

**NON-METALLIC INCLUSION COUNT - THROUGH HARDENED ROLLER
AND BALL BEARING STEELS**

Application

This method is applied to through hardened steels used in the manufacture of roller and ball bearings in order to evaluate the purity grade of the steel. A non-metallic inclusion rating number will be obtained which can be compared with requirements specified for the steel.

Apparatus Required

Cutting, Grinding and Polishing Equipment

For micro-specimens.

Microscope

With a magnification of X100.

Hydrochloric Acid

50 %, hot

Inclusion Classification Chart (based on Kugelfischer Co., chart)

See Appendix A. Full charts available from P.D.G. Material Laboratory.

Conditioning and Test Conditions

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 +/- 2 °C and 50 +/- 5 % relative humidity for not less than 24 h prior to testing and tested under the same conditions unless otherwise specified.

Sampling and Preparation of Samples

1. At least 5 different items shall be sampled from any one consignment. If the rating number obtained from the test is so close to the maximum requirement specified to give a doubt regarding rejection of the consignment a further 5 items must be examined in order to confirm or deny the rejection.

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2000 08 30	Revised	Editorial – no technical change A. Cockman
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2. The parts to be tested shall be cut in the hardened condition and in the exact plane of the rolling direction.

For inner and outer rings and rollers the longitudinal axis of the part can be seen to be the rolling direction but for the balls the poles will need to be revealed by a minimum etching time in hot hydrochloric acid (50 %) and the balls cut in the plane of the poles.

3. The items to be examined shall be cut in the longitudinal direction and the whole cut surface shall be prepared and examined.
4. The grinding and polishing must be carefully carried out to obtain a high quality surface preparation with the inclusions retained intact. Light etching and repolishing is allowable in the final stages of preparation but the surface must be evaluated in the unetched condition.

Procedure

1. The complete surface area of each section is examined under a microscope at X100 magnification and a field of view of 75 +/- 5 mm. Each field of view shall be examined and the worst of each type of inclusion, as shown on classification chart, shall be recorded (see Appendix A).
2. For vacuum melted steels inclusions corresponding to Rating Numbers 1/4 to 6 must be noted.
3. For non-vacuum melted steels only the Rating Numbers from 3 to 6 should be used unless the steel has a large number of the very small inclusions.
4. The total number for each size of each type of inclusion in all the prepared surfaces of all the items is then added together to give the totals.

Evaluation

The total surface area examined is also calculated and this is related to the standard unit surface area of 300 mm². Thus the number of each size of each type of inclusion is calculated per unit area of 300 mm².

These numbers are then multiplied by the relevant severity factors given in Table 1 and the numbers obtained totaled for all types and sizes of inclusions to give the "Inclusion Count Number" (see Appendix B).

Chemicals, materials, parts, and equipment referenced in this document must be used and handled properly. Each party is responsible for determining proper use and handling in its facilities.