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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 35 OF 1963.

REPORT ON MAGNETIC SEPARATOR TESTS DONE ON MAGNETITE FROM BON ACCORD FOR FEDERALE VANADIUM BPK.

BY:

E.L.GERICKE.

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INTRODUCTION:

This investigation was done at the request of Federale Vanadium, Bpk., who supplied 6 tons of their magnetic ore for this purpose.

The Company is interested in separating the non-magnetic material from the magnetic material in their ore used for the production of vanadium pentoxide. The non-magnetic constituent of the magnetite causes certain difficulties in the chemical extraction process used.

The Institute was consequently requested to investigate the possibility of carrying out such a separation in their pilot plant.

Two tests were done, one on material as milled by Federale Vanadium and one on their milled material after it had been milled in the Fuel Research Institute's ball mill. Three tons of magnetite were used for each test.

THE TEST:

For the first test 3 tons of magnetite were used as received. This material had been milled in the Company's ball mill. A representative sample of this raw material was taken by taking 30 increments during the time the magnetite was being brought into the plant.

The flow of material was determined by the lay-out of the plant and is shown in Figure 1.

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The magnetite was put into the circuit and passed through the magnetic separator. The magnetite suspension was circulated for half an hour and samples were taken every minute of the feed to the separator, the overdense suspension from the drum and the effluent. All increments taken were mixed together and a screen analysis was done on each of these samples except the effluent as there was too little magnetic material present to do a screen analysis. The percentage magnetic material in each sample was also determined. The results obtained are recorded in Table 1.

The rate of feed to the magnetic separator was 250 gals./min. and the amount of magnetite in the circuit was approximately 3 tons. The concentration was in the order of 3 lb./gal.; thus the circulation rate was 750 lb./min. which means that the total quantity was circulated once every 4 minutes. During the time of the test, which was half an hour, the total quantity of magnetite was circulated 7½ times. This was necessary to enable representative samples to be taken. In practice the material would be circulated only once and it is considered that the results would not be much different from those obtained.

The plus ½ mm material in the magnetite was removed from the circuit on the cyclone clean coal screen as the circuit could not be changed to include this material. Samples were taken of the material coming off the screen, also at one minute intervals, for a period of half an hour. A screen analysis was done on this material and the percentage of magnetic material determined. The results are recorded in Table 1.

The magnetite was removed from the circuit and the plant thoroughly cleaned.

Three tons of magnetite as supplied by the Company was milled for a period of three hours in the Fuel Research Institute's ball mill at the pilot plant. The above test was repeated with this milled magnetite. The magnetite was again circulated for half an hour and samples were taken every minute of the feed to the magnetic separator,

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the overdense suspension from the drum and the effluent. A screen analysis was done on each sample and the percentage magnetic material determined. These results are recorded in Table 2.

For both tests the feed to the magnetic separator was kept constant at 250 gallons/minute and the gap between the underpan and the drum was $\frac{3}{4}$" in each case. The average field strength of the four magnets on the drum surface was 1350 gauss.

DESTINATION OF PRODUCTS:

After each test the magnetite was collected in drums and this was sent back to the Company.

DISCUSSION OF RESULTS:

From Table 1 it will be seen that the percentage magnetic material was increased from 89.30 per cent to 97.80 per cent, showing that the non-magnetic material was reduced by 8.7 per cent of the original weight. It will be noticed that the percentage of non-magnetic material in the coarse ore collected from the screen is virtually the same as that of the overdense suspension from the drum.

The amount of magnetic material in the effluent was only 0.01 lb/gal. which is negligable.

From Table 2 it will be seen that the percentage magnetic material of ore which was milled in the ball mill was increased from 81.80 per cent to 91.70 per cent showing that there was a reduction in non-magnetic material of 10.8 per cent of the original weight.

Difficulty was experienced in the laboratory in separating the non-magnetic material of the ball milled ore which was not the case with the unmilled magnetite. In the pilot plant similar difficulties were encountered as is borne out by the fact that there were 31.1 gms/litre of solids in the effluent of the milled ore compared to only 4.17 gms/litre

4.17 gms/litre for the unmilled ore.

Although it is easier to obtain an almost purely magnetic product when treating the ore as received from the company, it does not necessarily mean that this is the better procedure. The material is much coarser and each individual particle may still contain non-magnetic material. Only a chemical or magnetic analysis could establish this. Actually the fact that the sample, after additional milling at the Institute, had a higher non-magnetic content than the unmilled sample, points in this direction.

(SIGNED) E. L. GERICKE.

TECHNICAL OFFICER.

PRETORIA.
3rd October, 1963.

TABLE 1.

UNMILLED ORE AS RECEIVED.

	RAW MATERIAL	FEED	OVERDENSE FROM DRUM	COARSE MATERIAL FROM CYCLONE C.C.SCREEN
% Magnetic Material	89.30	89.30	97.80	97.50
% + 100 Mesh	46.84	5.12	10.70	62.20
% + 200 Mesh	20.27	12.80	17.00	21.98
% + 325 Mesh	8.34	11.67	10.67	4.52
% - 325 Mesh	24.55	70.41	61.23	11.30

Solids in effluent = 4.17 gms/litre.
Magnetic material in effluent = 23.7%
Magnetic material in effluent = 0.99 gm/litre.
= 0.01 lb/gallon.

TABLE 2.

ORE MILLED FOR 3 HOURS IN F. R. I. BALL MILL.

	RAW MATERIAL	FEED	OVERDENSE FROM DRUM	EFFLUENT
% Magnetic Material	81.80	83.40	91.70	54.2
% + 100 mesh	0.22	0.70	1.05	1.42
% + 200 mesh	0.94	2.65	3.85	2.31
% + 325 mesh	6.24	5.14	6.96	7.82
% - 325 mesh	92.60	91.51	88.14	88.45

Solids in effluent = 31.1 gms/litre
Magnetic material in effluent = 54.2 %
Magnetic material in effluent = 16.8 gms/litre
= 0.17 lb/gallon.

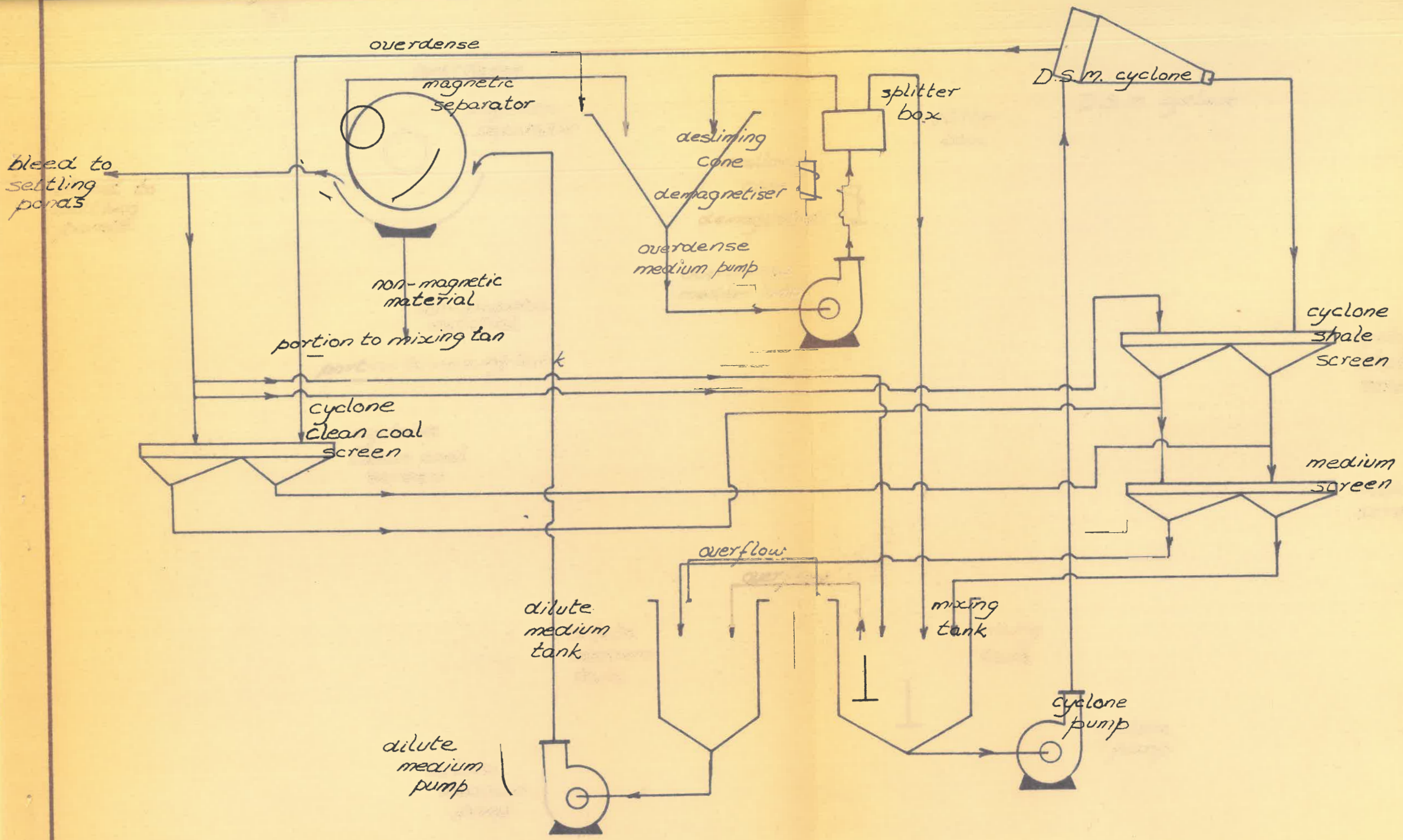

Figure No. 1

Flowsheet showing circuit used for magnetite tests.