# Test Plan for Bench Testing Straub Pipe Couplings

**Abstract:**

This test evaluates the ability of Straub brand 4-inch AGrip-L@ and "Flex" type pipe joints to replace conventional welding/brazing operations for CHT and VCHT system piping assembly and repairs. These flexible pipe joints are mechanically assembled without the application of hot work, resulting in significant labor and monetary savings. The AGrip-L@ joints are equipped with self-gripping anchor rings which allow their installation on piping systems with or without pipe hangers. Minimal preparation of the pipe ends is required. The "Flex" joints are intended specifically for pipe repairs. Therefore, pre-existing anchoring of the piping with hangers is required for the use of these couplings.

The test described herein consists of bench testing of the AGrip-L@ and Flex couplings. A three-foot section of 4-inch Cu-Ni piping will be installed between two (2) five-foot sections of similar piping using Straub joints at either end of the three-foot section. The pipe assembly will be rigidly fixed to the bench with pipe hangers. The ends of the piping assembly will be blanked off, filled with water and then pressurized to 225 psig to test the joints for leakage. The piping assembly will also be subjected to an axial load and a deflection angle of 5 degrees at each joint while under pressure to determine the joint's ability to maintain leakproof integrity. Both types of couplings will be tested in this manner.

**Background:**

U.S. Navy ships are outfitted with marine sanitation devices for the proper handling of sanitary waste in accordance with federal, state and local laws. Most surface ships are equipped with Collection, Holding and Transfer (CHT) systems or Vacuum CHT (VCHT) systems. Collection and discharge piping for these systems is designed to meet the requirements of MIL-STD-777. A typical shipboard installation consists of 90-10 copper-nickel piping with welded or brazed pipe joints. In some cases, entire sections of CHT/VCHT piping may need to be replaced aboard ship. At other times, piping may form a localized hole or crack. Currently, pipe section replacements or hole repairs are accomplished with traditional techniques of welding, brazing and applying patches. The pump discharge piping on some ships is coated on the interior with an epoxy coating, which is applied in-situ, after the piping installation is completed. Preservation of this coating renders pipe repairs or replacement of damaged/corroded pipe sections difficult and expensive. The possibility of melting the coating and its off-gassing due to hot work on the piping during repairs further complicates the problem. A simple means of replacing and/or repairing sanitary waste piping, both coated and uncoated, is desirable. One possible method employs the use of pipe joints that are mechanically assembled without the application of hot work. A damaged section of piping is removed, a replacement section is cut to length and is installed by use of mechanical pipe joints attached at either end. If the piping being repaired is coated, then the new pipe section can be coated by hand prior to its installation.

One company that manufactures such pipe joints is Straub. They have developed pipe-joining technologies for over thirty years and have installed their pipe joints at many shored-based facilities and aboard commercial ships. They advertise availability of leak-proof pipe joints for any pipe material in a wide range of diameters, suitable for pressure or vacuum applications. They further claim that their pipe joints can be installed on piping with various modes of pipe misalignment, piping under tensile or compressive loads, and piping of dissimilar materials. These joints can be installed with minimal preparation of the pipe ends. The joints are equipped with self-gripping anchor rings, and can therefore be used on piping installations with or without anchoring points (pipe hangers). As temperature or pressure increases within the piping, the sealing effect of the joint also increases. As axial loads on the pipe increase, the teeth in the anchor ring bite deeper into the pipe and thus its anchoring effect increases. The housing that bridges the pipe ends imparts no force of its own, and flexible pipe joints are therefore possible with the Straub pipe joint system.

**Pipe Joints to be Tested:**

The test described herein consists of a bench test of Straub's 4-inch AGrip-L@ and "Flex" type joints. These are Straub's most common, universal type joints that they claim to be ideal for shipbuilding, water and wastewater treatment plants. These joints are recommended by Straub for metal-to-metal pipe joinery. The AGrip-L@ joint is available for pipe diameters up to 24 inches, and the Flex joint, used for localized repairs, can fit pipe diameters up to 157.5 inches. Both are rated for temperature and pressure extremes that are well within those of typical Navy marine sanitation devices.

**Bench Testing**

**Test Stand**

For testing purposes, the AGrip-L@ and Flex joints will be tested in a mock repair set-up, as if a section of pipe was being replaced using the Straub joints. For the bench test, a three-foot section of 4-inch Cu-Ni piping (the mock repair section) will be installed between two five-foot sections of 4-inch Cu-Ni piping using Straub joints at either end of the three-foot section. This will result in a pipe assembly approximately 13 feet long with two Straub joints within it. The gap between the pipe sections will be as close as possible but will not exceed 0.4 inch, in accordance with the Straub pipe joint technical manual number 6/01. Locking bolts shall be tightened to 18 foot-pounds. The pipe assembly will be rigidly fixed to the bench with pipe hangers. See Figure 1.

**Bench Test Procedure:**

The ends of the piping assembly will be blanked off and filled with water. It will then be pressurized to 225 psig. This represents a pressure of 150 percent of the highest firemain pressure typically seen aboard ships (150 psig). This is the standard test procedure used for testing new sanitary waste system installations aboard Navy ships, in accordance with MIL-STD-777. This pressure will be held for 10 minutes while checking for leaks at the pipe joints. Upon successful completion of this test, the piping assembly will be subjected to an axial load of 250 pounds tension. The assembly will then be subjected to 225 psig pressure and the joints will be inspected for leakage for 10 minutes. Upon successful completion of this test, the piping assembly will be bent at each joint with a deflection angle of 5 degrees. This angle is in accordance with the Straub pipe joint technical manual number 6/01, which states that Straub joints permit all around angular deflection of the pipe axes by up to 5 degrees. The assembly will

then be subjected to 225 psig pressure and the joints will be inspected for leakage for 10 minutes. See Figure 2.

**Data Sheet #1 - Results of Hydro-Testing Piping Under No load**

Date _____ Start Time _____ Completion Time _____

| Pipe Joint Type | Target Pressure to be Applied (psig) | Actual Pressure Applied (psig) | Joint Leakage (Yes/No) | Estimated Leakage Rate |
|---|---|---|---|---|
| Grip-L | 225 | | | |
| Flex | 225 | | | |

**Notes:**

## Data Sheet #2 - Results of Hydro-Testing Piping Under Tensile Load

Date _____ Start Time _____ Completion Time _____

| Pipe Joint Type | Target Tensile Load to be Applied (pounds force) | Actual Tensile Load Applied (pounds force) | Target Pressure to be Applied (psig) | Actual Pressure Applied (psig) | Joint Leakage (Yes/No) | Estimated Leakage Rate |
|---|---|---|---|---|---|---|
| Grip-L | __ | | 225 | | | |
| Flex | __ | | 225 | | | |

**Notes**:

**Data Sheet #3 - Results of Hydro-Testing Piping Under 5-Degree Deflection**

Date _____ Start Time _____ Completion Time _____

| Pipe Joint Type | Target Pressure to be Applied (psig) | Actual Pressure Applied (psig) | Joint Leakage (Yes/No) | Estimated Leakage Rate |
|---|---|---|---|---|
| Grip-L | 225 | | | |
| Flex | 225 | | | |

**Notes:**

Provide services to assemble and test two (2) pipe coupling fittings manufactured by Straub Company.

Relevant information regarding this test:

A hydro-test of two (2) Straub brand pipe couplings (see attached test plan document) will be performed. The couplings will be installed in four-inch piping and subjected to a pressure equal to 150 percent of normal CHT pump discharge pressure. The couplings will then be subjected to tensile loading under hydro-test pressure, followed by a 5-degree pipe deflection under pressure. The test consists of looking for signs of leakage at the joints under these conditions. After successful completion of this bench test, a shipboard test will follow.

A draft test plan and diagrams (attached) provide details on the bench test portion of this project. Code 914 assistance is requested in setting up the bench test apparatus in accordance with the test plan. Refer to attached test plan and develop a material list. Provide material quotes along with availability and a purchase source. Our code will provide service to purchase the material. Once all materials are on hand to build the apparatus, we anticipate that this testing will be required in the January/February 2004 time frame.

Refer to Section L of the RFP, clause CAR-L11 which requires the offeror to provide a technical and cost proposal setting forth how they intend to accomplish this task including labor, materials and other direct costs.

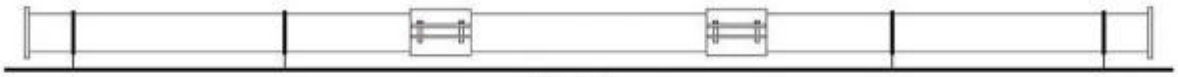

Figure 1
Pipe Joint Bench Test Set-up

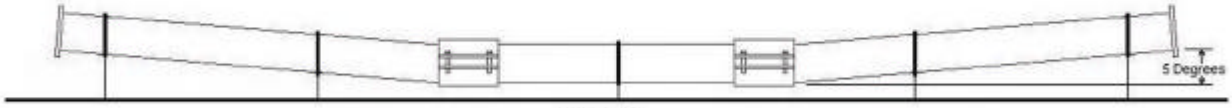


Figure 2
Bench Test Set-up with Piping
Deflected 5 Degress