

“TERRA TRADE” LLC

BOND BALL WORK INDEX TEST

GERMAN MONGOLIAN INSTITUTE FOR RESOURCES AND TECHNOLOGY

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INTRODUCTION

Total 285 pieces of ball with 19mm-38.1mm diameter and 285 pieces of Relo with 15.5mm-38.1mm were used for the test, and the close screen size was 125micron. In addition, the Bond mill named BICO F.C BOND BALL MILL 395-50X was used within the test.



Picture 2 Relo, Ball



Picture 1 F.C.BOND BALL MILL

BOND Ball mill Diameter: 305mmx305mm, Revolution: 70 rpm

Grinding Media specifications					
BALL Specification			RELO Specification		
Nominal Ball Size (mm)	Number of Balls	Total Mass (g)	Nominal RELO Size (mm)	Number of Relo	Total Mass (g)
38,10	25	5643,8	38,1	43	9245,1
31,8	39	5073,5	31,75	67	7804,5
25,4	62	4387,3	25,4	10	622,6
22,2	69	3109,7	19,1	71	1816
19	90	2550,4	15,5	94	1369,2
TOTAL	285	20764,7		285	20857,4
POUND		45,778			45,983

Table 1 weight of RELO and Ball

Sample preparation:

There was the sample of 30 kilogram with size of 150-250mm and it was selected from the stone sample, which was dedicated to the test, by the method of hand sorting.

Furthermore, the sample was crushed to the size of -3.35mm by the jaw crusher and roll crusher, and then the sample was mixed by the method of cones circle. After that, the sample was separated by the laboratory splitter, and then the screen analysis was done on the Electromagnetic Sieve Shaker- SV005.



Picture 3 the sample

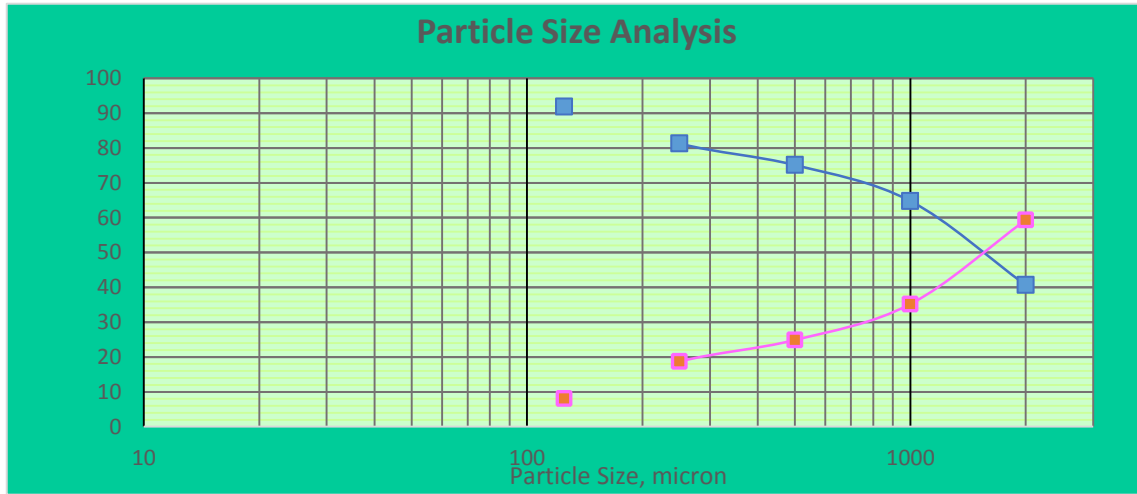


Picture 4 sample separation

Feed sample's 100% passing size was -3.35 mm , $F_{80}=1640\text{ }\mu\text{m}$, and undersize in feed was 8.1%. 700ml sample weight = 1093.7g

Tyler Mesh Opening	Weight	% Partial	% Cum Ret.	% Cum Pass
Nominal size	gram	f(x)	G(x)	F(x)
(micron)				
2000	463,22	40,65	40,65	59,35
1000	275,04	24,14	64,79	35,21
500	117,59	10,32	75,11	24,89
250	70,45	6,18	81,29	18,71
125	120,89	10,61	91,9	8,1
-125	92,29	8,1	100	0
TOTAL	1139,48	100		

Table 2 Fresh feed sieve analysis results



Ball bond index test

Weight of Feed (700ml):	1093,7g
Closing Screen Size:	125µm
Undersize in Feed:	8,10%
Target Weight of Product:	312,49g

Table 3 Ball bond index specification

Grinding Media specifications		
BALL Specification		
Nominal Ball Size (mm)	Number of Balls	Total Mass (g)
38,10	25	5643,8
31,8	39	5073,5
25,4	62	4387,3
22,2	69	3109,7
19	90	2550,4
TOTAL	285	20764,7
POUND		45,778

Table 4 Balls weight and numbers

	Weight Grams			Weight Grams					
Period	Fresh Feed	Undersize Fresh Feed	Ball Mill Revolutions	Oversize	Undersize	Net Undersize	Net Undersize Per Revolution	%Circulating	IPP
1	1093,7	88,58213659	100	794,45	299,25	210,667863	2,106678634	2,6548	312,49
2	299,25	24,23718056	136,82606	821,42	272,28	248,042819	1,812833187	3,0168	312,49
3	272,28	22,05279707	160,2094	769,15	324,55	302,497203	1,88813642	2,3699	312,49
4	324,55	26,2863056	151,57772	788,42	305,28	278,993694	1,840598336	2,5826	312,49
5	305,28	24,72556886	156,34054	774,7	319	294,274431	1,882265619	2,4285	312,49
6	319	25,83679398	152,2893	785,43	308,27	282,433206	1,854583344	2,5479	312,49

Table 5 Ball grinding test results

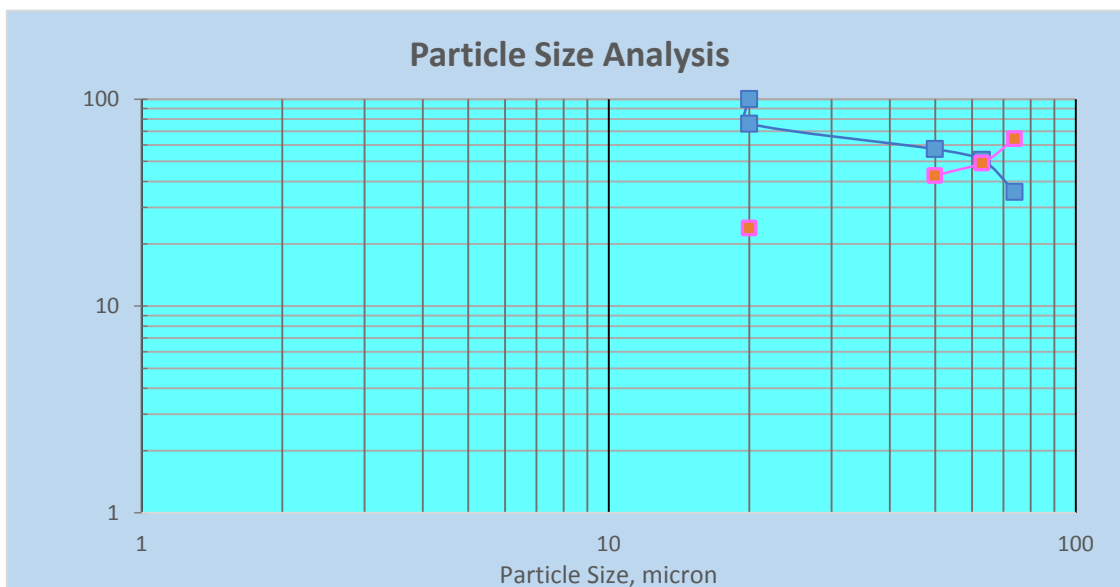
$$BWI = \frac{45.78}{P1^{0.23} \times Grp^{0.82} \times \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right)}$$

P1- 100% passing size of Product	125 µm
Grp-Grams per revolution	1.8546
F ₈₀ - 80% passing size of Feed	1640 µm
P ₈₀ - 80% passing size of Product	63 µm

Bond Ball Mill Work Index: 8.97 kWhr/tonne

Tyler Mesh Open	Weight	% Partial	% Cum Ret.	% Cum Pass
Nominal size (micron)	gram	f(x)	G(x)	F(x)
74	85.82	34.54	34.54	65.46
63	39.72	15.99	50.53	49.47
50	11.62	4.68	55.20	44.80
20	70.8	28.50	83.70	16.30
20	40.5	16.30	100.00	0.00
TOTAL	248.46	100		

Table 6 Product sieve analysis results



Relo bond index test

Weight of Feed (700ml):	1093,7g
Closing Screen Size:	125µm
Undersize in Feed:	8,10%
Target Weight of Product:	312,49g

Table 7 Relo bond index specification

Grinding Media specifications		
RELO Specification		
Nominal RELO Size (mm)	Number of Relo	Total Mass (g)
38,1	43	9245,1
31,75	67	7804,5
25,4	10	622,6
19,1	71	1816
15,5	94	1369,2
	285	20857,4
		45,983

Table 8 Relo weight and numbers

Period	Weight Grams		Weight Grams			Net Undersize	Net Undersize Per Revolution	%Circulating Load	IPP
	Fresh Feed	Undersize Fresh Feed	Ball Mill Revolutions	Oversize	Undersize				
1	1093,7	88,58213659	100	805,05	288,65	200,0678634	2,00067863	2,7890178	312,49
2	288,65	23,37865386	144,5045	805,47	288,23	264,8513461	1,83282424	2,7945391	312,49
3	288,23	23,34463676	157,7571	750,41	343,29	319,9453632	2,02808824	2,1859361	312,49
4	343,29	27,804116	140,3694	777,93	315,77	287,965884	2,05148568	2,4635969	312,49
5	315,77	25,57518631	139,855	747,4	346,3	320,7248137	2,29326671	2,1582443	312,49
6	346,3	28,04790518	124,0317	793,5	300,2	272,1520948	2,19421371	2,6432378	312,49
7	300,2	24,31412399	131,3325	785,83	307,87	283,555876	2,15906845	2,5524734	312,49
8	307,87	24,93534094	133,1826	780,37	313,33	288,3946591	2,16540776	2,490569	312,49

Table 9 Relo grinding test results

$$BWI = \frac{45.98}{P1^{0.23} \times Grp^{0.82} \times \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right)}$$

P1- 100% passing size of Product

125 µm

Grp- Grams per revolution

2.562 g

F₈₀-80% passing size of Feed

1640 µm

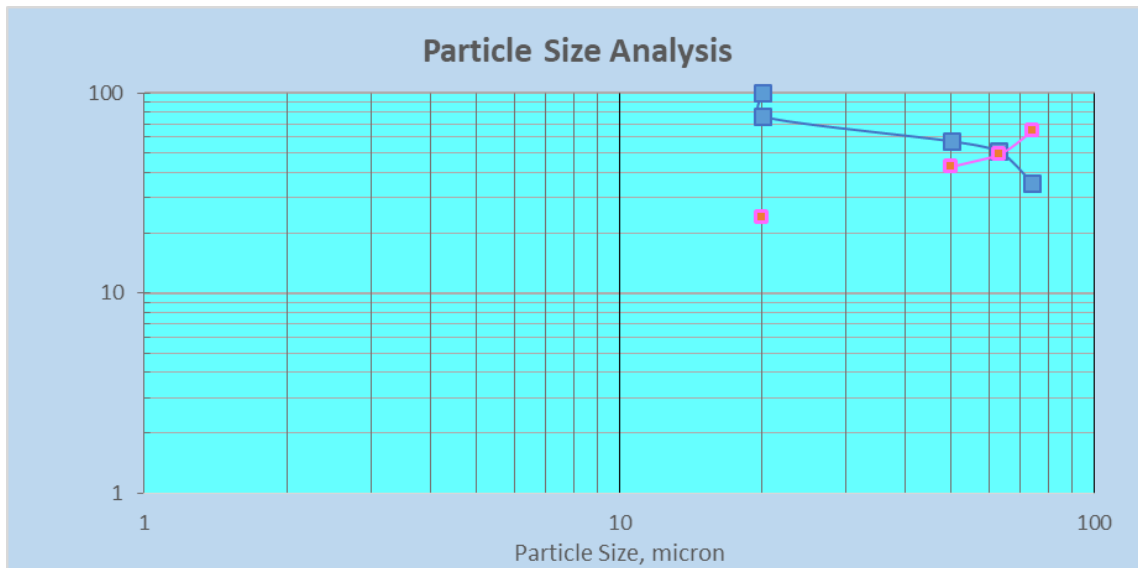
P₈₀-80% passing size of Product

63 µm

Bond Relo Mill Work Index: 6.91 kwhr/tonne

Tyler Mesh Opening	Weight	% Partial	% Cum Ret.	% Cum Pass
Nominal size (micron)	gram	f(x)	G(x)	F(x)
74	68.63	35.63	35.63	64.37
63	29.39	15.26	50.89	49.11
50	12.44	6.46	57.35	42.65
20	36.31	18.85	76.20	23.80
20	45.85	23.80	100.00	0.00
TOTAL	192.62	100		

Table 10 Product sieve analysis results



Conclusion:

In the result of the test, Bond index is 8.97kwh/t, which is the result of the spherical grinding media. Whereas, Bond index is 6.91kWh/t according to the Relo grinding bodies. It showed a difference of 22.96%.

Bond Ball Mill Test Results		
	Ball	Relo
100% Passing Size of Feed (μm)	3350	3350
80% Passing Size of Feed (μm)	1640	1640
100% Passing Size of Product (μm)	125	125
80% Passing Size of Product (μm)	63	63
Grams Undersize per Revolution	1,8546	2,562
Bond Ball Mill Work Index (kWhr/tonne)	8,97	6,91

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