How to Use the Hardnester

Essential Information

1. PREFACE

This document provides essential information to note when using the Hardnester to measure the hardness of a test specimen. Please read it carefully to ensure correct and effective use of the Hardnester.

2. HOW TO MAKE CONTACT BETWEEN A TOUCH MEASURE AND A SPECIMEN

When a touch measure, which consists of a large number of blades, is applied with force against a test specimen, the force is distributed over the ends of the blades that touch the specimen's surface. Therefore, contact pressure increases when fewer blades make contact with the surface. For this reason, to test a curved surface, the side face of the touch measure should be used as shown in Fig.1-(A), whereas the tip of the a touch measure should be used as in Fig.1-(B) to test a plane surface.

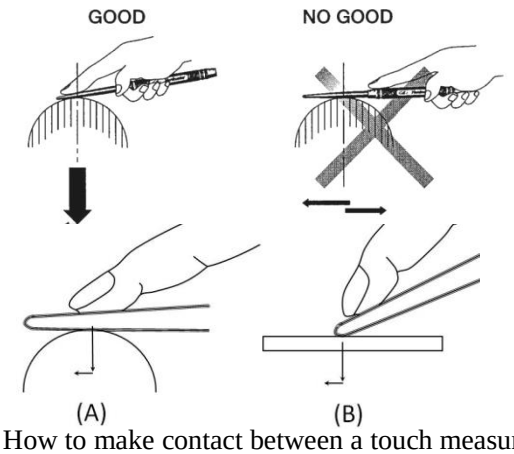

Fig.1 How to make contact between a touch measure and a specimen

3. HOW TO PRESS THE TOUCH MEASURE AGAINST A SPECIMEN

A force of about 5 kgf is required when pressing the touch measure against a test specimen. Apply the force by putting your forefinger at the point closest to the point of contact with the specimen and pressing it firmly against the specimen. As shown by the arrows in Fig.1-(A) and (B), first apply the force vertically, then push the touch measure slightly forward while continuing to apply pressure.

Provided the touch measure is softer than the test specimen, it will only slip and not penetrate the specimen. However, if the touch measure is harder than the specimen, no matter how little, it will penetrate the specimen.

4. DO NOT USE THE TOUCH MEASURE AS IF YOU WERE USING A FILE

You must not use the touch measure in a way that scratches the specimen as if it were being filed away. That not only decreases the accuracy of the hardness measurement, but also shortens the life of the touch measure. (See Fig.1)

5. SURFACE ROUGHNESS OF SPECIMEN

The surface of a test specimen should have as smooth a finish as possible to ensure measuring accuracy, which deteriorates when the surface roughness falls below 12S (JIS standard). The test specimen should have the surface roughness depicted by

a finishing mark of ▽▽▽ or smoother. If the specimen's surface has some directional and relatively large marks caused by a grinder or a file, the result when pressing the touch measure against the specimen will differ according to whether it is pressed in the vertical or horizontal direction to those marks. When applied vertically, it is less likely to slip on the surface, whereas it will slip more readily when applied horizontally. This difference could cause a measurement error. For the same reason, the utmost attention must be paid to the contact angle of the blades when the touch measure is used at a sharp corner.

6. ABRASION AND DEFORMATION OF TOUCH MEASURE BLADES

Repeated use of the touch measure will naturally cause abrasion and deformation of its blades, which will eventually result in erroneous measurements. To prevent this, it is recommended to avoid using blades that have already been used several times and to change the part of the touch measure pressed against a test specimen. At the same time, it is also recommended to regularly check the blades of the touch measure using standardized hardness test blocks or equivalent.

7. MEASURING HARDNESS WITH A HARDNESTER

(1) According to the results of our experiments shown in Fig.2, the difference in hardness between the Hardnester and test specimen when the touch measure does not slip and clearly penetrates (scratches) the specimen is around +50 or more in Vickers hardness. The difference in hardness when the touch measure clearly slips on the specimen and does not leave any scratches is around +25 or less. At between +50 and +25, the touch measure digs into the specimen only slightly, leaving fine scratches, but is possible to slide on the specimen. (Judgment becomes more difficult if the specimen has a rough surface).

Assuming that the range within which the touch measure does not penetrate the specimen is referred to as α, and the range within which the touch measure penetrates the specimen is referred to asγ, the transition from α to γis discontinuous. It is not a linear relationship with hardness difference passing through the point 0. This transitional period reveals the existence of the critical hardness when judging hardness using the Hardnester, which makes Hardnester-based hardness judgments significant and convenient.

The relationship shown in Fig.2 can be translated into the hardness relationship between the Hardnester (touch measures) and specimens as shown in Fig.3.

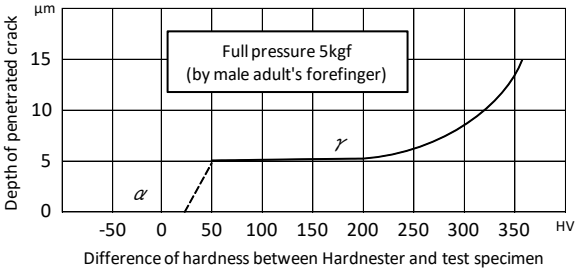

Fig.2 The difference in hardness between the Hardnester and test specimen

(2) To measure the hardness of a specimen using the Hardnester, select several touch measures that have a hardness approaching the hardness of the test specimen, and try pressing the touch measures, starting from one of the highest hardness, against the specimen to determine the minimum hardness of the touch measure that can penetrate the specimen (γ), which can be judged to be the hardness of the specimen. It is recommended to continue pressing lower-hardness touch measures to determine the maxi-

mum hardness of the touch measure that cannot penetrate the specimen at all (α), and reflect both results when judging the hardness of the specimen. The judgment chart in Fig.3 can be used conveniently for measuring the hardness of a specimen with the Hardnester. The boundary zone is the range within which the touch measure can scratch but might slip on the specimen. The solid line of the boundary zone adjacent to the penetrated area can be drawn with clarity, whereas the dotted line of the boundary zone adjacent to the slipped area is less clear.

(3) To determine the final value of hardness, various error factors concerning hardness measurements using the Hardnester, including the difference from the nominal hardness indicated on the touch measure itself and operator errors, must be taken into account. However, these errors can be controlled within about ±25 HV in total, if the hardness test is done strictly in accordance with the instructions above on using the Hardnester. To ensure the highest accuracy of hardness measurements using the Hardnester, it is also recommended to check the response of the Hardnester using standardized hardness test blocks or specimens of a known hardness.

(4) Given that the depth of scratches made with the

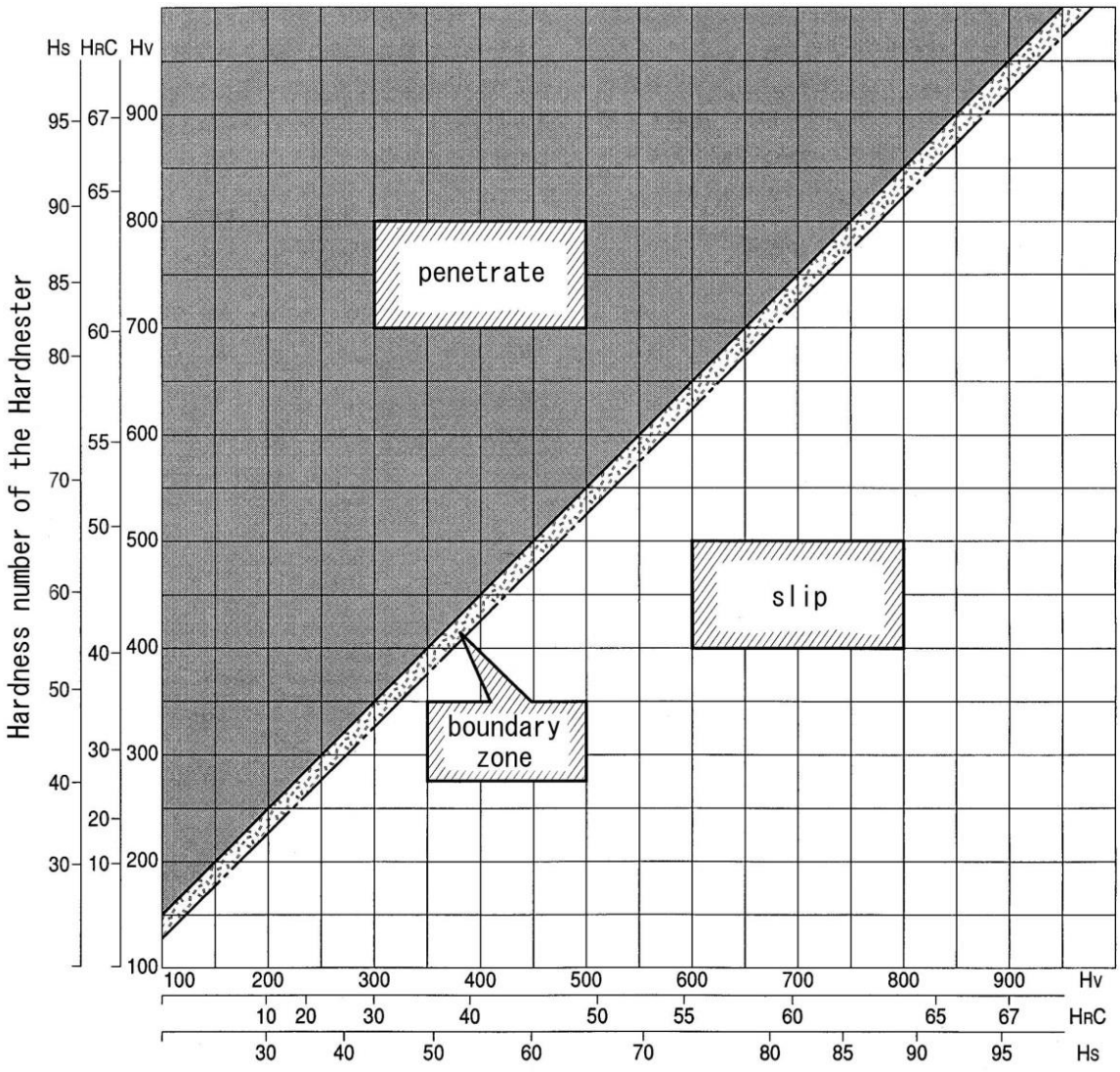

Fig.3 The hardness relationship between the Hardnester and specimens

Hardnester is several micrometers, the hardness measured with the Hardnester is the hardness of a specimen's surface-layer. In terms of the depth of penetrations measured, the Hardnester method can be categorized as a micro-hardness testing method. Therefore, users of the Hardnester must remind themselves that the Hardnester measures the surface hardness of a specimen, especially when the specimen has a surface layer that has been softened or hardened by decarburization, carburization, cutting, or polishing. Meanwhile, this feature of the Hardnester, which is not available with other penetration hardness tests, can be a great advantage, depending on its purpose.

8. OTHER INSTRUCTIONS

It should be noted that the relation above between the Hardnester and a test specimen relates to plain carbon steel and low-alloy steel. When used to measure the hardness of steel containing a higher ratio of alloy ingredients, the Hardnester may produce different results. Therefore, it is recommended to previously check the test results of the Hardnester by testing specimens of a known hardness.

When testing the hardness of surface-hardened parts that are particularly wear resistant, such as those coated with hard alumite and hard chromium, the Hardnester method can be said to be far more practical than other indentation hardness tests, even from the perspective of its measuring principle.

9. SUMMARY

In this document, we discuss some important matters to note when using the Hardnester. The Hardnester is a useful tool for obtaining rough, but effective hardness measurements conveniently. For ease of measurement and availability for measuring the hardness of an unlimited range of specimens, the Hardnester can be very useful at production sites. It is our hope that the Hardnester will display its full potential, based on a good understanding of its characteristics and by using it properly.