

SECTION 40 61 23

PROCESS CONTROL SYSTEM START-UP AND FIELD TESTING

PART 1 - GENERAL

1.1 SYSTEM CHECK-OUT AND START-UP RESPONSIBILITIES

- A. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all equipment and coordinate all activities necessary to perform check-out and start-up of the equipment.
- B. CONTRACTOR shall retain the services of the I&C System Supplier (hereinafter referred to as Supplier) to supervise and/or perform check-out and start-up of all system components. As part of these services, the Supplier shall include for those equipment items not manufactured by him the services of an authorized manufacturers' representative to check the equipment installation and place the equipment in operation. The manufacturers' representative shall be thoroughly knowledgeable about the installation, operation and maintenance of the equipment.

1.2 SYSTEM CHECKOUT AND START-UP

- A. CONTRACTOR, under the supervision of the Supplier, shall perform the following:
 - 1. Check and approve the installation of all PCS components including computer and network components, and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.
 - 2. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.
 - 3. Conduct a complete system checkout and adjustment, including checking each components functions, and testing of final computer and network actions. When there are future computer and network functions included in the Work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the computers and computer network.
 - 4. Check all I/O transmitted through digital communications to MCCs, VFDs, vendor-provided PLCs, and electrical metering devices.

- B. CONTRACTOR shall provide all test equipment necessary to perform the testing during system checkout and start-up.
- C. CONTRACTOR and Supplier shall be responsible for initial operation of process control system, computers, and network, and shall make any required changes, adjustment or replacements for operation, monitoring and control of the various processes and equipment necessary to perform the functions intended.
- D. CONTRACTOR shall furnish to the ENGINEER certified calibration reports for field instruments and devices specified in Section 40 70 05, Primary Sensors and Field Instruments, and panel mounted devices specified in Section 40 78 00, Panel-Mounted Instruments and Devices, as soon as calibration is completed.
- E. CONTRACTOR shall furnish ENGINEER an installation inspection report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both CONTRACTOR and the Supplier.
- F. Prior to integrated system field test, check and confirm REMOTE MANUAL control of all devices.

1.3 INTEGRATED SYSTEM FIELD TEST

- A. Following the PCS checkout and initial operation, CONTRACTOR, under the supervision of the Supplier, shall perform a complete system test to verify that all equipment, networks, and programmed software are operating properly as a fully integrated system, and that the intended monitoring and control functions are fully implemented and operational. Any defects or problems found during the test shall be corrected by CONTRACTOR and then retested to demonstrate proper operation.
- B. Following demonstration of all system functions, the PCS including field sensors/transducers and instruments shall be running and fully operational for a continuous 48 hour period. The Operational Availability Demonstration specified below shall not begin until the continuous 48 hour integrated system test has been successfully completed and OWNER and ENGINEER agree that the Operation Availability Demonstration can begin.

1.4 OPERATIONAL AVAILABILITY DEMONSTRATION

- A. Operational Availability Demonstration (OAD) shall begin following completion of the integrated system field test as specified above and shall continue until a time frame has been achieved wherein the system (both hardware and software) availability meets or exceeds 99.7 percent for 30 consecutive days and no system failures have occurred which result in starting the OAD over again. During the OAD the system shall be available to plant operating personnel for use in normal operation of the plant.

- B. For the purpose of the OAD, the system will be defined as consisting of the following systems and components:
1. Primary Sensors and Field Instruments
 2. Programmable Logic Controllers
 3. Control Panels and Enclosures
 4. Network Switches
 5. Network Cabinets (patch panels, media converters, fiber and copper connections)
 6. Servers
 7. Computers and ancillary equipment (keyboard/mouse/monitor)
 8. Communications to Ethernet-enabled MCCs and VFDs.
- C. The conditions listed below shall constitute system failures which are considered critical to the operability and maintainability of the system. The OAD shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 30 consecutive day OAD shall begin.
1. Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification.
 2. Recurrent hardware or software problems: if the same type of problem occurs three times or more.
 3. Software problem causing a processor to halt execution.
- D. The following conditions shall constitute a system failure in determining the system availability based on the equation specified in Paragraph 1.4.E., below:
1. Loss of communications between devices on the communications network, including those on Ethernet-enabled MCCs and VFDs.
 2. Failure of one or more computer or network components.
 3. Failures of any type affecting ten or more computer or network components simultaneously.
 4. Failure of one or more input/output components.
 5. Failures of any type affecting ten or more input/output points simultaneously.
 6. Failure of any type affecting one or more regulatory control loops or sequential control strategies thereby causing a loss of the automatic control of the process variable or process sequence operation.
 7. Failure of power supply. Where redundant power supplies are provided, failure of one power supply shall not constitute a system failure provided the backup power supply operates properly and maintains supply power. Failure of the backup supply to operate properly and maintain supply power shall constitute a system failure.
 8. Failure of three or more primary sensors/transducers or field instruments simultaneously.

- E. The system availability shall be calculated based on the following equation:

$$A = \frac{TTO}{TTO + TTR} \times 100 \text{ percent}$$

where, A = system availability in percent

TTO = total time in operation

TTR = total time to repair

- F. Time to repair shall be the period between the time that CONTRACTOR is notified of a system failure and the time that the system has been restored to proper operation in terms of hours with an allowance for the following dead times which shall not be counted as part of the time to repair period.
1. Actual travel time for service personnel to get to the Site up to six hours per incident from the time CONTRACTOR is notified of a system failure.
 2. Time for receipt of spare parts to the plant site once requested up to 24 hours per incident. No work shall be done on the system while waiting for delivery of spare parts.
 3. Dead time shall not be counted as part of the system available period. The dead time shall be logged and the duration of the OAD extended for an amount of time equal to the total dead time.
- G. Completion of a 30 consecutive day period without any restarts of the OAD and with a system availability in excess of 99.7 percent will constitute acceptance of the PCS by OWNER.
- H. All parts and maintenance materials required to repair the system prior to completion of the OAD shall be supplied by CONTRACTOR at no additional cost to OWNER. If parts are obtained from the required plant spare parts inventory, they shall be replaced to provide a full complement of parts as specified.
- I. A Process Control System Malfunction/Repair Reporting Form shall be completed by the plant personnel and ENGINEER to document system failures, to record CONTRACTOR notification, arrival and repair times and CONTRACTOR repair actions. Format of the form shall be developed and agreed upon prior to the start of the OAD.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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