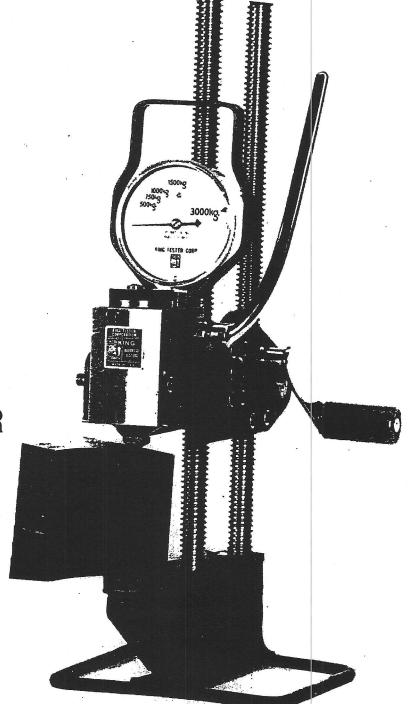
OPERATING INSTRUCTIONS

KING® BRINELL HARDNESS TESTER





KING TESTER CORPORATION

201 King Manor Drive
King of Prussia, PA 19406 USA
Phone: 610/279-6010 • Fax: 610/279-4596
Email:kingbrinell@aol.com

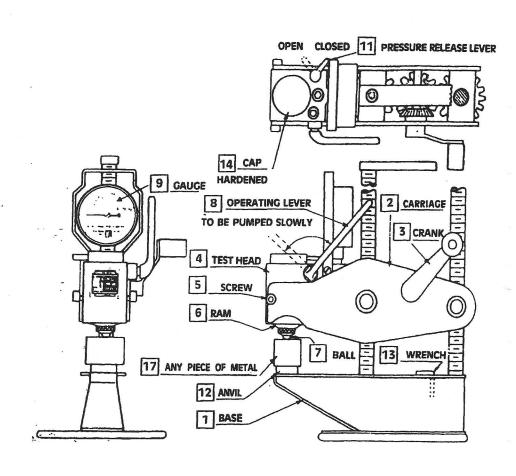
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DESCRIPTION

1 is the base, 2 is the carriage, movable up and

The maximum pressure which can be applied to the

IMPORTANT

The Calibration of the King Brinell Hardness Tester has been certified correct at the time of shipment from the factory. Warranty is enclosed with shipping papers. The possibility exists however, of the calibration changing because of extreme rough handling or accident during shipment. This instrument should be checked for accuracy by testing a piece of metal of known hardness (use a Brinell test bar) prior to use. It is recommended that the instrument be checked regularly for accuracy and if calibration is required, that instructions on page 6 be followed. Always replace worn or damaged Brinell balls. It is also recommended that the operator of this instrument be familiar with standard procedures for Brinell Testing with reference to different loads, materials and size of Brinell balls.

GENERAL MAINTENANCE

In order to prevent undue wear on the elevating screws and gears, it is important to keep the Base free from dirt and grit. It is recommended that the Base be cleaned with spirits or other cleaning fluid regularly and sufficient oil be applied to the elevating screws to provide lubrication.

When making tests, always be sure that the ball retainer is tight. This will prevent damage to the machine and insure accurate tests. The 10 mm. ball should be replaced from time to time as wear occurs. To replace ball, unscrew retainer and insert new ball.

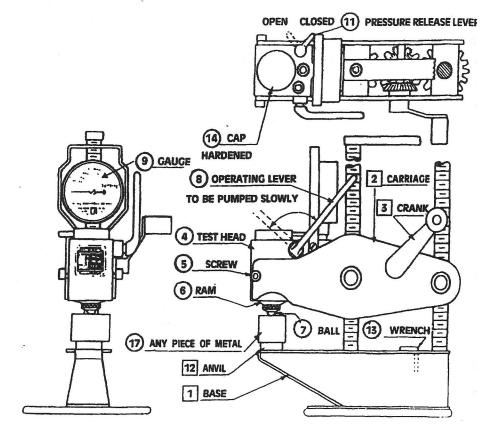
It is very important that the ram be pushed back as far as it will go before making a test. This may require considerable pressure on the crank, especially with a new machine. It is equally important to make sure that the ram does not get pumped down at any time more than 5/16". If the ram is pumped down further, air may enter the hydraulic system and the Test Head will no longer be calibrated correctly. Air in the hydraulic system can be removed as explained in Directions for Changing Oil, in the maintenance manual, page 2.

On older machines, examine the Test Head periodically for oil leakage around moving parts, packing nuts and set screws. If excessive oil leakage is apparent, it may be necessary to replace O-rings and to change the hydraulic oil.

When servicing or repairing the Test Head, it is recommended that all severely worn parts be replaced with new parts. It is important that all nuts with worn threads or slots be discarded and replaced in order to facilitate reassembly and to minimize further repairs.

INSTRUCTIONS FOR OPERATION KING PORTABLE BRINELL IMPORTANT

- 1 PUMP OPERATING LEVER 8 SLOWLY—ONLY A FEW STROKES WILL BE REQUIRED TO BRING UP THE PRESSURE. Pop off 3 or 4 times at 3000kg and release pressure. The 3000kg load is not maintained at all.
- 2 Do not pump lever (3) unless the ball (7) is down firmly on a piece of metal or on part being tested.
- Always keep the ball 7 firmly down on a piece of metal 17 as shown, except during tests.



OPERATION

Open valve (1), raise the carriage 2 enough to admit the part to be tested, clamp the part being tested firmly between the ball 7 and the anvil 12, making sure that the ram 6 is pushed in as far as it will go. Close the valve (1) and pump the operating lever (8) slowly until the full pressure has popped off three or four times as shown on the gauge 9. Open the valve (1) and raise the carriage 2. The impression made by the ball is a standard Brinell impression and is read in the usual manner.

It is very important that the ram be pushed in as far as it will go before making a test. This may require considerable pressure on the crank 3, especially in a new machine. It is equally important to make sure that the ram 6 does not get pumped down at any

time more than about 5/16". The amount of oil in the hydraulic system is necessarily small, only enough to allow the ram a maximum movement of about 5/16". If the ram is pumped down farther than this, air will be sucked in and it will be hard to pump up to pressure. The air must be taken out as explained in the directions for changing oil.

Between tests and when the tester is not in use, a small piece of metal (7) should be clamped firmly between the ball (7) and the anvil 12, to make sure that the ram will not be accidentally pumped down. The ram will not drop of its own weight but, when there is nothing under the ball, it takes only about 6 or 8 pumps to bring the ram down 5/16".

For applying loads under 3000kg, proceed as for the 3000kg test up to the point of applying the load. Then pump slowly, watching the dial until the pressure has reached the load desired, hold for a few seconds, if necessary, then release. The tests will be accurate, even though the machine does not pop off automatically at these intermediate loads.

The base is made with a narrow, shallow nose at the anvil and extends beyond the front end of the bottom frame of the base 1 to allow tests to be made in small places, tubes, etc. This gives the tester unlimited possibilities for quickly making tests in places and on parts hitherto thought too cumbersome or impossible to test. The King Portable Brinell can be operated in any position, even upside down, making accurate tests.

KING BRINELL HARDNESS TESTER STANDARD BASE

The Standard Base is supplied with THREE (3) ANVILS to ensure correct support of many configurations of test pieces.

IT IS IMPORTANT TO SELECT THE CORRECT ANVIL FOR EACH TEST CONDITION. The anvils supplied are:

FLAT ANVIL - For general use under most conditions and for use with test blocks.

V-ANVIL - For use with round bars and convex parts.

DOME ANVIL - For use with concave parts and to support the inside of tubing, cored parts, etc.

Use of the correct anvil will minimize misalignment of the test load and insure greater accuracy and reliability of tests. It will also minimize out of line loads on the tester ram and base improving the well known durability of the King Tester.

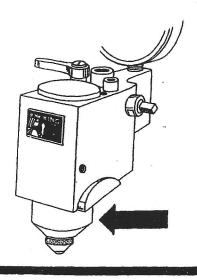
MAINTENANCE OF BASE

In order to ensure longer life of the elevating screws and carriage parts make certain the base is kept clean. After cleaning a very thin oil should be applied to the screws to aid carriage movement. DO NOT apply a heavy grease which would collect dust and become abrasive.

TESTING PARTS LARGER THAN THE CAPACITY OF THE STANDARD BASE

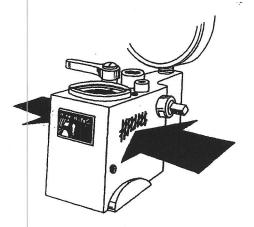
The test head 4 is taken out of the carriage 2 by taking out the screws 5 with the wrench 13.

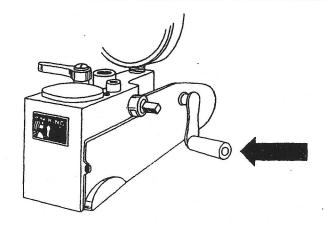
With this, parts of any size can be tested by providing means placed against the cap (14) to take the thrust of 3000kg, such as C-clamps. yokes, etc.



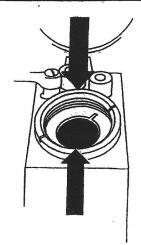
DON'T test with ram extended.

use the elevating crank to clamp on work.





DON'T clamp the block by its sides.



DON'T tamper with the sump nut.

The KING PORTABLE

Makes Tests Rapidly and Easily...

ADVANTAGES OF BRINELL TEST

The Brinell Test is undoubtedly the best known and the most frequently used test for hardness. It is an easy test to make, is easy to read and the impression can be checked at any time. The presence of an impression is proof that the piece has been tested. The test is especially easy with the King Portable.

ALLOYS

The increasing use of alloys makes a hardness test absolutely necessary especially when the parts are heat treated, because the physical properties and the hardness are tied up together and it is not always possible or desirable to make tensile tests.

TENSILE STRENGTH AND BRINELL HARDNESS NUMBER

In general, for steel and iron alloys, the Brinell Hardness Number divided by two will give the approximate tensile strength in thousands of pounds (kips) per square inch; therefore, the Brinell numbers provide simple, non-destructive means of getting good approximation of the tensile strength.

KIND OF BALL-CORRECTION MAY BE NECESSARY

The Brinell Test is used for testing the hardness of a wide range of materials. For most of them a 10 mm. steel ball and a load of 3000 kg. is used. This is entirely satisfactory for Brinell numbers ranging from 100 to 700, although a tungsten carbide ball is recommended for Brinell numbers above 600. A correction has to be applied for the harder ball as it will give a higher Brinell number than the steel ball. For Brinell numbers under 100, a 10 mm. ball with a load of 500 kg. is recommended.

TESTS BY DIFFERENT OPERATORS

The Brinell Hardness Number is a universally known means of comparing the hardness of various materials and the tests are very consistent; so that the tests made by widely differing kinds of operators working under widely differing conditions are more dependably compared than with other hardness tests. This is especially true when the Brinell Test is made with a King Portable because this instrument aligns itself almost automatically to the work and there is absolutely no inertia effect. Therefore, the difference in the operation of the machine by different operators does not affect the results appreciably.

CANNOT BE OVERLOADED

The King Portable is provided with means which limits the maximum load that can be applied to the ball to 3000 kg. and it is impossible to overload it regardless of how the load is applied.

ADVANTAGES OF LARGE IMPRESSION

The impression made by the Brinell test is comparatively large and the great advantage of a large impression is that small local differences of the composition or condition of the specimen does not affect the result to any extent. Therefore, the Brinell test would indicate the actual properties of the material much more closely than hardness tests making small indentations. It is therefore an advantage to use the Brinell test whenever consistency and accuracy are needed.

DIFFERENT LOADS

When the nature of the specimen is such that the impression made by the 3000 kg. load is too large, the use of a 500 kg. load will be found very useful. There are many tables calculated for both these loads including one by the National Bureau of Standards, Misc. Pub. BS 62 [1924], the Int. Ni. Co. and others.

IMPRESSIONS DIFFERENT IN DIFFERENT DIRECTIONS

In many materials the diameter of the impression is not the same in all directions and where this difference is noticeable, the average of the largest and smallest diameters should be used.

FOR TESTING HEAT TREATMENT

The Brinell Hardness Test applied by a King Portable is the simplest method of determining the correctness of the heat treatment as the machine can be taken near the furnaces and good results can be obtained even with a poor surface on the part tested.

THICKNESS OF MATERIAL

The thickness of the material tested has considerable influence on the Brinell number and for thicknesses less than χ'' for steel or χ'' for other materials, it may be necessary to apply a correction. This is, in general, only advisable where the impression shows on the back of the specimen. It is then best to use a load of 500 kg., which can be used down to thin as χ'' .

SPACING OF IMPRESSIONS

The distance of the impression from the edge is very important and should not be less than 3 times the diameter of the impression and the same applies to distances between the impressions.

CURVED SURFACES

When making a test on a curved surface, either concave or convex, the average of the small and large diameter should be used. This will give a small Brinell number and a correction must be added to get the true Brinell number as follows: the correction to be added will be less than 0.3% if the radius of the part tested is greater than 1". Where the part has a smaller radius, down to %" or so, the correction when testing the outside of a cylinder will be as much as 1%. In the case of a concave surface it may be as much as 3%.

CHANGING THE BALLS

The steel balls made for Brinell Testing are very rugged. For accuracy and consistency, however, it is well to change the ball every now and then, especially for castings having sand at or on the surface or when testing steels with a Brinell number over 550.

3000 kg. LOAD ON A 10mm BALL

	Brinel			realmate	1		1	rineli		erimate kwali	Tensili
	ġ,		1	ckwoll			1 =	<u>_</u>	1100	Men	Strgth
	98	365	÷ .		Tensil	1	8	N. S. S.	j .		1000
Dia.	47.0	9 (7)		-	the same of the sa	Dia	- 40	<u>a n</u>	C	В	psi.
2.00	158	94		ckwell		4.0	38.	1 22	9 21	98	107
2.05	150	89	9 51	reneths	apply	4.0				97	105
210	143	85		ly to B	. H. N. ka. lood	4.10				96	103
2.15	136	81 78	. !	1 2000	366	4.15				95 94	98
2.25	124	74		3	360	4.25				93	96
2.30	119	71		2	354	4,30				92	95
2.35	114	68		0	341	4.35	32.	0 19	2	91	93
2.40	109	65		-	329	4.40	10	- 67		90	91
2.45	105	62			317	4.45				88	89 87
2.55	96.3	57	., .	_	305 295	4.54			- 1	87	85
2.00	92.6	55			284	4.60				86	84
2.65	89.0	53			273	4.85				85	82
2.70	85.7	51	1 5	1	263	4.70				84	61
2.75	82.6	49		0	253	4.75	26.			13	79
2.80	79.6	47		- 1	242	4.00				82	78
2.85	76.8	46			233	4.85				01	76
2.90 2.95	74.1	444			221	4.90 4.95	24.4			79	75 74
3.00	69.1	418			202	5.00	23.			78	72
3.05	66.8	401			193	5.06	22.3			77	71
3.10	64.8	314	42		185	5.10	72.8			75	70
3.15	62.5	375			178	5.15	22.3	134		74	68
3.20	60.5	353	, -		171	5.20	21.5			73	66
3.25	58.6 56.8	. 352	, ,,,		165	5.25	21.0			72	65
3.35	55.1	341			159	5.30 5.35	20.9		1	71 69	64
3.40	53.4	321			148	5.40	20.1	121	1	68	62
3.45	51.8	311			143	5.45	19.7	118	1	67	61
3.50	50.3	302		- 1	139	6.50	19.3	116	1	65	60
3.55	48.9	2113		- 1	135	5.55	18.9	114	1	64	50
3.60	47.5	2115	30		131	5.60	18.6	111		62	58
3.65	45.1 44.9	217	29	- 1	127	5.65	18.2	109		61	56
	43.6	212	27		124	5.70 5.75	17.8 17.5	107		58	55 54
	42.4	215	25	- 1	117	5.00	17.2	103		57	53
	41.3	248	24		115	5.85	16.8	101		55	52
	40.2	241	23	100	112	5.90	16.5	99.2			51
3.95	39.1	235	22	99	109	5.95	16.2	97.3		- 1	50

LOW BRINELL LOADS APPLIED ON 5 mm BALL

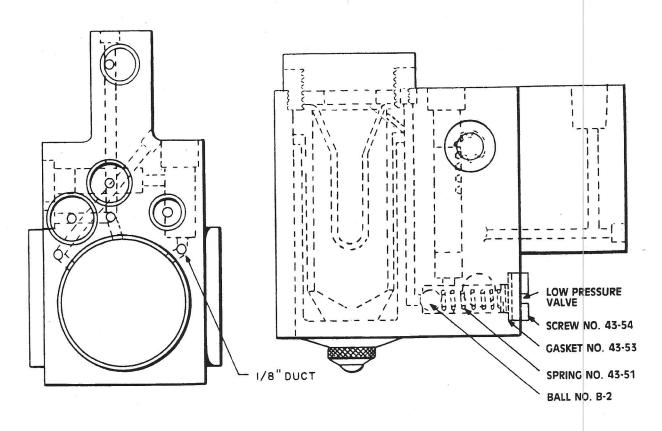
Dia.	1000	750	500	250	125	62-1/2
	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.
1.50	553	415	276	138	69	35
1.55	517	388	258	129	65	32
1.60	484	363	242	121	61	30
1.65	455	341	227	114	57	28
1.70	427	321	214	107	53	27
1.75	403	302	201	101	50	25
1.80	380	285	190	95	47	24
1.85	359	269	179	90	45	22
1.90	339	255	170	85	42	21
1.95	322	241	161	80	40	20
2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50	305 290 275 262 250 238 229 217 207 199 190	229 217 207 197 184 179 170 163 156 149 143	153 145 138 131 125 119 114 109 104 99	76· 72 69 66 62 60 57 54 52 50 48	38 36 34 33 31 30 28 27 26 25 24	19 18 17 16 16 15 14 14 13 12 12
2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95	182 175 168 161 154 148 143 137 132	137 131 126 121 116 111 107 103 99.2	91 87 84 80 77 74 71 69 66	46 44 42 40 39 37 36 34 33	23 22 21 20 19 19 18 17	11 11 10 10 10 9 9 9
3.00	128	95.5	64	32	15.9	8.0
3.05	124	92	62	31	15.3	7.8
3.10	120	89	60	30	14.8	7.5
3.15	112	85.5	56	28	14.2	7.0
3.20	108	82.5	54	27	13.7	6.8
3.25	105	80	52	26	13.0	6.5
3.30	98	75	49	25	12.5	6.1
3.35	95	72	48	24	12.2	6.0
3.40	93	71	47	24	12.0	5.9
3.45	91	69	46	23	11.7	5.8

1500 KG LOAD APPLIED ON A 5MM BALL

Dia.	BHN
1.50	829
	775
	726
	682
	641
1.75	604
1.80	570
1.85	538
1.90	509
1.95	482
2.00	458
2.05	434
2.10	413
	393
	374
	357
2.30	
2.35	
	311
2.45	
2.50	285
0.55	252
2.55	
2.60 2.65	262
2.70 2.75	232
	223
2.85	
	206
2.95	
3.00	192
	184
	180
3.15	168
3.20	162
3.25	156
3.30	147
3.35	144
3.35 3.40	

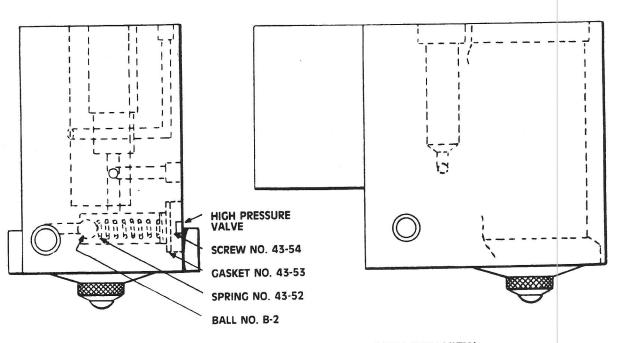
LOW BRINELL LOADS APPLIED ON 10 mm BALL

APPLIED ON 10 mm BALL							
Dia.	1000 Kg.	750 Kg.	506 Kg			62-1/2 Kg.	
1.50 1.55	578 540	434 405	289 270		72 68	36.1 33.8	
1.60 1.65	506 476	379 356	253 238	119	63 60	31.6 29.8	
1.70 1.75 1.80	446 420 392	334 314	223 210 196	105	56 52 49	27.9 26.2 24.5	
1.85	370 350	295 278 262	185	92	46 44	23. 1 21. 9	
1.95	332	249	166	84	42	20.8	_
2.05 2.10	299 286	224 214	150	75	37 36	18.8	
2, 15 2, 20	272 261	204 195	136 130	65	34 32	17.0 16.2	
2, 25 2, 30 2, 35	248 238 228	186 178 170	124 119 114	59	31 30 28	15.5 14.9 14.2	
2.40	217	163 156	109	54	27 26	13.6 13.1	
2.50 2.55	200 193	150 144	100 96		25 24	12.5 12.0	
2.60 2.65	185 177	138 133	93 89	44	23	11.6	
2.70 2.75 2.80	171 165 159	128 123 119	86 83 80	43 41 40	21, 6 20, 8 20, 0	10, 8 10, 4 16, 0	
2.85 2.90	153 148	115 111	77	38 37	19.2 18.4	9.6	-
3.00	139	104	72	36	17.6	8.8	1
3.05 3.10 3.15	134 129 125	100 96 93	67 65 63	33 32 31	16.8 16.2 15.8	8.4 8.1 7.9	-
3, 20 3, 25	121	91 87	61 59	30 29	15, 2 14, 8	7.6 7.4	
3.30	114	85 83	57 55 54	28 27.5	14.2	7, 1 6.9	
3, 40 3, 45 3, 50	108 104 100	80 77 75	52	27.0 26.0 25.0	13.6 13.0	6.8	-
3.55 3.60	98 96	73 71	49 48	24.5 24.0	12.2 12.0	6. 1 6. 0	
3.65	92 90	69 67	46 45	23.0	11.6	5.8 5.6	-
3.75	88 86	65 63	44	22.0	10.8	5. 5 5. 4	
3.85 3.90 3.95	82 80 78	62 60 58	41 40 39	20,5 20.0 19.5	10.2 10.0 9.8	5.1 5.0 4.9	
4.00	76 74	57 55	38 37	19.0 18.5	9.6	4.8	
4.10	72 70·	54 53	36 35	18.0 17.5	9.0 8.8	4.5	
4.20 4.25 4.30	69 67 65	51 50 49	34.5 33.6 32.6	17.2 16.8 16.3	8, 6 8, 4 8, 2	4.3 4.2 4.1	
4, 35 4, 40	64 62	48 46	32.0 31.2	16.0 15.6	8.0	4.0 3.9	
4.45	61 59	44	29.7	15.2	7.6	3.8	
4.55 4.60 4.65	58 57 55	43 42 41	29, 1 28, 4 27, 8	14.5 14.2 13.9	7.2 7.1 6.9	3.6 3.6 3.5	
4.70 4.75	54	40 9.5	27.2 26.5	13.6 13.2	6.8	3.4	
4.80 4.85	51 3	9.0 8.0	25,9 25,4	12.7	6.4	3.2	
4.90	49 3	7.0 6.0	24.9	12.4	6. 2 6. 1 5. 9	3.1 3.0 3.0	
5.00 5.05 5.10	47 3	5.5 5.0 4.0	23.8 23.3 22.8	11.9 11.6 11.4	5. 8 5. 7	2.9 2.8	
5. 15 5. 20	45 3 44 3	3.Q 2.5	22.3	11.1	5. 5 5. 4	2.8	
5. 25 5. 30	42 3	2.0 1.5	21.5	10.7	5, 3 5, 2	2.7	
5.35 5.40 5.45	40 3	1,0 0.0 9.5	20.6 20.1 19.7	10.3 10.0 9.8	5.1 5.0 4.9	2.6 2.5 2.5	
5.50 3	8.6 2	9.0 8.5	19.3	9.6	4.8	2.4	
5.60 3° 5.65 3°	7.2 2 6.0 2	8. C 7. O	18.6 18.2	9.3	4.6 4.5	2.3	
5.75 3	5.0 2	6.5 6.0 5.5	17.8 17.5 17.2	8.9 8.7 8.6	4.4 4.3 4.3	2. 2 2. 2 2. 2	
5.85 3: 5.90 3:	3.6 2 3.0 2	5.0 4.5	16.6	8.4	4.2	2.1	
6.00 3	1.8 2	4.0 3.5	16.2	7.9	3.9	2.0	
6.05 3 6.10 3	1.2 2: 0.6 2:	3. 2 3. 0	15.6 15.3	7.8 7.6	3.9 3.8		
6. 20 2	0,6 2	2.5 2.0	15.1	7.5	3.7		
6.30 2	3.4 2		14.5 14.2	7.2	3.6 3.5 3.5		
		1.0	14.0 13.7	7.0 6.8	3.4		



TOP VIEW

RIGHT SIDE VIEW



REAR VIEW

LEFT SIDE VIEW

TO REPLACE GAUGE

It is unnecessary to drain oil when replacing gauge.

Insert Test Head in vise (see Illustration #1).

Remove four screws #16.

Remove carrying handle #15.

Unscrew Gauge, using open end wrench, and discard old Gauge.

Fill gauge hole in Test Head with oil.

Screw on new Gauge with open end wrench. Tighten firmly but do not use excessive pressure. Gauge should face to the front on Standard Model Tester. Do not attempt to engage all threads on gauge connection unless necessary to make an oiltight joint.

Attach carrying handle with four screws.

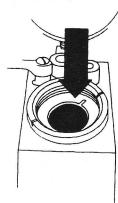
SPECIAL TOOLS TO REPAIR KING BRINELL TEST HEAD

	CATALOG NUMBER	DESCRIPTION
	SW-1	FLAT WRENCH TO TURN SAC NUT
	NA	TOOL TO INSERT RELEASE VALVE PACKING
	SNW-2	WRENCH TO TURN RELEASE VALVE PACKING NUT

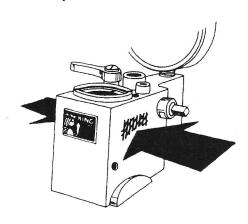
DON'T tamper with the sump nut.



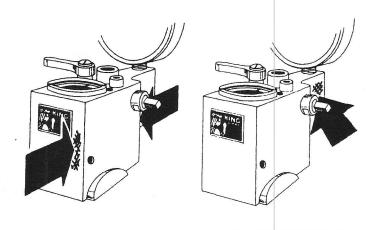
remove only the sac nut to add oil.



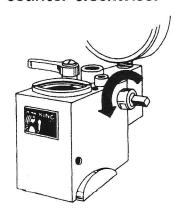
DON'T clamp the block by its sides.



DO hold as shown in the manual.



DON'Tundo the bronze
pump bushing
counter clockwise.



unscrew the bushing clockwise, it has left hand thread.



DO READ

OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

For Advice
DO CALL
Your Rep
or
KING TESTER



KING TESTER CORPORATION
201 King Manor Drive
King of Prussia, PA 19406 USA
Phone: 610/279-6010 • Fax: 610/279-4596