BMS BULUT® MAKİNA
SANAYİ VE TİCARET LTD. ŞTİ.

# BMS 201-R

## ROCKWELL HARDNESS TESTER

OPERATION MANUAL


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# 1. Technical Specifications

| | |
|---|---|
| Pre-load (kgf) | ***10*** |
| Test loads (kgf) | ***60,100,150*** |
| Load selection | ***Manual*** |
| Test method | ***Rockwell*** |
| Load application | ***Hydraulic*** |
| Max.test height | ***220 mm*** |
| Depth of throat | ***145 mm*** |
| Machine dim's | ***710x520x280 mm*** |
| Case dim's | ***790x590x420 mm*** |
| Weight (net/gross) | ***75/105 kg*** |

# 2. Standard Accessories

Rockwell Diamond Indenter : 1
1/16" Ball Indentor : 1
HRC Test Block : 1
HRB Test Block : 1
Flat Testing Table : 1
V Testing Table : 1
Hardness Conversion Table : 1
Wooden Case for Accessories : 1
Cover : 1
Allen Spanner : 2
Rubber Bellow for Elevating Screw : 1
Instruction Manual : 1
Calibration Certificate : 1

# 3. Unpacking Of Equipment

Unscrew fixing steel sheet plates of upper side to wooden base of case and hold up upper side of wooden case by means of carrying handles. Take out two M8 bolts fastening equipment to lower wooden case. Locate equipment on a special table (see drawing of table enclosed)) and fasten two M8 bolts by means of eye bull putting on flat testing table.
Open left cover .Take out wooden safety part. and loosen plastic strip which secure 60 kgf load during transport. Take out also 3 off M6 bolts of top cover (KP2) by means of 5 mm special alyen key which is in accessory box. Hold top cover up with care. Pay attention not to touch Rockwell Dial gauge (ST1). Take out plastic safety parts. Equipment is now ready for testing.

# 4. Setting into Operation

Before starting to test, load application lever (KL2) has to be in starting position (see drawing). Locate part to be tested on testing table, Insert indenter to holder (ML3) and choose the required load (according to testing method in attached table)

# 5. Choosing Loads

Test loads to be chosen according to following table.

| Test load( kgf) | Position of locating of test loads |
|---|---|
| 60 | 60 |
| 100 | 60 + 100 |
| 150 | 60 + 100 + 150 |

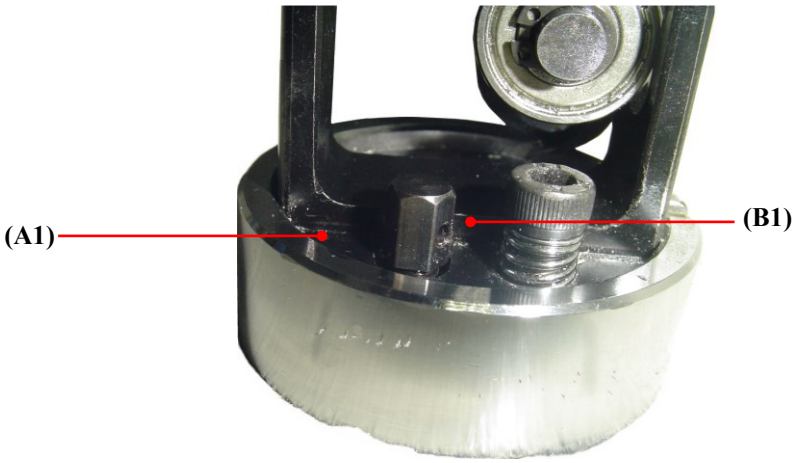
Please pay attention, load application lever (KL2) has to be in starting position
(Towards to you) Place part to be tested on testing table (TA1)

## 6. Testing

Insert indenter to indenter holder (UC1) .Slowly raise up elevating screw (ML1) until indenter touches on part to be tested, actuating by means of arms (SM1). Rockwell dial gauge pointers start movement. Keep going until big pointers at “0” and small pointer at 3 in red dot. Now Pre–load is applied. (If big pointer is exceeded by ± 3 points start to test again) Then apply total load application lever (KL2) to forward (see drawing) and follow movement of big pointer until it stops. Wait 3-5 sec. more then take back lever (KL2) to starting position. And read value on display. Black numbers on dial gauge for HRA, HRC and HRD with diamond indenter. Red values for HRB, HRE, and HRF etc. with ball indenter.

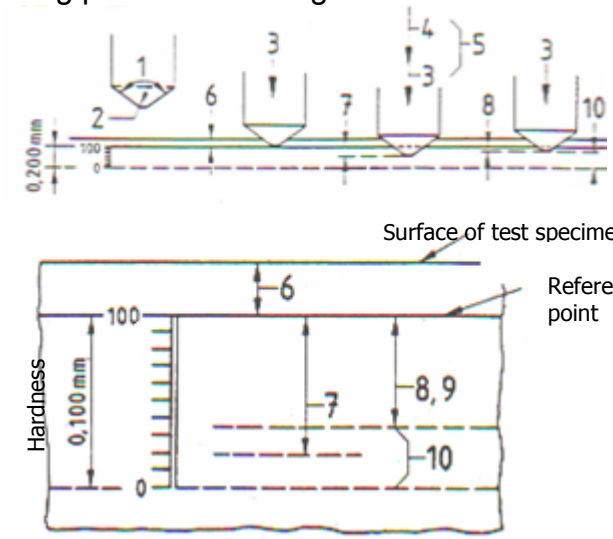
## 7. Adjusting Loading Speed

Load application is adjusted by hydraulic system. Hydraulic oil is filled at our works and hydraulic application speed is adjusted at our works. (But, working at extremely high temperatures or during transportation due to wrong handling if oil is reduced you may add some oil again. To do this, open left cover. There are two bolts on hydraulic piston (PS1) Take out bolt on the left (A1). Add some oil (Tellus 37 or similar) while adding oil, you can use load application lever (KL2) forward and backward. This helps oil to settle down easily. You can adjust hydraulic speed, by allen bolt on the right (B1).If you turn this bolt clockwise load application speed is decreased, If you turn anti clockwise it is increased.



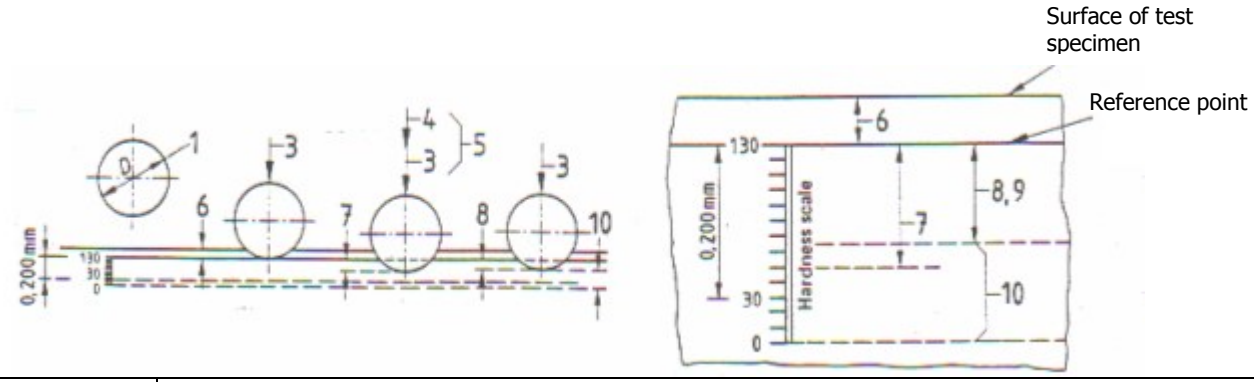

## 8. Rockwell Hardness Testing *(EN 6508-1, ASTM E18)*

Rockwell Hardness testing method is evaluated from penetration depth of 120° diamond cone or ball indenter with different dias (please refer to table enclosed) .
Below application shows working procedures using Rockwell diamond cone (HRC-HRA etc. )



| Nr | Symbol | Description |
|---|---|---|
| 1 | 0 | 120 ° Diamond cone |
| 2 | 0 | Radius of diamond tip= 0,2 mm |
| 3 | $F_0$ | Pre-Load |
| 4 | $F_1$ | Additional Load |
| 5 | F | Total load $F_0$+ $F_1$ |
| 6 | $t_0$ | Depth of penetration under pre-load, mm |
| 7 | $t_1$ | Depth of penetration under additional load, mm |
| 8 | $t_b$ | Increase in depth of penetration from $F_1$ to $F_0$, mm |
| 9 | e | Equality as of 0,002 mm increase of depth of penetration e= tb / 0,002 |
| 10 | 0 | Rockwell hardness = 100-e |

Below application shows working procedures using 1/16” ball indenter (HRB etc.)




| Nr | Symbol | Description |
|---|---|---|
| 1 | D | Ball dia=1/16 “ =1,5875 mm |
| 3 | $F_0$ | Pre-load |
| 4 | $F_1$ | Additional load |
| 5 | F | Total load =$F_0$+$F_1$ |
| 6 | $t_0$ | Depth of penetration under pre-load, mm |
| 7 | $t_1$ | Depth of penetration under additional load, mm |
| 8 | $t_b$ | Increase in depth of penetration from $F_1$ to $F_0$, mm |
| 9 | e | Equality as of 0,002 mm increase of depth of penetration e= tb / 0,002 |
| 10 | HRB/HRF | Rockwell hardness= 130-e |

# 10. Test Method

| Test method | Indentor | Pre-load (kgf | Total load (kgf) | Field of application |
|---|---|---|---|---|
| HRA | Diamond cone | 10 | 60 | Surface hardened parts with thin cases (0,4 mm) |
| HRB | 1/16" ball | 10 | 100 | Nonferrous metals, unhardened steels |
| HRC | Diamond cone | 10 | 150 | Hardened steels |
| HRD | Diamond cone | 10 | 100 | Surface hardened parts with medium cases |
| HRE | 1/8" ball | 10 | 100 | aluminum and magnesium alloys, antifriction metals,synetic metals |
| HRF | 1/16" ball | 10 | 60 | Annealed cupper alloys, thin sheet metals (0,6 mm) |
| HRG | 1/16" ball | 10 | 150 | Phospor-bronze,melleable iron of medium hardness |
| HRH | 1/8" ball | 10 | 60 | Aluminium,zinc,lead,grinding stones |
| HRK | 1/8" ball | 10 | 150 | Antifriction and other metals of very low hardness |
| HRL | 1/4" ball | 10 | 60 | As HRK and hard rubber |
| HRM | 1/4" ball | 10 | 100 | As HRK and HRL,laminated wood |
| HRP | 1/4" ball | 10 | 150 | HRK, HRL or HRM and synthetic materials |
| HRR | 1/2" ball | 10 | 60 | |
| HRS | 1/2" ball | 10 | 100 | |
| HRV | 1/2" ball | 10 | 150 | As HRK,HRL,HRM,HRP,HRR or HRS |