TEST REPORT

Ph: 909.472.4100 • Fax 909.472.4243 • Web: www.iapmo.org
5001 East Philadelphia Street • Ontario, California 91761-2816 - USA

Report Number: 321-11031 Project No.: 18826

Report Issued: June 8, 2011

Client: Mifab
1321 West 119th street
Chicago, IL 60643
Contact: Michael Whiteside

Source of Samples: The samples were shipped by the manufacturer, and received by IAPMO R&T Lab in good condition on March 31, 2011.

Date of Testing: April 08, 2011 to June 8, 2011

Sample Description: Heavy Duty Hubless Couplings

Model nos: MI-XHUB-150, MI-XHUB-2, MI-XHUB-3, MI-XHUB- 4", MI-XHUB-5, MI-XHUB-6, MI-XHUB-8 and MI-XHUB-10.

Each unit consisted of a rubber gasket, a corrugated stainless steel shield, and stainless steel bands / clamp assembly.

Scope of Testing: The purpose of the testing was to determine if the samples tested of the hubless couplings met the applicable requirements of FM 1680-1989, entitled "Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/Commercial and Residential".

Conclusion: The samples tested of the heavy duty hubless couplings models shown above, from Mifab, complied with all the applicable requirements of FM 1680-1989, Except for 4.1 Markings.

By our signatures below, we certify that all the testing and sample preparation for this report was performed under continuous, direct supervision of IAPMO R&T Lab, unless otherwise noted.

Tested by:

Hanks Ninh, Project Engineer

Reviewed by:

Ken Wijaya, Sr. Laboratory Director

Primary Standard: FM 1680-1989, Sections Tested/Evaluated:

4.1 Markings
4.2 Instructions
4.3 Physical or Structural Features
4.4 Drawings/Plans/Specifications Required with Samples
5.1 Hydrostatic Strength
5.2 Blockage
5.3 Bending Moment
5.4 Deflection Angle
5.5 Sealing Sleeve
5.6 Clamp Strength
5.7 Thrust Test
5.8 Salt Spray

Test Results: All tests and evaluations were conducted per the written procedures in the specified standard.

FM 1680-1989

4.1 Markings – COMPLIED, **EXCEPT for Sections 4.1.1 and 4.1.4**

4.1.1 Each coupling was permanently marked on its external surface with:
Mfr's name or trademark "MIFAB®", Model "MI-XHUB" and Pipe Size.
However, there was no FM Approved Mark and no rated pressure marking.

4.1.2 All information were visible without disassembly of an installed coupling, and the coupling was so designed that it could not be possible to assemble coupling components to produce an incompletely marked assembly.

4.1.3 The sealing sleeve compound was per ASTM C564.

4.1.4 The sealing sleeve was marked with raised letters. This marking consisted of:
Mfr's name or trademark "MIFAB®", Model "MI-XHUB", Pipe Size and material identification "ASTM C-564. **However, there was no mold number, no cavity number and no FM Approval Mark.**

4.2 Instructions – COMPLIED

The samples were packaged with complete installation instructions, including any dimensional requirements, fastener torque requirements, and specific torquing sequence.

4.3 Physical or Structural Features

4.3.1 Materials – COMPLIED

All materials were suitable for the intended service.

Sealing sleeve materials were suitable for continuous service in the temperature range of 0° to 180°F (-18° to 82°C). They were pliable, smooth, and free of obvious surface porosity and mold flash.

4.3.2 Pressure Rating – COMPLIED

All couplings were designed for a rated working pressure as listed in Paragraph 1.2.2 (15 psi for Class I, Industrial and Residential).

4.3.3 Sizes – COMPLIED

The couplings were standard nominal pipe sizes for drain, waste, or vent, storm and sanitary systems are from 1½ through 10 inches nominal diameter.

The dimensions of a coupling allowed its use with standard hubless cast iron soil pipe and fittings used in drain, waste, vent, storm and sanitary systems, as defined in Cast Iron Soil Pipe Institute (CISPI) 301 "Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications".

4.3.4 Connections – COMPLIED

A. Couplings were readily installed with no possibility of incorrect assembly.

B. When required by the given design, couplings meshed together properly with no interference. Assembly did not cause a pocket or recess with a lip, or reduction in pipe area, or cause an obstruction in flow path. No special tools were required for coupling assembly, except torque wrenches.

4.3.5 Test Pipe – FOLLOWED

Because of the inconsistencies in different lots and brands of hubless pipe, both in surface finish, dimension and porosity, as well as the irregular coating applied, all tests in this standard shall be run using the modified steel pipes or fabricated segments described below.

Steel pipes or fabricated steel segments used during testing shall be machined to the maximum and minimum outside diameters (in pairs) of CISPI Standard 301, and shall have 0.015 in. (0.38 mm) deep grooves circumferentially around the pipe. The grooves shall have a 60° included vee angle and be spaced at 3/16 in. (4.8 mm) intervals the width of the area covered by the coupling sleeve. The surface of the maximum and minimum diameter areas shall be 125 rms between vee grooves. Surfaces shall be uncoated during testing, and shall be solvent-cleaned prior to assembly.

4.3.6 Underground Installation –The acceptance of couplings per the requirements of this Standard extends to underground service only when systems are laid on a continuous, firm bed, or on Concrete or other adequate supports. Restraints, thrust blocks, and other supports may be necessary to prevent damaging external loads from being transmitted to couplings.

Joints shall be made up and torqued per manufacturer's instructions. Any required clamps, restraints, or supports shall be installed or framed prior to careful placement of backfill, and shall conform to the requirements of the authority having jurisdiction.

4.4 Drawings/Plans/Specifications Required with Samples – COMPLIED

Couplings submitted for testing were true production samples and were free of sharp edges, burrs or other imperfections likely to injure the installer or interfere with proper assembly of the unit.

In addition to the production samples, the manufacturer provided complete detail and assembly drawings and material specifications.

5.1 Hydrostatic Strength – COMPLIED

5.1.1 Requirement - Each coupling shall withstand 150 percent of its rated working pressure without leaking.

5.1.2 Test/Verification - One coupling of each size under examination was assembled in conformance with the manufacturer's instructions onto a test module which restrains the pipe from separation. A set of test pipes with one piece machined to the maximum diameter and one to the minimum diameter as described in Paragraph 4.3.5 was used. Each test assembly was pressurized to 1.5 times the rated working pressure of the coupling (mfr's rating: 15 psi x1.5 = 22.5 psi) for 5 minutes.

Findings: There was no leakage.

5.2 Blockage – COMPLIED

5.2.1 Requirement - Couplings shall not leak when operating for extended periods of time at rated working pressure.

5.2.2 Test/Verification - One of each size of coupling under investigation was mounted on a set of test pipes, the pressurized at the rated working pressure, 15 psi for a period of not less than 8 hours, and examined for leakage.

Findings: There was no leakage within the 8 hour period.

5.3 Bending Moment – COMPLIED

5.3.1 Requirement - Couplings shall not leak or otherwise fail when subjected to specified bending moments.

5.3.2 Test/Verification - Couplings were assembled as described below and subjected to the required bending moments listed in Table I of the specification. The required moments were calculated from the application of a factor of two (2) to the moment produced by a water-filled hubless cast iron pipe on a coupling which was adjacent to a pipe hanger, with the next hanger broken on the maximum allowable hanger spacing of 10 feet (3.07 m).

Couplings 10 inches nominal size and smaller were mounted per manufacturer's instructions between two pieces of test pipe at least 5 feet (1.8 m) long each. The outboard ends of the pipes were closed. The assembly was set on supports 24 inches (0.6 m) apart with the coupling centered as indicated in Figure 1. The assembly was filled with water and hydrostatically pressurized to the rated working pressure of the coupling of 15 psi, and held at that pressure for the duration of the test. The load was applied vertically on both sides of the coupling with a bridge within 1 inch (25 mm) of the maximum gripping dimension of the coupling, until the maximum bending moment as listed in Table I was reached. With this test configuration, the moment arm was taken to be 1 foot (0.3 m) and the load which was applied to the coupling was numerically equal to twice the required moment in English System units. No leakage occurred at the maximum bending moment.

Pipes were axially restrained in a fashion which did not interfere with application of the bending load, if such restraint was specified in the manufacturer's installation instructions.

Findings:

Size (inch)	Bending Moment (lb.ft)	Result
1-1/2	90	Passed
2	110	Passed
3	183	Passed
4	293	Passed
5	367	Passed
6	481	Passed
8	821	Passed
10	1309	Passed

5.4 Deflection Angle – COMPLIED

5.4.1 Requirement - Each coupling shall withstand a deflection of 1 inch per linear foot of pipe, without leakage, while pressurized to the rated working pressure.

5.4.2 Test/Verification - Each nominal size of coupling 10 inches or smaller was mounted per manufacturer's instructions between two pieces of test pipe. The outboard ends of the pipes were closed. The assembly was filled with water and hydrostatically pressurized to the rated working pressure of the coupling of 15 psi for the duration of the test. One pipe was rigidly supported while the opposite end of the other pipe was raised 1 in. (25.4 mm) per lineal foot of pipe. No leakage was found. Then the pipe continued to be raised until a failure (leakage or otherwise) occurred and the maximum deflection was recorded for information.

Findings:

Size (inch)	Deflection (inch) 1in./ft of pipe	Max. Deflection (inch)	Result
1-1/2	5"	52	Passed
2	5"	37	Passed
3	5"	33	Passed
4	5"	26-1/2	Passed
5	5"	22-1/4	Passed
6	5"	21-3/4	Passed
8	5"	12-1/4	Passed
10	5"	11-1/2	Passed

5.5 Sealing Sleeve – COMPLIED

5.5.1 Requirement - The sealing sleeve shall not crack or permit leakage when subjected to temperature and vibration exposure.

5.5.2 Test/Verification

A. One sealing sleeve under examination was subjected to high temperature exposure and one to low temperature exposure. Samples subjected to the temperature exposure tests were installed per manufacturer's instructions in coupling-pipe assemblies during exposure. One sample was exposed to a vibration environment while pressurized to the rated working pressure.

B. A sample nominal 3 inch coupling was installed between two pieces of 6 to 12 inch (152 to 305 mm) long test pipe. The high temperature exposure consisted of 180°F (82°C) oven-air exposure of 45 days. After exposure, the assembly was allowed to cool to ambient air temperature. It then was pneumatically pressurized to the rated working pressure (as shown in 5.1) and submerged in water.

Findings: No leakage was found. The sealing sleeve, after removal from the housing assembly, did not crack when squeezed.

C. A sample nominal 2 inch coupling was installed between two pieces of 6 to 12 inch (152 to 305 mm) long test pipe. The low temperature exposure consisted of 0°F (-18°C) air exposure for 4 days. After exposure, the assembly was submerged in a pail of 0°F (- 18°C) antifreeze and pneumatically pressurized to the rated working pressure (as shown in 5.1).

Finding: No leakage was found.

The assembly then was allowed to warm to ambient temperature and then was disassembled.

Finding: The sealing sleeve did not crack when squeezed together from any two opposite points.

D. A sample nominal 4 inch coupling was assembled according to Figure 2 connecting two 6 to 12 inch (152 to 305 mm) pipes with closed outer ends. The assembly was approximately one-half full of water, pneumatically pressurized to the rated working pressure (as shown in 5.1) and subjected to 0.020 inch (0.51 mm) full stroke vibration at a frequency constantly varying between 18 and 37 Hertz for 5 hours. At the conclusion of the vibration test, the assembly was hydrostatically pressurized to the rated working pressure (as shown in 5.1) for 5 minutes.

Finding: No leakage was found.

5.6 Clamp Strength – COMPLIED

5.6.1 Requirement - Clamp assemblies shall not separate from the housing when over-tightened.

5.6.2 Test/Verification – Each sample of clamp assemblies in nominal 2, 4, 6 and 8 inch sizes without elastomer sleeves, was placed over pipes and tightened to 115 percent of the manufacturer's highest rated installation torque. Mfr's rating torque 80 lb.ft x 1.15 = 100 lb.ft

Findings: Strip clamps did not separate from the housing during this test.

5.7 Thrust Test – COMPLIED

5.7.1 Requirement - Pipe sections shall not separate more than 0.150 in. (3.8 mm) when assembled and tested according to the procedure below

5.7.2 Test/Verification - One coupling of each diameter shall be assembled per Figure 3 onto two steel pipes or test segments as described in Paragraph 4.3.5. The assembly was filled with water and the hydrostatic pressure increased at the rate of 1 psi (7 kPa) every 30 seconds until the following test pressure was reached. The dial indicator was set to zero. Pressure was held for 10 minutes.

Findings:

Size (inch)	Test Pressure (psi)	Movement (inch)	Result
1-1/2	15	0.001	Passed
2	15	0.002	Passed
3	15	0.006	Passed
4	15	0.010	Passed
5	15	0.012	Passed
6	15	0.024	Passed
8	10	0.022	Passed
10	6	0.018	Passed

There was no leakage at the coupling, or joint separation of more than 0.150 in. (3.8 mm) from the initial pressurized position.

5.8 Salt Spray – COMPLIED

5.8.1 Requirement - Clamp assemblies shall not corrode or deteriorate when exposed to a salt fog environment.

5.5.2 Test/Verification - One sample nominal 4 inch coupling assembly was mounted per manufacturer's instructions on two pieces of pipe approximately 14 inches (0.35 in) long. The assembly then was placed in a salt spray (fog) environment as specified by ASTM B117-85, "Standard for Salt Spray (Fog) Testing". The salt solution shall consist of 5±1 percent by weight of common salt (sodium chloride) dissolved in deminer-alized water. The chamber temperature was maintained at 95° +2° -3° (350 +1.1° -1.7°C).

Following 10 days exposure to the salt spray; the sample was permitted to air dry for 2 to 4 days. A visual inspection was made for deterioration or impending failure. Then the assembly was washed with tap water and dried with a compressed air spray. Visual inspection then was made again to look for deterioration or impending failure of any component.

The coupling and sealing sleeve were removed from the pipe and examined again. Then the coupling and sealing sleeve were reassembled to the pipe and hydrostatically tested to the rated working pressure (as shown in 5.1) for 5 minutes.

Findings: The coupling exhibited no indications of failure.

Photograph of samples