Designation: F145 – 72 (Reapproved 2023)

Standard Practice for Evaluating Flat-Faced Gasketed Joint Assemblies[1]

This standard is issued under the fixed designation F145; 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 practice permits measurement of gasket compression resulting from bolt loading on a flat-face joint assembly at ambient conditions.

1.2 The values stated in SI units are to be regarded as the 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E171 Practice for Conditioning and Testing Flexible Barrier Packaging

3. Summary of Practice

3.1 The gasket compression and flange distortion are obtained from compressed-thickness measurements on cylindrically shaped soft-solder plugs (50-50 lead-tin by weight) inserted into holes, drilled or punched through the gasket in the thickness direction. Initial compression is accomplished in the flanged-joint assembly when the bolts are loaded at ambient temperature. Solder, being inelastic, will remain at the compressed thickness of the gasket after the joint is subsequently disassembled.

4. Significance and Use

4.1 Gasket compressions produced by bolt loads in a flanged joint are important in the application engineering of a joint assembly. They are related to the ability of a gasket to seal, to maintain tightness on assembly bolts, and to a variety of other gasket properties that determine the service behavior of a joint assembly. Thus, being able to determine the degree of compression in a gasket under the bolt loading will permit one to make qualitative predictions of the behavior of a joint assembly when it comes in contact with the application or service environment. With the plug test, bending of a flange facing between bolt centers can be measured; however, in a few highly distortable flanges the maximum bending between bolt centers may not be detected.

4.2 The variation in gasket compressions at selected points in a flat-face joint assembly reveals the degree of flange distortion or the ability of the flange to distribute satisfactorily the compressive forces from bolt loads throughout the gasket.

5. Apparatus (see Fig. 1)

5.1 *Test Assembly,* any flat-face flange design.

5.2 *Torque Indicating Device,* for bolt loading.

5.3 *Dial Gage Indicator,* graduated in 0.00254 mm (0.0001 in.) to measure thickness of the solder plugs and the uncompressed gasket.

5.4 *Leather Punch,* for punching holes in the gasket and fabricating the solder plugs.

5.5 *Tweezers,* to conveniently handle the solder plugs.

5.6 *Solder Plugs*—The solder must be made into a flat strip. This can be done by compressing wire in a vise, a pair of flanges, pliers, or passing it between two calender rolls. The solder plugs are punched from the strip by means of the leather punch. Recommended plug diameter is 0.8 mm (1/32 in.) and the height need only be such that the plug is compressed by the flanges when the gasket is also compressed. The initial thickness of the plug and gasket before compression need not be equal.

6. Test Specimens

6.1 Three gasket specimens shall be tested. The size and shape of the specimens must be such as to fit the particular flange design.

[1] This practice is under the jurisdiction of ASTM Committee F03 on Gaskets and is the direct responsibility of Subcommittee F03.20 on Mechanical Test Methods.

Current edition approved April 1, 2023. Published April 2023. Originally approved in 1972. Last previous edition approved in 2016 as F145 – 72 (2016). DOI: 10.1520/F0145-72R23.

[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.

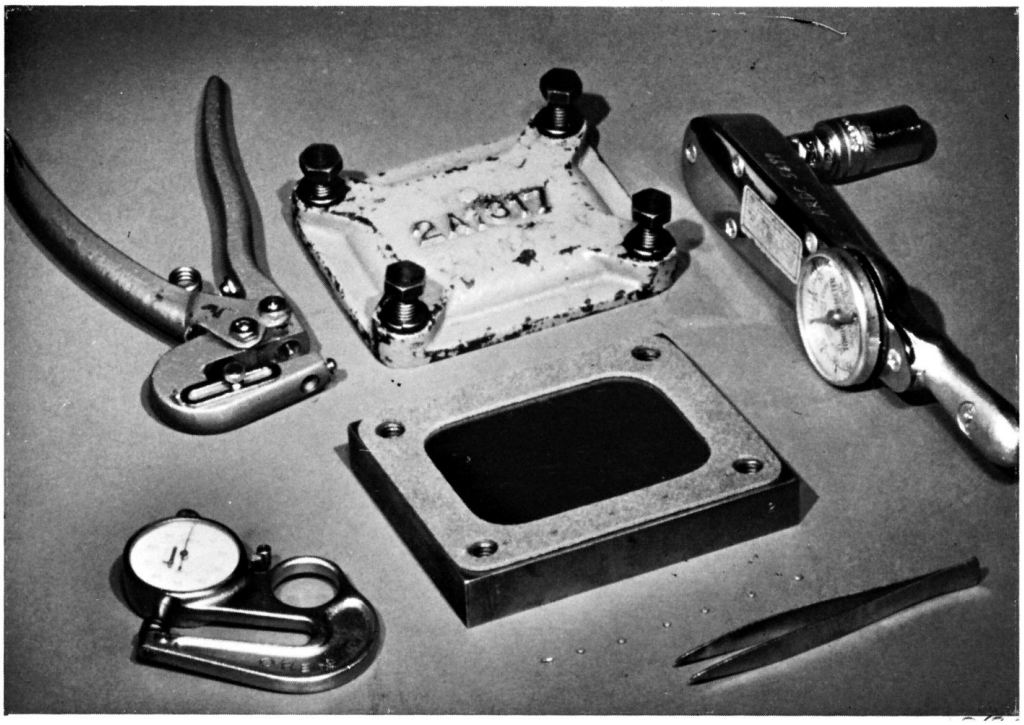

FIG. 1 Equipment for Performing the Solder-Plug Test of Gasket Compressions

7. Conditioning

7.1 When the test is performed on an assembly line or in a service environment, sufficient time should elapse for the flanges, bolts, and gasket to reach equilibrium with the ambient temperature and humidity conditions before assembly. (Heavy castings or forgings may require 8 to 24 h or more, contrasted to a brief period for light stampings.)

7.2 When the test is performed under controlled conditions in the laboratory the gasket specimen is conditioned in accordance with Specification E171, or in the humidity and temperature conditions used prior to obtaining the load-compression curve. Flange fasteners and washers are held at the test conditions for at least 4 h prior to assembly.

8. Procedure

8.1 Use the same flanges, fasteners, and washers as those specified for applications. Clean them with reagent-grade trichloroethylene or other suitable solvent. Use cleansing tissue to remove dirt, oil, or grease. After cleaning, give the mating screw threads a light coating of SAE 20 engine oil to minimize friction.

8.2 Measure the initial or uncompressed thickness of the gasket. Make holes, slightly larger than the solder plugs, in the gasket at the points where compressions are to be evaluated. Insert the plugs upright in the holes with the gasket resting on the lower flange facing. Then assemble the test assembly in the customary manner. Immediately disassemble the test assembly. Make compressed-thickness measurements on the solder plugs. These measurements are equal to the compressed thickness exhibited by the gasket when it was loaded in the test assembly.

9. Calculation and Interpretation of Results

9.1 Calculate the compression as a percentage of the original gasket thickness as follows:

$$C = \left[(t_o - t_c)/t_o \right] \times 100 \quad (1)$$

where:

C = percentage compression in the gasket,
t_o = initial uncompressed thickness of the gasket, and
t_c = compressed-gasket thickness as measured on a solder plug.

9.2 Fig. 2 illustrates a graph plotting compressed-thickness values of the solder plugs which are assumed to be equal to the compressed thickness of the gasket at the corresponding locations. These particular points for determining compression were selected to reveal the bending distortion in the flange facing between bolt centers. Bending is revealed by drawing a curve through the gasket compressed-thickness values which are represented by vertical dark bars. Percentage compression is indicated below each bar.

9.3 These percentage compressions were produced in the test flange by unequal flange pressures resulting from a specific bolt loading and bolt spacing. This approach to determining initial flange pressure is most adaptable to gasket materials whose load-compression characteristics are not dependent on shape factor.