OPERATION MANUAL

BMS BULUT® MAKİNA
SANAYİ VE TİCARET LTD. ŞTİ.

BMS 200-RB

ROCKWELL& BRINELL HARDNESS TESTER

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1 Technical Specifications

Pre-load (kgf)	**10**
Test loads (kgf)	**60,100,150 for Rockwell test** **62.5 & 187.5 for Brinell test**
Load selection	**by load selector disc**
Test method	**Rockwell, Brinell**
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)	**85/115 kg**

2 Standard Accessories

Rockwell Cone Diamond Indenter
1/16 “ Ball Indenter
2,5mm Ball Indenter
HRC Test Block
HRB Test Block
HB 2,5 / 187,5 Test Block
Flat Testing Table
V Testing Anvil For Round Parts
Hardness Conversion Table
Wooden Case For Accessories
Cover
Allen Spanners
Rubber Bellow For Elevating Screw
Instruction Manual
Calibration Certificate


DIAL GAUGE
TOP COVER
LOAD SELECTOR
INDENTER
TESTING TABLE
ELEVATING SCREW
LOAD APPLICATION LEVER
ARMS

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 parts .Take out also 3 off M6 bolts of top cover by means of 5 mm special allen key which is in accessory box. Hold top cover up with care. Pay attention not to touch Rockwell Dial gauge. 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 load by means of load selector disc (VL1) (according to testing method in attached table)

5 Testing

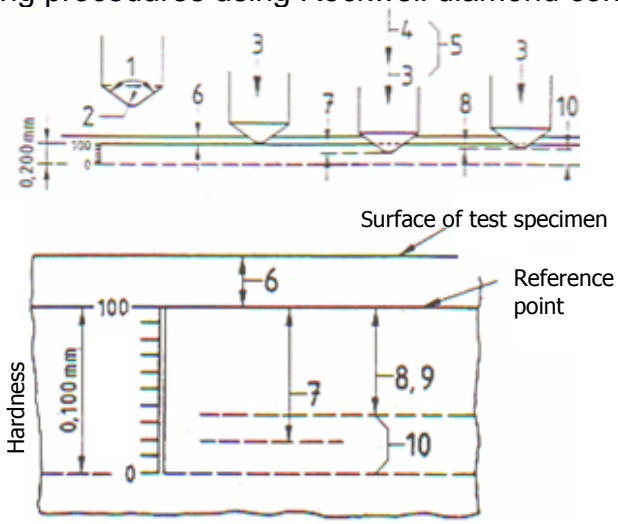
As soon as indenter touches on part, actuating main spindle (ML1) by means of arms (SM1) Rockwell dial gauge pointers start movement. Keep going until big pointers at “0” and small pointer at 3 in red dot. Now Pre –load is applied. (If big pointer is exceeded by ± 3 points start to test again) Then apply 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 indenters.

6 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 lock wise load application speed is decreased, if you turn anti clockwise it is increased.

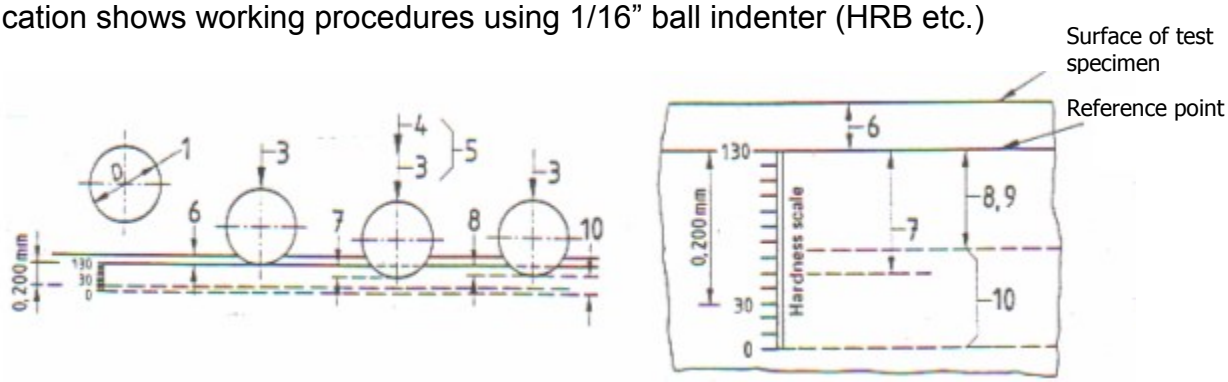
7 Rockwell Hardness Testing *(EN 6508-1, ASTM E18)*

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

8 Brinell Hardness Testing (EN 6506-1, ASTM E10)

Brinell hardness testing method is made by different balls depending on material type, thickness and loads applied.
Diameters of ball indentations can be evaluated by built in optical system or portable Brinell microscope.
To do this. Insert 2,5 mm indenter to holder. Apply position of load selector disc (VL1) on suitable load (62,5 kgf or 187,5 kgf) and do the same procedures as like Rockwell

Pls use following tables for this application.
Relations with thickness of specimen, ball dia and material shown in related the table

Thickness of material (mm)	Ball dia(mm)	$P=30D^2$ Steel, iron, cast iron	$P=10D^2$ Brass, Bronze, Cupper, Aluminum	$P=D^2$ Soft cupper	$P=5D^2$ Lead
6 mm and up	10	3.000 kgf	1.000 kgf	500 kgf	250 kgf
3 mm and up	5	750 kgf	250 kgf	125 kgf	62,5 kgf
1,2 mm and up	2,5	187,5 kgf	62,5 kgf	31,25 kgf	15,625 kgf
0,5 mm and up	1	30 kgf	10 kgf	5 kgf	-

THE VALUES TAKEN FROM DIAL GAUGE ACCORDING TO HB 2,5/62,5 BRINELL METHOD

value	ALUMINIUM AND ALUMINIUM ALLOY										value	COPPER AND COPPER ALLOY										value	BRASS AND BRONZE									
	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9
80						23	23	23	24	24	10				39	39	39	40	40	40	40	40			52	53	54	55	56	57	58	59
90	24	24	24	25	25	25	25	25	26	26	20	41	41	41	42	42	42	43	43	44	44	50	60	62	63	64	66	67	69	70	72	73
0	26	26	26	27	27	27	28	28	28	29	30	44	45	45	46	46	47	48	48	49	49	60	75	77	78	80	82	84	86	88	90	92
10	29	29	30	30	30	31	31	31	32	32	40	50	51	51	52	53	54	54	55	56	57	70	95	97	100	103	106	110	114	118	122	127
20	33	33	34	34	34	35	36	36	37	37	50	58	59	60	61	62	63	64	65	67	68	80	132	138	144	150	158	168	180	212		
30	38	39	40	40	41	42	43	44	45	45	60	69	71	72	73	75	76	78	80	81	83	90										
40	46	47	48	49	50	51	52	53	54	55	70	85	86	89	91	93	96	99	102	106	110											
50	56	57	58	59	60	61	62	63	64	65	80	115	120	128																		
60	69	70	72	74	76	78	80	82	84	86	90																					
70	88	91	93	96	99	103	106	110	114	118																						
80	123	127	132	137	143	150	158																									
90																																

THE VALUES TAKEN FROM DIAL GAUGE ACCORDING TO HB 2,5/187,5 BRINELL METHOD

value	STEEL										value	STAINLESS STEEL										value	CAST IRON									
	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9
20	110	112	114	116	118	120	122	124	126	128	10						110	111	112	113	114	60						65	66	66	66	66.5
30	131	133	135	138	140	143	146	148	151	154	20	115	116	117	119	120	122	123	125	127	129	70	67	67	68	68	69	69	70	70	70	71
40	157	160	163	166	169	172	175	178	182	185	30	131	133	135	137	140	142	145	147	150	153	80	71	71	72	72	73	74	75	75	75	76
50	189	192	196	200	204	208	212	216	221	226	40	155	158	161	164	167	170	173	176	180	184	90	76	77	78	79	79	80	81	82	83	83
60	230	235	240	246	252	258	265	273	280	288	50	187	191	195	198	202	206	210	214	218	222	0	84	85	86	87	88	89	90	91	92	93
70	296	305	314	324	334	345	356	367	380	394	60	226	231	236	240	245	250	256	261	267	273	10	94	95	96	98	99	100	102	103	104	106
80	408	424	440	458	478	500	524	549	574	600	70	280	287	294	301	309	317	325	334	343	352	20	107	109	110	112	113	115	117	119	121	123
90	625										80	353	374	396	400	415	435	455	480	510	575	30	125	128	130	133	135	138	140	143	146	149
100											90											40	152	155	158	162	165	168	172	176	179	183
																						50	187	191	195	199	203	207	211	216	220	225
																						60	230	234	240	245	250	256	261	267	273	279
																						70	285	293	300	308	317	326	335	344	354	365
																						80	378	392	408	445	470	505	550			

9 How to read Brinell values on Dial gauge?

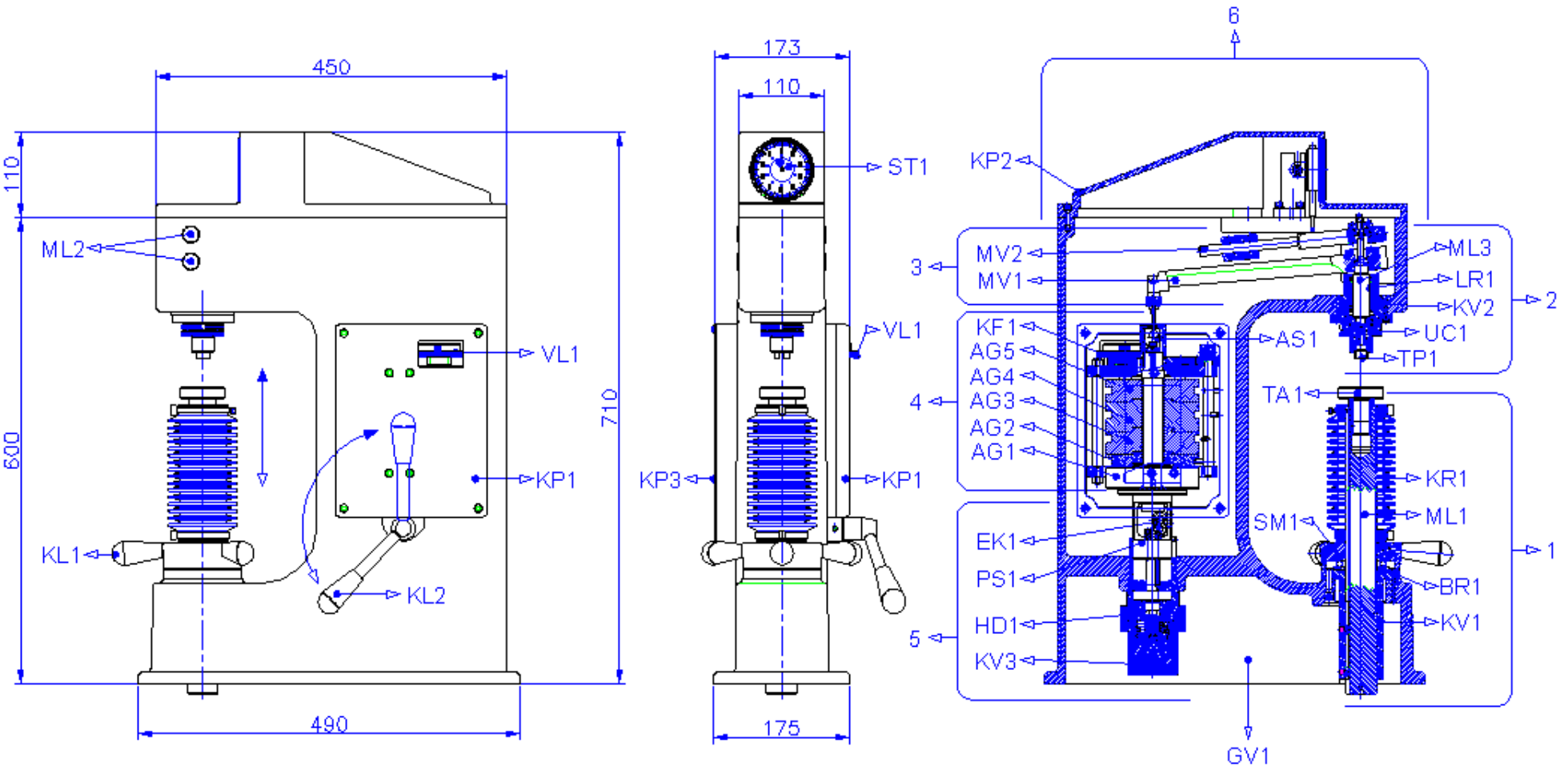
To make Brinell test for Steel,

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 ***2,5 mm ball indenter*** to holder (ML3) and choose load by means of load selector disc (VL1) ***187,5 kgf.***
Apply test same as Rockwell test same as 5.5

Read black value on dial gauge.

For example, if you read 60,3 on dial gauge , ***this is converted to 246 HB 2,5/187,5.***

BMS 200 RB


450
110
600
710
ML2
VL1
KP1
KL1
KL2
490
173
110
ST1
VL1
KP3
KP1
175
6
KP2
3
MV2
MV1
ML3
LR1
KV2
2
KF1
AG5
AG4
AG3
AG2
AG1
4
AS1
UC1
TP1
TA1
KR1
ML1
SM1
EK1
PS1
BR1
HD1
KV1
5
KV3
1
GV1

10 Parts List

BMS 200 RB Rockwell&Brinell		
Group Nr	**Code**	**Description**
1	GV1	Cast iron body
	ML1	Elevating screw
	SM1	Screw nut
	KR1	Rubber below for elevating screw
	KV1	Bush for elevating screw
	KL1	Arms
	BR1	Bearing
	TA1	Testing table
2	ML3	Indentor holder
	LR1	Linear bearing
	KV2	Bush for linear bearing
	UC1	Indentor
	TP1	Clamping cap
3	MV1	Lever
	MV2	Pre-load lever
	ML2	Side bushings
	AS1	Hook
4	KF1	Cage
	KP1	Right cover
	KP3	Left cover
	VL1	Load selector disc
	AG1	62,5 kg weight
	AG2	100 kg weight
	AG3	150 kg weight
	AG4	187,5 kg weight
5	EK1	Load application system
	PS1	Hydraulic damper piston
	HD1	Hydraulic oil
	KV3	Damper pot
	KL2	Load application lever
6	KP2	Top cover
	ST1	Rockwell dial gauge

11 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
HR 15 N HR 30 N HR 45 N	Diamond cone	3	15 30 45	As HRA,HRC or HRD ,but especially thin case depth (≥ 0,18 mm)
HR15T HR30T HR45T	1/16" ball	3	15 30 45	As HRB,HRF or HRG but especially for thin sheet metals (≥ 0,25 mm)
HR15W HR30W HR45W	1/8" ball	3	15 30 45	For metals with very low hardness and for very thin cases, for example thin linings of antifriction metals,HRX and HRY especially for sintered metals
HR15X HR30X HR45X	1/4" ball	3	15 30 45	
HR15Y HR30Y HR45Y	1/2" ball	3	15 30 45	