MDS

Minerals Density Separator.

A tool developed for the Mining world to characterise ores and measure densities up to and >4.

MINTEK
1934 — 2004

PROUDLY SOUTH AFRICAN

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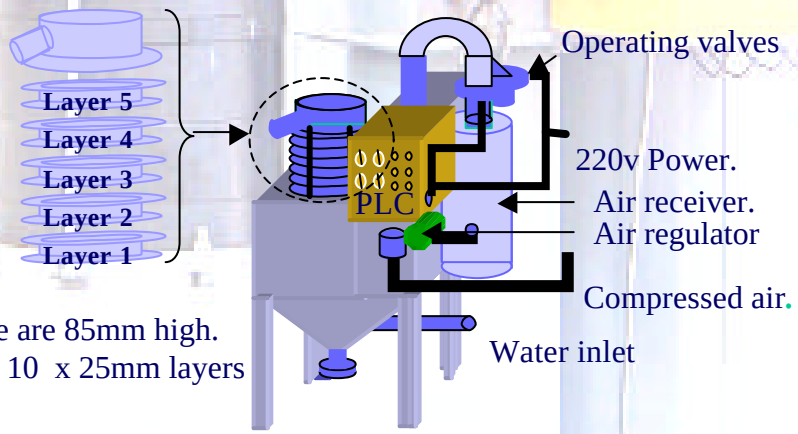
Mineral Density Separator Predicts Plant Performance

MINTEK has developed and tested a prototype mineral density separator (MDS) that can be used to characterise ores into different density classes, evaluate and predict dense-media and jigging plant efficiencies, as well as to design and optimise processing plants.

The MDS is capable of fractionating an ore sample into different density fractions at densities exceeding 4.0 - this being the highest limit of heavy-liquid separation where a mixture of tetrabromo-ethane and milled ferrosilicon is used. The unit can treat material that falls within the size range 2 mm to 30 mm, with a step-up ratio of <4:1. However, a 2 mm x 0.5 mm sample has also been successfully tested.



The testwork yields information on the relationships between:

- recovery and grade or recovery and density at different residence times
- grade versus density at equilibrium (washability), and
- recovery versus residence time at the required grade.

Mintek has conducted a large number of tests on various materials, including iron and manganese ores, chromite, coal, diamondiferous gravels, and tantalite. The results have shown that increased residence times result in improved separation at the finer sizes and at lower densities. Processing narrower size ranges will increase separation efficiency. The information from fractionation can be used to design and optimise processing plant performance by direct measurement of the effects of variables such as residence time and particle size distribution. The results can also be used to predict mineral separation in a plant, evaluate plant efficiencies, and to develop accurate scale-up models from a comparison of batch and plant operations.

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Equipment Description

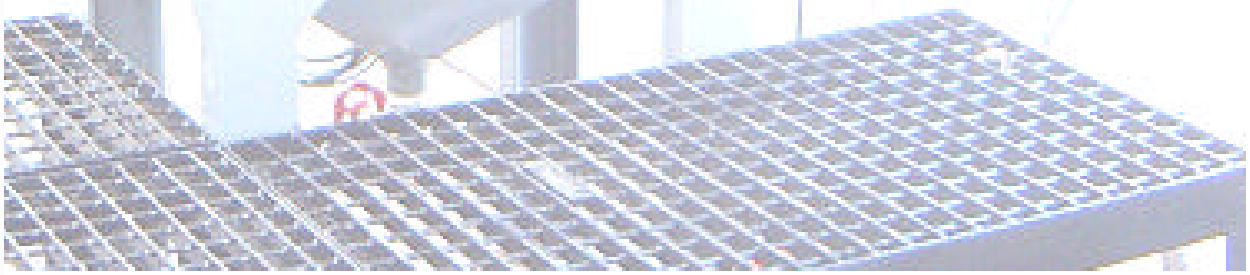
The prototype PLC controlled, pneumatically actuated MDS is shown in the front page. This consists of up to 10 rings (25-50-85mm high x 300mm diameter) which are clamped together to comprise the jig chamber. This is fitted to a water/air chamber or hutch where the air supply / exhaust are controlled with pneumatic valves from the PLC. The PLC controls the delay between strokes, the upstroke, holding and release times. The water supply is controlled with a rotameter and the manifold air supply pressure controlled by a manual pressure regulator.

The ore sample (±200 kg) is placed in the jig chamber, the required pulse, air pressure and water flow is fixed and the MDS is started. After the required residence time the test is stopped. The contents of the jig chamber are removed in separate layers.

Corresponding layers from the initial tests are composited and blended. A subsample is removed to determine the average density of the material in the separate layers and for chemical analysis if required.

The average density is obtained by weighing the sample in air and water and calculating the difference to obtain. This procedure has been shown to have an actual error of ±0.01.

In this way it is possible to fractionate a sample using the “release analysis approach” into different density fractions, provided a narrow feed size range is used. Alternatively the test will determine the potential separation at a given feed size distribution, residence time and operating conditions.



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Preliminary results show that it should be possible to use a PLC controlled, pneumatically actuated MDS to: -

Fractionate an ore sample into different density fractions, even at densities exceeding 4.0. However it should be noted that this is subject to a limitation in feed size distribution when near density particles are present.

MDS can be used to determine a **DCC** (Density Characterization Curve). The MDS fractionate an ore sample into different density fractions and could therefor not be called a washability curve.

Use the information gained by fractionation to evaluate plant efficiencies represented as an efficiency curve.

Develop accurate scale-up models from comparisons of batch and plant operations.

Use the information from the fractionation tests to develop grade, yield / residence time relationships to develop financial models incorporating capital and operating costs, throughput, yield and concentrate quality.

Reduce reliance on TBE or similar products for developing washability data thereby reducing safety, health and environmental impacts

Example of densities obtained.

Layer no	Fe	Chromite	Mn	Dolochar
	SG	SG	SG	SG
1	4.954	4.01	4.59	3.23
2	4.888	3.70	4.57	2.33
3	4.802	3.35	4.54	1.76
4	4.684	3.32	4.53	1.68
5	4.468	3.25	4.50	1.62
6	4.196	3.25	4.46	1.54
7	3.823	3.26	4.48	1.46
8	3.589	3.22	4.44	1.41
9	3.238	3.19	4.37	1.33
10	3.101			1.22

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The package consists of the following:

- MDS Minerals Density Separator.
- Compressor
- 3 sets of 300mm rings
- 60kg Industrial Weighing Scale.
- 6kg Industrial Weighing Scale.
- Density measuring devices.
- Operating manual.
- Operator training.
- MDS Forum where unit owners meet every 2 months.

The unit operates on water, compressed air and 380v for the compressor and 220v for the MDS electricity.

All the parts and equipment used to build the unit are locally of the shelve items.
Mintek will provide an after sales service.

Included to the sale are a 6 months operating and development assistance, where Mintek will do 3 comparison tests to evaluate your MDS performance.
All new development on the design and operating procedures will be provided to have a unit comparable with any other unit.

Layer rings and screen bed.

Density measuring devices.

For more information please contact.

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Some MDS test results.

Iron ore sample

-10+1mm 30 minutes

	Mass %	Cum % Mass	Density	% Fe	Cum % Fe	% Al_2O_3	Cum % Al_2O_3	% P	Cum % P	% SiO_2	Cum % SiO_2
1	9.5	9.5	4.42	68.76	68.76	1.05	1.05	0.06	0.06	0.29	0.29
2	9.3	18.8	4.30	67.58	68.18	1.27	1.15	0.09	0.08	0.29	0.29
3	9.3	28.1	4.26	67.08	67.81	1.35	1.22	0.09	0.08	0.33	0.30
4	9.9	37.9	4.25	67.67	67.78	1.65	1.33	0.10	0.08	0.42	0.33
5	9.4	47.3	4.20	67.07	67.64	1.58	1.38	0.11	0.09	0.40	0.35
6	9.2	56.5	4.19	66.72	67.49	1.62	1.42	0.11	0.09	0.33	0.34
7	8.4	64.9	4.15	66.99	67.42	1.89	1.48	0.12	0.10	0.38	0.35
8	7.2	72.1	3.89	64.38	67.12	2.63	1.59	0.18	0.10	0.56	0.37
9	7.0	79.1	3.75	63.33	66.78	3.44	1.76	0.22	0.11	0.83	0.41
10	17.3	96.4	3.53	59.25	65.43	4.96	2.33	0.29	0.15	1.37	0.58
	3.6	100.0		62.44	65.32	3.95	2.39	0.23	0.15	1.89	0.63
					64.10		2.59		0.17		0.68

MDS tests on PGM and Mn samples.

MDS -20mm+5mm

		Mass Distribution			PGM +Au grade (g/t)		PGM + Au Recovery		Cr2O3 Grade (%)	
Layer No.	SG	Mass (g)	Discrete	Cumulative	Discrete	Cumulative	Discrete	Cumulative	Discrete	Cumulative
1	3.773	19370	16.3	16.3	7.7	7.7	58.2	58.2	27.6	27.6
2	3.240	12362	10.4	26.7	2.6	5.7	12.7	70.9	10.4	20.9
3	3.134	15583	13.1	39.8	1.4	4.3	8.2	79.1	3.91	15.3
4	3.096	15913	13.4	53.2	0.8	3.4	5.2	84.3	1.69	11.9
5	3.021	10017	8.4	61.6	0.7	3.0	2.7	87.0	1.23	10.4
6	2.960	10068	8.5	70.1	0.6	2.7	2.3	89.2	1.23	9.3
7	2.917	14323	12.1	82.1	0.6	2.4	3.5	92.8	0.86	8.1
8	2.822	10499	8.8	91.0	1.2	2.3	5.0	97.8	1.1	7.4
9	2.793	10726	9.0	100.0	0.5	2.2	2.2	100.0	0.6	6.8
		118861	100.0		2.2		100.0		6.8	

(-8+2mm fines)

	Mass %	Overall mass %			Mn Grade %	R.Density [g/cm3]
	Discrete	Cum	Discrete	Cum	Discrete	Discrete
1	10.6	10.6	6.1	6.1	48.9	4.59
2	9.8	20.4	5.6	11.7	48.4	4.57
3	12.9	33.3	7.4	19.1	48.4	4.54
4	10.2	43.5	5.9	25.0	48.1	4.53
5	9.1	52.5	5.2	30.2	46.1	4.50
6	14.0	66.5	8.0	38.3	47.3	4.46
7	11.3	77.8	6.5	44.8	47.3	4.48
8	10.0	87.8	5.7	50.5	47.4	4.44
9	12.2	100.0	7.0	57.5	46.0	4.37
	100.0				47.5	