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REPORT NO. 0 - 690

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A Subsidiary of Magnetics International Ltd.

REPORT ON

FULL SCALE TEST PROGRAM

FOR

CANADIAN JAVELIN LIMITED

USING THE

JONES WET HIGH INTENSITY MAGNETIC SEPARATOR

ON

JULIAN DEPOSIT, LABRADOR

Prepared by: J.A. Bartnik

Date: August 7th, 1973

SCANNED IMAGE

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TEST PROGRAM FOR

CANADIAN JAVELIN LIMITED

INTRODUCTION

Canadian Javelin Limited contracted Ferro-Magnetics Ltd. to conduct detailed evaluations on the iron ore from Julian Deposit for concentration of iron values using the Jones Wet High Intensity Magnetic Separator.

The preliminary test results reported on May 24, 1973 demonstrated iron concentrate of 64.02% Fe at recovery of 71.1%.

Since the ore is amenable to the beneficiation on the Jones Separator, an agreement was reached to conduct a full scale test program on the Julian iron ore to optimize the separation conditions and determine certain criteria for commercial plant operation.

It was understood from the discussion and correspondence with Mr. W. Blakeman, Senior Geologist, Canadian Javelin Limited that:

1. A representative sample of the iron ore has been collected from the Julian Deposit. The samples tested were to be prepared from this product by Ferro-Magnetics.

2. Canadian Javelin Limited noted with great interest the encouraging preliminary test results and contemplates conducting process design and cost analyses after the full scale test program is completed.

3. The ore contains mainly specular hematite with some magnetite and geothite. The gangue consists of quartz with small quantity of carbonates. The typical analysis are:

Fe%	Al_2O_3%	TiO_2	P_2O_5%	S%	CaO%	MgO%	MnO%	SiO_2%
38.73	0.09	0.09	0.22	0.002	0.002	0.02	0.05	43.44

4. The objectives are to produce iron concentrate with 65% Fe at iron recovery above 80%.

5. The Julian iron ore deposit is located in Labrador close to Wabush Mines. The anticipated production is 3,000,000 tons per year of concentrate with 65% Fe.

RECOMMENDATIONS

The Jones Separator is efficient, well proven, simple and most probably the cheapest process for concentration of the Julian deposit iron ore. This is largely evident by the excellent results achieved in this test program. Based on the test data, a flow sheet can be designed and equipment required specified for production of iron concentrate from all the materials.

However, a meeting between the interested parties should take place to discuss various combinations of grade/recovery to arrive at an optimum process.

Subject to certain unknown factors, recommended flow sheets could be two passes of magnetics with recirculation of the wash $_2$ and non-magnetics $_2$, -150 mesh.

Preliminary operating costs and capital investment costs are outlined under the flow sheets. The description and further details will be provided for feasibility study on request from Canadian Javelin Limited.

CONCLUSIONS

1. The test program demonstrates that iron concentrate with over 65.0% Fe can be produced with recovery above 85% using the Jones Separator.

2. In Lock Test #83-86, it was demonstrated that a concentrate with about 65.06% Fe can be produced at recovery of 88.1% in a 2 pass magnetics separation with recirculation of wash.

3. For satisfactory liberation the ore should be ground -60 mesh and the recirculated middlings (wash $_2$ and non-magnetics $_2$) -150 mesh.

4. Assay results report loss on ignition about 0.5% weight in the magnetic concentrate. Consequently, most of the magnetic concentrates after L.O.I. will contain about 65.5% Fe.

5. General interpretation of the test results is that for the iron ore from Julian deposit the following operating conditions are recommended :

A. Two pass of magnetics separation with recirculation of wash $_2$ and non-magnetics $_2$.

B. The ore should be ground -60 mesh and the (wash $_2$ and non-magnetics $_2$) recirculating middling product -150 mesh.

C. Consequently for production of 3,000,000 tons per year of concentrate ten (10) Jones Separators, DP 317 will be required.

D. Intensity equivalent to 6 amps on the laboratory Jones Separator.

E. Gap 2.5 mm.

F. Feed should contain at least 40% solids.

G. Wash low.

MATERIAL

A 200 lb. sample was received by Ferro-Magnetics Ltd. from Canadian Javelin Limited marked "Julian Mine Iron Ore" on May 9th, 1973. The following data was reported on the sample.

The ore contains mostly specular hematite with some magnetite and goethite. The gangue is quartz and a small quantity of carbonates. The "as received" sample was reported to contain between 33% Fe and 40% Fe. Typical Analyses are:

Fe%	Al_2O_3%	TiO_2%	P_2O_5%	S%	CaO%	MgO%	MnO%	SiO_2%
38.73	0.09	0.09	0.22	0.002	0.002	0.02	0.05	43.44

This deposit is located in Labrador close to Wabush Mines. The anticipated production is 3,000,000 TPY of concentrate with 65% Fe.

Sieve distribution in the -20 mesh head sample is:

Mesh	% Wt.	% Fe	Fe Dist. %
+ 20	1.6	3[illegible].66	1.5
- 20 + 60	53.2	42.22	57.2
- 60 + 100	19.3	38.92	19.1
-100 + 150	11.5	32.19	9.4
-150 + 200	3.2	29.92	2.4
-200	11.2	39.25	10.4
TOTAL:	100.0	40.63	100.0

OBJECTIVE

The purpose of this test program was to obtain data from which projections could be made relating to the performance and certain operating data for commercial separators.

The grade and recovery to be aimed for are as follows:-

A) Concentrate grade over 65.0% Fe at minimum grind.

B) Iron recovery of over 80%.

TEST WORK

A considerable amount of test work was conducted on the material investigating various possible flow sheets and operating variables of the Jones Machine to determine the basic separation characteristics.

The specified grade of iron concentrate was produced by the Jones Separator with a very high recovery.

Attached is a set of test data sheets. On some of the tests all products were assayed for Fe content. On selected concentrate the L.O.I. was determined.

General comparison of the results is shown in Table 1.

The results are discussed under various classifications as follows:

Effect of grind	Effect of Gap
Effect of Intensity	Effect of Wash Water
Effect of Percent Solids	Effect of Passes
Effect of Feed Rate	Effect of Recirculation

EFFECT OF GRIND

It was suggested that the separation should be conducted at coarsest grind for 80% iron recovery and 65% Fe grade.

The test results demonstrate that this specified grade and recovery could be met at -60 mesh grind of the feed and -150 mesh grind of the $wash_2$ and $non\text{-}magnetics_2$ which is the recirculation product.

In a series of lock tests #83-86, already a concentrate was produced with 65.06% at iron recovery of 88.1%.

Some of the results are presented in Table 11.

At grind -60 mesh the specified grade (+65% Fe) was produced. However middlings were still consisting of intergrown quartz and hematite, thus required finer grinding (-150 mesh) to produce satisfactory total recovery.

EFFECT OF INTENSITY

It is very important to establish the effect of intensity on material tested.

On this particular material it is known that it contains relatively large quantities of fine grained hematite.

Table III shows the effect of intensity on magnetics in a series of tests with 1 pass and 2 passes of magnetics.

As expected with the increased intensity there is a decrease in the grade, however, there is an increase in iron recovery.

Consequently, it can be said that it is evident from the intensity test No. 34, a concentrate of over the desired 65.0% Fe before L.O.I. could be produced. It is considered that there is no significant increase in recovery with 2.5 mm. gap at intensity over 10 amps.

Test No. 4 demonstrates that 97.5% of the iron values responded to magnetic separation by the Jones Machine.

EFFECT OF % SOLIDS

It is important to determine if % Solids in the feed has an appreciable effect on the metallurgy. Usually it is desirable in a plant to run as high a % Solids as possible or take % Solids from the existing flow if such a flow exists, ie. if dewatering or diluting can be avoided, it is usually desirable. The results are presented in Table IV.

The results show only slight decrease in grade with small increase in recovery; so, for practical reasons with a slight adjustment of intensity the results would be the same.

The conslusion is that up to 40% there is no significant difference in the grade and recovery. The maximum physically achievable in the laboratory was 40% Solids. In commercial operation it appears that even 50% Solids would be feasible, certainly up to 40%.

Fortunately, there is no serious decline in grade or recovery at higher percent solids. This is a very desirable characteristic of this material.

EFFECT OF FEED RATE

Obviously as high a feed rate as possible is desirable. Tests were conducted on the laboratory separator to determine if there is any appreciable drop in metallurgy with an increased feed rate. The results are then interpreted to the commercial machines. Some comparable results are given in Table V. Since the results show only slight increase in grade with small decrease in recovery, for practical reasons, with small adjustment in intensity the results would be the same. There is a small increase in grade at the maximum feed rate. Recovery, of course, could be improved by recirculation of product or second pass.

The interpretation of overall results is that the commercial Jones Separator on this material will operate at the maximum rate capacity. Results indicate that a change in feed rate over the tested range would show no deterrent effect. Certainly, this is another very desirable characteristic of this ore.

SCANNED IMAGE

EFFECT OF GAP

Size of gap between the plates is important in a commercial operation and always should be related to the magnetics intensity. As plate gap is increased a compensation has to be made in the applied amps to compensate for the magnetic intensity. Selection of comparative tests is made on this basis together with experience.

Hence, generally it is important to establish the trend in grade, recovery and intensity at various gaps.

Table V1 shows selected examples.

The results show that tests with gaps of 1.8mm., 2.5mm. and 3mm. have a correspondingly increased intensity.

As expected, the tests demonstrate best grade with 3.0mm. gap and recovery with 1.8 mm. gap. However, the results show best median with 2.5mm. gap. In test No. 83, iron concentrate was produced with 64.54% Fe at recovery of 89%.

Interpretation of overall results and based on data from other commercial operations, 2.5mm. gap should be selecred.

EFFECT OF WASH WATER

For obvious reasons with this type of material it is advantageous if the desired separation can be obtained at a low wash water. The effect of wash water is usually to increase the grade of the concentrate by washing out a little entrapped non-magnetic particles. Experience results in general evaluation of the particular tests to determine that the sample in question remains within the general parameters established on other ores. In this case, it does and it will be seen in Table V11 that the grade of the 'wash' increase with an increase in wash water, up to medium wash.

The results presented do not show large differences in grade. However, a low wash is necessary on this type of ore and the results satisfy the parameters set by experience.

In Lock Test series 83-86 with 2.5mm. gap at 6 amps and low wash at maximum capacity concentrate was produced with 65.06% Fe and 88.1% recovery.

Generally the light and medium wash with 2.5mm. gap attains satisfactory grade.

EFFECT OF WASH WATER CONT'D.

Wash products were tested at grinds -48 mesh and -150 mesh. Since large proportions of the iron values in the wash require grinding - 150 mesh to liberate satisfactory grade (65.84% Fe) concentrate with additional 8.7%, iron recovery was produced at that grind.

Thus recirculation of wash could be advantageous. In a commercial operation on such material, if laboratory tests show that low wash gives relatively good results and they do on this material, then the commercial operation has a lot of leeway. This is done commercially by adjusting the wash water location and the launder location.

EFFECT OF PASSES

In an easy-to-treat material, one pass is usually all that is necessary to obtain an acceptable grade/recovery combination.

Since this ore has fine grained hematite and the objective is high recovery and grade with minimum grind, two passes of magnetics are necessary.

Selected test results are shown in Table V111.

Test # 21 demonstrates that after the second pass of magnetics, an iron concentrate can be produced with 67.42% Fe at relatively high recovery (73.3%). However, if the wash contains intergrown middlings it requires further grinding to produce specified grade iron concentrate with additional recovery. Consequently second pass of magnetics should be considered for production of high grade (+ 65% Fe) iron concentrate.

EFFECT OF RECIRCULATION

(LOCK TESTS)

It is advantageous to recirculate the wash product in order to have better control of the grade and higher recovery at maximum capacity. Consequently, series of lock tests were run with recirculation of the wash at various grinds, passes, intensities and wash.

The test results are shown in Table IX.

Recirculation in the series of tests No. 83 - 86 produced the specified grade (65.06% Fe) and recovery (88.1%). For better interpretation the results in Table IX show 2 of the recoveries and grades in two series of Lock tests.

The lock tests No. 83 - 86 were run at maximum rated capacity with the feed ground -60 mesh and the recirculated wash $_2$ and non-magnetics$_2$ ground$_2$-150 mesh. In the final run the recirculated wash represented 7.3% weight. Consequently it is estimated that by recirculation of the wash under these conditions the new feed throughput will be decreased only slightly.

The wash $_2$ and non-magnetics $_2$ respective assay and Fe distribution is 56.9% Fe, 4.0% and 31.68, 4.6%. Wash$_1$ contains only 10.45% Fe.

EFFECT OF RECIRCULATION

(LOCK TESTS) CONT'D.

Based on these test results and experience with iron ore, maximum feed rate is recommended with second pass of magnetics on the Jones Machine and recirculation of wash 2 and non-magnetics 2. The feed should be ground -60 mesh and the recirculation product -150 mesh.

TABLE 1

SUMMARY OF RESULTS

Test No.	Amps	Gap MM.	Wash Water	Capacity Index	Passes	%FE	Magnetics Fe Dist.%
20	5	2.5	L	200	1	66.40	77.1
30	5	2.5	L	400	1	62.18	79.0
34	5	2.5	L	400	2 Mag.	65.34	68.5
83	6	2.5	L	400	2 Mag.	64.54	89.0
86	6	2.5	L	400	2 Mag. + Recirc. $W_2 + M_2$ - 150 Mesh	65.06	88.1

TABLE 11

GRIND

Test No.	Grind Mesh	Amps	Magnetics % Fe	Fe Dist. %
62	- 20	3	60.53	37.8
1	- 20	6	62.52	86.5
13	- 35	4	61.28	66.8
14	- 35	5	60.97	72.8
16	- 48	4	64.76	71.7
17	- 48	5	63.75	65.3
19	- 60	4	66.06	68.8
20	- 60	5	66.40	77.1
34	All at - 60 + Recirc. $W_2 + NM_2$	5	65.34	68.5
86	Feed at -60 Recirc. $W_2 + NM_2$ at - 150 mesh	6	65.06	88.1

SCREEN ANALYSIS OF MAGNETICS AT -20 MESH GRIND (TEST #1)

Mesh	% Wt.	% Fe	Fe Dist. %
+ 20	21.3	63.81	21.7
- 20 + 60	29.8	64.45	30.6
- 60 +100	21.8	61.31	21.3
-100 +159	10.0	59.88	9.5
-150 +200	7.1	60.71	6.9
-200	10.0	62.78	10.0
TOTAL	100.0	62.74	100.0

TABLE 111.

INTENSITY

Test No.	Amps	Grind Mesh	Magnetics % Fe	Fe Dist. %
		(One Pass)		
1	6	- 20	62.52	86.5
2	8	- 20	61.56	85.8
3	10	- 20	60.45	95.1
4	12	- 20	59.63	97.5
19	4	- 60	66.06	68.8
20	5	- 60	66.40	77.1
		(TWO PASSES OF MAGNETICS AT MAXIMUM CAPACITY)		
34	5	- 60	65.34	68.5
83	6	- 60	64.54	84.0

TABLE IV.

% SOLIDS IN FEED

Test No.	% Solids	Magnetics % Fe	Fe Dist. %
25	10	62.79	80.5
35	20	61.15	83.8
26	30	59.25	85.0
27	40	60.06	83.1

TABLE V.

FEED RATE

Test No.	Capacity Index (Gap - 2.5 mm)	Magnetics % Fe	Fe Dist. %
28	120	60.52	85.3
35	200	61.15	83.8
29	300	62.59	83.2
30	400	62.18	79.0

TABLE VI.

G A P

Test No.	Gap	Amps	Magnetics % Fe	Fe Dist. %
37	1.8	3	61.04	93.2
35	2.5	5	61.15	83.8
81	3.0	12	62.73	80.8

AT MAXIMUM CAPACITY (One Pass)

Test No.	Gap	Amps	Magnetics % Fe	Fe Dist. %
38	1.8	3	61.97	86.7
30	2.5	5	62.18	79.0

(2 PASSES OF MAGNETICS)

Test No.	Gap	Amps	Magnetics % Fe	Fe Dist. %
34	2.5	5	65.34	68.5
41	3.0	7	65.43	62.9
83	2.5	6	64.54	89.0

TABLE VII.

WASH WATER

Test No.	Wash Water	Magnetics % Fe	Fe Dist.	Wash % Fe	Fe Dist. %
35	L	61.15	83.8	-	-
31	M	62.57	75.2	31.34	9.9
32	MH	62.02	76.4	32.16	8.0
33	H	62.05	73.3	37.06	11.5

WASH PRODUCT

Test No.	Wash Water	Magnetics % Fe	Fe Dist.	Wash % Fe	Fe Dist. %
48	L (-48#)	57.91	2.4	-	-
67	L (-150#)	65.84	8.7	-	-

TABLE V111.

PASSES

Test No.	Passes		Magnetics % Fe	Fe Dist.%
35	1		61.15	83.8
21	2 of Magnetics		67.42	73.3
35	2 of Non - Magnetics	# 1	61.15	83.8
		# 2	37.91	9.9
		TOTAL	57.45	94.7

AT MAXIMUM CAPACITY

Test No.	Passes	Magnetics % Fe	Fe Dist.%
30	1	62.18	79.0
34	2 of Magnetics	65.34	68.5

TABLE IX

RECIRCULATION

Test No.	Grind Mesh	Passes	Amps	Capacity	Magnetics % Fe	Fe Dist. %
		(Wash $_1$ +	Wash $_2$ +	Non-Mag. $_2$	Recirculated)	
57	-48	2 mag.	4	200	61.62	82.2
58	-48	2 mag.	4	200	62.18	81.7
59	-48	2 mag.	4	200	61.36	83.3
60	-48	2 mag.	4	200	60.31	83.8
		(Wash $_2$ + Non-Mag. $_2$ reground -150 mesh and recirculated)				
83	-60	2 mag.	6	400	64.54	89.0
84	-60	2 mag.	6	400	64.67	87.4
85	-60	2 mag.	6	400	65.15	88.3
86	-60	2 mag.	6	400	65.06	88.1

APPENDIX "A"

SCANNED IMAGE

EXPLANATION OF TERMS ON TEST DATA SHEETS

On the 'Summary of Test Data' sheets some explanation of the terms used may be helpful to the reader.

INTENSITY - AMPS

The laboratory Jones Separator on which the work was conducted has a maximum of 40 amperage that can be applied to the coils. From the amperage used on the laboratory machine, the size of the coils necessary for a commercial separator can be derived.

% SOLIDS

This is % solids of the slurry feed to the separator.

CAPACITY INDEX

This is an index unit in the laboratory from which the capacity of a commercial separator can be deduced.

WASH WATER

This is classified as Light (L), Medium (M), Medium/Heavy (M/H), and Heavy (H). From the results wash water requirements for a commercial machine can be deduced. Wash water removes entrapped non-magnetics usually with some magnetic minerals, thus wash product may be considered as middling product.

PLATES

There are generally two types of plates: salient pole and high extraction. Their composition can vary.

DISPERSANT

Some materials need a dispersant and this is usually presented as lbs. per ton if used.

PASSES

This is the number of times a product has been passed through the laboratory separator. Deductions are then made for the flow sheet of a commercial operation.

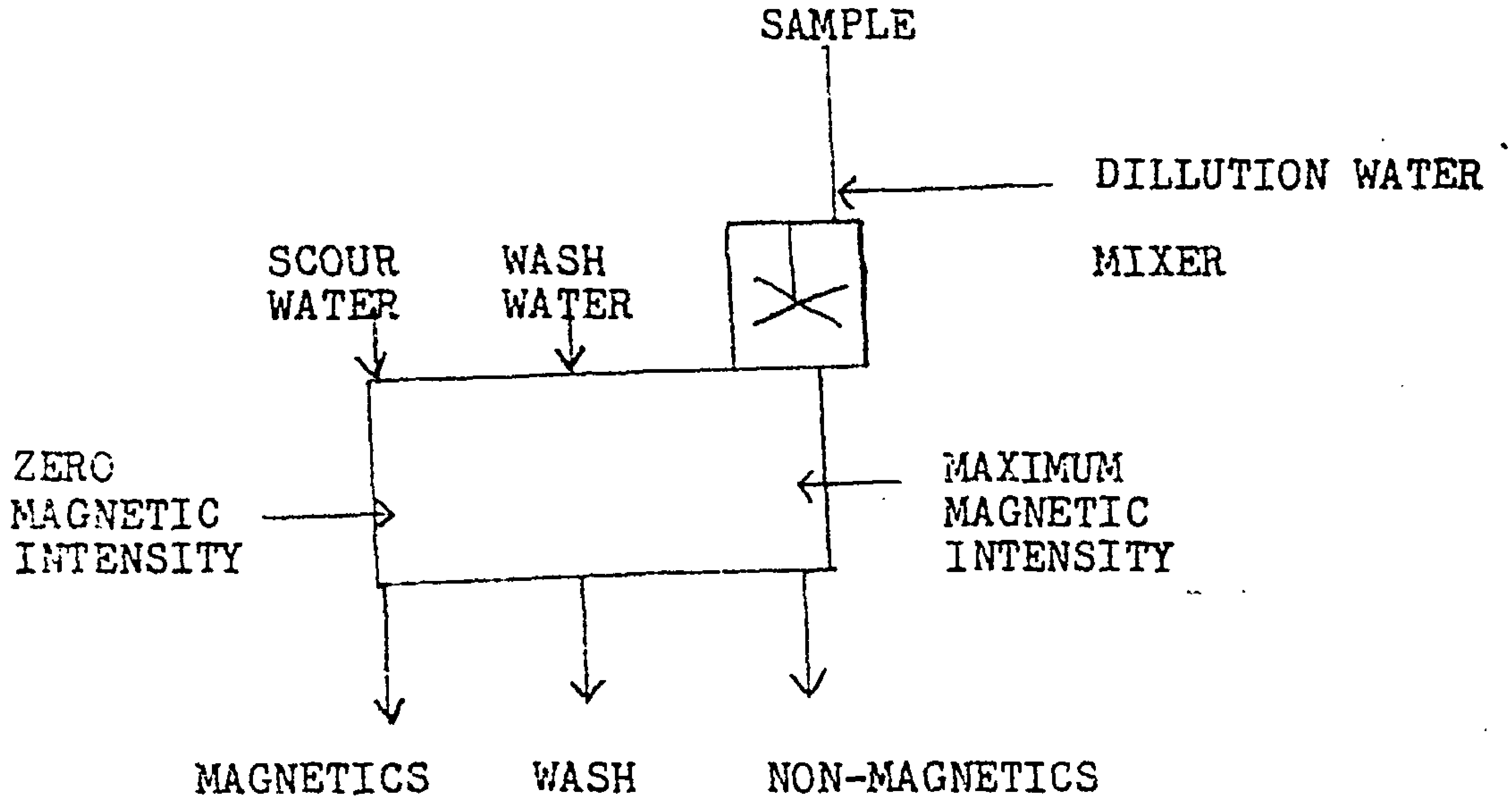
GAP

The air gap between the plates can be varied, usually up to a maximum of 3.0 mm. This data collected determines the gap setting on a commercial separator.

GENERAL

The above items are the result of working out certain factors in the laboratory and applying these factors to determine the parameters for a commercial separator.

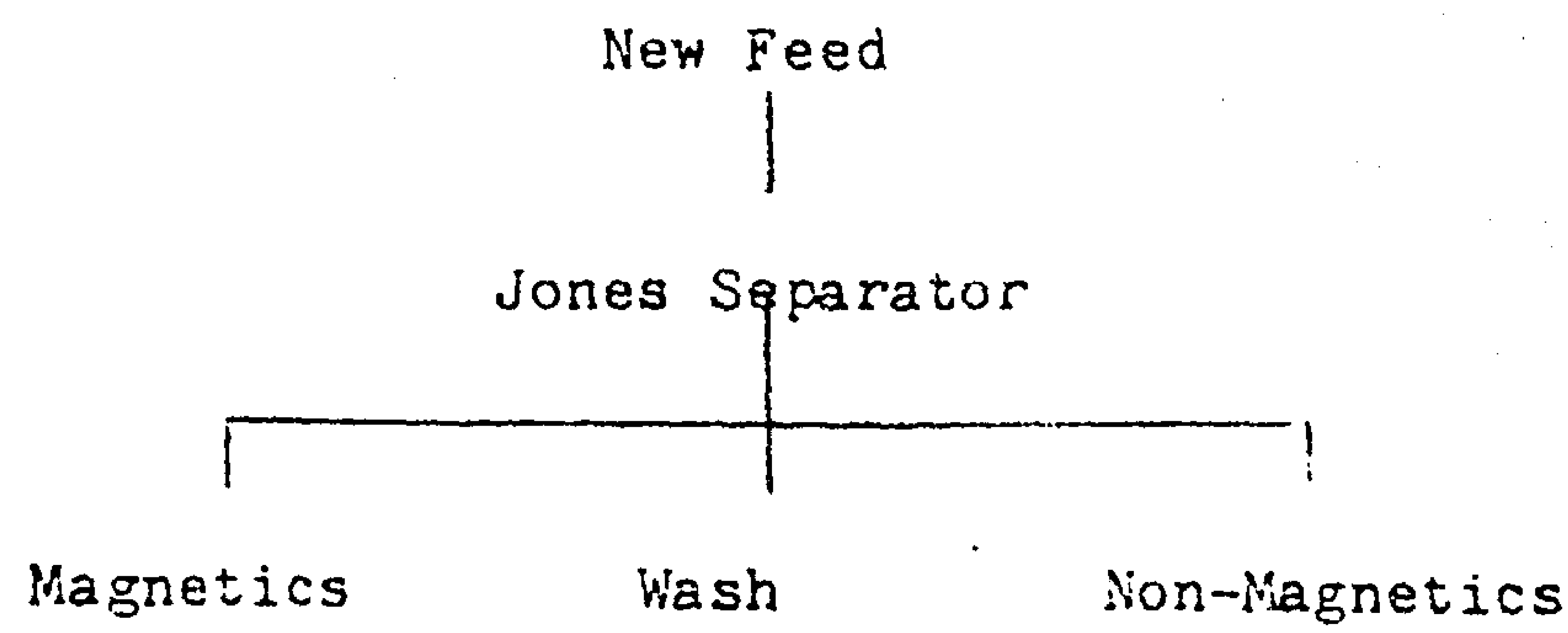
TEST PROCEDURE



APPENDIX "B"

FLOW SHEET

ONE PASS

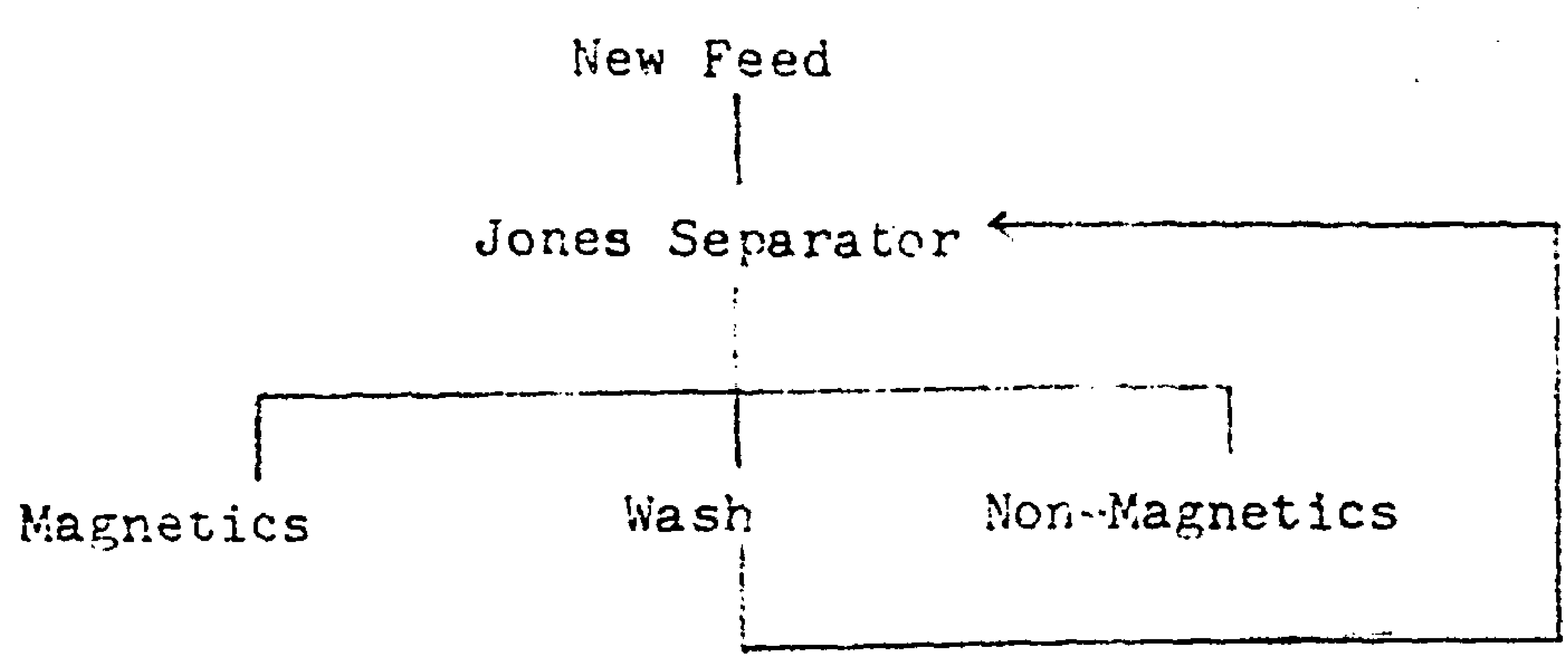


Throughput - 100% (New Feed)

Jones Separator Budget Capital and Operating Cost - $0.128/ton feed/year

(Operating Cost Only - $0.075/ton feed/year)

ONE PASS AND RECIRCULATION OF WASH



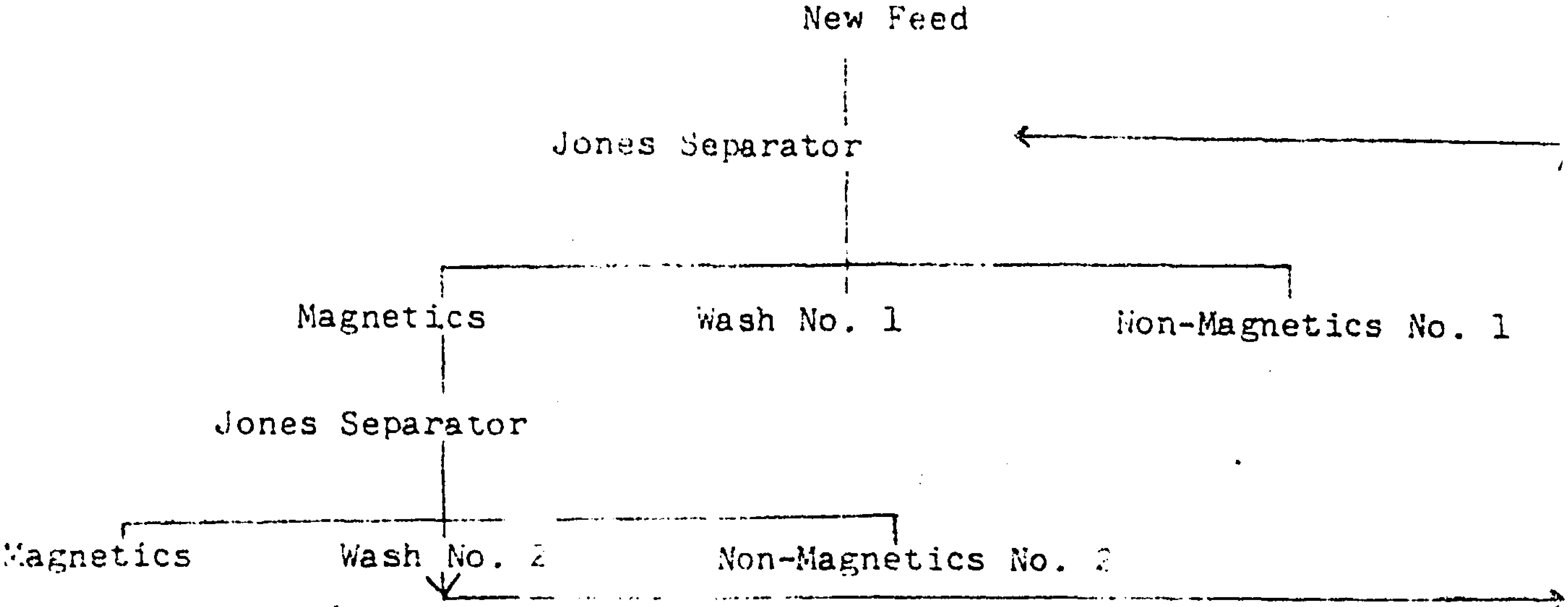
Throughput - 110% (New Feed + Wash)

Jones Separator Budget Capital and Operating Cost - $0.141/ton feed/year

(Operating Cost Only - $0.082/ton feed/year)

FLOW SHEETS

TWO PASSES MAGNETICS

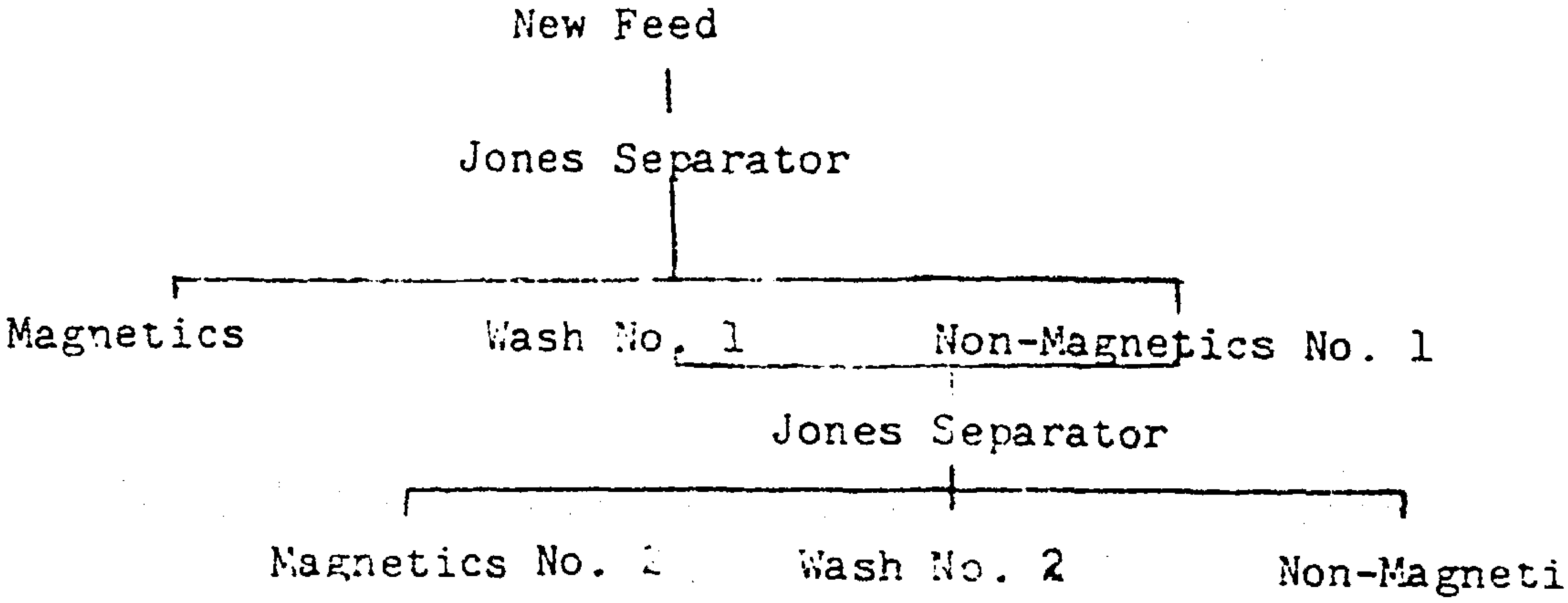


Throughput -140% (New Feed + Magnetics No. 1 + Wash No. 2 + Non-Magnetics

Jones Separator Budget Capital and Operating Cost - $0.180/ton feed/year

(Operating Cost - $0.105/ton feed/year)
Only

TWO PASSES OF NON-MAGNETICS



Throughput -170% (New Feed + Wash No. 1 + Non-Magnetics No. 1)

Jones Separator Capital and Operating Cost - $0.[illegible]18/ton feed/year

(Operating Cost - $0.107/ton feed/year
Only

APPENDIX "C"

SCANNED IMAGE

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A Subsidiary of Magnetics International Ltd.

CAPITAL AND OPERATING COSTS OF THE JONES HIGH INTENSITY WET MAGNETIC SEPARATOR PLANTS FOR IRON ORE CONCENTRATION

PREPRINT OF PAPER

to be presented

at

1972 A.I.M.E. MEETING

DULUTH, MINNESOTA

on

JANUARY 17, 1972

J. A. BARTNIK - Exec. Vice-President

W. J. D. STONE- President

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CAPITAL AND OPERATING COSTS OF THE JONES HIGH INTENSITY WET MAGNETIC SEPARATOR PLANTS FOR IRON ORE CONCENTRATION

INTRODUCTION

For a number of years, the Jones High Intensity Wet Magnetic Separator was under development and then found quite wide commercial use but on a relatively small scale compared with tonnages required by the Iron Ore industry.

Since 1965, Ferrox Iron Ltd. in Canada, have been commercially producing an iron superconcentrate with less than 0.5% insolubles. However, this production, although commercial, is relatively small. The feed for this operation is Quebec Cartier spiral concentrate.

Up to 1970, the main reason for the slow progress in acceptance of this new separator in the Iron Ore industry was the misconception of its cost and lack of a large operating installation.

Many large tonnage potential applications have been waiting for proof if a large scale operation would be feasible.

Now such proof has been provided.

A very progressive Brazilian company, Cia. Vale do Rio Doce, recognised the potential of the Jones Machine for iron ore and have operated, over the past 18 months, a Jones Separator Model DP-317 in a commercial plant. The results have warranted the further purchase of an additional 27 separators by the same company. Feed rate to the machine has been up to 120 tons per hour. In this operation, one machine will process approximately one million tons of ore per year.

The success of the first large separator has resulted in extensive laboratory and pilot plant testing on various iron ores for conventional concentrates, superconcentrates and on tailings on a world wide basis.

This has now led to the sale of the large DP-317 machines in Africa, Europe and North America.

In North America, Wabush Mines of Quebec, Canada, have recently concluded a pilot plant operation and have purchased a large DP-317 for treatment of the tailings from an existing spiral plant. This is interesting as it will be the first large installation on Iron Ore in Canada.

It is thus seen from the extent of commercial activity that the capital and operating costs for the Jones High Intensity Wet Magnetic Separator plant for the treatment of iron ore is low.

Almost certainly it is the most economic process for the concentration of -10 mesh sideritic, hematitic or a combination of hematite and magnetite ores and current work will probably show that the economics will be in its favour even on magnetite, especially when a high grade concentrate is essential.

CONCLUSIONS

GENERAL

The Jones Separator DP-317 with a capacity of one million tons per year concentrates siderite, goethite, hematite and mixtures of hematite with magnetite ores at a lower capital and operating cost than any other process with an equivalent metallurgy.

CAPITAL INVESTMENT

The capital investment per ton of feed is only:

a) $0.053 for concentration of iron ore (Flow Sheet I).

b) $0.133 for superconcentrate production (Flow Sheet II).

c) $0.076 for concentration of tailings (Flow Sheet III).

Such low investment is due to the very high unit capacity, small building space required, minimum auxiliary equipment needed and low installation costs.

OPERATING COST

The operating cost per ton of feed is only:

a) $0.075 for concentration of iron ore.

b) $0.188 for superconcentrate production.

c) $0.106 for concentration of tailings.

This low cost is due to the very high unit capacity, simplicity of the process control requiring minimum supervision, supplies and maintenance.

METALLURGY

Superior metallurgy results in added income due to higher iron recovery and grade of concentrate. There is usually only a minimum amount of fines lost and magnetite is recovered along with the hematite.

COST BASIS

GENERAL

The cost data collected for this survey is based on commercial and pilot plant operations. It is presented in current values valid in Quebec, Canada.

PLANT

The capital cost includes the building, installation cost and the Jones Separator with the auxiliary machinery.

The operating cost includes labour, power, water, supplies and maintenance.

The cost presented as Jones Separator with the auxiliary machinery includes (See Fig. 1) for each system:

1. Maintaining the slurry in suspension by means of an agitator.
2. The Jones High Intensity Wet Magnetic Separator DP-317 with power controls.
3. The provision of centrifugal pumps to pump products after separation to next process stage. An additional set of standby pumps is included.

FEED

One that is sufficiently liberated and supplied as a pulp of suitable size (-10 mesh) for the Jones Separator.

DISCHARGE

Since filtering and drying of the concentrate and disposal of tailings would be carried out independent of the separation system used, this section has not been included in this calculation.

P L A N T T Y P E S

Three types of plants have been selected for cost analyses.

1. Iron Ore Concentration.
2. Superconcentrate Production.
3. Tailings Concentration.

Such plants cover quite a range of applications. In addition, however, there are other types, e.g. concentration of low grade limonite/goethite ores, final cleaning of the magnetic wet drum concentrates and primary concentration before say, flotation.

A typical flow sheet is given for each type, together with relevant costs.

Each type considers the use of one Jones Separator Model DP-317.

IRON ORE CONCENTRATION

PRODUCTION DATA FOR A JONES SEPARATOR DP-317

Feed: (Itabirite with 53% hematite and 2.5% magnetite)

Grade	Capacity	Particle Size
39.7% Fe	1 Million TPY	-10 Mesh

Concentrate:

Grade	Recovery
67.9% Fe	95.5% (558,000 TPY)

Flow Sheet I:

HEAD		
% Wt.	% Fe	% Fe Dist.
100.0	39.7	100.0

JONES FEED		
% Wt.	% Fe	% Fe Dist.
112.6	38.6	109.4

JONES H.I.W.M. SEPARATOR								
MAGNETICS			WASH			NON-MAGNETICS		
% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.
55.8	67.9	95.5	12.6	29.6	9.4	44.2	4.0	4.5

CONCENTRATE

TAILINGS

SUPERCONCENTRATE PRODUCTION

PRODUCTION DATA FOR A JONES SEPARATOR DP-317

Feed: (Spiral Concentrate ~85% hematite and 6% magnetite)

Grade	Capacity	Particle Size
65.2% Fe	400,000 TPY	-35 Mesh

Concentrate:

Grade	Recovery
69.1% Fe	90.6% (342,000 TPY)

Flow Sheet II:

HEAD		
% Wt.	% Fe	% Fe Dist.
100.0	65.2	100.0

JONES FEED		
% Wt.	% Fe	% Fe Dist.
106.6	64.3	105.2

JONES H.I.W.M. SEPARATOR -#1 PASS								
MAGNETICS #1			WASH #1			NON-MAGNETICS #1		
% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.
90.01	68.2	94.2	2.1	48.9	1.6	14.5	42.3	9.4

JONES H.I.W.M. SEPARATOR - #2 PASS								
MAGNETICS #2			WASH # 2			NON-MAGNETICS #2		
% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.
85.5	69.1	90.6	1.4	55.9	1.2	3.1	50.5	2.4

SUPERCONCENTRATE
(<1.0% insolubles)

TAILINGS

TAILINGS CONCENTRATION

PRODUCTION DATA FOR A JONES SEPARATOR DP-317

Feed: (Spiral Plant Tailings ~6% goethite, 20% hematite and 4% magnetite)

Grade	Capacity	Particle Size
21.2% Fe	700,000 TPY	Most of the iron values are in the -150 mesh size fraction.

Concentrate:

Grade	Recovery
64.1% Fe	75.6% (175,000 TPY)

Flow Sheet III:

HEAD		
% Wt.	% Fe	% Fe Dist.
100.0	21.2	100.0

JONES FEED		
% Wt.	% Fe	% Fe Dist.
109.0	21.9	112.8

JONES H.I.W.M. SEPARATOR - #1 PASS								
MAGNETICS #1			WASH #1			NON-MAGNETICS #1		
% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.
31.7	57.0	85.3	2.3	28.6	3.1	75.0	6.9	24.4

JONES H.I.W.M. SEPARATOR - #2 PASS								
MAGNETICS #2			WASH #2			NON-MAGNETICS #2		
% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.	% Wt.	% Fe	% Fe Dist.
25.0	64.1	75.6	1.6	46.4	3.5	5.1	25.8	6.2

CONCENTRATE

TAILINGS

COST ANALYSIS

CAPITAL INVESTMENT	$	$
A. Equipment		
1 Jones Separator Model DP-317 (with 4 feed agitators and power controls)	347,000	
6 Centrifugal Pumps (Free delivery to German border)	24,000	
Total Equipment	371,000	
Freight charge to Montreal, Canada	20,000	
Equipment Cost (duty free) F.O.B. Montreal		391,000
B. Building and Installation		
Ground Area = (30' X 20') 600 sq. ft.		
Space = (600 sq.ft. X 42') 25,200 cu. ft.		
Subject to 3.5 lbs. of steel/cu. ft. 40 tons of steel at about $500/ton	20,000	
Construction work, electrical installation, erection, planning, supervision and start-up cost	75,000	
Building and Installation Cost		95,000
C. Total Capital Investment		486,000

D. Depreciation and Interest Rate

These are calculated by the formula: $K = \frac{A}{100}\left(\frac{100}{n} + \frac{P(n+1)}{2(n)}\right) = \$/\text{Year}$

Where:	A = Capital Investment	486,000
	P = Annual Interest Rate	8%
	n = Service Life	15 years
	K = Annual Depreciation and Interest Rate	53,168

SCANNED IMAGE

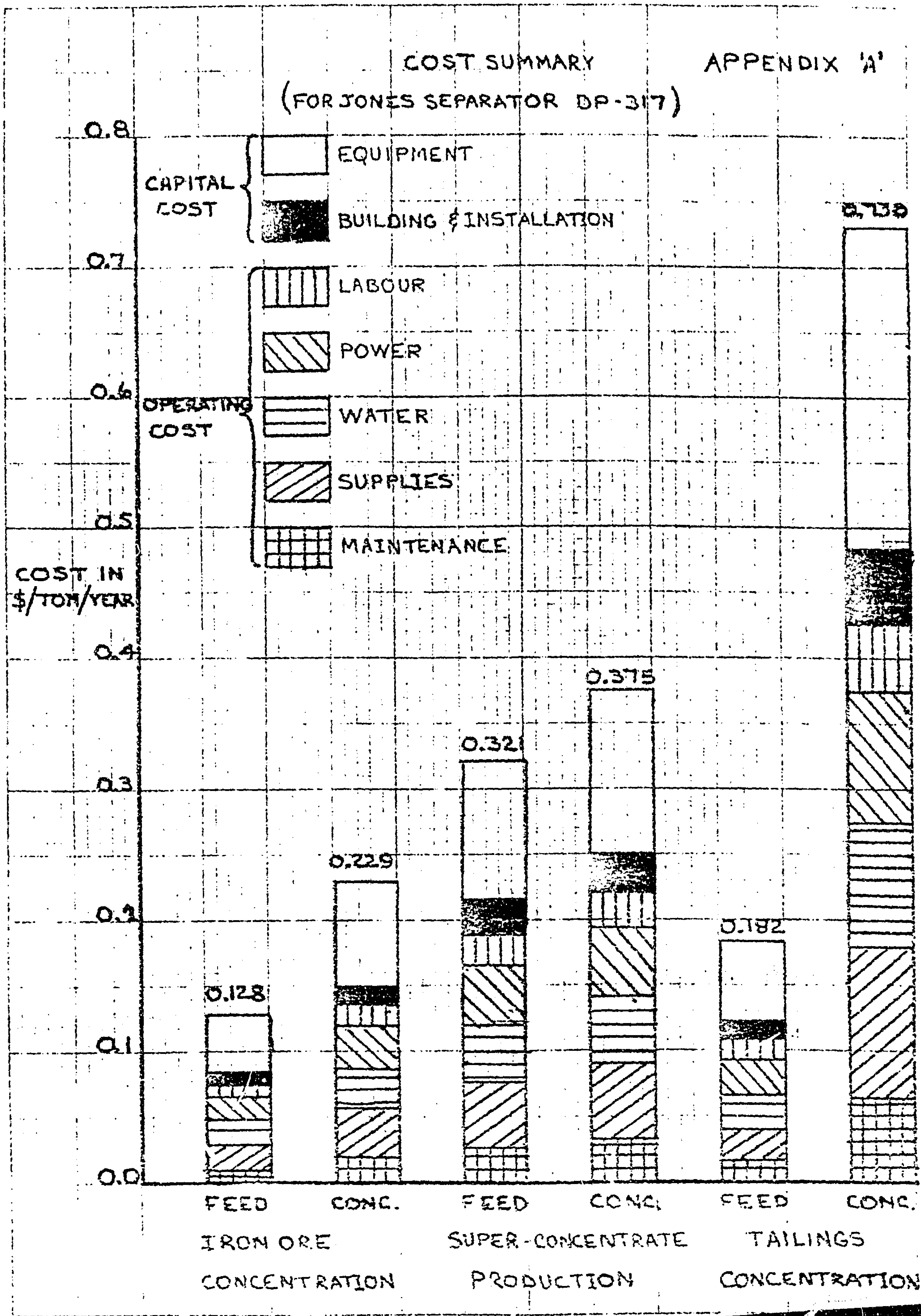
OPERATING COST PER YEAR		$	$
A.	Labour		
	20% Man Day -- 20% X 3 X $15,000	9,000	
B.	Power		
	1,800,000 KW at an electricity price of $0.01/KWH	18,000	
C.	Water		
	Total water consumption with feed at 40% solids, wash water and scour water is 5,000,000 cu. yds./yr.		
	Portion of recycled water amounts to 90% (Cost $7,000/year)		
	Consequently, about 500,000 cu.yds./yr. of make up water is required. (Cost at $0.02/cu.yd. = $10,000)	17,000	
D.	Supplies		
	Mainly cost of grooved plates of which average life is 2 years	20,000	
E.	Maintenance		
	Mechanical and Electrical equipment and building	11,000	
F.	Total Operating Cost Per Year		75,000

CAPITAL AND OPERATING COST PER YEAR			
A.	Annual Depreciation and Interest Rate Per Year	53,168	
B.	Total Operating Cost Per Year	75,000	
C.	Total Capital and Operating Cost Per Year		128,000

COST SUMMARY

COST DESCRIPTION	FLOW SHEET I Iron Ore Concentration (Feed rate 1 million TPY) Feed $/Ton	Conc. $/Ton	FLOW SHEET II Superconcentrate Production (Feed rate 400,000 TPY) Feed $/Ton	Conc. $/Ton	FLOW SHEET III Tailings Concentration (Feed rate 700,000 TPY) Feed $/Ton	Conc. $/Ton	COMMENTS
Equipment F.O.B. Montreal	0.043	0.080	0.107	0.125	0.062	0.247	Taking into account Service Life of 15 years. Interest rate of 8%. For details see Cost Analysis.
Building and Installation	0.010	0.015	0.026	0.030	0.014	0.057	
CAPITAL COST	0.053	0.095	0.133	0.155	0.076	0.304	
Labour	0.009	0.016	0.023	0.026	0.013	0.051	Based on costs prevailing in Canada. For details see Cost Analysis.
Power	0.018	0.032	0.045	0.053	0.025	0.101	
Water	0.017	0.030	0.043	0.050	0.024	0.097	
Supplies	0.020	0.036	0.050	0.059	0.028	0.114	
Maintenance	0.011	0.020	0.027	0.032	0.016	0.063	
OPERATING COST	0.075	0.134	0.188	0.220	0.106	0.426	
CAPITAL AND OPERATING COST	0.128	0.229	0.321*	0.375*	0.182	0.730**	*Cost based on double pass. Sometimes single pass sufficient with corresponding lower costs. **With the feed (Tails) inside the concentration plant this represents the total cost/ton of concentrate.

SCANNED IMAGE



SCANNED IMAGE

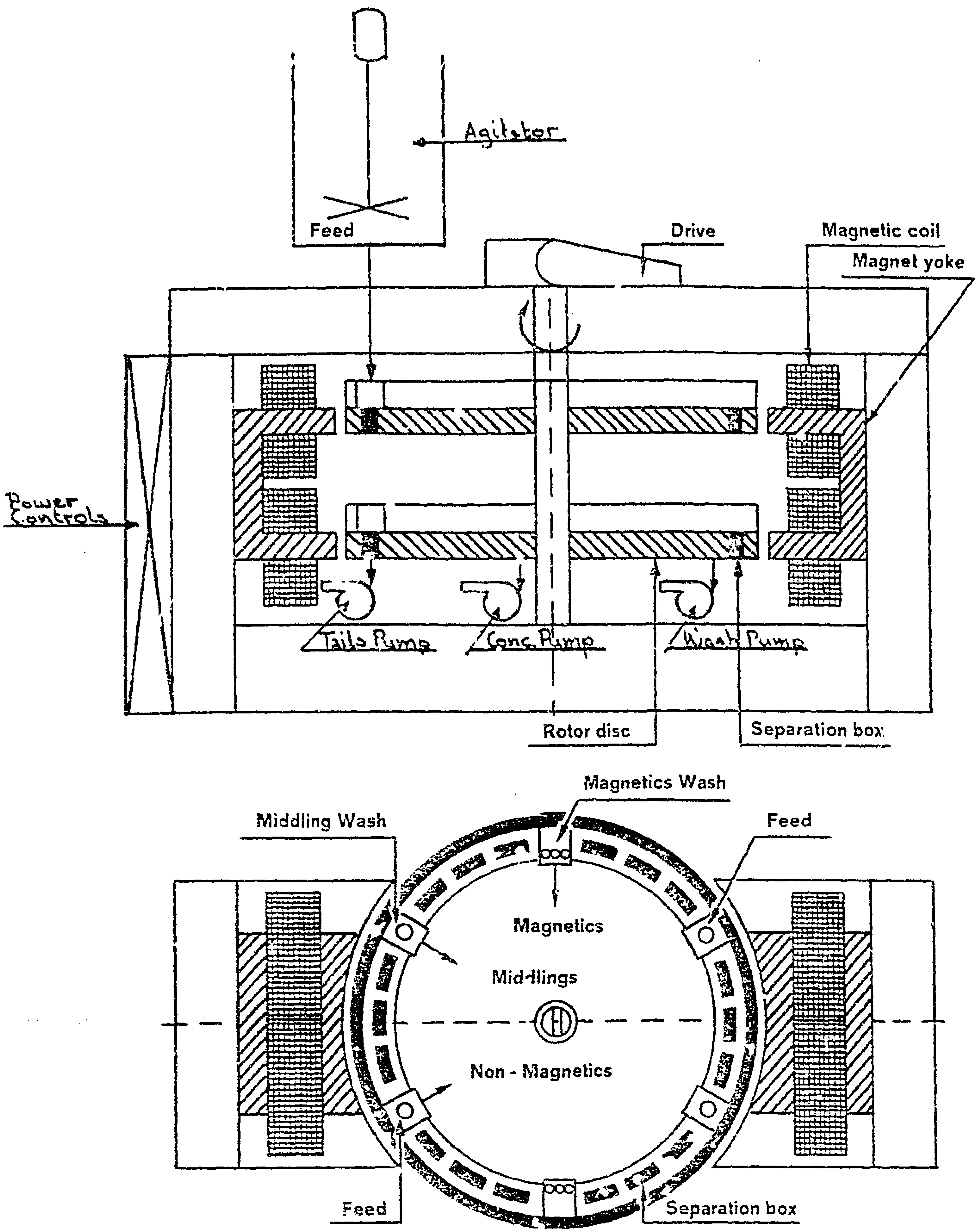
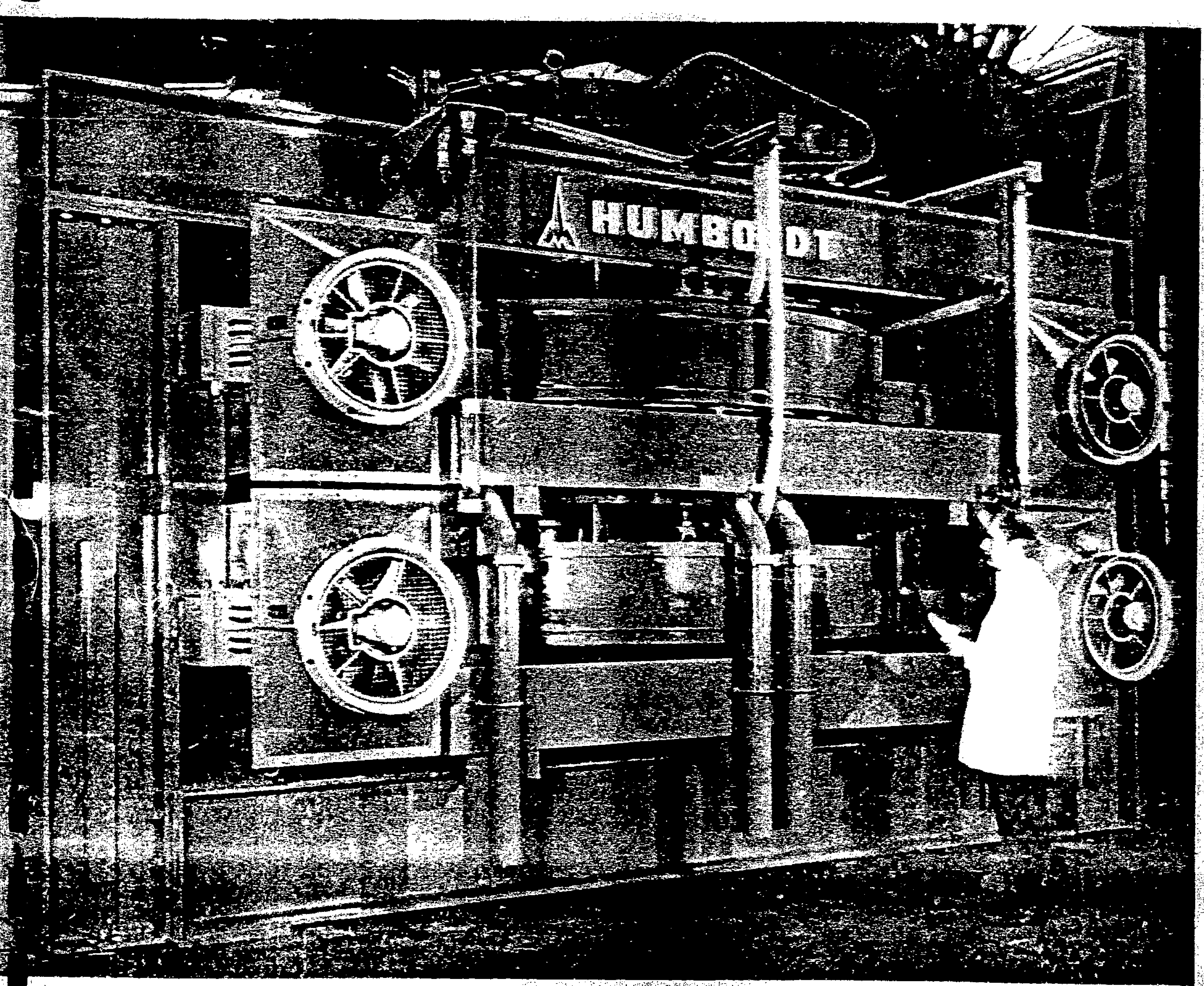


Fig. 1 Operating principle of the Humboldt manufactured JONES magnetic separator

SCANNED IMAGE

MAGNETICS INTERNATIONAL LTD.



JONES SEPARATOR

Jones Wet Magnetic Separator, now treating 120 tons-per-hour, the largest piece of mineral beneficiating equipment in the world, ready for shipment at the Humboldt Division of Klöckner-Humboldt-Deutz A.G., Cologne, Germany. The machine is one of fifteen for Brazil's largest iron ore producer, Cia. Vale do Rio Doce, to treat hematite ore.

APPENDIX "D"

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Test	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
	Head	779-1	100.0	40.63	100.0										
	Head +20	779-1A	1.6	36.66	1.5										
	-20 +60	-1B	53.2	42.22	57.2										
	-60 +100	-1C	19.3	38.92	19.1										
	-100 +150	-1D	11.5	32.19	9.4										
	-150 +200	-1E	3.2	29.92	2.4										
	-200	-1F	11.2	36.00	10.4										
			100.0	39.25	100.0										
1	Magnetics	779-2	56.2	62.52	86.5	-20	6	20	200	MH	SPCh	—	1	2.5	
	Weak	-3	9.4												
	Nonmagnetics	-4	34.4												
	Head		100.0												
	Mags +35	779-2A	21.3	63.81	21.7										
	-35 +60	-2B	29.8	64.45	30.6										
	-60 +100	-2C	21.8	61.31	21.3										
	-100 +150	-2D	10.0	59.88	9.5										
	-150 +200	-2E	7.1	60.71	6.9										
	-200	-2F	10.0	62.78	10.0										
			100.0	62.74	100.0										
2	Magnetics	779-5	59.9	61.56	85.8	-20	8	20	200	M.H.	S.P.Ch	—	1	2.5	10.08 % SiO_2
	Weak	-6	8.9	39.68	8.2										39.71 "
	Non-magnetics	-7	31.2	8.30	6.0										82.52 "
	Head (calc'd)		100.0	43.0	100.0										
3	Magnetics	779-8	63.9	60.45	95.1	-20	10	20	200	M.H.	S.P.Ch	—	1	2.5	
	Weak	-9	7.2												
	Nonmagnetics	-10	28.9												
	Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

[COMP]ANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Test No.	Description	Number	Weight %	Assays % Fe	Distribution % Fe	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
4	Magnetics	779-11	66.4	58.63	97.5	-20	12	20	200	M.H.	S.P.Ch	—	1	2.5	
	Wash	-12	5.5												
	Non-magnetics	-13	28.2												
	Head		100.0												
5	Magnetics	779-14	52.3	62.73	80.7	-35	6	20	200	M.H.	S.P.Ch	—	1	2.5	
	Wash	-15	5.6												
	Non-magnetics	-16	42.1												
	Head		100.0												
						-35	8	20	200	M.H.	S.P.Ch	—	1	2.5	11.24 % SiO_2
6	Magnetics	779-17	54.1	60.23	90.0										58.60 "
	Wash	-18	6.0	26.54	4.4										90.27 "
	Non-magnetics	-19	39.9	5.20	5.6										
	Head (calc'd)		100.0	36.23	100.0										
7	Magnetics	779-20	55.1	59.22	80.3	-35	10	20	200	M.H.	S.P.Ch	—	1	2.5	
	Wash	-21	5.5												
	Non-magnetics	-22	39.4												
	Head		100.0												
8	Magnetics	779-23	56.6	57.80	80.5	-35	12	20	200	M.H.	S.P.Ch	—	1	2.5	
	Wash	-24	4.6												
	Non-magnetics	-25	38.8												
	Head		100.0												
9	Magnetics	779-26	57.6	63.08	89.4	-48	6	20	200	M.H.	S.P.Ch	—	1	2.5	
	Wash	-27	7.9												
	Non-magnetics	-28	34.5												
	Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY CANADIAN JAVELIN MATERIAL JULIAN LAKE OBJECTIVE 65% Fe DATE JULY 31, 1973

Test No.	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
						-48	8	20	200	M.H	S.P.Ch	—	1	2.5	7.52 % SiO_2
10	Magnetics	779-29	60.1	62.47	90.9										50.98 "
	Wash	-30	5.3	30.16	3.9										78.95 "
	Non-magnetics	-31	34.6	6.20	5.2										
	Head (calcd)		100.0	41.29	100.0										
						-48	10	20	200	M.H.	S.P.Ch	—	1	2.5	
11	Magnetics	779-32	62.6	61.48	94.7										
	Wash	-33	4.2												
	Non-magnetics	34	33.2												
	Head		100.0												
						-48	12	20	200	MH	S.P.Ch	—	1	2.5	779-38 is C/A
12	Magnetics	779-35	63.7	61.25	96.0										on 779-35 - 60.9
	Wash	-36	3.8												779-35 - .83% LO
	Non-magnetics	-37	32.5												Fe after LOI - 61.7
	Head		100.0												
						-35	4	20	200	L	S.P.Ch	—	1	2.5	
13	Magnetics	779-39	44.3	61.28	66.8										
	Wash	-40	8.9												
	Non-magnetics	-41	46.8												
	Head		100.0												
						-35	5	20	200	L	S.P.Ch	—	1	2.5	
14	Magnetics	779-42	48.5	60.97	72.8										
	Wash	-43	7.2												
	Non-magnetics	-44	44.3												
	Head		100.0												
						-35	6	20	200	L	S.P.Ch	—	2 -	2.5	
15	Magnetics	779-45	45.0	64.76	71.7								of mags		
	Wash #1	-46	7.0												
	Wash #2	-47	1.2												
	Non-magnetics #1	-48	40.3												
	Non-magnetics #2	-49	6.5												
	Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Test No.	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
						-48	4	20	200	L	SPCh	—	1	2.5	
16	Magnetics	779-50	41.6	63.75	65.3										
	Wash	-51	8.7												
	Non-magnetics	-52	49.7												
	Head		100.0												
						-48	5	20	200	L	SPCh	—	1	2.5	
17	Magnetics	779-53	46.2	63.32	72.0										
	Wash	-54	6.9												
	Non-magnetics	-55	46.9												
	Head		100.0												
						-48	6	20	200	L	SPCh	—	2	2.5	
18	Magnetics	779-56	42.5	66.01	69.0								of mags		
	Wash #1	-57	5.6												
	Wash #2	-58	1.7												
	Non-magnetics #1	-59	45.4												
	Non-magnetics #2	-60	4.8												
	Head		100.0												
						-60	4	20	200	L	SPCh	—	1	2.5	
[illegible]	Magnetics	779-61	42.3	66.06	68.8										
	Wash	-62	8.0												
	Non-magnetics	-63	49.7												
	Head		100.0												
						-60	5	20	200	L	SPCh	—	1	2.5	
20	Magnetics	779-64	47.2	66.40	77.1										
	Wash	-65	6.8												
	Non-magnetics	-66	46.0												
	Head		100.0												
						-60	6	20	200	L	SPCh	—	2	2.5	
21	Magnetics	779-67	44.2	67.42	73.3								of mags		
	Wash #1	-68	5.5												
	Wash #2	-69	1.7												
	Non-magnetics #1	-70	43.6												
	Non-magnetics #2	-71	5.0												
	[illegible]		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 66% Fe DATE July 31, 1973

Test No.	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
22	Magnetics	779-72	54.8	64.23	86.6	-60	8	20	200	M.H.	SPCh	—	1	2.5	
	Wash	-73	4.7												
	Non-magnetics	-74	40.5												
	Head		100.0												
23	Magnetics	779-75	56.9	63.72	89.3	-60	10	20	200	M.H.	SPCh	—	1	2.5	
	Wash	-76	3.9												
	Non-magnetics	-77	39.2												
	Head		100.0												
24	Magnetics	779-78	51.1	69.56	81.2	-60	6	20	200	M.H.	SPCh	—	1	2.5	
	Wash	-79	6.3												
	Non-magnetics	-80	42.6												
	Head		100.0												
	Head	779-81		33.47											New feed sample tests 25-60
25	Magnetics	779-82	42.9	62.72	80.5	-60	5	10	200	L	SPCh	—	1	2.5	
	Wash	-83	5.3												
	Non-magnetics	-84	51.8												
	Head		100.0												
26	Magnetics	779-85	48.0	59.25	85.0	-60	5	30	200	L	SPCh	—	1	2.5	
	Wash	-86	6.8												
	Non-magnetics	-87	45.2												
	Head		100.0												
27	Magnetics	779-88	46.3	60.06	83.1	-60	5	40	200	L	SPCh	—	1	2.5	
	Wash	-89	7.2												
	Non-magnetics	-90	46.5												
	Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Test	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
28	Magnetics	779-91	47.2	60.52	85.3	-60	5	20	120	L	SPCh	—	1	2.5	
	Wash	-92	7.4												
	Non-magnetics	-93	45.4												
	Head		100.0												
9	Magnetics	779-94	44.5	62.59	83.2	-60	5	20	300	L	SPCh	—	1	2.5	
	Wash	-95	6.8												
	Non-magnetics	-96	48.7												
	Head		100.0												
0	Magnetics	779-97	42.5	62.18	79.0	-60	5	20	400	L	SPCh	—	1	2.5	
	Wash	-98	7.2												
	Non-magnetics	-99	50.3												
	Head		100.0												
1	Magnetics	779-100	42.8	62.57	75.2	-60	5	20	200	M	SPCh	—	1	2.5	0.034% TiO_2
	Wash	-101	11.2	31.34	9.9										
	Non-magnetics	-102	46.0	11.53	14.9										
	Head (calc'd)		100.0	35.59	100.0										
32	Magnetics	779-103	43.8	62.02	76.4	-60	5	20	200	MH	SPCh	—	1	2.5	
	Wash	-104	8.8	32.16	8.0										
	Non-magnetics	-105	47.4	11.75	15.6										
	Head		100.0	35.57	100.0										
33	Magnetics	779-106	42.1	62.05	73.3	-60	5	20	200	H	SPCh	—	1	2.5	
	Wash	-107	11.1	37.06	11.5										
	Non-magnetics	-108	46.8	11.56	15.2										
	Head		100.0	35.65	100.0										

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Test No.	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
34	Magnetics	779-109	35.1	65.34	68.5	-60	5	20	400	L	S.P.Ch	—	2 of mags	2.5	0.019% TiO_2
	Wash #1	-110	8.0												
	Wash #2	-111	1.8												
	Non-magnetics #1	-112	49.5												
	Non-magnetics #2	-113	5.6												
	Head		100.0												
35	Magnetics #1	779-114	45.9	61.15	83.8	-60	5	20	200	L	S.P.Ch	—	2 of non-mags & wash	2.5	
	Magnetics #2	-115	8.7	37.91	9.9										
	Wash	-117	14.1												
	Non-magnetics	-118	31.3												
	Head		100.0												
36	Magnetics	779-119	48.9	62.93	91.9	-60	4	20	200	L	S.P.Ch	—	2 of mags	1.8	
	Wash #1	-120	6.2												
	Wash #2	-121	.6												
	Non-magnetics #1	-122	39.9												
	Non-magnetics #2	-123	4.4												
	Head		100.0												
37	Magnetics	779-124	51.1	61.04	93.2	-60	3	30	200	L	S.P.Ch	—	1	1.8	
	Wash	-125	7.0												
	Non-magnetics	-126	41.9												
	Head		100.0												
38	Magnetics	779-127	46.8	61.97	86.7	-60	3	20	400	L	S.P.Ch	—	1	1.8	
	Wash	-128	5.5												
	Non-magnetics	-129	47.7												
	Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

NY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
Magnetics	778-130	40.1	63.07	75.6	-60	10	20	200	L	SPCh	—	2 of mag	3.0	
Wash #1	-131	5.5												
Wash #2	-132	1.0												
Non-magnetics #1	-133	47.4												
Non-magnetics #2	-134	6.0												
Head		100.0												
Magnetics	779-135	39.4	63.98	75.3	-60	7	20	200	L	SPCh	—	2 of mag	3.0	
Wash #1	-136	6.3												
Wash #2	-137	1.8												
Non-magnetics #1	-138	45.6												
Non-magnetics #2	-139	6.9												
Head		100.0												
Magnetics	779-140	32.2	65.43	62.9	-60	7	20	400	L	SPCh	—	2 of mag	3.0	
Wash #1	-141	8.6												
Wash #2	-142	2.5												
Non-magnetics #1	-143	48.4												
Non-magnetics #2	-144	8.3												
Head		100.0												
Magnetics	779-145	41.4	62.43	77.3	-80	5	20	200	L	SPCh	—	2 of mag	2.5	
Wash #1	-146	15.8												
Wash #2	-147	2.9												
Non-magnetics #1	-148	33.1												
Non-magnetics #2	-149	3.8												
Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Test No.	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
											SPCh	—	2	2.5	
43	Magnetics	779-150	52.5	61.94	97.2	-80	3	20	200	L			of mags		
	Wash #1	-151	15.8												
	Wash #2	-152	2.6												
	Non-magnetic #1	-153	25.4												
	Non-magnetic #2	-154	3.7												
	Head		100.0												
											SPCh	—	2	2.5	
44	Magnetics	779-155	38.7	63.87	75.2	-100	5	20	200	L			of mags		
	Wash #1	-156	19.4												
	Wash #2	-157	3.4												
	Non-magnetic #1	-158	33.7												
	Non-magnetic #2	-159	4.8												
	Head		100.0												
											SPCh	—	2	2.5	
45	Magnetics	779-160	40.1	62.07	74.4	-100	3	20	200	L			of mags		
	Wash #1	-161	19.5												
	Wash #2	-162	3.3												
	Non-magnetic #1	-163	31.7												
	Non-magnetic #2	-164	5.4												
	Head		100.0												
											SPCh	—	2	2.5	
46	Magnetics	779-165	49.1	59.52	87.3	-100	10	20	200	L			of mags		
	Wash #1	-166	16.9												
	Wash #2	-167	3.8												
	Non-magnetic #1	-168	24.0												
	Non-magnetic #2	-169	6.2												
	Head		100.0												
						-48	5	20	200	L	SPCh	—	1	2.5	
47	Magnetics	779-170	54.0	57.52	92.8										
	Wash (combined)	-171	17.8												
	Non-magnetics	-172	28.2												
	Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Test	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
3	Magnetics	779-173	1.4	57.91	2.4	-48	5	20	200	L	SPCh	—	3 of mags	2.5	
	Wash #1	-174	5.1												
	Wash #2	-175	.2												
	Wash #3	-176	.1												
	Non magnetics #1	-177	10.3												
	Non magnetics #2	-178	.6												
	Non magnetics #3	-179	.1												
	Head	-171	17.8												
2	Magnetics	779-180	65.0	57.35	91.4	-48	5	20	200	L	SPCh	—	1	2.5	
	Wash	-181	Total 50												
	Non magnetics	-182	35.0	10.06	8.6										
	Head (calc'd)			40.72											
	Magnetics	779-183	61.3	56.09	91.6	-48	5	20	200	L	SPCh	—	1	2.5	
	Wash	-184	Total 51												
	Non magnetics	-185	38.7	8.19	8.4										
	Head (calc'd)			37.55											
21	Magnetics	779-186	58.8	55.30	91.6	-48	5	20	200	L	SPCh	—	1	2.5	
	Wash	-187	Total 52												
	Non magnetics	-188	41.2	7.21	8.4										
	Head (calc'd)			35.49											
	Magnetics	779-189	54.8	54.71	89.0	-48	5	20	200	L	SPCh	—	1	2.5	
	Wash (Fines)	-190	(25.8)	8.48	(6.5)										
	Non magnetics	-191	45.2	8.24	11.0										
	Head (calc'd)		100.0	33.71											
3	Magnetics	779-192	64.3	57.11	91.2	-48	4	20	200	L	SPCh	—	1	2.5	
	Wash	-193	Total 54												
	[illegible]	-194	35.7	9.91	8.8										

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

…PANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
Magnetics	779-195	50.4	55.64	88.9	-48	4	20	200	L	SPCh	—	1	2.5	
Wash	-196	Total 55												
Non-magnetics	-197	40.6	10.15	11.1										
Head (calc'd)			37.57											
Magnetics	779-198	55.7	56.52	87.8	-48	4	20	200	L	SPCh	—	1	2.5	
Wash	-199	Total 56												
Non-magnetics	-200	44.3	9.54	12.2										
Head (calc'd)			35.84											
Magnetics	779-201	57.4	56.86	90.1	-48	4	20	200	L	SPCh	—	1	2.5	
(Wash (Recirc)	-202	(30.5)	9.74	(8.2)										
Non-magnetics	-203	42.6	8.42	9.9										
Head (calc'd)			36.23											
Magnetics	779-204	45.2	61.62	82.2	-48	4	20	200	L	SPCh	—	2 of mag	2.5	
Wash #1	-205	23.5	13.75	9.5										
Wash #2	-206	Total 58												
Non-magnetics #2	-208													
Non-magnetics #1	-207	31.3	8.95	8.3										
Head (calc'd)			33.88											
Magnetics	779-209	47.1	62.18	81.7	-48	4	20	200	L	SPCh	—	2 of mag	2.5	
Wash #1	-210	20.8	12.74	7.4										
Wash #2	-211	Total 59												
Non-magnetics #2	-213													
Non-magnetics #1	-212	32.1	12.17	10.9										
Head (calc'd)			35.84											

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY: Canadian Javelin MATERIAL: Julian Lake OBJECTIVE: 65% Fe DATE: July 31, 1973

Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
Magnetics	779-214	46.6	61.36	83.6	-48	4	20	200	L	SPCh	—	2	2.5	
Wash #1	-215	21.0	12.02	7.4								of mag		
Wash #2	-216	{ Total 60												
Non-magnetics #2	-218	}												
Non-magnetics #1	-217	32.4	9.81	9.0										
Head (Calc'd)			34.20											
Magnetics	779-219	46.2	60.31	83.8	-48	4	20	200	L	SPCh	—	2	2.5	779-224 is 59.00
Wash #1	-220	22.2	10.63	7.1								of mag		779-219 - 60.35% Fe
Wash #2	-221	(3.7)	28.09	(3.1)	{ Recirc									
Non-magnetics #2	-223	(5.9)	26.58	(4.7)	}									
Non-magnetics #1	-222	31.6	9.54	9.1										
Head (Calc'd)			33.24											
														New feed sample
Head	779-358		35.56											test 61-86
Magnetics	779-225	23.9	53.48	35.9	-20	3	20	200	L	SPCh	—	1	2.5	
Wash	-226	15.3	Total 67											
Non-magnetics	-227	60.8												
Head		100.0												
Magnetics	779-228	22.2	60.53	37.8	-20	3	20	200	L	SPCh	—	1	2.5	
Wash	-229	16.5	Total 63											
Non-magnetics	-230	61.3												
Head		100.0												
Magnetics	779-231	22.7	59.79	35.2	-20	3	20	200	L	SPCh	—	1	2.5	
Wash	-232	18.4	Total 63											
Non-magnetics	-233	58.9												
Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin   MATERIAL Julian Lake   OBJECTIVE 65% Fe   DATE July 31, 1973

Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
Magnetics	779-234	30.7	61.11	52.2	-60	3	20	200	L	S.P.Ch	—	1	2.5	
Wash	235	17.7	To test 70											
Non-magnetics	-236	51.6												
Head		100.0												
Magnetics	779-237	28.1	62.28	49.2	-60	3	20	200	L	S.P.Ch	—	1	2.5	
Wash	-238	17.1	To test 71											
Non-magnetics	-239	54.8												
Head		100.0												
Magnetics	779-240	27.8	63.05	49.3	-60	3	20	200	L	S.P.Ch	—	1	2.5	
Wash	-241	17.7	To test 72											
Non-magnetics	-242	54.5												
Head		100.0												
Magnetics	779-243	4.7	65.89	8.7	-150	5	20	200	L	S.P.Ch	—	3 of mags	2.5	
Wash #1	-244	1.7												
Wash #2	-245	.3												
Wash #3	-246	.1												
Non-magnetics #1	-247	6.8												
Non-magnetics #2	-248	1.3												
Non-magnetics #3	-249	.4												
Head	-226	15.3												
Magnetics	779-250	3.4	64.01	6.1	-200	5	20	200	L	S.P.Ch	—	3 of mags	2.5	
Wash #1	-251	2.0												
Wash #2	-252	.5												
Wash #3	-253	.3												
Non-magnetics #1	254	6.6												
Non-magnetics #2	-256	2.6												
Non-magnetics #3	-256	1.1												
Head	-229	16.5												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

NY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
Magnetics	779-257	3.0	63.74	5.4	-325	5	20	200	L	SPCh	—	3 of mags	2.5	
	-258	2.5												
Wash #1	-259	.5												
Wash #3	-260	.1												
Non-magnetic #1	-261	10.0												
Non-magnetic #2	-262	1.5												
Non-magnetic #3	-263	.3												
Head	-232	18.4												
Magnetics	779-264	3.2	65.25	5.9	-150	5	20	200	L	SPCh	—	3 of mags	2.5	
Wash #1	-265	2.8												
Wash #2	-266	.2												
Wash #3	-267	.1												
Non-magnetic #1	-268	9.6												
Non-magnetic #2	-269	1.3												
Non-magnetic #3	-270	.5												
Head	-235	17.7												
Magnetics	779-271	2.5	64.80	4.6	-200	5	20	200	L	SPCh	—	3 of mags	2.5	
Wash #1	-272	2.8												
Wash #2	-273	.3												
Wash #3	-274	.1												
Non-magnetic #1	-275	9.4												
Non-magnetic #2	-276	1.6												
Non-magnetic #3	-277	.4												
Head	-238	17.1												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

[COMPA]NY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
Magnetics	779-278	3.1	57.57	5.0	-325	5	20	200	L	SPCh	—	3 of mag	2.5	
Wash #1	-279	20												
Wash #2	-280	.5												
Wash #3	-281	.2												
Non-magnetics #1	-282	9.3												
Non-magnetics #2	-283	1.8												
Non-magnetics #3	-284	.8												
Head	-241	17.7												
Magnetics	779-285	36.3	69.99	66.3	-60	7	20	200	M.H.	SPCh	—	2 of mag	2.5	
Wash #1	-286	9.0	Total 76											
Wash #2	-287	3.0												
Non-magnetics #2	-289	4.4												
Non-magnetics #1	-288	47.3												
Head		100.0												
Magnetics	779-290	38.7	65.25	71.0	-60	7	20	200	M.H.	SPCh	—	2 of mag	2.5	779-290 - .43% LOI
Wash #1	-291	8.3	Total 77											Fe after LOI: 65.59
Wash #2	-292	3.0												
Non-magnetics #2	-294	3.9												
Non-magnetics #1	-293	46.1												
Head		100.0												
Magnetics	779-295	37.5	65.36	68.9	-60	7	20	200	M.H.	SPCh	—	2 of mag	2.5	
Wash #1	-296	8.0	Total 78											
Wash #2	-297	3.4												
Non-magnetics #2	-299	3.4												
Non-magnetics #1	-298	47.7												
Head		100.0												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

PANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65 % Fe DATE July 31, 1973

Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
Magnetics	779-300	6.3	65.83	11.7	-150	7	20	200	M.H.	S.P.Ch	—	3	2.5	779-300 - .66% LOI
Wash #1	-301	1.0										of mags		Fe after LOI: 66.25%
Wash #2	-302	.2												
Wash #3	-303	.1												
Non-magnetics #1	-304	7.3												
Non-magnetics #2	-305	1.1												
Non-magnetics #3	-306	.4												
Head		16.4												
Magnetics	779-307	5.3	64.51	9.6	-200	7	20	200	M.H.	S.P.Ch	—	3	2.5	
Wash #1	-308	.1										of mags		
Wash #2	-309	.1												
Wash #3	-310	.1												
Non-magnetis #1	-311	7.8												
Non-magnetis #2	-312	1.3												
Non-magnetics #3	-313	.5												
Head		15.2												
Magnetics	779-314	3.6	63.32	6.4	-325	7	20	200	M.H.	S.P.Ch	—	3	2.5	
Wash #1	-315	1.0										of mags		
Wash #2	-316	.3												
Wash #3	-317	.1												
Non-magnetics #1	-318	7.4												
Non-magnetics #2	-319	1.6												
Non-magnetics #3	-320	.8												
Head		14.8												

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

COMPANY Canadian Javelin   MATERIAL Julian Lake   OBJECTIVE 65% Fe   DATE July 31, 1973

Description	Number	Weight %	Assays % Fe	Distribution Fe%	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
Magnetics	779-321	35.8	64.66	65.1	-60	8	20	200	M.H.	S.P.Ch	—	1	3.0	
Wash	-322	10.8												
Non-magnetics	-323	53.4												
Head		100.0												
Magnetics	779-324	42.8	63.40	76.3	-60	10	20	200	M.H.	S.P.Ch	—	1	3.0	
Wash	-325	10.0	Total 82											
Non-magnetics	-326	47.2												
Head		100.0												
Magnetics	779-327	45.8	62.73	80.8	-60	12	20	200	M.H.	S.P.Ch	—	1	3.0	
Wash	-328	3.1												
Non-magnetics	-329	46.1												
Head		100.0												
Magnetics	779-330	2.2	63.75	3.9	-325	10	20	200	M.H.	S.P.Ch	—	1	3.0	779-337 [illegible]
Wash #1	-331	.5												779-330 - 63.95% Fe
Wash #2	-332	.2												
Wash #3	-333	.1												
Non-magnetics #1	-334	5.2												
Non-magnetics #2	-335	1.4												
Non-magnetics #3	-336	.4												
Head	-325	10.0												
Magnetics	779-339	47.1	64.54	89.0	-60	6	20	400	L	S.P.Ch	—	2	2.5	Recirculation product
Wash #1	-340	5.0	7.00	1.0								of mags		ground -150
Wash #2	-341	Total 84												
Non-magnetics #2	-343													
Non-magnetics #1	-342	47.9	7.10	10.0										
Head (calc'd)			34.15											

FERRO-MAGNETICS LTD.

SUMMARY OF TEST DATA ---- JONES SEPARATOR

PANY Canadian Javelin MATERIAL Julian Lake OBJECTIVE 65% Fe DATE July 31, 1973

Test	Description	Number	Weight %	Assays % Fe	Distribution Fe %	Grind Mesh	Intensity Amps	% Solids	Capacity Index	Wash Water	Plates	Dispers.	Passes	Gap	Comments
4	Magnetics	779-344	46.4	64.67	87.4	-60	6	20	400	L	SPCh	—	2	25	Recirculated produ
	Wash #1	-345	7.7	7.23	1.6								of mags		ground -150
	Wash #2	-346	Total 85												
	Non-magnetics #2	-348													
	Non-magnetics #1	-347	45.9	5.29	11.0										
	Head (calc'd)			34.56											
	Magnetics	779-349	47.6	65.13	88.3	-60	6	20	400	L	SPCh	—	2	25	Recirculated produ
	Wash #1	-350	5.7	9.78	1.6								of mags		ground -150
	Wash #2	-351	Total 86												779 349 - .43 %
	Non-magnetics #2	-353													Fe after ...: 65.41°
	Non-magnetics #1	-352	46.7	7.64	10.1										
	Head (calc'd)			35.13											
	Magnetics	779-354	46.0	65.06	88.1	-60	6	20	400	L	SPCh	—	2	25	
	Wash #1	-355	5.7	10.45	2.6								of mags		
	Wash #2	-356	(2.4)	56.99	(4.0)	} Recirc									
	Non-magnetics #2	-358	(4.9)	31.68	(4.6)										
	Non-magnetics #1	-357	48.3	9.56	9.3										
	Head			35.43											

APPENDIX "E"

ARBITRAGE
HYDROMÉTALLURGIE
TRAITEMENT DES MINERAIS

ASSAYING
UMPIRING
HYDROMETALLURGY
MINERAL PROCESSING

metriclab CASIER POSTAL 440, 956 CHEMIN D'OKA,
STE-MARTHE SUR LE LAC, QUÉ. TÉL. 514-473-0920

RECEIVED JUN 5 1973

REPORT OF ANALYSIS

No. : 0631684 to 0631705
Date : June 1st, 1973
Client : Ferro-Magnetics Limited

Ferro-Magnetics P.O. number : 98

NO. CERTIFICATE	NO. SAMPLE	% Fe (Total)	% Fe (Soluble)
0631684	779 - 1		40.63
0631685	760 - 1	2.45	
0631686	760 - 2	7.43	
0631687	760 - 3	6.26	
0631688	760 - 4	3.07	
0631689	760 - 5	2.88	
0631690	760 - 6	2.25	
0631691	760 - 11	2.43	
0631692	760 - 16	2.28	
0631693	760 - 20	2.75	
0631694	760 - 21	4.61	
0631695	760 - 22	5.38	
0631696	760 - 23	3.96	
0631697	760 - 24	2.94	
0631698	760 - 25	3.01	
0631699	760 - 26	3.04	
0631700	760 - 27	7.06	
0631701	760 - 30	2.72	
0631702	760 - 31	3.36	
0631703	760 - 32	0.20	
0631704	760 - 33	0.17	
0631705	760 - 34	2.43	

"The above results apply only to the submitted sample. Having no control on the initial sampling and on the use of these results, we decline all responsabilities for damage resulting from their utilisation."

H Blais.
Henri Blais

ARBITRAGE
HYDROMÉTALLURGIE
TRAITEMENT DES MINERAIS

ASSAYING
UMPIRING
HYDROMETALLURGY
MINERAL PROCESSING

metriclab CASIER POSTAL 440, 956 CHEMIN D'OKA,
STE-MARTHE SUR LE LAC, QUÉ. TÉL. 514-473-0920

RECEIVED JUL - 6 1973

REPORT OF ANALYSIS

No. : 0632703
Date : July 4, 1973
Client : Ferro-Magnetics Limited

NO. CERTIFICATE	NO. SAMPLE	% TiO_2
0632703	779 - 1	0.04

"The above results apply only to the submitted sample."

H Blais.
Henri Blais

ARBITRAGE
HYDROMÉTALLURGIE
TRAITEMENT DES MINERAIS
ASSAYING
UMPIRING
HYDROMETALLURGY
MINERAL PROCESSING

metriclab CASIER POSTAL 440, 958 CHEMIN D'OKA,
STE-MARTHE SUR LE LAC, QUÉ. TÉL. 514-473-0920

RECEIVED MAY 29 1973

REPORT OF ANALYSIS

No. : 0531640 to 0531664
Date : May 23, 1973
Client : Ferro-Magnetics Limited

Ferro-Magnetics P.O. number : 97

NO. CERTIFICATE	NO. SAMPLE	% Fe	% SiO_2
0531640	779 - 1 A	36.66	
0531641	779 - 1 B	42.27	
0531642	779 - 1 C	38.92	
0531643	779 - 1 D	32.19	
0531644	779 - 1 E	29.92	
0531645	779 - 1 F	36.00	
0531646	779 - 2	62.52	
0531647	779 - 5	61.56	10.08
0531648	779 - 6	39.68	39.71
0531649	779 - 7	8.30	82.52
0531650	779 - 8	60.45	
0531651	779 - 11	59.63	
0531652	779 - 14	62.73	
0531653	779 - 17	60.23	11.24
0531654	779 - 18	26.54	58.60
0531655	779 - 19	5.20	90.27
0531656	779 - 20	59.22	
0531657	779 - 23	57.80	
0531658	779 - 26	63.08	
0531659	779 - 29	62.47	7.52
0531660	779 - 30	30.16	50.48
0531661	779 - 31	6.20	78.45
0531662	779 - 32	61.48	
0531663	779 - 35	61.25	
0531664	779 - 38	60.96	

"The above results apply only to the submitted sample. Having no control on the initial sampling and on the use of these results, we decline all responsabilities for damage resulting from their utilisation."

H Blais

Henri Blais

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ANALYSES
ARBITRAGE
HYDROMÉTALLURGIE
TRAITEMENT DES MINERAIS

ASSAYING
UMPIRING
HYDROMETALLURGY
MINERAL PROCESSING

metriclab CASIER POSTAL 440, 956 CHEMIN D'OKA,
STE-MARTHE SUR LE LAC, QUÉ. TÉL. 514-473-0920

REPORT OF ANALYSIS

No. : 0631825 to 0631836
Date : June 7, 1973
Client : Ferro-Magnetics Limited

Ferro-Magnetics P.O. number : 103

NO. CERTIFICATE	NO. SAMPLE	% Fe
0631825	779 - 39	61.28
0631826	779 - 42	60.97
0631827	779 - 45	64.76
0631828	779 - 50	63.75
0631829	779 - 53	63.32
0631830	779 - 56	66.01
0631831	779 - 61	66.06
0631832	779 - 64	66.40
0631833	779 - 67	67.42
0631834	779 - 72	64.23
0631835	779 - 75	63.79
0631836	779 - 78	64.56

"The above results apply only to the submitted sample. Having no control on the initial sampling and on the use of these results, we decline all responsabilities for damage resulting from their utilisation."

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REPORT OF ANALYSIS

No. : 0732709 to 0732773
Date : July 6, 1973
Client : Ferro-Magnetics Limited

Ferro-Magnetics P.O. number : 112

NO. CERTIFICATE	NO. SAMPLE	% Fe	% TiO_2
0732709	779 - 81	33.47	
0732710	779 - 82	62.79	
0732711	779 - 85	59.25	
0732712	779 - 88	60.06	
0732713	779 - 91	60.52	
0732714	779 - 94	62.59	
0732715	779 - 97	62.18	
0732716	779 - 100	62.57	0.034
0732717	779 - 101	31.34	
0732718	779 - 102	11.53	
0732719	779 - 103	62.02	
0732720	779 - 104	32.16	
0732721	779 - 105	11.75	
0732722	779 - 106	62.05	
0732723	779 - 107	37.06	
0732724	779 - 108	11.56	
0732725	779 - 109	65.34	0.019

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REPORT OF ANALYSIS

NO. CERTIFICATE	NO. SAMPLE	% Fe
0732726	779 - 114	57.15
0732727	779 - 115	37.91
0732728	779 - 119	62.93
0732729	779 - 124	61.04
0732730	779 - 127	61.97
0732731	779 - 130	63.07
0732732	779 - 135	63.98
0732733	779 - 140	65.43
0732734	779 - 145	62.43
0732735	779 - 150	61.94
0732736	779 - 155	63.37
0732737	779 - 160	62.07
0732738	779 - 165	59.52
0732739	779 - 170	57.52
0732740	779 - 173	57.91
0732741	779 - 180	57.33
0732742	779 - 182	10.06
0732743	779 - 183	56.09
0732744	779 - 185	8.19
0732745	779 - 186	55.30
0732746	779 - 188	7.21
0732747	779 - 189	54.71
0732748	779 - 190	8.48
0732749	779 - 191	8.24
0732750	779 - 192	57.11
0732751	779 - 194	9.91
0732752	779 - 195	55.64
0732753	779 - 197	10.15
0732754	779 - 198	56.52
0732755	779 - 200	9.84

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REPORT OF ANALYSIS

NO. CERTIFICATE	NO. SAMPLE	% Fe
0732756	779 - 201	56.86
0732757	779 - 202	9.74
0732758	779 - 203	8.42
0732759	779 - 204	61.62
0732760	779 - 205	13.75
0732761	779 - 207	8.95
0732762	779 - 209	62.18
0732763	779 - 210	12.74
0732764	779 - 212	12.17
0732765	779 - 214	61.36
0732766	779 - 215	12.02
0732767	779 - 217	9.51
0732768	779 - 219	60.31
0732769	779 - 220	10.62
0732770	779 - 221	28.09
0732771	779 - 222	9.54
0732772	779 - 223	26.58
0732773	779 - 224	60.35

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REPORT OF ANALYSIS

No. : 0732850 to 0732879
Date : July 20, 1973
Client : Ferro-Magnetics Limited

Ferro-Magnetics P.O. number : 118

NO. CERTIFICATE	NO. SAMPLE	% Soluble Fe
0732850	779 - 2 A	63.81
0732851	779 - 2 B	64.45
0732852	779 - 2 C	61.31
0732853	779 - 2 D	59.88
0732854	779 - 2 E	60.71
0732855	779 - 2 F	62.78
0732856	779 - 225	53.48
0732857	779 - 228	60.53
0732858	779 - 231	59.79
0732859	779 - 234	61.11
0732860	779 - 237	62.28
0732861	779 - 240	63.05
0732862	779 - 243	65.89
0732863	779 - 250	64.01
0732864	779 - 257	63.74
0732865	779 - 264	65.25

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REPORT OF ANALYSIS

NO. CERTIFICATE	NO. SAMPLE	% Soluble Fe
0732866	779 - 271	64.80
0732867	779 - 278	57.57
0732868	779 - 285	64.99
0732869	779 - 290	65.25
0732870	779 - 295	65.36
0732871	779 - 300	65.83
0732872	779 - 307	64.51
0732873	779 - 314	63.32
0732874	779 - 321	64.66
0732875	779 - 324	63.40
0732876	779 - 327	62.73
0732877	779 - 330	63.75
0732878	779 - 337	63.95
0732879	779 - 338	35.56

"The above results apply only
to the submitted sample."

METRICLAB INC.

H. Blais

Henri Blais

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REPORT OF ANALYSIS

No. : 0732893 to 0732906
Date : July 30, 1973
Client : Ferro-Magnetics Limited

Ferro-Magnetics P.O. number : 121

NO. CERTIFICATE	NO. SAMPLE	% Soluble Fe
0732893	779 - 339	64.54
0732894	779 - 340	7.00
0732895	779 - 342	7.10
0732896	779 - 344	64.67
0732897	779 - 345	7.23
0732898	779 - 347	8.29
0732899	779 - 349	65.13
0732900	779 - 350	9.78
0732901	779 - 352	7.64
0732902	779 - 354	64.36
0732903	779 - 355	15.45
0732904	779 - 356	56.99
0732905	779 - 357	10.56
0732906	779 - 358	31.68

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REPORT OF ANALYSIS

No. : 0832907 to 0832910
Date : August 7, 1973
Client : Ferro-Magnetics Limited

Ferro-Magnetics P.O. number : 121

NO. CERTIFICATE	NO. SAMPLE	% Loss On Ignition
0832907	779 - 35	0.83
0832908	779 - 300	0.66
0832909	779 - 290	0.43
0832910	779 - 349	0.43

"The above results apply only to the submitted sample."

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