Designation: F112 – 00 (Reapproved 2013)

Standard Test Method for Sealability of Enveloped Gaskets[1]

This standard is issued under the fixed designation F112; 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 the evaluation of the sealing properties of enveloped gaskets for use with corrosion-resistant process equipment.[2] Enveloped gaskets are described as gaskets having some corrosion-resistant covering over the internal area normally exposed to the corrosive environment. The shield material may be plastic (such as polytetrafluoroethylene) or metal (such as tantalum). A resilient conformable filler is usually used inside the envelope. The design and construction of nonmetallic gaskets is covered in Practice F336.

1.2 The values stated in SI units are to be regarded as standard. The values 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.* For specific precautionary statements, see Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

F37 Test Methods for Sealability of Gasket Materials

F336 Practice for Design and Construction of Nonmetallic Enveloped Gaskets for Corrosive Service

2.2 *ASTM Adjuncts:*

Detailed Drawing of Test Fixture[4]

3. Summary of Method

3.1 An enveloped gasket is compressed between two bolted flanges in a special test fixture.[5] After the specified load is applied to the gasket, air at the specified pressure is introduced into the test chamber and then the test chamber is sealed. Pressure and temperature readings are taken and recorded at specified intervals. The leakage rate is measured by the change in the test chamber pressure over time. The flange load on the gasket is increased and the process is repeated.

3.2 Results of the sealability test are expressed as a graph of the remaining test chamber pressure versus time for the specified conditions.

4. Significance and Use

4.1 This test method is designed to evaluate all types of enveloped gaskets under controlled conditions with respect to leakage and to provide measurable leakage rates.

4.2 Determining torque required to seal a given gasket is also part of this test method. By converting the torque at sealing to total bolt load, useful design information may be obtained for other standard and nonstandard openings.

4.3 This test method may be used as an incoming quality control test to evaluate similar gaskets from different suppliers. This test method may also be used as a quality control test when parameters are agreed upon between the producer and the user.

4.4 Leakage through the gasket or over the gasket, or both, is determined by this test method.

5. Apparatus

5.1 *Leakage Test Unit*—The unit[5] shall contain a suitable pressure gauge to read from 0 to 2.1 MPa (0 to 300 psig) and mounted as shown in Fig. 1.

5.2 *Compressed Air Supply,* capable of supplying 621 kPa (90 psig) to the test unit.

[1] This test method is under the jurisdiction of ASTM Committee F03 on Gaskets and is the direct responsibility of Subcommittee F03.10 on Composite Gaskets.

Current edition approved May 1, 2013. Published May 2013. Originally approved in 1970. Last previous edition approved in 2006 as F112 – 00 (2006). DOI: 10.1520/F0112-00R13.

[2] This test method is to be used in place of Test Methods F37, which apply only to single-component gasket materials and are not applicable to envelope-style gaskets. This fixture may also be used for other gasket materials or designs, with or without modification.

Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:F03-1000.

[3] 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.

[4] Available from ASTM International Headquarters. Order Adjunct No. ADJF0112. Original adjunct produced in 1970.

[5] The sole source of supply of the apparatus known to the committee at this time is Pfaudler Co., 1000 West Ave., Rochester, NY 14603. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

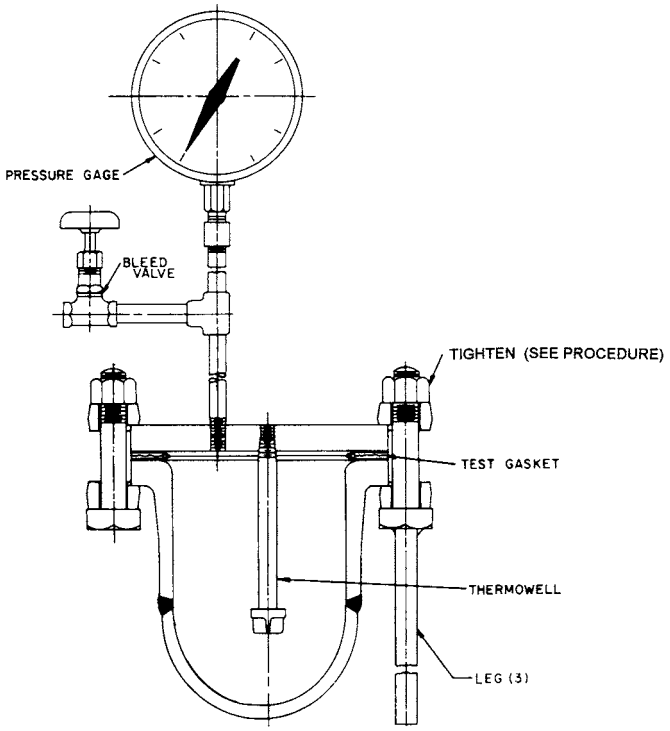


FIG. 1 Test Unit

5.3 *Temperature Indicating Device*—A thermometer capable of reading in increments of 1°C in the ambient temperature range.

6. Hazards

6.1 Use only a unit suitable for a minimum of 1034 kPa (150 psig).

6.2 A metal shield box with access doors is suggested as an added safety factor.

6.3 Prior to performing any tests, inspect the unit for damage, corrosion, and also for metal fatigue cracks that may have developed.

7. Test Specimen

7.1 Commercial 102-mm (4-in.) nominal size enveloped gasket with a shield 102 mm (4 in.) in inside diameter (minimum) and inserts 114 mm (4.5 in.) in inside diameter by 175 mm (6.88 in.) in outside diameter. The thickness of the test gasket will depend upon its expected usage and must be specified in the report as results will vary accordingly.

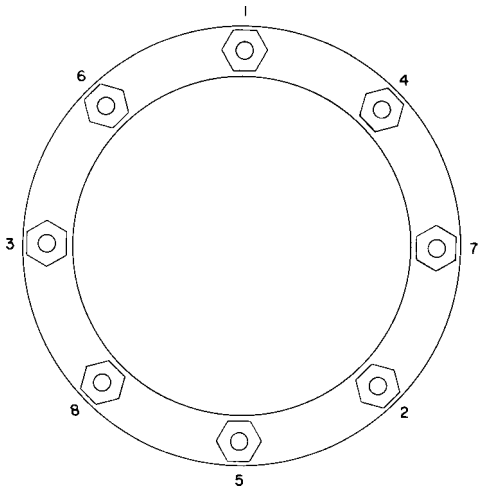
8. Conditioning

8.1 Conditioning of the test gasket is not necessary since this test method is designed for shelf stock. Assembled enveloped gaskets and the components used in their construction would not be affected by aging under normal storage conditions.

9. Procedure

9.1 The temperature for this test is normally ambient room temperature.

9.2 Assemble the gasket in the test unit.



NOTE 1—Tighten bolts evenly; follow numerical sequence.

FIG. 2 Bolt Tightening Progression

9.3 Lubricate the bolt threads well using molydisulfide dry film or grease. Sanding the bottom of the bolt heads and the washers will minimize torque variables and ensure duplication of results.

9.4 Gradually and evenly tighten the bolts to 39 N·m (29 lbf·ft) following the sequence indicated by the numbers in Fig. 2. Progression of the tightening on each bolt should be in approximately 7-N·m (5-lbf·ft) increments.

9.5 Apply 621 kPa (90 psig) of air pressure into the test unit and seal. Record the pressure readings every hour for 4 h and then at the end of 20 h, but since the readings are temperature dependent, take and record the temperature within the oil-filled thermowell to coincide with the time of the pressure readings. Apply corrections if required.

9.6 Fill the test fixture thermowell three-quarters full with a light oil.[6] Allow 15 minutes for the temperature to stabilize, and insert the temperature sensor.

9.7 Retighten the bolts to 57 N·m (42 lbf·ft) in accordance with 9.4 and proceed as in 9.5.

9.8 Continue testing using bolt tensions of 85 N·m (63 lbf·ft), 102 N·m (75 lbf·ft), and 122 N·m (90 lbf·ft) in accordance with 9.4 and proceed as in 9.5.

9.9 Repeat 9.2-9.8 using another gasket from the same lot.

10. Report

10.1 Report the following information:

10.1.1 Identification of the enveloped gasket,

10.1.2 Gasket thickness,

10.1.3 Pressure readings versus time, and

10.1.4 Plot of remaining pressure versus time, h, for each torque level.

[6] Mineral oil or commercially available heat transfer oil has been found satisfactory.

11. Precision and Bias

11.1 *Precision:*

11.1.1 The condition and the lubrication of the bolts have a direct bearing on the precision and bias of this test method.

11.1.2 A variation of 5 % between laboratories may be expected using this procedure.

11.2 *Bias*—since there is no accepted reference material suitable for determining the bias of the procedure in this test method for measuring sealability of gasket materials, no statement on bias is available.

12. Keywords

12.1 enveloped gaskets; metal; PTFE; sealability

APPENDIX

(Nonmandatory Information)

X1. TYPICAL EXAMPLES OF RECORDING AND PLOTTING ENVELOPED GASKET SEALABILITY TEST DATA

X1.1 Example 1

X1.1.1 A typical PTFE (polytetrafluoroethylene) enveloped gasket might give the pressure readings shown in Fig. X1.1 and Table X1.1.

X1.1.2 *Interpretation of Results*—A slight leakage was obtained at 39 and 57 N·m (29 and 42 lbf·ft) torque. Complete sealing was attained at the 85 N·m (63 lbf·ft) torque compression. By converting the torque at sealing to total bolt load, useful design information may be obtained for other standard or nonstandard openings.

X1.2 Example 2

X1.2.1 A typical metal enveloped gasket might give the pressure readings shown in Fig. X1.2 and Table X1.2.

X1.2.2 *Interpretation of Results*—The results indicate that 122 N·m (90 lbf·ft) torque is required to seal this particular metal shielded gasket against an internal pressure of 621 kPa (90 psi). This information may be used to check the adequacy of other standard opening sizes or to properly design nonstandard joints where this type of gasket is to be used.

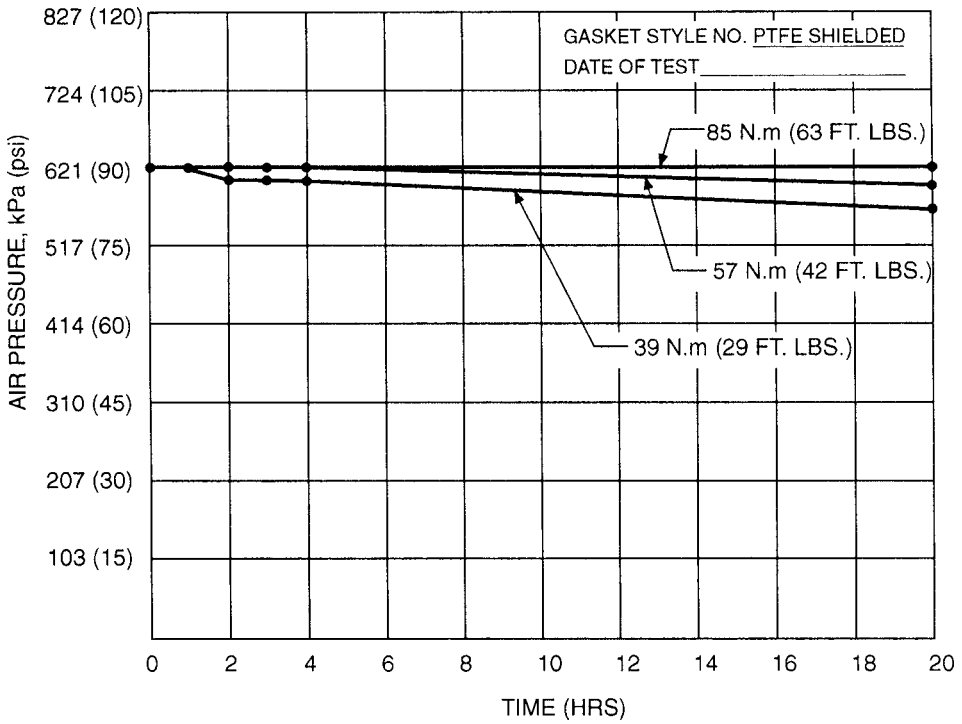


FIG. X1.1 Pressure Reading Plot for PTFE Enveloped Gaskets

TABLE X1.1 Pressure Readings for Typical PTFE Enveloped Gasket[A]

Torque		Original Pressure		1 h		2 h		3 h		4 h		20 h	
N·m	(lbf·ft)	kPa	(psi)	kPa	(psi)	kPa	(psi)	kPa	(psi)	kPa	(psi)	kPa	(psi)
39	(29)	621	(90)	621	(90)	614	(89)	614	(89)	614	(89)	586	(85)
57	(42)	621	(90)	621	(90)	621	(90)	621	(90)	621	(90)	607	(88)
85	(63)	621	(90)	621	(90)	621	(90)	621	(90)	621	(90)	621	(90)
102	(75)	621	(90)	621	(90)	621	(90)	621	(90)	621	(90)	621	(90)
122	(90)	621	(90)	621	(90)	621	(90)	621	(90)	621	(90)	621	(90)

[A] These figures would be plotted as shown in Fig. X1.1.

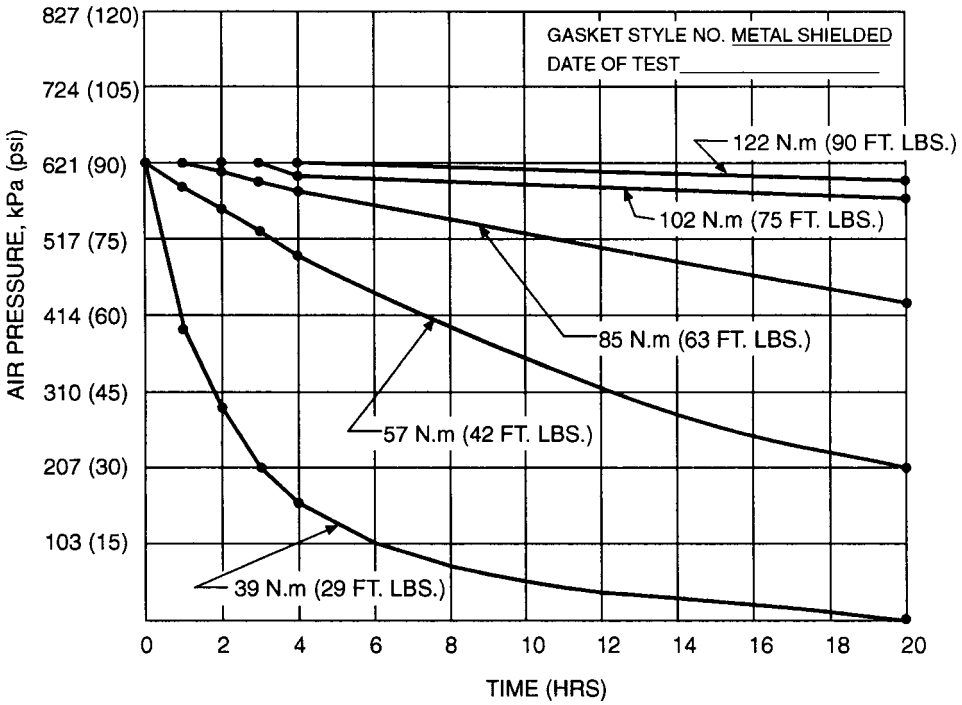


FIG. X1.2 Pressure Reading Plot for Metal Enveloped Gaskets

TABLE X1.2 Pressure Readings for Typical Metal Enveloped Gasket[A]

Torque		Original Pressure		1 h		2 h		3 h		4 h		20 h	
N·m	(lbf·ft)	kPa	(psi)	kPa	(psi)	kPa	(psi)	kPa	(psi)	kPa	(psi)	kPa	(psi)
39	(29)	621	(90)	393	(57)	276	(40)	207	(30)	152	(22)	0	(0)
57	(42)	621	(90)	565	(82)	531	(77)	510	(74)	469	(68)	214	(31)
85	(63)	621	(90)	621	(90)	607	(88)	600	(87)	586	(85)	441	(64)
102	(75)	621	(90)	621	(90)	621	(90)	621	(90)	614	(89)	558	(81)
122	(90)	621	(90)	621	(90)	621	(90)	621	(90)	621	(90)	600	(87)

[A] These figures would be plotted as shown in Fig. X1.2.