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SPECIFICATIONS FOR PROVING RINGS FOR CALIBRATING TESTING MACHINES

Superseding
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I. DEFINITIONS

1. PROVING RING

A proving ring is an elastic ring suitable for calibrating a testing machine. The deflection of the ring when loaded along a diameter is measured by means of a micrometer screw and a vibrating reed mounted diametrically in the ring.

2. READING

A reading is the value indicated by the micrometer dial when it has been adjusted to contact (see Paragraph V-3) with the vibrating reed.

3. DEFLECTION

The deflection of the ring for any load is equal to the difference between the reading for that load and the reading for zero load.

4. CALIBRATION CONSTANT

The calibration constant for a given deflection is the ratio of the corresponding load to the deflection.

II. REQUIREMENTS

1. WORKMANSHIP

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

b. The dial of the micrometer shall be uniformly graduated. The smallest division shall be not less than 0.05 and not more than 0.10 inch. The width of the graduation lines shall not exceed one-tenth of the distance between them. The width of the index line or lines shall not exceed the width of the graduation lines on the dial of the micrometer. The distance, measured

around the circumference of the dial, from any graduation line to any other graduation line on the dial shall not deviate from its correct value more than 1/20 of the smallest division of the dial.

2. MARKING

The maker's name, the capacity load, and the serial number of the ring shall be legibly marked upon some part of the instrument.

3. STIFFNESS

When under its capacity load the ring shall deflect not less than 0.040 inch.

4. OVERLOAD

The ring shall be overloaded repeatedly to a load of 10 per cent more than its capacity load. The difference between the zero load reading after the first overload and the zero load reading after any subsequent overload shall not exceed one-tenth of one per cent of the deflection of the ring under capacity load.

5. CONSTANCY

a. Range 1/10 to 2/10 Capacity Load. - The observed deflection of the ring, for an applied load of not less than one-tenth nor more than two-tenths of the capacity load, shall not differ from the average of a number of successive observations for the same applied load by more than one-half of one per cent of the deflection for the applied load.

b. Range 2/10 to Capacity Load. - The observed deflection of the ring, for any applied load not less than two-tenths nor exceeding the capacity load, shall not differ from the average of a number of successive observations for the same applied load by more than one-tenth of one per cent of the deflection for the capacity load.

c. Disassembling. - The difference between the deflections of the ring, observed before and after the deflection measuring apparatus is removed and then replaced, shall not be greater than the maxima specified in paragraphs II-5-a and II-5-b of this specification, under the loads there specified.

d. Bearing Blocks. - The deflection of a compression ring under the minimum load and under the maximum load used in the calibration, when applied by concave and then convex spherical bearing blocks, Brinell number between 400 and 600, radius of curvature 10 ft., shall not change more than 1/2 of one per cent of the observed deflection for the minimum load and 1/10 of one per cent of the observed deflection for the maximum load used in the calibration.

6. METHOD OF CALIBRATION

a. Loads not Exceeding 100,000 lb. - For loads not exceeding 100,000 lb. proving rings shall be calibrated by applying dead weights known to within 0.02 per cent.

b. Loads Exceeding 100,000 lb. - For loads exceeding 100,000 lb. the applied load shall be known to within 0.1 per cent.

INSTRUCTIONS FOR USE OF PROVING RING FOR CALIBRATION OF TESTING MACHINES

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.

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 for a calibration preload it by applying and removing the greatest load which is to be used in the calibration. This preloading is especially important if the ring is used for both tensile and compressive loads.

3. Apply the lowest calibration load to the ring and observe the reading of the ring and the load indicated by the testing machine. Remove the load and observe the zero load reading of the ring. From the two readings of the ring compute the deflection 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, observing both the reading of the ring and the reading of the testing machine, then removing the load and observing 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 other sequence but the zero load reading of the ring should be observed after each load is removed.

5. To determine the error of the testing machine, follow the Standard Methods of Verification of Testing Machines, E 4-27, 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. They will be calibrated under increasing loads unless it is specifically requested that they be calibrated under decreasing loads. If both are desired, they will be considered as two separate calibrations.

IV. APPLICATION OF LOAD

COMPRESSION

1. Put the ring on a flat, smooth hardened steel plate, Brinell hardness greater than 250, on the table of the testing machine. CAST IRON BEARING BLOCKS SHOULD NOT BE USED; THEY ARE DANGEROUS.

2. Put a piece of soft steel, Brinell hardness less than 200, on the upper rounded boss (or on the upper compression block) and apply the load. 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 insure that the flat surface of the boss bears uniformly on the steel plate, thus avoiding eccentric loading of the ring. Apply a small load and rotate the ring by hand. Continue to rotate the ring while slowly increasing the load until the friction is too great to allow further rotation by hand.

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.

TENSION

5. When using a tension ring, see that the pulling bars and the ring are in alignment with the axis of the testing machine.

6. 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 reed.

2. Set the reed in motion with a pencil or a stick by moving the end of the reed about half an inch to one side and then releasing it.

3. While the reed is vibrating, rotate the dial slowly until the rounded end of the micrometer screw comes in contact with the reed. 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 3 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 or if possible 0.05 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 indicated by the ring, multiply the deflection of the ring by the corresponding calibration constant obtained 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 or adjust them unless necessary. It is recommended that a ring be calibrated after the deflection measuring apparatus has been removed and replaced.

2. Avoid holding the ring and do not touch the reed except to deflect it. A change in the length of the reed 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 reed may be bent. This will cause a considerable change of the zero load reading. A bent reed will usually straighten in a short time, probably about half an hour. During this period the ring should not be used. 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.