

Quality Assurance Procedure  
QAP 5960

Method of Test For

**Superficial Hardness of Metallic Materials Using a  
Portable Hardness Testing Device**

**SCOPE**

1.1 This method measures the hardness of carbon steels units with Brinell values  $\geq$  HRB 100 (steel used for bridges) using static indentation testing. The test method uses or equates to the Rockwell (diamond) C scale. Values are expressed X RHCN, where S is the test number on the C scale using N a superficial Rockwell hardness testing apparatus.

1.2 The testing temperature of the material shall be between 50 and 95 degrees F.

1.3 This procedure is limited to a test specimen with HRC (hardness Rockwell C scale) readings between 20 and 67.

1.4 This procedure shall only apply to a test specimen greater than 0.020 inches thick.

1.5 This procedure shall apply only to test specimen whose test surface is flat to 0.001" in four inches, and sufficient area exists to preclude rocking of the test apparatus.

**PERSONNEL**

2.1 Personnel performing this test for the purpose of determining contract conformance shall be qualified per the Written Practice of SNT-TC-1A ASNT Qualification and Certification Program for Nondestructive Testing Personnel.

**REFERENCE**

3.1 American Society for Metals Handbook current edition.

3.3 American Society for Testing and Materials E18, E110.

**APPARATUS**

**NOTE:** Initial qualitative evaluations may be made using the PTC pencil-type indenter.

4.1 Verification of unacceptable hardness values (8.1) shall be conducted using a portable hardness testing apparatus which reads the difference between the minor and major load. The equipment shall meet the criteria specified in ASTM E110.

4.2 Standard Test Blocks shall meet the criteria of ASTM E18, Part D.

4.3 Grinder with discs capable of producing a 400 microinch surface finish .

4.4 Nitric acid etchant

4.5 Angle comparator

4.6 IOOx and 500x magnifiers

0.001 inch feeler gage

4.8 4 inch straightedge; within 0.0005 inch.

## **CALIBRATION**

5.1 Calibrate prior to testing on a daily basis, or when and if the unit is dropped or reason exists to question its accuracy.

5.2 The Diamond Sphero-conical Penetrator shall be calibrated once each month or prior to each test, whichever time period is longer.

5.3 This entails inspection with IOOx magnification to assure the diamond is not chipped.

The comparator shall be used to assure the included 120 degree angle does not deviate  $\pm 30$  degrees.

The contour of the tip of the cone shall have a nominal radius of 0.002 mm.

The tolerance of the tip shall meet the tolerance band shown in ASTM E18, figure 5.

5.4 Take five readings on the standard. The standard must be secured to preclude slippage during indentation. Report the hardness values within 1.0 unit for the equipment described in 4.0; Report the hardness values within 0.2 unit for the equipment described in 4.1.

Indentations shall be taken at least three indent diameters from an edge or another indentation.

Let the five readings = R1, R2, ...R5 in creasing order of magnitude.

Repeatability = R5-R1

R5-R1 shall be within 1RHCN

Error of the apparatus = Rmean-R; where: Rmean = R1 + R5/5; This value shall be within 1RHCN

## TEST SPECIMEN PREPARATION

6.1 Machined and oxycut surfaces shall meet the following criteria:

Apparatus meeting 4.0, 250 microinch; and 4.1.,  
60 microinch

6.2 Surfaces not meeting this tolerance shall be ground the minimum amount to achieve this condition (Care shall be taken not affect the test material due to high heat input). In addition, for the 4.1 apparatus, the test surface shall be free from all oxide scale, oils, and foreign matter.

6.3 The test surface shall be parallel and flat to within 0.001" in 4 linear inches. Questionable subject areas shall be checked with the straightedge and 0.001 inch feeler gauge. The test specimen shall be rigid and free from vibration. For apparatus meeting section 4.1, the test surface shall have sufficient area to preclude the apparatus from rocking.

## TEST PROCEDURE (4.1 Apparatus)

7.1 Apply the apparatus to the test surface and apply even and consistent pressure (above the preload). The dwell time for the initial preload shall not exceed 3 seconds. This shall be done without shock or vibration. Slippage during application of pressure negates the test.

7.2 Continue to increase the pressure for 1 to 8 seconds.

7.3 While maintaining the preload force, remove the additional pressure (in 7.2) within 5 to 6 seconds.

7.4 Acquire five readings in the test area.

## ACCEPTANCE

8.1 The mean value of the five readings shall be  $\leq 30\text{RH}\text{CN}$ .

## MATERIAL CORRECTION

9.1 Surface material exhibiting hardness values higher than the acceptance value shall be removed and retested.

## RECORDS

10.1 Calibrations specified in 5.1-5.4 shall be reported.

10.2 All readings and the mean values for each set of values shall be recorded.

10.3 The test operator, date, project, structure/piece number shall be recorded.