SECTION 40 61 21

PROCESS CONTROL SYSTEM FACTORY TESTING

PART 1 – GENERAL

1.1   DESCRIPTION

A. Scope
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as specified and required for factory testing at the process control system manufacturer's facility to verify that system components function properly and comply with the functional and performance requirements of the Contract Documents.
   2. Perform factory testing on the following types of equipment:
      a. Control Panels
      b. Servers
      c. Configured HMI Software
   4. CONTRACTOR shall advise ENGINEER in writing of the scheduled dates for process control systems factory testing; submit such notice not less than 28 days prior to the scheduled start of factory testing. OWNER and ENGINEER will be present at factory testing facility during operational testing of the process control systems at the factory, either for individual units or for the integrated system. Presence of OWNER and ENGINEER during testing does not relieve CONTRACTOR from complying with the Contract Documents and shall does not indicate or imply acceptance of the equipment.

B. Related Sections:
   1. 40 61 13, Process Control System General Provisions.

1.2   SUBMITTALS

A. Action Submittals: Submit the following:
   1. Testing Plans:
      a. Submit factory test procedures in accordance with Section 40 61 13, Process Control System General Provisions, for all equipment listed in Paragraph 1.1.A of this Section. Obtain ENGINEER's acceptance of testing plan not less than 28 days prior to scheduled start of factory test.

B. Informational Submittals: Submit the following:
   1. Source Quality Control Submittals:
      a. Written results of factory testing for process control systems. Submit the complete factory test report within two weeks after completion of the factory test.

PART 2 – PRODUCTS

2.1   SOURCE QUALITY CONTROL

A.   Inspections Prior to Factory Testing:
   1.   Inspect each panel, console, and cabinet to verify compliance with the Contract documents, and approved Shop Drawings and approved other CONTRACTOR submittals.
   2.   Inspection shall include, but not be limited to, the following:
      a.   Nameplates and tags.
      b.   Wire sizes and color coding.
      c.   Terminal block contact ratings and numbers.
      d.   Panel-mounted equipment and identification.
      e.   External and internal panel layout.
      f.   Proper wiring practices and grounding.
      g.   Enclosure flatness, finish and color.
      h.   NEMA rating and environmental control equipment.
      i.   Workstations and servers.
   3.   Correct materials and equipment that do not comply with the Contract Documents and submittals approved by ENGINEER, and re-inspect until compliance is verified.

B.   Factory Tests:
   1.   System Hardware Operational Testing:
      a.   Test each input/output device and component to verify operability. If panel or device being tested contains pneumatic systems, test the instruments associated with such systems to verify that calibration.
      b.   Test all system hardware components to verify proper operation of the equipment as stand-alone units and as a system. Tests shall include, but are not necessarily limited to, the following:
         1) AC/DC power checks.
         2) Power fail/restart tests.
         3) Verify that radio, network switch, and fiber-optic converters are powered by separate circuits.
         4) Verify that quantity of circuits assigned to power field instruments corresponds to approved Shop Drawings and approved other CONTRACTOR submittals.
      c.   Criteria for Acceptance: System hardware operational testing shall acceptably demonstrate that specified and required equipment operations capabilities function properly.
      d.   Test remote I/O, Modbus or foundation Fieldbus linking devices, and similar devices, to verify that communication between units functions properly.
      e.   Perform an integrated system test, with all control system equipment connected (excluding field sensors and instruments), to verify that equipment performs and functions properly as an integrated system.

During the factory test, simulate field sensors and instruments using appropriate signal generators, switches, and jumper cables.

2. System Hardware Demonstration

    a. CONTRACTOR shall perform and be solely responsible for system hardware demonstration factory test.

    b. Preparation:

       1) System performance shall be tested using fully-integrated system, including all software and hardware. Entire control system, excluding field devices, shall be assembled at the factory test location and simulated inputs applied. Signal generators shall be appropriately sized and calibrated for full range of use and shall have a power source to accommodate not less than a full day of testing. Prior to the factory test, provide process I/O simulation panel that includes the following:

          a) Toggle switches to simulate field or other input contacts.

          b) Indicating lights to simulate outputs from tested panels.

          c) Control relays to simulate motor control center coil inputs.

          d) Time relays to simulate position switches.

          e) Indications (in milliamps) to indicate every 4 to 20 ma-dc output from tested panel.

          f) Potentiometers to simulate 4 to 20 ma-dc inputs to tested panel.

          g) Each device shall have nameplate with description and device's process and instrumentation Drawings (P&ID) tag number. Nameplates shall be removable and interchangeable for multiple use of the panel during the test.

    c. Factory Test:

       1) CONTRACTOR shall demonstrate system software utility programs and system software security programs incorporated into the control system, to demonstrate proper functioning of the various functions and capabilities specified.

       2) Perform complete system test, during which entire system shall operate continuously without failure in accordance with the Contract Documents.

       3) Demonstrate the monitoring and control information displayed on each HMI screen, based on simulation of each associated point for each screen, in accordance with test procedure approved by ENGINEER. Simulation through forced values in the PLC programming is acceptable. In addition, OWNER or ENGINEER will randomly select, at the time of the factory test, additional inputs and outputs to be simulated in quantity not less than five percent of total I/O quantity. Demonstrate that monitoring and control application software associated with I/O points performs and functions as intended.

       4) Demonstrate communications between integrated system elements; include such demonstration in the testing procedure submittal, where applicable.

       5) Operator Interfaces:

a) During factory test, demonstrate overall display structure, including environment configurations, passwords, security, and other parameters and functions.
b) Review menu display contents to demonstrate how an operations person will navigate within the overall display structure.
c) Demonstrate assignment of displays to annunciator keys.
d) Review each graphic display for correctness relative to layout, symbols, color scheme, and other requirements.
e) Demonstrate operation of standard alarm management displays (current alarm display, alarm history, and similar alarm displays).
f) Perform demonstration of each type of report specified. Printing shall be an integral part of the report demonstration.

PART 3 – EXECUTION (NOT USED)

+ + END OF SECTION + +