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DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
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Letter
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LC 264

SPECIFICATIONS FOR PROVING RINGS FOR CALIBRATING TESTING MACHINES

May 13, 1929

I. WORKMANSHIP.

1. The parts of the ring shall fit accurately, shall be smooth and shall have a workmanlike finish.

2. Scales shall be uniformly graduated. The smallest division of any scale shall be not less than 0.05 and not more than 0.1 inch. The width of the lines dividing a scale shall be not over one-tenth the distance between them.

II. CALIBRATION OF PROVING RING.

1. The "reading" is the value for a given load indicated on the scale of the deformation measuring apparatus of the proving ring.

2. The "deflection" for a given load is the difference between the reading when that load is applied to the ring and the reading under no load.

3. The "calibration constant" for a given load is the value which multiplied by the deflection of the ring in divisions of the dial equals the load. The calibration constant is given either in pounds or kilograms per division of the dial, or in both.

4. The deflection of the ring when loaded to capacity shall be not less than 0.040 in.

5. After repeated applications of a load 10 per cent greater than the capacity of the ring, the no-load reading observed after each load is removed shall change not more than 1/10 of one per cent of the deflection when loaded to capacity.

6. The observed deflection of the ring, for a load not less than one-tenth nor more than two-tenths capacity, shall not differ from the average of a number of successive observations for that load by more than one-half of one per cent of the deflection for the applied load.

7. The observed deflection of the ring, for any load not less than two-tenths nor exceeding the capacity, shall not differ from the average of a number of successive observations for that load by more than one-tenth of one per cent of the deflection for the capacity load.

8. The deflection of the ring when loaded to capacity, observed before and after the deflection measuring apparatus is removed and then replaced in the ring, shall not change more than the maximums specified in paragraphs II-6 and II-7 of this specification.

9. The calibration constant of a compression ring when loaded to capacity on convex and then on concave spherical bearing blocks having a radius of curvature of 10 feet, shall not change more than the maximums specified in paragraphs II-6 and II-7 of this specification. The Brinell number of these spherical bearing blocks shall be between 400 and 500.

10. Proving rings shall be calibrated up to 100,000 lb. by applying dead weights. The error in these dead weights shall not exceed 0.01 per cent.

III. MARKING.

1. Each proving ring shall be legibly marked with the maker's name and the serial number of the proving ring.

LC 264 INSTRUCTIONS FOR USE OF PROVING RING FOR CALIBRATION OF TESTING MACHINES May 13, 1929

I. INSPECTION OF RING BEFORE TEST.

1. Inspect the surfaces of the ring and of its adapters which are subjected to compression during the test, and wipe off dirt.

2. See that the vibrator is not bent or noticeably off center. If it is bent, straighten it so that it is exactly above the micrometer screw.

II. PREPARATION OF RING FOR TEST.

1. Rotate the dial so that the rounded end of the micrometer screw is a few hundredths of an inch (depending upon the load which is to be applied) below the vibrator.

2. If the temperature of the room in which the ring is to be used differs appreciably from the temperature of the ring itself, leave the ring in the testing machine for about one-half hour before using it.

III. LOADING PROCEDURE.

1. As testing machines are ordinarily used to measure increasing loads, proving rings are calibrated for increasing loads (See note in paragraph III-5 of these instructions).

2. Before using a proving ring apply a load equal to the capacit of the ring and remove it. This is very important if the ring is used for both tensile and compressive loads. A preloading of the ring to its full capacity is also recommended for rings to be used only in one direction.

3. Apply the lowest calibration load to the ring, read the ring and the load indicated by the testing machine. Remove the load and obtain the zero load reading of the ring. From these two readings of the ring compute the deflection of the ring and the load indicated by the ring (See paragraphs V-5 and VI-1 of these instructions).

4. For successively higher loads follow the same procedure, by applying the load, reading both ring and testing machine, then removing the load and obtaining the zero load reading of the ring. This procedure decreases the errors caused by variations in

temperature during the calibration. If desired, the loads may be applied in any sequence but the zero load reading of the ring should be obtained after each load is removed.

5. To determine the error of the testing machine, follow the standard methods of Verification of Testing Machines, E4-27, p. 793, American Society for Testing Materials, Standards 1927, Part I - Metals. Note: Proving rings, like all elastic bodies, do not have identical calibration constants for increasing and decreasing loads. If they are to be used under decreasing loads, they will be calibrated under decreasing loads on request (Refer to paragraph 2, page 794, E4-27).

IV. APPLICATION OF LOAD.

A. Compression.

1. Put the ring on a flat, smooth hardened steel plate on the table of the testing machine.

2. Put a piece of soft steel on the upper rounded boss (or on the upper compression block) and apply load. The radius of the spherical surface of the upper boss is equal to the height of ring and therefore the resultant force passes through the center of the base. Do not disturb this piece when the load is removed. If it is disturbed accidentally, shift the piece of steel so that the boss is in contact with another spot.

3. When used in a horizontal testing machine, care must be taken to avoid loading the ring eccentrically due to the flat surface of the base not bearing uniformly on the steel plate. Apply a small load and rotate the ring. Continue to rotate the ring while slowly increasing the load.

4. For small rings to which load is transmitted through a ball, apply a small load and rotate the ring to insure central application of the load.

B. Tension.

1. See that the pulling bars and the ring are in alignment with the axis of the testing machine.

2. Apply a small load and rotate the ring to insure central application of load.

V. READING THE DIAL.

1. Rotate the dial until the rounded end of the micrometer screw is almost in contact with the vibrator.

2. To set the vibrator in motion use a pencil or stick to move the weight (not over 1/2 inch) at the end of the vibrator to one side then release it.

3. While it is vibrating rotate the dial slowly until the vibrator comes in contact with the micrometer screw. Contact is indicated by a buzzing sound.

4. The buzzing sound should continue from 3 to 5 seconds. If the dial is turned too far, the sound will die out in less than 2 seconds. If the dial is not turned far enough, the sound will not be distinct. It is desirable to obtain for each reading a sound of about the same intensity.

5. Read the dial to the nearest 0.1 of a division. The difference of the two readings, with and without load, is the deflection of the ring measured in divisions of the dial.

VI. COMPUTATION OF THE LOAD.

1. To determine the load, multiply the deflection of the ring by the corresponding calibration constant taken from the calibration certificate (or report).

2. The calibration constants diminish slightly with an increase of temperature and vice versa. The calibration constants may be corrected for temperature by the method given in the certificate (or report).

VII. SUGGESTIONS.

1. Do not remove parts of the ring nor adjust them unless necessary. If it is necessary to remove the micrometer screw or the vibrator, replace them in the ring in their original position. See that all the bearing surfaces are perfectly clean.

2. Avoid holding the ring or touching the vibrator except to deflect it. A change in the length of the vibrator caused by a change of temperature may cause an appreciable error.

3. If the micrometer is not lowered sufficiently before the load is applied, the vibrator may be bent. This will cause considerable change of the zero load reading. The difference of two readings, with and without load, would however, be the same unless the vibrator happens to be off center. The deformation of the vibrator will usually disappear in a short time. If the vibrator is bent, the ring should not be used for at least half an hour. During this period the vibrator will in most cases recover its original length. If this precaution is taken, the error which would be caused by a change in the length of the vibrator during the test, will be avoided.