



OPERATION INSTRUCTION
OF
HAMMER HITTING TYPE BRINELL HARDNESS TESTER
MODEL HBC



ISO9001

LAIZHOU HUAYIN TESTING INSTRUMENT CO., LTD.
SHANDONG LAIZHOU TESTING MACHINE FACTORY

1. General Description

HBC Hammer – Hitting Type Brinell Hardness Tester is designed to determine the Brinell hardness value of different metals by measuring the diameter of the indentations left on the testpiece and the standard hardness test block. The indentations are obtained in such a way that a steel ball of a certain diameter is put in between the testpiece and the standard hardness test block and then an instant impact load is applied onto them. The Brinell hardness value is thus obtained by first measuring the indentations and then referring to the conversion table attached.

This tester is especially suitable for the technician to use in workshops or material store houses due to its salient characteristics of simple construction, easy operation and convenience to carry.

This tester can approximately and rapidly measure the Brinell hardness of ferrous and non – ferrous metals as listed in this manual only.

2. Application

(1) Brinell hardness test of crude or annealed steel (of non – austenitic steel only).

- (2) Brinell hardness test of refinedly quenched or quenched and then tempered steel (of non-austenitic steel only).
- (3) Brinell hardness test of cast iron.
- (4) Brinell hardness test of brass casting.
- (5) Brinell hardness test of rolled brass.
- (6) Brinell hardness test of rolled copper.
- (7) Brinell hardness test of the alloy of tin and bronze.
- (8) Brinell hardness test of the casting of aluminium alloy.

Prior to the measurement, put the shaped end of the standard hardness test block in between the steel ball and the indenter (see Fig. 1), i. e. to let the spring inside the shell press the test block on to the steel ball tightly.

The rust or corrosion layer on the surface of the testpiece, if any, should be removed for a clear indentation so as to get a more accurate test result.

Having done the above, the test can be started. When doing the test, the hardness tester with

test block in must be first placed perpendicularly on the testpiece and then give a perpendicular and an instantaneous hit on the indenter with the hammer attached (The hit is not necessarily very heavy, see Fig. 2). Due to the hit by the hammer, an indentation is left at the same time on the standard hardness test block and the testpiece respectively. The diameter of the indentation on the standard hardness test block must not be beyond 4.2mm. If otherwise, the test is ineffective. When hitting the indenter, attention must be concentrated, not to hit second time on the same indentation.

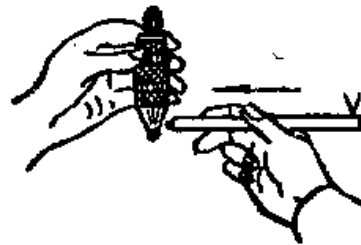


Fig. 1

The two indentations left on both the standard hardness test block and the testpiece should be measured by the attached $20\times$ microscope (the graduation of the knuckle wheel is 0.01mm). If the indentation is oval, the average diameter should be used. Besides, the center distance between the two adjacent indentations on the standard hardness

test block must not be less than 10 mm.

When the measurement of the indentations is taken (the third decimal be rounded or interpolated), you can look up from the attached conversion table the hardness value of the testpiece.

Finally, the user's attention is invited that after long service of the tester, the convex shaped end of the indenter will be deformed because of the frequent hitting by the hammer. In such a case, the indenter must be perfectly dressed before it is used again.

Instruction for how to use the conversion table;

First refer to the table which is for the material that you want to test, from which first find out the caption column "The Diameter of the indentation on the standard hardness test block" and

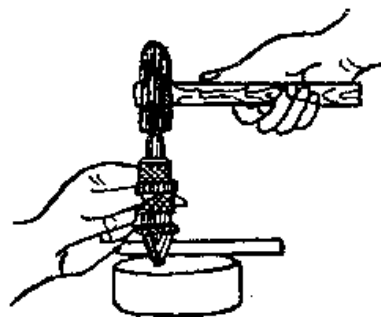


Fig. 2

consequently decide the transversal column according to the practically measured diameter of the indentation. Then find out the caption column “The diameter of the indentation on the testpiece” and consequently decide the longitudinal column according to the practically measured diameter of the indentation. And then extend the two columns to where they focus. And just here in the focused lattice you can get the wanted Brinell hardness value.

Example:

When the test is to be done by using the standard hardness test block, the hardness of which is 197HBS.

(Suppose the testpiece is of crude or annealed steel)

And as it is known: The diameter of the indentation left by the steel ball on the standard hardness test block is 2.3mm.

The diameter of the indentation left by the steel ball on the testpiece is 2.5mm.

Then; the Brinell hardness value looked up = 150 HBS. (from Table 1)

Thus; the Brinell hardness value of the testpiece = $150 \times$ proportional coefficient (here it is 1)

In this operation manual are included several digit tables, from which you can look up the Brinell value of the material that you want to test.

The digits given in the table are all based on the standard hardness test block, of which the Brinell hardness is 197 HBS. All the standard hardness test blocks attached to this tester are imprinted at the end with its actual Brinell hardness value and the proportional coefficient to be used in conversion. Therefore, if the hardness value of the attached hardness test block is greater or less than 197 HBS, the Brinell hardness value looked up from the conversion table must be multiplied by the proportional coefficient imprinted on the test block used. The result is the Brinell hardness of the testpiece.

Example:

If the Brinell hardness value of the standard hardness test block is 185 HBS.

Its proportional coefficient is 0.94.

So the Brinell hardness test value = $0.94 \times$ Brinell hardness value.

One more example;

If the Brinell hardness value of the standard hardness test block is 217HBS.

Its proportional coefficient is 1.10.

So the Brinell hardness test value = $1.10 \times$ Brinell hardness value.

The others by analogy.

Table 1 – Brinell Hardness Test Value of Crude or Annealed Steel

State Crude or Annealed	The diameter of the indentation on the testpiece(mm)														
	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
The diameter of the indentation on the standard hardness test block (mm) (The Brinell hardness value of the standard hardness test block 197 HES)	1.6	197	162	134	112										
	1.7	227	197	164	137	116	98								
	1.8	258	225	197	166	140	119	101							
	1.9	292	255	223	197	167	142	122	105						
	2.0	327	286	251	222	197	169	145	125	108					
	2.1	365	319	280	248	221	197	170	147	127	111	97			
	2.2		354	311	276	245	220	197	171	149	130	114	100		
	2.3			344	305	272	243	219	197	172	150	132	117	103	
	2.4				336	299	268	241	218	197	173	152	134	119	106
	2.5					328	294	264	239	217	197	174	154	136	121

Table 1 – Brinell Hardness Test Value of Crude or Annealed Steel

State Crude or Annealed	The diameter of the indentation on the testpiece(mm)														
	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
(The Brinell hardness value of the standard hardness test block 197 HBS)	2.6				358	321	289	261	237	216	197	175	155	138	123
	2.7					349	314	285	259	236	215	197	176	156	142
	2.8						341	309	281	256	234	215	197	177	158
	2.9							335	304	277	254	233	214	197	177
	3.0							361	328	299	274	252	232	214	197
	3.1								353	322	295	271	250	231	213
	3.2									346	317	292	268	248	229
	3.3										339	312	287	266	246
	3.4										363	334	308	285	263
3.5											356	328	303	281	

The diameter of the indentation on the testpiece(mm)																		
3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
110	99																	
125	115	104																
142	128	115	104															
159	144	129	117	106	96													
178	160	145	131	119	108	97												
197	178	161	146	133	121	110	101											
212	197	179	163	147	135	123	112	102										
228	212	197	180	163	149	136	124	114	105	96								
244	227	212	197	180	165	150	137	126	115	106	98							
261	243	226	211	197	181	165	151	139	127	117	108	100						

Table 1 - Brinell Hardness Test Value of Crude or Annealed Steel

State Crude or Annealed	The diameter of the indentation on the testpiece(mm)														
	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
(The Brinell hardness value of the standard hardness test block 197 HBS)	3.6					350	323	299	278	259	241	225	211	197	181
	3.7						343	318	296	275	257	240	225	210	197
	3.8						365	338	314	292	273	255	237	224	210
	3.9							358	333	310	289	270	253	238	223
	4.0								352	328	306	286	268	252	235
	4.1									347	323	303	283	266	250
	4.2									366	341	320	299	281	264
	4.3										360	337	315	296	278
	4.4											355	332	312	293
	4.5												349	328	309

The diameter of the indentation on the testpiece(mm)																		
3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6
163	152	140	129	119	110	101												
182	167	154	141	131	121	111	103	96										
197	182	168	154	143	132	122	113	105	98									
210	197	182	168	155	144	133	123	115	107	100								
223	209	197	182	169	156	145	134	125	116	108	101							
236	221	209	197	183	169	157	146	136	126	117	110	102	96					
249	234	221	209	197	183	170	158	147	137	127	119	111	104	79				
262	247	233	220	208	197	183	171	159	148	138	129	120	113	105	99			
276	260	246	232	220	208	197	184	172	160	149	139	130	122	114	107	100		
291	274	259	245	232	220	208	197	184	172	160	150	140	131	123	115	108		

Remarks for Table 1:

1. The table is suitable for non-austenitic steel only as the figure covered in the table refer to nothing about austenitic steel.
2. The heat treatment condition of the tested material should be better known. If otherwise, the table is only suitable for those materials of $HB < 360$.

Table 2 - Brinell Hardness Test Value of Refinedly Quenched or Quenched and then Tempered Steel

State Refined or Quenched	The diameter of the indentation on the testpiece(mm)															
	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	
(The Brinell hardness value of the standard hardness test block 197 HBS)	1.6	197														
	1.7	227	197													
	1.8	258	225	197												
	1.9	292	255	223	197											
	2.0	327	286	251	222	197										
	2.1	365	319	280	248	221	197									
	2.2	405	354	311	276	245	220	197								
	2.3	447	391	344	305	272	243	219	197							
	2.4	492	430	379	336	299	268	241	218	197						
	2.5	538	471	415	368	328	294	264	239	217	197					

Table 2 - Brinell Hardness Test Value of Refinedly Quenched or Quenched and then Tempered Steel

State Refined or Quenched	The diameter of the indentation on the testpiece(mm)														
	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
(The Brinell hardness value of the standard hardness test block 197 HBS)	2.6	513	452	401	358	321	289	261	237	216	197	175			
	2.7	558	492	437	390	349	314	285	259	236	215	197	176		
	2.8		533	473	422	379	341	309	281	256	234	215	197	177	
	2.9			511	457	410	369	335	304	277	254	233	214	197	177
	3.0			551	492	441	398	361	328	299	274	252	232	214	197
	3.1				529	475	428	388	353	322	295	271	250	231	213
	3.2					509	460	416	379	346	317	292	268	248	229
	3.3					545	492	446	405	370	339	312	287	266	246
	3.4						525	476	433	396	363	334	308	285	263
3.5						560	508	462	422	387	356	328	303	281	

The diameter of the indentation on the testpiece(mm)																		
3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
178																		
197	178																	
212	197	179																
228	212	197	180															
244	227	212	197	180														
261	243	226	211	197	181													

Table 2 - Brinell Hardness Test Value of Refinedly Quenched or Quenched and then Tempered Steel

State Refined or Quenched	The diameter of the indentation on the testpiece(mm)																
	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0		
The diameter of the indentation on the standard hardness test block (mm) (The Brinell hardness value of the standard hardness test block 197 HBS)	3.6							540	492	450	412	379	350	323	299		
	3.7								523	478	438	402	371	343	318		
	3.8								554	506	465	427	394	365	338		
	3.9									536	492	452	418	386	358		
	4.0										520	479	441	409	379		
	4.1											549	505	467	432	400	
	4.2												533	493	455	422	
	4.3													562	518	480	445
	4.4														545	504	468
	4.5															531	492

The diameter of the indentation on the testpiece(mm)																		
3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
278	259	241	225	211	197	181												
296	275	257	240	225	210	197	182											
314	292	273	255	239	224	210	197	182										
333	310	289	270	253	238	223	210	197	182									
352	328	306	286	268	252	236	223	209	197	182								
372	347	323	303	283	266	250	236	221	209	197	183							
393	366	341	320	299	281	264	249	234	221	209	197	183						
414	386	360	337	315	296	278	262	247	233	220	208	197	183					
436	406	376	355	332	312	293	276	260	246	232	220	208	197	184				
458	426	399	373	349	328	309	291	274	259	245	232	220	208	197	184			

Remarks for Table 2:

1. The table is suitable for non - austenitic steel only as the figure covered in the table refer to nothing about austenitic steel.

2. The heat treatment condition of the tested material should be better known. If otherwise, use table 1. But if the Brinell hardness of the tested materials are beyond 360HBS, use this table whatever condition.

Table 3 – Brinell Hardness Test Value of Cast Iron

		The diameter of the indentation on the testpiece(mm)														
		1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7
The diameter of the indentation on the standard hardness test block (mm)	1.5	280	237	203	176	153	134	119								
	1.6	323	274	235	203	177	156	138	122							
	1.7	369	314	269	233	203	179	158	141	126						
	1.8	419	356	305	265	231	203	180	160	143	129					
	1.9	473	402	345	299	261	230	203	181	162	146	132				
	2.0	530	449	386	334	293	258	228	203	182	164	148	135	122		
	2.1		501	430	373	326	287	255	227	203	183	165	150	137	125	
	2.2		555	477	413	362	319	282	252	226	203	184	167	152	139	128
	2.3			526	455	399	352	312	278	250	225	203	185	169	154	142
	(The Brinell hardness value of the standard hardness test block 197 HBS)	2.4			577	500	438	386	345	306	274	247	224	203	185	170
	2.5				548	480	423	375	335	301	271	246	223	203	186	171
	2.6					524	461	409	366	328	296	268	244	222	203	187
	2.7					568	502	445	397	357	321	291	265	242	222	203
	2.8						544	482	430	386	349	316	287	263	241	221
	2.9						587	522	466	418	377	342	311	284	260	239
	3.0							560	500	448	405	367	334	305	280	257

Table 3 – Brinell Hardness Test Value of Cast Iron

		The diameter of the indentation on the testpiece (mm)														
		2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
The diameter of the indentation on the standard hardness test block (mm)	3.1	538	483	435	394	360	328	301	277	255	236	218	203	189	176	165
	3.2	576	518	467	423	386	352	322	297	274	253	235	218	203	189	177
	3.3		554	500	463	412	377	346	318	293	271	252	234	218	203	190
	3.4			534	484	441	403	369	339	313	290	269	250	233	217	203
	3.5			568	516	470	430	394	363	334	309	287	267	249	232	217
	3.6				550	500	457	419	386	356	329	305	284	264	247	231
	3.7				583	531	485	445	409	378	350	324	302	281	262	246
	3.8					562	516	472	434	400	371	344	320	298	278	260
	3.9						546	501	460	425	393	365	339	316	295	276
(The Brinell hardness value of the standard hardness test block 197 HBS)	4.0						576	530	487	449	416	386	359	334	312	292
	4.1							558	514	474	439	407	379	353	330	309
	4.2								542	500	463	430	400	373	348	326
	4.3									571	528	488	453	421	392	367

Remarks: 1. The Brinell hardness test value in this table is measured under such conditions that the load applied is 9807N, the diameter of the steel ball is 10mm, and the thickness of the testpiece is greater than 6mm.

The diameter of the indentation on the testpiece(mm)																		
3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3
154	145	136	128															
166	155	146	137	129														
178	167	157	148	139	131	124												
190	179	168	158	149	140	133	126											
203	191	179	169	159	150	142	134	127										
216	203	191	180	169	160	151	143	136	129									
230	216	203	191	180	170	161	152	144	137	130	124							
244	229	215	203	191	181	171	162	153	146	138	131	125						
259	243	229	215	203	192	181	172	163	154	147	140	133	127					
274	257	242	228	215	203	192	181	172	163	156	148	141	134	128	122			
289	272	256	241	227	215	203	192	182	173	164	157	149	142	135	129	124		
305	289	270	254	240	227	214	203	192	183	174	165	157	150	143	137	131	125	
322	302	284	268	253	239	226	214	203	192	183	174	166	158	151	144	138	132	126

2. The figures in the table only stand for the Brinell hardness test value.

Table 4 - Brinell Hardness Test Value of Brass Casting

		The diameter of the indentation on the testpiece(mm)														
		1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
The diameter of the indentation on the standard hardness test block (mm)	1.5	204	177	155	136	121	108	97	87	79	72	65	60	55	50	46
	1.6		204	178	157	139	124	111	100	91	83	75	69	64	58	54
	1.7			204	130	159	142	127	115	104	95	87	79	73	67	62
	1.8				204	181	162	145	131	119	108	98	90	83	77	70
	1.9					204	182	163	147	134	122	111	102	93	86	80
	2.0						204	183	165	150	136	124	114	105	97	89
(The Brinell hardness value of the standard hardness test block 197 HBS)		The diameter of the indentation on the testpiece(mm)														
		2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
	2.1		204	184	167	152	138	127	117	108	99	92	85	80	74	69
	2.2			204	185	168	153	140	129	119	110	102	95	89	83	77
	2.3				204	185	169	155	143	132	122	113	105	98	91	85
	2.4					204	186	170	157	145	134	124	115	107	100	94
	2.5						204	187	172	159	147	137	127	118	110	103
2.6							204	187	173	160	149	138	129	120	112	

The diameter of the indentation on the testpiece(mm)																			
3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	
50	46																		
57	53	49	46																
65	60	56	52	49	46														
74	69	64	59	55	52	49	46												
83	77	71	67	62	58	54	51	48	46										

The diameter of the indentation on the testpiece(mm)																			
3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	
65	61	57	54	51	48	45													
72	68	64	60	56	53	50	48	45											
80	75	71	66	63	59	56	53	50	48	45									
88	82	78	73	69	65	62	58	55	52	50	48	45							
97	91	85	80	76	72	68	64	61	58	55	52	49	47	45					
105	99	93	88	83	78	74	70	66	63	60	57	54	51	49	47	45			

Table 4 – Brinell Hardness Test Value of Brass Casting

		The diameter of the indentation on the testpiece(mm)														
		2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
The diameter of the indentation on the standard hardness test block (mm)	2.7			204	188	175	162	150	140	131	122	114	108	101	95	90
	2.8				204	189	175	163	152	142	133	124	117	110	104	98
	2.9					204	190	176	164	153	143	134	127	119	112	106
	3.0						204	190	177	166	155	145	136	128	121	114
	3.1							204	190	178	167	157	147	138	130	122
	3.2								204	191	179	168	157	148	140	132
	3.3									204	192	179	169	158	149	141
	3.4										204	192	180	169	160	151
	3.5											204	192	180	170	160
	(The Brinell hardness value of the standard hardness test block 197 HBS)	3.6											204	193	181	171
	3.7												204	193	182	
	3.8													204	193	
	3.9														204	
	4.0															
	4.1															
	4.2															

Remarks: 1. The Brinell hardness test value in this table is measured under such conditions that the load applied is 9807N, the diameter of the steel ball is 10mm, and the thickness of the testpiece is greater than 6mm.

The diameter of the indentation on the testpiece(mm)																		
4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
85	80	76	72	69	65	62	59	56	54	51	49	47	45					
92	87	83	78	74	71	67	65	61	59	56	53	51	49	47	45			
100	95	89	85	81	77	73	69	66	63	60	58	55	53	51	49	47		
108	102	97	92	87	83	79	75	72	69	65	62	60	57	55	53	50		
116	110	104	99	94	89	85	81	77	73	70	67	64	62	59	57	54		
125	118	112	106	100	95	91	87	83	79	75	72	69	66	63	60	58		
133	126	119	113	108	102	97	93	88	84	81	77	74	71	68	65	62		
142	135	128	121	115	109	104	99	95	90	87	83	79	76	73	70	67		
152	143	137	129	123	117	111	106	101	97	92	88	84	81	77	75	71		
162	153	145	137	131	124	118	113	107	103	98	94	90	87	82	79	76		
172	163	154	146	139	132	127	120	114	109	104	100	96	92	88	84	81		
182	173	164	155	147	140	134	127	121	116	111	106	101	97	93	89	86		
194	183	174	165	157	149	142	135	129	123	118	112	107	103	99	95	91		
204	194	183	174	165	157	150	143	137	130	124	119	114	109	104	100	96		
	204	194	184	175	166	158	151	144	138	131	126	120	115	110	106	102		
		204	194	184	175	167	159	152	145	139	133	127	122	117	112	108		

2. The figures in the table only stand for the Brinell hardness test value of brass casting.

Table 5 – Brinell Hardness Test Value of Rolled Brass

		The diameter of the indentation on the testpiece(mm)														
		1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
The diameter of the indentation on the standard hardness test block (mm)	1.5	204	176	153	133	118	104	93	84	75	68	62	56	51	47	
	1.6		204	177	155	137	121	108	97	87	79	72	66	60	55	50
	1.7			204	179	157	140	125	112	101	91	83	75	69	63	58
	1.8				204	180	160	143	128	116	104	95	87	79	73	67
	1.9					204	181	162	145	131	119	108	98	90	83	76
	2.0						204	182	164	147	134	122	111	101	93	86
(The Brinell hardness value of the standard hardness test block 197 HBS)	The diameter of the indentation on the testpiece(mm)															
		2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
	2.1		204	183	165	150	136	124	114	104	96	89	82	79	71	66
	2.2			204	184	167	152	138	127	116	107	99	92	85	79	74
	2.3				204	185	168	154	140	129	119	110	102	95	88	82
	2.4					204	185	169	155	143	131	121	112	105	97	91
2.5						204	186	171	157	145	133	124	115	107	99	
2.6							204	187	172	158	147	135	126	117	109	

The diameter of the indentation on the testpiece(mm)																		
3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
46																		
54	50																	
62	57	53	49	46														
70	65	60	56	52	48	45												
79	73	68	63	59	55	51	48	45										
The diameter of the indentation on the testpiece(mm)																		
3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3
62	58	54	51	47	45													
69	64	60	56	53	50	47	44											
76	72	67	63	59	55	52	49	47	44									
85	79	74	69	65	61	58	55	52	49	46								
93	87	82	77	72	68	64	60	57	54	51	49	46						
102	96	89	84	79	75	70	66	62	59	56	53	50	48	46				

Table 5 - Brinell Hardness Test Value of Rolled Brass

		The diameter of the indentation on the testpiece(mm)														
		2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
The diameter of the indentation on the standard hardness test block (mm)	2.7			204	187	173	160	148	137	128	119	112	105	98	92	86
	2.8				204	188	174	161	150	139	130	121	114	107	100	94
	2.9					204	188	174	162	151	140	131	123	116	109	102
	3.0						204	189	175	163	152	142	133	125	117	111
	3.1							204	189	176	164	153	144	135	127	119
	3.2								204	189	177	165	155	145	136	128
	3.3									204	190	178	166	156	147	138
	3.4										204	190	178	167	157	148
	3.5											204	191	179	168	158
	(The Brinell hardness value of the standard hardness test block 197 HBS)	3.6											204	191	180	169
	3.7												204	192	180	
	3.8													204	192	
	3.9														204	
	4.0															
	4.1															
	4.2															

Remarks: 1. The Brinell hardness test value in this table is measured under such conditions that the load applied is 9807N, the diameter of the steel ball is 10mm, and the thickness of the testpiece is greater than 6mm.

The diameter of the indentation on the testpiece(mm)																		
4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
81	77	72	69	65	62	59	55	52	50	48	45							
89	83	79	75	71	67	64	60	57	54	52	50	47						
96	91	85	81	77	73	69	65	62	59	57	54	51	49	47				
104	98	93	88	83	79	75	71	67	64	61	59	56	53	51	49	47		
112	106	100	95	90	85	81	77	73	70	66	63	60	58	55	53	51		
121	114	108	102	97	92	87	83	79	75	72	68	65	62	59	57	55		
130	123	116	110	104	97	94	89	85	81	77	73	70	67	64	61	59		
139	132	125	118	112	106	100	96	91	87	83	79	75	72	69	66	63		
149	140	133	126	120	113	107	102	97	93	88	84	80	77	74	71	68		
159	150	142	134	127	121	115	109	104	99	94	90	86	82	79	75	72		
170	160	151	143	136	129	122	117	111	106	101	96	92	88	84	81	77		
181	171	161	153	145	137	130	124	118	112	107	102	98	94	90	86	82		
192	181	171	162	154	146	138	133	125	119	114	109	104	99	95	91	87		
204	192	182	172	163	155	147	140	133	127	121	115	110	106	101	97	93		
	204	193	182	173	164	156	148	141	134	128	122	117	112	107	102	98		
		204	193	182	173	165	156	149	142	135	129	124	119	113	108	104		

2. The figures in the table only stand for the Brinell hardness test value of the rolled brass.

Table 6 – Brinell Hardness Test Value of Rolled Copper

		The diameter of the indentation on the testpiece(mm)														
		1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
The diameter of the indentation on the standard hardness test block (mm)	1.5	204	175	152	133	117	104	93	83	75	68	62	56	51	47	43
	1.6		204	176	155	136	121	108	97	87	79	72	65	60	55	50
	1.7			204	178	157	139	124	112	101	91	83	75	69	63	58
	1.8				204	179	159	142	127	115	104	95	86	79	72	67
	1.9					204	180	161	145	130	118	107	98	90	82	76
	2.0						204	181	163	147	133	121	110	101	93	86
(The Brinell hardness value of the standard hardness test block 197 HBS)	The diameter of the indentation on the testpiece(mm)															
		2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5
	2.1	204	182	165	149	135	124	113	104	96	89	82	76	71	66	61
	2.2		204	182	166	151	148	126	116	107	99	91	85	79	73	69
	2.3			204	183	167	152	140	129	118	110	101	94	88	82	76
	2.4				204	184	169	154	142	131	121	112	104	97	90	84
	2.5					204	185	170	156	144	133	123	115	106	99	93
	2.6						204	186	171	158	146	135	125	117	109	102
	2.7							204	187	172	159	147	137	127	119	111

The diameter of the indentation on the testpiece(mm)																		
3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
40																		
47	43	40																
54	50	46	43	40														
61	57	53	49	45	42	40												
70	65	60	56	52	48	45	42	40										
79	73	68	63	59	55	51	48	45	42	40								
The diameter of the indentation on the testpiece(mm)																		
3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4
57	54	51	47	45	42	40												
64	60	56	53	50	47	44	42	40										
71	67	63	59	55	52	49	47	44	42	40								
79	74	70	65	61	58	55	52	49	46	44	42	40						
87	81	76	72	68	64	60	57	54	51	48	46	44	42	40				
95	89	84	79	74	70	66	62	59	56	53	50	48	46	44	41	39		
104	97	92	86	81	77	72	68	65	61	58	55	53	50	48	45	43	41	39

Table 6 - Brinell Hardness Test Value of Rolled Copper

		The diameter of the indentation on the testpiece(mm)														
		2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
The diameter of the indentation on the standard hardness test block (mm)	2.8				204	187	173	161	149	138	129	121	113	106	100	94
	2.9					204	187	174	162	150	140	131	123	115	108	102
	3.0						204	188	175	163	152	142	133	125	118	110
	3.1							204	188	175	164	153	143	135	127	119
	3.2								204	189	176	165	154	145	136	129
	3.3									204	189	177	166	155	146	137
	3.4										204	189	178	167	157	147
	3.5											204	190	179	168	158
	3.6												204	191	179	169
	3.7													204	191	179
	3.8														204	191
	3.9															204
	4.0															
4.1																
4.2																
4.3																

Remarks: 1. The Brinell hardness test value in this table is measured under such conditions that the load applied is 9807N, the diameter of the steel ball is 10mm, and the thickness of the testpiece is greater than 6mm.

The diameter of the indentation on the testpiece (mm)																		
4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
88	84	79	75	71	67	64	60	57	55	52	50	47	45	43	41	39		
96	91	86	81	77	73	69	66	63	60	57	54	52	49	47	45	43		
104	98	93	88	83	79	75	71	68	65	62	59	56	53	51	49	47		
112	106	100	95	90	86	81	77	73	70	67	63	60	58	55	53	51		
121	114	108	102	97	92	87	83	79	75	72	69	65	62	60	57	55		
130	123	116	110	104	99	94	89	85	81	77	74	71	67	64	61	59		
139	131	125	118	112	106	101	96	91	87	83	79	76	73	69	66	63		
149	141	133	126	120	114	108	103	98	93	89	85	81	78	75	71	68		
160	150	143	135	128	121	115	110	105	99	95	91	87	83	79	76	73		
169	160	152	143	136	129	123	117	111	106	101	97	92	88	85	81	78		
180	170	161	153	145	137	131	124	118	113	108	103	98	94	90	86	83		
191	180	170	162	153	145	138	132	125	119	114	109	104	99	95	91	87		
204	191	181	171	162	154	146	139	133	127	121	115	110	106	101	97	93		
	204	191	181	172	163	155	148	141	134	128	122	117	112	107	102	98		
		204	192	182	173	164	156	149	142	135	129	123	118	113	109	104		
			204	192	182	173	165	157	150	143	137	130	125	119	114	110		

2. The figures in the table only stand for the Brinell hardness test value of the rolled brass.

Table 7—Brinell Hardness Test Value of the Alloy of Tin and Bronze

		The diameter of the indentation on the testpiece(mm)														
		1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
The diameter of the indentation on the standard hardness test block (mm)	1.5	176	152	133	116	103	91	82	73	66	60	54				
	1.6	204	176	153	134	119	106	95	85	77	70	63	58	53		
	1.7	234	203	176	155	137	121	108	98	88	80	73	66	61	56	52
	1.8	266	231	201	176	156	139	124	111	101	91	83	76	70	64	59
	1.9		260	227	200	176	157	140	126	114	103	94	86	79	72	67
	2.0			255	224	198	176	158	142	128	116	106	97	89	82	76
	2.1				250	221	197	176	158	143	130	118	108	99	91	84
	2.2				277	246	218	196	176	159	145	132	120	110	101	94
	2.3					271	241	217	195	176	160	146	133	122	112	104
	2.4						266	238	215	194	176	161	147	135	123	114
(The Brinell hardness value of the standard hardness test block 197 HBS)	2.5						262	235	213	193	176	161	148	136	126	
	2.6							257	232	212	193	176	162	149	137	

The diameter of the indentation on the testpiece(mm)																		
3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
54																		
62	57	53																
69	64	60	56	52														
78	72	67	62	58	54	51												
87	81	75	70	65	61	57	53	50										
96	89	83	77	72	67	63	59	55	52									
106	98	91	85	80	74	69	65	61	58	54								
116	108	100	94	87	82	77	72	67	63	60	56	53						
127	118	109	102	95	89	84	79	74	69	66	62	58	55	52				

Table 7 - Brinell Hardness Test Value of the Alloy of Tin and Bronze

		The diameter of the indentation on the testpiece(mm)														
		2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
The diameter of the indentation on the standard hardness test block (mm)	2.7	253	230	210	192	176	162	150	139	128	119	111	104	97	91	86
	2.8	274	249	228	209	192	176	163	151	140	130	121	113	106	99	93
	2.9		271	247	226	208	191	176	163	152	141	131	122	115	107	101
	3.0			266	243	223	206	190	176	163	152	142	132	124	116	109
	3.1				263	241	222	205	190	176	164	153	143	134	125	117
	3.2					260	238	220	204	189	176	164	154	144	135	126
	3.3					277	255	236	219	203	189	176	165	155	145	136
	3.4						273	252	234	218	203	189	176	165	155	146
	3.5							270	250	232	216	202	188	176	165	155
	3.6								265	247	230	215	201	188	176	165
(The Brinell hardness value of the standard hardness test block 197 HBS)	3.7								263	244	228	213	200	187	176	
	3.8									260	242	226	213	199	187	
	3.9										257	241	225	212	199	
	4.0											272	255	238	224	211
	4.1												269	252	237	223
	4.2													265	250	235
	4.3														263	248

Remarks: 1. The Brinell hardness test value in this table is measured under such conditions that the load applied is 9807N, the diameter of the steel ball is 10mm, and the thickness of the testpiece is greater than 6mm.

The diameter of the indentation on the testpiece(mm)																		
3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6
81	76	71	68	64	60	57	54	51										
88	83	78	74	69	66	62	59	56	53	51								
95	90	85	80	75	71	68	64	61	58	55	52							
103	97	91	86	82	77	73	69	66	63	60	57	54						
111	104	99	93	88	83	79	75	71	68	65	61	58	56	53				
119	112	106	100	95	90	85	81	77	73	70	66	63	60	58	55	53		
127	120	113	107	101	96	91	87	82	78	75	71	68	65	62	59	57	54	52
137	129	121	115	108	103	98	93	88	84	80	76	73	70	67	64	61	58	56
146	138	130	123	116	110	104	99	94	90	85	82	78	74	71	68	65	62	60
156	147	138	131	124	117	111	106	100	96	91	87	83	79	76	72	70	67	64
166	157	147	139	132	125	118	112	107	102	97	93	88	85	81	77	74	71	68
176	166	157	148	140	133	126	120	114	108	103	99	94	90	86	82	79	76	72
187	176	166	157	149	141	134	127	121	115	109	104	100	95	91	87	84	80	77
198	187	176	167	157	150	142	135	128	122	116	110	105	101	97	92	89	85	82
210	198	187	176	167	158	150	143	136	129	123	117	112	107	102	98	94	90	87
222	209	197	186	176	167	158	151	143	136	130	124	118	113	108	103	99	95	92
233	221	208	196	186	176	167	159	151	144	137	131	125	119	114	109	104	100	96

2. The figures in the table only stand for the Brinell hardness test value of the alloy of tin and bronze having a tin content of 10~20%.

Table 8 – Brinell Hardness Test Value of The Castings of Aluminium Alloy

		The diameter of the indentation on the testpiece(mm)														
		2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
The diameter of the indentation on the standard hardness test block (mm)	1.3	82	71	62	54	47	41	37	33	29						
	1.4	103	89	77	67	59	52	46	41	37	33	30				
	1.5	126	109	95	83	73	65	57	51	46	41	37	33	30		
	1.6	152	131	115	100	89	78	70	62	56	50	45	40	37	33	30
	1.7		158	137	120	106	94	84	75	67	60	54	49	44	40	37
	1.8			162	142	126	111	99	89	79	72	65	58	53	48	44
	1.9				167	147	130	116	104	93	84	76	69	62	57	52
	2.0						152	136	121	109	98	89	80	73	67	61
	2.1							156	140	126	113	103	93	84	77	70
	2.2								160	143	130	117	107	97	89	81
(The Brinell hardness value of the standard hardness test block 197 HBS)	2.3									165	148	134	121	111	101	92
	2.4										168	152	138	126	115	105
	2.5												156	142	130	118

The diameter of the indentation on the testpiece(mm)																		
3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3
34	31																	
40	37	34	31	28														
47	43	40	37	34	31	29												
55	51	47	43	40	37	34	31											
64	59	54	50	46	43	39	37	34	32	29								
74	68	63	58	53	49	46	42	39	37	34	32	30						
85	78	72	66	61	57	52	49	45	42	39	37	34	32	30				
96	89	81	75	70	64	60	56	52	48	45	42	39	37	34	32	30		
109	100	92	85	79	73	68	63	59	55	51	48	45	42	39	37	34	32	30

Table 8 – Brinell Hardness Test Value of The Castings of Aluminium Alloy

		The diameter of the indentation on the testpiece(mm)														
		3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6
The diameter of the indentation on the standard hardness test block (mm)	2.6	159	146	133	122	112	103	96	89	82	76	71	66	61	57	54
	2.7		162	149	136	126	116	107	99	92	85	79	74	69	64	60
	2.8			165	152	140	129	119	110	102	95	88	82	77	72	67
	2.9				169	155	143	132	122	114	105	98	92	85	80	75
	3.0						158	146	135	126	117	109	101	95	89	83
	3.1							161	149	139	128	120	112	104	98	91
	3.2								164	152	141	131	122	115	107	100
	3.3									166	155	144	134	125	117	110
	3.4										169	157	147	137	128	120
	3.5												160	150	140	131
(The Brinell hardness value of the standard hardness test block 197 HBS)	3.6													163	152	142
	3.7														165	154
	3.8															167
	3.9															
	4.0															
	4.1															
	4.2															

The diameter of the indentation on the testpiece(mm)																		
4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5
50	47	44	41	39	37	35	32	31										
56	53	50	47	44	41	39	37	35	33	31	29							
63	59	55	52	49	46	43	41	39	37	34	33	31	29					
70	66	62	58	55	52	48	46	43	41	39	37	35	33	31	30			
78	73	68	64	61	57	54	51	48	45	43	41	38	36	35	33	32	30	
86	80	75	71	67	63	59	56	53	50	48	45	43	40	38	37	35	33	31
94	88	83	78	74	69	65	62	58	55	52	50	47	45	42	40	38	37	35
103	97	91	86	81	76	72	68	64	61	58	55	52	49	47	44	42	40	38
113	106	100	94	88	83	79	74	71	67	63	60	57	54	51	49	46	44	42
123	115	108	102	96	91	86	81	77	73	69	65	62	59	56	53	51	48	46
134	125	118	111	105	99	93	88	83	79	75	71	68	64	61	58	55	53	50
145	136	128	121	113	107	101	95	91	86	82	77	74	70	66	63	60	57	54
156	147	139	130	123	116	110	104	98	93	88	84	80	76	72	68	65	62	59
169	159	150	141	133	125	119	112	108	100	95	90	86	82	78	74	71	67	64
		161	152	143	135	128	121	115	109	103	97	93	88	84	80	76	73	69
			163	154	146	137	130	123	117	111	105	100	95	90	86	82	78	75
				165	156	148	140	132	125	119	113	108	102	97	93	88	85	81

Remarks:

1. The Brinell hardness test value in this table is measured under such conditions that the load applied is 9807N, the diameter of the steel ball is 10mm, and the thickness of the testpiece is greater than 6mm.
2. The figures in the table only stand for the Brinell hardness test value of the castings of aluminium alloy.