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CHEMICAL WOOD PRESERVATIVE PLANT

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CHEMICAL WOOD PRESERVATIVE PLANT

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ABSTRACT

A small plant for treating marine piling has been constructed at the Naval Civil Engineering Laboratory.

Although primarily designed for creosote service, the plant is readily adaptable to other treatments and simulates equipment in use by commercial treating firms.

Pre-service tests and initial operations indicate the treatment plant performs as expected and is ready for service applications.

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INTRODUCTION

In order to test and evaluate possible improvements in the commercial treatment of marine piling, a small treating plant was proposed and approved for construction at the Naval Civil Engineering Laboratory. A description of the completed plant, including design criteria, is the purpose of this report.

DESIGN CRITERIA

Since information obtained from the use of this equipment should be readily adaptable to existing processes, a preliminary investigation was conducted to study the types of equipment and processes used by commercial wood-treating firms. Operating temperatures, pressures and treating times for various treatments were noted and subsequently employed in the design studies for the Laboratory facility.

Reduction of available information led to the selection of criteria suited to the "full cell" process. Specifically, this refers to a system which has the capability of producing a sustained vacuum of at least 22 inches, pressures up to 200 psi and temperatures from 180 to 200 F.

Basic components of the plant were determined to be (1) a retort cylinder large enough to handle three full-size piles, (2) a vacuum system for evacuating air and water vapor, (3) a pressure and circulating system, (4) a heating system, and (5) a storage and mixing facility.

Preliminary work indicated a 30-inch diameter retort slightly longer than 60 feet. However, it was decided that initial testing could be carried out with 20-foot piling and still produce results that would be reasonably significant. Design studies made allowances for the eventual expansion of the retort to accommodate full-length (60-foot) piles.

PLANT DESCRIPTION

The Retort Cylinder was fabricated from a section of 30-inch O.D., schedule 10 pipe with 300-pound welding neck flanges butt-welded at both ends. The cylinder is closed with flanged domed caps and asbestos gasket. It is 22 feet 4-1/2 inches in overall length and will accept piling up to 21 feet long. The retort is supported in a horizontal position on two welded steel saddle supports. There are two 2-inch flanged openings as fittings.

A vertical Flash Tank has two 300-pound heads butt-welded to a 10-foot section of schedule 10 30-inch pipe. Another 4-foot section of pipe, with a 36-inch diameter steel plate bottom, serves as a skirt support. Three plate baffles are welded at intervals inside the tank to assist the separation process. Overall height is 15 feet.

The Condenser for the vacuum system has a shell fabricated from a 78-inch section of 10-inch schedule 40 pipe, with pipe caps welded at each end. Two-inch standard line pipe makes three lengthwise passes and forms a continuous flow path through the jacket. Other fittings include two 2-inch couplings into the water jacket and a 1-inch drain cock. Overall length of this vessel is 7 feet 4 inches.

The Heat Exchanger has the same physical configuration as the condenser except for a 4-pass run of 2-inch pipe. Appurtenances on this vessel include a Powers No. 11 Regulator and a Marsh Steam Trap.

All fabrication on these vessels was accomplished by certified welders to conform to applicable sections of the A.S.M.E. Boiler Code. All vessels were tested hydraulically at 400 psig. The retort, flash tank, and heat exchanger are insulated with 3-inch fiberglass and weatherproofed with 35-pound asphaltic cover.

Additional plant equipment requires little description and includes the following:

- a. Vacuum Pump, Kinney Mfg., 5-hp, electric serial No. 84711
- b. Receiver Tank, Walter R. Cole Mfg., A.S.M.E. 7120, vacuum tank, 24-inch diameter x 48-inch high
- c. Pressure and Circulating Pump, Ingersoll-Rand Model 1-1/2 MRV 20, rated 50 gpm @ 525 feet head, with 20-hp 3-phase motor
- d. Pressure Regulator, Fisher type 372, 1-1/2 inch, with laminated metal diaphragm
- e. Pressure Relief Valve, Lukenheimer, 2-inch, set for 250 psi
- f. Steam Generator, Clayton, serial RO-30 UL 13564, 30-hp automatic
- g. Storage Tanks, two 4000-gal. tanks; one 9 ft. diameter x 8 ft. high, one 8 ft. diameter x 10 ft. high, both with cone tops, welded construction and installed on rock grades. Two-inch steam coils are provided for heat
- h. Mixing Tank, 1200 gallon welded tank, 6 ft. diameter x 6 ft. high, cone top, welded construction with 2-inch tangency coupling for vortex mixing
- i. Forced Draft Cooling Tower
- j. Electrical Service and Control Panel

Installed piping, except for storage delivery lines, is all welded with flanged connections. Nordstrom lubricated 2-inch plug valves are installed in all main lines and by-passes for good visual flow reference. Preformed 2-inch fiberglass insulation covers process lines to minimize heat loss.

SYSTEM TESTS

Pre-service tests were conducted on each of the systems in the plant. Water was circulated at conditions simulating a treatment cycle.

The retort and flash tank were air evacuated and the vacuum was held at 27-1/2 inches for 20 minutes with no apparent system leaks.

Water was introduced at ambient conditions of temperature and pressure, and circulated in the vacuum system to determine liquid level in the flash tank.

With the vacuum system by-passed, pressure was adjusted to 200 psi on the retort. Temperature on the circulated water was raised from 68° to 200 F in 35 minutes and maintained at 200 F for an hour with no difficulty. Temperature drop through the pressure system was approximately 2 F. Plant layout for initial test is illustrated in Figure 1.

Overall operation easily met established criteria.

OPERATION AND MODIFICATION

Although the operation of the plant was adequate during the first creosote treatment, a few modifications were indicated. An orifice was installed on the discharge side of the pump to maintain a head on the pump when the system was unpressurized. The vacuum receiver tank was elevated to simplify the measurement of water extracted from the wood and the retort door was hinged to facilitate opening and closing. The final plant layout is illustrated in Figures 2 and 3.

Since initial treatments of piling did not produce the necessary penetration, the cycle was also revised to conform more closely to the accepted commercial practice. A longer period of boiling under vacuum appeared to be the major factor in providing successful runs on subsequent loads. No further modification of the plant appears necessary. Figure 4 illustrates typical flow patterns for various cycles.

RECOMMENDATIONS

The plant is recommended for service.



Figure 1. Initial test layout.



Figure 2. Main process equipment.



Figure 3. Central piping details.

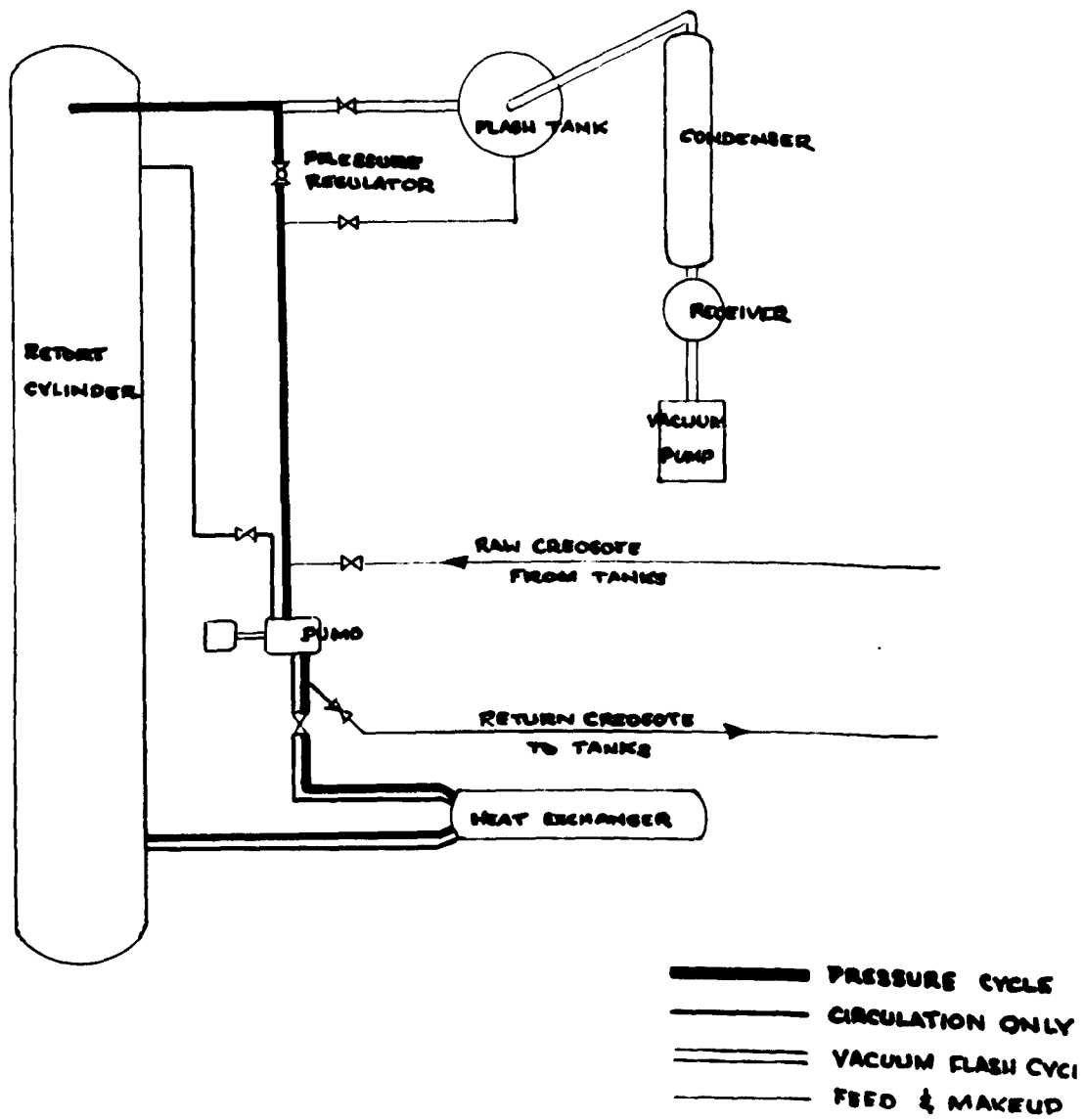


FIGURE 4
CYCLE FLOW DIAGRAM