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SML 606

BELTANA - AROONA REGION

PROGRESS AND TECHNICAL REPORTS FOR THE PERIOD 16/7/71 TO 15/7/72

Submitted by

Electrolytic Zinc Co. of Australasia Ltd
1972

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

EXPLORATION DEPARTMENT

SPECIAL MINING LEASE NO. 606

Report No. 1 for three months ended 16th October, 1971

BELTANA, SOUTH AUSTRALIA

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ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

EXPLORATION DEPARTMENT

SPECIAL MINING LEASE NO. 606

Report No. 1 for three months ended 16th October, 1971

INTRODUCTION

This report covers all exploration activity undertaken in the Beltana Special Mining Lease 606 and Mineral Claim 5350 for a period of three months ending 16th October, 1971.

ABSTRACT

An interim geophysical report was received. A sulphide occurrence to the west of the lease was examined.

Chip sampling commenced over Ajax limestone in the north of the lease.

Geological mapping continued.

GEOPHYSICS

An interim report was received from our geophysical consultants on a microgravity survey conducted over the area of Ajax limestone to the south of the main orebody.

Two anomalies were located, one associated with known mineralisation of the southern orebody extension, and one of unknown origin in the vicinity of 980N/1000E.

The latter anomaly is considered significant, considering the good correlation of gravity anomalies and willemite mineralisation in our previous gravimetric survey.

GEOCHEMISTRY

An occurrence of sphalerite/galena/pyrite/graphite mineralisation in grey/green Bunyeroo shale was located by Exoil N.L. some two miles west of our lease.

With the permission of the Company, a stream geochemical orientation study was undertaken to determine dispersion characteristics of the mineralisation. Our findings are tabulated below:

	Zn	Pb
Grain size of fraction with highest metal values	-20 +40	-60 +80
Nature of dispersion away from known mineralisation	Irregular	Fairly regular decrease in Pb%

It was concluded that -

1. Pb is a suitable indicator element in the search for mineralisation of the type located by Exoil.
2. The fine fraction of the stream sediments give the highest Pb values.

We regard the mineralisation as syngenetic in origin (see Geology below).

Further chip sampling is currently being undertaken over Ajax limestone in the north of the lease in an attempt to locate dispersion halos related to blind mineralisation.

GEOLOGY

Mapping was completed at a scale of 1" to 400' over an area of some two square miles surrounding the orebody.

The structure was interpreted as a Willouran "high" with progressively overlying Wilpena group and Cambrian sediments.

Subsequent tectonics have caused reverse faulting and thrusting on the eastern margin of the high due to compressional forces acting in a south west direction, and probably related to the Norwest fault system.

Geological mapping has extended into the northern part of the lease. On completion of mapping throughout the lease, a further appraisal of geology will be attempted.

FUTURE PROGRAMME

Geochemical sampling currently in progress, will continue in the coming quarter.

Geological mapping will commence in the south and east of the lease.

PERSONNEL

All geological mapping is undertaken by a qualified geologist, who also supervises the sampling programme.

Three field assistants accomodated at our Flinders Base undertook the sampling.

Geochemical analyses are performed by McPhar Geophysics, Unley.

PRESERVATION OF INFORMATION

Copies of all relevant plans are kept at our Adelaide and Melbourne offices.

R.A.Horn,
Senior Geologist,
Exploration Department.

RH:el

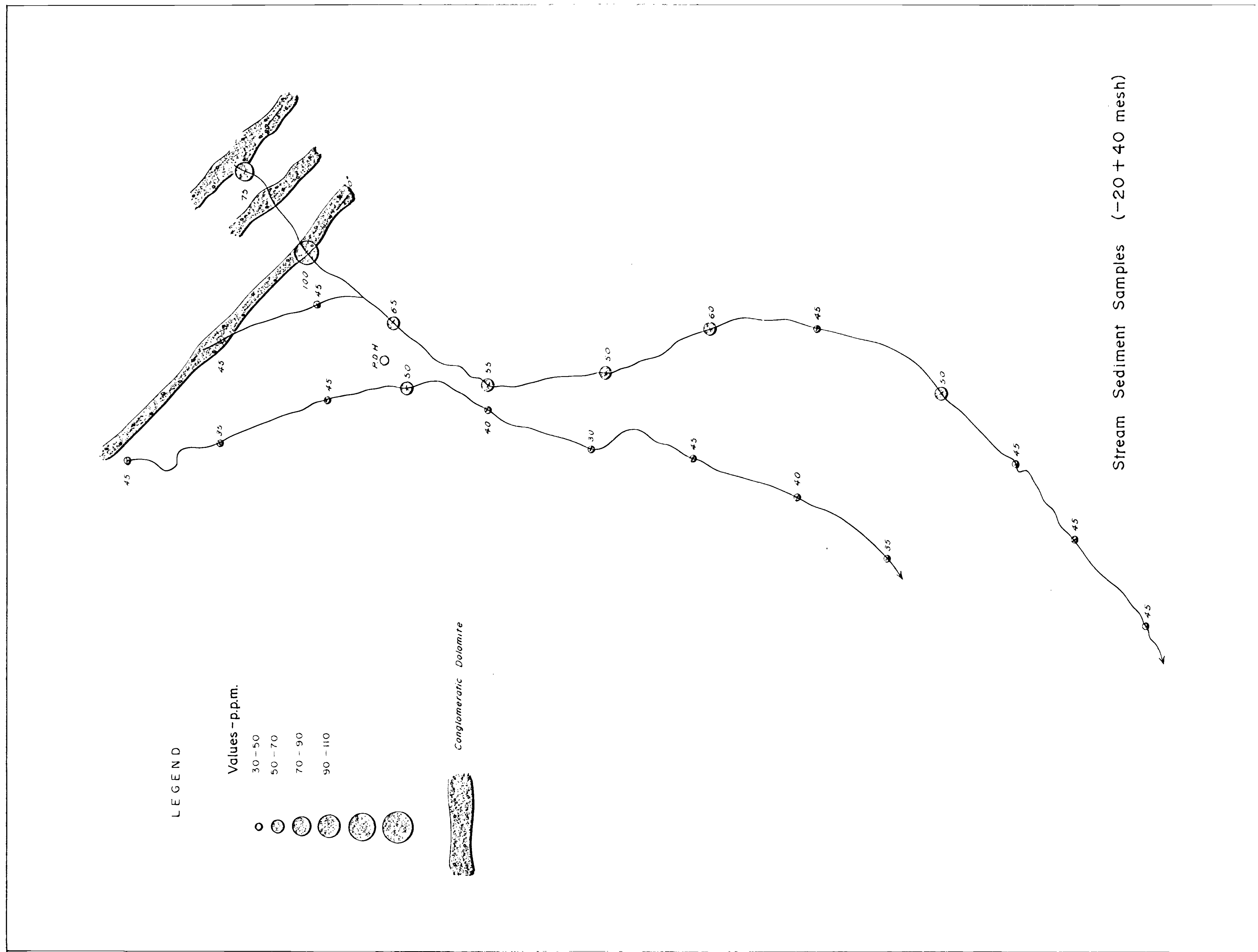
690/71

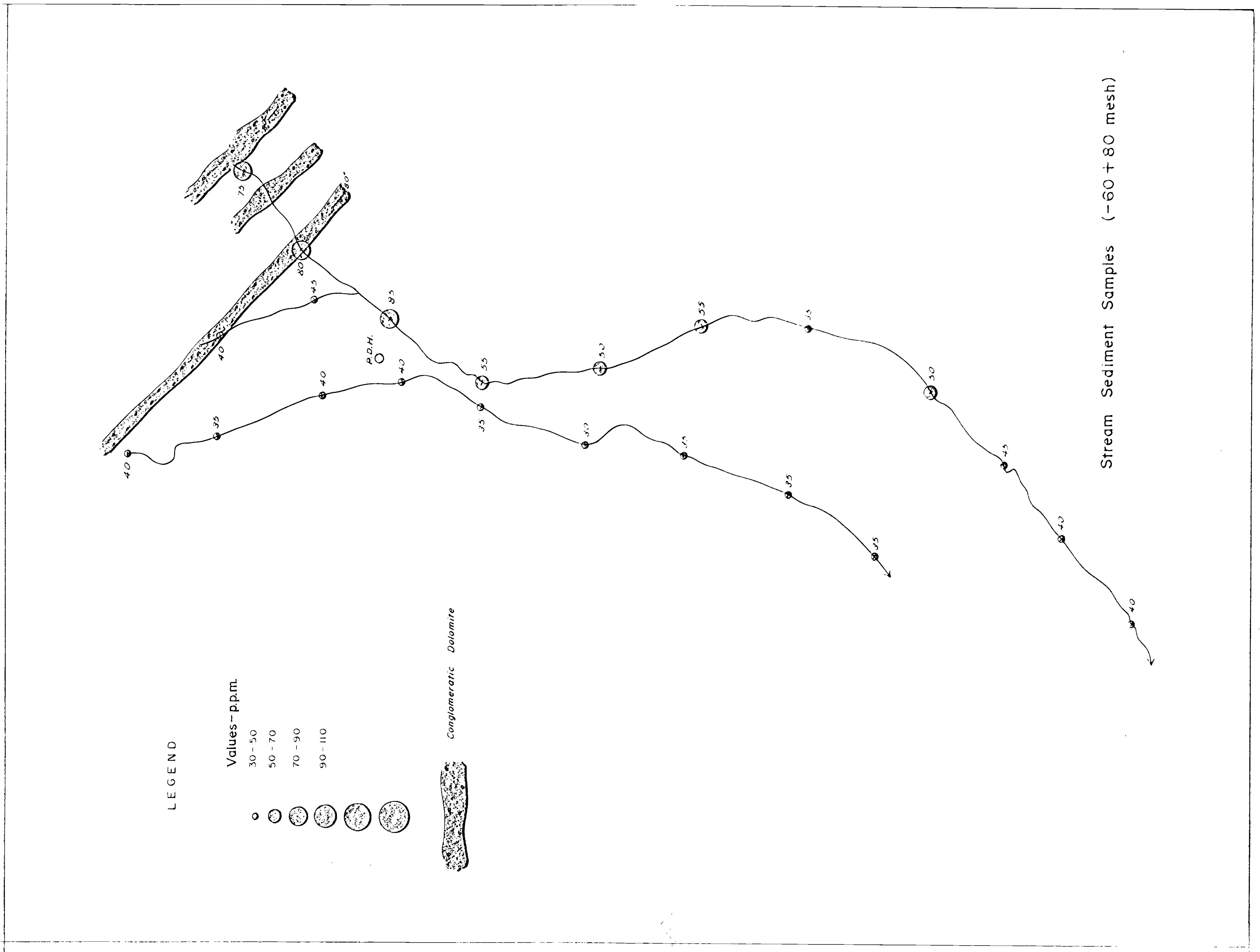
Plans to accompany this report:

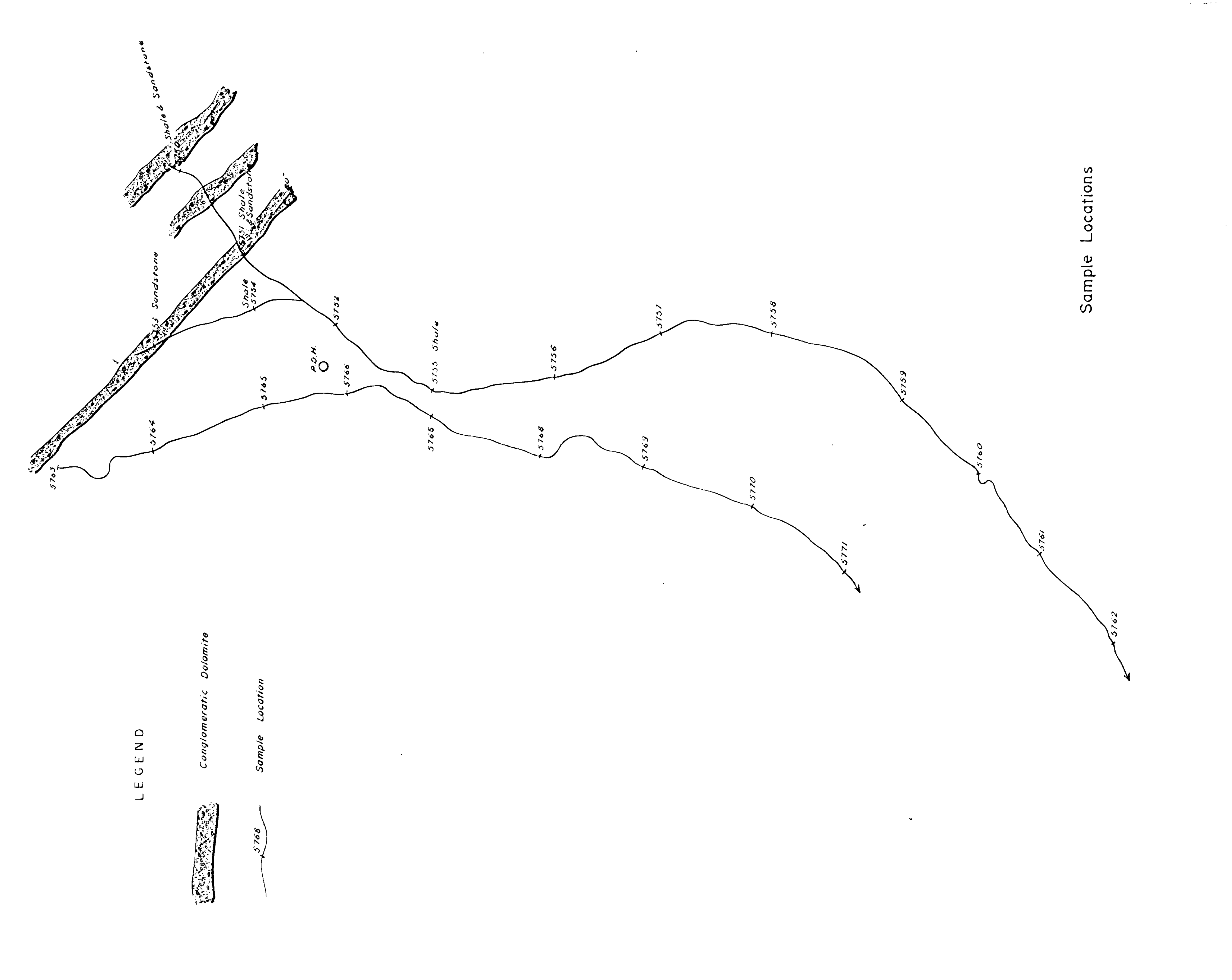
D100-50	Beltana General Geology 1" to 400'
CA100-51	Structural section
B100-52	Stratigraphic section
C100-53	Orebody Geology - cross sections as follows:

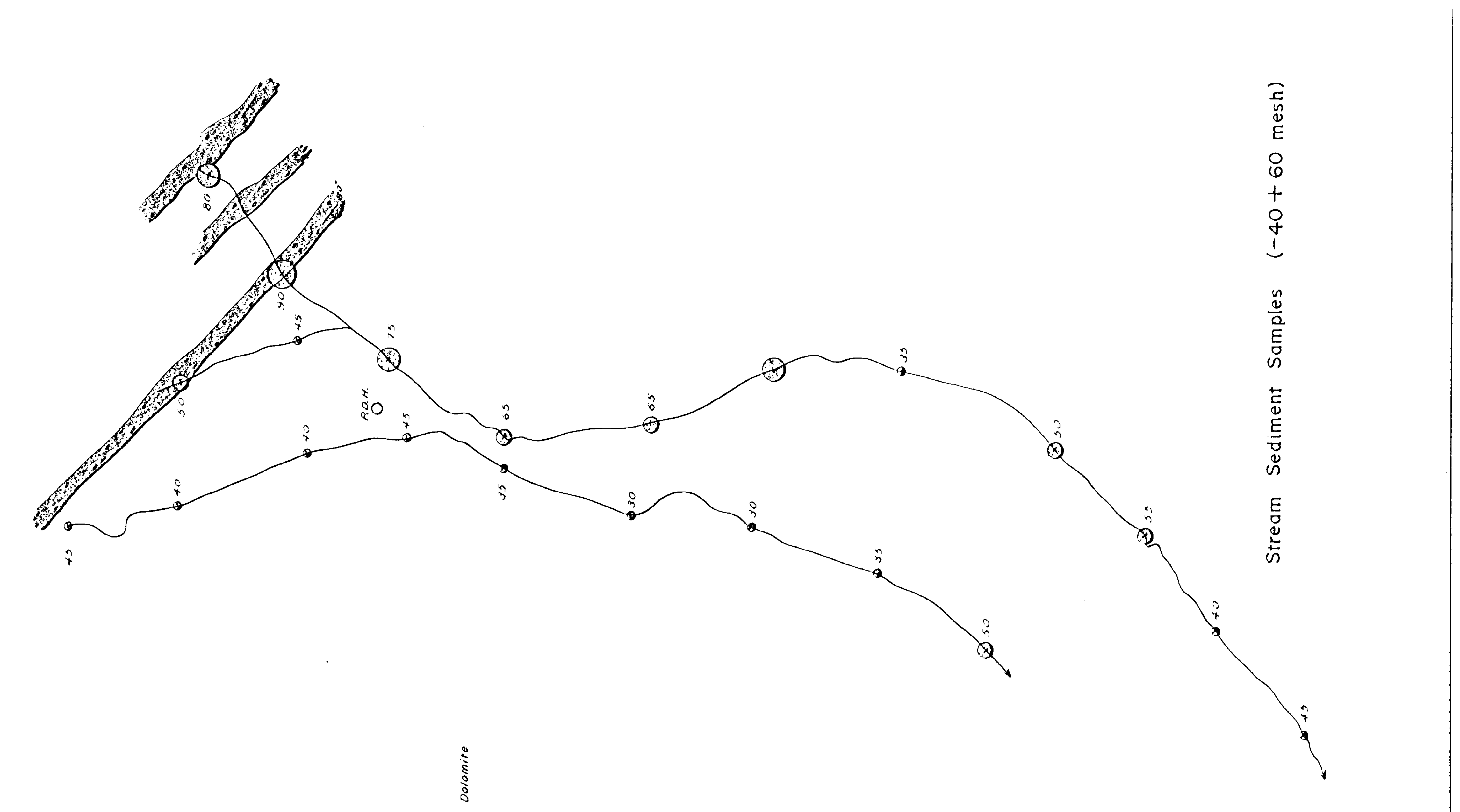
-1	987N	-10	994N
-2	988N	-11	994.5N
-3	990.5N	-12	995N
-4	991N	-13	995.5N
-5	991.5N	-14	996N
-6	992N	-15	997N
-7	992.5N	-16	998N
-8	993N	-17	999N
-9	993.5N	-18	1000N

D100-55	Orebody Longitudinal Sections
R100-56	Section on 1002E Geology
D100-57	Orebody Footwall Contours
D100-58	Longitudinal Section on 1003E Geology
R100-59	Longitudinal Section 1001E
R100-60	Longitudinal Section 1000E
C100-61	Geochemical Orientation Survey - lead values
C100-62	Geochemical Orientation Survey - zinc values
C100-63	Geochemical Orientation Survey - copper values









ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA EXPLORATION

SOUTH AUSTRALIA

GEOCHEMICAL ORIENTATION SURVEY

EXOIL PROSPECT

COPPER

SCALE: 1 in. to 40 ft.
Survey: R.A. Horn
Reference:
Date: Oct. 1971
Drawn: D.V.S.
Checked:

REF. NO.
C100-63

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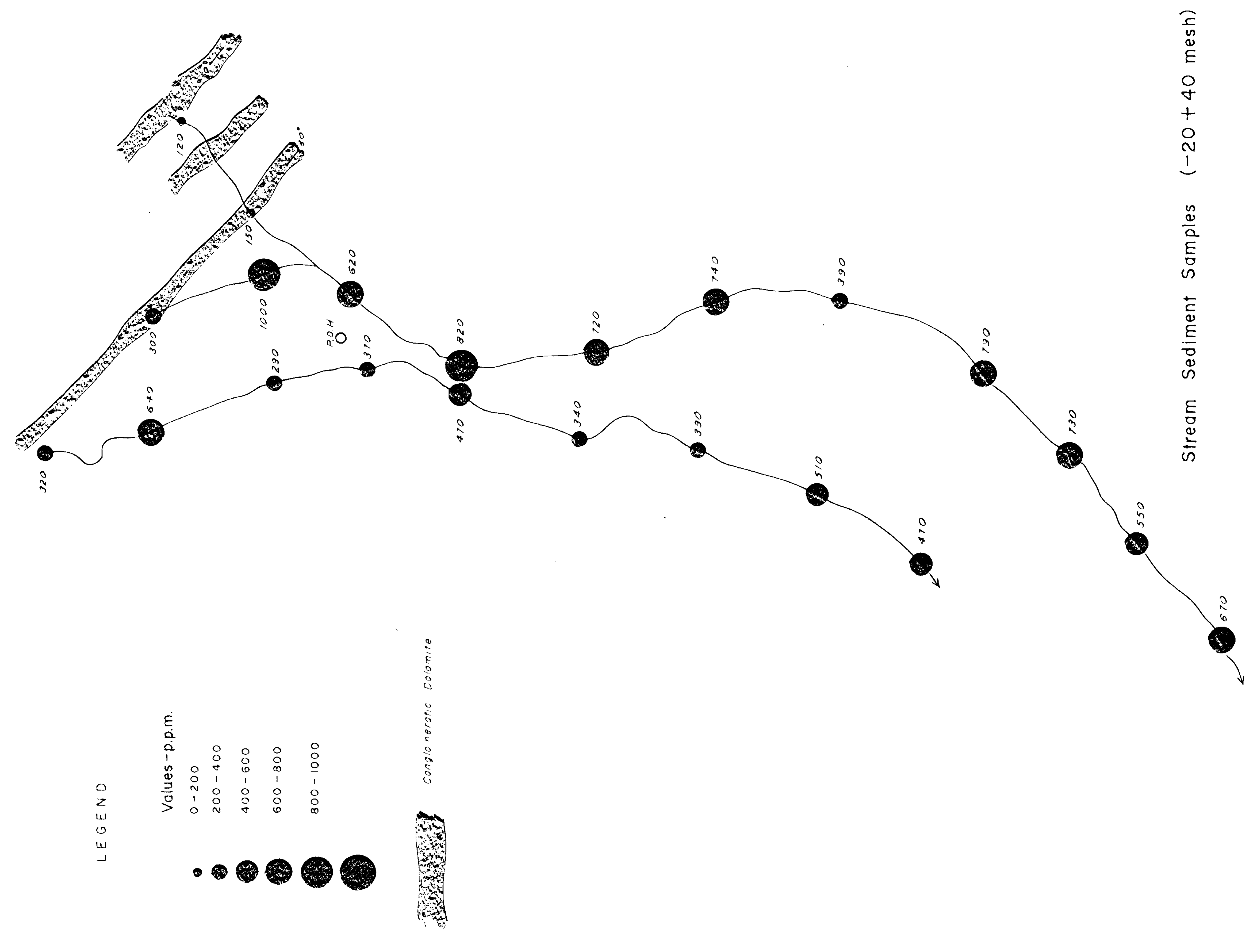

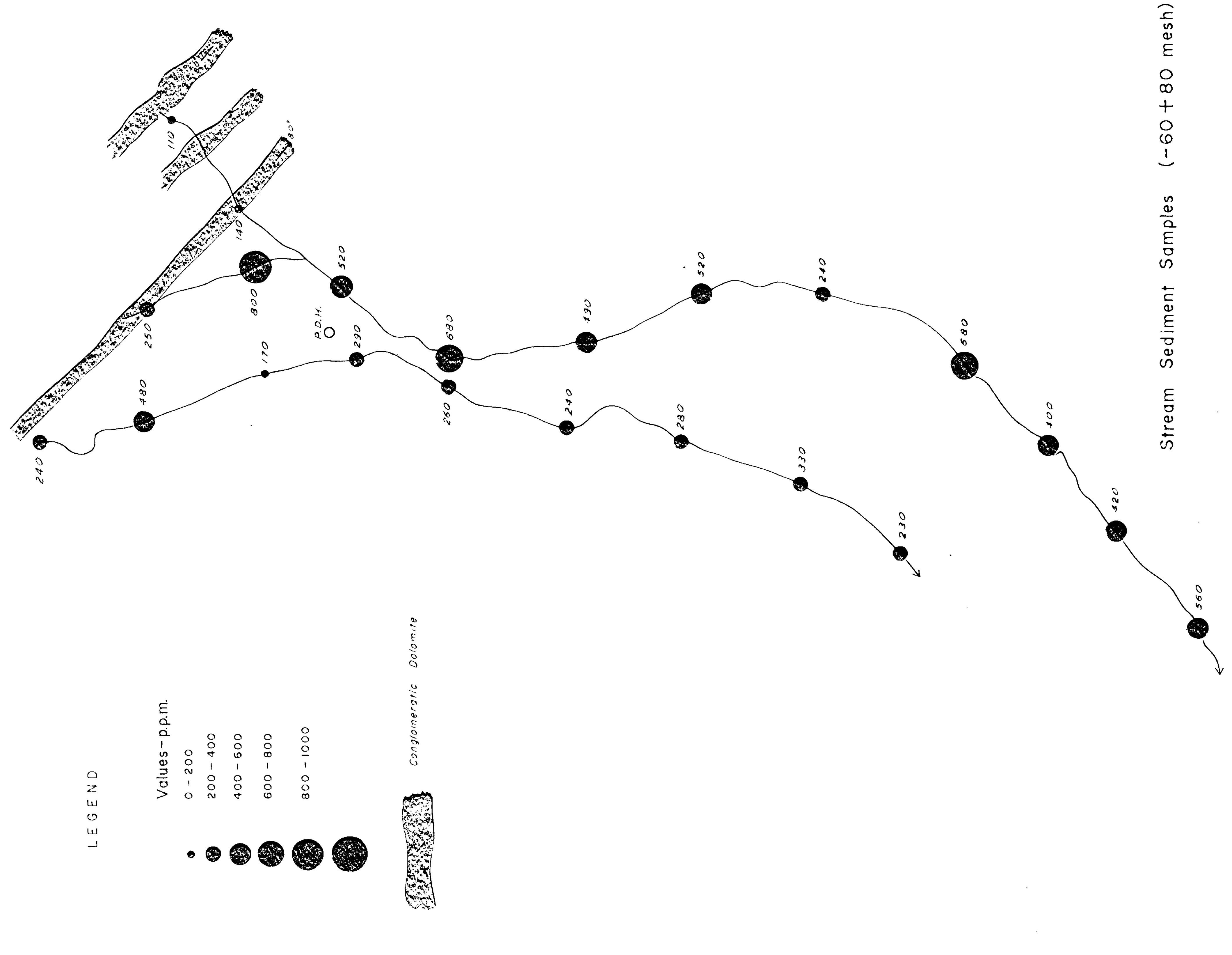

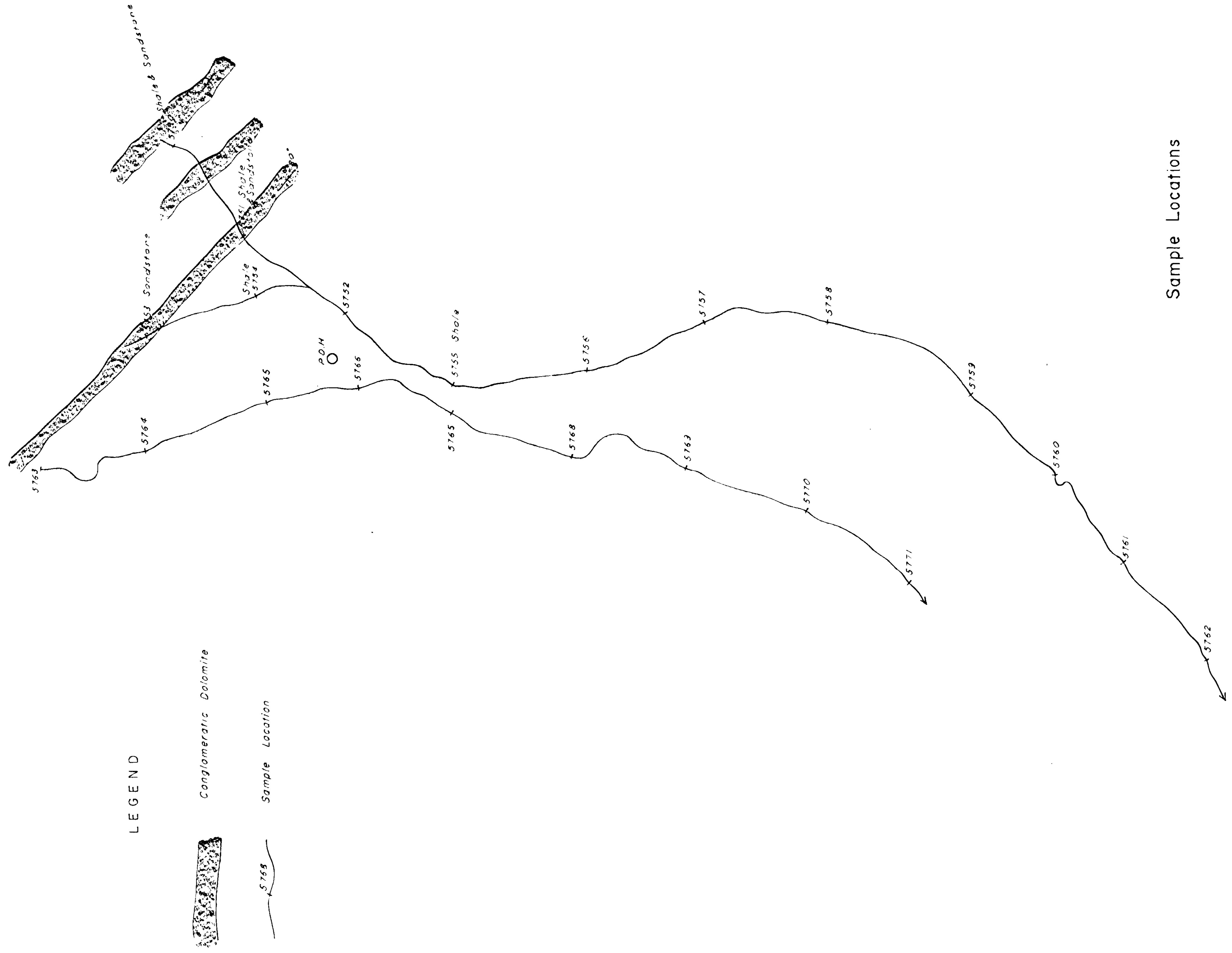

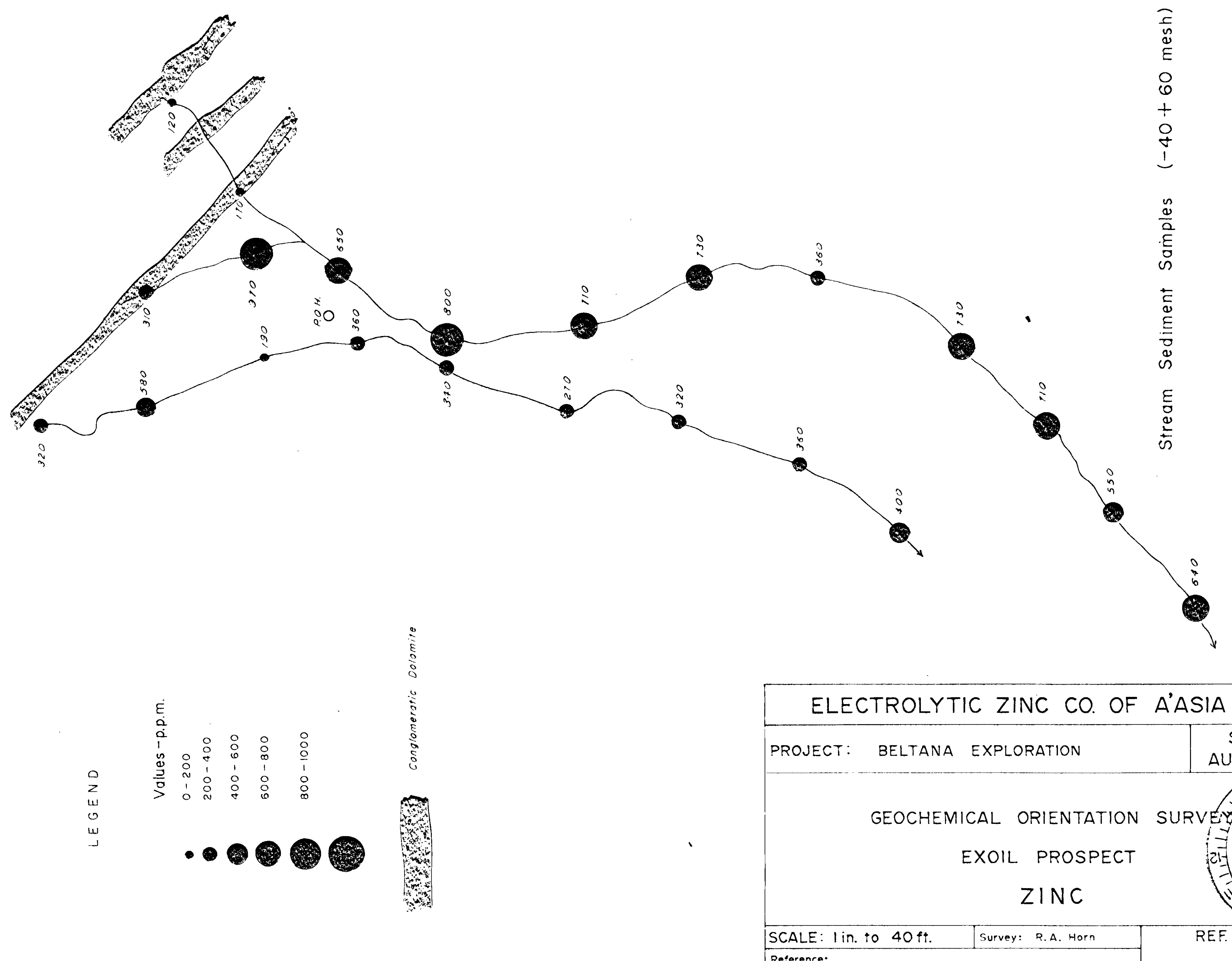

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA EXPLORATION

SOUTH AUSTRALIA

GEOCHEMICAL ORIENTATION SURVEY

EXOIL PROSPECT

ZINC

SCALE: 1 in. to 40 ft.
Survey: R.A. Horn
Reference:
Date: Oct. 1971
Drawn: D.V.S.
Checked:
REF. NO. C100-62

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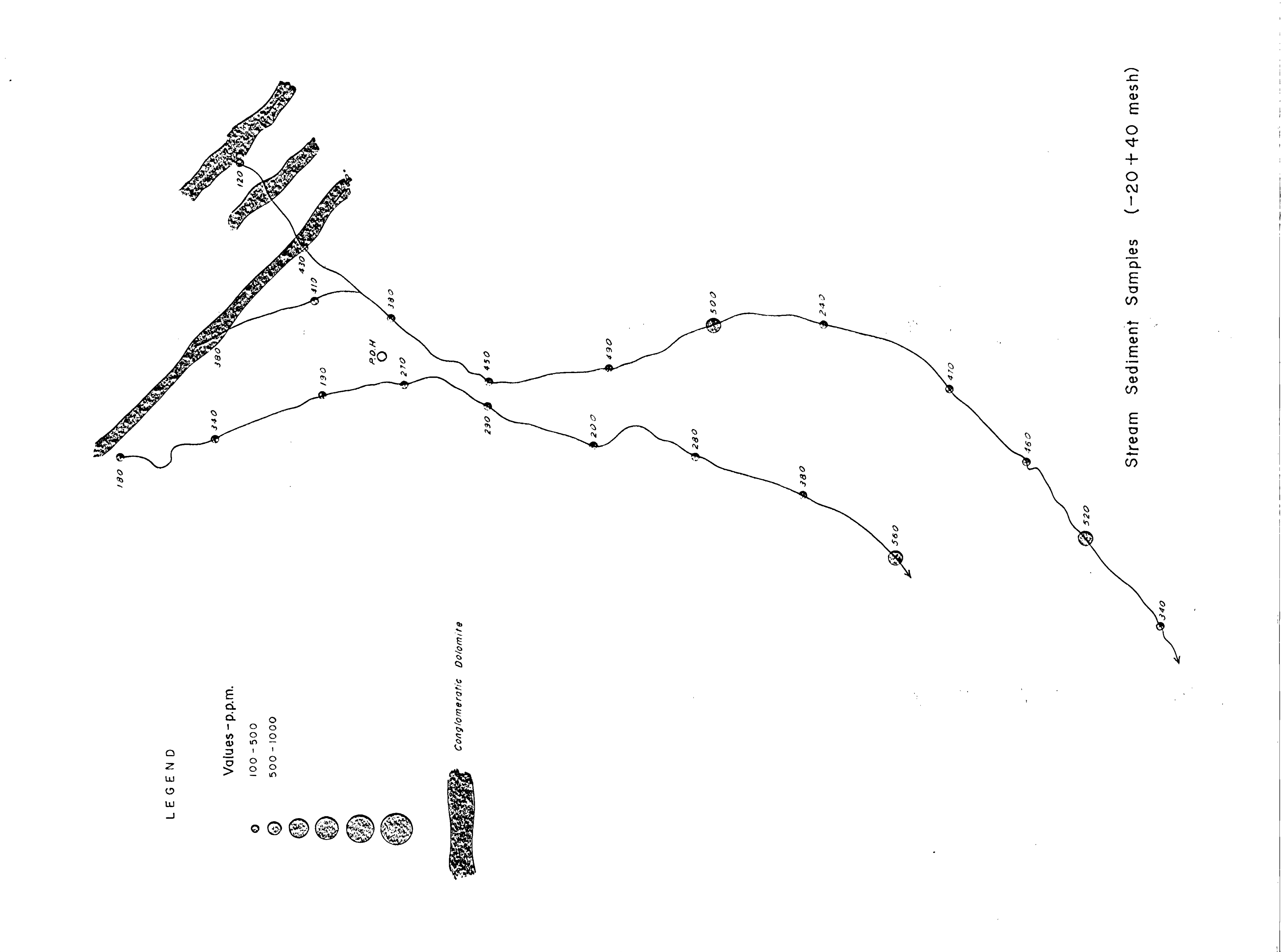
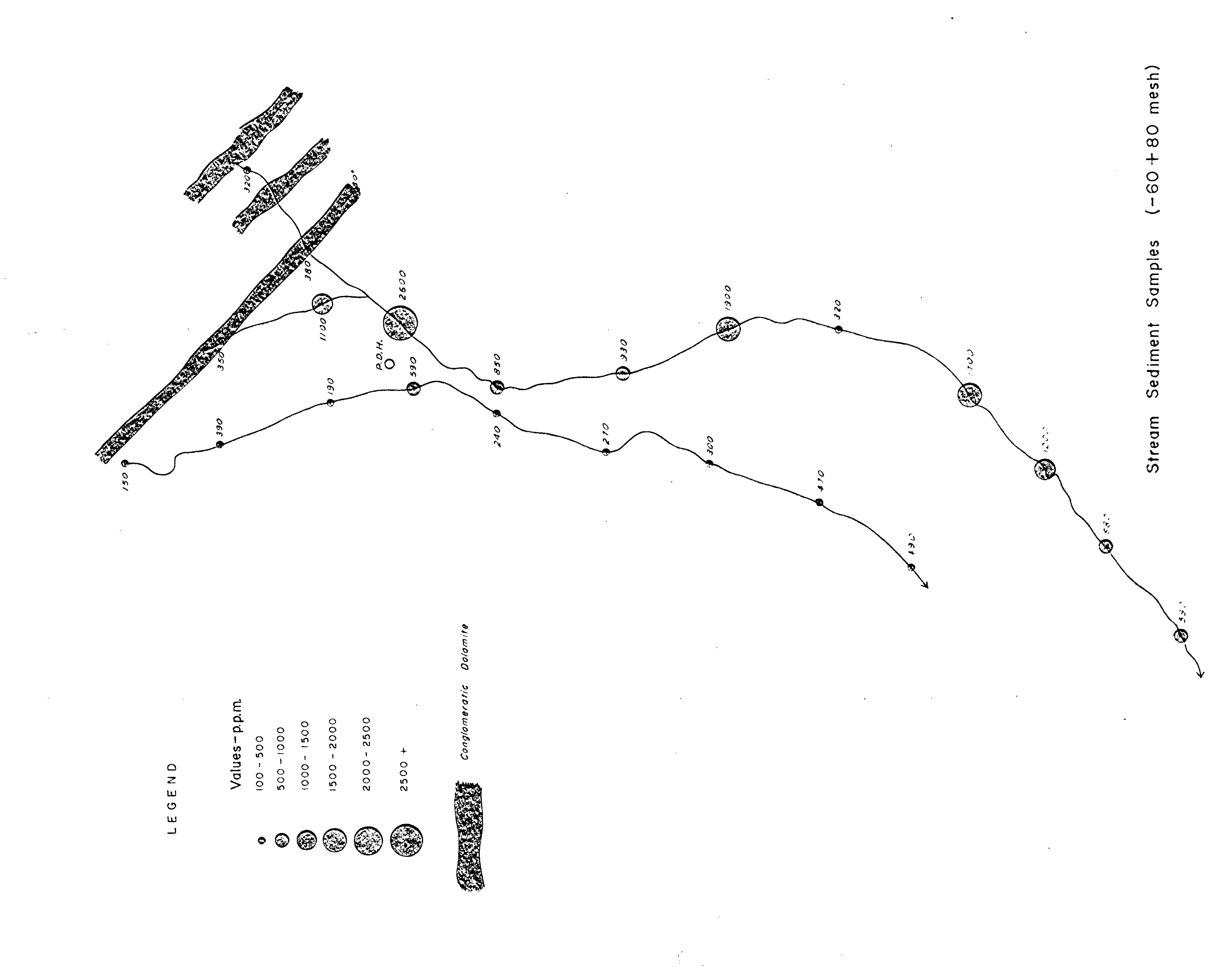
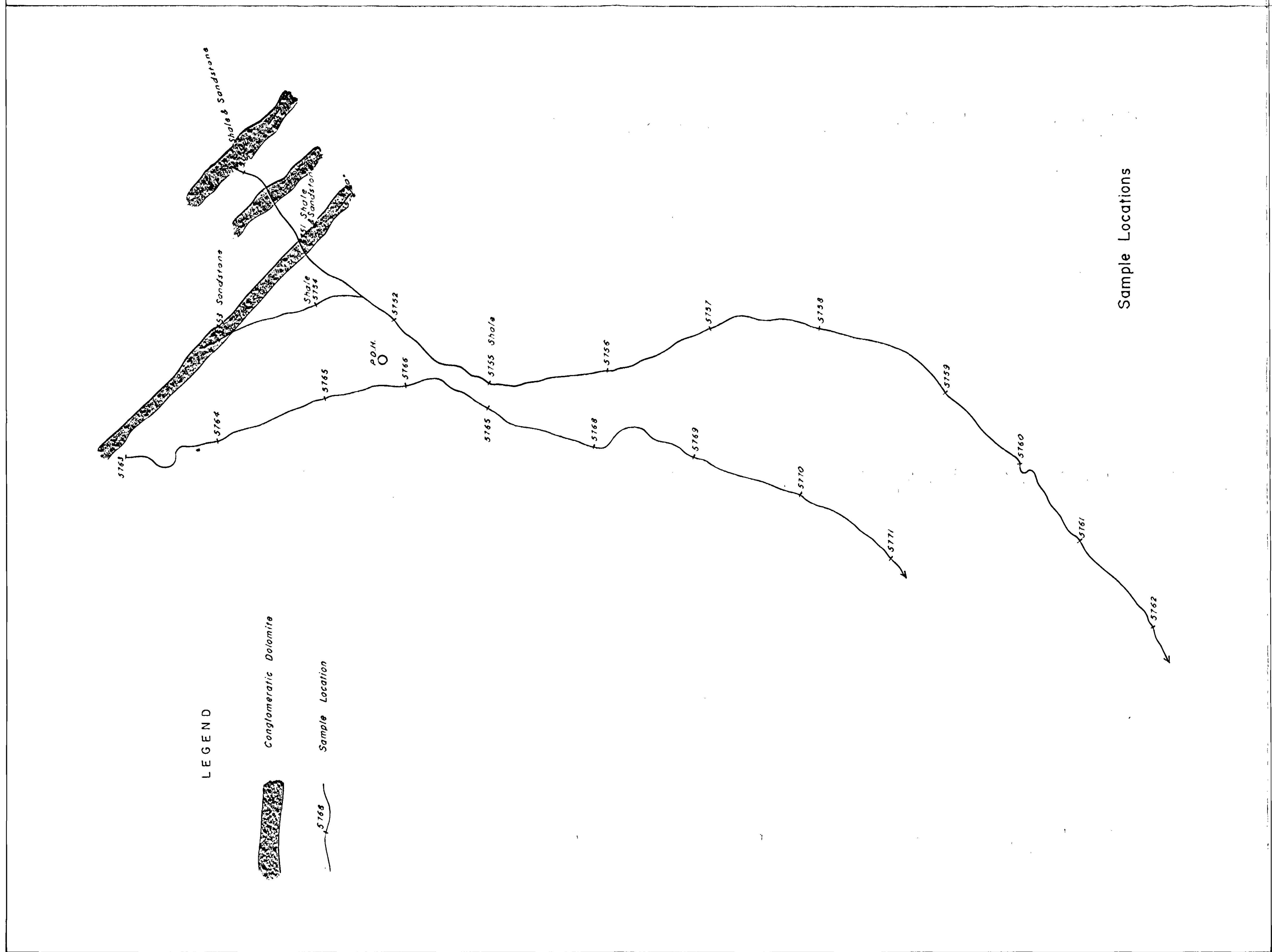
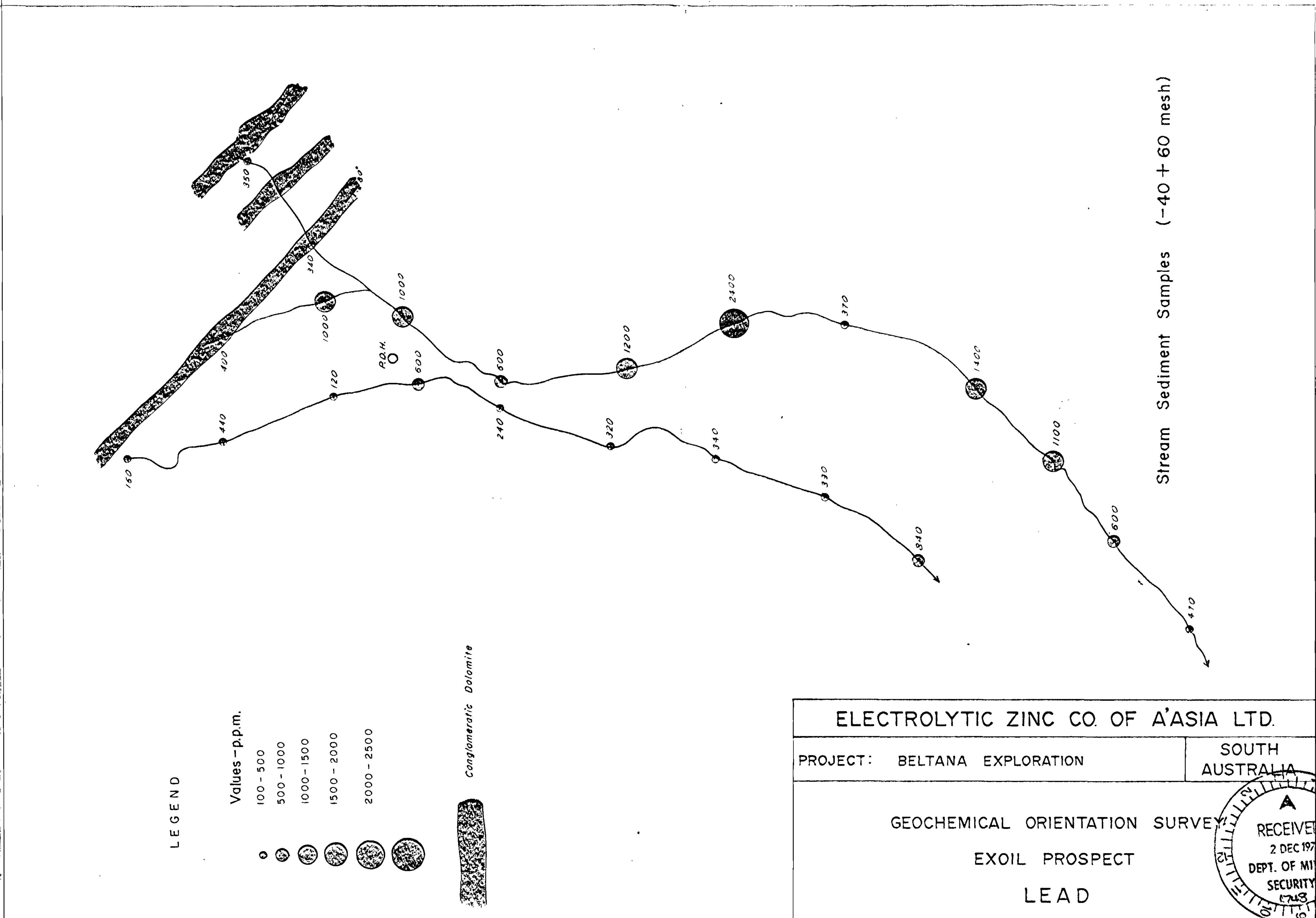








ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA EXPLORATION

SOUTH AUSTRALIA

GEOCHEMICAL ORIENTATION SURVEY

EXOIL PROSPECT

LEAD

SCALE: 1 in. to 40 ft.

Survey: R. A. Horn

Reference:

Date: Oct. 1971

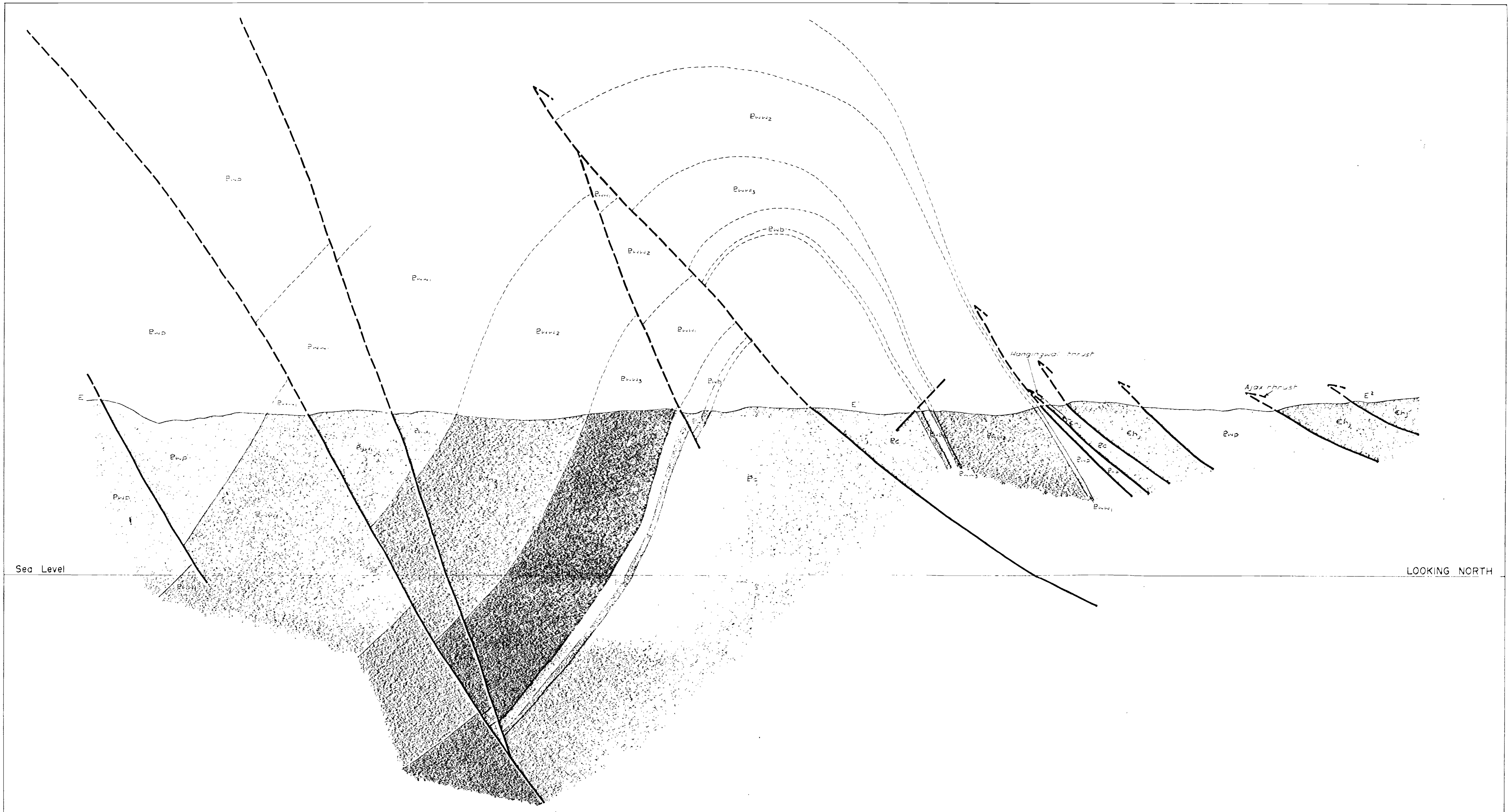
Drawn: D.V.S.

Checked:

REF. NO.

C100-61

1748-3



R E F E R E N C E

PALAEOZOIC	CAMBRIAN	LOWER CAMBRIAN	Hawker Group		Єhj	*Ajax limestone*
PROTEROZOIC	ADELAIDEAN	MARINOAN	Wilpena Group		Pwp	*Pound quartzite*
				Wonoka Formation	Pww1	*Buff dolomite*
					Pww2	*Green shale*
					Pww3	*Flaggy limestone*
				Bunyeroo Formation	Pwb	*Red shale* *Basal conglomerate*
		WILLOURAN			Pc	*Callana beds*

Geological boundary, dashed where approximate

Fault, dashed where approx imate

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA EXPLORATION — SOUTH AUSTRALIA

STRUCTURAL SECTION — BELTANA

SCALE: 1 in. to 400 ft. — Survey: R. A Horn

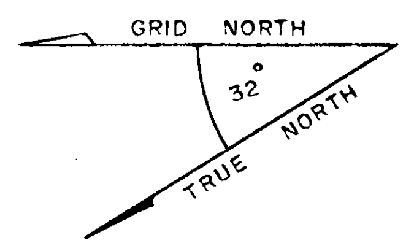
Reference: Beltana General Geology Plan – D100·50

Date: Sept. 1971 — Drawn: F. L. S. — Checked: R. A. H.

REF. NO. CA100·51

L E G E N D

- LIMIT OF OREBODY
- —?— ASSUMED LIMIT OF SOUTHERN EXT.
- ⇄ FAULT
- ⊥ DRILL HOLE
- B43 DRILL HOLE NO.
- ▯ ORE INTERSECTION >20% Zn
- ▨ ORE INTERSECTION >20% Zn >5% Pb
- ▮ ORE INTERSECTION >5% Pb <20% Zn



ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT : BELTANA DEVELOPMENT

SOUTH AUSTRALIA

OREBODY

LONGITUDINAL PROJECTION

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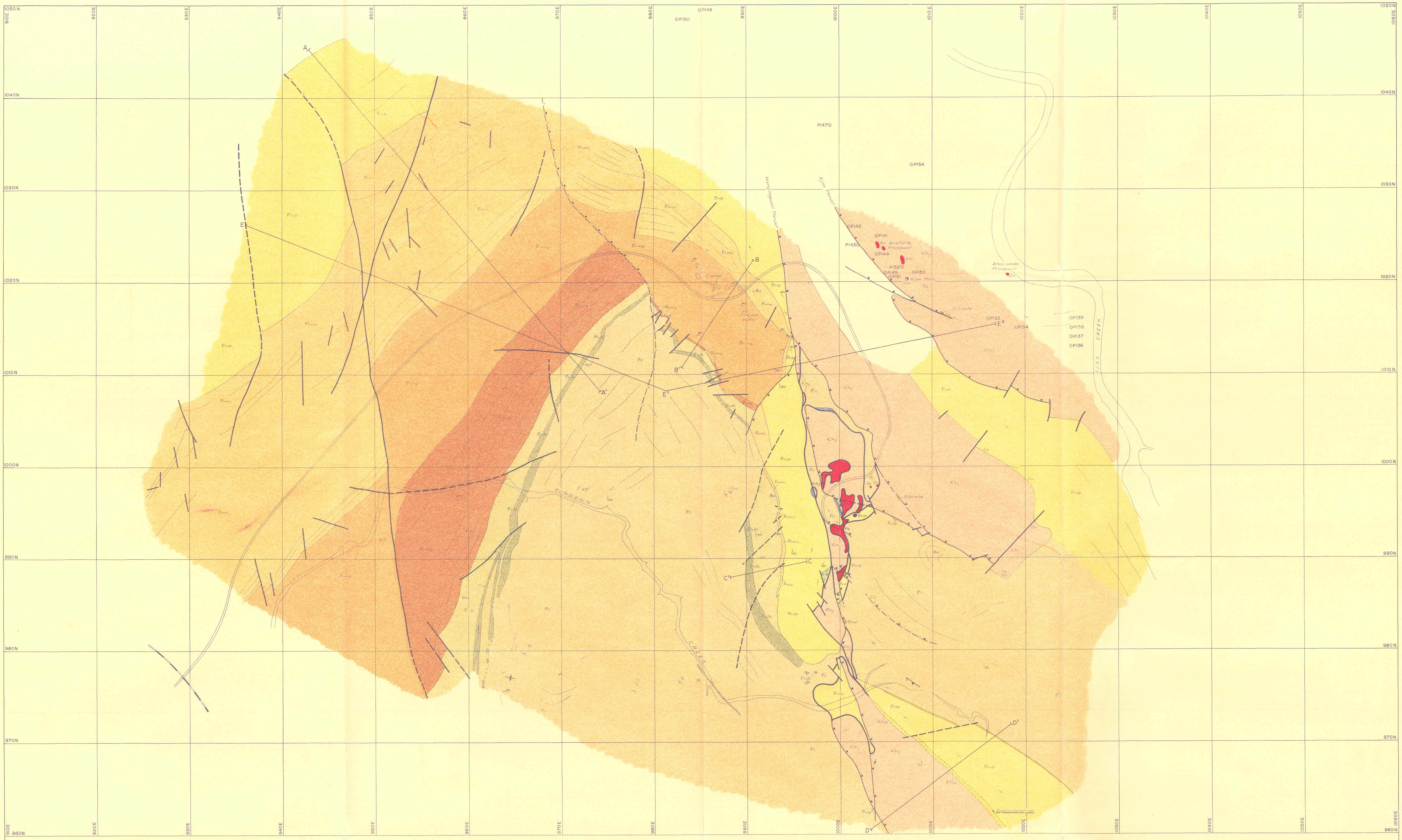
SCALE: 1in. to 40ft.
Survey : R. A. Horn.
Reference :
Date: Oct. 1971
Drawn: P. T. W.
Checked:

REF. NO.
D 100 — 55

1748-5



R E F E R E N C E

- PALAEOZOIC – CAMBRIAN – LOWER CAMBRIAN – Hawker Group
  - Ɛhj — Ajax Limestone - Grey, biostromal, fossiliferous. Trilobites, brachiopods and archaeocyathids.
  - Ɛhp — Parachilna Formation - Grey-green grits and ferruginous sandstones with minor dolomites. Trace fossils of *Diplocraterion*
  - Ɛ-P — Uratanna Formation - Green shales with minor dolomite bands, occupying graben in Pound Quartzite

∿∿∿∿∿∿∿∿∿∿ Unconformity

- PROTEROZOIC – ADELAIDEAN – MARINOAN – Wilpena Group
  - Pwp — Pound Quartzite - White, cross-bedded, competent. Local iron rich horizons
  - ∿∿∿∿∿∿∿∿∿∿ Unconformable on Willouran south of 980 N
  - Pww₁ — Wonoka Formation - Dolomite, grey-buff, cross-bedded, slumped conglomerate bands
  - ∿∿∿∿∿∿∿∿∿∿ Unconformable on Willouran 1000N to 1005N
  - Pww₂ — Shale, green well bedded.
  - Pww₃ — Limestone - Grey-green, cross-bedded, flaggy.
  - Pwb — Bunyeroo Formation ?- Shale, red, well bedded fissile. Limestone interbeds with Malachite mineralisation. Prominent conglomeratic limestone at base.

∿∿∿∿∿∿∿∿∿∿ Unconformity

- PROTEROZOIC – ADELAIDEAN – WILLOURAN – Callana Beds
  - Pc — Humanity Seat Formation - Sandstones, siltstones, shales, dolomites and limestones, cross-bedded with very abundant Halite casts in siltstone. Tectonically plastic. Commonly occurs (diapirically ?) in thrust faults. Possibly includes other younger sediments.

Massive Mineralisation.

🟥 Zn - Willemite.
Pb - Hedyphane - coronadite.

🟦 Quartz Vein on thrust fault.

Fe Geothite.
Mn. Manganese wad.
Cu. Copper.
Ba. Barite.

Geological boundary.
Fault.
Thrust fault.
Shear zone.
Syncline.
Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried.
Strike and dip of bedding.
Vertical bedding.
Overturned bedding.
Vertical joint.
⊙P142 Percussion drillhole.
Road.
Railway line.
Trend lines.
Drainage.
Section line.

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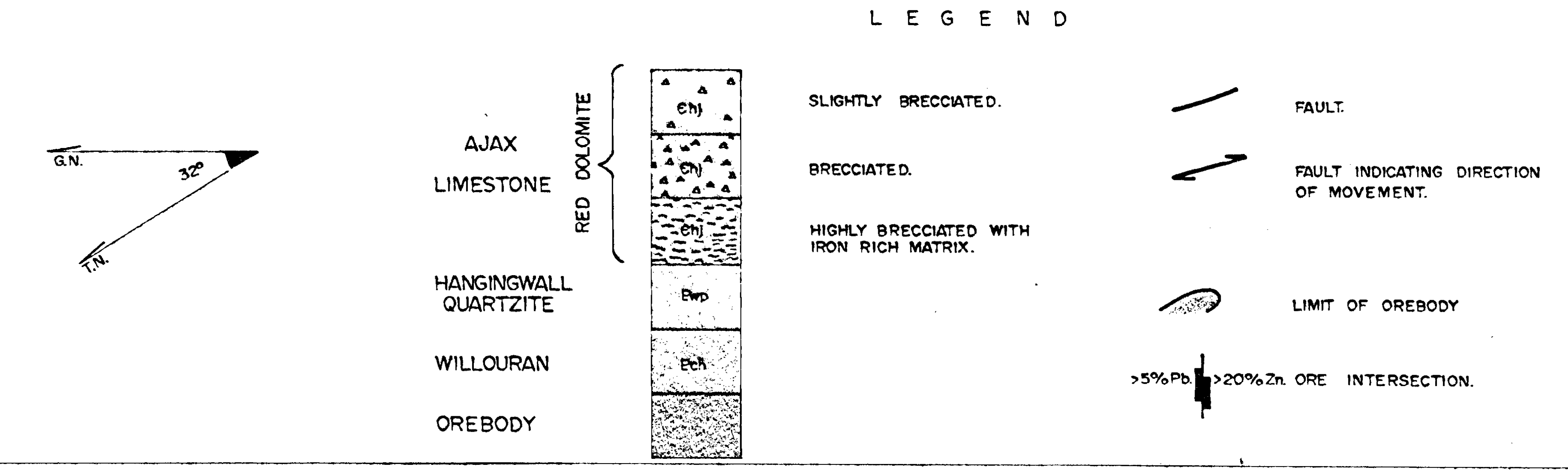
ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT : BELTANA EXPLORATION
SOUTH AUSTRALIA

BELTANA GENERAL GEOLOGY

SCALE : 1 in. to 400 ft.
Survey : R. A. Horn.
Reference :
Date : Sept. 1971
Drawn : F.L.S.
Checked : R.A.H.
REF. NO. D100·50

1748-6



ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA DEVELOPMENT

SOUTH AUSTRALIA

GEOLOGY

LONGITUDINAL SECTION ON 1002 E

(LOOKING GRID EAST)

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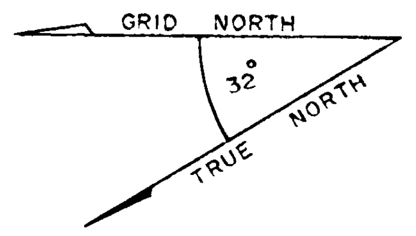
SCALE: 1 in. to 40 ft. H.& V.	Survey: R. A. Horn.
Reference:	
Date: Oct. 1971	Drawn: P.T.W.
Checked:	

REF. NO.
R 100—56

1748-7



LEGEND

——	LIMIT OF OREBODY.
—950—	CONTOUR LEVEL.
—(900)— —	CONTOUR LEVEL LEAD BODY.
930	FOOTWALL ELEVATION FROM SEA LEVEL.
(835)	FOOTWALL ELEVATION FROM SEA LEVEL LEAD BODY.
F —— F	FAULT.

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA DEVELOPMENT.

SOUTH AUSTRALIA

OREBODY

FOOTWALL CONTOURS

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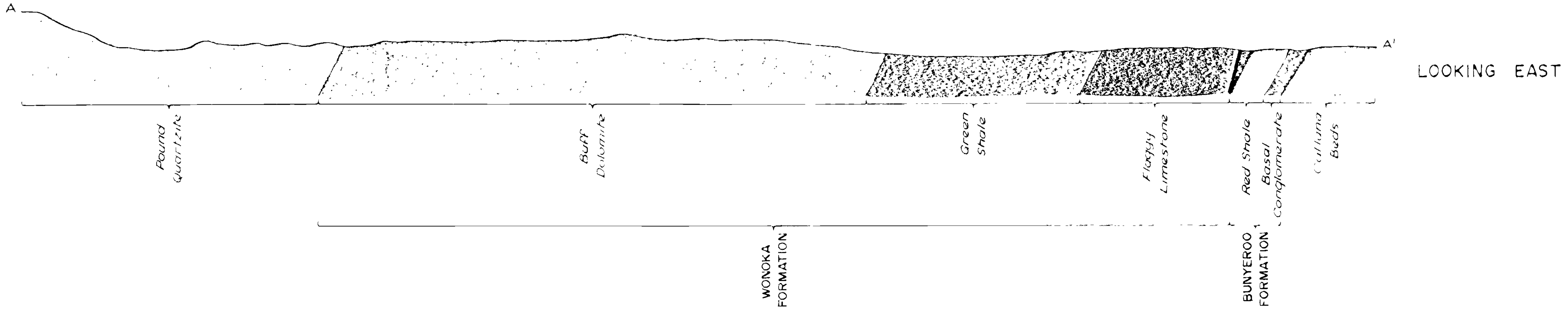
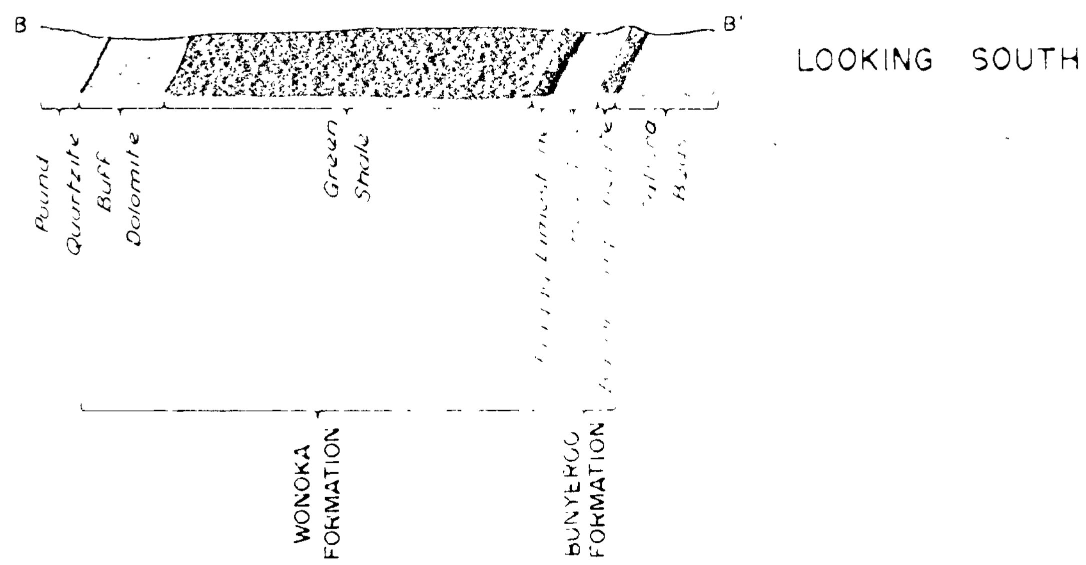
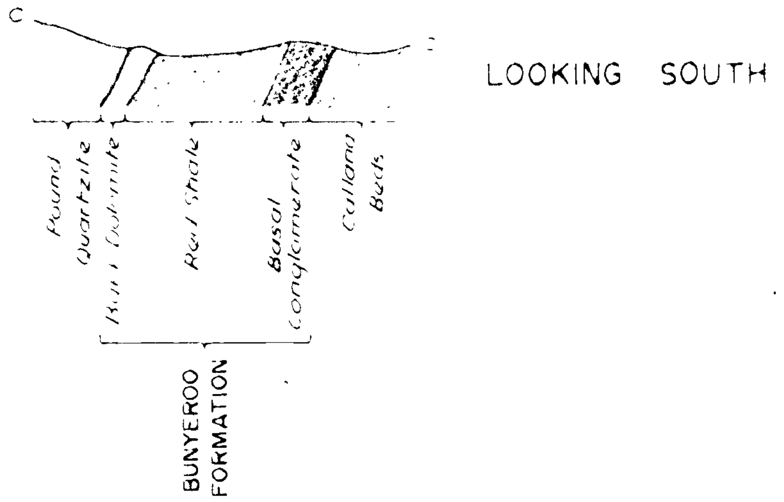
SCALE: 1in. to 40ft.
Survey: R. A. Horn
Reference:
Date: Oct. 1971
Drawn: P. T. W.
Checked: [illegible]

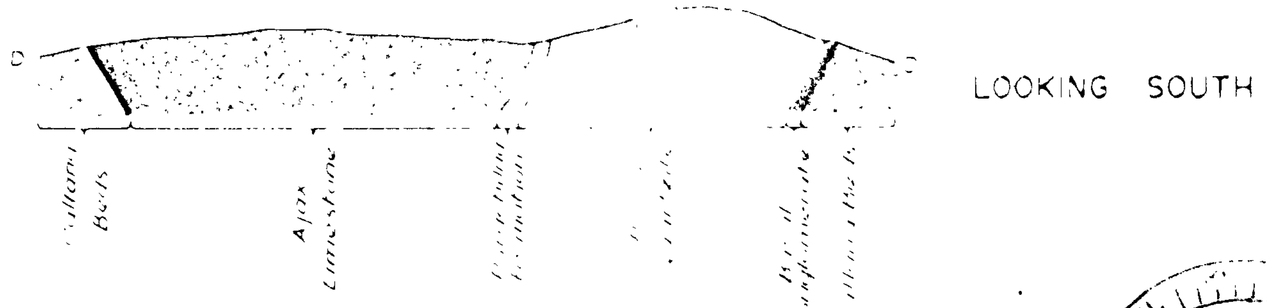
REF. NO.
D 100—57

1748-8









ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT BELTANA EXPLORATION

SOUTH AUSTRALIA

STRATIGRAPHIC SECTIONS — THINNING OF SEDIMENTS OVER WILLOURAN BASEMENT

SCALE 1 in to 400 ft.
Survey R. A. Horn
Reference Beltana General Geology Plan – D100 50
Date Sept 1971
Drawn F. L. S.
Checked R. A. H.

REF. NO B100·52

17489-9

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA DEVELOPMENT

SOUTH AUSTRALIA

GEOLOGY

LONGITUDINAL SECTION ON 1000E

(LOOKING GRID EAST.)

SCALE: 1 in. to 40 ft. H.&V.
Survey : R. A. Horn.
Reference :
Date : Oct. 1971
Drawn : P. T. W.
Checked :

REF. NO.
R 100 — 60

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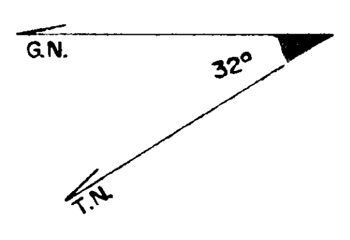
L E G E N D



AJAX LIMESTONE	RED DOLOMITE	Єhj	SLIGHTLY BRECCIATED.
		Єhj	BRECCIATED.
		Єhj	HIGHLY BRECCIATED WITH IRON RICH MATRIX.
HANGINGWALL QUARTZITE		Ewp	
WILLOURAN		Ech	
OREBODY		▨	

FAULT.

FAULT INDICATING DIRECTION OF MOVEMENT.

LIMIT OF OREBODY.

>5% Pb. >20% Zn. Fe. ORE INTERSECTION.

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ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA DEVELOPMENT

SOUTH AUSTRALIA

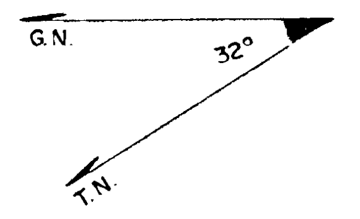
GEOLOGY

LONGITUDINAL SECTION ON 1001 E

(LOOKING GRID EAST.) 1748-11

SCALE: 1in. to 40ft. H.& V.
Survey : R. A. Horn.
Reference :
Date : Oct. 1971
Drawn : P.T.W.
Checked : RAH
REF. NO.
R 100 — 59

LEGEND



AJAX LIMESTONE — RED DOLOMITE
- Ehj — SLIGHTLY BRECCIATED.
- Ehj — BRECCIATED.
- Ehj — HIGHLY BRECCIATED WITH IRON RICH MATRIX.

HANGINGWALL QUARTZITE — Ewp

WILLOURAN — Ech

OREBODY — ▩

FAULT

FAULT INDICATING DIRECTION OF MOVEMENT

SHEAR

>5%Pb. ▮ >20%Zn. ORE INTERSECTION

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA DEVELOPMENT

SOUTH AUSTRALIA

GEOLOGY

LONGITUDINAL SECTION ON 1003E

(LOOKING GRID EAST)

SCALE: 1in. to 40ft. H.&V

Survey : R. A. Horn.

Reference :

Date : Oct 1971

Drawn P.T.W.

Checked :

REF. NO.

D 100—58

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ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

EXPLORATION DEPARTMENT

SPECIAL MINING LEASE NO. 606

MINERAL CLAIM 5350

Report No. 2 for period ended 31st May, 1972.

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Distribution List

1. Mines Department - South Australia
2. Manager, Exploration Department, Melbourne.
3. Adelaide Office.

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

EXPLORATION DEPARTMENT

SPECIAL MINING LEASE NO. 606

MINERAL CLAIM 5350

Report No. 2 for period ended 31st May, 1972.

INTRODUCTION:

This report covers all exploration work undertaken in Special Mining Lease 606 and Mineral Claim 5350 from the 11th October, 1971, to 31st May, 1972.

Peg Maintenance - M.C. 5350

Pegs and trenches marking the claim perimeter are maintained according to Mining Regulations by a caretaker employed permanently at our Flinders Base, one mile north of the claim.

A. GEOCHEMISTRY

(i) Ajax Limestone

The results of geochemical analyses for copper, lead and zinc of chip samples collected over exposed Ajax limestone in an area extending from the Sundown Creek in the south to the Emu Prospect in the north were plotted and contoured at a scale of 1" to 400 feet (see accompanying plans DA 100-67, 68 and 69.)

Geochemical values over the area surrounding the orebody included results from previous sampling by Anaconda Australia Inc., made available to this Company by the South Australian Department of Mines. Contour plans showing the distribution of lead and zinc values were plotted at a scale of 1" to 100 feet (see accompanying plan DA 100-72, 73).

Dispersion halos were found to surround the areas of known massive lead and zinc mineralisation. A significant anomaly with zinc values in excess of 1.5% was found at 981N/1000.6E grid reference.

Anomalous values in general were found to run parallel to mapped faults.

To the north of the Beltana orebody geochemical anomalies were found in the vicinity of the Moolooloo willemite prospect and several areas of high lead/zinc values were located between the Moolooloo and Emu Prospects in association with the Moolooloo thrust and minor cross faults.

Earlier work (Whitehead, S., 1969) demonstrated that zinc occurs in the dolomitized Ajax limestone in solid solution with dolomite.

Uratanna Shale

An exposure of green shale is preserved in a graben in the Pound Quartzite beneath the Ajax limestone some 300 feet south of the main orebody.

Chip sampling over this shale gave the following results:

	Zn%	Pb%	Lithology
988N (0-20)	0.005	0.002	Ajax Limestone
(20-40)	0.012	0.003	" "
(40-60)	0.27	0.021	Uratanna Shale
(60-80)	0.15	0.018	" "
(80-100)	0.13	0.027	" "
(100-120)	0.046	0.012	" "
(120-140)	0.015	0.066	" "
(140-160)	0.018	0.060	Pound Quartzite

Highly anomalous base metal values are possibly derived from zinc/lead rich groundwaters derived from the orebody.

The conditions of formation of the Uratanna Shale in grabens does not exclude the possibility of a syngenetic origin for the metals.

Bunyeroo Formation

Trench sampling was undertaken across predominantly red shales of the Bunyeroo Formation exposed some one mile west of the Main Orebody.

Results are tabulated below:

From	To	Cu%	Pb%	Zn%	Lithology
0	20	45	30	160	Wonoka Limestone
20	40	70	40	150	" "
40	60	240	20	110	Bunyeroo Formation
60	80	50	20	90	" "
80	100	30	20	90	" "
100	120	20	20	75	" "

120	140	15	20	80	Bunyeroo Formation
140	160	10	< 20	70	" "
160	180	10	< 20	65	" "
180	200	10	< 20	70	" "
200	220	10	< 20	75	" "
220	240	10	< 20	70	" "
240	260	10	< 20	65	" "
260	280	10	< 20	65	" "
280	300	10	< 20	70	" "
300	320	10	< 20	70	" "
320	340	10	< 20	55	" "
340	360	25	< 20	50	" "
360	380	45	< 20	60	" "
380	400	120	< 20	65	" "
400	420	15	< 20	60	" "
420	440	15	< 20	55	" "
440	460	45	< 20	55	" "
460	480	50	< 20	65	" "
480	500	45	< 20	55	" "
500	520	45	< 20	60	" "
520	540	45	< 20	35	" "
540	560	50	< 20	60	" "
560	580	15	< 20	75	" "

Barite mineralisation occurs in bands several inches thick, parallel to bedding.

Zinc and copper values are slightly higher than background at the base of the Bunyeroo Formation.

Geological Mapping

Geological Mapping at a scale of 1" to 400 feet (see accompanying plan R 100-71) was extended northward to cover the area of the Emu and Moolooloo Prospects and to link with mapping at the same scale over the Aroona syncline (plans D 103, 31, 32, 33 - Report No. 5 Special Mining Lease 485).

A structural section was constructed to illustrate the interpreted geological relationships at depth (see accompanying plan R 100-70).

Mapping in the Aroona syncline in the north and in the vicinity of the Beltana orebody in the south were drafted on one sheet at a scale of 1" to 2000 feet (see accompanying plan C 100-75).

Mineralogy

A sample of ferruginous material from the Main Orebody was examined by Dr. A. Whittle to determine its possible gossan affinities. Whittle concluded that the apparent boxwork visible in the sample does not represent alteration of in situ sulphides (see accompanying report).

Personnel

All geological work was supervised by a qualified geologist. A 3rd year student of the University of Adelaide assisted with geological mapping. Geochemical analyses were undertaken by McPhar Geophysics of Unley.

Preservation of Information

Copies of all relevant reports and plans are kept at both our Adelaide and Melbourne offices.

Future Programme

It is proposed that diamond drilling will continue in the southern orebody extension in an attempt to delimit known mineralisation in this area.

A percussion drilling programme is planned to investigate a geochemical and gravity anomaly situated in the vicinity of 980N/1000E.

Geological mapping at a scale of 1" to 400 feet will be extended to the south of the Sundown Creek.

R.A.Horn,
Senior Geologist,
Exploration Department.

Reference: - Whitehead, S., 1969
"Zinc-Bearing Carbonate Rocks"
Confidential Report AMDEL to EZ MP2143-69

APPENDIX 1

Exerpt from

Report EZ/10 - GOSSANOUS OUTCROPS - SOUTH AUSTRALIA

by

A.W.G.Whittle & Associates, Belair, South Australia

Sample B.

This surface outcrop is principally a mass of colloform banded and botryoidal black manganese oxide with thin interlayered deposits of white carbonate. The metal contents are as follow:

Cu, ppm	Pb, ppm	Zn, ppm	Mn, ppm
1,200	172,000	6,400	196,000

The sections of the sample display little original rock material, and the cavities are shown to be leached spaces into which the colloform minerals did not extend.

Microcrystalline clay is the only relic of the former rock, and all of this is heavily impregnated by equally finely crystallised manganese oxides. These relics of a former extensively decomposed and leached rock, (possibly shale or argillaceous limestone), were the nuclei upon which were moulded the colloform banded deposits. The thickest bands are composed of coronadite with a microcrystalline texture. Between the coronadite layers there are bands of well-crystallised carbonate, and thin bands of pyrolusite.

The carbonate mineral was examined in refractive index media to determine whether cerussite or smithsonite were present, but no carbonate with an index higher than calcite and dolomite was observed. It is therefore concluded that the geochemical values for lead are contained in coronadite, and those for zinc in the other manganese oxide minerals.

In common with the samples from Area K, this sample exhibits no replica or boxwork form, and there is no indication of a lode or vein structure. This again, would appear to be a near-surface metal accumulation with manganese oxides, with little possibility of depth extension.

AWG Whittle

A.W.G. Whittle & Associates,
Mineralogical Consultants.

March 9, 1972.

amdel
The Australian Mineral Development Laboratories
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Phone 79 1662, telex AA82520

Please address all correspondence to the Director
In reply quote. ME 3/30/0

7 January 1972

The Managing Director
Electrolytic Zinc Company of Australasia Ltd
GPO Box 856K
MELBOURNE Vic 3001

Attention: Mr N. Ashdown

Report: ME 2362/72

YOUR REFERENCE: Letter dated 12 November 1971.

MATERIAL: Zinc Ore Samples from Beltana, S.A.

IDENTIFICATION: Samples designated D and E.

DATE RECEIVED: 16 November 1971.

WORK REQUIRED: Each sample to be:

1. Crushed to minus 12.7 mm.
2. Wet scrubbed.
3. Wet screened at 0.5 mm.
4. Screen O/S treated in a heavy medium cyclone at 3 levels of medium density.
5. Test products and fines to be assayed for Zn, Pb, Fe, Ni, Ca, Mg, As, Cl and F.

Investigation and Report by: H.L. D'Rozario

Officer in Charge,
Mineral Engineering Section: G.A. Dunlop,

G. A. Dunlop.

for F.R. Hartley
Director

RECEIVED
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c.c. Mr C. White

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amdel

BENEFICIATION OF LOW-GRADE BELTANA ORES

1. INTRODUCTION

In reply to an enquiry from Mr P. Greeff of the Electrolytic Zinc Company of Australiasia Limited, Amdel was requested to carry out heavy medium cyclone separation tests on two samples of Beltana zinc ores designated 'D' and 'E'. The test programme was to be the same as that previously conducted on samples 'A', 'B' and 'C'.

2. MATERIALS EXAMINED

The test work was carried out on the following:

1. A 565-Kg sample of minus 15 cm lump ore contained in 2 x 200-litre steel drums, marked 'D' - 39.34% Zn (calculated).

2. A 450-Kg sample of minus 15 cm lump ore contained in 2 x 200-litre drums marked 'E' - 36.12% Zn (calculated).

3. EXPERIMENTAL PROCEDURE AND RESULTS

3.1 Sample Preparation

The total quantity of each sample was jaw crushed in stages to minus 12.7 mm and then riffled in halves. Half quantities were re-drummed and stored.

The remaining portions were wet scrubbed in 27-Kg batches, in a 60-litre concrete mixer at a pulp density of 50% solids. Scrubbing was for a period of 2 minutes at a drum speed of 28 rpm (50% of critical). The scrubbed products were wet screened on a special ½ x 5 mm slotted mesh screen (screen aperture similar to that of the heavy medium cyclone plant feed preparation screen). Weight distributions were as under:

Screen Fractions	Weight %	
	Sample D	Sample E
O/S	73.5	81.5
U/S	26.5	18.5

The oversize products were riffled into batches of approximately 20 Kg in preparation for the heavy medium cyclone tests.

3.2 Heavy Medium Cyclone Tests

Samples from each of the ore types were treated in a Mitchell Cotts heavy medium cyclone pilot plant which had been charged with ferrosilicon of "Cyclone 60" grade as heavy medium.

Separations were made at four levels of medium density. A spigot density of 3.47 was the highest attainable for the series; at this point the medium was noted to have become excessively viscous and was not being satisfactorily returned to the agitator. The products were weighed and sampled for analysis. Test conditions and results are shown in Table 1. The undersize fractions from the wet screening were also assayed; these results and the calculated head values for the two samples are shown in Table 2.

4. DISCUSSION

Samples 'D' and 'E' gave calculated head values of 39.34 and 36.12% zinc respectively. These are noted to be closely similar to the earlier samples C(39.76% Zn) and A(35.62% Zn) previously tested (Report No. CME 2257/71 dated 5 January 1972). This similarity is however limited to the zinc contents only as samples D and E have appreciably higher Pb and Fe contents and very much lower Ca and Mg (Table 1).

The results of the test work (Table 1) show the samples to be of similar behaviour with neither indicating an amenability to beneficiation by heavy medium cyclone treatment. Liberation of the zinc minerals from gangue has apparently not been achieved to any significant extent by size reduction to minus 12.7 mm size and indications are that these are finely associated with each other in each ore.

These samples would therefore differ very considerably from the earlier samples A and C which showed surprisingly good liberation of the zinc minerals at the very much coarser size of minus 3 inch.

5. RECOMMENDATIONS FOR FURTHER WORK

It is recommended that further investigations for the beneficiation of the ore types represented by Samples A and C should include mineralogical examination of specimens. This may be followed by feasibility testing for the application of gravity separation treatments at finer sizes, or flotation.

TABLE 1: CONDITIONS AND RESULTS OF HEAVY MEDIUM CYCLONE TESTS

Sample Identification & Test No.	Medium Density	Feed Pressure	Products	Weight	Assay, %									Distribution, %								
					Zn	Pb	Fe	Ni	Ca	Mg	As	Cl	F	Zn	Pb	Fe	Ni	Ca	Mg	As	Cl	F
'D'	Sp. 3.31	30	Sink	97.1	41.0	3.90	5.90	0.005	1.17	0.78	2.55	0.11	0.14	98.8	97.9	91.3	95.0	94.2	90.4	98.4	99.2	96.7
1	Fd. 3.08		Float	2.9	18.6	2.82	18.5	0.010	1.77	2.58	1.44	0.03	0.16	1.2	2.1	8.7	5.0	5.8	9.6	1.6	0.8	3.3
			Feed (calc)	100.0	40.35	3.87	6.27	0.005	1.19	0.83	2.52	0.108	0.141	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3	3.35	31	Sink	94.8	41.0	3.75	5.70	0.015	1.09	0.66	2.45	0.10	0.08	97.2	95.7	86.2	96.4	92.2	84.7	96.3	97.2	93.6
	3.26		Float	5.2	20.6	2.92	16.5	0.010	1.72	2.16	1.74	0.04	0.10	2.8	4.3	13.8	3.6	7.8	15.3	3.7	2.8	6.4
			Feed (calc)	100.0	39.94	3.71	6.26	0.015	1.12	0.74	2.41	0.097	0.08	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
5	3.42	32	Sink	92.1	Not assayed																	
	3.34		Float	7.9																		
			Feed (calc)	100.0																		
7	3.47	32	Sink	87.5	41.5	3.90	5.10	0.010	1.09	0.66	2.65	0.09	0.07	91.7	90.9	72.4	87.5	85.6	74.0	90.9	95.5	87.5
	3.40		Float	12.5	26.5	2.75	13.5	0.010	1.24	1.65	1.85	0.03	0.07	8.3	9.1	27.6	12.5	14.4	26.0	9.1	4.5	12.5
			Feed (calc)	100.0	39.63	3.76	6.15	0.010	1.11	0.78	2.55	0.08	0.07	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
'E'	3.31	30	Sink	96.5	38.2	5.75	4.60	0.005	1.25	0.38	0.83	0.09	0.16	98.4	98.7	95.5	90.2	81.0	87.9	99.5	98.6	98.2
2	3.08		Float	3.5	20.4	2.18	6.10	0.015	8.15	1.35	0.37	0.04	0.08	1.6	1.3	4.5	9.8	19.0	12.1	0.5	1.4	1.8
			Feed (calc)	100.0	37.58	5.63	4.65	0.005	1.49	0.41	0.81	0.09	0.16	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
4	3.35	31	Sink	95.6	37.4	5.75	4.30	0.005	0.96	0.29	0.86	0.10	0.06	97.2	97.7	94.1	91.7	72.0	82.5	98.3	97.8	95.6
	3.26		Float	4.4	21.7	2.71	5.90	0.010	8.10	1.34	0.34	0.05	0.06	2.8	2.3	5.9	8.3	28.0	17.5	1.7	2.2	4.4
			Feed (calc)	100.0	36.71	5.62	4.37	0.005	1.27	0.34	0.84	0.10	0.06	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6	3.42	32	Sink	95.4	Not assayed																	
	3.34		Float	4.6																		
			Feed (calc)	100.0																		
8	3.47	32	Sink	94.2	38.2	5.85	4.50	0.005	1.20	0.40	0.86	0.10	0.04	96.5	97.0	92.0	89.1	73.5	84.4	97.8	97.0	91.7
	3.40		Float	5.8	23.7	3.05	6.35	0.010	7.15	1.22	0.34	0.05	0.06	3.5	3.0	8.0	10.9	26.5	15.6	2.2	3.0	8.3
			Feed (calc)	100.0	37.36	5.69	4.61	0.005	1.59	0.45	0.83	0.10	0.04	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 2: HEAD ANALYSES OF SAMPLES AS CALCULATED FROM TEST RESULTS

Sample Identification	Screen Fractions	Weight %	Assay %								
			Zn	Pb	Fe	Ni	Ca	Mg	As	Cl	F
D	+½ x 5 mm	73.5	39.97	3.78	6.23	0.010	1.14	0.78	2.49	0.095	0.097
	-½ x 5 mm	26.5	37.6	3.95	7.50	0.010	1.23	0.81	2.15	0.12	0.08
	Head (Calc.)	100.0	39.34	3.83	6.57	0.010	1.16	0.79	2.40	0.10	0.09
E	+½ x 5 mm	81.5	37.22	5.65	4.54	0.005	1.43	0.40	0.83	0.09	0.09
	-½ x 5 mm	18.5	31.3	6.00	7.35	0.010	1.35	0.62	0.83	0.09	0.08
	Head (Calc.)	100.0	36.12	5.71	5.06	0.006	1.41	0.44	0.83	0.09	0.09

N.B. Figures given for the +½ x 5 mm fractions are mean values of the calculated feeds from Table 1.

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In reply quote: ME3/30/10

6 January 1972

Mr G.A. Mackay
General Manager - Mining Division
Electrolytic Zinc Co. of Australasia Ltd
GPO Box 856K
MELBOURNE Vic 3001

BENEFICIATION OF BELTANA ZINC ORE FINES

PROGRESS REPORT No.1

From 10 October 1971

To 30 November 1971

Investigation and Report by: H.L. D'Rozario and P.J.Berndt.

Officer in Charge,
Mineral Engineering Section: G.A. Dunlop.

for F.R. Hartley
Director.

c.c. Mr C. White
Chief Metallurgist
Electrolytic Zinc Co. of Australasia Ltd
ROSEBERY TAS 7470

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1. INTRODUCTION

Previous work by Amdel (Report CME2257/71 dated 5 January 1971) on samples of zinc silicate ores from Beltana, S.A., covered an investigation of gravity concentration of lump material by heavy medium separation. The work demonstrated that the ores were amenable to heavy medium cyclone separation, and concentrate grades of in excess of 50% Zn were obtained at satisfactory recovery from treatment of the plus 0.5 mm fraction of ore crushed to 12.7 mm (½ inch).

However, the minus 0.5 mm fraction of ore, which was not treatable in the heavy medium cyclone, contained 30 to 35 per cent of the zinc in the crude ores.

A further investigation was requested into recovery of additional zinc values from the minus 0.5 mm fines. The mutually agreed test programme covered investigation of fines beneficiation by gravity means using pinched sluices, spirals and tables, and by flotation.

2. REVIEW OF PROGRESS

2.1 Gravity Separation

Tests have been carried out in which the minus 28 mesh fines from samples A and C were:

1. Hydrosized and the four size fractions treated separately on laboratory tables.
2. Beneficiated by treatment in a 900 mm pinched sluice - one pass only.
3. Treated in standard, single start five turn spiral concentrator - one pass only.

The test results are summarised below.

Sample	Treatment Process	Conc product as Wt.% of Head	Assay %		Recovery %	
			Zn	Pb	Zn	Pb
'A' Average Head Analyses Zn - 33.1% Pb - 2.3%	1. Hydrosizing and tabling of size fractions.	39.6	41.3	4.86	51.6	67.2
	2. Treatment by pinched sluice.	55.0	37.5	2.25	59.5	60.3
	3. Spiral concentration	44.6	39.7	3.42	53.2	61.7

Sample	Treatment Process	Conc product as Wt.% of Head	Assay %		Recovery %	
			Zn	Pb	Zn	Pb
'C'						
Average Head Analyses Zn - 33.1% Pb - 2.1%	1. Hydrosizing and tabling of size fractions	41.3	40.3	3.67	52.2	71.7
	2. Treatment by pinched sluice	38.5	40.2	3.48	47.3	49.8
	3. Spiral concentration	44.4	40.9	3.25	61.2	56.1

The hydrosizer overflows contained ultrafine products of nominally minus 20 microns which amounted to 11.8 and 12.1% by weight of the minus 28 mesh fractions of samples A and C respectively.

2.2 Flotation

The feasibility of producing a satisfactory grade of zinc concentrate by flotation from the minus ½ x 5 mm fraction of Beltana ore has been demonstrated. The best results to date were obtained by grinding the -½ x 5 mm material and floating it in two separate sized fractions, minus 240/plus 400 mesh and minus 400 mesh using AeroAmine 3037 collector.

For ore type A, the best results obtained are 97.3% recovery at 46.1% zinc grade and 95.1% recovery at 44.2% grade for the coarse and fine fractions respectively, and for ore type C, 93.9% recovery at 42.0% zinc grade and 74.3% recovery at 46.5% zinc grade. These figures represent overall results for the -½ x 5 mm fraction of ore of 95.6% recovery at 44.7% zinc for sample A and 82.9% at 44.7% zinc for sample C.

Flotation of unground minus 0.5 mm fraction of ore was unsuccessful. It is believed that this is due to the age of the sample which has been stored at Amdel for over one year. Flotation of an unground minus 200 mesh fraction which has been similarly stored was also unsuccessful.

3. WORK IN HAND

All test work envisaged in the current investigation programme is complete. Assessment of flotation conditions using fresh ore, designated composite samples D and E,was conducted. In particular, the ratio of sodium sulphide modifier to AeroAmine 3037 collector was varied to establish the optimum dosage of the former reagent, as it constitutes a major cost in the flotation process. The optimum gangue depressant was also sought.

4. MATERIAL EXAMINED

The minus 28 mesh fines products remaining from the original heavy medium cyclone separation test work on samples A and C (Report No. CME2257/71 dated 5 January 1971) were used for the wet tabling and flotation tests. Tabling was done on separate size fractions obtained by hydrosizing. The pinched sluice and spiral concentrator test work was carried out on the minus ½ x 5 mm fines fractions of head samples of the two ores (A and C) composited from the sink, float and minus 10 mesh products from the earlier static heavy medium separation tests. The composites were crushed to minus ½ inch then screened on a ½ x 5 mm rectangular aperture screen. The fines tested by gravity concentration were of the following average analysis:

	% Zn	% Pb
Sample A	33.1	2.3
Sample C	33.1	2.1

The zinc analyses on the minus 28 mesh fractions used in flotation test work are 34.2% and 23.0% for composite samples A and C respectively. The head analysis of sample C varies from the average of 33.1% Zn used in gravity concentration tests because this sample was taken from a bagged portion of the original sample which had been stored separately.

5. EQUIPMENT AND ANCILLARY MATERIALS USED

5.1 Equipment

British Standard Screens.
Wilfley and James Tables, Laboratory Models.
Spiral Concentrator, Single Start, Five-turn.
Pinched Sluice Tray, Reichert Mining Equipment.
Rod Mill, Batch, 7 inch dia x 10 inch, stainless steel, with 15 x 1 inch dia Rods.
Flotation Machine, Denver Laboratory Unit, with 1.5 litre capacity cell.

5.2 Ancillary Materials Used

Soda Ash, Ajax Chemicals Ltd, Australia.
Sodium Silicate, Nightingale Chemicals Ltd, Australia.
Carrybon L400, Bieth Chemical Materials Ltd.
Marasperse CB, Marathon Corp, USA.
Tylose CBR4000, Hoescht AG, Germany.
Tetrasodium phosphates, Albright & Wilson (Aust.) Pty Ltd.
Trisodium polyphosphates.
Sodium sulphides, BDH chemicals, England.
AeroAmine 3037, Cyanamid Aust. Pty Ltd.
Armac T, Chemical Materials Ltd, Australia.
Potassium Hexyl Xanthate, Dow Chemical Co., USA.
Pine Oil, Hercules Inc, USA.
Aerofroth 65, Cyanamid Aust. Pty Ltd.
Teric 401, I.C.I.A.N.Z, Australia.

Adelaide mains water was used throughout.

6. EXPERIMENTAL PROCEDURE AND RESULTS

6.1 Tabling

6.1.1 Sample Preparation

Portions of the minus 28 mesh fines fractions of samples A and C which remained from the previous heavy medium cyclone test work were taken for flotation tests. The rest of these samples were oven dried, weighed and individually dry screened at 0.251 mm (60 mesh). The undersize fractions were hydraucally classified in a three compartment laboratory unit where size cuts were made. The size cuts made, calculated from classifier water velocities and the average specific gravity of the ore, were at nominally 0.152, 0.076 and 0.020 mm. The minus 20 micron classifier sluices were not recovered but a representative sample of this product was taken for analysis and its weight was calculated by difference. Size distributions for the two samples were as under:

Nominal Size of Hydrosizer Fractions (mm)	Sample A		Sample C	
	Assay % Zn	Distribution % Zn	Assay %	Distribution %
+0.251	32.6	49.8	33.8	52.5
-0.251 +0.152	39.1	8.6	37.2	4.9
-0.152 +0.076	34.8	10.6	25.8	7.8
-0.076 +0.020	30.3	22.0	32.7	24.5
-0.020	24.0	9.0	27.3	10.3
Calculated Head	31.7	100.0	32.1	100.0

6.1.2 Tabling of Sized Fractions

The plus 0.076 mm size fractions of each sample were treated on a laboratory Wilfley table under the following conditions:

Table - 935 x 356 mm Wilfley, linoreum deck.
Stroke - ½ inch.
Frequency - 300 rpm.

Two tests were carried out on each size of feed with table slope and cutter positions being adjusted to give higher concentrate weight recoveries for the second test in each case. The minus 0.076 mm size fractions were treated on a 1240 x 533 mm laboratory James Slimes table. Products were assayed for zinc and lead. Results are shown in Tables 1 and 2. Table 3 shows the weight distribution grades and recoveries for concentrate products comprising the combined concentrate and middling fractions from the test 1 series of each sample. From these results the weights, grades and recoveries of the overall concentrates based on head values were calculated. It is to be noted that the overall figures are based on only the plus 20 micron fraction of the respective heads with the minus 20 micron sluices being regarded as waste.

6.2 Pinched Sluice and Spiral Concentration

6.2.1 Sample Preparation

The amounts of minus 28 mesh fines remaining from the earlier test work were sufficient for the tabling tests only. Fines material for pinched sluice and spiral concentrator tests was obtained by compositing head samples of the ore types A and C from the sink, float and minus 10 mesh products of static heavy medium separation tests carried out previously (Tests Nos. 5 and 4). The composites were stage crushed to minus ½ inch and the products were screened on a special screen of ½ x 5 mm rectangular aperture (similar to the heavy medium cyclone feed preparation screen cloth).

Size Fraction	Weight %	
	Sample A	Sample C
+½ x 5 mm	57.7	69.0
-½ x 5 mm	42.3	31.0
	100.0	100.0

6.2.2 Pinched Sluice Concentration

Representative portions of the fines products from each sample were treated in a laboratory tray of 900 mm length which tapered from 240 mm at the feed end to 51 mm at the discharge end. This was set up at a fixed slope of 18°. The fines were fed to the tray as pulps of 50% solids through a flat nozzle of feed end width. Feed rates were controlled to give a smooth even flow of pulp over the tray with three products being collected in each case. Results are shown in Table 4.

6.2.3 Spiral Concentration

The samples were treated as pulps of 20% solids density in a standard size, single start, five-turn concentrator with a rubber lined trough. Each sample was treated in two tests in which throughput rates were varied. The results are shown in Table 5.

6.3 Flotation

6.3.1 Effect of Extent of Grind

The size distributions of ground products from both composite samples were determined by wet and dry screening. Grinding was carried out in the laboratory rod mill at 60 weight per cent solids for periods of 5, 7 and 9 minutes. The sizings of minus 28 mesh head samples and ground material are given in figures 1 and 2. Composite sample A gave appreciably greater weight proportions of fines at all grind intervals tested. This is illustrated in figure 3.

The effect of extent of grind on sample C was determined by staged batch flotation under standard conditions of 500 g charges ground for 3.1, 4.2 and 6.0 minutes respectively.

The flotation feed was 'deslimed' at 350 mesh to eliminate the effect of a variable slime content at the different grinding periods. The overall recovery of zinc into the rougher concentrate, expressed as a percentage of the zinc content of the flotation feed, that is, ignoring the slime losses, affords an indication of the optimum flotation feed size required.

The deslimed charges were floated in a 1.5 litre Denver cell using sodium sulphide activation, Armac T collector, soda ash and sodium silicate as gangue depressants. The collector was added stage-wise in increments of 0.25 lb per ton for 4 stages with a separate froth concentrate removed for each stage after 2 minutes of flotation.

The results expresced as percentages or the total ground product, are given in Tables 12 to 14, figure 4 shows the effect on rougher recovery with variation in grinding periods. The optimum grinding period is about 5 minutes, corresponding to a sizing of 80% passing 30 microns. Beyond this time, the rougher recovery, as a percentage of float feed, increases insufficiently to justify further grinding and in fact falls off slightly when the slime losses are taken into account.

The slimes contain about 18% of the zinc in the minus ½ x 5 mm material and therefore desliming at such a coarse size should be avoided. Indeed, it should not be necessary from the point of view of successful flotation, to deslime at 350 mesh. However some amount of desliming is necessary, as was indicated by the poor results of a test conducted on sample C ground for 6 minutes and not deslimed. At reagent levels (equivalent to those in other tests) the grade and recovery were extremely low due to the high floatability of low grade slimes.

6.3.2 Investigation of Flotation Flowsheet

A flotation test was conducted on unground minus ½ x 5 mm feed to investigate flotation of the total zinc content of the material with a minimum amount of slimes in the flotation circuit.

Staged rougher flotation, using the standard conditions described, was performed for a total of 5 stages on each ore type. The rougher tailing was then wet screened at 240 mesh and the oversize was lightly ground in a laboratory rod mill for 2 minutes using only 9 rods as against the usual 15. The ground product was again wet screened on 240 mesh and the oversize returned to the mill for a further 2 minute grind, and so on until the rougher tailing was 100% minus 240 mesh. This procedure simulated conventional continuous closed-circuit grinding and produced a minimum amount of ultrafines. The amount of minus 400 mesh material produced by this method for ore type C after a cumulative grinding interval of 6 minutes, was 63%, whereas a single stage grind under full load for 9 minutes to produce 100% minus 240 mesh feed gave almost 90% minus 400 mesh.

The ground tailing was subjected to scavenger flotation at a higher reagent level.

The results of these tests, suggested that the majority of the zinc minerals in both composites are locked with gangue in the unground feed. The bulk rougher concentrates represented only a small proportion of the zinc content of the feed and assayed only 30.6% and 13.4% zinc for composites A and C respectively. The scavenger concentrate for sample C assayed 41.5% zinc and represented a recovery of 60.5% and for sample A, 44.0% zinc at 47% recovery.

A similar situation occurred during flotation of an unground minus 200 mesh/plus 20 micron fraction of sample C. This material was screened out of the bulk -½ x 5 mm material and so had a similar 'surface age'. This fraction did not respond to flotation at all until it was attritioned for 15 minutes. It then produced excellent results as indicated in Table 20.

In view of the poor rougher concentrate grades obtained using unground ore, the investigation was continued using rougher feed which was stage ground to 100% minus 240 mesh. The results of these tests on samples A and C are given in Tables 8 and 15 respectively.

Sample C gave relatively high grade concentrates at low collector levels (42.4% zinc at 72.3% recovery using 0.75 lb/ton) and overall gave a grade of 38.5% zinc at 80.3% recovery into the rougher concentrate. Sample A gave concentrates of grade increasing with collector level. It is thought that the feed was not deslimed at a sufficiently coarse size (about 5 microns) to exclude their effect from the circuit. The latter stage concentrates, however, were high grade and collectively contained 47.3% of the zinc at a grade of approxmately 45% zinc.

A duplicate test on ore type A was conducted using AeroAmine 3037 collector to compare its performance with Armac T. The test results, given in Table 7, follow the same pattern as test A2, but in general are slightly better. For example, the last two stage concentrates contained 51.8% of the zinc at 44% zinc grade.

Desliming of the flotation feed for both composite samples at about 10 to 15 microns is necessary because of their high flotability and low grade. This entails zinc losses into the slimes of about 25% for composite A and 15% for composite C. Therefore, split-circuit flotation of separate coarse and fine fractions was investigated. Slimes were eliminated from minus 240 mesh material, obtained by simulated closed circuit grinding as described previously, by wet-screening on 400 mesh.

The results of these tests are given in Tables 9, 10, 16 and 17. For sample A, the recovery of coarse (-240/+400 mesh) zinc was about 97% at grades in excess of 42% zinc (see Tables 9 and 10), but the slimes float was unsuccessful without stringent desliming. The slimes float for test A6 was totally unsuccessful whereas in test A7 92.8% recovery of floated zinc at 46.6% zinc was achieved. However, the unfloated portion contained 47% of the zinc in the total -½ x 5 mm fraction of ore. For sample C, Table 16 shows that an overall recovery of 85.8% at a rougher grade of 28% zinc was achieved. Of the coarse zinc, 97%, at a grade of 31.9% zinc, was recovered and of the fine zinc 95.2% at a grade of 24.4%. A cleaner test, test C6 (Table 17) successfully upgraded the concentrate to 41.6% zinc at 57.3% recovery. 93.9% of the coarse zinc at 42% grade was recovered and 26.9% of the fine zinc at 40.5% grade.

Further tests were conducted on hydrosizer slimes (nominally minus 20 microns) to establish the most effective gangue depressant combination. Sodium silicate and Corrybon L400 in combination, Marasperse CB, Tylose CBR 4000 and Tetrasodium phosphate were evaluated on sample A. Of these, only the latter produced good results: 44.2% zinc grade at 95.1% recovery. The results of this test are given in Table 11.

For sample C, the depressant combination Tylose CBR 4000 and Tri-sodium polyphosphate was tested. The results, given in Table 18, were quite successful, the rougher concentrate containing 95.1% of the zinc at 32.0% zinc grade. A cleaner test, using the same conditions, produced a concentrate of 46.5% zinc grade containing 74.3% of the zinc in the hydrosizer slimes.

Details of this test are given in Table 19.

To determine the possible effect of surface oxidation on the flotation behaviour of fines from ore-types A and C due to their length of storage in the ground state, the flotation investigation was carried further using fresh fines from ore type D. However, this sample behaved similarly to the others in that successful flotation could only be achieved after grinding or attritioning. This suggests that scrubbing may need to be an integral part of a flotation circuit for the -½ mm ore if the material is not to be ground before flotation.

Staged rougher flotation tests were conducted on ore type D using samples which were ground to 100% minus 240 mesh and deslimed at 400 mesh. Tests D1 and D2 compare the depressants sodium silicate and Carrybon L400 while tests D1 and D3 show the effect of varying the dosage of sodium sulphide used, all other conditions being the same.

These tests indicate that sodium silicate is a more effective gangue depressant for both coarse and fine fractions and that the ratio of sodium sulphide to AeroAmine 3037 can be reduced from 12:1 to 6:1, with increase in grade and recovery for the coarse fraction only.

7. DISCUSSION

At the discussions held at Amdel on 25 November 1971 with Mr N.C. Ashdown of Electrolytic Zinc and Messrs Brown and Melbourne of Davy-Ashmore Pty Ltd it was intimated that:

1. Physical concentration methods for Beltana zinc are strongly favoured for the heavy medium cyclone process.
2. The ore would be treated by heavy medium cyclone at minus ½ inch plus ½ mm size.
3. Additionally, minus ½ mm fines may be physically concentrated, the product from which would be blended with the concentrates from the heavy medium cyclone.
4. The final blended concentrate product should be of plus 50% Zn grade.

7.1 GRAVITY CONCENTRATION

The results of the gravity separation test work are summarised in Table 6. Of the three processes investigated tabling and spiral concentration yield concentrates of better grades and higher recoveries. It should be noted however that the figures shown for the tabling test work are based on the treatment of the plus 20 micron fraction of the total fines with the slimes being considered as waste material.

It is conservatively estimated from these results that treatment of the fines by a suitable gravity concentration method would recover a concentrate product amounting to 45% by weight of feed, at a grade of 40% Zn and 3.5% Pb. and that this would contain 50% of the zinc and 60% of the lead in the feed to the process.

Calculating grades and recoveries of the combined concentrates for Samples A and C from the test results it is shown that:

1. From screening of the minus ½ inch head samples (Report CME2257/71 dated 5 January 1971):

Size Fraction	Weight %		Distribution % Zinc	
	Sample A	Sample C	Sample A	Sample C
+28 Mesh	56.9	71.1	54.2	78.1
-28 Mesh	43.1	28.9	45.8	21.9

2. From Heavy Medium Cyclone Separation of the plus 28 mesh fraction (as from above report):

Test Products	Sample A (Test 7)			Sample C (Test 2)		
	Wt.%	Zn %	Dist. of Zn	Wt.%	Zn %	Dist. of Zn
H.M. Cyclone:						
Sink	51.1	56.8	91.0	81.1	58.4	99.2
Float	48.9	5.90	9.0	18.9	2.15	0.8
Feed (Calc)	100.0	31.92	100.0	100.0	47.48	100.0

Combining the above sink products with our assumed weights and zinc recoveries of concentrates from a gravity separation treatment of the minus 28 mesh fines (45% by weight of feed at a grade of 40% Zn):

Concentrate Products	Sample 'A'			Sample 'C'		
	Wt.% of Head	% Zn	Zn recov. as % of Hd	Wt.% of Head	% Zn	Zn recov. as % of Hd
Coarse (+28 mesh) Conc	29.1	56.8	49.2	56.9	58.4	77.5
Fine (-28 mesh) Conc	19.4	40.0	22.9	13.0	40.0	11.0
Total Gravity Conc	48.5	50.0	72.1	69.9	54.9	88.5

7.2 Flotation

Flotation of unground batches of ore types A and C is not feasible without attritioning. Ore type D, from which the fines were freshly separated similarly, did not respond well to flotation when unground.

Test work so far has indicated that size fractionation of the bulk minus ½ x 5 mm ore is desirable before flotation. Both sand and slime fractions respond favourably to flotation and concentrate grades in excess of 45% can be predicted.

The optimum flotation conditions differ for both sand and slime fractions and for each ore type. For ore type A, the coarse fraction floated best using AeroAmine 3037 collector (1.6 lb/ton), Sodium Sulphide activator (26.0 lb/ton), Sodium Silicate (4.3 lb/ton) and Soda Ash (5.1 lb/ton) dispersants and depressants, and Arofroth 65 frother (0.05 lb/ton). These conditions yielded 97.6% recovery of the coarse zinc at 42.1% Zn grade and 93.9% recovery of the lead at 2.36% Pb grade into the rougher concentrate.

For the slimes fraction of ore type A the best results were obtained using 2.0 lb/ton of collector, 24.0 lb/ton of activator, 3.5 lb/ton of tetrasodium phosphate as iron oxide dispersant, 4.0 lb/ton of soda ash and 0.05 lb/ton of Aerofroth 65. Using these conditions 95.1% zinc recovery at 42.0% Zn grade was achieved.

The coarse fraction of ore type C yielded 93.9% zinc recovery at 42.0% Zn grade and 91.0% lead recovery at 3.15% Pb grade using 0.71 lb/ton of collector, 8.2 lb/ton of activator, 1.0 lb/ton of Carrybon L400 depressant, 11.4 lb/ton of soda ash dispersant and 0.05 lb/ton of Aerofroth 65 frother. 74.3% zinc recovery at 46.5% Zn grade in the cleaner concentrate was achieved for the slimes fraction of ore type C in a cleaner flotation test using 1.4 lt/ton of collector, 14.0 lb/ton of activator, 4.0 lb/ton of soda ash, 1.5 lb/ton of TriSodium polyphosphate, 0.09 lb/ton of Tylose CBR4000, 3.6 lb/ton of sodium silicate and 0.05 lb/ton of Aerofroth 65.

These reagent quantities have not been optimised in the current investigation. The results of test work on ore type D indicated that the amount of sodium sulphide can be reduced to 0.6 lb/ton for successful flotation of the sands fraction with increase in concentrate grade without loss in recovery. The activator to collector ratio of 6:1 was unsuccessful for flotation of the slimes fraction.

Also, for ore type D, sodium silicate proved a more selective gangue depressant than Corrybon L400.

Tabling work on coarse fractions has indicated that high grades, in excess of 50% zinc, can be achieved at coarse sizes and therefore liberation of the zinc minerals appears to be essentially complete below say, 60 mesh. However, it may not be feasable to effectively reagentize particles as coarse as 28 mesh sufficiently to achieve flotation collection in continuous machines. It is realised that the overall economics of flotation as against coarse tabling with rejection of fine material may depend on whether further grinding is necessary for flotation and therefore the current investigation should be carried further to evaluate this requirement.

The flotation results obtained on coarse (-74 +20 microns) and fine (-20 microns) fractions are summarised in relation to the total minus 0.5 mm fraction ore for ore types A and C in the following tabulation:

Ore Type	Fraction	Flotation Results		
		Test	Concentrate Grade, % Zn	Recovery % of Float Feed
A	Coarse	A3	46.1	97.3
	Fine	A5	44.2	95.1
	Total		44.7	95.6
C	Coarse	C6	42.0	93.9
	Fine	C8	46.5	74.3
	Total		44.1	82.9

The tests reported above for ore type C are from cleaner flotation tests while those for ore type A ore from rougher tests.

The results of gravity separation on all size fractions except the smallest (minus 20 microns) may be regarded as satisfactory. Flotation of this fraction was also satisfactory and is included in the overall results for -0.5 mm ore in the following tabulation:

Treatment Process	Ore Type A			Ore Type C		
	Concentrate Wt.% of -0.5 mm	Conc Assay % Zn	Recov.% Zn	Concentrate Wt.% of -0.5 mm	Conc Assay % Zn	Recov.% Zn
Hydrosizing and wet tabling of size fractions to 20 microns	39.6	41.3	51.6	41.3	40.3	52.2
Flotation of hydrosizer overflow (-20 microns)	9.7	44.2	8.7	4.6	46.3	9.6
TOTAL	49.3	41.9	60.3	44.9	40.8	61.8

The results for the overall treatment process, using Heavy Medium Cyclone separation of the plus 0.5 mm fraction and either the above combined process or flotation of the minus 0.5 mm fraction are given below:

Treatment Process	Ore Type A			Ore Type C		
	Concentrate Wt.% of Lead	Conc Assay % Zn	Recov.% Zn	Concentrate Wt.% of Lead	Conc Assay % Zn	Recov.% Zn
I H.M.C.Separation of +0.5 mm fraction	29.1	56.8	49.2	56.9	58.4	77.5
II Tabling of -0.5 mm plus flotation of -20 micron fraction	16.8	41.9	27.7	13.1	40.8	13.5
III Flotation of -0.5 mm fraction	34.3	44.7	43.9	15.3	44.1	18.2
Total I, plus II	45.9	51.3	76.9	70.0	55.1	91.0
Total I, plus III	63.4	50.3	93.1	72.2	55.5	95.7

TABLE 1: RESULTS OF TABLING TESTS - SAMPLE 'A'

Size Fraction mm	Test Products	Test 1					Test 2				
		Wt %	Assay %		Dist. %		Wt %	Assay %		Dist. %	
			Zn	Pb	Zn	Pb		Zn	Pb	Zn	Pb
+0.251	Conc	20.1	39.7	4.65	24.5	40.9	40.6	37.4	ND	47.0	-
(60 mesh)	Mids	24.5	42.4	2.35	31.9	25.2	31.1	36.5	ND	35.2	-
	Tails	55.4	25.6	1.40	43.6	33.9	28.3	20.3	ND	17.8	-
	Feed (Calc)	100.0	32.55	2.28	100.0	100.0	100.0	32.8	-	100.0	-
+0.152	Conc	23.0	38.6	12.6	22.7	70.1	29.4	38.7	ND	29.1	-
(100 mesh)	Mids	20.7	45.2	2.3	23.9	11.5	27.5	45.9	ND	32.2	-
	Tails	56.3	37.0	1.35	53.4	18.4	43.1	35.2	ND	38.7	-
	Feed (Calc)	100.0	39.07	4.13	100.0	100.0	100.0	39.17	-	100.0	-
+0.076	Conc	20.9	43.5	5.85	26.2	67.2	37.2	36.5	ND	41.9	-
(200 mesh)	Mids	19.6	45.1	1.56	25.4	16.8	21.8	43.7	ND	29.5	-
	Tails	59.5	28.3	1.02	48.4	16.0	41.0	22.6	ND	28.6	-
	Feed (Calc)	100.0	34.77	1.82	100.0	100.0	100.0	32.37	-	100.0	-
+0.020	Conc	48.0	40.4	7.20	64.1	79.4	70.5	34.7	ND	85.3	-
	Mids	16.4	38.5	2.50	20.8	9.4	14.0)	14.5	ND	14.7	-
	Tails	35.6	13.0	1.37	15.1	11.2	15.5)				
	Feed (Calc)	100.0	30.34	4.35	100.0	100.0	100.0	28.74	-	100.0	-
-0.020	NOT TREATED		24.0	2.30							

TABLE 2: RESULTS OF TABLING TESTS - SAMPLE 'C'

Size Fraction mm	Test Products	Test 1					Test 2				
		Wt %	Assay %		Dist. %		Wt %	Assay %		Dist. %	
			Zn	Pb	Zn	Pb		Zn	Pb	Zn	Pb
+0.251	Conc	30.0	42.6	5.75	37.8	66.1	41.7	41.6	ND	49.3	-
(60 mesh)	Mids	28.8	36.8	1.90	31.4	21.0	30.7	38.1	ND	33.2	-
	Tails	41.2	25.3	0.82	30.8	12.9	27.6	22.4	ND	17.5	-
	Feed (Calc)	100.0	33.80	2.61	100.0	100.0	100.0	35.23	-	100.0	-
+0.152	Conc	30.6	40.6	11.0	33.4	81.8	40.0	39.7	ND	52.9	-
(100 mesh)	Mids	24.5	44.5	1.94	45.4	11.5	27.8	39.8	ND	36.8	-
	Tails	44.9	17.6	0.61	21.2	6.7	32.2	9.6	ND	10.3	-
	Feed (Calc)	100.0	37.23	4.12	100.0	100.0	100.0	30.04	-	100.0	-
+0.076	Conc	22.9	42.6	7.60	37.8	73.5	30.3	42.6	ND	48.0	-
(200 mesh)	Mids	22.3	39.2	1.68	33.9	15.8	17.5	41.6	ND	27.1	-
	Tails	54.8	13.3	0.40	28.3	10.7	52.2	12.8	ND	24.9	-
	Feed (Calc)	100.0	25.79	2.37	100.0	100.0	100.0	26.87	-	100.0	-
+0.020	Conc	26.1	41.8	1.05	33.4	26.0	6.1)	40.7	ND	11.0	-
	Mids	22.3	33.0	0.80	22.5	16.9	3.4)				
	Tails	51.6	27.9	1.17	44.1	57.1	90.5	34.5	ND	89.0	-
	Feed (Calc)	100.0	32.66	1.06	100.0	100.0	100.0	35.09	-	100.0	-
-0.020	NOT TREATED		27.3	2.65							

TABLE 3: SUMMARISED RESULTS OF TABLING TESTS

Sample Identification	Size Fraction mm	Concentrate Product	Wt % of Size Fraction	Calculated Assay %		Distribution %	
				Zn	Pb	Zn	Pb
'A'	+0.251	Conc & Mids	44.6	41.1	3.39	56.4	66.1
	+0.152	" "	43.7	41.8	7.72	46.6	81.6
	+0.076	" "	40.5	44.3	3.77	51.6	84.0
	+0.020	Conc only	48.0	40.4	7.20	64.1	79.4
		Total conc	39.6(a	41.2	4.82	51.3(a	67.2(a
HEAD (Calculated)				31.3	2.86		
'C'	+0.251	Conc & Mids	58.8	39.7	3.86	69.2	87.1
	+0.152	" "	55.1	42.2	6.97	78.8	93.3
	+0.076	" "	45.2	40.9	4.68	71.7	89.4
	+0.020	Conc only	36.1	41.8	1.05	33.4	26.0
		Total conc	42.3(a	40.3	3.67	52.2(a	71.7(a
HEAD (Calculated)				32.6	2.31		

a) As percent of total -0.50 mm material.

TABLE 4: RESULTS OF PINCHED SLUICE CONCENTRATION

Sample Identification	Throughput Kg/Hr	Products	Wt %	Assay %		Dist. %	
				Zn	Pb	Zn	Pb
'A'	1200	Conc 1	28.7) a)	39.7	2.65	32.9	37.0
		" 2	26.3)	35.1	1.82	26.6	23.3
		Tails	45.0	31.1	1.82	40.5	39.7
		Head (calc)	100.0	34.62	2.06	100.0	100.0
'C;	1260	Conc 1	31.3) a)	41.0	3.80	39.2	44.2
		" 2	7.2)	36.9	2.10	8.1	5.6
		Tails	61.5	28.1	2.20	52.7	50.2
		Head (calc)	100.0	32.77	2.69	100.0	100.0

a) Concentrates 1 and 2 were combined to give the total concentrate products shown in the summarised test results, Table 6.

TABLE 5: RESULTS OF SPIRAL CONCENTRATION

Sample Identification	Through-put Kg/hr	Products	Weight		Assay %				Distribution %			
			%	Cum %	Zn	Cum Zn	Pb	Cum Pb	Zn	Cum Zn	Pb	Cum Pb
'A'	1000	Conc 1	28.1		39.7		3.55		33.5		47.2	
		" 2	16.5	44.6	39.7	39.7	1.85	3.42	19.7	53.2	14.5	61.7
		Mid	13.6		25.8		1.20		10.5		7.7	
		Tails	41.8		29.0		1.55		36.3		30.6	
		Head(calc)	100.0		33.33		2.11		100.0		100.0	
	457	Conc 1	41.6	41.6	38.6	38.6	ND		48.2	48.2	-	-
		" 2	7.7		31.0		ND		7.2		-	-
		Mid	12.1		29.0		ND		10.5		-	-
		Tails	38.6		29.5		ND		34.1		-	-
		Head(calc)	100.0		33.34		-		100.0		-	-
'C'	755	Conc 1	29.2		42.2		3.90		41.8		44.2	
		"	15.2	44.4	37.5	40.9	2.00	3.25	19.4	61.2	11.9	56.1
		Mid	12.0		22.5		1.35		9.2		6.3	
		Tails	43.6		20.0		2.20		29.6		37.6	
		Head(calc)	100.0		29.44		2.56		100.0		100.0	
	613	Conc 1	44.3		37.0		ND		53.3		-	-
		" 2	12.0	56.3	42.2	38.2	ND		16.5	69.8	-	-
		Mid	9.2		21.4		ND		6.4		-	-
		Tails	34.5		21.3		ND		23.8		-	-
		Head(calc)	100.0		30.77		-		100.0		-	-

TABLE 6: SUMMARISED RESULTS OF GRAVITY CONCENTRATION TESTS

Sample identification	Treatment Process	Conc product as Wt % of Head	Assay %		Distribution %	
			Zn	Pb	Zn	Pb
'A' Average Head Analyses Zn 33.1% Pb 2.3%	1. Hydrosizing and Tabling of Size Fractions	39.6	41.3	4.86	51.6	67.2
	2. Pinched Sluice Concentration	55.0	37.5	2.25	59.5	60.3
	3. Spiral Concentration	44.6	39.7	3.42	53.2	61.7
'C' Average Head Analyses Zn 33.1% Pb 2.1%	1. Hydrosizing and Tabling of Size Fractions	41.3	40.3	3.67	52.2	71.7
	2. Pinched Sluice Concentration	38.5	40.2	3.48	47.3	49.8
	3. Spiral Concentration	44.4	40.9	3.25	61.2	56.1

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: A.1

Table No: 7

Grinding Time: 2 Min *

Sample: A

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4.0	cell	20			
Carrybon L400	0.6	"	20			
Sodium Sulphide)	3.0	"	10)	Stages 1 to 5	3	
AeroAmine 3037)	0.25	"	9)			
Aerofroth 65		"	0.25			

Product	Weight, %		Assays, % Zn		Distribution, % Zn	
		Cum		Cum		Cum
Concentrate 1	12.72	-	27.2	-	10.50	-
2	17.44	30.16	29.3	28.4	15.50	26.00
3	16.04	46.20	29.8	28.9	14.50	40.50
4	14.48	60.68	45.3	32.8	19.90	60.40
5	24.28	84.96	43.3	35.8	31.89	92.29
Tailing	7.48	92.44	7.4	33.5	1.68	93.97
Feed Slimes	7.56	100.00	26.3	33.0	6.03	100.00

* Flotation Feed stage ground in 2 min. intervals to 100% -240 mesh.

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: A.2

Table No: 8

Grinding Time: 2 Min. *

Sample: A

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4.0	cell.	20			
Carrybon L400	0.6	"	20			
Sodium sulphide)	3.0	"	10)	Stages 1 to 5	3	
Armac T)	0.25	"	9)			
Aerofroth 65		"	0.25			

Product		Weight, %	cum	Assays, % Zn	cum	Distribution, % Zn	cum
Concentrate	1	12.84	-	26.3	-	12.87	-
	2	10.76	23.60	28.5	27.30	11.69	24.56
	3	8.04	31.64	29.3	27.8	8.98	33.54
	4	13.04	44.68	40.0	31.4	19.88	53.42
	5	15.12	59.80	47.6	35.5	27.43	80.85
Tailing		32.64	92.44	9.3	26.2	11.57	92.42
Slimes		7.56	100.00	26.3	26.3	7.58	100.00

* Flotation Feed stage ground to 100% -240 mesh.

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: A.3
Table No: 9
Grinding Time: 2 Min. Stages
Sample: A.

Reagents Name	Addition lb/ton SANDS	 SLIMES	Point of Addition	Cond. Time min.	Flotation Stage	Time min.	pH
Soda Ash	16.8	5.6	Cell	20			
Carrybon L400	1.4	1.1	"	20			
Sodium Sulphide	12.5	4.9)	"	10)	Stages 1 to 4	3	
AeroAmine 3037	1.0	0.38)	"	10)			
Aerofroth 65	0.05	0.05	"	0.5			

Product		Weight, %	Cum	Assays, %	Cum	Distribution, %	Cum
Sand Concentrate	1	35.93	-	49.0	-	45.88	-
	2	42.38	78.31	46.0	47.38	50.80	96.68
	3	1.93	80.23	9.9	46.48	0.50	97.18
	4	0.84	81.07	5.2	46.05	0.11	97.29
Sand Tailing		18.93	100.00	5.5	38.38	2.71	100.00
Slimes Concentrate							
	1	8.49	-	28.0	-	7.14	-
	2	16.70	25.19	27.5	27.68	13.80	20.95
	3	5.32	30.51	26.0	27.38	4.16	25.11
	4	4.68	35.19	27.0	27.33	3.80	28.91
Slimes Tailing		64.81	100.00	36.5	33.27	71.09	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: A-4
Table No: 10
Grinding Time: 2 Min. Stages
Sample: A

Reagents					Flotation		
Name	Addition lb/ton		Point of Addition	Cond. Time min.	Stage	Time min.	pH
	Sands	Slimes					
Soda Ash	5.1	11.5	Cell	20			
Sodium Silicate	4.3	14.2	"	20			
Sodium Sulphide	) 8.7	19.4	"	)			
AeroAmine 3037	) 0.53	1.2	"	10)	Stages 1 to 4	3	
Aerofroth 65	0.05	0.05	"	0.5			

Product		Weight, %		Assays, %				Distribution, %			
			Cum	Zinc	Cum	Lead	Cum	Zinc	Cum	Lead	Cum
Sand Concentrates 1 and	2	21.47	-	32.5	-	3.2	-	17.69	-	29.91	-
	3	70.04	91.51	45.0	42.07	2.1	2.36	79.94	97.63	64.03	93.94
Sands Tailing		8.49	100.00	11.0	39.43	1.64	2.28	2.37	100.00	6.06	100.00
* Slimes Concentrate	1	28.19	-	32.5	-	2.5	-	25.79	-	30.95	-
	2	12.76	40.95	40.0	34.84	1.85	2.30	14.37	40.17	10.37	41.32
	3	40.19	81.14	46.5	40.61	1.74	2.02	52.62	92.78	30.71	72.04
	4	5.33	86.48	24.5	39.62	3.95	2.14	3.68	96.46	9.25	81.29
Slimes Tailing		13.52	100.00	9.3	35.52	3.15	2.78	3.54	100.00	18.71	100.00

* Slimes fraction further deslimed at about 10 microns - zinc loss 47% of total minus ½ x 5 mm.

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: A-5

Table No: 11

Grinding Time: -

Sample: A. Hydrosizer Slimes

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4.0	Cell	20			
Tetrasodium phosphate	3.5	"	20			
AeroAmine 3037	0.5	"	10)	Stages 1 to 4		
Sodium Sulphide	6.0	"	10)			
Aerofroth 65	0.05	"	0.5			

Product	Weight, %	Cum	Assays, % Zn	Cum	Distribution, % Zn	Cum
Concentrate 1	16.57	-	33.5	-	14.54	-
2	35.70	52.27	49.0	44.09	45.83	60.37
3	20.35	72.62	46.2	44.68	24.63	85.00
4	9.55	82.17	40.2	44.16	10.05	95.05
Tailing	17.83	100.00	10.6	38.17	4.95	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C-1

Table No: 12

Grinding Time: 3.1 Min.

Sample: C

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4.0	Mill	-			
Sodium Silicate	3.5	"	-			
Sodium Sulphide	10.0	Cell	6			
Armac T	0.25	"	5			
Pine Oil	0.40	"	0.25	Stage 1	2	
Armac T	0.25	"	5	2	2	
Armac T	0.25	"	5	3	2	
Armac T	0.25	"	5	4	2	

Product	Weight, %		Assays, % Zn		Distribution, % Zn	
		Cum		Cum		Cum
Concentrate 1	19.08	-	46.1	-	35.12	-
2	12.32	31.40	42.2	44.57	20.77	55.88
3	7.41	38.81	31.8	42.13	9.40	65.29
4	12.34	51.16	20.9	37.01	10.30	75.59
Tailing	27.49	78.65	10.2	27.64	11.20	86.79
* Minus 350 Mesh	21.35	100.00	15.5	25.05	13.21	100.00

* Calculated weight based on grind sizing.

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C-2

Table No: 13

Sample: C

Grinding Time: 4.2 Min.

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4.9	Mill				
Sodium Silicate	3.5	"				
Sodium Sulphide	10.0	Cell	6			
Armac T	0.25	"	5			
Pine Oil	0.40	"	0.25	Stage 1	2	
Armac T	0.25	"	5	2	2	
Armac T	0.25	"	5	3	2	
Armac T	0.25	"	5	4	2	

Product	Weight, %		Assays, % Zn		Distribution, % Zn	
		Cum		Cum		Cum
Concentrate 1	36.9	-	42.2	-	63.95	-
2	8.24	45.14	27.3	39.48	9.24	73.19
3	4.08	49.22	12.2	37.22	2.04	75.23
4	3.76	52.98	8.55	35.18	1.32	76.55
Tailing	20.22	73.20	7.3	27.48	6.06	82.61
Minus 350 Mesh	26.80	100.00	15.8	24.35	17.39	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C.3

Table No: 14

Grinding Time: 6.0

Sample: C

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4.0	Mill	-			
Sodium Silicate	3.5	"	-			
Sodium Sulphide	10.0	Cell	6			
Armac T	0.25	"	5			
Pine Oil	0.40	"	0.25	Stage 1	2	11.0
Armac T	0.25	"	5	2	2	
Armac T	0.25	"	5	3	2	
Armac T	0.25	"	5	4	2	

Product	Weight, %		Assays, % Zn		Distribution, % Zn	
		Cum	Zn	Cum	Zn	Cum
Concentrate 1	39.66	-	39.6	-	65.33	-
2	10.04	49.70	20.0	35.64	8.35	73.69
3	4.18	53.88	9.2	33.59	1.60	75.29
4	3.74	57.62	7.45	31.89	1.16	76.45
Tailing	15.26	72.88	7.6	26.81	4.82	81.27
Minus 350 Mesh	27.12	100.00	16.6	24.04	18.73	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C-4 Table No: 15 Grinding Time: * 2 Min.

Sample: C

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4.0	Cell	20			
Carrybon L400	0.45	"	20			
Aerofroth 65	0.40	"	0.25			
Sodium Sulphide	2.25	"	10			
Armac T	0.25	"	10	Stages 1 to 5	3	

Product	Weight, %	Cum	Assays, % Zn	Cum	Distribution, % Zn	Cum
Concentrate 1	13.02	-	34.0	-	16.85	-
2	16.56	29.58	44.4	39.82	27.98	44.83
3	15.22	44.80	47.5	42.43	27.52	72.34
4	8.04	52.84	23.4	39.53	7.16	79.50
5	2.00	54.84	10.0	38.46	0.76	80.26
Tailing	26.53	81.31	6.2	27.94	6.26	86.52
Feed Slimes	18.63	100.00	19.0	28.27	13.48	100.00

* Rougher feed stage ground in 2 minute intervals to pass 240 mesh and deslimed.

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C-5

Table No: 16

Grinding Time: 2 Min. *

Sample: C

Reagents Name	Addition lb/ton	Point of Addition	Cond. Time min.	Flotation Stage	Time min.	pH
Soda Ash	12.1	Cell	20			
Carrybon L400	1.0	"	20			
Sodium Sulphide)	9.0	"	10)			
AeroAmine 3037)	0.76	"	10)			
Aerofroth 65	0.05	"	0.5	Sand Float, Stages 1 to 4	3	
Soda Ash	7.0	"	20			
Carrybon L400	1.3	"	20			
Sodium Sulphide	6.1	"	10)			
AeroAmine 3037	0.47	"	10)	Slimes Float, Stages 1 to 4	3	
Aerofroth 65	0.05	"	0.5			

Product	Weight, %	Cum	Assays, % Zn	Cum	Distribution, % Zn **	Cum
Sands Concentrate 1	29.88	-	36.5	-	43.91	-
2	0.77	30.65	8.4	35.79	0.26	44.17
3 & 4	1.20	31.85	6.0	36.56	0.29	44.46
Slimes Concentrate 1	28.62	60.47	18.0	26.78	20.74	65.20
2	12.66	73.13	40.0	29.07	20.39	85.59
3	8.19	81.32	25.5	28.71	8.41	94.00
4	3.81	85.13	11.9	27.96	1.83	95.83
Sands Tailing	5.04	90.30	7.5	26.78	1.52	97.35
Slimes Tailing	9.70	100.00	6.8	24.84	2.65	100.00

** Overall Recovery (Sands Conc 1 plus Slimes concs 1, 2 and 3: 93.57% at 30.2% Zn grade.

* Minus 25 mesh feed stage ground to 100% minus 240 mesh.

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C-6

Table No: 17

Grinding Time: 2 Min. Stages

Sample: C

Reagents				
Name	Addition lb/ton		Point of Addition	Cond. Time min.
	Sands	Slimes		
Soda Ash	11.4	5.9	Cell	20
Carrybon L400	1.0	1.2	"	20
Sodium sulphide	8.2	17.6	"	10
AeroAmine 3037	0.71	1.5	"	10
Aerofroth 65	0.05	0.05	"	0.5

Flotation			
Stage	Time min.		pH
	Sands	Slimes	
Rougher	3.0	8.0	
Cleaner	2.5	3.0	
Recleaner	2.0	2.0	

Product	Weight, %		Assays, %				Distribution, %			
		Cum	Zn		Pb		Zn		Pb	
				Cum		Cum		Cum		Cum
Sand Fraction										
Concentrate	67.95	-	42.0	-	3.15	-	93.89	-	91.00	-
2nd Cleaner Tail	4.55	72.50	4.25	39.63	0.89	3.01	0.64	94.53	1.72	92.71
1st Cleaner Tail	8.07	80.57	4.35	36.10	0.68	2.78	1.15	95.68	2.33	95.04
Rougher Tail	19.43	100.00	6.75	30.40	0.60	2.35	4.32	100.00	4.96	100.00
Slimes Fraction										
Concentrate	15.15	-	40.5	-	3.80	-	26.93	-	24.11	-
2nd Cleaner Tail	12.79	27.93	35.0	37.98	2.20	3.07	19.65	46.57	11.70	35.81
1st Cleaner Tail	19.62	47.55	23.0	31.80	2.85	2.73	19.81	66.38	18.36	54.18
Rougher Tail	52.45	100.00	14.6	22.78	2.10	2.40	33.62	100.00	45.82	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C-7 Table No: 18 Grinding Time: None

Sample: C, Hydrosizer Overflow

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4 .0	Cell	30			
Trisodium polyphosphate	3.0	"	28			
Tylose CBR4000	0.13	"	25			
Sodium Sulphide	4.5)	"	10)	Stages 1 to 4	2	
AeroAmine 3037	0.23)	"	10)			
Aerofroth 65	0.05	"	0.5			

Product	Weight, %		Assays, % Zn		Distribution, % Zn	
		Cum		Cum		Cum
Concentrate 1	26.39	-	23.2	-	25.78	-
2	28.56	54.95	50.0	37.13	60.12	85.90
3	9.15	64.10	19.2	34.57	7.39	93.30
4	6.50	70.60	6.4	32.00	1.75	95.05
Tailing	29.40	100.00	4.0	23.75	4.95	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C-8

Table No: 19

Grinding Time: Zero

Sample: C, Hydrosizer Slimes

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	4.0	Cell	25			
Trisodium polyphosphate	1.5	"	25			
Tylose CBR4000	0.09	"	25			
Sodium silicate	3.6	"	25			
Sodium sulphide	7.0	"	10			
AeroAmine 3037	0.70	"	10			
Aerofroth 65	0.05	"	0.5	Rougher	3.0	
				Cleaner	2.0	
				Recleaner	1.5	

Product	Weight, %	Cum	Assays, % Zn	Cum	Distribution, %	Cum
Concentrate	37.76	-	46.5	-	74.28	-
Recleaner Tailing	6.36	44.12	19.8	42.65	5.32	79.60
Cleaner Tailing	14.02	58.14	11.7	35.19	6.94	86.54
Rougher Tailing	41.86	100.00	7.60	23.64	13.46	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: C-9 Table No: 20 Grinding Time: -

Sample: C, Deslimed Hydrosizer U/F, Attritioned

Reagents				Flotation		
Name	Addition lb/ton	Point of Addition	Cond. Time min.	Stage	Time min.	pH
Soda Ash	12.1	Cell	20			
Carrybon L400	1.0	"	20			
Sodium sulphide)	9.0	"	10)			
AeroAmine 3037)	0.76	"	10)	Rougher, 2 stages	6 (total)	
Aerofroth 65	0.05	"	0.5			
				Cleaner	2.5	

Product	Weight, %	Cum	Assays, %	Cum	Distribution, %	Cum
Cleaner Concentrate	51.05	-	48.5	-	91.72	-
Cleaner Tailing	8.00	59.05	9.5	43.22	2.82	94.54
Rougher Tailing	40.95	100.00	3.60	27.00	5.46	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: D-1

Table No: 21

Grinding Time: 2 Min. Stages

Sample: D

Reagents					Flotation		
Name	Addition lb/ton		Point of Addition	Cond. Time min.	Stage	Time min.	pH
	Coarse	Fine					
Soda Ash	4.0	4.0	Cell	20			
Carrybon L400	0.85	1.9	"	20			
Sodium sulphide	3.0	6.0	"	10)	Stages 1 to 4	2	
AeroAmine 3037	0.25	0.5	"	10)			
Teric 401	0.05	0.05	"	0.5			

Product	Weight, %		Assays, % Zn		Distribution, % Zn	
		Cum		Cum		Cum
Coarse Concentrate 1	13.18	-	36.0	-	13.22	-
2	12.07	25.25	48.5	42.0	16.32	29.54
3	53.58	78.82	40.0	40.6	59.72	89.26
4	4.47	83.29	23.8	39.7	2.96	92.22
Coarse Tailing	16.71	100.00	16.7	35.9	7.78	100.00
Fine Concentrate 1	3.17	-	34.5	-	3.02	-
2	53.12	56.29	34.5	34.5	50.68	53.70
3	29.68	83.97	45.5	38.3	37.34	91.04
4	1.34	87.32	32.5	38.2	1.21	92.25
Fine Tailing	12.68	100.00	22.1	36.2	7.75	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: D-2

Table No: 22

Sample: D

Grinding Time: 2 Min. Stages

Reagents					Flotation		
Name	Addition lb/ton		Point of Addition	Cond. Time min.	Stage	Time min.	pH
	Coarse	Fine					
Soda Ash	4.0	4.0	Cell	20			
Sodium silicate	2.5	5.0	"	20			
Sodium sulphide	3.0	6.0	"	10)	Stages 1 to 4	2	
AeroAmine 3037	0.25	0.50	"	10)			
Teric 401	0.05	0.05	"	0.5			

Product		Weight, %	Cum	Assays, % Zn	Cum	Distribution, % Zn	Cum
Coarse Concentrate	1	4.99	-	40.0	-	4.71	-
	2	76.33	81.32	47.6	47.1	85.62	90.33
	3	7.94	89.26	28.9	45.4	5.42	95.74
	4	1.62	90.87	19.0	45.0	0.72	96.46
Coarse Tailing		9.13	100.00	16.4	42.4	3.54	100.00
Fine Concentrate	1	16.87	-	34.9	-	15.00	-
	2	16.20	33.07	37.1	36.0	15.31	30.31
	3	41.68	74.75	48.5	43.0	51.50	81.81
	4	12.78	87.52	34.0	41.6	11.07	92.88
Fine Tailing		12.48	100.00	22.4	39.3	7.12	100.00

Form 35

CHEMICAL AND METALLURGICAL ENGINEERING SECTION

FLOTATION

Test No: D-3 Table No: 23 Grinding Time: 2 Min. Stages

Sample: D

Reagents					Flotation		
Name	Addition lb/ton		Point of Addition	Cond. Time min.	Stage	Time min.	pH
	Coarse	Fine					
Soda Ash	4.0	4.0	Cell	20			
Carrybon L400	0.85	1.9	"	20			
Sodium sulphide	1.5	3.0	"	10)	Stages 1 to 4	2	
AeroAmine 3037	0.25	0.5	"	10)			
Teric 401	0.05	0.05	"	0.5			

Product	Weight, %	Cum	Assays, % Zn	Cum	Distribution, % Zn	Cum
Coarse Concentrate 1	3.49	-	40.0	-	5.19	-
2	13.49	18.98	47.6	45.4	15.17	20.36
3	25.81	44.85	47.0	46.3	28.71	49.07
4	43.25	88.11	44.8	45.6	45.76	94.83
Coarse Tailing	11.89	100.00	18.4	42.3	3.17	100.00
Fine Concentrate 1	9.25	-	37.1	-	8.94	-
2	9.43	18.68	35.0	36.0	8.60	17.54
3	29.72	48.41	35.5	35.7	27.48	45.03
4	9.43	57.84	36.0	35.8	8.35	53.87
Fine Tailing	42.16	100.00	42.0	38.4	46.13	100.00

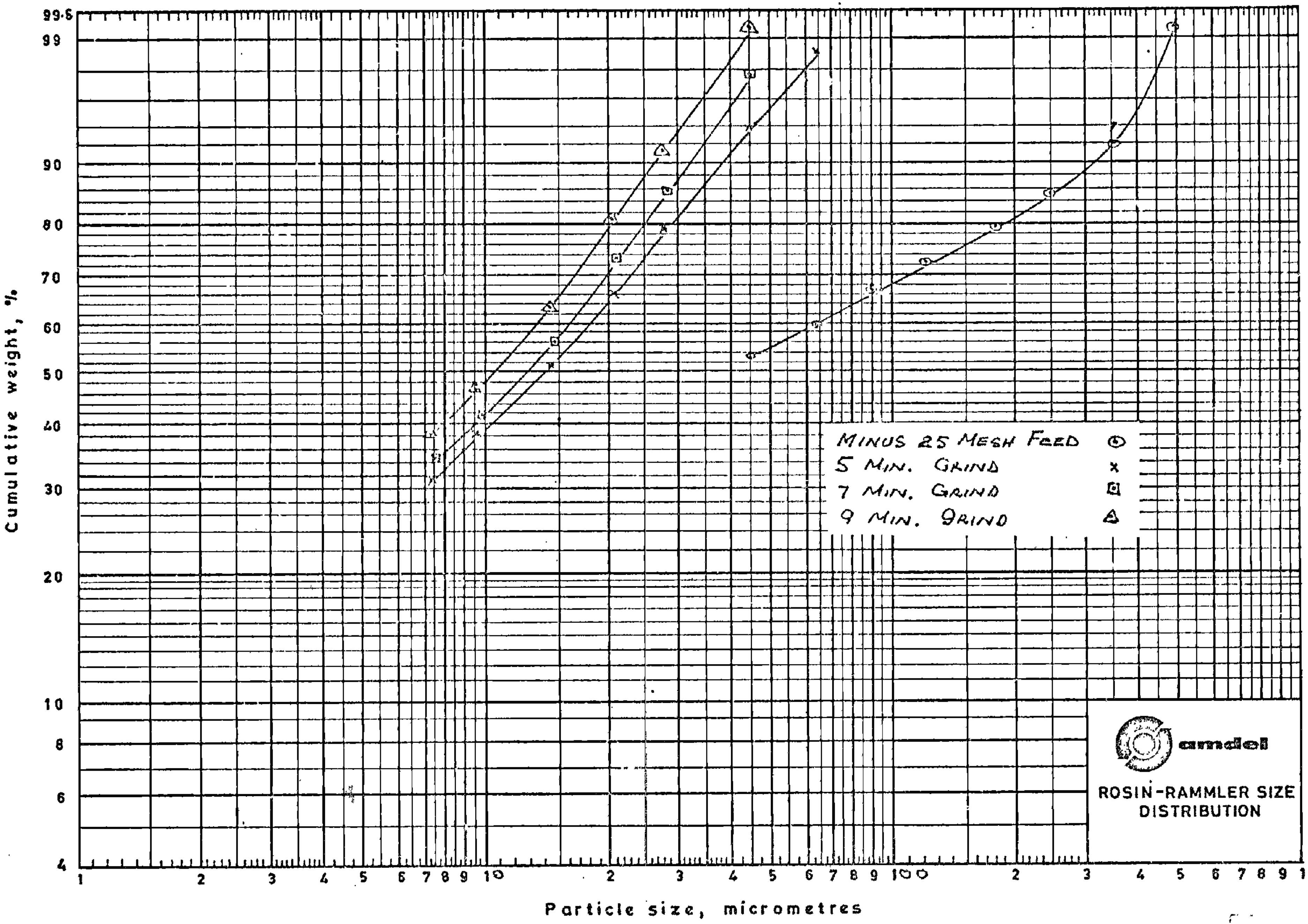


FIG: 1 Size Distributions of Feed and Ground Products for Sample A

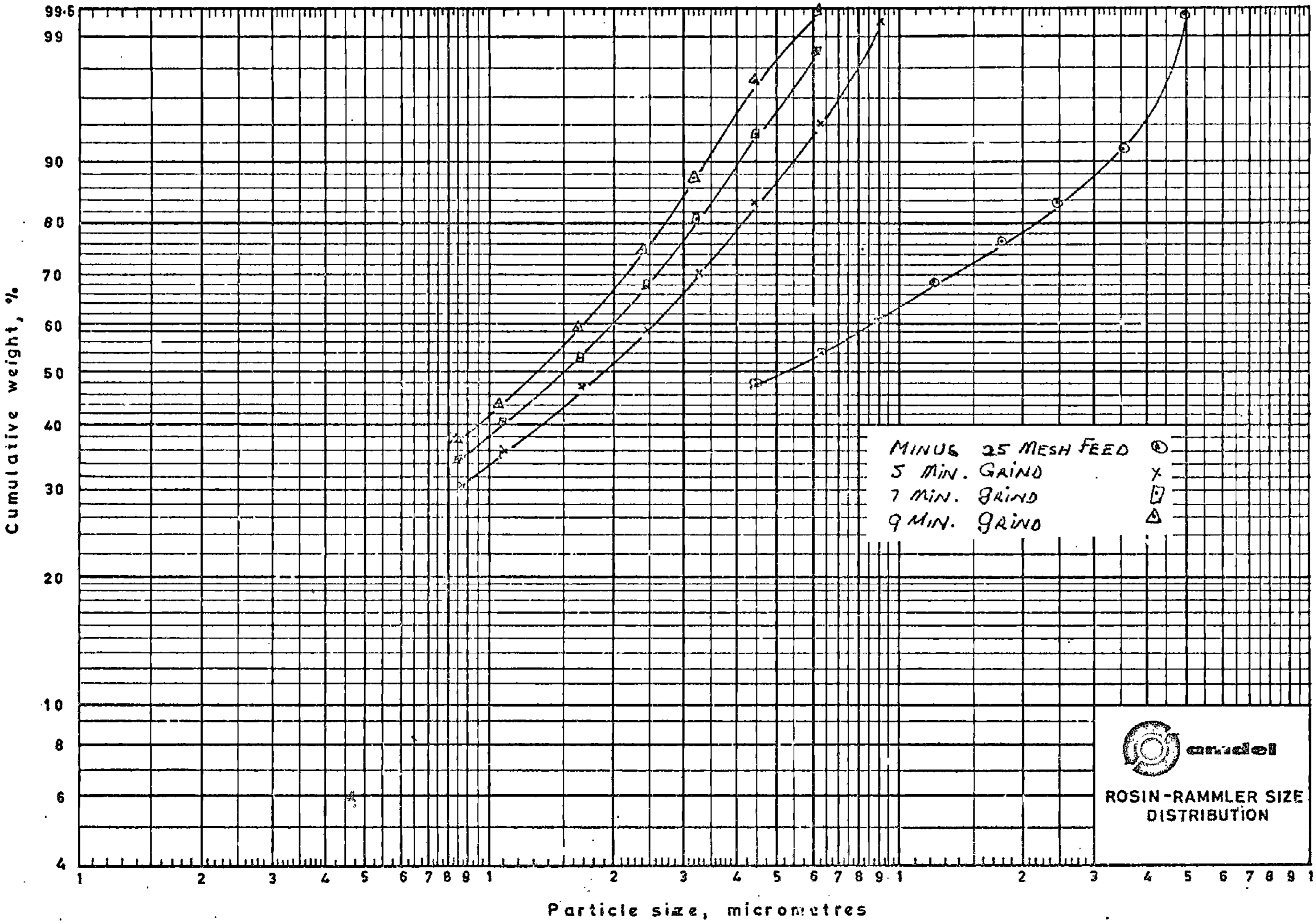


FIG : 2 Size Distributions of Feed and Ground Products for Sample C

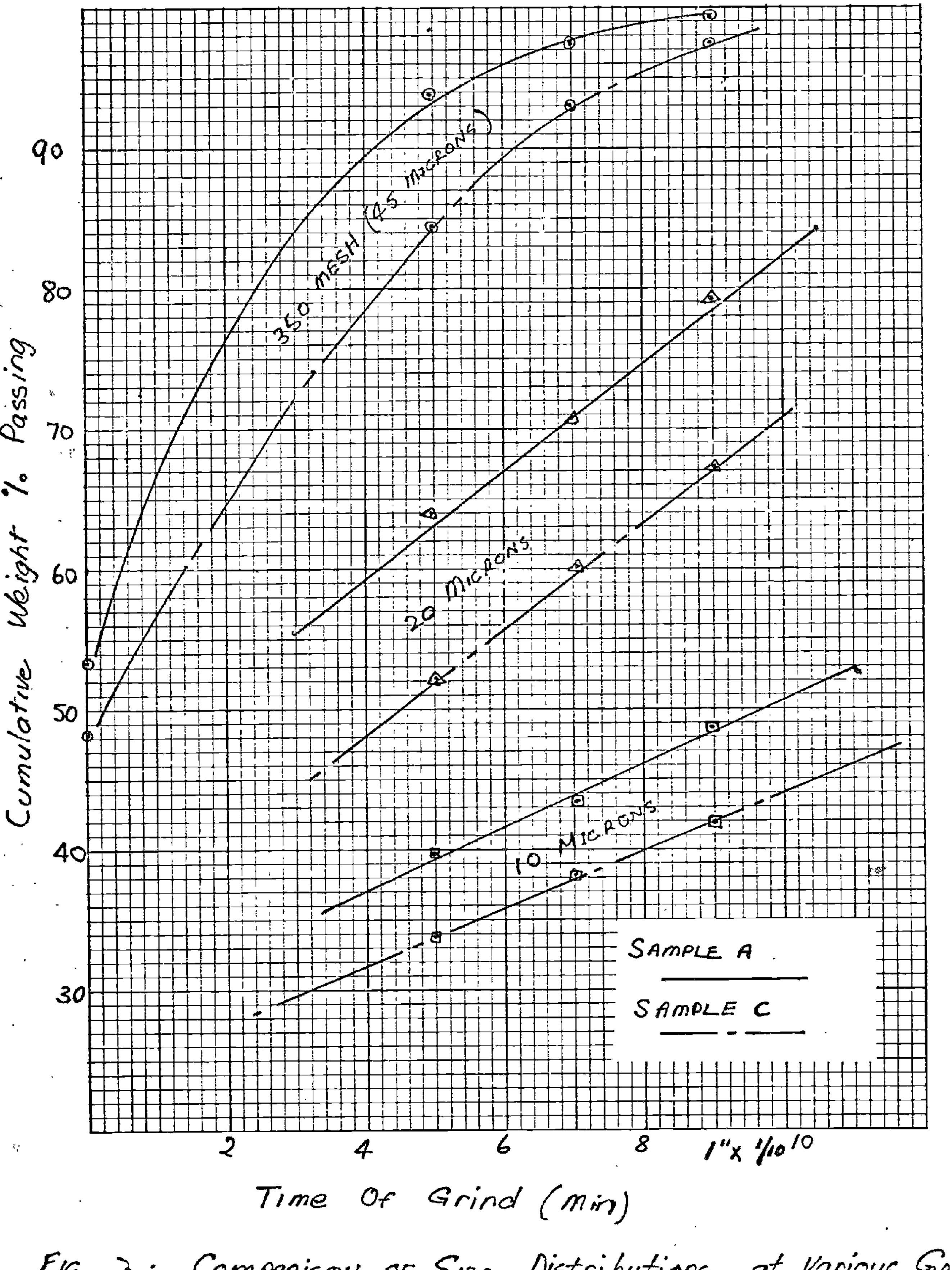


FIG. 3: COMPARISON OF SIZE DISTRIBUTIONS AT VARIOUS GRINDS

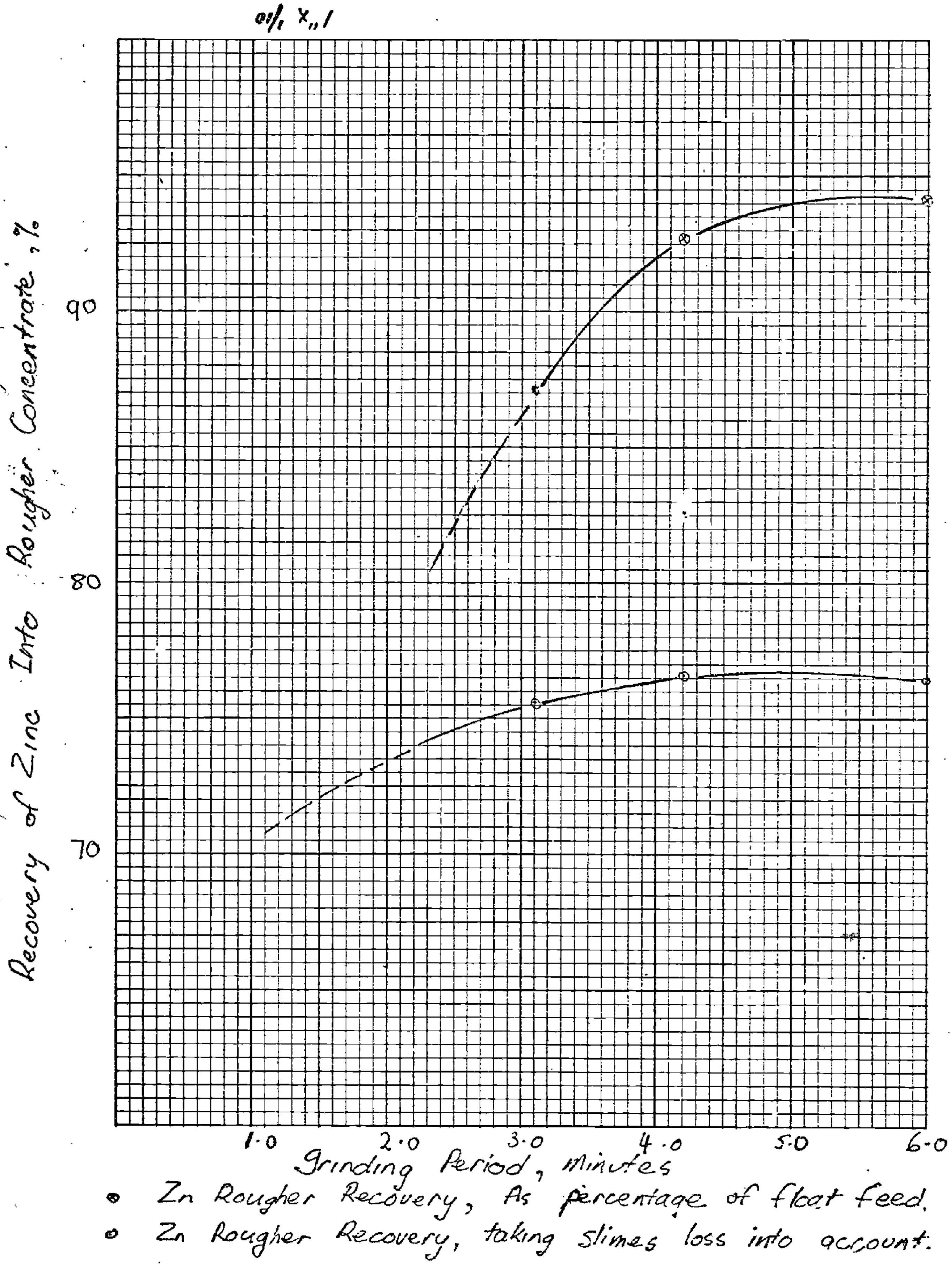


FIG. 4 : Rougher Recovery as a function of Grinding Period

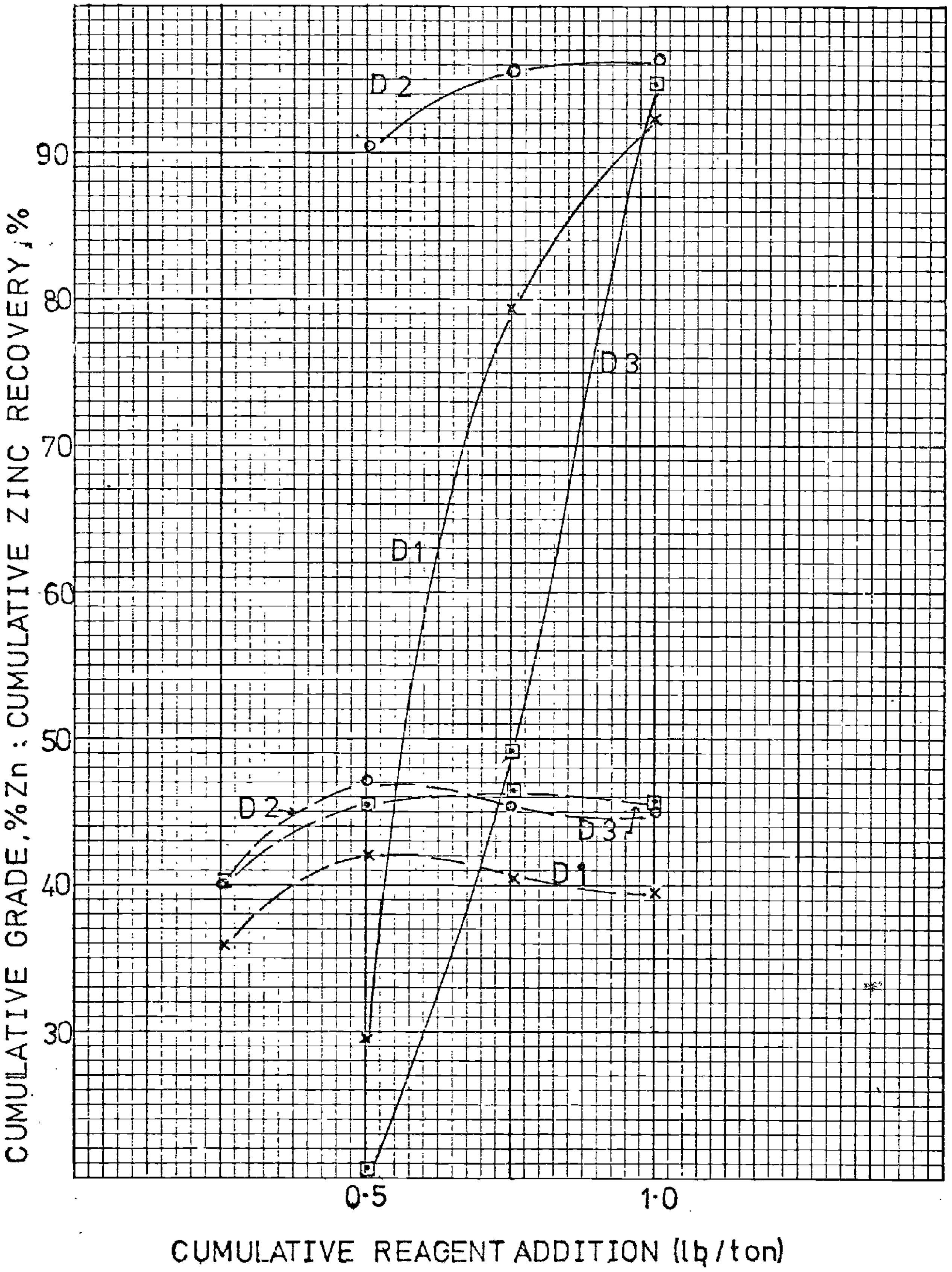
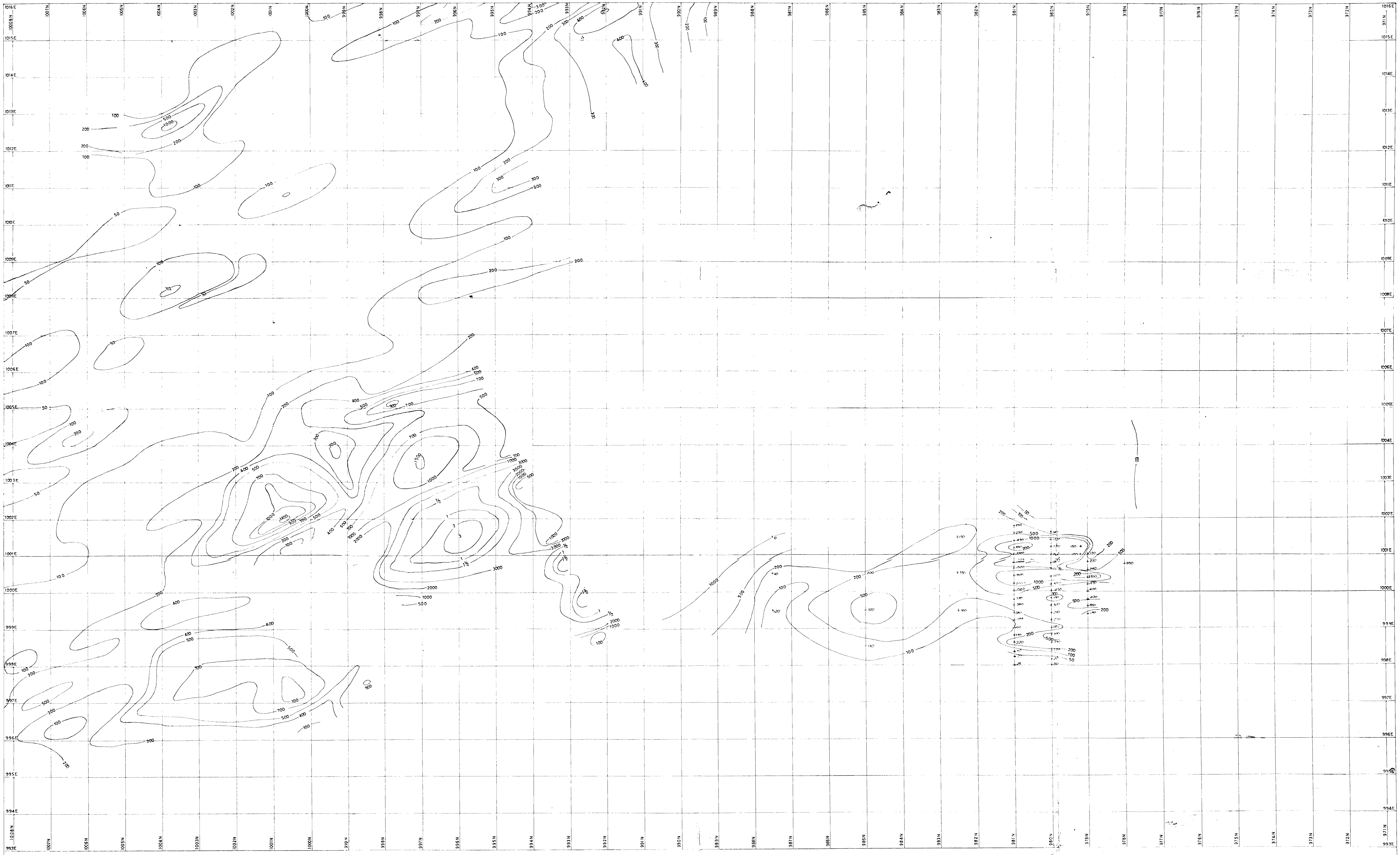


Fig 5: Flotation Tests on Ore type D.



LEGEND.

1000	1000 P.P.M. Pb. Contour
1/2 %	1/2 % Pb. Contour
270	Sample value (E.Z.) in P.P.M.
2 9	Sample value (E.Z.) in %

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

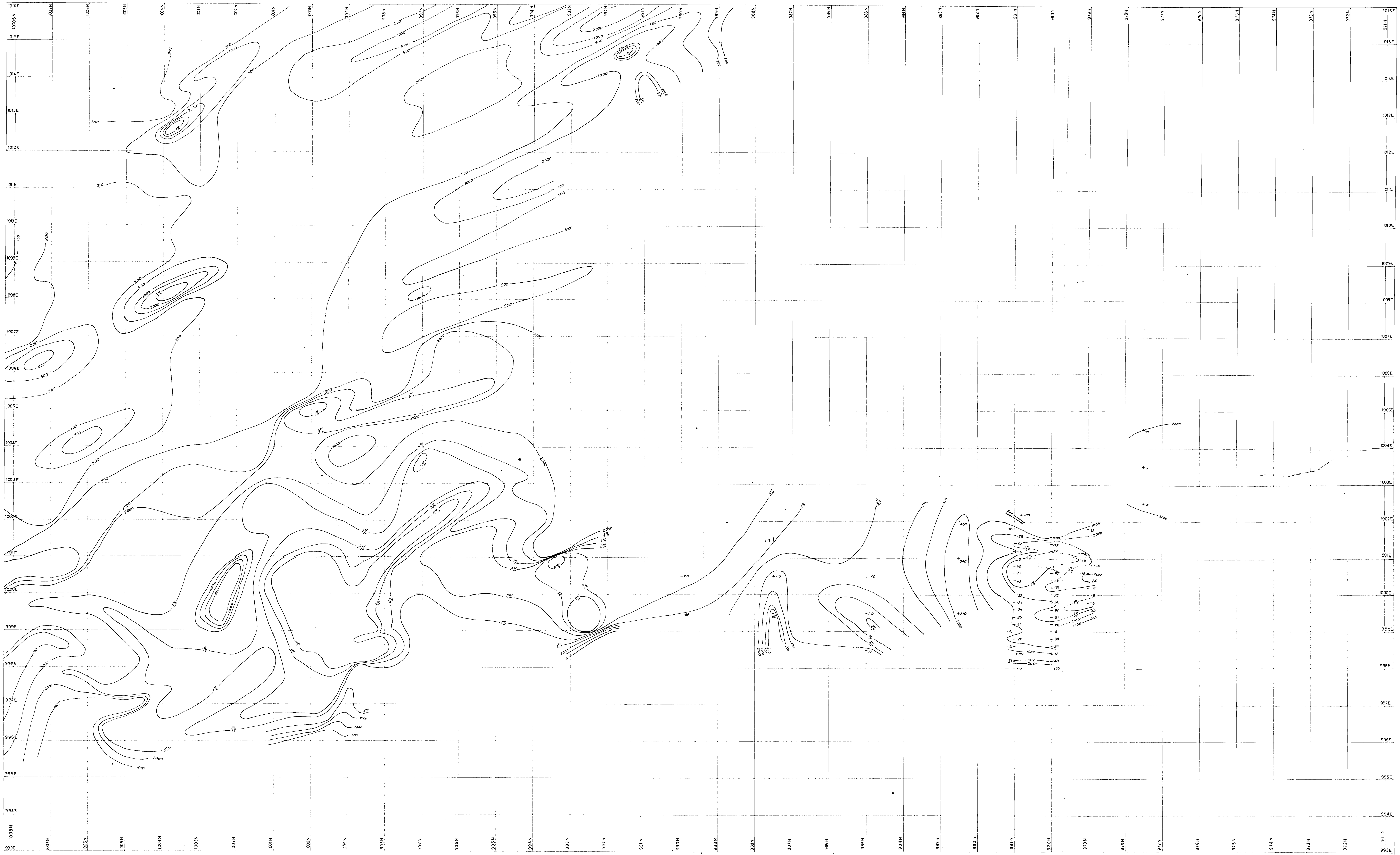
PROJECT: BELTANA EXPLORATION

SOUTH
AUSTRALIA

GEOCHEMICAL CONTOURS
LEAD VALUES.

SCALE: 1 in. to 100 ft.
Survey: R. A. Horn.
Reference:
Date: April 1972
Drawn: C.M
Checked: R.A.H.

REF. NO.
D100·72



LEGEND.

1000	1000 P.P.M. Zn Contour
½ %	½ % Zn Contour
+ 270	Sample value (E.Z.) in P.P.M.
+ 2 9	Sample value (E.Z.) in %

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1748-II

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

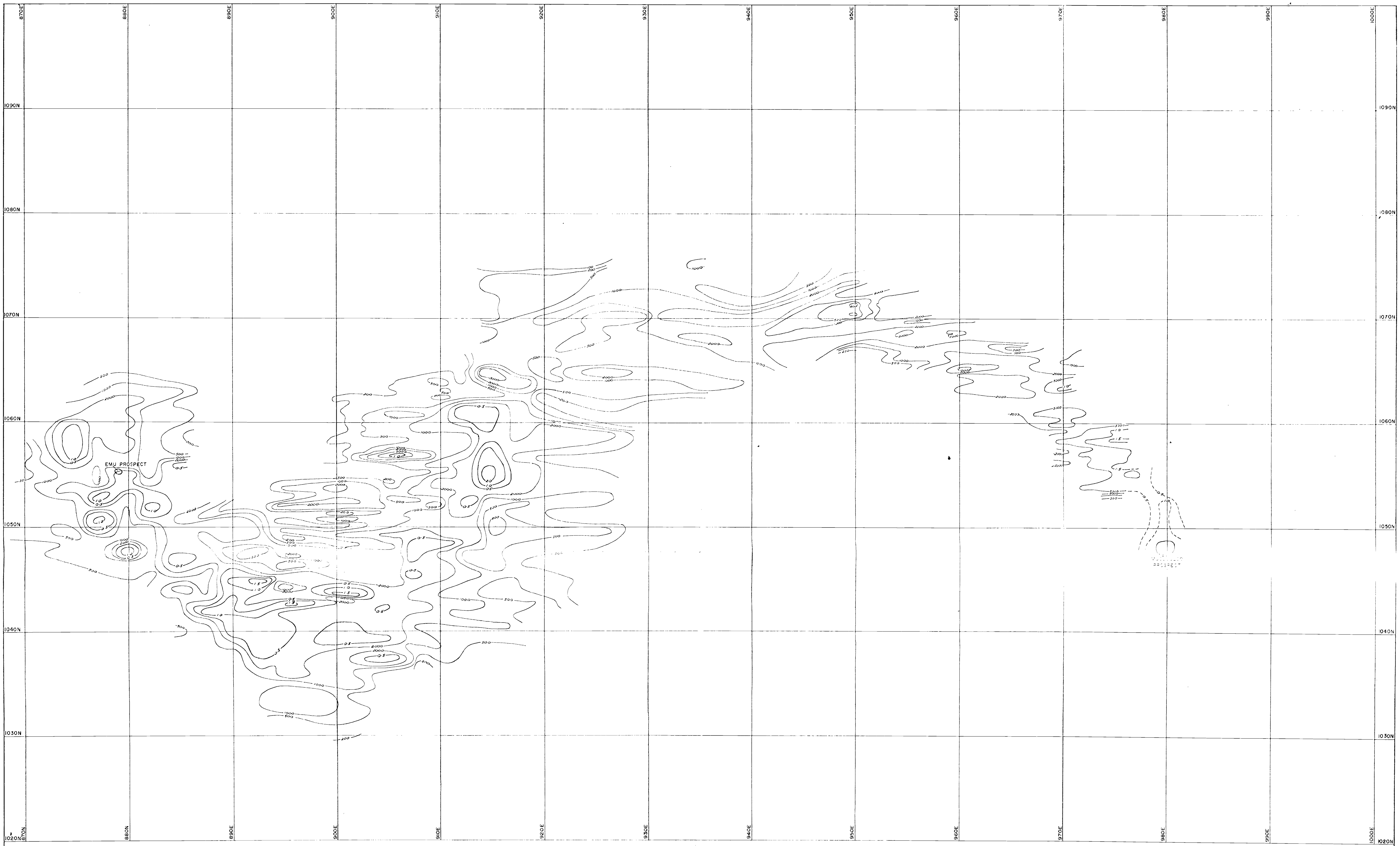
PROJECT: BELTANA EXPLORATION	SOUTH AUSTRALIA

GEOCHEMICAL CONTOURS

ZINC VALUES

SCALE: 1 in. to 100 ft.		Survey: R. A. Horn.	REF. NO.
Reference:			D100·73
Date: April 1972	Drawn: C.M.	Checked: R.A.H.	

1748-2-2



R E F E R E N C E

☐	>1 0%
☐	0 5-1 0%
☐	>10,000ppm
☐	5,000 -10,000ppm
☐	2,000 -5,000ppm
☐	1,000 -2,000ppm
☐	200 -1,000ppm
——	Zn % Contour
——	Zn ppm Contour
- - - -	Soil sample Contour

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA EXPLORATION

SOUTH AUSTRALIA

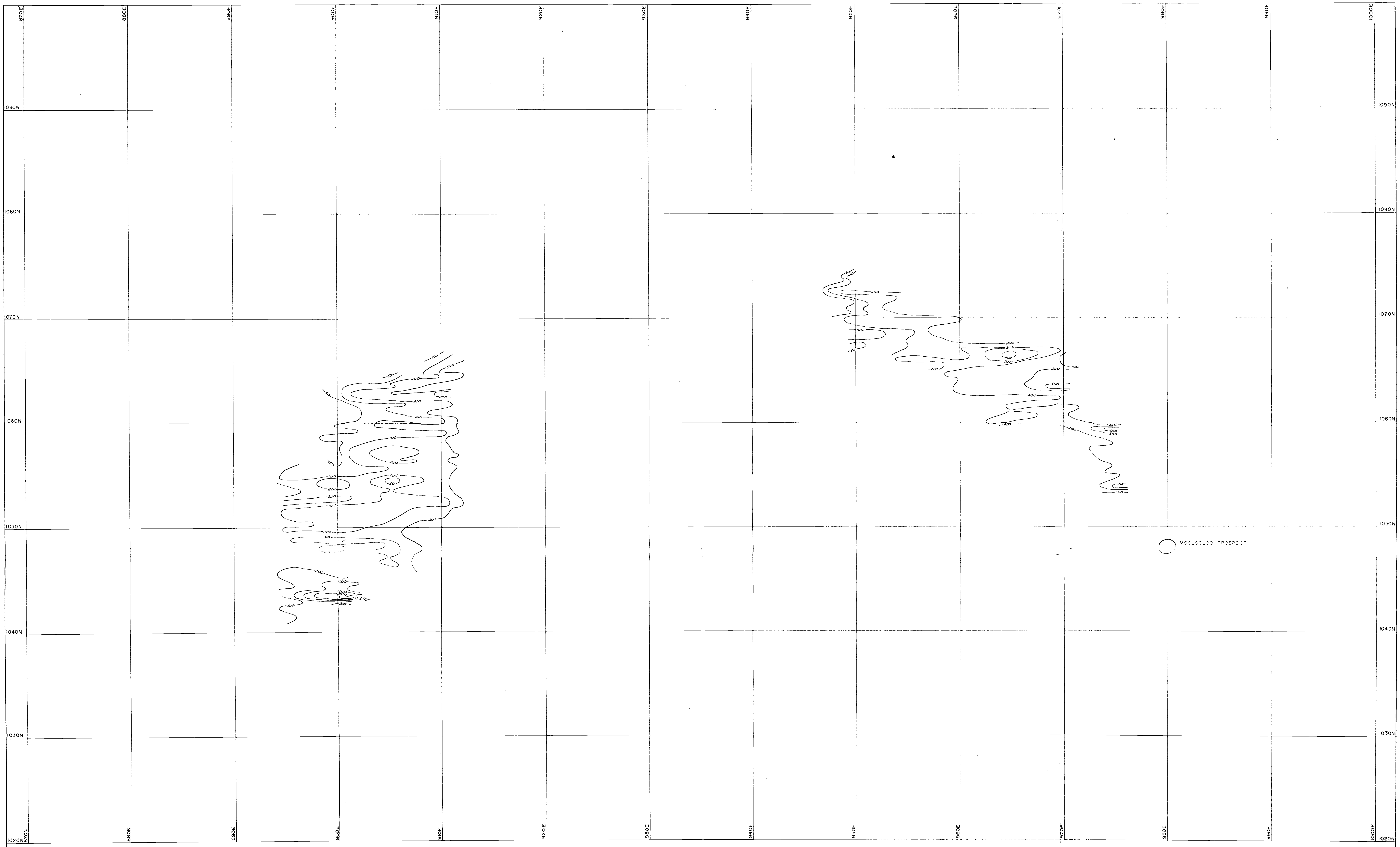
BELTANA NORTH ROCKCHIP GEOCHEMISTRY

ZINC CONTOURS

N.B
GRID MODIFIED FROM PLAN DA100·66 TO FIT UNCONTROLLED AERIAL PHOTOGRAPHIC MAP, PLAN R100·71.

SCALE: 1in to 400ft
Survey: N.J. Moriarty
Reference:
Date: March 1972
Drawn: M.D.C
Checked: R.A.H
REF. NO.
DA100·69

1748-2-3



R E F E R E N C E

- ☐ 0 5%
- ☐ >500ppm
- ☐ 200 - 500ppm
- ☐ 100 - 200ppm
- ☐ 50 - 100ppm
- ☐ 0 - 50ppm
- —— Pb % Contour
- —— Pb ppm Contour

RECEIVED
1 JUN 1972
DEPT. OF MINES
SECURITY
1748-II

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA EXPLORATION

SOUTH AUSTRALIA

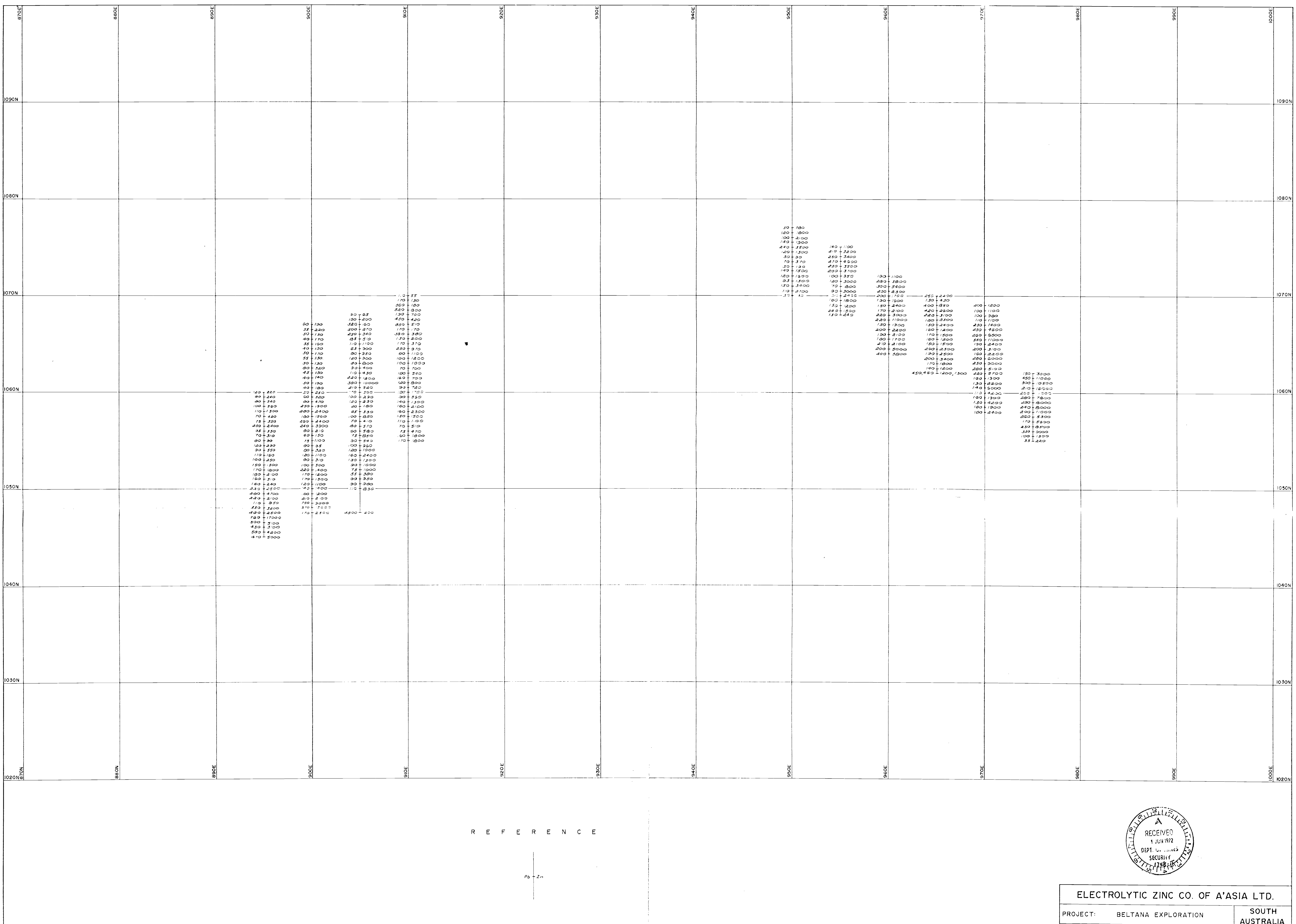
BELTANA NORTH ROCKCHIP GEOCHEMISTRY

LEAD CONTOURS

N.B
GRID MODIFIED FROM PLAN DA100 66 TO FIT UNCONTROLLED AERIAL PHOTOGRAPHIC MAP, PLAN R100 71

SCALE: 1in to 400ft	Survey: N.J Moriarty	REF. NO.
Reference:		DA100·68
Date: March 1972	Drawn: M.D.C	Checked: R.A.H

1748-2-4



ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA EXPLORATION

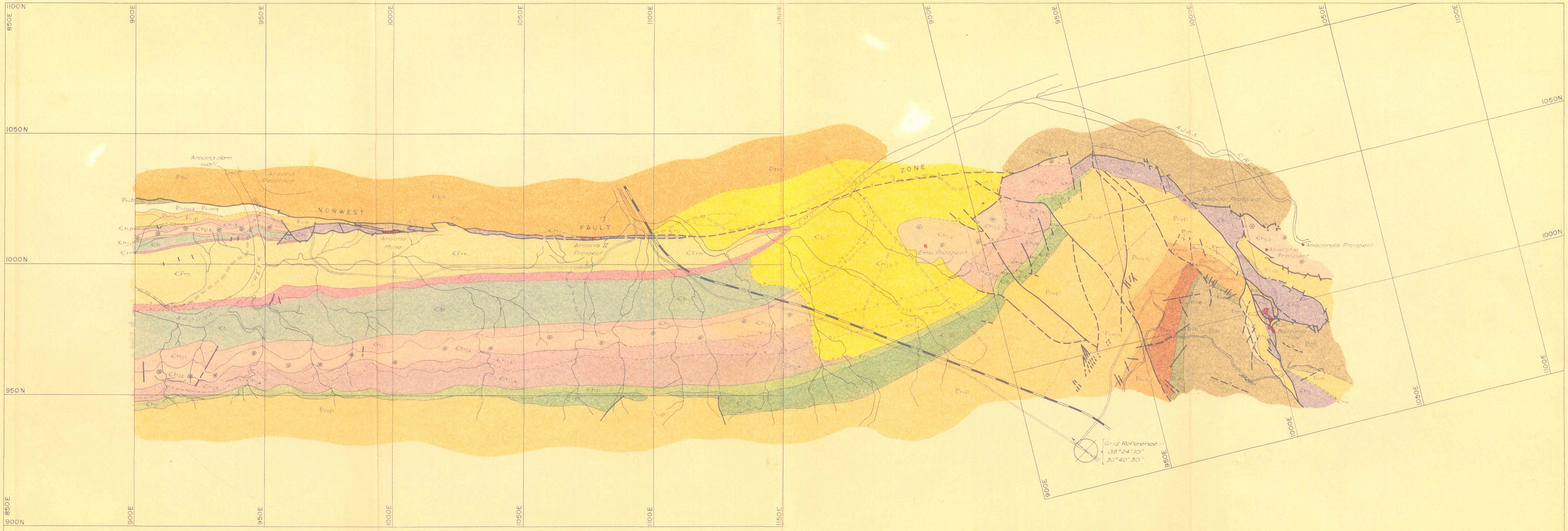
SOUTH AUSTRALIA

BELTANA NORTH GEOCHEMISTRY

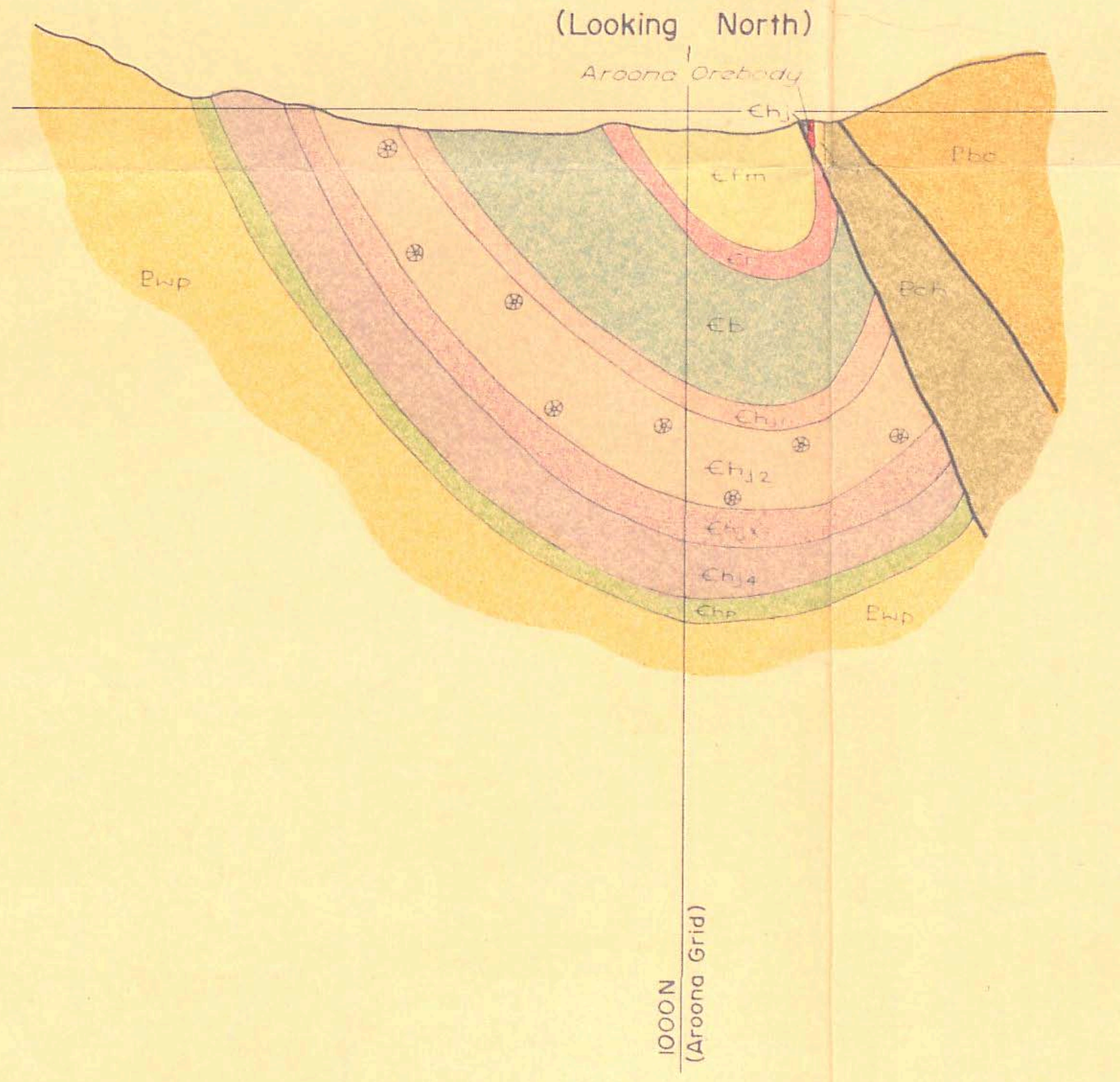
LEAD AND ZINC VALUES (P.P.M)

SCALE: 1in to 400ft	Survey: M. Paton		REF. NO.
Reference:			DA100·67
Date: March 1972	Drawn: M.D.C.	Checked: R.A.H.	

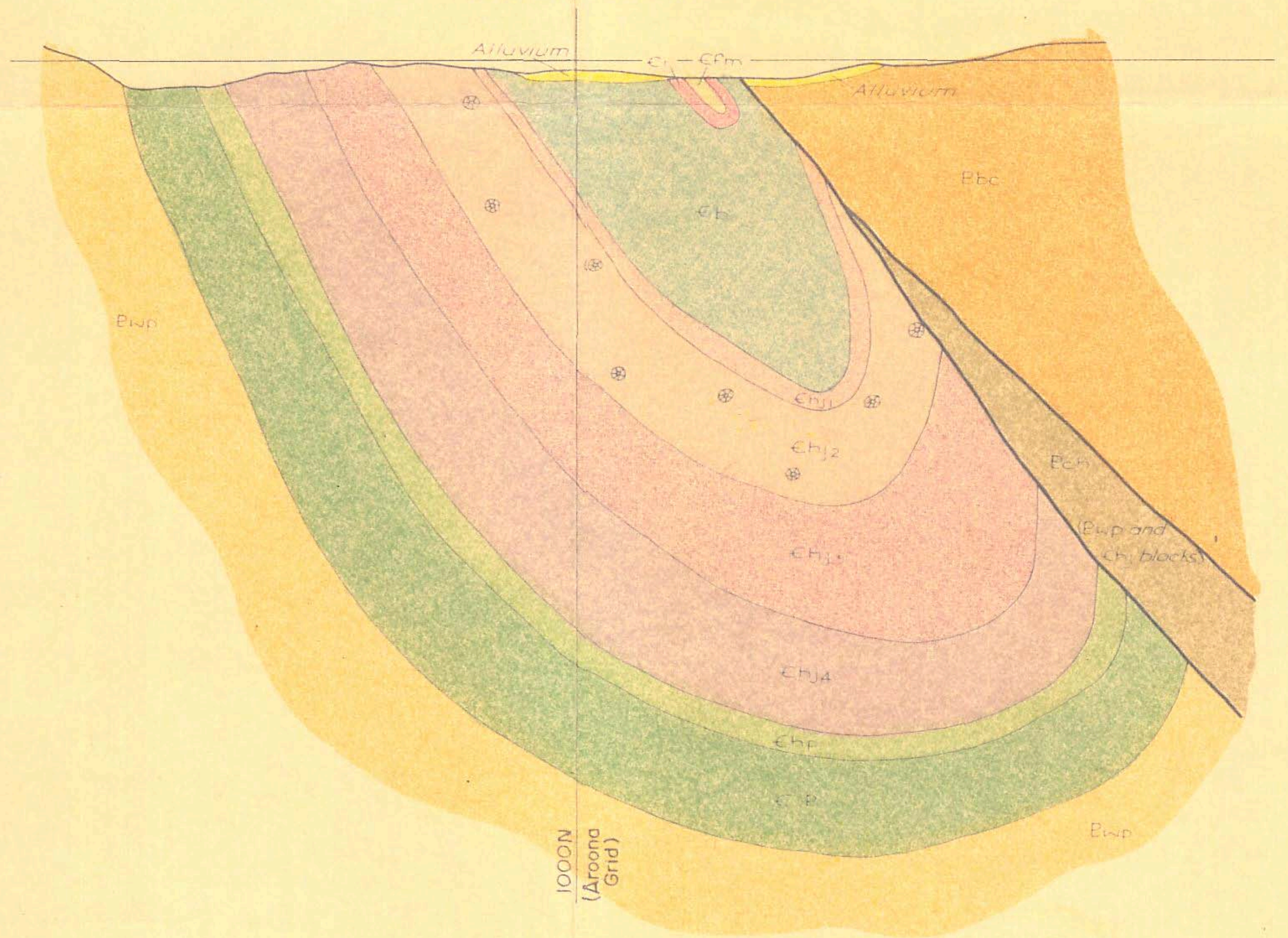
1748-2-5



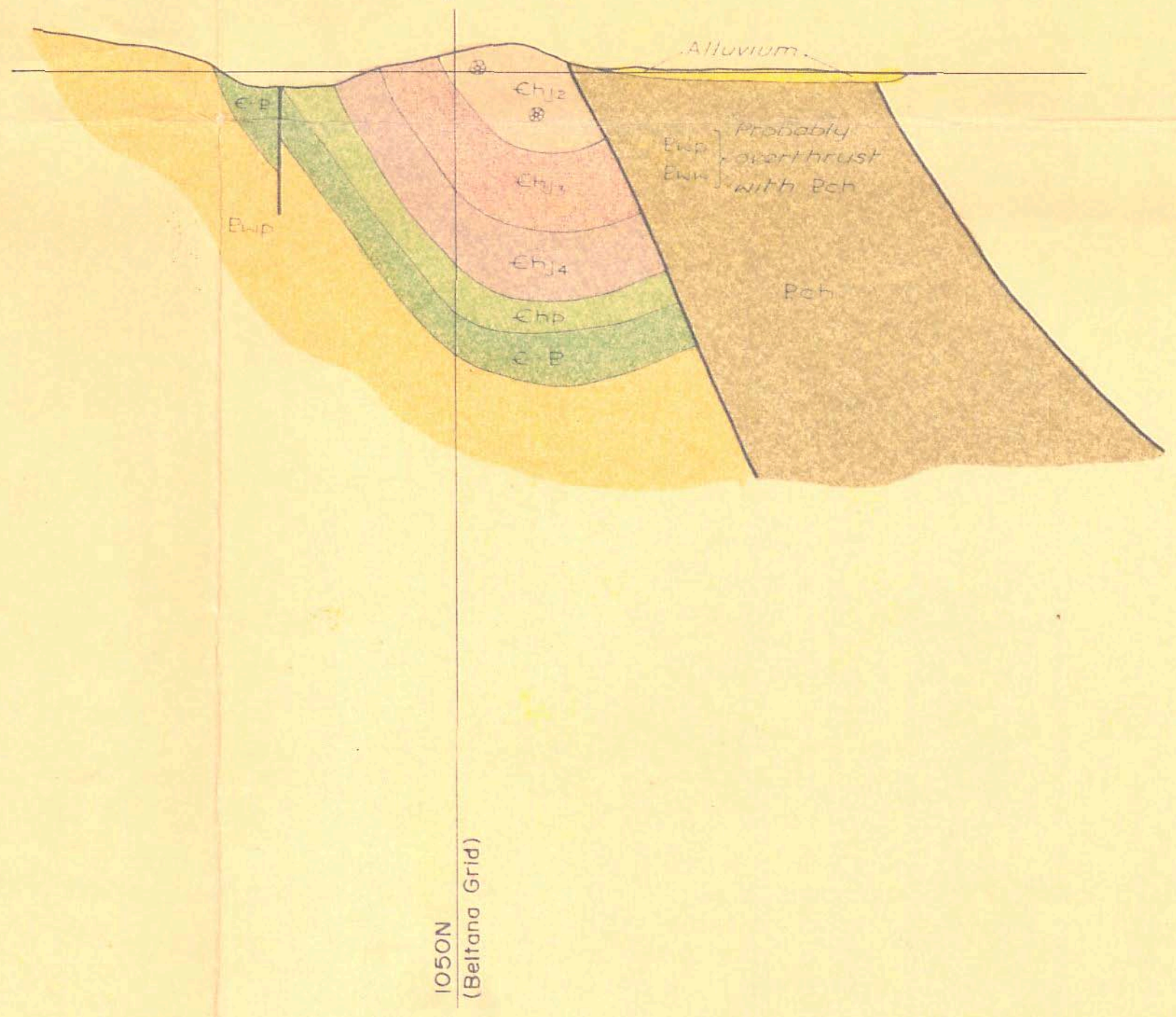
SECTION 1000E (Aroona Grid)
(Looking North)



SECTION 1150E (Aroona Grid)
(Looking North)



SECTION 900E (Beltana Grid)
(Looking North)



R E F E R E N C E

			🟨	Alluvium
CAMBRIAN	MIDDLE CAMBRIAN	Lake Frome Group	Єfm	Moodlatana Formation: *Sandstone and siltstone, buff/brown*
			Єr	Aroona Creek Limestone
			Єb	Billy Creek Formation *Siltstones, red*
	LOWER CAMBRIAN	Hawker Group (Undifferentiated Єhj)	Єhj1	Ajax Limestone *Dolomite - buff*
			Єhj2	*Limestone and Dolomite - Fossiliferous.*
			Єhj3	*Dolomite - massive.*
			Єhj4	*Dolomite - laminated, cross bedded.*
			Єhp	Parachilna Formation *Grits*
			Є-P	Uratanna Formation *Shale, green*
ADELAIDEAN	MARINOAN	Wilpena Group	Pwp	Pound Quartzite *White, cross-bedded.*
			Pww1	Wonoka Formation *Dolomite, with pebble bands.*
		(Undifferentiated Pwb, Pww3, Pww2)	Pww2	*Shale - green, well-bedded.*
			Pww3	*Limestone and Shale - grey/green cross-bedded.*
			Pwb	Bunyeroo Formation *Shale and siltstone, red.*
	TORRENSIAN	Burra Group	Pbc	Copley Quartzite *White massive.*
	WILLOURAN	Callanna Beds	Pch	Humanity Seat Formation *Shale and siltstone, purple; with halite casts.*
			🟥	Massive Mineralisation *Willemite.* *Hedyphane - Coronadite*

——— *Stratigraphic boundary.*
——— *Orebody boundary.*
··········· *Outcrop boundary*
━━━ *Fault*
∿∿∿∿ *Shear zone*
Where location of boundaries and faults is approximate, line is broken; where inferred, queried.
═══ *Road*
= = = *Track*
═▬═ *Railway line*
≈≈≈ *Drainage*

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT :	BELTANA DEVELOPMENT	SOUTH AUSTRALIA

BELTANA — AROONA

GEOLOGY AND SECTIONS

1748·2-6

SCALE : 1 in. to 2000 ft.	Survey : R.A.H. & B.L.S.	REF. NO.
Reference :		C100·75
Date : May 1972	Drawn : F.L.S.	Checked : R.A.H.

REFERENCE

PALAEOZOIC – CAMBRIAN – LOWER CAMBRIAN – Hawker Group

- Chj — **Ajax Limestone** - Grey, biostromal, fossiliferous, trilobites, brachiopods and archaeocyathids. Locally red recrystalised, dolomitised.
- Chp — **Parachilna Formation** - Grey-green grits and ferruginous sandstones with minor dolomites. Trace fossils of Diplocraterion and Plagiogmus.
- C-P — **Uratanna Formation** - Green shales with minor dolomite bands, occupying grabens in Pound Quartzite.

∿∿∿∿∿ Unconformity

PROTEROZOIC – ADELAIDEAN – MARINOAN – Wilpena Group

- Pwp — **Pound Quartzite** - White cross-bedded, competent. Local iron rich horizons.
- Basal conglomerate on Pch

∿∿∿∿∿ Unconformable on Pch south of 980 N

- Pww1 — **Wonoka Formation** - Dolomite, grey-buff, cross-bedded, slumped, pebble bands. Minor sandstone.

∿∿∿∿∿ Unconformable on Pch 1000 N to 1005 N

- Undifferentiated Pwb, Pww1, Pww2 — Pww2 — Shale, green well bedded, with minor dolomite.
- **Limestone** - Grey-green, cross-bedded, flaggy.
- Pwb — **Bunyeroo Formation** - Shale, red, well bedded fissile. Dolomite interbeds with Malachite mineralisation. Dolomitic basal conglomerate.

∿∿∿∿∿ Unconformity.

WILLOURAN – Callanna Beds

- Pch — **Humanity Seat Formation** - Sandstones, siltstones, shales, dolomites and limestones, cross-bedded with Halite casts in siltstone. Tectonically plastic. Commonly occurs (diapirically?) in thrust faults.
- Dolomite beds

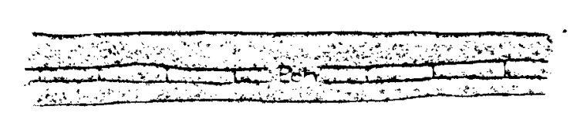
Massive Mineralisation

- ▨ Zn - Willemite. Pb - Hedyphane - Coronadite.

- ——— Stratigraphic boundary, dashed where approximate.
- ━━━ Fault, dashed where approximate.
- ∿∿∿∿ Shear zone.
- → Facing of Willouran sediments

GEOLOGICAL HISTORY

1. LOWER CALLANNA TIMES



Humanity Seat Formation deposited in evaporative shallow water environment

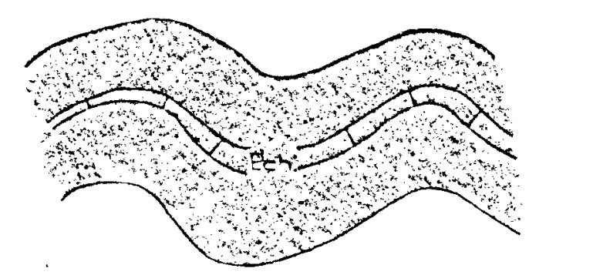
2. UPPER CALLANNA BURRA AND UMBERATANA TIMES

No deposition due to 3

OR

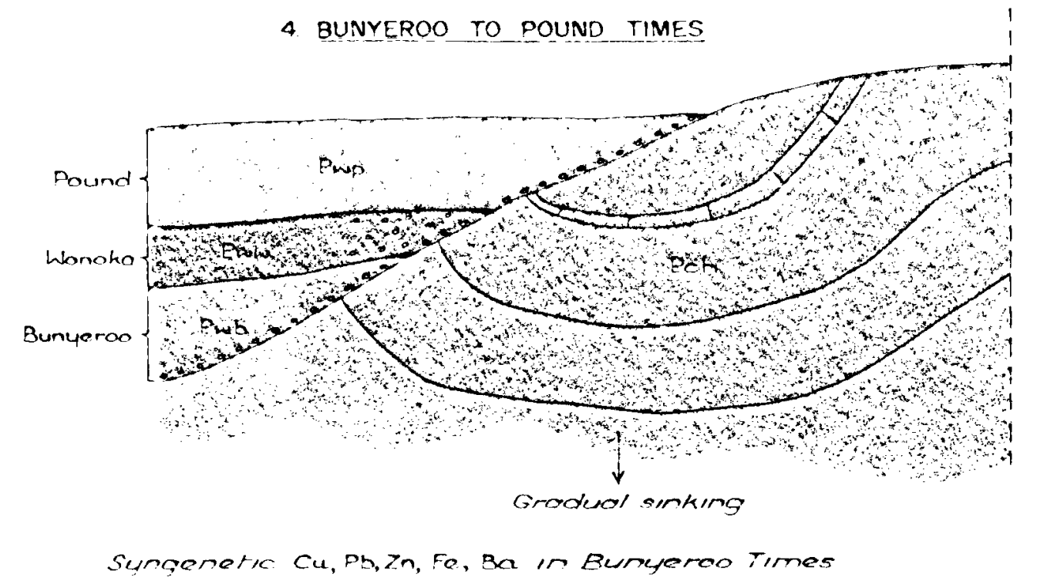
Deposition of Burra Sediments or Burra and Umberatana Sediments, subsequently eroded due to 3

3. TECTONISM (STURTIAN ?)



Mild folding and uplift

4. BUNYEROO TO POUND TIMES



Syngenetic Cu, Pb, Zn, Fe, Ba in Bunyeroo Times

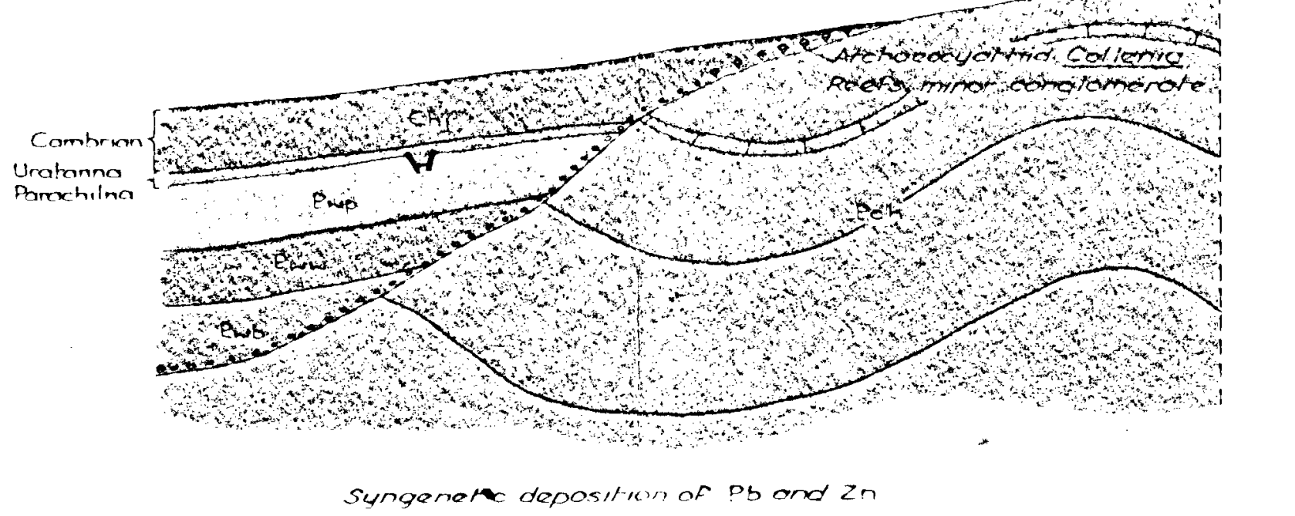
5. DUTTONIAN TECTONISM

Minor block faulting

6. URATANNA TIMES

In filling of grabens formed in Duttonian Tectonism

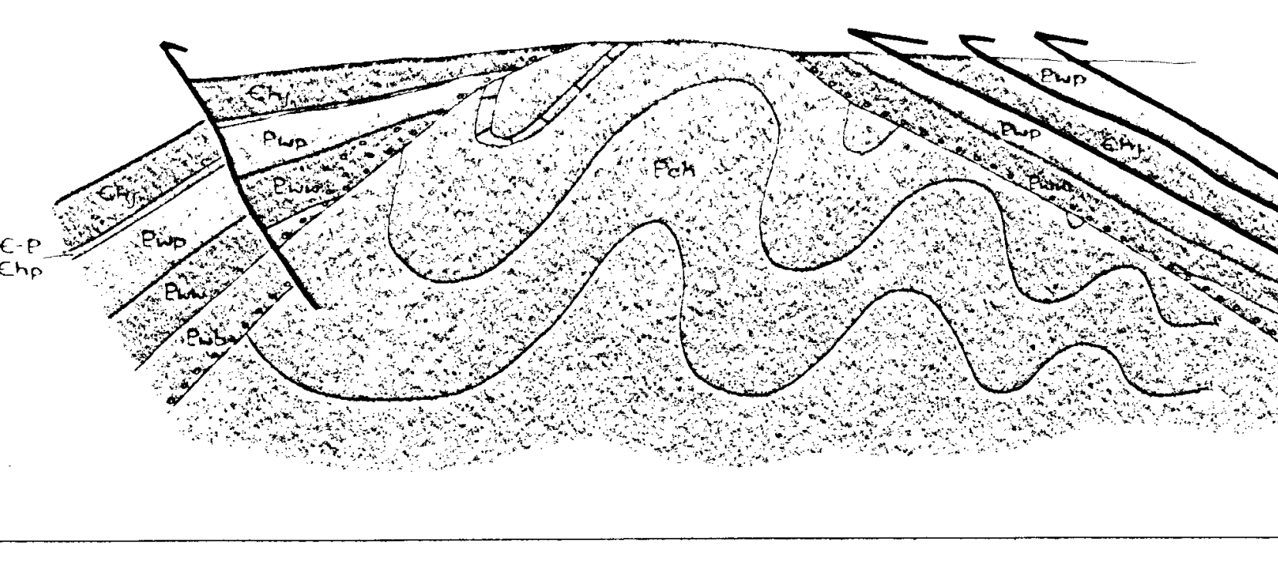
7. CAMBRIAN TIMES



Syngenetic deposition of Pb and Zn

8. DELAMERIAN TECTONISM

(a) Thrusting and folding
(b) Increased deformation of Lower Callanna beds on (Pch)



Emplacement of Pb/Zn and minor Cu sulphides in thrust faults

9. ORDOVICIAN TO TERTIARY TIMES

(a) Erosion
(b) Supergene enrichment of sulphides

10. TERTIARY TO RECENT TIMES

(a) Continued erosion
(b) Continued supergene enrichment
(c) Minor block faulting

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT: BELTANA EXPLORATION — SOUTH AUSTRALIA

BELTANA STRUCTURE SECTION

1748-2-7

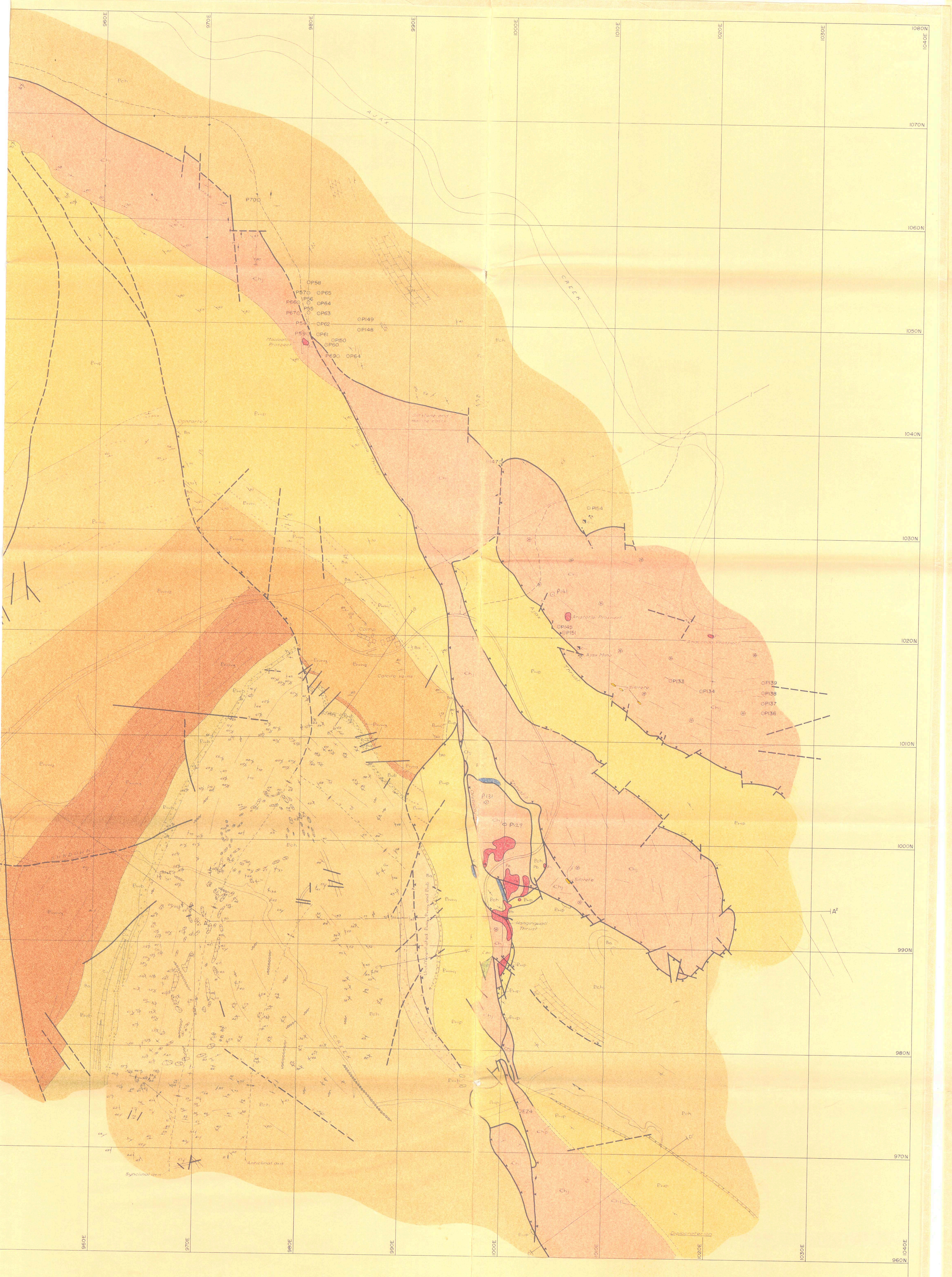
SCALE: 1 in. to 400 ft.
Survey: R. A. Horn.
Reference: Beltana Local Geology Plan – R100·71
Date: Feb. 1972
Drawn: F.L.S.
Checked: R.A.H.
REF NO. R100·70

R E F E R E N C E

PALAEOZOIC	CAMBRIAN	LOWER CAMBRIAN	Hawker Group	€hj	Ajax Limestone - Grey, biostromal, fossiliferous, trilobites, brachiopods and archaeocyathids. Locally red recrystalised, dolomitised.
				€hp	Parachilna Formation - Grey-green grits and ferruginous sandstones with minor dolomites. Trace fossils of *Diplocraterion* and *Plagiogmus*.
				€-P	Uratanna Formation - Green shales with minor dolomite bands, occupying grabens in Pound Quartzite.
					Unconformity.
PROTEROZOIC	ADELAIDEAN	MARINOAN	Wilpena Group	Pwp	Pound Quartzite - White cross-bedded, competent. Local iron rich horizons Basal conglomerate on Pch.
					Unconformable on Pch south of 980 N
				Pww1	Wonoka Formation - Dolomite, grey-buff, cross-bedded, slumped, pebble bands. Minor sandstone.
					Unconformable on Pch 1000 N to 1005 N
				Undifferentiated Pwb, Pww3, Pww2 Pww2	Shale, green well bedded, with minor dolomite.
				Pww3	Limestone - Grey-green, cross-bedded, flaggy.
				Pwb	Bunyeroo Formation - Shale, red, well bedded fissile. Dolomite interbeds with Malachite mineralisation. Dolomitic basal conglomerate.
					Unconformity.
		WILLOURAN	Callanna Beds	Pch	Humanity Seat Formation Sandstones, siltstones, shales, dolomites and limestones cross-bedded with Halite casts in siltstone. Tectonically plastic. Commonly occurs (diapirically ?) in thrust faults Dolomite beds.

Massive Mineralisation

🟥	Zn - Willemite Pb - Hedyphane - Coronadite
🟦	Quartz vein on thrust Fault
Fe	Goethite
Mn	Manganese wad.
Cu	Malachite
Ba	Barite



Stratigraphic boundary
Orebody boundary
Fault
Thrust fault; showing direction of movement
Shear zone
Synclinal axis
Recumbant syncline, showing bearing of axis
Anticlinal axis
Where location of boundaries, folds and faults is approximate, line is broken, where inferred, queried
45 Strike and dip of bedding
80 Strike and dip, facing not known
Vertical bedding
30 Vertical dip - "30" shows facing
61 Overturned bedding
90 Strike and dip of joint
Vertical joint
Archaeocyathinae
Shaft
Mine
Costean
OP58 Percussion drillhole
Road
Railway line
Rabbit proof fence
Drainage
Section line
Trend lines
Track

ELECTROLYTIC ZINC CO. OF A'ASIA LTD.

PROJECT : BELTANA EXPLORATION

SOUTH AUSTRALIA

BELTANA LOCAL GEOLOGY

1748-2-8

NOTE : Compiled from uncontrolled aerial photographs. Unreconciled with pegged grid.

SCALE : 1 in. to 400 ft.
Survey : R. A. Horn.
Reference :
Date : March 1972
Drawn : F.L.S.
Checked : R.A.H.

REF. NO.
R100·71

CONTENTS

INTRODUCTION

The engineering design and cost estimate for the silicate leaching plant are based on an overall mass balance and equipment schedules produced by the technical committee at Risdon. The plant is designed to treat 70,000 tons per year of Willemite ore from Beltana with an average grade of 50% zinc.

During the design period it was realised that the most likely feed assay would be 40% zinc. The effect of this change on the plant design has been studied and the amended speficiations and plant performance data are included in this document.

The site designated for this plant is adjacent to the residue treatment plant, which allows convenient interconnection of services and more importantly transfer of products. This site requires considerable preparation to make it suitable for this type of plant where one operating level is preferred.

The major items of equipment were selected on the basis of the experience gained during the operation of the large-scale pilot plant. Standard designs offered by equipment manufacturers have been selected with advantages in cost, delivery time and supply of spare parts.

This section of the study does not include the equipment necessary for disposal of the silicate and iron residues. This will be covered by separate studies into various methods of residue disposal.

1. PROCESS DESCRIPTION

The process has been designed to treat silicate ore received from Beltana as a crushed material. The ore is first ground in a wet mill before entering the leaching circuit where it is leached with spent electrolyte fortified with contact acid. Following leaching the solution enters the coagulation stage where the pH of the solution is raised using calcine as the neutralising agent to precipitate the colloidal silica in a filterable form. After filtering, the solids enter the acid repulp stage where additional zinc is leached from the calcine and ore residue. The solution is again coagulated, this time using limestone as the neutralising agent, to obtain the final silica residue in filterable form. The silica residue is filtered, washed on the filter and then discarded from the process.

All filtrates are combined and sent to a germanium purification section. A solution from residue treatment section containing ferric iron is added at this stage. Neutralisation with limestone produces ferric hydroxide which removes the germanium ions from solution. The resulting slurry is filtered and half the filter cake is discarded; the other half being recycled to the first germanium purification vessel to improve the utilisation of limestone.

From this point the solution is split into two portions; the greater part being sent to an extended nickel purification section, and the remainder being sent to the basics section in the new plant. The proportions sent to each section are determined by the T/Cl level acceptable in the cell feed solution.

The solution entering the basics section is heated and neutralised with limestone, precipitating a basic zinc sulphate. The slurry is then filtered and the cake, which contains the basic zinc sulphate, unconsumed limestone and gypsum, is slurried and pumped to the residue treatment section, while the filtrate is discarded to drain.

The solution sent to the nickel purification is blended with solution also coming from the residue treatment section in the first of three tanks in series. Zinc dust addition followed by pressure filtration produces a solution of acceptable nickel concentration.

2. PLANT PERFORMANCE

2.1 Feed Specification

The feed to this plant is Willemite ore from Beltana S.A., which has been mined, crushed to $-\frac{1}{2}$" size and where necessary upgraded using heavy medium separation. As explained under "Beneficiation" only part of the ore will be amenable to upgrading and much of the ore will be crushed and not upgraded.

Feed rate - 70,000 tpa total ore
Ave. Feed Assay - 50% Zn.

2.2 Product

The product of the silicate leaching plant is in the form of partly purified zinc sulphate solution and as a basic zinc sulphate. These two products are fed to different sections of the existing plant. The effective output of this plant is best reported as the slab zinc equivalent. The overall efficiency of recovery from ore to slab zinc is 86%.

Equivalent slab zinc produced - 30,100 tpa.

2.3 Utilities

The following are the average material and utility consumptions of the silicate leaching plant:-

Limestone - 87.4 tpd (dry basis)
Delivered by local supplier crushed to -1/8" sizing

Calcine - 22.2 tpd (dry basis)
Pumped from slurry holding tank in Roasting Division.

Contact Acid - 23.2 tpd
Pumped from storage tank in R.T. Division.

Spent Electrolyte - 337,000 gallons/day
Piped from electrolyte return main to Leaching Division.

2. PLANT PERFORMANCE CONTINUED

2.3 Utilities continued

Mains Water - 229,000 gallons/day
Pipe from water main on 76' level.

Fuel oil - 24 tpd
Delivered by road tanker to connection on 76' level.

Power -

Installed	1925 KW
Normally operating	1435 KW
Lighting & Misc. Power	50 KW

Supply taken from No. 4 sub-station

Water Treatment Chemicals - negligible quantity.
Salt for regeneration, hydrazine

2.4 Manning

	Men/ Shift	Man Shifts /day	Men required.
(i) Stockpiling & Handling ore & Limestone.	1*	1	1.6
(ii) Operation of Mills and Boiler	1	3	4.8
(iii) Leaching, Coagulation and Acid Repulping	2	6	9.6
(iv) Purification and filtering	2	6	9.6
(v) General (incl.crib relief and basis section).	1	3	4.8
TOTAL	7	19	30.4

say 31 men.

* Day shift only

2. PLANT PERFORMANCE CONTINUED

2.5 Residues

Silicate Residue - 425 tpd (wet basis)
Iron Precipitate - 35 tpd (wet basis)
Jarosite Residue - 50 tpd (wet basis)
(additional residue due to
silicate leaching).

These quantities will be increased when the residues are slurried for pumping and disposal.

2.6 Plant Availability

This type of plant is normally available for 95% of the year which is equivalent to 347 days/year.

PLANT PERFORMANCE MODIFICATIONS FOR 40% ORE

2.1

Feed Rate - 90,000 tpa ore

Average Feed Assay - 40% Zn.

2.2

Equivalent slab zinc producted - 30,960 tons.

2.3

Limestone - 106.5 tpd (dry basis)

Calcine - 28.5 tpd (dry basis)

Contact Acid - 50.4 tpd

Spent Electrolyte - 368,000 gallons/day

Mains Water - 242,000 gallons/day

Fuel Oil - 25 tpd

Power - Installed - 2020 KW

Normally operating - 1507 KW

2.4

Manning - 31 men

2.5

Silicate Residue - 548 tpd (wet basis)

Iron Precipitate - 45 tpd

Jarosite Residue - 65 tpd

2.6

Plant Availability - 347 days/year

3. PLANT DESCRIPTION

3.1 Civil Work

The site selected for this plant is of convenient size and location for this process. However it is desirable to have a site that is nearly level to facilitate operator movement and flow of material. For this reason it is proposed to excavate the upper part of the site next to the "76' level", build a retaining wall next to this roadway, and make use of the height of this wall for the loading of ore and limestone bins.

The bulk of the concrete work is associated with the foundations, the floor of the filter building and the external tank areas. These paved areas are well graded for good drainage into several sumps. They are finished with Zaganite acid-resistant coating to prevent corrosion of the cement surface. Other major foundations are provided for the package boiler and stack and the two ball mills.

An access road, bitumen paved with concrete kerbing, encircles the main process area providing maintenance access to all parts of the plant. Existing overhead power lines have been retained and are high enough above the roadways so that access will not be impeded. Areas surrounding process areas or equipment which are not paved will be surfaced with screenings.

3.2 Buildings & Structures

There is one major building associated with this plant which houses filters on the main floor and tanks and pumps in the basement. The building is of portal frame construction with a 10 ton crane running the full length of this building. The crane is primarily for handling the Moore filter baskets, but can also be used for maintenance throughout the building. A lifting well is provided in the main floor in order to lower filter baskets for maintenance and to provide maintenance access.

3. PLANT DESCRIPTION CONTINUED

3.2 Buildings & Structures continued

The filter building is sheeted to within 12ft. of the ground providing some shelter for the basement and easy access for pump maintenance. Ventilation of this building is achieved by the provision of louvres for most of the length of the building about 5ft. above the filter floor. Ridge ventilators are fitted to most of the length of the ridge to provide the upward flow of air.

Natural lighting of the main floor of this building is provided by fixed translucent sheeting which encircles the building in a 6ft. strip just below the crane rails. Artificial lighting is provided by flood lights mounted near the roof to gain reflection from the roof.

A control room and two offices are provided at the end of the filter building at main floor level and the space under these rooms houses the motor control centre. A concrete floor will be provided for the control room and offices.

The boiler is provided with a small housing for the firing end of the boiler to protect the control panel and operators. A skillion type awning is provided over the ball mills for weather protection.

A crib-room and changehouse is provided for operators of this and other nearby plants. It will be of brick construction on a concrete floor slab with galvanised steel sheeted roof.

Other structures provided in the plant are primarily agitator support bridges which also incorporate walkways over tanks. Supporting structures for various headtanks are located near the leach tanks and the basics tanks. Other structures include piperacks, pipe supports and several access stairs in the plant.

3. PLANT DESCRIPTION CONTINUED

3.3 Tanks & Vessels

The majority of tanks in the plant are wood-stave tanks which are well proven for this type of service. Celery Top pine has been specified but this will have to be installed with a minimum of air-drying. Complete drying to equilibrium moisture content would necessitate a 2 year delivery. Western Red Cedar is recommended as an alternative that is ideal for the operating conditions and little different in price.

A cost comparison was made for all tanks between F.R.P. and wood-stave construction. Overall the cost of F.R.P. was 30% greater than wood-stave tanks. However in the smaller sizes (< 9' dia.) the F.R.P. was slightly cheaper, due probably to shop fabrication on standard mandrels. It is proposed that F.R.P. tanks be considered in the small sizes should construction proceed.

The Moore filter vats are of F.R.P. construction incorporating mild steel stiffeners and support brackets within the laminate. This is a cheaper technique than using stainless steel for this type of construction.

The ore bins are of mild steel construction with external stiffening provided to handle the large loading expected. The bins have long outlet sections designed to receive unloading belts.

The boiler is a standard package unit which is delivered to site assembled requiring only piping, electrical and instrument connections to be made. A stack 130 ft. high is provided to ensure that the gases clear surrounding buildings. An insulated steel stack, or alternatively a fibreglass stack, would be necessary for Risdon conditions. The latter if supported by a steel framework shows a cost saving and has been proposed.

3. PLANT DESCRIPTION CONTINUED

3.3 Tanks & Vessels continued

Water treatment is quite simple for Risdon quality water and consists of sand filters, a mixed bed unit and a deaerator. An injection unit is also provided dosing the boiler with chemicals.

The cooling tower is also a standard unit with induced draught. It is constructed on a concrete base/tank using prefabricated components.

There are a number of feed-splitters provided in the plant, which are based on the most recent Risdon design which includes modification to reduce build-up of solids.

3.4 Mechanical Equipment

The major mechanical items are filters, agitators, ball mills and pumps. The filters consist of two large disc filters for primary filtration and the remaining four are belt discharge drum filters fitted with compression rolls and wash belt to ensure thorough cake washing without cracking. The cake from all filters is discharged into screw conveyors for transport to repulping tanks. All continuous filters are constructed in 316 SS. The Moore filter leaves are similar to those used at Risdon. However Eimco have offered leaves made of polypropylene which although more costly should be considered further.

Agitators of Lightnin make have been selected for uniformity with existing equipment and the price premium for this advantage is small.

The ore and limestone ball mills are installed adjacent to each other and are in the open except for a roof overhead. Both mills are wet mills operating in closed circuit using hydrocyclones. The mill drives are the largest power consumers in the plant so the motor controls are located nearby to minimise cabling. The mills have a local control panel in a central

3. PLANT DESCRIPTION CONTINUED

3.4 Mechanical Equipment continued

position with alarms registering in the boiler house. This will allow one operator to tend both the mills and the boiler and use the boiler house as his headquarters especially in winter.

Pumps are of two basic types; rubber lined slurry pumps and stainless steel pumps for filtrates. The majority of pumps are located along one side of the filter building basement for easy access. All pumps have been selected for low internal velocities, and have belt drives to facilitate speed adjustment. Mechanical seals are not provided. All pumps have been provided with a standby as the extra expense is easily justified by minimising plant down time.

Two vacuum systems are included with a cross-connection for emergencies. No standby units are provided because these pumps require little maintenance and are most reliable. One vacuum pump serves the Moore filters and a vacuum receiver is provided in the system to minimise surges. Two vacuum pumps serve the continuous filters, all connected to a common system. Nash pumps have been selected for this duty, although the Roots type vacuum pump appears less expensive and requires less sealing water. These should be investigated further during the final design stages.

The sealing water system provided for the Nash pumps includes an air/water separator which allows the water to recirculate. Sufficient mains water will be added to the system to prevent temperature rise, and the overflow will pass to drain. The use of closed circuit cooling via the cooling tower is not proposed for this system as Risdon water is not scarce nor costly.

3. PLANT DESCRIPTION CONTINUED

3.4 Mechanical Equipment continued

The overhead travelling crane is provided with motorised travel, traverse and lifting. The crane can travel the complete length of the filter building controlled by pendent from the main floor. Power to the crane is supplied through insulated bar conductors.

3.5 Piping and Valves

The piping for services is generally in carbon steel in accordance with Risdon standards. Some minor changes are incorporated where some types of piping and fittings are now unavailable or require special orders.

Piping provided for the process lines carrying acidic solutions is of PVC reinforced with fibreglass. This piping is now available in stock sizes and lengths from several suppliers. Pipe lengths are butted together and bolted with loose flanges which are easy to disconnect for cleaning.

Valves for most services are in accordance with Risdon standards. Valves for process fluids are of the diaphragm type and tight sealing butterfly type. The latter are quick in operation and simple to install.

3.6 Electrics (see Dwg. No. PR-2978-33)

The electrical equipment provided for the silicate leaching plant comprises wiring, motors, motor controls, HV and MV switchgear, lighting, fire alarms and telephones.

The power is supplied from the existing No. 4 substation adjacent to the plant, and is run via underground cables to two power transformers installed in the basement of the filter building. These transformers are separated from the

3. PLANT DESCRIPTION CONTINUED

3.6 Electrics continued

process equipment by a metal clad wall and chain wire gates are provided for easy access from the roadway.

Two 1500 KVA transformers were selected in preference to one larger unit because:-

(a) one of these transformers would be sufficient to keep the plant running if the other should fail (provided care was exercised by the plant operators), and

(b) these are a common size of transformer and one is presently available at Risdon.

The motor control centre (M.C.C.) is located at the end of the filter building adjacent to the power transformers. This location enables the cable runs to the major power consumers - the ball mills - to be minimised. Back-to-back type switchboards of Mechanical Services manufacture are provided which are in accordance with Risdon standards. The M.C.C. also includes the supplies for two remote secondary resistance starters of GEC manufacture for the ball mills and variable speed drives for the mill feed conveyors. General purpose power, welding, low voltage circuits and lights are supplied from a distribution board in the M.C.C.

Each motor is controlled by a local motor safety station of E.Z. design.

Cabling for medium, low and extra low voltage is PVC/PVC type run on cable ladders fixed to structures. High voltage cable is required for modifications to sub-station No. 4 and feeders to the silicate leaching plant. High voltage installation work will be carried out by E.Z. Electrical Division, and the cost of this work is included in the estimate.

3. PLANT DESCRIPTION CONTINUED

3.6 Electrics continued

Lighting is provided for all operating and access areas of the plant. High bay, corrosion-resistant mercury vapour fittings are provided near the roof of the filter building clear of the crane, providing maximum reflected light from the walls. Mercury vapour floodlights and 2 x 20 Watt fluorescents are provided in outdoor operating areas, stairs, landings and walkways.

Three telephone are provided, connected to the existing 50-line PAX system. Thermal fire detectors are fitted in the control and switchroom areas, and three electric clocks are provided.

In providing motors, maximum use has been made of spare motors presently available at Risdon. Where new motors are necessary,metric sizes to E.Z. standards have been chosen.

3.7 Instrumentation

Instrumentation is provided in accordance with normal Risdon practice. The main instrument panel is located in the control room at the end of the main filter floor, which is central to the plant. The panel will not include a mimic diagram, but will be divided into logical operating areas. A simplified process flow diagram can be provided on space above the panel for the purpose of operator training. Clear access is provided at the rear of the panel for instrument maintenance.

A control panel is provided in the boiler house housing all controls for the boiler and water treatment. Alarms are also provided on this panel for malfunctioning of the ball-mills. A local panel is provided to house instruments and alarms associated with both ball-mills, and this is mounted under the ball mill awning.

3. PLANT DESCRIPTION CONTINUED

3.7 Instrumentation continued

Considerable thought was given to the relative merits of pneumatic versus electronic instrumentation. Electronic instruments were finally chosen as pH equipment is necessarily electronic and constitutes a large part of the instrumentation, and the premium for using total electronics is small.

3.8 Painting & Insulation

All fabricated mild steel structures are treated by wire-brushing followed by a zinc oxide primer and chemical-resistant finishing coats. Sand blasting and the use of expensive zinc-based resins is not considered necessary in this environment. Equipment delivered with finishing coats applied will be painted if necessary in accordance with an overall colour scheme. Building sheeting is of galvanised sheet with a factory-applied polyurethane coating, which has good chemical resistance.

Insulation is required only for parts of the boiler, steam lines and the solution heat exchanger. Generally rockwool insulation is specified with galvanised cladding for protection.

PROPOSAL No. 418/4

EQUIPMENT No.

SERVICE Equipment List.

No. UNITS

TANKS

1-3-2	Hydro Cycl. Pump Feed Ore Tank	1	4' x 4' x 4'	Wood
2-2-2	" " " " L/S "	1	4' x 4' x 4'	Wood
2-4-0	Limestone Pulp	1	12' x 12'	Wood
2-6-0	Feed Splitter Head Tank	1	2' x 2'	Wood
3-1-0	Calcine, Pulp tank	1	12' x 12'	M.S.
3-3-0	Feed Splitter Head Tank	1	2' x 2'	Wood
4-3-0	Acid Head Tank	1	3' x 3'	M.S.
6-1-0	Leaching	3	12' x 13'6"	Wood
7-1-0	Coagulation	3	15' x 20'	Wood
7-3-1	Pri. Filt. Feed Head Box.	1	3' x 3'	Wood
8-1-0	Acid Repulp	2	10' x 11'	Wood
8-2-0	Recoagulation	3	12'6" x 13'	Wood
8-4-1	Fin. Filt. Feed Head Box.	1	3' x 3'	Wood
8-5-0	Repulp	1	9' x 9'	Wood
8-8-0	Wash Filtrate	1	9' x 10'	Wood
9-1-1	Germ. Puri.	3	15' x 15'	Wood
9-3-0	Repulp	1	10' x 10'	Wood
9-8-0	Surge	1	28' x 15'	Wood
10-1-0	Precipitation	4	13' x 14'	Wood
10-2-0	Cooler	1	15' x 15'	Wood
10-5-0	Basics Slurry	1	6' x 6'	Wood
10-7-0	Basics Slurry	1	14' x 16'	Wood
10-9-0	Basics Splitter Head Tank	1	2' x 2'	Wood
10-14-0	Calcine Split. Head Tank	1	2' x 2'	Wood
12-3-0	Feed Water	1	11' x 11'	M.S.
13-1-0	Ni Purifier	1	22' x 23'	M.S.
14-8-0	Wash Water	1	8' x 7'	FRP
14-3-0	Seal Water	1	4' x 4'6"	M.S.

Equipment List

PUMPS

1-4-0	Hydrocyclone Feed (Ore)	2	
2-3-0	Hydrocyclone Feed (L/S)	2	
2-5-0	Limestone Pulp Feed	2	
3-2-0	Calcine Pump	2	
4-2-0	Acid Supply pump	2	
7-4-0	Primary Filtrate	2	
8-6-0	Silica Residue	2	
8-7-0	Wash Filtrate	2	
9-1-5	Filter Feed	2	
9-5-0	Return Cake	2	
9-7-0	GE. Filtrate	2	
9-10-0	Basics Feed (GE)	2	
10-3-0	Basics Filter Feed	2	
10-6-0	Basics Slurry	2	
10-8-0	Basics Feed	2	
10-10-0	Discard Solution	2	
10-11-1	Cooling Water	1	
10-13-0	Calcine Pump	2	
12-2-1	Deaerator Feed	2	
12-3-1	Boiler Feed Water	2)	Part of Boiler Supply
12-4-1	Boiler Feed Oil	2)	
14-2-0	Sump Pump	4	
14-4-0	Portable Sump Pump	1	
16-1-0	Preneutralisation thickener O/F Pump	2	

AGITATORS

2-4-1	Limestone Pulp Tank	1 off
3-1-1	Calcine Pump Tank	1
6-1-2	Leaching Tank	3
7-1-2	Coagulation Tank	3
8-1-1	Acid Repulp Tank	2
8-2-1	Recoagulation Tank	3
8-5-1	Repulp Tank	1
9-1-3	GE. Puri. Tank	3
9-3-1	Unwashed Cake Tank	1

Equipment List

AGITATORS CONTINUED

10-1-1	Basic Precipitation Tank	2 Impellers - 4 off		
10-2-1	Cooler Tank	1		
10-5-1	Basics Slurry Tank	1		
10-7-1	Basics Slurry Storage Tank	1		
13-1-1	Ni Purifier Tank	1		
14-2-1	Drainage Sumps	4		
1-1-0	Ore Bin		350 T	M.S.
1-1-1	Bin Extractor Conveyor			
1-2-0	Mill Feed Conveyor 18" Belt & Weigher			
1-3-0	Ball Mill 8.5 TPH 90% - 100 mesh 100% - 65 mesh Ore S.G. 4.23			
1-3-1	Direct Mill Feed Chute			
1-4-1	Hydrocyclone - 6" cyclone	4 off		
2-1-0	Limestone Bin		150 T	M.S.
2-1-1	Bin Extractor Conveyor L/S			
2-1-2	Mill Feed Conveyor & Weigher L/S			
2-2-0	Limestone Mill 4.1 TPH 100% - 200 mesh 90% - 400 mesh S.G. 1.66			
2-2-1	L/S Direct Mill Feed Chute			
2-3-1	Hydrocyclones - 6" cyclone	3 off		
2-6-0	Feed Splitters - 3 Swing Launder Total Flow 1400 G.P.H.			
2-6-1	Feed Splitters	3 off		
3-3-1	Feed Splitters			
5-1-0	8" Vinyl glass line - 700' 300 G.P.M.			
6-1-1	Connecting Launders	3 off		
7-1-1	Connecting Launders	2 off		
7-1-3	Co-ag. Tank Heading Element			
7-2-0	Primary Filter Air Lift 21,000 G.P.H. 4½" dia.			
7-3-0	Disc Filters 8'6" x 12 disc 2 off			
7-3-2	Coagulation Precipitate Conveyor 3 off			
7-4-1	Filtrate Receiver 7'6" x 8'6" 1 off			
8-1-2	Connecting Launders	2 off		
8-2-2	Connecting Launders	2 off		
8-2-3	Recoag. Tank Heading Element			

Equipment List

8-3-0	Final Filter Air Lift 9,000 G.P.H.		
8-4-0	Drum Filter SS	3 off	12' x 12' Face
8-4-2	Final filter Residue Screw Conveyor	1 off	
8-4-3	" " " "	1 off	
9-1-2	Connecting Launders	2 off	
9-1-4	Air Spargers 2" S.S.	3 off	
9-2-0	Leaf Filter Basket	2 off	44 leaves
9-2-1	Filter Vats	3 off	
9-2-2	Filter Cake Discharge Hopper	1 off	
9-2-3	Gantry Crane 45' Span 10 T Lift		
9-2-4	3½" Air Lifts	2 off	
9-7-1	Moore Filter Vacuum Drum		
9-9-0 & 9-9-1	Shell & Tube Heat Exchangers		
9-12-0	Air Blower	1 off	
10-1-2	Connecting Launders		
10-2-2	Cooler Elements -Segmental Nests		
10-4-0	Drum Filter 12' dia. x 12' S.S.		
10-4-1	Basics Cake Screw Conveyor		
10-9-1	Basics Splitter	2 off	existing
10-10-2	Discard Sampler	1 off	existing
10-11-0	Cooling Tower 28,000 G.P.H.		
10-12-0	Vent Stack & Associated Ductwork		
10-12-1	Vent Fan 5,000 B.C.F.M. F.R.P. Construction		
10-14-1	Calcine Splitter	1 off	
11-1-0	Vacuum Pumps	Total	9000 CFM
11-1-1	Vacuum Pump	1 off	1500 CFM
11-2-0	Vacuum Seal Tanks	2 off	
11-3-0	Barometric Leg Head Tank	2 off	
11-4-0	Moisture Trap		
12-1-0	Boiler 50,000 lb/hr. Water tube packaged Oil Fired Unit incl: F.D. Fan & Ducting & Instrument Panel.		
11-5-0	Filter Vac. Receivers		
11-6-0	Vacuum Seal Water Tank		
12-1-1	Boiler Stack		
12-1-2	Boiler Dosing Equipment		
12-2-0	Water Treatment Plant Filter, Softener, etc.		
12-3-2	Deaerator 6' x 12'		
12-4-0	Oil Storage Tank - Existing relocated		
12-4-2	Oil Heaters (Boiler)	2 off	existing

13-3-0	Zinc Dust Belt Conv.	1 off
13-2-0	Ni Purifier Filter Press - 660 ft.^{2} each	2 off
14-2-0	Drainage Sumps	
14-5-0	High Pressure water cleaning unit	
14-7-0	Haulpak Unit 35 Ton	1 off
14-16-0	Urinal	

PROPOSAL No. 418/4

EQUIPMENT No.

SERVICE Tanks

No. UNITS

SUMMARY OF TANKS

Item No.	Tank	No.off	Size	Roof	Mat'l of Constr.
6-1-0	Leaching	3	12'Ø x 12'	Yes	Wood
7-1-0	Coagulation	3	15'Ø x 19'	Yes	Wood
8-5-0	Repulp	1	9'Ø x 9'	-	Wood
8-1-0	Acid Repulp	2	9'Ø x 11'	Yes	Wood
8-2-0	Recoagulation	3	12'Ø x 12'	Yes	Wood
9-1-1	Germ. Puri.	3	15'Ø x 15'	Yes	Wood
9-3-0	Repulp	1	10'Ø x 10'	-	Wood
9-8-0	Surge	1	28'Ø x 10'	-	Wood
10-2-0	Cooler	1	15'Ø x 15'	-	Wood
10-1-0	Precipitation	4	12'Ø x 14'	Yes	Wood
10-5-0	Basics Slurry	1	6'Ø x 6'	Yes	Wood
8-8-0	Wash Filtrate	1	9'Ø x 10'	-	Wood
2-4-0	Limestone Pulp	1	12'Ø x 12'	-	Wood
14-8-0	Wash Water	1	8'Ø x 7'	-	FRP
3-1-0	Calcine Pulp	1	12'Ø x 12'	-	M.S.
12-3-0	Feed Water	1	11'Ø x 11'	Yes	M.S.
13-1-0	Ni Purifier	1	22'Ø x 23'	Yes	MS/A.B.L.L.
10-7-0	Basics Slurry	1	14'Ø x 16'	Yes	Wood

Baffles in Tanks

10% Tank Dia., 1/26th. Tank Dia. Clear from walls and bottom

1-3-2	Hydro.cycl.feed	1
2-2-2	" " "	1
4-3-0	Acid Head	1
2-6-0	Feed Splitter	1
3-3-0	" "	1
7-3-1	Dri. Filt. Head	1
8-4-1	Fin. " "	1
10-9-0	Feed Splitter	1
10-14-0	" "	1
14-3-0	Seal Water	1

PROPOSAL No.	418/4
EQUIPMENT No.	Wood Stave Tanks
SERVICE	Standard Specification
No. UNITS	

1. SCOPE

This specification provides for the design, fabrication, supply, erection and testing of wood stave tanks.

2. DESIGN, CONSTRUCTION AND ERECTION

Shall be in accordance with Davy-Ashmore drawings, this specification and good engineering practice. In the event of any conflict between Davy-Ashmore drawings and this specification, Davy-Ashmore drawings shall take precedence.

Tolerance on diameter shall be ±1%. Maximum moisture content shall be 18%.

Staves shall be machined to give a true circumferential fit and shall be bevelled on the outside edges to allow free drainage past the Hoops.

Bottom timbers shall be machined square and joined by 3/4" dia. wood dowels. With the exception of tanks being leadlined, all bottom timbers shall be splined using 1.3/8" x 3/8" Hardwood. Where it is necessary to butt and join bottom timbers, a double spline shall be used.

Erection shall be carried out under the terms of Davy-Ashmore Standard Conditions of Erection No. DASC/103.

3. MATERIALS

Vendors Tender shall state either that materials of construction are in accordance with Davy-Ashmore stated requirements or in the event of departure from those requirements, the Vendors alternatives.After order placement any changes of material proposed by Vendor shall be subject to Davy-Ashmore approval in writing.

3. MATERIALS CONTINUED

Hoops shall be of mild steel bar, 1" dia., with a minimum UTS of 26 Tons/square inch, and designed for a working stress of 10,000 p.s.i. maximum, with a S.G. of contents of 1.0. Each hoop section shall be in one piece without joints by welding.

Draw lugs shall be of malleable Iron.

4. TANK SUPPORTS

Vendors supply shall include Chime Joists, using 8" x 4" unmachined Jarrah, on edge at 2'0" centres. Chime Joists will be supported on Concrete Piers, spaced as shown on Davy-Ashmore drawings.

5. TREATMENT AND PAINTING

The external surface of the bottomsand the chime of all staves shall be given one coat of pentachlorphenal wood preservative. Chime joists shall be given one coat of creosote oil.

Hoops and Lugs shall be pickled, galvanised and given one dip coat of suitable bitumastic based anti-corrosive paint. After assembly threaded portions of hoop shall be given one brush coat of the above paint.

6. INSPECTION AND TEST

All items shall be subject to Davy-Ashmore inspection. Each tank shall, upon completion of erection, be thoroughly freed of all dirt and loose matter and shall be hydrostatically tested by filling with water. Upon completion of test each tank is to be left filled with water to prevent drying out of timbers.

7. DATA REQUIRED FROM VENDOR

1. Vendors tender shall state:-
   (a) Nominal thickness and estimated finished thickness of timbers, and any variation in tank dimensions from Davy-Ashmore requirements resulting from manufacturing methods proposed.

7. DATA REQUIRED FROM VENDOR CONTINUED

1. Cont'd
   - (b) Number and diameter of hoops and number of hoop sections per circumference.
   - (c) Details of Preservative Paint (as required).
   - (d) Estimated erected weight/s.

2. Within two weeks (14 days) from receipt of order, Vendor shall supply two copies of a procurement, shop, and where applicable erection, programme which is to include the date for receipt of Davy-Ashmore orientation details.

3. Within four weeks (28 days) of receipt of order, Vendor is to advise the following for each Tank supplied:-
   - (a) Details of Croze and Chime on Tank.
   - (b) Size and layout of Chime Joists under Tank.
   - (c) Spacing of Hoops on Tank side.

TANK AND VESSEL SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	1-3-2
SERVICE	Ore Hydrocyclone pump feed tank
No. UNITS	1
SPECIFICATION	Refer 418/4-3200-S1
~~DESIGN CODE~~ HEIGHT	3ft.
~~SHELL~~ LENGTH	5'6"
~~SHELL DIAMETER~~ WIDTH	4ft.
~~DESIGN PRESSURE~~ WORKING VOL.	300 GALS
WORKING PRESSURE	Open to atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	Wood - Celery Top or Huon Pine
SUPPORTS)	Nozzle details see dwg. 277-3200-72 (typ. only)
INTERNALS)	

REMARKS Material being handled

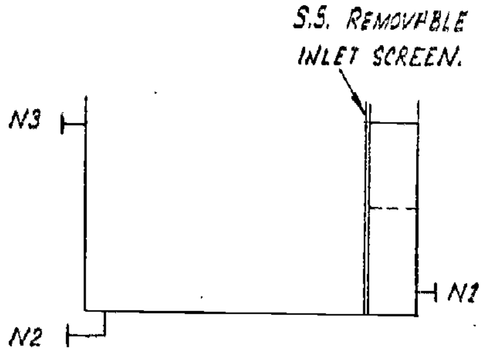
Ground ore pulp

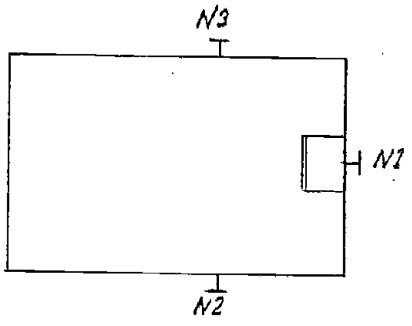
SG. 1.85

N_1 - 3"Ø outlet

N_2 - 3"Ø scuttling drain

N_3 - 3"Ø overflow





TANK AND VESSEL SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	2-2-2
SERVICE	Limestone Hydrocyclone pump feed tank
No. UNITS	1
SPECIFICATION	Refer 418/4-3200-S1
~~DESIGN CODE~~ HEIGHT	3ft.
~~SHELL~~ LENGTH	5'6"
~~SHELL DIAMETER~~ WIDTH	4 ft.
~~DESIGN PRESSURE~~ WORKING VOL.	300 GALS
WORKING PRESSURE	Open to atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	Wood - Celery Top or Huon Pine
SUPPORTS)	Nozzle details see dwg. 277-3200-72 (typ. only)
INTERNALS)	

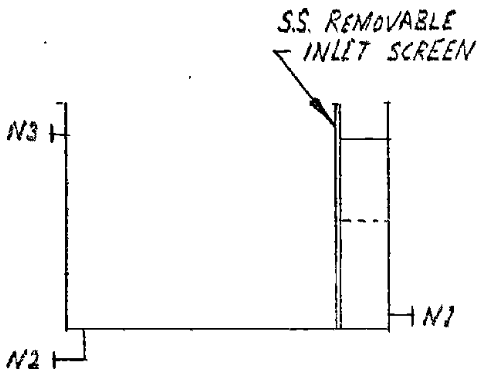
REMARKS Material Being Handled

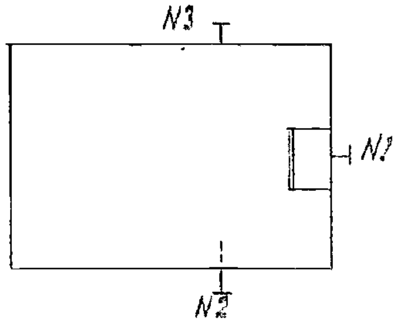
Limestone/Water pulp

N_1 - 2" Ø outlet

N_2 - 3" Ø Scuttling drain

N_3 - 2" Ø Overflow





TANK AND VESSEL SPECIFICATION DAVY ASHMORE PTY. LTD.

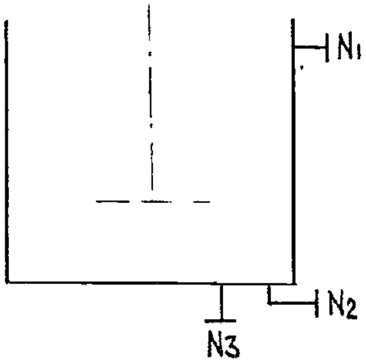
PROPOSAL No.	418/4
EQUIPMENT No.	2-4-0
SERVICE	Limestone Pulp Tank
No. UNITS	1
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	12 ft.
SHELL DIAMETER	12 ft.
~~DESIGN PRESSURE~~ CAPACITY	8500 GAL.
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	5^{o} - 30^{o}C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	Wood - Celery Top Pine or Western Red Cedar
LINING)	For typ. details see E.Z. Dwg. Std. 128 & 183
SUPPORTS)	Nozzles Detail see Dwg. 277-3200-72 (Typ. only)
INTERNALS)	

REMARKS

Materials being handled

Limestone/Water Pulp

Moderately Abrasive



N_1 - 4" O/F

N_2 - 6" Scuttling Drain

N_3 - 3" Outlet

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

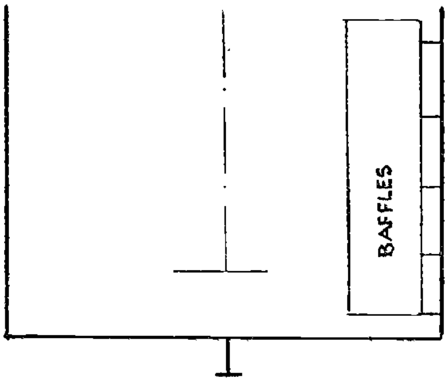
PROPOSAL No.	418/4
EQUIPMENT No.	3-1-0
SERVICE	Calcine Pulp Feeder Tank
No. UNITS	1
SPECIFICATION	
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	12 ft.
SHELL DIAMETER	12 ft.
~~DESIGN PRESSURE~~ CAPACITY	8500 Gal
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	15° - 20°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	
SUPPORTS)	M.S.
INTERNALS)	

REMARKS

Material being handled

Calcine Pulp — Abrasive Solids
S.G. 1.7

Baffles 4 off Eq. spaced

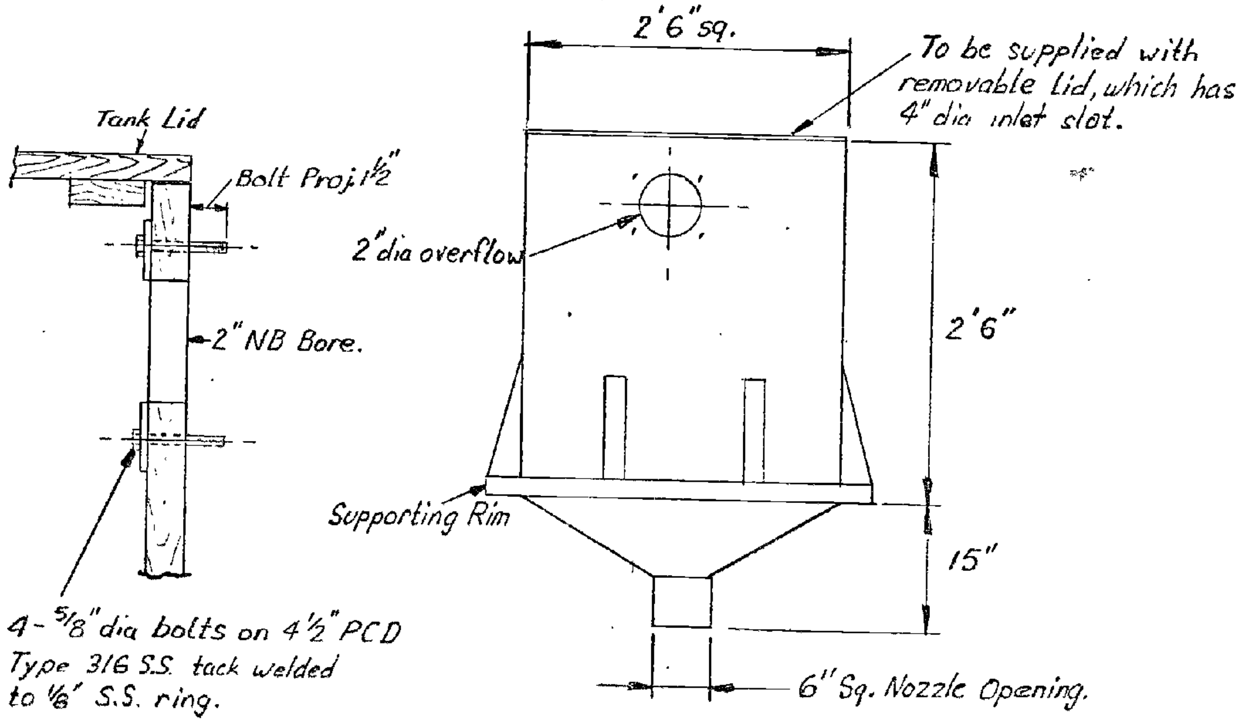


TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418-4
EQUIPMENT No.	3-3-0, 2-6-0, 10-9-0 & 10-14-0
SERVICE	Pulp: Coagulation, recoagulation or calcine pulp.
No. UNITS	5 required.
SPECIFICATION	
DESIGN CODE	
SHELL LENGTH	
SHELL DIAMETER	
DESIGN PRESSURE	
WORKING PRESSURE	open to atmosphere
DESIGN TEMPERATURE	
WORKING TEMPERATURE	70°C
CORROSION ALLOWANCE	Nil
STRESS RELIEF	Nil
INSULATION	Nil
MATERIALS OF CONSTRUCTION	
SHELL	Timber: Celery Top or Huonpine
LINING	
SUPPORTS	
INTERNALS	

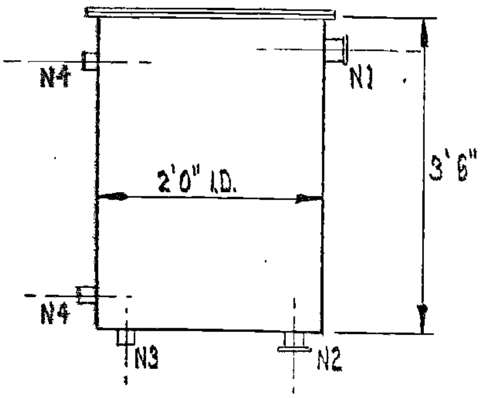
REMARKS



OVERFLOW DETAILS.

TANK AND VESSEL SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	4-3-0
SERVICE	Acid supply head tank
No. UNITS	1
SPECIFICATION	
DESIGN CODE	
SHELL LENGTH	3'6"
SHELL DIAMETER	2'0"
DESIGN PRESSURE	
WORKING PRESSURE	Atmospheric
DESIGN TEMPERATURE	
WORKING TEMPERATURE	Ambient
CORROSION ALLOWANCE	Nil
STRESS RELIEF	Nil
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	M.S.
LINING	
SUPPORTS	
INTERNALS	
REMARKS	



N_1 - Inlet 2" BSTable 'D'
N_2 - Outlet " "
N_3 - Drain 1" SCD BSP
N_4 - Level Gauge 1" SCD BSP

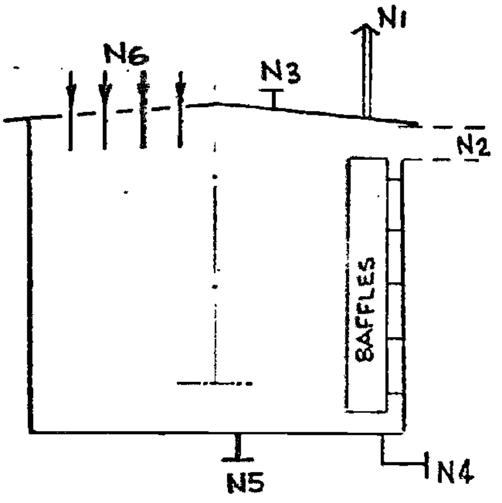
TANK AND VESSEL SPECIFICATION DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	6-1-0
SERVICE	Leaching
No. UNITS	3
SPECIFICATION	Refer 418/4 - 3200- S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	12ft.
SHELL DIAMETER	12ft.
~~DESIGN PRESSURE~~ WORKING VOL.	8000 Gal
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	30°-50°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	Wood - Celery Top Pine or Western Red Cedar
LINING)	Typ. details see Dwg. EZ Std. 128 & 183
SUPPORTS)	Nozzle Details see Dwg. 277-3200-72 (Typ. only)
INTERNALS)	

REMARKS

Material Being Handled

Leach Pulp Viscosity 4.6 Relative SG - 1.35
pH 1.0 - 1.25 of soln. 2.8 C.P.
Corrosive, mildly abrasive, slightly scaling
Pulp or solution will gel. in stagnant pockets
after several days.
Tanks to have wood pine covers.



N_1 - 12"Ø Fibreglass vent
N_2 - Laundered outlet
N_3 - Inst. Conn. 2"
N_4 - 6" Scuttling Drain
N_5 - 4½ Air Lift outlet
N_6 - Inlets (Holes in Tank)

Baffles 4 off eq. spaced
St. St. Support Brackets

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	7-1-0
SERVICE	Coagulation Tanks
No. UNITS	3
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
HEIGHT	19 ft
SHELL DIAMETER	15 ft.
WORKING VOL.	19,300 gal.
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	63° - 75°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	Wood - Celery Top Pine or Western Red Cedar
LINING)	Typ. Details EZ Dwg. Std. 128 & 183
SUPPORTS)	Nozzle Details Dwg. 277-3200-72 (Typ only)
INTERNALS)	

REMARKS

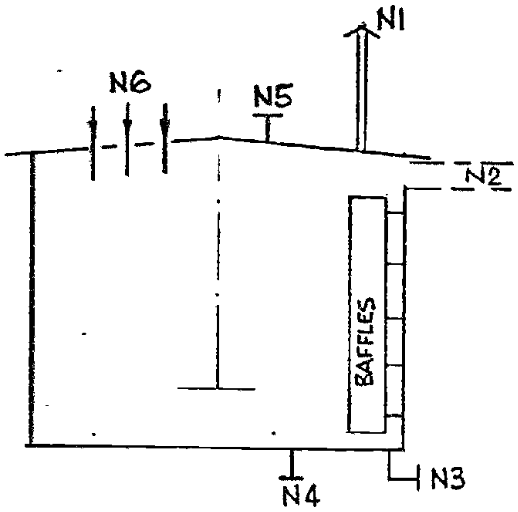
Material Being Handled

Coagulation Pulp	Viscosity	3.7 Relative
pH 4.8 - 5.6	of Sol'n	1.6 C.P.
SG - 1.30		

1 off Tank has heating elements

Tanks to have wood pine covers

Baffles 4 off eq. spaced St. St. Support Brackets



N_1 - 12"Ø Fibreglass Vent

N_2 - Laundered Outlet

N_3 - 6' Scuttling Drain

N_4 - 4½ Air Lift Outlet

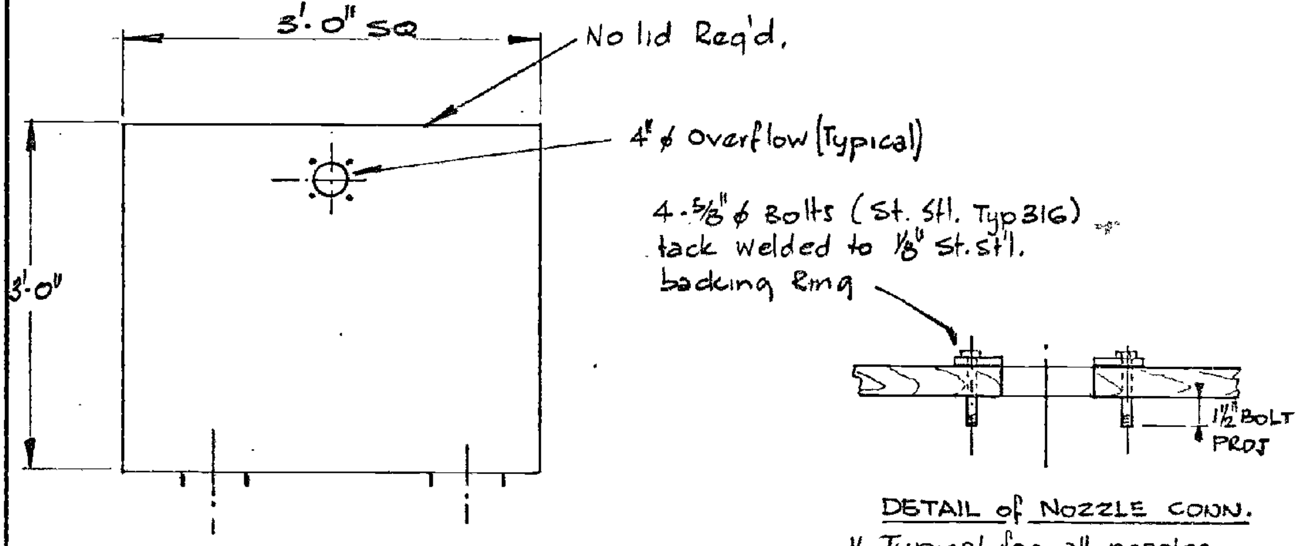
N_5 - Inst. Conn. 2"

N_6 - Inlet/Holes in Tank

TANK AND VESSEL SPECIFICATION DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	7-3-1 & 8-4-1
SERVICE	Coagulation and Recoagulation pulp
No. UNITS	2 required
SPECIFICATION	
DESIGN CODE	
SHELL LENGTH	
SHELL DIAMETER	
DESIGN PRESSURE	Atmospheric
WORKING PRESSURE	"
DESIGN TEMPERATURE	
WORKING TEMPERATURE	70°C
CORROSION ALLOWANCE	Nil
STRESS RELIEF	Nil
INSULATION	Nil
MATERIALS OF CONSTRUCTION	
SHELL	Timber: Celery Top or Huon Pine
LINING	
SUPPORTS	
INTERNALS	

REMARKS



DETAIL of NOZZLE CONN.

1/ Typical for all nozzles incl. overflow.

2/ All nozzles to be B.S. Table D Drilled.

Vessel 7-3-1 :- 4 - 4" NB Nozzles req'd in base of Tank

Vessel 8-4-1 :- 2 - 4" NB Nozzles req'd. in base of Tank

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-1-0
SERVICE	Acid Repulp Tanks
No. UNITS	2
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
HEIGHT	11'0"
SHELL DIAMETER	9'0"
~~DESIGN PRESSURE~~ WORKING VOL.	4,400 Gal.
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	20° - 45°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	
LINING	Wood - C.T. Pine or Western Red Cedar
SUPPORTS	Typ. Details see Dwg. EZ Std. 128 & 183
INTERNALS	

REMARKS

Material Being Handled

Acid Repulp Leach Pulp   Viscosity of Sol'n   3.0 Relative 2.4 C.P.

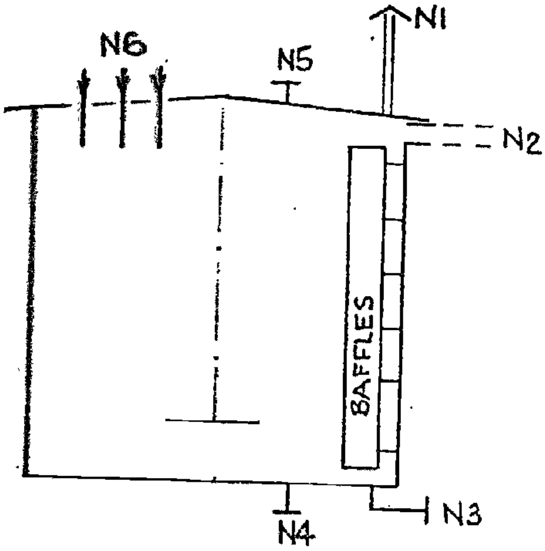
pH 1.0 - 1.25

SG 1.29

Tanks to have wood pine covers

For Nozzles see dwg. 277-3200-72 Typ. only

Baffles 4 off eq.spaced,St. St. Support Brackets



N_1 - 12" Fibreglass Vent

N_2 - Laundered Outlet

N_3 - 6" Scuttling Drain

N_4 - 4½ Nozzle

N_5 - Instr. Conn. 2"

N_6 - Inlet (Holes in Tank)

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-2-0
SERVICE	Recoagulation Tank
No. UNITS	3
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
HEIGHT	12ft.
SHELL DIAMETER	12ft.
WORKING VOL.	6,000 GAL.
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	63°-70°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	)
LINING	) Wood - C.T. Pine or Western Red Cedar
SUPPORTS	) Typ. Details see E.Z. Dwg. Std. 128 & 183
INTERNALS	)

REMARKS

Material Being Handled

Recoagulated pulp	Viscosity of	2.8 Relative
pH 4.8 - 5.6	Sol'n	1.2 C.P.
S.G. 1.34		

Tanks to have wood pine covers

Baffles 4 off eq. spaced on circ. St. St. Bracket Supports

For Details of Nozzles see Dwg. 277-3200-72 (Typ only)

N_1 - 12" Ø Fibreglass Vent

N_2 - Laundered outlet

N_3 - 6" Scuttling Drain

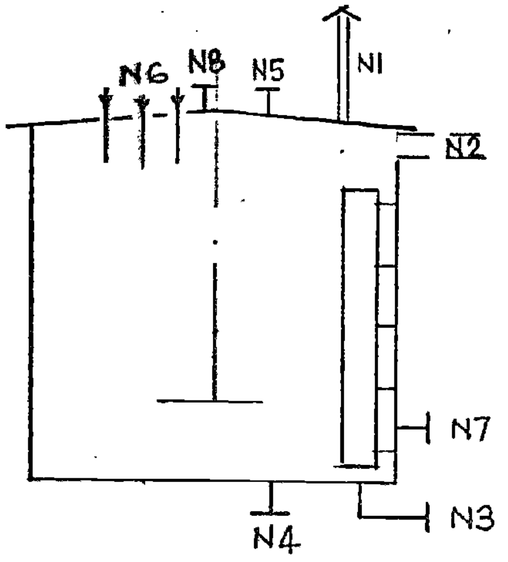
N_4 - 4½" Nozzle

N_5 - Instr. Conn. 1"

N_6 - Inlets (Holes in Roof)

N_7 - 4" Instr. Conn.

N_8 - 2" Instr. Conn.



TANK AND VESSEL SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	8-5-0
SERVICE	Final Filter Residue Repulp Tank
No. UNITS	1
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	9 ft.
SHELL DIAMETER	9 ft.
~~DESIGN PRESSURE~~ CAPACITY	3,200 Gal.
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	40° - 60°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	Wood - C.T. Pine or Western Red Cedar
SUPPORTS)	Typ. Details see E.Z. Dwg. Std. 128 & 183
INTERNALS)	

REMARKS

Material Being Handled

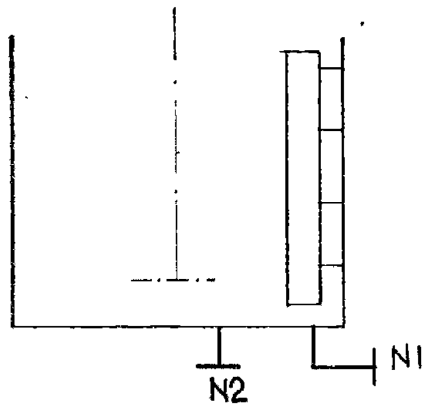
Silica Residue 80#/cu.ft.

For details of nozzles see Dwg. 277-3200-72 (Typ. Only)

Baffles 4 off eq. spaced, St. St. Support Brackets

N_1 - 6" Scuttling Drain

N_2 - 4" Outlet



TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-8-0
SERVICE	Wash Filtrate Storage Tank
No. UNITS	1
SPECIFICATION	Refer 418/4-3200/S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	10 ft.
SHELL DIAMETER	9 ft.
~~DESIGN PRESSURE~~ WORKING VOL.	4,000 GAL.
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	10^{o} - 30^{o}C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	

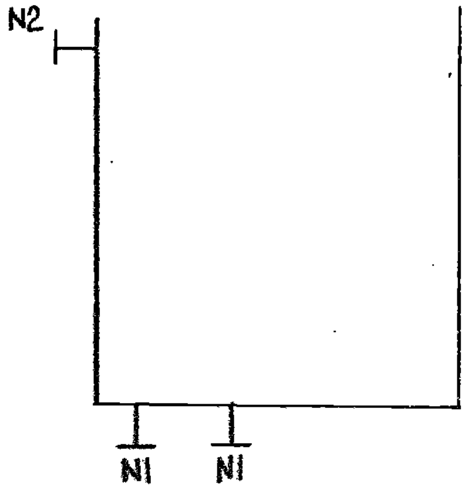
MATERIALS OF CONSTRUCTION

SHELL)	Wood - C.T. Pine or Western Red Cedar
LINING)	
SUPPORTS)	Typ. Details EZ Dwg. Std 128 & 183
INTERNALS)	For Nozzles see Dwg. 277-3200-72 (Typ. only)

REMARKS Material Being Handled Wash Filtrate

Mildly Corrosive - No Solids

SG. 1.11



N_1 - 1½" outlet

N_2 - O/F 2"

TANK AND VESSEL SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	9-1-1
SERVICE	Germanium Purification Tanks
No. UNITS	3
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	15 ft.
SHELL DIAMETER	15 ft.
~~DESIGN PRESSURE~~ WORKING VOL.	15,500 GAL
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	45° - 60°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	Wood - C.T. Pine or Western Red Cedar
SUPPORTS)	Typ Details see E.Z. Dwg. STD 128 & 183
INTERNALS)	

REMARKS

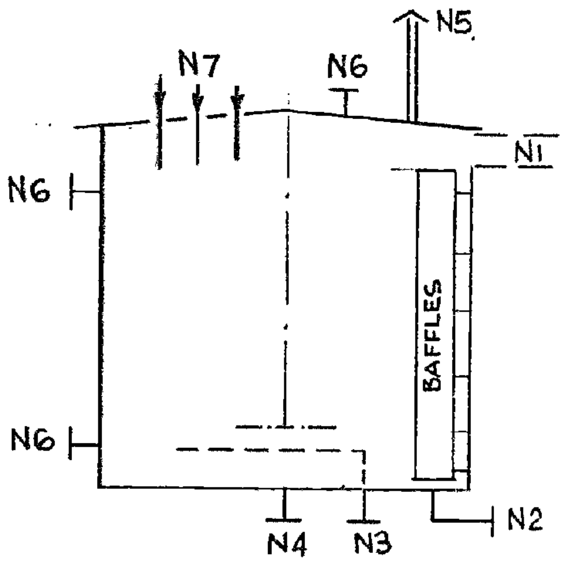
Material Being Handled - Germanium Purifier Pulp

pH 4.8 - 5.6	Viscosity	3.1 Relative
SG 1.28	of sol'n	1.8 C.P.

Tank to have Wood Pine Roof

Baffles - 4 off eq. spaced on circ. St. St. Bracket Supports

For Details of Nozzles see Dwg. 277-3200-72 (Typ only)



N_1 - Laundered outlet
N_2 - 6" Scuttling Drain
N_3 - 2"Air Inlet
N_4 - Air 3"
N_5 - 12"Ø Fibreglass Duct
N_6 - Inst. Conn. 2"
N_7 - Inlets (Holes in roof)

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	9-3-0
SERVICE	Return Cake Repulp Tank
No. UNITS	1
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	10'0"
SHELL DIAMETER	10'0"
~~DESIGN PRESSURE~~ WORKING VOL. 3,000 GAL	
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	
LINING	Wood C.T. Pine or Western Red Cedar
SUPPORTS	Typ. Details see EZ Dwg. Std. 128 & 183
INTERNALS	

REMARKS

<u>Material Being Handled</u>

Germanium Precipitate

600-700 G/L solids

pH 5.5

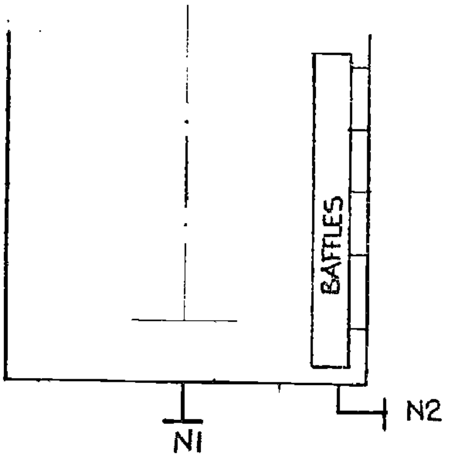
SG 1.55

Baffles - 4 off eq. spaced on Circ. St. St. Bracket Supports

For Details of Nozzles see Dwg. 277-3200-72 (Typ. only)

N_1 - 4" Outlet

N_2 - 6" Scuttling Drain



TANK AND VESSEL SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	9-8-0
SERVICE	Germanium Purification Surge Tank
No. UNITS	1
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
SHELL LENGTH	15 ft.
SHELL DIAMETER	28 ft.
~~DESIGN PRESSURE~~ Working Vol.	50,000 gal.
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	)
LINING	) Wood - C.T. Pine or Western Red Cedar
SUPPORTS	) Typ. Details see dwg. EZ std. 128 & 183
INTERNALS	)

REMARKS

Material being handled

Germanium Precipitate

For details of nozzles see dwg. 277-3200-72 (Typ. only)

N_1 6" outlet

N_2 Scuttling Drain

N_3 4" Instr. Conn.

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-1-0
SERVICE	Precipitation Tanks
No. UNITS	4
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
SHXXXXXXXXXX HEIGHT	14 ft.
SHELL DIAMETER	12 ft.
XXXXXXXXXXXXXXXX WORKING VOL.	6,000 GAL
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	90° - 98°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	Wood - C.T. Pine or Western Red Cedar
SUPPORTS)	Typ. Details see E.Z. Dwg. Std 128 & 183
INTERNALS)	

REMARKS Material Being Handled

Basics Pulp

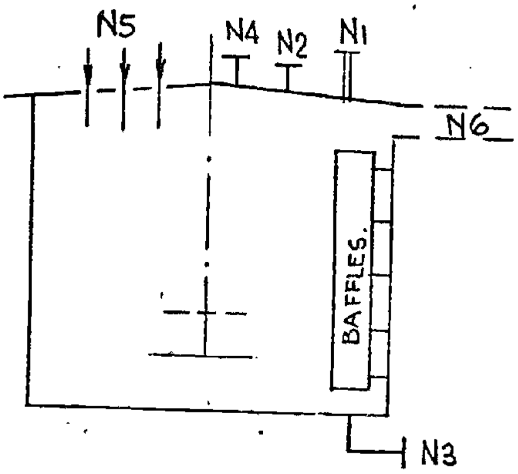
pH 5.6 - 7.0 Viscosity Rel 2.2 - 1.5 ± 30%

SG 1.2 of Soln. ABS 0.7 - 0.5 CP ± 50%

Tanks to have wood pine covers

For details of nozzles see dwg. 277-3200-72 (Typ. only)

Baffles - 4 off eq. spaced on circ. St. St. Bracket Supports



N_1 - 6" Ø Vent

N_2 - Instr. Conn. 2"

N_3 - 6" Scuttling Drain

N_4 - 1" Instr. Conn

N_5 - Inlets (Holes in roof)

N_6 - Laundered outlet

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-2-0
SERVICE	Pulp cooler tank
No. UNITS	1
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	15ft.
SHELL DIAMETER	15ft.
~~DESIGN PRESSURE~~ WORKING VOL.	15,000 Gal.
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	50°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	

MATERIALS OF CONSTRUCTION

SHELL)	
LINING)	Wood - C.T. Pine or Western Red Cedar
SUPPORTS)	Typ. details see E.Z. Dwg. Std. 128 & 183
INTERNALS)	

REMARKS

Material being handled

Basics Pulp

pH 5.6 - 7.0

SG 1.2

Tank to have internal cooling coils (not vendor supply)

agitator (not vendor supply)

No Baffles. Tank to have wood pine cover.

For details of nozzles see dwg. 277-3200-72 (typ. only)

N_1 - 6" Ø Vent

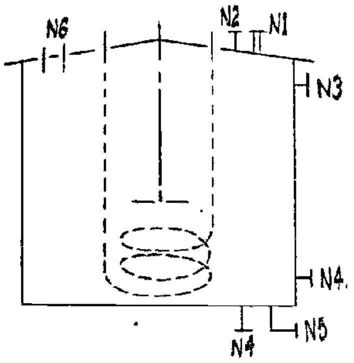
N_2 - Instr. Conn. 1"

N_3 - 6" Overflow

N_4 - 6" Outlet

N_5 - 6" Scuttling Drain

N_6 - Inlets (holes in roof)



TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-5-0
SERVICE	Basics Slurry Tank
No. UNITS	1
SPECIFICATION	Refer 418/4 - 3200 - S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	6ft.
SHELL DIAMETER	6ft.
~~DESIGN PRESSURE~~ WORKING VOL.	800 GAL
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	60° - 80°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	
LINING	Wood - C.T. Pine or Western Red Cedar
SUPPORTS	Typ. Details See EZ Dwg. Std. 128 & 183
INTERNALS	

REMARKS

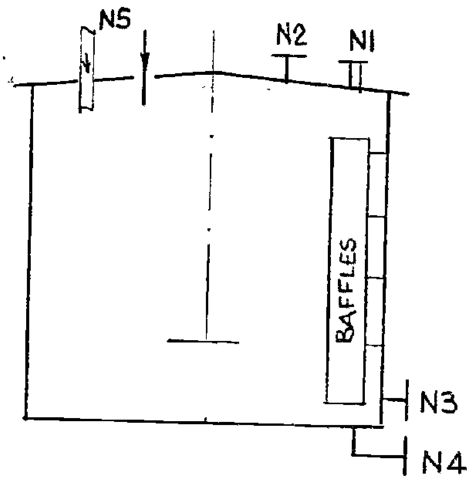
Material Being Handled

Basics Slurry	Viscosity of	Rel. 3.8 ±70%
pH 5.6 - 6.5	Soln.	Abs. 1.6 CP ±50%
SG 1.26		

Severely abrasive solids in suspension

Tank to have wood pine covers

For details of nozzles see Dwg. 277-3200-72 (Typ. only)



N_1 - 4" Ø Vent

N_2 - Instr. Conn. 2"

N_3 - 4" outlet

N_4 - Scuttling Drain 6"Ø

N_5 - Inlets (hole in roof)

Baffles 4 off eq. spaced circ. St. St. Bracket supports

TANK AND VESSEL SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	10-7-0
SERVICE	Basics Slurry Storage Tank
No. UNITS	1
SPECIFICATION	
DESIGN CODE	
XXXXXXXXXXXX HEIGHT	16 ft.
SHELL DIAMETER	14 ft.
DESIGN PRESSURE	
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	60° - $80^{\circ}C$
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	Wood C.T. Pine or Western Red Cedar
SUPPORTS)	Typ. details see EZ Dwg. STD 128 & 183
INTERNALS)	Nozzle details see Dwg. 277-3200-72 Typ. only

REMARKS Material being handled

Basics slurry

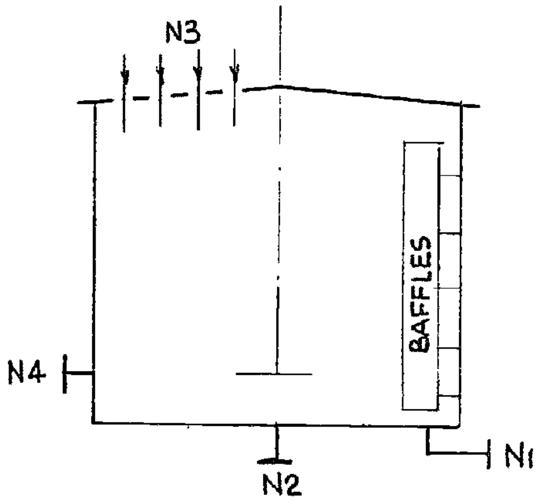
pH 5.6 - 6.5

SG 1.26

Severely abrasive solids in suspension

Tank to have wood pine roof

Baffles 4 off eq. spaced St. St. support brackets



N_1 - 6" Ø Scuttling Drain
N_2 - 6" Ø outlet
N_3 - Inlets (holes in roof)
N_4 - 4" Instr. Conn

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

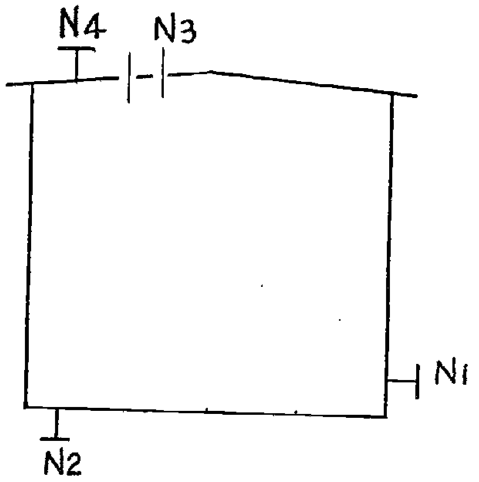
PROPOSAL No.	418/4
EQUIPMENT No.	12-3-0
SERVICE	Feed Water Tank
No. UNITS	1
SPECIFICATION	
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	11 ft.
SHELL DIAMETER	11 ft.
~~DESIGN PRESSURE~~ CAPACITY	6,000 GAL
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	To be primed and epoxy coated on inside
SUPPORTS)	Mild Steel
INTERNALS)	

REMARKS

Material Being Handled   Filtered Towns Water

Tank to have roof

N_1 - 3" outlet
N_2 - 2" drain
N_3 - Inlet (holes in roof)
N_4 - 2" instr. Conn.



TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	13-1-0
SERVICE	Nickel Purifier Tank
No. UNITS	1
SPECIFICATION	
DESIGN CODE	
SHELL ~~LENGTH~~ HEIGHT	23 ft.
SHELL DIAMETER	22 ft.
DESIGN PRESSURE	
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	Mild Steel
LINING	Lead & A/R Brick Lined
SUPPORTS	
INTERNALS	

REMARKS

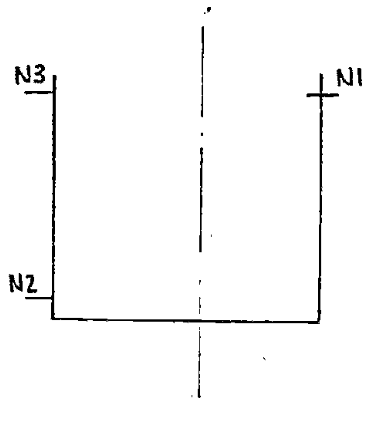
Identical to exist ni. purifier in residue treat. div.
Refer EZ. Dwgs. E5-1283, 84, 97,98, 99.

TANK AND VESSEL SPECIFICATION DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	14-3-0
SERVICE	Seal Water Tank
No. UNITS	1
SPECIFICATION	
DESIGN CODE	
SHELL LENGTH	4'6"
SHELL DIAMETER	4'
DESIGN PRESSURE	
WORKING PRESSURE	Atmos.
DESIGN TEMPERATURE	"
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	M.S.
SUPPORTS)	Galv.
INTERNALS)	

REMARKS

Handling Mains Water



N_1 - 2" Inlet

N_2 - 2" Outlet

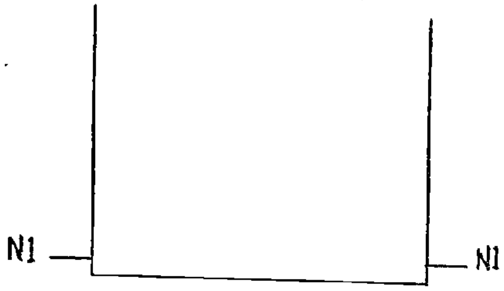
N_3 - 2" O/F

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	14-8-0
SERVICE	Wash water head tank
No. UNITS	1
SPECIFICATION	
DESIGN CODE	
SHELL LENGTH	7 ft.
SHELL DIAMETER	8 ft.
~~DESIGN PRESSURE~~ WORKING VOL.	2000 Gal.
WORKING PRESSURE	
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	Fibreglass reinforced plastic.
LINING)	
SUPPORTS)	
INTERNALS)	

REMARKS



N_1 - 1½" outlet

PROPOSAL No.	418/4
EQUIPMENT No.	Pumps
SERVICE	Standard Specification
No. UNITS	

1. This specification provides for the design, construction, testing and supply to site (Risdon Tasmania) of pumps.

2. The pumps shall be suitable for continuous duty unless specified otherwise.

3. The materials of construction are as specified on the data sheet.
Where materials have not be specified on the data sheet, the Tenderer shall select, and specify in detail, the materials most suitable for the particular service conditions. Materials selected shall comply with established Standards or Codes.

4. For details and characteristics of solutions as stated on pump data sheets, see attached sheets.

5. In general, pumps are specified as having low internal velocities, slow speed, good clearances and low port velocities. It is desirable that all pulp pumps should have belt drives to allow changes in speed, and no mechanical seals are acceptable.

6. Motors:
The preferred makes of motors are G.E.C., A.E.I., and Pope.

Metric sizes are required.
Motors to be T.E.F.C. weatherproof.
4 pole motors only to be used.
Geared motors are to be A.E.I. Barlow make.

PROPOSAL No. 418/4

EQUIPMENT No. Pumps

SERVICE

No. UNITS

PUMP SUMMARY

		No.off
1- 4-0	Hydrocyclone Feed (Ore)	2
2- 3-0	" " L/S	2
2- 5-0	Limestone Pulp Feed	2
3- 2-0	Calcine Pulp	2
7- 4-0	Primary Filtrate	2
8- 6-0	Silica Residue	2
8- 7-0	Wash Filtrate	2
9- 1-5	Filter Feed	2
9- 5-0	Return Cake	2
9- 7-0	GE. Filtrate	2
9-10-0	Basics Feed (GE)	2
10- 3-0	Basics Filter Feed	2
10- 6-0	Basics Slurry	2
10- 8-0	Basics Feed	2
10-10-0	Discard Solution	2
10-11-1	Cooling Water	1
12- 2-1	Deaerator Feed Water	2
12- 3-1	Boiler Feed Water	2
12- 4-1	" " Oil	2
14- 2-0	Sump Pump	4
14- 4-0	Portable Sump Pump	1
4- 2-0	Acid	2
10-13-0	Calcine Pulp	2
16- 1-0	Preneutralisation Thickener O/Flow	2

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4		
EQUIPMENT No.	1-4-0		
SERVICE	Hydrocyclone feed pump		
No. UNITS	2		

OPERATING CONDITIONS

LIQUID	Ground ore pulp		
ANALYSIS			
VISCOSITY REL 1.58	1.8 C.P.		
SPECIFIC GRAVITY $1.85^{+.3}_{-.85}$		TEMPERATURE	10°-30°C
CAPACITY PER UNIT	NORMAL 40 GPM	DESIGN	
PRESSURES	INLET Flooded suction	OUTLET	100' Head of liquid

SPECIFICATION

TYPE PUMP	
BEARINGS	
LUBRICATION OF PUMP BEARINGS	
SHAFT SEAL	
TYPE BASEPLATE	
ABSORBED SHAFT H.P.	
PUMP SPEED	
INSTALLED MOTOR H.P.	
TYPE DRIVE	
DRIVE TRANSMISSION	

MATERIALS OF CONSTRUCTION

CASING	Rubber lined
SHAFT	St. St.
IMPELLER	Rubber covered
SHAFT SLEEVES	
SHAFT SEAL	

REMARKS

Material being handled

Course solids settle rapidly

Solids severely abrasive

Suspended in dilute $ZnSO_4$ Soln. (Zn approx. 40 gm/L)

pH 5.6

CENTRIFUGAL PUMP SPECIFICATION DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4		
EQUIPMENT No.	2-3-0		
SERVICE	Hydrocyclone feed pump		
No. UNITS	2		
OPERATING CONDITIONS			
LIQUID	Limestone pulp		
ANALYSIS			
VISCOSITY			
SPECIFIC GRAVITY	1.66 (pulp)	2.93 (L/S)	TEMPERATURE 5^{o}-30^{o}C
CAPACITY PER UNIT	NORMAL 20 GPM		DESIGN
PRESSURES	INLET Flooded suction		OUTLET 100' head of Fluid
SPECIFICATION			
TYPE PUMP			
BEARINGS			
LUBRICATION OF PUMP BEARINGS			
SHAFT SEAL			
TYPE BASEPLATE			
ABSORBED SHAFT H.P.			
PUMP SPEED			
INSTALLED MOTOR H.P.			
TYPE DRIVE			
DRIVE TRANSMISSION			
MATERIALS OF CONSTRUCTION			
CASING	C.I. Rubber Lined		
SHAFT			
IMPELLER	Rubber covered		
SHAFT SLEEVES			
SHAFT SEAL			

REMARKS

Material Being Handled

10# of solids/1 gal of pulp

pH 7

moderately abrasive

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No. 418/4

EQUIPMENT No. 2-5-0

SERVICE Limestone Pulp Feed Pump

No. UNITS 2

OPERATING CONDITIONS

~~LIQUID~~ Limestone/Water Pulp

ANALYSIS

VISCOSITY

SPECIFIC GRAVITY 1.66 (Pulp) 2.93 (L/S) TEMPERATURE 5°-30°C

CAPACITY PER UNIT NORMAL 24 G.P.M. DESIGN

PRESSURES INLET Flooded Suction OUTLET 37 ft. head ~~of fluid~~

SPECIFICATION

TYPE PUMP

BEARINGS

LUBRICATION OF PUMP BEARINGS

SHAFT SEAL

TYPE BASEPLATE

ABSORBED SHAFT H.P.

PUMP SPEED

INSTALLED MOTOR H.P.

TYPE DRIVE

DRIVE TRANSMISSION

MATERIALS OF CONSTRUCTION

CASING C.I. Rubber Lined

SHAFT

IMPELLER Rubber Covered

SHAFT SLEEVES

SHAFT SEAL

REMARKS

Material Being Handled

10# of solids/1 Gal of Pulp

PH ≃ 7

Moderately abrasive

CENTRIFUGAL PUMP SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4				
EQUIPMENT No.	3-2-0				
SERVICE	Calcine Pulp Pump				
No. UNITS	2				
OPERATING CONDITIONS					
LIQUID	Calcine Pulp				
ANALYSIS					
VISCOSITY					
SPECIFIC GRAVITY	1.7			TEMPERATURE	15°-20°
CAPACITY PER UNIT		NORMAL	6.7 G.P.M.	~~DESIGN~~	Max. 10 GPM
PRESSURES		INLET	Flooded Solution 10'-1'	OUTLET	23' Head of Liquid
SPECIFICATION					
TYPE PUMP					
BEARINGS					
LUBRICATION OF PUMP BEARINGS					
SHAFT SEAL					
TYPE BASEPLATE					
ABSORBED SHAFT H.P.					
PUMP SPEED					
INSTALLED MOTOR H.P.					
TYPE DRIVE					
DRIVE TRANSMISSION					
MATERIALS OF CONSTRUCTION					
CASING	C.I. Rubber Lined				
SHAFT					
IMPELLER	Rubber Covered				
SHAFT SLEEVES					
SHAFT SEAL					

REMARKS

Material Being Handled Calcine Pulp

Abrasive solids

50% Solids

850 G/L

CENTRIFUGAL PUMP SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4		
EQUIPMENT No.	4-2-0		
SERVICE	Acid Pumps		
No. UNITS	2		
OPERATING CONDITIONS			
LIQUID	98.6% $H_2 SO_4$		
ANALYSIS			
VISCOSITY			
SPECIFIC GRAVITY	1.84		TEMPERATURE $20^{\circ}-40^{\circ}C$
CAPACITY PER UNIT		NORMAL 3 G.P.M.	MAX. ~~DESIGN~~ 4 G.P.M.
PRESSURES		INLET Flooded Suction	OUTLET 50' Head of Liquid
SPECIFICATION			
TYPE PUMP			
BEARINGS			
LUBRICATION OF PUMP BEARINGS			
SHAFT SEAL			
TYPE BASEPLATE			
ABSORBED SHAFT H.P.			
PUMP SPEED			
INSTALLED MOTOR H.P.			
TYPE DRIVE			
DRIVE TRANSMISSION			
MATERIALS OF CONSTRUCTION			
CASING)			
SHAFT)	Suitable for acid duty		
IMPELLER)	316 St. St.		
SHAFT SLEEVES)			
SHAFT SEAL			

REMARKS

CENTRIFUGAL PUMP SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	7-4-0
SERVICE	Primary Filtrate Pump
No. UNITS	2

OPERATING CONDITIONS

XXXXXX Coagulation Filtrate + Acid Repulp Recoagulation Filtrate

ANALYSIS

VISCOSITY 3.7 Relative 1.7 C.P.

SPECIFIC GRAVITY 1.29 TEMPERATURE

CAPACITY PER UNIT NORMAL 270 G.P.M. MAX. ~~DESIGN~~ 340 GPM

PRESSURES INLET Flooded Suction OUTLET 52' Head of Liquid

SPECIFICATION

TYPE PUMP

BEARINGS

LUBRICATION OF PUMP BEARINGS

SHAFT SEAL

TYPE BASEPLATE

ABSORBED SHAFT H.P.

PUMP SPEED

INSTALLED MOTOR H.P.

TYPE DRIVE

DRIVE TRANSMISSION

MATERIALS OF CONSTRUCTION

CASING)	
SHAFT)	
IMPELLER)	St. St.
SHAFT SLEEVES)	
SHAFT SEAL)	

REMARKS

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4	
EQUIPMENT No.	8-6-0	
SERVICE	Silica Residue Pump	
No. UNITS	2	
OPERATING CONDITIONS		
LIQUID	Silica Residue	
ANALYSIS		
VISCOSITY		
SPECIFIC GRAVITY		TEMPERATURE 40°-60°C
CAPACITY PER UNIT	NORMAL 83 GPM	MAX.~~XXXXXX~~ DESIGN 104 GPM
PRESSURES	INLET Flooded suction 8'-2'	OUTLET 23' Head of ~~Liquid~~
SPECIFICATION		
TYPE PUMP		
BEARINGS		
LUBRICATION OF PUMP BEARINGS		
SHAFT SEAL		
TYPE BASEPLATE		
ABSORBED SHAFT H.P.		
PUMP SPEED		
INSTALLED MOTOR H.P.		
TYPE DRIVE		
DRIVE TRANSMISSION		
MATERIALS OF CONSTRUCTION		
CASING	Rubber lined	
SHAFT		
IMPELLER	Rubber covered	
SHAFT SLEEVES		
SHAFT SEAL		

REMARKS

Material being handled

50-80 #/cu. ft.

38% solids

Glutinous slurry

pH 5.2

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4				
EQUIPMENT No.	8-7-0				
SERVICE	Wash Filtrate				
No. UNITS	2				
OPERATING CONDITIONS					
LIQUID	Wash Filtrate				
ANALYSIS					
VISCOSITY					
SPECIFIC GRAVITY	1.11			TEMPERATURE	10°-30°C
CAPACITY PER UNIT		NORMAL	74 G.P.M.	MAX.	120 GPM
PRESSURES		INLET	Flooded Suction	OUTLET	72' Head of liquid
SPECIFICATION					
TYPE PUMP					
BEARINGS					
LUBRICATION OF PUMP BEARINGS					
SHAFT SEAL					
TYPE BASEPLATE					
ABSORBED SHAFT H.P.					
PUMP SPEED					
INSTALLED MOTOR H.P.					
TYPE DRIVE					
DRIVE TRANSMISSION					
MATERIALS OF CONSTRUCTION					
CASING	)				
SHAFT	)				
IMPELLER	) 316St. St.				
SHAFT SLEEVES	)				
SHAFT SEAL	)				

REMARKS

Material Being Handled

Corrosive No Solids

Equivalent to impure solution

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4			
EQUIPMENT No.	9-1-5			
SERVICE	Filter Feed Pump			
No. UNITS	2			
OPERATING CONDITIONS				
LIQUID	Germanium Purifier Pulp			
ANALYSIS				
VISCOSITY	2.0 C.P.	3.25 REL.		
SPECIFIC GRAVITY	1.26		TEMPERATURE	39°-59°C
CAPACITY PER UNIT	NORMAL	285 G.P.M.	MAX.~~DESIGN~~	360 G.P.M.
PRESSURES	INLET	Flooded Suction	OUTLET	32' Head of Liquid
SPECIFICATION				
TYPE PUMP				
BEARINGS				
LUBRICATION OF PUMP BEARINGS				
SHAFT SEAL				
TYPE BASEPLATE				
ABSORBED SHAFT H.P.				
PUMP SPEED				
INSTALLED MOTOR H.P.				
TYPE DRIVE				
DRIVE TRANSMISSION				
MATERIALS OF CONSTRUCTION				
CASING)				
SHAFT)				
IMPELLER)	316 St. St.			
SHAFT SLEEVES)				
SHAFT SEAL)				

REMARKS

Moderately Abrasive

.17# Solids/Gal Pulp

pH 4.8 - 6.0

CENTRIFUGAL PUMP SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	9-5-0
SERVICE	Return Cake Pump
No. UNITS	2
OPERATING CONDITIONS	
LIQUID	Germanium Precipitate
ANALYSIS	
VISCOSITY	
SPECIFIC GRAVITY	1.55 TEMPERATURE 45°-60°C
CAPACITY PER UNIT	NORMAL MAX. ~~DESIGN~~ 100 G.P.M.
PRESSURES	INLET Flooded Suction 8'-2 OUTLET 23' Head of Liquid
SPECIFICATION	
TYPE PUMP	
BEARINGS	
LUBRICATION OF PUMP BEARINGS	
SHAFT SEAL	
TYPE BASEPLATE	
ABSORBED SHAFT H.P.	
PUMP SPEED	
INSTALLED MOTOR H.P.	
TYPE DRIVE	
DRIVE TRANSMISSION	
MATERIALS OF CONSTRUCTION	
CASING	C.I. Rubber Lined
SHAFT	316 St. St.
IMPELLER	Rubber Covered
SHAFT SLEEVES	316 St. St.
SHAFT SEAL	

REMARKS

Material Being Handled

Moderately abrasive

5# solids/Gall of pulp

pH 5-5.4

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4	
EQUIPMENT No.	9-7-0	
SERVICE	Filtrate Pump	
No. UNITS	2	
OPERATING CONDITIONS		
LIQUID	Germanium Purified Solution	
ANALYSIS		
VISCOSITY	3.35 REL 2.0 C.P.	
SPECIFIC GRAVITY	1.27	TEMPERATURE
CAPACITY PER UNIT	NORMAL 286 G.P.M.	MAX. ~~DESIGN~~ 358 G.P.M.
PRESSURES	INLET Flooded Suction 7'-2'	OUTLET 40' Head of Liquid
SPECIFICATION		
TYPE PUMP		
BEARINGS		
LUBRICATION OF PUMP BEARINGS		
SHAFT SEAL		
TYPE BASEPLATE		
ABSORBED SHAFT H.P.		
PUMP SPEED		
INSTALLED MOTOR H.P.		
TYPE DRIVE		
DRIVE TRANSMISSION		
MATERIALS OF CONSTRUCTION		
CASING	316 St. St.	
SHAFT		
IMPELLER		
SHAFT SLEEVES		
SHAFT SEAL		

REMARKS

Material Being Handled

No solids

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4	
EQUIPMENT No.	9-10-0	
SERVICE	Basics Section Feed pump	
No. UNITS	2	
OPERATING CONDITIONS		
LIQUID	Germanium Purified Solution	
ANALYSIS		
VISCOSITY	3.35 REL. 2.0 C.P.	
SPECIFIC GRAVITY	1.27	TEMPERATURE 85°C
CAPACITY PER UNIT	NORMAL 72.5 G.P.M.	MAX. ~~DESIGN~~ 91 GPM
PRESSURES	INLET Flooded Suction 8'-2'	OUTLET 78' Head of Liquid
SPECIFICATION		
TYPE PUMP		
BEARINGS		
LUBRICATION OF PUMP BEARINGS		
SHAFT SEAL		
TYPE BASEPLATE		
ABSORBED SHAFT H.P.		
PUMP SPEED		
INSTALLED MOTOR H.P.		
TYPE DRIVE		
DRIVE TRANSMISSION		
MATERIALS OF CONSTRUCTION		
CASING)		
SHAFT)		
IMPELLER)	316 St. St.	
SHAFT SLEEVES)		
SHAFT SEAL)		

REMARKS

Material Being Handled

No solids

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4	
EQUIPMENT No.	10-3-0	
SERVICE	Basics Filter Feed Pump	
No. UNITS	2	
OPERATING CONDITIONS		
LIQUID	Basics Pulp	
ANALYSIS		
VISCOSITY	2.2 - 1.5 REL	.7 - .5 CP
SPECIFIC GRAVITY	1.2	TEMPERATURE 40°-60°C
CAPACITY PER UNIT	NORMAL 153 GPM	MAX~~DESIGN~~ 208 GPM
PRESSURES	INLET Flooded Suction 12'-2'	OUTLET 32' Head of Liquid
SPECIFICATION		
TYPE PUMP		
BEARINGS		
LUBRICATION OF PUMP BEARINGS		
SHAFT SEAL		
TYPE BASEPLATE		
ABSORBED SHAFT H.P.		
PUMP SPEED		
INSTALLED MOTOR H.P.		
TYPE DRIVE		
DRIVE TRANSMISSION		
MATERIALS OF CONSTRUCTION		
CASING	C.I. Rubber Lined	
SHAFT	316 St. St.	
IMPELLER	Rubber Covered	
SHAFT SLEEVES	316 St. St.	
SHAFT SEAL		

REMARKS

Material Being Handled

Severely abrasive

Settled solids can fomaccretions - Flushing facilities required

¼" build up possible.

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.		418/4		
EQUIPMENT No.		10-6-0		
SERVICE		Basics Slurry Pump		
No. UNITS		2		
OPERATING CONDITIONS				
LIQUID		Basics Slurry		
ANALYSIS				
VISCOSITY	REL 3.8 ±20%	1.6 CP ±50%		
SPECIFIC GRAVITY		1.26	TEMPERATURE	
CAPACITY PER UNIT	NORMAL	58 GPM	MAX.~~DESIGN~~	87 GPM
PRESSURES	INLET	Flooded suction	OUTLET	41' Head of Liquid
SPECIFICATION				
TYPE PUMP				
BEARINGS				
LUBRICATION OF PUMP BEARINGS				
SHAFT SEAL				
TYPE BASEPLATE				
ABSORBED SHAFT H.P.				
PUMP SPEED				
INSTALLED MOTOR H.P.				
TYPE DRIVE				
DRIVE TRANSMISSION				
MATERIALS OF CONSTRUCTION				
CASING		M.S. Rubber Covered		
SHAFT	316	St. St.		
IMPELLER		Rubber Covered		
SHAFT SLEEVES				
SHAFT SEAL				

REMARKS

Material being handled

Severely abrasive solids in suspension

pH 5.6 - 6.5

5.3 #/GAL solids

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	Basics Feed Pumps
EQUIPMENT No.	10-8-0
SERVICE	Basics Feed Pumps
No. UNITS	2
OPERATING CONDITIONS	
LIQUID	Basics Slurry
ANALYSIS	
VISCOSITY REL 3.8 ±20%	1.6 CP ±50%
SPECIFIC GRAVITY 1.26 5.3 #/GAL solids	TEMPERATURE 60°-80°C
CAPACITY PER UNIT	NORMAL 87 gpm MAX. DESIGN XXXXXX 87 GPM
PRESSURES	INLET Flooded suction 14'-3' OUTLET 38' Head of Liquid
SPECIFICATION	
TYPE PUMP	
BEARINGS	
LUBRICATION OF PUMP BEARINGS	
SHAFT SEAL	
TYPE BASEPLATE	
ABSORBED SHAFT H.P.	
PUMP SPEED	
INSTALLED MOTOR H.P.	
TYPE DRIVE	
DRIVE TRANSMISSION	
MATERIALS OF CONSTRUCTION	
CASING	C.I. Rubber Lined
SHAFT	St. St.
IMPELLER	Rubber lined
SHAFT SLEEVES	
SHAFT SEAL	

REMARKS

Severely abrasive solids in suspension.

CENTRIFUGAL PUMP SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4			
EQUIPMENT No.	10-10-0			
SERVICE	Discard Solution Pump			
No. UNITS	2			
OPERATING CONDITIONS				
LIQUID	Discard Solution			
ANALYSIS				
VISCOSITY 1.5 REL	0.9 C.P. ABS			
SPECIFIC GRAVITY	1.09		TEMPERATURE	33°-57°
CAPACITY PER UNIT	NORMAL	155 GPM	DESIGN	
PRESSURES	INLET	Flooded Suction	OUTLET	34' Head of liquid
SPECIFICATION				
TYPE PUMP				
BEARINGS				
LUBRICATION OF PUMP BEARINGS				
SHAFT SEAL				
TYPE BASEPLATE				
ABSORBED SHAFT H.P.				
PUMP SPEED				
INSTALLED MOTOR H.P.				
TYPE DRIVE				
DRIVE TRANSMISSION				
MATERIALS OF CONSTRUCTION				
CASING)				
SHAFT)				
IMPELLER)	316 St. St.			
SHAFT SLEEVES)				
SHAFT SEAL)				

REMARKS

Material being handled

No solids

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4	
EQUIPMENT No.	10-11-1	
SERVICE	Cooling Water Pumps	
No. UNITS	1	
OPERATING CONDITIONS		
LIQUID	Water	
ANALYSIS		
VISCOSITY		
SPECIFIC GRAVITY		TEMPERATURE
CAPACITY PER UNIT	NORMAL 433 GPM	MAX. ~~DESIGN~~ 483 GPM
PRESSURES	INLET Flooded suction	OUTLET 78ft. head
SPECIFICATION		
TYPE PUMP		
BEARINGS		
LUBRICATION OF PUMP BEARINGS		
SHAFT SEAL		
TYPE BASEPLATE		
ABSORBED SHAFT H.P.		
PUMP SPEED		
INSTALLED MOTOR H.P.		
TYPE DRIVE		
DRIVE TRANSMISSION		
MATERIALS OF CONSTRUCTION		
CASING	Cast Iron	
SHAFT	St. St.	
IMPELLER	Cast Iron	
SHAFT SLEEVES	St. St.	
SHAFT SEAL		

REMARKS

Hot water - may have additives - Cl, Cu.

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.		418/4		
EQUIPMENT No.		10-13-0		
SERVICE		Calcine Pulp Pumps		
No. UNITS		2		
OPERATING CONDITIONS				
LIQUID		Calcine Pulp		
ANALYSIS				
VISCOSITY				
SPECIFIC GRAVITY		1.6 - 1.7 (Pulp), 5 (solids)	TEMPERATURE	to 80°C
CAPACITY PER UNIT	NORMAL	120 GPM	MAX.~~DESIGN~~	140 GPM
PRESSURES	INLET	Flooded Suction	OUTLET	50' Head of Fluid
SPECIFICATION				
TYPE PUMP				
BEARINGS				
LUBRICATION OF PUMP BEARINGS				
SHAFT SEAL				
TYPE BASEPLATE				
ABSORBED SHAFT H.P.				
PUMP SPEED				
INSTALLED MOTOR H.P.				
TYPE DRIVE				
DRIVE TRANSMISSION				
MATERIALS OF CONSTRUCTION				
CASING		CI Rubber Lined		
SHAFT		Stainless Steel		
IMPELLER		Rubber covered		
SHAFT SLEEVES				
SHAFT SEAL				

REMARKS

Quantity of solids, 300-500 gm/litre

pH - 5.6

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4			
EQUIPMENT No.	12-2-1			
SERVICE	Deaerator Feed Water Pump			
No. UNITS	2			
OPERATING CONDITIONS				
LIQUID	Treated Water			
ANALYSIS				
VISCOSITY				
SPECIFIC GRAVITY			TEMPERATURE	
CAPACITY PER UNIT	NORMAL		DESIGN	30 GPM
PRESSURES	INLET	Flooded suction	OUTLET	50 psig
SPECIFICATION				
TYPE PUMP				
BEARINGS				
LUBRICATION OF PUMP BEARINGS				
SHAFT SEAL				
TYPE BASEPLATE				
ABSORBED SHAFT H.P.				
PUMP SPEED				
INSTALLED MOTOR H.P.				
TYPE DRIVE				
DRIVE TRANSMISSION				
MATERIALS OF CONSTRUCTION				
CASING	Cast Iron			
SHAFT	St. St.			
IMPELLER	Cast Iron			
SHAFT SLEEVES				
SHAFT SEAL				

REMARKS

CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4				
EQUIPMENT No.	14-2-0				
SERVICE	Sump Pumps				
No. UNITS	4				

OPERATING CONDITIONS

LIQUID					
ANALYSIS					
VISCOSITY					
SPECIFIC GRAVITY	1.5 SG.			TEMPERATURE	60°C
CAPACITY PER UNIT		NORMAL	50 G.P.M.	DESIGN	
PRESSURES		INLET		OUTLET	55' Head of Liquid

SPECIFICATION

TYPE PUMP	
BEARINGS	
LUBRICATION OF PUMP BEARINGS	
SHAFT SEAL	
TYPE BASEPLATE	
ABSORBED SHAFT H.P.	
PUMP SPEED	
INSTALLED MOTOR H.P.	
TYPE DRIVE	
DRIVE TRANSMISSION	

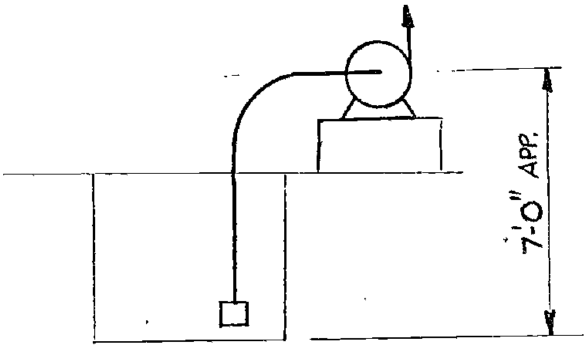
MATERIALS OF CONSTRUCTION

CASING	)
SHAFT	)
IMPELLER	) 316 St. St.
SHAFT SEEVES	)
SHAFT SEAL	)

REMARKS To handle various solutions and pulps

SG. 1.5

(Aus.Chalmers) 2" x 2" x 10 SRL Or Equivalent



CENTRIFUGAL PUMP SPECIFICATION

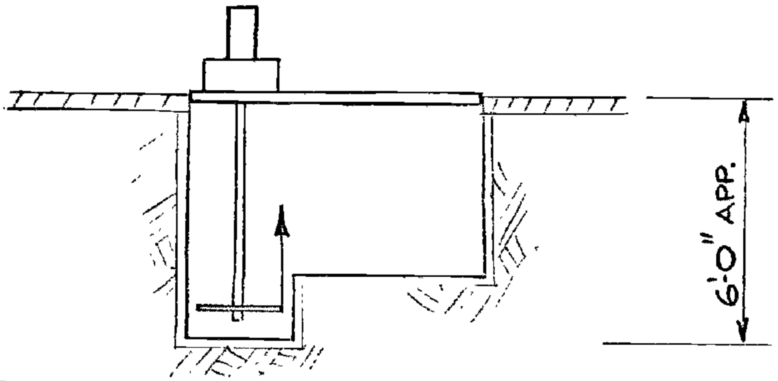
DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4			
EQUIPMENT No.	14-4-0			
SERVICE	Portable Sump Pump			
No. UNITS	1			
OPERATING CONDITIONS				
LIQUID				
ANALYSIS				
VISCOSITY				
SPECIFIC GRAVITY	1.1 - 1.8		TEMPERATURE	60°C
CAPACITY PER UNIT	NORMAL	150 G.P.M.	DESIGN	
PRESSURES	INLET	Flooded Suction	OUTLET	30' Head of Liquid
SPECIFICATION				
TYPE PUMP				
BEARINGS				
LUBRICATION OF PUMP BEARINGS				
SHAFT SEAL				
TYPE BASEPLATE				
ABSORBED SHAFT H.P.				
PUMP SPEED				
INSTALLED MOTOR H.P.				
TYPE DRIVE				
DRIVE TRANSMISSION				
MATERIALS OF CONSTRUCTION				
CASING	Durimet 20			
SHAFT	317 S.S.			
IMPELLER	Durimet 20			
SHAFT SLEEVES				
SHAFT SEAL				

REMARKS

Pump to be portable and suitable for use in sumps, tanks etc.

Equiv. to Harland 3/3 VSC 3.



CENTRIFUGAL PUMP SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4		
EQUIPMENT No.	16-1-0		
SERVICE	Preneutralisation thickener O/flow pumps		
No. UNITS	2		
OPERATING CONDITIONS			
LIQUID	Pre Neutralization thickener overflow		
ANALYSIS	See remarks		
VISCOSITY	3-4 relative to water		
SPECIFIC GRAVITY	1.3		TEMPERATURE 70° - 95°C
CAPACITY PER UNIT		NORMAL 9 G.P.M.	MAX. ~~DESIGN~~ 12 GPM
PRESSURES		INLET Flooded Suction	OUTLET 45' head of Fluid
SPECIFICATION			
TYPE PUMP			
BEARINGS			
LUBRICATION OF PUMP BEARINGS			
SHAFT SEAL			
TYPE BASEPLATE			
ABSORBED SHAFT H.P.			
PUMP SPEED			
INSTALLED MOTOR H.P.			
TYPE DRIVE			
DRIVE TRANSMISSION			
MATERIALS OF CONSTRUCTION			
CASING	316 or 317 St. St.	(317 preferred)	
SHAFT	"	"	
IMPELLER	"	"	
SHAFT SLEEVES			
SHAFT SEAL			

REMARKS Material being handled.

Consist of corrosive aqueous solution of zinc sulphate, ferric, ferrous, and copper sulphates containing 10-30 gram. H_2SO_4/Litre. Mn, Mg, F, Cl etc., also present plus up to 2 grams solids/litre.

Although design at max. capacity rate is recommended, pump must be capable of operating down to 2 G.P.M.

PROPOSAL No.	418/4
EQUIPMENT No.	See specs.
SERVICE	Agitators
No. UNITS	-

1. This specification provides for the design, construction, testing and supply to site (Risdon, Tasmania) of agitators.

2. The agitators shall be suitable for continuous duty unless otherwise specified.

3. The materials of construction are as specified on the data sheet.

   Where materials have not been specified on the data sheet, the Tenderer shall select, and specify in detail, the materials most suitable for the particular service conditions. Materials selected shall comply with established standards or codes.

4. For details and characteristics of solutions as stated on agitator data sheets, see attached sheets.

5. Baffles will be provided in all tanks by tank manufacturer:
   4 off per tank equally spaced on tank circumference; 10% tank dia., 1/26th tank dia. clear from walls and bottom.

6. Motors:
   The preferred makes of motors are G.E.C., A.E.I. and Pope.
   Metric sizes are required.
   Motors to be T.E.F.C. weatherproof
   4 pole motors only to be used.
   Geared motors are preferred to be A.E.I. Barlow type.

PROPOSAL No.	418/4
EQUIPMENT No.	2-4-1
SERVICE	Limestone Pulp Tank Agitator
No. UNITS	1

Duty: To maintain a suspension of limestone and water pulp suitable for pumping.

Specific Gravity:- 1.66 (pulp) 2.93 (L/S) pH:- 7

Temperature :- 5° - 30°C

Tank Details See Spec. - 2-4-0

Capacity :- 8,500 GAL.

Dim's :- 12'0 x 12'

Construction Materials

Impeller and Lower Shafts :- M.S.

Upper Shafts & Rigid Couplings:- M.S.

Dim's from underside unit to mid. depth impeller:- 10'6"

Dim's from mid depth impeller to Bot. of tank :- 2'6"

Material being handled

Limestone/Water Pulp

Moderately abrasive

Solids tend to settle and difficult to resuspend.

H.P. Required:- 10

PROPOSAL No.	418/4
EQUIPMENT No.	3-1-1
SERVICE	Calcine Pulp Tank Agitator
No. UNITS	1

Duty: To maintain a solution of calcine pulp suitable for pumping

Specific Gravity:- 1.7 pH 5-6

Temperature :- 15° - 20°C

Tank Details See spec. 3-1-0

Capacity :- 8,500 GAL

Dim's :- 12'0 x 12'

Construction Materials

Impeller : 316 St. St. Shaft:- M.S. Rubber covered

Upper Shafts & Rigid Couplings:- M.S.

Dim's from underside unit to mid depth impeller - 11'

Dim's from mid depth impeller to Bot. of tank - 2'

Material being handled

Calcine pulp

Pulp settles readily and is difficult to resuspend.

HP required - 3

PROPOSAL No.	418/4
EQUIPMENT No.	6-1-2
SERVICE	Leach Tank Agitator
No. UNITS	3

Duty:- To agitate solution to allow leaching reaction to proceed.

Specific Gravity :- 1.35 pH 1.0 - 1.5

Temperature :- 30° - 50°C

Tank Details see spec. 6-1-0

Capacity :- 8,000 GAL

Dim's :- 12' 0 x 12'

Construction Materials

Impeller:- 316 St. St. Shaft M.S. Rubber covered

Upper shafts and rigid couplings:- M.S.

Dim's from underside unit to mid depth impeller - 11'

Dim's from mid depth impeller to Bot. of tank - 2'

Material being handled

Leach pulp

Mildly abrasive, slightly scaling

Top entering mixer

Closed top on tank

H.P. required - 3

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	7-1-2
SERVICE	Coagulation Tank Agitator
No. UNITS	3

Duty:- To agitate solution to allow coagulation process to occur.

Specific Gravity :- 1.30 pH:- 4.8 - 5.6

Temperature :- 63° - 75°C

Tank Details see spec. 7-1-0

Capacity :- 19,300 work. vol.

Dim's :- 15'Ø x 19'

Construction Materials

Impeller :- 316 St. St. Shaft :- M.S. Rubber covered

Upper shafts and rigid couplings:- M.S.

Dim's from underside unti to mid depth impeller 17'6"

Dim's from mid depth impeller to Bot. of tank 2'6"

Top entry mixer

Closed top on tank

Material being handled

Coagulation pulp

H.P. required 10

PROPOSAL No.	418/4
EQUIPMENT No.	8-1-1
SERVICE	Acid Repulp Tank Agitator
No. UNITS	2

Duty:- To agitate pulp to allow leaching reaction to proceed.

Specific Gravity:- 1.29

Temperature :- 20° - 45°C pH:- 1.0 - 2.5

Tank Details see spec. 8-1-0

Capacity :- 4,400 work. vol.

Dim's :- 9'Ø x 11'

Construction Materials

Impeller :- 316 St. St. Shaft:- Rubber covered M.S.

Upper shafts and rigid couplings M.S.

Dim's from underside unit to mid depth impeller 10'

Dim's from mid depth impeller to Bot. of tank 2'

Top entry mixer

Closed top on tank

Material being handled

Acid repulp leach pulp

H.P. required - 10

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-2-1
SERVICE	Neutralisation/Recoagulation Tank Agitator
No. UNITS	3

Duty:- To agitate pulp to allow coagulation process to occur.

Specific Gravity:- 1.34 pH 4.8 - 5.6

Temperature :- 63° - 70°C

Tank Details see spec. 8-2-0

Capacity:- 6,000 gal. work. vol.

Dim's :- 12'0 x 12'

Construction materials

Impeller:- AISI type 316 St. St. Shaft:- Rubber covered M.S.

Upper shafts and rigid couplings:- M.S.

Dim's from underside unit to mid depth impeller :- 11'

Dim's from mid. depth impeller to bot. of tank :- 2'

Top entry mixer

Closed top on tank

Material being handled

Recoagulated pulp.

H.P. required - 15

PROPOSAL No.	418/4
EQUIPMENT No.	8-5-1
SERVICE	Final filter residue repulp tank agitator
No. UNITS	1

Duty:- To maintain a pulp of silica residue in repulp tank suitable for pumping.

Specific Gravity :- 1.1 pH - 5.2
Temperature :- 40° - 60°C

Tank Details:- See spec. 8-5-0
Capacity :- 3,200 GALL
Dim's :- 9'0 x 9'

Construction Materials
Impeller - 316 St. St. Shaft Rubber covered M.S.
Upper shafts and rigid couplings M.S.

Dim's from underside unit to mid depth impeller 8'6"
Dim's from mid depth impeller to bot. of tank 1'6"

Top entry mixer
Open top on tank

Material being handled
Silica residue
80#/cu. ft.

H.P. required - 2

SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	9-1-3
SERVICE	Purifier Agitator
No. UNITS	3

Duty To agitate solution to allow reaction similar to leaching to proceed.

Specific Gravity : 1.28 pH 4.8 - 5.6

Temperature : 45° - 60°C

Tank Details

Capacity : 15,500 Work vol.

Dim's : 15'Ø x 15'

Construction Materials

Impeller : 316 St. St. Shaft: Rubber covered M.S.

Upper shafts and rigid couplings : M.S.

Dim's from underside unit to mid depth impeller - 14'

Dim's from mid depth impeller to bot. of tank - 2'

Top entry mixer

Closed top on tank

Material being handled

Germanium purifier acid

H.P. required - 50

PROPOSAL No.	418/4
EQUIPMENT No.	9-3-1
SERVICE	Return cake repulp tank agitator
No. UNITS	1

Duty: To maintain solids in suspension in repulp tank suitable for pumping.

Specific Gravity :- 1.55

Temperature :- 45° - 60°C

Tank Details

Capacity :- 3,000 Gal. Work Cap.

Dim's :- 8'Ø x 8'

Construction Materials

Impeller : 316 St. St. Shaft :- Rubber covered M.S.

Upper shafts and rigid couplings:-M.S.

Dim's from underside unit to mid depth impeller :- 7'6"

Dim's from mid depth impeller to Bot. of tank :- 1'6"

Top entry mixer

Open top on tank

Material being handled

Germanium precipitate

600 - 700 G/L solids

pH - 5.5

H.P. required - 2

SPECIFICATION DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-1-1
SERVICE	Precipitation Tank Agitators
No. UNITS	4

Duty :- Thorough mixing and suspension of solids required.
Precipitation to occur.

Specific Gravity :- 1.2 pH 5.6 - 7.0

Temperature :- 90° - 98°C

Tank Details see spec. 10-1-0

Capacity:- 6,500 gal. working vol.

Dim's 120 x 14'

Construction Materials

Impellers :- M.S. Shaft :- M.S. Rubber covered

Upper shafts and rigid couplings :- M.S.

Dim's from underside unit to mid depth impeller :- 13'

Dim's from mid depth impeller to Bot. of tank 2'

Top Entry mixer

Closed top on tank

2 impellers per shaft required

Disc type turbine

6 straight blades 1/3 tank dia.

Material being handled

Basics pulp

H.P. required 15

PROPOSAL No.	418/4
EQUIPMENT No.	10-2-1
SERVICE	Cooler Tank Agitator
No. UNITS	1

Duty:- To maintain solids in suspension while cooling takes place.

Specific Gravity :- 1.2 pH - 6.5

Temperature :- 50°C

Tank Details See spec 10-2-0

Capacity :- 15,000 working vol.

Dim's :- 15'0 x 15'

Construction Materials

Impeller :- M.S. Shaft:- M.S. Rubber covered

Upper shafts and rigid couplings:- M.S.

Dim's from underside unit to mid depth impeller :- 13'6"

Dim's from mid depth impeller to bot. of tank :- 2'6"

Top entry mixer

Closed top on tank

Material being handled

Basics Pulp

H.P. required :- 40

PROPOSAL No.	418/4
EQUIPMENT No.	10-5-1
SERVICE	Basics slurry tank agitator
No. UNITS	1

Duty:- To maintain solids in suspension suitable for pumping

Specific gravity:- 1.26 pH 5.6 - 6.5

Temperature:- 60° - 80°C

Tank Details see spec. 10-5-0

Capacity:- 800 Gal. working vol.

Dim's 6'0 x 6'

Construction Materials

Impeller:- 316 St. St. Shaft:- Rubber covered M.S.

Upper shafts and rigid couplings:- M.S.

Dim's from underside unit to mid depth impeller - 5'6"

Dim's from mid depth impeller to bot. of tank - 1'6"

Top entry mixer

Closed top on tank

Material Being Handled

Basics slurry

Severely abrasive solids in suspension

H.P. required 2

SPECIFICATION DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-7-1
SERVICE	Basics slurry storage tank agitator
No. UNITS	1

Duty To maintain solids in suspension sutiable for pumping

Specific Gravity :- 1.26 pH 5.6 - 6.5

Temperature :- 60° - 80°C

Tank Details

Capacity :- 14,000 gal. working vol.

Dim's 14'0 x 16'

Construction Materials

Impeller :- St. St. Shaft :- Rubber Covered M.S.

Upper Shafts and rigid couplings :- M.S.

Dim's from underside unit to mid depth impeller - 15'

Dim's from mid depth impellers to bot. of tank - 2'

Top entry mixer

Closed top on tank

Material being handled

Basics slurry

5.3#/Gal. solids

Severely abrasive solids in solution.

H.P. required 7½

PROPOSAL No.	418/4
EQUIPMENT No.	13-1-1
SERVICE	Ni Purification Tank Agitator
No. UNITS	1

Duty

Specific Gravity : —

Temperature 85°C

Tank Details

Capacity 45,000 gal. working vol.

Dim's 22'0 x 23'

Construction Materials

Impeller :- St.St. 316 Shaft:- M.S. Rubber covered

Upper shafts and rigid couplings:- M.S.

Dim's from underside unit to mid depth impeller:-

Dim's from mid depth impeller to bot. of tank:-

Top entry mixer

Closed top on tank

Lightnin Model No. 8M-TBS-75.3

75 H.P. Motor

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	14-2-1
SERVICE	Drainage Sump Agitator
No. UNITS	4

Duty: Thorough mixing and suspension of solids required in drainage sump

Specific Gravity: 1.5 pH up to 7

Temperature 60°C

Tank Details

Capacity:- 35°Gal

Dim's :- 4' x 4' x 4'

Construction Materials

Impellers and lower shafts :- St. St.

Upper shafts and rigid couplings:- M.S.

Dim's from underside unit to mid depth impeller 4'

Dim's from mid depth impeller to bot. of tank 1'

Agitator suitable for use in various solutions and pumps.

Generally as per Lightnin Model No. 114-TELB - 3.3 or equiv.

H.P. required 2

PROPOSAL No.	418/4
EQUIPMENT No.	1-1-0
SERVICE	Ore Feed Bin
No. UNITS	1 required

Capacity : 300 tons total min.

Capacity Rate.: 202 tons/day

Material handled: Willemite Size: 100% -½"

Bulk Density: 147-180 lb/cu. ft. Average 161 lb. cu. ft.

Bin Construction Material : Mild steel

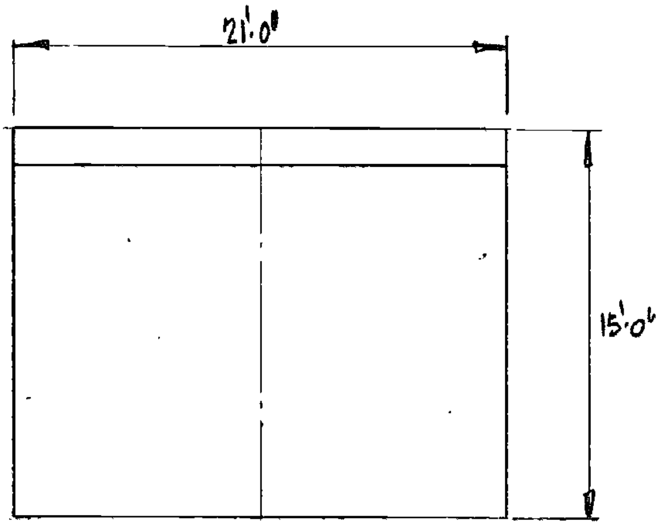
Adjustable gate outlet to be automatically controlled.

Discharge side of bin to be vertical

Max. possible slope in valleys.

Delivery by road vehicle of max. gross wt. 55 tons

Open grid at Bin Top.



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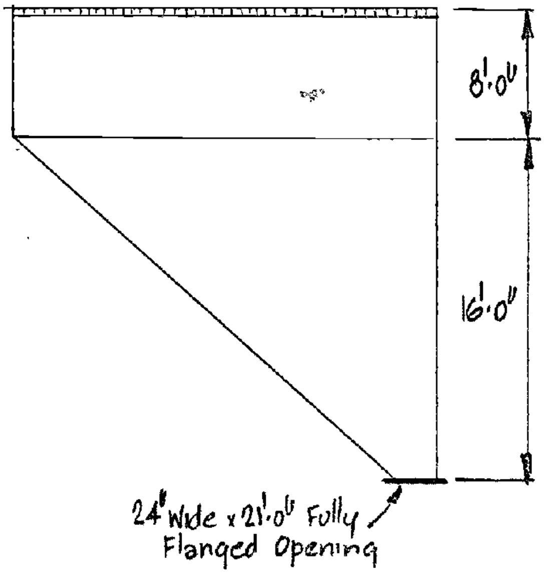


— SIDE ELEVATION. —

PROPOSAL No.	418/4
EQUIPMENT No.	1-1-1, 1-2-0
SERVICE	Ore Mill Feed Weighing/Feeding Conveyors
No. UNITS	1
OPERATING CONDITIONS	
MATERIAL HANDLED	Ore
MATERIAL CONDITIONS	
LUMP SIZE	-½"
BULK DENSITY	120 lb/ft.^{3}
TEMPERATURE	Atmospheric
PERIOD OF FEED	
RATING	Design:- 12 L.T.P.H. Normal:- 10 L.T.P.H. Min:- 4 L.T.P.H.

REMARKS

The weigher feeder consists of a belt type extraction feeder drawing material out of the storage bin and feeding it on to a separate weighing conveyor.

Flanged connection to hopper outlet.
Belt runs on ball bearing rollers.
Adjustable belt tension.
Drive:- 2 H.P. variable speed DC motor
through reduction box.
Variable speed control.

Electricity Supply:-
415V, 3 phase 50 cycles
240V, Single Phase 50 cycles.
Control to be automatic.

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	Grinding Mills
SERVICE	1-3-0, 2-2-0
No. UNITS	

1. SCOPE

For the design, supply, fabrication, delivery and commissioning of the following grinding equipment to Risdon, Tasmania.

2. GENERAL

Mills to be of the ball mill type complete with motors, reduction gears, couplings, guards etc. associated with the mill drive and access platforms. The mills will be protected by alarms and trip systems which will shut the grinding mill down on bearing over-temperature, lubrication failure, motor protection etc.
The mills will be controlled from a panel located adjacent to the grinding area.

3. CAPACITY AND MATERIAL DATA

Limestone Mill	2-2-0	1 only
Capacity	4.1 TPH	
Material	Limestone/water pulp 10 lb. of solids/gall of pulp see attached specification.	
Temp.	5-30°C	
pH	7	
SG	1.66 (pulp) 2.93 (L/S)	

Materials of Construction

Shell Liner	SKEGA RUBBER
Balls	C.S.

Motor HP 400

Wet Grinding Mill - 8' x 13' overflow

Feed	1/8"
Product	95% - 400 mesh 100% - 200 mesh

Equipment No. 1-3-0, 2-2-0

3. CAPACITY AND MATERIAL DATA CONTINUED.

Ore Mill 1-3-0 — 1 only

Capacity	8.5 TPH
Material	Willemite/Wash liquor 10.1 lb. ground ore/ gall of pulp See attached specification.
Temperature	10 - 30°C
pH	5-6
SG	1.85 $^{+.3}_{-.85}$
Viscosity (Sol'n)	1.3 - 1.9 Rel. 1.1 - 2.5 CP

Materials of Construction

Shell liner	SKEGA RUBBER
Balls	C.S.

Motor HP 125

Wet Grinding Mill - 6' x 8' Centrix overflow.

Feed - ½" Mesh

Product - 100% - 65 mesh

90% - 100 mesh

4. LIMESTONE ANALYSIS

Tylex mesh	%		
+ 8	10.5	+ 100	3.1
+14	31.2	+ 150	2.3
+28	25.6	+ 200	1.9
+65	16.6	- 200	8.8

5. ORE ANALYSIS

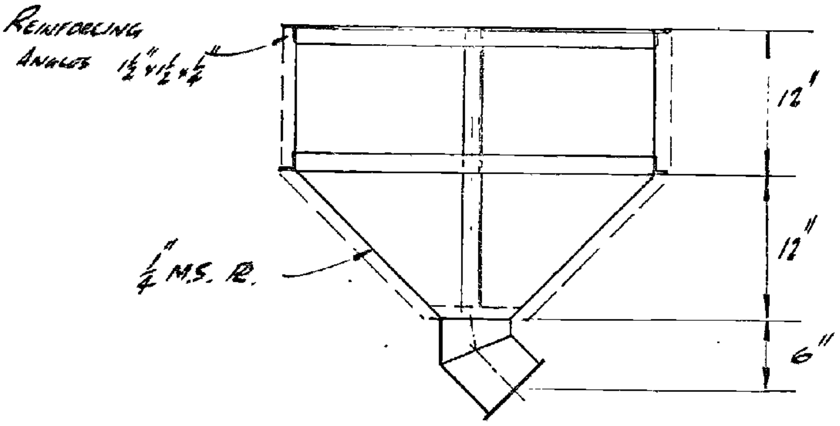
- ½" +¼"	26.5	+ 100	6.8
+ 1/8"	16.5	+ 200	2.5
+ 14 mesh	13.0	+ 325	0.3
+ 28 "	18.5	+ 400	0.2
+ 48 "	15.0	- 400	0.7

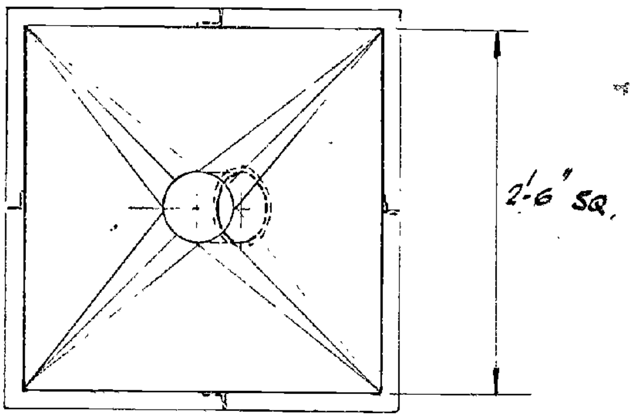
SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	1-3-1
SERVICE	Ore Direct Mill Chute
No. UNITS	1

Material of Construction: MS





PROPOSAL No.	418/4
EQUIPMENT No.	1-4-1 & 2-3-1
SERVICE	Hydrocyclones
No. UNITS	2 systems

1. SCOPE

This specification covers the design, supply of all material, manufacture, testing and packing for delivery to Risdon, Tasmania for:-

1.1 Hydrocyclones for size classification of a closed circuit grinding system for Limestone and Willemite. The following to be included:-

- 1.1.1 Pressure gauge of each inlet with a suitable seal to prevent material blocking the gauge entry.
- 1.1.2. Variable underflow control-manual operation.
- 1.1.3. Cyclone connections to be flanged to ASA 125.

2. GENERAL

The number of cyclones will be determined by the supplier and will include for one standby cyclone. Material of construction to be mild steel with rubber liner.

Surface Treatment - External surfaces to be cleaned and prime coated.

Cyclones to have individual mounting brackets and flanged top cover.

3. DESIGN BASIS

3.1	Material Handled :	Limestone pulp	
	Flow rate of slurry:	Feed G.P.H. -	Normal 1200 Minimum 600
		Underflow:	not given
		Overflow	not given
	Material % Solids:	Feed:	10 lbs. of solid/gallon pulp
		Underflow:	oversize returned to mill
		Overflow:	Product from guiding circuit (see screen analysis)

3. DESIGN BASIS CONTINUED

3.1 Continued

Note: Underflow and overflow % solids dependent on screen analysis at mill discharge.

Sizing Analysis: Feed to Ball Mill:-

Tyler Mesh	% w/w
+ 8	10.5
+ 14	31.2
+ 28	25.6
+ 65	16.6
+ 100	3.1
+ 150	2.3
+ 200	1.9
- 200	8.8

Product from cyclone discharge:

- 200	100%
- 400	95%

Probable discharge from mill will have nothing greater than +150 mesh in overflow (to be confirmed if firm prices required).

Material properties:	S.G. Limestone	2.93
	S.G. Slurry	1.66 (Approx)
	Solution pH	7 (Approx)

3.2	Material Handled:	Willemite Pulp	
	Flow rate of slurry:	Feed G.P.H. -	Normal 2400 Minimum 1200
		Underflow:	0-500
		Overflow:	-
	Material % Solids	Feed:	10:1 lbs. ground ore/gallon
		Underflow:	return to mill circuit
		Overflow:	product from grinding circuit (see screen analysis).

Note: Underflow and overflow % solids dependent on screen analysis at mill discharge.

3. DESIGN BASIS CONTINUED

3.2 Continued

Sizing Analysis : Feed to Ball Mill:-

Tyler Mesh	% w/w
-½" +¼"	26.5
+1/8	16.5
+ 14	13.0
+ 28	18.5
+ 48	15.0
+100	6.8
+200	2.5
+325	0.3
+400	0.2
-400	0.7

Product from cyclone discharge:-

- 65	100%
-100	90%

Probable discharge from mill will be nothing greater than + 65 mesh in the overflow

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	2-1-0
SERVICE	Limestone feed bin
No. UNITS	1 required

Capacity : 150 tons

Capacity Rate : 4-1 tons/hr.

Material being handled : limestone

Bulk Density : 94-117 lb/cu. ft. Size: 100% - 1/8"

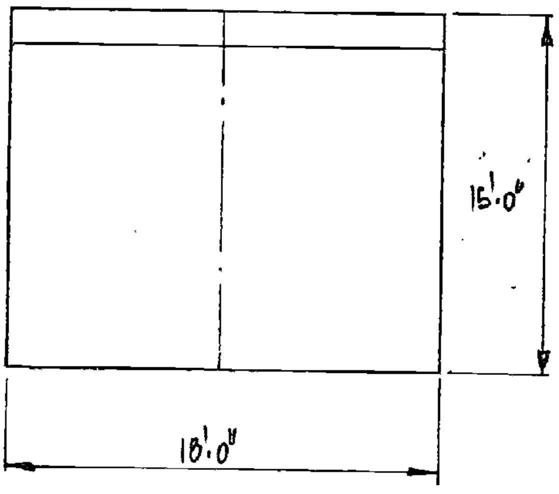
Bin Construction Material : Mild steel

Adjustable outlet gate automatically controlled.

Discharge side of bin vertical.

Delivery by road vehicle Max. Gross wt. 55 tons.

Open grid over bin.



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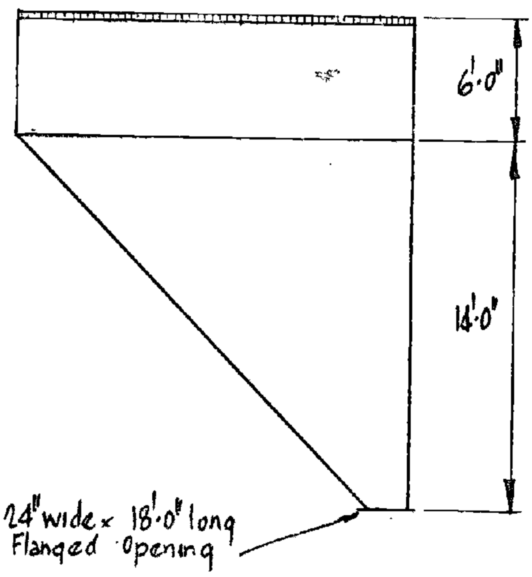


— SIDE ELEVATION —

PROPOSAL No.	418/4
EQUIPMENT No.	2-1-1, 2-1-2
SERVICE	Limestone mill feed weighing/feeding conveyors
No. UNITS	1
OPERATING CONDITIONS	
MATERIAL HANDLED	Limestone
MATERIAL CONDITIONS	
LUMP SIZE	-1/8"
BULK DENSITY	90 lb/ft.^{3}
TEMPERATURE	Atmospheric
PERIOD OF FEED	
RATING	Design:- 5 L.T.P.H. Normal:- 4 LTPH Min. 2 LTPH

REMARKS

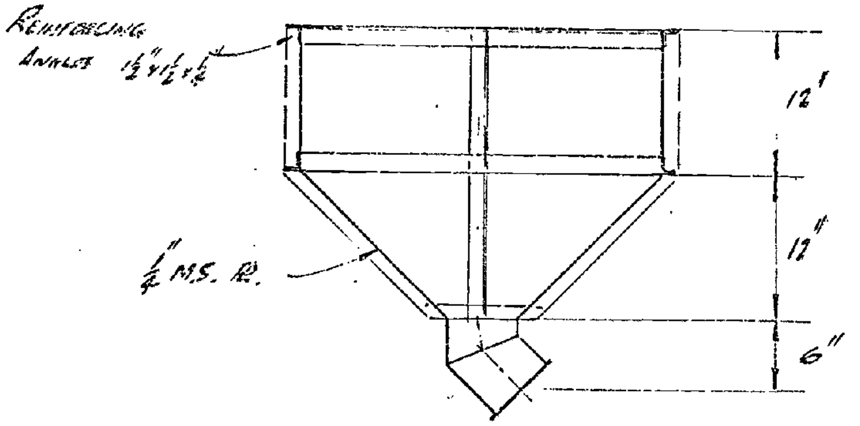
The weigher feeder consists of a belt type extraction feeder drawing material out of the storage bin and feeding it on to a separate weighing conveyor.

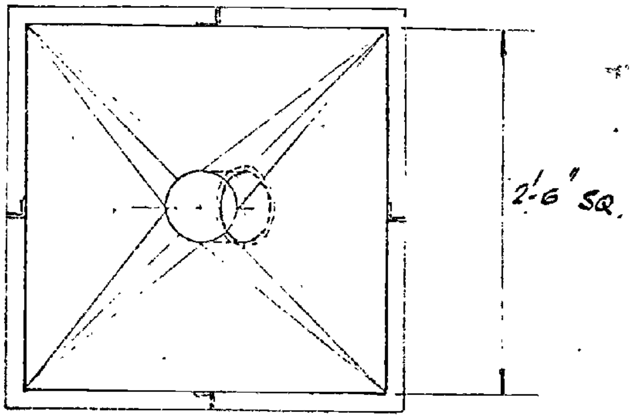
Flanged connection to hopper outlet.
Belt runs on ball bearing rollers
Adjustable belt tension
Drive:- 2 H.P. variable speed DC motor
through reduction box.
Variable speed control.

Electricity Supply:-
415V, 3 phase 50 cycles
240V, Single Phase 50 cycles.
Control to be automatic.

PROPOSAL No.	418/4
EQUIPMENT No.	2-2-1
SERVICE	Limestone Direct Mill Chute
No. UNITS	

Material of Construction:- MS





SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	2-6-1
SERVICE	Limestone Feed Splitter
No. UNITS	3 required

Material Handled : Limestone Pulp

Capacity Rate : Normal 1400 G.P.H. Max. 1400 GPH

Splitter Construction Material : Mild Steel

Materials handled are moderately abrasive.

For details refer to E.Z. standard drg. with D.A.P.L. Drg. No. 418/4-140.

PROPOSAL No.	418/4
EQUIPMENT No.	3-3-1
SERVICE	Calcine Supply Feed Splitter
No. UNITS	1 required

Material Handled : Calcine Pulp

Capacity Rate : Normal 6.7 GPM Max. 100 G.P.M.

% Time at Max. Capacity : 100%

Splitter Construction Material : Mild Steel

For details refer to E.Z. Standard Drg. with D.A.P.L. Drg. No. 418/4-140.

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No. 418/4

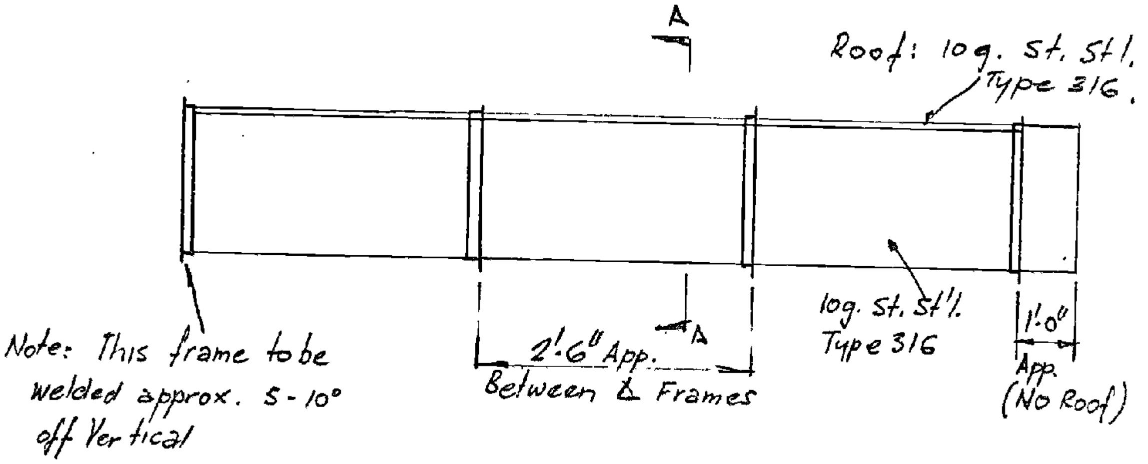
EQUIPMENT No. 6-1-1, 7-1-1, 8-1-2, 8-2-2, 9-1-2, 10-1-2

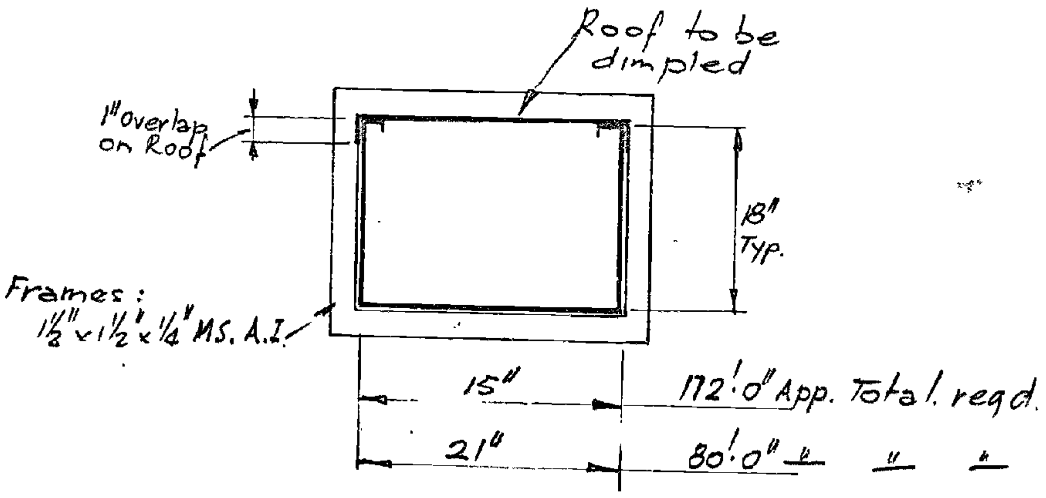
SERVICE St. St. Launders

No. UNITS

15'' x 18'' - 112 ft. total required

21'' x 18'' - 80 ft. total required





SECTION A-A

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	7-2-0
SERVICE	Coagulation - Primary Filter Air Lift
No. UNITS	1

Capacity 21,000 G.P.H. Normal
16,500 G.P.H. Max.

Material being handled:- Coagulated Pulp
Temp - 3-5°C
pH - 4.8 - 5.6

Size: 4½" Dia.

Material: 316 St. St.

See Dwg. E.Z. No's Std. 586, 589, 597.

PROPOSAL No.	DA. 418/4
EQUIPMENT No.	7-3-0
SERVICE	Primary Filters
No. UNITS	Two (No Standby)

Capacity (per filter) : dry solids - 4.3 tons/hr.
feed - 8,250 gallons/hr.

Material Handled : Coagulated pulp with 1.1 lbs. solids per gallon of pulp, 8.9% solids by weight. Solids are abrasive and are suspended in zinc sulphate solution of pH 4.8 - 5.6
S.G : 1.3 Temperature : 63-75°C

Sizing of Coagulated Solids:

Tyler Mesh	% by Weight
+48	Nil
-48+65	Trace
-65+100	0.3
-100+150	0.7
-150+200	1.0
-200+400	Trace
-400	98.0
	100.0

Filter type : Disc

Discharge type : Roller preferred

Filtration Rate : Test filter rate at 1.5 minutes from time gave a filtration rate of 0.32 gal/ft^2/min.

Filter Area : Installed area per filter - 1210 ft.^{2}
Size: 8'10"Ø x 12 disc

Materials of Construction: 316 SS

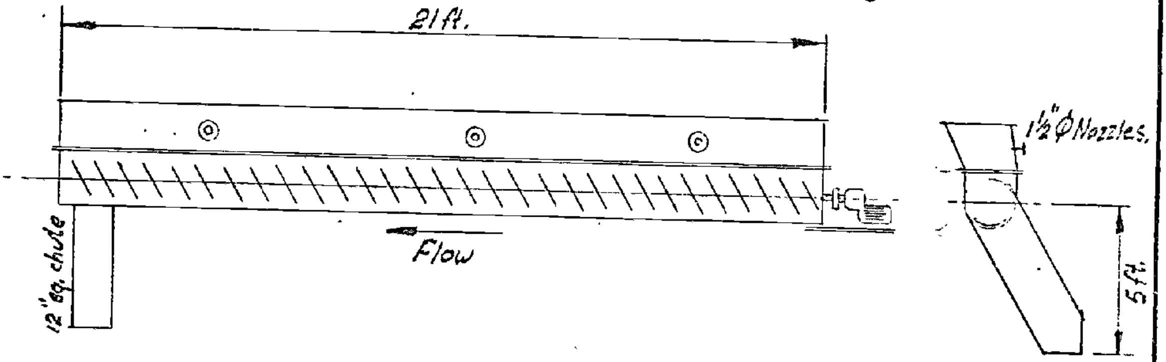
MATERIAL HANDLING SPECIFICATION DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	7-3-2
SERVICE	Coagulation Precipitate Conveyors
No. UNITS	3
OPERATING CONDITIONS	
MATERIAL HANDLED	Primary Filter Cake
MATERIAL CONDITIONS	
LUMP SIZE	
BULK DENSITY	
TEMPERATURE	
PERIOD OF FEED	
RATING	242 T.P.D. (norm). 600 T.P.D. (max.)

REMARKS

Stainless Steel Construction

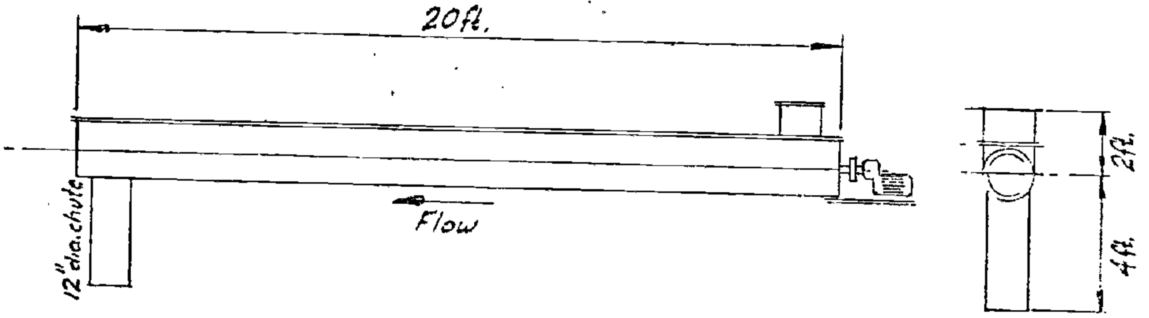
Removable lid. Intermediate hanger bearings



12" Ø screw

2 HP motor 2 off required

25 R.P.M.



12"Ø screw

5 HP Motor 1 off required

42 R.P.M.

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	7-4-1 & 9-7-1
SERVICE	Filtrate Receiver & Moore Filter Vacuum Drum
No. UNITS	2
SPECIFICATION	
DESIGN CODE	
SHELL LENGTH	8'0"
SHELL DIAMETER	7'6"
DESIGN PRESSURE	25" of mercury vac.
WORKING PRESSURE	18" " " "
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	
LINING	
SUPPORTS	
INTERNALS	

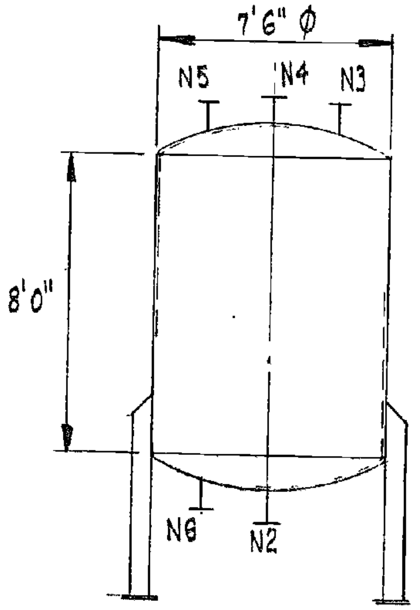
REMARKS

3 Alternatives

A - Concrete as per E.Z. dwg. E3-505

B - St. St. see sketch below

C - PVC reinforced fibreglass



4 off supports.
3"x3"x3/8" ∠

N_1 - 18"⌀ Manhole
N_2 - 8"⌀ Inlet
N_3 - 2"⌀
N_4 - 8"⌀ Outlet
N_5 - 1"⌀
N_6 - 3"⌀
All nozzles 150# ASA

St. St. Vessel

3/16" shell and
dished ends

P.V.C. Reinforced
Fibreglass

To be determined.

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-2-3
SERVICE	Neutralization/Recoagulation No. 1 Tank Heating Element
No. UNITS	1 required

Material Handled: Coil: Steam Tank : Recoagulation Pulp

Tank Capacity: 7090 G.P.H. From 20°C to 70°C

Coil Capacity: Normal 3,940 lb/hr. Max. 6,280 lb/hr.

Min: 1,970 lb/hr. % time at Max. Capacity 100%

Coil Construction Material :- Carbon Steel

Remarks:-

1. Steam assumed to be at 50 psig, dry saturated
2. Brittle, thin, hard scales form on tubes within several months, but can be easily removed by light rapping.
3. Must be easily removable for cleaning and replacement Vertical tubes in sections preferred.

Construction:-

1½" Dia. Tubes at 6" CRS around circum.
U tube 9' high
Arrange in 3 segmental nests
Ring dia - Inlet header 10')
" " - Outlet " 9') 2" dia. pipes

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-3-0
SERVICE	Final Filter Feed Air Lift
No. UNITS	1

Capacity: 9,000 G.P.H.

Material Being Handled: Recoaulated Pulp

Temp:

pH :

Size $4\frac{1}{2}$" Dia

Material 316 St. St.

See Dwg. E.Z. Nos. Std. 586, 589, 597

PROPOSAL No.	DA.418/4
EQUIPMENT No.	8-4-0
SERVICE	Final Filters
No. UNITS	Three (No standby)

Capacity (per filter)	:	dry solids - 2.23 tons/hr feed - 2360 gallon/hr. wash water - 1460 gallon/hr.
Material Handled	:	Recoagulated pulp with 2.12 lbs. solids per gallon of pulp, 17% solids by weight. Solids are abrasive and are suspended in zinc sulphate solution of pH 5-5.6 S.G. : 1.34 Temperature : 70°C max Sizing of solids : similar to solids in 7-3-0
Filter type	:	Drum filter
Discharge type	:	Belt
Filtration Rate	:	Test filter rate at 1.0 minutes form time and 60°C gave filtration rate of 1.0 gal/ft^2/min
Filter Area	:	Installed area per filter - 450 ft.^{2}. Drum Size - 12'Ø x 12'
Special Requirements	:	Wash water to be separated from primary filtrate with separate receiver
	:	Compression rolls with wash belt for washing cake on drum.
Materials of Construction	:	316 S.S.

RFMB 7.2.72

PROPOSAL No.	DA.418/4
EQUIPMENT No.	8-4-0
SERVICE	Final Filters
No. UNITS	Three (No standby)

Capacity (per filter) : dry solids - 2·23 tons/hr
feed - 2360 gallon/hr.
wash water - 1460 gallon/hr.

Material Handled : Recoagulated pulp with 2.12 lbs. solids per gallon of pulp, 17% solids by weight. Solids are abrasive and are suspended in zinc sulphate solution of pH 5-5.6

S.G. : 1.34 Temperature : 70°C max
Sizing of solids : similar to solids in 7-3-0

Filter type : Drum filter

Discharge type : Belt

Filtration Rate : Test filter rate at 1.0 minutes form time and 60°C gave filtration rate of 1.0 gal/ft^2/min

Filter Area : Installed area per filter - 450 ft.^{2}.
Drum Size - 12'Ø x 12'

Special Requirements : Wash water to be separated from primary filtrate with separate receiver

: Compression rolls with wash belt for washing cake on drum.

Materials of Construction: 316 S.S.

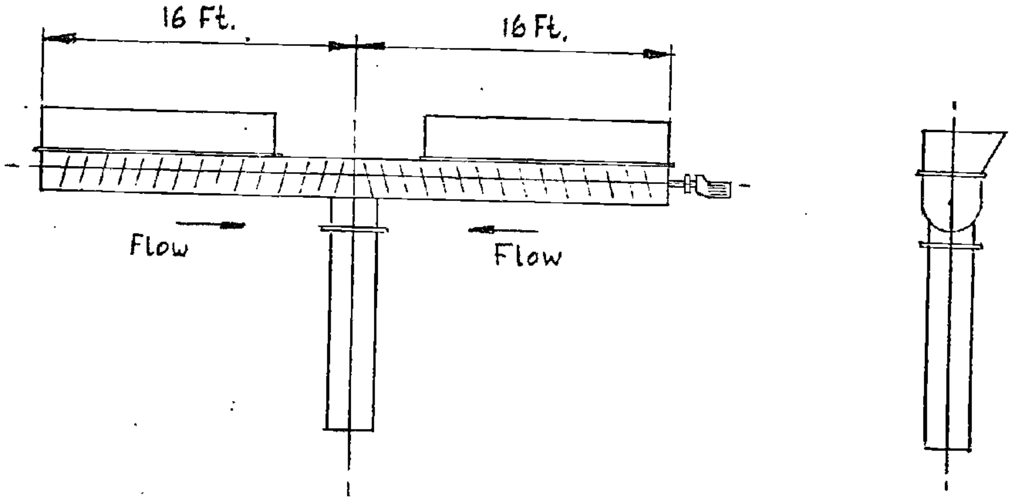
RFMB 7.2.72

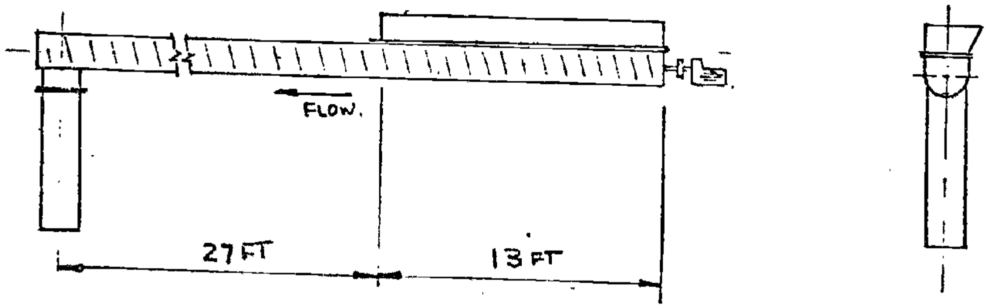
MATERIAL HANDLING SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-4-2 & 8-4-3
SERVICE	Final Filter Residue Screw Conveyor
No. UNITS	2
OPERATING CONDITIONS	
MATERIAL HANDLED	Silica Residue
MATERIAL CONDITIONS	Glutinous slurry
LUMP SIZE	
BULK DENSITY	38% solids 50 - 80#/cu. ft.
TEMPERATURE	
PERIOD OF FEED	
RATING	17.7 T.P.H. (norm.) 26 T.P.H. (max.)
REMARKS	

Stainless steel construction





12" Ø Screws

5 H.P. Motors

68 R.P.M.

PROPOSAL No.	DA.418/4
EQUIPMENT No.	9-2-0
SERVICE	Germanium Precipitate Filter Basket
No. UNITS	2 (1 standby)

Capacity:- (per filter)	17,000 G.P.H. (pulp)
Material Handled:-	Germanium precipitate Bulk Density 600-700 G/L solids pH - 5.5 SG - 1.55 Temp - 45° - 60°C
Filter type:-	Moore For details of construction see E.Z. dwgs. E3-1069 E3-449 E3-492
Materials:-	Filter leaves - 316 St. St. Filter Frame - MS Vacuum header - Acid Proof Rubber hose

TANK AND VESSEL SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	9-2-1
SERVICE	Germanium Precipitate (see remarks below)
No. UNITS	4
SPECIFICATION	
DESIGN CODE	
~~SHELL~~ LENGTH	20'0"
~~SHELL DIAMETER~~ WIDTH	12'6"
DESIGN PRESSURE	Atmos.
WORKING PRESSURE	"
DESIGN TEMPERATURE	"
WORKING TEMPERATURE	"
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	Fibreglass with M.S. Framework
SUPPORTS)	Built into walls of tank
INTERNALS)	

REMARKS

Material being handled

Germanium Precipitate

Bulk Density 600 - 700 G/L solids

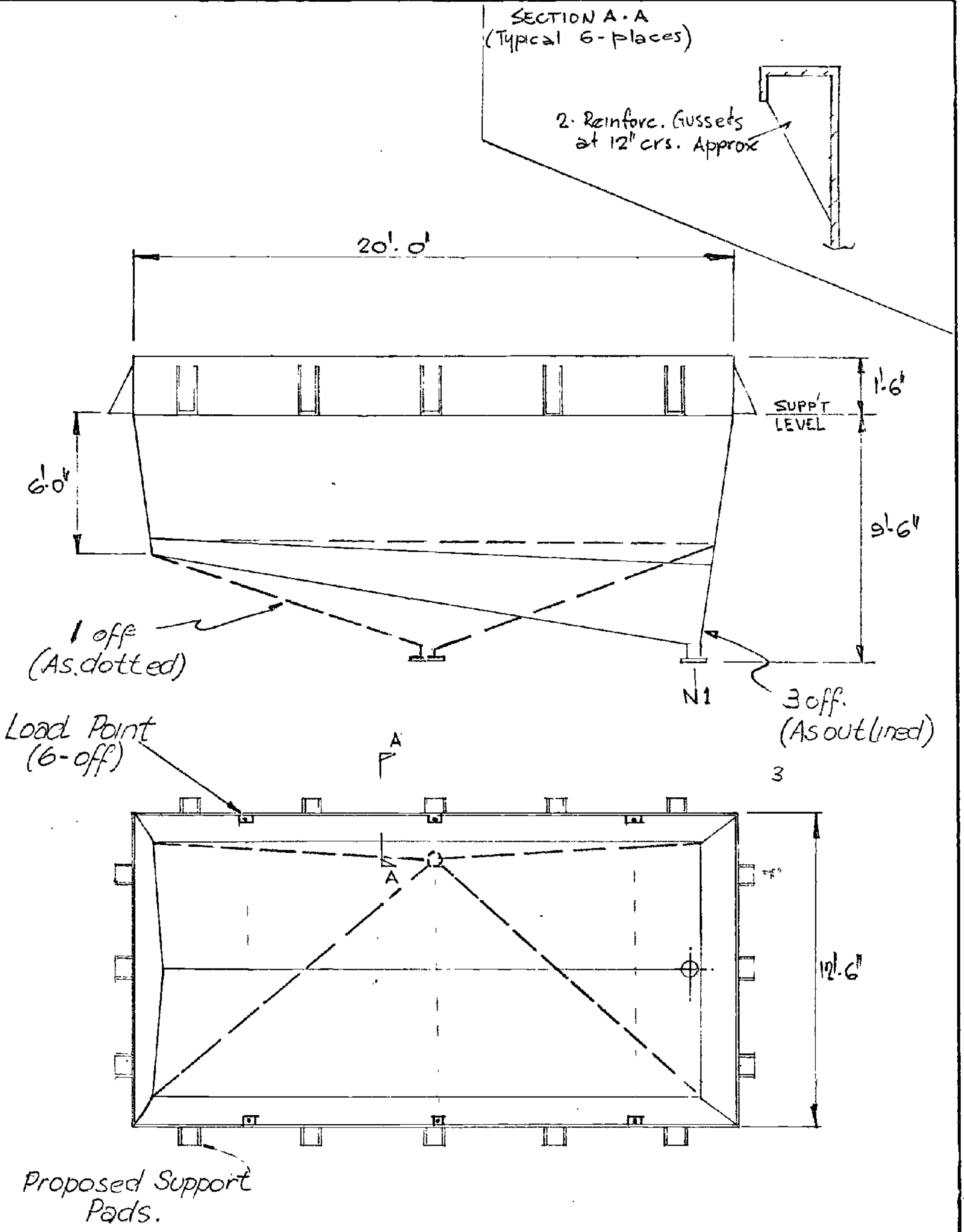
pH - 5.5

SG - 1.55

Weight supported at load points (6 off)

≍ 1.3/4 tons (total 10T)

PROPOSAL No.	418/4
EQUIPMENT No.	9-2-1
SHEET	2 of 2



N1	3"	B.S.TABLE'D'	OUTLET	1
Nº	SIZE	CONNECTION	SERVICE	QTY

CRANE SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	9-2-3
SERVICE	Lifting of Filter Drums & Filter Baskets (Crane)
No. UNITS	1
GENERAL DESIGN	
STANDARDS	Australian Crane Code CB2-1960 Class 3 Duty
	and to Tas. Factory Inspector Department of Mines.
MAX. WORKING LOAD	10 tons
SPAN. CENTRE TO CENTRE OF GANTRY RAILS	45 ft.
DISTANCE FROM FLOOR TO TOP OF GANTRY RAIL	46 ft.
CRANE TYPE	
SPEED HOIST	16 ft/min
CROSS TRAVERSE	50 ft/min
LONG TRAVEL	50 ft/min
TYPE OF HOOK	
CONTROL	Push button pendant
	from 22' floor
BRAKING SYSTEM	
LUBRICATION	
DRIVE EQUIPMENT	Power supply 415V 3phase 50 cycle

REMARKS

Flexible cable and Catenary wire

Length of travel 135 ft.

Height Requirement - u/s beam to roof
app. 5'6"

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No. 418/4

EQUIPMENT No. 9-9-0

SERVICE Shell & Tube Heat Exchanger

No. UNITS 1

Material being handled

Combined filtrate and wash solution from G.E. purification filters.
300 I.G.P.M. design flow rate

Steam:- 150 psig saturated

Solution Temp. change - 83°F

Exchanger

14.94×10^6 BTU/hr.
Bundle length - 12ft.
Tubes - 144 x 1" O.D. x 14 BWG on 1¼" △ pitch
Area - 442 ft^2
Shell I.D. = 20" containing 4 tube passes
S.S. Tubes & tubesheet
M.S. shell

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	9-9-1
SERVICE	Shell & Tube Heat Exchanger
No. UNITS	1

Material Being Handled

Combined filtrate and wash solution from G.E. Purification Filters
110 IGPM Design Flow Rate

Steam 50 P.S.I.G. Saturated

Solution Temp. Change 83°F

Exchanger

5.48×10^6 BTU/Hr.
Bundle Length - 12 ft.
Tubes - 1'' OD x 14 BWG
Area 236 Sq. Ft.
Shell ID = 16'' containing 4 tube passes
S.S. Tubes & Tubesheet
M.S. Shell.

PROPOSAL No.	418/4
EQUIPMENT No.	9-12-0
SERVICE	Process Air Blower
No. UNITS	1

Capacity	:	700 CFM at NTP
Press	:	9 PSIG
Type	:	Waller 8 x 8 blower
Blower RPM	:	1200
Motor HP	:	40

Including baseplate, motor, coupling, guards, pressure switch and non return valves.

PROPOSAL No.	418/4
EQUIPMENT No.	10-2-2
SERVICE	Pulp Cooler Cooling Element
No. UNITS	1 required

Material Handled: Coil: Water Tank: Basics Pulp

Coil Capacity: Max: 26,000 G.P.H. Normal: 26,000 G.P.H.
Min: 13,000 G.P.H. % Time at Max. Capacity 100%

Coil Construction Material:- Carbon Steel

Remarks:

1. Tubes are to be arranged in U Tube nests.
2. Headers to be segmented for easy removal for cleaning and maintenance.
3. U Tubes on approx. 6" centres and 7'0" length maximum.

PROPOSAL No.	DA. 418/4
EQUIPMENT No.	10-4-0
SERVICE	Basics Filter
No. UNITS	One (No standby)

Capacity	:	dry solids	7.9 tons/hr
		feed	5,880 gallon/hr.
		wash water	1520 gallon/hr.

Material Handled : Basics pulp with 3.0 lb. solids per gallon of pulp. The solids have been precipitated from a zinc sulphate solution and zinc is still present in the filtrate. The solids are abrasive. pH 5.6 - 7.0 SG - 1.2

Filter Type : Drum filter

Discharge Type : Belt

Filter Area : Total Area - 450 ft.^{2}

Drum Size - 12'0 x 12'

Special Requirements : Compression rolls with wash belt for washing cake on drum.

Materials of Construction: 316 SS

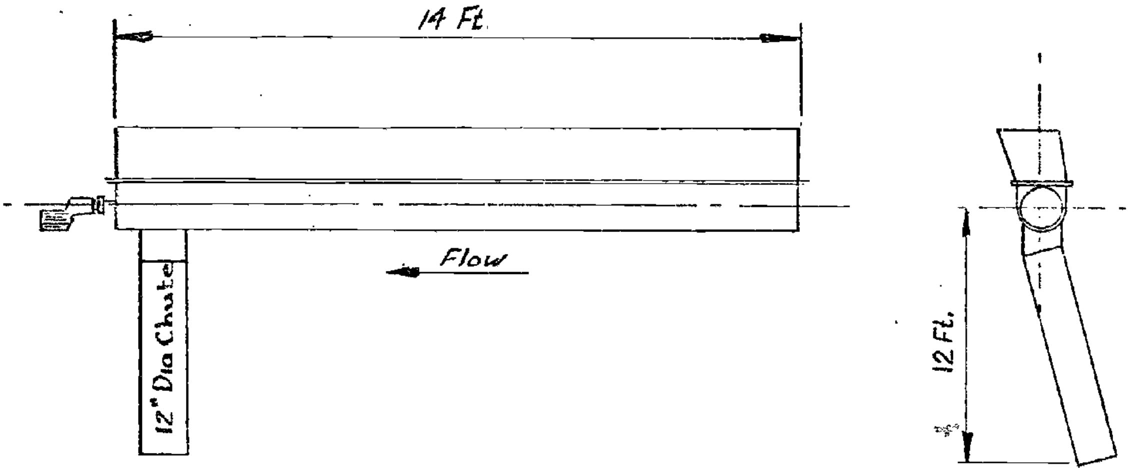
RFMB 7.2.72

PROPOSAL No.	418/4
EQUIPMENT No.	10-4-1
SERVICE	Basics Filter Cake conveyor
No. UNITS	1
OPERATING CONDITIONS	
MATERIAL HANDLED	Basics Filter Cake
MATERIAL CONDITIONS	Abrasive wet solids
LUMP SIZE	
BULK DENSITY	120#/cu.ft. S.G.:- 2.39
TEMPERATURE	30° - 50°C
PERIOD OF FEED	
RATING	25,400#/hr. (norm.) 31,800#/Hr. (max)

REMARKS

Stainless steel construction

Removable lid. Intermediate hanger bearings



12" dia. screw

3 HP motor

Speed 16 R.P.M.

PROPOSAL No.	418/4
EQUIPMENT No.	10-11-0
SERVICE	Water Cooling Tower
No. UNITS	1

1. This specification details the requirements for the design, manufacture, supply and erection of all materials, parts and equipment required for the construction of a Water Cooling Tower complete with the exception of the R/C basin (which will be provided by others). Supplier will provide all fittings for supply, chain and suction lines.

2. Design Data:

Capacity of Tower	25,000 Imp. G.P.H. (norm)
	28,000 Imp. G.P.H. (max)
	12,500 Imp. G.P.H. (min)
Input Water Temperature	77° - 96°F
Output Water Temperature	75°F
Air Inlet Wet Bulb Temperature	70°F
Air Outlet Wet Bulb Temperature	83°F
Dry Bulb Temperature	80°F

Continuous Operation

Water to Contain Cl and Cu additives.

3. The tower shall be of the induced draft type.

The tower shall be of robust construction and possess good weathering characteristics.

Interior access shall be provided for routine cleaning and maintenance.

All structures, platforms, ladders and handrailing to be provided by supplier and in accordance with relevant Australian or British Standards.

Motors:

The preferred makes of motors are G.E.C., A.E.I. and Pope.

Metric sizes are required.

Motors to be T.E.F.C. weatherproof

4 pole motors only to be used.

Geared motors are preferred to be A.E.I. Barlow type.

4. Location of plant: Risdon, Tasmania.

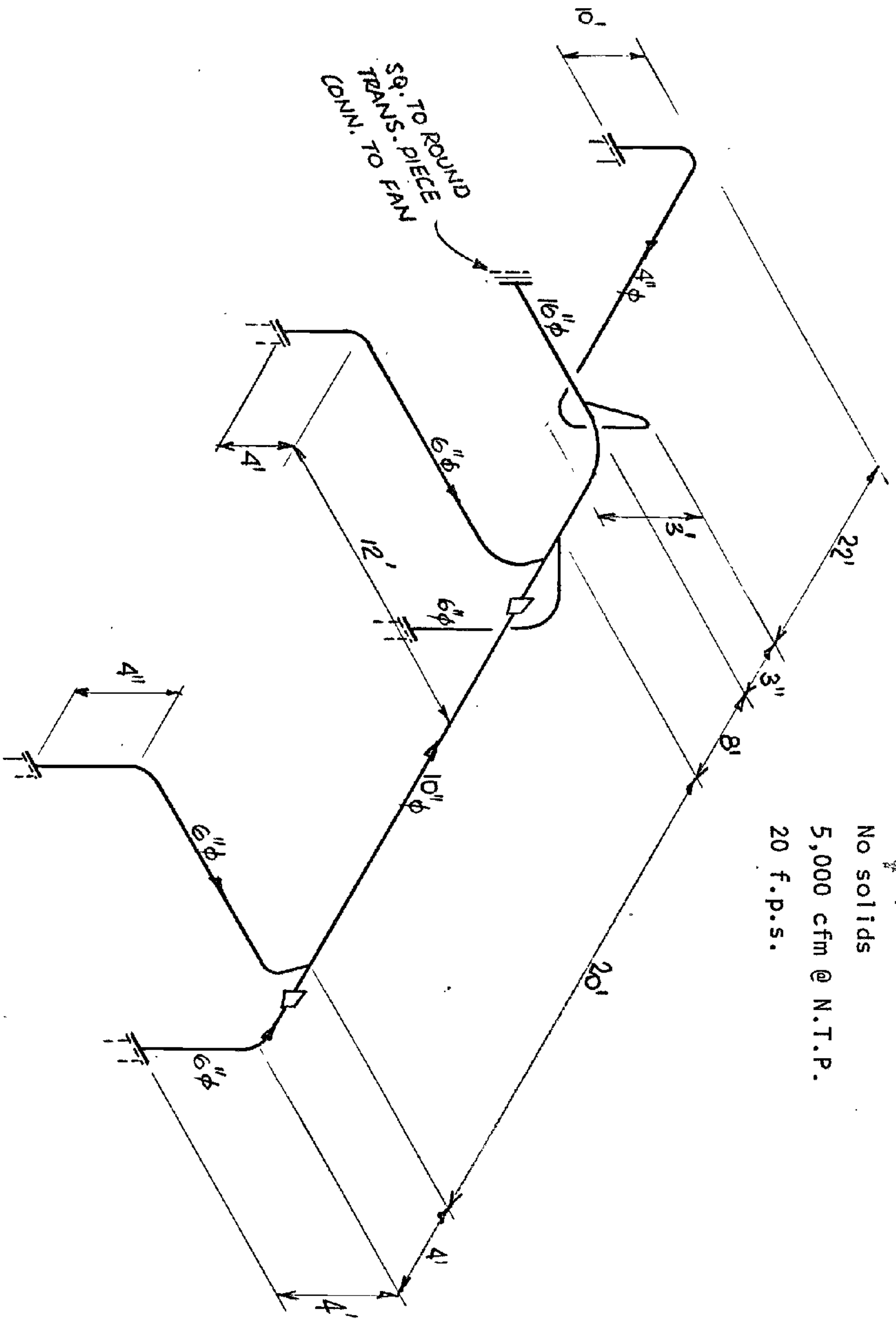
PROPOSAL No.	418/4
EQUIPMENT No.	Vent System 10-12-0 & 10-12-1
SHEET	1

This Specification covers the construction, supply and delivery to site (Risdon, Tasmania) of equipment and ducting required on ventilation system.

Vent Stack
Vent Fan
Ducting

SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	10-12-0
SERVICE	Ducting for Vent Fan
No. UNITS	1



Materials being handled CO$_2$ & H$_2$O
pH 6.0
Temp 95°C
Weak carbonic acid
Mildly corrosive
No solids
5,000 cfm @ N.T.P.
20 f.p.s.

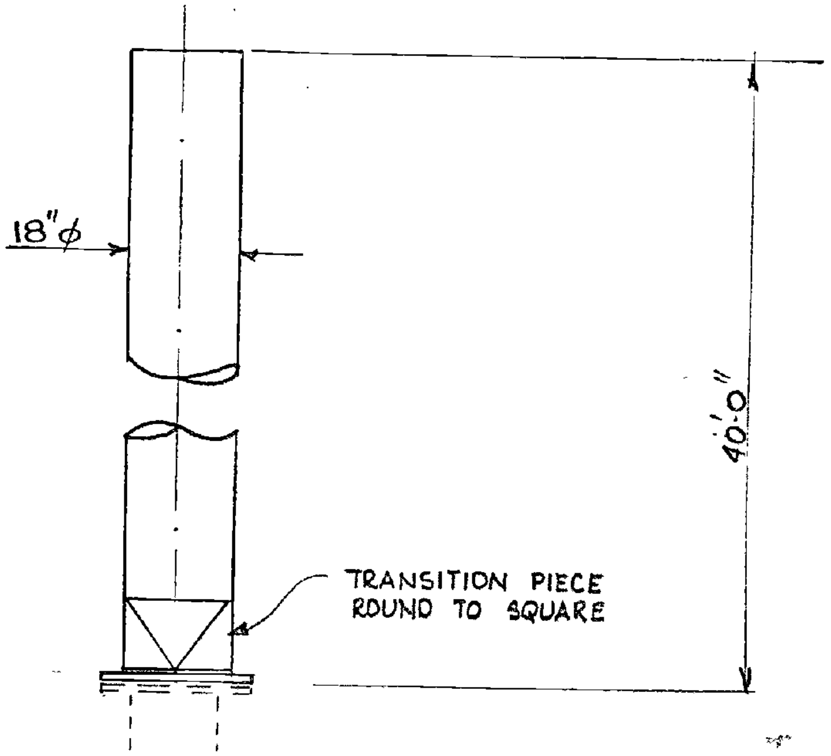
Sheet 1 of 2

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-12-0
SERVICE	Exhaust Stack Vent Fan
No. UNITS	1

For material being handled see Sht. 1



Sheet 2 of 2

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-12-1
SERVICE	Ventilation Fan
No. UNITS	1

Capacity 5000 N.C.F.M.

Material being handled

CO_2 & H_2O
pH 6.0
Temp. - 95°C
Weak carbonic acid, mildly corrosive
No solids

Motors - The preferred makes of motors are G.E.C., A.E.I. & Pope
Metric sizes are required.
Motors to be T.E.F.C. weatherproof
4 pole motors only to be used.
Vee-belt drive required

PROPOSAL No.	418/4
EQUIPMENT No.	10-14-1
SERVICE	Calcine Feed Splitter
No. UNITS	1 required

Material handled : Calcine Pulp

Capacity Rate : Normal 120 GPM Max.: 140 GPM

% Time at Max. Capacity : 100% Min.: 90 GPM

Splitter Construction Material : 316 Stainless Steel

For details refer to E.Z. Standard Drg. with D.A.P.L. Drg. No. 418/4 - 140

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	11-1-0, 11-1-1
SERVICE	Vacuum Pumps
No. UNITS	

1. SCOPE

This specification covers for the design, supply of all materials, manufacture, testing and packing for delivery to Risdon, Tasmania for:-

Vacuum pumps and ancillary equipment to accomplish duty detailed below.

2. DESIGN BASIS

The vacuum system will be required to deliver at 20-22" Hg,vacuum for a filter system operating with slurries at a max. temperature of 75°C. Air from the filter will be assumed to be saturated and at approx. 60°C maximum entering the vacuum system.

Based on filtration area and estimated filter load a vacuum requirement of 9,000 cubic ft/min, at vacuum, being based on 2 $ft^3/ft.^2$ filter area/ min is required.

In addition, a system requiring only a $ft.^3/ft.^2/min.$ giving 1,500 cubic ft/min at vacuum.

3. EQUIPMENT

For plant layout purposes, three machines are required with two (2) for first requirement and one (1) for second requirement. Each machine will be independent in all respects with regard to protective devices. A common seal water system with suitable valving and control.

The vacuum pumps will come complete with drives, guards, seal water filters, reserve tank with water make-up level control, circulation pumps, separation and silencing equipment.

4. MACHINE PROTECTION

The controls for the vacuum system will include vacuum control and a suitable protection system for the bearings, seal water and cooling circuits. Supply to include sensor equipment and control only. All temperature sensors to have thermowells and pressure gauges fitted with isolation valves.

5. POWER AVAILABLE

415 volts, 30, 50 HZ. Control voltage 240 bolt, 10, 50 HZ.

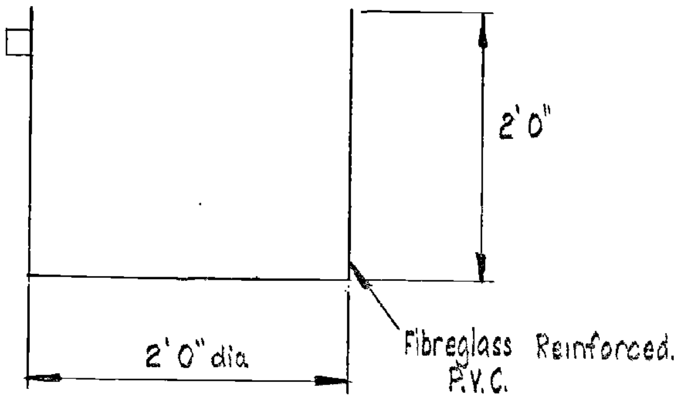
6. CONNECTIONS

Piping connections to equipment to be flanged to ASA rating.

SPECIFICATION

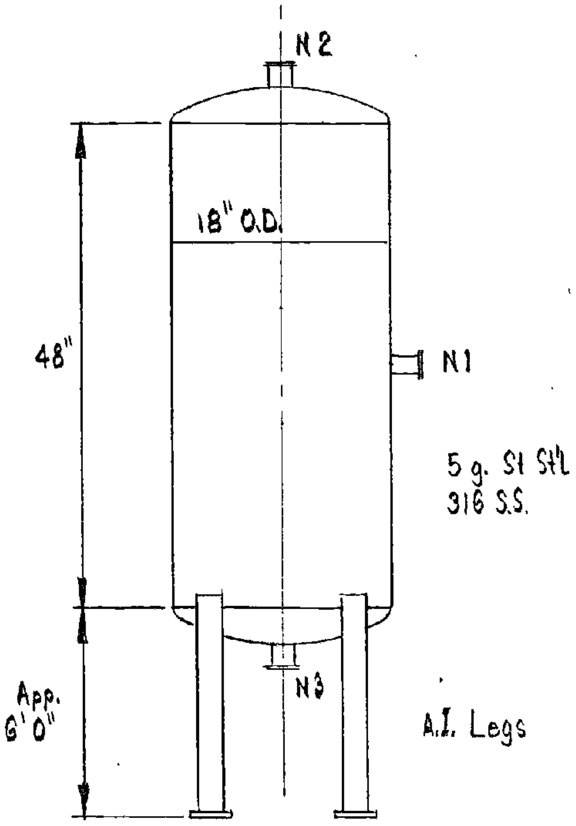
DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	11-2-0
SERVICE	Vacuum seal pot
No. UNITS	2



PROPOSAL No.	418/4
EQUIPMENT No.	11-3-0
SERVICE	Barometric leg head tank
No. UNITS	2

Operation conditions :- 18" mercury



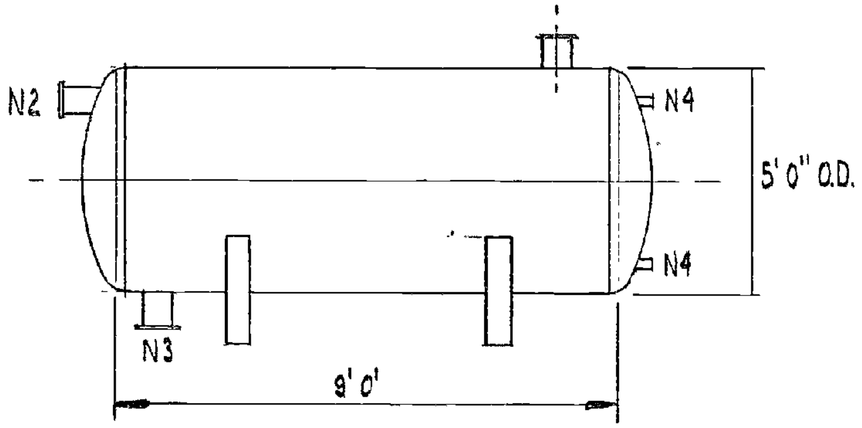
N_1 - 5" flange BST 'D'
N_2 - 6" " "
N_3 - 4" " "

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	11-4-0
SERVICE	Vacuum system Moisture trap
No. UNITS	1
SPECIFICATION	
DESIGN CODE	
SHELL LENGTH	9'
SHELL DIAMETER	5'
DESIGN PRESSURE	
WORKING PRESSURE	22" H.g Max.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	80°C max.
CORROSION ALLOWANCE	
STRESS RELIEF	Nil
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	Carbon Steel
LINING	
SUPPORTS	Carbon Steel
INTERNALS	

REMARKS



N_1 - Inlet 6" B.S.Table D

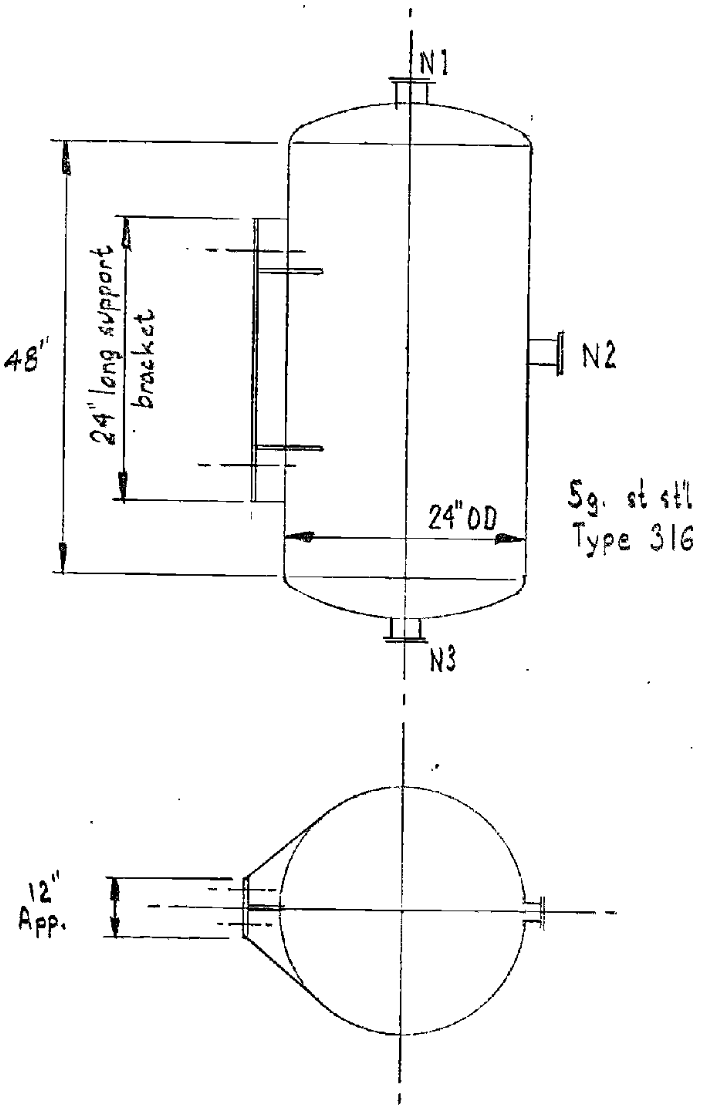
N_2 - Outlet 6" " "

N_3 - Drain 3" " "

N_4 - Leval Gauge SCD.1"
BSP CPLG

PROPOSAL No.	418-4
EQUIPMENT No.	Associated with vac. filters 11-5-0
SERVICE	Filter vacuum receivers
No. UNITS	5

Operating Conditions: 18 inches of Mercury



N_1 - 6" Flange BST 'D'
N_2 - 6" " "
N_3 - 6" " "

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

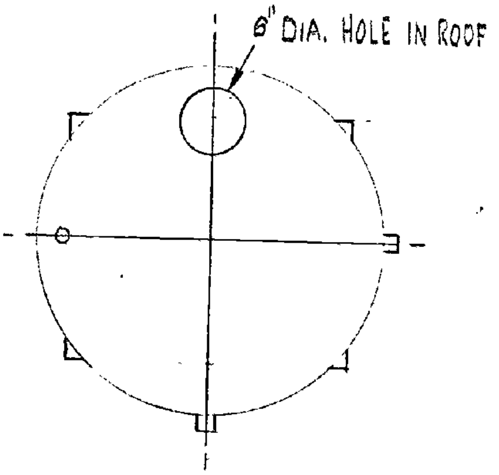
PROPOSAL No.	418/4
EQUIPMENT No.	11-6-0
SERVICE	Vacuum Seal Water
No. UNITS	2
SPECIFICATION	
DESIGN CODE	
SHELL LENGTH	3'0"
SHELL DIAMETER	4'0"
DESIGN PRESSURE	
WORKING PRESSURE	Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL	Carbon Steel
LINING	
SUPPORTS	Carbon Steel
INTERNALS	

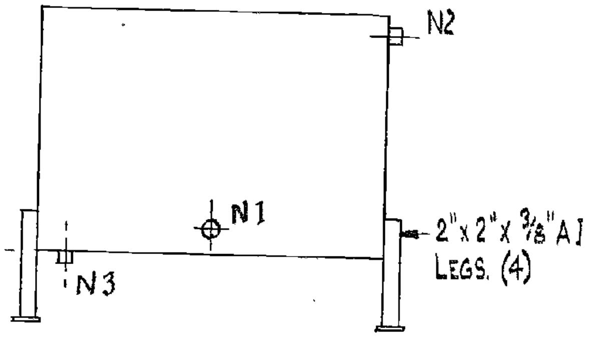
REMARKS

N_1 Outlet 2" SCD BSP

N_2 Overflow 1" SCD BSP

N_3 Drain 1" SCD BSP

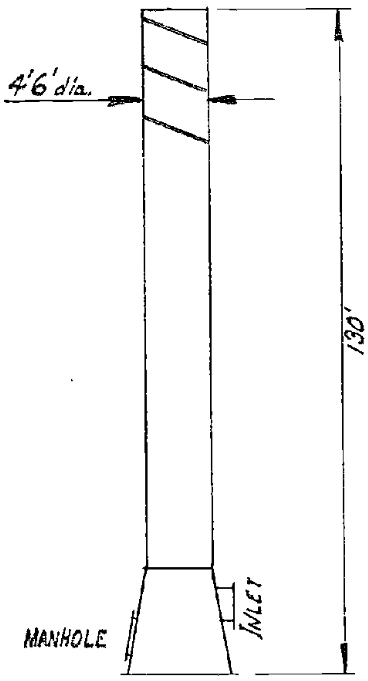




PROPOSAL No.	418/4
EQUIPMENT No.	12-1-1
SERVICE	Boiler Stack
No. UNITS	1

Flue Gas temperature : $525^{\circ}F$ @ M.C.R.
$420^{\circ}F$ @ 0.5 M.C.R.

Stack may be guyed



PROPOSAL No.	418/4
EQUIPMENT No.	12-2-0, 12-3-2
SERVICE	Water Treatment Plant
No. UNITS	

1. SCOPE

This specification provides for the design, supply, fabrication, delivery and commissioning at site of one only water softening plant and deaerator to supply fresh treated water at a nominal rate of 18,000 lb/hr. to a boiler operating at 150 psig saturated and a nominal 50,000 lb/hr.

2. GENERAL

Both units will have fully automatic operation and have alarms and controls to allow for continuous unattended operation. The unit for water softening will be skid mounted including all valves and fittings to operate the plant including chemicals for regenerations etc.

3. CAPACITY AND OPERATING DATA

Water treatment - 1. Mains water as exists at Risdon, Tasmania.
2. Deaerator - treated water and co-ordinator at approx. 220-230°F

Capacity	-	Normal	: 18,000 lb/hr. fresh make up
		Minimum	: 6,000 lb/hr. " " "

4. ANALYSIS OF WATER

The figures supplied are derived from analyses carried out by our own Analytical Laboratories, and some analyses carried out by the Permutit Company of Australia Ltd. Although some of the concentrations reported show a wide range, they reflect our experience over the past two years or so, and indicate the necessity to size approximately any future water treatment installations.

TEST OR COMPONENT	CONCENTRATION		
Hardness (total)	28 - 50	p.p.m.	($CaCO_3$)
Calcium	20 - 30	"	"
Magnesium	8 - 30	"	"
Equivalent Mineral Acidity	16 - 20	"	"
Total Alkalinity	30 - 32	"	"
Phenolphthalein Alkalinity	zero	"	"
Bicarbonate	30 - 32	"	"
Carbonate	zero	"	"
Sulphate	5 - 25	"	(SO_4)
Chloride	12 - 20	"	(Cl)
Total Silica	8 - 25	"	(SiO_2)
'Reactive' Silica	4 - 14	"	"
Organics	0.68 expressed as O_2 absorbed ½ hour at 100°C.		
pH	7.0 - 7.5		
Aluminium	0.05 - 0.20	p.p.m.	(Al)
Sodium	7 - 9	"	(Na)
Free Carbon Dioxide	2 - 4	"	(CO_2)
Total Iron	0 - 1	"	(Fe)
Iron in Solution	0 - 1	"	(Fe)
Total Dissolved Solids	50 - 100	"	
Conductivity	70 - 90	micromhos/c.c at 20°C	
Turbidity	6 - 12	(silica scale)	
Colour	15 - 35	(Hazen)	
Nitrate	1.0	p.p.m.	(N)
Nitrite	0.005	"	(N)

PROPOSAL No.	418/4
EQUIPMENT No.	12-3-0 & 12-3-1
SERVICE	Steam Generating Equipment
No. UNITS	1

1. SCOPE OF WORK

1.1 The design, obtaining all necessary Statutory approvals, supply of all materials, manufacture, testing and delivery to site at Risdon, Tasmania (off-loading and installation by others) of :-

One (1) : PACKAGED BOILER having nominal capacity of 50,000 lb/hr. of steam.

2. BOILER CAPACITY AND OPERATING DATA

2.1 At maximum flow, the required steam pressure at the steam header located after the steam motor shall be 130 psig.

2.2 The steam condition shall be dry saturated at 150 psig.

2.3 Capacity and turndown:

The unit must be capable of producing not less than 50,000 lb/hr when working at continuous normal output and must be capable of turndown in order to maintain a stable output rate of 16,000 lb/hr. and/or values in between these rates. The capacity of 50,000 lb/hr. includes for deaeration oil heaters, etc. of the boilers ancillary equipment.

2.4 Feed water:

Will be provided between 3 psig and 7 psig. Tenderer to include Feed Water pumps and drives and to nominate required chemical analysis of water to be provided.

2.5 Fuel:

Supplied as per specification attached.

2.6 Initial steam tracing and heating:

A supply of low pressure steam at approx. 50 psig sat. would be available for initial start-up purposes.

Equipment No. 12-3-0 & 12-3-1

3. AUXILIARY EQUIPMENT

3.1 Drum for collection of both continuous and intermittent blowdown water, to be discharged at 120oF using quench water that will be available at 60°F, allowing for steam to be released at least 20 ft. above grade.

4. INSTRUMENTATION AND CONTROL

4.1 To be pneumatic and "fail safe" in respect of power and/or instrument air failure.

4.2 Provision to allow for necessary panel instrumentation but the installation of the panel and locally mounted instruments by others.

4.3 Safety trip systems as protection against flame failure, hi-low levels etc. with audible alarm prior to reaching trip condition.

4.4 Datalarm or equal standard sequential annunciating systems.

5. ELECTRICAL

5.1 Power available: 415V, 3 phase, 50 cps
5.2 Motor starters and controls: supplied and installed by others.
5.3 Preferred motor makes are GEC/AEI or Simpson Pope.

FUEL OIL SPECIFICATION
(British Standard BS 2869 Clause F)

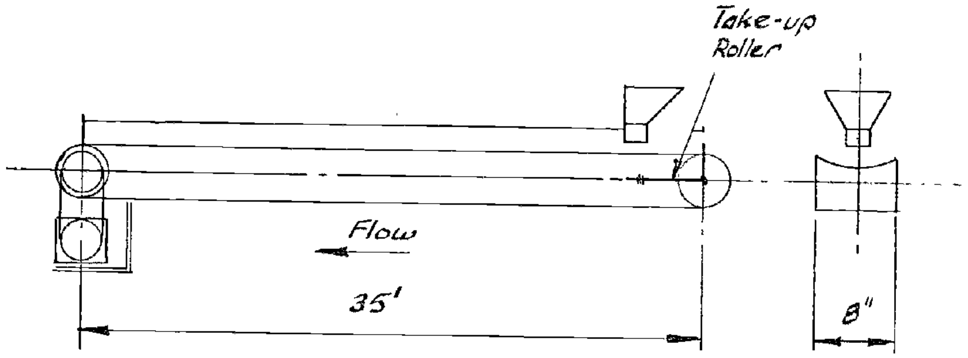
	Guaranteed	Typical
Specific Gravity	0.986 max.	0.940
Flash Point (Abel)	150°F min.	220°F
Pour Point	55°F max.	40°F
Viscosity sus. @ 100°F	650 max.	630
Gross Calorific value	18,500 min.	19,000
Sulphur % wt.	3 max.	2.4
Vanadium (V_2O_5)	100 PPM max.	40
Ash wt.%	0.1 max.	<0.1
Strong Acid No. (MGM KOH/GM)	Nil	Nil
Sediment & Water (% vol)	0.5 max.	0.2
Sediment by extraction (% wt.)	0.1 max.	<0.1
Conradson carbon (% wt)	-	6.5 max.

MATERIAL HANDLING SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	13-3-0
SERVICE	Zinc dust belt conveyor
No. UNITS	1
OPERATING CONDITIONS	
MATERIAL HANDLED	Zinc dust
MATERIAL CONDITIONS	
LUMP SIZE	Fine
BULK DENSITY	
TEMPERATURE	Ambient
PERIOD OF FEED	Intermittent
RATING	Approx. 1 FT/SEC.

REMARKS



PROPOSAL No. 418/4

EQUIPMENT No.

SERVICE LIST OF PIPING SPECIFICATIONS

No. UNITS

SPECIFICATION NO.	SERVICE
418/4-5101-S1	Steam & Cond. Return
-5105-S1	Fuel Oil
-5110-S1	Boiler Feed Water (to boiler feed pumps)
-5111-S1	" " " (from B.F.W. pump to boiler)
-5115-S1	98% Sulphuric Acid
-5116-S1	Plant Air
-5120-S1	Cooling Water
-5121-S1	Water (incl., plant, sealing, domestic & fire)
-5601-S1	Process F/Glass Reinf. P.V.C.
-5602-S1	Vacuum System F/Glass Reinf. P.V.C.
-5605-S1	Process Rubber Hose
-5610-S1	Steam " "
-5611-S1	Plant Air " "

PIPING DATA SHEET

STD.

SERVICE:	STEAM & COND. RETURN			1
ANALYSIS OF SERVICE:				2
RATING	SEE 'CONNECTIONS'	TEMP. LIMITS		3
CODES-DESIGN	AS B65 - 1956 (BS 806)	CORROSION ALLOW.		4
FABRICATION		WELDING		5

CONDITION	WORKING	DESIGN	6
TEMPERATURE	365°F		7
PRESSURE	150 PSIG		8
PIPE-TYPE	SEAMLESS		9
MAT'L. SPEC.	CARBON STEEL TO ASTM A53 Gr. A or B		10
SIZE	TO 1½"	TO 6"	11
THICKNESS	SCH. 80	SCH. 40	12

CONNECTIONS	SIZE		13
SCREWED	TO 3/4"	VALVES & STEAM TRAPS	14
			15
FLANGED	1" TO 2"	BS TABLE 'F' SLIP ON	16
	3"& ABOVE	BS TABLE 'H' SLIP ON	17
WELDED	TO 1½"	SOCKETWELD	18
	2"&ABOVE	BUTTWELD	19

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION	20
FLANGES	ALL	SLIP ON BORED TO USAS B16.5	CARBON STEEL ASB52-1964	21
		BST 'D'		22
BENDS	TO1½"	SOCKETWELD 3000# SCH. 80	" " ASTM - A10S Gr.II	23
	2"&ABOVE	BUTTWELD SCH. 40	" " " A234 WPB	24
TEES-EQUAL	TO 1½"	SEE BENDS		25
	2"&ABOVE			26
" REDUCING	TO 1½"			27
	2"&ABOVE			28
REDUCERS	TO 1½"			29
	2"&ABOVE			30
UNIONS	TO 1½"			31
				32
				33
				34

GASKETS	WALKERS METAFLEX TYPE SG OR EQUIV.	35
JOINTING	PTFE TAPE	36
BOLTING	STUDBOLTS TO BS 1750 PART 1 GRADE B7 BOLTS, GRADE 2 H NUTS	37
INSULATION	SEE INSULATION SPEC.	38

VALVES	SIZE	D.A. TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION	39
GATE	TO 1"	JOHN FIG.101	SCD.BSP	GATE	ABOVE3"	JOHN FIG 201	BS TABLE 'H'	40
	1"TO2"	" FIG.102	BS TABLE 'F'					41
GLOBE								42
								43
CHECK								44
								45

STRESS RELIEF	NIL	46
		47
RADIOGRAPHY	10%	48
		49
TESTING-SHOP		50
-FIELD	1½ WORKING PRESSURE	51
REMARKS		52
		53

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REV.	LINE	ALTERATION	BY	DATE	AUTH.

MADE	KJJ	11 JAN 72
CH'K'D		
AUTH.		

CONTRACT
ZINC PLANT
RISDON - TASMANIA

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5101-S1 PAGE1 OF

PIPING DATA SHEET

STD.

SERVICE:	FUEL OIL			1
ANALYSIS OF SERVICE:	FROM HEATING UNIT TO BOILER			2
RATING	BS TABLE F	TEMP. LIMITS		3
CODES-DESIGN		CORROSION ALLOW.		4
FABRICATION		WELDING		5

CONDITION	WORKING	DESIGN	6
TEMPERATURE			7
PRESSURE	140 PSIG MAX.		8

PIPE-TYPE	SEAMLESS OR WELDED	9
MAT'L. SPEC.	CARBON STEEL TO ASTM A53 Gr. A or B	10
SIZE	TO 1½"	11
THICKNESS	SCH. 80	12

CONNECTIONS	SIZE		13
SCREWED	NIL		14
			15
FLANGED	ALL	BS TABLE F	16
			17
WELDED	ALL	SOCKETWELD	18
			19

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION	20
FLANGES				21
				22
BENDS				23
				24
TEES-EQUAL				25
				26
* REDUCING				27
				28
REDUCERS				29
				30
UNIONS				31
				32
				33
				34

GASKETS	1/16" CAF FULL FACE - OIL RESISTANT	35
JOINTING	NIL	36
BOLTING	HEX. HEAD BOLTS & NUTS - BSW - CARBON STEEL	37
INSULATION	SEE INSULATION SPEC.	38

VALVES	SIZE	~~D.A.~~ TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION	39
GATE	TO 1½	JOHN FIG 60	FLANGED					40
								41
GLOBE								42
								43
CHECK								44
								45

STRESS RELIEF	NIL	46
		47
RADIOGRAPHY	NIL	48
		49
TESTING-SHOP		50
-FIELD	1½ WORKING PRESSURE	51
REMARKS		52
		53

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RISDON - TASMANIA

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5105-S1

PAGE 1 OF

PIPING DATA SHEET

STD.

SERVICE:	BOILER FEED WATER		
ANALYSIS OF SERVICE:	TO BOILER FEED PUMPS		
RATING	BST 'E'	TEMP. LIMITS	
CODES-DESIGN		CORROSION ALLOW.	
FABRICATION		WELDING	

CONDITION	WORKING	DESIGN
TEMPERATURE		
PRESSURE	50 PSIG	

PIPE-TYPE	SEAMLESS OR WELDED	
MAT'L. SPEC.	CARBON STEEL TO ASTM A53-Gr A or B	
SIZE	TO 1½"	ABOVE 2"
THICKNESS	SCH. 80	SCH 40

CONNECTIONS	SIZE	
SCREWED	TO 1½	AT VALVES ONLY
FLANGED	ALL	B.S. TABLE 'E'
WELDED	TO 1½"	SOCKETWELD
	ABOVE 2"	BUTTWELD

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION
FLANGES	ABOVE 2"	BST 'E'SLIP ON BORED TO USAS B16.5	CARBON STEEL AS B52-1964
BENDS	TO 1½"	SOCKETWELD 3000# SCH 80	CARBON STEEL ASTM A105 Gr II
	ABOVE 2"	BUTTWELD SCH 40	" " " A234 WPB
TEES-EQUAL	TO 1½"	SEE BENDS	
	ABOVE 2"	↓	
" REDUCING	TO 1½"	↓	
	ABOVE 2"	↓	
REDUCERS	TO 1½"	↓	
	ABOVE 2"	↓	
UNIONS	TO 1½"	↓	

GASKETS	1/16" CAF FULL FACE
JOINTING	
BOLTING	HEX HEAD BOLTS & NUTS - BSW - CARBON STEEL
INSULATION	

VALVES	SIZE	XXX. TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION
GATE	TO 1½"	JOHN FIG59M	SCD BSP				
	2"&ABOVE	" " 600	FLANGED				
GLOBE							
CHECK							

STRESS RELIEF	NIL
RADIOGRAPHY	NIL
TESTING-SHOP	
-FIELD	1½ WORKING PRESSURE
REMARKS	

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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ZINC PLANT
RISDON - TASMANIA

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5110-S1

PAGE 1 OF

PIPING DATA SHEET	STD.

SERVICE:	BOILER FEED WATER			1
ANALYSIS OF SERVICE:	FROM BOILER FEED PUMPS TO BOILER			2
RATING	BS TABLE 'H'	TEMP. LIMITS		3
CODES-DESIGN		CORROSION ALLOW.		4
FABRICATION		WELDING		5

CONDITION	WORKING	DESIGN	6
TEMPERATURE			7
PRESSURE	190 PSIG MAX.		8

PIPE-TYPE	SEAMLESS OR WELDED		9
MAT'L. SPEC.	CARBON STEEL TO ASTM A53 Gr. B		10
SIZE	TO 1½''	2'' & ABOVE	11
THICKNESS	SCH. 80	SCH. 40	12

CONNECTIONS	SIZE		13
SCREWED	TO 1½	AT VALVES ONLY	14
			15
FLANGED	ALL	BS TABLE 'H'	16
			17
WELDED	TO 1½''	SOCKETWELD	18
	2'' & ABOVE	BUTTWELD	19

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION	20
FLANGES	2''&ABOVE	BST 'H' SLIP ON, BORED TO USAS B16.S	CARBON STEEL AS-B52-1964	21
				22
BENDS	TO 1½''	SOCKETWELD 3000# SCH. 80	CARBON STEEL ASTM-A105 Gr.II	23
	2''&ABOVE	BUTTWELD SCH. 40	" " " A234 WPB	24
TEES-EQUAL	TO 1½''	SEE BENDS		25
	2'' & ABOVE			26
REDUCING	TO 1½''			27
	2''&ABOVE			28
REDUCERS	TO 1½''			29
	2''&ABOVE			30
UNIONS	TO 1½''			31
				32
				33
				34

GASKETS	1/16'' CAF FULL FACE	35
JOINTING		36
BOLTING	HEX. HEAD BOLTS & NUTS - BSW - CARBON STEEL	37
INSULATION		38

VALVES	SIZE	~~D.A.~~ TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION	39
GATE	TO 1½	JOHN 7910 SB	SCD					40
	2''&ABOVE	" 600 S	FLANGED					41
GLOBE								42
								43
CHECK								44
								45

STRESS RELIEF	NIL	46
		47
RADIOGRAPHY	NIL	48
		49
TESTING-SHOP		50
-FIELD	1½ WORKING PRESSURE	51
REMARKS		52
		53

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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RISDON - TASMANIA.

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5111-S1

PAGE 1 OF

PIPING DATA SHEET

STD.

SERVICE:	SULPHURIC ACID		
ANALYSIS OF SERVICE:	98%		
RATING	B.S. TABLE 'D'	TEMP. LIMITS	
CODES-DESIGN		CORROSION ALLOW.	
FABRICATION		WELDING	

CONDITION	WORKING	DESIGN
TEMPERATURE	AMBIENT	
PRESSURE	30 PSIG	

PIPE-TYPE SEAMLESS

MAT'L. SPEC. CARBON STEEL TO ASTM A-53 Gr. B

SIZE TO 2"

THICKNESS SCH.80

CONNECTIONS	SIZE	
SCREWED	NIL	
FLANGED	ALL	AT VALVES & VESSELS
WELDED	ALL	SOCKET WELD FITTINGS
		BUTTWELD JOINTINGS

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION
FLANGES	ALL	BS TABLE 'D' SLIP ON	CARBON STEEL AS B52 - 1964
		BORED TO USAS B16.5 DIMN	
BENDS	ALL	SOCKETWELD 3000# SCH. 80	" " ASTM A105 Gr. II
TEES-EQUAL	ALL		" " " " "
" REDUCING	ALL		" " " " "
REDUCERS	ALL		" " " " "
UNIONS	ALL		" " " " "

GASKETS FLUOLION ENVELOPE (JAMES WALKER)

JOINTING

BOLTING

INSULATION

VALVES	SIZE	TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION
GATE				DIAPHRAGM	ALL	SAUNDERS	BS TABLE 'D
						TYPE 'A' C.	I.BODY
GLOBE							
CHECK							

STRESS RELIEF NIL

RADIOGRAPHY 10% RADIOGRAPHY - FULL PENETRATION REQUIRED

TESTING-SHOP

-FIELD 45 PSIG

REMARKS

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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CONTRACT
ZINC PLANT
RISDON - TASMANIA

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5115-S1

PAGE 1 OF

PIPING DATA SHEET

STD.

SERVICE:	PLANT AIR			1
ANALYSIS OF SERVICE:				2
RATING		TEMP. LIMITS		3
CODES-DESIGN		CORROSION ALLOW.		4
FABRICATION		WELDING		5

CONDITION	WORKING	DESIGN	6
TEMPERATURE	AMBIENT		7
PRESSURE	90 PSIG		8

PIPE-TYPE	SEAMLESS OR WELDED		9
MAT'L. SPEC.	CARBON STEEL TO ASTM A53 - Gr. A or B		10
SIZE	TO 1½"	2" AND ABOVE	11
THICKNESS	SCH 80	SCH 40	12

CONNECTIONS	SIZE		13
SCREWED	TO 1½"	SCREWED BSP	14
			15
FLANGED	2"&ABOVE	BS TABLE 'D'	16
			17
WELDED	2"&ABOVE	BUTTWELD FITTINGS AND STUB INS	18
			19

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION	20
FLANGES	ALL	SLIP ON BS TABLE 'D'	CARBON STEEL AS B52 - 1964	21
		BORED TO USAS B16-5		22
BENDS	TO 1½"	BSP SCREWED	" " BS 1740	23
	2"&ABOVE	BUTTWELD	" " A234 WPB	24
TEES-EQUAL	TO 1½"	SEE BENDS	SEE BENDS	25
	2" & ABOVE	↓	↓	26
" REDUCING	TO1½"			27
	2"&ABOVE			28
REDUCERS	TO 1½"			29
	2"&ABOVE			30
UNIONS	TO 1½"	BSP BARREL TYPE	MALL IRON	31
				32
				33
				34

GASKETS	1/16" CSF FULL FACE	35
JOINTING	P.T.F.E. TAPE	36
BOLTING	HEX HEAD BOLTS & NUTS - BSW - CARBON STEEL	37
INSULATION		38

VALVES	SIZE	D.A. TYPE	CONNECTION	VALVES	SIZE	TYPE	CONNECTION	39
GATE				DIAPHRAGM	TO1½"	'SAUNDER'TYPE A	SCD BSP	40
				"	2"TO6"	" "	BS TABLE D	41
GLOBE								42
								43
CHECK								44
								45

STRESS RELIEF	NIL	46
		47
RADIOGRAPHY		48
		49
TESTING-SHOP		50
-FIELD	150 PSIG AIR TEST	51
REMARKS		52
		53

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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MADE	KJJ	11 JAN 72
CH'K'D		
AUTH.		

CONTRACT
ZINC PLANT
RISDON TASMANIA

SPEC. NO.
418/4-5116-S1

PAGE 1 OF

DAVY ASHMORE PTY. LTD.

PIPING DATA SHEET

STD.

SERVICE:	COOLING WATER			1
ANALYSIS OF SERVICE:				2
RATING	BST 'D'	TEMP. LIMITS		3
CODES-DESIGN		CORROSION ALLOW.		4
FABRICATION		WELDING		5

CONDITION	WORKING	DESIGN	6
TEMPERATURE	96°F		7
PRESSURE	50 PSIG		8

PIPE-TYPE	SEAMLESS OR WELDED		9
MAT'L. SPEC.	CARBON STEEL TO ASTM A53 Gr. A or B		10
SIZE	TO 1½"	2" & ABOVE	11
THICKNESS	SCH. 80	SCH. 40	12

CONNECTIONS	SIZE		13
SCREWED	TO 1½"	AT VALVES ONLY BSP SCD	14
			15
FLANGED	2"&ABOVE	BSD 'D' SLIP ON	16
			17
WELDED	TO 1½"	SOCKETWELD	18
	2"&ABOVE	BUTTWELD	19

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION	20
FLANGES	ALL	SLIP ON BORED TO USAS B16.5	CARBON STEEL AS52-1964	21
		BS TABLE 'D'		22
BENDS	TO 1½"	SOCKET WELD 3000# SCH.80	" " ASTM-A105 Gr. II	23
	2"&ABOVE	BUTTWELD SCH.40	" " ASTM-A234 Gr.WPB	24
TEES-EQUAL		SEE BENDS		25
				26
" REDUCING				27
				28
REDUCERS				29
				30
UNIONS				31
				32
				33
				34

GASKETS	1/8" NEOPRENE	35
JOINTING	NIL	36
BOLTING	HEX. HEAD BOLTS & NUTS - BSW - CARBON STEEL	37
INSULATION	NIL	38

VALVES	SIZE	~~XXA~~. TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION	39
GATE	TO1½"	JOHN 59M	SCD BSP					40
	ABOVE2"	" FIG 600	FLANGED					41
GLOBE								42
								43
CHECK	6"	" FIG 600	FLANGED					44
								45

STRESS RELIEF	NIL	46
		47
RADIOGRAPHY	NIL	48
		49
TESTING -SHOP		50
-FIELD	1½ WORKING PRESSURE	51
REMARKS		52
		53

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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MADE	KJJ	11 JAN 72
CH'K'D		
AUTH.		
CONTRACT	ZINC PLANT RISDON - TASMANIA	

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5120-S1

PAGE 1 OF

PIPING DATA SHEET

STD.

SERVICE: WATER: INCL. PLANT SEALING, DOMESTIC & FIRE

ANALYSIS OF SERVICE:

RATING	B ST 'D'	TEMP. LIMITS	
CODES-DESIGN		CORROSION ALLOW.	
FABRICATION		WELDING	

CONDITION	WORKING	DESIGN
TEMPERATURE	AMBIENT	
PRESSURE	100 PSIG MAX.	

PIPE-TYPE SEAMLESS OR WELDED

MAT'L. SPEC. GALV. CARB. STEEL TO AS-B105

SIZE TO 6"

THICKNESS MEDIUM CLASS

CONNECTIONS	SIZE	
SCREWED	ALL	SCD. BSP
FLANGED	2"&ABOVE	BST'D'
WELDED	NIL	

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION
FLANGES	2"&ABOVE	BST 'D' SCD	GAL. STEEL TO BS. 1740
BENDS	ALL	SCD GAL. MALL	
TEES-EQUAL	"	" " "	
" REDUCING	"	" " "	
REDUCERS	"	" " "	
UNIONS	"	~~SCD BARREL TYPE~~	GAL STEEL BS 1740

GASKETS 1/8" NEOPRENE

JOINTING PTFE TAPE

BOLTING HEX. HEAD BOLTS & NUTS - BSW - CARBON STEEL

INSULATION NIL

VALVES	SIZE	D.A. TYPE	CONNECTION	VALVES	SIZE	XXX. TYPE	CONNECTION
GATE				DIAPHRAGM	TO1½"	SAUNDER TYPE	A SCD BSP
GLOBE				"	2"&ABOVE	" "	BS TABLE D
CHECK							

STRESS RELIEF NIL

RADIOGRAPHY NIL

TESTING-SHOP

-FIELD 1½ WORKING PRESSURE

REMARKS WHERE BELOW GROUND TO BE DENSO WRAPPED AND COATED

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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RISDON - TASMANIA

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5121-S1

PAGE 1 OF

PIPING DATA SHEET

STD.

SERVICE:	PROCESS			1
ANALYSIS OF SERVICE:	SEE "TABLE 1 OF CHARACTERISTICS OF SOLUTIONS & PULPS'			2
RATING	B.S. TABLE 'D'	TEMP. LIMITS		3
CODES-DESIGN	BRITISH AND AUSTRALIAN	CORROSION ALLOW.		4
FABRICATION		WELDING		5
CONDITION	WORKING	DESIGN		6
TEMPERATURE	20 - 80°C CONTINUOUS (95°C INTERMITTENT)			7
PRESSURE	60 PSIG MAX.			8
PIPE-TYPE	SEAMLESS FIBREGLASS REINFORCED P.V.C.			9
MAT'L. SPEC.	PVC TO A SK.138 CLAUSE A			10
SIZE	TO 8''			11
THICKNESS				12

CONNECTIONS	SIZE		
SCREWED	NIL		14
			15
FLANGED	ALL	B.S.T.'D'	16
			17
WELDED	2''&ABOVE	AT REDUCERS ONLY	18
	1½''&BELOW	ALL CONNECTIONS	19

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION	20
FLANGES	ALL	BS TABLE 'D' LOOSE BACKING FLANGE	MILD STEEL BACKING FLANGE	21
				22
BENDS	2''&ABOVE	FLANGED	F/GLASS REINFORCED P.V.C.	23
	1½&BELOW	WELDED	" "	24
TEES-EQUAL	2''&ABOVE	FLANGED	" "	25
	1½''&BELOW	WELDED	" "	26
" REDUCING				27
				28
REDUCERS	ALL	WELDED		29
				30
UNIONS	NONE			31
				32
				33
				34

GASKETS	1/8'' NEOPRENE	35
JOINTING		36
BOLTING	HEX. HEAD BOLTS & NUTS	37
INSULATION	NIL	38

VALVES	SIZE	~~RXX~~ TYPE	CONNECTION	VALVES	SIZE	~~DXX~~ TYPE	CONNECTION	39
GATE				DIAPHRAGM	TO 1½''	SAUNDERS DIAP	BSTABLE D	40
						TYPE KB CIBODY		41
GLOBE				BUTTERFLY	2''TO6''	AUDCO ICW 1	BS TABLE D	42
				"	8''	" ICGI	" "	43
CHECK	TO 6''	LINATEX	BS TABLE D					44
								45

STRESS RELIEF	NIL	46
		47
RADIOGRAPHY	NIL	48
		49
TESTING-SHOP	NIL	50
-FIELD	1½ WORKING PRESSURE	51
REMARKS	ALL PIPE IN 20FT. FLANGED LENGTHS	52
		53

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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MADE	KJJ	11 JAN 7
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CONTRACT
ZINC PLANT
RISDON - TASMANIA

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5601-S1

PAGE 1 OF

PIPING DATA SHEET

STD.

SERVICE:	VACUUM SYSTEM			1
ANALYSIS OF SERVICE:				2
RATING	B.S.	TEMP. LIMITS		3
CODES-DESIGN		CORROSION ALLOW.		4
FABRICATION		WELDING		5

CONDITION	WORKING	DESIGN	6
TEMPERATURE	20°C TO 80°C MAX.		7
PRESSURE	20" HG NORMAL TO 22" HG MAX.		8
PIPE-TYPE	SEAMLESS FIBREGLASS REINFORCED P.V.C.		9
MAT'L. SPEC.	PVC TO A.S.K. 138 CLAUSE A (SEE REMARKS)		10
SIZE	TO 6"		11
THICKNESS			12

CONNECTIONS	SIZE		13
SCREWED	NIL		14
			15
FLANGED	ALL	BS TABLE 'D'	16
			17
WELDED	2"&ABOVE	AT REDUCERS ONLY	18
	1½"&BELOW	ALL CONNECTIONS	19

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION	20
FLANGES	ALL	BS TABLE 'D' LOOSE BACKING FLANGE	MILD STEEL BACKING FLANGE	21
				22
BENDS	2"&ABOVE	FLANGED	F/GLASS REINFORCED P.V.C.	23
	1½&BELOW	WELDED	" " "	24
TEES-EQUAL	2"&ABOVE	FLANGED	" " "	25
	1½"&BELOW	WELDED	" " "	26
" REDUCING				27
				28
REDUCERS	ALL	WELDED		29
				30
UNIONS				31
				32
				33
				34

GASKETS	1/8" NEOPRENE	35
JOINTING	NIL	36
BOLTING	HEX. HEAD BOLTS & NUTS	37
INSULATION	NIL	38

VALVES	SIZE	D.A. TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION	39
GATE								40
								41
GLOBE								42
								43
CHECK								44
								45

STRESS RELIEF	NIL	46
		47
RADIOGRAPHY	NIL	48
		49
TESTING-SHOP		50
-FIELD		51
REMARKS	ALL PIPE IN 20FT FLANGED LENGTHS	52
		53

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RISDON - TASMANIA

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418/4-5602-S1
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PIPING DATA SHEET

STD.

SERVICE:	PROCESS		
ANALYSIS OF SERVICE:	SEE 'TABLE 1 OF CHARACTERISTICS OF SOLUTIONS AND PULPS'		
RATING	B.S. TABLE D	TEMP. LIMITS	
CODES-DESIGN		CORROSION ALLOW.	
FABRICATION		WELDING	

CONDITION	WORKING	DESIGN
TEMPERATURE	20-80°C CONTINUOUS (95°C INTERMITTENT)	
PRESSURE	60 PSIG MAX.	

PIPE-TYPE	ACID & ABRASION RESISTING HOSE
MAT'L. SPEC.	RUBBER
SIZE	TO 8½" I.D.
THICKNESS	3 PLY

CONNECTIONS	SIZE	
~~SCREWED~~		
CLAMPED	ALL	
~~FLANGED~~	ALL	
	ALL	VICTAULIC COUPLINGS ON P.V.C. PIPE AT PUMP CONNECTION FOR QUICK
WELDED		CHANGE-OVER

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION
FLANGES			
BENDS			
TEES-EQUAL			
REDUCING			
REDUCERS			
UNIONS			

GASKETS	-
JOINTING	-
BOLTING	-
INSULATION	-

VALVES	SIZE	D.A. TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION
GATE							
GLOBE							
CHECK							

STRESS RELIEF	-
	-
RADIOGRAPHY	-
	-
TESTING-SHOP	-
-FIELD	1½ WORKING PRESSURE
REMARKS	

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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ZINC PLANT
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418/4-5605-S1 PAGE 1 OF

PIPING DATA SHEET

STD.

SERVICE: STEAM

ANALYSIS OF SERVICE:

RATING	TEMP. LIMITS
CODES-DESIGN	CORROSION ALLOW.
FABRICATION	WELDING

CONDITION	WORKING	DESIGN
TEMPERATURE	365°F	
PRESSURE	150 PSIG	

PIPE-TYPE RUBBER HOSE

MAT'L. SPEC. GOODYEAR STEAM HOSE STYLE M OR EQUAL

SIZE 1"

THICKNESS 4 PLY

CONNECTIONS	SIZE	
SCREWED		
FLANGED		
WELDED		

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION
FLANGES			
BENDS			
TEES-EQUAL			
" REDUCING			
REDUCERS			
UNIONS			

GASKETS

JOINTING

BOLTING

INSULATION

VALVES	SIZE	D.A. TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION
GATE							
GLOBE							
CHECK							

STRESS RELIEF

RADIOGRAPHY

TESTING-SHOP

-FIELD

REMARKS

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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ZINC PLANT
RISDON - TASMANIA

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418/4-5610-S1 PAGE 1 OF

PIPING DATA SHEET

STD.

SERVICE:	PLANT AIR TO SCUTTLES AND UTILITY STATIONS			1
ANALYSIS OF SERVICE:				2
RATING		TEMP. LIMITS		3
CODES-DESIGN		CORROSION ALLOW.		4
FABRICATION		WELDING		5
CONDITION	WORKING	DESIGN		6
TEMPERATURE	AMBIENT			7
PRESSURE	90 PSIG			8
PIPE-TYPE	DUNLOP WRAPPED AIR NOSE OR EQUAL			9
MAT'L. SPEC.	RUBBER			10
SIZE	3/4" & 1"			11
THICKNESS	3 PLY			12

CONNECTIONS	SIZE		
SCREWED			14
			15
FLANGED			16
			17
WELDED			18
			19

FITTINGS	SIZE	TYPE	MATERIAL SPECIFICATION	20
FLANGES				21
				22
BENDS				23
				24
TEES-EQUAL				25
				26
" REDUCING				27
				28
REDUCERS				29
				30
UNIONS				31
				32
				33
				34

GASKETS		35
JOINTING		36
BOLTING		37
INSULATION		38

VALVES	SIZE	D.A. TYPE	CONNECTION	VALVES	SIZE	D.A. TYPE	CONNECTION	39
GATE								40
								41
GLOBE								42
								43
CHECK								44
								45

STRESS RELIEF		46
		47
RADIOGRAPHY		48
		49
TESTING-SHOP		50
-FIELD		51
REMARKS		52
		53

REV.	LINE	ALTERATION	BY	DATE	AUTH.
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CONTRACT
ZINC PLANT
RISDON - TASMANIA

DAVY ASHMORE PTY. LTD.

SPEC. NO.
418/4-5611-S1

PAGE 1 OF

PROPOSAL No.	418/4
EQUIPMENT No.	
SERVICE	Electrics
No. UNITS	1 set

1. SCOPE OF WORK

The supply of all equipment and materials including delivery, off-loading and erection at Risdon, Tasmania plus all necessary labour, plant, site huts, tools, tackle, etc., for the whole of the works in accordance with the enclosed Drawings and Specifications together with all documentation, line lists and drawings on the attached list of drawings and documents. Particular items are as follows:-

1.1 H.V. Switchgear - 6100

Supply and installation of new 11 KV switchgear and sub-station modifications as per E.Z. Equipment Schedule PI No. 15-2

1.2 Power Transformers - 6200

Supply one off 1500 KVA 11000V/424-245V Transformer as per E.Z. Equipment Schedule PI No. 15-5

1.3 Power Transformers - 6200

Install two only 1500 KVA 1100/424-245V Transformers (one 1500 KVA transformer as free issue at site) as per E.Z. Equipment Schedule No. PI 15-5.

1.4 Medium Voltage Distribution Board - 6301

Supply, install and connect Med. Voltage Distribution Boards as required and as per E.Z. Equipment Schedule PI Nos. 15 - 8 & 9. and as shown on single line diagram Drg. No. PR-2978-33.

1.5 Field Equipment - 6350

Supply, install and connect all field devices including local motor safety stations, conveyor stop switches, lighting and field terminal/marshalling boxes, portable pump outlets and the like as per E.Z. Equipment Schedule PI Nos. 12, 13, 14, 16 & 22 (inclusive).

1.15 Motors - 6600

Supply, deliver and install (with the exception of mechanical lining up, etc.), 415/440 volts Squirrell cage induction motors as per E.Z. Equipment Schedule PI No. 15-10 & as shown on single line diagram dwg. No. PR-2978-33.

1.16 Labour for Installation - 6900

Labour for installation associated with all those items included in 1.14 above.

1.17 Additions to existing Residue Treatment Distribution Boards and additions to No. 2 Sub-station

Supply, install and connect all equipment necessary to carry out the work as described in Equipment Schedule PI No. 15-25

2. SPECIFICATIONS, STANDARDS, LISTS, DRAWINGS, ETC.

The following documents are enclosed and form part of this Enquiry:-

2.1 Specifications, Standards and Lists.

PI No.	15-2	Rev. A.	Scope of work, 11KV switchgear
	15-5	Orig.	1500 KVA Transformers
	15-8	Rev. A.	Low Voltage Switchgear
	15-16	Rev. A.	Power Outlets
	15-12	Rev. A.	Motor Safety Stations
	15-22	Rev. A.	Current Transformers
	15-23	Rev. A.	Preferred Electrical Equipment
	15-6	Rev. A.	Transformer Control and Protection
	15-14	Rev. A.	Conveyor Trip Wires
	15-13) 15-12)	Rev. A.	Motor Control
	15-3	Rev. A.	11KV Cables
	15-4	Rev. A.	11KV Cables, Terminations and Joints
	15-11	Rev. A.	Wiring
	15-7	Rev. A.	Transformer L.V. Connections
	15-18	Rev. A.	Lighting
	15-17	Rev. A.	Earthing
	15-19	Rev. A.	Telephones
	15-20	Rev. A.	Fire Protection
	15-21	Rev. A.	Clocks

2. SPECIFICATIONS, STANDARDS, LISTS, DRAWINGS, ETC. CONTINUED

2.1 Specifications, Standards and Lists continued

PI No. 15-24	Rev. A.	Additions to existing Residue Treatment DB's.
15-21	Rev. A.	Additions to No. 2 Sub-station

2.2 Drawings

E.Z.Dwg. No. E1-2026	Orig.	Power system single line diagram
SE-145	Rev.A.	Motor safety station
SE-148	Rev.A.	" " "
SE-150	Orig.	" " "
SE-159	Orig.	L.V. Distribution Board
SE-160	Orig.	" " "
SE-161	Orig.	" " "
SE-162	Orig.	" " "
SE-163	Orig.	" " "
SEB-138	Orig.	D.O.L.Starters, Wiring & Contro Gear
SEB-139	Orig.	" " " "
SEB-140	Orig.	" " " "
E1-731	Rev.W.	Poles, Location Plan
E1-1901	Orig.	L.V. Busbars arrangement
E1-1923	Rev.C.	L.V. Switchgear
SE-5	Orig.	Dist. Transformers (phasing)
SE-143	Rev.A.	Transformers protection
E1-1149	Rev.B.	No. 1 Distribution Board
E1-1150	Rev.B.	No. 1A Distribution Board
E1-1151	Rev.B.	No. 2B Distribution Board
E1-1465	Orig.	Portable pump supply arrangement
E1-1523	Rev.A.	No.3 L.V.Distribution Board
SE-76	Rev.C.	Conveyor Trip Wires
E1-1694	Orig.	No.2 Sub-station LVSW/B
E1-1878	Rev.B.	" " " "
E1B-626	Rev.D.	Sub-station No.2-Single line diagram
STD-22	Orig.	Squirrel cage motors(dimensions)
E5B-174	Rev.A.	Denver sampler schematic
E5B-250	Rev.A.	Portable pump schematic
E5B-203	Orig.	Hydrolysis Tank mixer schematic
PR-2978-22	Orig.	Plant Elevation

2.2 Drawings continued

418-6410-1	Orig.	Electrical Equipment Layout (marked up copy of Dwg. PR2978-21 only).

1.6 <u>Cabling - High Voltage - 6410</u>

Supply, install and connect (underground) High Voltage cables as per E.Z. PI Nos. 15-3 & 4.

1.7 <u>Wiring - 6411</u>

Medium and Low Voltage. Supply, install and connect medium and low voltage cabling on cable ladder and in conduit as per E.Z. PI No. 15-11

1.8 <u>A.C. Busbars - 6412</u>

Supply, install and connect copper enclosed busbar systems between 1500 KVA L.V. Terminals and the 425/245 volt M.C.C. as per E.Z. Equipment Schedule PI No. 15-7.

1.9 <u>Lighting - 6420</u>

Supply, install and connect a complete lighting system as per E.Z. Equipment Schedule PI No. 15-18. Fittings small generally be 2 x 20W fluorescent, with highbay M.V. in the filter building. M.V. Floods for outdoor yard and storage areas and glare control fluorescents in control room.

1.10 <u>Earthing System - 6430</u>

Supply, install and connect an earthing system as per E.Z. Equipment Schedule PI No. 15-17.

1.11 <u>Telephones - 6450</u>

Supply, deliver and install and connect telephones as per E.Z. Equipment Schedule PI No. 15-19.

1.12 <u>Fire Protection - 6470</u>

Supply, delivery, install and connect Thermal Fire detection systems as per E.Z. Equipment Schedule PI No. 15-20. Detectors system shall be extended from the existing circuitry in sub-station No. 4.

1.13 <u>Clocks - 6480</u>

Supply, delivery, install and connect electric clocks as per E.Z. Equipment Schedule PI No. 15-21.

1.14 <u>Materials for Installation - 6460</u>

Including cable accessories, marker posts, ladders, consumables, site establishment, slabs, sand, brackets, fixings, etc. for the complete installation. Refer E.Z. Equipment Schedule PI No. 15-23

PROPOSAL No. 418/4

EQUIPMENT No.

SERVICE Electric Motor List

No. UNITS

Item No.	Description	No. off	BHP	R.P.M.
1-4-0	Hydrocyclone Feed (ore) pump	2	15	1440
2-3-0	" " (L/S) pump	2	10	1435
2-5-0	L/S pulp feed pump	2	3	1400
3-2-0	Calcine Pump	2	3	1400
7-4-0	Primary Filtrate pump	2	15	1450
8-6-0	Wash Filtrate pump	2	7.5	1460
9-1-5	Filter Feed pump	2	10	1435
9-5-0	Return Cake pump	2	3	1400
9-7-0	G.E. Filtrate pump	2	20	1475
9-10-0	Basics Feed pump	2	20	1460
10-3-0	Basics Filter feed pump	2	5.5	1420
10-6-0	Basics Slurry pump	2	4	1400
10-8-0	Basics Feed pump	2	4	1400
10-10-0	Discard sol'n pump	2	3	1440
10-11-1	Cooling water pump	1	20	1450
12-2-1	Deaerator feed pump	2	5	1440
12-3-1	Boiler feed water pump	2	40	1440
12-4-1	Boiler feed oil pump	2	3	1440
14-2-0	Sump pump	4	5.5	1420
14-4-0	Portable sump pump	1	15	1440
12-1-2	Boiler dosing Eq'p pump	2	5.5	710
4-2-0	Acid Supply pump	2	3/4	1440
10-13-0	Calcine pump	2	10	1440
16-1-0	Pre-neut th. O/F	2	3/4	1440
2-4-1	L/S pulp tank agt.	1	10	1440
3-1-1	Calcine pulp tank agt.	1	3	1440
6-1-2	Leaching tank agt.	3	3	1440
7-1-2	Coagulation tank agt.	3	10	1440
8-1-1	Acid repulp tank agt.	2	10	1440
8-2-1	Recoagulation tank agt.	3	15	1440
8-5-1	Repulp tank agt.	1	2	1440
8-7-0	Wash Filtrate pump	2	7.5	1440

Electric Motor List

DAVY ASHMORE PTY. LTD.

Item No.	Description	No. Off	BHP	R.P.M.	
9-1-3	G.E. Puri. tank agt.	3	50	1440	
9-3-1	Unwashed cake tank agt.	1	2	1440	
10-1-1	Basic PPT tank agt.	4	15	1440	
10-2-1	Cooler tank agt.	1	40	1440	
10-5-1	Basics slurry tank agt.	1	2	198	Gear motor
10-7-1	Basics slurry storage tank agt.	1	7½	1440	
14-2-1	Drainage sump agt.	4	2	198	Gear motor
13-1-1	Ni. Puri Tank agt.	1	75	1440	
1-1-1	Bin. ext. convy. (ore)	1	2	Variable speed D.C.	
1-2-0	Mill feed conv. (ore)	1	1	1410	
1-3-0	Ball mill (ore)	1	125	980	
2-1-1	Bin ext. conv. (L/S)	1	2	Variable speed D.C.	
2-1-2	Mill feed conv. (L/S)	1	1	1410	
2-2-0	Ball mill(L/S)	1	400	740	
7-3-2	Coag. PPT Conv.	2	2	1440/25	Gear motor
	" " " to A.R.T.	1	3	1440/42	" "
7-3-0	Disc. Filter	2	3	1440	
7-3-0	Disc. Filter agt.	2	5	1440	
8-4-0	Drum filter	3	3	1440	
8-4-0	Drum filter agt.	3	5	1440	
8-4-2	Drum filter conv.	1	5	1440	
8-4-3	" " "	1	5	1440	
9-2-3	Gantry Crane	1	35)	1440	
		1	5)		
		1	10)		
10-4-0	Basics drum filter	1	3	1440	
	" " " agt.	1	5	1440	
10-4-1	" " " conv.	1	3	1440/16 R.P.M.	
10-12-1	Vent Fan	1	3	1440	
11-1-0	Vac. Pumps	3	150	960	
	" "	1	125	1440	
12-1-0	Boiler Fan	1	50	1440	
13-2-0	Ni Puri. Filter Press	2	½	1440	
14-13-0	Air blower	1	40	1440	
10-11-0	Cooling tower fan	1	25	1440	
13-3-0	Zn. Dust Belt Conv.	1	1	1440	

SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	
SERVICE	SCOPE OF INSTRUMENT SUPPLY AND INSTALLATION
No. UNITS	

SUPPLY

The instruments for this plant are shown on the engineering flow diagrams. The lists are derived from the E.Z. flowsheets and show all major components in each control loop but do not include control panels or ancilliary equipment such as airsets.

Two control panels are included in the supply. The main panel is a straight fronted cubicle type 7'0" high x 12'0" long with an open back. This panel is to be mounted in the control room. No "mimic" or "graphic" diagram is included on the panel and instruments are grouped in plant sections to facilitate easier operation. The other panel which will be fitted in the boiler house is a 6' x 9" high x 5'0" wide x 7'0" long dustproof, straight fronted cubicle, housing the appropriate boiler and grinding section instruments.

Two alarm annunciators are supplied. A 28 point unit on the main panel and a 10 point system on the boiler panel. These alarms are low voltage D.C. systems incorporating alarm acknowledge buttons situated near each initiating switch.

TYPE OF INSTRUMENTATION

All transmitters and controllers are electronic with current to pneumatic positioners fitted to the final operators. A valve operator has been included for each swing launder but the launder itself is not included.

pH equipment is of "Bechman" manufacture with M.V. output for connection to controllers of the same make as used generally in the plant.

Temperature controllers are M.A. inputs using M.V. to current converters connected to thermocouples.

INSTALLATION

The installation of instruments and ancillary equipment is based on Davy-Ashmore's standard procedures. It includes all instruments together with the installation of cabling and tubing from the boiler panel to local junction points for the appropriate boiler instruments.

Precommissioning calibration checking of instruments is included but actual commissioning of plant is not included in the capital cost estimate.

PROPOSAL No. 418/4

EQUIPMENT No.

SERVICE Main process buildings

No. UNITS 1

1. SCOPE

This specification covers the design, supply of all materials manufacture and construction of one only process building at Risdon, Tasmania.

2. GENERAL

Building to be generally in accordance with dwg. No. PR2978-35 135' long x 45' wide, 56' high. An extra building 45' x 15' containing a switchroom (bottom floor) and a control room and two offices is attached to the main building.

3. CONSTRUCTION

The main building is of steel construction containing one intermediate floor for supporting heavy equipment and having chequer plate flooring.

Outside cladding is 22 gge Stainless steel Stran-Satin 262 Profile yellow PT 1817 outside. Gull grey inside.

Roof 24 gge Colourbond Spander cleating - Charcoal outside. Gull grey inside.

4. CRANE

Internal crane as per specification 9-2-3.

5. STAIRS

Two stairways - one external, one internal - at each end of building.

6. CODE

Building to be in accordance with the local building regulation and structural steel to be to AS. CA1

7. PAINTING

As per painting specification.

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	
SERVICE	Surface Preparation and Painting
No. UNITS	

1. SCOPE

This specification covers the procedure for the preparation, prime and finish coating of all surfaces except galvanised steel and stainless steel.

2. SURFACE PREPARATION

All acid or chemically contaminated steel surfaces shall be thoroughly washed with clean, fresh water to remove any salts and acid residues.

Heavy deposits of oil or grease may be removed by scrubbing with brushes or rags wetted with a suitable solvent.

All other surfaces shall be thoroughly cleaned by wire brushing with automatic tools.

3. PRIME COAT

After cleaning by airless spray, conventional spray or brush, one coat of "British Paints" LUXAPRIME ZINC PHOSPHATE High Build Primer to a wet film thickness of .006" (150 microns), dry film thickness of .003"(75 microns).

4. SECOND COAT

After priming apply by airless spray, conventional spray or brush one coat of "British Paints" PHENOLIC ENAMEL (white) to a dry film thickness of .0015".

5. FINISH COAT

After second coat apply by airless spray, conventional spray or brush one top coat of PHENOLIC ENAMEL (colour) to a dry film thickness of .0015".

6. Total film thickness after all coats must be .006" or more.

7. LOCATION

Plant is Electrolytic Zinc Co. of Australasia Pty. Ltd. Silicate Treatment Plant at Risdon Tasmania.

SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No. 418/4

EQUIPMENT No.

SERVICE Equipment List.

No. UNITS

TANKS

1-3-2	Hydro Cycl. Pump Feed Ore Tank	1	4' x 4' x 4'	Wood
2-2-2	" " " " L/S "	1	4' x 4' x 4'	Wood
2-4-0	Limestone Pulp	1	12' x 12'	Wood
2-6-0	Feed Splitter Head Tank	1	2' x 2'	Wood
3-1-0	Calcine, Pulp tank	1	12' x 12'	M.S.
3-3-0	Feed Splitter Head Tank	1	2' x 2'	Wood
4-3-0	Acid Head Tank	1	3' x 3'	M.S.
6-1-0	Leaching	3	12' x 13'6"	Wood
7-1-0	Coagulation	3	15' x 20'	Wood
7-3-1	Pri. Filt. Feed Head Box.	1	3' x 3'	Wood
8-1-0	Acid Repulp	2	10' x 11'	Wood
8-2-0	Recoagulation	3	12'6" x 13'	Wood
8-4-1	Fin. Filt. Feed Head Box.	1	3' x 3'	Wood
8-5-0	Repulp	1	9' x 9'	Wood
8-8-0	Wash Filtrate	1	9' x 10'	Wood
9-1-1	Germ. Puri.	3	15' x 15'	Wood
9-3-0	Repulp	1	10' x 10'	Wood
9-8-0	Surge	1	28' x 15'	Wood
10-1-0	Precipitation	4	13' x 14'	Wood
10-2-0	Cooler	1	15' x 15'	Wood
10-5-0	Basics Slurry	1	6' x 6'	Wood
10-7-0	Basics Slurry	1	14' x 16'	Wood
10-9-0	Basics Splitter Head Tank	1	2' x 2'	Wood
10-14-0	Calcine Split. Head Tank	1	2' x 2'	Wood
12-3-0	Feed Water	1	11' x 11'	M.S.
13-1-0	Ni Purifier	1	22' x 23'	M.S.
14-8-0	Wash Water	1	8' x 7'	FRP
14-3-0	Seal Water	1	4' x 4'6"	M.S.

PUMPS

1-4-0	Hydrocyclone Feed (Ore)	2	
2-3-0	Hydrocyclone Feed (L/S)	2	
2-5-0	Limestone Pulp Feed	2	
3-2-0	Calcine Pump	2	
4-2-0	Acid Supply pump	2	
7-4-0	Primary Filtrate	2	
8-6-0	Silica Residue	2	
8-7-0	Wash Filtrate	2	
9-1-5	Filter Feed	2	
9-5-0	Return Cake	2	
9-7-0	GE. Filtrate	2	
9-10-0	Basics Feed (GE)	2	
10-3-0	Basics Filter Feed	2	
10-6-0	Basics Slurry	2	
10-8-0	Basics Feed	2	
10-10-0	Discard Solution	2	
10-11-1	Cooling Water	1	
10-13-0	Calcine Pump	2	
12-2-1	Deaerator Feed	2	
12-3-1	Boiler Feed Water	2)	Part of Boiler Supply
12-4-1	Boiler Feed Oil	2)	
14-2-0	Sump Pump	4	
14-4-0	Portable Sump Pump	1	
16-1-0	Preneutralisation thickener O/F Pump	2	

AGITATORS

2-4-1	Limestone Pulp Tank	1 off
3-1-1	Calcine Pump Tank	1
6-1-2	Leaching Tank	3
7-1-2	Coagulation Tank	3
8-1-1	Acid Repulp Tank	2
8-2-1	Recoagulation Tank	3
8-5-1	Repulp Tank	1
9-1-3	GE. Puri. Tank	3
9-3-1	Unwashed Cake Tank	1

AGITATORS CONTINUED

10-1-1	Basic Precipitation Tank	2 Impellers - 4 off		
10-2-1	Cooler Tank	1		
10-5-1	Basics Slurry Tank	1		
10-7-1	Basics Slurry Storage Tank	1		
13-1-1	Ni Purifier Tank	1		
14-2-1	Drainage Sumps	4		
1-1-0	Ore Bin		350 T	M.S.
1-1-1	Bin Extractor Conveyor			
1-2-0	Mill Feed Conveyor 18" Belt & Weigher			
1-3-0	Ball Mill 11.2TPH 90% - 100 mesh 100% - 65 mesh Ore S.G. 4.23			
1-3-1	Direct Mill Feed Chute			
1-4-1	Hydrocyclone - 6" cyclone	4 off		
2-1-0	Limestone Bin		150 T	M.S.
2-1-1	Bin Extractor Conveyor. L/S			
2-1-2	Mill Feed Conveyor & Weigher L/S			
2-2-0	Limestone Mill 4.5 TPH 100% - 200 mesh 90% - 400 mesh S.G. 1.66			
2-2-1	L/S Direct Mill Feed Chute			
2-3-1	Hydrocyclones - 6" cyclone	3 off		
2-6-0	Feed Splitters - 3 Swing Launder Total Flow			
2-6-1	Feed Splitters	3 off		
3-3-1	Feed Splitters			
5-1-0	8" Vinyl glass line - 700' 300 G.P.M.			
6-1-1	Connecting Launders	3 off		
7-1-1	Connecting Launders	2 off		
7-1-3	Co-ag. Tank Heading Element			
7-2-0	Primary Filter Air Lift 21,000 G.P.H. 4½" dia.			
7-3-0	Disc Filters 10'6"x 10 disc	2 off		
7-3-2	Coagulation Precipitate Conveyor	3 off		
7-4-1	Filtrate Receiver 7'6" x 8'6"	1 off		
8-1-2	Connecting Launders	2 off		
8-2-2	Connecting Launders	2 off		
8-2-3	Recoag. Tank Heading Element			

Equipment List

8-3-0	Final Filter Air Lift 9,000 G.P.H.		
8-4-0	Drum Filter SS	3 off	12' x 12' Face
8-4-2	Final filter Residue Screw Conveyor	1 off	
8-4-3	" " " "	1 off	
9-1-2	Connecting Launders	2 off	
9-1-4	Air Spargers 2" S.S.	3 off	
9-2-0	Leaf Filter Basket	2 off	50 leaves
9-2-1	Filter Vats	3 off	
9-2-2	Filter Cake Discharge Hopper	1 off	
9-2-3	Gantry Crane 45' Span 10 T Lift		
9-2-4	3½" Air Lifts	2 off	
9-7-1	Moore Filter Vacuum Drum		
9-9-0	Shell & Tube Heat Exchanger		
9-12-0	Air Blower	1 off	
10-1-2	Connecting Launders		
10-2-2	Cooler Elements -Segmental Nests		
10-4-0	Drum Filter 12' dia. x 14' S.S.		
10-4-1	Basics Cake Screw Conveyor		
10-9-1	Basics Splitter	2 off existing	
10-10-2	Discard Sampler	1 off existing	
10-11-0	Cooling Tower 30,000 G.P.H.		
10-12-0	Vent Stack & Associated Ductwork		
10-12-1	Vent Fan 5,000 B.C.F.M. F.R.P. Construction		
10-14-1	Calcine Splitter	1 off	
11-1-0	Vacuum Pumps	Total	10,000 CFM - 1 off 4000 CFM 2 off 3000 CFM
11-1-1	Vacuum Pump	1 off	1500 CFM
11-2-0	Vacuum Seal Tanks	2 off	
11-3-0	Barometric Leg Head Tank	2 off	
11-4-0	Moisture Trap		
12-1-0	Boiler 51,000 lb/hr. Water tube packaged Oil Fired Unit incl: F.D. Fan & Ducting & Instrument Panel.		
11-5-0	Filter Vac. Receivers		
11-6-0	Vacuum Seal Water Tank		
12-1-1	Boiler Stack		
12-1-2	Boiler Dosing Equipment		
12-2-0	Water Treatment Plant Filter, Softener, etc.		
12-3-2	Deaerator 6' x 12'		
12-4-0	Oil Storage Tank - Existing relocated		
12-4-2	Oil Heaters (Boiler)	2 off existing	

Equipment List

13-3-0	Zinc Dust Belt Conv.	1 off
13-2-0	Ni Purifier Filter Press - 660 ft.^{2} each	2 off
14-2-0	Drainage Sumps	
14-5-0	High Pressure water cleaning unit	
14-7-0	Haulpak Unit 35 Ton	1 off
14-16-0	Urinal	

PROPOSAL No. 418/4

EQUIPMENT No.

SERVICE Tanks

No. UNITS

SUMMARY OF TANKS

Item No.	Tank	No.off	Size	Roof	Mat'l of Constr.
6-1-0	Leaching	3	12'Ø x 13'6"	Yes	Wood
7-1-0	Coagulation	3	15'Ø x 20'	Yes	Wood
8-5-0	Repulp	1	9'Ø x 9'	-	Wood
8-1-0	Acid Repulp	2	10'Ø x 11'	Yes	Wood
8-2-0	Recoagulation	3	12'6"Ø x 13'	Yes	Wood
9-1-1	Germ. Puri.	3	15'Ø x 15'	Yes	Wood
9-3-0	Repulp	1	10'Ø x 10'	-	Wood
9-8-0	Surge	1	28'Ø x 10'	-	Wood
10-2-0	Cooler	1	15'Ø x 15'	-	Wood
10-1-0	Precipitation	4	13'Ø x 14'	Yes	Wood
10-5-0	Basics Slurry	1	6'Ø x 6'	Yes	Wood
8-8-0	Wash Filtrate	1	9'Ø x 10'	-	Wood
2-4-0	Limestone Pulp	1	12'Ø x 12'	-	Wood
14-8-0	Wash Water	1	8'Ø x 7'	-	FRP
3-1-0	Calcine Pulp	1	12'Ø x 12'	-	M.S.
12-3-0	Feed Water	1	11'Ø x 11'	Yes	M.S.
13-1-0	Ni Purifier	1	22'Ø x 23'	Yes	MS/A.B.L.L.
10-7-0	Basics Slurry	1	14'Ø x 16'	Yes	Wood

Baffles in Tanks

10% Tank Dia., 1/26th. Tank Dia. Clear from walls and bottom

1-3-2	Hydro.cycl.feed	1
2-2-2	" " "	1
4-3-0	Acid Head	1
2-6-0	Feed Splitter	1
3-3-0	" "	1
7-3-1	Dri. Filt. Head	1
8-4-1	Fin. " "	1
10-9-0	Feed Splitter	1
10-14-0	" "	1
14-3-0	Seal Water	1

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	6-1-0
SERVICE	Leaching
No. UNITS	3
SPECIFICATION	Refer 418/4 - 3200- S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	13'6"
SHELL DIAMETER	12ft.
~~DESIGN PRESSURE~~ WORKING VOL.	9000 Gal
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	30°-50°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	

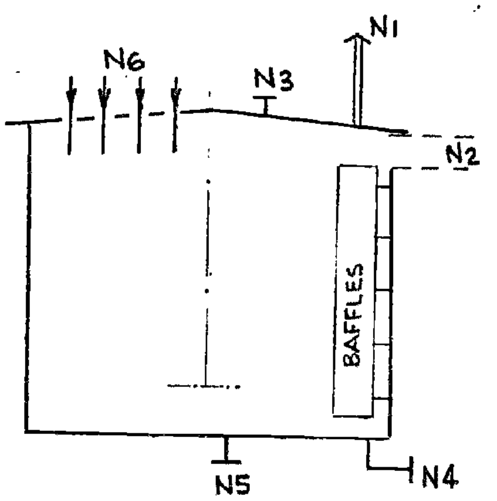
MATERIALS OF CONSTRUCTION

SHELL)	Wood - Celery Top Pine or Western Red Cedar
LINING)	Typ. details see Dwg. EZ Std. 128 & 183
SUPPORTS)	Nozzle Details see Dwg. 277-3200-72 (Typ. only)
INTERNALS)	

REMARKS

Material Being Handled

Leach Pulp Viscosity 4.6 Relative SG - 1.35
pH 1.0 - 1.25 of soln. 2.8 C.P.
Corrosive, mildly abrasive, slightly scaling
Pulp or solution will gel. in stagnant pockets
after several days.
Tanks to have wood pine covers



N_1 - 12"Ø Fibreglass vent
N_2 - Laundered outlet
N_3 - Inst. Conn. 2"
N_4 - 6" Scuttling Drain
N_5 - 4½ Air Lift outlet
N_6 - Inlets (Holes in Tank)

Baffles 4 off eq. spaced
St. St. Support Brackets

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	7-1-0
SERVICE	Coagulation Tanks
No. UNITS	3
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
HEIGHT	20 ft
SHELL DIAMETER	15 ft.
WORKING VOL.	21,000 gal.
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	63° - 75°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	

MATERIALS OF CONSTRUCTION

SHELL)	Wood - Celery Top Pine or Western Red Cedar
LINING)	Typ. Details EZ Dwg. Std. 128 & 183
SUPPORTS)	Nozzle Details Dwg. 277-3200-72 (Typ only)
INTERNALS)	

REMARKS

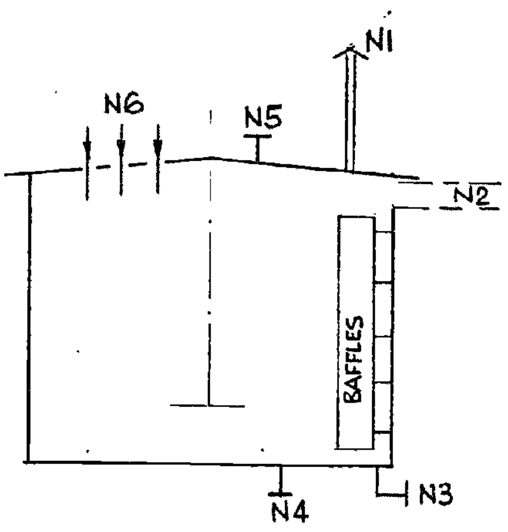
Material Being Handled

Coagulation Pulp	Viscosity	3.7 Relative
pH 4.8 - 5.6	of Sol'n	1.6 C.P.
SG - 1.30		

1 off Tank has heating elements

Tanks to have wood pine covers

Baffles 4 off eq. spaced St. St. Support Brackets



N_1 - 12"Ø Fibreglass Vent

N_2 - Laundered Outlet

N_3 - 6' Scuttling Drain

N_4 - 4½ Air Lift Outlet

N_5 - Inst. Conn. 2"

N_6 - Inlet/Holes in Tank

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-1-0
SERVICE	Acid Repulp Tanks
No. UNITS	2
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
~~SHELL LENGTH~~ HEIGHT	11'0"
SHELL DIAMETER	10'
~~DESIGN PRESSURE~~ WORKING VOL.	4,550 GAL
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	20° - 45°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	
MATERIALS OF CONSTRUCTION	
SHELL)	
LINING)	Wood - C.T. Pine or Western Red Cedar
SUPPORTS)	Typ. Details see Dwg. EZ Std. 128 & 183
INTERNALS)	

REMARKS

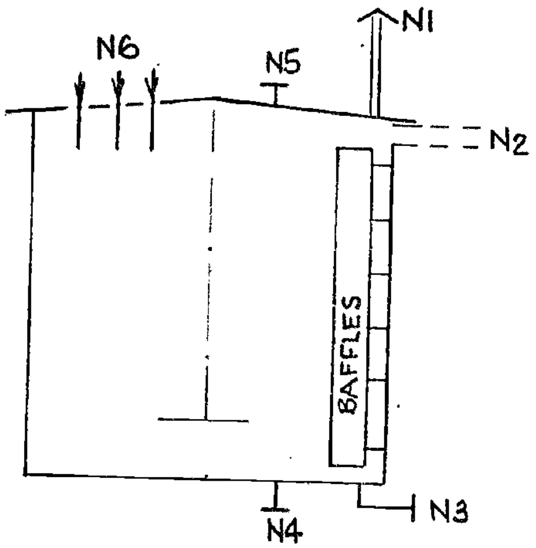
Material Being Handled

Acid Repulp Leach Pulp	Viscosity of	3.0 Relative
pH 1.0 - 1.25	Sol'n	2.4 C.P.
SG 1.29		

Tanks to have wood pine covers

For Nozzles see dwg. 277-3200-72 Typ. only

Baffles 4 off eq.spaced, St. St. Support Brackets



N_1 - 12Ø" Fibreglass Vent

N_2 - Laundered Outlet

N_3 - 6" Scuttling Drain

N_4 - 4½ Nozzle

N_5 - Instr. Conn. 2"

N_6 - Inlet (Holes in Tank)

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-2-0
SERVICE	Recoagulation Tank
No. UNITS	3
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
HEIGHT	13 ft
SHELL DIAMETER	12ft.6"
WORKING VOL.	7,600 GAL.
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	63°-70°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	

MATERIALS OF CONSTRUCTION

SHELL	)
LINING	) Wood - C.T. Pine or Western Red Cedar
SUPPORTS	) Typ. Details see E.Z. Dwg. Std. 128 & 183
INTERNALS	)

REMARKS Material Being Handled

Recoagulated pulp

pH 4.8 - 5.6

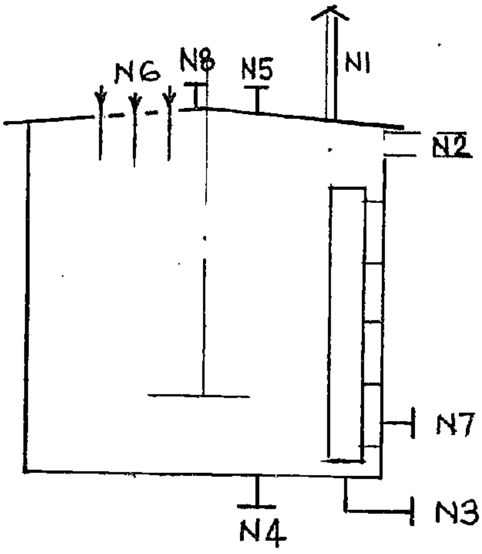
S.G. 1.34

Viscosity of Sol'n 2.8 Relative 1.2 C.P.

Tanks to have wood pine covers

Baffles 4 off eq. spaced on circ. St. St. Bracket Supports

For Details of Nozzles see Dwg. 277-3200-72 (Typ only)



N_1 - 12" Ø Fibreglass Vent
N_2 - Laundered outlet
N_3 - 6" Scuttling Drain
N_4 - 4½" Nozzle
N_5 - Instr. Conn. 1"
N_6 - Inlets (Holes in Roof)
N_7 - 4" Instr. Conn.
N_8 - 2" Instr. Conn.

TANK AND VESSEL SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-1-0
SERVICE	Precipitation Tanks
No. UNITS	4
SPECIFICATION	Refer 418/4-3200-S1
DESIGN CODE	
SXXXXXXXXXXXX HEIGHT	14 ft.
SHELL DIAMETER	13 ft.
XXXXXXXXXXXXXXXX WORKING VOL.	7,700 GAL
WORKING PRESSURE	Open to Atmos.
DESIGN TEMPERATURE	
WORKING TEMPERATURE	90° - 98°C
CORROSION ALLOWANCE	
STRESS RELIEF	
INSULATION	

MATERIALS OF CONSTRUCTION

SHELL)	
LINING)	Wood - C.T. Pine or Western Red Cedar
SUPPORTS)	Typ. Details see E.Z. Dwg. Std 128 & 183
INTERNALS)	

REMARKS

Material Being Handled

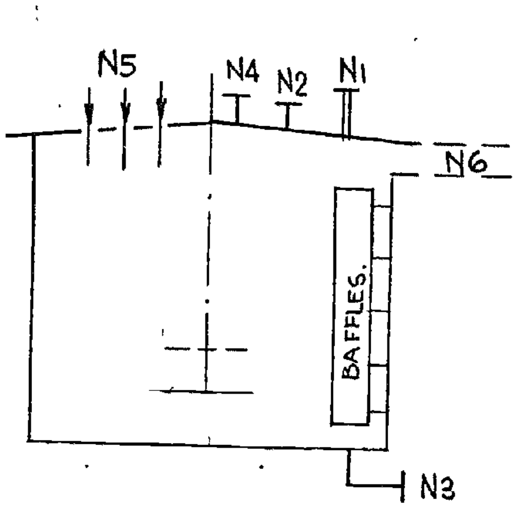
Basics Pulp

pH 5.6 - 7.0	Viscosity Rel	2.2 - 1.5	± 30%
SG 1.2	of Soln. ABS	0.7 - 0.5 CP	± 50%

Tanks to have wood pine covers

For details of nozzles see dwg. 277-3200-72 (Typ. only)

Baffles - 4 off eq. spaced on circ. St. St. Bracket Supports



N_1 - 6" Ø Vent

N_2 - Instr. Conn. 2"

N_3 - 6" Scuttling Drain

N_4 - 1" Instr. Conn

N_5 - Inlets (Holes in roof)

N_6 - Laundered outlet

PROPOSAL No. 418/4

EQUIPMENT No. Pumps 40% Zn

SERVICE

No. UNITS

PUMP SUMMARY

		No.off	Capacities
1- 4-0	Hydrocyclone Feed (Ore)	2	42 IGPM
2- 3-0	" " L/S	2	21.7 "
2- 5-0	Limestone Pulp Feed	2	26 "
3- 2-0	Calcine Pulp	2	No change
7- 4-0	Primary Filtrate	2	370 IGPM
8- 6-0	Silica Residue	2	117 "
8- 7-0	Wash Filtrate	2	145 "
9- 1-5	Filter Feed	2	420 "
9- 5-0	Return Cake	2	320 IGPH
9- 7-0	GE. Filtrate	2	350 IGPM
9-10-0	Basics Feed (GE)	2	104 IGPM
10- 3-0	Basics Filter Feed	2	No change
10- 6-0	Basics Slurry	2	"
10- 8-0	Basics Feed	2	"
10-10-0	Discard Solution	2	183 IGPM
10-11-1	Cooling Water	1	500 IGPM
12- 2-1	Deaerator Feed Water	2	No change
12- 3-1	Boiler Feed Water	2	"
12- 4-1	" " Oil	2	"
14- 2-0	Sump Pump	4	"
14- 4-0	Portable Sump Pump	1	"
4- 2-0	Acid	2	260 IGPH
10-13-0	Calcine Pulp	2	154 IGPM
16- 1-0	Preneutralisation Thickener O/Flow	2	No change

For complete specifications other than capacities refer to specification sheets on 50% Zn ore.

PROPOSAL No.	418/4
EQUIPMENT No.	6-1-2
SERVICE	Leach Tank Agitator
No. UNITS	3

Duty:- To agitate solution to allow leaching reaction to proceed.

Specific Gravity :- 1.35 pH 1.0 - 1.5

Temperature :- 30° - 50°C

Tank Details see spec. 6-1-0

Capacity :- 9,000 GAL

Dim's :- 12' Ø x 13'6"

Construction Materials

Impeller:- 316 St. St. Shaft M.S. Rubber covered

Upper shafts and rigid couplings:- M.S.

Dim's from underside unit to mid depth impeller - 12'6"

Dim's from mid depth impeller to Bot. of tank - 2'

Material being handled

Leach pulp

Mildly abrasive, slightly scaling

Top entering mixer

Closed top on tank

H.P. required - 5

PROPOSAL No.	418/4
EQUIPMENT No.	7-1-2
SERVICE	Coagulation Tank Agitator
No. UNITS	3

Duty:- To agitate solution to allow coagulation process to occur.

Specific Gravity :- 1.30 pH:- 4.8 - 5.6

Temperature :- 63° - 75°C

Tank Details see spec. 7-1-0

Capacity :- 21,000 work. vol.

Dim's :- 15'0 x 20'

Construction Materials

Impeller :- 316 St. St. Shaft :- M.S. Rubber covered

Upper shafts and rigid couplings:- M.S.

Dim's from underside unti to mid depth impeller 18'6"

Dim's from mid depth impeller to Bot. of tank 2'6"

Top entry mixer

Closed top on tank

Material being handled

Coagulation pulp

H.P. required 15

PROPOSAL No.	418/4
EQUIPMENT No.	8-1-1
SERVICE	Acid Repulp Tank Agitator
No. UNITS	2

Duty:- To agitate pulp to allow leaching reaction to proceed.

Specific Gravity:- 1.29

Temperature :- 20° - 45°C pH:- 1.0 - 2.5

Tank Details see spec. 8-1-0

Capacity :- 4,550 work. vol.

Dim's :- 10'0 x 11'

Construction Materials

Impeller :- 316 St. St. Shaft:- Rubber covered M.S.

Upper shafts and rigid couplings M.S.

Dim's from underside unit to mid depth impeller 10'

Dim's from mid depth impeller to Bot. of tank 2'

Top entry mixer

Closed top on tank

Material being handled

Acid repulp leach pulp

H.P. required - 10

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	8-2-1
SERVICE	Neutralisation/Recoagulation Tank Agitator
No. UNITS	3

Duty:- To agitate pulp to allow coagulation process to occur.

Specific Gravity:- 1.34 pH 4.8 - 5.6

Temperature :- 63° - 70°C

Tank Details see spec. 8-2-0

Capacity:- 7,600 gal. work. vol.

Dim's :- 12'6"0 x 13'

Construction materials

Impeller:- AISI type 316 St. St. Shaft:- Rubber covered M.S.

Upper shafts and rigid couplings:- M.S.

Dim's from underside unit to mid depth impeller :- 12'

Dim's from mid. depth impeller to bot. of tank :- 2'

Top entry mixer

Closed top on tank

Material being handled

Recoagulated pulp.

H.P. required - 20

PROPOSAL No.	418/4
EQUIPMENT No.	10-1-1
SERVICE	Precipitation Tank Agitators
No. UNITS	4

Duty :- Thorough mixing and suspension of solids required.
Precipitation to occur.

Specific Gravity :- 1.2 pH 5.6 - 7.0

Temperature :- 90^{o} - 98^{o}C

Tank Details see spec. 10-1-0

Capacity:- 7,700gal. working vol.

Dim's 130 x 14'

Construction Materials

Impellers :- M.S. Shaft :- M.S. Rubber covered

Upper shafts and rigid couplings :- M.S.

Dim's from underside unit to mid depth impeller :- 13'

Dim's from mid depth impeller to Bot. of tank 2'

Top Entry mixer

Closed top on tank

2 impellers per shaft required

Disc type turbine

6 straight blades 1/3 tank dia.

Material being handled

Basics pulp

H.P. required 15

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	Grinding Mills
SERVICE	1-3-0, 2-2-0
No. UNITS	

1. SCOPE

For the design, supply, fabrication, delivery and commissioning of the following grinding equipment to Risdon, Tasmania.

2. GENERAL

Mills to be of the ball mill type complete with motors, reduction gears, couplings, guards etc. associated with the mill drive and access platforms. The mills will be protected by alarms and trip systems which will shut the grinding mill down on bearing over-temperature, lubrication failure, motor protection etc.
The mills will be controlled from a panel located adjacent to the grinding area.

3. CAPACITY AND MATERIAL DATA

Limestone Mill	2-2-0	1 only
Capacity	4.5 TPH	
Material	Limestone/water pulp 10 lb. of solids/gall of pulp see attached specification.	
Temp.	5-30°C	
pH	7	
SG	1.66 (pulp) 2.93 (L/S)	

Materials of Construction

Shell Liner	SKEGA RUBBER
Balls	C.S.

Motor HP 400

Wet Grinding Mill - 8' x 13' overflow

Feed	1/8"
Product	95% - 400 mesh 100% - 200 mesh

Equipment No. 1-3-0, 2-2-0

3. CAPACITY AND MATERIAL DATA CONTINUED.

Ore Mill 1-3-0	1 only
Capacity	11.2 TPH
Material	Willemite/Wash liquor 10.1 lb. ground ore/ gall of pulp See attached specification.
Temperature	10 - 30°C
pH	5-6
SG	1.85 $^{+.3}_{-.85}$
Viscosity (Sol'n)	1.3 - 1.9 Rel. 1.1 - 2.5 CP

Materials of Construction

Shell liner	SKEGA RUBBER
Balls	C.S.
Motor HP	125

Wet Grinding Mill - 6' x 8' Centrix overflow.

Feed - ½" Mesh

Product - 100% - 65 mesh

90% - 100 mesh

4. LIMESTONE ANALYSIS

Tylex mesh	%		
+ 8	10.5	+ 100	3.1
+14	31.2	+ 150	2.3
+28	25.6	+ 200	1.9
+65	16.6	- 200	8.8

5. ORE ANALYSIS

- ½" +¼"	26.5	+ 100	6.8
+ 1/8"	16.5	+ 200	2.5
+ 14 mesh	13.0	+ 325	0.3
+ 28 "	18.5	+ 400	0.2
+ 48 "	15.0	- 400	0.7

PROPOSAL No.	418/4
EQUIPMENT No.	1-4-1 & 2-3-1
SERVICE	Hydrocyclones
No. UNITS	2 systems

Design Basis

Limestone Pulp

Feed	-	Normal	1300 GPH
		Min.	700 GPH

Willemite Pulp

Feed	-	Normal	2620 GPH
		Min.	1420 GPH

For specifications other than feed refer specification sheets for 50% Zn ore.

SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	= 418/4
EQUIPMENT No.	7-1-3
SERVICE	Coagulation Tank Heating Element
No. UNITS	

Material Handled	Coil	-	Steam
	Tank	-	Coagulation Pulp
Tank Capacity	18,100 G.P.H.		63° - 75° C
Coil Capacity	Normal		Max. 18,100 lb/hr.
	Min		% Time at Max. Cap. 100%

Coil Construction Material:- Carbon Steel

Remarks:- Steam to be at 50 psig dry. sat.

Coil easily removable

Construction

1½" dia. tubes at 4" CRS around circum.

U tubes 10' high

Arrange in 3 segmental nests

Ring. Dia. - Inlet Header 14') 2" dia. pipes
" " - Outlet " 13')

PROPOSAL No.	DA. 418/4
EQUIPMENT No.	7-3-0
SERVICE	Primary Filters
No. UNITS	Two (No Standby)

Capacity (per filter) : dry solids - 4.7 tons/hr.
feed - 9,050 gallons/hr.

Material Handled : Coagulated pulp with 1.1 lbs. solids per gallon of pulp, 8.9% solids by weight. Solids are abrasive and are suspended in zinc sulphate solution of pH 4.8 - 5.6

S.G : 1.3 Temperature : 63-75°C

Sizing of Coagulated Solids:

Tyler Mesh	% by Weight
+48	Nil
-48+65	Trace
-65+100	0.3
-100+150	0.7
-150+200	1.0
-200+400	Trace
-400	98.0
	100.0

Filter type : Disc

Discharge type : Roller preferred

Filtration Rate : Test filter rate at 1.5 minutes from time gave a filtration rate of 0.32 gal/ft^2/min.

Filter Area : Installed area per filter - 1500 ft.^{2}

Size: 10'6"0 x 10 disc

Materials of Construction: 316 SS

RFMB 7.2.72

MATERIAL HANDLING SPECIFICATION

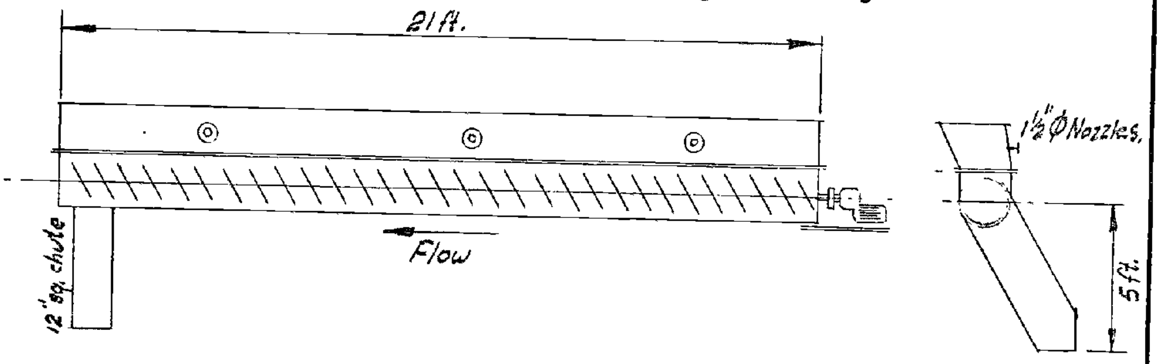
DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	7-3-2
SERVICE	Coagulation Precipitate Conveyors
No. UNITS	3
OPERATING CONDITIONS	
MATERIAL HANDLED	Primary Filter Cake
MATERIAL CONDITIONS	
LUMP SIZE	
BULK DENSITY	
TEMPERATURE	
PERIOD OF FEED	
RATING	277 T.P.D. (norm). 635 T.P.D. (max.)

REMARKS

Stainless Steel Construction

Removable lid. Intermediate hanger bearings

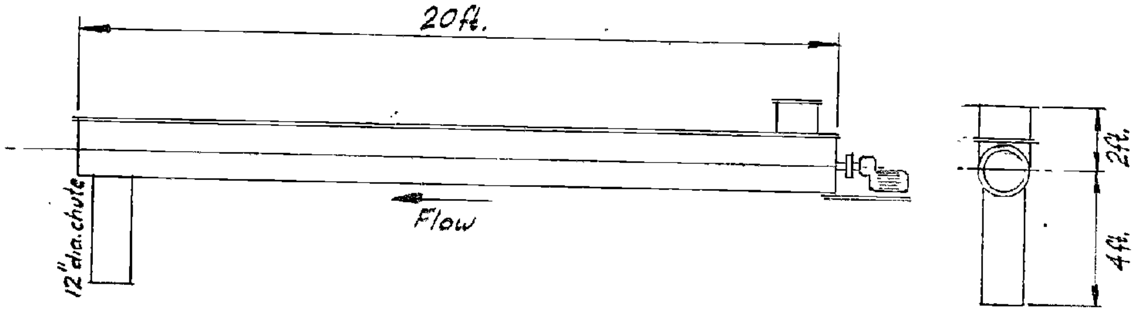


12" Ø screw

2 HP motor

27 R.P.M.

2 off required



12"Ø screw

5 HP Motor

45 R.P.M.

1 off required

PROPOSAL No.	418/4
EQUIPMENT No.	8-2-3
SERVICE	Neutralization/Recoagulation No. 1 Tank Heating Element
No. UNITS	1 required

Material Handled: Coil: Steam Tank : Recoagulation Pulp

Tank Capacity: 9100 G.P.H. From 20°C to 70°C

Coil Capacity: Normal 6,280 lb/hr. Max. 9,100 lb/hr.

Min: 1,970 lb/hr. % time at Max. Capacity 100%

Coil Construction Material :- Carbon Steel

Remarks:-

1. Steam assumed to be at 50 psig, dry saturated
2. Brittle, thin, hard scales form on tubes within several months, but can be easily removed by light rapping.
3. Must be easily removable for cleaning and replacement Vertical tubes in sections preferred.

Construction:-

1½" Dia. Tubes at 5½"CRS around circum.
U tube 10' high
Arrange in 3 segmental nests
Ring dia - Inlet header 10'6")
" " - Outlet " 9'6") 2" dia. pipes

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	DA.418/4
EQUIPMENT No.	8-4-0
SERVICE	Final Filters
No. UNITS	Three (No standby)

Capacity (per filter) : dry solids - 2.88 tons/hr
feed - 3035 gallon/hr.
wash water - 1900 gallon/hr.

Material Handled : Recoagulated pulp with 2.12 lbs. solids per gallon of pulp, 17% solids by weight. Solids are abrasive and are suspended in zinc sulphate solution of pH 5-5.6

S.G. : 1.34 Temperature : 70°C max
Sizing of solids : similar to solids in 7-3-0

Filter type : Drum filter

Discharge type : Belt

Filtration Rate : Test filter rate at 1.0 minutes form time and 60°C gave filtration rate of 1.0 gal/ft^2/min

Filter Area : Installed area per filter - 450 ft.^{2}.
Drum Size - 12'Ø x 12'

Special Requirements : Wash water to be separated from primary filtrate with separate receiver

: Compression rolls with wash belt for washing cake on drum.

Materials of Construction: 316 S.S.

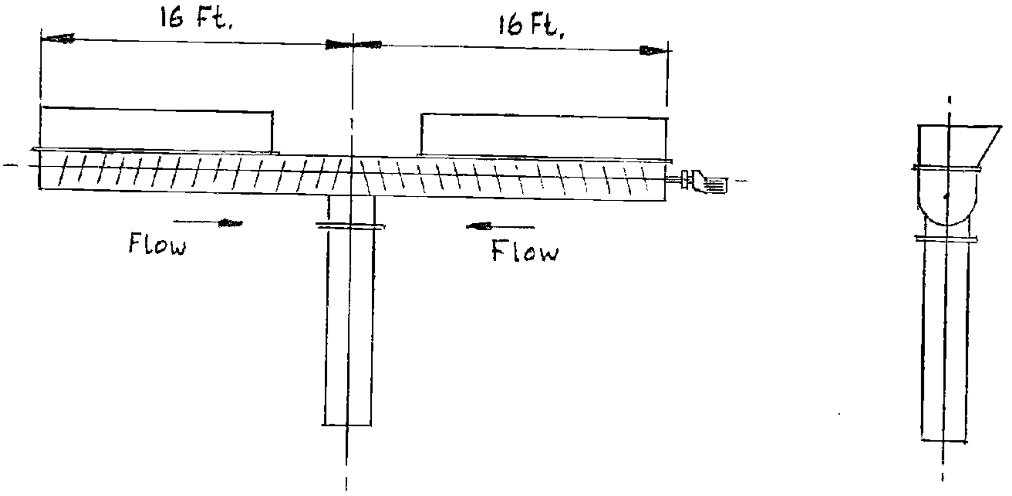
RFMB 7.2.72

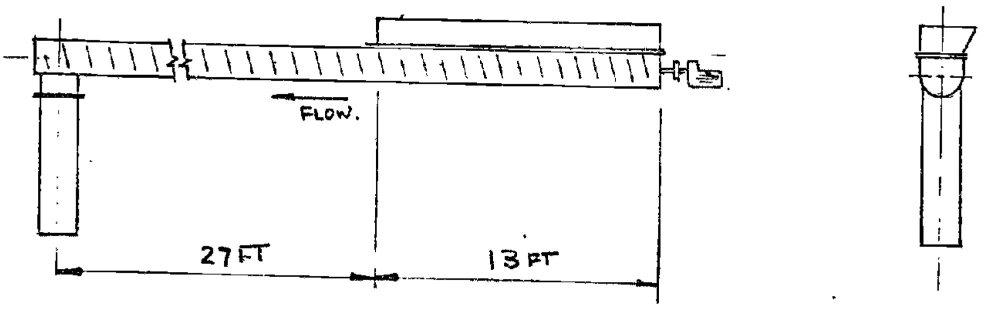
MATERIAL HANDLING SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	8-4-2 & 8-4-3
SERVICE	Final Filter Residue Screw Conveyor
No. UNITS	2
OPERATING CONDITIONS	
MATERIAL HANDLED	Silica Residue
MATERIAL CONDITIONS	Glutinous slurry
LUMP SIZE	
BULK DENSITY	38% solids 50 - 80#/cu. ft.
TEMPERATURE	
PERIOD OF FEED	
RATING	23 T.P.H. (norm.) 32 T.P.H. (max.)

REMARKS

Stainless steel construction





12" Ø Screws

5 H.P. Motors

84 R.P.M.

PROPOSAL No.	DA.418/4
EQUIPMENT No.	9-2-0
SERVICE	Germanium Precipitate Filter Basket
No. UNITS	2 (1 standby)

Capacity:- (per filter)	19,200 G.P.H. (pulp)
Material Handled:-	Germanium precipitate Bulk Density 600-700 G/L solids pH - 5.5 SG - 1.55 Temp - 45° - 60°C
Filter type:-	Moore For details of construction see E.Z. dwgs. E3-1069 E3-449 E3-492
Materials:-	Filter leaves - 316 St. St. Filter Frame - MS Vacuum header - Acid Proof Rubber hose 50 Leaves 4'' CRS

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	9-9-0
SERVICE	Shell & Tube Heat Exchanger
No. UNITS	1

Material being handled

Combined filtrate and wash solution from G.E. purification filters.
400 I.G.P.M. design flow rate

Steam:- 150 psig saturated

Solution Temp. change - 83°F

Exchanger

19.9' x 10^6 BTU/hr.
Bundle length - 12ft.
Tubes - 1" O.D. x 14 BWG on 1¼" △ pitch
Area - 492 ft^2
Shell I.D. = 22" containing 4 tube passes
S.S. Tubes & tubesheet
M.S. shell

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	10-2-2
SERVICE	Pulp Cooler Cooling Element
No. UNITS	1 required

Material Handled: Coil: Water Tank: Basics Pulp

Coil Capacity: Max: 30,000 G.P.H. Normal: 30,000 G.P.H.
Min: 13,000 G.P.H. % Time at Max. Capacity 100%

Coil Construction Material:- Carbon Steel

Remarks:

1. Tubes are to be arranged in U Tube nests.
2. Headers to be segmented for easy removal for cleaning and maintenance.
3. U Tubes on approx. 4" centres and 9'0" length maximum.

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	DA. 418/4
EQUIPMENT No.	10-4-0
SERVICE	Basics Filter
No. UNITS	One (No standby)

Capacity : dry solids 9.85 tons/hr
feed 7,130 gallon/hr.
wash water 1,800 gallon/hr.

Material Handled : Basics pulp with 3.0 lb. solids per gallon of pulp. The solids have been precipitated from a zinc sulphate solution and zinc is still present in the filtrate. The solids are abrasive. pH 5.6 - 7.0 SG - 1.2

Filter Type : Drum filter

Discharge Type : Belt

Filter Area : Total Area - 528 ft.^{2}
Drum Size - 12'0 x 14'

Special Requirements : Compression rolls with wash belt for washing cake on drum.

Materials of Construction: 316 SS

RFMB 7.2.72

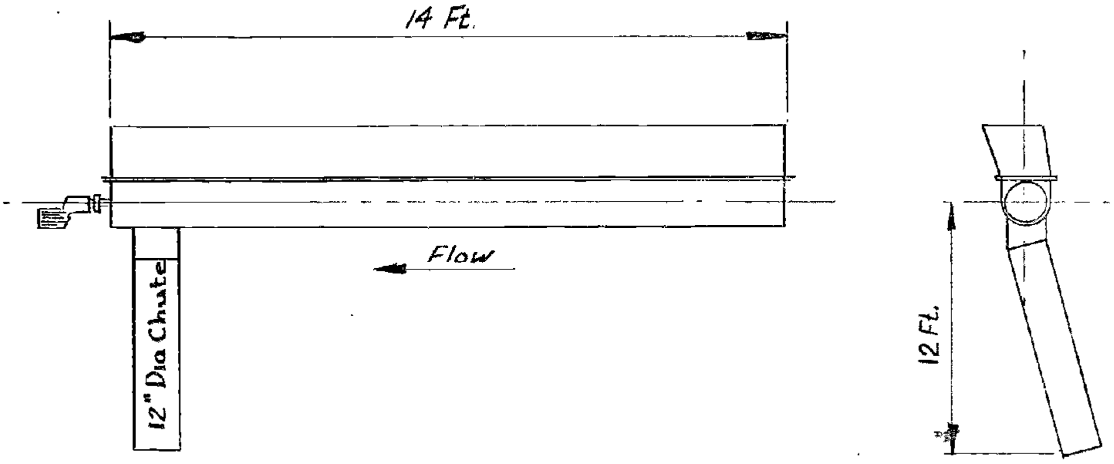
MATERIAL HANDLING SPECIFICATION **DAVY ASHMORE PTY. LTD.**

PROPOSAL No.	418/4
EQUIPMENT No.	10-4-1
SERVICE	Basics Filter Cake conveyor
No. UNITS	1
OPERATING CONDITIONS	
MATERIAL HANDLED	Basics Filter Cake
MATERIAL CONDITIONS	Abrasive wet solids
LUMP SIZE	
BULK DENSITY	120#/cu.ft. S.G.:- 2.39
TEMPERATURE	30° - 50°C
PERIOD OF FEED	
RATING	30,000#/hr. (norm.) 36,400#/hr. (max)

REMARKS

Stainless steel construction

Removable lid. Intermediate hanger bearings



12" dia. screw

3 HP motor

Speed 19 R.P.M.

PROPOSAL No.	418/4
EQUIPMENT No.	10-11-0
SERVICE	Water Cooling Tower
No. UNITS	1

1. This specification details the requirements for the design, manufacture, supply and erection of all materials, parts and equipment required for the construction of a Water Cooling Tower complete with the exception of the R/C basin (which will be provided by others). Supplier will provide all fittings for supply, chain and suction lines.

2. Design Data:

Capacity of Tower	26,000 Imp. G.P.H. (norm)
	30,000 Imp. G.P.H. (max)
	12,500 Imp. G.P.H. (min)
Input Water Temperature	77^o - 96^oF
Output Water Temperature	75^oF
Air Inlet Wet Bulb Temperature	70^oF
Air Outlet Wet Bulb Temperature	83^oF
Dry Bulb Temperature	80^oF

Continuous Operation

Water to Contain Cl and Cu additives.

3. The tower shall be of the induced draft type.

The tower shall be of robust construction and possess good weathering characteristics.

Interior access shall be provided for routine cleaning and maintenance.

All structures, platforms, ladders and handrailing to be provided by supplier and in accordance with relevant Australian or British Standards.

SPECIFICATION

DAVY ASHMORE PTY. LTD.

PROPOSAL No.	418/4
EQUIPMENT No.	11-1-0, 11-1-1
SERVICE	Vacuum Pumps
No. UNITS	

1. SCOPE

This specification covers for the design, supply of all materials, manufacture, testing and packing for delivery to Risdon, Tasmania for:-

Vacuum pumps and ancillary equipment to accomplish duty detailed below.

2. DESIGN BASIS

The vacuum system will be required to deliver at 20-22" Hg,vacuum for a filter system operating with slurries at a max. temperature of 75°C. Air from the filter will be assumed to be saturated and at approx. 60°C maximum entering the vacuum system.

Based on filtration area and estimated filter load a vacuum requirement of 10,000cubic ft/min, at vacuum, being based on 2 ft^3/ft.^{2} filter area/ min is required.

In addition, a system requiring only a 1ft.^{3}/ft.^{2}/min. giving 1,500 cubic ft/min at vacuum.

3. EQUIPMENT

For plant layout purposes, four machines are required with three (3) for first requirement and one (1) for second requirement. Each machine will be independent in all respects with regard to protective devices. A common seal water system with suitable valving and control.

The vacuum pumps will come complete with drives, guards, seal water filters, reserve tank with water make-up level control, circulation pumps, separation and silencing equipment.

Pumps

2 off @ 3000 CFM)
1 off @ 4000 CFM)
)

1 off @ 1500 CFM

PROPOSAL No.	418/4
EQUIPMENT No.	12-3-0 & 12-3-1
SERVICE	Steam Generating Equipment
No. UNITS	1

Boiler Capacity

The unit is to be capable of producing not less than 51,000 lb/hr. when working at continuous normal output. This includes for deaeration, oil heaters, etc. of the boiler ancilliary equipment.

For specifications other than capacity refer to specification sheets for 50% Zn ore.

PROPOSAL No. 418/4

EQUIPMENT No.

SERVICE Electric Motor List

No. UNITS

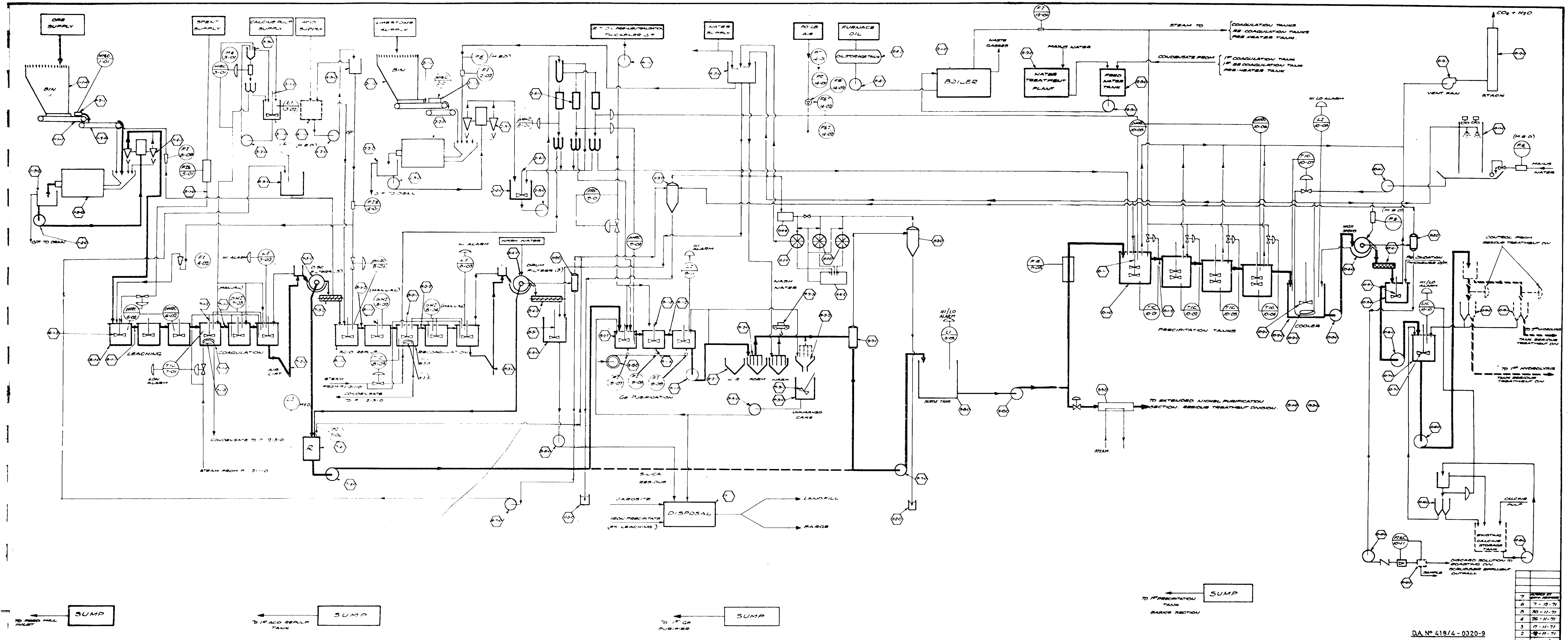
Item No.	Description	No. off	BHP	R.P.M.
1-4-0	Hydrocyclone Feed (ore) pump	2	15	1440
2-3-0	" " (L/S) pump	2	10	1435
2-5-0	L/S pulp feed pump	2	3	1400
3-2-0	Calcine Pump	2	3	1400
7-4-0	Primary Filtrate pump	2	15	1450
8-6-0	Wash Filtrate pump	2	7.5	1460
9-1-5	Filter Feed pump	2	10	1435
9-5-0	Return Cake pump	2	3	1400
9-7-0	G.E. Filtrate pump	2	20	1475
9-10-0	Basics Feed pump	2	20	1460
10-3-0	Basics Filter feed pump	2	5.5	1420
10-6-0	Basics Slurry pump	2	4	1400
10-8-0	Basics Feed pump	2	4	1400
10-10-0	Discard sol'n pump	2	3	1440
10-11-1	Cooling water pump	1	20	1450
12-2-1	Deaerator feed pump	2	5	1440
12-3-1	Boiler feed water pump	2	40	1440
12-4-1	Boiler feed oil pump	2	3	1440
14-2-0	Sump pump	4	5.5	1420
14-4-0	Portable sump pump	1	20	1440
12-1-2	Boiler dosing Eq'p pump	2	5.5	710
4-2-0	Acid Supply pump	2	3/4	1440
10-13-0	Calcine pump	2	10	1440
16-1-0	Pre-neut th. O/F	2	3/4	1440
2-4-1	L/S pulp tank agt.	1	10	1440
3-1-1	Calcine pulp tank agt.	1	3	1440
6-1-2	Leaching tank agt.	3	5	1440
7-1-2	Coagulation tank agt.	3	15	1440
8-1-1	Acid repulp tank agt.	2	10	1440
8-2-1	Recoagulation tank agt.	3	20	1440
8-5-1	Repulp tank agt.	1	2	1440
8-7-0	Wash Filtrate Pump	2	7.5	1440

Electric Motor List

Item No.	Description	No. Off	BHP	R.P.M.	
9-1-3	G.E. Puri. tank agt.	3	50	1440	
9-3-1	Unwashed cake tank agt.	1	2	1440	
10-1-1	Basic PPT tank agt.	4	15	1440	
10-2-1	Cooler tank agt.	1	40	1440	
10-5-1	Basics slurry tank agt.	1	2	198	Gear motor
10-7-1	Basics slurry storage tank agt.	1	7½	1440	
14-2-1	Drainage sump agt.	4	2	198	Gear motor
13-1-1	Ni. Puri Tank agt.	1	75	1440	
1-1-1	Bin. ext. convy. (ore)	1	2	Variable speed D.C.	
1-2-0	Mill feed conv. (ore)	1	1	1410	
1-3-0	Ball mill (ore)	1	125	980	
2-1-1	Bin ext. conv. (L/S)	1	2	Variable speed D.C.	
2-1-2	Mill feed conv. (L/S)	1	1	1410	
2-2-0	Ball mill(L/S)	1	400	740	
7-3-2	Coag. PPT Conv.	2	2	1440/25	Gear motor
	" " " to A.R.T.	1	3	1440/42	" "
7-3-0	Disc. Filter	2	3	1440	
7-3-0	Disc. Filter agt.	2	5	1440	
8-4-0	Drum filter	3	3	1440	
8-4-0	Drum filter agt.	3	5	1440	
8-4-2	Drum filter conv.	1	5	1440	
8-4-3	" " "	1	5	1440	
9-2-3	Gantry Crane	1	35)		
		1	5)	1440	
		1	10)		
10-4-0	Basics drum filter	1	3	1440	
	" " " agt.	1	5	1440	
10-4-1	" " " conv.	1	3	1440/16 R.P.M.	
10-12-1	Vent Fan	1	3	1440	
11-1-0	Vac. Pumps	(2 1	150 250	960	
	" "	1	125	1440	
12-1-0	Boiler Fan	1	50	1440	
13-2-0	Ni Puri. Filter Press	2	½	1440	
14-13-0	Air blower	1	40	1440	
10-11-0	Cooling tower fan	1	30	1440	
13-3-0	Zn. Dust Belt Conv.	1	1	1440	

DRAWING INDEX

E.Z. No.	D.A.P.L. No.	Description
PR 2978-8	418/4-0320-9	General Flow Diagram
-21	-0300-1	Preliminary Plant Layout
-22	-0300-2	Preliminary Plant Elevations
-24	-0320-1	F/Sheet - Equipment List & General Notes
-25	-0320-2	" - Leaching & Coagulation
-26	-0320-3	" - Acid Repulp & Recoagulation
-27	-0320-4	" - Limestone Section
-28	-0320-5	" - Basics Section
-29	-0320-6	" - GE Purification
-30	-0320-7	" - Vacuum System, Acid Supply, Calcine Supply
-31	-0320-8	" - Boiler & Water Treatment
-33	-6000-1	Electric Single Line Diagram
-35	-2101-1	Main Building Elevations



ISSUE	DATE
7	ALTERED BY DRWY. ASHMORE
6	7-12-71
5	30-11-71
4	26-11-71
3	17-11-71
2	[illegible]-11-71
1	9-11-71.

D.A. Nº 418/4-0320-9

THIS DWG. SUPERSEDES PR-2978/5

APPROVED BY SILICATE TREATMENT TECHNICAL COMMITTEE 12-11-71.

APPROVED BY	DATE		DATE
		DRAWN BY	
J. [illegible]	[illegible]-71	TRACED BY C. TOWNSEND	3-11-71
[illegible]	[illegible]	CHECKED BY	
		O.K. BY P.L. Coakley	12-11-7

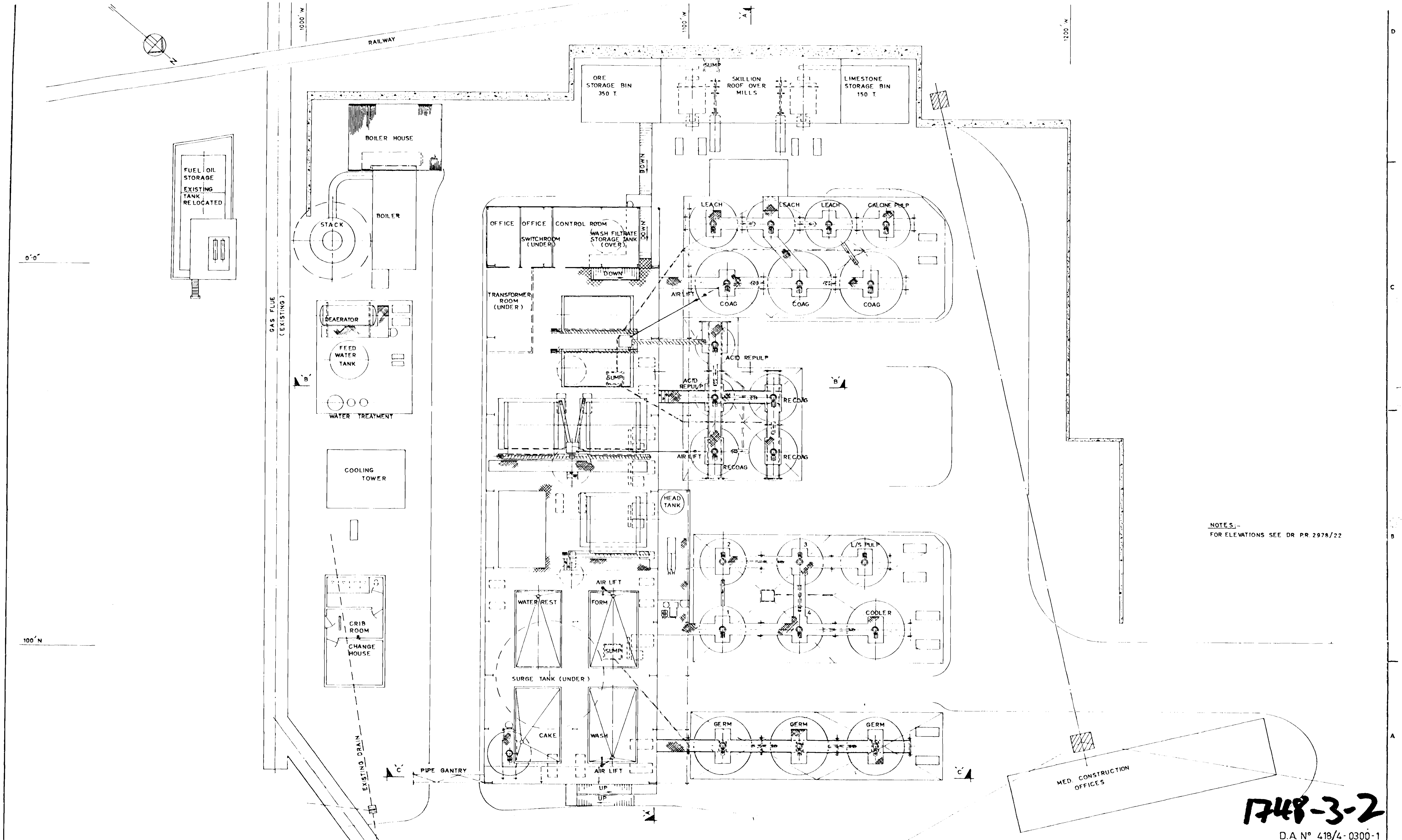
ELECTROLYTIC ZINC CO.
OF AUSTRALASIA LTD.
RISDON WORKS
HOBART TASMANIA

ZINC PLANT SILICATE TREATMENT DIV
GENERAL
FLOW DIAGRAM

SCALE:

PR-2978/8

1748-3-1



NOTES:-
FOR ELEVATIONS SEE DR. P.R. 2978/22

1748-3-2

D.A N° 418/4-0300-1

					DRAWN	H.S. / A.M.	9-12-1971
					CHECKED	H.S.	11-2-72
					APPR'D.	/	/
					APPR'D. CONSTRUCT.		
	A	15-12-71	GENERAL REVISIONS	K.J.J.	SCALE	1" = 10 FT.	
APPR'D.	REV.	DATE	DESCRIPTION	BY	REF. DRG. No.		
REVISION							

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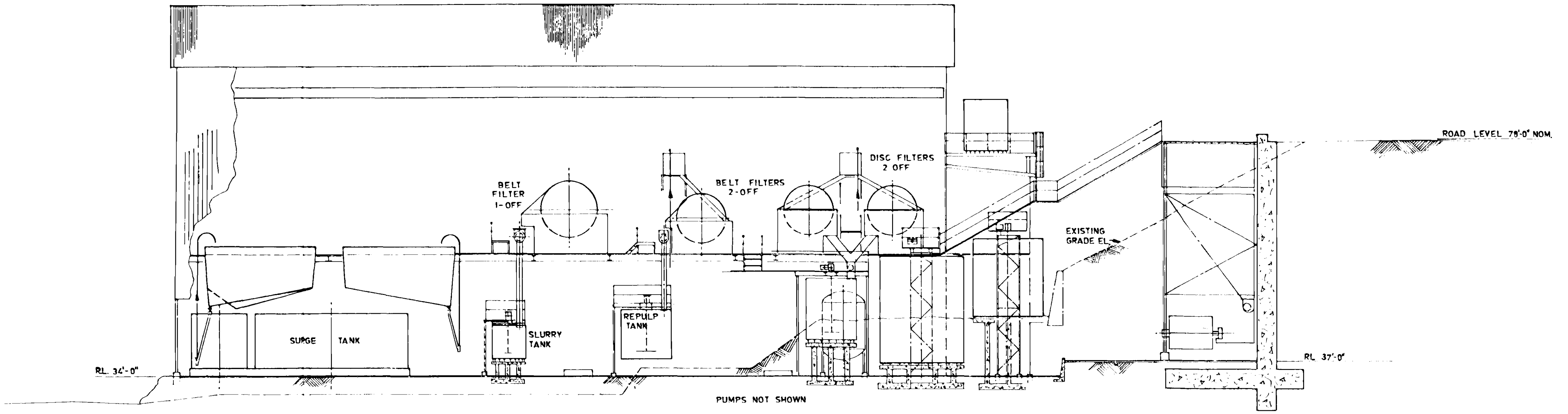
DAVY-ASHMORE
DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

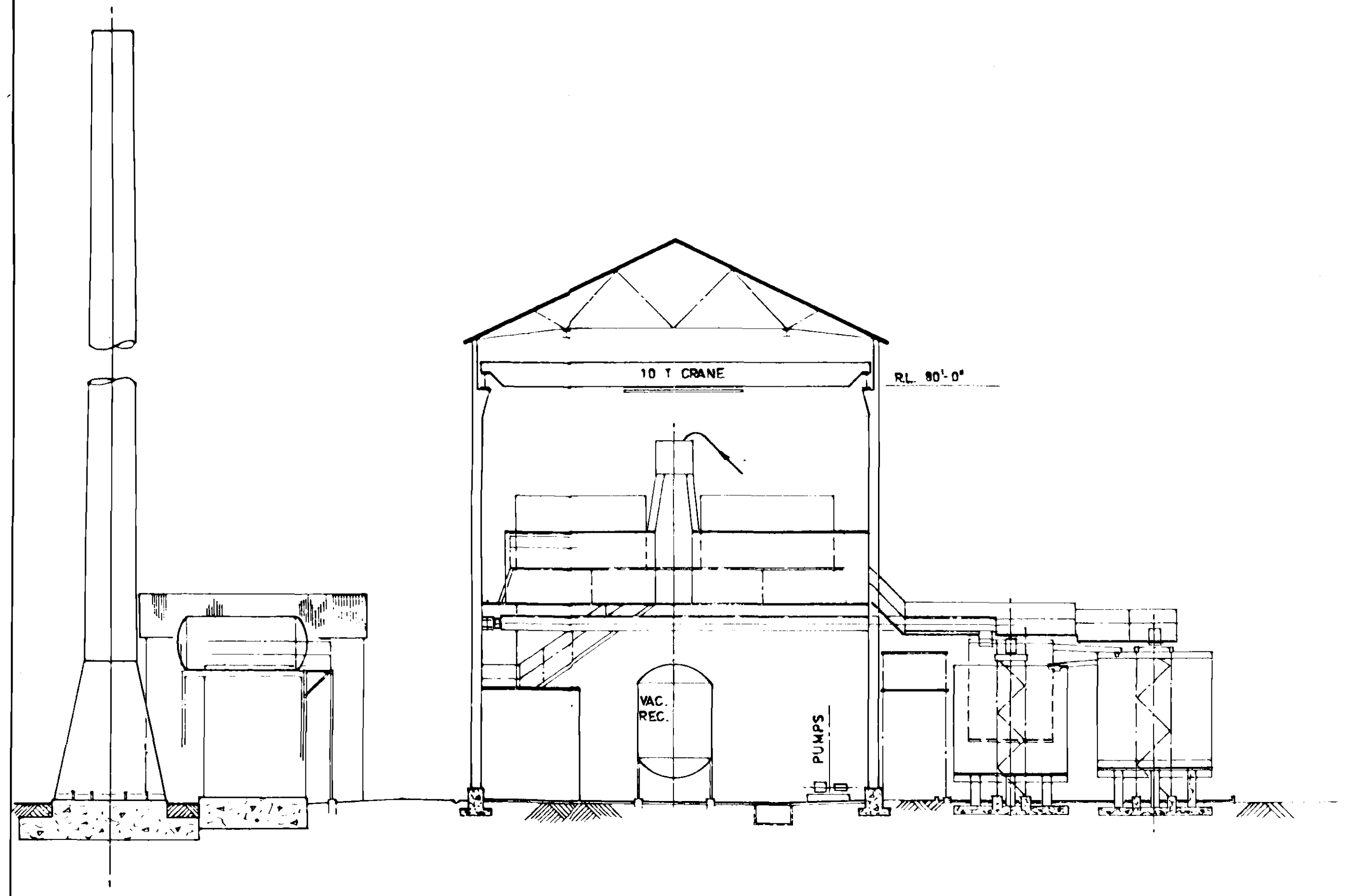
Client ELECTROLYTIC ZINC Co. of A'SIA. LTD.

TITLE: ZINC PLANT
SILICATE TREAT. DIV.
PLANT LAYOUT
PRELIMINARY ONLY
RISDON
TASMANIA

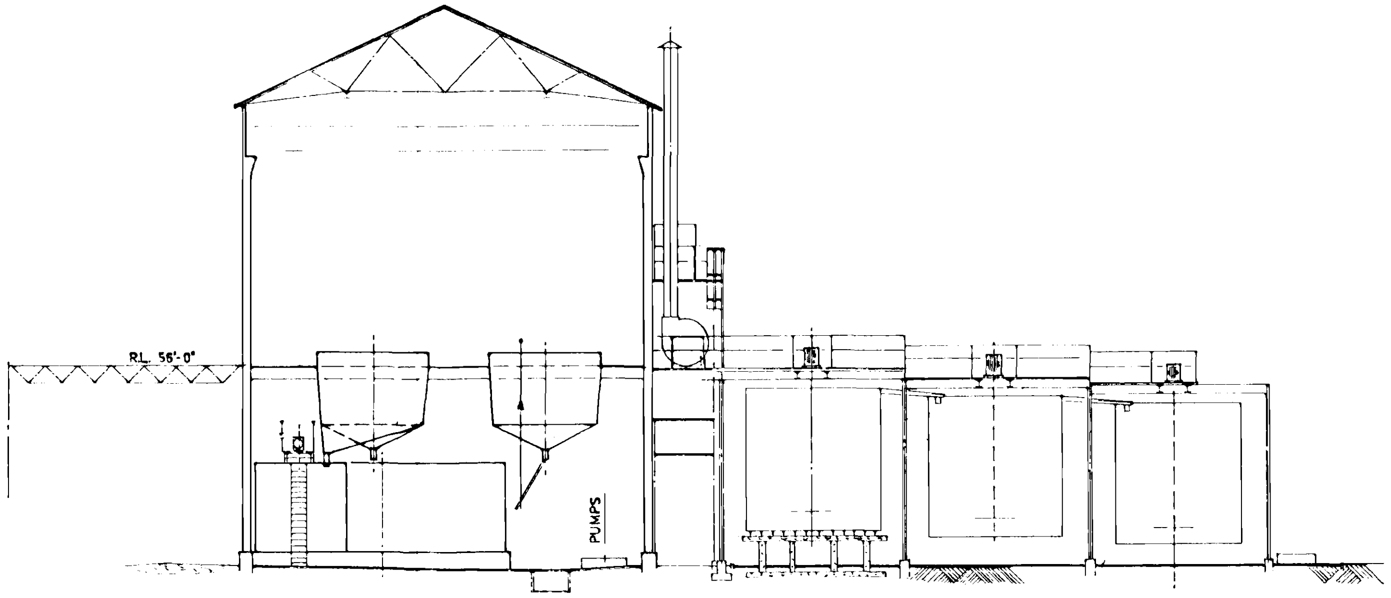
DRG.No. P.R. 2978/21
A



SECTION A-A



SECTION B-B



SECTION C-C

NOTES :-

1. FOR PLAN & LAYOUT SEE DRG. PR 2978/4

1748-3-3

D.A. Nº 418/4 - 0300-2

					DRAWN	C. LAMBERT.	1 FEB '72
					CHECKED	NS	11-2-72
					APPR'D.	/	/
					APPR'D. CONSTRUCT.		
					SCALE	1" = 10'-0"	
APPR'D.	REV.	DATE	DESCRIPTION	BY	REF. DRG. No.		
REVISION							

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client ELECTROLYTIC ZINC Co. of A'SIA. LTD.

TITLE: ZINC PLANT
RISDON
PLANT ELEVATIONS
PRELIMINARY ONLY
SILICATE TREAT. DIV.
TASMANIA.

DRG. No. PR 2978/22
A

FLOWSHEET EQUIPMENT LIST

PR 2978-25

ITEM Nº	DESCRIPTION	QTY
1-1-0	ORE FEED BIN (350 TON)	1
1-1-1	BIN EXTRACTOR CONVEYOR	1
1-2-0	MILL FEED CONVEYOR & WEIGHER	1
1-3-0	BALL MILL	1
1-3-1	.. .. FEED TANK	1
1-3-2	HYDROCYCLONE PUMP FEED TANK	1
1-4-0	.. FEED PUMPS	2
1-4-1	HYDROCYCLONES	4
6-1-0	LEACH TANKS	3
6-1-1	.. .. CONNECTING LAUNDERS	3
6-1-2	.. .. AGITATORS	3
7-1-0	COAGULATION TANKS	3
7-1-1	.. .. CONNECTING LAUNDER	2
7-1-2	.. .. AGITATORS	3
7-1-3	HEATING COIL FOR 7-1-0	1
7-2-0	PRIMARY FILTER AIR LIFT	1
7-3-0	PRIMARY FILTERS	2
7-3-1	.. .. FEED HEAD BOX	1
7-3-2	COAGULATION PRECIPITATE CONVEYOR	3
7-4-0	PRIMARY FILTRATE PUMP	2
7-4-1	.. .. RECEIVER	1
5-1-0	SPENT SUPPLY LINE	1
8-8-0	WASH FILTRATE	1

PR 2978-26

ITEM Nº	DESCRIPTION	QTY
8-1-0	ACID REPULP TANKS	2
8-1-1	.. .. .. AGITATOR	2
8-1-2	.. .. .. CONNECTING LAUNDERS	2
8-2-0	NEUTRALIZATION/RECOAGULATION TANKS	3
8-2-1	AGITATORS FOR 8-2-0	3
8-2-2	CONNECTING LAUNDERS FOR 8-2-0	2
8-2-3	HEATING COIL FOR 8-2-0	1
8-3-0	FINAL FILTER FEED AIRLIFT	1
8-4-0	FINAL FILTERS	2
8-4-1	.. .. FEED HEAD BOX	1
8-4-2	FINAL FILTER RESIDUE CONVEYOR	1
8-5-0	.. .. .. REPULP TANK	1
8-5-1	AGITATOR FOR 8-5-0	1
8-6-0	PRIMARY FILTER RESIDUE PUMPS	2
8-7-0	WASH FILTRATE PUMP	2
11-5-0	FILTER VACUUM RECEIVERS	2
14-2-0	SUMP & SUMP PUMPS	1
14-2-1	SUMP AGITATOR	1

PR 2978 - 27

ITEM Nº	DESCRIPTION	QTY
2-1-0	LIMESTONE FEED BIN (150 TONS)	1
2-1-1	BIN EXTRACTOR CONVEYOR	1
2-1-2	MILL FEED CONVEYOR & WEIGHER	1
2-2-0	LIMESTONE BALL MILL	1
2-2-1	BALL MILL FEED TANK	1
2-2-2	HYDROCYCLONE PUMP FEED TANK	1
2-3-0	HYDROCYCLONE FEED PUMPS	2
2-3-1	HYDROCYCLONES	3
2-4-0	LIMESTONE PULP TANK	1
2-4-1	AGITATOR FOR 2 4 1	1
2-5-0	LIMESTONE PULP FEED PUMPS	2
2-6-0	LIMESTONE FEED SPLITTER HEAD TANKS	3
14-2-0	SUMP & SUMP PUMP	1
2-6-1	LIMESTONE FEED SPLITTERS	3
14-2-1	SUMP AGITATOR	1

PR 2978 - 28

ITEM Nº	DESCRIPTION	QTY
10-1-0	PRECIPITATION TANKS	4
10-1-1	PRECIPITATION TANKS AGITATORS	4
10-1-2	CONNECTING LAUNDERS FOR 10-1-0	4
10-2-0	PULP COOLER TANK	1
10-2-1	PULP COOLER TANK AGITATOR	1
10-2-2	COOLING ELEMENT FOR 10-2-0	1
10-3-0	BASIC FILTER FEED TANK	2
10-4-0	BASICS FILTER	1
10-4-1	BASICS FILTER CAKE CONVEOR	1
10-5-0	BASICS SLURRY TANK	1
10-5-1	BASICS SLURRY TANK AGITATOR	1
10-6-0	BASICS SLURRY PUMPS	2
10-7-0	BASICS SLURRY STORAGE TANK	1
10-7-1	AGITATOR FOR 10-7-0	1
10-8-0	BASICS FEED PUMP	1
10-9-0	BASICS FEED SPLITTER HEAD TANK	1
10-9-1	BASICS FEED SPLITTERS (EXISTING)	2
10-10-0	DISCARD SOLUTION PUMP	2
10-12-0	VENTILATION STACK	1
10-12-1	VENTILATION FAN	1
10-13-0	CALCINE PULP PUMP	2
10-14-0	CALCINE FEED SPLITTER HEAD TANK	1
14-2-0	SUMP & SUMP PUMP	1
11-5-0	FILTER VACUUM RECEIVER	1
10-14-1	CALCINE FEED SPLITTER	1
10-10-2	DISCARD SAMPLER	1
14-2-1	SUMP AGITATOR	1

PR 2978 - 29

ITEM Nº	DESCRIPTION	QTY
9-1-1	PURIFIERS	3
9-1-2	PURIFIER CONNECTING LAUNDERS	2
9-1-3	PURIFIER AGITATORS	3
9-1-4	PURIFIER AIR SPARGERS	3
9-1-5	FILTER FEED PUMPS	2
9-2-0	GERMANIUM PRECIP FILTER BASKETS	2
9-2-1	FILTER FORM & WASH VATS	3
9-2-2	FILTER CAKE DISCHARGE HOPPERS	1
9-2-3	FILTER CRANE	1
9-2-4	3½" AIR LIFTS	2
9-3-0	RETURN CAKE REPULP TANK	1
9-3-1	AGITATOR FOR 9-3-0	1
9-5-0	RETURN CAKE PUMPS	2
9-7-0	FILTRATE PUMPS	2
9-9-0	SHELL & TUBE HEAT EXCHANGER	1
9-10-0	BASICS SECTION FEED PUMPS	2
9-12-0	PROCESS AIR BLOWER	1
14-2-0	SUMP & SUMP PUMP	1
9-7-1	MOORE FILTER VACUUM DRUM	1
16-1-0	PRE NEUTRALIZATION THICKENER O/F. PUMP	1
13-1-0	NI PURIFIER TANK	1
13-1-0	AGITATOR FOR 13-1-0	1
13-2-0	FILTER PRESSES	2
13-3-0	ZINC DUST CONVEYORS	1
14-2-1	SUMP AGITATOR	1

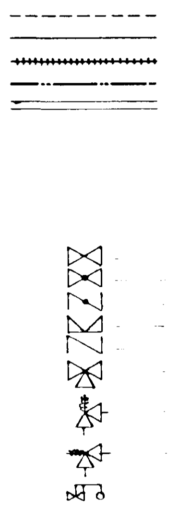
PR 2978 - 30

ITEM Nº	DESCRIPTION	QTY
3-1-0	CALCINE PULP FEEDER TANK	1
3-1-1	AGITATOR FOR 3-1-0	1
3-2-0	CALCINE PULP FEEDER PUMPS	2
3-3-0	CALCINE PULP SPLITTER FEED TANK	1
3-3-1	CALCINE PULP FEED SPLITTER	1
4-1-0	EXISTING ACID STORAGE TANK	1
4-2-0	ACID SUPPLY PUMPS	2
4-3-0	ACID SUPPLY HEAD TANK	1
10-11-0	COOLING TOWER	1
10-11-1	COOLING WATER SUPPLY PUMP	1
11-1-0	VACUUM PUMPS (4000 CFM)	2
11-1-1	VACUUM PUMP (1500 CFM)	1
11-2-0	BAROMETRIC LEG SEAL POTS	2
11-3-0	BAROMETRIC LEG HEAD TANKS	2
11-4-0	MOISTURE TRAP	1
11-6-0	VACUUM SEAL WATER TANK	1
5-1-0	SPENT SUPPLY LINE.	1
14-3-0	SEAL WATER TANK	1

PR 2978-31

ITEM Nº	DESCRIPTION	QTY
12-1-0	PACKAGE BOILER (50000 LB/HR CAP.)	1
12-1-1	BOILER STACK	1
12-2-0	WATER TREATMENT PLANT	1
12-2-1	FEED WATER PUMPS	2
12-3-0	FEED WATER STORAGE TANK	1
12-3-1	BOILER FEED WATER PUMPS	2
12-3-2	DEAERATOR	1
12-4-0	EXISTING FUEL OIL STORE (RELOCATED)	1
12-4-1	EXISTING FUEL OIL SUPY PUMPS (REL'D)	2
12-4-2	FUEL OIL HEATERS (RELOCATED)	2
12-1-2	BOILER DOSING EQUIP'T	1

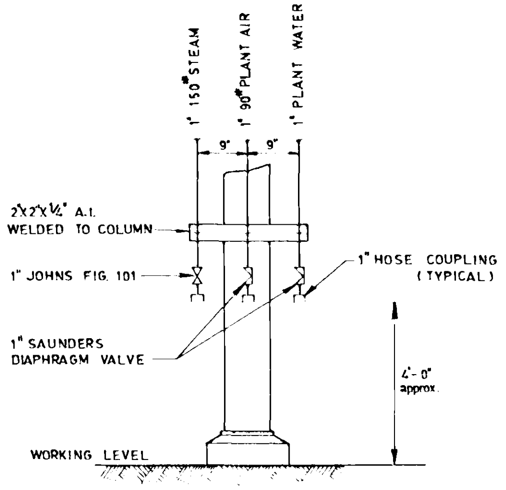
PIPING SYMBOLS:-



EXISTING PIPING
NEW PIPING
FLEXIBLE HOSE (RUBBER)
AREA LIMITS
LAUNDERS

GATE VALVE
GLOBE VALVE
BUTTERFLY VALVE
DIAPHRAGM VALVE
CHECK VALVE
3 WAY PLUG COCK
RELIEF VALVE
VACUUM BREAKER
BALL FLOAT VALVE

N.C. NORMALLY CLOSED



STANDARD DETAIL FOR
HOSE STATION

P.&I. FLOW DIAGRAMS:-

EZ Nº	DAPL Nº	TITLE
PR 2978-25	418/4-0320-2	LEACHING & COAGULATION
PR2978-26	.. -0320-3	SILICA RESIDUE SECTION
PR2978-27	.. -0320-4	LIMESTONE SECTION
PR2978-28	.. -0320-5	BASICS SECTION
PR2978-29	.. -0320-6	Ge. PURIFICATION SECTION
PR2978-30	.. -0320-7	VACUUM SYSTEM, ACID SUPPLY, CALCINE SUPPLY SEC
PR2978-31	.. -0320-8	STEAM GENERATION SECTION

PIPING SPECIFICATIONS:-

418/4-5101-S1	STEAM & CONDENSATE RETURN
.. -5105-S1	FUEL OIL
.. -5110-S1	BOILER FEED WATER (TO B.F.W. PUMPS)
.. -5111-S1	.. .. .. (FROM B.F.W PUMPS TO BOILER)
.. -5115-S1	98% SULPHURIC ACID
.. -5116-S1	PLANT AIR
.. -5120-S1	COOLING WATER
.. -5121-S1	WATER (INCL. PLANT, SEALING, DOMESTIC & FIRE)
.. -5601-S1	PROCESS (FIBREGLASS REINF. P.V.C.)
.. -5602-S1	VACUUM .. .. ..
.. -5605-S1	PROCESS (RUBBER HOSE)
.. -5610-S1	STEAM .. ..
.. -5611-S1	PLANT AIR .. ..

1748-3-4

D.A. DRG. Nº 418/4-0320-1

APP'D.	REV.	DATE	DESCRIPTION	BY

REVISION

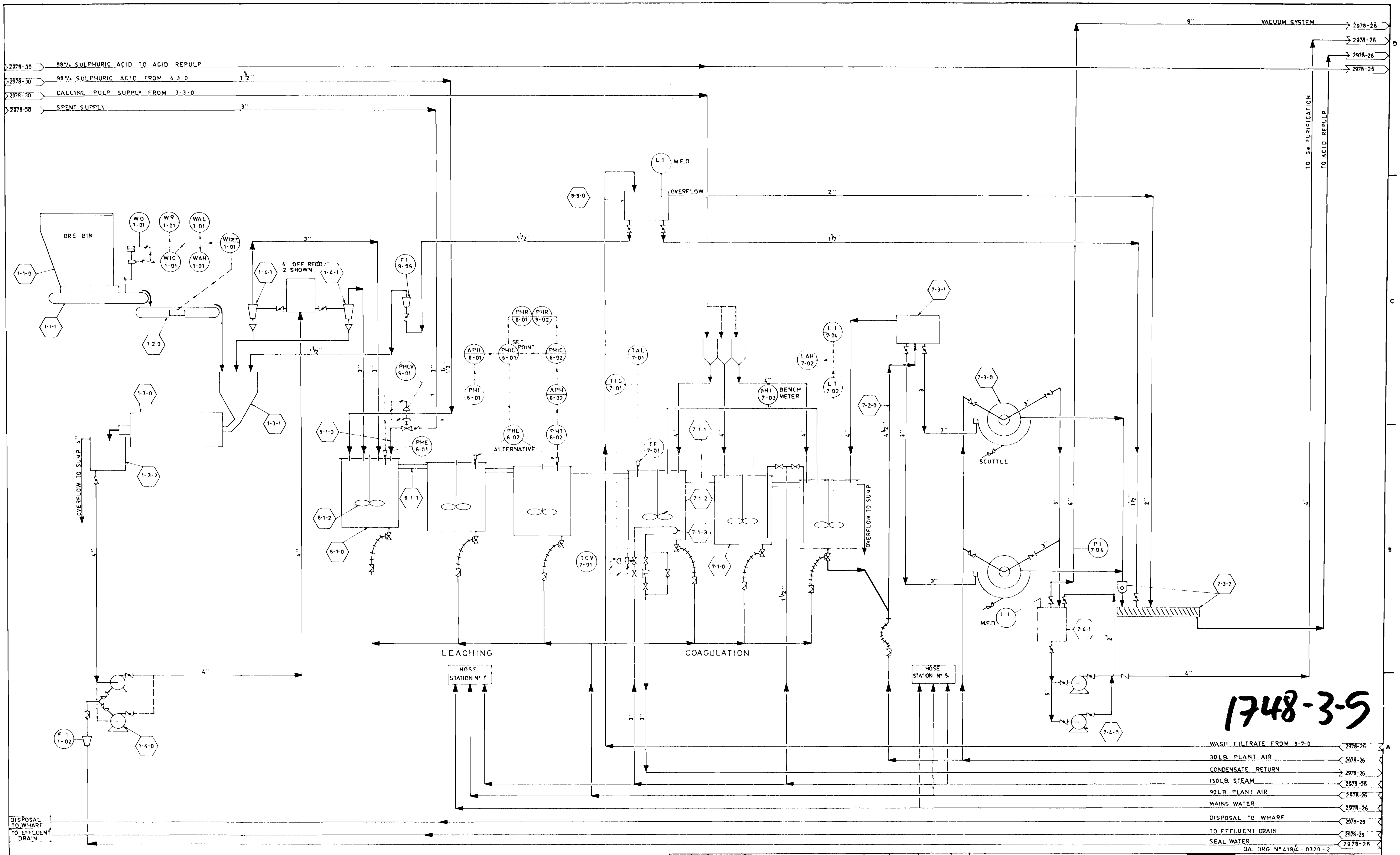
DRAWN	C. LAMBERT.	4-2-'71
CHECKED	H.S.	14-2-72
APP'D.		
APP'D. CONSTRUCT.		
SCALE		
REF. DRG. No		

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client
ELECTROLTIC ZINC Cº of A'SIA LTD.

TITLE: ZINC PLANT SILICATE TREAT DIV.
EQUIPMENT LIST AND FLOWSHEET NOTES
RISDON TASMANIA

DRG. No. PR 2978-24



1748-3-5

DA. DRG. Nº 418/4 - 0320 - 2

APPD.	REV.	DATE	DESCRIPTION	BY
		REVISION		

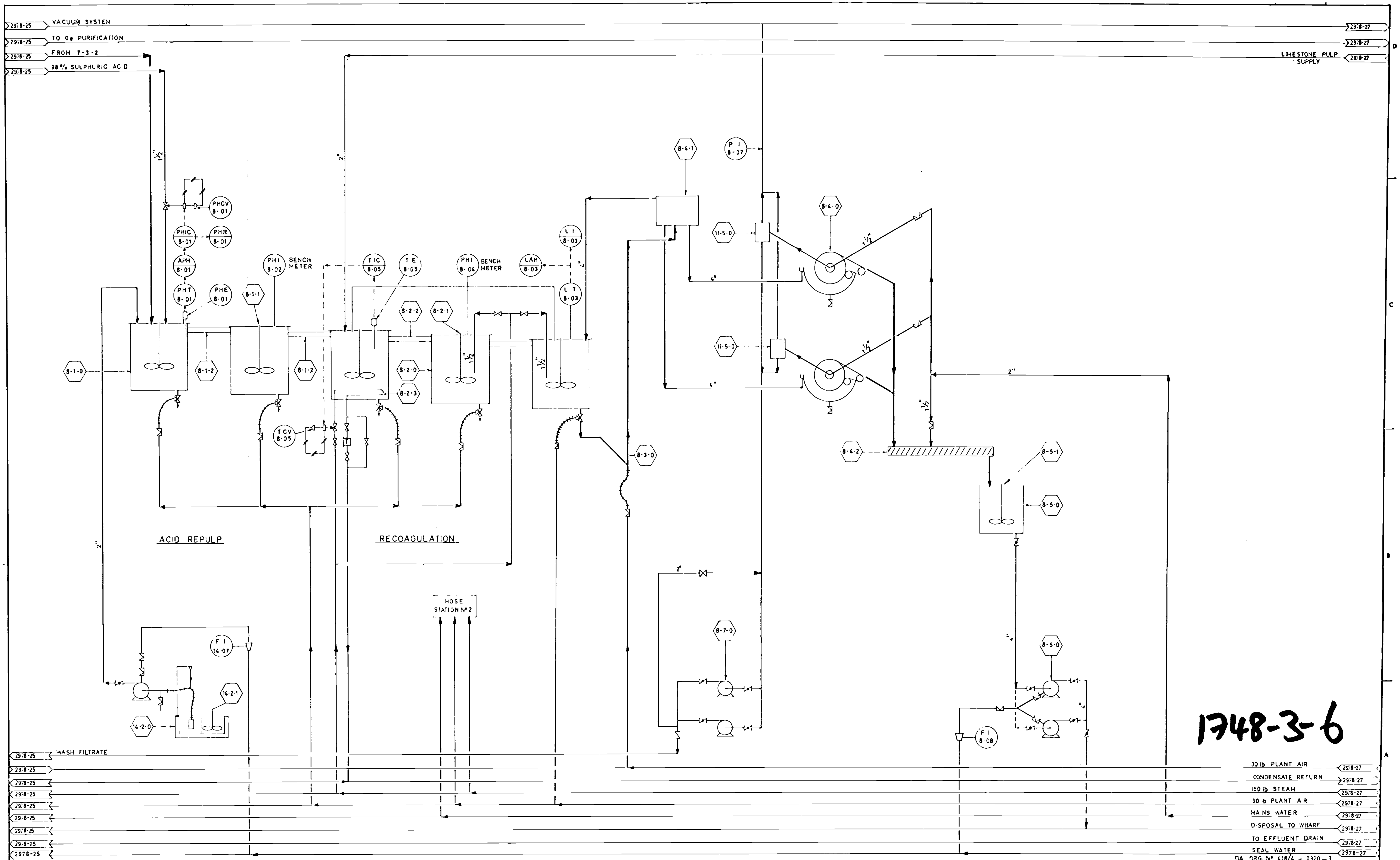
DRAWN	C.J.N.	2-2-72
CHECKED	HS	14-2-72
APPR'D.		
APPR'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client
ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE: ZINC PLANT
SILICATE TREAT. DIV'N.
P.& I. FLOW DIAGRAM - LEACHING & COAGULATION SECTIONS
RISDON
TASMANIA

DRG. No. PR 2978-25



1748-3-6

CA. DRG. Nº 418/4 – 0320 – 3

APPR'D.	REV.	DATE	DESCRIPTION	BY
			REVISION	

DRAWN	C.J.N.	3 FEB 72
CHECKED	HS	14-2-72
APPR'D.		
APPR'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

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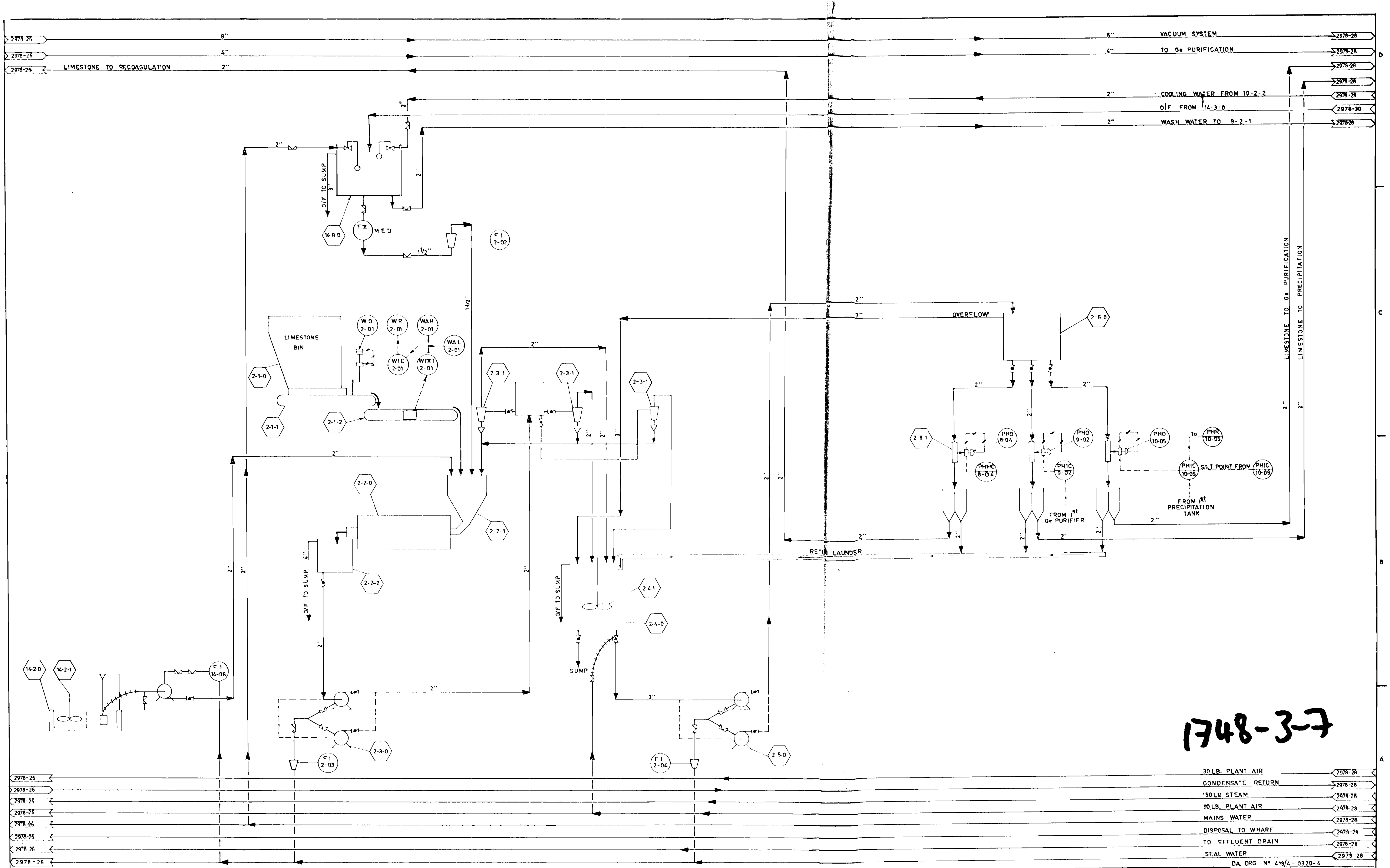
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY ASHMORE GROUP

Client
ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE: ZINC PLANT
SILICATE TREAT. DIV'N.
P. & I. FLOW DIAGRAM - SILICA RESIDUE SECTIONS
RISDON
TASMANIA.

DRG. No. PR 2978-26



1748-3-7

DA DRG. N° 418/4-0320-4

DRAWN	A.M.	3 FEB '72
CHECKED	HS	14-2-77
APP'D.		
APP'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

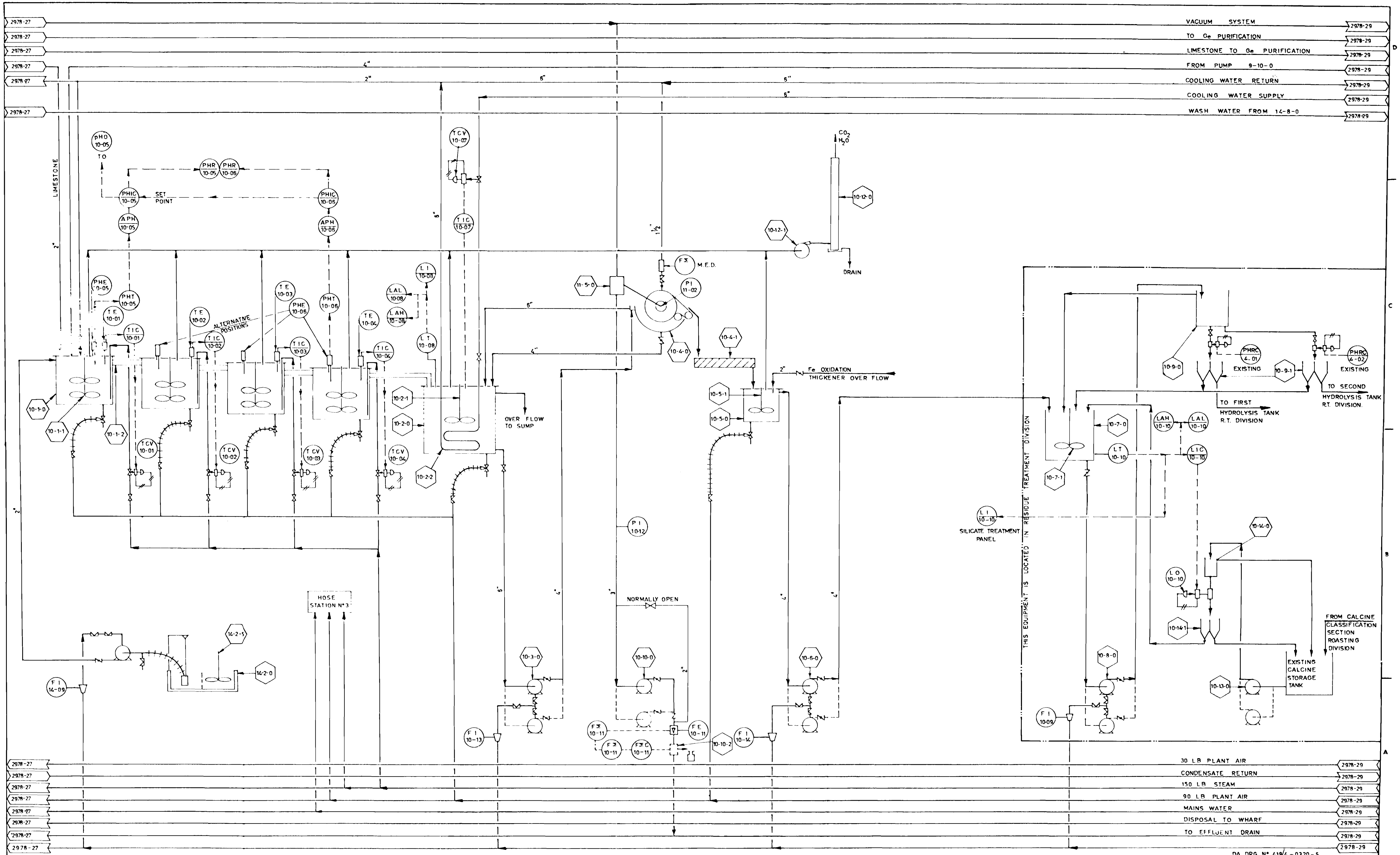
APP'D.	REV.	DATE	DESCRIPTION	BY
		REVISION		

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client
ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE: ZINC PLANT SILICATE TREAT. DIV'N.
P. & I. FLOW DIAGRAM – LIMESTONE SECTION
RISDON TASMANIA.

DRG. No. PR 2978-27



DA. DRG. N° 418/4 - 0320 - 5

APP'D.	REV.	DATE	DESCRIPTION	BY
REVISION				

DRAWN	K.T.C.	3 FEB 72
CHECKED	HS	14-2-72
APP'D.		
APP'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

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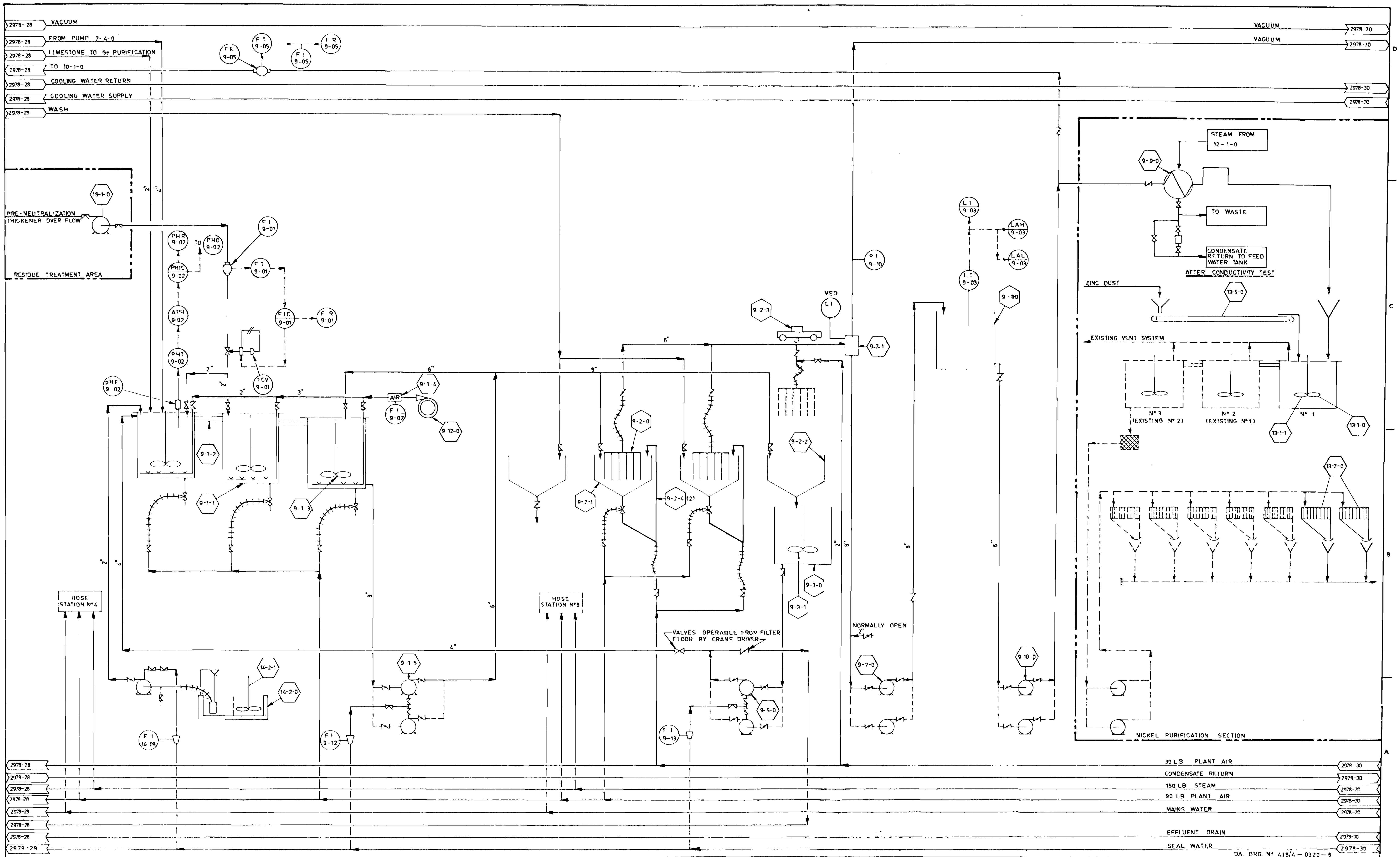
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client
ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE: ZINC PLANT. SILICATE TREAT. DIV'N.
P. & I. FLOW DIAGRAM - BASICS SECTION
RISDON TASMANIA

DRG. No. PR 2978-28

1748-3-8



DA. DRG. Nº 418/4 – 0320 – 6

DRAWN	K.T.C.	3 FEB 72
CHECKED	HS	14-2-72
APP'D.		
APP'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

APP'D.	REV.	DATE	DESCRIPTION	BY
REVISION				

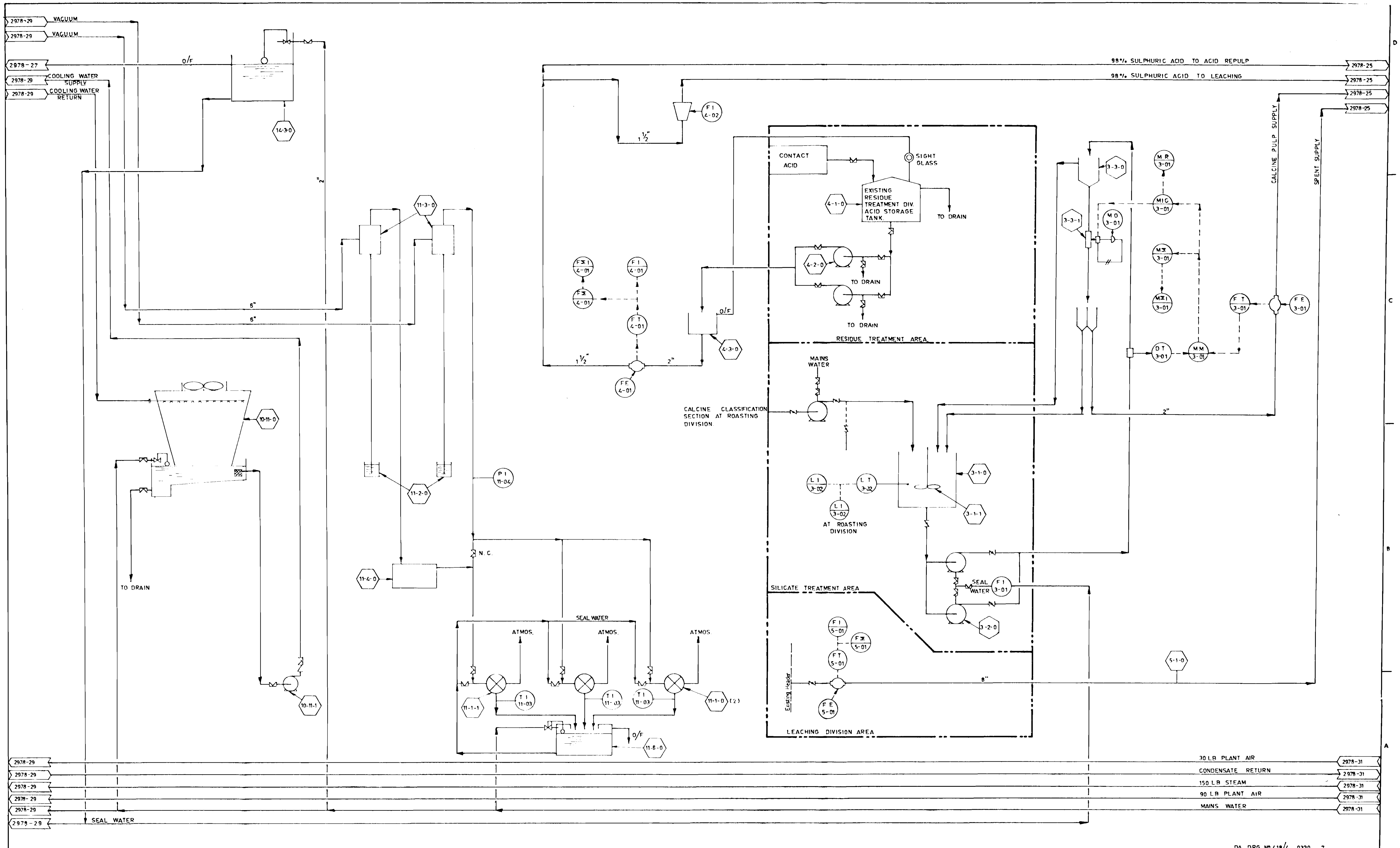
DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client
ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE: ZINC PLANT. SILICATE TREAT. DIV'N.
P. & I. FLOW DIAGRAM – Ge PURIFICATION SECTION
RISDON TASMANIA

DRG. No. PR 2978-29

1748-3-9



DA. DRG. Nº 418/4 – 0320 – 7

					DRAWN	K.T.C.	2 FEB '72
					CHECKED	HS.	14-2-72
					APPR'D.		
					APPR'D. CONSTRUCT.		
					SCALE		
APPR'D.	REV.	DATE	DESCRIPTION	BY	REF. DRG. No.		
REVISION							

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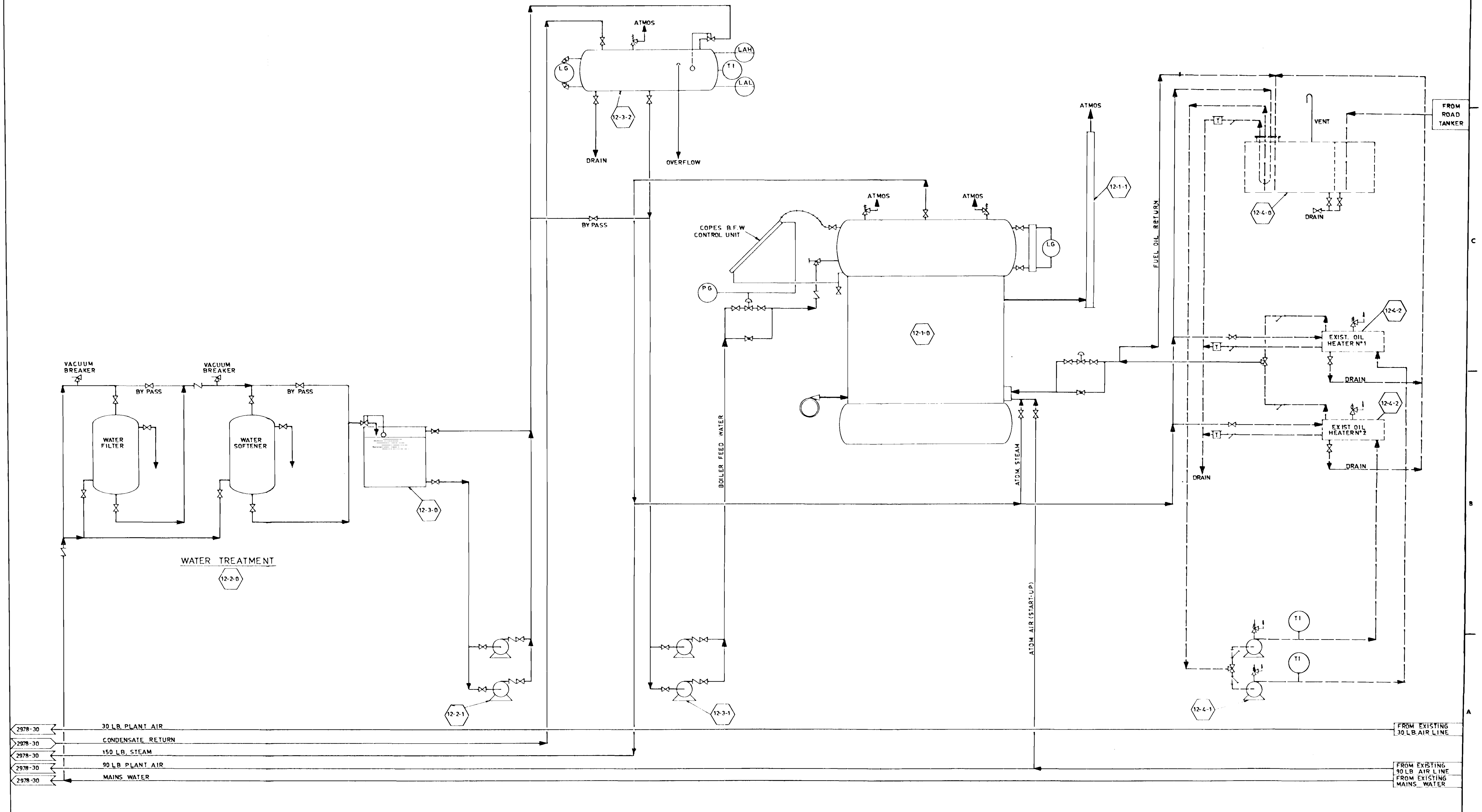
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client
ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE: ZINC PLANT
P & I. FLOW DIAGRAM { VACUUM SYSTEM / ACID SUPPLY / CALCINE SUPPLY } SILICATE TREAT. DIV'N. SECTIONS
RISDON
TASMANIA

DRG. No. PR 2978-30

1748-3-10



DA. DRG. Nº 418/4 – 0320 – 8

APP'D.	REV.	DATE	DESCRIPTION	BY
REVISION				

DRAWN	C.J.N.	3 FEB '72
CHECKED	14S.	14-2-72
APP'D.		
APP'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

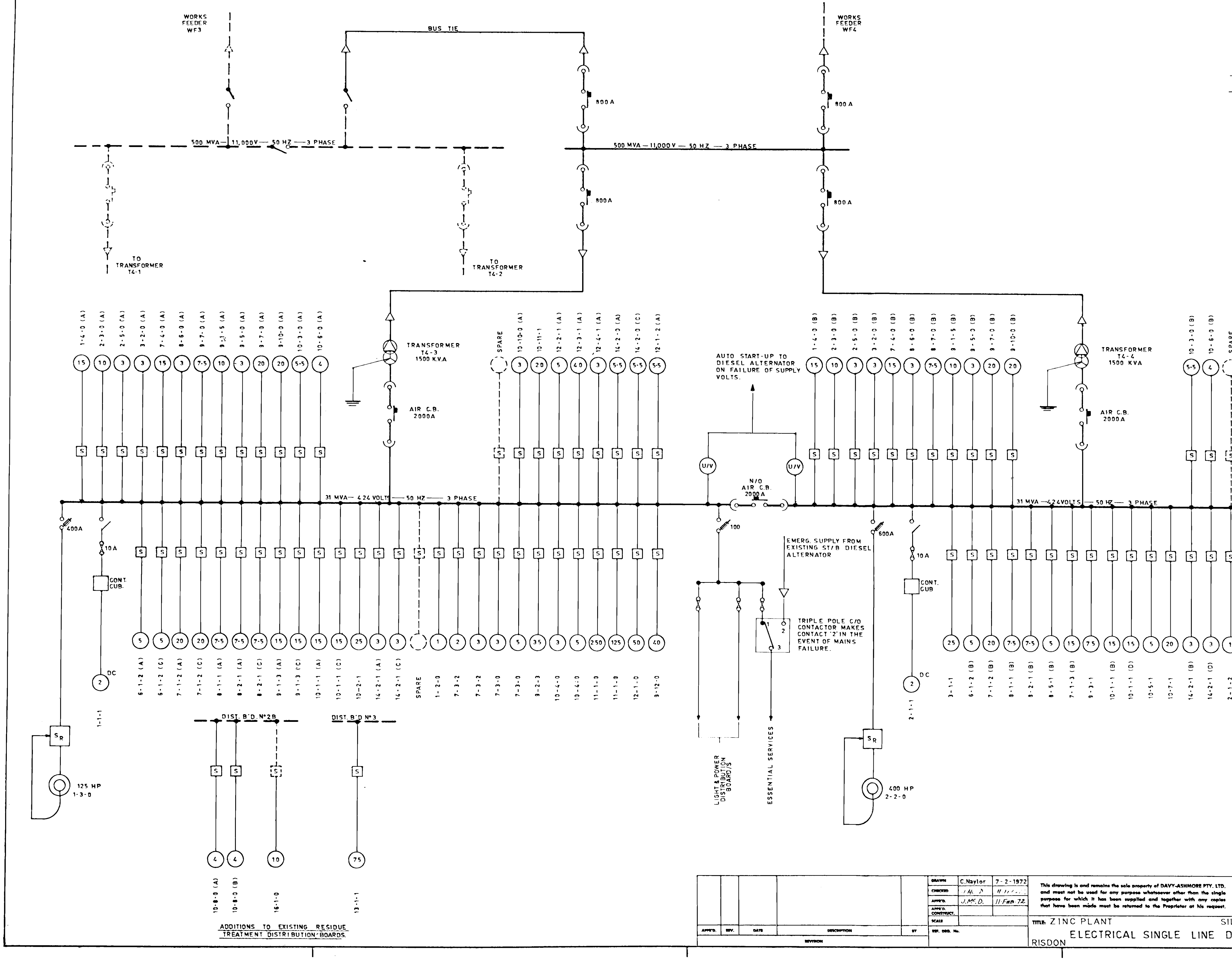
DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE ZINC PLANT SILICATE TREAT. DIV'N.
P. & I. FLOW DIAGRAM – STEAM GENERATION SECTION
RISDON TASMANIA

DRG. No. PR 2978-31

1748-3-11



LEGEND

- — — — EXISTING EQUIPMENT.
- ——— NEW EQUIPMENT.
- AUTOMATIC OIL CIRCUIT BREAKER (RATING SHOWN)
- COMBINED FUSE-SWITCH (UNIT RATING SHOWN)
- SR SECONDARY RESIST. STARTER
- ENGLISH ELECTRIC H.R.C FUSE (RATING SHOWN)
- S MAGNETICALLY HELD CONTACTOR COMPLETE WITH OVERLOAD, FUSES, ISOLATING SWITCH, ETC....

NOTE

1. ELECTRICAL & MECHANICAL INTER-LOCKS NOT SHOWN
2. ALL MOTORS 3 PHASE.

1748-342

D.A N°418/4 - 6000 -1

APPR'D.	REV.	DATE	DESCRIPTION	BY
REVISION				

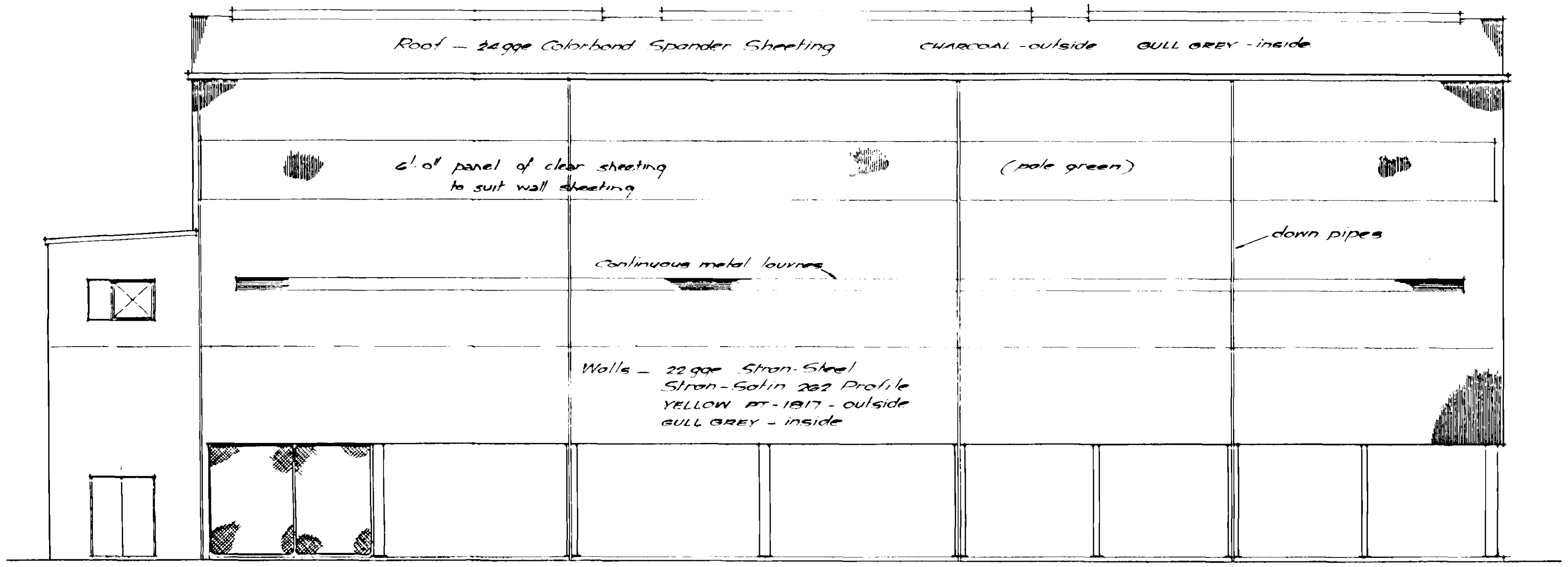
DRAWN	C.Naylor	7-2-1972
CHECKED	J.McD.	11.2.72
APPR'D.	J.McD.	11 FEB 72
APPR'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client ELECTROLYTIC ZINC C° OF A'SIA. LTD.

TITLE ZINC PLANT SILICATE TREAT. DIV.
ELECTRICAL SINGLE LINE DIAGRAM
RISDON TASMANIA

DRG.No. PR - 2978 - 33



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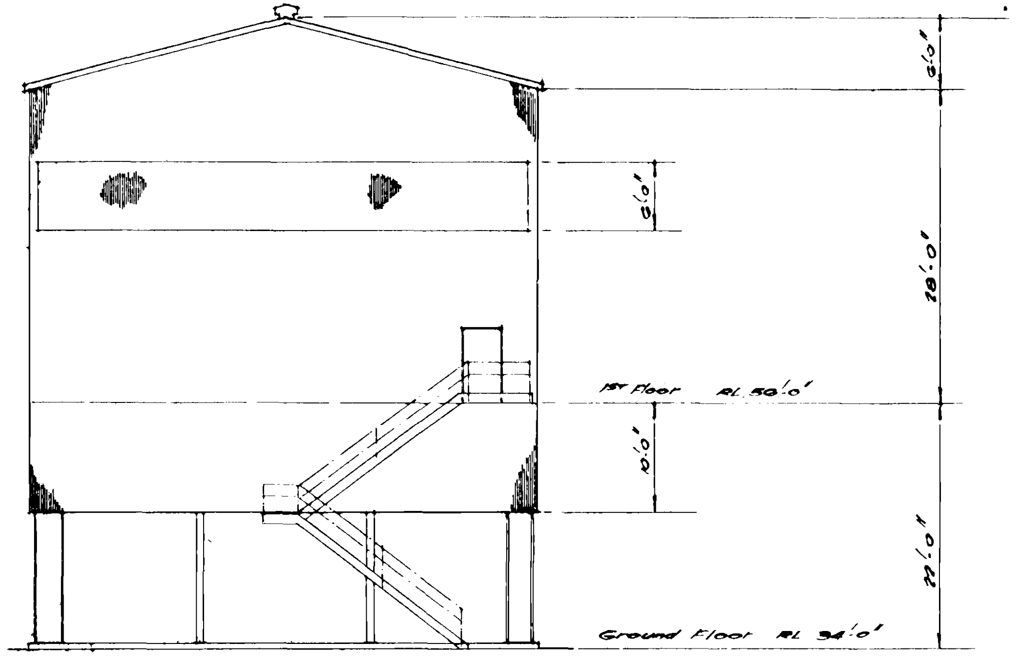

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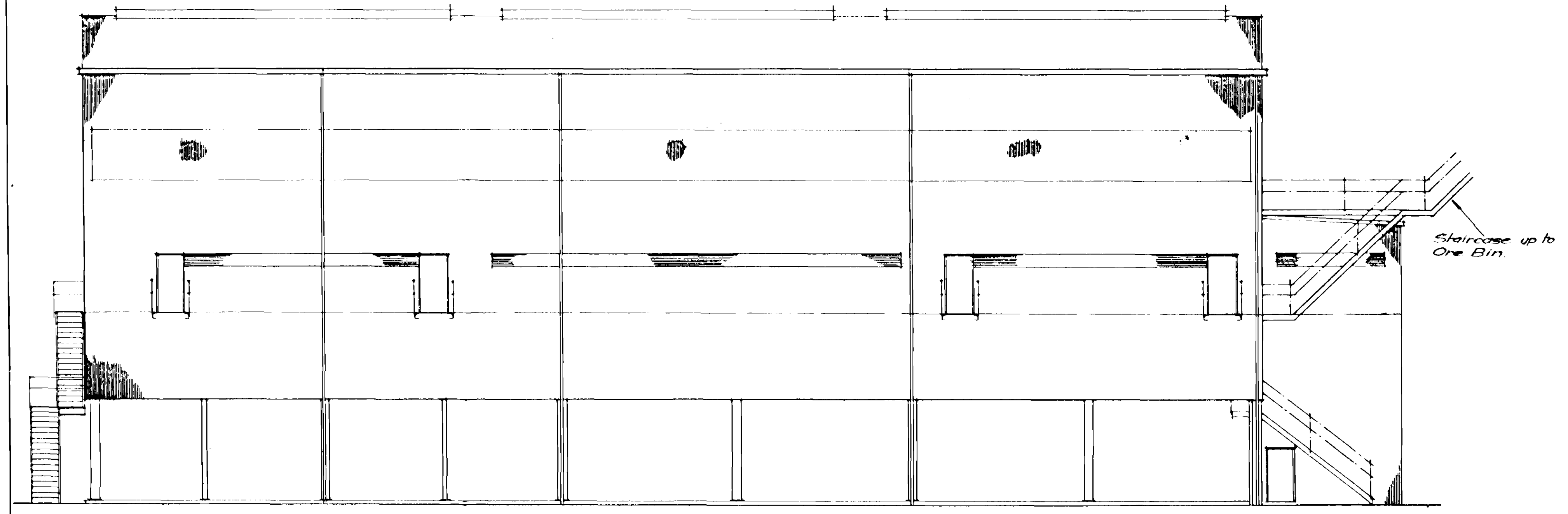

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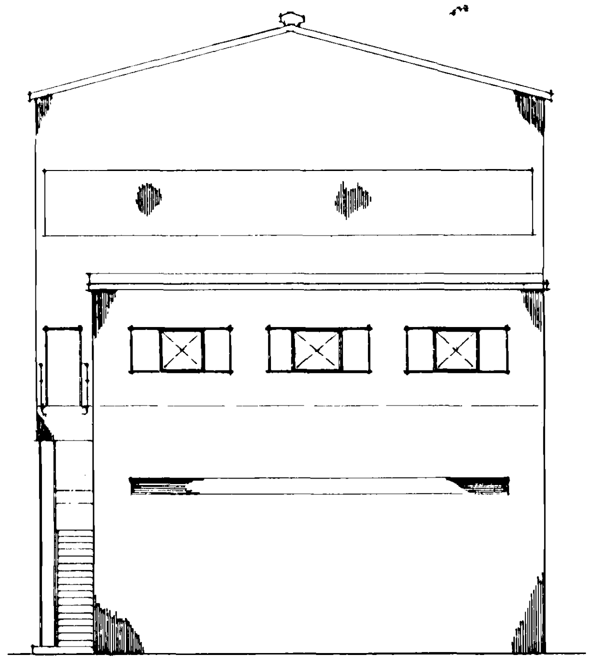

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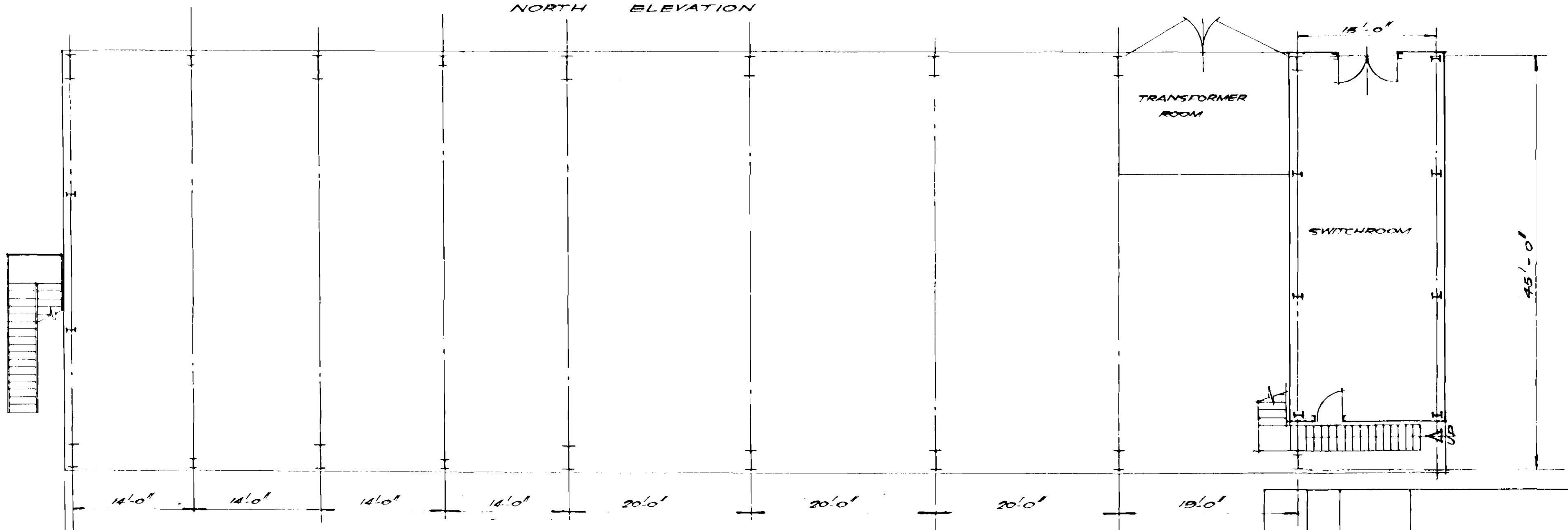
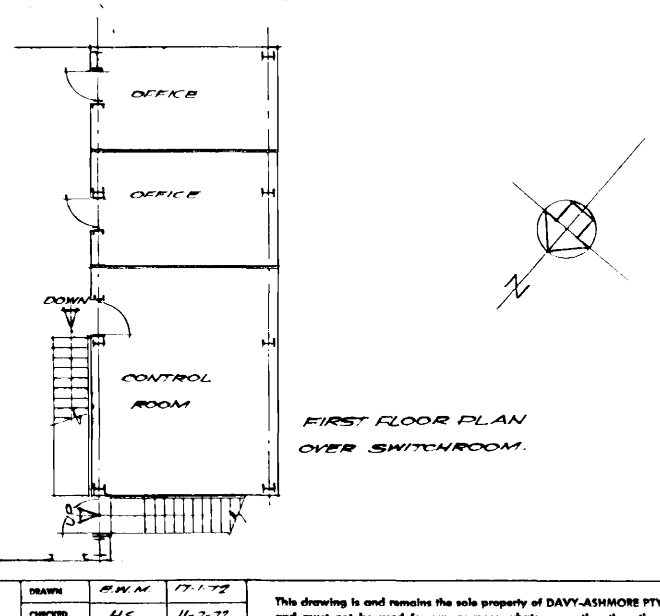


PLAN



FIRST FLOOR PLAN OVER SWITCHROOM.

1748-3-13

D.A. No: 418/4-2101-1

					DRAWN	E.W.M.	17-1-72
					CHECKED	H.S	11-2-72
					APPR'D.	R.S.M.S	14-
					APPR'D. CONSTRUCT.		
					SCALE	1/8" = 1'-0"	
APPR'D.	REV.	DATE	DESCRIPTION	BY	REF. DRG. No.		
REVISION							

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client ELECTROLYTIC ZINC CO. OF ASIA. LIMITED.

TITLE: ZINC PLANT SULPHATE TREAT DIV.
MAIN BUILDING ELEVATIONS
RISDON TASMANIA

DRG. No. PR-2978-35

6. PROJECT EXECUTION. (See Dwg. No. PR-2978-34)

The estimated time required to design and construct the silicate leaching plant to the stage where it is ready for commissioning is 16 months. This is based on the existing design remaining essentially unchanged with respect to the process flowsheet, equipment schedules, and layout.

All equipment in this plant is supplied in relatively small units making the delivery period for each item quite short. Consequently the time required for civil and structural work in the beginning, and the time required for installation of pipework at the end are controlling factors and therefore fall on the critical path. However considerable overlap in these activities is possible by concentrating the work in key areas of the plant.

Engineering design work will be carried out in Melbourne. E.Z. will provide a full-time project engineer to assist in co-ordination of the work, and the part-time assistance of operating and process engineers in the early stages.

Construction will be undertaken by a limited number of contractors typically handling the following major activities : civil works and small buildings, steelwork fabrication and erection, mechanical installation, piping installation, wooden tank erection, electrical installation and instrument installation.

Control and supervision of all contractors will be necessary to ensure correctness and quality of work and to maintain the work schedule. A site team consisting of site manager, site engineer administrative assistant will be provided, and a storeman and typist/clerk will be recruited locally. Specialist engineers for civil, electrical and instrument work will spend time on site as required to assist in these fields. Site offices already exist adjacent to the site which will be adequate for these personnel.

Temporary site services will be required and this can be run conveniently from existing plant operating nearby and little extra cost will be involved.

6. PROJECT EXECUTION CONTINUED

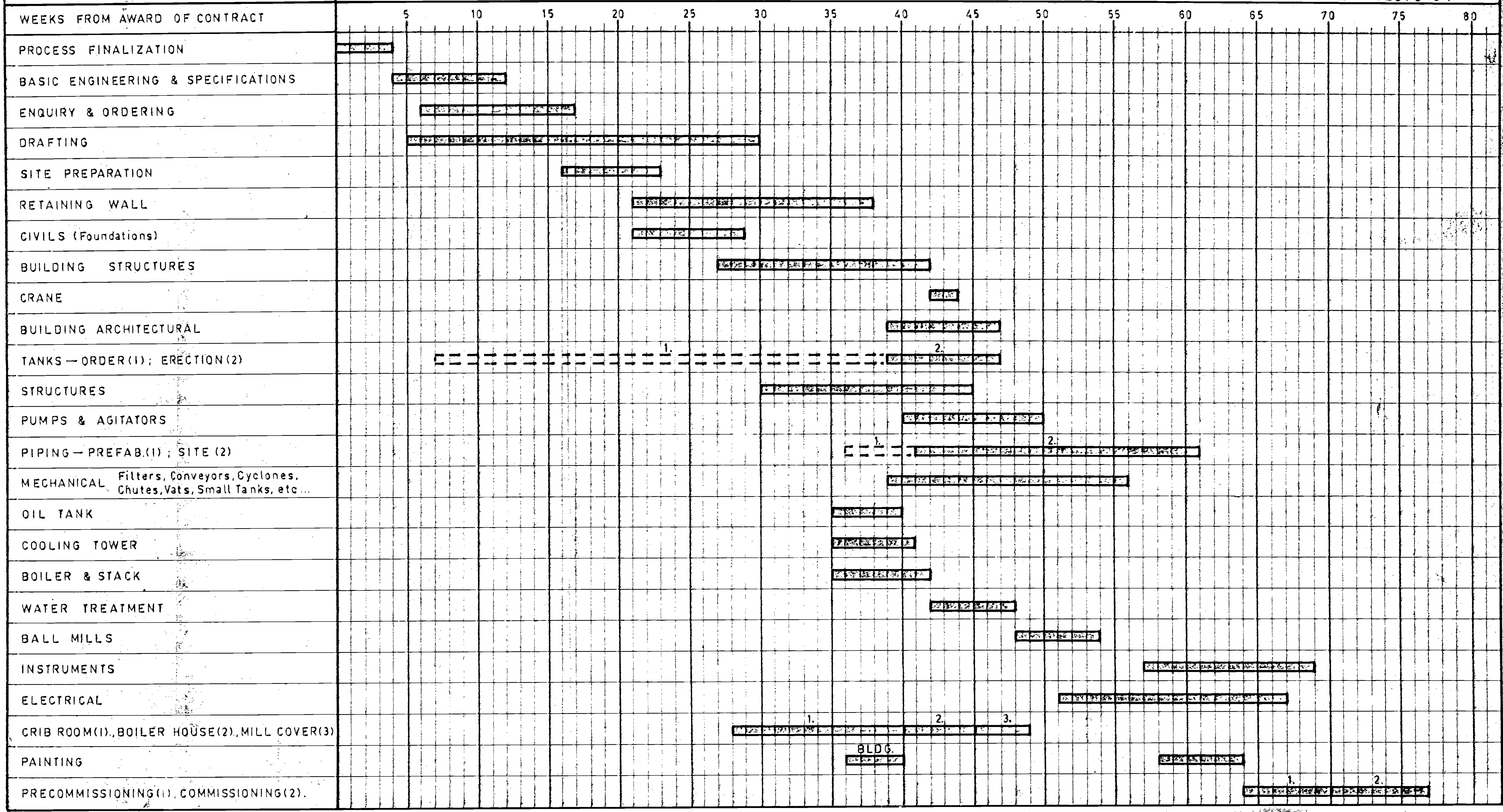
Precommissioning or mechanical testing of all equipment will commence near the end of the construction phase, in many cases using water as the process fluid to ensure that the equipment is adequately "run-in" prior to commissioning. The boiler and water treatment plant will undergo a guarantee test to ensure that the meet the specified duties. Project personnel will be available during commissioning to check the performance of all equipment during proper process operation.

DAVY-ASHMORE PTY. LTD.
MELBOURNE

CLIENT — ELECTROLYTIC ZINC CO. OF A'SIA. LTD.
PLANT — DIRECT LEACHING PLANT~RISDON TASMANIA

PROJECT SCHEDULE

DRG. NOS. 1748-3-14
DA. 418/4-0380-1
E.Z. PR 2978-34



ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

BELTANA PROJECT

FEASIBILITY STUDY
1972

PART 2A: CRUSHING AND GRINDING

DA 418

FEBRUARY 1972

DAVY-ASHMORE

DAVY-ASHMORE PTY. LTD.
MELBOURNE

MEMBER OF THE DAVY-ASHMORE GROUP

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CONTENTS

INTRODUCTION

The run of mine ore from Beltana requires reduction prior to introduction to any further process, whether it be a beneficiating or extractive process. Two methods of extraction are being considered; namely leaching, which requires beneficiation of the low grade ore at Beltana, and fuming, which requires size reduction only. For both beneficiation or fuming, a maximum particle size of ½" is required, and especially for beneficiation the quantity of fines should be minimised.

The feed specification for this plant was established by the Electrolytic Zinc Company. A number of proposals were received from equipment suppliers, some of whom offered the complete crushing circuit. These proposals differed considerably in detail and to some degree in price. The design discussed in this section is conventional although some savings might be achieved by certain variations. However, it is apparent that seemingly minor changes in the feed specification can effect the overall design and cost dramatically, and it is suggested that some trial mining and sample testing be undertaken before finally setting these parameters.

1. PROCESS DESCRIPTION

The size of the primary crusher is determined by the maximum lump size that will be fed to it, and not by the desired throughput. The sizes of the secondary and perhaps tertiary crusher are dependent on the output from the primary crusher. Consequently the specified maximum lump size will to a large extent determine the cost of the whole plant.

Some of the proposals were based on a lump size of 30 inches thereby requiring primary crushers capable of about 5 times the desired throughput. The product from these crushers was large as a result, and the secondary and tertiary units had to be oversized in capacity to handle the lump size. By reducing the maximum lump size to 20 inches thereby making a 36" x 25" primary crusher feasible, the cost of the whole circuit can be considerably reduced.

The proposed circuit includes a primary, secondary and tertiary crusher; the two latter being gyratory types. The tertiary unit is operating in closed-circuit in order to obtain an even sizing of final product. It is considered that if the fuming process were selected (where the quantity of fines is less important), that the circuit could be simplified with significant cost savings.

The final product conveyor shown in this design is a fixed type which feeds both the rich ore stockpile and the heavy medium feed stockpile. A scraper is provided to divert low-grade crushed product from the belt to the HM feed stockpile. An alternative method is a stacking conveyor that can be rotated from one stockpile to the other. This however would be a longer operation than using the deflector.

2. PLANT PERFORMANCE

2.1 Feed Material

Willemite ore varying from pure Willemite to low grade ore with dolomite and other impurities. Maximum lump size - 20 inch cube.

Capacity - 85 long tons/hour.

The above capacity is nominal only, and it is ancitipated that because of the "step change" effect in available equipment sizes, the selected equipment would be capable of up to 50% greater capacity.

2.2 Product

Crushed ore 100% minus ½" mesh. Size analysis not known until further fullscale tests are carried out.

Expected fines (-½ mm) - 25 to 36%
Production : up to 200,000 tpa

2.3 Utilities

Compressed air : The plant has its own air compressor and is therefore self-sufficient.

Water : Water is required for cleaning purposes only, and the consumption will be negligible.

Power : Installed - 270 KW
Normal consumption - 220 KW
Lighting - negligible

2. PLANT PERFORMANCE CONTINUED

2.4 Manning

a) If crushing plant is to operate with no HM plant installed nearby the following manning is required:-

Supervision	-	1 Foreman
Labour	-	1 Operator

b) If crushing plant operates in conjunction with HM plant, see section 2.4 under "Beneficiation" for total manning.

2.5 Plant Availability

On the basis of operating 2500 hours per year, it is expected that the plant availability will be 100% provided sufficient operating spares are kept on hand and maintenance is carried in the evening or over weekends.

3. PLANT DESCRIPTION (See Dwg. No. 418-2-0300-1)

The plant layout is designed to take advantage of the sloping site to assist material flow and minimise the lengths of conveyors.

An ore feed bin is provided to hold up to 2 hours feed material. This bin is filled by front-end loader using an earth ramp to approach the bin. The ore is fed to the crusher using a vibrating feeder, and the rate is controlled by the mill operator who stands on a platform near this feeder. A roof is provided over this platform for sun protection.

The crushed ore at -3" sizing passes by belt conveyor to the secondary crusher mounted on a common foundation with the tertiary crusher. A simple roof is provided over these two units to prevent overheating in the sun. The product of both crushers passes on to a belt conveyor underneath and is elevated to a vibrating screen with a ½" bottom deck. Material passing through this screen falls to the product conveyor. and is fed to the tertiary crusher, a gyratory crusher of the shorthead type.

The product conveyor continues in the downhill direction, passing over the HM feed stockpile to discharge normally on the rich ore stockpile. When low-grade ore is passing through the plant, a gate is swung across to discharge ore on to the first stockpile.

4. EQUIPMENT SPECIFICATION

4.1 Mechanical Equipment

Item No.	Description	No. off
1	Storage bin complete with liners, supporting steelwork and cut off gate, capacity - 100 tons.	1
2	Vibrating feeder. 36" wide x 8 ft. long supported from storage bin .	1
3	Primary crusher. 36" wide x 25" single toggle jaw crusher with slipring motor and vee-rope drive.	1
4	Belt conveyor - 24" wide, troughed. 85 ft. long running at 250 ft./min.	1
5	Secondary crusher. Standard cone crusher with coarse bowl liner, complete with motor and vee-rope drive.	1
6	Belt conveyor - 24" wide, troughed 60 ft. long running at 250 ft/min.	1
7	Vibrating screen. 48" wide x 12' long with deck mesh ½" sq.	1
8	Belt conveyor - 18" wide, troughed 57 ft. long running at 250 ft./min.	1
9	Tertiary crusher. Shorthead cone crusher with medium bowl liner, complete with motor and vee-rope drive	1

4. EQUIPMENT SPECIFICATION CONTINUED

4.1 Mechanical Equipment continued

Item No.	Description	No. off
10	Belt conveyor. 18" wide troughed. 350 ft. long running at 250 ft/min. Complete with intermediate discharge gate.	1

4.2 Electrics

Battery Limits - The battery limits are defined as the LV terminals of the E.T.S.A. supply transformer located not more than 50ft. route length from the main M.C.C.

Motor Control Centre - A demountable cubicle type of M.C.C., will be mounted on a concrete slab and enclosed in a steel framed lean-to sheet with A.C. sheeting.

Cabling - Cabling will be run overhead on cable ladders or conveyor structures. Cable types used are PVC/PVC for motors, power and control. Lighting cable will be both PVC/PVC and PVC building wire in Class 'B' galvanised screwed conduit.

Mains Cable - Incoming mains will be in PICC SWA & S double brass taped to resist termites.

Motors - Motor encloses to suit the particular location in which they are installed.

Lighting - Generally the lighting system comprises 2 x 20 watt fluorescent lamps throughout the plant. Floodlights have been included for general yard and storage areas.

4. EQUIPMENT SPECIFICATION CONTINUED

4.3 Civils

The civil works associated with the crushing plant comprise the following:-

Excavation - to achieve desired plant levels on the sloping site, and preparation for foundations.

Foundations - one major foundation for the primary crusher and another for the two cone crushers.

Footings - for all structures

Retaining wall - to retain earth near the primary crusher

Earth ramp - to provide access to feed bin.

Foundations and footings will be designed to the relevant Australian codes. A bearing load of 4 tons/sq. ft. has been assumed at Beltana.

4.4 Structures

The structures included in the crushing plant comprise the following:-

Bin supports - for ore feed bin with steel ramp for trucks and support for vibrating feeder

Crusher structure - operators platforms and weather-protection structures.

Conveyor supports - including access walkways and supporting gantries for all conveyors.

4. EQUIPMENT SPECIFICATION CONTINUED

4.4 Structures continued

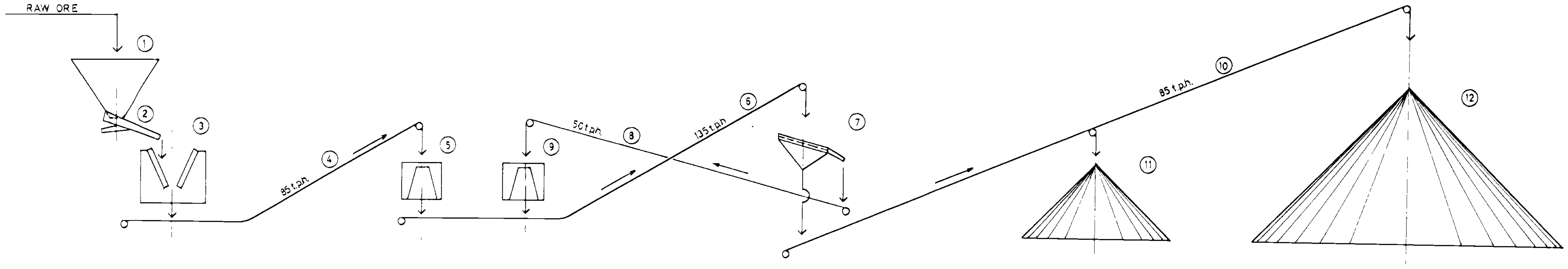
Screen structure - supporting vibrating screen.

All structures are designed to the relevant Australian codes and standards.

SECTION 5

DRAWINGS.

Contents.



SCHEDULE OF EQUIPMENT

ITEM Nº	DESCRIPTION	Nº OFF
1	100 TON CAPACITY BIN	1
2	VIBRATORY FEEDER	1
3	S.T. JAW CRUSHER	1
4	24" BELT CONVEYOR	1
5	3' STD. CONE CRUSHER	1
6	24" BELT CONVEYOR	1
7	SINGLE DECK SCREEN	1
8	18" BELT CONVEYOR	1
9	3' S H CONE CRUSHER	1
10	18" BELT CONVEYOR	1
11	1000 TON STOCKPILE - HEAVY MEDIA	1
12	5000 TON STOCKPILE	1

1748-4-1

APPR'D.	REV.	DATE	DESCRIPTION	BY

REVISION

DRAWN	E.M	24 2 · 72
CHECKED	H.S.	24 2 · 72
APPR'D.	R.T.M.	25 2 72
APPR'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

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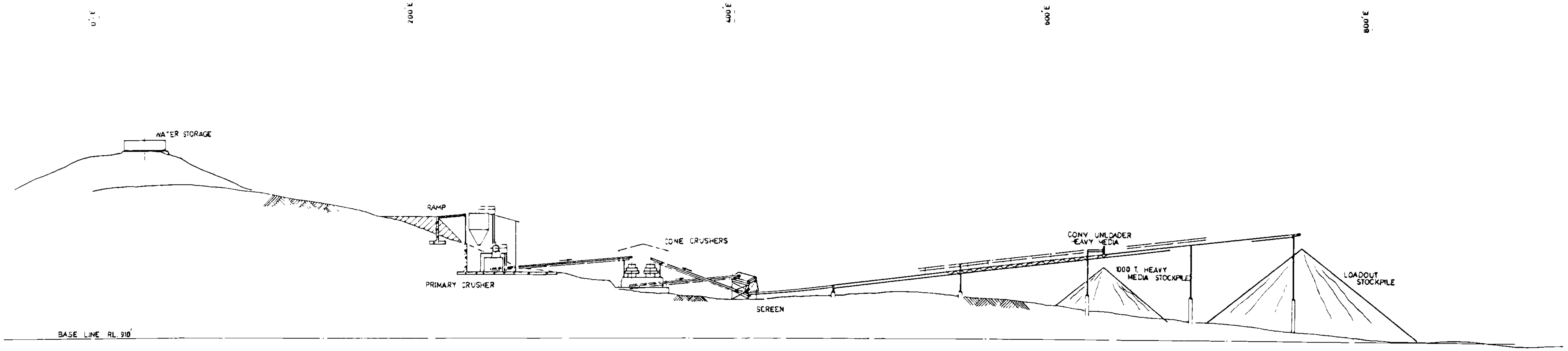
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

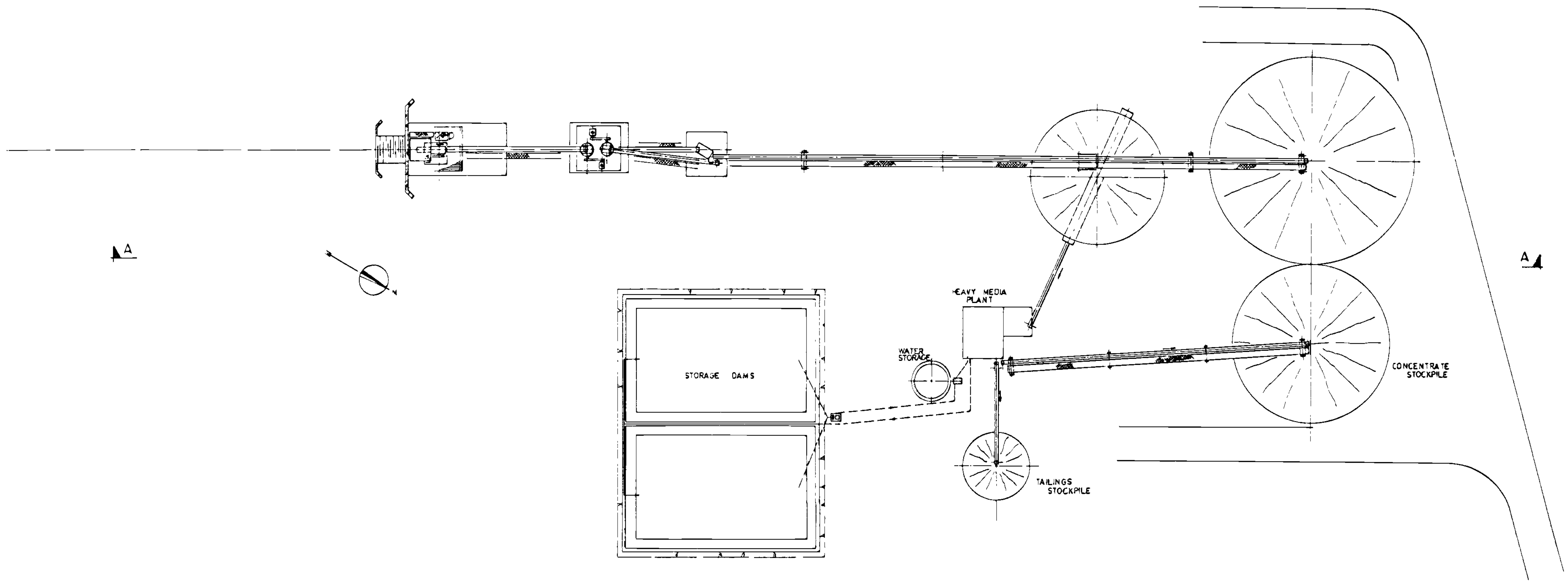
Client ELECTROLYTIC ZINC CO. OF A'SIA LTD.

TITLE: CRUSHING AND SCREENING PLANT
PROPOSED ORE FLOWSHEET
BELTANA S.A.

DRG.No. 418/2-0320-1



SECTION A-A



PLAN

1748-4-2

APPR'D.	REV.	DATE	DESCRIPTION	BY	
REVISION					

DRAWN	M Swan	24-1-72
CHECKED	HS	25-1-72
APPR'D.	RFMR	25 2 72
APPR'D. CONSTRUCT.		
SCALE	1" = 30 FT.	
REF. DRG No.		

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DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client ELECTROLYTIC ZINC CO. OF A'SIA LTD

TITLE: ORE CRUSHING PLANT
PROPOSED PLANT LAYOUT
BELTANA
STH. AUST.

DRG.No. 4'8/2-0300-1

6. PROJECT EXECUTION (See Drg. No. 418-2-0380-1)

The estimated time required to design and construct the crushing plant to the stage where it is ready to commence operations is 9 months. If there is an advantage in having the plant ready to operate in a shorter period, the project duraction can be shortened to about 5 months by selecting equipment that is available "off the shelf". In this case the equipment is unlikely to be optimum for the duty and will possibly cost more.

It is envisaged that design, supply, delivery, erection and commissioning of the complete crushing plant will be handled by one supplier employing his own sub-contractors. The design and construction of civil works will be independent of this supplier.

The civil design work will be carried out in Melbourne. Tenders will be called from local civil contractors for the earthwork and concrete work, and a site engineer will be sent to Beltana to supervise the work of this contractor. This engineer will also remain on site to supervise the construction work of the equipment supplier. If suitable mining equipment is available on site consideration will be given to using this for the excavation work. If the HM plant is to be constructed, the foundations for the plant could be incorporated in the civil contract.

It is assumed that temporary accommodation is available at Beltana for the site supervising engineer, and that the sub-contractors (both civil and erection) will provide their own accommodation. Water and power supplies will be made available early to assist the construction work.

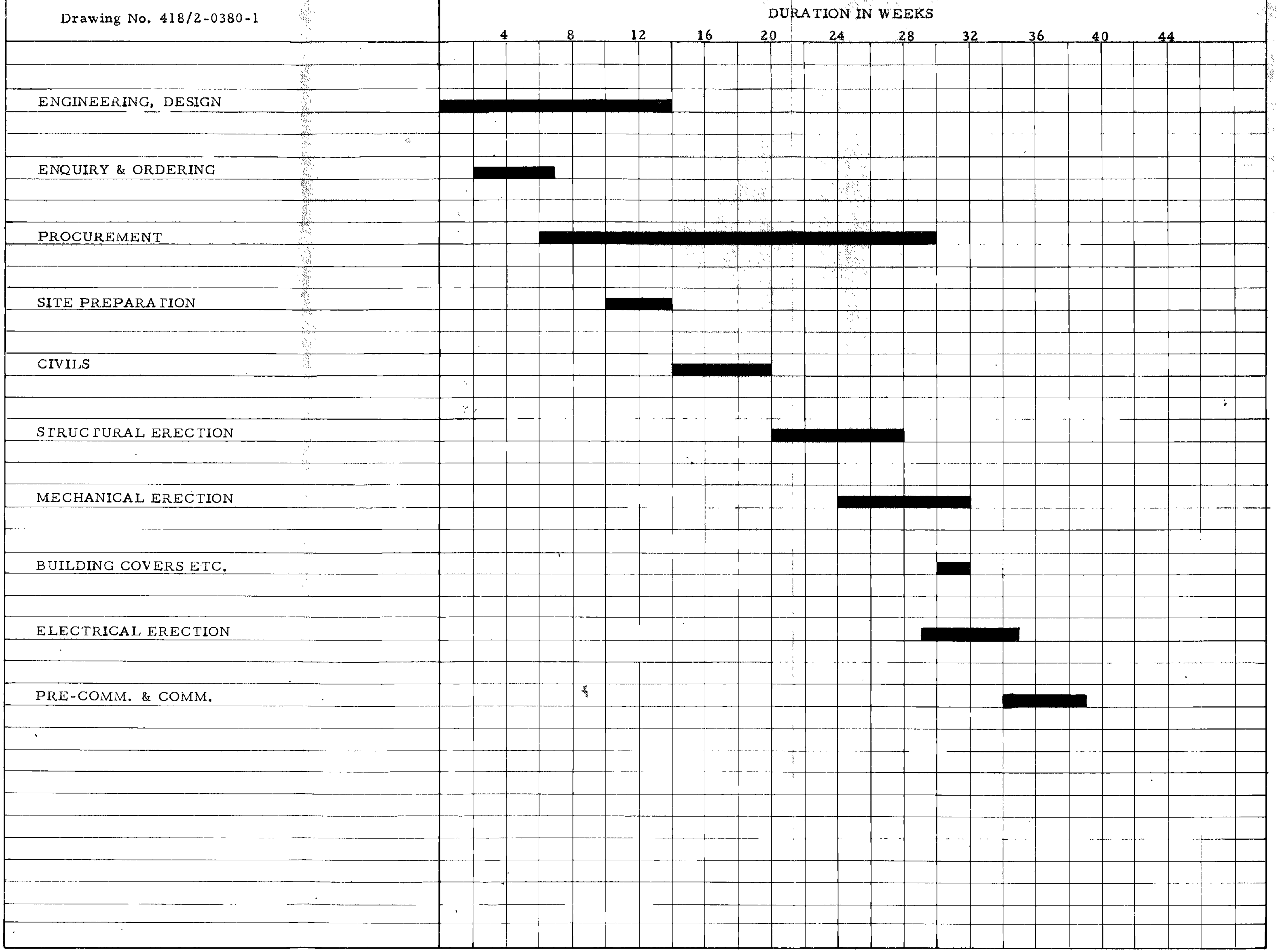
The equipment supplier will be responsible for the precommissioning of the plant and his representative will also be present for the initial start-up.

DAVY ASHMORE PTY LTD
MELBOURNE

BELTANA PROJECT
GRINDING & CRUSHING

PROJECT SCHEDULE

Drawing No. 418/2-0380-1



ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

BELTANA PROJECT

FEASIBILITY STUDY
1972

PART 2B: ORE BENEFICIATION

DA 418

FEBRUARY 1972

DAVY-ASHMORE

DAVY-ASHMORE PTY. LTD.
MELBOURNE

MEMBER OF THE DAVY-ASHMORE GROUP

CONTENTS

INTRODUCTION

The following plant design and costs are based on an engineering study by Mitchell-Cotts Construction Pty. Ltd. who are associated with Fraser and Chalmers of South Africa. The plant capacity was selected by the Electrolytic Zinc Company following sink/float tests carried out on all core samples available from Beltana. These tests indicated that the original samples A and C tested by Amdel represented only a small section of the orebody, and consequently the heavy medium separation has become a small supplementary operation running concurrently with the main crushing operation.

The plant described in this section is sized to handle a feed of 15 tons per hour of low grade ore. The production expected from the plant will vary with the head grade, but in order to gain some knowledge of the plant performance, the results of the Amdel work on samples A and C are shown in Tables 1 and 2 as a guide.

The plant has been designed with a minimum of buildings in accordance with the normal climatic conditions in the Beltana area. It has also been designed to operate for 50 hours per week in keeping with the crushing plant.

It is expected that the HMS plant will be installed only if the ore is to be sent to Risdon, in order to reduce shipping costs and acid consumption in the leaching operation.

CONTENTS

INTRODUCTION

The following plant design and costs are based on an engineering study by Mitchell-Cotts Construction Pty. Ltd. who are associated with Fraser and Chalmers of South Africa. The plant capacity was selected by the Electrolytic Zinc Company following sink/float tests carried out on all core samples available from Beltana. These tests indicated that the original samples A and C tested by Amdel represented only a small section of the orebody, and consequently the heavy medium separation has become a small supplementary operation running concurrently with the main crushing operation.

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The plant has been designed with a minimum of buildings in accordance with the normal climatic conditions in the Beltana area. It has also been designed to operate for 50 hours per week in keeping with the crushing plant.

It is expected that the HMS plant will be installed only if the ore is to be sent to Risdon, in order to reduce shipping costs and acid consumption in the leaching operation.

1. PROCESS DESCRIPTION

Ore crushed to -½" is reclaimed from a stockpile and fed to a scrubber which is designed to separate the -½ mm fines from the coarse particles. The drum type scrubber provides intimate mixing of ore and water and allows the fines to separate from the coarse particles.

From the washing drum within the scrubber the ore and water pass over the trommel screen section, -½" ore and water passing through the trommel, and any oversize passing over is discharged to the ground for collection and disposal.

The -½" ore and water passing through the trommel is pumped to the feed preparation screen on which, by means of high pressure water sprays,the slimes are washed off the ore and pass through the wedge wire screen deck to the tailings sump, later to be pumped to the storage lagoons.

The deslimed ore, nominally -½" to ½ mm passing over the screen passes to the mixing sump where it is joined by the heavy medium. From the mixing sump, the ore and medium is pumped to the heavy medium cyclone in which the separation of the concentrate and tailings take place.

Both the concentrate and tailings, i.e. spigot discharge and cyclone overflow, from the heavy medium cyclone, are discharged into a split curved wedge wire fixed panel, on which the bulk of the heavy medium is removed, from the end of the curved wedge wire panel the concentrate and tailings discharge onto the drain and rinse screen, which also is split along its length, in order to keep both products separate.

Over the first section of the screen further draining of heavy medium occurs, and the medium passing through the wedgewire deck is joined with that which has passed through the curved wedge wire panel, and gravitates to the densified medium sump.

1. PROCESS DESCRIPTION CONTINUED

The ore passing onto the second section of the screen passes under water sprays, which wash any adhering medium off. The medium passes with the water through the wedge wire deck of the screen and gravitates to the heavy medium magnetic separator on which the medium will be recovered and pass to the densified medium sump.

The slimes, non magnetics and water passing through the magnetic separator gravitate to the tailings sump, there joining the slimes from the feed preparation screen, and from the sump are pumped to storage lagoons.

From the densified medium sump, the heavy medium will be pumped back into the circuit for reuse, passing through a densifier, and density controller to maintain the correct separation gravity, before entering the medium storage agitator sump, where it is retained in suspension with a gravity feed to the mixing sump.

Any spillage within the plant is collected in a reinforced concrete catchment basin, which forms the ground floor to the plant and gravitates to the reclaim sump from which it can be reclaimed via the sump pump, either to the magnetic separator or medium storage sump.

Fresh medium, to replace that which is lost in the circuit can enter the circuit via the sump and sump pump.

Water reclaimed from the storage lagoons is pumped back to the plant and held in the water storage tank, where it is joined by make up water, to be pumped where required via the circulating water pump.

2. PLANT PERFORMANCE

2.1 Feed Specification

The plant is designed to handle low grade Willemite ore obtained from the halo area of the orebody. The major impurities to be removed are dolomite and limestone which are amenable to heavy media separation. No representative samples are available, although Samples A and C (Table 1) are indicative of some of the material which can be treated by this plant. The average grade fed to this plant is expected to be substantially less than Samples A and C.

Feed to Scrubber - 15 tons/hour crushed ore.
Feed Size - -½"
Approx. feed assay - 25 - 30% Zn.

It is intended that this plant will operate on a 2500 hours/year basis (50 weeks of 50 hours/week). This will give a capacity of 37,500 tpa or 37.5% of total ore mined, giving some reserve capacity for variability of ore.

2.2 Product

The product from this plant consists of:-

a)	Sink material	(-½" to +½ mm)	- up to 8 tons/hour
b)	Fines	(-½ mm)	- up to 6 tons/hour
c)	Float material	(-½" to +½ mm)	- up to 6 tons/hour

The sink material is delivered to the product stockpile adjacent to the rich ore stockpile, while the fines are sent to storage lagoons for dewatering and drying. The fines are reclaimed when dry using a front-end loader, and are blended with the sink material and rich ore for shipment.

2. PLANT PERFORMANCE CONTINUED

2.2 Product continued

The maximum rates given above are due to variability of the feed material and these are incorporated in the design of equipment. However the average product is expected to be similar to that shown in Table 2. This will give an output of sink plus fines of 10 tph with an assay of approximately 40% Zn.

2.3 Utilities

The following are the average utility consumptions for the heavy medium plant:-

Heavy Medium - 15 lb per hour
delivered by rail from Port Pirie.

Power - Installed 170 KW
Operating 110 KW
Lighting negligible
Supplied to plant switchboard from power transformer.

Water - 60,000 gallons/day (approx.)

2.4 Manning

The manning of this plant will be shared with that of the crushing plant. It is considered that one full-time operator will be required in the heavy medium plant plus the part-time assistance of another operator to check the storage dam and pumps. A plant foreman would be in charge of both plants and therefore half his time would be allocated to the heavy medium plant.

2. PLANT PERFORMANCE CONTINUED

2.4 Manning continued

The combined manning for the crushing plant and heavy medium plant will be :-

	No. men per day
(i) Supervisor (foreman)	1
(ii) Crusher operator	1
(iii) H.M.S. plant operator	1
(iv) General assistant	1

2.5 Tailings Disposal

A conveyor delivers the tailings (or float material) from the heavy medium plant to a stockpile with a capacity of 500 tons. This will provide at least 2 weeks capacity after which the material will be trucked away to a tailings dump nearby.

2.6 Plant Availability

This plant has been nominally designed to run for 50 hours per week for 50 weeks per year at a feed capacity of 15 ton/hour. Consequently the plant will be operating for 8-10 hours per day. Maintenance of the plant can be carried out during the evenings or weekends if necessary, and provided adequate spares are kept on hand, a plant availability of 100% is attainable.

TABLE 1

SUMMARY OF RESULTS - TEST NO. 2 ON SAMPLES A & C TREATED IN H.M. CYCLONE

SAMPLE		'A'	'C'	'A' + 'C'
FEED	% Wt	100.0	100.0	100.0
	Assay % Zn	35.64	39.40	37.52
	% Distrib.	100.0	100.0	100.0
	Assay % Pb	1.84	2.31	2.07
	% Distrib.	100.0	100.0	100.0
SINK	% Wt.	33.3	53.8	43.6
	Assay % Zn	54.00	56.00	55.24
	% Distrib.	50.5	76.5	64.2
	Assay % Pb	2.20	2.94	2.66
	% Distrib.	39.8	68.6	55.9
FLOAT	% Wt.	23.6	17.3	20.4
	Assay % Zn	5.70	2.75	4.45
	% Distrib.	3.8	1.2	2.4
	Assay % Pb	0.86	0.10	0.54
	% Distrib.	11.0	0.7	5.3
FINES	% Wt.	43.1	28.9	36.0
	Assay % Zn	37.80	30.40	34.83
	% Distrib.	45.7	22.3	33.4
	Assay % Pb	2.1	2.45	2.24
	% Distrib.	49.2	30.7	38.9
COMB. SINK + FINES	% Wt.	76.4	82.7	79.6
	Assay % Zn	44.87	47.06	46.00
	% Distrib.	96.2	98.8	97.6
	Assay % Pb	2.14	2.77	2.47
	% Distrib.	89.0	99.3	94.7

Sample A + C results are calculations based on a weighted 1 : 1 ratio of samples A and C.

418/2B

TABLE 2

ESTIMATED CONCENTRATE GRADE & DISTRIBUTION AT 27% Zn HEAD GRADE FOR SAMPLE A & C TREATED IN H.M. CYCLONE

SAMPLE		'A'	'C'	'A' + 'C'
FEED	% Wt.	100.0	100.0	100.0
	Assay % Zn	27.00	27.00	27.00
	% Distrib.	100.0	100.0	100.0
SINK	% Wt.	25.3	36.9	31.4
	Assay % Zn	54.00	56.00	55.23
	% Distrib.	50.5	76.5	64.6
FLOAT	% Wt.	31.6	34.2	33.0
	Assay % Zn	3.22	0.95	1.98
	% Distrib.	3.8	1.2	2.4
FINES	% Wt.	43.1	28.9	35.6
	Assay % Zn	28.64	20.83	25.33
	% Distrib.	45.7	22.3	33.4
COMB. SINK + FINES	% Wt.	68.4	65.8	67.0
	Assay % Zn	38.01	40.55	39.32
	% Distrib.	96.2	98.8	97.6

NOTE: Above estimations assumes the same distribution of the Zn in each of the products as has occurred in the higher head grade samples. The Zn grade of the H.M.S. sink fraction has also been taken as that obtained in the higher head grade samples. Sample A + C results are calculations based on a weighted 1 : 1 ratio of samples A and C.

418/2B

3. PLANT DESCRIPTION

(See Drg. Nos. J1041/A/L1 and L2)

Crushed low-grade ore is reclaimed from the stockpile through two openings with vibrating feeders feeding on to a belt conveyor. The feeders and conveyor are situated in a pressed steel tubular tunnel, part-buried in the ground beneath the stockpile. The tunnel has openings at both ends at the extremities of the stockpile, providing easy access for operating and maintenance. The conveyor is inclined on leaving the tunnel to deliver the ore to the scrubber feed chute.

An alternative means of feeding the plant has been considered. This consists of a 15 ton bin feeding onto a belt conveyor, and an earth ramp is provided to allow a front-end loader to fill the bin regularly. The capital cost of this alternative is lower, but the front-end loader is required to be in almost continuous attendance.

The heavy medium plant consists of 6 skid-mounted units which are transported to the site fully assembled, ready to place in position. One unit contains the scrubber with its drive and pump; four other units contain the remaining equipment, and these are stacked two-on-two; the other unit comprises a hoist and gantry to service the cyclone, and this sits on top of the other four units. The units require only bolting in position and piping and electrical connections to complete the installation, thus minimising the amount of site construction work. Stairways are provided to give access to the first and second level operating platforms.

The heavy medium plant is supported on a monolithic concrete base incorporating sloping floors and sump to recover any medium that is lost from the process. Two storage dams are provided formed in earth to receive the fines and water, and allow the fines to settle. The water is decanted using a water return pipe that is adjusted to draw from just below the surface. When one dam is full the fines and water are diverted to the other dam to allow the full dam to dry out by drainage and evaporation. The dry fines are removed from the dam by means of a front-end loader.

3. PLANT DESCRIPTION CONTINUED

The heavy medium plant is covered with a light-frame building with roof and part-walls sheeted with galvanised steel sheeting. A skillion roof of similar construction is provided for the protection of the scrubber.

The design of this plant is such that the units can readily be dismantled for transport to a new site in a short time and for little cost.

4. EQUIPMENT SPECIFICATIONS

The item numbers referred to below correspond with those on flowsheet J1041/A/F1.

Item No.	Description	No. off
1	Untreated ore stockpile 1000 tons capacity	1
2	Vibrating feeders, capacity 10tph	2
3	Cylindrical pressed steel tunnel of "Armco" manufacture, approx. 75ft. long.	1
4	18" trough belt conveyor. Capacity 20 tph max. - ½" low grade ore. Centres - 113 ft.	1
Alt.2	Vibrating feeder, capacity 20 tph	1
Alt.3	½" low grade ore hopper capacity 15 tons.	1
Alt.4	18" trough belt conveyor, centres approx. 30ft.	1
5	Rotary scrubber 4'0" diameter x 7'6" long complete with trommel, independent drive and support frame.	1
6	Scrubber discharge sump	1
7	Scrubber discharge pump, Warman manufacture, size 4/3 CAM	1
8	Feed Box for Feed Preparation Screen	1

418/2B

4. EQUIPMENT SPECIFICATIONS CONTINUED

Item No.	Description	No. off
9	Feed Preparation Screen. Allis Chalmers "Low Head" vibrating screen 12'0" long x 4'0" wide with ½ mm aperture stainless steel wedge wire deck, and complete with underpan.	1
10	Mixing sump to mix wash ore fraction with medium.	1
11	Cyclone Feed Pump of Warman manufacture size 6/4 CAM.	1
12	Medium storage agitator sump	1
13	Heavy medium cyclone complete with cyclone spigot box and cyclone overflow box.	1
14	Curved wedgewire sieve with centre divider	1
15	Products drain and rinse screen, Allis Chalmers "Low Head" vibrating screen 12'0" long x 4'0" wide, with central division, fitted with ½ mm wedge wire deck.	1
16	Magnetic separator 36" x 36"	1
17	Densified medium sump	1
18	Circulating medium pump of Warman manufacture, size 6/4 CAM	1

4. EQUIPMENT SPECIFICATIONS CONTINUED

Item No.	Description	No. Off
19	Tailings sump	1
20	Tailings pump of Warman manufacture, size 4/3 CAM	1
21	Sump pump of Warman manufacture, size 2/1½. Fitted to floor sump	1
22	Densifier	1
23) 24)	Set of specific gravity controls of "Ramsay" type	1
25	18" troughed belt conveyor. Capacity 10 tph - ½" concentrated ore, centres - 180 ft.	1
26	Concentrate stockpile, capacity 2000 tons	1
27	18" troughed belt conveyor. Capacity 8 tph, -½" float material, centres - 65ft.	1
28	Tailings stockpile, capacity 500 tons	1
29	Fines storage dams, area 100' x 60', available depth 4'6", earthwall construction	2
30	Return water pump of Kelly & Lewis manufacture, size 2½/3, series 2	1
31	Water storage tank, capacity 3000 gallons	1
32	Water circulating pump of Kelly & Lewis manufacture, size 3/4, Series 4	1

3. PLANT DESCRIPTION

(See Drg. Nos. J1041/A/L1 and L2)

Crushed low-grade ore is reclaimed from the stockpile through two openings with vibrating feeders feeding on to a belt conveyor. The feeders and conveyor are situated in a pressed steel tubular tunnel, part-buried in the ground beneath the stockpile. The tunnel has openings at both ends at the extremities of the stockpile, providing easy access for operating and maintenance. The conveyor is inclined on leaving the tunnel to deliver the ore to the scrubber feed chute.

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The heavy medium plant is supported on a monolithic concrete base incorporating sloping floors and sump to recover any medium that is lost from the process. Two storage dams are provided formed in earth to receive the fines and water, and allow the fines to settle. The water is decanted using a water return pipe that is adjusted to draw from just below the surface. When one dam is full the fines and water are diverted to the other dam to allow the full dam to dry out by drainage and evaporation. The dry fines are removed from the dam by means of a front-end loader.

3. PLANT DESCRIPTION CONTINUED

The heavy medium plant is covered with a light-frame building with roof and part-walls sheeted with galvanised steel sheeting. A skillion roof of similar construction is provided for the protection of the scrubber.

The design of this plant is such that the units can readily be dismantled for transport to a new site in a short time and for little cost.

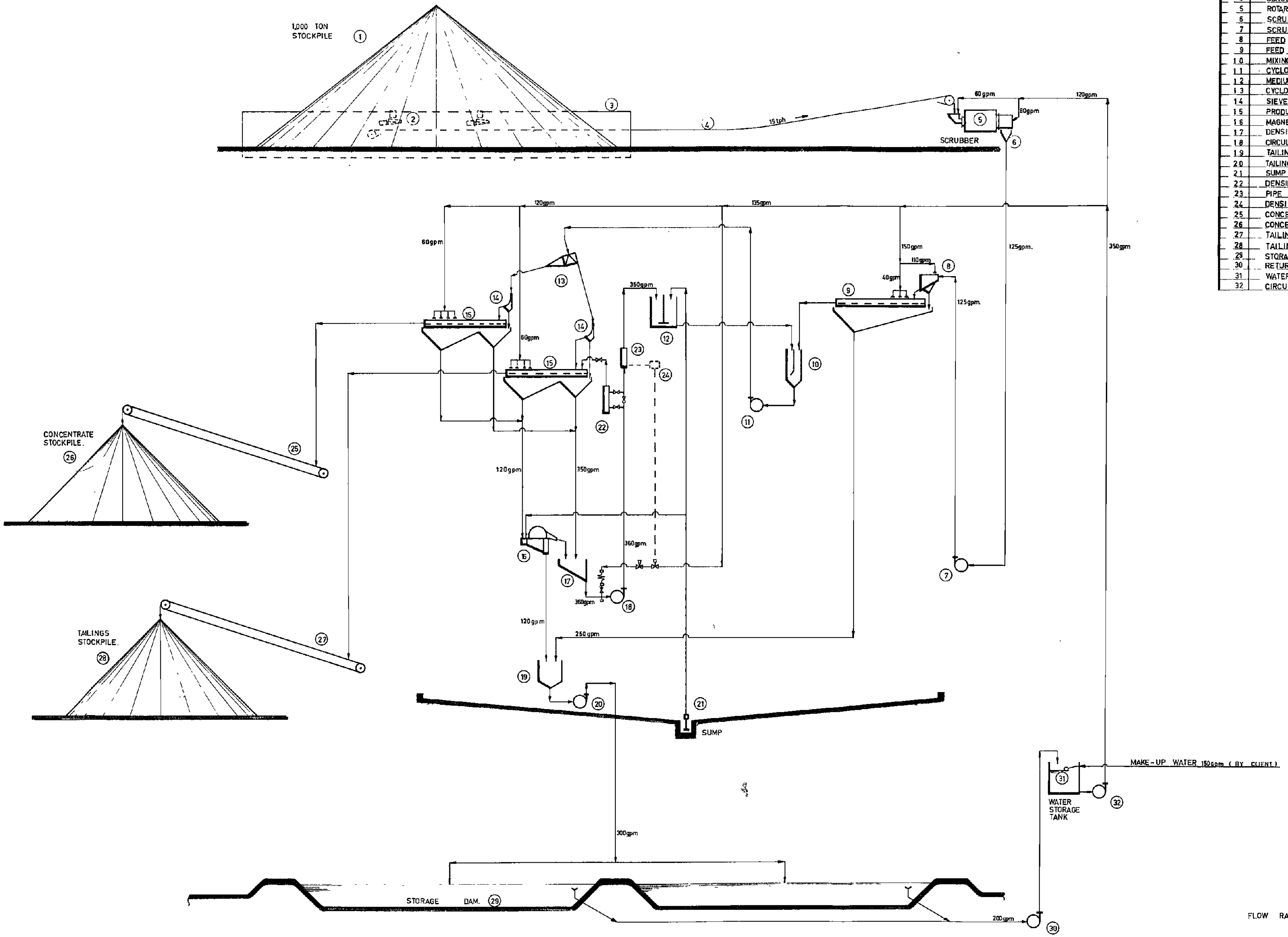
SECTION 5

DRAWINGS.

Contents

DRAWING NUMBER

1041 A / F1



SCHEDULE OF EQUIPMENT

ITEM Nº	DESCRIPTION		Nº OFF
1	STOCKPILE		1
2	VIBRATING FEEDER		2
3	RECLAIM TUNNEL		1
4	SCRUBBER FEED CONVEYOR		1
5	ROTARY SCRUBBER WITH TROMMEL		1
6	SCRUBBER DISCHARGE SUMP		1
7	SCRUBBER DISCHARGE PUMP		1
8	FEED BOX FOR FEED PREP. SCREEN.		1
9	FEED PREPARATION SCREEN & UNDERPAN.		1
10	MIXING SUMP		1
11	CYCLONE FEED PUMP		1
12	MEDIUM STORAGE AGITATOR SUMP		1
13	CYCLONE		1
14	SIEVE BEND - DIVIDED SIEVE		1
15	PRODUCT SCREEN WITH DIVIDED DECK		1
16	MAGNETIC SEPARATOR		1
17	DENSIFIED MEDIUM SUMP		1
18	CIRCULATING MEDIUM PUMP.		1
19	TAILINGS SUMP		1
20	TAILINGS PUMP		1
21	SUMP PUMP		1
22	DENSIFIER		1
23	PIPE COIL.		1
24	DENSITY CONTROLLER		1
25	CONCENTRATE FEED CONVEYOR	BY CLIENT	1
26	CONCENTRATE STOCKPILE	" "	1
27	TAILINGS FEED CONVEYOR	" "	1
28	TAILINGS STOCKPILE	" "	1
29	STORAGE DAM	" "	1
30	RETURN WATER PUMP		1
31	WATER STORAGE TANK		1
32	CIRCULATING WATER PUMP		1

FLOW RATES SHOWN ARE APPROXIMATE ONLY.

THIRD ANGLE PROJECTION

Dimension Tolerance - Unless otherwise specified

BASIC DIMENSION	MACHINE WORK		STRUCTURAL
	Fractional	Decimal	
Up to 6"	± 1/64"	± .005	± 1/16"
6 to 24"	± 1/32"	± .005	± 1/16"
Over 24"	± 1/16"	± .010	± 1/16"

MACHINING SYMBOLS 1 ROUGH ▼ 1 FINISH ▼▼ 1 GRIND ▼▼▼

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DAVY ASHMORE PTY. LTD.

FLOWSHEET.

BELTANA ORE TREATMENT PLANT.

Mitchell Cotts Construction Pty. Ltd. Melbourne

A Member of the Mitchell Cotts Group

J 1041 A

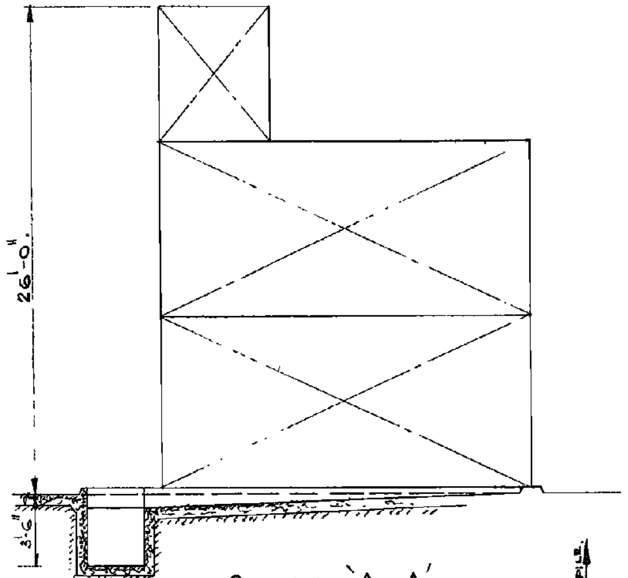
DRAWING NUMBER

1041 A / F1.

REVISION

FOLD

DRAWING NUMBER
1041A/L1



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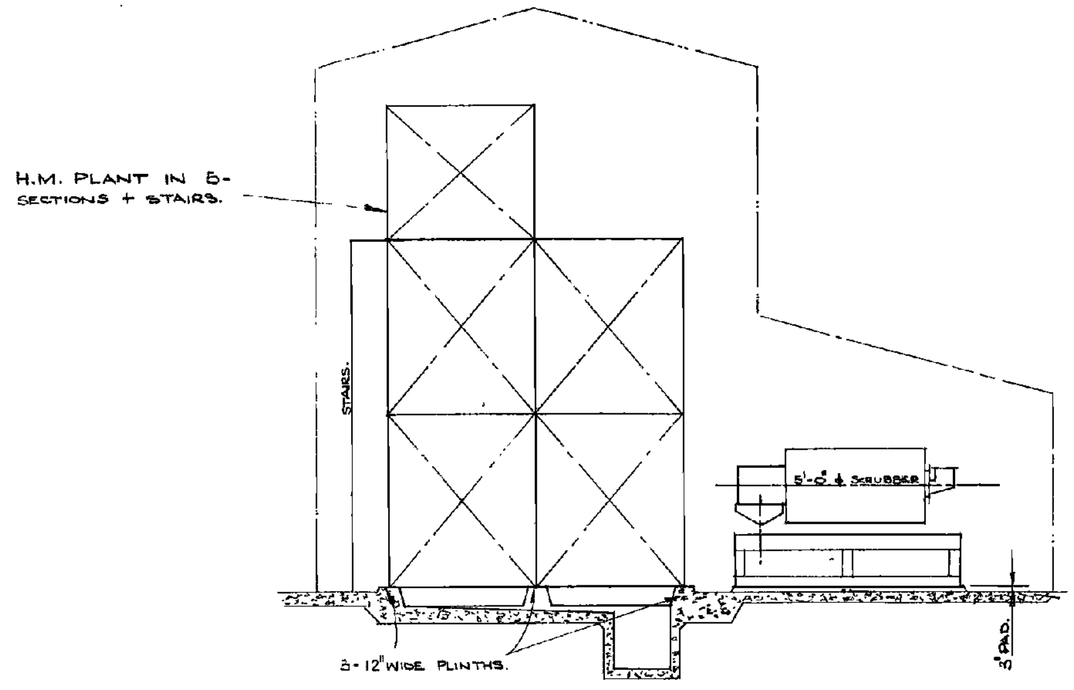

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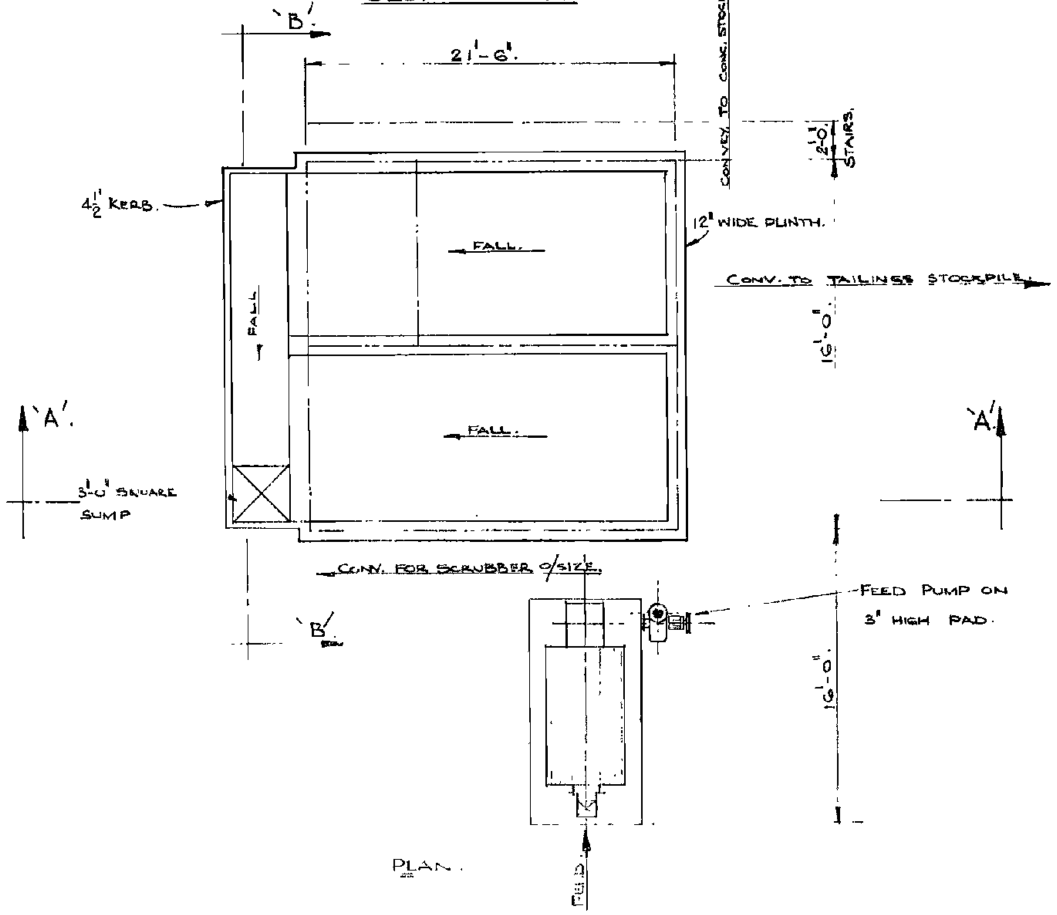

PLAN.

NOTE! H.M. PLANT FIXED TO PLINTHS WITH 16-$\frac{3}{4}$"φ H.D. BOLTS CAST IN CONC.
SCRUBBER " " PAD " 6- " " " " " ".
PUMP " " " " 4-$\frac{7}{8}$" " " " " ".
SUMP PUMP " " PLINTHS " 4-$\frac{3}{4}$" " " " " ".

THIRD ANGLE PROJECTION			
Dimension Tolerance - Unless otherwise specified			
BASIC DIMENSION	MACHINE WORK		STRUCTURAL
	Fractional	Decimal	
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MACHINING SYMBOLS 1 ROUGH ▼ 1 FINISH ▼▼ 1 GRIND ▼▼▼

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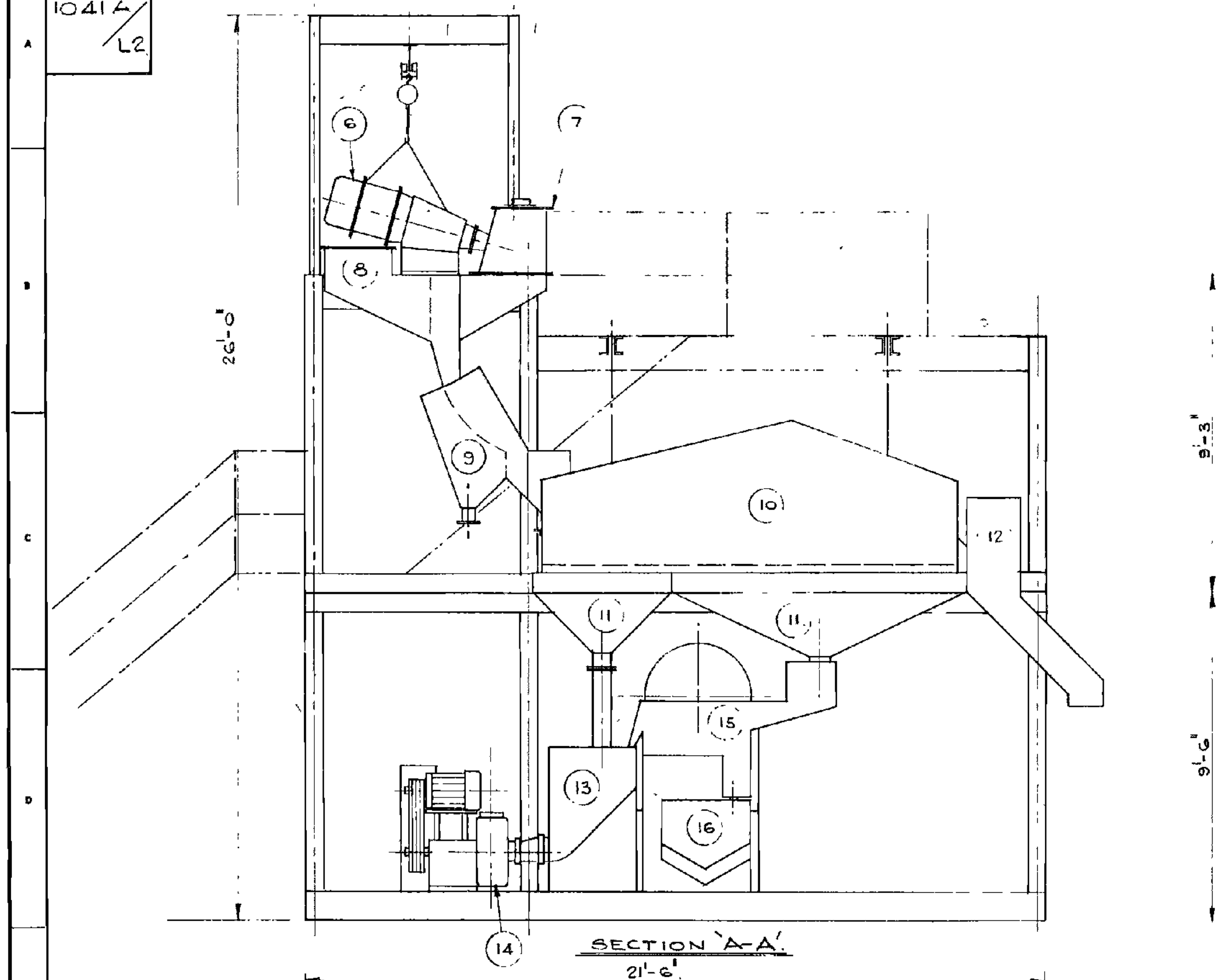
DAVY-ASHMORE PTY. LTD.

HEAVY MEDIUM SEPARATION PLANT —
BELTANA ORE TREATMENT PLANT.
PRELIMINARY PLAN LAYOUT.

Mitchell Cotts Construction Pty. Ltd. Melbourne
A Member of the Mitchell Cotts Group

J1041 A.
DRAWING NUMBER
1041A/L1.
REVISION

DRAWING NUMBER
1041A/L2



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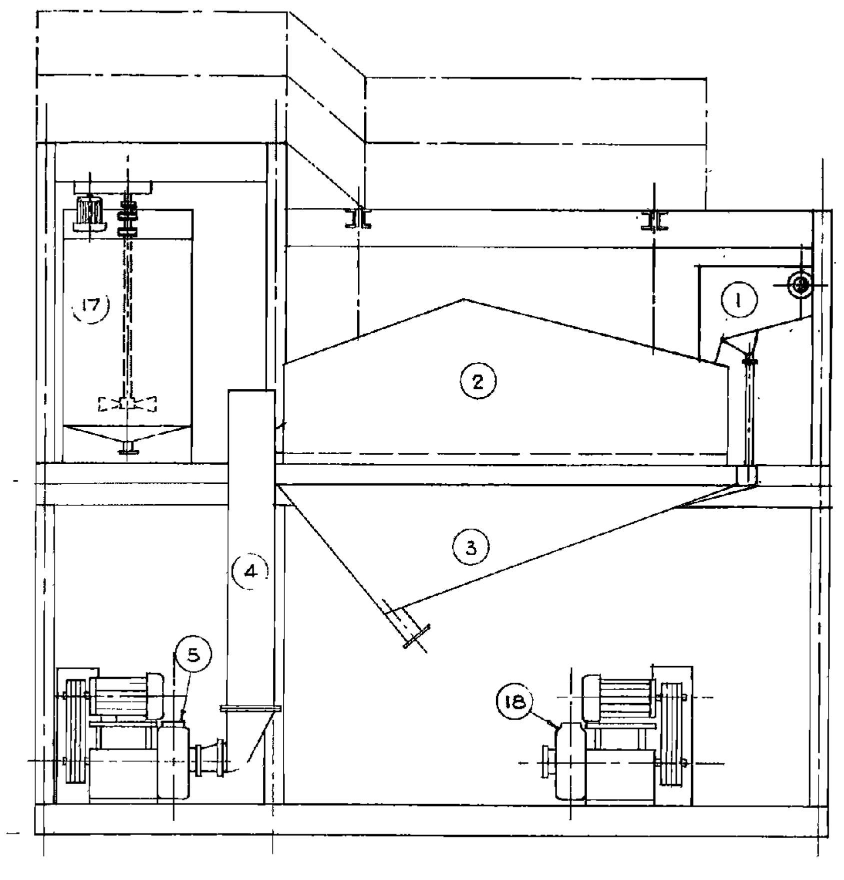

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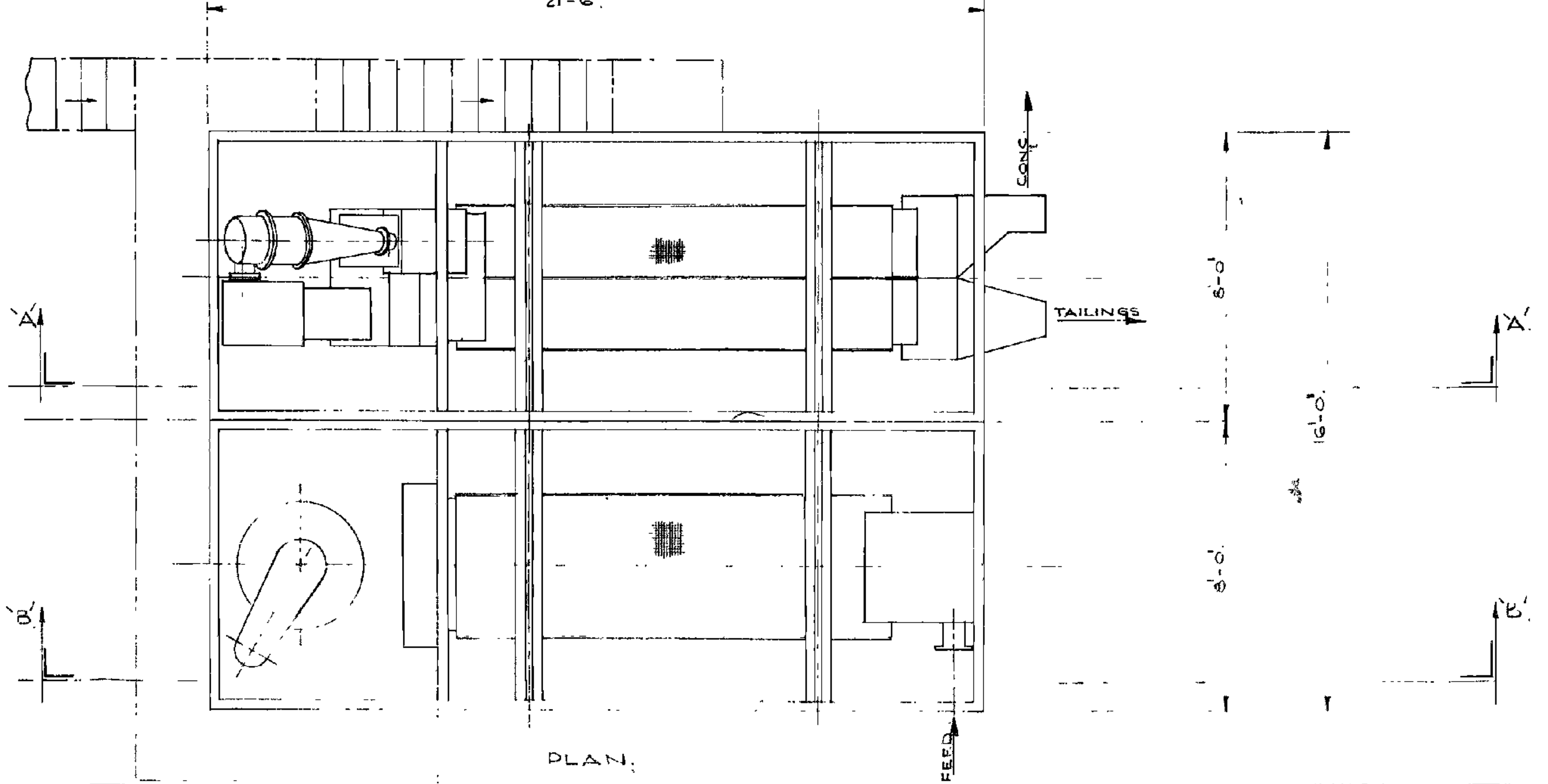

PLAN.

ITEM	DESCRIPTION.	Nº OFF
22		
21		
20		
19		
18	TAILINGS PUMP.	1.
17	AGITATOR TANK.	1.
16	MAGNETIC SEPARATOR TAILINGS HOPPER.	1
15	MAGNETIC SEPARATOR.	1.
14	CIRCULATING MEDIUM PUMP.	1.
13	DENSIFIED MEDIUM HOPPER.	1.
12	PRODUCT DISCHARGE CHUTE.	2.
11	PRODUCT SCREEN UNDERPAN.	1.
10	PRODUCT SCREEN (DIVIDED).	1.
9	SIEVE BEND	1.
8	CYCLONE OVERFLOW BOX	1
7	CYCLONE SPIGOT BOX.	1.
6	CYCLONE.	1
5	CYCLONE FEED PUMP.	1.
4	MIXING SUMP.	1.
3	FEED PREP. SCREEN UNDERPAN	1.
2	FEED PREP. SCREEN.	1.
1	FEED PREP. SCREEN FEED BOX.	1.

THIRD ANGLE PROJECTION

Dimension Tolerance - Unless otherwise specified

BASIC DIMENSION	MACHINE WORK		STRUCTURAL
	Fractional	Decimal	
Up to 6"	± 1/64"	± .005	± 1/16"
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MACHINING SYMBOLS 1 ROUGH ▼ 1 FINISH ▼▼ 1 GRIND ▼▼▼

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DAVY ASHMORE PTY. LTD.

PROPOSED 15 T.P.H. HEAVY MEDIA
SEPARATION PLANT
BELTANA ORE TREATMENT PLANT.

J1041 A

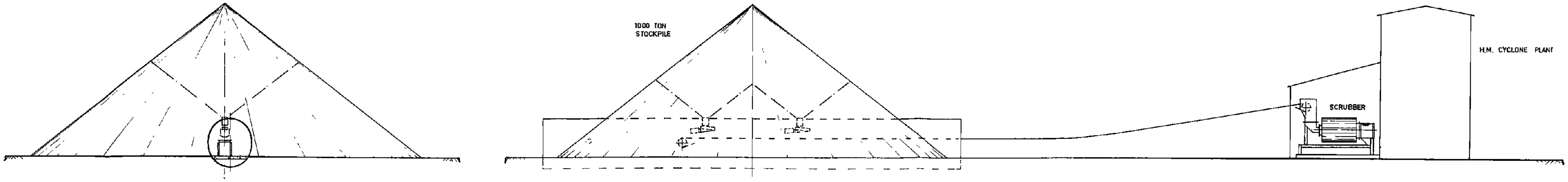
DRAWING NUMBER
1041A/L2.

REVISION

Mitchell Cotts Construction Pty. Ltd. Melbourne
A Member of the Mitchell Cotts Group

FOLD

DRAWING NUMBER
1041 A / L3



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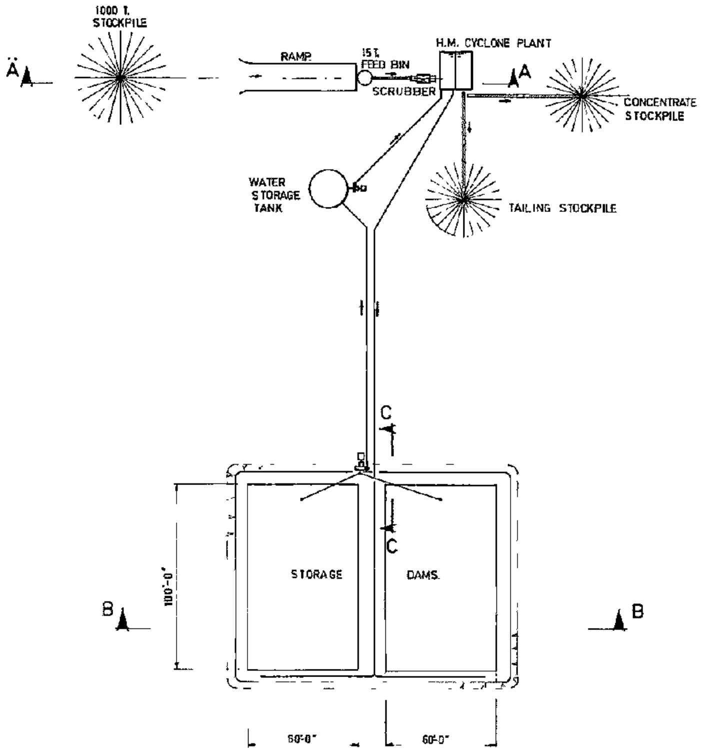
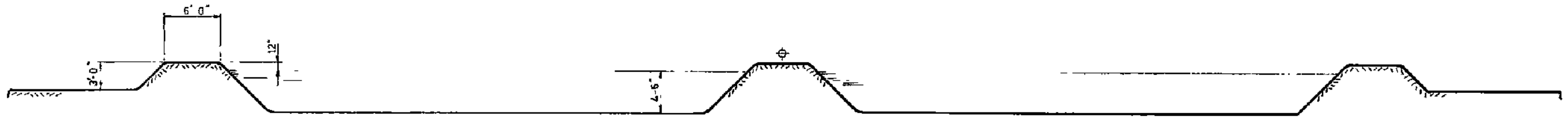
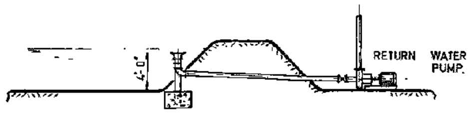
ELEVATION 'A-A' (ALTERNATIVE 'B').



TYP. SITE PLAN



SECT. B-B (STORAGE DAM)



SECT. 'C-C'

THIRD ANGLE PROJECTION

Dimension Tolerance - Unless otherwise specified

BASIC DIMENSION	MACHINE WORK Fractional	MACHINE WORK Decimal	STRUCTURAL
Up to 6"	± 1/64"	± .005	± 1/16"
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MACHINING SYMBOLS: ROUGH ▼ FINISH ▼▼ GRIND ▼▼▼

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DAVY ASHMORE PTY. LTD.

PROPOSED SITE PLAN

BELTANA ORE TREATMENT PLANT.

Mitchell Cotts Construction Pty. Ltd. Melbourne MC GROUP

A Member of the Mitchell Cotts Group

J 1041 A

DRAWING NUMBER 1041A / L3.

REVISION

FOLD

6. PROJECT EXECUTION (See Drg. No. 418-2-0380-2)

The estimated time required to design and construct the heavy medium plant to the stage where it is ready to commence operations is 8 months.

The plant is designed to be prefabricated in Melbourne as a set of skid-mounted units; each unit capable of being transported by road to the site. This reduces the time required for site erection to 9 weeks with considerable cost savings.

The detailed design work and the prefabrication will be carried out by the contractor in Melbourne. Inspection of the work during the prefabrication stage will be carried out in Melbourne to ensure quality of workmanship.

The plant foundation will be designed separately and tenders called for the construction of the foundation in conjunction with civil works for the crushing plant. A site supervisor will be provided to supervise the civil construction work and the erection of the plant by the contractor. This site supervisor would also be responsible for the crushing plant.

The contractor will provide site accommodation for his personnel, however it is assumed that existing accommodation will be available for the site supervisor. Site services such as power and water will be made available early to assist the contractor in the erection of the plant.

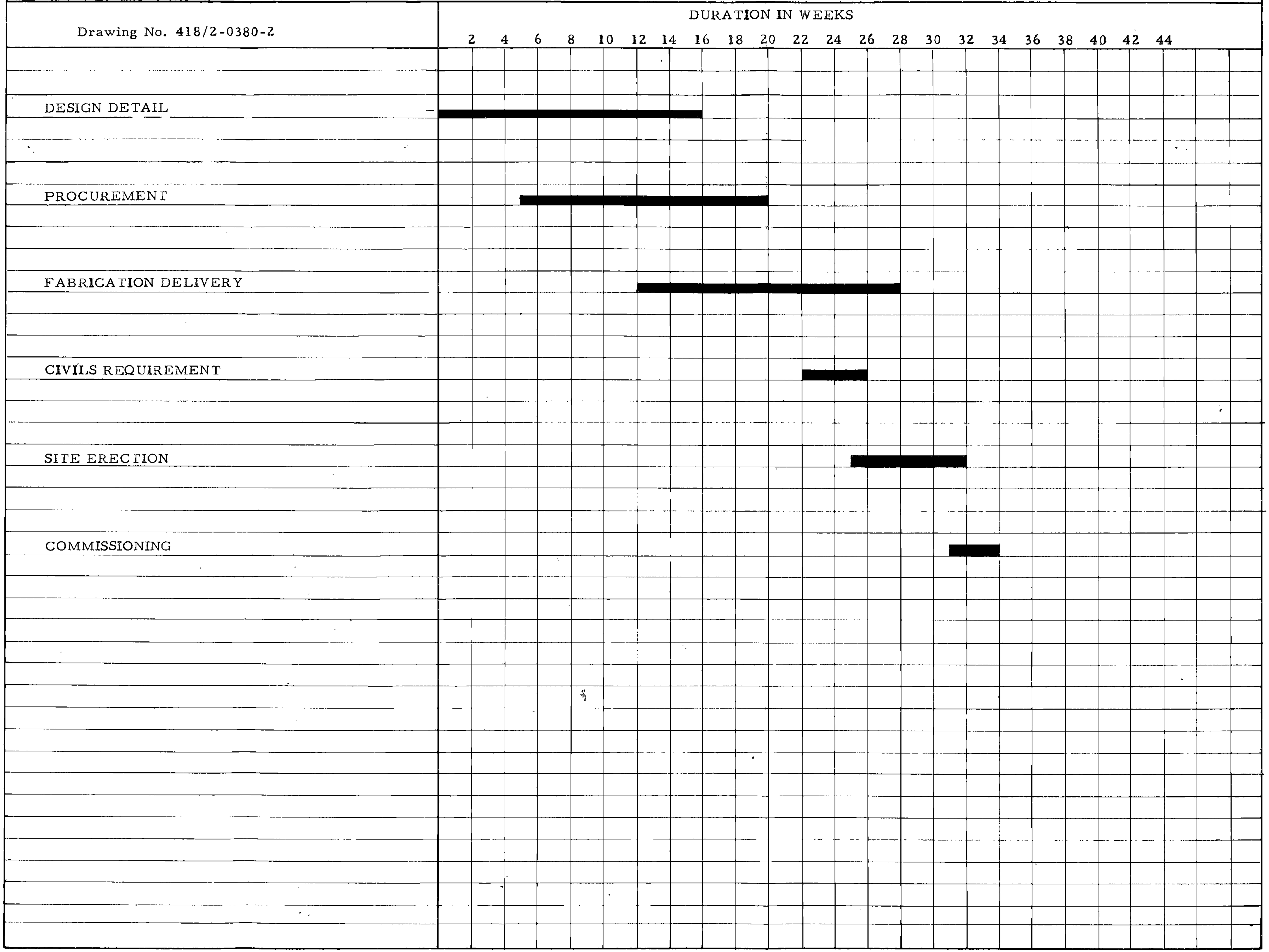
The contractor will be responsible for the testing and commissioning of the plant. During that period he will be required to train the plant operators in the operation and maintenance of the plant.

DAVY ASHMORE PTY LTD
MELBOURNE

BELTANA PROJECT
HEAVY MEDIA PLANT

PROJECT SCHEDULE

Drawing No. 418/2-0380-2



S1-12

THE BROKEN HILL ASSOCIATED SMELTERS PROPRIETARY LIMITED

(Incorporated in Victoria)

TECHNICAL REPORT

REFERENCE No. R/1358

SUBJECT: PILOT KILN ROASTING TESTS ON ZINC OXIDE FUME OBTAINED FROM WILLEMITE ORE - BLAST FURNACE SLAG CHARGES.

SERIES:

AUTHOR: I. BRETT

DATE: JANUARY, 1972.

OBJECT:

1. To determine if the zinc oxide fume could be deleaded, and the conditions necessary for satisfactory lead elimination.
2. To study the behaviour of arsenic under dehalogenating and deleading conditions.

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PORT PIRIE
S. AUSTRALIA

S1-1

THE BROKEN HILL ASSOCIATED SMELTERS PTY. LTD. — PORT PIRIE
(Incorporated in Victoria)

SUMMARY SHEET NO.

R/1358

SUBJECT:

PILOT KILN ROASTING TESTS ON ZINC OXIDE FUME OBTAINED FROM WILLEMITE ORE - BLAST FURNACE SLAG CHARGES.

AUTHOR:

I. BRETT

DATE:

JANUARY, 1972.

OBJECT:

1. To determine if the zinc oxide fume could be deleaded, and the conditions necessary for satisfactory lead elimination.
2. To study the behaviour of arsenic under dehalogenating and deleading conditions.

PRECIS:

The deleading experiments were carried out on the Research Pilot kiln, which had been modified by the addition of a 6 inch thick castable refractory lining. Further modifications were made to the equipment during the test work.

CONCLUSIONS AND RECOMMENDATIONS:

The major conclusions are:-

1. The raw fume obtained from Willemite ore - blast furnace slag charges can be successfully deleaded.
2. Arsenic is eliminated at deleading temperatures and reports in the kiln baghouse product. A portion of the arsenic may pass through the collection system.
3. Accretion buildup at the deleading temperatures will be a major problem.

(Signed)........I. BRETT........
Author

(Signed)........D.H. WARD........
Head of Division

PLEASE CONSULT THE FULL REPORT IF FURTHER DETAIL IS REQUIRED OR DEDUCTIONS QUERIED.

TECHNICAL REPORT NO. R/1358

CONTENTS

A. INTRODUCTION

1. The treatment of Willemite ore at Port Pirie would entail a slag fuming type operation to produce raw zinc oxide fume containing an appreciable percentage of lead. This lead rich fume would be deleaded in a rotary kiln and the densified zinc oxide product shipped to Risdon, Tasmania.

2. This report describes a series of tests carried out on the pilot rotary kiln in an attempt to reproduce overseas deleading practice, and includes results from work previously described by W.J. Thomas[1] in an interim report. (Appendix 2)

3. The preliminary investigations were designed to determine the preferred form of carbon required for the elimination of lead from the fume, and to establish optimum operating conditions.

4. In the later stages of the work, the significance of the distribution of arsenic between the products of a deleading roast became apparent, and close attention was paid to establishing mass balances for zinc, lead, arsenic and the halogens, fluorine and chlorine, over the kiln in each test. If arsenic reported in the baghouse fume, the treatment costs for this material at Port Pirie would be greatly increased. A series of dehalogenating roasts were performed to determine the behaviour of arsenic at lower temperatures (830-1130oC).

B. MODIFICATIONS TO PILOT KILN

5. The 20 ft. long pilot kiln described by Ward[2] was relined with a castable refractory to give a wall thickness of 6 in. The resulting internal diameter was 14 ins. A bank of U-tube coolers was added to the offtake flue to cool the exit gases to approximately 100°C. Six 9 in. diameter Nomex bags were used to filter the gases and allow collection of a baghouse product.

6. Calculations indicated that the kiln would handle approximately 50-70lbs/hr of B.H.A.S. fume. In early experiments no restriction on the feed rate was made as it was important that the maximum feed rate should be established. However, analyses of the baghouse dust and fume deposited in the feed end hood indicated that a considerable quantity of feed was spilling over or being entrained in the exit gas stream. The feeding equipment installed on the kiln had an excess capacity and was unsatisfactory for feeding at 50lb/hr and control over feed rate was maintained by adding measured quantities of fume at fixed time intervals to the feed hopper. The fume had a tendency to "hang-up" in the hopper.

7. Modifications to the feed system were made prior to test WF1. A panel of the feed hopper was replaced with a 16 gauge stainless steel plate and an air vibrator fitted to the plate in an attempt to keep the fume flowing freely. These modifications were reasonably

successful in preventing build ups of fume on the side walls of the hopper, but the system had to be kept under close surveillance throughout the tests. The motor and gearbox from the feed screw were replaced with a combined unit which was designed to give a larger reduction ratio. This ratio was selected to give a feed rate of approximately 50lb/hr but in practice, under the deaerating action of the vibrator, the raw fume gained in bulk density and a feed rate of approximately 65lb/hr of zinc oxide fume from the Willemite ore - slag charges was maintained in tests WF1-WF9. Thus some spillover of raw feed into the discharge hood still occurred, but as the amount was also governed by the condition of the seal between the inlet weir and the kiln, it was not expedient to further modify the feeding arrangement.

C. PRACTICAL OBSERVATIONS

(1) Temperature Measurement

8. The measurement of product temperatures of up to 1405°C under fuming conditions presented some difficulty. An optical pyrometer (Siemens Ardocol two colour pyrometer) was adequate for control purposes in the early tests. Temperatures measured with this unit were compared with those obtained by means of "Temtip" expendable tip thermocouples. These temperatures related to only the exit temperature of the product, however, and the maximum temperature along the kiln was not able to be established because of practical difficulties. In tests WF1-9, a Leeds & Northrup Optical Pyrometer was used and it was possible to focus this unit deep into the kiln for spot readings.

9. A calibration curve for oil required to maintain the kiln at a desired temperature under fixed draught conditions is shown in figure 1. This relationship was a rough approximation when the kiln was under load, and when product temperatures were in excess of 1200°C. The figures indicate the oil rate required to maintain the kiln at temperature under no-feed conditions.

(2) Carbon Addition

10. Three sources of carbon addition were used, namely pulverised coal dust from the slag Fuming Plant, coke breeze fines, and lump coal. Either of the first two materials appeared satisfactory, but the lump coal tended to pass through the kiln and appeared in the product clinker as lumps of coke. Several tests in the series WF1-9 were operated under conditions of added pulverised coal (1% Carbon in feed) and incomplete combustion of the oil (a long lazy flame). The baghouse product contained excess carbon, but it was possible to obtain good elimination of lead from the fume at lower oil rates than the tests with a short bright flame. Zinc elimination tended to increase, however, as the carbon in the baghouse fume increased.

Accretion Formation

11. It was evident from the test work that accretion formation in a deleading kiln will be a problem. Accretions formed in each deleading tests and became more significant as the product temperature increased - from 1350°C up to 1405°C, the accretion growth is quite fast - at 1400°C it is very rapid. It is not possible to give an accurate quantitative assessment of the relative accretion growth in each test because as the rings of clinkered material began to form they were barred off and were included in the product. A temperature is reached where the zinc oxide prills develop a sticky surface as they begin to fuse, and these prills coagulate into larger semi fused lumps. The buildup of an accretion ring in this high temperature area is rapid. This phenomenon occurs at temperatures approaching 1375°C (measured by an optical pyrometer) although local temperatures in the vicinity of the flame may be significantly higher. The position of accretion formation was characterised by flame type. A long lazy flame tended to produce accretions deep into the kiln, a short bright flame caused the formation of accretions in the vicinity of the flame. It was noticed in early test work that the accretions sometimes occurred in bands which corresponded with the roller bands and ring gear on the kiln shell.

12. The accretion buildup was insignificant in the short period low temperature dehalogenating roasts, and should be of the same order as the buildup obtained in dehalogenating roasts in the existing kilns.

D. RESULTS

13. The results of test DL1-7 have been reported in the interim report by W.J. Thomas. These tests indicated that zinc oxide obtained from all slag charges, and oxide obtained from slag - willemite ore charges could be deleaded, and that pulverised coal or coke breeze fines could be successfully used as an added reducing agent. It was possible to achieve deleading by using excess fuel oil and no added carbon. The tests also indicated that arsenic was eliminated in the deleading roasts and reported in the lead rich baghouse fume.

14. A series of deleading tests on B.H.A.S. zinc oxide fume under varying oil rates and additions of carbon were carried out to determine the effects of these variables on lead elimination. Results for the tests (DL8-14) are shown in Appendix^{I} in table 1.

15. Test DL15 was a deleading test on willemite fume, with an addition of 5% by weight of pulverised coal. The input fume assayed 8.6%Pb and 64.3%Zn. Two product samples assayed 1.8%Pb, 75.8%Zn and 0.4%Pb and 78.2%Zn respectively. The product arsenic assays were 0.17% and 0.0056%.

16. Arsenic elimination under dehalogenating roast conditions was studied in tests DL16-24. These tests indicated that under 900°C (tests DL16-20) the elimination of arsenic was negligible. In the range 1100-1130°C the product clinker assayed 0.67-0.88%As from an input figure of 1%As. Results are shown in table 2.

17. The tests DL1-24 were carried with substantially the same flame type and draught. Under these conditions it is reasonable to expect that energy balances would follow the same pattern, and accordingly, plots of the variables lead and arsenic elimination against energy input to the kiln are shown in figures 2 & 3. In both cases, the elimination figure is obtained from the empirical relationship

$$\% \text{ elimination} = \frac{\text{input assay} - \text{product assay} \times 100}{\text{input assay}}$$

These results, which include the assumption of steady operating conditions throughout the test, do show significant trends and indicate the likely composition of product clinker from raw feed (with similar composition to the test material) under stated fuel rates.

18. The kiln feed system was modified at this stage to provide continuous feeding at a reduced rate. Test WF1 was a preliminary test on willemite fume to determine the operating details of the modified equipment. The operating times of tests WF2-WF9 varied from approximately 4.5 to 6 hours. Mass balances over the kiln for each of these tests are shown in table 3. These balances are affected by the quantity of accretion which could be removed from the kiln refractory after each test. In some cases it was impossible to remove fused accretion completely and this material later spalled off into the product of the next test - when this happened, the zinc balance for the succeeding test was slightly greater than 100%. There was an inevitable gas loss through the stack, usually an insignificant wisp of fume, but full gas flow through the stack occurred during a bag shake. In test WF4, the stack damper jammed open during a baghouse shake and gases were sent to atmosphere for the remainder of the test. It can be seen from the recoveries listed in the table that rarely more than two thirds of the arsenic were recovered in the test series. Recoveries of fluorine and chlorine indicated that considerable quantities of halogens can also escape from the system. A strong smell of arsenic could be detected in the vicinity of the bags and on the roof over the feed system.

19. Lead elimination results from these tests are included in figure 3, for comparison with the DL series (under lower draught, 0.26 in W.G. for the DL series vs. 0.54 in W.G. for the WF series). All the tests with reducing flames gave lead eliminations on the upper edge of the range i.e. for a given input of energy in the form of oil (or oil plus coal) reducing type flames are associated with more efficient lead elimination.

20. Input fume, product clinker, and baghouse and cooler product analyses are shown in tables 4 and 5. The cooler product was obtained after each test by rapping each section of cooler. Accretion assays, and assays of the material collected in the feed hood are included.

21. With the exception of WF8, tests WF2-9 contained 1.5% pulverised coal (corresponding to 1%C). Knacke & Neumann, in a paper on volatilisation of lead from "technical" zinc oxide, assert that good mixing of burner gases and volatilised products is essential for optimum lead elimination. They considered that the ideal conditions were an eddying flame in close contact with the solid layer in a reducing atmosphere of approximately 1%CO, and achieved this by using two burners, one extending assymetrically into the kiln to produce a vigorously eddying flame. These authors found that increasing the CO content above 1% did not improve deleading. We were unable to test the exit gases for CO and did not have accurate volume recording equipment for these experiments, but compromised by reducing the combustion air to the burner to produce a long eddying flame. Baghouse fume from these experiments contained significant quantities of unburnt carbon, and considerably more zinc than fume from tests in which a short "oxidising" flame was used. However, the results from WF7 indicated that it was possible to lower the lead in fume to acceptable levels at lower than normal temperatures under these conditions. Thus the instrumentation on a deleading kiln should include carbon monoxide and dioxide detecting apparatus to obtain optimum deleading at the lowest temperature possible to minimise accretion formation. A balance would have to be struck between CO from added solid carbon, intimately mixed with the feed material, and CO obtained from incomplete combustion of the burner fuel.

22. Knacke and Neumann also found that the addition of zinc sulphide to the combustion air stream increased the yield of lead from the fume. The SO_2 formed is required for the maintenance of lead sulphide (lead sulphide has a higher vapour pressure than lead or lead oxide). Lead sulphide condenses below 950°C however, and thus the feed end of the kiln should be held above this temperature to prevent condensation and hence recirculation of this material i.e. care should be taken to ensure that the design length of the kiln is not too long to satisfy this requirement.

23. The bulk density of partially deleaded fume increased to approximately three times the value for raw fume, and values of 175 - 200 lb/c.ft. were obtained in the test work when a product containing approximately 3% lead was produced. When the product contained less than 1% lead, a bulk density of 130 - 170 lb/c.ft. was obtained.

24. The raw fume used in the pilot scale deleading tests did not have uniform composition. Although the fume was thoroughly mixed prior to the WF series, arsenic varied from 0.7 to 1.4%, lead from 8.0 to 9.0%, and zinc from 63.6 to 66.2%. In the DL series an even larger composition range occurred. Raw fume produced in the slag fuming furnaces will vary widely in composition throughout the charge cycle. Table 7 is a reproduction of Table 2 from the memo of March 9th, 1971,[3] showing the range of zinc and lead composition of the fume throughout the cycle. The arsenic analysis for the samples from charge 224 are shown graphically in figures 4 and 5. The calculated composition of the raw fume samples, including the first 67 minutes for which no samples were collected are also shown. These calculations are approximate only, it is difficult to make allowance

for the change in slag composition as slag melts off the furnace walls during the fuming cycle. The tables and figures highlight the fact that raw fume obtained from the slag fuming furnaces during the charging cycle contains a very large proportion of the total arsenic and lead in the charge - in charge 224, approximately 80% of the lead in fume was eliminated from the slag 8 minutes into the fuming cycle. The figure for arsenic was approximately 90%. Raw fume obtained from the final 120 mins. of the fuming cycle contained an average of 2.6% lead and 0.18%As. These figures, which may be verified by analysing fume samples from charges 161 and and 345 for arsenic, and by future work, suggest the possibility that raw fume could be split into two streams - high lead and arsenic fume from the charging cycle to be treated in a small deleading kiln (and producing a small quantity of high lead and arsenic kiln baghouse product), and low lead and arsenic fume to be given a dehalogenating roast only before shipment to Risdon.

25. The average recovery of zinc (in product plus accretions) was 92%. This result, obtained from short term tests on the pilot kiln, may not be particularly accurate for a full scale unit. Direct losses of fume from the tests, excluding baghouse and cooler products ranged as high as 9% of the input material. The complete removal of accretions after each test was an extremely difficult operation, and the percentage loss of material was quite significant if a few pounds of accretion were not collected. As mentioned before, there was a small direct loss of material through the stack.

E. CONCLUSIONS AND RECOMMENDATIONS

26. The raw fume obtained from Willemite ore - granulated slag charges can be deleaded in a rotary kiln.

27. Pulverised coal dust and coke breeze are suitable added reducing agents. It is possible to delead without the addition of an added reducing agent.

28. Incomplete combustion of the oil, producing a long lazy flame may lead to more efficient deleading at lower temperatures.

29. Accretion formation, especially at temperatures approaching 1400°C will be a major problem in a deleading kiln.

30. Carbon monoxide and dioxide detecting apparatus should be installed on a deleading kiln to help establish optimum conditions.

31. Arsenic is eliminated from the raw fume at deleading temperatures and will report in the baghouse products. From the test work, it is evident that a proportion of the arsenic will escape collection and appear in the exhaust gases.

32. It may be feasible to design a plant to produce a high lead and arsenic raw fume for treatment in a small deleading kiln, and a low lead and arsenic raw fume for treatment in a dehalogenating kiln.

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APPENDIX I

TABLE 1. DELEADING TESTS ON B.H.A.S. RAW FUME

Test	Energy BTU/lb	Added Carbon	Product Temp. $^{\circ}$C	Input Lead %	Product Lead %	Lead Elimination %	Lead in Baghouse Product	Zinc in Baghouse Product
DL 8	12000	-	1300	9.9	0.4	96	39.6	36.5
DL 9	12000	10%Coal	1300	10.2	1.4	86	23.6	53.7
DL 10	8100			10.9	3.8	65	46.4	30.3
DL 11	14000	10%Coke	1350	9.3	0.7	92	37.8	39.8
DL 12		CONDITIONS	VARIED	DURING	TEST		55.2	21.0
DL 13	12900			16.8	5.0	70	37.4	24.0
DL 14	9700	10%Coal		15.7	7.6	52	53.3	39.0

The product lead assay from test DL 10 was affected by accretions from the previous test.

TABLE 2. DEHALOGENATING TESTS ON B.H.A.S. RAW FUME

Test	Energy BTU/lb	Product Temp. $^{\circ}$C	Input Lead %	Product Lead %	Lead Elimination %	Input Arsenic %	Product Arsenic %	Arsenic Elimination %
DL 16	7370		8.5	8.0	6	1.4	1.6	-
DL 17	5900		9.1	8.6	5.5	0.9	0.9	-
DL 18	7450	830	9.3	9.0	3.5	1.7	1.7	-
DL 19	7900	850	10.1	10.0	1	1.6	1.5	-
DL 20	8000	875	9.3	8.9	4.3	1.1	1.1	-
DL 21	10000	1130	9.1	6.0	34	1.0	0.88	12
DL 22	9000	1120	8.5	5.8	32	1.0	0.67	33
DL 23	10500	1110	8.2	5.0	39	1.1	0.72	34.5
DL 24	8500	1110	8.2	6.7	18	0.92	0.79	14

TABLE 3. MASS BALANCES FOR WF SERIES

Test	Date	Element	Input Wt. lbs.	Output Wt. lbs.	Recovery %	
WF1	7/7/71	Zn	89	90	100	Small quantity of accretions from previous test included in product weight.
		Pb	11.5	10.3	90	
		As	1.22	0.67	55	
		F	.51	.18	35	
		Cl	.42	.31	75	
WF2	20/7/71	Zn	270	254	94	
		Pb	34.2	19.1	56	
		As	4.3	1.7	40	
		F	1.57	0.43	27	
		Cl	1.34	0.65	48	
WF3	22/7/71	Zn	247	245	99	
		Pb	28	22	79	
		As	2.45	1.5	61	
		F	1.2	0.31	26	
		Cl	1.2	0.75	63	
WF4	3/8/71	Zn	227	218	96	Stack damper jammed open during test and gases sent to atmosphere.
		Pb	31.5	15	48	
		As	3.0	1.4	46	
		F	1.12	0.63	56	
		Cl	1.05	1.13	100	
WF5	6/8/71	Zn	255	235	92	
		Pb	35.7	32.4	91	
		As	3.33	2.3	69	
		F	0.95	1.05	100	
		Cl	0.95	1.40	100	
WF6	16/8/71	Zn	191	202	100	Small quantity of accretions from previous test included in product weight.
		Pb	26.4	23.5	89	
		As	4.2	1.9	45	
		F	0.9	0.62	69	
		Cl	0.76	0.71	93	
WF7	19/8/71	Zn	227	220	97	
		Pb	29.8	26.3	88	
		As	3.5	2.0	57	
		F	1.04	0.93	89	
		Cl	0.91	0.86	94	
WF8	1/9/71	Zn	191	194	100	Small quantity of accretions from previous test included in product weight.
		Pb	23.9	22.7	95	
		As	3.36	2.47	73	
		F	0.98	0.67	68	
		Cl	0.95	0.84	88	
WF9	9/9/71	Zn	251	249	99	
		Pb	33.2	25.5	77	
		As	3.8	2.3	61	
		F	1.26	0.78	62	
		Cl	1.15	0.86	75	

TABLE 4. ANALYSES OF RAW FUME SAMPLES USED IN TEST SERIES.*

Test	Date	Zn %	Pb %	As %	F %	Cl %
WF1	7/7/71	65.3	8.4	0.89	0.37	0.31
2	20/7/71	66.2	8.7	1.1	0.38	0.34
3	22/7/71	65.0	8.0	0.70	0.33	0.34
4	3/8/71	65.0	9.0	0.85	0.32	0.30
5	6/8/71	64.2	9.0	0.84	0.24	0.24
6	16/8/71	63.6	8.8	1.4	0.30	0.26
7	19/8/71	65.4	8.3	1.03	0.30	0.26
8	1/9/71	64.7	8.1	1.14	0.33	0.32
9	9/9/71	63.6	8.4	0.96	0.32	0.29

* ALL SAMPLES ARE COMPOSITES TAKEN THROUGHOUT THE TESTS

TABLE 5. PRODUCT ROAST FUME - WILLEMITE FUME ROASTS

Test	Date	Zn	Pb	As	F	Cl	C	S	Comments
WF1	7/7	71.0 72.4 72.4	37 3.9 3.5	.17 .38 .33	<.001 <.001 <.001	.010 .003 .003			Test run for new equipment - gearbox or screw, vibrator. Flame indicating not quite complete combustion. No added C. Oil rate 3.1gph Product temp. 1310°C Bulk density 205 lb/c.ft.
2	20/7	76.2 76.4 76.8 77.6	2.6 0.56 0.76 0.22	.25 .009 0.16 <.001	<.001 <.001 <.001 <.001	.005 .005 .007 .007	<.02 <.02 <.02 .04		1½% coal added. long lazy (reducing flame) Oil rate 3.73 gph product temp. 1340°C. bulk density 168 lb/c.ft.
3	22/7	72.9 74.3 75.3	3.0 2.0 1.4	.094 .066 .028	<.001 <.001 <.001	.005 .002 .003	.02		1½% coal added. short bright flame (complete combustion) 3.81 gph product temp. 1330°C bulk density 177 lb/c.ft.
4	3/8	77.0 76.6 77.0 76.2 76.2	1.14 .08 .11 .13 .06	.10 .019 .019 .009 .009	<.001 <.001 <.001	.013 .010 .016	<.1 <.1 <.1	<.01 <.01 .014	1½% coal added. long lazy flame, excess of C in stack fume (black) oil rate 3.86 gph product temp. from 1325 up to 1405°C bulk density 138 lb/c.ft.
5	6/8	74.8 75.0 75.0 75.2 75.8	1.0 1.0 1.2 1.2 0.8	.13 .094 .019 .019 .019	<.001 <.001	.007 .001	<.1 <.1	.015 .014	1½% coal added. long lazy flame, no C visible in stack gases oil rate 3.67 gph product temp. 1365 - 1405°C bulk density 176 lb/c.ft.
6	16/8	81.0 78.4 75.0 72.4 79.4	0.7 1.0 4.2 3.8 1.1	.019 .019 .10 .24	<.001 <.001	.002 .002	<.1 <.1	.01 .02	1½% coal added. long lazy flame at lower oil rate than earlier tests. oil rate 3.41 gph. zinc figures look high. sample check showed reduction in lead & zinc assay on sample 3. No heating up previous night product temp. 1270°C. bulk density 128 lb/c.ft.
7	19/8	77.0 77.4 75.0 73.2	1.2 0.5 1.0 4.4	.010 .019 .24 .23	<.001 <.001	.005 .064 .002	.14 .12	<.01 <.01	1½% coal added. Long lazy flame at relatively low oil rate 2.92 gph sample 4 corresponded to 2.64 galls/hour. product temp. 1250°C bulk density 147 lb/c.ft.

TABLE 5. (Cont).

Test	Date	Zn	Pb	As	F	Cl	C	S	Comments
WF8	1/9	72.2	3.02	.39		.005			No added carbon. Long lazy flame at relatively low oil rate 3.04 gph. product temp. 1305°C bulk density 190 lb/c.ft.
		72.8	3.30	.47	<.001	.002	<.1	<.01	
		73.3	3.02	.27		.002			
		74.4	1.38	.06	.005	.003	<.1	.014	
9	9/9	70.1	4.8	.21	<.001	.007	<.1	<.01	1½% coal added. Short bright flame, substantially complete combustion of oil. Oil rate varied throughout test, high oil rate (up to 3.9 gph) corresponding to high product temperature & best lead elimination (samples 3 & 4). Sample 1 corresponded to 3.05 gph. product temp. 1230 - 1330°C. bulk density 192 lb/c.ft.
		71.0	3.9	.15		.003			
		70.6	1.1	.023	<.001	.003	<.1	.04	
		70.4	1.5	.086	<.001	.003	<.1	<.01	
		70.8	3.1	.082		.007			

TABLE 6. ANALYSES OF BAGHOUSE & COOLER SAMPLES FROM DELEADING ROASTS

Test	Date	Zn%	Pb%	As%	Cl%	F%	C%	S%	SasSO4	
WF1	7/7/71	24.6 27.0	43.7 43.9	3.2 3.3	2.5 2.5	1.38 1.38	2.1	4.0	1.9	
WF2	20/7/71	36.7	36.9	3.9	1.7	1.2	5.1	5.8	1.92	
WF3	22/7/71	18.1	51.8	5.4	3.1	1.6	0.8	3.4	2.61	Excess of Carbon (from incomplete combustion of flame + added coal)
WF4	3/8/71	34.4 44.2 38.0	13.3 13.8 16.5	0.58 3.62 1.5	1.7 1.7 3.0	0.82 0.96 3.4	27.6 13.4	2.75 2.47	0.69 0.66	
WF5	6/8/71	26.0 22.0	44.0 47.4	4.6 2.0	2.9 2.7	1.6 2.5	5.5 3.0	1.65 1.78	0.96 1.10	
WF6	16/8/71	37.0 42.0	31.9 22.6	2.4 1.7	1.6 1.4	1.1 3.1	8.5 6.0	5.8 5.2	0.96 1.35	
WF7	19/8/71	36.0 44.2	30.9 23.3	2.1 2.16	1.39 1.39	1.0 2.2	8.8 5.9	2.8 2.25	0.60 1.06	
WF8	1/9/71	26.6 38.6	41.4 29.3	5.4 2.5	2.8 1.9	1.4 2.5	3.7 5.1	2.18 2.05	0.96 1.10	
WF9	9/9/71	26.7 40.8	37.7 23.3	3.96 2.93	2.97 2.11	3.1 1.9	0.7 1.5	2.75 3.00	1.17 1.23	

TABLE 7. RAW FUME ANALYSES

Charge No.	Sample No.	Sample Time (Mins)	% Zn	% Pb	% As
161	1	0-30	56.0	14.9	
	2	45-90	49.2	17.3	
	3	90-135	70.6	7.3	
	4	135-180	77.2	2.5	
	5	180-225	75.6	2.7	
	6	Composite	69.6	6.2	
224	1	67-112	57.4	19.8	2.56
	2	112-157	68.0	11.9	0.75
	3	157-202	78.2	3.5	0.26
	4	202-247	79.4	1.9	0.15
	5	247-282	79.2	2.4	0.15
	6	Composite	75.8	5.2	0.70
345	1	0-35	53.9	15.2	
	2	35-80	62.2	12.4	
	3	80-125	62.6	11.9	
	4	125-170	69.3	9.2	
	5	170-215	75.6	2.8	
	6	215-260	77.8	1.5	
	7	Composite	72.3	6.2	

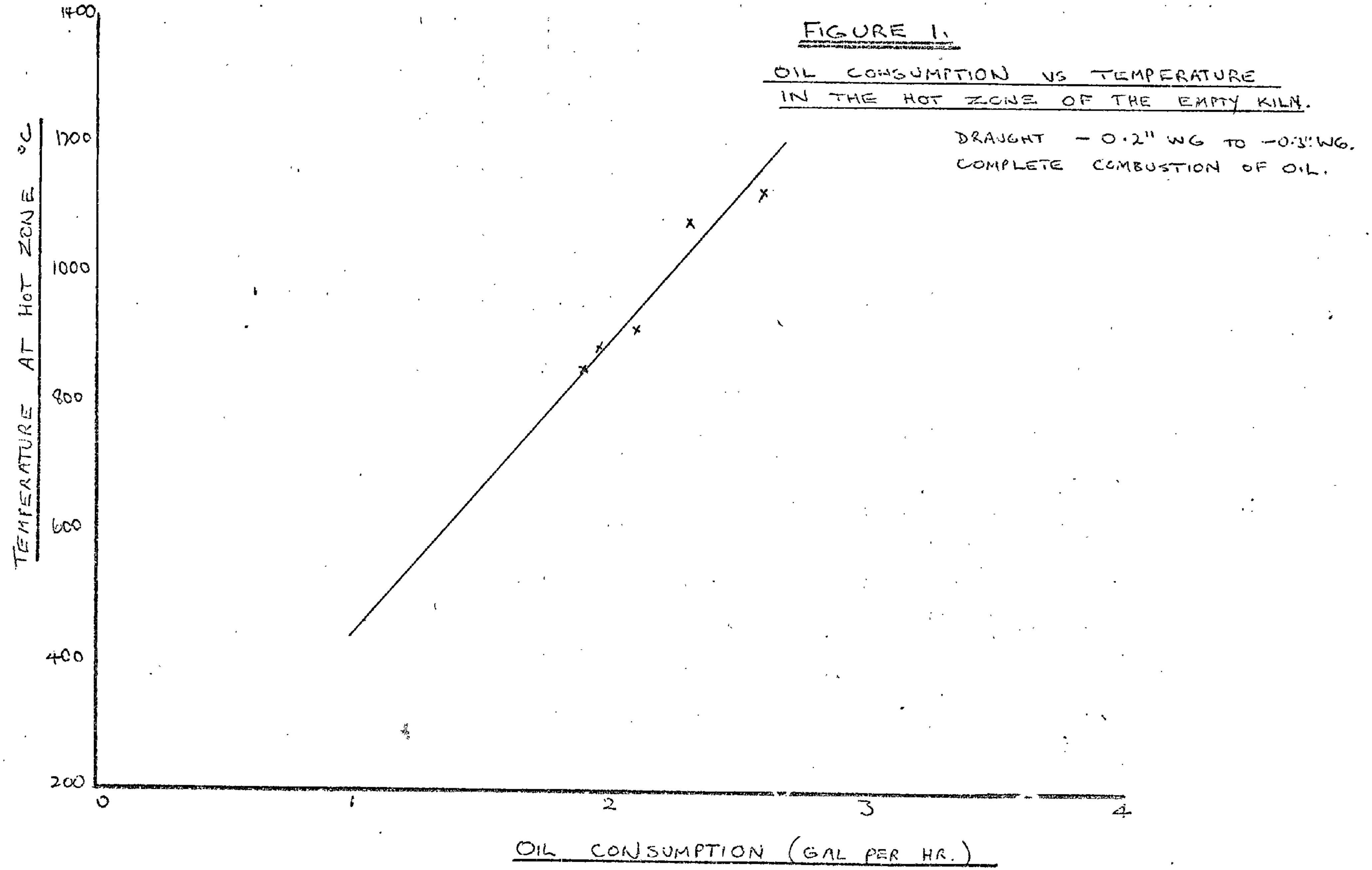
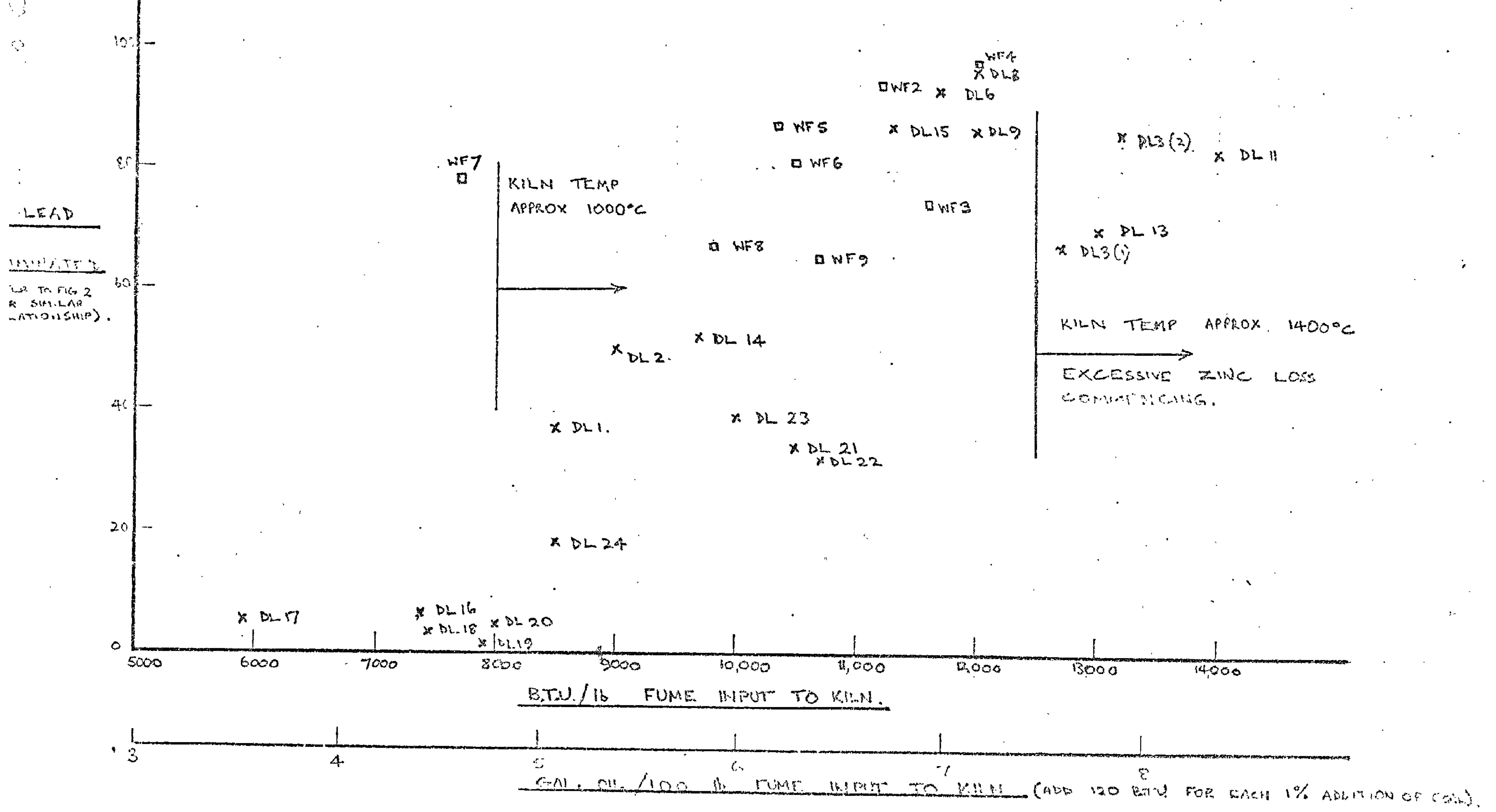


FIGURE 1.

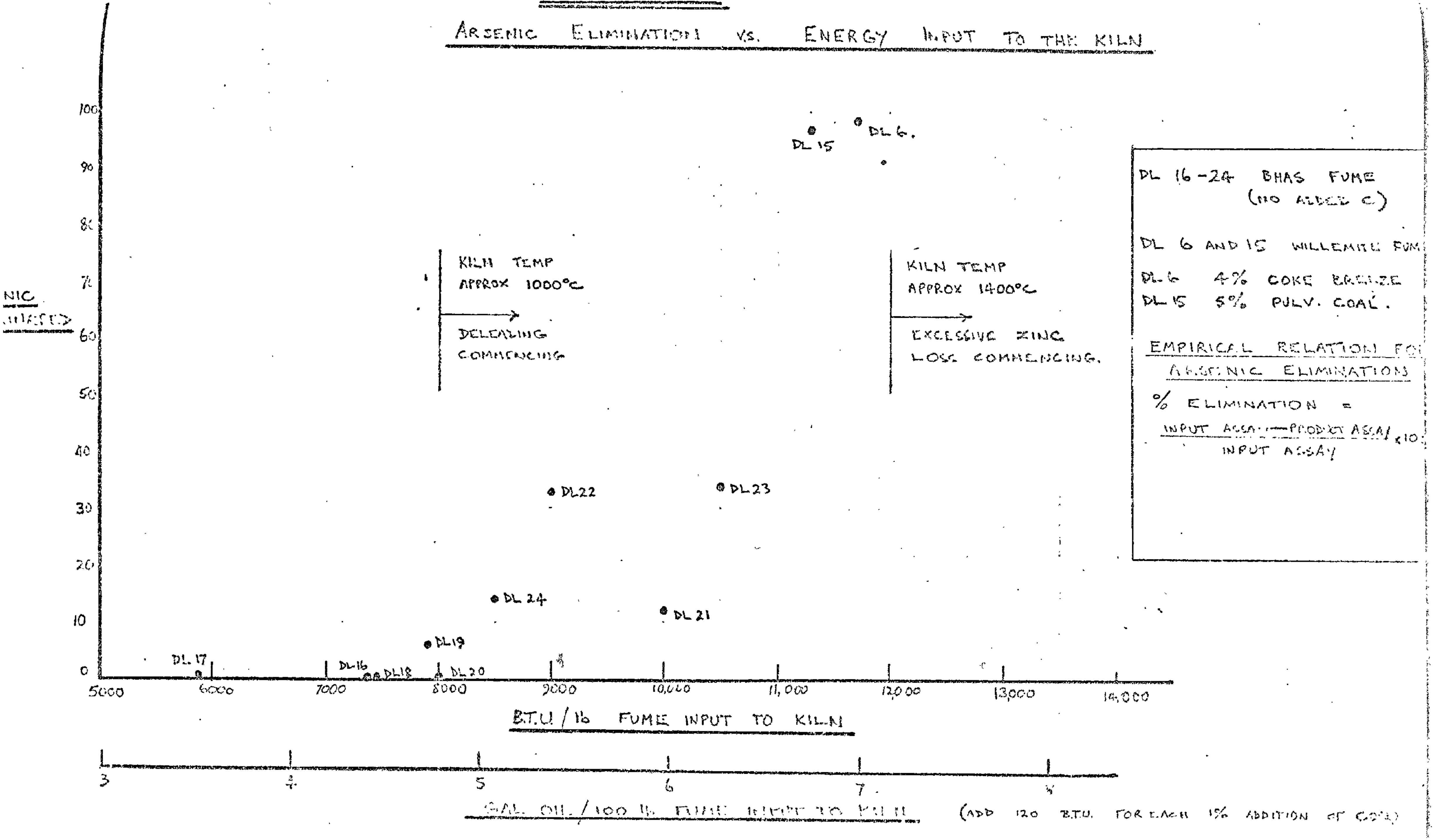
OIL CONSUMPTION VS TEMPERATURE IN THE HOT ZONE OF THE EMPTY KILN.

DRAUGHT – 0.2" WG TO –0.3" WG.
COMPLETE COMBUSTION OF OIL.

LEAD ELIMINATION VS. ENERGY INPUT TO THE KILN.



ARSENIC ELIMINATION VS. ENERGY INPUT TO THE KILN



(ADD 120 B.T.U. FOR EACH 1% ADDITION OF COKE)

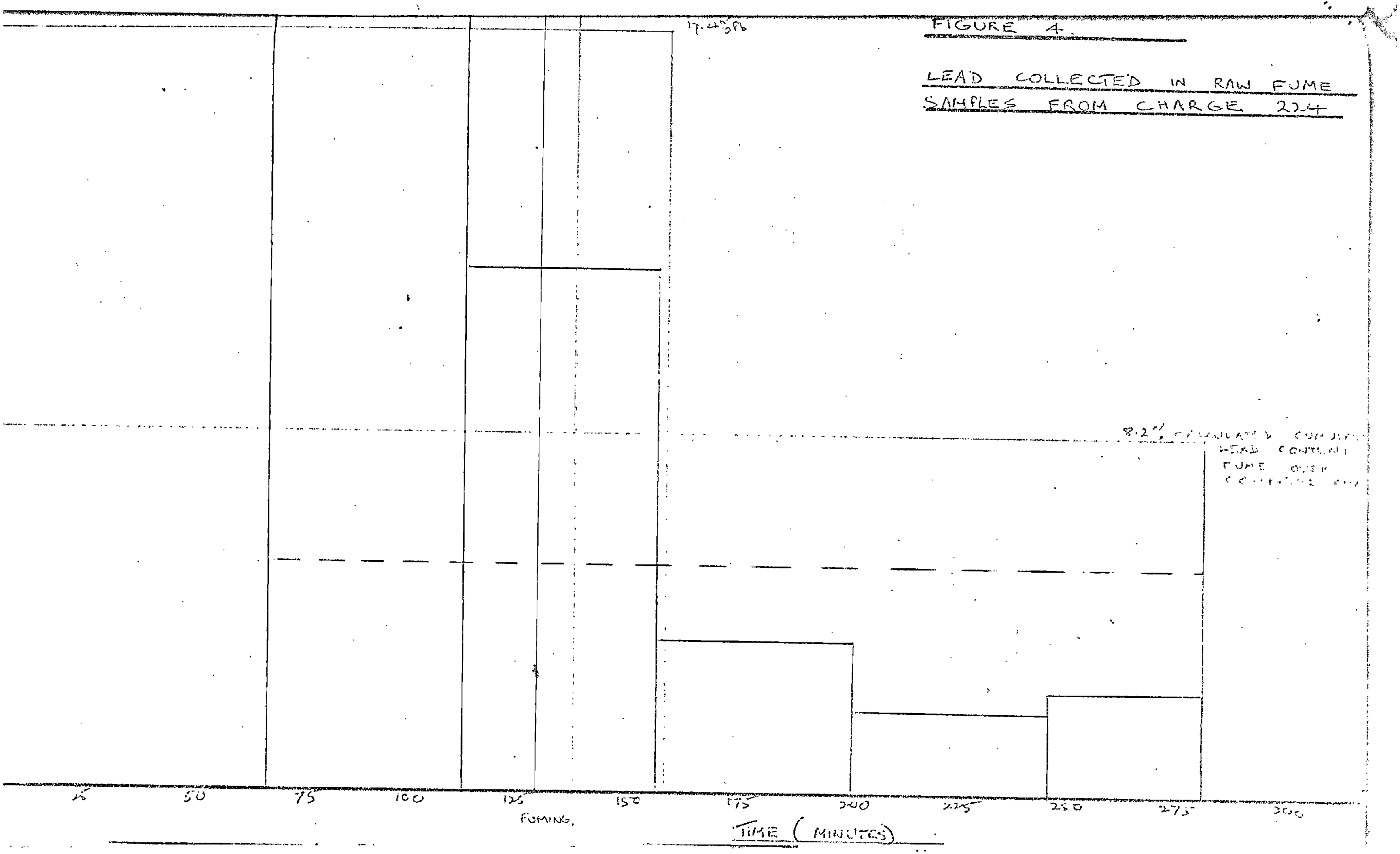
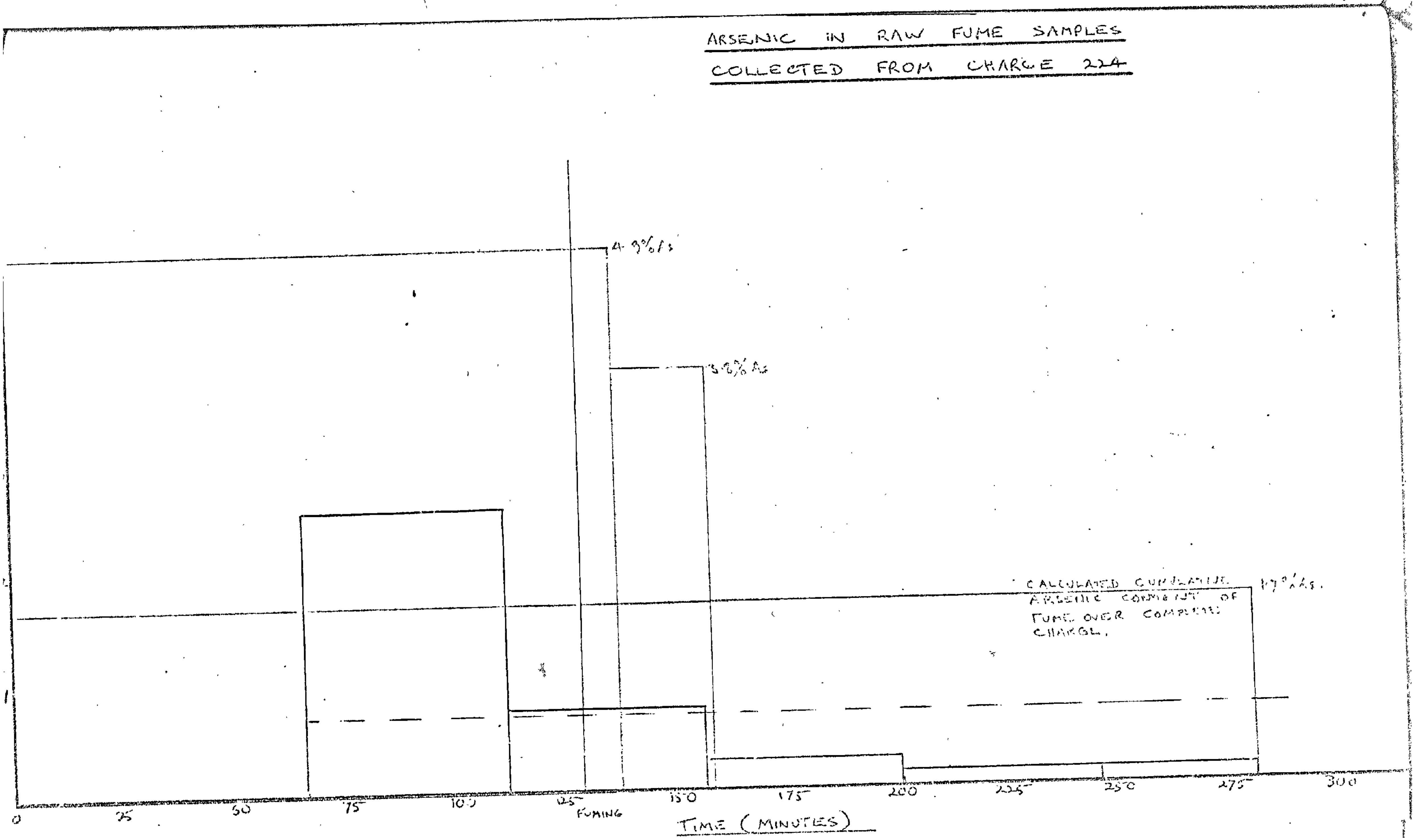


FIGURE 4.

LEAD COLLECTED IN RAW FUME SAMPLES FROM CHARGE 224



ARSENIC IN RAW FUME SAMPLES COLLECTED FROM CHARGE 224

INTERIM REPORT

DELEADING TESTS ON ZINC OXIDE FUMES

By: W.J. THOMAS

Introduction

1. The treatment of Willemite Ores at Port Pirie by a slag-fuming process would include a deleading treatment of the zinc oxide fume produced prior to its shipment to Tasmania.

2. This report describes a preliminary series of tests carried out on the B.H.A.S. pilot rotary kiln to try to reproduce overseas deleading practice. The results of these tests, although of a preliminary nature, showed that this object was achieved and in addition some indication was obtained of the preferred form of carbon addition and the correct ratio of feed to oil consumption to carbon addition.

3. The tests were designed to take place over five days operating three shifts per day. The first two days were set aside for familiarisation but no operating difficulties were encountered during this period and a number of tests were successfully completed.

4. A preliminary series of four short tests was carried out:

(1) With B.H.A.S. fume without carbon

(2) With B.H.A.S. fume and carbon (pulverized coal)

(3) With Willemite fume without carbon

(4) With Willemite fume and carbon (pulverized coal).

The reasons for these tests were as follows:

(1) Some results would be available in the event of a major breakdown.

(2) Because of the short supply of Willemite fume, to see if the response with B.H.A.S. fume was similar to that of the Willemite fume.

(3) The difference in response due to the presence of carbon.

5. Following these tests a number of tests of longer duration were undertaken both with Willemite fume and with the B.H.A.S. fume. It was not intended that optimum operating conditions would be established during this first week of experimentation, and fuel and reducing agents were set at what was believed to be the highest level in order to achieve the objective of adequate deleading.

6. The shift log is set out in Table I below:

TABLE I
Shift Log

Shift	Tests
D/S ending 23/3	BHAS fume no carbon BHAS fume with pulverized coal 4%
A/S ending 23/3	Willemite fume no carbon Willemite fume with pulverized coal 4%
N/S ending 23/3	BHAS fume no carbon

Table 1 (contd.)

D/S ending 24/3	Maintenance, measuring, recording data
A/S ending 24/3	BHAS fume with 4% coke breeze fines
N/S ending 24/3	BHAS fume with 4% coke breeze fines
D/S ending 25/3	Maintenance, measuring, recording data
A/S ending 25/3	BHAS fume with 4% lump coal
N/S ending 25/3	BHAS fume no carbon
D/S ending 26/3	Maintenance, measuring, recording data
A/S ending 26/3	Willemite fume with 4% coke breeze fines
N/S ending 26/3	Willemite fume with 4% coke breeze fines
D/S ending 27/3	Maintenance, measuring, recording data
A/S ending 27/3	BHAS fume - minimum requirements to achieve object
N/S ending 27/3	BHAS fume - minimum requirements to achieve object

Practical Observations

General

7. The pilot kiln was relined with a castable refactory to give a wall thickness of 6". This meant that the overall dimensions of the kiln were 20' long by 14" diameter. U-tube coolers were erected to cool the exit gases to a point where they could be filtered for the collection of the baghouse product. The operation of the kiln at temperatures up to 1400° was a considerable departure from previous practice and a number of techniques had to be evolved for its successful operation.

Temperature Measurement

8. The measurement of product temperatures of up to 1400°C under fuming conditions presented many difficulties. It was found that an optical pyrometer (Siemen's Ardocol two-color pyrometer) was adequate for control purposes. Temperatures obtained with this instrument were compared with those measured by means of "Temtip" expendable tip thermocouples. These temperatures, however, related only to the exit temperature of the product, and the maximum temperature along the kiln was not able to be established because of the practical difficulties.

9. In an endeavour to set up a practical operating control by means of draft and burner control; very careful measurements were made of oil consumption and temperature readings over periods of four to eight hours. These are plotted in Graph No. 1. It was found in practice that this relationship was approximate only when the kiln was under load and when temperatures were in excess of 1200°C. However, the figures demonstrate that about 3¼ gallons/hr of oil is necessary just to maintain temperature.

Accretion Formation

10. Throughout the tests accretion build-up was significant and barring was necessary 3-4 times per shift. Observations on day-shift established that often the accretion build-up

occurred in bands which seemed to correspond with the roller bands and other attachments to the outside surface of the kiln. The largest accretion was in the vicinity of the flame and decreased rapidly in size towards the feed end.

11. The accretion build-up was insignificant in the last test when oil consumption was held to 3 gallons/hr (other tests 4 gallons/hr) and no carbon was added.

12. The accretion had at times a slightly metallic glint suggesting that it was the product of excessive reduction reaction. Photographs of the accretion are attached.

Feed Problems

13. Calculations indicated that the kiln would handle about 50-70 lbs/hr of BHAS fume. In early experiments no restriction on the feed rate was made as it was important that the maximum feed rate should be established. However, the analyses of the bagdust and the accumulation of material in the feed end hood indicated that considerable amount of feed was spilling over and/or being entrained in the exit gas stream.

14. The Willemite fume was less dense than the BHAS fume which restricted its rate of treatment which is normally on a volume basis. The Willemite fume flowed a little less readily than the BHAS material but no real difficulties were encountered with feeding.

Carbon Addition

15. Three sources of carbon were used, namely coal dust ex the Slag Fuming Plant, coke breeze fines, and lump coal. Eithe of the first two materials appeared to be quite satisfactory but the lump coal appeared to come through the kiln unreacted in the form of large lumps of coke.

Results

Deleading

16. The efficiency of deleading is set out in Table II. These results, however, should be read in conjunction with the Material Distribution Table No. III. The latter reveals a number of shortcomings of the series of tests which were largely due to their preliminary nature.

TABLE II
Deleading Roasts
Test Data

Test	Feed	Before Roast		After Roast		Before Roast Bulk Density lb/cft	After Roast Bulk Density lb/cft	
		%Pb	%Zn	%Pb	%Zn			
DL1	BHAS Fume (No C)	18.3	59.4	11.3	68.8			
		17.7	59.2	11.3	68.4			
DL2	" " (with 4% pulv. coal)	19.4	59.2	9.5	70.6			
		18.1	60.4	3.5	75.8			
DL3	Willemite Fume (No C)	9.8	65.9	3.7	73.0	36	102	Accretion Pb 0.8% Zn 75.9%
		10.3	66.2	1.5	76.7	33		
	Willemite Fume (with 4% pulv. coal)	9.6	66.5	0.9	76.2			

Table II (contd.)

DL4	BHAS Fume (with 4% coke breeze fines	12.1	65.1	0.4	77.3	63	108,102
		12.7	63.8	0.5	76.7	63	102, 99
DL5	BHAS Fume (NoC)	10.8	65.1	0.5	75.1	63	84
		9.0	65.0	8.1	67.4	63	72
	" " (with small lump coal)	8.2	67.8	0.5	65.2	51	87
		8.3	67.9	0.4	72.5	51	
DL6	Willemite Fume (with Coke Breeze Fines)	8.9	65.6	0.5	65.8	33	90
		9.4	65.4	0.5	65.8		
		9.1	65.6	0.6	51.0		
		9.1	66.2	0.6	73.5		
DL7	BHAS Fume (NoC and $\frac{3}{4}$ oil cons.)	9.3	67.1	0.4	74.5	54	156
		9.0	66.6	0.8	74.4		
		13.1	62.6	4.7	71.5	54	195
		12.9	63.1	6.3	70.6		

TABLE III

Deleading Roasts

Materials Distribution

Test	Shift	Feed lbs	Product lbs	Bags lbs	Hood lbs	Accretion lbs	Bulk Density		Description
							In lb/cft	Out lb/cft	
DL4	A/S 24/3 N/S 24/3 Total	1070 945 2015	296	122 193 315	279	314 296+314 16 = 38 lb/hr	63 63	110 101	BHAS fume with Coke Breeze
DL5	A/S 25/3 N/S 25/3 Total	960 760 1720	161 339 500	121 148 270	192	97 500 + 97 16 = 37 lb/hr	63	84 85	BHAS fume with small lump coal
DL6	A/S 26/3 N/S 26/3 Total	324 284 608	96	200	182	105 96 + 105 10 = 20 lb/hr	33	90	Willemite with Coke Breeze
DL7	A/S 27/3 N/S 27/3 Total	216 486 702	516	51	100	nil 516 12 = 43 lb/hr	63	108	BHAS fume controlled feed & oil burning 3 gal/hr.

17. For instance, the large accumulation of material in the bags, hood and cooler in tests DL4, DL5 and DL6 was due to inexperience with the new kiln. Operators were feeding the kiln to the limit of the feed delivery mechanism and con-

sequently excess material was spilt into the hood and whipped into the bags. The more carefully controlled test DL7 confirmed this fact. It must be concluded from these results that the feed rate of the kiln is about 50 lbs/hr for BHAS fume and 25 lbs/hr for Willemite fume. This agrees with the calculated figure.

18. Attention is drawn to the percentage lead of DL5 BHAS fume (no carbon) 0.5% and 8.1%. It is considered that the latter value is probably wild and due to a head sample being substituted for a product sample. On the other hand, the reading of 0.5% also appears to be low and is attributed to carbon in accretions within the furnace. A similar situation arose in DL7 when BHAS fume (no carbon) followed immediately a test with carbon. The first two product samples 0.4%Pb and 0.8%Pb again appear to be low and are attributed to carbon in accretions within the kiln. The product samples five hours later during the same run were more realistic at 4.7%Pb and 6.3%Pb.

19. Samples were taken at times of stable conditions. Duplicates were taken within each test at random with only the proviso that product samples had a fixed time relationship to the head sample (60 minutes later). This figure corresponds to the estimated retention time for the material in the kiln of approximately 60 minutes.

20. Because of the shortcomings of the experimental results no statistical analysis of the data was carried out.

21. Graph II shows the relationship between lead elimination, oil consumption and carbon addition with reference to the type of carbon addition. The efficiency of lead elimination is clearly related to the amount of fuel consumed and in the tests without carbon is probably a function of temperature.

22. At an overall feed rate of 50 lbs/hr or less it can be seen that with the use of a solid reductant a given level of lead elimination is achieved with a smaller expenditure of fuel.

Distribution of Other Elements

23. The analysis for minor elements relating to the Willemite tests DL3 and DL6 are given in Tables IV and V.

TABLE IV

Deleading Roasts

Distribution of Minor Elements

	Sample	Percentage									Oil gal /hr	Feed lb/ hr
		Pb	Zn	Ge	Sn	Ne	F	Cl	As	C		
DL1& DL2& (part) DL3	Bagdust from roasts of BHAS &Willemite (no C)	47.4	27.4		.005	.001	.75	1.06	1.00	1.5	3	30
(part) DL3	Bagdust from roast of Willemite fume with coal	33.4	41.6		.004	.001	.67	1.19	1.45	3.6	3	20

ble IV (contd.)

	Sample	Percentage									Oil gal /hr	Feed lb/ nr
		Pb	Zn	Ge	Sn	Ne	F	Cl	As	C		
ainten- nce	Bagdust from roast of BHAS fume (no C)	30.9	47.5		.002	.0005	.75	.03	.67	3.6	3	38
L	1, 2&3 Accretion	0.8	75.9									
L4	Bagdust from BHAS fume & Coke Breeze Fines	29.8 18.8	47.2 58.4		.001 .001	.001 .0005	.95 .84	.92 .66	.4 .4	0.8 0.7	4.1 4.1	38 38
DL6	Bagdust from roast of Willemite fume with 4% coke breeze fines	11.5 15.2	61.8 56.7		.002 .003	.0005 .0007	.55 .32	.40 .20	.65 .67	3.9 6.2	3.6 4.4	20 20
DL7	Bagdust from roast of BHAS fume (no C). Feed & oil controlled 3 gal/hr.	52.2	24.6		.008	.0006	1.0	1.2	1.25	.6	3	38

TABLE V

Deleading Roasts

Distribution of Minor Elements

Test	Sample	Percentage									Oil gal /hr	Feed lb/ hr
		Pb	Zn	Ge	Sn	Ni	F	Cl	As	C		
DL3	Unroasted Willemite Fume	10.0 9.6	66.5 66.5	.0035 .0036	.025 .030	.0015 .0015	.28 .30	.33 .30	.80 .65	.3 .2		
	Willemite roasted with pulv.coal	1.9 0.9	75.8 76.2	.0015 .0010	.018 .005	.0016 .0012	.0004 .0016	.007 .003	.095 .014	.2 .1	3 3	20 20
DL6	Unroasted Willemite Fume	8.9 9.4	65.6 65.4	.0032 .0032	.030 .032	.0008 .0009	.28 .30		.70 .75			
	Willemite roasted with Coke Breeze Fines	0.5 0.5 0.6 0.6	65.8 65.8 51.0 73.5	.0005 .0005 .0005 .0006	.004 .003 .002 .002	.0060 .010 .014 .006	.0004 .0004 .0004 .0008	.002 .002 .002 .002	.012 .006 .008 .006	.4 .4 .4 .2	3.6 3.6 4.4 4.4	20 20 20 20

Since the value of the experimental results of DL6 are in doubt due to the carry over of feed material, the following mass balance Table VI gives some idea of the distribution of these elements between the deleaded product and the baghouse dust.

TABLE VI

Distribution of Minor Elements - Test DL3 by Weight

	Weight	Pb	Zn	Ge	Sn	Ni	As
Input	100	10.0	66.5	0.0035	0.025	0.0015	0.80
Output	72	0.65	55.0	0.0007	0.035	0.0009	0.010
Bagdust	28	9.35	11.6		0.0011	0.0007	0.41

24. Of particular interest to B.H.A.S. is the distribution of arsenic. Unlike in the low temperature dehalogenating roast, the arsenic appears to have been almost entirely vaporized from the zinc oxide, presumably due to its reduction to arsenic metal or the more volatile As_2O_3. The implication of this, of course, is that most of the arsenic in the Willemit Ore will report in that fraction of the material containing the lead values, i.e., to be cycled through the B.H.A.S. Lead Plant. It is unlikely that B.H.A.S. would be able to handle such an arsenic load which would amount to several times the present figure. Difficulties can be predicted in the Copper Drossing, Softening, and Antimonial Lead sections, with the ultimate problem of arsenic disposal.

25. A separate process for the separation of the arsenic, e.g., alkaline leaching with either NaOH or Na_2CO_3, will probably be necessary.

Heat Balance

26. Table VII gives an approximate heat balance for run No. DL6 based on measurements taken throughout the run.

TABLE VII

Heat Balance On DL6 - Willemite Run 26/3/71 For 11 Hours			
Heat Input	- due to oil	6,530,000	B.T.U.
Heat Output	Gas	4,715,000	
	Product	34,600	
	Baghouse Dust	34,060	
	Accretions	64,100	
	Heat to Atmosphere through kiln shell	925,000	
		5,772,760	
Unaccounted for heat loss	=	11.6%.	

As can be seen from the heat output figures the major source of heat loss is in the exit gases, but radiation throug the kiln shell is also significant at about 16% of the total heat input. These figures are approximate only and their further refinement will be attempted during subsequent runs.

Conclusions

(1) Deleading of zinc oxide fume deriving from the Slag Fuming process can be effectively carried out on the B.H.A.S. pilot kiln.

(2) The addition of some form of solid carbon as a reductant is beneficial to the operation which, however, can still be carried out effectively in the absence of solid carbon by the use of excess fuel oil.

(3) Arsenic is eliminated from the zinc oxide fume along with the lead and reports in the baghouse product.

Recommendations

It is recommended that further deleading tests be carried out both with B.H.A.S. fume and also Willemite fume with a view to optimising the operation from the point of view of fuel consumption and obtaining the necessary design parameters for the installation of a full size kiln.

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

BELTANA PROJECT

FEASIBILITY STUDY
1972

PART 4: FUMING

DA 418

FEBRUARY 1972

DAVY-ASHMORE

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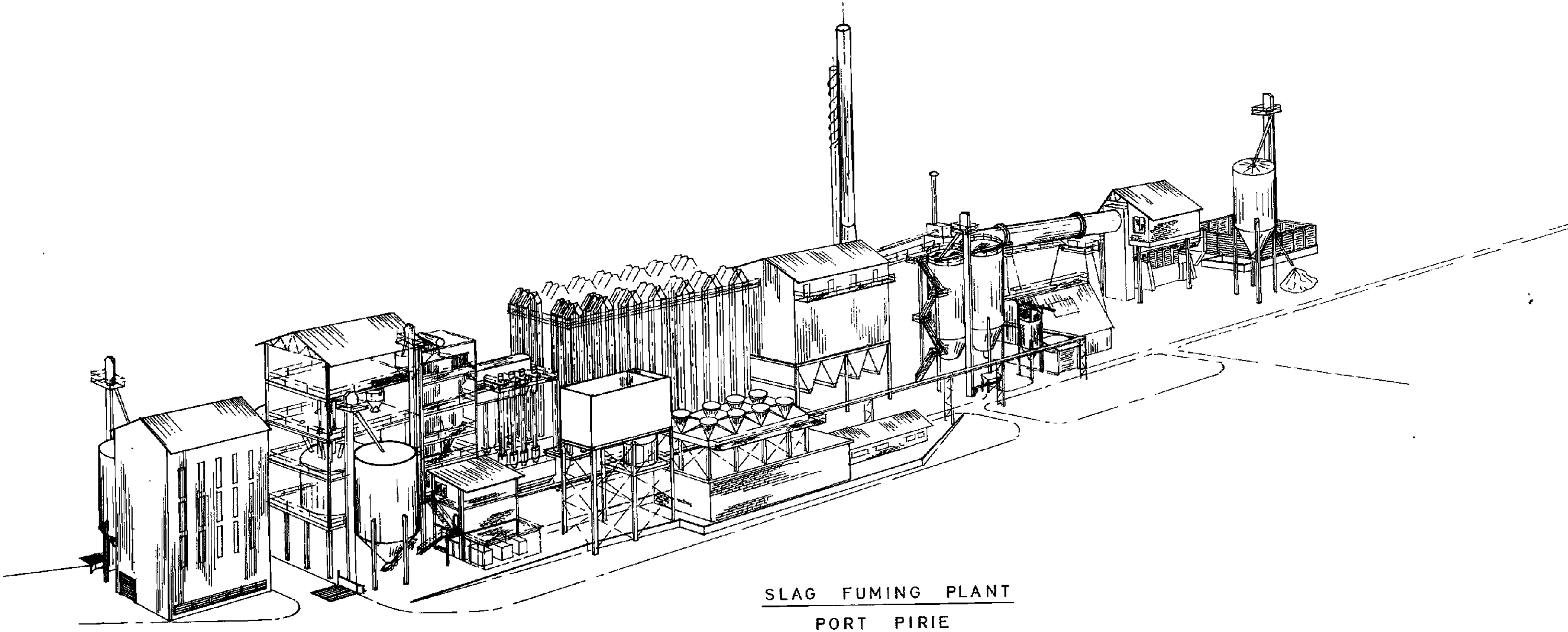

SLAG FUMING PLANT

PORT PIRIE

CONTENTS

INTRODUCTION

This study is based on the concept of treating at Port Pirie 100,000 tons per annum of non-upgraded willemite ore from Beltana with a zinc assay of 36.5%. The amount of granulated slag required in the process is the result of metallurgical considerations and was established as 60% ore/40% slag.

The site chosen for this fuming plant was as near as practicable to the existing fuming plant at Port Pirie. This allows some interconnection of services and operations, but essentially confines this type of operation to one area of B.H.A.S. works.

The basic case, described in detail in this study, incorporates a number of important changes in process design when compared with the original fuming plant at Port Pirie. These changes are not only due to the differing feed material and product, but also due to experience gained by B.H.A.S. in their operation and anticipated legislation concerning plant effluents.

As well as presenting the design and cost estimate for the basic case, a number of variations to the process route have been investigated. These alternative routes show significant differences in capital and operating costs, which could have a large effect on their economic viability.

Operating cost information provided for the fuming process, was obtained from B.H.A.S. during recent discussions. The general layout of the plant and the requirements for materials and services were discussed with B.H.A.S. to obtain their general approval.

SECTION 1

PROCESS DESCRIPTION

Contents

1. PROCESS DESCRIPTION

1.1 Introduction

This section discusses the selection of the various unit processes and operations that comprise the process route for the basic fuming case. At the end of this section several alternatives or variations to the process route are outlined and their advantages and disadvantages discussed.

As mentioned earlier the basic feed was determined from metallurgical considerations and fixed as 60% ore/40% slag. Before fixing the parameters of the basic case three variations were considered using the same feed proportions, namely:-

(i) All molten charge to the fumer; premelted in an electric furnace.
(ii) Molten slag and cold ore feed to the furnace.
(iii) Cold slag and cold ore feed to the furnace.

Computer runs were carried out on these variations using the B.H.A.S. slag fuming model- FUME 6. As a result of these runs the cold slag plus ore feed case was eliminated, molten slag plus cold ore feed was selected for the basic case, while the all-molten charge case was considered as an alternative and discussed in Section 1.11.

1.2 Plant Capacity

The plant is designed to treat 100,000 long tons/year of Beltana ore and 66,700 long tons/year of slag from the dump at Port Pirie. It produces 43,400 long tons per year of zinc in roasted oxide.

1. PROCESS DESCRIPTION CONTINUED

1.2 Plant Capacity continued

Provision is made for melting and preheating all the slag to 1200°C in an electric furnace before being run into the fuming bath. The ore is charged to the bath directly.

The ratio of slag to ore must be such as to give a melt of the required viscosity at 1200°C and B.H.A.S. have indicated that a ratio of 60%ore/40%slag fulfils this requirement. The lime/silica ratio of this mixture (0.6) is also stated to be satisfactory.

1.3 Rich Slag Melting

Since there is no basic quantity of molten lead blast furnace slag regularly available, as is the case for the existing slag-fuming plant at Port Pirie, it is necessary that the slag component of the feed to the fuming furnace be melted before charging to the fuming furnace. An electric furnace is chosen for this duty, which though expensive is efficient and compact, and does not require ancillary gas cleaning and cooling equipment as would a reverberatory or cyclone furnace.

1.4 Coal Firing and the Fuming Process

There are two main phases of operation in the slag fuming batch process - heating and fuming.

In the heating phase, pulverised coal with an excess of combustion air is injected through tuyeres beneath the surface of the bath of molten slag to melt any solid slag present and to bring the bath up to the operating temperature of approximately 1250°C.

1. PROCESS DESCRIPTION CONTINUED

1.4 Coal Firing and the Fuming Process continued

In the fuming phase only some 60-75% of theoretical air is provided, with the result that carbon monoxide is available to reduce the zinc and lead oxides present in the slag to the metallic state. These metals vaporise, and additional air is added above the bath to reoxidise them.

The coal has to supply the conflicting requirements of a high carbon monoxide concentration to achieve a high zinc elimination rate, and a heat release to supply the highly endothermic reactions and the loss to the walls of the bath in order to maintain the molten slag at the required operating temperature. Preheating the combustion air to the bath provides part of the heat requirements, and permits operation at a higher air to fuel ratio resulting in considerable economies in coal usage.

During fuming there is a considerable heat release above the bath from secondary combustion of the excess carbon monoxide and from reoxidation of the zinc vapour. The result is a high temperature process gas with a heavy dust burden of zinc oxide which must be cooled in order that the zinc oxide may be collected in a baghouse or an electrostatic precipitator. A waste heat boiler usually provides part of the cooling duty and utilisation of the steam potential is important to the overall economics of operation.

There is general agreement that the slag and the reducing gases are at all times in equilibrium in accordance with the reactions:-

$$ZnO + CO = Zn + CO_2$$
$$H_2O + CO = H_2 + CO_2$$

1. PROCESS DESCRIPTION CONTINUED

1.4 Coal Firing and the Fuming Process continued

There is also evidence to suggest that the overall zinc oxide reduction reaction proceeds through the following steps:-

$$ZnO + 3FeO = Fe_3O_4 + Zn$$
$$Fe_3O_4 + CO = 3FeO + CO_2$$

The composition of the slag, in particular the lime/silica ratio, has a marked effect on the activity of the zinc oxide in the slag and consequently on the zinc elimination rate. The indications are that the optimum molar lime/silica ratio is of the order of 0.75

1.5 Bath Cooling

It is proposed that the slag bath of the fuming furnace be built of membrane wall panels cooled by forced-circulation of water, the heat being rejected to salt water in an exchanger. The pressure of the circulating water would be such as to prevent the formation of steam under operating conditions.

This type of cooling system is considered by John Thompson to be the most suitable for the conditions of the slag bath, and is the same as that used in Boliden's furnace.

1.6 Waste Heat Recovery

The boiler of the slag-fuming furnace will generate a minimum of 50,000 lb/hr. of steam during the heating part of the cycle, and a maximum of 100,000 lb/hr. during the fuming part. The condition of the steam will be 450-480 psig, and 700-750°F.

1. PROCESS DESCRIPTION CONTINUED

1.6 Waste Heat Recovery continued

This quantity of steam represents ca. 4-8 MW of electric power, worth $224,000 - $448,000 a year at 0.7 cents/unit, and so merits steps to utilize it, particularly in view of the power requirements of the electric slag melting furnace, rated at 7 MW.

The generation of electric power from the steam is obviously the most efficient means of recovering its energy since the rotating machines of the plant require only about 2 MW, and anyway it is not economic to use steam turbines instead of electric motors except for those of large horsepower.

One large horsepower drive that also requires speed control is the secondary air blower (1 MW), and for this a steam turbine would probably be considerably cheaper than an electric motor.

Hence, it is proposed to use some of the steam (ca 25,000 lb/hr.) for driving the secondary air blower, and the remainder for generating electric power. It is understood that the Electricity Trust would permit a turbo-alternator to be parallelled with their system, and this would allow all of the available steam to be used at all times.

However, the efficiency of conversion of the steam to electric power depends upon the pressure at which it is exhausted from the turbine, i.e. upon the temperature at which the exhaust steam is condensed.

There are three appropriate media for condensing the exhaust steam:

1. Air condenser
2. Fresh water and cooling tower.
3. Salt water

1. PROCESS DESCRIPTION CONTINUED

1.6 Waste Heat Recovery continued

1. It is considered that an air condenser unless very large and expensive, would give an exhaust temperature only as low as 228°F.

2. Condensation by fresh water from a cooling tower would probably achieve a temperature of 115°F, with a considerably greater output of electric power. The capital cost would be only about two-thirds that of an air condenser.

3. The existing B.H.A.S. salt water pumping station could make available 5000 gpm for about three quarters of an hour in each hour. This is insufficient for condensing the steam but might be used to advantage.

In order to avoid an expensive extension to the present pumping station and large main across to the new slag-fuming unit, it is thought that the turbo-alternator might be located as near as possible to the river, together with its condenser and circulating pumps. Only the turbine would require housing and the expenditure on the small steam and condensate lines and 6.6 KV cable would be small in comparison with a 20" salt water main.

For lack of time, the engineering flow-sheets and estimate have assumed condensing in an air condenser, but if the project should proceed this last alternative should certainly be examined because the capital and operating costs are likely to be lower than for the other alternatives, and the electric power recovered would be similar to that when using a cooling tower.

1. PROCESS DESCRIPTION CONTINUED

1.7 Spent Slag Disposal

At the end of the fuming cycle when the recoverable zinc has been eliminated, the spent slag is run out of the furnace through a tap hole, and flows along a trough to the granulation launder where it is broken up and chilled with jets of high pressure water (75 psig). A flow of low pressure water (20 psig) flushes the granulated slag down the launder to a pit from which it is recovered and transported by road vehicle to disposal dump.

Fresh water is used in closed circuit, the water being cooled in a spray pond. The only purge required is provided by moisture in the slag removed from the granulation pit.

1.8 Process Gas Cooling

As mentioned in paragraph 1.4, the hot process gas carrying the zinc oxide in suspension gives up some of its heat in generating steam in the boiler. Some heat is also given up in heating the secondary air to about 550°C in the air preheaters. However, if the temperature of the process gas leaving the boiler is too high for the materials of construction of the preheaters, the gas can be cooled to 950°C by the injection of water through sprays in the flue after the boiler.

Upon leaving the air preheaters the gas temperature (650°C) is too high for admission to the zinc oxide collector, and the gas is further cooled in a bank of inverted U tubes exposed to atmospheric conditions. These reduce the temperature to about 200°C, and if further minor cooling is necessary for control purposes, dilution air is admitted after the coolers.

1. PROCESS DESCRIPTION CONTINUED

1.9 Zinc Oxide Fume Collection

The zinc oxide fume from slag fuming plants is traditionally collected in bag filters, but recently two or three plants have adopted electrostatic precipitators for the duty. The latter are able successfully to use water sprays for cooling the process gas before it enters the precipitator, and this leads to a more compact plant than using U tube coolers which occupy a large area.

When a bag filter is used water sprays may be used only to a limited extent because of the risks of the fume becoming sticky and clogging the filter cloth, and of corrosion due to the presence of chlorine,fluorine and sulphur in the gas. Cooling by air dilution can also be used only to a limited extent because of the larger capacity of bag filter, fans and ductwork than required to handle the larger gas volume.

Since the combination of U tube coolers and bag filter is considerably lower in cost than water spray conditioning and electrostatic precipitator, it is adopted in this case.

1.10 Oxide Roasting

Because of the presence of arsenic chlorine, fluorine and lead in the zinc oxide fume, and the harmful nature of these elements in the recovery process for the zinc metal, it is necessary to eliminate the elements by roasting the oxide at 1350°C. The operation is carried out in an oil-fired rotary kiln and 2% ground coal is added to increase the rate of volatilisation of lead.

The harmful elements are driven off in the exhaust gas from the kiln, and the exhaust gas is cleaned in a venturi scrubber to avoid atmospheric pollution. The scrubbing liquor is then

1. PROCESS DESCRIPTION CONTINUED

1.10 Oxide Roasting continued

treated with lime to precipitate the noxious elements and sent to a thickener for separation of solids which are removed as underflow and pumped to a dam which is fitted with a waterproof liner.

The refined oxide is cooled in a rotary water-cooled cooler, crushed to less than 3 inch and conveyed to a road bin for despatch.

1.11 Process Alternatives

1.11.1 Oil Firing

Pulverised coal has been used as the fuel and reductant for slag fuming since the inception of the process. Although coal is generally a relatively cheap fuel, the cost of pulverising and distribution to a multiplicity of points adds considerably to capital and maintenance charges. For this reason, research and plant-scale testing has been carried out to assess the suitability of liquid and gaseous fuels as alternatives to coal. This work has definitely established that natural gas and medium to light fuel oils are ineffective for slag fuming, but heavy residual oils give excellent fuming rates, comparable with (if not better than) good quality coal. To the best of our knowledge, the only plant using fuel oil for slag fuming is at Plovdiv, Bulgaria. This plant was visited by members of BHAS/DAPL in July 1970 to discuss the use of fuel oil, and the party was impressed with the construction and operation of the plant. The quoted oil consumption per tonne zinc eliminated is about the same as that indicated in testwork by Asarco in U.S.A.

1. PROCESS DESCRIPTION CONTINUED

1.11 Process Alternatives continued

1.11.1 Oil Firing continued

The use of oil permits a saving in capital cost of about $A750,000 and in addition shows a small saving in labour and power costs. In the present case the annual cost of heavy fuel oil for fuming is approx. $90,000 higher than that of coal although less oil is required due to its higher calorific value. However future cost trends must be taken into account as these could alter the picture considerably. In addition, the storage and injection plant is much simpler and more reliable in the case of oil, reducing maintenance and increasing over-all plant availability.

It is considered that sufficient information is available for the design of a slag fuming plant using fuel oil instead of coal, but further development work would be required in the design of the oil injection guns. A sum of $100,000 has been included to cover this cost.

1.11.2 All-Molten Charge

The slag fuming furnace is inefficient as a melting furnace owing to the conflicting requirements of the fuel-firing described in 1.4 Therefore, although up to fifty per cent of the feed to the furnace may be added cold, there is an appreciable increase in coal consumption per ton of zinc and in batch time. This adds to the capital and operating costs per ton of zinc fumed.

1.11.1 All-Molten Charge continued

If the whole charge to the furnace is added in the molten form the charging time is reduced and no time is lost in heating the charge to fuming temperature so the throughput of the furnace is much greater.

By increasing the capacity of the electric melting furnace the Beltana ore, as well as the rich slag, may be melted before charging to the fuming furnace, and the shorter overall cycle time will not only allow a greater quantity of rich slag to be treated during the chosen life of the Beltana ore, but will also permit a smaller fuming furnace to be used.

The operating cost of this alternative increases only to the extent of the additional coal and electric power consumed, and the overall economies are considered in Part 1, Section 3.

The plant is sized to handle twice as much slag as in the basic case but the batch time is reduced by nearly 40% because there is no heating time. The length of the fuming furnace is reduced to 15ft. and the coal firing rate, and sizes of boiler, gas cooling train and baghouse decrease correspondingly.

SECTION 2

PLANT PERFORMANCE.

Contents

2. PLANT PERFORMANCE

2.1 Introduction

The plant quantities summarised in this section reflect the basic design concept illustrated on the process flowsheet and discussed in Section 3. Yearly quantities are based on continuous operation for 350 days per year at 90% availability.

2.2 Zinc Oxide Production

The plant is designed to produce 43,400 tonnes/year of equivalent zinc. The corresponding quantity of roasted slag oxide is 56,200 tonne/year at 77% zinc.

In addition some 7,050 tonnes/year of lead rich oxide with an approximate analysis of 50% lead and 30% zinc and 14% arsenic is produced as a slurry from the venturi scrubber which cleans roasting kiln off-gas. This material is treated with lime and pumped to a dam where noxious elements settle out and clear water overflows into the sea.

2.3 Raw Materials

The compositions of slag and ore assumed for this study are indicated below:

	Ore	Slag
Zn	36.5%	19.0 %
Pb	2.0	2.3
As	1.0	Nil
CaO	10.0	15.5
SiO_2	21.0	19.5

Fuming down to 3% zinc in tail slag, consumption rates are
ore 100,000 long tons/year slag 66,700 long tons/year.

The granulated slag is premelted in a submerged arc electric furnace.

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2. PLANT PERFORMANCE CONTINUED

2.4 Utilities

2.4.1. Coal

The coal consumption is based on a firing rate of 222 lb/min. The time cycle and fuming rates are estimated on the basis of information provided by BHAS from runs on their computer model of the slag fuming furnace.

Annual consumption is estimated to be 42,500 long tons per year.

2.4.2 Fuel Oil

Coal drying	1,000 long tons/year
Kiln Firing	4,500 long tons/year

2.4.3 Electric Power

a) Electric Arc Furnace	6.5 MW
b) Remainder of Plant	2.0 MW
Total	8.5 MW
(c) Generated	3.5 MW
Nett	5.0 MW

2.4.4 Steam

HP steam generated (450 psig, 400°C)	75,000 lbs/hr.
HP steam used for turbine drive for secondary air compressor	25,000 lbs/hr.
Balance of steam - to turbo alternator	50,000 lbs/hr.

2. PLANT PERFORMANCE CONTINUED

2.4. Utilities continued

2.4.5. Cooling Water

Heat transferred to plant cooling water is removed by heat exchange with salt water, so make up is required only to account for losses from the system.

Estimated requirement is 200 gallons/hour.

2.4.6. Boiler Feed Water

This is required as make up to the slag bath cooling and H.P. boiler systems.

Estimated requirement is 500 gallons/hour.

2.4.7. Salt Water

Heat from the slag bath jacket cooling, general cooling system and roasted fume cooling water is rejected to salt water.

The requirement of salt waster for these purposes is:

slag bath cooling	70,000	gallons/hour.
cooling water systems	40,000	" "
roasted fume cooler	8,000	" "

2.4.8. Towns Water

Towns water is used as make up to the slag granulation system and to the venturi scrubber that cleans the flue gases leaving the deleading kiln.

Make up to slag granulation	2,800 gallons/hour
Make up to venturi scrubber	4,200 gallons/hour.

2. PLANT PERFORMANCE CONTINUED

2.4 Utilities continued

2.4.9. Coal for Deleading 1,300 tons/year

An allowance is included for 2% coal addition to the kiln feed. This is intended to increase the rate of lead elimination and reduce the risk of ring formation.

2.4.10. Lime 1,000 tons/year

The venturi scrubber effluent is neutralised with hydrated lime before being thickened and sent to the tailings dam.

2.5 Direct Labour and Supervision

Based on the existing slag fuming operation at Port Pirie which has two furnaces and gas trains, the following manning is considered appropriate for this single large train:-

2.5.1. Supervision

	Day	Shift
Shift Foreman	-	2
Day Foreman	1	-
Technical Assistant	1	-
	2	2 x 4
	Total	10

2.5.2. Labour

Control Room Operator	1
Furnace attendant	1
Coal plant attendant (and relief furnace attendant)	1
Boiler attendant	1
Slag pit operator	1
Melting furnace operator	1
Baghouse and gas train attendant	1
Kiln attendants	2
Rouseabout	1
	10 x 4
Total	40

2. PLANT PERFORMANCE CONTINUED

2.5 Direct Labour and Supervision continued

2.5.3 Day Gang

Mainly to undertake baghouse maintenance, fume handling, water-jet cleaning and filling of bins

Leading hand plus labourers	6

2.6 Plant Availability

Slag fuming is an arduous operation and the on-stream time of the plant is estimated on the basis of a 15 day annual shutdown for boiler inspection, extensive system cleanout and major maintenance work, and 90% availability during the rest of the year. This amounts to 7560 hours per year.

Planned shut downs for one shift every two weeks are advisable for cleaning the boiler and gas ducts and maintenance of running equipment.

2. PLANT PERFORMANCE CONTINUED

2.7 Alternatives to Base Case (Case 1)

CASE 2 (18ft. furnace, molten slag only, oil fired).

The following summarises the plant performance figures for this alternative.

Products	
- Zinc Oxide	56,200 tons/year
- Lead Rich Oxide	7,050 tons/year
Raw Materials	
- Ore	100,000 tons/year
- Rich Slag	66,700 tons/year
Utilities	
- Fuel Oil	4,500 tons/year
- Electric Power	4.7 MW
- Cooling Water	200 gall/hour
- Boiler Feed Water	500 gall/hour
- Salt Water	118,000 gall/hour
- Towns Water	7,000 gall/hour
- Coal for Deleading	1,300 ton/year
- Lime	1,000 ton/year

Direct Labour could be reduced by 1 shift operator, supervision would remain the same as the base case.

2. PLANT PERFORMANCE CONTINUED

2.7 Alternatives to Base Case continued

CASE 3 (18ft. furnace, molten slag + ore, coal fired)

The following summarises the plant performance for this alternative.

Products	
- Zinc Oxide	67,500 tons/year
- Lead Rich Oxide	8,400 tons/year
Raw Materials	
- Ore	100,000 tons/year
- Rich Slag	127,000 tons/year
Utilities	
- Coal for fuming	37,600 tons/year
- Fuel Oil	6,000 tons/year
- Electric Power	20 MW
- Cooling Water	200 gall/hour
- Boiler Feed Water	500 gall/hour
- Salt Water	100,000 gall/hour
- Towns Water	7,500 gall/hour
- Coal for Deleading	1,400 tons/year
- Lime	1,000 tons/year

Direct labour and supervision as for base case.

2. PLANT PERFORMANCE CONTINUED

2.7 Alternatives to Base Case continued

CASE 4 (18ft furnace, molten slag + ore, oil fired)

The following summarises the plant performance figures for this alternative.

Products	
- Zinc oxide	67,500 tons/year
- Lead Rich Oxide	8,400 tons/year
Raw Materials	
- Ore	100,000 tons/year
- Rich Slag	127,000 tons/year
- Heavy Oil	26,500 tons/year
Utilities	
- Fuel Oil	6,000 tons/year
- Electric Power	20 MW
- Cooling Water	200 gall/hour
- Boiler Feed Water	500 gall/hour
- Salt Water	100,000 gall/hour
- Towns Water	7,500 gall/hour
- Coal for Deleading	1,500 ton/year
- Lime	1,000 ton/year

Direct Labour could be reduced by 1 shift operator, supervision would remain the same as the base case.

2. PLANT PERFORMANCE CONTINUED

2.7 Alternatives to Base Case continued

CASE 5 - (15 ft. furnace, molten slag + ore, coal fired)

The following summarises the plant performance for this alternative.

Products	
- Zinc Oxide	58,700 tons/year
- Lead Rich Oxide	8,400 tons/year
Raw Materials	
- Ore	87,000 tons/year
- Rich Slag	110,000 tons/year
Utilities	
- Coal for fuming	35,400 tons/year
- Fuel Oil	5,450 tons/year
- Electric Power	17.5 MW
- Cooling Water	200 gall/hour
- Boiler Feed Water	500 gall/hour
- Salt Water	100,000 gall/hour
- Towns Water	7,500 gall/hour
- Coal for Deleading	1,400 tons/year
- Lime	1,000 tons/year

Direct Labour and supervision as for base case

2. PLANT PERFORMANCE CONTINUED

2.7 Alternatives to Base Case continued

CASE 6 (15 ft. furnace, molten slag + ore, oil fired)

The following summarises the plant performance figures for this alternative.

Products	
- Zinc Oxide	58,700 tons/year
- Lead Rich Oxide	8,400 tons/year
Raw Materials	
- Ore	87,000 tons/year
- Rich Slag	110,000 tons/year
- Heavy Oil	22,100 tons/year
Utilities	
- Fuel Oil	5,450 tons/year
- Electric Power	17.5 MW
- Cooling Water	200 gall/hour
- Boiler Feed Water	500 gall/hour
- Salt Water	100,000 gall/hour
- Towns Water	7,500 gall/hour
- Coal for Deleading	1,500 ton/year
- Lime	1,000 ton/year

Direct Labour could be reduced by 1 shift operator, supervision would remain the same as the base case.

SECTION 3

PLANT DESCRIPTION

Contents

3. PLANT DESCRIPTION

3.1 Layout

The plant is situated to the west of the present slag fuming plant and is arranged in line from south to north, the raw materials being taken in at the south end, and the product zinc oxide being taken away from the north end.

The layout avoids having to remove the present amenities building, and assumes that the ore will be brought from a stockpile in the "pit", and coal from the existing coal storage area.

3.2 Ore and Slag Handling

Both these materials are brought by road vehicle during the day shift to separate handling systems comprising ground hopper, feeder, elevator, and storage bin. From the storage bins the materials are withdrawn at the process operating rate and conveyed to the slag-fuming furnace in the case of the ore and to the elctric melting furnace in the case of the slag. The conveying systems each comprise a feeder, elevator and weigh-feeder, the latter being controlled from the Control Room.

3.3 Slag-melting Furnace

The rich slag is melted in an electric melting furnace of 7 MW rating situated at a level that allows direct discharge by launder to the slag-fuming furnace. Electric supply to the furnace will be at 6.6 kV.

3.4 Coal Grinding and Injection

Coal is brought by road vehicle to a ground hopper and elevated to a storage bin. From the bin it is withdrawn at the operating

3. PLANT DESCRIPTION CONTINUED

3.4 Coal Grinding and Injection continued

rate and conveyed by Redler conveyor to the mill feed hopper, whence it passes by table feeder to the mill.

An 8' x 6' Hardinge ball mill has capacity to grind 8 tons/hr of coal to 85-90% through 200 mesh. Hot air provided by an oil-fired heater circulates through the mill system and dries the coal to less than 1% moisture. Moist air from the system is purged through a dust collector to atmosphere.

The pulverised coal is delivered to a 20 ton hopper from which it is fed through a screen to a Petrocarb injection system.

This system allows the desired amount of coal to be fed equally to the 36 tuyeres of the fuming furnace.

3.5 Fuming Furnace

The slag-fuming furnace, or bath, is 18' x 8' x 21' and has a nominal capacity of 52 long tons of slag. It is of membrane-wall construction cooled by forced-circulation of water and exchange with salt cooling water in a heat exchanger. The furnace floor and tap-hole blocks and charging spout are included in the cooling system.

Studs are fixed to the inside walls of the furnace to promote adhesion of solidified slag and consequent reduction of heat loss.

Molten slag is charged by launder from the melting furnace, and ore is fed to the furnace charging spout by conveyor via a chute.

3. PLANT DESCRIPTION CONTINUED

3.5 Fuming Furnace continued

There are eighteen tuyeres on each side of the furnace, entering through headers in the membrane wall. Pulverised coal and secondary air are blown into the molten slag through the tuyeres.

Spent slag is tapped from the furnace through tap-holes in the end opposite the feed entry.

3.6 Boiler

Above the furnace is a boiler of membrane-wall construction and of nominal rating 100,000 lb/hr. of steam at 460-480 psig and 700-750°F.

The boiler is approx. 15' x 8' x 40' high and is followed by a slag chamber containing the steam superheater. The membrane walls are made by solidly welding 3" O.D. finned tubes at 4" centres.

A system of automatically controlled retractable sootblowers using 3000 Ncfm of air at 250 psig prevents excessive building up of oxide on the walls; hand lancing ports are provided in addition. Oil burners are installed for starting up.

The steam produced is used for driving the secondary air blower and for generating electric power.

3.7 Slag Granulation

At the end of the fuming cycle the molten spent slag is discharged through the tap hole to a launder and is granulated by means of jets of high pressure water.

3. PLANT DESCRIPTION CONTINUED

3.7 Slag Granulation continued

The launder discharges the granulated slag to a collecting pit from which it is recovered by grab and delivered either directly to a road vehicle for removal or temporarily to a dump beside the pit.

Water from the pit is pumped to a spray pond, and thence to an overhead tank for recycle to the slag launder and high pressure granulating pump. Make up water is admitted to the tank from the town water system.

In case of power failure there is standby emergency power supplied to the HP pump.

3.8 Secondary Air Preheaters

The air heaters are of the Escher type comprising a 24 inch diameter shell 20 feet long containing a number of radial hollow-fin tubes through which the secondary air passes.

The process gas from the boiler flows over the flat surfaces of the fin tubes at high velocity so minimising the adhesion of fume. Each heater is fitted with an integral sootblower that has both rotational and up and down motions to remove fume from the heat transfer surfaces. Eight heaters are installed, seven of which are normally operating. Each can be isolated from its inlet and outlet flues while the plant is running, and can be removed for more thorough cleaning.

The inlet and outlet gas manifolds have means for continuously removing deposited fume which passes to the fume conveying system for transfer to the roasting section.

3. PLANT DESCRIPTION CONTINUED

3.9 Process Gas Cooling

Process gas leaving the air preheaters at about 650°C is cooled to 200°C in a bank of U-tube atmospheric coolers, comprising 6 parallel groups each of which has 7 U-tubes in series. Each U-tube has vibrators to prevent the formation of thick dust deposits.

The U-tubes terminate in dust hoppers fitted with screw conveyors to deliver deposited fume to the fume system.

Access is provided to clean-out openings in the U-tubes and to the vibrators.

3.10 Baghouse

The process gas is drawn through the air heaters and U-tube coolers by means of a slow-speed radial-blade fan and is delivered to the baghouse.

In order to ensure that its temperature of gas entering the baghouse does not exceed 200°C, provision is made for admitting dilution air at the fan suction.

The baghouse comprises eight chambers containing a total of 1728 bags made of Du Pont "Nomex" cloth. The total effective filtering area is 59,000 sq. ft. Six of the chambers are normally in operation, one being off-line for rapping, and one off-line for maintenance or standby.

Each chamber has a hopper-bottom with screw conveyor and rotary air lock by means of which the collected zinc oxide is discharged to the fume system.

3. PLANT DESCRIPTION CONTINUED

3.10 Baghouse continued

The baghouse is operated at atmospheric pressure by the control of a fan between the baghouse and a chimney stack from which the cleaned gas is discharged to atmosphere.

As an alternative to the U-tube cooler and baghouse, the use of water-spray cooling and conditioning and an electrostatic precipitator was considered, but would have been considerably higher in capital cost, though probably considerably lower in operating cost.

3.11 Fume Roasting Section

The zinc oxide fume from the baghouse, together with that removed at various points from the process gas system, is brought by the conveying system to two storage bins.

From these it is mixed with about 2% ground coal and fed to a rotary kiln where it is roasted at 1350°C. The kiln is 10 ft. diameter and 130 ft. long, and is oil-fired.

The roasting operation drives off chlorine and fluorine, most of the lead, some zinc, and minor elements such as arsenic and sulphur. In order to prevent these substances being discharged to atmosphere, the exhaust gases from the kiln are cleaned in a venturi scrubber before going to the chimney stack.

The slurry leaving the scrubber is treated with lime to precipitate noxious elements, and clarified to permit re-cycling of the water.

The sludge from the clarifier and recycle purge are pumped to an earth dam where the solids settle out and clear water overflows into the sea.

3. PLANT DESCRIPTION CONTINUED

3.11 Fume Roasting Section continued

The roasted oxide from the kiln is cooled in a rotary cooler splash-cooled by water, and is transferred to a bin from which it may be taken by road vehicle for shipment.

3.12 Hygiene

Fume arising from tapping the melting furnace is drawn from hoods over the tapping points by the tertiary air fan and so enters the process gas stream and is recovered.

The fume from tapping the slag bath and steam resulting from slag granulation is withdrawn by separate fans and exhausted to atmosphere through a stack.

3.13 Instrumentation and Control

In order that the plant may be operated efficiently and manual control minimised, instruments are provided to indicate or record conditions throughout the process and to control operations automatically where possible. The majority of instruments are mounted in an air-conditioned control room close to the fuming furnace.

An alarm/annunciator system draws attention to important conditions that vary from pre-set limits, and an intercom system enables communication between all important operating points throughout the plant.

An emergency diesel/generator is provided to supply essential drives in the event of power failure, and provision is made for the safety of the plant and personnel arising from the failure or abnormal condition of any individual item of equipment.

SECTION 4

EQUIPMENT SPECIFICATIONS

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4.1 INTRODUCTION

In this section all of the major items of equipment are listed and briefly specified. The scope of work and design standards used are also detailed.

Equipment items are subdivided into civils, structures, vessels, mechanical equipment, piping and ductwork, electrics, instrumentation and surface treatment. These subdivisions conform with those used in the capital cost estimate breakdown.

4.2. CIVILS

4.2.1 Basis of Design

Relevant Australian codes and standards are used for civils estimating and design purposes within this study. No special consideration has been given to design for earthquake conditions.

4.2.2 Site Levelling

It is assumed that the site does not require any imported fill, but some earthworks have been allowed to bring the site to a suitable level or levels.

4.2.3 Foundations

It has been assumed that soil conditions at this site are similar to those at the B.H.A.S. slag fuming site where bore holes revealed a layer of fill over 40 feet of poorly consolidated clays and silts which is underlain by more compact material.

The recommendations for the type of foundations is also assumed to apply : viz. that major loads and, where differential settlement must be avoided are to be supported on piles.

Minor foundations are assumed to be of the spread footing type, designed for an allowable bearing pressure of 3kps/ sq. ft. It is also recommended that a soil investigation be carried out as it may be possible to support higher bearing pressures on the fill than on the B.H.A.S. site.

4.2.4 Roads

The extent of the roads within the battery limits is shown on the general arrangement drawing. Roads are of the modified Macadam type with an overall pavement thickness of 8 inches.

4.2 CIVILS CONTINUED

4.2.5 Paving

Concrete paving is kept to a minimum, and is included in and around the following areas of the plant:

- fuming and electric melting furnaces
- spent slag drainage bay
- slurry storage and pumping area
- miscellaneous paythways connecting areas requiring regular operator supervision.

4.2.6 Miscellaneous

4.2.6.1. Granulated Slag Pit

This comprises a reinforced concrete pit approximately 20 ft. long by 10 ft. wide, and 12 ft. deep with adjacent overflow pit approximately 10 ft. long by 6 ft. wide.

4.2.6.2. Rotary Cooler Basin

This comprises a reinforced concrete basin at ground level approximately 30 ft. long by 7 ft. wide and 5 ft. deep.

4.2.6.3. Tailings Dam (V510)

An earth wall dam approximately 300 ft. x 150 ft. x 7 ft. deep and lined with an impervious polythene sheet liner covered after laying with a 9" layer of sand.

This dam will be filled during 12 months operation and a similar dam will have to be provided each year.

4.2. CIVILS CONTINUED

4.2.6 Miscellaneous continued

4.2.6.4. Water Spray Pond

This is a reinforced concrete pit approximately 50 ft. long by 50 ft. wide and 4 ft. deep.

4.3. STRUCTURES

4.3.1 Basis of Design

Structures are designed generally in accordance with the relevant Australian codes and standards.

Floor loadings are taken in accordance with normal requirements for industrial plants, except where special loadings occur from equipment and/or operating conditions. Wind loading will be calculated from AS CA34 SAA Loading Code Part II Wind Forces. Earthquake conditions are not considered.

The major structures and buildings are listed below. In addition, there are smaller structures, such as pipe bridges and equipment supports, which are not listed but which are included in the price estimate.

An appreciation of the buildings and structures may be obtained by reference to the arrangement drawings.

4.3.2 Buildings

4.3.2.1. Coal Mill Building

This is a three storey steel framed building 50 ft. long, 44 ft. wide and 71 ft. high to the eaves.

The building is sheeted in steel wall cladding and the roof covered in steel roof decking. Air louvres and roof ventilators are provided in the walls and roof respectively.

Natural light is provided by perspex or fibreglass sheeted panels in the walls.

4.3. STRUCTURES CONTINUED

4.3.2 Buildings continued

4.3.2.2. Furnace Control Room/Office/Switchroom

This comprises a three storey building, 30 ft. long by 20 ft. wide with reinforced concrete frame and floors and concrete block walls. The switchroom and transformer bay are placed at ground level, the office and laboratory on the second level, and the furnace control room on the third level.

4.3.2.3. Kiln Control Room

This is a single storey building, 40 ft. long by 15 ft. wide, located on the kiln firing end structure. Construction is in reinforced concrete and concrete block.

4.3.2.4. Compressor Building

This comprises a single storey building, 75 ft. long by 38 ft. wide, housing the compressors and associated equipment. The deaerator and H.P. steam condensers are located on the roof of the building. A steel framed building incorporating supports for the deaerator and steam condenser is provided. Walls are of brick to sill level. Walls above sill level and the roof are clad with steel sectional cladding.

43.2.5. Furnace and HP Boiler Structure

This is a steel structure housing the slag fuming furnace and the boiler and associated equipment.

4.3. STRUCTURES CONTINUED

4.3.2 Buildings continued

4.3.2.6. Kiln Structure

This steel structure supports the operating platform at the charge end of the kiln and the access walkway along the length of the kiln. The kiln itself is separately supported on reinforced concrete pedestals and foundations.

4.3.2.7. Electric Furnace Structure

This steel structure houses the electric furnace and associated equipment. The furnace is supported in separate foundations.

4.3.2.8. Granulated Slag Grab Hoist Structure

This steel gantry of 20 ft. span supports the spent slag grab hoist and extends over the spent slag storage heap for a distance of 30 ft.

4.3.2.9. Amenities Building

A solid brick building 64 ft. long by 17 ft. wide. It contains a dirty and clean change room, and ablution area and a dining room. Fittings include a S.S. sink, four W.C., a 7 ft. long urinal, 2 showers, a wash trough and thirty two lockers. Hot water is provided at the sinks and showers.

4.3.2.10. Main Chimney

A 5ft. 6ins. inside diameter by 150 ft. high concrete chimney, lined with 4½" - 22-24% alumina firebrick.

4.3 STRUCTURES CONTINUED

4.3.2 Buildings continued

4.3.2.11. Raw Fume Storage Building

50 ft. x 36 ft. steel and concrete, 10'6" high walls, max. inside height 26 ft. Capacity 400 tons. Conveyor on roof, discharging at two points.

4.3.2.12. Kiln Stack

Rubber lined mild steel stack 3 ft. dia. x 120 ft. high self supporting.

4.4 Vessels

4.4.1. Introduction

The major pressure vessels, tanks and heat exchangers are listed in this section. The numbers indicated against each of these items conform with those used on the process flowsheet.

4.4.2. Design Codes

As a basis for the capital cost estimate, vessel desings are assumed to conform with the following design codes:-

- Atmospheric storage tanks	API Standard 650
- Pressure vessels	ASME Section V111
- Air Cooled Condensers and Oil Heaters	TEMA Class C where applicable.

4.4 Vessels continued

4.4.3 Vessels List

V101	Raw Ore Ground Hopper	1 off

Mild steel hopper, feeding bucket elevator, complete with inlet grid (to receive ore from dump trucks) and discharge gate, of welded construction suitably stiffened and fitted with mounting lugs for vibratory feeder.

V102	Raw Ore Storage Bin	1 off

Mild steel circular bin with conical bottom capacity 900 tons, diameter 26'0" straight shell height 31'6", complete with supports, discharge gate, access ladder and top platform.

V103	Raw Ore Feed Bin	1 off

Mild steel circular bin with conical bottom, capacity 100 tons, diameter 12'0" straight shellheight 16'6", complete with supports and discharge gate.

V104	Granulated Slag Ground Hopper	1 off

Mild steel hopper, feeding bucket elevator, complete with inlet grid (to receive slag from dump trucks) and discharge gate. All welded construction suitably stiffened and fitted with mounting lugs for vibratory feeder.

4.4 Vessels continued

4.4.3 Vessels List continued

V105 Granulation slag storage bin 1 off

Mild steel circular bin with conical bottom capacity 900 tons, diameter 26'0" straight shell height 31'6", complete with discharge gate and access ladder and top platform.

V106 Granulated Slag Feed Bin 1 off

Mild steel circular bin with conical bottom, capacity 20 tons, 7'0" diameter, straight shell height 10'0". All welded construction and complete with discharge gate.

V107 Feed Slag Fume Hood 1 off

Mild steel hood approx. 20'0" long with ducted off-take to fan B201. Hood has removable section for inspection of melting furnace tapping points, and is also equipped with inspection doors for examination of launder.

V201 Fuming Bath Cooling System 1 off

Membrane-wall panels with headers top and bottom; cooling by forced-circulation of water; side panels have an intermediate header to accommodate the tuyeres;panels at one end contain two 5"/6" tap-holes or slag outlets sealed by clay and steel stopper with retaining catch.

4.4 Vessels continued

4.4.3 Vessels List continued

V202 Fuming Bath Floor 1 off

Comprises six sections of tube and flat bar construction cooled by forced circulation of water. Inlet and outlet headers are of cast steel and are kept in place with clips.

V203 Expansion Drum - Bath Cooling System 1 off

An expansion drum for the water in the forced-circulation cooling system of bath and drum is 5 ft. diam x 25 ft. long.

V204 Condensate Knock-out Drum 1 off

Mild steel vessel, diameter 4'0", straight shell length 8'0", dished ends, working pressure 15 PSIG. Complete with manhole, tangential steam inlet and support legs.

V205 Deaerator 1 off

Mild steel vessel, diameter 7'0" straight shell length 16'0". Deaerator is part of the boiler system and is of standard design for boiler feedwater treatment.

V206 Boiler Blowdown Vessel 1 off

Mild steel vessel, diameter 4'0", shell length 10'0" with dished ends. Vessel mounted vertically on legs at ground level.

4.4 Vessels continued

4.4.3 Vessels List continued

V207 Treated Water Storage Tank 1 off

Mild steel tank, capacity 10,000 gallons, diameter 16'0", height 8'0" complete with roof, manhole and fittings and supporting structure.

V208 Spent Slag Pit 1 off

Reinforced concrete pit, 20'0" x 10'0" x 12'0" deep, fed by spent slag launder M202 fitted with concrete weir spilling to pump suction chamber 6'0" x 10'0", and incorporating a pump compartment 12'0" x 10'0".

An overhead travelling grab crane C201 discharges slag to dump trucks.

Pit is below ground level.

V209 Granulated Water Spray Pond 1 off

Reinforced concrete pond 50'0" x 50'0" x 4'0" deep with separate pump compartment (for pumps P207), 20'0" x 12'0". A wooden slat tower 8'0" high is installed above pit to cool water discharges from pumps P206.

V210 Taphole Fume Hood 1 off

Mild steel hood to enclose furnace tapping points equipped with ducted off-take to fan B202. Hood has armour plate heat resistant glass doors to allow ready inspection and rodding of furnace tap holes.

4.4 Vessels continued

4.4.3 Vessels List continued

V211 Granulated Slag Launder Vapour Hood 1 off

Mild steel hood closely similar to V107.

V213 Granulated Water Head Tank 1 off

Mild steel tank, capacity 100,000 gallons, dimensions 40'0" x 21'0" x 20'0" deep with open top.

V214 L.P. Dosing Tank 1 off

Mild steel tank, open top, diameter 1'6", height 2'6", equipped with sight glass and closing control valve.

V215 H.P. Dosing Tank 1 off

Generally as for V214

V301 Boiler Off-take Duct 1 off

Mild steel duct developed to suit rectangular connection to furnace at one end (approx. 8' x 6') and irregular sectioned connection to recuperator at other end, refractory brick lined and fitted with soot blower connections.

V302 Soot Blowing Air Receiver 1 off

Mild steel vessel, capacity 300 c. ft., diameter 15'0", length 5'0". Working pressure 275 psig.

4.4 Vessels continued

4.4.3 Vessels List continued

V401 Coal Ground Hopper 1 off

Mild steel hopper, feeding bucket elevator, complete with inlet grid (to receive coal from dump trucks) and discharge gate. All welded construction suitably stiffened and fitted with mounting lugs for vibratory feeder.

V402 Coal Storage Bin 1 off

Mild steel circular bin with conical bottom, capacity 440 tons, diameter 26'0", straight shell height 37'0", complete with vertical supports and discharge gate.

V403 Coal Feed Bin 1 off

Mild steel circular bin, conical bottom, capacity 4 tons, fitted with outlet feeder to table feeder.

V404 Main Separator 1 off

Included in coal grinding plant.

V405 Main Cyclone 1 off

Included in coal grinding plant.

V406 Fine Coal Bin 1 off

Mild steel circular bin with conical bottom, capacity 20 tons, diameter 10'0", straight shell height 8'0". Bin has closed roof and discharge feeder.

4.4 Vessels continued

4.4.3. Vessels List continued

Coal Injection Plant 1 off

Designed by Petrocarb Inc., N.Y. to receive dry coal ground to 85% minus 200 mesh, and not finer than 65% - 300 mesh, from a 20 ton storage bin, and to feed the coal automatically and continuously into the tuyeres at any selected rate between 75 and 165 lbs/minute, uniformly distributing the coal between the tuyeres at any furnace back-pressure within the range 3 to 7 psig. The coal injection rate is a function of the differential pressure of the Primary Injector above the furnace bustle main pressure, and is established by adjusting the set point of the Rate Controller. Total air requirements are approx: 4 s.c.f.m. per tuyere for coal injection; 112 scfm for Primary Injector for pressurising; 350 s.c.f.m. for feed injection and transport; 2.5 s.c.f.m. per system for instruments and purge requirements.

Principal items are:-

V407 - 1 Feed Injector, 6 ft x 3 ft. straight length, with conical bottom. Operating pressure 70 psig, stainless steel clad.

V408 - 1 Primary Injector, 6 ft. dia. x 12 ft. straight length, operating pressure 30 psig. Stainless steel clad. Three 2" flanged connections to secondary injection vessels.

V409 - 3 Secondary Injectors
1 Vibrating Feeder
1 Vibrating Screen
Instruments and Control.

4.4 Vessels continued

4.4.3 Vessels List continued

V501 Raw Fume Bin 2 off

Mild steel circular bin with conical bottom capacity 175 tons, diameter 20'0", straight shell height 30'0", complete with vertical supports and access ladder. Bin has closed top (roof) and is fitted with manhole. Conical base is fitted with lugs for attachment of bin vibrator.

V502 Coal Feed Bin 1 off

Mild steel circular bin with conical bottom, capacity 10 tons, diameter 9'0", straight shell height 12'0", complete with discharge gate. Bin has access ladder, top handrails and an overhead monorail carries C516 for charging.

C503 Reclaimed Fume Bin 1 off

Mild steel triangular section bin, length 10'0", fitted with counterbalanced flap cover and water filled counterweight. Extraction conveyor C501 is fitted at bottom of this bin.

4.4 Vessels continued

4.4.3. Vessels List continued

V504. Venturi Scrubber 1 off

This comprises two venturis in series of the following approximate dimensions.

	1st	2nd
inlet diameter	36"	21"
convergent length	39"	20"
throat diameter	15"	10"
throat length	18"	18"
divergent length	66"	66"
transition length	21"	34"
overall length	12'0"	11'6"
number of jets	16	12
diameter of jets	0.25"	0.5"
exit diameter	21"	30"

Water is supplied to the jets at 3-4 gals per 1000 acfm in the first scrubber and at 7-8 gals/ 1000 acfm in the second.

The cyclone separator following the scrubber will be approximately 5'6" diameter and 20 ft. high.

V505. Lime Feed Bin 1 off

Mild steel circular bin with conical bottom, capacity 10 tons, diameter 9'0", straight shell height 12'0", complete with discharge gate and access ladder. Bin has access ladder, top handrails and an overhead monorail carries C517 fan bin charging.

4.4 Vessels continued

4.4.3 Vessels List continued

V506 Lime Treatment Tank 1 off

Mild steel circular tank, conical bottom, capacity 1000 gallons, complete with mixer M507 and support structure.

V507 Residue Thickener 1 off

Mild steel circular thickener, diameter 40'0" fitted with scraper and mechanical drive, complete with access walkways and foundations.

V508 Scrubbing Liquor Tank 1 off

Mild steel circular tank with conical bottom, diameter 4'0", straight shell height 4'0", open top and complete with support legs.

V509 Roasted Fume Bin 1 off

Mild steel circular bin with conical bottom, capacity 500 tons, diameter 20'0" straight shell height 23'0", complete with vertical supports, closed top (roof) and manhole, access ladder and discharge gate.

V510 Residue Settling Pond 1 off

For one year's operation pond is approx. one acre in area and 7'0" deep (208'0" x 208'0" x 7'0"). Pond is formed by consolidating the ground surface and building a bund wall from spent granulation slag and lining the pond with an impermeable membrane. Client to nominate site location of pond which should be as close as possible to V507

4.18/3

4.4 Vessels continued

4.4.3 Vessels List continued

V512 Fuel Oil Day Tank	1 off

Mild steel tank, capacity 7000 gallons, diameter 12'0", height 12'0", with cone roof and flat base. Complete with manhole, level indicator and concrete bund.

V513 Clinker Cooler Cooling Water Sump	1 off

Coated mild steel tray sump to entrain water from cooling sprays over M501. The sump is supported between concrete foundations for M501. The sump is approx. 50'0" long and is suitably stiffened and is provided with off-take to pump P602.

V601 Primary Air Receiver	1 off

Mild steel Class II vessel, capacity 1100 C. Ft. diameter 8'0" length 20'0".
Working Pressure 110 psig.

V603 Cooling Water Head Tank	1 off

Mild steel tank, capacity 12,500 gallons, dimensions 21'0" x 5'0" x 20'0" deep. This tank is integral with V213.

418/3

4.4 Vessels continued

4.4.4. Heat Exchangers

E201 H.P. Boiler System 1 off

Boiler of membrane-wall construction comprising 3" O.D., 8 gauge finned tubes at 4" centres. Steam drum 5 ft. diam x 12ft. Rating 110,000 lb/hr. steam at 450-480 psig, 700-750°F.

Feed water system comprises deaerator, turbo and electric pumps, and chemical dosing facilities and boiler feed water make up pumps.

The boiler is mounted above the fuming furnace bath consisting of steel tube and cast steel bath structure cooled by forced water circulation The bath cooling system is complete with circulating pumps, make up pumps, dosing equipment and heat exchangers.

The bath system is fired by pulverised coal fed by a coal injection system refer V407-409.

E202 Steam Condenser 1 off

Air cooled tube bundled condenser to condense 100,000 lbs/hour of saturated steam at 15 PSIG Air supply by six draught fans each driven by 25 HP motor.

E203 Bath Cooling Water Exchanger 1 off

Plate type heat exchanger using sea water as cooling medium to cool plant water at the rate of 1100 IGPM from 140°F to 110°F. Titanium plates and titanium fittings in contact with sea water.

4.4 Vessels continued

4.4.4. Heat Exchangers continued

E301 Recuperator 7 + 1 off

Eight (7 working, 1 spare) parallel jacketted tubes, each 27" ID x 19'0" with 18 fins per unit, complete with flues, soot blowers and dust removal screws.

Fabrication is in Type 321 stainless steel and carbon steel.

Total air volume 22,400 Ncfm, outlet temperature 550°C. Flue gas volume 37,000 Ncfm, inlet temperature 800°C outlet temperature 650°C. Total heat exchange area 1000 sq. ft.

E302 Air Cooler 1 off

Natural draught air cooler to cool process gas at the rate of 60,000 NCFM (maximum) at 630° to approx. 200°C. Cooler consists of 42 M.S. inverted U-tubes each 36" diam. and 120'0" long with dust and fume hoppers and screw extractors at the bottom - each tube fitted with 4 electromagnetic vibrators.

E401 Oil Heater for Coal Mill 1 off

Fuel oil fired direct air heater to heat 600 lbs/minute of air to 300°C complete with control equipment. Turn down ratio 5:1. Heater of M.S. plate refractory lined.

4.4 Vessels continued

4.4.4. Heat Exchangers continued

E601 Clinker Cooler Exchanger 1 off

Shell and tube heat exchanger using seawater as cooling medium to cool 100 IGPM of plant water from 150°F to 100°F. Exchanger uses aluminium brass tubes with faced tube sheets and removable end covers.

E602 Plant Cooling Water Exchanger 1 off

Shell and tube heat exchanger using seawater as cooling medium to cool 700 IGPM of plant water from 130°F to 100°F. Exchanger uses aluminium brass tubes with faced tubed sheets and removable ends.

4.5 Mechanical

4.5.1. Mechanical Equipment

M101	Granulated Slag Melting Furnace	1 off

An electric arc melting furnace charged from above by hoppers arranged around the periphery and tapped by means of a replaceable tap hole and plug.

M203	B.F.W. Pump Turbine	1 off

A back pressure steam turbine driving the main B.F.W. Pump.

M302	Secondary Air Blower Turbine	1 off

Similar to M203.

M305	Baghouse for Raw Fume	1 off

Dimensions 60' x 40' x 60' high. Comprising 8 chambers (6 operating, 1 shaking, 1 off-line).
Nominal capacity 60,000 Ncfm, 200°C (104,000 Acfm) on 6 chambers.
Operating filter area 59,000 sq. ft.
Filter ratio 1.76 cfm/sq. ft. at 200°C.
Bags 8" diam, 22 ft. long of "Nomex" cloth.
Each chamber contains 216 bags, total 1728.

Max. pressure drop across bags 4" W.G. Bag cleaning by external shaker mechanism automatically initiated by pressure drop and controlled by adjustable timer.

4.5 Mechanical continued

4.5.1. Mechanical Equipment continued

M305 continued
Walls of seal-welded steel plate, insulated between chambers by mineral wool.

Each chamber has hopper-bottom with rapper, screw conveyor and rotary discharge valve. Collecting conveyors alongside and one end bring all fume to one corner.

M401 Coal Grinding Plant 1 off

Hardinge conical ball mill 8 ft. x 6 ft. including 4 ton capacity feed hopper, table feeder, 7 ft. dia. moving vane double cone separator, 9 ft. dia. cyclone with rotary air lock, exhauster fan, one 20 ton product bin. Plant capacity 8 tons/hour to 85-90% through 200 mesh. Weight of ball charge 42,000 lbs.

Feed: minus 3/4" coal of Hardgrove index 77, max. 10% moisture.

Mill motor 275 HP, 960 RPM, slip ring, TEFC
Fan motor 120 HP, 1450 RPM, S.C.
Table feeder 2 HP, 720 RPM, S.C.
Cyclone 1 HP, 118 RPM, S.C., TEFC.
McPherson's 'Dustube' collector 32 ft. x 10 ft. consisting of 4 cells, each containing 180 bags, 5" dia.
Exhaust fan 12,000 CFM 7" S.W.g. at 200°F with 30 H.P.
1440 RPM, TEFC electric motor.
Two Screw conveyors provided with 3 H.P. AEI Barlow geared units and chain drive. 1 under dust collector with rotary valves, 1 inclined to product bin.

M402 Coal Mill Bag Filter
Refer M401 above.

4.5 Mechanical continued

4.5.1. Mechanical Equipment continued

M501 Deleading Kiln and Coolers 1 off

10'0" diameter, 120 ft. long, with water-cooled feed screw conveyor, and water-cooled product cooler. Designed to handle 10.76 tons per hour, material temperature 1350°C. Full floating air seals each end, firing hood track mounted for inspection. Residence time 25 to 75 mins.

Kiln all welded steel, slope ½" per foot. Speed infinitely variable from 0.6 to 2 RPM. Shell thickness 5/8" except under tyers and stiffeners. Two riding rings, two carrying roller assemblies. Drive 50 HP, 970 RPM motor through Heenan Dynaspeed water-cooled eddy-current adjustable speed magnetic coupling (0-910 RPM), and Sonnerdale triple reduction speed reducer, double helical gear. Final drive cast steel spur gear. Firing hood steel plate, retractable, with burner opening, peephole and barring doors, auxiliary poker bar opening, brick-lined and insulated.
Burner - J.T./Kennedy air atomisation type.
Length 6 ft. dia. 6".
Oil booster pump - Worthington type IG.ARM.
Max.pressure 300 psig.
Motor for pump 1 HP, 960 RPM.
Primary turbine blower - 1000 CFM at 70°F, pressure 40" swg. Motor 20 HP.

Refractory lining - 6" thick, first three firing end rows Kaiser castable refractory, next 30 ft. Newbolds HIAL 70, remaining 60 ft. Newbold RHM. All bricks are 50/50 9" x 6" x 3"/2½" and 9" x 6" x 3"/2¼"

4.5 Mechanical continued

4.5.1. Mechanical Equipment continued

M503 Clinker Crusher

5ft. dia x 8 ft. long wet grinding overflow ball mill complete with drum feeder and discharge housing Driven through a triple reduction gearbox by 100 HP electric motor.

M601 Primary Air Dryer

Automatic changeover two vessel adsorption type dryer.

Outlet dew point less than 30^{0}F at 100 psig. Steam heated for regeneration.

M602 Emergency Diesel Alternator

A 300 KW 440 Volt Alternator set driven by a 450 HP diesel engine.

M603 Turbo Alternator

A 6.6 KV 5.4 MW Alternator set driven by a back pressure steam turbine exhausting at 15 psig.

4.5.2 Materials Handling Equipment

C101	Raw Ore Vibratory Feeder	1 off

Vibratory feeder with troughed bottom and replaceable liners. Unit underslung from base of road hopper.

Capacity 60 ton/hour

Electromagnetic drive - 1 H.P.

C102	Raw Ore Elevator	1 off

Elevates ore from road hopper to storage bin. Chain and bucket type. Shaft centres 90'0"

Capacity 60 ton/hour

C103	Raw Ore Belt Conveyor	1 off

Conveyors are from storage bin to elevator C104.

Length 40'0"

C104	Raw Ore Elevator	1 off

Elevates ore from conveyor C103 to surge bin.

Chain and bucket type. Shaft centres 70'0"

Capacity 60 ton/hour

C105	Weigh Belt	1 off

Weighs raw ore from surge bin V103 to furnace.

Variable speed, manual control.

Integrates weight of ore feed.

Capacity 30-40 tons/hour.

4.5.2 Materials Handling Equipment continued

C106 Raw Ore Belt Conveyor 1 off

Conveys ore from weigh belt C105 to furnace.
Length 10'0"
Capacity 40 ton/hour.

C107 Granulated Slag Vibrator Feeder 1 off

Similar to C101.

C108 Granulated Slag Elevator 1 off

Elevates slag from road hopper to storage bin.
Chain and bucket type.
Shaft centres 90'0"
Capacity 60 ton/hour.

C109 Granulated Slag Belt Conveyor 1 off

Conveys slag from storage bin to Elevator C110.
Length 30'0"
Capacity 30 ton/hour.

C110 Granulated Slag Elevator 1 off

Elevates slag from conveyor C109 to charge hopper. Chain and bucket type.
Shaft centres 90'0"
Capacity 60 ton/hour.

C111 Weigh Belt 1 off

Batch weighs slag from feed hopper V106.
Automatic batch weighing under control of mobile charge skip. Meters 1 ton batches.
Capacity 30 ton/hour.

4.5.2. Materials Handling Equipment continued

C112 Melting Furnace - Electric Hoist 1 off

Capacity 1 ton

C113 Melting Furnace - Charge Bucket Hoist 1 off

3 ton electric hoist running on circular monorail. Manual control.

C114 Melting Furnace - Tap Hole Gun Hoist 1 off

Capacity 1 ton
For positioning tap hole gun to plug tap hole.

C201 Spent Slag Crane 1 off

20 ft. Span. 7 ton capacity EOT Crane
Hoist 20 FPM Long Travel 120 FPM Cross Travel 4 FPM.
Total Lift 34 ft.
Complete with control cabin, and 2 cubic yard double rope grab.

C301 Fume Outlet Duct Screw Conveyor 1 off

Collects from furnace outlet duct scraper conveyor. Mild steel toughts, Helicord or sectional flights. Flights welded to shaft.
Geared motors or standard motors and gearbox.
Chain and sprocket drive.
Length - 32'0"
Capacity 1 ton/hour

4.5.2. Materials Handling Equipment continued

C302.	Recuperator Hopper Screw Conveyors	2 off

Collects deposited fume in recuperator hoppers.
Description as C301.
Length - 30'0"
Capacity 10 tons/hour.

C303	Collecting Screw Conveyor	1 off

Collects feed from C301 and C302.
Description as C301.
Length 40'0"
Capacity 10 tons/hour.

C304	Gas Cooler Hopper Screws	8 off

Collects fume deposited in cooler hoppers.
Description as C301
Length 55'0"
Capacity 10 tons/hour.

C305	Collecting Screw Conveyors	2 off

Collects fume from C303 and C304
Description as C301
Length 65'0"
Capacity 10 tons/hour.

C306	Collecting Screw Conveyors	1 off

Collects fume from C305
Description as C301
Length 60'0"
Capacity 10 tons/hour

4.5.2. Materials Handling Equipment continued

C307 Baghouse hopper discharge screws 8 off

Mounted under baghouse trough hoppers and complete with rotary valve discharge.

C308 Baghouse collecting screw conveyors 2 off

Collects feed from screws C307 and discharges to C309

C309 Collecting Screw Conveyor 1 off

Collects feed from C308 and discharges to C310

C310 Collecting Screw Conveyor 1 off

Collects from C306 and C309
Description as C301
Length 60'0"
Capacity 30 tons/hour.

C311 Rotary Valves 11 off

To prevent the ingress of air at the discharge of screws C301, C302, C304 and C307

C401 Raw Coal Elevator 1 off

Elevates coal from road hopper to storage bin
Shaft centres 100'0"
Capacity 60 tons/hour.

C402 Weigh Belt 1 off

Weighs raw coal from storage V402. Variable speed manual control. Integrate weight of coal feed to mill. Capacity 5-10 tons/hour

4.5.2. Materials Handling Equipment continued

C403	Raw Coal Elevator	1 off

Elevates coal from weighbelt C402
Shaft centres 40'0"
Capacity 10 tons/hour

C404	Raw Coal Vibratory Feeder	1 off

Similar to C101

C405	Table Feeder	1 off

With Coal Grinding Plant

C406	Transfer Screw Conveyor	1 off

For returning baghouse direct to bin.
Length 30'0"

C407	Coal Dust Screw Conveyor	1 off

Mounted under Coal Dust Collector M402
Length 30'0"

C501	Raw Fume Screw Conveyor for F.E. Loader Feed	1 off

Screw mounted under hopper V503
Description as C301
Length 10'0"
Capacity 30 tons/hour

C502	Elevator to Raw Fume Bins	1 off

Chain and bucket type.
Shaft centres 70'0"
Capacity 30 tons/hour

4.5.2. Materials Handling Equipment continued

C503	Feed Screw Conveyor to Raw Fume Bins	1 off

Description as C301
Length 50'0"
Capacity 30 tons/year

C504	Screw Conveyor to Raw Fume Storage	1 off

Description as C301
Length 65'0"
Capacity 30 tons/hour.

C505	Bin Activators	2 off

To prevent arching of fume in bins V501.
Discharge cone with vibrating baffle and gyrator motor assembly.
Motor special to activator and part of that supply 2 H.P.

C506	Variable Feed Screw	1 off

Feeding fume of a controlled rate from raw fume bins.
Controlled by weigh belt signal.
Length 30'0"
Capacity 8-10 tons/hour.

C507	Transfer screw conveyor	1 off

Feeds raw fume from C506 to weigh belt C508
Length 15'0"
Capacity 10 tons/hour.

4.5.2. Materials Handling Equipment contined

C508 Weigh belt 1 off

Weigher controls feed from storage bins V501 through variable speed screw feeder C506. Enclosed unit, indicator - Summater - Controller. Capacity 8-10 tons/hour

C509 Kiln Feed Elevator 1 off

Elevates raw fume and pulverised coal to the rotary kiln feed screw.
Shaft centres 50'0''
Capacity 12 tons/hour

C510 Transfer screw conveyor 1 off

Feeds from elevator C509 to kiln feed screw.
Length 35'0''
Capacity 12 tons/hour

C511 Rotary Kiln Feed Screw 1 off

Included with kiln

C512 Weigh Belt 1 off

Weigher controls feed from storage bin V502.
Feed rate controlled by signal from C508.
Capacity - oil tons/hour.

C513 Weigh Belt 1 off

Weigher controls feed from storage bin V505.
Capacity 0.15 tons/hour.

4.5.2 Materials Handling Equipment contined

C514 Roasted Oxide Screw Conveyor 1 off

Conveys roasted product from crusher to elevator C515.
Length 20'0"
Capacity 10 tons/hour.

C515 Roasted Oxide Elevator 1 off

Elevates roasted product to storage bin V509
Shaft centres 60'0"
Capacity 10 tons/hour

C516 Pulverised Coal Hoist 1 off

To lift coal skips over bin. Electric hoist.
Pendant operated.
Capacity 1 ton

C517 Lime Hoist 1 off

To lift bags of lime to lime bin. Electric hoist.
Pendant operated.
Capacity 1 ton.

4.5.3 Pumps

P201 Bath Cooling Water Pump 1 + 1 off

Included in item E201

P203 B.F.W. Feed Pump 1 + 1 off

Include in item E201

P204 Bath Cooling Water Makeup Pump 1 + 1 off

Included in item E201

P206 Granulating Water Spray Pump 2 + 1 off

Horizontal centrifugal pump, capacity 2600 IGPM, head 30 PSIG, directly connected to 100 HP motor on unit baseplate

P207 Granulating Water Return Pump 2 + 1 off

Horizontal centrifugal pump, capacity 950 IGPM, head 45 PSIG, directly connected to 40 HP motor.

P208 H.P. Granulating Water Pump 1 + 1 off

Horizontal centrifugal pump
Duty 2500 IGPM at 80 PSIG
Electric Motor Drive 180 HP at duty point

P209 B.F.W. Makeup Pump 1 + 1 off

Included in item E201

4.5.3. Pumps continued

P210 L.P. Boiler Dosing Pump 1 off

Reciprocating pump to meter dosing chemicals to boiler feed water. Electric motor drive 1 H.P.

P211 H.P. Boiler Dosing Pump 1 off

Reciprocating pump to meter dosing chemicals to boiler feedwater. Electric motor drive 1 HP

P501 Fuel Oil Pump 1 + 1 off

Included in item M501

P502 Scrubber Feed Pump 1 + 1 off

Horizontal single stage centrifugal pump
Capacity 200 IGPM at 70 psig.
Electric motor drive - duty 15.3 HP.

P503 Residue Pump 1 + 1 off

Horizontal single stage centrifugal slurry pump rubber lined casing S.G. iron impeller.
Capacity 70 IGPM at 20 psig.
Electric motor drive - duty 2.2 HP

P504 Thickener Feed Pump 1 + 1 off

Horizontal single stage centrifugal pump.
Capacity 200 IGPM at 10 psig.
Electric motor drive - duty 2.2 HP

4.5.3. Pumps continued

P601 Cooling Water Pump 1 + 1 off

Horizontal single stage centrifugal pump
Capacity 1000 IGPM at 100 ft. head.
Electric motor drive - duty 40 H.P.

P602 Clinker Cooling Water Pump 1 + 1 off

Horizontal single stage centrifugal pump
Capacity 100 IGPM at 150 ft. head
Electric motor drive - duty 8.5 HP

4.5.4. Compressors & Blowers

B201 Tertiary Air Fan — 1 off

Centrifugal fan with inlet damper control. Capacity 18000 NCFM against a head of 7" W.G. Direct connection with unit baseplate, 40 H.P. motor.

B202 Taphole Fume Fan — 1 off

Tube axial fan, capacity 7000 ACFM at 250°F, outlet head 1" W.G. Belt driven fan with 3 H.P. motor

B203 Granulation Slag Vapour Fan — 1 off

Centrifugal fan, single inlet, capacity 21,000 ACFM, head 0.8" W.G. Belt driven fan with 7½ H.P. motor

B301 Process Gas Fan — 1 off

Centrifugal fan, capacity 80,000/60,000 NCFM, head 12" W.G., inlet temperature 200°C. Direct driven by 500/250 H.P., 805/605 RPM variable speed motor.

B302 Stack Gas Fan — 1 off

Centrifugal fan, capacity (nominal) 100,000 NCFM, head 8½" W.G. Direct driven by 500/150 H.P., 640/380 RPM variable speed motor.

4.5.4. Compressors & Blowers continued

B303 Tempering Air Fan 1 off

Centrifugal fan, capacity 10,000 CFM (maximum), head 2" W.G. Fan fitted with variable inlet vanes to control air flow. Direct drive from 7½ H.P. motor.

B304 Soot Blowing Air Compressors 4 + 1 off

Reciprocating, 2 stage, double acting, 2 cylinder compressors. Capacity 679 CFM each at 275 PSIG. Each driven by 220 H.P. motor and complete with unit intercoolers and aftercoolers.

B305 Secondary Air Blower 1 off

Single stage turbo-blower, Demag SEZ 512, capacity 21,500 NCFM at 12 PSIG. Speed 1500 RPM Steam turbine (M302) drive through reduction gearbox, steam supply from boiler E201.

B306 Emergency Air Blower 1 off

Roots type blower, capacity 1000 NCFM, 12 PSIG delivery. Belt driven from 100 HP motor.

B401 Coal Mill Circulation Fan 1 off

Centrifugal Fans, capacity 12000 NCFM, head 20" W.G., direct driven by 120 H.P. motor.

B402 Coal Dust Collecting Fan 1 off

Centrifugal fan, capacity 12000 CFM, head 7" W.G., belt driven from 30 HP motor.

4.5.4. Compressors & Blowers continued

B403 Coal Drying Air Fan 1 off

Centrifugal limit load fan, capacity (nominal) 7000 NCFM having throttled discharge down to 2000 NCFM. Head 3" W.G. Directly connected to 20 H.P. motor

B501 Kiln I.D. Fan 1 off

Centrifugal fan, capacity 19000 ACFM, head across fan 53" W.G. Direct driven from 250 HP motor.

B502 Kiln Combustion Air Fan 1 off

Centrifugal fan, capacity 2000 SCFM, head 8" W.G. Direct driven from 5 HP motor. Fan is louvre damper-remote manual control.

B503 Kiln Nose Ring Cooling Fan 1 off

Centrifugal fan. Capacity 2500 SCFM, head 2" W.G. Direct driven from 3 HP motor.

B601 Air Compressor 1 off

Spiral rotor compressor (screw compressor), capacity 1235 free CFM at 125 PSIG. Direct driven from 300 HP (approx.) motor and complete with unit baseplate and aftercooler and silencers.

418/3

4.6 Piping

4.6.1. Carbon Steel

Carbon steel piping and materials are in accordance with ASTM B31.1 Flanges are to BS 10.

4.6.2. Hot Gas Ducts

Mild steel fabricated ducts brick lined to suit the working temperature.

4.6.3. Tuyeres

2¼" Internal diameter cast stainless steel H.H. material.

4.6.4. Launders

Cast iron launders open V shape 18" deep x 24" wide.

4.7 ELECTRICAL EQUIPMENT

4.7.1 Scope

This specification covers the principal items of electrical equipment required for the operation of the plant. A single line diagram is attached - see Drg. No. 418-3-6100-1.

4.7.2 Extent of Supply

Battery limits are taken as the incoming terminals on the 33 KV and 6.6 KV Switchgear respectively.

4.7.3 Standards

- Equipment manufactured in Australia conforms to Australian standards, rules, regulations and codes of practice.

- Equipment manufactured in countries other than Australia conforms to the national standards of the country of manufacture, although preference is given to equipment designed and manufactured in accordance with the recommendations of the International Electro-technical Commission (I.E.C.) which now has world-wide acceptance.

4.7.4 Electrical System Stability

For the purpose of this study it is assumed that the Electricity Supplies are stable and free from voltage dips or switching surges in excess of ±5% of the declared voltage, and the frequency variation does not exceed 1 cycle per second.

4.7.5 Scheme of Electrical Distribution

The electrical system comprises two separate voltage sources namely, 33 KV for the slag melting furnace and 6.6 KV for the remainder of the slag fuming plant. The 33 KV system is

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.5 Scheme of Electrical Distribution continued

via a radial feeder and is used solely for the slag melting furnace. The 6.6 KV system involves power generation and transformation. Final plant sub-distribution is via a 440-250 volt system. A 5.4 M.Watt turbo alternator is connected to the 6.6 KV bus and supplies power in excess of that required by the fuming plant, thus some power (approx. 2.5 MW) is fed back into the clients grid (preferably via a radial feeder to minimise disturbance to existing protection schemes). The 6.6 KV feeder is rated to provide 100% standby supply in the event of shutdown of the turbo-alternator set.

The 440/250 volt system comprises a main switchboard with radial distribution feeders to the respective motor control centres and the larger 415 volt motors.

Motor control centres used are the separate multi-motor, fully withdrawable cubicle type, include a lighting and power distribution board and where required, a relay panel section for sequence interlocking and control.

The components of the scheme as described above are briefly listed below.

- One 33 KV radial feeder rated at 9 MVA for supply to the electric furnace.

- One 6.6 KV radial feeder rated at 7 MVA for supply to the main substation where it is transformed from 6.6 KV to 440-250 volt thus providing a sub-distribution voltage for the following main plant sections:

  Coal Plant
  Furnace area
  Product treatment
  Gas cooler, baghouse areas.

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.5 Scheme of Electrical Distribution continued

The emergency supply is obtained from a 300 KW 440 volt Diesel alternator and is distrubted to the various distribution boards in the plant.

4.7.6 Distribution Transformers

Distribution transformers are of the oil immersed, naturally cooled, double wound delta/star connected, outdoor type. Tappings for ±2½% and ±5% are provided for supply voltage variation and operated by an off-load tapchange switch.

Each transformer is provided with a conservator tank, silica-gel breather, a Buchholz type gas and oil relay, and a dial type thermometer.

Terminations are cable boxes (and disconnect chambers) on 6.6 KV and busbar connections on 440V.

4.7.7 33 KV Switchgear

1-1 panel switchboard 1500 MVA rating is provided, for switching and protection of the slag melting furnace transformer. The switchboard is of the indoor withdrawable type and contains as a minimum;English Electric CDG31 or similar O/C and E/F relays, a set of protection and metering, voltage and current transformers. Note that 33 KV inter-trips, pilot protection which may be required to tie-in with the existing 33KV system have not been included at this stage.

4.7.8 Slag Melting Furnace Transformer and Equipment

The furnace transformer is 7MW 33 KV/200-100V, it is oil immersed with forced oil circulation and water cooled for indoor erection. The primary side is connected in delta and the

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.8 Slag Melting Furnace Transformer and Equipment continued

secondary in open delta configuration. The transformer is equipped with an on-load tap changer.

Furnace control equipment is contained in a single control desk and includes meters, current and voltage transformers, tap changing pushbuttons, furnace protection equipment and so on.

A separate panel is provided for control of the electrode slipping gear.

Connection from the secondary of the transformer is via water cooled copper busbars and thence high temperature flexible cables.

4.7.9. 6.6 KV Incoming Feeder Circuit Breaker

This circuit breaker is an 800 amp 250 M.V.A. withdrawable truck type O.C.B. and is equipped with:-

- IDMT relay, 3 elements overcurrent and high set instantaneous trip element.

- Ammeter with phase selection switch.

- Voltmeter with phase selection switch.

4.7.10 Distribution Transformer Feeder Circuit Breakers

These circuit breakers are 400 amp 250 M.V.A. O.C.B.'s as per clause 7.9 above and are equipped with:-

- IDMT relay, 2 overcurrent and 1 earth fault element (plus instantaneous high set for transformers not fitted with restricted earth fault protection).

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.10 Distribution Transformer Feeder Circuit Breakers continued

- Intertrip relay for Transformer Buehaltz Relay
- Ammeter with phase selection switch
- Transformer overtemperature trip.
- Kilowatt-hour meter.

4.7.11 Unit Transformers (used for motors over 500 H.P.)

Protection for unit transformers for 500 HP motors are high voltage H.R.C. fuse-switch units (fuses are of the stiker-pin type).

4.7.12 Induction Motor Feeders Protection

These are protected by 600 amp - 31 M.V.A. draw out type air circuit breakers and are equipped with the following:-

- Thermal overcurrent and earth fault relay.
- Under voltage relay with time delay
- Ammeter with phase selection switch.
- Kilowatt-hour meter
- Local/remote change-over switch.

4.7.13 440 Volt Motor Control Centres

The 440 volt motor control centres are grouped to form composite switchboards. Incoming supply is connected to a manually operated air-break circuit breaker controlling the incoming supply to a motor starterboard.

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.13 440 Volt Motor Control Centres continued

Protection and instrumentation is arranged as follows:-

4.7.13.1 Incoming Feeders (2000 Amp O.C.B.'s)

- IDMT overcurrent relay
- Voltmeter with phase selection switch
- Ammeter with phase selection switch.

4.7.13.2 Each Motor Starter will incorporate:

- A load breaking isolator
- HRC fuse protection
- Contactor starter
- Thermal overload device
- Remote starting and stopping by START/STOP lock-off push buttons located in vicinity of the motor.
- Motors above 10 h.p. have an ammeter.
- Running and stopped lamps

4.7.13.3 Feeders to Sub-distribution Fuse Boards

Fuse switches or moulded case circuit breakers have back up HRC protection where necessary.

4.7.14 Motors

In general, motors above 300 HP are supplied from the 6.6 KV system with unit transformers. Except for the special applications noted on the single line diagram all motors 300 H.P. and below are squirrel cage, totally enclosed, fan cooled and weatherproof when located out-of-doors.

They have Class "B" insulation and are suitable for direct-on-line starting.

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.15 Plant Lighting Scheme

The lighting scheme includes for all the lighting fittings, switches and distribution fuse boards required to give a suitable level of illumination both inside and outside buildings in the plant area.

Roadway lighting is included.

An adequate number of appropriate industrial and commercial lighting fittings are provided to give the minimum illumination levels as recommended by the I.E.S. of Great Britain and the Australian Code for artificial lighting of Buildings.

Each area of plant has a proportion of the calculated number of lighting fittings connected to the emergency supply by a changeover contactor in the event of failure of the mains supply.

4.7.16 Cables

- 33 KV cables are PILC and S and PVC covered(single core)
- 6.6 KV cables are PILC SWA and PVC covered.(single & multi-core)
- PVC insulated and PVC covered cables with copper conductors are used for working voltages up to 440 volts.

Motors are earthed by a fourth core in the cable.

For the purpose of this proposal the cables are sized using ratings proposed by the Standards Association of Australia Wiring Rules.

The minimum size of 440 volts power cables is 3/.036 and for lighting 3/.029.

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.16 Cables continued

Cables are sized to ensure that voltage drop under normal full load does not exceed 5%.

Cables having aluminium cores may be used instead of copper if these are found to be economically and technically justified.

4.7.17 Cable Routing and Installation

The main cable routes follow pipebridges or other suitable structures, but where this is not feasible, they are laid in ducts or direct in the ground.

4.7.18 Lightning Protection

Lightning protection of the main furnace-boiler structure is included.

4.7.19 Welding Socket Outlets

440 volt 60 amp triple pole switched socket outlets are provided for welding equipment.

4.7.20 Lighting and Small Power Outlets

Low Voltage single phase 2 pin and earth switched socket outlets are provided in the control rooms, switchrooms, and at key points in the plant area for portable lamps and small power tools.

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.21 Communication Systems

A communication system is included to enable two way communication between any outstation and the control room. The outstations are located at various control points within the plant.

The equipment included comprises:-

- A desk mounting control console fitted with an audible warning device, selection switch for each outstation, and a speaker unit.
- A table mounting hand microphone.
- Combined speaker microphone units having a calling pushbutton and speak pushbutton, for use at the outstations.

4.7.22 Fire Alarm System

20 glass covered pushbuttons are positioned at key points. These give an audible and visible alarm in the control room and also at the position where the fire appliances are stored.

The fire alarm electrical system is supplied from a 110 volt d.c. battery and trickle charger so that it is independent of both the mains and emergency supplies.

4.7.23 Turbo-alternator

One only 6.6 KV 5.4 MW back-pressure turbo alternator set (see mechanical section for details). The unit is complete with turbo-alternator control boards and recording panels which contain the following equipment.

4.7. ELECTRICAL EQUIPMENT CONTINUED

4.7.23 Turbo-alternator continued

- Turbo alternator D.C. supply

- Turbo alternator Standard heating

- Turbo alternator Governor motor

- Turbo alternator Measurement

- Turbo alternator Synchronizing

- Turbo alternator Annunciation

- Turbo alternator Voltage Regulation and De-excitation

- Turbo alternator Protection

- Alternator Circuit Breaker is an 800 amp 250 M.V.A. O.C.B. as described in Clause 7.9 above.

4.8 Instrumentation and Control

4.8.1. Scope

The instruments on flowsheets 418-3-0310-4, 5, 6, 7 and 8 show the measurement and control instruments required for this plant with the exception of items which are part of "package" units to be supplied by specialist equipment manufacturers.

A control panel housing instruments for the raw ore and granulated slag feed, the gas cooling and slag granulation together with the steam system is situated in a central control room.

The product treatment instruments are grouped in a separate control panel mounted in a control room adjacent to the rotary kiln.

4.8.2 Type of Instrumentation

In general all controllers, control valves and transmitters are of the pneumatic operating type.

The alarm systems fitted to the control panels are low voltage D.C. systems isolated from shutdown circuitry. The shutdown circuits are operated from contacts separate from those used for the alarm and generally operate threeway solenoid valves installed in the control valves input signal lines.

4.8.3. Installation

The installation of all instrumentation and ancilliary equipment is based on D.A.P.L. standard procedures.

It includes all instruments supports, brackets, tubing wiring and junction boxes required on the project together with precommissioning calibration checking of instruments.

4.8 Instrumentation and Control continued

4.8.4 Standards

The principles used in design and application of instruments are as shown in the following standards.

- Instrument Society of America Standards and Recommended Practices.

- A.S.M.E. Power Test Codes

- B.S. 1042 1964 Flow Measurement

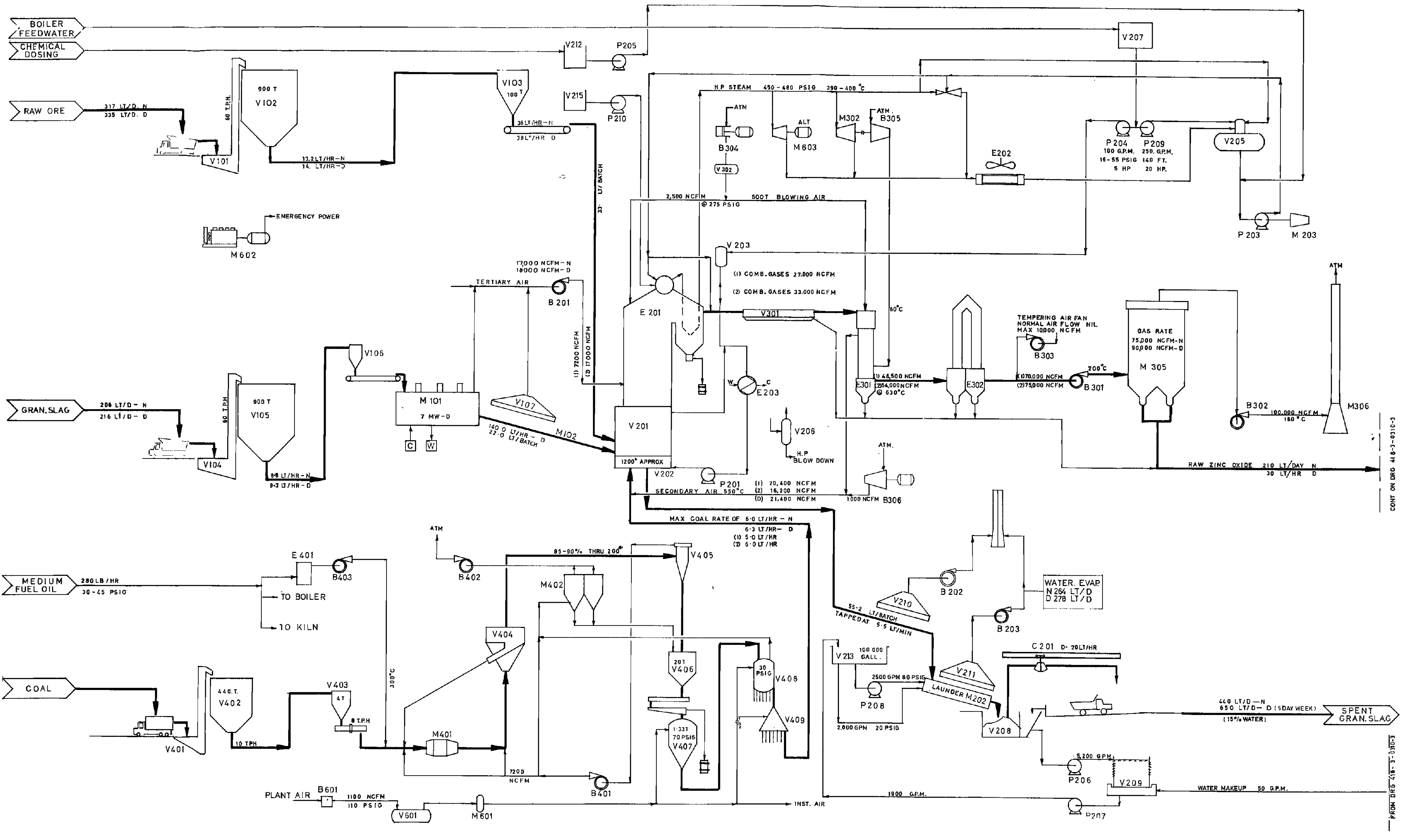
- A.P.I. R.P. 500 and R.P. 550 (with reservations where inapplicable to the process).

SECTION 5

DRAWINGS.

Contents.

418/3



NOTES
1 - CHARGING
2 - FUMING /TAPPING
N - NORMAL
D - DESIGN

APPR'D.	REV.	DATE	DESCRIPTION	BY
REVISION				

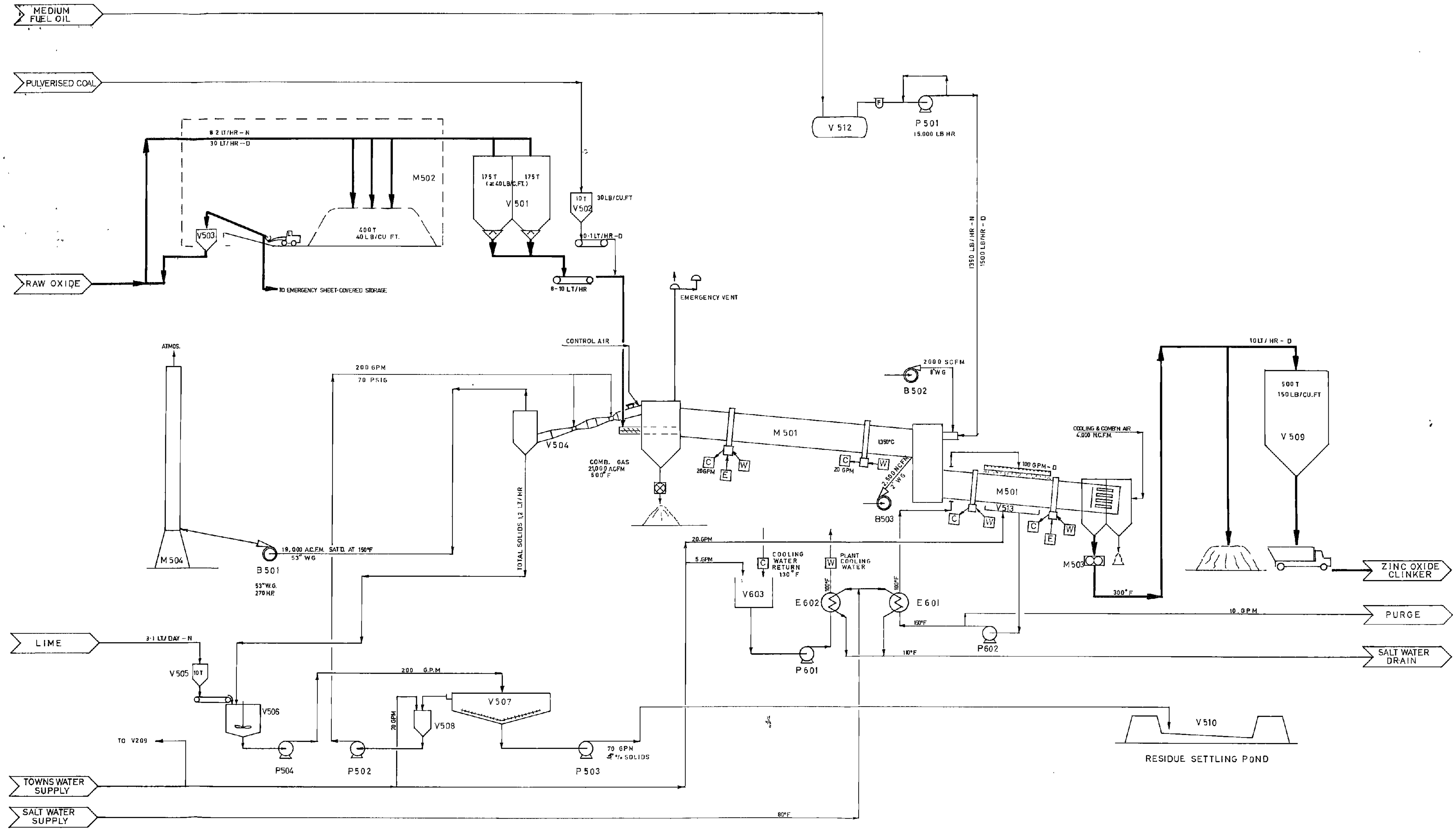
DRAWN E. R 21-1-72
CHECKED
APPR'D. RMB 23/2-72.
APPR'D CONSTRUCT
SCALE
REF. DRG. No. 418-3-0310-3

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client ELECTROLYTIC ZINC CO. OF A/ASIA LTD.

TITLE: SLAG FUMING PLANT - PORT PIRIE
PROCESS FLOW SHEET - SHEET 1

DRG. No. 418-3-0310-2



NOTES:
1 - CHARGING
2 - FUMING/TAPPING
N - NORMAL
D - DESIGN

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APPR'D.	RCMS	23/2/72
APPR'D. CONSTRUCT.		
SCALE		
REF. DRG. No. 418-3-0310-2		

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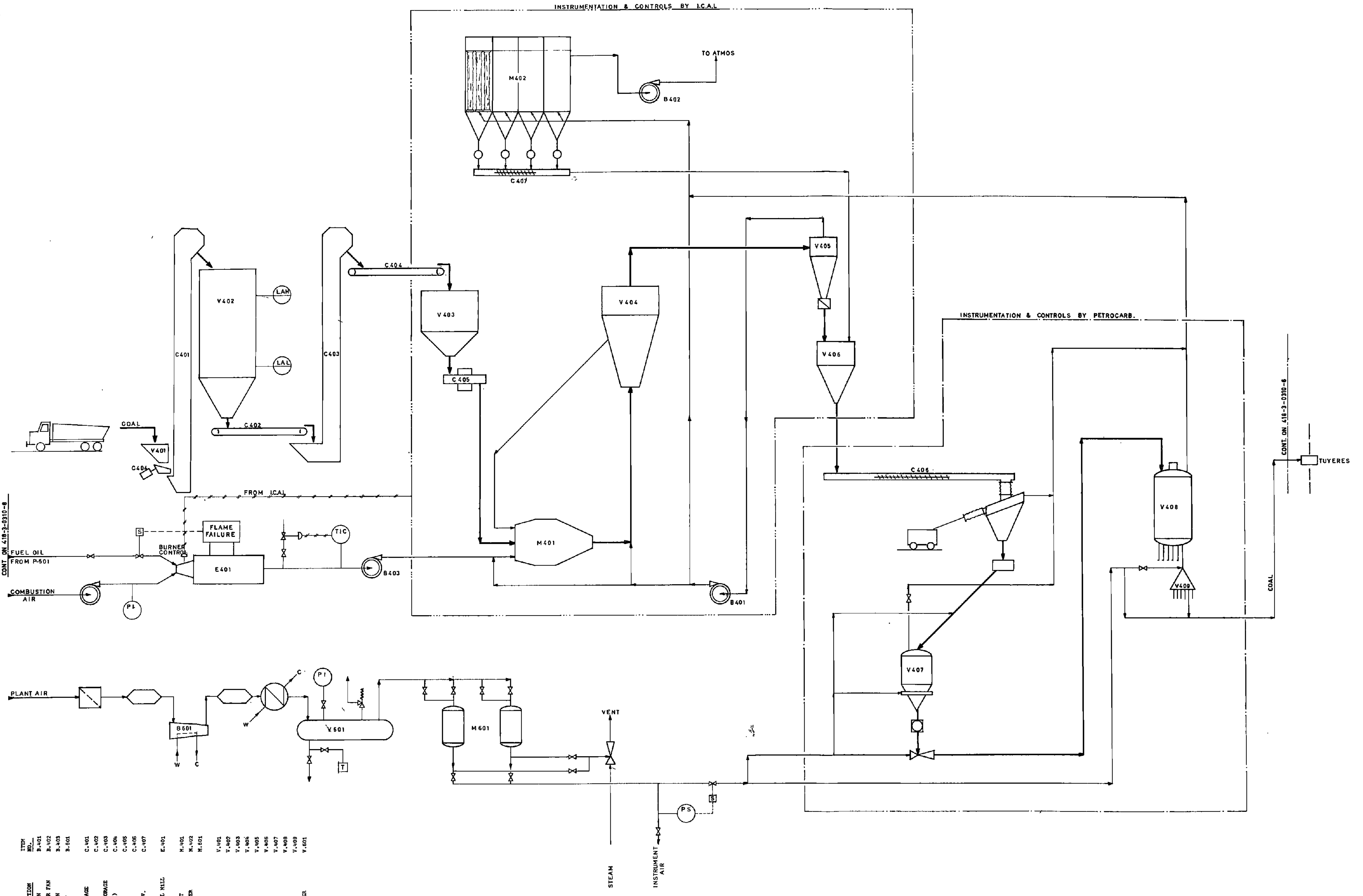
Client ELECTROLYTIC ZINC CO OF A/ASIA LTD

TITLE: SLAG FUMING PLANT - PORT PIRIE
PROCESS FLOW SHEET - SHEET 2

DRG.No. 418-3-0310-3



NO. OFF	DESCRIPTION	ITEM NO.
1	COAL MILL CIRN. FAN	B.401
1	COAL DUST COLLECTOR FAN	B.402
1	COAL DRYING AIR FAN	B.403
1	AIR COMPRESSOR	B.601
1	COAL ELEV. TO STORAGE	C.401
1	COAL WEIGH BELT	C.402
1	COAL ELEV. FROM STORAGE	C.403
1	COAL FEEDER (VIBR.)	C.404
1	TABLE FEEDER	C.405
1	PULV. COAL CONV.	C.406
1	DUST COLLECTOR CONV.	C.407
1	AIR HEATER FOR COAL MILL	E.401
1	COAL GRINDING PLANT	M.401
1	COAL MILL BAG FILTER	M.402
1	PRIMARY AIR DRYER	M.601
1	COAL GROUND HOPPER	V.401
1	COAL STORAGE BIN	V.402
1	COAL FEED BIN	V.403
1	MILL SEPARATOR	V.404
1	MILL CYCLONE	V.405
1	FINE COAL BIN	V.406
1	FEED INJECTOR	V.407
1	PRIMARY INJECTOR	V.408
3	SECONDARY INJECTOR	V.409
1	PRIMARY AIR RECEIVER	V.601

APPR'D.	REV.	DATE	DESCRIPTION	BY
REVISION				

DRAWN C.Naylor 23-2-1972
CHECKED
APPR'D. RFMKE 23/2-72
APPR'D. CONSTRUCT.
SCALE None
REF. DRG. No.

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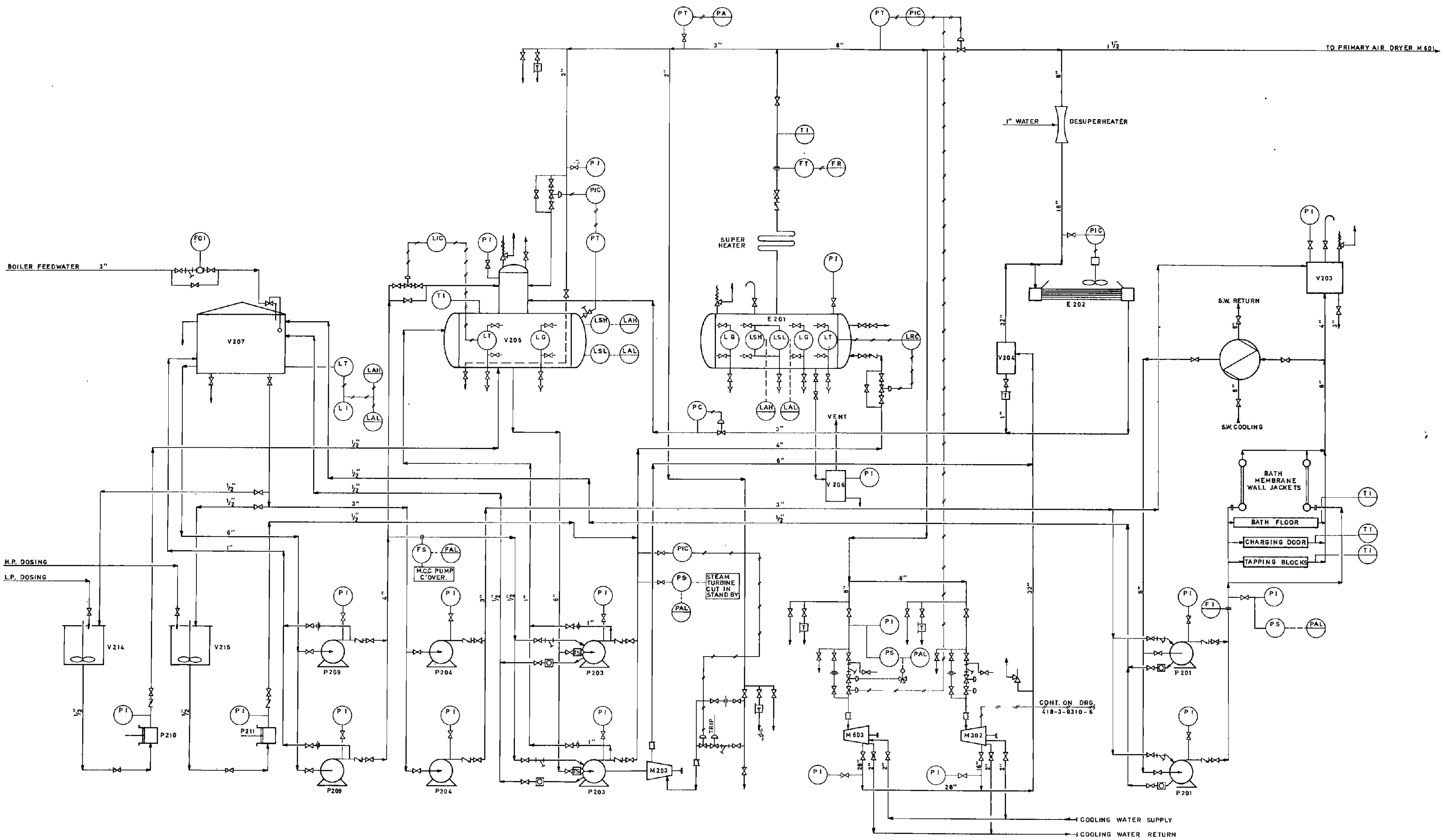
Client ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE: SLAG FUMING PLANT ~ PORT PIRIE
ENGINEERING FLOW SHEET — COAL SYSTEM

DRG.No. 418-3-0310-4



NO. OFF	DESCRIPTION	ITEM NO.
1	H.P. BOILER SYSTEM	E.201
1	CONDENSOR	E.202
1	BATH COOLING WATER EXCHANGER	E.203
1	BFW PUMP TURBINE	M.203
1	SEC. AIR BLOWER TURBINE	M.302
1	TURBO-ALTERNATOR	M.603
1+1	BATH COOLING WATER PUMP	P.201
1+1	BFW FEED PUMP	P.203
1+1	BATH COOLING WATER MU PUMP	P.204
1+1	BFW MU PUMP	P.209
1	L.P. BOILER DOSING PUMP	P.210
1	H.P. BOILER DOSING PUMP	P.211
1	EXPANSION DRUM (BATH COOLING SYSTEM)	V.203
1	CONDENSATE KO DRUM	V.204
1	DEAERATOR	V.205
1	BOILER BLOWDOWN VESSEL	V.206
1	TREATED WATER STORAGE TANK	V.207
1	L.P. DOSING TANK	V.214
1	H.P. DOSING TANK	V.215

APPR'D.	REV.	DATE	DESCRIPTION	BY
			REVISION	

DRAWN	C.Naylor	24-2-1972
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APPR'D. CONSTRUCT		
SCALE	None	
REF DRG No		

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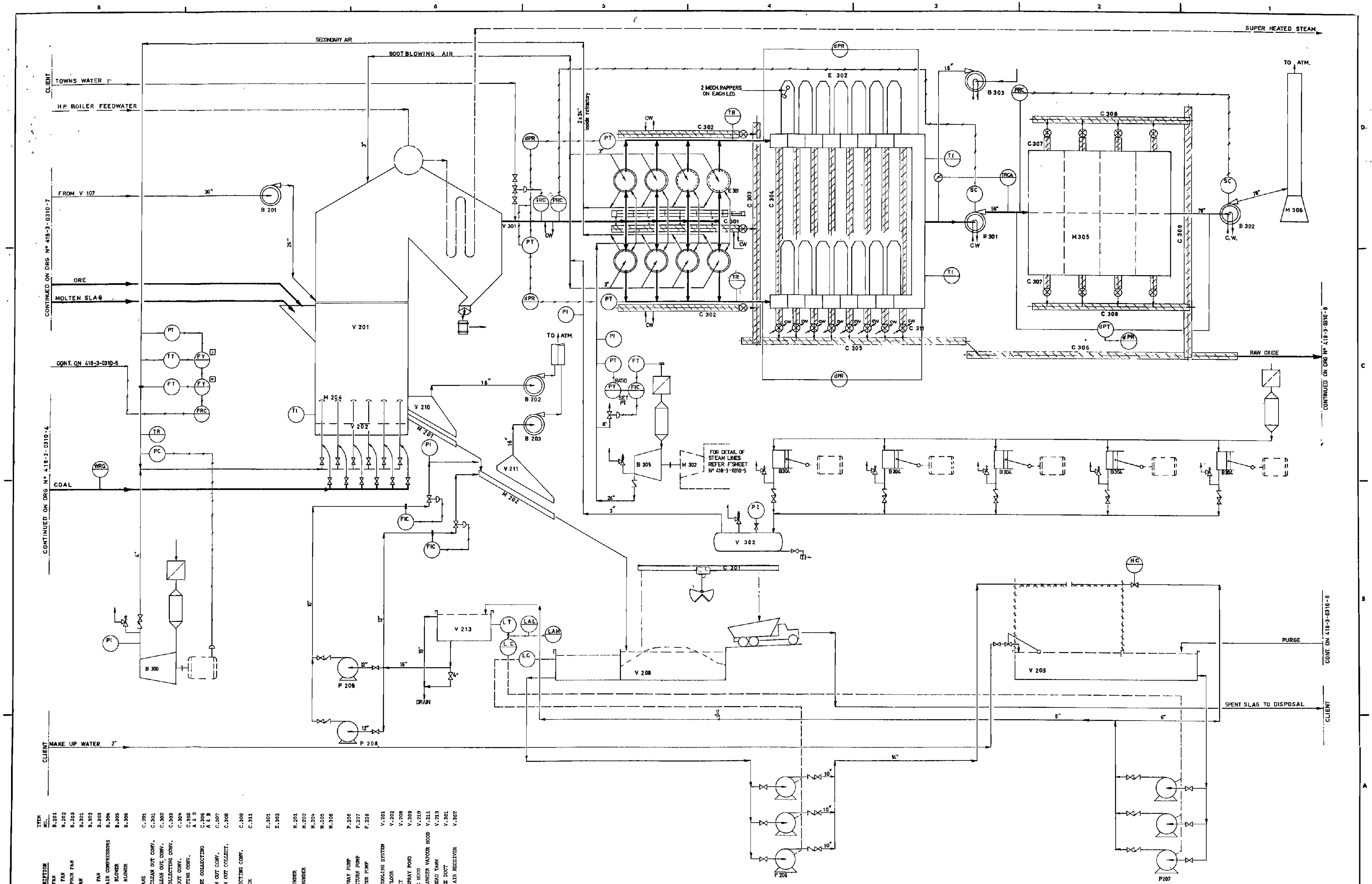
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client
ELECTROLYTIC ZINC CO. OF A'SIA. LTD.

TITLE: SLAG FUMING PLANT ~ PORT PIRIE
ENGINEERING FLOW SHEET — STEAM SYSTEM

DRG.No. 418-3-0310-5



NO. OFF	DESCRIPTION	ITEM NO.
1	TERTIARY AIR FAN	B.201
1	TAP HOLE FUME FAN	B.202
1	GRAN. SLAG VAPOUR FAN	B.203
1	PROCESS GAS FAN	B.301
1	STACK GAS FAN	B.302
1	TEMPERING AIR FAN	B.303
4+1	SOOT BLOWING AIR COMPRESSORS	B.304
1	SECONDARY AIR BLOWER	B.305
1	EMERGENCY AIR BLOWER	B.306
1	SPENT SLAG CRANE	C.201
1	FLUE CHAMBER CLEAN OUT CONV.	C.301
2	RECUPERATOR CLEAN OUT CONV.	C.302
1	RECUPERATOR COLLECTING CONV.	C.303
8	COOLER CLEAN OUT CONV.	C.304
2	COOLER COLLECTING CONV.	C.305 A & B
2	COOLER/BAGHOUSE COLLECTING CONV.	C.306 A & B
8	BAGHOUSE CLEAN OUT CONV.	C.307
2	BAGHOUSE CLEAN OUT COLLECT. CONV.	C.308
1	BAGHOUSE COLLECTING CONV.	C.309
19	ROTARY AIR LOCK	C.311
7+1	RECUPERATOR	E.301
1	AIR COOLER	E.302
1	SPENT SLAG LAUNDER	M.201
1	GRANULATING LAUNDER	M.202
36	TUYERES	M.204
1	BAGHOUSE	M.305
1	MAIN STACK	M.306
2+1	GRAN. WATER SPRAY PUMP	P.206
2+1	GRAN. WATER RETURN PUMP	P.207
1+1	H.P. GRAN. WATER PUMP	P.208
	FUMING BATH COOLING SYSTEM	V.201
	FUMING BATH FLOOR	V.202
1	SPENT SLAG PIT	V.208
1	GRAN. WATER SPRAY POND	V.209
1	TAP HOLE FUME HOOD	V.210
1	GRAN. SLAG LAUNDER VAPOUR HOOD	V.211
1	GRAN. WATER HEAD TANK	V.213
1	BOILER OFFTAKE DUCT	V.301
1	SOOT BLOWING AIR RECEIVER	V.302

APPR'D.	REV.	DATE	DESCRIPTION	BY
		REVISION		

DRAWN	A.M.	4-2-1972
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APPR'D.	Rlmr	25/2-72
APPR'D. CONSTRUCT.		
SCALE		

REF. DRG. No. 418-3-0310-7,8 / 4

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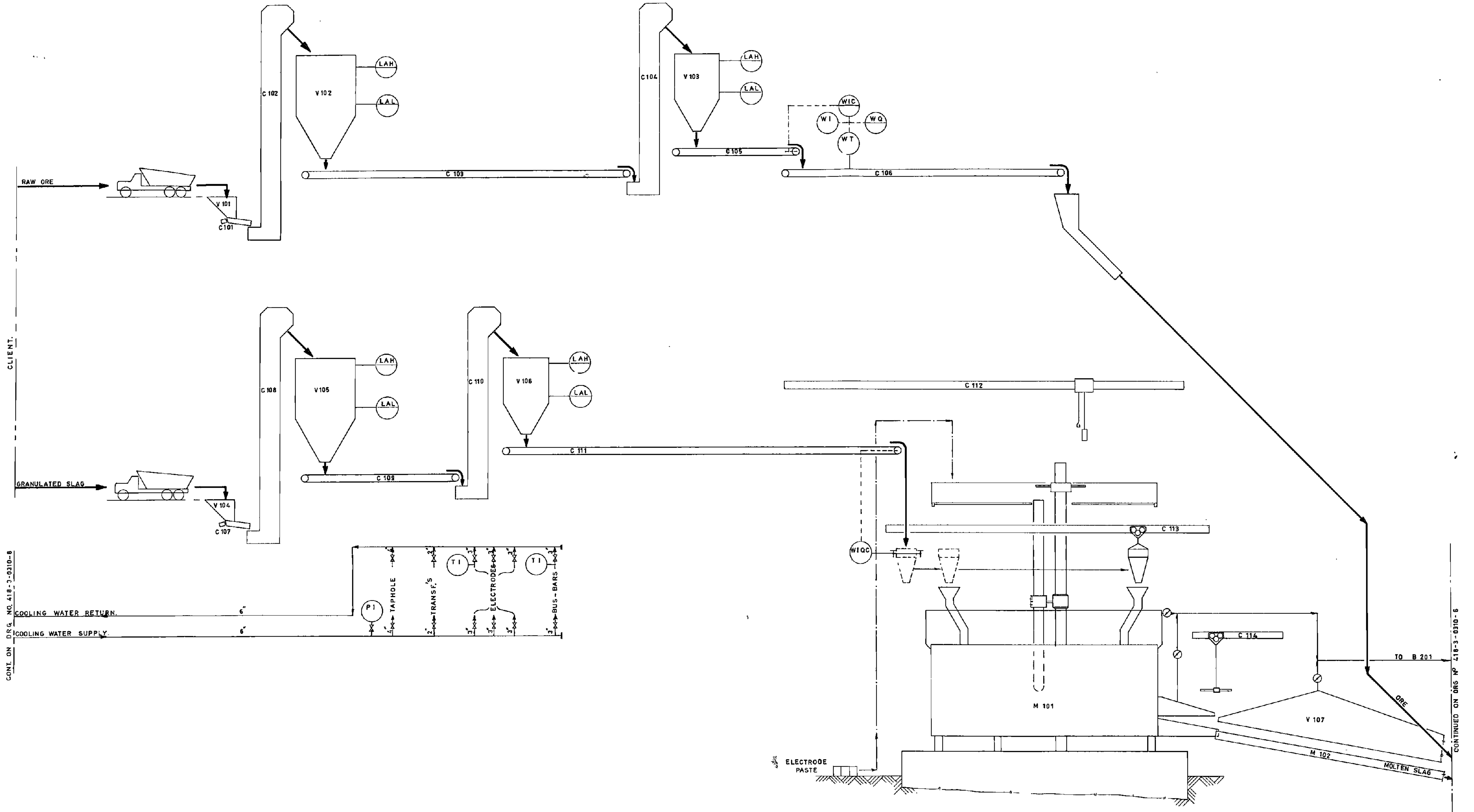
Client ELECTROLYTIC ZINC CO. OF A/ASIA LTD.

TITLE: SLAG FUMING PLANT PORT PIRIE
ENG. FLOW SHEET - GAS COOLING & SLAG GRANULATION

DRG.No. 418-3-0310-6



NO. OFF	DESCRIPTION	ITEM NO.
1	RAW ORE FEEDER (VIBR.)	C.101
1	RAW ORE ELEV. TO STORAGE	C.102
1	RAW ORE CONVEYOR	C.103
1	RAW ORE ELEV. FROM STORAGE	C.104
1	RAW ORE WEIGH BELT	C.105
1	RAW ORE CHARGE CONV.	C.106
1	GRAN. SLAG FEEDER (VIBR.)	C.107
1	GRAN. SLAG ELEV. TO STORAGE	C.108
1	GRAN. SLAG CONVEYOR	C.109
1	GRAN. SLAG ELEV. FROM STORAGE	C.110
1	GRAN. SLAG WEIGH BELT	C.111
1	MELTING FURN. - ELECTRODE HOIST	C.112
1	MELTING FURN. - CHARGING BUCKET HOIST	C.113
1	MELTING FURN. - TAP HOLE GUN HOIST	C.114
1	RAW ORE GROUND HOPPER	V.101
1	RAW ORE STORAGE BIN	V.102
1	RAW ORE FEED BIN	V.103
1	GRAN. SLAG GROUND HOPPER	V.104
1	GRAN. SLAG STORAGE BIN	V.105
1	GRAN. SLAG FEED BIN	V.106
1	FEED SLAG FUME HOOD	V.107
1	GRAN. SLAG MELTING FURNACE	M.101
1	FURNACE FEED LAUNDER	M.102

APP'D.	REV.	DATE	DESCRIPTION	BY
			REVISION	

DRAWN	A.M.	4-2-1972
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APP'D.	RbMB	23/2-72
APP'D. CONSTRUCT.		
SCALE		

REF. DRG. No. 418-3-0310-6

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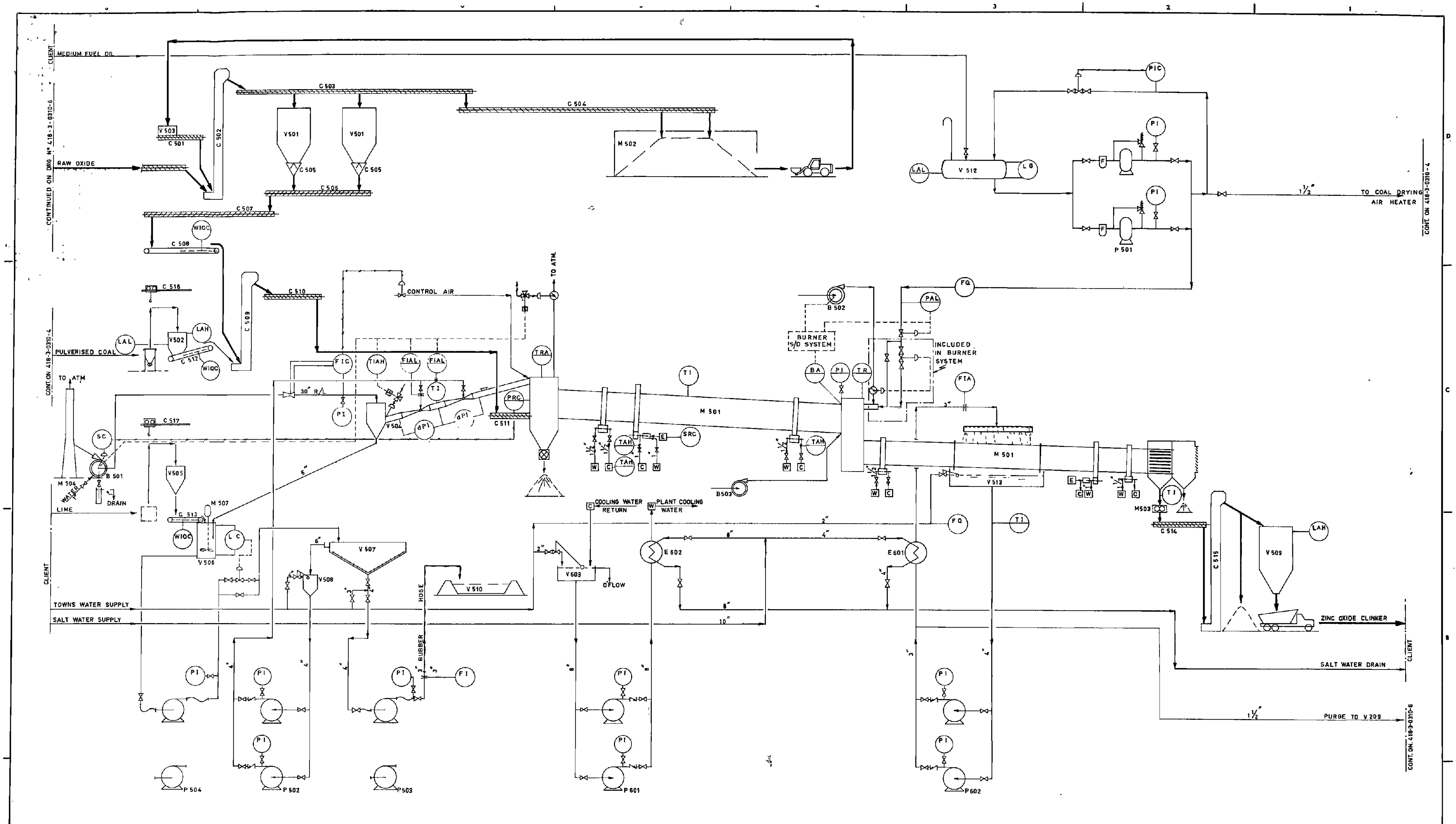
Client ELECTROLYTIC ZINC CO. OF A/ASIA LTD

TITLE: SLAG FUMING PLANT PORT PIRIE
ENG. FLOW SHEET - RAW ORE & GRAN. SLAG FEED

DRG. No. 418-3-0310-7



NO. OFF	DESCRIPTION	ITEM NO.
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1	KILN COMB. AIR FAN	B.502
1	KILN NOSE RING COOLING FAN	B.503
1	RAW FUME HOPPER DISCH. CONV.	C.501
1	ELEVATOR TO RAW FUME BINS	C.502
1	FEED CONV. TO RAW FUME BINS	C.503
1	FEED CONV. TO RAW FUME BUILDING	C.504
2	RAW FUME BIN DISCHARGER	C.505
1	OUTLET CONV. FROM RAW FUME BINS	C.506
1	RAW FUME DISCHARGE CONV.	C.507
1	RAW FUME WEIGH BELT	C.508
1	ELEVATOR TO KILN	C.509
1	CONVEYOR TO KILN	C.510
1	KILN FEED CONV.	C.511
1	KILN COAL FEED WEIGH BELT	C.512
1	LIME FEED WEIGH BELT	C.513
1	CRUSHER DISCHARGE CONV.	C.514
1	ELEV. TO ROAST OXIDE BIN	C.515
1	HOIST - COAL FEED	C.516
1	HOIST - LIME FEED	C.517
1	CLINKER COOLER EXCHANGER	E.601
1	PLANT COOLING WATER EXCHANGER	E.602
1	DELEADING KILN AND COOLER	M.501
1	RAW FUME STORAGE BUILDING	M.502
1	CLINKER CRUSHER	M.503
1	KILN STACK	M.504
1+1	FUEL OIL PUMP	P.501
1+1	SCRUBBER FEED PUMP	P.502
1+1	RESIDUE PUMP	P.503
1+1	THICKENER FEED PUMP	P.504
1+1	COOLING WATER PUMP	P.601
1+1	CLINKER COOLER WATER PUMP	P.602
2	RAW FUME BIN	V.501
1	COAL FEED BIN	V.502
1	RECLAIMED FUME BIN	V.503
1	VENTURI SCRUBBER	V.504
1	LIME FEED BIN	V.505
1	LIME TREATMENT TANK	V.506
1	RESIDUE THICKENER	V.507
1	SCRUBBING LIQUOR TANK	V.508
1	ROASTED FUME BIN	V.509
2	RESIDUE SETTLING POND	V.510
1	FUEL OIL DAY TANK	V.512
1	CLINKER COOLER COOLING WATER SUMP	V.513
1	COOLING WATER HEAD TANK	V.603

APP'D.	REV.	DATE	DESCRIPTION	BY

REVISION

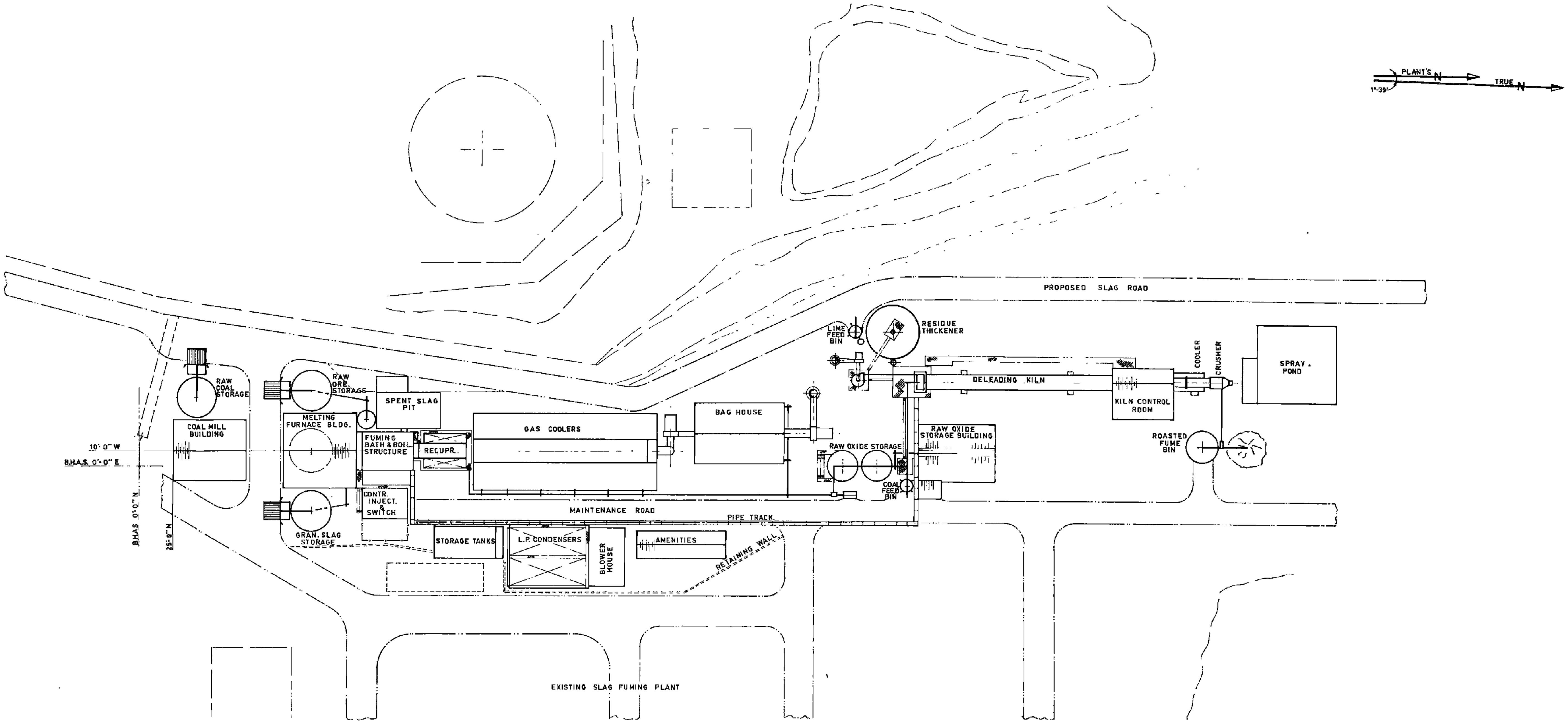
DRAWN A.M. 9-2-1972
CHECKED
APP'D. Ravis 23/2-72.
APP'D. CONSTRUCT.
SCALE
REF. DRG. No 418-3-0310-6

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client ELECTROLYTIC ZINC CO. OF A/ASIA LTD.

TITLE: SLAG FUMING PLANT PORT PIRIE
ENG. FLOW SHEET - PRODUCT TREATMENT

DRG.No. 418-3-0310-8



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					CHECKED		
					APPR'D.	RMB	23/2-72.
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					SCALE	1" = 30'-0"	
APPR'D	REV.	DATE	DESCRIPTION	BY	REF DRG No		
REVISION							

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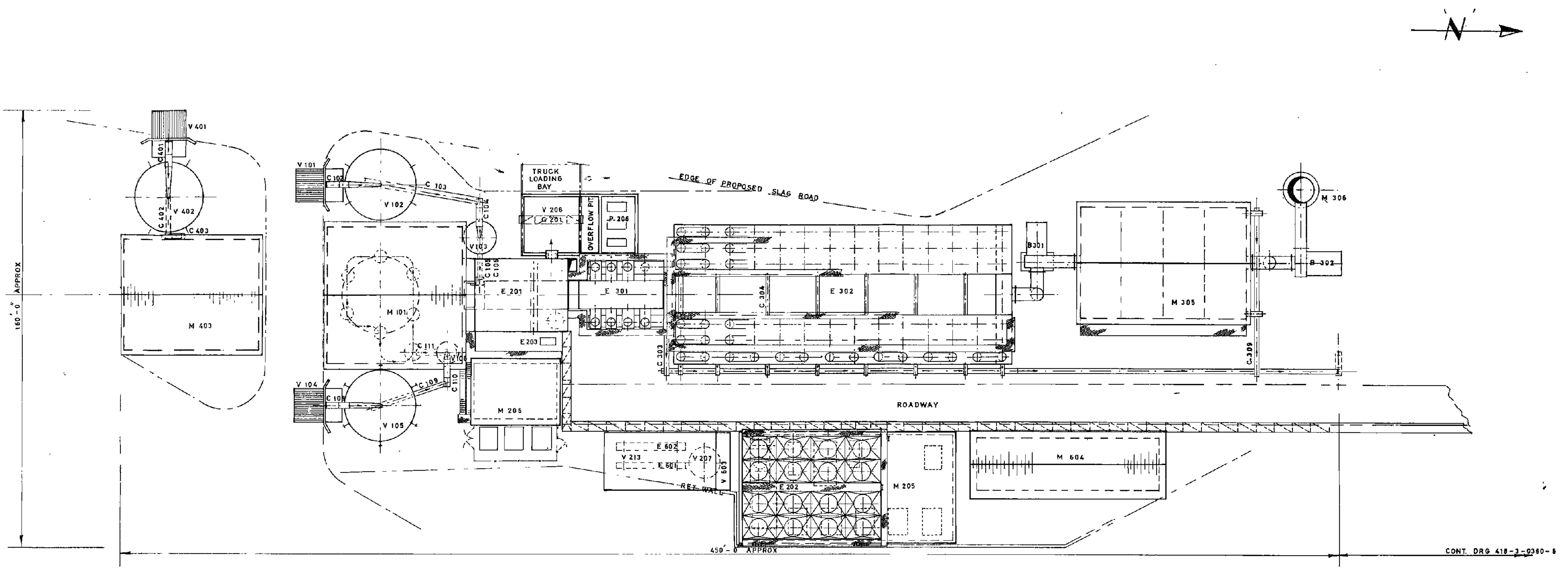
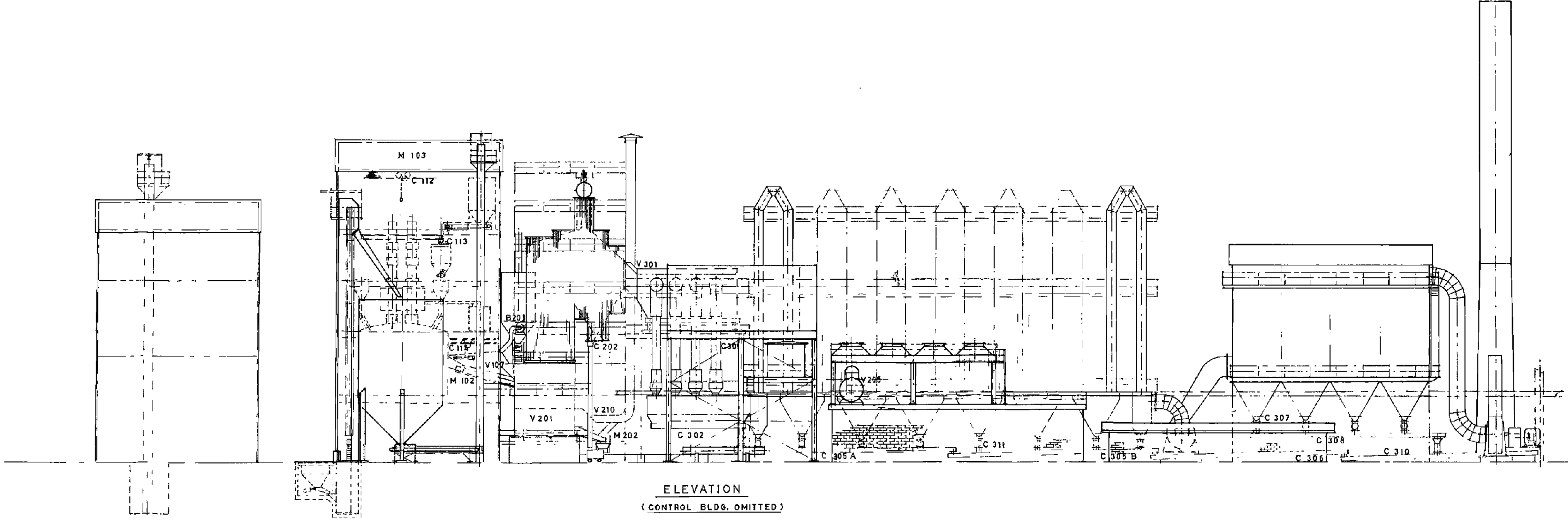
TITLE: SLAG FUMING PLANT — PORT PIRIE

PLOT PLAN

DRG.No. 418/3-0360-3



PLAN VIEW



ELEVATION

(CONTROL BLDG. OMITTED)

APPR'D.	REV.	DATE	DESCRIPTION	BY

REVISION

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CHECKED		
APPR'D.	RCMB	23/2-72
APPR'D. CONSTRUCT		
SCALE	1/16" = 1'-0"	
REF DRG No	418-3-0360-6	

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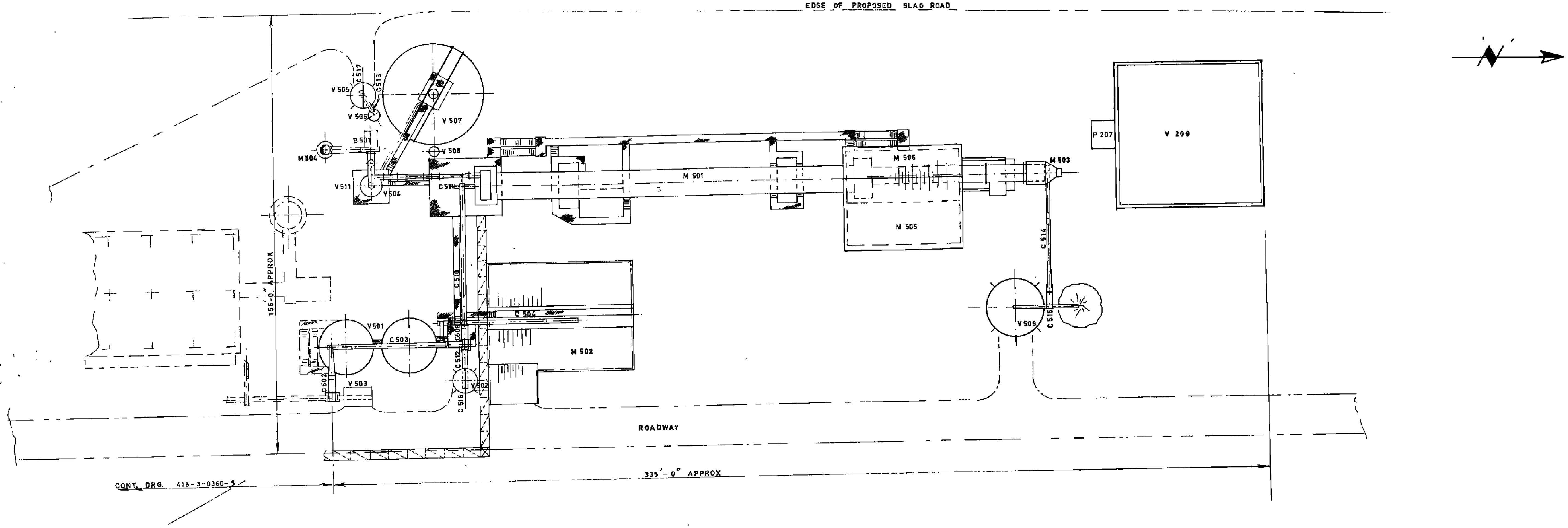
Client ELECTROLYTIC ZINC CO OF A/ASIA LTD

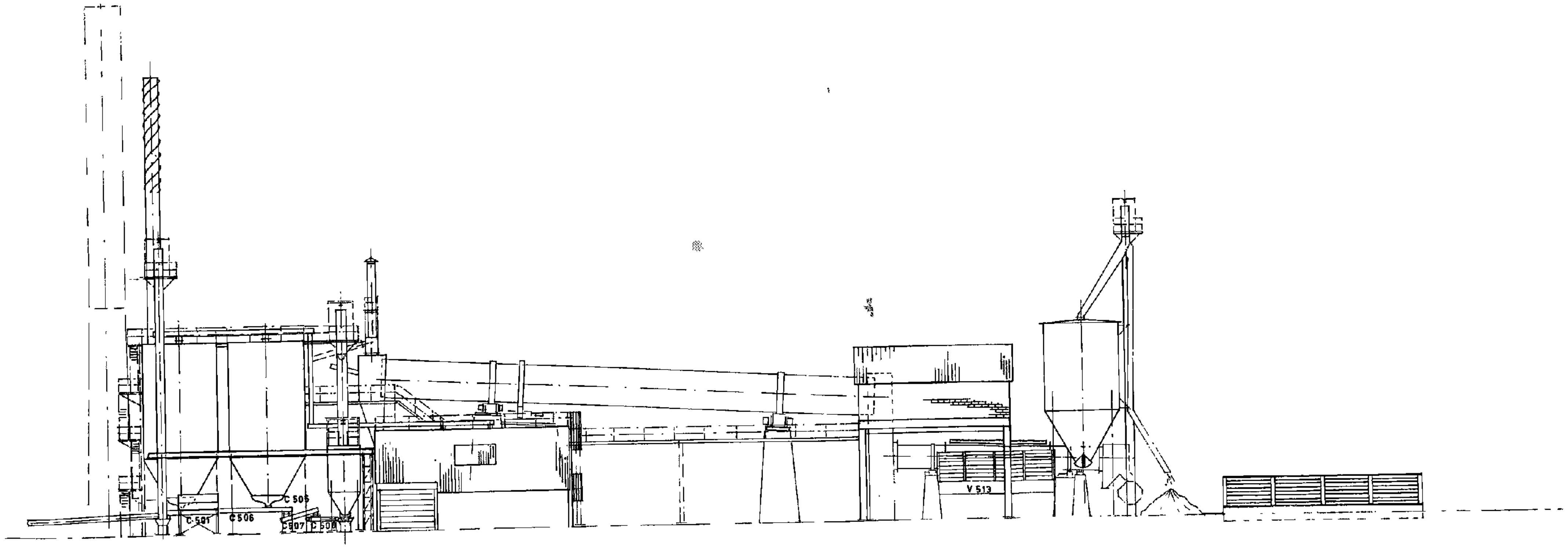
TITLE: SLAG FUMING PLANT - PORT PIRIE

PLANT ARRGT - MELTING & FUMING SECTION

DRG.No. 418-3-0360-5



PLAN VIEW



ELEVATION

APP'D.	REV.	DATE	DESCRIPTION	BY
REVISION				

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CHECKED		
APP'D.	RGmB	23/2-72
APP'D. CONSTRUCT.		
SCALE	1/16" = 1'-0"	
REF. DRG. No.		

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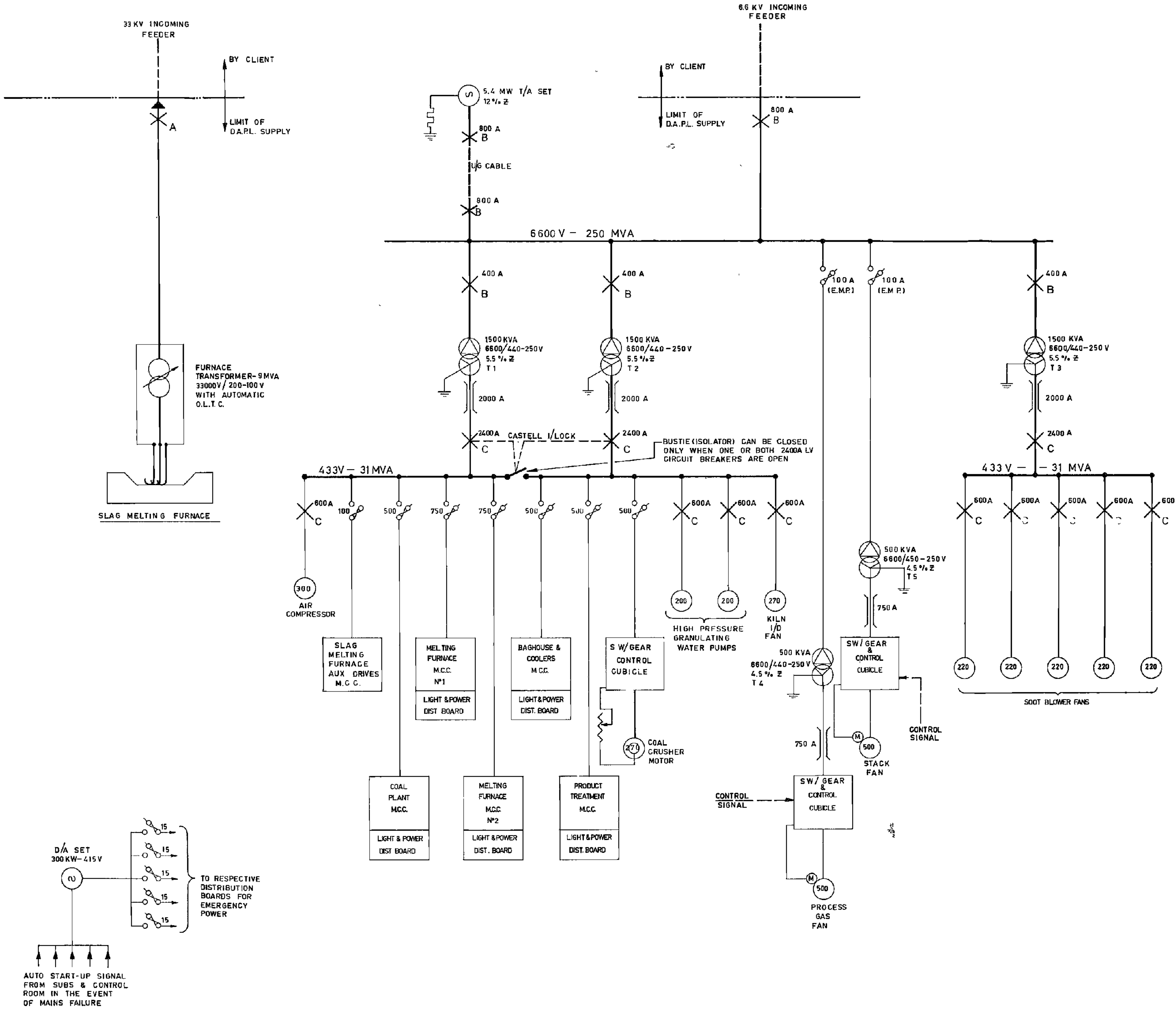
TITLE: SLAG FUMING PLANT - PORT PIRIE

PLANT ARRGT - PRODUCT TREATMENT SECT.N

DRG. No. 418 - 3 - 0360 - 6



LEGEND

$\times_A$ 33 KV - 1500 MVA, WITHDRAWABLE TRUCK TYPE M.O.C.B.

$\times_B$ 6.6 KV - 250 MVA, WITHDRAWABLE TRUCK TYPE O.C.B. RATING AS SHOWN.

$\times_C$ 440 VOLT - 31 MVA, DRAWOUT TYPE A.C.B. RATING AS SHOWN.

COMBINED H.R.C. FUSE-SWITCH UNIT. RATING AS SHOWN.

H.C.H.D. 440/250 VOLT WEATHERPROOF BUS. RATING AS SHOWN.

SLIPRING MOTOR WITH SECONDARY RESISTANCE STARTER.

VARIABLE SPEED SCHRAGE MOTOR WITH MOTOR-DRIVEN BRUSHGEAR.

NOTES

1. CIRCUIT BREAKERS AND STARTERS ARE COMPLETE WITH ALL MOTORS AND PROTECTION EQUIPMENT INCLUDING PT'S AND CT'S, OVERCURRENT EARTH FAULT, REVERSE POWER, THERMAL OVERLOAD, THERMISTOR, ETC. AS APPLICABLE.
2. REMOTE ISOLATORS AND PUSHBUTTONS ARE INCLUDED ADJACENT TO EACH MOTOR. THESE DEVICES ARE NOT SHOWN.
3. ALL MCC'S AND DISTRIBUTION BOARDS ARE EQUIPPED WITH AUTOMATIC CHANGEOVER CONTACTORS TO EMERGENCY SUPPLY FOR ESSENTIAL SERVICES IN THE EVENT OF MAINS FAILURE.

APPR'D.	REV.	DATE	DESCRIPTION	BY
REVISION				

DRAWN	K.T.C.	23-2-72
CHECKED		
APPR'D.		
APPR'D. CONSTRUCT.		
SCALE		
REF. DRG. No.		

DAVY-ASHMORE PTY. LTD.
MELBOURNE & SYDNEY
AUSTRALIAN MEMBER OF THE DAVY-ASHMORE GROUP

Client
ELECTROLYTIC ZINC CO. OF A/ASIA LTD.

TITLE: SLAG FUMING PLANT- PT. PIRIE
ELECTRICAL POWER SYSTEM SINGLE LINE DIAGRAM

DRG.No. 418-3-6100-1

6. PROJECT EXECUTION (See Drg. No. 418-3-0212-1)

The estimated time required to design and construct the fuming plant to the stage where it is ready for commissioning is 24 months. Time has been allowed to discuss the process details with BHAS and make any changes to the process flowsheet that might be necessary.

This plant consists of a number of large items of equipment supplied as "packages" by suppliers. These items determine the length of the project and hence their basic design must be established early in the project and orders placed. The waste heat boiler is the most complex major item of equipment and its delivery is such that it determines the critical path. For this reason the waste heat boiler is shown separately at the bottom of the project schedule.

All process engineering and detailed design for the plant will be carried out in Melbourne with the possible exception of engineering work done by the suppliers of large items such as the boiler, baghouse, kiln etc. The majority of the equipment will be fabricated in Australia, with the notable exception of the secondary air blower and part of the electric melting furnace.

A project manager will be appointed to control all facets of the project and to provide liaison with both EZ and BHAS during the design and construction phases. A project design engineer will be appointed to co-ordinate the engineering work and will be responsible to the project manager.

Construction will be carried out by a limited number of specialist contractors. Construction of the large "package" items will be responsibility of the suppliers, however there is a large number of the structural and mechanical items that must be separately erected to complete the plant. It is expected that civil, structural steel, mechanical erection, electrical and instrumentation contractors will be required in addition to the package suppliers, and some other specialist sub-contractors.

6. PROJECT EXECUTION CONTINUED

Control and supervision of all contractors working on the site will be necessary to ensure correctness and quality of work and to maintain the project schedule. A site team consisting of a site manager, site engineers, specialist engineers in particular fields, and a site accountant will be required. Storemen and clerical assistants will be recruited locally to assist this team. Site offices of the mobile camp type would be used to accommodate these personnel.

Temporary site services for power and water will be required, and these can be run from existing sub-stations or lines at little cost.

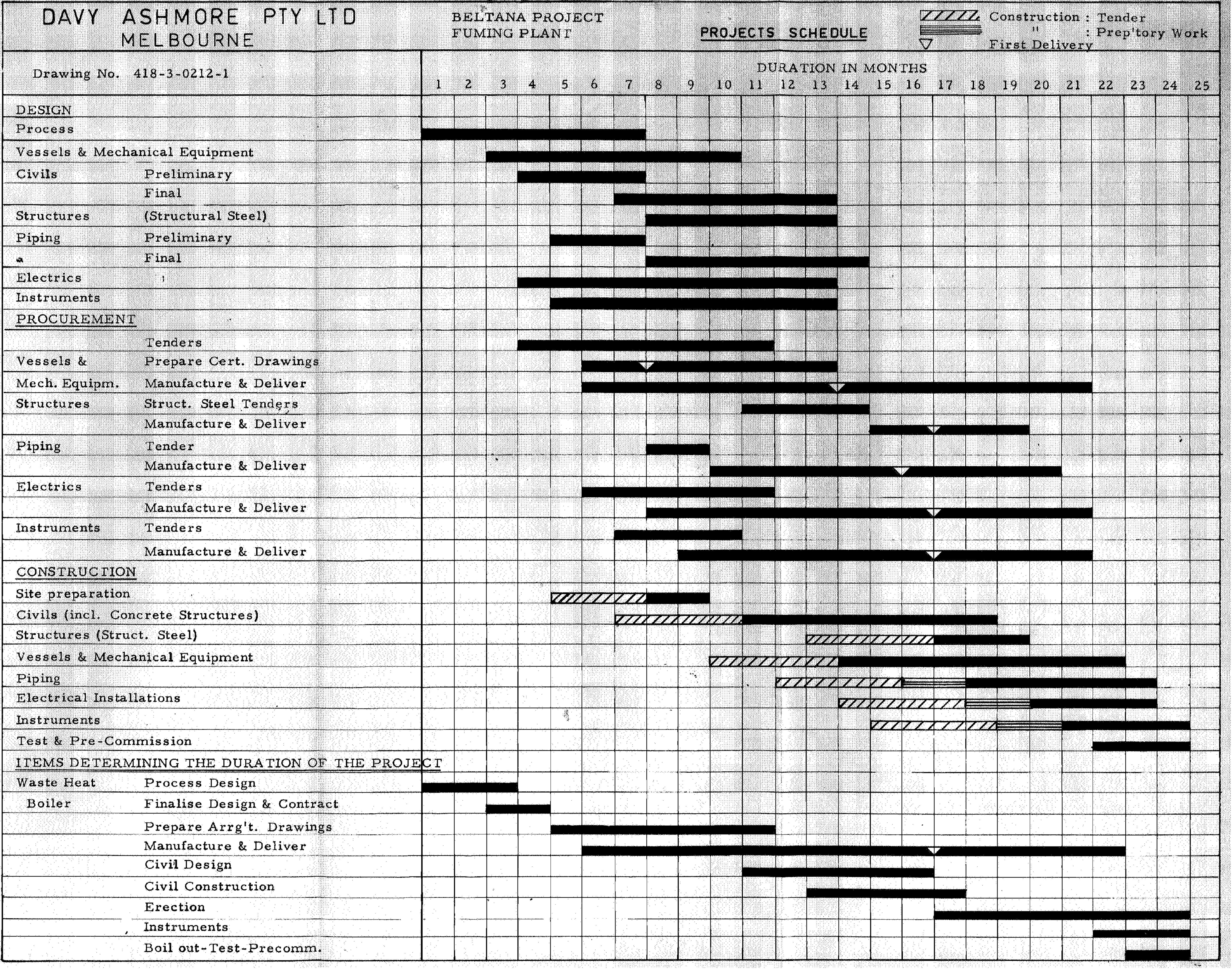
Precommissioning or mechanical testing of all equipment and the "boil-out" of the HP boiler will commence near the end of the construction phase. Suppliers of "package" equipment will be on hand to test their equipment. Project design and construction personnel will be present during the testing and commissioning stages to ensure that the equipment works correctly and achieves the specified performance. It is assumed that BHAS will train operating personnel on their existing plant and make them available during precommissioning to gain experience prior to the commissioning date.

DAVY ASHMORE PTY LTD
MELBOURNE

BELTANA PROJECT
FUMING PLANT

PROJECTS SCHEDULE

Drawing No. 418-3-0212-1



ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

BELTANA PROJECT

FEASIBILITY STUDY

1972

PART 5 - GEOLOGY

R. A. Horn
30th March, 1972

Prepared by:
Exploration Department

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CONTENTS:

INTRODUCTION

This report is intended to provide a brief guide to geological information relevant to mining at Beltana.

1. OREBODY NOMENCLATURE

	Main Orebody	991N	to	995.5N	Beltana grid
	Northern Extension (zinc)	998N	to	1001N	
Excluded from Reserves	Northern Extension (lead)	995.5N	to	998N	
	Southern Extension	986N	to	989N	
	Aroona	996E	to	1003E	Aroona grid

2. MINERALOGY

2.1 Main Orebody

2.1.1 Ore Mineralogy

Based on assay results of a 500 ton bulk ore sample taken from the 1010 bench and analysed at E.Z., Risdon, Tasmania, an estimated mineralogy has been calculated, viz:

Mineral	Content in orebody %	Analyses %
Willemite Zn_2SiO_4	54.0	T/Zn 40.0, SiO_2 14
Hematite Fe_2O_3	10.0	T/Fe 7.0
Calcite $CaCO_3$)	8.5	CaO 2.8, CO_2 5.6
Dolomite $CaCO_3MgCO_3$)		MgO 1.5
Coronadite $MnPbMn_6O_{14}$	6.0	Pb 2.1, As 0.7, Mn 1.
Hedyphane $(CaPb)_5(AsO_4)_3Cl$		Cl 0.004
Smithsonite $ZnCO_3$	2.5	
Quartz SiO_2	4.0	
Sulphides	0.5	T/S 0.25
Loss on ignition	7.7	
Others (including minor clay minerals, carbonates, vanadates, etc.)	7.0	

Grade calculation figures are consistent with the bulk sample assays. In addition, minor quantities of germanium and bismuth have been recorded, the former apparently associated with willemite with a constant ratio to zinc of about 7:100,000.

It must be emphasised that the above mineralogy is calculated from the 1010 bench only. However, it can be assumed within the main orebody that, with minor variations, the figures quoted above can be applied to the lower levels.

2.1.2 Dilution Mineralogy

The 60,000 tons of mineral dilution consists for the most part of dolomite with associated minor calcite, zinc in solid solution, and framboidal hematite. Willemite, coronadite and hedyphane situated peripherally to the zinc orebody are also included in the dilution halo.

Mineralogically, much of the hanging wall dilution consists of clay minerals, calcite and quartz with minor lead-zinc mineralisation. It is expected that, due to the visually obvious contact of hanging wall ore and waste, together with their differing blasting characteristics, it should be possible to mine with a minimum of overbreak.

An approximate estimation of dilution mineralogy is shown below:

Dolomite)	69%
Calcite)	
Quartz	10%
Clay minerals	10%
Hematite	5%
Zinc (willemite)	3%
Zinc (solid solution)	3%

2.1.3 Mineral Distribution

In general the main orebody is fairly homogenous. However, manganese-arsenic-lead minerals in the form of hedyphane and coronadite with associated hematite tend to occur in discrete concentrations associated with shearing and weak ground. One such concentration is exposed on the north wall of the 1010 bench level.

A similar concentration has been delineated on the longitudinal projection (D100.55) extending from cross-sections 993N to 996N, and from elevations 800 feet to 900 feet.

Other smaller occurrences have been intersected during exploration drilling, which will be located more accurately in the course of mining.

Within the central portion of the orebody from 992.5N to 993.5N the hanging wall waste consists of brecciated dolomite with abundant hematite but low lead, arsenic and manganese values. Hematite is also disseminated throughout the willemite ore in the form of framboidal particles $\sim 10\mu$ diameter.

2.2 Northern Extension (zinc)

2.2.1 Ore Mineralogy

The mineralogy below is based on assay results obtained by E.Z., Risdon, from a 1 ton sample:

Mineral	Content in orebody %	Analyses %
Willemite Zn_2SiO_4	77 (54.0)	T/Zn 56.0, SiO_2 25.1
Hematite Fe_2O_3	2	T/Fe 1.2
Coronadite $MnPbMn_6O_{14}$	1 (6.0)	Pb o.5, As 0.2, Mn 0.
Hedyphane $(CaPb)_5(AsO_4)_3Cl$		Cl 0.004
Quartz	4	
Loss on ignition	8 (assumed)	
Others	8	

Grade calculation figures and bulk sample assay results are inconsistent. Willemite and lead-arsenic-manganese mineral quantities deduced from diamond drill assays are shown in parentheses.

2.2.2 Dilution Mineralogy

Dilution consists almost entirely of dolomite with minor calcite and coronadite.

2.2.3 Mineral Distribution

The zinc rich portion of the Northern Extension consists largely of white colloform willemite distributed uniformly within the orebody.

The footwall and lateral contacts of the orebody are locally very rich in coronadite mineralisation.

2.3 Aroona

2.3.1 Ore Mineralogy

On the basis of diamond drill assay results, an approximate mineralogy has been estimated:

Mineral		Content in orebody %	Analyses %
Willemite	Zn_2SiO_4	52.0	Zn 41.8
Dolomite	$CaCO_3$)	20.0	
Calcite	$CaCO_3MgCO_3$)		
Heterolite	$ZnOMn_2O_3$	6.0	
Hematite	Fe_2O_3	5.0	
Lead minerals		4.5	Pb 1.6
Others		13.5	

2.3.2 Dilution Mineralogy

Mined dilution will consist mineralogically mainly of dolomite with clay minerals and minor quartz.

2.3.3 Mineral Distribution

Unlike the main orebody, lead mineralisation is disseminated throughout the Aroona body.

Dolomite consists of small fragments commonly >1 inch in diameter contained within the willemite mineralisation.

3. SELECTIVE MINING OF DILUTION

3.1 Main Orebody

(see MINERALOGY, 2.1 Main Orebody, 2.1.3 Mineral Distribution - above)

It is recommended that ore dilution be mined under the following categories:

3.1.1 Lead and Deleterious Dilution with Orebody

In order to maintain a consistent grade of lead and zinc, and to avoid undue fluctuations of deleterious arsenic and chlorine, it will be necessary to mine the main orebody selectively.

Although the major part of the orebody consists of homogenous willemite with associated hematite, discrete areas with high manganese, arsenic, chlorine and lead values are common.

These areas are visually distinguishable from the host willemite ore by a pronounced red colouration, and an earthy texture.

Where such areas are of sufficient volume and are exposed over a width of 10 feet, they should be blasted separately and selectively mined.

It is envisaged that blasthole and trench sample assay data should provide sufficient information to enable each bench to be blocked out into high grade willemite ore and dilution blocks.

3.1.2 Footwall Dilution

Ten feet of footwall ore together with 3 feet of waste will be mined as diluted ore. The assumed 3 feet dilution halo on the orebody footwall consists entirely of dolomite or ferruginous dolomitic breccia. The ore contact is impossible to determine visually, and blasting characteristics of the footwall ore and dolomite are similar. It will be necessary, therefore, to mine to contacts deduced from blasthole and trench sample assays.

3.1.3 Hanging Wall Dilution

Ten feet of hanging wall ore together with 3 feet of waste will be mined as diluted ore. Above the 800 feet elevation, hanging wall dilution consists of dolomite, quartzite and breccia. Although the contacts of the orebody with quartzite and breccia are easily recognised visually, the dolomite contact presents the same problems as outlined for the footwall.

Below the 800 feet elevation, quartzite overlies the entire orebody presenting an easily recognisable contact.

It is probable that, due to differing blasting characteristics and the obvious textural and colour differences between hanging wall ore and waste, a dilution halo of less than 3 feet may be achieved. This should offset any overbreak in excess of 3 feet on the footwall.

3.2 Northern Extension (zinc)

(see MINERALOGY, 2.2 Northern Extension, 2.1.3 Mineral Distribution - above)

Due to the homogeneity of the Northern Extension willemite ore, it will not be feasible to selectively mine lead rich ore.

The exposed orebody is sub-horizontal and planar in form and therefore has no mining hanging wall.

A footwall dilution halo of 3 feet is assumed which consists of dolomite with localised lead rich areas.

The principal lead mineral is coronadite which gives a black colouration and earthy texture to the lead rich dilution.

It should be possible to distinguish willemite ore from lead rich dilution using visual criteria only.

3.3 Northern Extension (lead)

High grade zinc mineralisation is localised in discrete blocks within the lead rich portion of the Northern Extension. Although ore in this area is excluded from reserves, it should prove possible to recover willemite ore 40% zinc by careful selective mining.

3.4 Aroona

(see MINERALOGY, 2.3 Aroona, 2.3.3 Mineral Distribution - above)

The disseminated lead mineralisation of the Aroona body is not amenable to selective mining.

It is recommended that diluted ore be mined in two categories:

3.4.1 Footwall Dilution

Ten feet of ore together with 3 feet of footwall waste will be mined as diluted ore.

The footwall waste consists mainly of red siltstone which is visually distinguishable from the willemite ore. However, to the west of section 996.7E in the upper levels of above 780 feet elevation, red dolomite directly underlies the orebody. In this area reliance must be placed on blasthole and trench sampling assays in determining contacts.

3.4.2 Hanging Wall Dilution

Ten feet of ore together with 3 feet of hanging wall waste will be mined as hanging wall diluted ore. The hanging wall waste consists of white quartzite which is readily distinguishable from willemite ore. To the east of section 1001E, dolomite overlies the orebody. It will therefore be necessary to determine the hanging wall contact in this area from assay data.

The horizontal thickness of the orebody is commonly less than 30 feet. In this case it would not be practicable to mine hanging wall and footwall diluted ore selectively.

4. ORE CONTROL AND SAMPLING PROCEDURES

Ore will be mined in four categories:

(i) Undiluted ore
(ii) Hanging wall diluted ore
(iii) Footwall diluted ore
(iv) Lead rich ore

It will be necessary to block out each bench to indicate the limits of the above ore types before ore excavation commences. Tonnages and grades of each block will be calculated, from which it will be possible to estimate the ratio of ore required from each category to maintain a consistent head grade.

To this end it is recommended that at least in the early stages of mining detailed sampling be undertaken on each bench as outlined below.

Total samples and costs are estimated from the top four bench levels.

4.1 Trench sampling

Chip samples collected at 5 feet intervals along trenches spaced at 50 feet.

Total samples per bench = 100

Lead/zinc assay cost at $3.50 per sample = $350.00

4.2 Blasthole sampling

Samples collected at 4 feet intervals in a 20 feet blasthole.

All blastholes would be sampled in areas of possible dilution and at the hanging wall and footwall contacts.

Alternate holes would be sampled in the remainder of the orebody.

Assuming a blasthole spacing of 8 feet by 8 feet of which two-thirds would be sampled:

Total blastholes in ore per bench = 290

Total samples per bench = 960

Lead/zinc assay cost at $3.50 per sample = $3,360

4.3 Truck sampling

Five samples collected every tenth truck.

Assuming 1,200 truck-loads at 35 tons per truck:

Total samples per bench = 600

Zinc assay cost at $3.00 per sample = $1,800

Total assay costs per bench = $5,510

4.4 Personnel

It is recommended that grade control and sampling be supervised by a surveyor/grade control officer with one assistant.

5. BLASTING CHARACTERISTICS

The table below has been derived from observations of blasting during bulk sampling:

Material	Comments	Recommended blasthole size
Willemite ore	Tendency to fly and crater. Breaks to coarse fragments <40 inches diameter	2 inches (to reduce cratering and assist ore control)
Dolomite	---	4 inches
Quartzite	---	4 inches
Breccia (decomposed)	Breaks to fine fragments <6 inches	4 inches
Breccia (undecomposed)	---	4 inches

6. ORE RESERVES DETERMINATION

Using assay data from diamond drill holes and ore limits from both diamond and percussion drilling, grade and tonnage figures were estimated.

Areas were measured from 1 inch to 40 feet mining sections (CA100.48) by planimeter.

Block volumes were estimated using the formula:

$$V = \frac{A1 + A2 + \sqrt{A1A2}}{3} \times D$$

where:

V = volume
A1 = area on section 1) for a block
A2 = area on section 2) between
D = distance between sections) section 1 and 2

This formula is designed to correct an over-estimation if the simple

$$\frac{A1 \times A2}{2} \times D$$

formula is applied to a block with greatly differing areas on its bounding sections.

Diamond drill hole assay results were weighted by their intersected footage to give an overall linear intersected grade.

Intersected grades were, in turn, weighted by their area of influence, to give section grades.

The block grades between two sections were estimated by weighting the section grades with the areas on each section.

Finally, block grades were weighted by block tonnages to give an average weighted grade.

Volumes of diluted ore and undiluted ore were estimated separately.

Factors of 10 cubic feet per ton of ore and 13 cubic feet per ton of waste were applied to volumes to obtain tonnages which were corrected to the lowest 1,000 tons.

7. COMMENTS ON ACCURACY OF ESTIMATION

7.1 Drilling density

The ratios of weight of assayed diamond drill core to weight of established ore are quoted in Table 1.

Figures of 1,000,000:1 by weight and 500 tons to one foot drilled ore are within the range of drilling and assay densities quoted for several established orebodies.

Drilling density may be represented more graphically as one foot of core per cube of ore with sides of 17 feet.

In common with most orebodies, there is insufficient data to apply statistical correlation tests to determine degrees of confidence in correlating grade and thickness from one hole to another.

7.2 Grade correlation

To test the degree of correlation of grades, bar-graphs were drawn showing variation in grade from diamond drill hole assays, on six cross-sections between 991.5N and 994N.

Assuming a simple correlation, a distribution curve was drawn between the plotted intersected grades. Longitudinal sections were then constructed in the same manner on 1001E and 1002E. Where no drill hole assay data was available, the interpolated grade derived from cross-sections were plotted.

Distribution curves were then drawn on the longitudinal sections and found to be regular and consistent. In other words, interpolations are equally consistent on east-west and north-south sections.

It was concluded that, although grades are variable, the variation is regular and plots of intersected grades from one drill hole to another approximate to a straight line.

It is therefore valid to calculate block grades by weighting the section grade by the area outlined on the bounding section of the block.

7.3 Orebody thickness correlation

Longitudinal and cross-sections have been constructed, and thicknesses found to be generally consistent.

As a further test, a comparison was made between ore limits derived from diamond drill holes alone with limits derived from both diamond and percussion drill hole data. Results are shown in Table 2.

It was demonstrated that results from 28 diamond drill holes agreed closely with those from 40 diamond and percussion drill holes.

It is mathematically reasonable that as the number of drill holes testing the orebody is increased, the consequent change in ore outlines so revealed will become less. The increase from 28 to 40 intersections resulted in minor changes. Intersections in excess of 40 should reasonably have still less effect.

7.4 Other considerations

The $\frac{A1 + A2 + \sqrt{A1A2}}{3} \times D$ formula used in calculating block volumes includes an empirical reduction factor.

Where two interpretations of orebody outline were available, the one giving the lowest area was taken in every case.

The ore calculation is therefore designed to produce a low tonnage.

Due to the lack of information required to apply statistical correlation tests to drill hole information, reliance is placed on the experience of workers involved and in that sense is subjective.

It is emphasised that the above comments apply only to the Main Orebody.

Further drilling will be required to test the upper levels of the Aroona body.

Discontinuous grades in the Northern Extension will be determined in the course of mining.

TABLE 1 - RATIO OF WEIGHT OF ASSAYED CORE TO TONNAGE PROVED

Block	Weight of ore (lbs)	Weight of assayed core (lbs)	Ratio	Tonnage proved per foot drilled (diamond drilling only) in tons/foot
991.5/992	203×10^6	99	2,000,000:1	907
992 /992.5	342×10^6	392	880,000:1	737
992.5/993	363×10^6	288	1,220,000:1	656
993 /993.5	304×10^6	335	900,000:1	376
993.5/994	179×10^6	191	940,000:1	695
994 /994.5	74×10^6	214	346,000:1	153
994.5/995	26×10^6	65	400,000:1	367
	Average		940,000:1	517

As about one-half of the available core was sampled, the ratio of drilled ore to total ore by weight is 470,000:1

TABLE 2 - COMPARISON OF ORE LIMITS DERIVED FROM DIAMOND DRILL HOLES ALONE AND DIAMOND AND PERCUSSION DRILL HOLES

Section	Total number of diamond drill holes	Total number of percussion drill holes	Change in ore area on section
991.5N	3	1	Nil
992 N	5	1	Nil
992.5N	4	3	Nil
993 N	6	2	Minor increase
993.5N	3	3	Substantial increase
994 N	7	2	Nil

8. ORE QUANTITIES

8.1 Ore included in Reserves

(refer Part 7 - Data Information Sheet 1)

	Tonnage	Pb %	Zn %
Northern Extension (zinc)			
Undiluted	75,000	2.2	39.9
Dilution	13,000	0.7	4.5
Diluted	88,000	2.0	35.3
Main Orebody			
Undiluted	700,000	2.2	41.4
Dilution	65,000	3.9	4.0
Diluted	765,000	2.3	38.2
Aroona (calculated from bench plans - P. McPaul, 1970)			
Undiluted	120,000	1.6	41.8
Dilution	30,000	1.6	5.0
Diluted	150,000	1.6	34.4
Total Ore			
Undiluted	895,000	2.1	41.3
Dilution	108,000	2.9	4.3
Diluted	1,003,000	2.2	36.8

8.2 Ore excluded from Reserves

	Tonnage	Pb %	Zn %
Northern Extension (lead)			
Undiluted	69,000	10.6	22.2
Dilution	25,000	21.3	7.2
Diluted	94,000	13.6	17.0
Southern Extension			
Undiluted	132,000	6.6	22.0

9. ROCK STRENGTH AND SLOPE STABILITY

The table below shows rock types which will be encountered during mining in the Main Orebody: .

Rock type	Location	Hardness (Moh's scale)	Strength *	Abundance	Rippabilit
Willemite	orebody	5.5	S	12%	No
Lead rich ore	orebody	3?	M.W	2%	Yes
Dolomite	hanging wall (minor footwall)	3.5 - 4	M	10%	Partially
Quartzite	hanging wall	7	S	25%	No
Breccia	hanging wall	3?	W-M	51%	Partially

*Key

S = Strong (e.g. massive quartzite)

M = Moderate (e.g. strong, massive limestone)

W = Weak (e.g. gravel)

It can be seen from the above table that 37% of the material to be mined has a hardness in excess of 5. This will naturally increase wear on drill bits and loader buckets.

The pit slope on the western wall is governed by the dip of the orebody footwall (45°).

As this wall will be mined in dolomite, it is improbable that slope stability problems will be encountered.

The eastern wall of the final pit, however, will consist mainly of breccia which may tend to slump, particularly in the event of torrential rain to which the area is occasionally subject.

Several large quartzite blocks 200 feet are situated within the breccia, dipping towards the east. Due to their attitude and strength, it is possible that these blocks may be used to advantage to hold up overlying slumped breccia.

10. HYDROLOGY AND PIT DEWATERING

Water table should be encountered at a depth of approximately 120 feet, from which depth pit dewatering will become an increasing problem.

It would be advisable to maintain a permanent sump drained by a submersible pump throughout the pit life to collect surface water from occasional torrential storms and to drain ground water below the water table.

Adequate supplies of domestic and industrial water are available within the Special Mining Lease (see Percussion Drill holes - Water Table and Flow - reference B100.54 and memorandum SAE/449).

A total flow of 17,000 gallons per hour of domestic water is available from four percussion drill holes.

A further 20,000 gallons per hour of industrial water is available from several other percussion drill holes.

Further work is required to fully test estimated water reserves.

11. DEAD GROUND AND PLANT SITING

(see Beltana General Geology D100.50)

Several areas outside of the present known mineralised zones are considered favourable sites for possible further ore occurrences.

Siting of plant and permanent buildings should be undertaken bearing in mind the potential for ore extensions in the areas listed below:

Area	Ore potential	Available for development
West of line 990E (excluding mapped Willouran)	Nil	Yes
Mapped Willouran west of line 990E	Slight	Yes
Pound Quartzite	Nil	Yes
Pound Quartzite and Wonoka Formation between lines 990E and 1000E	Nil	Yes
Mapped Willouran east of line 1000E	Fair	No (unless unavoidable)
Lower Cambrian	High	No
Area 400 feet east of mapped hanging wall thrust (i.e., from 980N/1000E to 1020N/994E)	Very high	No
Areas within 500 feet radius of 980N/1000E	Very high	No

STATEMENT DESCRIBING WORK DONE BY THE RESEARCH DEPARTMENT, RISDON, ON THE TREATMENT OF BELTANA ORE DURING THE YEAR 1971/72

INTRODUCTION:

At the beginning of the financial year, previous experimental work and economic studies had developed the flowsheet for the direct leaching of Beltana ore at Risdon to the stage set out in Figure 1.

FLOWSHEET:

This flowsheet in Figure 1 was based on experimental data derived from continuous laboratory 6 litre scale work and pilot plant work in which 5 tonne of Beltana ore was treated each day. Additionally other experimental work had been done by treating small quantities of Beltana ore in the existing Risdon Zinc Plant circuit.

The flowsheet is fairly complex, especially after integration into the existing zinc plant circuit at Risdon. However, this complexity is a necessary consequence of the nature of Beltana ore: it poses special problems because of its silica content. In addition, it unfortunately possesses a wide range of other impurities in sufficiently large amounts to create problems when the ore is treated in the Zinc Plant. The nickel, magnesium, arsenic, chlorine, fluorine, and germanium contents are each high enough to require attention or additional purification steps to control their level in circuit solution.

Because of these problems, a new plant would have to be built at Risdon to treat Beltana ore. This plant would be integrated into the existing zinc plant at appropriate points. The new plant has been called the Silicate Treatment Division.

GERMANIUM PURIFICATION SECTION

It will be noted that no germanium purification section is included in the flowsheet. It had been hoped that there would be adequate germanium removal in another part of the Risdon Zinc Plant (Residue Treatment Division) to avoid the need for a germanium purification section in the Silicate Treatment Division. However, experimental data on germanium removal in the various sections of the Residue Treatment Division could not be obtained until November 1971, i.e. some months after the start-up of that Division.

Detailed mass balances were then performed for germanium for the whole Risdon circuit with Beltana ore being treated in the Silicate Treatment Division. These showed that without the germanium purification section under present circumstances, the germanium content in feed solution to the cell room might rise to between 7 and 9 micrograms/litre. This was too high to be acceptable in the light of present knowledge.

TYPE OF GERMANIUM PURIFICATION SECTION

The germanium purification section recommended for inclusion in the Silicate Treatment Division would consist of the addition of iron bearing solutions from the Residue Treatment Division, followed by neutralisation with limestone to give ferric hydroxide. The germanium in solution is removed by adsorption on the precipitated ferric hydroxide. Oxidation of the ferrous iron in solution by blowing air through the pulp is also necessary.

A germanium purification section of this type would be placed in the Silicate Treatment Division so that solutions from both the coagulation and acid repulp stage would be treated to remove germanium before passing to either the basics section in the Silicate Treatment Division or the nickel purification section in the Residue Treatment Division.

OTHER DUTIES OF GERMANIUM PURIFICATION SECTION

A germanium purification section of this type and at this point will serve a number of purposes in addition to germanium removal. The two most significant other duties are the removal of fluorine and colloidal silica in solutions coming forward from the coagulation and acid repulp sections.

Two detailed fluorine mass balances were made for the whole Risdon Circuit to assess the effect of including the germanium purification section on the fluorine level in circuit solution. When Beltana ore is not being treated at all, the fluorine level in spent electrolyte from the cell room is 4 mg/litre. When Beltana ore is being treated and there is a germanium purification section, the estimated fluorine level is about 35 mg/litre; when there is no germanium purification section, the estimated fluorine level is about 40 mg/litre. This narrows the margin between the estimated fluorine level and the currently accepted limit of 50 mg F/litre. Therefore the germanium purification section is desirable on grounds of controlling the fluorine level at a somewhat lower level.

With respect to the colloidal silica in coagulation and acid repulp solutions, it was found that the expected levels in these solutions were comparable or lower than those being experienced in the Residue Treatment Division. Consequently, the germanium purification section would possess only the advantage of removing colloidal silica when either the coagulation or acid repulp sections were not functioning properly.

ALTERNATIVE TO GERMANIUM PURIFICATION SECTION:

At this point it was therefore clear that the germanium purification section was required. However, the operating and capital costs of this section are large. The only technical alternative was the addition of iron bearing solutions during or before the coagulation stage. It was possible that this would exercise adequate control on both the germanium and fluorine levels in solution. Acid repulp solution could easily be returned to the coagulation stage, avoiding the need for iron additions during the acid repulp recoagulation stage. However, conditions during the acid repulp stage probably would have to be adjusted to prevent appreciable re-dissolution or desorption of the germanium precipitated in the coagulation stage. The only other disadvantage is that it would be essential that the colloidal silica content of solution from the coagulation stage should not exceed about 0.2 grams/litre at any time. Otherwise some decline in filtration rate during the filtration of precipitate from the nickel purification stage would be expected.

EXPERIMENTAL WORK TO EXAMINE ADDITION OF IRON BEARING SOLUTIONS

To examine these issues, the 6 litre continuous apparatus was reactivated and run 24 hours per day for five days in each week for 8 1/2 weeks. Iron bearing solutions from the preneutralisation thickeners in Residue Treatment Division were added to either the leaching stage, the first vessel or second vessels in the coagulation stage, or both vessels in the coagulation stage. The effect of varying the pH in the coagulation stage by adjusting the amount of calcine added as a neutralizing agent in the coagulation stage was examined in detail, together with the effect of temperature.

It was found that additions of iron bearing solution did not effectively remove additional germanium from solution. If the iron bearing solution was added to the coagulation stage, the filterability of the coagulated silica pulp was impaired. At iron levels less than 5 gram/litre in leach solution after the addition of iron bearing solution to the leaching stage, there was no impairment to the filterability of the coagulated silica pulp. The admission of air to the coagulation stage to oxidise ferrous iron in solution derived from the iron bearing solutions added had no detrimental effect on the filtration properties of the coagulated silica pulp. Unfortunately, addition of iron bearing solutions leads to a higher calcine addition to the coagulation stage to reach a given end point pH. Since the filterability of the coagulated silica pulp is strongly dependent on pH, it is clear that for a given size filter installation, more calcine will be required as a neutralizing agent if iron bearing solutions are added to either the leaching or coagulation stage. Since there is a low zinc recovery from calcine used as a nuetralizing agent, the profitability of the process is reduced when iron bearing solutions are added. Consequently their use cannot be recommended.

Taking all factors into account, a germanium purification section must be included in the Silicate Treatment Division.

GERMANIUM REMOVAL IN COAGULATION STAGE

The extent of germanium removal during the coagulation stage without the addition of iron bearing solutions was strongly dependent on the pH in the coagulation stage, which in turn depends on the amount of calcine added as a neutralising agent in that stage. A calcine consumption of about 0.15 grams/gram of ore would be necessary to ensure that the germanium level in coagulation solution was below 30 micrograms/litre. This calcine addition is materially above the present design figure of 0.11 grams/gram of ore.

ACID REPULPING OF COAGULATED SILICA

Tests on acid repulping the coagulated silica showed that severe redissolution or desorption of germanium occurred when the pH was lowered to a sufficient extent to give reasonable zinc extraction from unconsumed calcine in the coagulated silica. Therefore conditions in the acid repulp recoagulation stage will probably always have to be controlled carefully to ensure reasonably low germanium levels in solution leaving the acid repulp recoagulation stage.

OTHER ASPECTS OF WORK RELATING TO 6 LITRE CONTINUOUS APPARATUS

The settling rates of coagulated silica in impure solution were low and none of the flocculants tested gave a satisfactory settling rate.

The extractions for zinc, magnesium, manganese, chlorine, fluorine, nickel, cobalt, copper, and cadmium from Beltana ore were again determined and checked.

Solutions and coagulated silica pulps from the 6 litre continuous apparatus were stored for two other investigations.

FILTERABILITY OF COAGULATED SILICA

The filterability of the stored coagulated silica pulp was examined using a 10 sq.ft. drum filter and the results compared with those obtained using a 0.1 sq.ft. Dorr-Oliver test filter leaf. Problems were encountered due to ageing of the pulp over a five week period before the test could commence and some uncertainties have yet to be clarified. Back washing of the filter cloth is required to prevent blinding.

ELECTROLYTIC TEST WORK

The stored solutions were purified by a two stage zinc dust purification and then electrolysed in a small test cell. The first batch of solution was contaminated with copper and gave low current efficiencies. The second batch of solution gave satisfactory current efficiencies. The average current efficiency over 9 operating days (4 strips) was 91.1% compared with an average of 90.1% for Risdon pure solution over 8 operating days prior to commencement of electrolyses of the second batch of Beltana solution. This suggests a safe position with respect to the effect on current efficiency due to the treatment of Beltana ore. With the flowsheet as proposed, solution from the treatment of Beltana ore will be subject to a double stage "iron" purification which was not included in the program for the experimental solution tested electrolytically. This should provide adequate safe guard against the cyclic build-up of other toxic impurities. This point is of importance in the case of Beltana ore, as it will not be roasted prior to treatment. All the concentrates currently received at Risdon are zinc sulphide concentrates which are roasted in flash or fluid roasters. Apart from removing most of the sulphide sulphur, the roasting operation also removes many other impurities.

OTHER EXPERIMENTAL WORK

During the financial year under review experimental work has also been conducted on the setting and drying of coagulated silica on exposure outside to the weather. The effect of various additives such as lime, limestone, cement, was also determined.

Leaching tests were also conducted to examine further the extraction of selenium and tellurium from Beltana ore. The most recent analyses indicate that Beltana ore contains 0.3 p.p.m. of selenium and < 0.1 p.p.m. of tellurium. The analytical accuracy for these elements in solids or solutions is still poor. However, no decline in current efficiency due to tellurium is expected. The position with respect to selenium is less satisfactory, but no substantial decline in current efficiency is likely.

The acid repulp section in the Silicate Treatment Division requires a recoagulation section to obtain a final pulp with an acceptable filterability. A technical alternative is to acid wash the coagulated silica pulp from the first coagulation stage on a belt discharge filter. A preliminary evaluation was made of this possibility. It was unencouraging. Although approximately 60% of the total less water soluble zinc can be recovered using a two displacement wash with wash water containing $\geqslant$ 40 gram H_2SO_4/litre, the residual water soluble zinc in the washed residue was approximately 5%. This is unacceptable. In addition, it is doubtful whether acid washing can be successfully applied on continuous filtration equipment. Some of the major obstacles are: premature cake cracking, low wash filtration rates, and cloth blinding. It was concluded that acid repulping of coagulated silica followed by recoagulation and water washing was the best way of recovering zinc values in the coagulated silica.

DESIGN WORK

Apart from activities orientated towards clarifying the flowsheet and obtaining additional experimental information, the Research Department was called upon to spend considerable time and effort on assisting with the design of the Silicate Treatment Division and commenting upon proposals from equipment manufacturers.

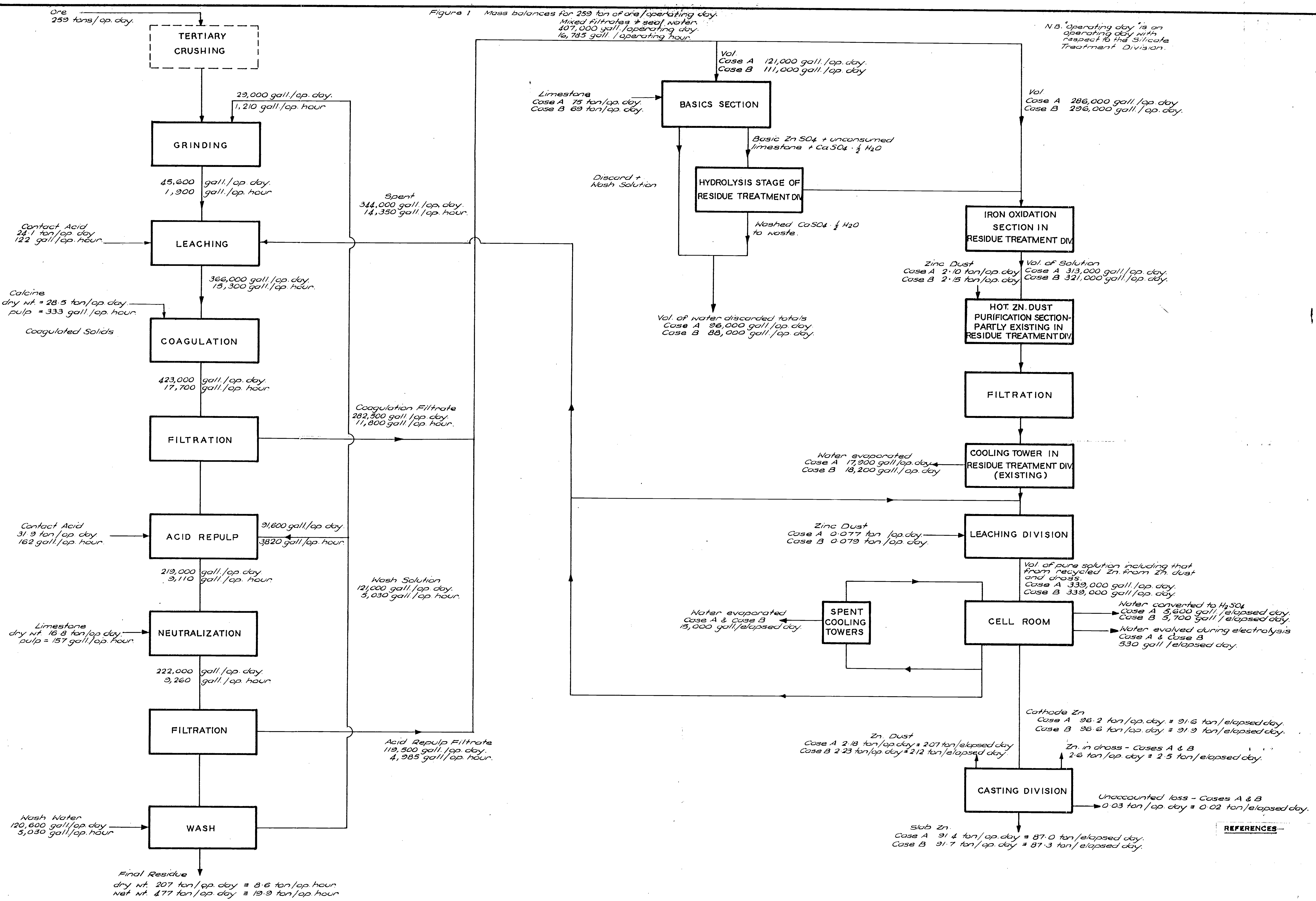
COSTS

The Research Department costs to the 3rd May, 1972, in the financial year 1971/72 for investigating the treatment of Beltana ore were

	$
Labour	18,787
Materials	290
Other charges	1,869
Analytical charges	11,526
Overheads	21,142
	53,616

Research Department expenditure for the whole financial year on this project is expected to be about $58,000.

Figure 1 Mass balances for 259 ton of ore/operating day.



REFERENCES—

REVISIONS | MADE BY | DATE | DESCRIPTION

APPROVED BY | DATE

DRAWN BY
TRACED BY C. Townsend 9·6·71
CHECKED BY
O.K. BY

ELECTROLYTIC ZINC CO.
OF AUSTRALASIA LTD.
RISDON WORKS
HOBART TASMANIA

SCHEMATIC FLOWSHEET
BELTANA ORE TREATMENT
PLANT

D.M.L. No.
SCALE—

1748-5-1

MERCURY WALCH 784100

6 70/71

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

A-Z

TELEPHONE: 60 0591
TELEX: AA30463
TELEGRAMS & CABLES: "ELECTZINC" MELBOURNE

G.P.O. BOX 856K, MELBOURNE
AUSTRALIA, 3001

REGISTERED OFFICE:
390 LONSDALE STREET,
MELBOURNE, AUSTRALIA, 3001

Cl
$25

30th May, 1972

R/35 X89

DEPT. OF MINES
$25 —
31 MAY 1972
RECEIVER OF REVENUE

83/2
R272

The Director of Mines,
Department of Mines,
Box 38, Rundle Street P.O.,
Adelaide,
South Australia, 5000.

Dear Sir,

Special Mining Lease No. 606 - Beltana

Special Mining Lease No. 606 is due to expire on 15th July, 1972, and we now report on our activities during the past twelve months and make application for a twelve months' extension of the lease.

Reporting

The conditions of Special Mining Lease No. 606 require us to report on all metallurgical work on Beltana willemite ore and also all geological work carried out.

During the lease year under review, a considerable amount of work has been completed which we summarise as follows:

1. Geological

Further structural geology was completed on the Beltana ore environment. A programme of geochemical sampling was carried out in the western part of the lease and mapping completed in the south and east of the lease.

2...

Report No. 1 for three months to 16th October, 1971, has previously been submitted, and Report No. 2 covering the further work to date is now enclosed together with the following plans:

R 100-70 400 feet to 1 inch Structural Cross Section
R 100-71 400 feet to 1 inch Local Geology
C 100-75 2,000 feet to 1 inch Beltana and Aroona Geology
DA100-67)
-68) Geochemistry
-69)
D 100-72)
-73)

Expenditure on the above work amounted to $23,840.

2. Feasibility Study

A full scale feasibility study was undertaken, commencing in October, 1971, and completed in March, 1972. Davy-Ashmore Pty. Ltd. was commissioned for the engineering studies of the different processes for the extraction of zinc from the Beltana ore.

The following technical sections of this report are enclosed:

Beltana Project Feasibility Study, 1972 -

Part 2A Crushing and Grinding
Part 2B Ore Beneficiation
Part 3 Leaching
Part 4 Fuming
Part 5 Geology

The cost of this study was $71,190.

3. Beneficiation

Work was carried out by AMDEL on the on-site beneficiation of Beltana ore and the following reports are enclosed:

Beneficiation of Beltana Zinc Ore Fines -

Progress Report No. 1, December, 1971
Service Report No. 2362/72, January, 1972.

This work cost $10,650.

3...

4. Direct Leaching

Concurrently with the above work, our Risdon research staff continued investigations on the direct leaching process for Beltana ore.

Enclosed is a statement describing work done by Research Department, Risdon, on the treatment of Beltana ore during 1971-72.

The internal charges for this research were $58,000.

5. Fuming

Broken Hill Associated Smelters, Port Pirie, were working throughout the year on proposals for fuming Beltana ore.

Their first proposal forms the basis of Part 4 of the Beltana Project Feasibility Study, and is additionally reported on in the enclosed Report R/1358 "Pilot Kiln Roasting Tests on Zinc Oxide Fume Obtained From Willemite Ore - Blast Furnace Slag Charges".

Work is currently continuing by B.H.A.S. on a second proposal, which also involves treating Beltana ore with furnace slag. This study envisages utilising the existing Port Pirie plant with some additions, principally an electric pre-melting furnace.

This proposal has certain advantages to both B.H.A.S. and E.Z., and when the study is completed it will be reported to your Department.

The work completed to date has cost $16,000.

The total expenditure incurred on the Beltana project in the past year amounts to $179,680. We are pleased to note that the reports being submitted remain confidential not only during the currency of the lease but also any mining title that may issue pursuant thereto.

4...

Application for Extension of Special Mining Lease No. 606

We wish to make application for a twelve months' extension of Special Mining Lease No. 606, in support of which we advise the following work programme:

Metallurgical work will continue during the requested twelve months' extension. In particular, the studies of the possibility of treating Beltana ore by B.H.A.S. at Port Pirie will be extended as, at present, this method of treatment has the most appeal. It is estimated that a minimum expenditure of $20,000 will be incurred in this work.

In addition, drilling in the lease area will be recommenced. A minimum of 1,600 feet of diamond core drilling and 1,200 feet of percussion drilling is proposed to test the open southern end of the Beltana orebody and to test a gravity anomaly located in a favourable geological setting some 1,200 feet south of the main ore development. There remains some geological mapping to complete the coverage of the entire lease area and this will be carried out in conjunction with the drilling. The estimated cost of the drilling and geological work is $29,000. A further $5,000 will be spent on ground water testing for both domestic and industrial purposes.

We enclose our cheque for $25 for the forthcoming year's rental and ask for your agreement to the extension of Special Mining Lease No. 606.

Yours faithfully,

R D Pratten

R. D. PRATTEN,
Manager, Exploration Dept.

RDP:RK