

OPERATING INSTRUCTIONS

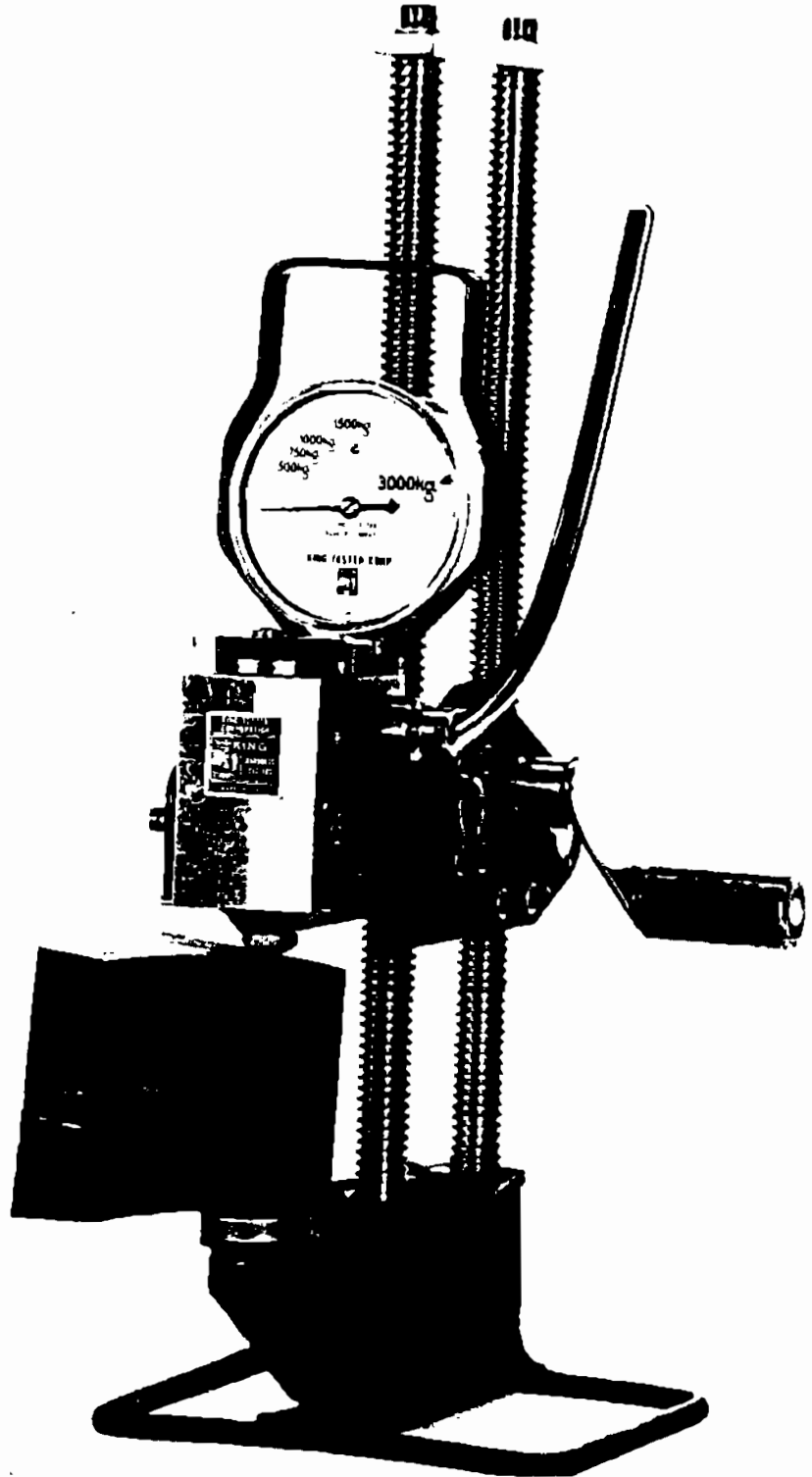
King Tester Corporation is temporarily out of our manuals. We apologize for any inconvenience.

Please accept these copies until we are able to update our current manuals. Once we receive them we will send you new ones.
Thank you.

THE KING PORTABLE
HARDNESS TESTER

KING

KING TESTER CORPORATION
201 King Manor Drive
King of Prussia, PA 19406 USA
Phone: 610/279-8010 • Fax: 610/279-4596



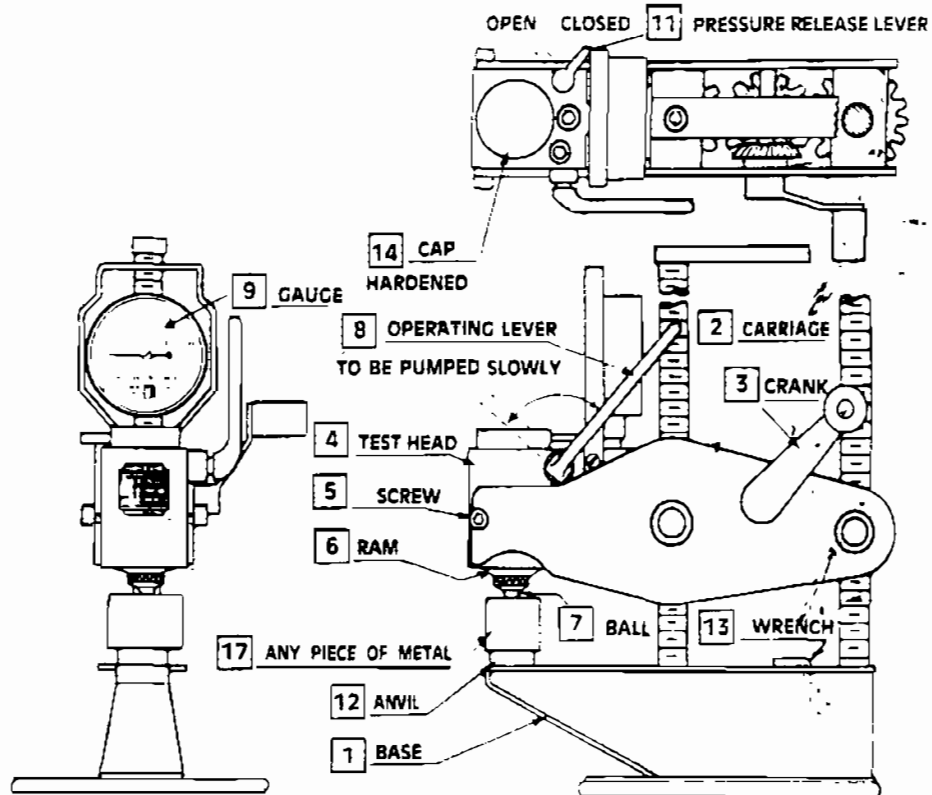
CONTENTS

DESCRIPTION
CALIBRATION
GENERAL MAINTENANCE

OPERATION
STANDARD BASE
SPECIAL APPLICATIONS

HINTS AND USES
CONVERSION TABLES

- 1 BASE
- 2 CARRIAGE
- 3 CRANK
- 4 TEST HEAD
- 5 SCREWS
- 6 RAM
- 7 BALL
- 8 OPERATING LEVER
- 9 GAUGE
- 10 BALL CAP
- 11 PRESSURE RELEASE LEVER
- 12 ANVIL
- 13 WRENCH
- 14 CAP-HARDENED
- 15 CARRYING HANDLE
- 16 7/8" ACME THREAD SCREWS
- 17 ANY PIECE OF METAL



DESCRIPTION

1 is the base, 2 is the carriage, movable up and down by the crank 3. The head 4 is mounted in the carriage and held by the screws 5. (Note that the carriage has side motion on the 7/8" screws 16. This permits elastic deformation of the screws when aligning the test head to the work. It also prevents jamming, should foreign matter lodge in the threads.)

Comprising the head 4 is the ram 6 with a 10mm ball 7 attached by ball cap 10; an operating lever 8 for operating the pump and a gauge 9 for showing when the pressure reaches the proper point.

The maximum pressure which can be applied to the ball is 3000kg. The gauge 9 shows visually that the machine is operating, but it does not control the pressure.

The operating lever 8 is pushed on the square end of the pump shaft and can be placed in any position according to requirements.

The head 4 is the unit which applies the pressure. It is readily detachable from the carriage 2 by backing out the screws 5. A hardened steel cap 14 takes the thrust of the load when the head is used out of the carriage. A handle is provided for carrying the head.

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.

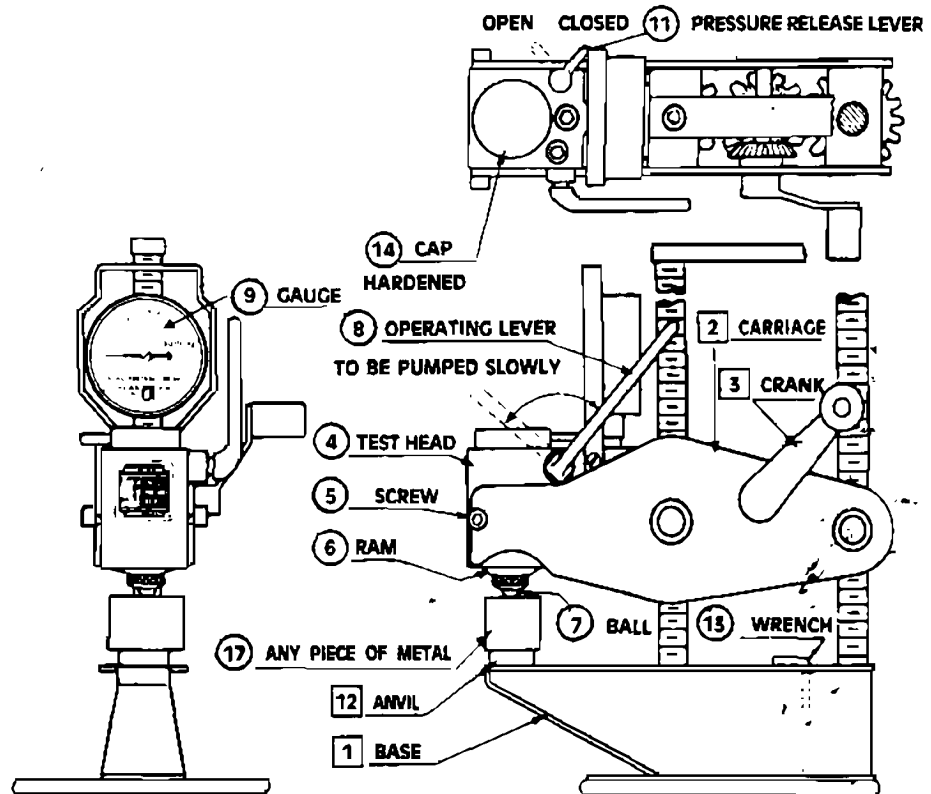
When servicing or repairing the Test Head, it is recommended that all severely worn parts be replaced with new parts. It is important that all nuts with worn threads or slots be discarded and replaced in order to facilitate reassembly and to minimize further repairs.

INSTRUCTIONS FOR OPERATION

ING 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 (8) unless the ball (7) is down firmly on a piece of metal or on part being tested.
- 3 Always keep the ball (7) firmly down on a piece of metal (17) as shown, except during tests.



OPERATION

Open valve (11), 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 (11) 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 (11) 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 (17) 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.

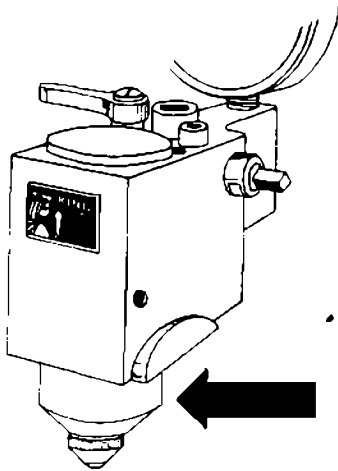
MAINTENANCE OF BASE

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

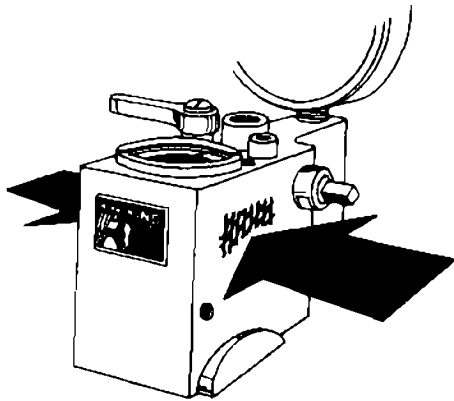
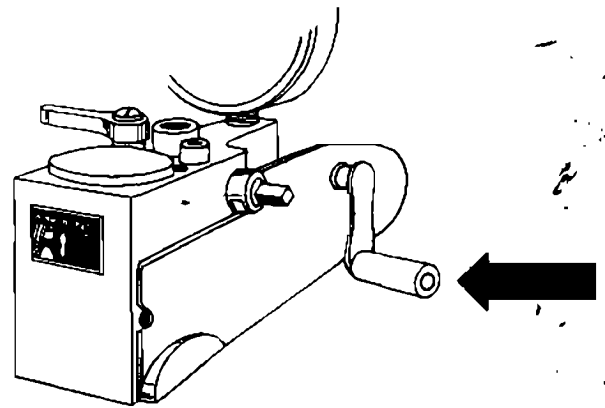
The test head (4) is taken out of the carriage [2] by taking out the screws (5) with the wrench (13).

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.

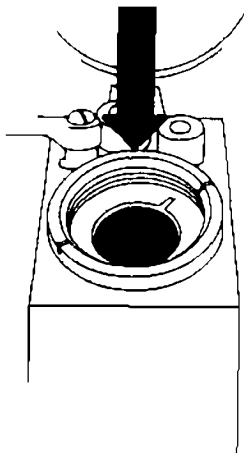


DON'T
test with ram
extended.

DO
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 mate-

rial 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 $\frac{1}{4}$ " for steel or $\frac{3}{8}$ " 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 material as thin as $\frac{1}{8}$ ".

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 $\frac{3}{8}$ " 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

Dia.	Brinell		Rockwell		Tensile Strgth. 1000 psi.	Dia.	Brinell		Rockwell		Tensile Strgth. 1000 psi.
	BHN	C	H	B			BHN	C	B		
2.00	946				4.00	228	21	98		107	
2.05	898				4.05	223	20	97		105	
2.10	857				4.10	217	18	96		103	
2.15	817				4.15	212	17	96		100	
2.20	782				4.20	207	16	95		98	
2.25	744				4.25	202	15	94		96	
2.30	713				4.30	196	14	93		95	
2.35	683				4.35	192	12	92		93	
2.40	652				4.40	187	12	91		91	
2.45	627				4.45	183	11	90		89	
2.50	600				4.50	179	10	89		87	
2.55	578				4.55	174	9	88		85	
2.60	555	55	120		4.60	170	8	87		84	
2.65	532	53	119		4.65	166	7	86		82	
2.70	512	52	119		4.70	163	6	85		81	
2.75	495	50	117		4.75	159	5	84		79	
2.80	477	48	116		4.80	156	4	83		78	
2.85	460	47	116		4.85	153	3	82		76	
2.90	444	46	115		4.90	149	2	81		75	
2.95	430	44	114		4.95	146	1	80		74	
3.00	418	43	114		5.00	143	0	79		72	
3.05	402	42	113		5.05	140	-2	78		71	
3.10	387	41	112		5.10	137	-3	77		70	
3.15	375	39	112		5.15	134		76		68	
3.20	364	38	110		5.20	131		74		66	
3.25	351	37	110		5.25	128		73		65	
3.30	340	36	109		5.30	126		72		64	
3.35	332	35	108		5.35	124		71		63	
3.40	321	34	108		5.40	121		70		62	
3.45	311	32	107		5.45	118		69		61	
3.50	302	31	106		5.50	116		68		60	
3.55	293	30	105		5.55	114		67		59	
3.60	286	29	104		5.60	112		66		58	
3.65	277	28	104		5.65	109		65		56	
3.70	269	27	104		5.70	107		64		55	
3.75	262	26	103		5.75	105		62		54	
3.80	255	25	102		5.80	103		61		53	
3.85	248	24	102		5.85	101		60		52	
3.90	241	23	100		5.90	99		59		51	
3.95	235	22	99		5.95	97		57		50	

LOW BRINELL LOADS APPLIED ON 10 mm BALL

Dia.	1000 Kg.	750 Kg.	500 Kg.	250 Kg.	125 Kg.	62-1/2 Kg.
1.50	578	434	289	144	72	36.1
1.55	540	405	270	135	68	33.8
1.60	506	379	253	126	63	31.8
1.65	476	356	238	119	60	29.8
1.70	446	334	223	112	56	27.9
1.75	420	314	210	105	52	26.2
1.80	392	295	196	98	49	24.5
1.85	370	278	185	92	46	23.1
1.90	350	262	175	88	44	21.9
1.95	332	248	166	84	42	20.8
2.00	315	236	158	79	40	19.8
2.05	299	224	150	75	37	18.8
2.10	286	214	143	71	36	17.9
2.15	272	204	136	68	34	17.0
2.20	261	195	130	65	32	16.2
2.25	248	186	124	62	31	15.5
2.30	238	178	119	59	30	14.9
2.35	228	170	114	57	28	14.2
2.40	217	163	109	54	27	13.6
2.45	209	156	105	52	26	13.1
2.50	200	150	100	50	25	12.5
2.55	193	144	96	48	24	12.0
2.60	185	138	93	46	23	11.6
2.65	177	133	89	44	22	11.1
2.70	171	128	86	43	21.6	10.8
2.75	165	123	83	41	20.8	10.4
2.80	159	119	80	40	20.0	10.0
2.85	153	115	77	38	19.2	9.6
2.90	148	111	74	37	18.4	9.2
2.95	143	107	72	36	18.0	9.0
3.00	139	104	70	35	17.6	8.8
3.05	134	100	67	33	16.8	8.4
3.10	129	96	65	32	16.2	8.1
3.15	125	93	63	31	15.8	7.9
3.20	121	91	61	30	15.2	7.6
3.25	118	87	59	29	14.8	7.4
3.30	114	85	57	28	14.2	7.1
3.35	110	83	55	27.5	13.8	6.9
3.40	108	80	54	27.0	13.6	6.8
3.45	104	77	52	26.0	13.0	6.5
3.50	100	75	50	25.0	12.4	6.2
3.55	98	73	49	24.5	12.2	6.1
3.60	96	71	48	24.0	12.0	6.0
3.65	92	69	46	23.0	11.6	5.8
3.70	90	67	45	22.5	11.2	5.6
3.75	88	65	44	22.0	11.0	5.5
3.80	86	63	43	21.5	10.8	5.4
3.85	82	62	41	20.5	10.2	5.1
3.90	80	60	40	20.0	10.0	5.0
3.95	78	58	39	19.5	9.8	4.9
4.00	76	57	38	19.0	9.6	4.8
4.05	74	55	37	18.5	9.2	4.6
4.10	72	54	36	18.0	9.0	4.5
4.15	70	53	35	17.5	8.8	4.4
4.20	69	51	34.5	17.2	8.6	4.3
4.25	67	50	33.6	16.8	8.4	4.2
4.30	65	49	32.6	16.3	8.2	4.1
4.35	64	48	32.0	16.0	8.0	4.0
4.40	62	46	31.2	15.6	7.8	3.9
4.45	61	45	30.4	15.2	7.5	3.8
4.50	59	44	29.7	14.8	7.4	3.7
4.55	58	43	29.1	14.5	7.2	3.6
4.60	57	42	28.4	14.2	7.1	3.6
4.65	55	41	27.8	13.9	6.9	3.5
4.70	54	40	27.2	13.6	6.8	3.4
4.75	53	39.5	26.5	13.2	6.6	3.3
4.80	52	39.0	25.9	12.9	6.4	3.2
4.85	51	38.0	25.4	12.7	6.3	3.2
4.90	50	37.0	24.9	12.4	6.2	3.1
4.95	49	36.0	24.4	12.2	6.1	3.0
5.00	48	35.5	23.8	11.9	5.9	3.0
5.05	47	35.0	23.3	11.6	5.8	2.9
5.10	46	34.0	22.8	11.4	5.7	2.8
5.15	45	33.0	22.3	11.1	5.5	2.8
5.20	44	32.5	21.8	10.9	5.4	2.7
5.25	43	32.0	21.5	10.7	5.3	2.7
5.30	42	31.5	21.0	10.5	5.2	2.6
5.35	41	31.0	20.6	10.3	5.1	2.6
5.40	40	30.0	20.1	10.0	5.0	2.5
5.45	39	29.5	19.7	9.8	4.9	2.5
5.50	38.6	29.0	19.3	9.6	4.8	2.4
5.55	38.0	28.5	19.0	9.5	4.7	2.4
5.60	37.2	28.0	18.6	9.3	4.6	2.3
5.65	36.0	27.0	18.2	9.1	4.5	2.3
5.70	35.6	26.5	17.8	8.9	4.4	2.2
5.75	35.0	26.0	17.5	8.7	4.3	2.2
5.80	34.0	25.5	17.2	8.6	4.3	2.2
5.85	33.6	25.0	16.9	8.4	4.2	2.1
5.90	33.0	24.5	16.6	8.3	4.1	2.1
5.95	32.4	24.0	16.2	8.1	4.0	2.0
6.00	31.8	23.5	15.9	7.9	3.9	
6.05	31.2	23.2	15.6	7.8	3.9	
6.10	30.8	23.0	15.3	7.6	3.8	
6.15	30.2	22.5	15.1	7.5	3.7	
6.20	29.6	22.0	14.8	7.4	3.7	
6.25	29.0	21.5	14.5	7.2	3.6	
6.30	28.4	21.2	14.2	7.1	3.5	
6.35	28.0	21.0	14.0	7.0	3.5	
6.40	27.4	20.5	13.7	6.8	3.4	

LOW BRINELL LOADS APPLIED ON 5 mm BALL

Dia.	1500 Kg.	1000 Kg.	750 Kg.	500 Kg.	250 Kg.	125 Kg.	62-1/2 Kg.
1.50	834	566	417	278	139	69	34.8
1.55	771	514	385	257	128	64	32.1
1.60	708	472	354	236	118	59	29.5
1.65	669	447	334	223	111	55	27.9
1.70	633	423	316	211	105	52	26.4
1.75	597	398	298	199	99	49	24.9
1.80	561	374	280	187	93	46	23.4
1.85	531	355	265	177	88	44	22.1
1.90	504	336	252	168	84	42	21.0
1.95	480	319	240	160	80	40	20.0
2.00	456	303	228	152	76	38	19.0
2.05	432	288	217	144	72	36	18.0
2.10	414	276	207	138	69	34.5	17.2
2.15	390	260	196	130	65	32.6	16.2
2.20	372	248	187	124	62	31.2	15.5
2.25	354	236	179	118	59	29.7	14.8
2.30	342	228	170	114	57	28.4	14.2
2.35	324	216	163	108	54	27.2	13.5
2.40	312	208	156	104	52	25.9	13.0
2.45	300	200	149	100	50	24.9	12.5
2.50	288	192	143	96	48	23.8	12.0
2.55	276	184	137	92	46	22.8	11.5
2.60	264	176	131	88	44	21.8	11.0
2.65	252	168	126	84	42	21.0	10.5
2.70	240	160	121	80	40	20.1	10.0
2.75	234	156	116	78	39	19.3	9.8
2.80	222	148	112	74	37	18.6	9.2
2.85	216	144	107	72	36	17.8	9.0
2.90	204	136	103	68	34	17.2	8.5
2.95	198	132	99	66	33	16.6	8.2
3.00	192	128	95	64	32	15.9	8.0
3.05	186	124	92	62	31	15.3	7.8
3.10	180	120	88				