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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 1 OF 1961.

CONFIDENTIAL

A REPORT OF THE RESULTS OF TWO TESTS CARRIED OUT ON THE DEWATERING PLANT AT DOUGLAS COLLIERY ON THE 4th NOVEMBER, 1960.

by

B. VAN ECK

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INTRODUCTION

A centrifuge was recently installed at Douglas Colliery for dewatering the Baum-washed fine coal after extraction from the settling ponds.

The centrifuge is of the horizontally vibrating type and has a nominal capacity of some 130 t.p.h. when treating this size of coal.

The machine was installed by Messrs. Norton's Tividale South Africa (Pty) Ltd. at whose request this Institute carried out certain tests to establish its performance.

FLOW SHEET OF THE DEWATERING PLANT

The raw coal at the Colliery is crushed to a top size of some 6" - 8" and is then washed in two parallel Baum-jigs. The washed fine coal from the clean coal classifying screens is laundered into two parallel concrete settling ponds. The settled fine coal is extracted from these ponds by means of two scraper conveyors and is discharged, after some preliminary dewatering onto a common belt conveyor. The feed to the new dewatering section of the plant is picked up from this conveyor.

On entering the dewatering plant, the fine coal from the settling ponds can either go straight into the centrifuge or it can first be passed over a fixed screen with 0.5 mm. slots where water is added to facilitate the removal of minus 0.5 mm. particles before entering the centrifuge. The latter procedure is the one normally followed.

The centrifuge is fitted with a wedge-wire basket with 0.5 mm. slots. The coal entering the centrifuge is not only subjected to the normal centrifugal force but also to a vibratory action. The dewatered coal is horizontally discharged onto a belt conveyor which transfers it to the fine coal storage bins.

The filtrate/.....

The filtrate from the machine joins the underflow from the fixed screen (when this is in operation) and is collected in a sump from where it is pumped to thickening cyclones. The overflow from these cyclones is used as wash water on the fixed screen, any excess being returned to the settling ponds. The thickened underflow from the cyclones is passed over a dewatering screen and then onto a conveyor discharging onto the main discard conveyor from the washing plant.

TEST PROCEDURE: Two tests, one of one hours duration and the other one of 30 minutes duration, were carried out. In the main test, viz. 1 hours duration, the fines from the settling ponds were passed over the fixed screen before entering the centrifuge. In the second test this screen was by-passed and the fine coal entered the centrifuge directly.

Test No. 1. Duration of test: One hour.

The products entering and leaving the dewatering plant were sampled in the following manners:

(a) Product from the settling ponds: This coal was sampled at the point where the pond conveyor discharges onto the dewatering plant feed conveyor. Increments of approximately 3 lb. each were collected at 2 minute intervals.

(b) Feed to the centrifuge: A sample of this material was obtained by collecting increments, taken at 2 minute intervals by means of a special container from the chute feeding the centrifuge.

(c) Centrifuge dewatered Product: The dewatered fine coal was sampled at the point where the relevant conveyor discharges into the storage bins. Increments of approximately 3 lb. each were collected at 2 minute intervals.

(d) Centrifuge Filtrate: This product was sampled by collecting small increments from the relevant overflow weir at two minute intervals.

(e) Dewatered Cyclone Underflow. A sample of this material was obtained by collecting increments from the discharge lip of the dewatering screen at two minute intervals.

(f) Effluent Bleed. Increments of this product were taken by passing a small container through the discharge end of the bleed pipe at two minute intervals.

All samples were stored in watertight containers fitted with lids or stoppers.

Test No. 2/.....

Test No. 2. Duration of test: 30 minutes.

By altering a flap-door in the feed chute, the fixed screen was by-passed and the fine coal from the settling ponds was passed directly into the centrifuge.

Only the dewatered product from the centrifuge was sampled during this test. Increments of this product were collected in the same manner as during the first test except that the time interval between increments was reduced to one minute.

ANALYSES OF SAMPLES: All samples were transported to and analysed in the laboratories of the F.R.I. in Pretoria.

On arrival at the laboratories the superficial moisture contents of the following samples were determined:

(a) Product from settling ponds.
(b) Feed to the centrifuge.
(c) Dewatered coal from centrifuge: Test 1.
(e) Dewatered under-flow from cyclones.
(g) Dewatered coal from centrifuge: Test 2.

The solids concentrations and specific gravities of samples (d) Filtrate from centrifuge and (f) Effluent Bleed, were determined.

The ash contents as well as inherent moisture contents were determined on these samples. All these results are reported in Tables 1 and 2.

Sub-samples of the air-dried material from each of these samples were then subjected to screen analysis. In all cases screen analyses at 16 mesh, 30 mesh, 60 mesh and 100 mesh (all B.S.S.) were done while additional analyses at $\frac{1}{4}$" sq. and $\frac{1}{8}$" sq. were also carried out on samples a, b, c and g. The results of the screen analyses are reported in Tables 3 and 4.

EVALUATION AND DISCUSSION OF RESULTS.

As no facilities for weighing of the different products were available, the respective yields of the products leaving the dewatering plant had to be derived by way of calculation. The screen analyses of these products are considered to be the only basis on which such a calculation can be based. When this is done, it appears that some 91 per cent of the feed to the dewatering plant was recovered as saleable dewatered fine coal in the first test.

Although/.....

Although the average load to the centrifuge was probably not far off the designed figure of 130 t.p.h. it was noticed that the actual load fluctuated considerably and at times the machine was in fact grossly overloaded (probably some 250 t.p.h.). This fluctuation in the rate of feed can be ascribed to the pattern in which the two sets of scraper conveyors discharge onto the feed belt. When these conditions are taken into consideration the superficial moisture content of the final dewatered product - 8.9% - is very good.

It is also quite clear from the results of the two tests that a much drier final product is obtained when the fine coal from the slurry ponds is passed over a screen before entering the centrifuge. (Compare 8.9% moisture as against 16.9%)

PRETORIA.
21st February, 1961.

B. VAN ECK
SENIOR TECHNICAL OFFICER.

TABLE 1.

SUPERFICIAL MOISTURE, INHERENT MOISTURE AND ASH CONTENT OF FINE COAL SAMPLES.

Sample		Superficial Moisture %	Inherent Moisture %	Ash %
A	Settling pond product	22.2	1.9	11.2
B	Feed to centrifuge	26.8	1.7	10.2
C	Centrifuge product	8.9	1.8	9.8
E	Cyclone underflow (screen product)	36.3	1.6	14.0
G	Centr. product (screen by-passed)	16.9	2.0	10.6

TABLE 2.

ANALYSIS OF EFFLUENT SAMPLES.

Sample		Solids Concentration lb/gall	S.G.	Solids	
				Inherent Moisture %	Ash %
D	Centrifuge Filtrate	1.52	1.041	1.8	12.6
F	Effluent Bleed	1.72	1.044	2.1	11.8

TABLE 3.

SCREEN ANALYSIS OF FINE COAL SAMPLES.

Size	Settling Pond Product A		Feed to Centrifuge B		Centrifuge Product C		Centrifuge Product (Screen by-passed) G	
	Fract. %	Cum. %	Fract. %	Cum. %	Fract. %	Cum. %	Fract. %	Cum. %
+ ¼"	3.7	3.7	3.8	3.8	4.6	4.6	2.4	2.4
- ¼" + ⅛"	34.2	37.9	30.0	33.8	33.3	37.9	26.5	28.9
- ⅛" + 16 mesh	33.5	71.4	40.2	74.0	39.0	76.9	34.7	63.6
- 16 + 30	10.8	82.2	12.0	86.0	12.4	89.3	13.8	77.4
- 30 + 60	6.6	88.8	4.9	90.9	4.6	93.9	8.9	86.3
- 60 + 100	3.0	91.8	1.8	92.7	1.7	95.6	3.8	90.1
- 100	8.2		6.2	98.9	3.2	98.8	8.7	98.8
Loss	-		1.1		1.2		1.2	
Total	100.0		100.0		100.0		100.0	

TABLE 4.

SCREEN ANALYSIS OF FILTRATE, CYCLONE UNDERFLOW AND EFFLUENT BLEED.

Size.	Centr. Filtrate D		Cyclone Underflow E		Effluent Bleed F	
	Fract. %	Cum. %	Fract. %	Cum. %	Fract. %	Cum. %
+ 16 mesh	0.1	0.1	0.2	0.2	-	-
- 16 + 30	2.8	2.9	7.1	7.3	1.7	1.7
- 30 + 60	7.9	10.8	35.0	42.3	3.5	5.2
- 60 + 100	11.8	22.6	22.7	65.0	8.2	13.4
- 100	77.4		35.0		86.6	
Total	100.0		100.0		100.0	