C901	1	VACUUM PUMP
E51-C902	1	CONDENSATE PUMP
E51-F001	1	MO GATE VALVE
E51-F004	1	MO GATE VALVE
E51-F005	1	A0 CHECK VALVE
E51-F006	1	MO GATE VALVE
E51-F008	1	MO GLOBE VALVE
E51-F009	1	MO GLOBE VALVE
E51-F011	1	MO GLOBE VALVE
E51-F012	1	MO GLOBE VALVE
E51-F026	1	AO GLOBE VALVE
E51-F031	1	SO DIAPHRAM VALVE
E51-F032	1	SO DIAPHRAM VALVE
E51-F035	1	MO GATE VALVE
E51-F036	2	MO GATE VALVE
E51-F037	1	MO GLOBE VALVE
E51-F039	1	MO GATE VALVE
E51-F040	1	AO GLOBE VALVE
E51-F041	1	AO GLOBE VALVE
E51-F045	1	MO GLOBE VALVE
E51-F047	1	MO GATE VALVE
E51-F048	1	MO GLOBE VALVE
E51-F058	1	AO GLOBE VALVE
E51-FT007-1	1	FLOW TRANSMITTER
E51-FT007-2	1	FLOW TRANSMITTER
E51-LS011	1	LEVEL SWITCH
E51-POT901	1	POSITION TRANSMITTER
E51-POT902	1	POSITION TRANSMITTER
E51-PT001	1	PRESS TRANSMITTER
E51-PT002	1	PRESS TRANSMITTER
E51-PT005	1	PRESS TRANSMITTER
E51-PT008	1	PRESS TRANSMITTER
E51-PT009	1	PRESS TRANSMITTER
E51-PT013A	1	PRESS TRANSMITTER

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
E51-PT013E	1	PRESS TRANSMITTER
E51-PT014A	1	PRESS TRANSMITTER
E51-PT014B	2	PRESS TRANSMITTER
E51-PT014E	1	PRESS TRANSMITTER
E51-PT014F	2	PRESS TRANSMITTER
E51-SE997	1	SPEED ELEMENT
G31-F002	2	MO GATE VALVE
G31-F003	1	MO GATE VALVE
G31-F015	1	MO GLOBE VALVE
G31-F017	1	MO GATE VALVE
G51-F001	2	MO GATE VALVE
G51-F002	1	MO GATE VALVE
G51-F007	2	MO GATE VALVE
K11-C001A	1	LCW PUMP - DRYWELL SUMP
K11-C001B	2	LCW PUMP - DRYWELL SUMP
K11-C101A	1	HCW PUMP - DRYWELL SUMP
K11-C101B	2	HCW PUMP - DRYWELL SUMP
K11-C102A	1	HCW PUMP FOR SUMP (A)
K11-C102B	2	HCW PUMP FOR SUMP (B)
K11-C102C	3	HCW PUMP FOR SUMP (C)
K11-C102D	1	HCW PUMP FOR SUMP (D)
K11-C102E	2	HCW PUMP FOR SUMP (E)
K11-C102F	3	HCW PUMP FOR SUMP (A)
K11-C102G	1	HCW PUMP FOR SUMP (B)
K11-C102H	2	HCW PUMP FOR SUMP (C)
K11-C102I	3	HCW PUMP FOR SUMP (D)
K11-C102J	1	HCW PUMP FOR SUMP (E)
P13-LT001A	1	COND STORAGE POOL LEVEL
P13-LT001B	2	COND STORAGE POOL LEVEL
P13-LT001C	3	COND STORAGE POOL LEVEL
P13-LT001D	4	COND STORAGE POOL LEVEL
P21-C001A	1	PUMP
P21-C001B	2	PUMP
P21-C001C	3	PUMP
P21-C001E	2	PUMP
P21-C001F	3	PUMP

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
P21-C001D	1	PUMP
P21-DPS033A	1	DIFF PRESS SWITCH
P21-DPS033B	2	DIFF PRESS SWITCH
P21-DPS033C	3	DIFF PRESS SWITCH
P21-DPS034A	1	DIFF PRESS SWITCH
P21-DPS034B	2	DIFF PRESS SWITCH
P21-DPS034C	3	DIFF PRESS SWITCH
P21-E/P605A	1	E/P CONVERTER
P21-E/P605B	2	E/P CONVERTER
P21-E/P605C	3	E/P CONVERTER
P21-F004A	1	MO GATE VALVE
P21-F004B	2	MO GATE VALVE
P21-F004C	3	MO GATE VALVE
P21-F004D	1	MO GATE VALVE
P21-F004E	2	MO GATE VALVE
P21-F004F	3	MO GATE VALVE
P21-F004G	1	MO GATE VALVE
P21-F004H	2	MO GATE VALVE
P21-F004J	3	MO GATE VALVE
P21-F013A	1	MO GLOBE VALVE
P21-F013B	2	MO GLOBE VALVE
P21-F013C	3	MO GLOBE VALVE
P21-F018A	1	MO GLOBE VALVE
P21-F018B	2	MO GLOBE VALVE
P21-F018C	3	MO GLOBE VALVE
P21-F019A	1	AO GLOBE VALVE
P21-F019B	2	AO GLOBE VALVE
P21-F019C	3	AO GLOBE VALVE
P21-F025A	1	MO GLOBE VALVE
P21-F025B	2	MO GLOBE VALVE
P21-F025C	3	MO GLOBE VALVE
P21-F025E	2	MO GLOBE VALVE
P21-F025F	3	MO GLOBE VALVE
P21-F055A	1	MO GATE VALVE
P21-F055B	2	MO GATE VALVE
P21-F055C	3	MO GATE VALVE

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
P21-F055D	1	MO GATE VALVE
P21-F055E	2	MO GATE VALVE
P21-F055F	3	MO GATE VALVE
P21-F072A	1	AO VALVE
P21-F072B	2	AO VALVE
P21-F072C	3	AO VALVE
P21-F072D	1	AO VALVE
P21-F072E	2	AO VALVE
P21-F072F	3	AO VALVE
P21-F074A	1	MO GATE VALVE
P21-F074B	2	MO GATE VALVE
P21-F074C	3	MO GATE VALVE
P21-F075A	1	MO GATE VALVE
P21-F075B	1	MO GATE VALVE
P21-F080A	2	MO GATE VALVE
P21-F080B	2	MO GATE VALVE
P21-F081A	1	MO GATE VALVE
P21-F081B	1	MO GATE VALVE
P21-F082A	1	MO GATE VALVE
P21-F082B	2	MO GATE VALVE
P21-F082C	3	MO GATE VALVE
P21-F084A	1	MAN OPER GATE VALVE
P21-F084B	2	MAN OPER GATE VALVE
P21-F084C	3	MAN OPER GATE VALVE
P21-F195A	1	MO GATE VALVE
P21-F195B	2	MO GATE VALVE
P21-F196A	1	MO GATE VALVE
P21-F196B	2	MO GATE VALVE
P21-FT006A	1	FLOW TRANSMITTER
P21-FT006B	2	FLOW TRANSMITTER
P21-FT006C	3	FLOW TRANSMITTER
P21-FT008A	1	FLOW TRANSMITTER
P21-FT008B	2	FLOW TRANSMITTER
P21-FT008C	3	FLOW TRANSMITTER
P21-FT042A	1	FLOW TRANSMITTER
P21-FT042B	2	FLOW TRANSMITTER

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
P21-FT042C	3	FLOW TRANSMITTER
P21-LS015A	1	LEVEL SWITCH
P21-LS015B	2	LEVEL SWITCH
P21-LS015C	3	LEVEL SWITCH
P21-LT013A	1	LEVEL TRANSMITTER
P21-LT013B	2	LEVEL TRANSMITTER
P21-LT013C	3	LEVEL TRANSMITTER
P21-LT014A	1	LEVEL TRANSMITTER
P21-LT014B	2	LEVEL TRANSMITTER
P21-LT014C	3	LEVEL TRANSMITTER
P21-LT014D	1	LEVEL TRANSMITTER
P21-LT014E	2	LEVEL TRANSMITTER
P21-LT014F	3	LEVEL TRANSMITTER
P21-LT014G	1	LEVEL TRANSMITTER
P21-LT014H	2	LEVEL TRANSMITTER
P21-LT014J	3	LEVEL TRANSMITTER
P21-PT004A	1	PRESS TRANSMITTER
P21-PT004B	2	PRESS TRANSMITTER
P21-PT004C	3	PRESS TRANSMITTER
P21-TE005A	1	TEMP ELEMENT
P21-TE005B	2	TEMP ELEMENT
P21-TE005C	3	TEMP ELEMENT
P21-TE009A	1	TEMP ELEMENT
P21-TE009B	2	TEMP ELEMENT
P21-TE009C	3	TEMP ELEMENT
P24-F053	1	MO GATE VALVE
P24-F141	2	MO GATE VALVE
P24-F142	1	MO GATE VALVE
P25 F016A	1	TEMP CONTROL VALVE
P25-C001A	1	HECW PUMP
P25-C001B	2	HECW PUMP
P25-C001C	3	HECW PUMP
P25-C001E	2	HECW PUMP
P25-C001F	3	HECW PUMP
P25-D001A	1	REFRIGERATOR
P25-D001B	2	REFRIGERATOR

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
P25-D001C	3	REFRIGERATOR
P25-D001E	2	REFRIGERATOR
P25-D001F	3	REFRIGERATOR
P25-DPT007A	1	DIFF PRESS TRANSMITTER
P25-DPT007B	2	DIFF PRESS TRANSMITTER
P25-DPT007C	3	DIFF PRESS TRANSMITTER
P25-F005B	2	TEMP CONTROL VALVE
P25-F005C	3	TEMP CONTROL VALVE
P25-F012A	1	PRESSURE CONTROL VALVE
P25-F012B	2	PRESSURE CONTROL VALVE
P25-F012C	3	PRESSURE CONTROL VALVE
P25-F016B	2	TEMP CONTROL VALVE
P25-F016C	3	TEMP CONTROL VALVE
P25-F022A	1	TEMP CONTROL VALVE
P25-F022B	2	TEMP CONTROL VALVE
P25-F022C	3	TEMP CONTROL VALVE
P25-FIS003A	1	FLOW IND SWITCH
P25-FIS003B	2	FLOW IND SWITCH
P25-FIS003C	3	FLOW IND SWITCH
P25-FIS003E	2	FLOW IND SWITCH
P25-FIS003F	3	FLOW IND SWITCH
P25-TE005A	1	TEMP ELEMENT
P25-TE005B	2	TEMP ELEMENT
P25-TE005C	3	TEMP ELEMENT
P41-C001A	1	RSW PUMP
P41-C001B	2	RSW PUMP
P41-C001C	3	RSW PUMP
P41-C001D	1	RSW PUMP
P41-C001E	2	RSW PUMP
P41-C001F	3	RSW PUMP
P41-DPI004A	1	DIFF PRESS INDICATOR
P41-DPI004B	2	DIFF PRESS INDICATOR
P41-DPI004C	3	DIFF PRESS INDICATOR
P41-DPI004D	1	DIFF PRESS INDICATOR
P41-DPI004E	2	DIFF PRESS INDICATOR
P41-DPI004F	3	DIFF PRESS INDICATOR

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
P41-DPS004A	1	DIFF PRESS SWITCH
P41-DPS004B	2	DIFF PRESS SWITCH
P41-DPS004C	3	DIFF PRESS SWITCH
P41-DPS004D	1	DIFF PRESS SWITCH
P41-DPS004E	2	DIFF PRESS SWITCH
P41-DPS004F	3	DIFF PRESS SWITCH
P41-DPT004A	1	DIFF PRESS TRANS
P41-DPT004B	2	DIFF PRESS TRANS
P41-DPT004C	3	DIFF PRESS TRANS
P41-DPT004D	1	DIFF PRESS TRANS
P41-DPT004E	2	DIFF PRESS TRANS
P41-DPT004F	3	DIFF PRESS TRANS
P41-F003A	1	MO BUTTERFLY VLV
P41-F003B	2	MO BUTTERFLY VLV
P41-F003C	3	MO BUTTERFLY VLV
P41-F003D	1	MO BUTTERFLY VLV
P41-F003E	2	MO BUTTERFLY VLV
P41-F003F	3	MO BUTTERFLY VLV
P41-F004A	1	MO BUTTERFLY VLV
P41-F004B	2	MO BUTTERFLY VLV
P41-F004C	3	MO BUTTERFLY VLV
P41-F004D	1	MO BUTTERFLY VLV
P41-F004E	2	MO BUTTERFLY VLV
P41-F004F	3	MO BUTTERFLY VLV
P41-F005A	1	MO BUTTERFLY VLV
P41-F005B	2	MO BUTTERFLY VLV
P41-F005C	3	MO BUTTERFLY VLV
P41-F005D	1	MO BUTTERFLY VLV
P41-F005E	2	MO BUTTERFLY VLV
P41-F005F	3	MO BUTTERFLY VLV
P41-F005G	1	MO BUTTERFLY VLV
P41-F005H	2	MO BUTTERFLY VLV
P41-F005J	3	MO BUTTERFLY VLV
P41-F006A	1	MO BUTTERFLY VLV
P41-F006B	2	MO BUTTERFLY VLV
P41-F006C	3	MO BUTTERFLY VLV

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
P41-F006D	1	MO BUTTERFLY VLV
P41-F006E	2	MO BUTTERFLY VLV
P41-F006F	3	MO BUTTERFLY VLV
P41-F009A	1	AO GLOBE VALVE
P41-F009B	2	AO GLOBE VALVE
P41-F009C	3	AO GLOBE VALVE
P41-F009D	1	AO GLOBE VALVE
P41-F009E	2	AO GLOBE VALVE
P41-F009F	3	AO GLOBE VALVE
P41-F009G	1	AO GLOBE VALVE
P41-F009H	2	AO GLOBE VALVE
P41-F009J	3	AO GLOBE VALVE
P41-F011A	1	AO GLOBE VALVE
P41-F011B	2	AO GLOBE VALVE
P41-F011C	3	AO GLOBE VALVE
P41-F011D	1	AO GLOBE VALVE
P41-F011E	2	AO GLOBE VALVE
P41-F011F	3	AO GLOBE VALVE
P41-F011G	1	MO BUTTERFLY VLV
P41-F011H	2	MO BUTTERFLY VLV
P41-F011J	3	MO BUTTERFLY VLV
P41-F013A	1	MO BUTTERFLY VLV
P41-F013B	2	MO BUTTERFLY VLV
P41-F013C	3	MO BUTTERFLY VLV
P41-F013D	1	MO BUTTERFLY VLV
P41-F013E	2	MO BUTTERFLY VLV
P41-F013F	3	MO BUTTERFLY VLV
P41-F014A	1	MO BUTTERFLY VLV
P41-F014B	2	MO BUTTERFLY VLV
P41-F014C	3	MO BUTTERFLY VLV
P41-F015A	1	MO BUTTERFLY VLV
P41-F015B	2	MO BUTTERFLY VLV
P41-F015C	3	MO BUTTERFLY VLV
P41-PT003A	1	PRESS TRANSMITTER
P41-PT003B	2	PRESS TRANSMITTER
P41-PT003C	3	PRESS TRANSMITTER

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
P51-F276	1	MO GLOBE VALVE
P54-F003A	1	MO GLOBE VALVE
P54-F003B	2	MO GLOBE VALVE
P54-F007A	1	MO GLOBE VALVE
P54-F007B	2	MO GLOBE VALVE
P54-F012A	1	MO GLOBE VALVE
P54-F012B	2	MO GLOBE VALVE
P54-F200	1	MO GLOBE VALVE
P54-PIS001A	1	PRESS IND SWITCH
P54-PIS001B	2	PRESS IND SWITCH
P54-PT002A	1	PRESS TRANSMITTER
P54-PT002B	2	PRESS TRANSMITTER
P54-PT005	1	PRESS TRANSMITTER
R24 MCC C10	1	MOTOR CONTROL CENTER
R24 MCC C11	1	MOTOR CONTROL CENTER
R24 MCC C12	1	MOTOR CONTROL CENTER
R24 MCC C13	1	MOTOR CONTROL CENTER
R24 MCC C14	1	MOTOR CONTROL CENTER
R24 MCC C17	1	MOTOR CONTROL CENTER
R24 MCC D10	2	MOTOR CONTROL CENTER
R24 MCC D11	2	MOTOR CONTROL CENTER
R24 MCC D12	2	MOTOR CONTROL CENTER
R24 MCC D14	2	MOTOR CONTROL CENTER
R24 MCC D17	2	MOTOR CONTROL CENTER
R24 MCC E10	3	MOTOR CONTROL CENTER
R24 MCC E11	3	MOTOR CONTROL CENTER
R24 MCC E14	3	MOTOR CONTROL CENTER
R24 MCC E17	3	MOTOR CONTROL CENTER
R42-P005A	1	125 VDC NORM CHARGER
R42-P005B	2	125 VDC NORM CHARGER
R42-P005C	3	125 VDC NORM CHARGER
R42-P005D	4	125 VDC NORM CHARGER
R42-P006A	1	125 VDC NORM CHARGER
R42-P006B	2	125 VDC NORM CHARGER
R42-P006C	3	125 VDC NORM CHARGER
R42-P006D	4	125 VDC NORM CHARGER

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
R42-P007A	1	125 VDC CNTR DIST BD
R42-P007B	2	125 VDC CNTR DIST BD
R42-P007C	3	125 VDC CNTR DIST BD
R42-P007D	4	125 VDC CNTR DIST BD
R42-P008A	1,2	125 VDC STBY CHARGER
R42-P008B	1,3	125 VDC STBY CHARGER
R43-C201A	1	COMPRESSOR
R43-C201B	2	COMPRESSOR
R43-C201C	3	COMPRESSOR
R43-C202A	1	COMPRESSOR
R43-C202B	2	COMPRESSOR
R43-C202C	3	COMPRESSOR
R43-C401A	1	LUBE OIL PUMP
R43-C401B	2	LUBE OIL PUMP
R43-C401C	3	LUBE OIL PUMP
R43-DPS091A	1	DIFF PRESS SWITCH
R43-DPS091B	2	DIFF PRESS SWITCH
R43-DPS091C	3	DIFF PRESS SWITCH
R43-J001A	1	DIESEL GENERATOR
R43-J001B	2	DIESEL GENERATOR
R43-J001C	3	DIESEL GENERATOR
R43-LIS191A	1	LEVEL IND SWITCH
R43-LIS191B	2	LEVEL IND SWITCH
R43-LIS191C	3	LEVEL IND SWITCH
R43-LS142A	1	LEVEL SWITCH
R43-LS142B	2	LEVEL SWITCH
R43-LS142C	3	LEVEL SWITCH
R43-LS395A	1	LEVEL SWITCH
R43-LS395B	2	LEVEL SWITCH
R43-LS395C	3	LEVEL SWITCH
R43-P001A	1	DG(A) CONTROL PNL (A)
R43-P001B	2	DG(B) CONTROL PNL (A)
R43-P001C	3	DG(C) CONTROL PNL (A)
R43-P002A	1	DG(A) SCT PANEL
R43-P002B	2	DG(B) SCT PANEL
R43-P002C	3	DG(C) SCT PANEL

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
R43-P003A	1	DG(A) CONTROL PNL (B)
R43-P003B	2	DG(B) CONTROL PNL (B)
R43-P003C	3	DG(C) CONTROL PNL (B)
R46-J002A1	1	VITAL DIST PNL A1
R46-J002B1	2	VITAL DIST PNL B1
R46-J002C1	3	VITAL DIST PNL C1
R46-J002D1	4	VITAL DIST PNL D1
R46-P001A	1	VITAL CVCF A
R46-P001B	2	VITAL CVCF B
R46-P001C	3	VITAL CVCF C
R46-P001D	4	VITAL CVCF D
T22-B001B	2	DIFF PRESS TRANSMITTER
T22-B001C	3	DIFF PRESS TRANSMITTER
T22-C001B	2	PROCESS FAN (B)
T22-C001C	3	PROCESS FAN (C)
T22-C002B	2	COOLING FAN (B)
T22-C002C	3	COOLING FAN (C)
T22-D001B	2	FILTER TRAIN UNIT (B)
T22-D001C	3	FILTER TRAIN UNIT (C)
T22-DPT003	3	DIFF PRESS TRANSMITTER
T22-DPT007	3	DIFF PRESS TRANSMITTER
T22-DPT008	3	DIFF PRESS TRANSMITTER
T22-DPT012	3	DIFF PRESS TRANSMITTER
T22-DPT017	3	DIFF PRESS TRANSMITTER
T22-DPT021A	1	DIFF PRESS TRANSMITTER
T22-DPT021B	2	DIFF PRESS TRANSMITTER
T22-DPT021C	3	DIFF PRESS TRANSMITTER
T22-DPT021D	4	DIFF PRESS TRANSMITTER
T22-DPT022	2	DIFF PRESS TRANSMITTER
T22-DPT027	2	DIFF PRESS TRANSMITTER
T22-DPT103	2	DIFF PRESS TRANSMITTER
T22-DPT107	2	DIFF PRESS TRANSMITTER
T22-DPT108	2	DIFF PRESS TRANSMITTER
T22-F002B	2	MO BUTTERFLY VALVE
T22-F002C	3	MO BUTTERFLY VALVE
T22-F004B	2	MO BUTTERFLY VALVE

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
T22-F004C	3	MO BUTTERFLY VALVE
T22-F005B	2	MO BUTTERFLY VALVE
T22-F005C	3	MO BUTTERFLY VALVE
T22-FT018B	2	FLOW TRANSMITTER
T22-FT018C	3	FLOW TRANSMITTER
T22-H001C1	3	PRE SPACE HEATER
T22-H001C2	3	PRE SPACE HEATER
T22-H001C3	3	AFTER SPACE HEATER
T22-H001C4	3	AFTER SPACE HEATER
T22-H001B1	2	PRE SPACE HEATER
T22-H001B2	2	PRE SPACE HEATER
T22-H001B3	2	AFTER SPACE HEATER
T22-H001B4	2	AFTER SPACE HEATER
T22-LS004B	2	LEVEL SWITCH
T22-LS004C	3	LEVEL SWITCH
T22-LS029C	3	LEVEL SWITCH
T22-LS029B	2	LEVEL SWITCH
T22-ME011B	2	MOISTURE ELEMENT
T22-ME011C	3	MOISTURE ELEMENT
T22-ME012B	2	MOISTURE ELEMENT
T22-ME012C	3	MOISTURE ELEMENT
T22-MT011B	2	MOISTURE TRANSMITTER
T22-MT011C	3	MOISTURE TRANSMITTER
T22-MT012B	2	MOISTURE TRANSMITTER
T22-MT012C	3	MOISTURE TRANSMITTER
T22-POE001B	2	POSITION ELEMENT
T22-POE001C	3	POSITION ELEMENT
T22-TE002B	2	TEMP ELEMENT
T22-TE002C	3	TEMP ELEMENT
T22-TE010B	2	TEMP ELEMENT
T22-TE010C	3	TEMP ELEMENT
T22-TE013B	2	TEMP ELEMENT
T22-TE013C	3	TEMP ELEMENT
T22-TE014B	2	TEMP ELEMENT
T22-TE014C	3	TEMP ELEMENT
T22-TE016B	2	TEMP ELEMENT

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
T22-TE016C	3	TEMP ELEMENT
T22-TS005B	2	TEMP SWITCH
T22-TS005C	3	TEMP SWITCH
T22-TS009B	2	TEMP SWITCH
T22-TS009C	3	TEMP SWITCH
T22-TS013B	2	TEMP SWITCH
T22-TS013C	3	TEMP SWITCH
T22-TS015B	2	TEMP ELEMENT
T22-TS015C	3	TEMP ELEMENT
T31-F001	1	AO VALVE
T31-F002	2	AO VALVE
T31-F003	2	AO VALVE
T31-F004	2	AO VALVE
T31-F005	2	AO VALVE
T31-F006	2	AO VALVE
T31-F007	2	AO VALVE
T31-F008	1	AO VALVE
T31-F009	1	AO VALVE
T31-F010	1	AO VALVE
T31-F011	3	AO VALVE
T31-F025	1	AO VALVE
T31-F039	1	AO VALVE
T31-F040	2	AO VALVE
T31-F041	2	AO VALVE
T31-F044A-H	1	POSITION SWITCH
T31-F044A-H	2	POSITION SWITCH
T31-F731	1	SO VALVE
T31-F733A	1	SO VALVE
T31-F733B	1	SO VALVE
T31-F735A	1	SO VALVE
T31-F735B	2	SO VALVE
T31-F735C	3	SO VALVE
T31-F735D	4	SO VALVE
T31-F737A	1	SO VALVE
T31-F737B	1	SO VALVE
T31-F739A	1	SO VALVE

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
T31-F739B	2	SO VALVE
T31-F739C	3	SO VALVE
T31-F739D	4	SO VALVE
T31-F741A	1	SO VALVE
T31-F741B	2	SO VALVE
T31-F741C	3	SO VALVE
T31-F741D	4	SO VALVE
T31-F743A	1	SO VALVE
T31-F743B	2	SO VALVE
T31-F745A	1	SO VALVE
T31-F745B	2	SO VALVE
T31-F801A	1	SO VALVE
T31-F801B	2	SO VALVE
T31-F803A	1	SO VALVE
T31-F803B	2	SO VALVE
T31-F805A	1	SO VALVE
T31-F805B	2	SO VALVE
T31-LT058A	1	LEVEL TRANSMITTER
T31-LT058B	2	LEVEL TRANSMITTER
T31-LT058C	3	LEVEL TRANSMITTER
T31-LT058D	4	LEVEL TRANSMITTER
T31-LT059A	1	LEVEL TRANSMITTER
T31-LT059B	2	LEVEL TRANSMITTER
T31-LT100A	1	LEVEL TRANSMITTER
T31-LT100B	2	LEVEL TRANSMITTER
T49-C001B	2	BLOWER
T49-C001C	3	BLOWER
T49-D002B	2	HEATER
T49-D002C	3	HEATER
T49-F001B	2	MO GATE VALVE
T49-F001C	3	MO GATE VALVE
T49-F002A	1	AO GATE VALVE
T49-F002A	3	AO GATE VALVE
T49-F002E	1	AO GATE VALVE
T49-F002E	2	AO GATE VALVE
T49-F003B	2	MO GLOBE VALVE

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
T49-F003C	3	MO GLOBE VALVE
T49-F004B	2	MO GLOBE VALVE
T49-F004C	3	MO GLOBE VALVE
T49-F006A	1	AO GATE VALVE
T49-F006A	3	AO GATE VALVE
T49-F006E	1	AO GATE VALVE
T49-F006E	2	AO GATE VALVE
T49-F007B	2	MO GATE VALVE
T49-F007C	3	MO GATE VALVE
T49-F008B	2	MO GATE VALVE
T49-F008C	3	MO GATE VALVE
T49-F009B	2	MAN OPER GLOBE VALVE
T49-F009C	3	MAN OPER GLOBE VALVE
T49-F010B	2	MO GLOBE VALVE
T49-F010C	3	MO GLOBE VALVE
T49-F013B	2	MAN OPER GATE VALVE
T49-F013C	3	MAN OPER GATE VALVE
T49-F014B	2	MAN OPER GATE VALVE
T49-F014C	3	MAN OPER GATE VALVE
T49-FT002B	2	FLOW TRANSMITTER
T49-FT002C	3	FLOW TRANSMITTER
T49-FT004B	2	FLOW TRANSMITTER
T49-FT004C	3	FLOW TRANSMITTER
T49-PT003B	2	PRESS TRANSMITTER
T49-PT003C	3	PRESS TRANSMITTER
T49-TE001B	2	TEMP ELEMENT
T49-TE001C	3	TEMP ELEMENT
T49-TE005B	2	TEMP ELEMENT
T49-TE005C	3	TEMP ELEMENT
T49-TE006B-1	2	TEMP ELEMENT
T49-TE006C-1	3	TEMP ELEMENT
T49-TE007B-1	2	TEMP ELEMENT
T49-TE007C-1	3	TEMP ELEMENT
T49-TE008B-1	2	TEMP ELEMENT
T49-TE008C-1	3	TEMP ELEMENT
T49-TE009B-1	2	TEMP ELEMENT

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
T49-TE009C-1	3	TEMP ELEMENT
T49-TE010B-1	2	TEMP ELEMENT
T49-TE010C-1	3	TEMP ELEMENT
T49-TE011B-1	2	TEMP ELEMENT
T49-TE011C-1	3	TEMP ELEMENT
T53-TE001A	1	TEMPERATURE ELEMENT
T53-TE001C	3	TEMPERATURE ELEMENT
T53-TE001E	1	TEMPERATURE ELEMENT
T53-TE001G	3	TEMPERATURE ELEMENT
T53-TE001J	1	TEMPERATURE ELEMENT
T53-TE001L	3	TEMPERATURE ELEMENT
T53-TE001N	1	TEMPERATURE ELEMENT
T53-TE001R	3	TEMPERATURE ELEMENT
T53-TE002B	2	TEMPERATURE ELEMENT
T53-TE002D	4	TEMPERATURE ELEMENT
T53-TE002F	2	TEMPERATURE ELEMENT
T53-TE002H	4	TEMPERATURE ELEMENT
T53-TE002K	2	TEMPERATURE ELEMENT
T53-TE002M	4	TEMPERATURE ELEMENT
T53-TE002P	2	TEMPERATURE ELEMENT
T53-TE002S	4	TEMPERATURE ELEMENT
T53-TE003B	2	TEMPERATURE ELEMENT
T53-TE003D	4	TEMPERATURE ELEMENT
T53-TE003F	2	TEMPERATURE ELEMENT
T53-TE003H	4	TEMPERATURE ELEMENT
T53-TE003K	2	TEMPERATURE ELEMENT
T53-TE003M	4	TEMPERATURE ELEMENT
T53-TE003P	2	TEMPERATURE ELEMENT
T53-TE003S	4	TEMPERATURE ELEMENT
T53-TE004A	1	TEMPERATURE ELEMENT
T53-TE004C	3	TEMPERATURE ELEMENT
T53-TE004E	1	TEMPERATURE ELEMENT
T53-TE004G	3	TEMPERATURE ELEMENT
T53-TE004J	1	TEMPERATURE ELEMENT
T53-TE004L	3	TEMPERATURE ELEMENT
T53-TE004N	1	TEMPERATURE ELEMENT

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
T53-TE004R	3	TEMPERATURE ELEMENT
T53-TE005A	1	TEMPERATURE ELEMENT
T53-TE005C	3	TEMPERATURE ELEMENT
T53-TE005E	1	TEMPERATURE ELEMENT
T53-TE005G	3	TEMPERATURE ELEMENT
T53-TE005J	1	TEMPERATURE ELEMENT
T53-TE005L	3	TEMPERATURE ELEMENT
T53-TE005N	1	TEMPERATURE ELEMENT
T53-TE005R	3	TEMPERATURE ELEMENT
T53-TE006B	2	TEMPERATURE ELEMENT
T53-TE006D	4	TEMPERATURE ELEMENT
T53-TE006F	2	TEMPERATURE ELEMENT
T53-TE006H	4	TEMPERATURE ELEMENT
T53-TE006K	2	TEMPERATURE ELEMENT
T53-TE006M	4	TEMPERATURE ELEMENT
T53-TE006P	2	TEMPERATURE ELEMENT
T53-TE006S	4	TEMPERATURE ELEMENT
T53-TE007B	2	TEMPERATURE ELEMENT
T53-TE007D	4	TEMPERATURE ELEMENT
T53-TE007F	2	TEMPERATURE ELEMENT
T53-TE007H	4	TEMPERATURE ELEMENT
T53-TE007K	2	TEMPERATURE ELEMENT
T53-TE007M	4	TEMPERATURE ELEMENT
T53-TE007P	2	TEMPERATURE ELEMENT
T53-TE007S	4	TEMPERATURE ELEMENT
T53-TE008A	1	TEMPERATURE ELEMENT
T53-TE008C	3	TEMPERATURE ELEMENT
T53-TE008E	1	TEMPERATURE ELEMENT
T53-TE008G	3	TEMPERATURE ELEMENT
T53-TE008J	1	TEMPERATURE ELEMENT
T53-TE008L	3	TEMPERATURE ELEMENT
T53-TE008N	1	TEMPERATURE ELEMENT
T53-TE008R	3	TEMPERATURE ELEMENT
U41-C201A	1	DG(A) SUPPLY FAN (A)
U41-C201E	1	DG(A) SUPPLY FAN (E)
U41-C202A	1	DG(A) EXHAUST FAN (A)

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
U41-C202E	1	DG(A) EXHAUST FAN (E)
U41-C203A	1	DG(A) EMER SUPP FAN (A)
U41-C203E	1	DG(A) EMER SUPP FAN (E)
U41-C204B	2	DG(B) SUPPLY FAN (B)
U41-C204F	2	DG(B) SUPPLY FAN (F)
U41-C205B	2	DG(B) EXHAUST FAN (B)
U41-C205F	2	DG(B) EXHAUST FAN (F)
U41-C206B	2	DG(B) EMER SUPP FAN (B)
U41-C206F	2	DG(B) EMER SUPP FAN (F)
U41-C207C	3	DG(C) SUPPLY FAN (C)
U41-C207G	3	DG(C) SUPPLY FAN (G)
U41-C208C	3	DG(C) EXHAUST FAN (C)
U41-C208G	3	DG(C) EXHAUSR FAN (G)
U41-C209C	3	DG(C) EMER SUPP FAN (C)
U41-C209G	3	DG(C) EMER SUPP FAN (G)
U41-C601B	2	MCR SUPPLY FAN (B)
U41-C601F	2	MCR SUPPLY FAN (F)
U41-C602B	2	MCR EXHAUST FAN (B)
U41-C602F	2	MCR EXHAUST FAN (F)
U41-C603B	2	MCR RECIRC SUPP FAN (B)
U41-C603F	2	MCR RECIRC SUPP FAN (F)
U41-C604A	1	EMER EQ FAN(A) ZONE(A)
U41-C604E	1	EMER EQ FAN(B) ZONE(A)
U41-C605A	1	EM EQ EX FAN(A) ZONE(A)
U41-C605E	1	EM EQ EX FAN(B) ZONE(A)
U41-C606B	2	EMER EQ FAN(A) ZONE(B)
U41-C606F	2	EMER EQ FAN(B) ZONE(B)
U41-C607B	2	EM EQ EX FAN(A) ZONE(B)
U41-C607F	2	EM EQ EX FAN(B) ZONE(B)
U41-C608C	3	EMER EQ FAN(A) ZONE(C)
U41-C608G	3	EMER EQ FAN (B) ZONE(C)
U41-C609C	3	EM EQ EX FAN(A) ZONE(C)
U41-C609G	3	EM EQ EX FAN(B) ZONE(C)
U41-C621C	3	MCR SUPPLY FAN (C)
U41-C621G	3	MCR SUPPLY FAN (G)
U41-C622C	3	MCR SUPPLY FAN (C)
U41-C622G	3	MCR SUPPLY FAN (G

Table 7A-1 List of Equipment Interface with ECFs Signals (Typical) (Continued)

Device	Div	Description
U41-C623C	3	MCR RECIRC SUPP FAN (C)
U41-C623G	3	MCR RECIRC SUPP FAN (G)
U41-D101	1	RCIC PUMP ROOM HVH
U41-D102	3	HPCF PUMP (C) ROOM HVH
U41-D103	1	RHR PUMP (A) ROOM HVH
U41-D104	3	RHR PUMP (C) ROOM HVH
U41-D105	2	RHR PUMP (B) ROOM HVH
U41-D106	2	HPCF PUMP (B) ROOM HVH
U41-D109	1	FPC PUMP (A) ROOM HVH
U41-D110	2	FPC PUMP (B) ROOM HVH
U41-D111	3	SGTS ROOM HVH (C)
U41-D112	2	SGTS ROOM HVH (B)
U41-D113	1	CAMS (A) ROOM HVH
U41-D114	2	CAMS (B) ROOM HVH
U41-F001A	1	AO VLV - R/A SUP ISO VLV
U41-F001B	2	AO VLV - R/A SUP ISO VLV
U41-F002A	1	AO VLV - R/A EXH ISO (A)
U41-F002B	2	AO VLV - R/A EXH ISO (B)
U41-F003A	1	MO VALVE
U41-F003B	2	MO VALVE
U41-F003C	3	MO VALVE
U41-F004A	1	MO VALVE
U41-F004B	2	MO VALVE
U41-F004C	3	MO VALVE
U41-F005A	1	MO VALVE
U41-F005B	2	MO VALVE
U41-F005C	3	MO VALVE
U41-TE052	1	TEMP ELEMENT
U41-TE056	2	TEMP ELEMENT
U41-TE060	3	TEMP ELEMENT
U41-TE103B	2	TEMP ELEMENT
U41-TE103C	3	TEMP ELEMENT

Figure 7A-1 Not Used (See Figure 7.9-1)

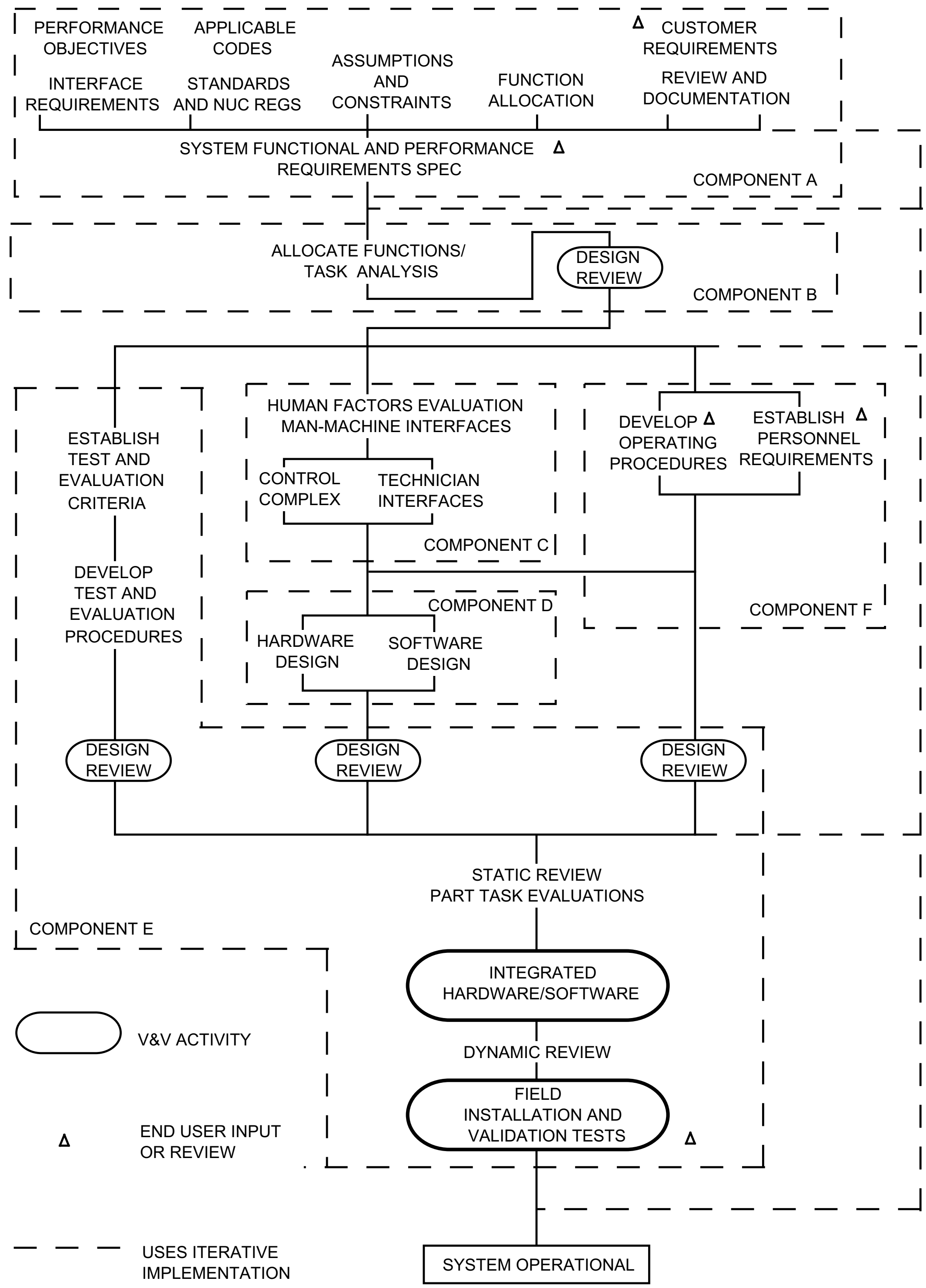

Figure 7A-2 Structure for Control and Instrumentation System Design