

## HR-1 PRECISION PORTABLE HARDNESS TESTER



**BMS Bulut Makina Sanayi ve Ticaret Ltd. Şti.**

Kocaeli KOBİ OSB Köseler Mahallesi

6. Cadde No: 20/2 Dilovası / KOCAELİ / TURKEY

Phone: +90 262 502 97 73-76 / +90 262 503 06 51

Web: [www.bulutmak.com](http://www.bulutmak.com) e-mail: [bms@bulutmak.com](mailto:bms@bulutmak.com)

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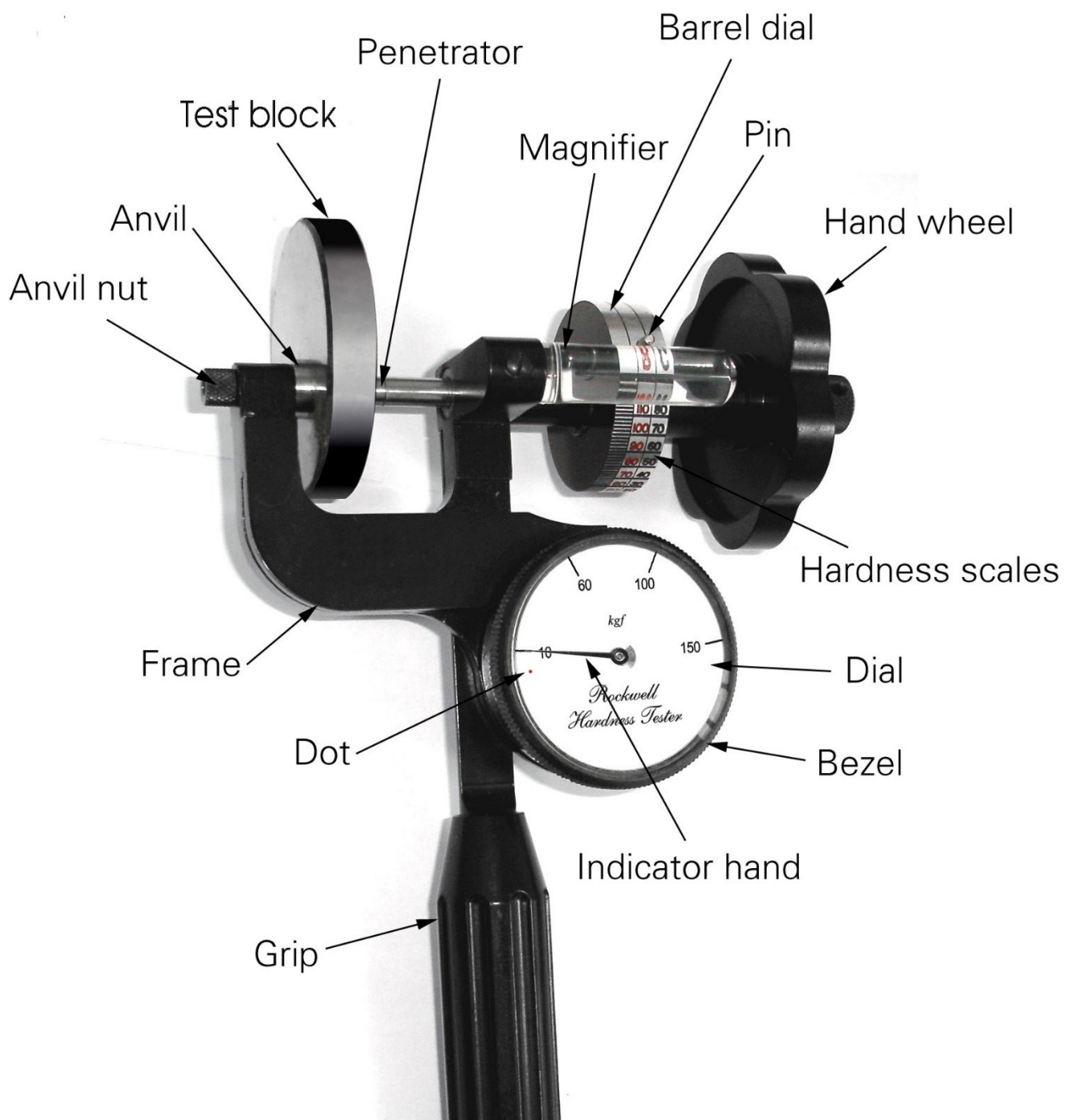
The HR-1 Precision Hardness Tester is a hand-held, manually-operated instrument used to perform superficial or standard Rockwell Hardness Tests in the field or laboratory.

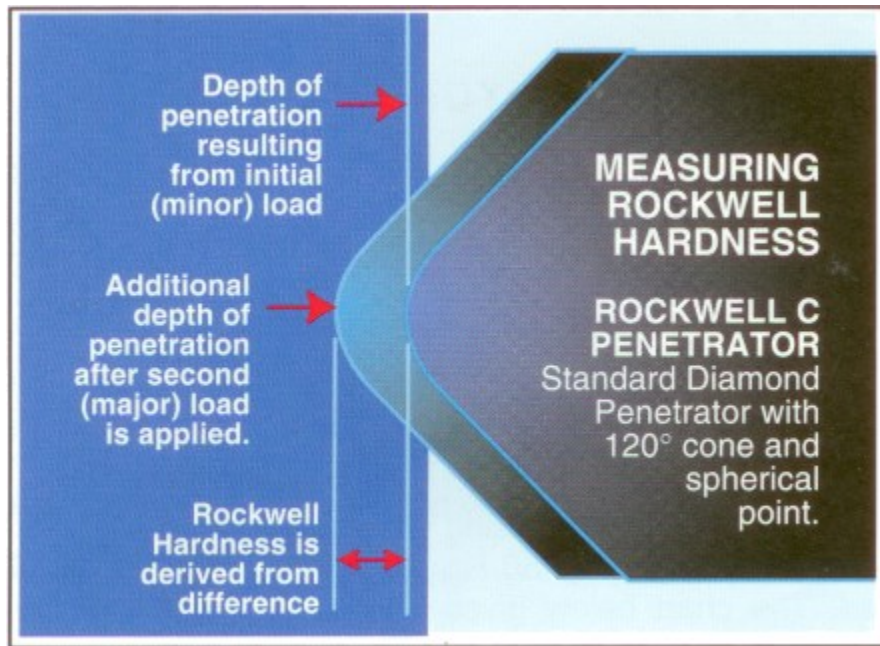
## 1 Features

- Accurate—providing true Rockwell tests with accuracy to  $\pm 1.5$  point
- Reliable—provide up to 20years' service when properly maintained and calibrated
- Versatile—a variety of models to cover varying needs-plus reversible anvil/penetrator orientation to allow internal surface testing

## 2 Maintaining your HR-1Hardness Tester

All HR-1 testers are factory lubricated. Do not attempt additional lubrication. Keep the tester dry and free from oil. Store in the case provided. When necessary, wipe with a commercial cleaner.





### 3 Hardness Testing - Rockwell Scales

Rockwell Hardness testing is a system for determining the hardness of metals and alloys of all kinds. The American Society for Testing and Materials (ASTM) has established a standard recognized worldwide to help manufacturers maintain the qualities they want in their products.

ASTM Standard E-110 defines the test method and parameters for a valid test using a portable frame type testing apparatus. Following is a general description of the method.

A spheroconical diamond penetrator or a hard steel ball penetrator is forced into the surface being tested at a predetermined pressure load. The hardness is read as a function of the depth of penetration.

To overcome errors in measurement, two pressure loads are applied in sequence. The first, a minor load, is applied and the instrument is “zeroed” with the part being tested still under load. Then the major load is applied.

The penetrator is withdrawn back to the zero point to read the distance. The hardness reading represents the additional depth of penetration beyond the minor load.

Tester accuracy is checked by running the test on specimens whose hardness has been certified by an independent testing laboratory.

All HR-1 hardness testers perform genuine Rockwell Hardness tests and read directly in the Rockwell scale. Their accuracy meets or exceeds ASTM Standard E-110. Each tester comes complete with test specimens to assure continued accuracy.

### 4 Using HR-1 Hardness Testers

#### 4.1 *Select the Penetrator and Test Block*

Soft materials are usually tested in the Rockwell B Scale, using 1/16" ball penetrator and 100 kg Major Load. Hardened steel and hard alloys are tested in the Rockwell C Scale, using a diamond penetrator and a 150 kg Major Load. The chart below gives some basic guidelines for scales and penetrators.

Do not use the ball penetrator with the hard steel test block or when testing hard steel. Such a procedure will damage the penetrator and result in invalid tests.

#### 4.2 *Set Up the Tester*

Secure the appropriate penetrator and anvil in the tester. (Refer to chart below or additional chart provided with this manual.)

**Some of the most frequently  
Used scales available on HR Hardness Tester Models**

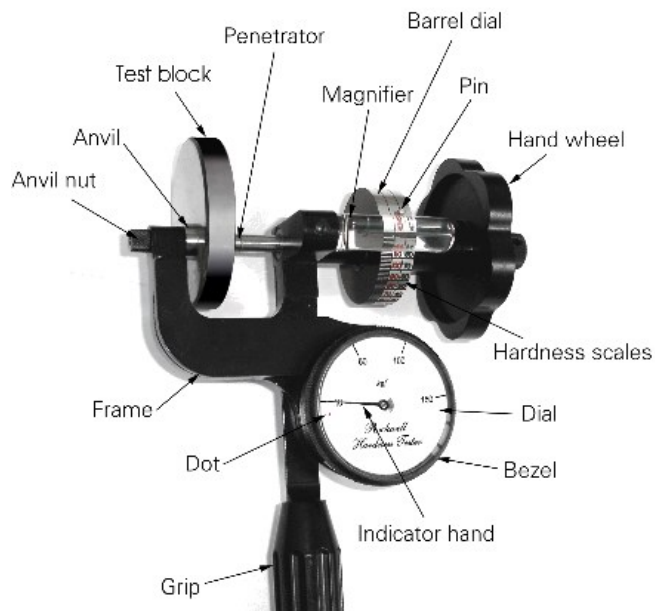
See chart provided for other scales

Scale Minor Load Major Load Penetrator

|   |       |        |           |
|---|-------|--------|-----------|
| A | 10kg  | 60kg   | Diamond   |
| B | 10 kg | 100 kg | 1/16"Ball |
| C | 10 kg | 150 kg | Diamond   |
| E | 10 kg | 100 kg | 1/8"Ball  |

Superficial Models:

|      |     |       |           |
|------|-----|-------|-----------|
| 15-N | 3kg | 15 kg | Diamond   |
| 30-N | 3kg | 30 kg | Diamond   |
| 45-N | 3kg | 45 kg | Diamond   |
| 15-T | 3kg | 15 kg | 1/16"Ball |
| 30-T | 3kg | 30 kg | 1/16"Ball |
| 45-T | 3kg | 45 kg | 1/16"Ball |



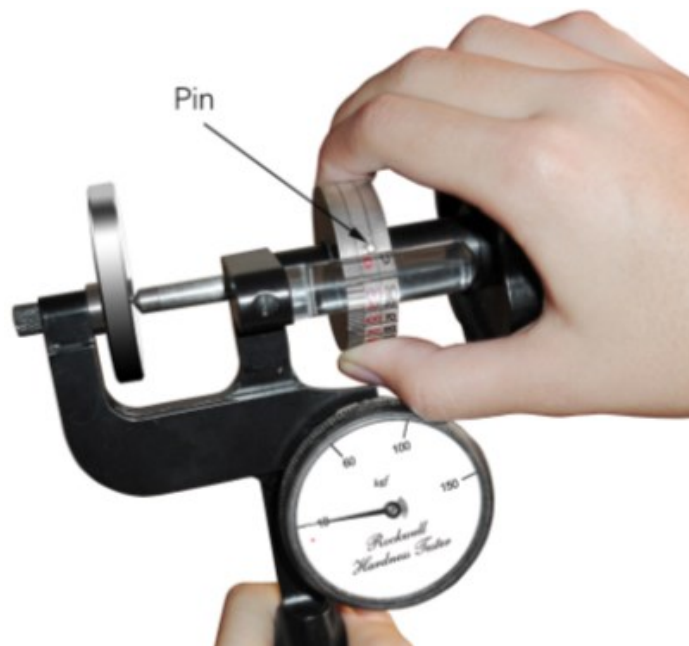
### 4.3 Step 1

Check the position of the indicator hand. It should rest directly on the dot on the indicator dial. If it doesn't, adjust the dial by turning the bezel to locate the dot under the pointer.



### 4.4 Step 2. Apply Minor Load

Slowly turn the hand wheel to bring the indicator hand to the line marked "3kg" or "10kg." This applies minor pressure load to the penetrator.



### 4.5 Step 3. Set the Barrel Dial

Rotate the barrel dial until its pin rests against the upper edge of the Lucite magnifier. The upper line of the barrel's hardness scales should be exactly aligned beneath the hairline on the magnifier. (NOTE: Model 1-4 has no pin, and must be aligned visually.)

Shown here is a major load of 150 kg being applied for reading in the Rockwell C scale. With HR Superficial tester models, the gauge shows 15, 30 and 45 kg pressures and indicates in the Rockwell N and T scales.



#### **4.6 Step 4. Apply Major Load**

Turn the hand wheel only until the dial pointer rests on the major load. Be careful to bring the indicator hand exactly to the desired graduation on the dial. **ACCURACY:** your tester is guaranteed to  $\pm 1.5$  point Rockwell. When using this tester, you must use extreme care to position the pointer exactly on the minor and major load marks.

#### **4.7 Step 5. Take the Reading**

Turn the hand wheel back to bring the indicator hand back to 3kg or 10kg and take the reading on the barrel dial looking through the Lucite magnifier. Each graduation on the barrel dial indicates two points in the Rockwell scale.

#### **4.8 Standard Tester**

With the diamond penetrator, read column C on the barrel dial (black numbers).

With the ball penetrator, read column B (red numbers).

#### **4.9 Superficial Tester**

With either the diamond or ball penetrator, take your reading from the black-numbered N-T column on the barrel dial (The difference in reading is created by the difference in penetrators: N with diamond, T with 1/16" ball.)



### **5 Using Tester Accessories**

#### **5.1 Changing Penetrator/Anvil**

Make sure to tighten it securely. (Hint: take a “dry run” reading to seat the penetrator and/or the anvil before taking an actual reading.)

#### **5.2 Anvils**

Use the flat anvil for work where the surfaces are parallel. Use the “V” anvil to hold round stock, and the raised flat anvil for irregular surfaces. Make sure to tighten it securely.

#### **5.3 Extensions**

Models with jaw openings larger than 1" come with jaw opening extensions to allow testing of samples in the 0-1" thickness range. Insert the sample between the anvil and the open end of the jaw. Be sure to tighten it securely.

NOTE: The first two or three tests may be low, until the penetrator and anvil have become firmly seated.

### **6 Maintaining Accuracy**

All HR Hardness Testers, whether in constant use or not, require accuracy checks. To check accuracy, take the average of 5 readings on the test block. The readings on barrel dial should agree with the marking on the test block within  $\pm 1.5$  point.

Always apply the penetrator to the same side of the test block, only on areas not marked by previous tests. When you cannot be certain of placing the penetrator on a perfectly unaffected part of the surface, you need a new test block.

## 7 Choosing Hardness Scales

| MAJOR BARREL<br>MATERIAL TO BE TESTED   | PENETRATOR | SCALE | LOAD(kg) | DIAL |
|---|------------|-------|----------|------|
| Extremely hard materials, tungsten carbide, thin steel low case hardened steel  | Diamond    | A     | 60       | C    |
| Medium hard materials, low and medium hardened steels, brass, bronze, aluminum alloys, malleable iron, etc.                                     | 1/16" ball | B     | 100      | B    |
| Hardened steels, hardened, and tempered alloys, hard cast iron, pearlite malleable iron, titanium and other materials harder than B100          | Diamond    | C     | 150      | C    |
| Medium case hardened steel, thin steel, and pearlite malleable iron   | Diamond    | D     | 100      | C    |
| Cast iron, aluminum and mag-Nexium alloy bearing metals   | 1/8" ball  | E     | 100      | B    |
| Annealed brass and copper alloys; thin soft sheet metals  | 1/16" ball | F     | 60       | B    |
| Beryllium copper, phosphor bronze, malleable irons, etc.  | 1/16" ball | G     | 150      | B    |
| Aluminum sheet, zinc, lead  | 1/8" ball  | H     | 60       | B    |
| Cast iron, aluminum alloys, Bearing materials   | 1/8" ball  | K     | 150      | B    |
| Plastics; thin materials, soft metals such as lead  | 1/4" ball  | L     | 60       | B    |
|   | 1/4" ball  | M     | 100      | B    |
|   | 1/4" ball  | P     | 150      | B    |
|   | 1/2" ball  | R     | 60       | B    |
|   | 1/2" ball  | S     | 100      | B    |
|   | 1/2" ball  | V     | 150      | B    |
| Hardened steels, shallow case hardened steels, hardened strip steels down to about .006 thick or where minimum surface distortion is desirable. | Diamond    | 15N   | 15       | N    |
|   | Diamond    | 30N   | 30       | N    |
|   | Diamond    | 45N   | 45       | N    |
| Soft steels, copper and aluminum alloys, etc., or where minimum surface distortion is desirable.  | 1/16" ball | 15T   | 15       | T    |
|   | 1/16" ball | 45T   | 45       | T    |

## 8 Correction Charts

### 8.1 Corrections to Be Added To Rockwell C, A and D, Values Obtained On Cylindrical Specimens Of Various Diameters.

| Dial     |         |         |         |         |         |         |       |           |           |
|----------|---------|---------|---------|---------|---------|---------|-------|-----------|-----------|
| Readings | 1/4 in. | 3/8 in. | 1/2 in. | 5/8 in. | 3/4 in. | 7/8 in. | 1 in. | 1-1/4 in. | 1-1/2 in. |
| 20       | 6.0     | 4.5     | 3.5     | 2.5     | 2.0     | 1.5     | 1.5   | 1.0       | 1.0       |
| 25       | 5.5     | 4.0     | 3.0     | 2.5     | 2.0     | 1.5     | 1.5   | 1.0       | 1.0       |
| 30       | 5.0     | 3.5     | 2.5     | 2.0     | 1.5     | 1.5     | 1.0   | 1.0       | 0.5       |
| 35       | 4.0     | 3.0     | 2.0     | 1.5     | 1.5     | 1.0     | 1.0   | 0.5       | 0.5       |
| 40       | 3.5     | 2.5     | 2.0     | 1.5     | 1.0     | 1.0     | 1.0   | 0.5       | 0.5       |
| 45       | 3.0     | 2.0     | 1.5     | 1.0     | 1.0     | 1.0     | 0.5   | 0.5       | 0.5       |
| 50       | 2.5     | 2.0     | 1.5     | 1.0     | 1.0     | 0.5     | 0.5   | 0.5       | 0.5       |
| 55       | 2.0     | 1.5     | 1.0     | 1.0     | 0.5     | 0.5     | 0.5   | 0.5       | 0         |
| 60       | 1.5     | 1.0     | 1.0     | 0.5     | 0.5     | 0.5     | 0.5   | 0         | 0         |
| 65       | 1.5     | 1.0     | 1.0     | 0.5     | 0.5     | 0.5     | 0.5   | 0         | 0         |
| 70       | 1.0     | 1.0     | 0.5     | 0.5     | 0.5     | 0.5     | 0.5   | 0         | 0         |
| 75       | 1.0     | 0.5     | 0.5     | 0.5     | 0.5     | 0.5     | 0     | 0         | 0         |
| 80       | 0.5     | 0.5     | 0.5     | 0.5     | 0.5     | 0       | 0     | 0         | 0         |
| 85       | 0.5     | 0.5     | 0.5     | 0       | 0       | 0       | 0     | 0         | 0         |
| 90       | 0.5     | 0       | 0       | 0       | 0       | 0       | 0     | 0         | 0         |

## ***8.2 Corrections to Be Added To Rockwell 15n, 30n, and 45n***

## ***8.3 Values Obtained On Cylindrical Specimens of Various Diameters.***

| Dial     |         |         |         |         |         |       |
|----------|---------|---------|---------|---------|---------|-------|
| Readings | 1/8 in. | 1/4 in. | 3/8 in. | 1/2 in. | 3/4 in. | 1 in. |
| 20       | 6.0     | 3.0     | 2.0     | 1.5     | 1.5     | 1.5   |
| 25       | 5.5     | 3.0     | 2.0     | 1.5     | 1.5     | 1.0   |
| 30       | 5.5     | 3.0     | 2.0     | 1.5     | 1.5     | 1.0   |
| 35       | 5.0     | 2.5     | 2.0     | 1.5     | 1.5     | 1.0   |
| 40       | 4.5     | 2.5     | 1.5     | 1.5     | 1.5     | 1.0   |
| 45       | 4.0     | 2.0     | 1.5     | 1.0     | 1.0     | 1.0   |
| 50       | 3.5     | 2.0     | 1.5     | 1.0     | 1.0     | 0.5   |
| 55       | 3.5     | 2.0     | 1.5     | 1.0     | 1.0     | 0.5   |
| 60       | 3.0     | 1.5     | 1.0     | 1.0     | 1.0     | 0.5   |
| 65       | 2.5     | 1.5     | 1.0     | 0.5     | 0.5     | 0.5   |
| 70       | 2.0     | 1.0     | 1.0     | 0.5     | 0.5     | 0.5   |
| 75       | 1.5     | 1.0     | 0.5     | 0.5     | 0.5     | 0     |
| 80       | 1.0     | 0.5     | 0.5     | 0.5     | 0.5     | 0     |
| 85       | 0.5     | 0.5     | 0.5     | 0.5     | 0.5     | 0     |
| 90       | 0       | 0       | 0       | 0       | 0       | 0     |