LEAD INDUSTRIES ASSOCIATION, INC.
292 MADISON AVENUE
NEW YORK, N. Y. 10017
TELEPHONE — AREA CODE 212
ON 3-0080

PERFORMANCE OF CAULKED LEAD JOINTS*

Harold A. Montgomery
Assistant Professor of Mechanical Engineering
Purdue University
Lafayette, Indiana

Lead-oakum joints in bell and spigot cast-iron pipe for water supply and waste lines have been used for more than a century with most satisfactory results. Current consumption for this purpose, according to the U. S. Bureau of Mines, is over 70,000 tons of lead a year. It continues to be the unquestioned leader in joints for cast-iron bell and spigot water supply mains.

In waste systems however, the greater use of automatic appliances which require high temperature and large volumes of water have apparently created some doubts as to their effectiveness at the operating temperatures involved. These doubts have resulted in substitution of other piping systems or other methods of joining cast-iron soil pipe because of the lack of proper engineering data.

It was for this reason that the International Lead Zinc Research Organization requested that I undertake a research project that would determine the maximum operating conditions under which standard lead-oakum joints in cast-iron soil pipe will not leak under pressure-temperature fluctuations; second, to test a modified lead-oakum-neoprene joint developed by one of the cast-iron soil pipe manufacturers for high temperature use where the leaded joint might prove unsatisfactory.

Testing was begun in September, 1963, and it is my considered opinion, based on the results achieved so far, that the conventional lead-tarred oakum joint, Fig. 1, is satisfactory for practically all installations. For those few instances where the temperature of the joint will reach temperatures approximating 200 degrees F, the use of the lead-oakum-neoprene joint, described later, appears to be suggested based on pilot tests.

The test joints are prepared by calking in a vertical position two 5-ft. lengths of standard weight cast-iron pipe in the conventional manner and then placing them in the test rig (Fig. 2 and 3).

In setting up the test rig, rigid clamping of the pipe ends was purposely incorporated to simulate a most extreme field condition. Lateral movement, a most significant cause of leakage, was not controlled. As a result, pipe movement during the tests was nil in the longitudinal direction but quite pronounced in the lateral direction. The average movement obtained thus far is 0.056 inches.

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Look Ahead with Lead

The test procedures we are using are as follows:

1. Fill test system with cold water at 10 psi for 20 minutes, thus simulating conventional on-the-job testing procedures.

2. Circulate hot water at 10 psi until joint reaches 160 deg. F. The temperature is measured on the outer surface of the hub by means of a tempetik, a device accurate within reasonable limits as determined by other checks made during pilot runs.

3. Introduce circulating cold water at 10 psi immediately replacing the hot water. The cold water is circulated until the joint reaches room temperature.

4. Continue to run alternate hot and cold water cycles until 20 cycles are completed.

The series of tests run in this manner indicate the lead-tarred oakum joints to be excellent in the temperature range of room temperature to a joint temperature at its outer perimeter of 160 deg. F. at 10 psi pressure. Pilot tests at 170 deg. F. joint temperature have also proved most satisfactory and such tests will continue.

The lead-tarred oakum-neoprene joint, Fig. 4, has shown in pilot tests that they are satisfactory at pressures up to 25 psi and possibly higher and from room temperature up to 200 deg. F. joint temperature. This work is also continuing.

I do believe it should be pointed out that the test procedures used would be rarely if ever encountered in the ordinary waste system. For example, it would be most unusual for sufficient hot water to be discharged to completely fill the waste pipe building up to 10 psi and be continued until the outer perimeter of the joint reaches even the temperatures at which this test is being conducted.

This short review of the work I am doing at Purdue University should be considered as an interim report. The work is continuing and a much more comprehensive report will be issued when the work is concluded.