

SECTION 01650
FACILITY AND SYSTEM START-UP

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: *{Engineer to determine if this section is needed and how it complements or replaces HRSD's Master Specification 01520 – Maintenance of Pipeline and Pumping Operations}*
1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
 2. Requirements for Substantial Completion Submittals.
- B. Related Sections include but are not necessarily limited to:
1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 2. Division 1 - General Requirements.
 3. Section XXXXX - Equipment: Basic Requirements. *{Engineer to provide this specification section and any other applicable sections as needed for specific project}*

1.2 DEFINITIONS

- A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe and independent system.
- B. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which the Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
1. Completion of the filing of all required submittals.
 2. Completion of finish-type construction work to ensure the Work and each PCS has reached a state of Substantial Completion.
 3. Initial equipment start-up, testing and checkout.
 4. Personnel training.
 5. Filing of the Contractor's Notice of Substantial Completion and Request for Inspection.
 6. Obtaining Certificate of Occupancy and other related permits. *{Engineer to review relevance of this requirement for specific project}*
- C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Owner, with the Contractor's assistance, initiates process flow through the facility or PCS and starts up and operates the PCS or facility, without exceeding specified downtime limitations, to prove: *{Engineer and HRSD to collaboratively establish demonstration durations for each equipment or process}*
1. Functional integrity of the system.
 2. Proper integration of the mechanical, electrical and control components and functions of the system.
- D. Substantial Completion: See Division 0, General Conditions.

1.3 SUBMITTALS

- A. Submit in the chronological order listed below:
1. Master Facility and System Start-up Schedule:
 - a. Submit prior to or at the same time as the first shutdown submittal required in Section XXXX *{Engineer to edit this referenced Technical Specification section for the specific project}*. Submittal to be in the required format *{Engineer to specify the requirements in this Section or reference the Sections where these reside in the Bid Documents}*.

- b. Schedule to include the following for each Phase of Work:
 - 1) Time line for shutdowns and tie-ins.
 - 2) Time line for Pre-Demonstration Period requirements.
 - 3) Time line for Demonstration Period requirements.
- 2. Master Operation and Maintenance Training Schedule:
 - a. Submit at least 20 business days prior to first training session for the Owner's personnel.
 - b. Schedule to include:
 - 1) Date and time for the Owner witnessing of each equipment and system initial start-up.
 - 2) Date and time for Operation and Maintenance training for each system, both field and classroom.
 - 3) Target date for initiation of Demonstration Period.
 - c. Submit for review and approval by the Owner.
 - d. Include holidays observed by the Owner.
 - e. Attend a schedule planning and coordination meeting 15 business days prior to first scheduled training session.
 - 1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.
 - 2) Identify final dates for individual manufacturer's training sessions.
 - f. Owner reserves the right to insist on a minimum 5 business days' notice of rescheduled training session not conducted on master schedule for any reason.
 - g. Schedule to be resubmitted until approved and re-submitted when changes are required.
- 3. Substantial Completion Submittal:
 - a. File the Contractor's Notice of Substantial Completion and Request for Inspection in accordance with Division 1 requirements.
 - b. Approved Operation and Maintenance manuals must be received by the Owner minimum 10 business days prior to scheduled training.
 - c. Written request for the Owner to witness each system pre-demonstration start-up. Request to be received by the Owner minimum of 5 business days before scheduled training of the Owner's personnel on that system.
 - d. Equipment installation and pre-demonstration start-up certifications.
 - e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

B. Submittals for Personnel Training Requirements: See Part 3 of this Section.

1.4 FACILITY AND SYSTEM PHASING AND SCHEDULING

- A. Phased Construction: The major categories of the phased construction activities are described Section **XXXX, Maintenance of Plant Operation** *{Engineer to edit and provide this Section}* and on the Drawings. Not all required phased construction activities are described. The Contractor is responsible for developing a detailed Progress Schedule and Master Facility and System Start-up Schedule incorporating all the Work activities including Pre-Demonstration Period and Demonstration Period requirements.

1.5 COST OF START-UP

- A. The Owner will provide reasonable and necessary quantities of the items listed below during start-up. Contractor shall pay for all other costs associated with System and Facility Start-up.
 - 1. Electric power required to operate plant process equipment and to provide building lighting and heat. The starting and operation of large motors (>50 Hp) must be coordinated with the Owner at least 48 hours in advance. The Owner can incur substantial demand charges from the power utility as a result of large motor operation and the Owner may elect to shed other loads or operate the engine generator during the start-up and testing of large motors.
 - 2. Engine generator diesel fuel.

3. [Add process-specific chemicals here as appropriate – for example, polymer, hypochlorite, caustic, etc.]
4. Non-potable water (NPW). This includes only the water; Contractor to provide all equipment, temporary piping, connections and appurtenances required.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 GENERAL

- A. Facility Start-up is divided into two periods: Pre-Demonstration Period and Demonstration Period. See paragraph 1.2 Definitions.

3.2 PRE-DEMONSTRATION PERIOD

- A. Complete the submittal and approval process of all required submittals:
 1. Shop Drawings.
 2. Operation and Maintenance Manuals.
 3. Training schedule, agenda and materials.
- B. Completion of Construction Work: Complete the Work to bring the Project or PCS to a state of Substantial Completion as defined in the General Conditions.
- C. Initial Equipment Start-up:
 1. Requirements for individual items of equipment are included in Divisions 1 through 17 of these Specifications. *{Engineer to verify these are correct Division references and edit as necessary}*
 2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
 3. Perform Equipment Start-up to the extent possible without introducing product flow.
 - a. Test tanks, pumping and similar equipment requiring a fluid, using NPW.
 - b. Dispose of water used for Equipment Start-up in a manner dictated by the Owner.
 4. Procedures include but are not necessarily limited to the following:
 - a. Test or check and correct deficiencies of:
 - 1) Power, control, and monitoring circuits for continuity prior to connection to power source.
 - 2) Voltage of all circuits.
 - 3) Phase sequence.
 - 4) Cleanliness of connecting piping systems.
 - 5) Alignment of connected machinery.
 - 6) Vacuum and pressure of all closed systems.
 - 7) Lubrication.
 - 8) Valve orientation and position status.
 - 9) Tankage for integrity and water tightness.
 - 10) Pumping equipment.
 - 11) Instrumentation and control signal generation, transmission, reception, and response.
 - 12) Tagging and identification systems.
 - 13) Proper connections, alignment, calibration and adjustment of all equipment.
 - b. Calibrate all safety equipment.
 - c. Manually rotate or move moving parts to assure freedom of movement.
 - d. "Bump" start electric motors to verify proper rotation.
 - e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.

- f. Documentation: Prepare a log showing each equipment item and listing what is to be accomplished during Equipment Start-up. Provide a place for the Contractor to record date and person accomplishing required work. Submit completed document before requesting inspection for Substantial Completion certification.
 - 5. Obtain certifications, without restrictions or qualifications, and deliver to the Engineer:
 - a. Manufacturer's equipment installation check letters.
 - b. Instrumentation Supplier's Instrumentation Installation Certificate.
 - 6. Cleanup: After successful demonstration, discontinue process flow, drain system and clean as necessary to achieve safe and sanitary conditions.
- D. Personnel Training:
1. *{See Training Schedule at the end of this Section} {project-specific, to be prepared by Engineer and appended to this section}.*
 2. Conduct all personnel training after completion of Initial Equipment Start-up for the equipment for which training is being conducted.
 - a. Personnel training on individual equipment or systems will not be considered completed unless:
 - 1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
 - 2) No system malfunctions occur during training.
 - 3) All provisions of field and classroom training specifications are met.
 - b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to the Owner.
 3. Field and classroom training requirements:
 - a. Hold classroom training on-site.
 - b. Training instructor:
 - 1) Factory trained and familiar with giving both classroom and "hands-on" instructions. Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule. Normal time lengths for class periods can vary.
 - 2) Submit qualifications and resume of proposed training instructor for approval. Replace proposed training instructor if not acceptable to the Owner or Engineer.
 - c. Organize training sessions as shown in the Training Schedule (Operations, Maintenance and Electrical / Instrumentation and Control). Provide general training to all sessions as part of the specific training required for each group. Training material and sessions shall be specifically developed and tailored to the group being trained.
 - d. Plan for minimum class attendance of 12 people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
 - e. Instructors to have a typed agenda, outline and well prepared instructional material. The use of visual aids, e.g., films, pictures, and slides is recommended for use during the classroom training programs. Submit proposed training agendas and outlines to the Owner and Engineer for approval a minimum of 15 business days prior to the training. Revise until acceptable. Provide equipment required for presentation of films, slides, and other visual aids. Training materials shall be related to the specific equipment; general sales brochures are not acceptable.
 - f. In the on-site training sessions, cover the information required in the Operation and Maintenance manuals and the following areas as applicable to the PCS.
 - 1) Operation of equipment.
 - 2) Lubrication of equipment.
 - 3) Maintenance and repair of equipment.
 - 4) Troubleshooting of equipment.
 - 5) Preventive maintenance procedures.
 - 6) Adjustments to equipment.
 - 7) Inventory of spare parts.
 - 8) Optimizing equipment performance.
 - 9) Capabilities.

- 10) Operational safety.
 - 11) Emergency situation response.
 - 12) Takedown procedures (disassembly and assembly).
 - g. Maintain a log of classroom training provided including: Instructors, topics, dates, time, and attendance.
 - h. Provide an electronic copy (pdf or PowerPoint format) of the training handouts.
- E. Filing of the Contractor's Notice of Substantial Completion and Request for Inspection of Project or PCS:
- 1. File the notice when the following have been completed:
 - a. Submittal of required documents.
 - b. Construction work (brought to state of Substantial Completion).
 - c. Equipment Start-up.
 - d. Personnel Training.
 - 2. Engineer will review required submittals for completeness.
 - 3. Engineer will inform the Contractor in writing of the status of the Work reviewed.
 - a. Work determined not meeting state of Substantial Completion:
 - 1) Contractor: Correct deficiencies noted or submit plan of action for correction.
 - 2) Engineer: Re-inspect work within after notice of correction of deficiencies.
 - 3) Reinspection costs incurred by the Engineer will be billed to the Owner who will deduct them from final payment due the Contractor.
 - b. Work determined to be in state of tentative Substantial Completion: Engineer to prepare tentative "Engineer's Certificate of Substantial Completion."
 - c. Engineer's Certificate of Substantial Completion:
 - 1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
 - 2) Issued for Project as a whole or for one or more PCS.
 - 3) Issued subject to completion or correction of items cited in the certificate (punch list).
 - 4) Issued with responsibilities of the Owner and Contractor cited.
 - 5) Executed by the Engineer.
 - 6) Accepted by the Owner.
 - 7) Accepted by the Contractor.
 - d. Upon successful completion of Demonstration Period, the Engineer will endorse certificate attesting to the successful demonstration, and citing the hour and date of beginning the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.3 DEMONSTRATION PERIOD

- A. General:
- 1. Demonstrate the functional integrity of the mechanical, electrical and control interfaces of the respective equipment and components comprising the facility or PCS as evidence of Substantial Completion.
 - 2. Duration of Demonstration Period: 120 consecutive hours. *{Engineer to provide specific durations for each type equipment or process to be demonstrated}*
 - 3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
 - 4. Conduct the demonstration of functional integrity under full operational conditions.
 - 5. Owner will provide operational personnel to operate the equipment and system. Contractor will perform all equipment repair, maintenance and corrective actions until successful completion of the Demonstration Period.

6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.
7. Time of beginning and ending any Demonstration Period shall be agreed upon by the Contractor, Owner and Engineer in advance of initiating Demonstration Period.
8. Throughout the Demonstration Period, provide knowledgeable personnel and manufacturer's representatives to answer the Owner's questions, provide final Personnel Training on select systems and to respond to any equipment or system problems or failures which may occur. Provide final Personnel Training as indicated in the Training Schedule.
9. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

END OF SECTION