

# **Do you know what the metal hardness is?**

## **What is the Hardness?**

Hardness indicates the ability of materials to resist hard objects from pressing into their surfaces. It is one of the important performance indexes of metal materials. The higher the general hardness, the better the wear resistance. Commonly used hardness indexes are Brinell hardness (HB), Rockwell hardness (HRC) and Vickers hardness (HV), of which HB and HRC are more commonly used.

## **What's the Difference from HB/HRC/HV?:**

When Brinell hardness (HB) >450 or specimen is too small, it is not possible to use Brinell hardness test instead of Rockwell hardness (HRC). It is a diamond cone with a top angle of 120 degrees or a steel ball with a diameter of 1.59 and 3.18mm. It is pressed into the surface of the measured material under a certain load, and the hardness of the material is calculated from the depth of the indentation.

HRC is suitable for characterizing high hardness materials, such as heat treatment hardness, etc. The difference between them is that the probe of hardness tester is different, the probe of Brinell hardness tester is steel ball, and the probe of Rockwell hardness tester is diamond.

And the Vivtorinox hardness means the pressure head of a diamond positive pyramid with a relative angle of 136 degrees, which is pressed into the surface of the tested sample under the prescribed load  $F$ , and then the load is removed after the fixed time, the length of the indentation diagonal line is measured by  $D$ , and the indentation surface area is calculated. Finally, the average pressure on the indentation surface area is calculated, that the hardness value of the metal for Vivtorinox. In actual measurement, it does not need to be calculated, but according to the measured  $D$  value, the hardness value is obtained directly through the look-up table.

### **Scope of application:**

Brinell hardness (HB) is used to press a hardened steel ball with a certain diameter (the diameter is generally 10mm) into the material surface under a certain load (general 3000kg), staying for a period of time, and after loading, the ratio of load to indentation area is Brinell hardness (HB), and the unit is  $\text{kg}/\text{mm}^2$  ( $\text{N}/\text{mm}^2$ ). HB is widely used, and the supply status is commonly used, Cu and Al are also available.

Rockwell hardness is determined by indentation plastic deformation depth to determine the hardness value, with 0.002 millimeter as a hardness unit. The pressure head of the Rockwell hardness gauge C is a

diamond cone with a top angle of 120 degrees. The test load is a fixed value, and the Chinese standard is 150 kilograms force. The hardness of the Rockwell is very small. The measuring value is localized. The average value must be measured, and the finished products and lamellae should be applied to non-destructive testing. The hardness of Rockwell hardness is an unknown number, no unit. The hardness is displayed on the dial directly. It is easy to operate, fast and intuitive, and is suitable for mass production.

The Brinell hardness is the test load of a certain size, the hardened steel ball or hard alloy ball of a certain diameter is pressed into the surface of the measured metal, and the specified time is kept, then the load is unloaded and the measured surface indentation diameter is measured. The hardness value is the quotient of the load divided by the surface area of the indentation. The hardness of cloth hardness is larger, the measurement value is accurate, and it is not suitable for finished products and lamellae. The hardness of Brinell hardness has a unit and has a similar relationship with tensile strength. It is necessary to measure the indentation diameter with a microscope, and then check the table or calculate. The Vivtorinox hardness meter has a wide range of measurements and can measure almost all of the metal materials used in industry, from very soft materials (several Vivtorinox hardness units) to very hard materials (3000 units of Vivtorinox hardness).



(a)



(b)

## How to find the relationship between them?

Under certain conditions, HB and HRC can be interchanged. The conversion formula can be roughly summed up as:  $1\text{HRC} \approx 1/10\text{HB}$ .

$$\text{HV} = \text{F}/\text{Sx}0.102.$$

布氏硬度计-压痕直径与硬度值对照								布氏硬度计-压痕直径与硬度值对照															
测头直径			布氏硬度		洛氏硬度		维氏硬度		Hard Temp	抗拉强度		测头直径			布氏硬度		洛氏硬度		维氏硬度		Hard Temp	抗拉强度	
10 mm	5 mm	2.5 mm	HB	HRC	HRB	HV	kg/mm2			kg/mm2	RmN/mm2	10 mm	5 mm	2.5 mm	HB	HRC	HRB	HV	kg/mm2		kg/mm2	RmN/mm2	
2.25	1.125	0.5625	745	65.3	-	840	-	-	-	-	-	3.75	1.875	0.9375	262	26.6	103	276	89.3	-	875		
2.3	1.15	0.575	712	-	-	-	-	-	-	-	-	3.8	1.9	0.95	255	25.4	102	269	86.7	-	850		
2.35	1.175	0.5875	682	61.7	-	737	-	-	-	-	-	3.85	1.925	0.9625	248	24.2	101	261	84.2	-	825		
2.4	1.2	0.6	653	60	-	697	-	-	-	-	-	3.9	1.95	0.975	241	22.8	100	253	81.6	-	800		
2.45	1.225	0.6125	627	58.7	-	667	-	-	-	-	-	3.95	1.975	0.9875	235	21.7	99	247	80.1	-	785		
2.5	1.25	0.625	601	57.3	-	640	-	-	-	-	-	4	2	1	229	20.5	98.2	241	78.1	-	765		
2.55	1.275	0.6375	577	56	-	615	-	-	-	-	-	4.05	2.025	1.0125	223	18.9	97.0	234	76.0	-	745		
2.6	1.3	0.65	555	54.8	-	591	-	-	-	-	-	4.1	2.05	1.025	217	17.5	95.8	228	74.0	-	725		
2.65	1.325	0.6625	534	53.5	-	569	-	-	-	-	-	4.15	2.075	1.0375	212	16	95.5	222	71.9	-	705		
2.7	1.35	0.675	514	52.1	-	547	-	-	-	-	-	4.2	2.1	1.05	207	15.2	94.6	218	70.4	-	690		
2.75	1.375	0.6875	495	51	-	528	-	-	-	-	-	4.25	2.125	1.0625	201	13.8	93.8	212	68.9	-	675		
2.8	1.4	0.7	477	49.6	-	508	-	-	-	-	-	4.3	2.15	1.075	197	12.7	92.8	207	66.8	-	655		
2.85	1.425	0.7125	461	48.5	-	491	-	-	-	-	-	4.35	2.175	1.0875	192	11.5	91.9	202	65.3	-	640		
2.9	1.45	0.725	444	47.1	-	472	-	-	-	-	-	4.4	2.2	1.1	187	10	90.7	196	63.3	-	620		
2.95	1.475	0.7375	429	45.7	-	455	-	-	-	-	-	4.45	2.225	1.1125	183	9	90	192	62.8	-	615		
3	1.5	0.75	415	44.5	-	440	-	-	-	-	-	4.5	2.25	1.125	179	8	89	188	61.2	-	600		
3.05	1.525	0.7625	401	43.1	-	425	-	-	-	-	-	4.55	2.275	1.1375	174	6.4	87.8	182	59.7	-	585		
3.1	1.55	0.775	388	41.8	-	410	-	-	-	-	-	4.6	2.3	1.15	170	5.4	86.8	178	58.2	-	570		
3.15	1.575	0.7875	375	40.4	-	396	-	-	-	-	-	4.65	2.325	1.1625	167	4.4	86	175	57.1	-	560		
3.2	1.6	0.8	363	39.1	-	383	-	-	-	-	-	4.7	2.35	1.175	163	3.3	85	171	55.6	-	545		
3.25	1.625	0.8125	352	37.9	110	372	-	-	-	-	-	4.8	2.4	1.2	156	0.9	82.9	163	53.6	-	525		
3.3	1.65	0.825	341	36.6	109	360	-	-	-	-	-	4.9	2.45	1.225	149	-	80.8	156	51.5	-	505		
3.35	1.675	0.8375	331	35.5	108.5	350	-	-	-	-	-	5	2.5	1.25	143	-	78.7	150	50.0	-	490		
3.4	1.7	0.85	322	34.4	108	340	-	-	-	-	-	5.05	2.525	1.2625	137	-	76.4	143	48.5	-	460		
3.45	1.725	0.8625	313	33.3	107.5	330	-	-	-	-	-	5.1	2.55	1.275	131	-	74.1	137	46.9	-	440		
3.5	1.75	0.875	305	32.2	107	319	-	-	-	-	-	5.3	2.65	1.325	126	-	72	132	44.4	-	435		
3.55	1.775	0.8875	299	30.9	106	309	-	-	-	-	-	5.4	2.7	1.35	121	-	69.9	127	42.2	-	415		
3.6	1.8	0.9	285	29.9	105	301	-	-	-	-	-	5.5	2.75	1.375	116	-	67.6	122	40.8	-	400		
3.65	1.825	0.9125	277	28.8	104.5	292	-	-	-	-	-	5.6	2.8	1.4	111	-	65.7	117	39.3	-	385		
3.7	1.85	0.925	269	27.6	104	284	-	-	-	-	-												

(c)

Our Website: [www.fuchun-casting.com](http://www.fuchun-casting.com) / [www.fuchungroup.com](http://www.fuchungroup.com)

E-mail: [fuchun@fu-chun.cn](mailto:fuchun@fu-chun.cn)

FAX: 0086-574-89017166

TEL: 0086-574-89017168-8007

SKYPE: lilydong522

ADD: Trade Centre of Ningbo, Tiantong South Road No.588, Yinzhou  
District, Ningbo