
TSBC
THE STEEL BALL COMPANY LIMITED

A RANGE DESIGNED TO MEET DEMAND

ROLLED STEEL BALLS

The major advantage of precision ball rolling, compared with traditional forging methods, is the uninterrupted grain flow. Grinding balls are rolled from selected carbon and alloy steels, produced to customers' precise specifications. A special feature of the TSBC manufacturing process is the computerised quench facility, giving uniform surface hardness and controlled cross-sectional hardness essential for very even wear.

SPECIFICATIONS

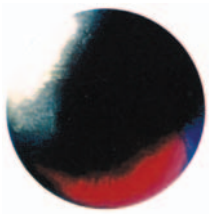
- Rolled direct from bar, followed by in-line heat treatment and uniform quenching, tailored to give even hardness throughout.
- Hardness: ranging up to and including 739 Brinell.
- Ball sizes: 10 diameters available, from 16 mm to 70 mm.
- Other sizes may be available on request, subject to volume and lead time.

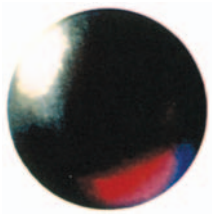
FORGED STEEL BALLS

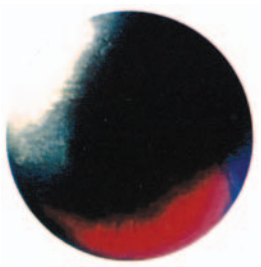
TSBC forged steel balls are essentially for semi-autogenous and primary milling, where balls over 70 mm diameter are required for impact grinding.

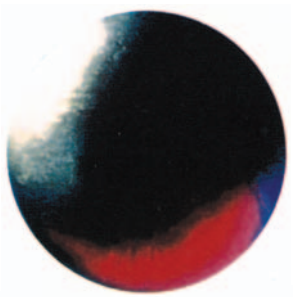
SPECIFICATIONS

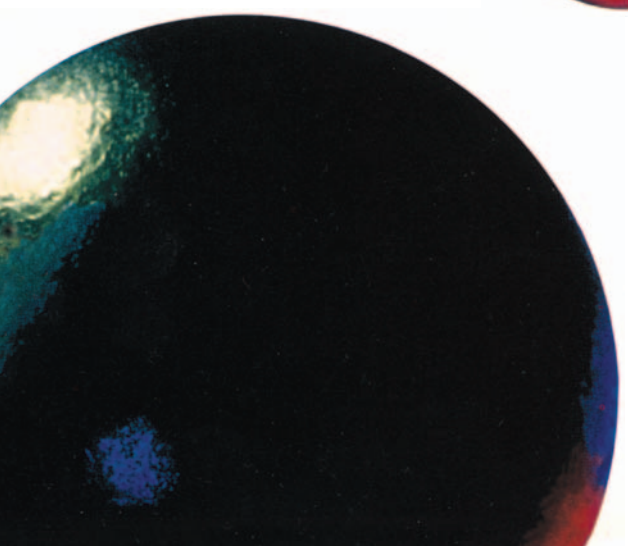
- Hammer forged from selected carbon and alloy steels.
- Hardness: maximum 500 Brinell.
- Ball sizes: 6 diameters available, from 75 mm to 150 mm.
- Other sizes may be available on request.

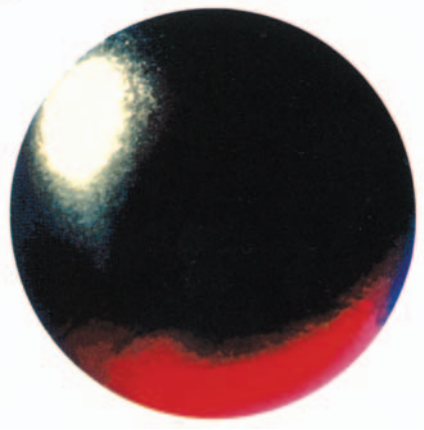












QUALITY CONTROL AND HARDNESS MEASUREMENT

PRODUCT DATA				
Nominal ball diameter mm	Approx. Mass per ball g	Approx. Surface area mm^2	Average number of balls per m^3	Average number of balls per tonne (1000 kg)
ROLLED STEEL BALLS				
16	17	805	274,991	59,374
20	33	1,257	140,795	30,400
22	44	1,521	105,782	22,840
25	64	1,964	72,087	15,565
30	111	2,829	41,717	9,007
40	263	5,029	17,599	3,800
50	514	7,857	9,011	1,946
60	888	11,314	5,215	1,126
65	1,129	13,279	4,101	886
70	1,410	15,400	3,284	709
FORGED STEEL BALLS				
75	1,735	17,679	2,670	576
80	2,105	20,114	2,200	475
90	2,998	25,457	1,545	334
100	4,112	31,429	1,126	243
120	7,105	45,257	652	141
150	13,878	70,714	334	72

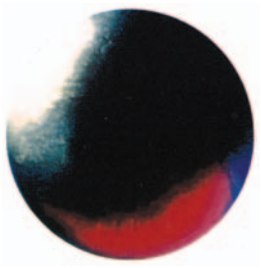
The above tables are presented for your reference and for your convenience.

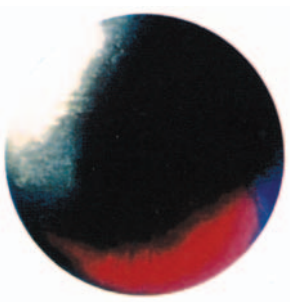
In the long term, the effectiveness of grinding media must be measured by the final cost per tonne of product efficiently ground. TSBC advanced manufacturing methods and materials guarantee the maintenance of the geometrical tolerances and correct structures vital to reliable, consistent performance and long life. TSBC products are rigorously tested to ensure that they meet the agreed specifications.

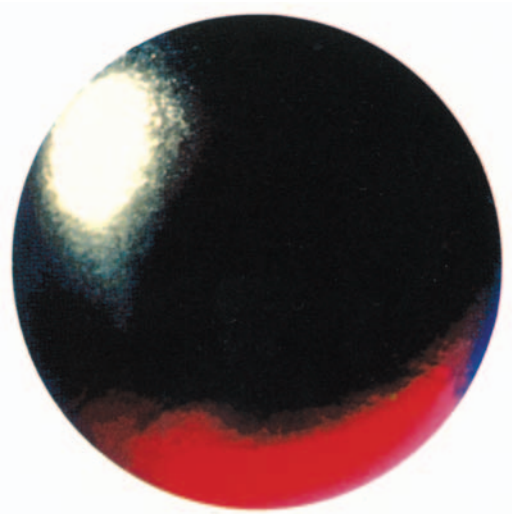
BALL HARDNESS: 'THRU HARD' OR 'TOUGH CORE'

TSBC expertise will ensure that you specify the most suitable grinding media for your particular application. The TSBC 'thru hard' ball has a uniform high hardness from surface to core, thus maintaining very good wear properties down to very small diameters.

The 'tough core' ball has a hard outer layer for long life, coupled with a tough, resilient core giving good impact resistance.







PRESENTING THE HARD FACTS ON AVERAGE VOLUMETRIC HARDNESS

HARDNESS CONVERSION TABLE

Rockwell C Scale Hardness Number	Brinell Hardness Number 10 mm Ball, 3000 kg Load		Vickers Hardness Number
	Standard Ball	Tungsten Carbide Ball	
68	–	–	940
67	–	–	900
66	–	–	865
65	–	739	832
64	–	722	800
63	–	705	772
62	–	688	746
61	–	670	720
60	–	654	697
59	–	634	674
58	–	615	653
57	–	595	633
56	–	577	613
55	–	560	595
54	–	543	577
53	–	525	560
52	500	512	544
51	487	496	528
50	475	481	513
49	464	469	498
48	451	455	484
47	442	443	471
46	432	432	458
45	421	421	446
44	409	409	434
43	400	400	423
42	390	390	412
41	381	381	402
40	371	371	392
39	362	362	382
38	353	353	372
37	344	344	363
36	336	336	354
35	327	327	345
34	319	319	336
33	311	311	327
32	301	301	318
31	294	294	310
30	286	286	302
29	279	279	294
28	271	271	286
27	264	264	279
26	258	258	272
25	253	253	266

ASTM E140-67

How hard is hard? The illustrations shown here tell an interesting story. Illustration 'A' shows an analysis of the cross sectional hardness of a TSBC 'thru hard' ball. Illustration 'B' shows the same analysis carried out on a ball from another major grinding media manufacturer. The ball in illustration 'B' has the same AVH figure as the TSBC ball. Yet there the similarity ends. After three quarters of the radius, the hardness of the 'B' ball dips below that of the TSBC ball and the wear rate increases. This brings into focus the area of greatest discussion about using AVH values. Over 72% of the final value is made up from the surface and ¾ radius hardness readings. So AVH tells us relatively little about how a ball is going to perform once it has worn past that stage. The cross sectional hardness profile tells the full 'inside story'.

Q What kind of performance will the ball in illustration 'B' give?

A *Once the ball has worn down to approximately ⅔ diameter, the remainder will wear away very quickly.*

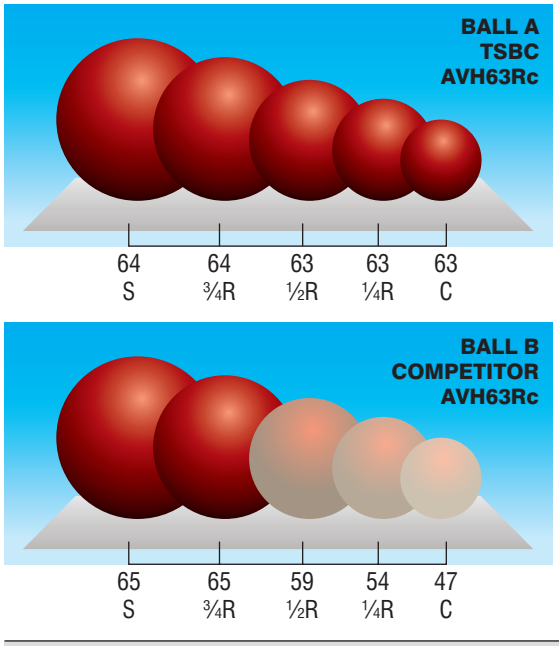
Q How will this affect the mill output?

A *The rapidly wearing grinding media will give rise to an unstable and imbalanced ball charge, resulting in the possibility of more than one top up size being required to ensure the correct mesh of grind.*

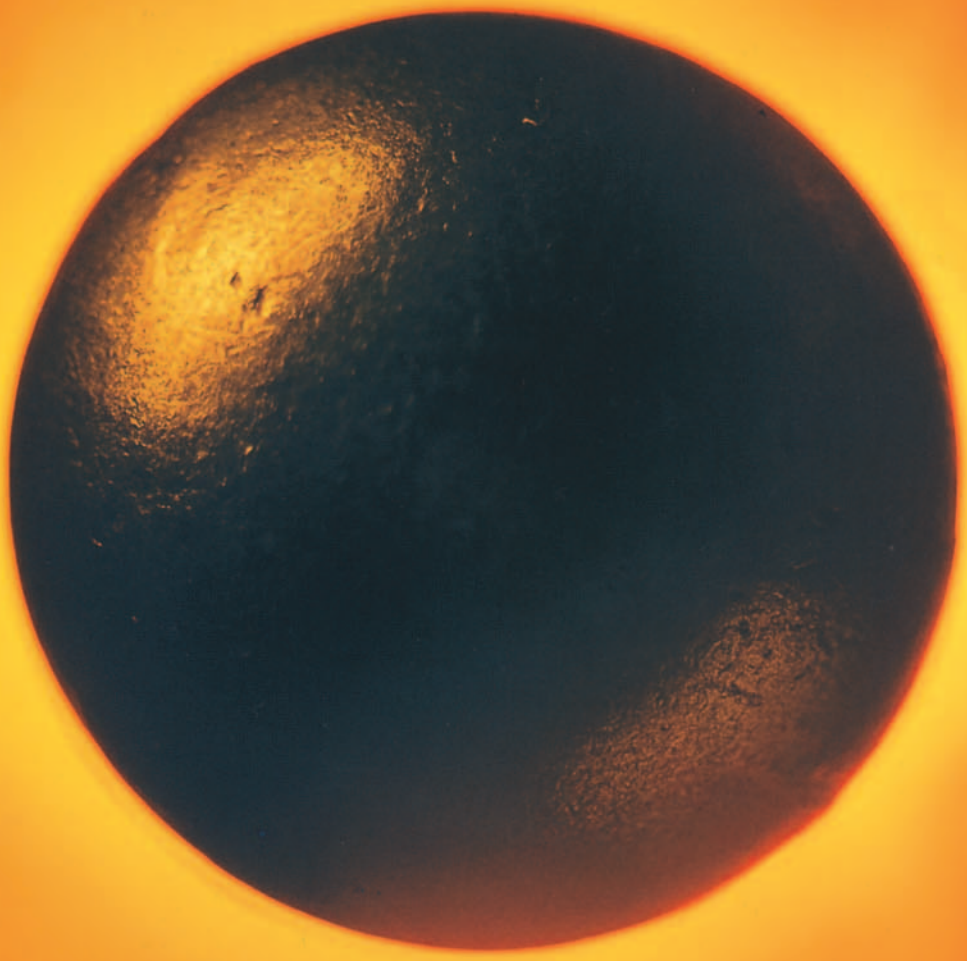
Q How will the TSBC ball perform?

A *The cross sectional hardness profile shows that the TSBC 'thru hard' ball will wear evenly throughout its life. This will give a better size distribution in the mill, and avoid 'dead zone grinding'. The shape of the ball will be preserved for much longer, giving a far more efficient grind.*

The conclusions are obvious. High quality such as TSBC offer, always saves money in the long run.



AVH = 0.289 x Surface Hardness (S) + 0.437 x Hardness ¾ R + 0.203 x Hardeness ½ R + 0.063 x Hardness ¼ R + 0.008 x Centre Hardness (C)



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FROM ENQUIRY TO DELIVERY, TSBC SUPPORT GOES FURTHER

When you contact TSBC, you'll find an expert service to meet your needs cost-effectively, quickly, and to the highest standards of quality.

WORKING OUT THE SOLUTION

Working with you, TSBC staff establish the most efficient solution to your particular grinding requirements.

DELIVERY – AND FOLLOW UP

Once your grinding media arrive to start on their long and efficient service,TSBC monitor the results as closely as you, by keeping in touch. And if you need any further advice, it's just a phone call away.

A WORLDWIDE REPUTATION FOR LEADING-EDGE MANUFACTURING TECHNOLOGY

REVOLUTIONISING CEMENT GRINDING

Historically the company's organisation was one of the first in Europe to supersede the use of flint pebbles as grinding materials for cement manufacture with their own specially developed cylindrical steel bodies.

Soon afterwards, the company designed, developed and subsequently took its name from the spirally coiled steel wire grinding media which revolutionised the cement grinding process.

HIGHER TECHNOLOGY. WIDER CHOICE

The company's continued development of advanced grinding media technology has established the company at the forefront of grinding media manufacturers.

One of the company's major strengths is in manufacturing the FULL RANGE of grinding media hardnesses, providing precisely the right solution for a particular application.

QUALITY 'THRU AND THRU': THE TSBC HALLMARK

TSBC customers know that they can rely on grinding media products that will always give them sustained and consistent performance, hence a higher quality mill output.

Throughout their life, TSBC grinding balls retain their original shape, as they wear, keeping grinding efficiency to a maximum.

The consistent high quality of TSBC products is stringently maintained through advanced manufacturing techniques backed up by a continual programme of monitoring and quality control.

A TOTAL SERVICE TO MEET YOUR NEEDS

Equally important, you can count on comprehensive support and expertise.

Because TSBC manufacture the grinding media, the company has the flexibility to meet your specification to the last detail.

TSBC staff are highly qualified professionals who understand your needs, and are totally committed to providing the solutions which will serve you best.

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