

Checklist for Plant Completion

Refining Department

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Checklist for Plant Completion

SECTION 1—PURPOSE

This checklist is intended to assist the Contractor and Owner in defining their separate responsibilities in the execution of work assignments as the plant or various areas, systems, and facilities of the plant are being completed. It is also intended to facilitate the transfer of responsibility from the Contractor to the Owner for the care, custody, and control of the plant.

In order to satisfy the requirements of each Contractor-Owner relationship, it may be necessary for the parties to make some revisions to the checklist.¹ Negotiations between the Contractor and Owner shall establish the desired division of responsibility.

SECTION 2—DEFINITIONS

Section 2 presents definitions which along with the general and specific procedures given in Sections 3 and 4 serve to clarify the basic principles associated with the transfer of responsibility from the Contractor to the Owner at commissioning time.

(a) *Precommissioning*. Precommissioning activities are the nonoperating adjustments and cold alignment checks detailed in Sections 3 and 4 that are generally made by the Contractor.

(b) *Ready for commissioning*. The plant, or part thereof, is "ready for commissioning" when the plant, or any part thereof, has been erected in accordance with drawings, specifications, instructions, and applicable codes and regulations to the extent necessary to permit commissioning and when the precommissioning activities detailed in Sections 3 and 4 have been completed.

(c) *Commissioning*. The commissioning period follows the completion of the precommissioning activities performed by the Contractor. Commissioning activities are associated with the operation of items of equipment or facilities in preparation for plant startup and may continue through the initial operation of the plant. These activities are the Owner's responsibilities unless the contract specifically provides otherwise.

(d) *Completion of construction*. Completion of construction means that the Contractor has:

1. Erected the plant.
2. Completed precommissioning work.
3. Completed all special commissioning activities.
4. Completed final cleanup, painting, and insulation work.

SECTION 3—GENERAL PROCEDURES

The general procedures listed in Section 3 outline the work to be performed by the Contractor and by the Owner. Procedures applicable to specific systems or items of equipment are covered separately in Section 4.

¹ In order to define more clearly the specific responsibilities for each work requirement, the checklist can be used with a code of activities to detail specific assignments. The following code is typical:

| | | | |
|---|--------------|---|--------------|
| X | Perform work | W | Witness work |
| R | Review work | I | Inspect work |

CONTENTS

| | Page |
|---|------|
| SECTION 1—PURPOSE | 1 |
| SECTION 2—DEFINITIONS | 1 |
| SECTION 3—GENERAL PROCEDURES | 1 |
| 3.1 Manufacturer or Vendor Service Assistance | 2 |
| 3.2 Permits | 2 |
| 3.3 Instructions | 2 |
| 3.4 Removal of Rust Preventives | 2 |
| 3.5 Lubricants | 2 |
| 3.6 Packing and Seals | 2 |
| 3.7 Removal of Temporary Bracing | 2 |
| 3.8 Rotation and Alignment | 3 |
| 3.9 Tie-Ins at Unit Limits | 3 |
| 3.10 Leak and Pressure Tests | 3 |
| 3.11 Inspection | 3 |
| 3.12 Pressure/Vacuum Safety Relief Devices | 4 |
| 3.13 Flushing and Chemical/Mechanical Cleaning | 4 |
| 3.14 Temporary Screens, Strainers, and Blinds | 4 |
| 3.15 Purging/Inerting | 4 |
| 3.16 Drying Out | 4 |
| 3.17 Vessel Packing and Fixed Beds | 5 |
| 3.18 Housekeeping | 5 |
| 3.19 Maintenance, Spare Parts, and Special Tools | 5 |
| 3.20 Noise Survey | 5 |
| SECTION 4—SPECIFIC PROCEDURES | 5 |
| 4.1 Vessels | 5 |
| 4.2 Shell and Tube Exchangers | 6 |
| 4.3 Air-Cooled Exchangers | 6 |
| 4.4 Fired Heaters | 6 |
| 4.5 Pumps, Compressors, and Drivers | 6 |
| 4.6 Tanks | 7 |
| 4.7 Piping Systems | 7 |
| 4.8 Electrical Power and Lighting Systems | 8 |
| 4.9 Instrument Systems | 8 |
| 4.10 Boilers | 9 |
| 4.11 Water Treatment Plants | 9 |
| 4.12 Water Systems (Service Wells, Cooling Towers, Fire Water Systems, and Sea Water Systems) | 9 |
| 4.13 Waste Disposal | 10 |
| 4.14 Buildings and Accessories | 10 |
| 4.15 Miscellaneous Equipment (Agitators, Mixers, Rotary Filters, Weigh Scales, and Materials Handling Equipment) | 10 |

3.1 Manufacturer or Vendor Service Assistance

Where responsibility is not indicated in Section 4:

- a. Obtain the assistance of the manufacturer or vendor, when necessary, to make a satisfactory installation as agreed on by the Contractor and the Owner.....
- b. Obtain the assistance of the manufacturer or vendor, as required, for technical assistance during run-in by the Owner's operating and maintenance personnel, for training, or for informational and operating purposes
- c. Furnish names and telephone numbers, including emergency contacts, of manufacturers' and vendors' technical service representatives for use by the Owner

| Work Responsibility | |
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| Contractor | Owner |

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3.2 Permits

- a. Assist the Owner in procuring all necessary permits and certifications required to be secured by the Owner for initial use of the plant
- b. Make applications for all necessary permits issued in the Owner's name that are required for plant use, occupancy, and operation

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3.3 Instructions

- a. Maintain an adequate vendor instruction file so that information may be readily retrieved through plant commissioning
- b. Transmit to the Owner all applicable vendor's or manufacturer's instructions and drawings
- c. Provide the Owner with any special instructions, such as the required procedures for drying liners

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3.4 Removal of Rust Preventives

- a. Remove all rust preventives and oils used to protect the equipment during the construction period whenever these protective materials will be detrimental to operation...
- b. Provide the Owner with a record of work completed

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3.5 Lubricants

- a. Provide a list of the manufacturer's recommended lubricants for use in the plant ...
- b. Approve the lubricant list
- c. Provide all lubricants
- d. Flush systems and install initial charge of all lubricants. Dispose of all flushing oil in accordance with the Owner's instructions
- e. Maintain lubrication after initial charge

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3.6 Packing and Seals

- a. Install mechanical seals and accessories, as required
- b. Install permanent packing and accessories, as required
- c. Adjust and replace mechanical seals, packing, and accessories, as necessary, during commissioning period

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3.7 Removal of Temporary Bracing

- a. Remove all temporary supports, bracing, or other foreign objects that were installed

in vessels, ducts, piping, transformers, machinery, or other equipment to prevent damage during shipping, storage, and erection and repair any damage sustained.

b. Remove other items as specified in items 4.7h and 4.9a for the appropriate equipment type.

| Work Responsibility | |
|---------------------|-------|
| Contractor | Owner |

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3.8 Rotation and Alignment

a. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting the driver.

b. Perform cold alignment to the manufacturer's tolerances and record data.

c. Perform hot alignment.

d. Perform any doweling required.

e. Obtain the services of a factory representative to witness installation of equipment, as required.

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3.9 Tie-Ins at Unit Limits

a. Prepare all systems for safe tie-ins.

b. Obtain approval and make the necessary tie-ins at the unit limits, as required by the specifications and as directed by the Owner.

c. Remove blinds, car seals, and so forth, as required.

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3.10 Leak and Pressure Tests

a. Notify the Owner of the schedule for nonoperating field leak tests or field pressure tests on piping and field fabricated equipment, unless otherwise directed by the Owner.

b. Provide any special media for test purposes.

c. Conduct all tests in accordance with applicable codes, specifications, regulations, and the Owner's instructions.

d. Witness tests.

e. Maintain records, as required.

f. Dispose of all test media in accordance with the Owner's instructions.

g. Conduct all operational tightness tests.

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NOTE: Individual items of equipment of the following types, if pressure tested in the fabricator's shop, will not require retesting in the field, unless specified by the Owner. Such individual items of equipment shall be included in the testing of attendant piping systems whenever practical and approved by the Owner.

1. Vessels

2. Shell and tube exchangers

3. Air cooled exchangers

3.11 Inspection

a. Provide inspection of the plant to verify that erected facilities conform to flow diagrams, construction drawings, vendor prints, and specifications.

b. Verify that specified materials have been installed in the plant and document verification to the extent required by the Owner.

c. Verify and approve the plant inspection. Note any exceptions on a separate work order list (punch list).

d. Provide for special inspections, such as those required by insurance or governmental agencies.

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- e. Perform and report routine shop inspection
- f. Perform shop inspection and witness tests, as desired
- g. Witness final shop inspections, as specified

NOTE: Shop inspected equipment will not be reopened for inspection in the field except as specified by the Owner or as specifically noted in 4.1.

3.12 Pressure/Vacuum Safety Relief Devices

- a. Provide the Owner with a list of proper pressure settings
- b. Transfer relief devices to and from the Owner's specified testing facility
- c. Test and adjust all devices and seal wherever necessary or desirable
- d. Install all devices after testing, adjusting, and tagging
- e. Maintain records, as required

3.13 Flushing and Chemical/Mechanical Cleaning

- a. Except as noted in 3.14, 4.4, 4.5, 4.9, 4.10, and 4.12:
 - 1. Conduct all flushing, blowing, and chemical/mechanical cleaning operations where such operations can be accomplished without using permanently installed equipment. ...
 - 2. Conduct all flushing and blowing operations where permanently installed equipment must be used to obtain proper line velocities
 - 3. Provide any special media for flushing and/or cleaning purposes
 - 4. Dispose of all media in accordance with the Owner's instructions
- b. Turn systems over to the Owner free of trash and construction debris (not necessarily free of welding slag)
- c. Maintain records, as required

3.14 Temporary Screens, Strainers, and Blinds

- a. Provide and install all required temporary strainers
- b. Clean strainers, as required, during circulation
- c. Remove strainers when system is adequately cleaned
- d. Provide, install, and remove all blinds required for flushing
- e. Provide, install, and remove all blinds required for isolation
- f. Maintain records, as required

3.15 Purging/Inerting

- a. Install purge/inerting connections
- b. Provide purge materials and conduct necessary purge operations
- c. Provide inerting materials and introduce where specified

3.16 Drying Out

- a. Dry out facilities, as specified by the Owner, to prevent contamination of catalysts, operating materials, and/or product
- b. Dry out systems, refractories, and linings when this drying operation is to be accomplished with temporary facilities

Work Responsibility

Contractor Owner

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c. Dry out systems, refractories, and linings when this drying operation is to be accomplished by means of permanently installed equipment

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3.17 Vessel Packing and Fixed Beds

a. Install all inert materials such as sand, gravel, balls, rings, and saddles

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b. Install all materials, other than the materials specifically noted in Section 4, such as chemicals, resins, desiccants, and catalysts

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c. Install all mixed beds involving combinations of materials covered by a and b above

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d. Inspect the vessel interior before and during loading to ensure proper installation

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e. Maintain records, as required

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3.18 Housekeeping

a. At completion of construction, remove excess materials, temporary facilities, and scaffolding; rough sweep or rake the area; and pick up trash. Perform washing or further cleanup, as required

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b. After completion of construction, maintain adequate housekeeping practices, as required for safe operation

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3.19 Maintenance, Spare Parts, and Special Tools

a. After precommissioning is complete, protect equipment from normal weather conditions, corrosion, or damage

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b. After precommissioning is complete, provide adequate maintenance for equipment, including the cleaning of strainers and the repairing of steam traps

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c. Provide the Owner with spare parts lists, as recommended by the manufacturers

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d. After precommissioning is complete, maintain adequate spare parts and supplies

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3.20 Noise Survey

a. Conduct individual equipment noise surveys, as required by the Occupational Safety and Health Administration or the Owner's specifications

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b. Document all survey data

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SECTION 4—SPECIFIC PROCEDURES

In addition to the work responsibilities described in Section 3, the detailed procedures outlined below further define the work responsibilities of the Contractor and the Owner for specific systems and items of equipment.

4.1 Vessels

a. Open the vessel after erection and put in place any internals requiring field installation. These internals will be inspected before and after installation

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b. Open both internal and external manways for inspection of the vessel by the Owner, unless otherwise specified

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c. Witness inspections to the extent desired

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- | Work Responsibility | |
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| Contractor | Owner |
| <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> |

- a. Perform field inspection, if required, of exchangers that have previously been shop inspected

- a. Inspect exchangers to ensure that temporary shipping supports and erection materials have been removed
- b. Adjust fan assemblies to obtain specified tip clearance and test.
- c. Check operation of louvers and operating linkage

- a. Perform the pressure test in accordance with the applicable codes, specifications, and the Owner's instructions, if required.
- b. Provide all nonoperating prefiring checks in accordance with the manufacturer's instructions
- c. Blow fuel lines, check them for cleanliness, and connect burner piping
- d. Check operation of registers and dampers and verify position of indicators.
- e. Check operation of air preheaters, blowers, and soot blowers
- f. Dry refractories during initial firing by following the manufacturer's temperature cycles.
- g. Conduct boilout, chemical cleaning, and flushing operations, as required. Dispose of wastes and cleaning media in accordance with the Owner's instructions
- h. Obtain and charge liquid heat transfer media, if required.
- i. Conduct lightoff, drying, and purging operations.
- j. Obtain the assistance of a service engineer for technical advice during installation or startup, if desired

- a. Level baseplates and soleplates and grout all bearing surfaces.....
- b. Alleviate any excess piping stresses that may be imposed on pumps, compressors, and drivers.....
- c. Chemically clean any completed lube and seal oil system, when specified. Dispose of wastes and cleaning media in accordance with the Owner's instructions.....
- d. Charge the lube oil, seal oil, and oil cooling systems with flushing oil and circulate for cleaning purposes. Dispose of any flushing oil in accordance with the Owner's instructions.....
- e. Charge the lube oil, seal oil, and oil cooling systems with the operating oil recommended by the manufacturer.....
- f. Operate equipment and make vibration, trip, governor, and safety device checks and any operating tests and adjustments, as required.....

4.8 Electrical Power and Lighting Systems

- a. Notify the Owner of the test schedule
- b. Witness tests when notified and record test data, as required.
- c. Using a megohmmeter, make insulation tests on all wiring except lighting wiring ..
- d. Using a megohmmeter, make insulation tests on motor and transformer windings from phase to phase and phase to ground
- e. Make grounding system tests to determine the continuity of connections and the value of resistance to ground
- f. Arrange for breakdown tests on oil samples from oil insulated transformers larger than 100 kilovolts absolute
- g. Charge electrical gear with oil and/or other media, as required
- h. Perform trials and adjustments on all switchgear, motor control equipment, and generators
- i. Test and set switchgear and circuit breaker relays for proper coordination
- j. Obtain local inspector's approval, where required
- k. Energize all substations with approval of the Owner after completion of all tests ...
- l. Check phase sequence, polarity, and motor rotation
- m. Check installation of emergency power and lighting systems, including light intensity
- n. Provide the Owner with a record of work completed

Work Responsibility
Contractor Owner

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4.9 Instrument Systems

- a. Conduct any non-operating checks to ensure instrument operability, that is, remove all shipping stops; check pointer travels; and verify instrument capability to measure, operate, and stroke in the direction and manner required by the process application. ...
- b. As dictated by the Owner's practice, bench or field calibrate instruments with standard test equipment and make all required adjustments and control point settings.
- c. Clean all transmission and control tubing by blowing with cooled and filtered clean air before connecting to instrument components
- d. Clean all air-supply headers by blowing with clean air and check them for tightness
- e. Leak test pneumatic control circuits in accordance with the latest edition of ISA² Recommended Practice 7.1, *Pneumatic Control Circuit Pressure Test*
- f. Check piping from instruments to process piping for tightness
- g. Install and connect all system components and verify their conformance to specifications and design criteria for function and range using dummy transmission signals, as needed
- h. Check all electrical signals and alarm wiring for continuity, correct source of power, and polarity
- i. Check thermocouples for proper joining of wires, position of elements in wells, proper polarity, and continuity of receiving instruments
- j. Identify orifice plates by tagging and deliver to the Owner
- k. Check and record bores of orifice plates and install after completion of flushing operations

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² Instrument Society of America, 67 Alexander Drive, Box 12277, Research Triangle Park, North Carolina 27709.

| | Work Responsibility | |
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| | Contractor | Owner |
| l. Isolate or remove, if necessary, inline components such as control valves, positive displacement meters, and turbine meters for pressure testing. Reinstall these items after testing the system with the components removed or isolated. | <input type="checkbox"/> | <input type="checkbox"/> |
| m. Isolate or remove components for flushing operations and reinstall them on the completion of these operations | <input type="checkbox"/> | <input type="checkbox"/> |
| n. Install any sealing fluids, as required. | <input type="checkbox"/> | <input type="checkbox"/> |
| o. Fully pressurize and energize the transmitting and control signal system(s) by opening process connections at primary sensors and final regulators and by making control mode settings for automatic operation of equipment as the process unit is charged and brought on stream | <input type="checkbox"/> | <input type="checkbox"/> |
| p. Provide a schedule of recorder charts. | <input type="checkbox"/> | <input type="checkbox"/> |

4.10 Boilers

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| a. Make a nonoperating boiler pressure test in accordance with applicable codes, specifications, and the Owner's instructions, if required | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Inspect the boiler for completeness and correctness of installation, and make other nonoperating prefiring checks. | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Check operation of air preheaters, dampers, soot blowers, and other equipment for proper positioning and travel | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Dry refractories during initial firing by following the manufacturer's temperature cycles. | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Purge, flush, and drain steam mains, as necessary | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Obtain and charge treated water for boilout and initial operation, as required. | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Commission auxiliaries as detailed elsewhere under the appropriate equipment type | <input type="checkbox"/> | <input type="checkbox"/> |
| h. Conduct boilout, chemical cleaning, and flushing operations, as required. Dispose of wastes and cleaning media in accordance with the Owner's instructions. | <input type="checkbox"/> | <input type="checkbox"/> |
| i. Conduct initial lightoff, making the associated checks and adjustments. | <input type="checkbox"/> | <input type="checkbox"/> |
| j. Obtain the assistance of a service engineer for technical advice during installation or startup, if desired | <input type="checkbox"/> | <input type="checkbox"/> |
| k. Conduct all operating tests and obtain the required certification | <input type="checkbox"/> | <input type="checkbox"/> |
| l. Recheck and set pressure-relief valves | <input type="checkbox"/> | <input type="checkbox"/> |

4.11 Water Treatment Plants

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| a. Inspect for completeness and correctness of installations and make any nonoperating checks that may be required. | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Provide and install the initial charge of ion-exchange resins and inert bed material. . | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Provide all water treatment chemicals except the initial charge of ion-exchange resins | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Make the necessary operating tests and adjustments to water treatment systems | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Obtain the services of a water consultant to advise and monitor the water treatment operation, as required by the Owner | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Purify potable water systems | <input type="checkbox"/> | <input type="checkbox"/> |

4.12 Water Systems (Service Wells, Cooling Towers, Fire Water Systems, and Sea Water Systems)

| | | |
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| a. Inspect for completeness and correctness of installations and make any nonoperating checks that may be required. | <input type="checkbox"/> | <input type="checkbox"/> |
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| | Work Responsibility | |
|---|--------------------------|--------------------------|
| | Contractor | Owner |
| b. Clean the cooling tower basin and install screens in the suction pit before water circulation | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Provide test pump for wells; test well delivery; and flush wells as they are made available | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Flush, drain, and clean the cooling tower basins | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Clean intake screens | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Adjust cooling tower fans to obtain specified tip clearance and test | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Operate fire pumps to check performance of systems | <input type="checkbox"/> | <input type="checkbox"/> |
| h. Head up reservoirs, vessels, tanks, and other water system equipment, as required, fill with water, check for leaks, and flush to clean | <input type="checkbox"/> | <input type="checkbox"/> |
| i. Provide insurance company inspection of the fire systems, as required | <input type="checkbox"/> | <input type="checkbox"/> |
| j. Obtain and install all required fire-fighting chemicals and portable equipment, such as hoses, fire extinguishers, and related equipment | <input type="checkbox"/> | <input type="checkbox"/> |
| k. Establish the water treatment program | <input type="checkbox"/> | <input type="checkbox"/> |
| l. Obtain the services of a water consultant to advise and monitor the water treatment, as required by the Owner | <input type="checkbox"/> | <input type="checkbox"/> |

4.13 Waste Disposal

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| a. Inspect facilities for completeness and correctness of installation and make any non-operating checks to ensure their conformance to specifications | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Operate all equipment and supply all chemicals and agents related to waste treatment | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Obtain the services of a waste treatment consultant to advise and monitor the system operation, as required by the Owner | <input type="checkbox"/> | <input type="checkbox"/> |

4.14 Buildings and Accessories

| | | |
|--|--------------------------|--------------------------|
| a. Check installation of buildings and accessories, including all heating, ventilating, and air-conditioning equipment, to ensure their completeness and conformance to specifications | <input type="checkbox"/> | <input type="checkbox"/> |
| b. As required, obtain certification that all plumbing, electrical, fire protection, elevator, and special materials handling installations comply with local government regulations | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Operate heating, ventilating, and air-conditioning units and make all performance tests | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Obtain certificate for occupancy and use, if required | <input type="checkbox"/> | <input type="checkbox"/> |

4.15 Miscellaneous Equipment (Agitators, Mixers, Rotary Filters, Weigh Scales, and Materials Handling Equipment)

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|---|--------------------------|--------------------------|
| a. Fully assemble rotary filters except for final filter media (cloth, precoat, or screen) | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Install all final filter media | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Level and calibrate weigh scales with the assistance of the manufacturer's representative and set tare weights wherever possible | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Manually check materials handling equipment for freedom and direction of movement | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Check clearances on materials handling equipment, as directed by the Owner | <input type="checkbox"/> | <input type="checkbox"/> |

- f. Make all final adjustments during run-in and conduct any required performance tests
- g. Obtain a service engineer for technical assistance during installation or startup, if required
- h. As required, obtain certification that all lifting and materials handling installations and other items of equipment comply with government regulations

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Order No. 822-70000