Designation: A 926 – 03 (Reapproved 2008)

Standard Test Method for Comparing the Abrasion Resistance of Coating Materials for Corrugated Metal Pipe[1]

This standard is issued under the fixed designation A 926; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers a procedure for comparing materials used for coating, paving and lining corrugated metal pipe by use of a bed load abrasion testing machine. The procedure attempts to simulate the effect of stone, gravel and sand carried by a stream through corrugated metal pipe.

1.2 The values stated in inch-pound units are to be regarded as standard. The SI units given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 742/A 742M Specification for Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe

A 849 Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe

A 929/A 929M Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe

C 131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

3. Summary of Test Method

3.1 Curved steel panels, coated with the matter to be evaluated, are mounted on the inside surface of a cylindrical drum. A charge of fine aggregate coarse aggregates and water are added and the drum is sealed. Then the drum is rotated to cause an abrasive flow over the materials being tested. After the prescribed number of revolutions, the panels are removed from the drum, inspected and weighed for loss; or Alternative 2 counting grid method is used.

4. Significance and Use

4.1 This test method provides a means of determining an abrasion rate (weight and calculated average thickness loss) when comparing materials, coatings, pavings, or linings under test conditions that will be subjected to abrasive bed loads. The importance of this information is recognized when dealing with culverts, storm and sanitary sewer applications, although the last two generally do not have the same degree of abrasion due to the flatter slopes and less bed loads than culverts. Specifically, the invert of these types of pipe, regardless of the material used, can be exposed to flows containing abrasive bed loads or solid particulates that cause wearing of the pipe wall.

4.2 By subjecting materials to wear in the bed load abrasion machine with a controlled bed load charge made up of fine aggregate and coarse aggregate over a specified period, a comparison of the resistance between materials can be established.

4.3 This test method does not simulate the effect of abrasive material striking the upstream face of corrugations, as would be typical for coating materials which do not completely fill the corrugations.

NOTE 1—**Caution:** This test method uses specific quantitative values to encourage repetitive results and does not consider varying bed load characteristics, ratio of water to bed load, velocity, time or actual field conditions, and the effect of exposed edges on laminates. The user must use extreme care in comparing one test result to another because of these and other variables.

[1] This test method is under the jurisdiction of ASTM Committee A05 on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.17 on Corrugated Steel Pipe Specifications.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

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5. Apparatus

5.1 *Bed Load Abrasion Machine*, equipped with a counter and conforming in all essential characteristics to the design shown in Fig. 1. The machine shall consist of a hollow steel cylinder, closed at both ends, having an outside diameter of 24 ± 0.2 in. (610 ± 5 mm). One closed end of the cylinder shall have four bolted plexiglass windows one of which is elongated to provide placement of the specimens. A shaft mounted horizontal and through the cylinder shall have a drive pulley at one end and be supported by bearings connected to a frame allowing the cylinder to turn freely and be in alignment with a drive motor below.

5.2 The machine shall consistently rotate at 50 ± 5 r/min when specimens are mounted and drum is fully charged.

6. Test Specimens

6.1 *Panels*—Test specimens shall consist of zinc-coated steel sheet with or without a nonmetallic protective coating to be evaluated. The steel sheet shall conform to Specification A 929/A 929M with a specified thickness of 0.064 in. (1.63 mm). All panels are curved as shown in Fig. 2, with the test surface concave. A plain zinc-coated panel serves as a control specimen.

6.1.1 Panels to serve as a substrate for coating materials to be applied to fabricated pipe shall be curved prior to application of the coating material. The control panel and panels having factory applied nonmetallic coating (such as polymer precoated sheet, Specification A 742/A 742M) shall be in the as-received condition.

6.1.2 Fabricate the panels as shown in Fig. 2. Take care in fabricating panels with preapplied nonmetallic coatings to avoid damage to the coating. Curve the panels to a smooth, uniform radius with no straight tangent portions at the ends. A device as described in Appendix X1 shall be used.

6.2 *Coating*—Coat the panels as recommended by the manufacturer of the coating material. The thickness of the coating shall be equal to, or greater than, the minimum thickness proposed or required to be used on pipe (usually on the crest of corrugations).

6.3 *Mounting*—Mount the coated test panels in the drum using 5/16 in. (or M8) steel bolts. Other sizes of bolts may be used provided appropriate adjustments are made in the mounting hole slot. Use washers under the bolt head (or nut) to protect the coating from damage when tightening the bolt (or nut). Place a thin foam cushion (expanded neoprene, etc.) under the panels to provide a tight fit against the drum and to

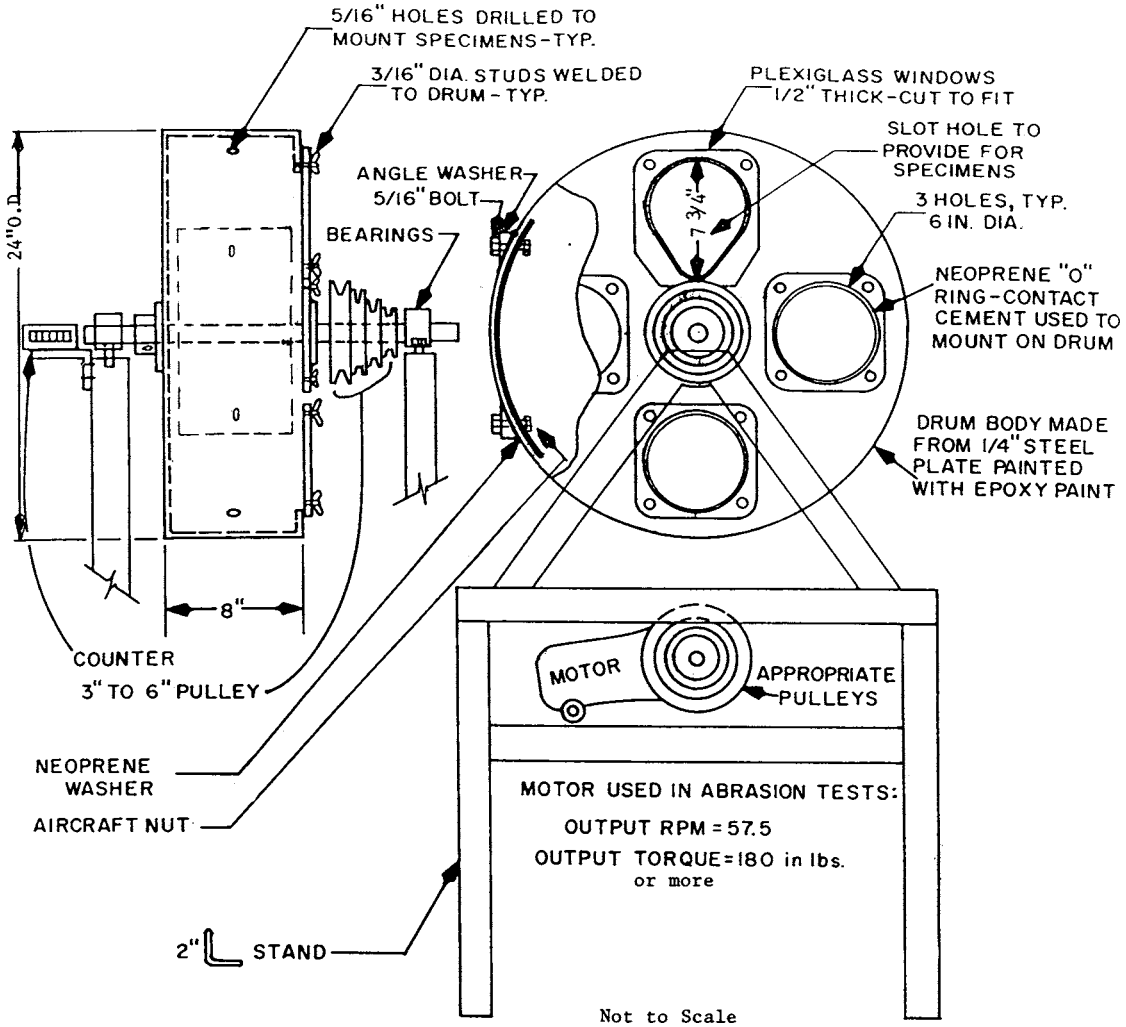


FIG. 1 Bed Load Abrasion Testing Machine

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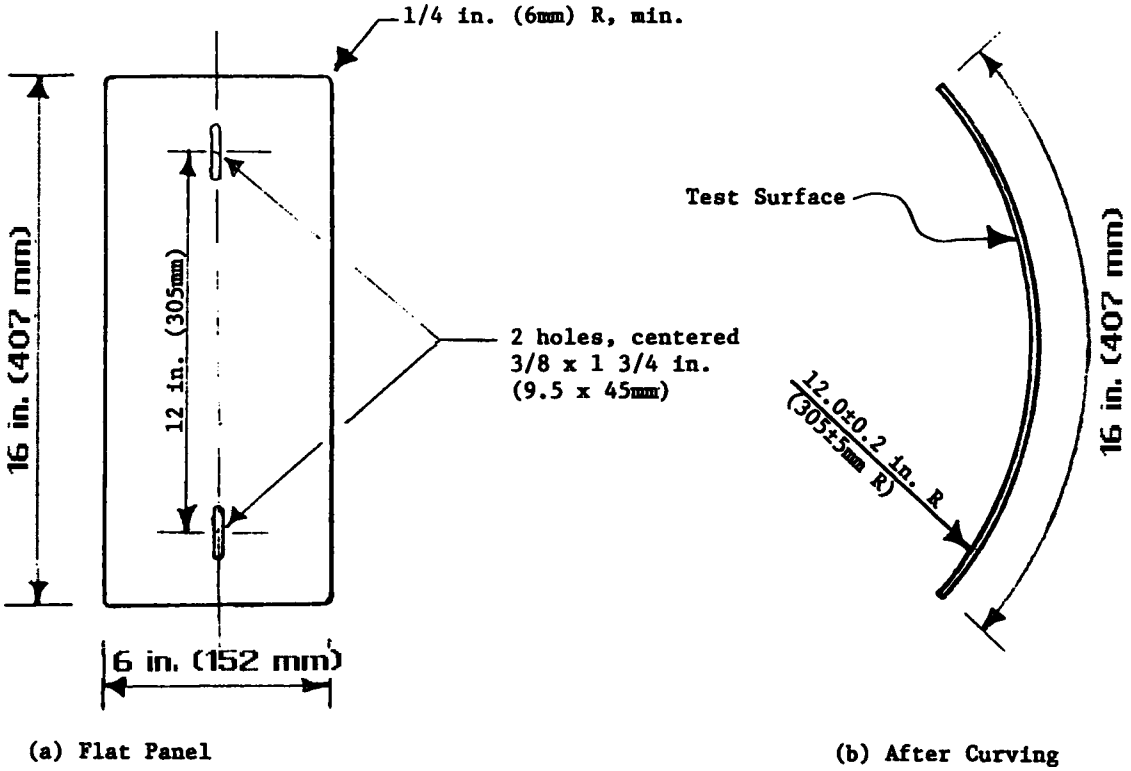


FIG. 2 Test Panel

keep fines from eroding the backside of the panel. Shims shall be used as required under the test panels to maintain the same height between the surface of adjacent specimens and the drum when mounted.

6.4 *Panel Weight*—In order to evaluate the effect of the test, determine the panel weight using a balance accurate to 0.01 g.

6.4.1 Panel substrate prior to application of coating,

6.4.2 Panel with the coating before test, and

6.4.3 Panel with the coating after testing.

6.4.4 Panels tested with factory applied coating do not permit determination of the weight as described in 6.4.1. Panels used as reference panels without non-metallic coating require weighing before and after test.

7. Procedure

7.1 Mount three test specimens with coating, paving, or lining and one control specimen made of a panel with no coating. Take care not to damage or alter test specimens after they have been coated and weighed.

7.2 *Charge*—The charge shall consist of 7 lb (3.2 kg) of aggregate and 35 lb (15.9 kg) of water having a pH of 7.0 ± 0.5. The aggregate shall be 3½ lb (1.6 kg) of ⅜ in. (9.5 mm) to No. 4 coarse and 3½ lb (1.6 kg) of fine (wash sand) graded as in Table 1.

7.2.1 Sieve the aggregate according to the procedure in Test Method C 136 and recombine to obtain the grading in Table 1.

7.2.2 For comparison of coatings performed by one agency, the aggregate may be from any source able to supply a consistent product. The aggregate shall be a crushed rock having a loss in the Los Angeles test (see Test Method C 131) not greater than 20 %.

TABLE 1 Typical Grading Analysis—Percent Passing

Coarse Aggregate		Fine Aggregate (Wash Sand)	
Sieve Size	Percent Passing	Sieve Size	Percent Passing
½ in. (12.5 mm)	100	No. 4 (4.75 mm)	100
⅜ in. (9.5 mm)	100	No. 8 (2.36 mm)	91
No. 4 (4.75 mm)	14	No. 16 (1.18 mm)	71
No. 8 (2.36 mm)	0	No. 30 (600 µm)	42
		No. 50 (300 µm)	11
		No. 100 (150 µm)	2
		No. 200 (75 µm)	1

7.2.3 For comparison of coatings performed by different agencies, use either a reference aggregate (see Note 2) or establish by comparison tests that the aggregate used by each agency provides comparable results.

NOTE 2—The following source has been used as a reference by some agencies: Bear River Aggregate, available from R. J. Miles Co., Corner of Railroad and Oak, Colfax, CA.

7.3 *Alternative 1*—Perform the test in two segments with measurements being made at the conclusion of both. The first stopping shall be at 500,000 revolutions, approximately 6.95 days or 166 h and 50 min and the second stopping shall be at 1,000,000 revolutions, approximately 13.89 days or 333 h and 20 min concluding the test. Inspection shall be done with caution so as not to damage the samples or disturb the charge.

7.3.1 During testing maintain the ambient temperature at 68 to 86°F (20 to 30°C).

7.3.2 Upon completion of the test, wash, dry, weigh, photograph, and log each sample.

7.3.3 Make comparison between the weight of the coated, paved, or lined test specimen before the test and after.

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7.4 *Alternative 2*—Perform the test as Alternative 1 except the charge shall be replaced with new material every 250 000 revolutions and the test will continue until at least one specimen has exceeded the limits of 7.4.1.

7.4.1 An acrylic counting grid using 1 in. (25 mm) squares (6 in. (152 mm) by 16 in. (407 mm) panel or 6 grid squares by 16 grid squares totaling 96 grid squares) shall be used to measure performance. The number of grid squares showing exposed metal shall not exceed 10 grid squares of the total grid squares.

NOTE 3—Certain coatings may coat the aggregate and affect the test results.

8. Report

8.1 Prepare a report for each set of samples run, and report the following essential information:

8.1.1 Color photographs of the sample taken before and after the test,

8.1.2 A complete identification of all four samples (User option is to include an IR fingerprint of the coating material).

8.1.3 A complete description of the location of any visible surface flaws,

8.1.4 The weight of each sample substrate after preparation (holes, etc.),

8.1.5 The weight of samples after coating has been applied,

8.1.6 The weight of samples after the specified number of revolutions have been completed,

8.1.7 The number of revolutions,

8.1.8 Duration, days, hours and minutes of test,

8.1.9 Notation of any deviation in test procedure from that set forth in preceding paragraphs, that is, RPM at which test was conducted, and

8.1.10 When using Alternative 2 document the wear pattern and number of grid squares affected for each test specimen at each charge change until at least one specimen has exceeded the limits of 7.4.1.

8.1.11 Comments.

9. Precision and Bias

9.1 *Precision*—The precision of this test method has not been determined.

9.2 *Bias*—No statement is being made about the bias of this test method since there is no accepted reference material suitable for determining the bias of this procedure.

10. Keywords

10.1 abrasion resistance of pipe coatings; coatings—abrasion; corrugated metal pipe; resistance of coating materials to abrasion; steel pipe coatings

APPENDIX

(Nonmandatory Information)

X1. PANEL CURVING DIE

X1.1 Curving the uncoated, paved or lined zinc-coated culvert sheet shall be accomplished by using the two part wooden die shown in Fig. X1.1 and a hydraulic press. The radius of the die shall be 7 ± 0.2 in. (175 ± 5 mm) to allow for springback. If materials to be curved do not meet the requirements of Section 6 the die radius must be altered to allow for a differing degree of springback to achieve the final specimen radius of curvature required.

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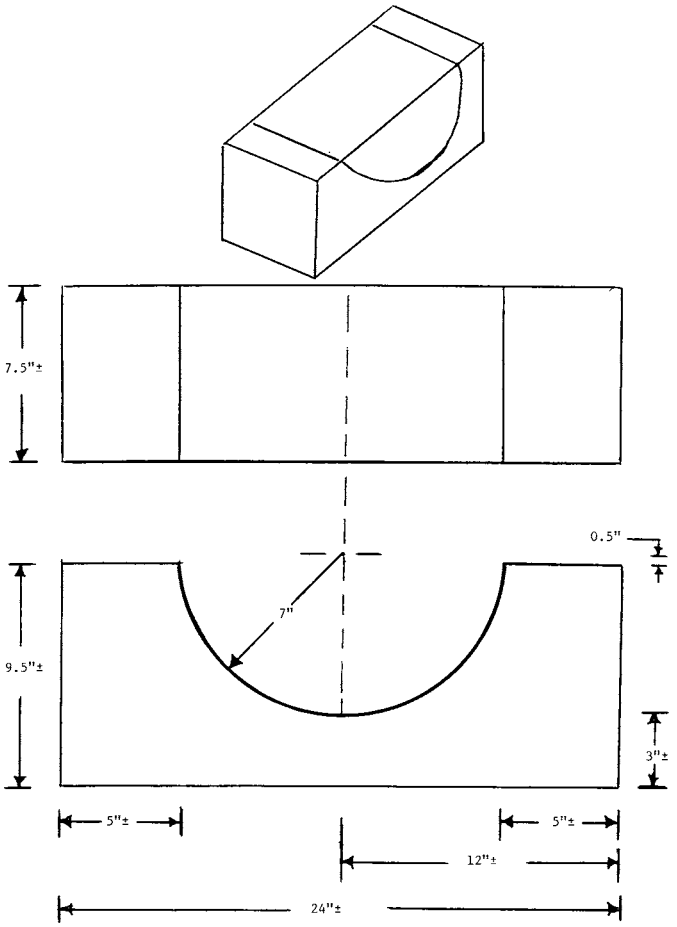


FIG. X1.1 Wooden Two Part Die

SUMMARY OF CHANGES

Committee A05 has identified the location of selected changes to this standard since the last issue (A 926 - 97) that may impact the use of this standard.

A 926 - 03:

(*1*) Replaced reference to Specification A 444/A 444M with its replacement: Specification A 929/A 929.

(*2*) Replaced "may" with "shall" in several instances.

(*3*) Added text to Summary of Test Method for clarity.

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