



AMERICAN SOCIETY FOR TESTING AND MATERIALS

COMMITTEE F-3 ON GASKETS

Organized in 1962

CHAIRMAN: L. F. CRYSTAL, CATERPILLAR TRACTOR CO., EAST PEORIA, ILL. 611
VICE-CHAIRMAN: J. C. TOMAN, VICTOR-DANA CORP., 3750 W. ROOSEVELT BLVD., CHICAGO, ILL. 60650
VICE-CHAIRMAN: G. G. PECK, GENERAL MOTORS CORP., DETROIT DIESEL ENGINE DIV., 3400 W. OUTER DR., DETROIT, MICH. 48228
SECRETARY: J. A. LAANSMA, AC SPARK PLUG DIV., GENERAL MOTORS CORP., 1601 N. AVERILL AVE., FLINT, MICH. 48336
MEMBERSHIP SECRETARY: AGNES K. POTEPAK, GREENE, TWEED AND CO., ELM AVE., NORTH WALES, PA. 19434

Address reply to →

October 23, 1969

To: L. F. Crystal
R. F. Anderson
G. E. Becker, Jr.
J. A. Laansma
G. D'Olier
W. F. Hulse

From: J. C. Toman

SUBJECT: RECOMMENDED PRACTICE FOR EVALUATING
NONMETALLIC GASKET COMPRESSIONS
(Draft No. 1)

Enclosed you will find a copy of subject test method which was letter balloted in Subcommittee F-3.20 this summer.

Please review the proposed method for editorial changes and bring your comments to the meeting in Williamsburg for further discussion. Subcommittee F-3.20 hopes to have this method letter balloted in F-3 and advanced to ASTM for inclusion in the book of standards.

Best regards - see you at the meeting.

Yours truly,

John C. Toman, Chairman
Subcommittee F-3.10

pt

Enclosure

VPD-153-0002333

DANA-290

4/13/69

Recommended Practice For
Evaluating Nonmetallic Gasket Compressions
In Flat Face Casketed Joint Assemblies

WORKING DOCUMENT FOR ASTM COMMITTEE
USE ONLY, NOT FOR PUBLICATION EXCEPT
AS EXPRESSLY APPROVED BY THE CHAIRMAN
OF THE COMMITTEE OR THE EXECUTIVE
SECRETARY OF THE SOCIETY.

1. SCOPE

- 1.1 This method of test permits measurement of gasket compression resulting from the bolt preload on a flat face joint assembly at ambient temperature.

2. SUMMARY OF METHOD

- 2.1 The gasket compression is obtained from compressed thickness measurements on soft cylindrically shaped solder plugs inserted in holes drilled or punched through the gasket in the thickness direction. Compression is accomplished in the flanged joint assembly when the bolts are preloaded at ambient temperature. Solder, being inelastic, will remain at the compressed thickness of the gasket after the joint has been disassembled.

3. SIGNIFICANCE

- 3.1 Gasket compressions produced by bolt preloads in a flanged joint are important in the application engineering of a joint assembly. ^{It} They ^{is} are related to the ability of a gasket to seal, to maintain tightness on ^{flange} assembly bolts, and to a variety of other gasket properties which determine the service behavior of a joint assembly. Thus being able to determine the degree of compression in a gasket under the bolt preloading will permit one to make qualitative predictions on 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.

VPD-153-0002334

- 3.2 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 the bolt preloads uniformly over the gasket.

4. APPARATUS

- 4.1 Equipment for carrying out the test is shown in Figure 1. The test joint assembly can be almost any flat face flange design. Bolt preloading is accomplished by the hand torque wrench, or high speed automatic wrenches ~~may be employed~~. Thickness measurements on the solder plugs and the uncompressed gasket thickness are obtained using a dial gauge indicator graduated in .0001 in. The leather punch is for punching holes in the gasket as well as for fabricating the solder plugs. Tweezers make it possible to handle the solder plugs in a convenient manner. Not shown is a vise for holding the joint assembly and a round tapered file for enlarging the holes punched through the gasket.
- 4.2 The equipment for fabricating the solder plugs is shown in Figure 2. Solder is 50/50 tin lead wire wrapped on a spool. The wire must be made into a flat strip. This can be done by compressing the wire in a vise, a pair of flanges, pliers, or the wire may be passed between two calender rolls used for processing elastomers. The solder plugs are punched from the strip with the aid of the leather punch. Plug diameter is $1/32$ 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.

5. CONDITIONS

- 5.1 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.
- 5.2 When the test is performed under controlled conditions in the laboratory, the gasket specimen is conditioned in accordance with the procedure described in the classifications (Type 1, 2, or 3) in ASTM F104, Classification System for Nonmetallic Gasket Materials. Flange fasteners and washers are held at the test temperature (70 to 300°F) : at least 4 hours prior to assembly.

6. TEST SPECIMENS

- 6.1 Three gasket specimens are tested. They are die cut from the gasket material in sheet form. Size and shape of the specimens must be such as to fit the particular flange design.
- 6.2 Flanges, fasteners, and washers are the same as those specified for application. They should be cleaned with reagent grade trichloroethylene or other suitable solvent. Cleansing tissues may be used to remove dirt, oil or grease. After cleaning the mating screw threads should be given a light coating of SAE 20 engine oil.

7. PROCEDURE

- 7.1 The initial or uncompressed thickness of the gasket is measured. Holes are punched through the gasket at the points where compressions are to be evaluated, the holes being enlarged using a round tapered file so

VPD-153-0002336

that they are slightly larger than the diameter of a solder ^{plug} plug.

Plugs are inserted in the holes with the gasket resting on a flange facing. The test joint assembly is assembled, preloaded to some prescribed tightening torque, then disassembled immediately. Compressed thickness measurements are made on the solder plugs. These measurements are equal to the compressed thickness exhibited by the gasket when it was loaded in the joint assembly.

8. CALCULATION AND INTERPRETATION

8.1 Equation for calculating the compression as a percentage of the original gasket thickness is:

$$c = \frac{t_o - t_c}{t_o} \times 100$$

where:

c = percentage compression in the gasket,

t_o = initial uncompressed thickness of the gasket, in,

t_c = compressed gasket thickness as measured on a solder plug, in.

8.2 Figure 3, illustrates a graph for plotting compressed thickness values for the gasket. The particular points of 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 data which are represented by vertical dark bars. Percentage compression is indicated below each bar.

8.3 These percentage compressions were produced in the test flange by an initial flange pressure which can be obtained from a load compression or stress strain curve for the gasket material. This approach to determining initial flange pressure is most adaptable to gasket materials whose load compression characteristics are not dependent on shape factor.

8.4 The plug test will indicate not only the distribution of gasket compressions but also the distribution of initial flange pressures in joint assemblies exhibiting flange distortion.

9. REPORT

9.1 The report should indicate the following:

- 9.1.1 Uncompressed gasket thickness,
- 9.1.2 Compressed gasket thickness,
- 9.1.3 Percentage compression in the gasket,
- 9.1.4 Conditions of test, temperature, relative humidity,
- 9.1.5 Photograph of a disassembled view of the joint assembly,
- 9.1.6 Gasket identification,
- 9.1.7 Method of bolt loading
- 9.1.8 Bolt torque,
- 9.1.9 Bolt size, material and thread condition,
- 9.1.10 Top view of gasket showing solder plug locations,
- 9.1.11 Data plot similar to Figure 3,
- 9.1.12 Flange: material, thickness, width, and bolt spacing,
- 9.1.13 Conditioning of gasket before test,
- 9.1.14 Tightening sequence on bolts.

VPD-153-0002338