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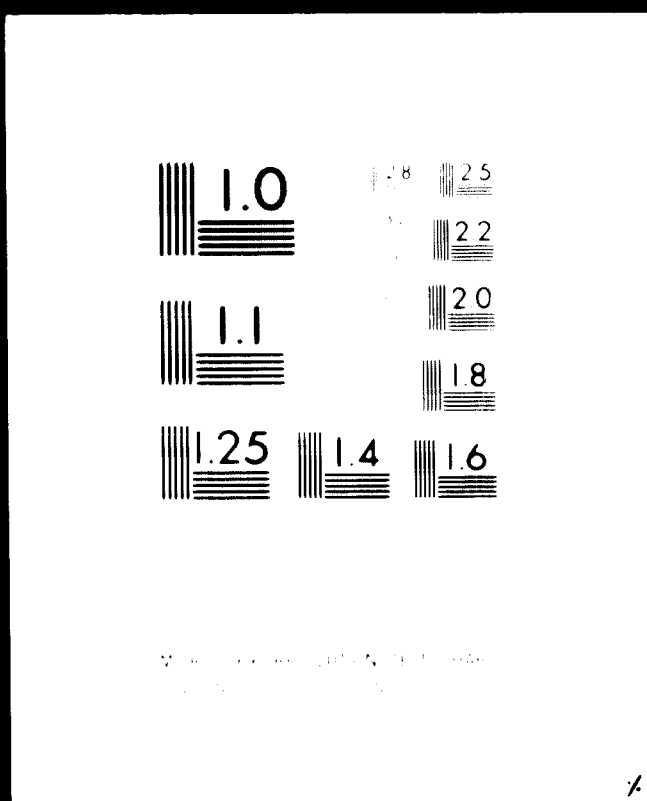
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REPORT ON
**EXPERIMENTAL PRODUCTION PLANT
FOR ASBESTOS PROCESSING
COCHABAMBA, BOLIVIA, UNDP/SF**
SYMBOL: BOL-20
PHASE II
FEASIBILITY STUDY
SNC CONTRACT NO 3049

00000

Prepared for:

The United Nations Industrial
Development Organization
UNIDO
AUSTRIA.

Prepared by:

The Mining & Metallurgy Department
Surveyer, Nenniger & Chenevert Inc.
MONTREAL
CANADA.

April 8, 1971

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MONTREAL 107, CANADA

April 8, 1971.

Our Ref.: #3049

Mr. D.C. Newton, Chief,
Technical Equipment Procurement
and Contracting Office (TEPCO),
United Nations Industrial
Development Organization (UNIDO),
Felderhaus,
Rathausplatz 2,
A-1010 Vienna, AUSTRIA.

Dear Mr. Newton:

Re: Experimental Production Plant for Asbestos
Processing - Contract 70/15 - Phase II

We attach our final report of Phase II of the project "Experimental Production Plant for Asbestos Processing, Cochabamba, Bolivia, UNDP/SF Symbol: BOL 20", Contract No. 70/15.

Our studies on this project were more time consuming than first predicted because the design conditions had to be changed in order to achieve a practicable plant. The data from results of Phase I of this project, when applied to the design of plant, showed that substantial additions were required to the basic flowsheet to cope with the indicated conditions of the ores. We have accordingly incorporated our recommendations to meet the requirements as now indicated, but our report emphasizes the urgent need for an exploration program to define the ore resources before making any further commitments towards plant construction.

We would be pleased to make available the services of our staff and our associates, to prepare and conduct a program of exploration and to establish a mining program.

. . . 2

SURVEYER, NENNIGER & CHÉNEVERT INC.

**United Nations Industrial
Development Organization**

April 8, 1971.

- 2 -

We trust that you will find the report to your satisfaction and that we have correctly met your requirements for the second phase of this project. We regret that it has not been possible for us to despatch the report at the originally scheduled date, but we believe that it will have been worthwhile to complete the study of alternatives before issuing the document to you. We are at your disposal for further discussions.

Thank you for entrusting us with this interesting assignment. We look forward to the opportunity of being of further service to you.

Yours very truly,

SURVEYER, NENNIGER & CHÉNEVERT INC.


**J. Hahn,
Vice-President.**

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SUMMARY

An experimental production plant has been laid out to produce 1500 tons per year of asbestos fibre from Bolivian asbestos ore concentrate. The flowsheet, equipment list and process costs have been developed on the basis of tests made on ore samples. The capital cost for the plant has been estimated at \$1,007,000. It appears that a market exists to absorb the output of 1500 tons of production per year and that the market could increase to 4500 tons per year.

The cash generated by sales of fibre would be sufficient to pay the direct costs of operation and to make a significant contribution to the cost of raw material concentrate, provided there are no capital charges for the plant.

The raw material ores contain substantially lower asbestos fibre than the 40-95% content on which the initial study of this project was based. The plant equipment as envisaged at the initial concept would not be at all suitable for production of fibre from the ores which have been examined to date, and the cost of the plant which could do the work is significantly higher.

The equipment shown on the original flowsheet would produce fibre, but not a good quality fibre. Based on the test results of Phase I, additional equipment was necessary to recover more fibre and control the quality.

So little is known about the extent of ores that would be available for this project that it is essential to complete an exploration program before taking any further steps in the development.

1.0 INTRODUCTION

On March 5, 1970, the United Nations Industrial Development Organization awarded a contract to Surveyer, Nenniger & Chenevert Inc. "for testing of asbestos samples, preparation of a feasibility study, selection of a manufacturing process, supply of equipment, spares and designs and provision of services for the erection and commissioning of an experimental production plant for asbestos processing".

Report of Phase I "Experimental Production Plant for Asbestos Processing" was submitted on August 5, 1970. From the transmittal letter of that report, we quote:

"Our conclusions indicate that the Bolivian fibre can be successfully cleaned and processed. However, it is weaker than competitive South African fibre and may therefore have to be sold at a discount on the world market."

"Based on the recoveries obtained from the different samples, 3000 - 4000 tons of concentrate from the Philadelphia mine would produce 1500 tons of fibre. To obtain 1500 tons of fibre from the San Francisco and Tres Amigos mines would require from 5000 - 8000 tons of concentrate respectively. The grades obtained were somewhat lower than expected. The fibre predominantly grade D."

"The information in our possession on the work done to date does not indicate whether sufficient reserves are available to produce 1500 tons of fibre per year in the experimental plant and, even much less, the 10,000 tons per year projected for the future. Before proceeding with final feasibility, design and construction, we therefore recommend that the deposits be explored further, both geologically and for economics of mining. We suggest that a minimum of ten year ore reserves be proven to make sure that Bolivia does not find itself in the unfortunate position of owning an inoperative plant."

1.0 INTRODUCTION (cont'd)

The United Nations Industrial Development Organization, by its letter of September 11, 1970, authorized Surveyer, Nenniger & Chenevert Inc. to proceed with Phase II of the project: "The Feasibility Study".

The scope of Phase II includes all work of the above mentioned contract with the exception of:

- a) projection of future demand, prices and production for a minimum of 5 years based on anticipated market developments and information obtained in Bolivia.
- b) calculation of return on investment by discounted cash flow method.

The data to be used in Phase II is defined in article (f) of that letter. (See appendix "A") We quote:

"In general, the work to be executed under Phase II of the contract will be predicated upon the results and/or extrapolation of the results of Phase I, and can only take into account any unexpected developments arising from further explorations as may be communicated in good time to your company".

The intentions of UNIDO relative to further geological and mining investigation and testing were outlined in closing paragraph of that same letter. We quote:

"As discussed in the meeting today in the offices of the Director, TCD, Mr. Quijano-Caballero, the UNIDO is planning to have additional exploratory drilling carried out by GEOBOL in Bolivia. As technical back-stopping may be necessary for this work, your firm has kindly agreed to recommend the names of individuals or companies who would be in a position to provide the necessary technical advice at the earliest possible date and on the most favourable terms. It has also been agreed that further laboratory testing will be necessary on the expected additional ore samples, for which your office is prepared to supervise the necessary work, to be carried out in the laboratories of the Quebec Provincial Government in Quebec.

1.0 INTRODUCTION (cont'd)

This report covers Phase II of the project, namely "The Preparation of the Feasibility Study and Selection of a Manufacturing Process for the Alto Chapare Deposits".

An asbestos specialist of Survever, Nenniger & Chenevert Inc. visited the site. He investigated Bolivian construction materials and methods. He discussed and established with various Bolivian Government departments, regulations, sales taxes and custom duties, applying to the project.

Upon his return, the flowsheet was designed, layout was prepared, equipment selected and capital cost estimate prepared for a plant to produce 1500 tons of fibre per year.

Economic feasibility of the plant was studied on the basis of estimated operating costs. Revenues generated from fibre sold would not be sufficient to pay for the expenses of operating the mill.

A more detailed survey of the market available to Bolivian fibres was undertaken. The study outlined a potential 4500 ton per year market capable of growing up to 10,000 tons.

The flowsheet and layouts were revised and new capital estimate made for a mill capable of generating sufficient funds to cover its expenses.

The lack of information on the ore reserves, the lack of a suitable mining plan, both of which would have defined the fibre and type of concentrate to be processed, required that the report totally describe the parameters and assumptions made to arrive at the conclusions.

The lack of information forced us to include provisions for additional equipment. Such equipment would be also required if the decision is taken to build a mill to process concentrate from the three concessions. Such equipment would be required since more rock tonnages than contracted would have to be processed. Additional equipment would also be required due to the very hard rock to be crushed and the high dust content which were determined in the tests of Phase I.

2.0 MARKETS2.1 BOLIVIAN MARKET2.1.1 Manufacturers

- a) Industria Boliava de Asbesto-Cemento (IBACSA) operates an asbestos-cement plant in Cochabamba. The plant produces flat and corrugated sheets. Its capacity is 60 tons of sheets per day. This plant will also produce low and high pressure pipes. Its capacity will be 17 tons of pipes per day.

The plant designer specified the following asbestos proportions:

Sheet:

<u>Weight</u>	<u>%</u>	<u>Grade</u>
42 Kg.	70	5M Canadian Chrysotile
12 Kg.	20	4T Canadian Chrysotile
<u>6 Kg.</u>	<u>10</u>	ML3 South African Crocidolite
60	100	

Pipe:

<u>Weight</u>	<u>%</u>	<u>Grade</u>
8.5 Kg.	48.5	4K Canadian Chrysotile
5.5 Kg.	31.5	5M Canadian Chrysotile
<u>3.5 Kg.</u>	<u>20.0</u>	L6 South African Crocidolite
17.5	100.0	

At capacity, the plant would use the following crocidolite tonnages, (Based on an average 16% of Asbestos Fiber)

	<u>Daily Tonnage</u>		<u>Days/Year</u>		<u>Croc. Content</u>		<u>Fiber Content</u>		
<u>Sheet</u>	60 tons	x	300 days	x	10%	x	16%	=	290 tons
<u>Pipe</u>	17 tons	x	300 days	x	25%	x	16%	=	<u>205 tons</u>
									495 tons

During our visit in November, Bolivian fibers were used in the manufacture of sheets. Tests were later made in a manufacturer's plant in Canada, using a fibre sample from Bolivia. The sample could not be considered as a cleaned and graded fibre and it would be advisable to make a more exhaustive test with prepared fibre to properly determine whether the Bolivian fibre would be suitable for the manufacture of pipes.

2.0 MARKETS (cont'd)2.1 BOLIVIAN MARKET (cont'd)2.1.1 Manufacturers (cont'd)

- b) Fabrica de Tejas de Asbesto-Cemento Otokar operates a very small plant in Cochabamba producing asbestos shingles reportedly at the rate of three hundred square metres per day, from crude asbestos concentrate from Alto Chapare. This has reputedly been a very profitable operation for the sole owner, Mr. Otokar. He stated that his annual consumption is approximately two hundred tons.
- c) A third plant is located in Santa Cruz. No production data was available. Crude asbestos fibre is used for the production of roof tiles.

2.1.2 Asbestos Production

Production from the Alto Chapare region has been very erratic over the years. No reliable statistics exist. The following are the reported exports for the period 1940 to 1967:

1940 - 1951	1,500 tons
1953 - 1957	800 tons estimated
1958 -	-
1959	168 tons
1960	66 tons
1961	57 tons
1962	56 tons
1963	11 tons
1964	139 tons
1965	178 tons
1966	26 tons
1967	4 tons

The maximum tonnage produced might have reached 300 tons per year.

2.1.3 Imports

No fibre was imported in Bolivia prior to 1969.

2.0 MARKETS (cont'd)2.1 BOLIVIAN MARKET (cont'd)2.1.4 Asbestos Consumption

To forecast the possible asbestos consumption, we made the following assumptions based on the provisions that:

- a) qualities of Bolivian fibres can be demonstrated
- b) IBACSA achieves successful operation, marketing and acceptance of its products.

A) **The Experimental Production Plant will produce:**

<u>Year</u>	<u>Capacity</u>	<u>Tons Fibre</u>
1972	25%	375
1973	75%	1125
1974	100%	1500

B) **IBACSA will produce as follows:**

<u>Year</u>	<u>Capacity</u>
1970	10%
1971	30%
1972	50%
1973	75%
1974	100%

C) **IBACSA can successfully substitute Bolivian fibres to replace imported fibres in the manufacture of sheets and pipes, to the following degree:**

<u>Year</u>	<u>South-African</u>	<u>Canadian</u>
1972	50% replaced	0% replaced
1973	90%	10%
1974	95%	15%
1975	95%	20%

2.1.4 Potential Asbestos Consumption in Bolivia

YEAR	FORECASTED DOMESTIC PRODUCTION	TOTAL CONSUMPTION		CONSUMPTION OF IMPORTED FIBRE BY IBACSA (1)	CONSUMPTION OF BOLIVIAN FIBRE BY IBACSA (1)	CONSUMPTION OF BOLIVIAN FIBRE BY OTOKAR	CONSUMPTION OF BOLIVIAN FIBRE BY PLANT IN SANTA CRUZ	TOTAL POTENTIAL CONSUMPTION OF BOLIVIAN FIBRES
		CONSUMPTION BY IBACSA (1)	CONSUMPTION OF BOLIVIAN FIBRE BY IBACSA (1)					
1969	310	0	0	0	200	100	300	
1970	300	337	337	0	200	100	300	
1971	300	1012	1012	0	200	100	300	
1972	375	1687	1586	101	200	100	401 *	
1973	1125	2531	2056	475	200	100	775	
1974	1500	3375	2547	828	200	100	1128	
1975	1500	3375	2398	977	200	100	1277	
1976	1500	3375	2398	977	200	100	1277	

* Filled partly from the asbestos inventory of Banco Minero of Bolivia.

(1) As estimated.

2.0 MARKETS (cont'd)2.1 BOLIVIAN MARKET (cont'd)2.1.5 Pricesa) General

Asbestos ore value depends on the fibre, length, strength and degree of openness. This value is defined by tests made in the laboratory and at customers plants. The data accumulated is insufficient to assess such value.

b) Prices - South Africa

The price, in U.S. dollars, of the South-Africa Crocidolite delivered to IBACSA in 1970 was:

<u>Grade</u>	Price per short ton CIF Matarani Peru	Freight cost per short ton Matarani to Cochabamba	Price per short ton CIF Cochabamba	Price per metric ton CIF Cochabamba
L6	\$ 240.25	\$ 40.00	\$ 280.25	\$ 308.90
ML3	224.75	40.00	264.75	291.75
M5	204.00	40.00	244.00	268.90
MS6	183.00	40.00	223.00	245.75
FS6	163.90	40.00	203.90	224.70

Prices - Ungraded Bolivian Fibre

The price paid in 1970 by the Banco Minero de Bolivia for the unclassified fibre is \$b 1,800 per metric ton, or U.S. \$153.05. The price paid for the unclassified fibre by Fabrica de Tepas de Asbesto-Cemento Otokar is approximately U.S. \$150. per metric ton.

c) Forecast Selling Price

As established in Phase I, Paragraph 8.2, the Bolivian fibre is weaker than the South African fibre and may therefore have to be sold at a discount on the world market. Until more valid information becomes available, the following selling prices, f.o.b. plant, suggested by Bolivia, will be used in our studies.

Long crude fibre, not milled	\$ 700.00/ton
Bolivian grade B	\$ 215.00/ton
Bolivian grade C	\$ 175.00/ton
Bolivian grade D	\$ 145.00/ton

2.0 MARKETS (cont'd)

2.2 LATIN AMERICAN MARKET

2.2.1 General

The growth and development of Latin America will result in a corresponding increase in demand for asbestos products as expressed by Figure 1 - Appendix "B".

Latin America Asbestos imports were 104,427 metric tons (estimated) in 1969, an increase of more than 100% over 1962. Total consumption in 1969 was 114,967 tons (estimated), a 100% increase since 1964. Table II, Appendix "B", shows these asbestos imports by country of origin, for 1962 to 1969.

Of the 104,427 tons asbestos imported by Latin America in 1969, 77,582 tons or 74% was supplied by Canada.

Table III, Appendix "B", shows the quantity of asbestos imported by Latin American countries from Canada, by grade, for the years 1964 to 1969. The greatest demand in each country is for grades 4 and 5. In 1964, these grades formed 80% of total asbestos imported from Canada, while in 1969, this group formed 99% of total asbestos imported from Canada.

The increasing demand for these grades reflects the growth of the asbestos cement industry in these countries.

2.0 MARKETS (cont'd)2.2 LATIN AMERICAN MARKET (cont'd)2.2.2 Argentinaa) Imports

In 1969, Argentina imported 16,452 metric tons of asbestos.

The asbestos cement industry accounts for approximately 80% of the asbestos consumed. The remaining 20% of the market consists of the manufacture of friction products such as brake blocks, linings and clutch facings, as well as the production of electrical and thermal insulating tapes, gaskets, wicks and wick packings, acoustical insulation, etc. The market for friction products may be expected to grow considerably as the Argentine automotive industry continues its rapid expansion. Asbestos may also find a market as filtering material for industrial oil purifiers.

b) Consumers

The major consumers of asbestos in Argentina are:

Cefico S.A.,
4 de Febrero 240, San Andres,
Buenos Aires.

Eternit Argentina S.A.,
Esmeralda 15,
Buenos Aires.

Cofic S.A.I.C.
Iquazu 2493, Haedo,
Prov. de Buenos Aires.

Monofort S.A.I.C.,
25 de Mayo 267
Buenos Aires.

c) Producers

Occurrences of asbestos are known in Argentina. No deposits are exploited. None are expected to be brought in production in the immediate future.

d) Crocidolite

Crocidolite use in Argentina is increasing each year and in 1969 accounted for 4.4% of the asbestos market as compared to 0.5% in 1966. All imports are from South-Africa, as follows:

<u>Year</u>	<u>Metric Tons</u>
1966	56
1968	276
1969	718
1970	500 *

* Monofort S.A.I.C. only.

2.0 MARKETS (cont'd)**2.2** LATIN AMERICAN MARKET (cont'd)**2.2.3** Brazil**a)** Imports

In 1969, Brazil imported 17,876 metric tons of asbestos. 76% of imports came from Canada, 5% South Africa and 9% the United States.

To qualify for import duty exemption, the Brazilian importers are required to procure the equivalent of 35% of the quantity imported from local sources. However, textiles and friction products are made exclusively with imported asbestos.

b) Duties

Brazil does not grant customs duty concessions on asbestos to members of the Latin American Free Trade Area. The present import tax levied on asbestos is 33% ad valorem whether in ore, fibre or powder. An importer can import chrysotile, anthophyllite, amosite and crocidolite duty free if he can prove to the authorities that he has purchased Brazilian-produced chrysotile and anthophyllite equivalent to 21% and 14% respectively of the foreign asbestos he intends to import.

c) Consumers

Brazil is the second largest consumer of asbestos in Latin America. The increase in imports and production in recent years is due to the growing construction underway in Brazil. The main manufacturer of asbestos cement products in Brazil is S/A Mineracao de Amianto of Salvador.

d) Producers

Brazil produces suitable tonnage of asbestos. The quality of Brazilian fibre is lower than Canadian. It is widely used for asbestos cement products.

e) Crocidolite

The imports of crocidolite into Brazil were 760 metric tons in 1963 and 746 metric tons in 1964. From January to August 1970, imports of 15.4 metric tons of crocidolite are reported. This is less than 0.1% of the asbestos market in Brazil. This market could probably be developed.

2.0 MARKETS (cont'd)2.2 LATIN AMERICAN MARKET (cont'd)2.2.4 Chilea) Imports

Chile imported 8,618 metric tons of asbestos in 1968; 84% originated in Canada. Manufacturers of asbestos cement products are the major consumers of asbestos fibre. Asbestos is also widely used in packing, brake lining, woven goods and to a minor extent in automobile under-coatings.

b) Crocidolite

The only available data for crocidolite use in Chile are 347 tons in 1963 and 221 tons in 1964. Import figures for the last few years are not broken into asbestos types.

2.0 MARKETS (cont'd)2.2 LATIN AMERICAN MARKET (cont'd)2.2.5 Colombiaa) Imports

There is a large market for asbestos in Colombia at present. However, by 1972-1973, Colombia could supply most of its own asbestos requirements. A large reduction in imports is expected.

b) Duties

Asbestos fibre falls under Colombian Custom Heading 25.24. Customs duties are 5% ad valorem, and subject to payment of 30% previous deposit (refundable). It is still included in the list of free import items.

c) Consumers

The main consumers of asbestos in Colombia are:

	<u>Tonnage consumed (metric tons)</u>		
	<u>1967</u>	<u>1968</u>	<u>1969</u>
Eternit Colombiana S.A.	17,815	11,499	9,650
Pavco S.A.	500	300	600
Colombit S.A.	750	1,200	1,424
Repuestos Colombianos Ltda.	350	450	500
Rusco de Colombia S.A.	304	250	425
Total	19,719	13,699	12,599

Eternit produces asbestos cement products. It is by far the largest user of asbestos in Colombia. It imported in 1969 chrysotile of grades 3, 4, 5 and 6 and 45 tons of amosite.

Colombit S.A. manufactures cement products. In 1969, it used groups 4T3, 5A, 5D, 4TE, C65 and amosite.

2.0 MARKETS (cont'd)2.2 LATIN AMERICAN MARKET (cont'd)2.2.5 Colombia (cont'd)c) Consumers (cont'd)

Other companies using asbestos in Colombia are:

- Pavco S.A. produces asbestos-vinyl tiles and sheets. It uses AZ and ZO fibre.
- Reco Ltda manufactures clutch, discs and brake linings with type 5R fibre.
- Ruscode Colombia S.A. produces clutch, discs and brake linings with 5K, 7D and 7M fibres.

d) Producers

Asbestos deposits exist in Colombia, Plans exist to bring into production at the latest in 1973, a large deposit which will fill all the asbestos requirements of Colombia. Colombia could produce fibre for the U.S.A. and Japan markets.

e) Crocidolite

In 1969, crocidolite accounted for 9.7% of the total asbestos market in Colombia. Imports of crocidolite were:

<u>Year</u>	<u>Metric Tons</u>
1963	1,669
1964	762
1967	1,756 *
1968	454 *
1969	1,226
1970	2,300 *

* Used by Eternit Colombiana S.A. only.

Imports of crocidolite for 1970 were of grades 3Y and 4, mostly from South Africa. As crocidolite use is preferred for some products, its market may expand.

2.0 MARKETS (cont'd)2.2 LATIN AMERICAN MARKET (cont'd)2.2.6 Ecuadora) Imports

In 1968, imports were 1,125 metric tons. In 1969, imports were 900 tons. These were grades 4 and 5.

b) Duties

Asbestos falls under Ecuadorian Custom Heading 194-6. Duties are 20% ad valorem plus U.S. \$1.24 per kilogram.

c) Consumers

Eternit Ecuatoriana S.A. is the only one plant consuming asbestos fibre. They makes asbestos cement piping, tubing, roofing, wallsiding and other asbestos cement products.

d) Crocidolite

No crocidolite is imported in Ecuador.

Ecuador is a member of LAFTA and the Andean Group and is a potential customer for asbestos from Bolivia.

2.2.7 Mexicoa) Imports

Mexico is the largest user of asbestos in Latin America importing over 37,000 metric tons per year. The asbestos market is expected to increase 12 to 15% annually for the next five to ten years.

b) Producers

Asbestos occurrences are known in Mexico. One mine scheduled to produce 300 tons per day should start production in 1971. A second and large project is under study.

c) Crocidolite

Mexico imported from South Africa in 1963 - 2,696 metric tons of crocidolite and - 590 metric tons in 1964. Mexican statistics do not indicate the varieties of asbestos fibre imported.

2.0 MARKETS (cont'd)

2.2 LATIN AMERICAN MARKET (cont'd)

2.2.8 Peru

a) Imports

Peru imported 4,239 metric tons of asbestos in 1967 and 3,966 tons in 1968. There are no comparative figures available for 1969.

b) Crocidolite

Peru imported from South Africa 227 metric tons in 1963 and 296 metric tons in 1964.

2.2.9 Venezuela

a) Imports

Venezuela imported in 1969 - 4,673 metric tons of asbestos fibre. 88% came from Canada and 11% from South Africa.

b) Consumers

Consumption is about two-thirds of groups 4 and 5 and one-third of groups 6 to 9. About two-thirds of the market is tied up with Canadian suppliers and the remaining one-third is open to independents.

c) Crocidolite

There is no breakdown as to varieties of asbestos imports in Venezuelan customs statistics. No record of crocidolite imports are available.

2.2.10 Estimated Crocidolite Potential Market in Latin America

We forecast the growth and market penetration of the Latin American asbestos markets by Bolivian fibres as follows:

2.0 MARKETS (cont'd)2.2 LATIN AMERICAN MARKET (cont'd)2.2.10 Estimated Crocidolite Potential Market in Latin America (cont'd)

<u>Country</u>	<u>Year</u>	<u>Total Asbestos Consumption</u>		<u>Crocidolite Consumption</u>		<u>Potential Market for Bolivian Fibre</u>	
		<u>tons</u>	<u>%</u>	<u>Tons</u>	<u>% of Crocidolite Consumption</u>	<u>Tons</u>	
Argentina	1969	16,452	4.4	718	0	0	
	1970	18,000	5.0	900	0	0	
	1971	19,500	5.0	975	0	0	
	1972	21,000	5.5	1125	0	0	
	1973	22,500	5.5	1240	2	25	
	1974	24,000	6.0	1440	5	72	
	1975	26,000	6.0	1560	8	125	
	1976	28,000	6.0	1680	10	168	
Brasil	1969	17,876			0	0	
	1970	18,000	0.2	31	0	0	
	1971	18,400	0.6	108	0	0	
	1972	18,800	1.0	188	0	0	
	1973	19,200	1.5	288	2	5	
	1974	19,700	2.0	394	5	20	
	1975	20,200	2.0	404	8	32	
	1976	21,700	2.0	434	10	43	
Chile	1972	9,000	16.0	1,440	0	0	
	1973	9,300	16.0	1,490	2	30	
	1974	9,600	16.0	1,530	5	76	
	1975	10,000	16.0	1,600	8	128	
	1976	10,400	16.0	1,664	10	166	
Colombia	1969	12,599	9.7	1,226	0	0	
	1970	12,800	18.0	2,300	0	0	
	1971	13,000	18.0	2,340	0	0	
	1972	13,300	18.0	2,380	0	0	
	1973	13,600	18.0	2,440	0	0	
	1974	14,000	18.0	2,510	0	0	
	1975	14,500	18.0	2,600	0	0	
	1976	15,000	18.0	2,700	0	0	

2.0 MARKETS (cont'd)2.2 LATIN AMERICAN MARKET (cont'd)2.2.10 Estimated Crocidolite Potential Market in Latin America (cont'd)

<u>Country</u>	<u>Year</u>	<u>Total Asbestos Consumption</u>		<u>Crocidolite Consumption</u>		<u>Potential Market for Bolivian Fibre</u>	
		<u>tons</u>	<u>%</u>	<u>Tons</u>	<u>% of Crocidolite Consumption</u>	<u>Tons</u>	
Ecuador	1969	900	0	0	0	0	
	1970	920	0	0	0	0	
	1971	940	0	0	0	0	
	1972	970	0	0	0	0	
	1973	1,000	2	20	100	20	
	1974	1,040	4	42	100	42	
	1975	1,080	5	54	100	54	
	1976	1,130	6	68	100	68	
Mexico	1971	37,000	5	1,850	0	0	
	1972	42,000	5	2,100	0	0	
	1973	48,000	5	2,400	2	48	
	1974	54,000	5	2,700	5	135	
	1975	61,000	5	3,050	8	244	
	1976	69,000	5	3,450	10	345	
Peru	1972	4,000	7.5	300	0	0	
	1973	4,200	7.5	315	2	6	
	1974	4,400	7.5	330	5	16	
	1975	4,700	7.5	353	8	28	
	1976	5,000	7.5	375	10	37	
Venezuela	1969	4,673	11.0	514	0	0	
	1970	4,900	11.0	539	0	0	
	1971	5,100	11.0	561	0	0	
	1972	5,300	11.0	583	0	0	
	1973	5,600	11.0	616	2	12	
	1974	5,900	11.0	649	5	32	
	1975	6,300	11.0	693	8	55	
	1976	6,700	11.0	737	10	73	

2.0 MARKETS (cont'd)2.2 LATIN AMERICAN MARKET (cont'd)2.2.11 Summary of Latin American Potential Market
for Bolivian Crocidolite Fibre in Metric Tons

<u>Year</u>	<u>Argentina</u>	<u>Brazil</u>	<u>Chile</u>	<u>Columbia</u>	<u>Ecuador</u>	<u>Mexico</u>	<u>Peru</u>	<u>Venezuela</u>	<u>Total</u>
1972	0	0	0	0	0	0	0	0	0
1973	25	5	30	0	20	48	6	12	146
1974	72	20	76	0	42	135	16	32	393
1975	125	32	128	0	54	244	28	55	666
1976	168	43	166	0	68	345	37	73	900

2.0 MARKETS (cont'd)2.3 NORTH AMERICAN MARKET2.3.1 Canada

In 1969, Canada consumed 63,500 metric tons of asbestos. 2,768 metric tons (estimated) or 4.4% was crocidolite. This crocidolite market has been stable over the past decade. Import figures for crocidolite are:

<u>Year</u>	<u>Metric Tons</u>
1963	1,819
1964	2,544
1965	N/A
1966	2,976 (est.)
1967	2,927 (est.)
1968	2,740
1969	2,768 (est.)

2.3.2 United States of America

The U.S.A. is the largest consumer of asbestos fibre in North America. Its apparent consumption was 711,520 metric tons in 1969. They imported 630,089 metric tons and exported 32,815 metric tons. The market has been very stable for the past decade. 9,800 metric tons (1.4%) was crocidolite representing the largest market for crocidolite in North and South America. Although the tonnage of crocidolite dropped to 9,800 metric tons in 1969 from 12,741 tons in 1968, it is still a very large market.

Import figures for the U.S.A. are:

<u>Year</u>	<u>Metric Tons</u>
1963	12,729
1964 *	22,490
1965 *	21,165
1966 *	26,995
1967	13,532
1968	12,741
1969	9,800

* Figures for 1964 - 1966 are high due to government stockpiling.

2.0 MARKETS (cont'd)2.3 NORTH AMERICAN MARKET (cont'd)2.3.3 Estimated Crocidolite Potential Market in North America

<u>Country</u>	<u>Year</u>	<u>Total Asbestos Consumption</u>		<u>Crocidolite Consumption</u>		<u>Potential Market for Bolivian Fibre</u>	
		<u>Tons</u>	<u>%</u>	<u>Tons</u>	<u>% of Crocidolite Consumption</u>	<u>Tons</u>	
Canada	1969	63,500	4.4	2,768	0	0	
	1970	65,000	4.4	2,850	0	0	
	1971	66,000	4.4	2,930	0	0	
	1972	69,000	4.4	3,040	0	0	
	1973	71,000	4.4	3,120	2	62	
	1974	73,000	4.4	3,210	5	160	
	1975	75,000	4.4	3,300	8	264	
	1976	77,500	4.4	3,400	10	340	
U.S.A.	1969	711,520	1.4	9,800	0	0	
	1970	713,000	1.4	9,982	0	0	
	1971	715,000	1.4	10,010	0	0	
	1972	717,000	1.4	10,938	0	0	
	1973	720,000	1.4	10,080	2	202	
	1974	723,000	1.4	10,122	5	506	
	1975	726,000	1.4	10,164	8	813	
	1976	730,000	1.4	10,220	10	1022	

2.3.4 Summary of North American Potential Market for Bolivian Crocidolite Fibre in Metric Tons

<u>Year</u>	<u>Canada</u>	<u>U.S.A.</u>	<u>Total</u>
1972	0	0	0
1973	62	202	264
1974	160	506	666
1975	264	813	1,077
1976	340	1,022	1,362

2.0 MARKETS (cont'd)2.4 COMBINED BOLIVIAN, LATIN AMERICAN
AND NORTH AMERICAN POTENTIAL
MARKET FOR BOLIVIAN CROCIDOLITE FIBRE IN METRIC TONS

<u>Year</u>	<u>Bolivia</u>	<u>Latin America</u>	<u>North America</u>	<u>Total</u>
1972	401	0	0	401
1973	775	146	264	1,185
1974	1,128	393	666	2,187
1975	1,277	666	1,077	3,020
1976	1,277	900	1,362	3,539

2.0 MARKETS (cont'd)

2.5 TRANSPORTATION

2.5.1 To Domestic Market

The two main Bolivian buyers of asbestos are located in the Cochabamba region. Shipping cost should not exceed \$0.15 per metric ton. The other Bolivian users could be served by rail from Cochabamba railway station at an estimated cost of \$1.35 per ton.

2.5.2 Shipping for the Export Market

Shipping to the foreign customers would be:

- a) by rail from Cochabamba to Antofagasta, Chili, at a cost of \$44.00 per metric ton.
- b) by sea from the port of Antofagasta, Chili, to the export destination.

2.6 CONCLUSIONS

Markets exist for crocidolite in Bolivia and in all major countries using asbestos in North and South America.

As soon as it can be demonstrated that the Bolivian fibre can replace the South African asbestos, Bolivia should be able to gain enough of the market to support an asbestos mill of 1500 tons per year.

The foreign markets are favourably located with respect to a Bolivian source of supply, which should result in a lower CIF price for crocidolite. Bolivian crocidolite should be competitive with that of South Africa provided that the quality of the fibre is demonstrated acceptable.

3.0 GEOLOGY

3.1 ADDITIONAL EXPLORATIONS

As of January 15, Surveyer, Nenniger & Chenevert Inc. were not informed of additional explorations or drillings carried out.

The following data was extracted from previous reports, including our Phase I report: "Experimental Production Plant for Asbestos Processing".

3.2 OCCURENCES

3.2.1 General

All mining is done on concessions which have been awarded by the Government. The exact boundaries of these concessions are not known (see Sketch No. 3). The concessions are merely defined as being a number of hectares in a certain region and the annual nominal lease payments are based on that number. It is probable that boundary disputes will arise in the event that any significant discoveries are made or if the economic outlook for the known deposits improves considerably.

The crocidolite is generally found in a series of quartzites and iron-bearing sandstones. Overlying these rocks is a black, argillaceous shale followed by a dolomite. The thickness of the quartzites and sandstones varies and in one adit on the San Francisco concession, they were exposed for sixty metres.

The structural geology of the area is extremely complex. Numerous folds were observed as well as extensive faulting. The dense growth and overburden make it difficult to do any detailed interpretation of the area.

The fibre veins are very irregular in their number and orientation. In some locations they are conformable with the bedding planes and in others at right angles to the beds. Frequently the orientation is neither one nor the other.

3.0 GEOLOGY (cont'd)

3.2 OCCURENCES (cont'd)

3.2.2 Filadelfia Concession

Several scattered veins were observed around the pit. It is claimed that there are veins of long fibre in the pit floor which are now covered with soil and waste from veins which were easier to get at in the walls of the excavation. There is possibly some justification for believing this claim as several rocks were accumulated in one area which contained good fibre but which would have required crushing to liberate.

The types of fibre included cross fibre, slip fibre and mass fibre with the latter being most predominant. A good percentage of the fibre contained in the hard rock which could not be hand-cobbed without drilling, blasting and crushing was cross fibre and thus this type may increase with depth.

3.2.3 San Francisco Concession

Almost all fibre was of the mass variety. In all of the underground workings, extremely wet conditions prevailed and the fibre was saturated, but the bulk of the fibre was less than twelve millimetres.

3.2.4 Tres Amigos Concession

The fibre is generally all of the mass variety and short. Only one vein containing fibre greater than twenty-five millimetres was observed and it was located in a steep face.

All the workings at Tres Amigos were surface showings and the fibre was being recovered from unconsolidated material. A notable characteristic of the fibre exposures at Tres Amigos is that all will require substantial amounts of overburden to be removed if fibre production is to be increased.

3.0 GEOLOGY (cont'd)

3.3 ORE RESERVES

No geological mapping and drilling has been made on the three main concessions. The information available on the quantity of ore present and the quantity contained is as follows:

3.3.1 Filadelfia Concession

From what could be observed, it would appear that the Filadelfia mine offers the best possibilities of any of the properties visited for fibre in the quantities required.

3.3.2 San Francisco Concession

The ore reserves calculated by GEOBOL, (Servicio Geologico de Bolivia) during their geological survey in 1967, suggested that the greatest tonnage of reserves was located on the San Francisco property. If this is in fact the case and it is desired to supply a substantial portion of the fibre requirements for the experimental plant from this deposit, then, considerable thought and money is going to have to be allocated to provision of access, definition of ore blocks and methods of mining.

3.3.3 Tres Amigos Concession

The economic attractiveness of the Tres Amigos deposits would appear to be rather limited pending further exploration and development.

3.0 GEOLOGY (cont'd)3.4 ASBESTOS FIBRE

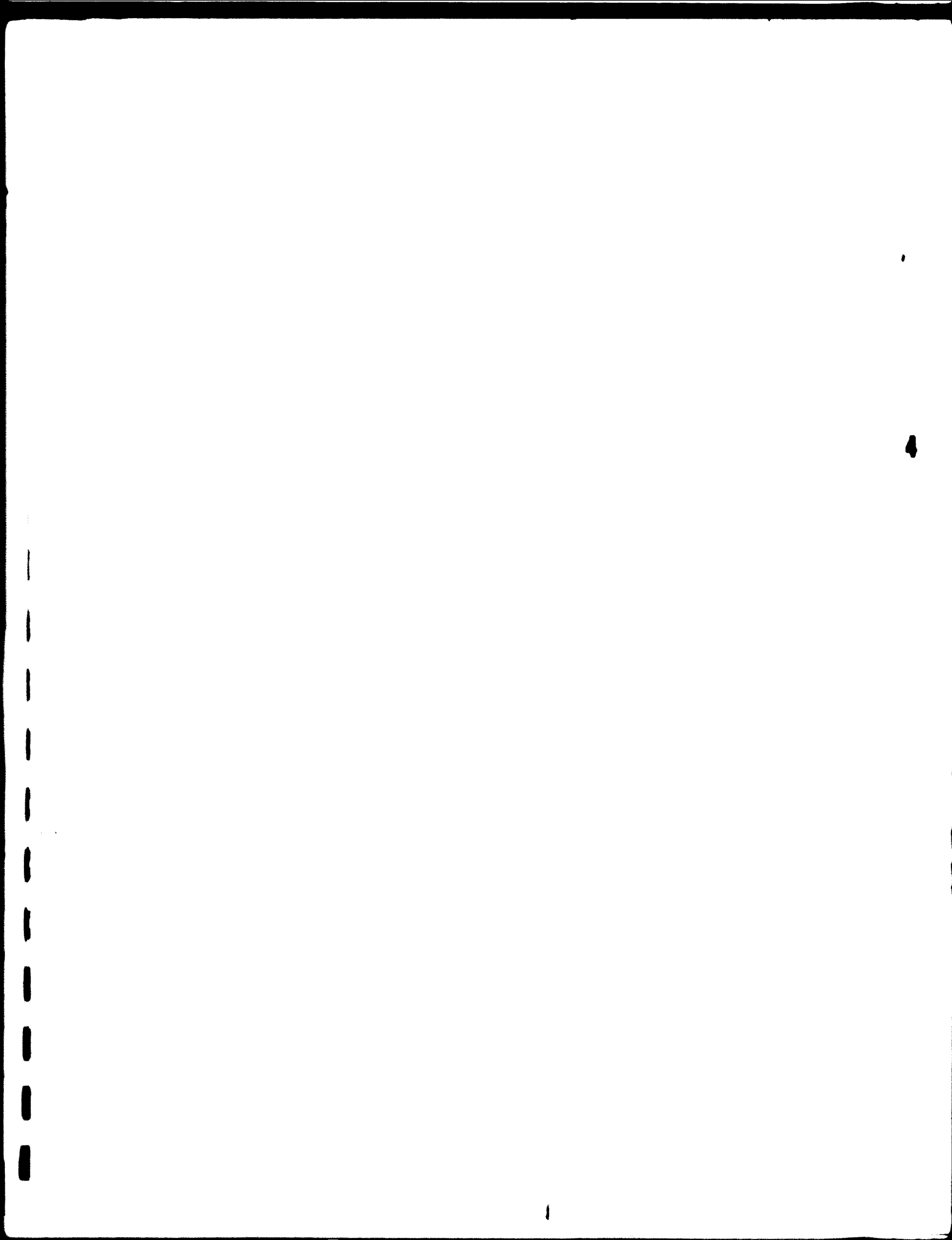
From the two tons hand picked ore sample during Phase I of the project, the fibre was recovered as follows:

3.4.1 Fibre Yield

<u>Location</u>	<u>Grade A & B</u>	<u>Grade C</u>	<u>Grade D</u>	<u>Total</u>
Filadelfia Mine (rock sample)	4.23%	11.02%	22.87%	38.12%
Filadelfia Mine (fine ore)	2.90	18.38	25.49	46.77%
San Francisco Mine (fine ore)	0.22	4.63	23.36	28.21%
Tres Amigos Mine (fine ore)	0.49	2.58	15.79	18.86%

3.4.2 Fibre Recovery

<u>Location</u>	<u>Grade A & B</u>	<u>Grade C</u>	<u>Grade D</u>	<u>Total</u>
Filadelfia Mine (rock sample)	11.1%	28.9%	60.0%	100.0%
Filadelfia Mine (fine ore)	6.2	39.3	54.5	100.0%
San Francisco Mine (fine ore)	0.8	16.4	82.8	100.0%
Tres Amigos Mine (fine ore)	2.6	13.7	83.7	100.0%



4.0 LOCATION, CLIMATE, COMMUNICATION AND FACILITIES

4.1 LOCATION

4.1.1 Mine

The deposits are located in the Alto Chapare region of Bolivia, about one hundred kilometres northeast of Cochabamba, in a zone which has long been known for its surface showings of crocidolite asbestos.

4.1.2 Plant Site

The site selected by for the experimental production plant is located about nine kilometres from Cochabamba on the road to Villa-Tunari and three kilometres from Sacaba, the nearest town. (See sketches No. 1 and No. 2)

Cochabamba, with a population of 137,000 is the second largest Bolivian city. Its altitude is 2500 metres above sea level. The city is well developed and include hospitals, schools, churches, stores, recreational facilities and hotels.

Sacaba is a town with a population of 3,500.

4.2 CLIMATE

4.2.1 Mine

The Alto Chapare region receives the greatest amount of rainfall of any region in Bolivia with an annual average of approximately 4,000 millimetres. Most of this falls during the period from December to March inclusive. At that time of the year, it is almost impossible to carry on normal mining operations.

Dense growth covers most of the region except for those steep slopes where erosion has occurred due to the slide of water saturated material.

4.2.2 Plant Site

The plant site area is considered as a sub-tropical region, with inland temperate climatic conditions. Average annual rainfall is 500 mm. with approximately 80 days of intermittent rains between November and March. Minimum and maximum temperatures recorded were respectively 11°C and 28°C with mean temperature of 17°C.

4.0 LOCATION, CLIMATE, COMMUNICATION AND FACILITIES (cont'd)4.3 COMMUNICATIONS4.3.1 Road

The Cochabamba - Villa Tunari road will be the main road connecting the plant with the mine. It is scheduled to be completed before the end of 1971. 66 km have been asphalted, 24 km have gravel surface and 36 km are still to be constructed.

From Cochabamba, roads and highway truck transports connect all the major cities of Bolivia.

4.3.2 Railroad

Cochabamba has rail connections to the Chilean ports of Arica and Autofagosta on the Pacific Coast. It has rail connections with the Bolivian Markets.

4.3.3 Airlines

The City of Cochabamba is served by the Bolivian Airline with regular services from La Paz the Capital.

4.4 POWER

Supply of power to the experimental production plant is based on availability from the existing sub-station.

4.5 WATER

Water supply is assumed based on deep wells and a pumping station to be installed on the site.

5.0 DESIGN CRITERIA5.1 MINE5.1.1 Contractual Obligations

The following criteria were extracted from the mining program submitted by Bolivia (Appendix "C"), and the limited available geological data summarized in Section 3 of this report.

5.1.2 Ore Reserves

Unknown.

5.1.3 Ore Value

Unknown.

5.1.4 Fibre Content

- | | | |
|----|---|--|
| a) | Filadelfia Concession | Unknown |
| b) | San Francisco Concession | Estimated by our geologist
as probably 3-5% |
| c) | Tres Amigos Concession | Unknown |
| d) | Bolivian Estimate | 6% (as extracted from Bolivia
Mining Program) |
| e) | As estimated by our
geologist based on
surface examination
of the showings, audits | 4% |

5.1.5 Fibre Recovery

The mining program proposes that fibre bearing rocks be hand cobbled by workers from the blasted face. We estimated that the fibre recovery of that operation, based on our review of available information:

- | | | |
|----|--------------------------|-----|
| a) | Filadelfia Concession | 70% |
| b) | San Francisco Concession | 60% |
| c) | Tres Amigos Concession | 50% |

5.1.6 Humidity Content

- | | | |
|----|--------------------|---------|
| a) | In the Ore | 20% |
| b) | In the Concentrate | 5 - 10% |

5.0 DESIGN CRITERIA (cont'd)5.1 MINE (cont'd)5.1.7 Concentrate Fibre Content

The two-ton experimental sample was carefully picked by an experienced geologist to obtain the best representative "ore available and the type of raw material to be delivered to the plant".

In consultation with our geologist, we estimated the average fibre content in the concentrate to be produced by the mining operations and to be delivered to the plant, as follows:

a) Filadelfia Concentrate

Test Result - Rock	38.12%
- Fine Ore	46.77%

b) San Francisco Concentrate

Test Result - Fine Ore	28.21%
Estimated Fibre Content	20.0%

c) Tres Amigos Concentrate

Test Result - Fine Ore	18.86%
Estimated Fibre Content	12.5%

d) Contractual Obligations

Under the terms of the contract between Surveyer, Nenniger & Chenevert Inc. and UNIDO, the experimental production mill is to be provided with 40-95% asbestos content ore.

The above assumptions, based on test results of Phase I, indicate that concentrate of 12.5% to 30.0% would be supplied under the mining program proposed.

5.1.8 Concentrate Size

The concentrate maximum size will be 30 cm supplied to the mill as per the mining program proposed by Bolivia.

5.1.9 Mine Schedule

As per the mining program proposed by Bolivia, the mine will work one 8 hour shift (7 effective hours) per day, six days per week and ten months or 250 operating days per year.

5.0 DESIGN CRITERIA (cont'd)

5.2 MILL

5.2.1 Production Rate

a) Contractual Obligation

The mill is to be designed to produce 1500 tons of asbestos fibre per year, from 40 - 95% concentrate.

b) Design Basis

For the purpose of this study and based on the test results of Phase I, the flowsheet and mill layout were prepared to produce 1500 tons of asbestos fibre per year when supplied with a 12.5 to 30.0% concentrate.

5.2.2 Fibre Distribution

a) Contractual Obligation

The percent distribution of Bolivian Asbestos in the mill product was to be as follows:

Grade A - Not less than 12%

B - Not less than 40%

C - Not less than 30%

D - Not less than 18%

b) Flowsheet Design

The test results of Phase I indicate that the fibre distribution would be:

Grade A & B Up to 15%

Grade C 10 - 40%

Grade D 50 - 85%

5.2.3 Flexibility

Unless the criteria are firmly established, we believe to the best of our ability that the original mill will not be able to do the job intended. Based on our careful analysis of the situation we recommend that the mill be designed for flexibility which would include ability to cope with:

- a) the extreme variations between the characteristics of the ore from the three concessions;
- b) the variation of concentrate fibre content between ores of the three concessions.

5. DESIGN CRITERIA (cont'd)5.2 MILL (cont'd)5.2.3 Flexibility (cont'd)

- c) total lack of information on **type and quality of ore** to be found below the surface.
- d) probable large variation of **fibre concentrate content** between each truck shipment produced under the proposed mining program.

We recommend that ore reserves and mining methods be established before taking any other steps.

In these cases where flexibility would require additional equipment over our contractual obligations, the flowsheet and plant layout should contain provision for such addition and the additional costs should be defined for consideration.

Equipment supplied should be limited to the contractual obligations until such time that additional costs required for flexibility be approved by UNIDO. However, the financial studies should include the cost of such provisions.

5.2.4 Plant Schedule

The mill will operate 300 days per year, 8 hours per day (7 effective working hours), and six days per week, as per information received during our visit to Bolivia.

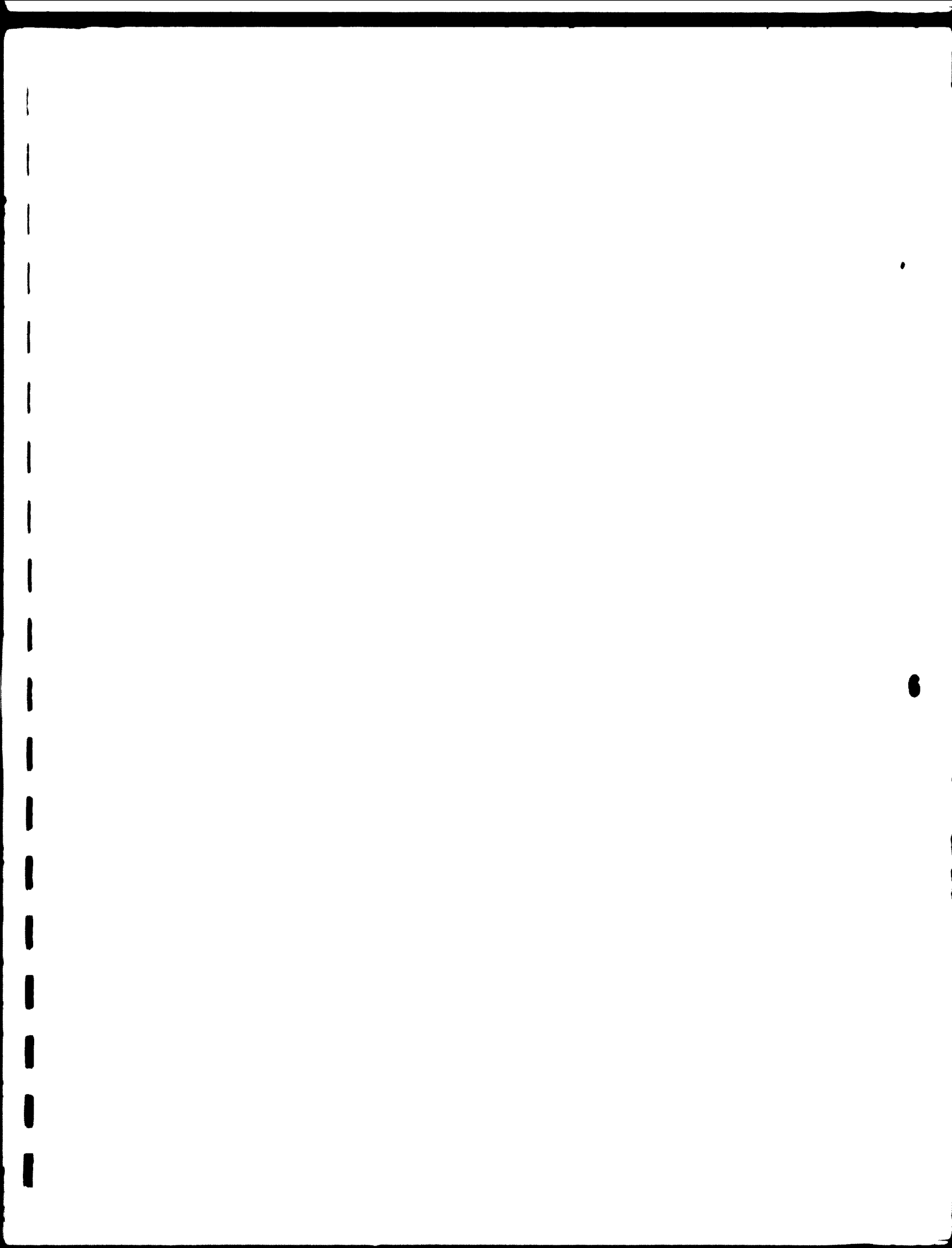
5.0 DESIGN CRITERIA (cont'd)5.3 TONNAGE TO BE PROCESSED

The mill flowsheet and plant layout are designed to process either a concentrate from any of the three concessions or a combination of concentrates from the three concessions. The mill feed tonnage to be processed and design plant capacity for the alternatives are as follows:

	METRIC TONS			
	<u>Required</u>	<u>Filadelfia</u>	<u>San Francisco</u>	<u>Tres Amigos</u>
Fibre Yearly Production	1500			
Fibre Daily Production (300 days)	5			
Fibre Required Daily 5 tons / 85% mill recovery	5.9			
(1) Dry Concentrate Required Daily				
(a) with Contractual Fibre Content of 40%	14.8			
(b) with Indicated Filadelfia @ 30%		19.6		
(c) with Indicated San Francisco @ 20%			29.5	
(d) with Indicated Tres Amigos @ 12.5%				47.2
(2) Wet Concentrate Required Daily				
Item (1) 10% humidity	16.2	21.8	32.8	52.5
	TPH	TPH	TPH	TPH
(3) Hourly Mill Feed Wet				
Item (2) /7 hours shift	2.31	3.13	4.68	7.5
Average Mill Feed (Wet) 3 Concessions 3.13 + 4.68 + 7.5 / 3	5.1			
Design Dry Mill Feed Selected in Tons per Hour	5.0	5.0	5.0	5.0
Maximum Fibre Production per Shift	12.0	9.0	6.0	3.7

5.0 DESIGN CRITERIA (cont'd)5.3 TONNAGE TO BE PROCESSED (cont'd)

	METRIC TONS			
	<u>Required</u>	<u>Filadelfia</u>	<u>San Francisco</u>	<u>Tres Amigos</u>
Concentrate Content in %	40	30	20	12.5
Design Mill Feed (Dry) in Tons per Hour	5	5	5	5
Tonnage processed (Dry) per one 8-hour shift	35	35	35	35
two 8-hour shifts	70	70	70	70
three 8-hour shifts	105	105	105	105
Tonnage processed (Dry) yearly (300 days):				
one 8-hour shift	10,500	10,500	10,500	10,500
two 8-hour shifts	21,000	21,000	21,000	21,000
three 8-hour shifts	31,500	31,500	31,500	31,500
Fibre produced per day:				
one 8-hour shift	11.9	8.9	6.0	3.7
two 8-hour shifts	23.8	17.9	11.9	7.4
three 8-hour shifts	35.7	26.8	17.9	11.1
Fibre produced yearly:				
one 8-hour shift	3,570	2,678	1,785	1,313
two 8-hour shifts	7,140	5,355	3,570	2,625
three 8-hour shifts	10,710	8,033	5,355	3,938



6.0 PROPOSED OPERATIONS**6.1** MINING

Our contractual obligations include:

"Assessment of the cost of ore or ores delivered to the Plant based on present or suggested improved future mining and transportation methods after consultation with existing producers and Bolivian Government authorities."

We studied the mining program submitted by Bolivia (see Appendix "C") and have the following comments:

- a) The principle of the mining program is sound. The feasibility of continuously moving mining equipment from one property to the other is doubtful.
- b) The mining program and costs thereof are based on the production of 40 - 95% asbestos ore concentrate. They should be revised for the 12.5 to 30.0% concentrate as indicated by test results of Phase I.
- c) Methods of removal of material from the blasted face, crushing and screening to a maximum size of 30 cm. disposal of waste and overburden should be detailed.
- d) The hand cobbing operations should be mechanized.
- e) Drying and storing of concentrate prior to trucking to Cochabamba should be further investigated. Shelter for concentrate during the rainy season might be needed.
- f) A time study should clarify the trucking costs of concentrate to Cochabamba, estimated at more than \$5.00/ton. One or two additional trucks might be needed.
- g) The provisions of \$5,000.00 might be sufficient to build the access road to the Filadelfia concession. A much larger sum will be needed to gain access to the other concessions.
- h) No provisions were made to remove the overburden at the three concessions or to develop the San Francisco and Tres Amigos concessions as may be required.
- i) Provisions should be made to mix the concentrate from the three concessions. Such mixing should be done before the concentrate is delivered to the plant. Provisions suggested to be made by Bolivia and included in the mill flowsheet and plant layout are not sufficient.

6.0 PROPOSED OPERATIONS (cont'd)**6.1** MINING (cont'd)

Until the above items have been clarified, we cannot positively assess the cost of ore delivered to the plant. We believe it is necessary that:

- a) Sufficient ore reserves be established by supervised drilling and exploration.
- b) The decision be taken that the Filadelfia concession be the first brought into production for the following reasons:
 - i) Filadelfia is the only one readily accessible;
 - ii) Amount of overburden to remove is small;
 - iii) Development work required is much less than for other concessions.
- c) The title of the Filadelfia concession be cleared, its boundaries defined and well established.
- d) A contract be entered with the Owner of the Filadelfia concession before the design starts.
- e) A complete and detailed mining plan for the Filadelfia concession be prepared.

6.0 PROPOSED OPERATIONS (cont'd)

6.2 PROCESS (See Flowsheet Drawing No. 1)

6.2.1 Crushing and Drying

The mine truck will dump the concentrate into a 15 metric tons concrete hopper. An apron feeder will deliver the concentrate into the jaw crusher.

At the rate of 5 tons per hour, a belt conveyor will deliver the crushed concentrate to the secondary crushing station.

The concentrate will be crushed and dried in a combination crushing-drying unit.

The combined crushing-drying operations, supplemented by the mechanical and pneumatic swirling action inside the crusher-dryer, will tend to reduce the moisture content of the concentrate from about 10% to about 1.5%.

6.2.2 Milling

The mill flowsheet has been laid out to recover approximately 85% of fibre. The mill feed has been set at 5 metric tons per hour of concentrate.

Long crude fibre will not be milled. We estimated 25 tons will be produced and sold yearly in the world markets.

The mill is designed to produce three Bolivian grades of fibre, groups B, C and D. The flowsheet permits their production simultaneously.

The following basic operations are incorporated in the flowsheet:

6.0 PROPOSED OPERATIONS (cont'd)

6.2 PROCESS (See Flowsheet Drawing No. 1)

6.2.2 Milling

- The fibre will be liberated from the concentrate and aspirated. This function will be performed in the rock circuit.
- The fibre will be cleaned and graded. This function will be performed in the fibre circuit.

a) Rock Circuit

The mill will have one rock line. Its design capacity is 5 tons per hour of concentrate containing 12.5 to 30.0% fibre.

Two principles were followed in the design:

- Free fibre is aspirated as soon as possible after liberation.
- Subsequent re-treatment of rock is done only after free fibre has been removed.

The free fibre in the concentrate received at the mill will be aspirated on the first screen.

The concentrate will then go to the first crushing stage, Hazemag impact crusher. The fibre freed by that operation will be aspirated from the second screen.

6.0 PROPOSED OPERATIONS (cont'd)

6.2 PROCESS (cont'd)

6.2.2 Milling (cont'd)

a) Rock Circuit (cont'd)

The concentrate will go to the second crushing stage, another Hazemag impact crusher. The fibre freed there will be aspirated from a third screen.

The undersize of all screens will be collected and sent to tailings.

b) Fibre Circuit

The mill will have three fibre lines and a provision for a fourth one to produce the cleanest and strongest fibres possible from Bolivian ore.

Cleaning of fibre will be done on screens for granular material and paddle trommels for fines and dust.

Two graders have been included to give increased flexibility for the production of grades B, C and D products. Graded fibre will be stored in bins. From the bins, the fibre will be conveyed by a mixing screw to a screw packer. The fibre will be packed in jute bags.

The fibre will be stored in the fibre warehouse. Bagged fibre will be loaded directly from warehouse into trucks.

6.0 PROPOSED OPERATIONS (cont'd)6.3 EQUIPMENT INCLUDED AS PER CONTRACTUAL OBLIGATIONS AND PROPOSED ADDITIONS

<u>Item</u>	<u>Contract Quantity</u>	<u>Additional Capacity on Flowsheet</u>	<u>Reasons</u>
Apron Feeder	1	-	
Primary Crusher	1	Increased Size	Due to larger feed size of concentrate to be processed, Bolivian request.
Rock Screens	2	1	More tonnage to be processed due to 12.5 to 30.0% concentrate.
Crusher-Dryer	1	Yes	More tonnage to be processed due to 12.5 to 30.0% concentrate.
Impact Crusher	1	1	More tonnage to be processed due to 12.5 to 30.0% concentrate.
Paddle Trommels	2	1	More tonnage to be processed due to 12.5 to 30.0% concentrate.
Fibre Screens	2	1	More tonnage to be processed due to 12.5 to 30.0% concentrate.
Cyclone Collectors	4	2	More tonnage to be processed due to 12.5 to 30.0% concentrate. The sixth one is required at a later stage and not contracted for.
Air Locks	4	2	More tonnage to be processed due to 12.5 to 30.0% concentrate.
Graders	2	-	-
Mixing Screw	1	-	-
Screw Packer	1	-	-

6.0 PROPOSED OPERATIONS (cont'd)6.3 EQUIPMENT INCLUDED AS PER CONTRACTUAL OBLIGATIONS
AND PROPOSED ADDITIONS

<u>Item</u>	<u>Contract Quantity</u>	<u>Additional Capacity on Flowsheet</u>	<u>Reasons</u>
Elevators	1	2	One for more tonnage to be processed due to 12.5 to 30.0% concentrate. One suggested by Bolivia.
Pipe and Ducts	Lot	Increase	More tonnage to be processed due to 12.5 to 30.0% concentrate.
Dust Filter Complete	22,500 cfm	7,500 cfm	More tonnage to be processed due to 12.5 to 30.0% concentrate.
Rock Chutes	Lot	Increase	Due to provisions for third impact crusher.
Fibre Chutes	Lot	Increase	Due to provisions for third rock screen, fibre screen, paddle trommel and fifth cyclone collector.
Conveyors - Rock	2	2	Two suggested by Bolivia.
- Fibre	2	-	
Bins	4	-	
Concentrate Storage Bins	-	Lot	Suggested by Bolivia.

The additions as recommended are to enable a maximum fibre recovery and a clean product from the indicated ores. Some degree of flexibility has been provided to allow for other conditions which differ from the contractual criteria.

6.0 PROPOSED OPERATIONS (cont'd)

6.4 EQUIPMENT

The following equipment selected for the Experimental Production Plant supersedes the equipment selected by Surveyer, Nenniger & Chenevert Inc. under their contractual obligations for Phase IV. The selection provides for processing more tonnage than contracted for, because of the lower fibre content. (See also Section 5 - Design Criteria.)

6.4.1 Apron Feeder

One medium duty apron feeder 450 mm wide and 4.0 metres long, having one piece cast manganese steel pans driven by electric motor designed to have feeder capacity of 25 metric tons per hour of wet asbestos ore weighing 1600 kg/cubic metre.

(This apron feeder supersedes the vibrating grizzly included in Annex "F" of contract between UNIDO and Surveyer, Nenniger & Chenevert Inc.)

6.4.2 Primary Crusher

One 250 mm x 500 mm jaw crusher. Capacity 25 metric tons. Crusher setting 50 mm.

This large crusher is required to handle the 30 cm size concentrate selected by Bolivia. (See Appendix "B".) A smaller 250 mm x 400 mm jaw crusher was included in proposal.

This piece of equipment was indicated in our proposed flow-sheet but omitted from Annex "F" of contract between UNIDO and Surveyer, Nenniger & Chevert Inc.

6.4.3 Crusher-Dryer

One Hazemag crusher-dryer, type APT 2 with a throughput of 6 to 15 tons per hour. The rated water evaporation is 1.4 tons per hour. Size of feed 150 mm maximum.

The crusher-dryer is equipped with mechanically operated double pendulum flap gates to control the loss of pressure or heat.

An oil burner and a furnace with the necessary controls and fans will supply hot gases into the lower end of the crusher and rise in the opposite direction to the falling material up through the crusher-dryer.

The exhaust fan, connected to the high efficiency cyclone, will discharge the gases to the atmosphere. The fibre collected in the cyclone will be discharged through a high temperature rotary air lock.

6.0 PROPOSED OPERATIONS (cont'd)

6.4 EQUIPMENT (cont'd)

6.4.4 Rock Screens

Two rock screens and provisions for a third one, Rotex type, Model No. 42, 40 inch by 84 inch. Screens equipped with an aspirating hood at the discharge end. The third screen is required to process more tonnage than contracted for due to larger quantity of rock to be processed because of lower fibre recovery.

These items were indicated on our proposed flowsheet but omitted from Annex "F" of contract between UNIDO and Surveyer, Nenniger & Chenevert Inc.

6.4.5 Impact Crushers

One high speed impact crusher and provisions for a second one, Hazemag Impeller Breaker, Model F-10. Nominal throughput capacity: 10 tons per hour per machine.

The ore is very hard to crush and in order to liberate all the fibre, more crushing has to be provided.
(See Phase I report)

(The second impact crusher is also required to process more tonnage than contracted for, due to 12.5 to 30.0% concentrate.)

Dust control provided by exhausting 800 c.f.m. from the hopper located below the impactor.

6.4.6 Paddle Trommels

Two paddle trommels and provisions for a third one, having a 36 inch diameter horizontal revolving trommel containing within it a co-axially mounted, counter-rotating shaft, carrying paddle arms. One access door in the lower section provided. Trommels exhaust air capacity: 1600 c.f.m.

(The third paddle trommel required to process more tonnage than contracted for, due to 12.5 to 30.0% concentrate. Annex "F" showed these equipments as "Screen Trommels".)

6.4.7 Fibre Screens

Two fibre cleaning screens and provisions for a third one, Rotex type, Model No. 21, 40 inch by 84 inch. Screens equipped with an aspirating hood at the discharge end.

6.0 PROPOSED OPERATIONS (cont'd)

6.4 EQUIPMENT (cont'd)

(The third fibre screen required to process more tonnage than contracted for, due to 12.5 to 30.0% concentrate.)

6.4.8 Cyclone Collectors

Four 54 inch diameter cyclone collectors and provisions for two, appropriate inlet and outlet for ducts, fabricated of 10 gauge sheet steel, designed to handle up to 3,700 c.f.m. Rock handling cyclone collector will be lined with 3/16 inch Linatex or equal in the inlet transition and cylinder. Fibrelite cyclone collectors will not be lined.

The fifth cyclone collector required when the third fibre screen will be installed.

The sixth one will be required only, and not contracted for, when the fibre opener circuit is added at a later date.

6.4.9 Graders

Two 26 inch diameter graders for the separation of processed fibre and restricted to two separations. Each unit will have 1,600 c.f.m. of dust control.

This piece of equipment was indicated on our proposal flowsheet but omitted from Annex "F" of contract between UNIDO and Surveyer, Nenniger & Chenevert Inc.)

6.4.10 Air Locks

Four 13 inch by 15 inch rotary air locks, and provisions for one, similar to those used in Canadian asbestos mills.

The fifth air lock required for the fifth cyclone collector above.

This piece of equipment was indicated on our proposal flowsheet but omitted from Annex "F" of contract between UNIDO and Surveyer, Nenniger & Chenevert Inc.

6.4.11 Mixing Screw

One mixing screw of 20 inch diameter and less than 20 feet pipe length. Drive on the discharge end.

6.0 PROPOSED OPERATIONS (cont'd)

6.4 EQUIPMENT (cont'd)

This piece of equipment was indicated on our proposal flowsheet but omitted from Annex "F" of contract between UNIDO and Surveyer, Nenniger & Chenevert Inc.

6.4.12 Screw Packer

One screw packer.

This piece of equipment was indicated on our proposal flowsheet but omitted from Annex "F" of contract between UNIDO and Surveyer, Nenniger & Chenevert Inc.

6.4.13 Elevator

One continuous belt bucket elevator, and provisions for two additional, with air relief holes and abrasion resistant lined. Tail pulley self-cleaning type and take-up screw type. Belts will be spliced. The drive to include a holdback to prevent reverse rotation.

(Provisions for Bucket elevator No. 1 was made to bring the concentrate to the three 250 ton storage bins suggested by Bolivia. This storage system is not included in our scope of work.)

Bucket elevator No. 3 required to process more tonnage than contracted for due to 12.5 to 30.0% concentrate.

(This piece of equipment was included in Annex "F" as part of "Conveyor Belt Elevator".)

6.4.14 Pipes and Ducts

Aspirating pipes straight and free of bends as much as possible.

Material for rockline ducts will be 12 gauge black iron. Fibreline ducts will be 14 gauge black iron. Certain fittings will be rubber lined in the rock lines. All elbows and fittings will be standard.

The additional pipes and ducts required to process more tonnage than contracted for due to the 12.5 to 30.0% concentrate.

6.0 PROPOSED OPERATIONS (cont'd)**6.4** EQUIPMENT (cont'd)**6.4.15** Dust Filter Complete

One three compartments, 22,500 c.f.m. capacity. Cloth tube dust collector, with provisions for a fourth compartment. Complete with fan.

All dust producing equipment in the mill will be hooded and vented to the dust control system. Sheet metal ducts will be constructed in accordance with Surveyer, Neuniger & Chenevert Inc. standards.

(The fourth compartment is required to process more tonnage than contracted for due to the 12.5 to 30.0% concentrate.)

6.4.16 Rock Chutes and Hoppers

Rock chutes and hoppers will be fabricated of 3/16 inch mild steel plate with flanged connections and removable top cover. Oversize and middle size chutes will be lined at the bottom and on the sides. The liners to be fastened to the chute with square taper head bolts. Undersize chutes will not be lined. Inspection doors will be provided as required.

Provisions for additional rock chutes and hoppers required due to provisions made for the second impact crusher.

Rock chutes and hoppers were included under miscellaneous in Annex "F" of contract between UNIDO and Surveyer, Neuniger & Chenevert Inc.

6.4.17 Fibre Chutes and Hoppers

Fibre chutes and hoppers will be made of 10 gauge steel. Minimum slope of 55 degrees. Inspection doors to be provided and installed on the job as required.

Provisions for additional fibre chutes and hoppers required due to provisions made for third rock screen, third fibre screen, third paddle trommel and fifth cyclone collector.

Fibre chutes and hoppers were included under miscellaneous in Annex "F" of contract between UNIDO and Surveyer, Neuniger & Chenevert Inc.

6.0 PROPOSED OPERATIONS (cont'd)**6.4** EQUIPMENT (cont'd)**6.4.18** Belt Conveyors

One tailing rock carrying belt conveyor of medium-duty, with provisions for two additional, measuring 60.0, respectively 22 metres and 38.0 metres.

Rock carrying belt conveyors of medium-duty designed to accommodate surge requirements. Loading points will be enclosed for dust control.

Two fibre carrying belt conveyors will be of medium-duty design for fibre with a density of 15 pounds per cubic foot.

(Provisions for belt conveyors No. 2 and No. 3, to deliver the concentrate to the three 250 ton storage bins suggested by Bolivia.)

6.4.19 Bins

Three steel fibre bins of 1000 Kg capacity, complete with screws and drives. Tailings bins located outside of the mill building will have a capacity of 15 tons.

6.4.20 Ore Storage Bins

Suggested by Bolivia, provisions to store the concentrate in three 250 ton concrete storage bins. Such bins were designed complete with elevator, enclosed conveyor, stationary plows to discharge into the bins, reclaim feeders and conveyor under the bins with steel conical bottom.

6.0 PROPOSED OPERATIONS (cont'd)

6.5 BUILDINGS - GENERAL SPECIFICATIONS

6.5.1 General

All buildings will be designed and built by the Bolivian Government in accordance with technical specifications to be prepared by Surveyer, Nenniger & Chenevert Inc. during phase III of that project.

Ground floor of all buildings will be 30 cm above the general yard elevation.

6.5.2 Plot Plan (Drawings Nos 6 and 7)

The proposed building arrangement on the 15,000 square metre Cochabamba site is shown on Drawing No. 6.

Drawing No. 7 is a proposed landscaping plan of the same site.

6.5.3 Crushing and Drying (Drawings Nos. 2 and 3)

The secondary crusher-dryer building will measure 4.0 meters by 8.5 meters by 7.2 meters high. It will be a reinforced concrete framed structure enclosed with corrugated asbestos siding. The roof will consist of corrugated asbestos-cement sheets on steel beams. All floors will be reinforced concrete beams and slabs.

6.5.4 Mill Building (Drawings Nos. 4 and 5)

The Experimental Production Plant mill building will measure 8.0 meters by 14.0 meters by 15.0 meters high with 3.5 meters by 4.0 meters column spacing. It will be a reinforced concrete framed structure enclosed with corrugated asbestos siding. The roof will consist of corrugated asbestos-cement sheets on steel beams. All floors will be reinforced concrete beams and slabs. A lean-to to the mill building will house locker and lunch rooms. The mill will not be heated. (See sketch No. 7)

The laboratories will be located in a 4.0 meter by 10.5 meter area on the ground floor of the mill building. Storage of samples is allowed on the ground floor close to the laboratories.

6.0 PROPOSED OPERATIONS (cont'd)6.5 BUILDINGS - GENERAL SPECIFICATIONS (cont'd)6.5.5 Fibre Storage Building

The fibre storage building will be adjacent to the mill building. The floor will be level with the mill floor, to permit ready movement of fork-lift truck from one building to the other. Floors will be wire-mesh reinforced concrete on well compacted granular fill. Large door for truck access will be provided.

6.5.6 Administration Building (Sketch No. 5)

The administration building will measure 9.5 meters by 17.5 meters and be constructed of locally available bricks. Offices will be provided for all management and administrative personnel. Roof design will be of corrugated asbestos-cement sheets over wooden purlins. The ceiling will be constructed of flat asbestos cement sheets. The floors will be ceramic tiles on concrete. Interior partitions will be of brick.

6.5.7 Machine Shop and Garage (Sketch No. 6)

The machine shop and garage will measure 10.0 meters by 19.0 meters and will include in addition to an office the following facilities:

Tool crib	8.75	square	meters
Garage	50.00	"	"
Storage	21.25	"	"
Shops	90.00	"	"

One 5 ton capacity overhead crane to be installed in the machine shop. One 3 ton capacity monorail to be installed in the garage.

This building and partitions to be constructed of locally available bricks. Roof will be of corrugated asbestos-cement sheets on steel roof trusses. The floor will be of wire-mesh reinforced concrete on well compacted granular fill. Doors into the garage area to be 3.75 meters by 4.30 meters roll-up type.

6.5.8 Guard House

A guard house will be located adjacent to the entrance to the plant.

6.5.9 Lunch Room and Change House (Sketch No. 7)

A 6.0 meter x 14.5 meter lunch room and change house complete with wash room facilities.

6.0 PROPOSED OPERATIONS (cont'd)**6.6** SERVICES**6.6.1** General

All services will be designed and built by and for the account of the Bolivian Government in accordance with design criteria and specification to be prepared by SNC Inc. during Phase III.

6.6.2 Yard

The ground has a 1% slope to the West. The site will be graded to provide good natural drainage running to open ditches.

Roads to connect all buildings on the site will be built of well compacted gravel and surfaced with bituminous material. The parking lot will be of the same construction.

Fencing will be done around the complete plant. A manually operated gate will block the road entrance to the plant site.

6.6.3 Power Supply and Yard Lighting

Electrical power will be supplied by Empresa De Luz Y Fuerza Electrica Cochabamba S.A. from a 15,000-Volt line running parallel to the main road. The primary supply voltage will be stepped down to 380-volts by a transformer to be supplied and installed by the above power company. From the 380-volt substation feeders will supply all floors in the mill building, crushing and drying area, office, machine shop and garage.

Lighting will be provided in the parking lot and along the roads. Areas around the various buildings will be illuminated by exterior lights.

6.6.4 Water Supply

The main water supply to the plant will be from a well located on the site. The pumping station will have a pump to be used for domestic water supply, rated at 50 gpm and 116 feet head.

Water will be pumped from the well at the rate of 100 gpm and 170 feet head to a 24,000 gallon water storage tank.

A package unit water treatment plant will be located in the pump room if required.



6.0 PROPOSED OPERATIONS (cont'd)**6.6** SERVICES (cont'd)**6.6.5** Sanitary Drainage and Septic Tank

Sanitary drainage from the plant buildings will be gravity fed to one 500 gallon and one 1000 gallon concrete septic tanks. The effluent will flow to the nearby river, below the pumping station. The storm drainage from the plant area will run off to the river.

6.6.6 Fire Protection

One fire pump with rated capacity of 500 gpm and 116 feet head will be located in the pump room.

Two 2½" nozzles on fire pump with two sets of 2½" hose 100 feet long will be provided.

6.6.7 Fuel Supply

Storage and pumping facilities for gasoline and diesel fuel will be assumed available from an oil company without charge.

A 10,000 kg fuel tank for dryer fuel oil will be located adjacent to the dryer.

6.6.8 Power, Water and Fuel supply assumptions are based on information given to us by the Bolivian Authorities.

7.0 ORGANIZATION AND LABOUR

7.1 ORGANIZATION CHART

The operations of the Experimental Production Plant should be directed by a General Manager. To him would report the five supervisors responsible for the operation of the Experimental Production Plant. (See Sketch No. 4)

This type of organization is similar to others in the asbestos industry. It was proven quite effective.

7.2 ADMINISTRATIVE AND SUPERVISORY FUNCTIONS

7.2.1 General Manager

The General Manager will be responsible for the overall operation of the Experimental Production Plant. He should be an individual of proven executive competence with the ability to motivate his subordinates in administration, sales, production, maintenance and quality control.

He should be an engineer with several years of supervisory experience in an asbestos mill.

His presence at the site will be required during equipment installation. Past experience during the pre-production phase of a project would be a definite asset.

He could be supported by SNC advice during the start-up and first year of operation of the mill. His function and that of quality control will be merged after attainment of successful operating practice.

7.2.2 Sales Manager

The Sales Manager will handle all sales for the domestic and the foreign markets. He will report to the General Manager. He should have contact with or be able to develop the necessary contacts with the asbestos consumers.

7.2.3 Office Manager

The Office Manager will organize and oversee all accounting and clerical functions of the plant. He will be responsible for purchasing. Previous experience in the asbestos industry is not necessary for this position.

7.0 ORGANIZATION AND LABOUR (cont'd)

7.2 ADMINISTRATIVE AND SUPERVISORY FUNCTIONS (cont'd)

7.2.4 Mill Foreman

The Mill Foreman will be responsible for the mill operations, reporting directly to the General Manager. He should be experienced in supervision of a production plant operation. Experience in the asbestos industry would be advantageous but not essential.

7.2.5 Maintenance Superintendent

The Maintenance Superintendent will be responsible for all maintenance of buildings, equipment and property. He will train his staff, prepare maintenance schedules and procedures and stress preventive maintenance. He should act as safety engineer at the plant and mine and supply necessary guidelines to the foremen of all divisions. Several years' experience in an asbestos operation would be preferable.

7.2.6 Quality Control Supervisor (Initial years of operations only)

The function of the Quality Control Supervisor will be required for the first two years of plant operation. He will have experience in the testing and evaluation of asbestos fibres. He will report directly to the General Manager. He will be responsible for the quality of all products shipped to the customers. He will be responsible to set up and monitor quality control and to train personnel to perform those duties.

This function will be assumed by the General Manager after the attainment of successful operating practice.

7.3 LABOUR FORCE

With the exclusion of the mine personnel, the mill labour force will include the following persons:

7.3.1 Administration

9 Persons:

- 1 General Manager
- 1 Office Manager
- 1 Accountant
- 1 Office Clerk
- 2 Secretaries
- 3 Security Guards

7.0 ORGANIZATION AND LABOUR (cont'd)7.3 LABOUR FORCE (cont'd)7.3.2 Plant

10 Persons:

- 1 Mill Foreman
- 3 Floor Operators
- 1 Crusher Operator
- 1 Bagger
- 1 Palletizer
- 1 Fibre Clerk
- 1 Fork Lift and Truck Operator
- 1 Labourer

7.3.3 Maintenance

11 Persons:

- 1 Maintenance Superintendent
- 1 Master Mechanic
- 2 Mechanics
- 1 Welder - Tinsmith
- 1 Helper - Mechanic
- 1 Carpenter
- 1 Tool Crib and Store Keeper
- 1 Chief Electrician
- 1 Helper Electrician
- 1 Labourer

7.3.4 Sales

1 Person:

- 1 Sales Manager

7.3.5 Quality Control

3 Persons:

- 1 Quality Control Supervisor *
- 1 Laboratory Technician
- 1 Tester

* 1st and 2nd Years only

7.4 NORMAL PRACTICE

In such an experimental plant, the staffing required is higher than would normally be found in a regular production plant. Normal practice would be to have a single person to fill each of the following groups of functions:

- a) Three floor operators.
- b) Bagger and palletizer.
- c) Fibre clerk, fork lift operator, labourer and truck driver.
- d) Master mechanic and mechanics.
- e) Welder-tinsmith and helper-mechanics.
- f) Chief electrician and helper-electrician.
- g) Laboratory technician and tester.

Training of local personnel will take place during the initial year of operation. Staffing levels may have to be adjusted to accommodate local conditions.

8.0 CAPITAL COST

8.1 BASIS OF ESTIMATE

The Capital Cost Estimates are for the plant as laid out to produce 1500 tons per year of fibre from concentrate with a range of 12.5 to 30.0% content, in accordance with the Design Criteria, Section 5, of this report. The Estimates define and indicate the additional costs arising from provisions for these conditions which differ from the contractual obligation to process concentrate with 40-95% content.

8.1.1 Data

Estimates are for 1971 and based on data obtained during visits to Bolivia.

8.1.2 Wage Rates

The wage rates include an allowance of 65% for social benefits, public holidays, annual vacations, family allowances and overtime. The allowance of 65% is based on information supplied to us by the office of the Bolivian Planta Experimental.

8.1.3 Construction Cost

Construction costs in Bolivia, based on methods, efficiency and labour rates, were evaluated and taken into consideration in arriving at the construction cost.

These include direct costs for labour, materials, construction supplies and equipment and contractors' overhead and profit.

8.1.4 Equipment Costs

Equipment costs include allowances for crating.

8.1.5 Taxes and Duties

Materials and equipment are assumed exempt from sales taxes and customs duties, as determined during discussions with local authorities. Any applicable levy will be extra for UNIDO account.

8.1.6 Exchange Rate

All costs are in U.S. dollars. The Bolivian peso was converted at the current nominal rate of 12 pesos to one U.S. dollar.



8.0 CAPITAL COST (cont'd)8.1 BASIS OF ESTIMATE (cont'd)8.1.7 Inflation

Factors of inflation have not been included. The effect of applicable indices will be subject to the escalation clause of the contract.

8.2 EQUIPMENT COST

a) Equipment and services included to be provided per Contractual obligation, Annex I Cost Data Break-down, Phase III and IV.

b) Additional cost of equipment due to provision for plant as laid out to produce 1500 tons per year of fibre from three concentrates containing 12.5 - 30.0% fibre according to Design Criteria, Section 5.

\$ US 330,780

8.2.1 Primary Crushing, Storage and Mill Feed Equipment

<u>Items</u>	<u>A</u> <u>Basic included</u> <u>in Contract</u>	<u>B</u> <u>Additional Cost</u> <u>for new Criteria</u>
Apron feeder	Yes	\$ 3,840
Jaw crusher	Yes	5,880
Belt conveyors	Yes	17,725
Belt feeders	-	5,670
Bucket elevator	-	8,520
Misc. chutes, hoppers	<u>Yes</u>	<u>390</u>
SUB TOTAL		\$ 42,025

8.0 CAPITAL COST (cont'd)8.2 EQUIPMENT COST (cont'd)8.2.2 Mill Equipment

<u>Items</u>	<u>A</u> <u>Basic included</u> <u>in Contract</u>	<u>B</u> <u>Additional Cost</u> <u>for new Criteria</u>
Crushing & drying equipment including Hazemag crushers, dryer, cyclone, air lock, stack, etc.	Yes	\$ 5,040
Bucket elevators	-	13,320
Screens	Yes	11,520
Cyclones	Yes	1,200
Air locks	Yes	2,460
Paddle trommels	Yes	9,160
Graders	Yes	4,320
Mixing screw	-	3,780
Screw packer	Yes	
Conveyors	Yes	7,470
Fibre bins	Yes	
Dust collector	Yes	13,080
Dust collecting pipes	Yes	3,390
Fibre and rock chutes and hoppers	Yes	
S B TOTAL		\$ 74,740

8.2.3 Spare Parts

Immediate inventory purchase of spare parts for crushing and mill equipment	Yes	\$ 20,400
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8.2.4 Office Building

Office Furnishing and Equipment	-	\$ 5,000
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8.0 CAPITAL COST (cont'd)8.2 EQUIPMENT COST (cont'd)8.2.5 Machine Shop and Garage

Detailed estimate sheet 19.

Items	<u>A</u> <u>Basic included</u> <u>in Contract</u>	<u>B</u> <u>Additional Cost</u> <u>for new Criteria</u>
2 ton monorail hoists		\$ 5,000
1 ton hand chain hoist		225
1 1/2 ton cap'v car jack		200
Portable drum lubricator		450
Battery charger		250
10" pedestel grinder		300
Floor mount drill		500
Bench grinder		150
Shaper		1,700
Band saw		2,150
Power hack saw		900
25 ton hydraulic		900
295 Amp. welder		450
Bending brake		1,900
Shearing unit		325
Pipe threader		1,050
7" wood table saw		850
Planer		1,000
Misc. small tools		1,500
Stationary compressor		2,500
		<hr/>
SUB TOTAL		\$ 22,500

- 8.0 CAPITAL COST (cont'd)
 8.2 EQUIPMENT COST (cont'd)
 8.2.6 Laboratory Equipment

<u>Items</u>	<u>A</u> <u>Basic included</u> <u>in Contract</u>	<u>B</u> <u>Additional Cost</u> <u>for new Criteria</u>
Quebec Standard Asbestos Testing Machine		\$ 6,340
Bauer-McNett Classifier		4,150
Rotap Testing Sieve Shaker		1,250
Suter-Webb Comb sorter		1,350
Drying Oven		300
Scoop Balance		60
Precision Balance		750
Filter Paper		100
Graduated Cylinders for Mechanical Inversion		180
Mechanically Driven Inverter		1,100
Alpine Air-Jet Sieve		1,800
Blaine Dyckerhoff Air Permeability Tester		1,800
Stoppered Glass Bottles		10
Desiccator		40
Analytical Balance		330
Standard Filtration Tester		200
Stopwatch		50
Hounsfield Tensometer		800
Board Making Apparatus		1,950
Laboratory Hydraulic Press		600
Humidity Cabinet		950
Ignition Loss Apparatus		950
Impact Crusher		2,650
Disintegrator		1,670
Rotex Screen		1,670
Cyclone Collector		1,660
Scoop Scale		100
Glass Beakers and Measuring Cylinders		90
Stereoscopic Microscope		
SUB TOTAL	—————	\$ 34,000

8.0 CAPITAL COST (cont'd)8.2 EQUIPMENT COST (cont'd)8.2.7 Mobile Equipment

Required for general plant use and for fibre handling and transportation to Cochabam.

<u>Items</u>	<u>A</u> <u>Basic included</u> <u>in Contract</u>	<u>B</u> <u>Additional Cost</u> <u>for new Criteria</u>
1 - Fork lift truck 1500 Kg capacity		\$ 8,000
1 - 10 ton capacity truck		12,000
1 - Service vehicle 3/4 Ton	_____	_____ 3,600
SUB TOTAL	-	\$ 23,600

8.2.8 Total All Equipment

Primary crushing, storage and mill feed equipment	Yes	\$ 42,025
Mill Equipment	Yes	57,675
Spare Parts	Yes	20,400
Office Equipment	-	5,000
Machine Shop and Garage	-	22,500
Laboratory Equipment	-	34,000
Mobile Equipment	_____ -	_____ 23,600
	-	\$ 222,265

8.3 SERVICE COST

All Service Costs are for the account of the Government of Bolivia, as per Contract.

8.0 CAPITAL COST (cont'd)8.3 SERVICE COST (cont'd)8.3.1 Site Improvements

Detailed estimate sheets 2 and 3.
Include roads, parking, fencing and yard lighting.

Items:

Roads and parking	\$ 11,500
Fencing	4,000
Yard Lighting	<u>1,500</u>
SUB TOTAL	\$ 17,000

8.3.2 Power Supply

Detailed estimate sheet 46.
Include 380 Volt feeders.

Items:

Earthwork	\$ 1,000
Electrical distribution	<u>5,000</u>
SUB TOTAL	\$ 6,000

8.3.3 Water Supply

Detailed estimate sheets 43 to 45.
Include well, pumping station, reserve tank and
distribution piping.

Items:

Earthwork	\$ 3,700
Architectural	1,600
Equipment	8,200
Piping	1,600
Electrical	<u>700</u>
SUB TOTAL	\$ 15,800 (1)

8.3.4 Sanitary Drainage and Septic Tank

Detailed estimate sheet 47.

Items:

Earthwork	\$ 2,800
Equipment	1,400
Piping	<u>3,000</u>
SUB TOTAL	\$ 7,200

(1) Fire protection included in paragraph 8.3.5.

8.0 CAPITAL COST (cont'd)8.4 BUILDING COST

All building costs for Mill, as laid out, are for the account of the Government of Bolivia, as per Contract.

8.4.1 Concentrate Unloading and Storage Building

Include provisions for three 250 metric ton concrete storage bins and conveyors.

Detailed estimate sheets 22 to 28.

Items:

Earth Work	\$ 2,450
Concrete	45,550
Structural Steel	21,800
Architectural	1,100
Electrical	<u>2,600</u>
SUB TOTAL	\$ 73,500

8.4.2 Mill Building including Outside Fuel Piping

Detailed estimate sheets 30 to 35.

Items:

Earth work	\$ 1,700
Concrete	37,700
Structural Steel	14,700
Architectural	10,500
Piping and Services	10,300
Electrical	<u>27,000</u>
SUB TOTAL	\$ 101,900

8.0 CAPITAL COST (cont'd)8.4 BUILDING COST (cont'd)8.4.3 Fibre Storage Building

Detailed estimate sheets 36 to 38.

Items:

Earth work	\$	300
Concrete		1,250
Structural Steel		2,450
Architectural		2,000
Electrical		<u>700</u>
SUB TOTAL	\$	6,700

8.4.4 Office Building (1)

Detailed estimate sheets 5 to 9.

Items:

Earth work	\$	1,600
Concrete		3,200
Architectural		15,000
Piping and Services		5,400
Electrical		<u>6,500</u>
SUB TOTAL	\$	31,600

(1) Office furnishing and equipment included in paragraph 8.2.4.

8.0 CAPITAL COST (cont'd)8.4 BUILDING COST (cont'd)8.4.5 Machine Shop and Garage (2)

Detailed estimate sheets 14 to 18.

Items:

Earth work	\$ 1,800
Concrete	4,900
Structural Steel	4,200
Architectural	11,800
Piping and Services	2,000
Electrical	<u>7,000</u>
SUB TOTAL	\$ 31,700

8.4.6 Guard House

Detailed estimate sheet 20.

Items:

Earth work	\$ 200
Concrete	500
Architectural	1,500
Electrical	<u>300</u>
SUB TOTAL	\$ 2,500

(2) Machine shop and garage equipment included in paragraph 8.2.5.

8.0 CAPITAL COST (cont'd)

8.4 BUILDING COST (cont'd)

8.4.7 Lunch and Change Room

Detailed estimate sheets 10 to 13.

Items:

Earth work	\$	1,050
Concrete		2,350
Architectural		8,200
Piping and Services		8,100
Electrical		<u>4,000</u>
SUB TOTAL	\$	23,700

8.4.8 Tailings Bin

Detailed estimate sheet 39.

Items:

Earth work	\$	200
Concrete		650
Structural Steel		4,850
Architectural		<u>200</u>
SUB TOTAL	\$	5,900

8.0 CAPITAL COST (cont'd)8.4 BUILDING COST (cont'd)8.4.9 Total All Buildings

Concentrate Unloading and Storage	\$ 73,500
Mill	101,900
Fibre Storage	6,700
Office	31,600
Machine Shop and Garage	31,700
Guard House	2,500
Lunch and Change Room	23,700
Tailings Bin	<u>5,900</u>
	<u>\$ 277,500 (1)</u>

(1) \$ 5,000 for office furnishing and equipment included in paragraph 8.2.4.

\$28,000 for machine shop and garage equipment included in paragraph 8.2.5.

\$45,000 for laboratory equipment included in paragraph 8.2.6.

8.0 CAPITAL COST (cont'd)8.5 PACKING, TRANSPORTATION AND INSURANCE COST

<u>Items</u>	<u>A</u> <u>Basic included</u> <u>in Contract</u>	<u>B</u> <u>Additional Cost</u> <u>for new Criteria</u>
Crushing and process equipment	Yes	\$ 7,500
Spare parts	Yes	-
Machine shop and garage equipment	-	2,500
Laboratory equipment	-	4,500
Mobile equipment	-	2,500
SUB TOTAL	Yes	\$ 17,000

8.6 HANDLING AND INSTALLATION COST

<u>Items</u>		
Crushing and process equipment	Yes	\$ 19,000
Machine shop and garage equipment	-	3,000
Laboratory	-	6,500
SUB TOTAL	Yes	\$ 28,500

8.7 INDIRECT COST

<u>Items</u>		
Include sub-contractor overhead and profit of 10% on buildings and services portions	Yes	-

8.0 CAPITAL COST (cont'd)

8.8 CONTINGENCIES

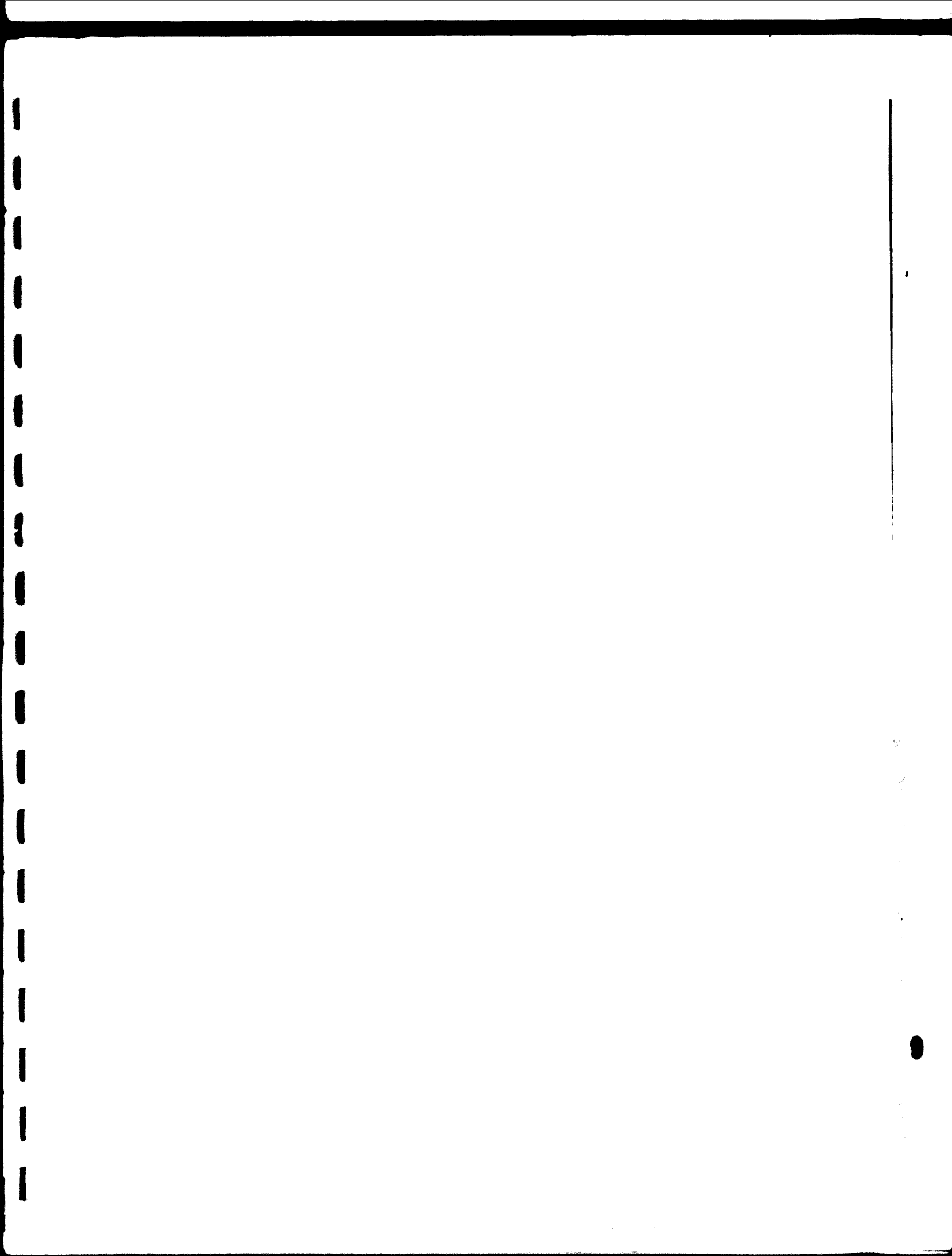
<u>Items</u>	<u>A</u> <u>Basic included</u> <u>in Contract</u>	<u>B</u> <u>Additional Cost</u> <u>for new Criteria</u>
Buildings (10% and 15%)	-	\$ 37,700
Services (15%)	-	8,000
Crushing and process equipment (11%)	Yes	12,800
Office equipment	-	500
Machine shop and garage equipment (10%)	-	2,800
Laboratory equipment (10%)	-	5,000
Mobile equipment (10%)	-	2,750
Installation (12%)	Yes	3,300
Indirect cost		<u>6,990</u>
SUB TOTAL		\$ 79,840

8.9 CONTRACTOR'S FEES

<u>Items</u>		
Engineering services	Yes	\$
Travel	Yes	
Subsistence	Yes	
Field Supervision	Yes	
Start-up	Yes	
SUB TOTAL	Yes	\$ 0

8.0 CAPITAL COST (cont'd)8.10 TOTAL CAPITAL COST

<u>Items</u>	<u>A</u> <u>Basic included</u> <u>in Contract</u>	<u>B</u> <u>Additional Cost</u> <u>for new Criteria</u>	<u>Total</u>
Buildings	-	\$ 277,500	\$ 277,500
Services	-	51,500	51,500
Equipment	Yes	222,265	359,465
Packing, transportation and insurance	Yes	17,000	27,500
Handling and installation	Yes	28,500	52,400
Indirect cost	Yes	0	41,000
Contingencies	Yes	77,640	92,450
Contractor's fees	Yes	0	103,370
	\$330,780	\$ 676,605	\$1,007,385



9.0 OPERATING COST

All cost estimates are based on a study of Bolivian operating practices, labour standards and wage rates and the availability and cost of necessary supplies and materials.

Rates and conventions were determined from data provided to us by the Project Director, Planta Experimental Beneficiadora de Minerales de Asbesto.

These costs are based on a production rate of 1,500 tons per annum, processing concentrate as rated in the design criteria, Section 5.

9.1 MILL COST

9.1.1 Labour

<u>Position</u>	<u>Cost/Man per year</u>	<u>Number of men</u>	<u>Cost</u>
Mill Foreman	\$ 6,000		\$ 6,000
Floor Operators	1,040	3	3,120
Dryer-Crusher Operator	1,040	1	1,040
Bagger	950	1	950
Sewer and Palletizer	950	1	950
Fibre Clerk	1,730	1	1,730
Fork Lift and Truck Operator	1,210	1	1,210
Labourer	520	1	520
SUB TOTAL		9	\$15,520

9.0 OPERATING COST (cont'd)9.1 MILL COST (cont'd)9.1.2 Fuel and Lubricants

a) Fuel for drying:

Concentrate to be dried:	14,100 tons *	
Moisture content before drying:	10%	
Moisture content after drying:	1.5%	
Estimated fuel oil per ton:	6.15 liters	
Cost of fuel oil per liter:	\$0.025	\$ 2,168

b) Diesel oil:

5 metric tons at \$49./ton	\$ 245
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c) Gasoline:

5 cubic meters at \$56./cu.m.	\$ 280
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d) Oil and greases

	\$ 800
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SUB TOTAL	\$ 3,493
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9.1.3 Electrical Power

Total connected load is 200 kw. Maximum demand load using a diversity factor of 0.8 is 160 kw.

at \$0.026/kw/hr	\$ 12,500
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9.1.4 Jute Bags

35,000 jute bags per year:

at \$0.40/bag	\$ 14,000
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* In the less favorable case, i.e., with concentrate at 12.5% from Tres Amigos.

9.0 OPERATING COST (cont'd)9.1 MILL COST (cont'd)9.1.5 Shipping

Tonnage to be shipped:	1500 tons	
Distance from warehouse to Cochabamba rail facilities:	9 Km	
Cost per Km/ton:	\$0.15	\$ 2,025

9.1.6 Summary of Mill Cost

Labour		\$ 15,520
Fuel and lubricants		3,493
Electrical power		12,500
Jute bags		14,000
Shipping		<u>2,025</u>
		<u>\$ 47,538</u>

9.0 OPERATING COST (cont'd)9.2 MAINTENANCE COST9.2.1 Labour

<u>Position</u>	<u>Cost/Man per year</u>	<u>Number of men</u>	<u>Cost</u>
Maintenance Superintendent	\$ 5,940	1	\$ 5,940
Master Mechanic	2,800	1	2,800
Mechanics	1,780	2	3,560
Welder - Tinsmith	1,780	1	1,780
Helper Mechanic	1,390	1	1,390
Carpenter	1,190	1	1,190
Tool Crib and Warehouse	1,580	1	1,580
Chief Electrician	1,580	1	1,580
Helper Electrician	1,190	1	1,190
Labourer	520	<u>1</u>	<u>520</u>
SUB TOTAL		11	\$ 21,530

9.2.2 Maintenance Supplies for Crushing and Mill Equipment

Estimated at 12% of capital cost of equipment,

i.e.: $0.12 \times \$209,900$ \$ 25,190

9.2.3 Maintenance Supplies for Buildings and Services

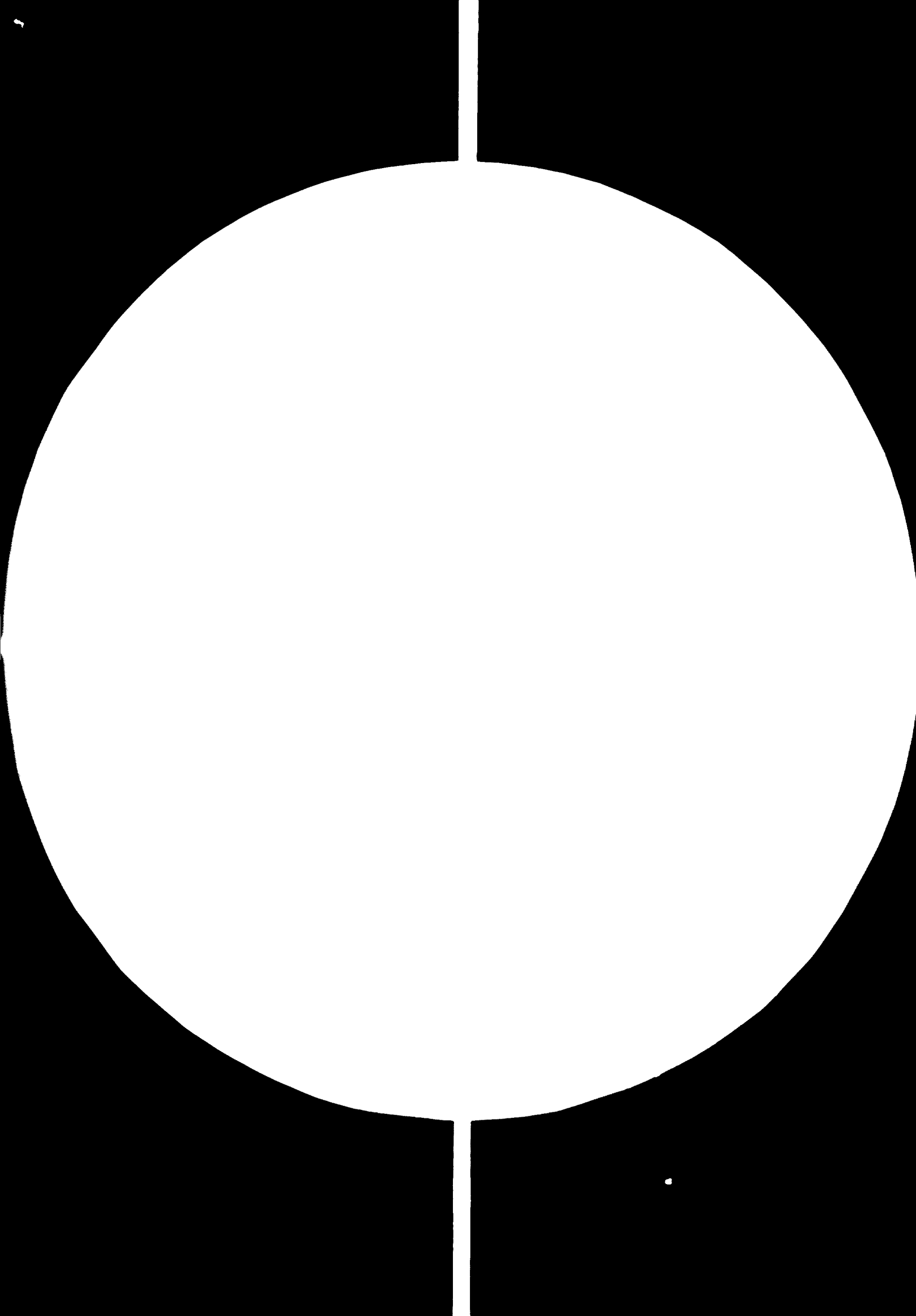
Estimated at 2% of capital cost of buildings
and services,

i.e.: $0.02 \times \$329,000$ \$ 6,580

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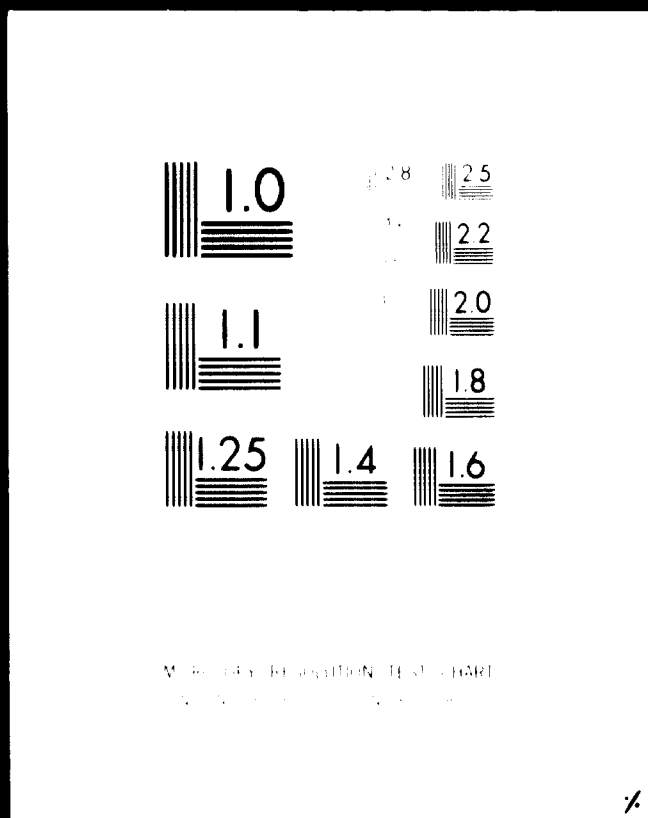
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9.0	<u>OPERATING COST</u> (cont'd)	
9.2	<u>MAINTENANCE COST</u> (cont'd)	
9.2.4	<u>Miscellaneous Maintenance Supplies</u>	
	For mobile equipment	\$ 4,000
	For laboratory equipment	\$ 600
	For maintenance equipment	\$ 800
	For roads and yards	\$ 345
	TOTAL	\$ 5,745
9.2.5	<u>Summary of Maintenance Cost</u>	
	Labour	\$ 21,530
	Maintenance supplies for mill equipment	25,190
	Maintenance supplies for buildings & services	6,580
	Miscellaneous maintenance supplies	5,745
	TOTAL	\$ 59,045

9.0 OPERATING COST (cont'd)9.3 ADMINISTRATION COST9.3.1 Labour

<u>Position</u>	<u>Cost/Man per year</u>	<u>Number of persons</u>	<u>Cost</u>
General Manager	\$ 25,000	1	\$ 25,000
Office Manager	3,960	1	3,960
Accountant	2,970	1	2,970
Office Clerk	2,400	1	2,400
Secretary	1,580	2	3,160
Security	790	<u>3</u>	<u>2,370</u>
SUB TOTAL		9	\$ 39,860

9.4 QUALITY CONTROL COST9.4.1 First and Second Years Only

Quality Control Supervisor	\$ 5,940	1	\$ 5,940
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9.4.2 Labour

Laboratory Technician	\$ 2,970	1	\$ 2,970
Tester	1,980	<u>1</u>	<u>1,980</u>
		2	\$ 4,950

9.4.3 Consumable Supplies

Estimated annually			\$ 400
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9.4.4 Summary Quality Control Cost9.4.4. a) First and Second Years Only

Supervision	\$ 5,940
Labour	4,950
Consumable supplies	400
	<u>\$ 11,290</u>

b) Subsequent Years

Labour	\$ 4,950
Consumable supplies	400
	<u>\$ 5,350.</u>

9.0	<u>OPERATING COST</u> (cont'd)	
9.5	<u>SALES COST</u>	
9.5.1	<u>Labour</u>	
	One sales officer	\$ 5,000
9.5.2	<u>Miscellaneous Sales Costs</u>	
	Travelling	\$ 4,000
	Entertainment	1,000
	Advertising	<u>2,000</u>
	SUB TOTAL	\$ 7,000
9.5.3	<u>Summary of Sales Cost</u>	
	Labour	\$ 5,000
	Miscellaneous Sales Costs commissions	7,000
	Sales commissions, freight allowances, 2% estimated	<u>5,000</u>
		\$17,000
9.6	<u>MISCELLANEOUS COSTS</u>	
	Insurance Allowances	\$ 5,000
	Telephone	1,200
	Cleaning Services	<u>350</u>
		\$ 6,550

9.0 OPERATING COST (cont'd)9.7 SUMMARY OF OPERATING COST

Mill Cost	\$ 47,538
Maintenance Cost	59,045
Administration Cost	39,860
Quality Control Cost	5,350 *
Sales Cost	17,000
Miscellaneous Cost	<u>6,550</u>
TOTAL OPERATING COST, above raw materials	<u>\$ 175,343 *</u>

* Add, Quality Control Supervisor,
first two years of operation only

\$ 5,940.



10.0 PROFITABILITY10.1 SALES10.1.1 First Full Year of Operation

<u>Grade</u>	<u>Tonnage</u>	<u>Sales Value</u>
B	100	\$ 21,500
C	400	70,000
D	600	<u>87,000</u>
	SUB TOTAL	\$ 178,500

10.1.2 For Following Four Years

<u>Grade</u>	<u>Tonnage</u>	<u>Sales Value</u>
B	135	\$ 29,025
C	510	89,250
D	855	<u>123,975</u>
		\$ 242,250

10.2 OPERATING COST (excluding ore)

The operating costs in American dollars are expected to remain constant at \$175,343 over the first five years, except for an additional cost of \$5,940 for Quality Control Supervision in the first two years.

10.

10.3 DEPRECIATION

Depreciation rates are proposed as follows:

On fixed assets : 10% on declining balance

On mobile equipment : 20% lineal

On other movable assets : 10% lineal.

10.0 PROFITABILITY (cont'd)10.3 DEPRECIATION (cont'd)

<u>Items</u>	<u>Original Cost</u>	<u>DEPRECIATION</u>				
		<u>1st Year</u>	<u>2nd Year</u>	<u>3rd Year</u>	<u>4th Year</u>	<u>5th Year</u>
Fixed Assets	\$886,235	88,623	79,761	71,785	64,606	58,146
Mobile Equip- ment	28,850	5,770	5,770	5,770	5,770	5,770
Other movable	82,300	8,230	8,230	8,230	8,230	8,230
TOTAL	\$1,007,385	102,623	93,761	85,785	78,606	72,146

10.4 FINANCING

The following funds are required to build, commission and operate the plant:

- 10.4.1 A "fixed capital investment" credit of \$1,007,385. Annual interest charges at 6% will amount to \$60,443.10.
- 10.4.2 Working capital amounting to \$40,000, the annual interest at 10% starting the second year will amount to \$4,000.
- 10.4.3 Interest during construction - provide \$40,000.

10.5 TAXES AND ROYALTIES

Based on our understanding of the local conditions, we have assumed that the operation is exempted from all taxes, duties, dues and other similar fees or charges by the local authorities.

The operation is not expected to be assessable for payments of any royalties.

10.0 PROFITABILITY (cont'd)10.6 CASH FLOWS

The cash flow from sales revenue and plant operating costs shows a balance of cash generated which would be available to contribute to the cost of ores.

Depreciation and interest on investment are not shown in the cash flow. It is assumed that the pilot plant project would be built with funds provided by UNIDO and the Government of Bolivia. The operation would not generate any funds to carry interest charges on the capital cost or to amortize the investment.

CASH FLOW

	<u>1st</u> <u>Year</u>	<u>2nd</u> <u>Year</u>	<u>3rd</u> <u>Year</u>	<u>4th</u> <u>Year</u>	<u>5th</u> <u>Year</u>
Sales Revenues	\$ 178,500	\$ 242,250	\$ 242,250	\$ 242,250	\$ 242,250
Plant Operating Costs	181,283	181,283	175,343	175,343	175,343
Plant Operating Surplus	-(2,783)	60,967	66,907	66,907	66,907
Cumulative Cash Surplus	- 2,783	58,184	125,091	191,998	258,901

11.0 RECOMMENDATIONS

- 11.1 We recommend strongly that additional exploration work be carried out to establish if there are sufficient ore reserves containing the desired quality of fibre to supply the experimental production plant. ✓

The samples, tested in the Quebec Pilot Plant, were taken from the surface and these samples would represent the ore most likely to be mined in the first year of production only. ✓

Geological mapping of the Alto Chapare region asbestos properties carried out up to date is not sufficient to evaluate the extent of the asbestos deposits. There are no reports available covering the extent of the asbestos deposits or the quality of fibre at depth. ✓

- 11.2 We recommend that a detailed mining program for the exploitation of the deposits be prepared, including: ✓

- (a) Analysis of exploration results
- (b) Determination of mining plan
- (c) Determination of mining costs.

- 11.3 We recommend testing and evaluation of recovered fibre from the core samples which would be obtained during the exploration work of 11.1, as follows: ✓

- (a) Test core samples
- (b) Determine fibre content and recovery
- (c) Test and analyse fibre recovered
- (d) Send representative samples of fibre to prospective customers for testing and evaluation.

- 11.4 We recommend setting up a laboratory for quickly achieving a testing program. ||

- 11.5 We recommend an interim expansion of the existing Banco Minera fibre production facilities, to improve the quality and quantity of their fibre production. For that purpose, we recommend adding to their production line certain items which could be used at a later date in the experimental production plant. ✓

- 11.6 We would be pleased to offer our resources to undertake or assist in the implementing of the above recommendations. ✓

12.0 CONCLUSIONS

The market survey established that a market exists in North and South America more than sufficient to sustain a 1500 tons per year mill, provided the fibre is of the quality desired.

A program of adequate exploration and testing must be carried out to establish if sufficient reserves of fibre exist to supply an experimental production plant.

An experimental production mill has been laid out, capable of producing 1500 tons of fibre per year on a single-shift operation, or 4500 tons per year on a three-shift basis, using the indicated quality of available ore concentrates.

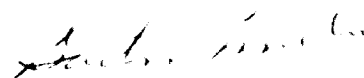
The capital cost of the mill facility, including all equipment, buildings and services, to operate with the indicated ores, is estimated at \$1,007,385.

The sale of plant production of 1500 tons per year will generate an income which would pay for the direct costs of plant operation and contribute approximately \$18 per ton for concentrate delivered to the mill. When operating on a three-shift basis, the contribution should rise to approximately \$31.

No further work should be done towards design or construction of the facility until our recommendations to define ore reserves and fibre grading have been implemented and satisfactory results obtained.

Respectfully submitted,

SURVEYER, NENNIGER & CHENEVERT INC.



G. Lavallée, Eng.
 Manager
 Mining & Metallurgy Department

CONTRIBUTORS:

Report prepared by G. Lavallée, Eng.
 Report checked by J. Lemberg, Eng.
 Flowsheet and layouts prepared by J. Lemberg, Eng.
 Capital cost estimates prepared by D. Plumbley
 Feasibilities prepared by G. Ladouceur, Eng.
 Report reviewed by W. R. Lewis, Eng.
 Report approved by J. Hahn, Eng.



APPENDIX "A"

LETTER OF UNITED NATIONS INDUSTRIAL

DEVELOPMENT ORGANIZATION OF

SEPTEMBER 11, 1970

UNITED NATIONS  **NATIONS UNIES**
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

FELDERHAUS, RATHHAUSPLATZ 2, A-1010 VIENNA, AUSTRIA
TELEPHONE: 43 50
CABLE ADDRESS: UNIDO, VIENNA, P.O. BOX 707

REFERENCE: **TP/DCN/1d**

11 September 1970

**Subject: Experimental Production Plant for
Asbestos Processing, Cochabamba, Bolivia;
UNIDO Contract 70/15, UNDP SF BOL 20**

Dear Mr. Hahn:

Reference is made to your final report on Phase I dated 5 August 1970, our last letter to you 24 August, our cable Sent. 2 and to your Mr. Lavallee's reply 5 September, in connection with the above project.

At this time I am happy to convey to you our appreciation of the Phase I report and the valuable information which it contained, also to acknowledge the useful discussions which have taken place in Vienna today with the interested UNIDO officials.

This letter constitutes our official request to your company to proceed with the execution of the work as described in Phase II of the subject contract. It is understood and agreed that the original terms and conditions of the contract will apply, except as noted below:

(a) Amend paragraph b) (i) 13, last word second line, page 5, to read "minin" instead of "mixin".

(b) Work as specified in clauses (b) (i) 14 and 15, page 6, cannot be carried out at this time and a proportionate reduction of the originally agreed charges for Phase II will be made, on a basis to be mutually agreed upon between the two parties. I would appreciate receiving your proposal in this connection as early as possible, but not later than 15 October 1970.

(c) With reference to the laboratory equipment referred to in (b) (v), page 6, a list of laboratory equipment will be sent to your firm within the next 14 days, which is to be reviewed by your company with the UNIDO Project Manager, Mr. Sumbolovich, amended as necessary to meet the requirements of the project, and finalized in terms suitable for international bidding. You

Survever, Kemper and Chenevert
1550 West De Maisonneuve Blvd.
Montreal 25, Quebec, Canada

are also requested to suggest the names of prospective manufacturers or suppliers in North America, Europe or elsewhere, to facilitate bidding to be carried out by the UNIDO.

(d) Reference (v) para 6 - receiving ore bins: delete "(to stock 250 tons) and add: "of sufficient capacity to suit local conditions and requirements.

(e) The time table for the submission of the report as referred to in sub-paragraph (b) (vii), para 7, will remain as maximum four (4) months, but every effort will be made to submit the report at an earlier date. On this point, I would appreciate your subsequent earliest advice.

(f) In general, the work to be executed under Phase II of the contract will be predicated upon the results and/or extrapolation of the results of Phase I, and can only take into account any unexpected developments arising from further explorations as may be communicated in good time to your company.

As discussed in the meeting today in the offices of the Director, TCD, Sr. Quijano-Caballero, the UNIDO is planning to have additional exploratory drilling carried out by GEOBOL in Bolivia. As technical back-stopping may be necessary for this work, your firm has kindly agreed to recommend the names of individuals or companies who would be in a position to provide the necessary technical advice at the earliest possible date and on the most favourable terms. It has also been agreed that further laboratory testing will be necessary on the expected additional ore samples, for which your office is prepared to supervise the necessary work, to be carried out in the laboratories of the Quebec Provincial Government in Quebec. If this latter testing is required, this will be covered by an amendment to the present contract incorporating the agreed extra charges.

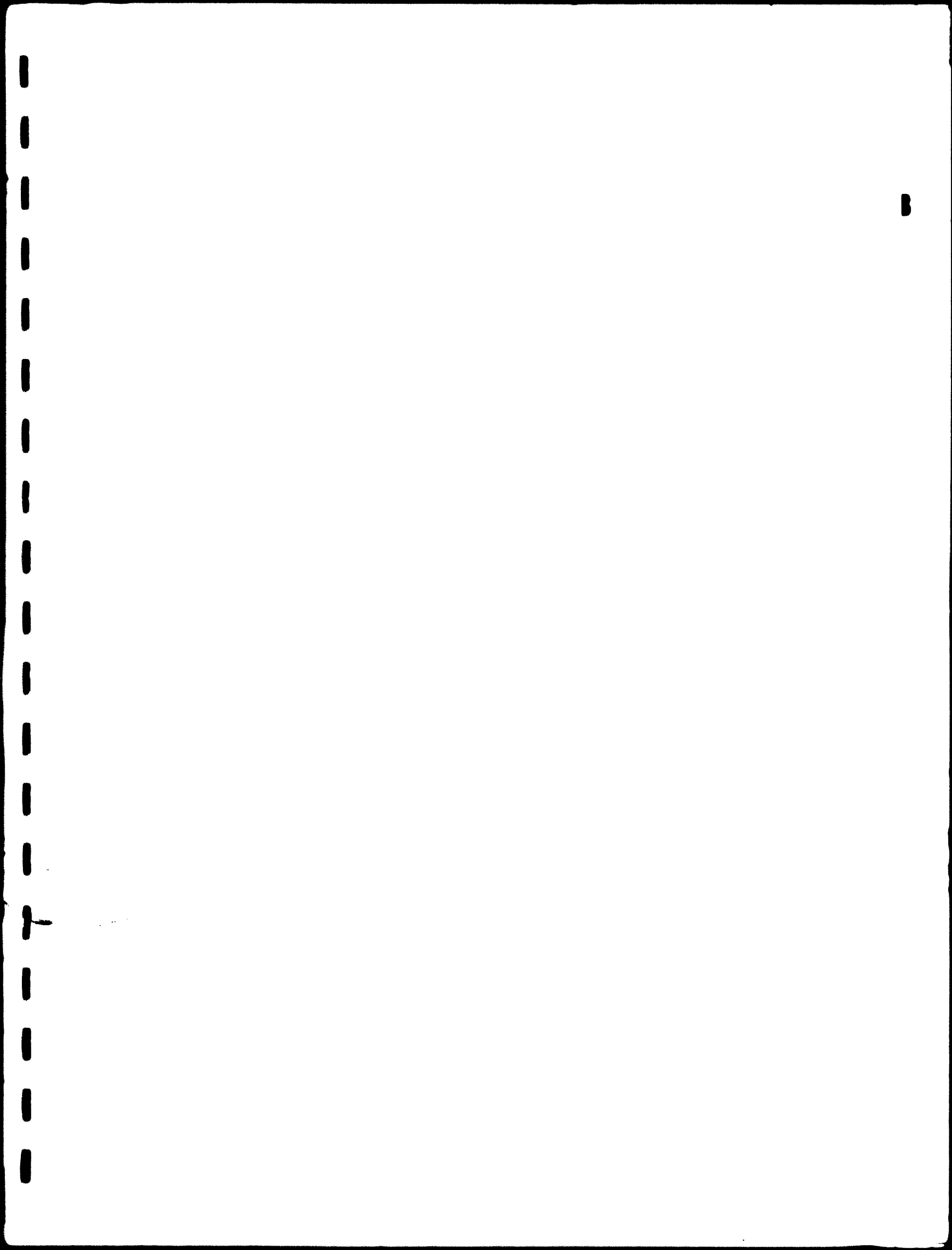
Thanking you again for your contribution to date toward the success of this project and looking forward to the results of the second phase, I am

Yours sincerely,



D. C. Lewis
Chief

Technical Equipment Procurement
and Contracting Office



APPENDIX "B"

MARKET SURVEY TABLES

TABLE I
PRODUCTION OF ASBESTOS - LATIN AMERICA

Metric Tons

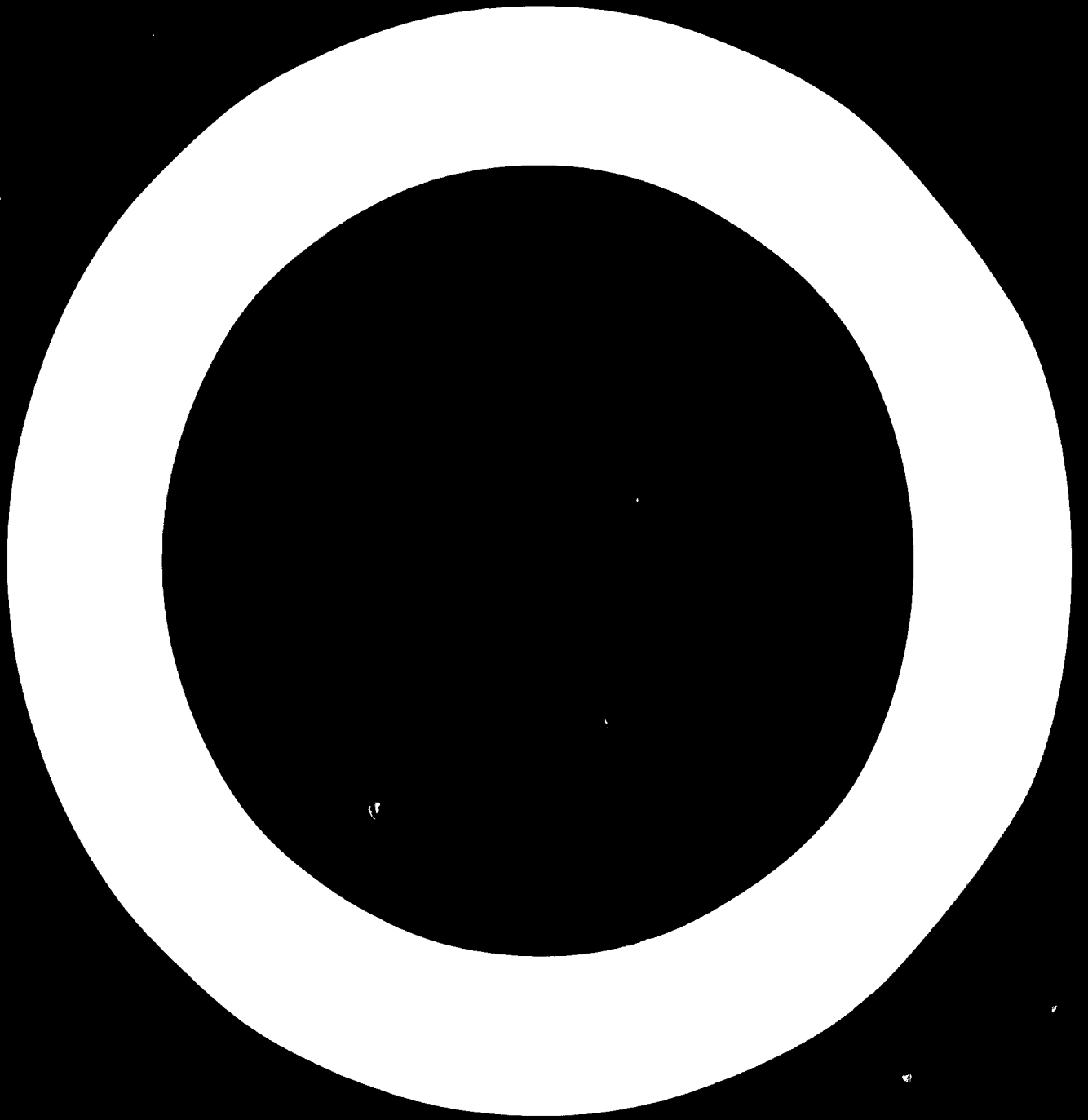
	1962	1963	1964	1965	1966	1967	1968	1969
Argentina	184	331	492	220	57	182	--	--
Bolivia	56 z	11 z	139 z	178 z	26 z	4 z	--	--
Brazil	4,400	1,306 +	1,300 +	1,092 +	2,500 *	3,500 *	4,500 *	10,500 *
Colombia	--	--	36	44	40	40	40	40
TOTAL	4,640	1,648	1,967	1,534	2,623	4,166	4,540	10,540

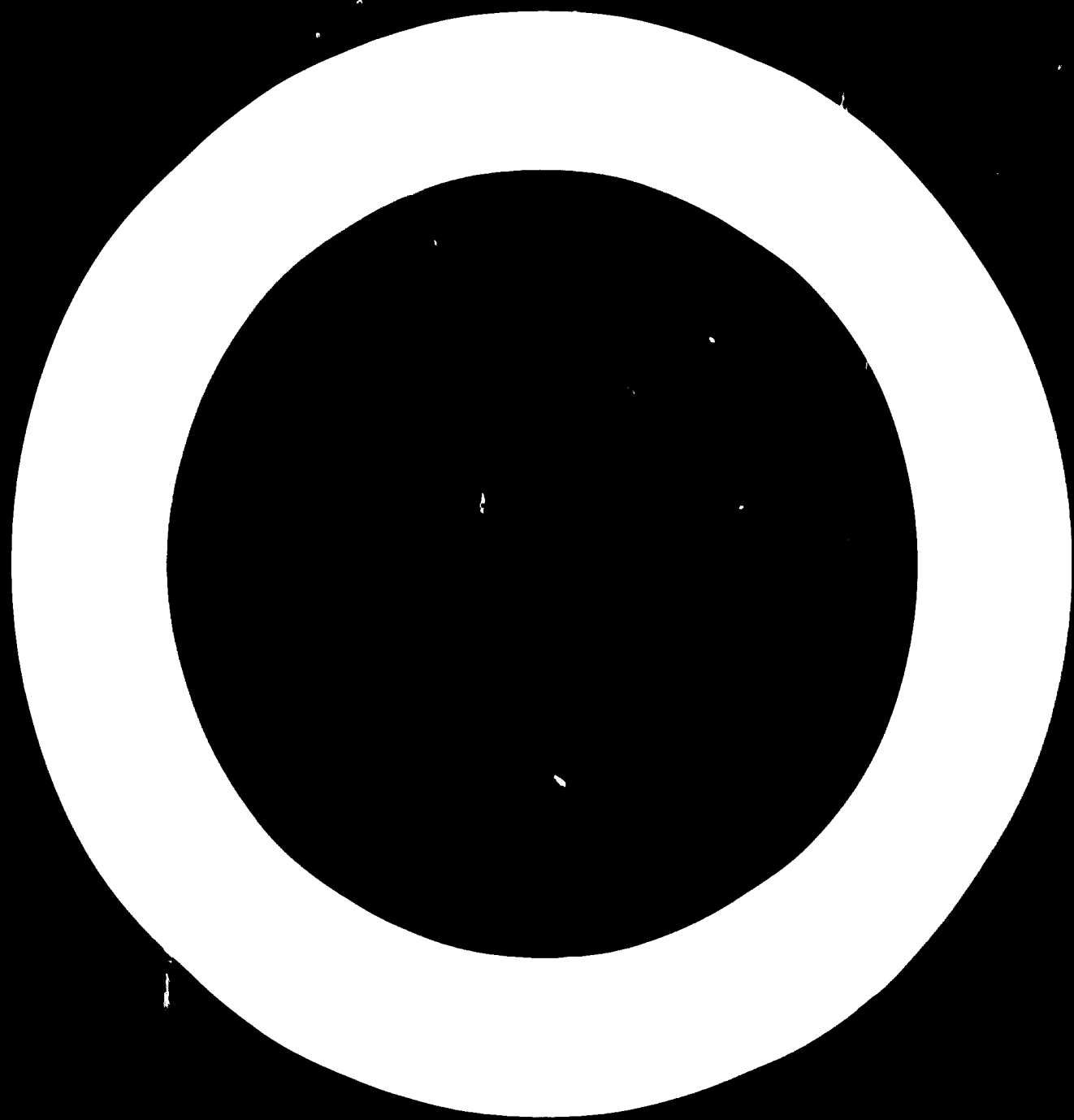
- * 1966 Includes 750 tons anthophyllite
- * 1967 Includes 1,050 tons anthophyllite
- * 1968 Includes 1,350 tons anthophyllite
- * 1969 Includes 1,500 tons anthophyllite
- + Figures for State of Bahia only
- z Crocidolite fibre

TABLE I
PRODUCTION OF ASBESTOS - LATIN AMERICA
Metric Tons

	1962	1963	1964	1965	1966	1967	1968	1969
Argentina		331	492	220	57	--	--	--
Bolivia	56	11z	139z	178z	26z	4z	--	--
Brazil	4,400		1,300+	1,092-	2	3,500	4,500 ^z	10,500 ^z
Colombia	--	--	36	41	40	40	40	40
TOTAL	4,640	1,648	1,828	1,311	2,623	4,165	4,540	10,540

* 1966 Includes 750 tons anthophyllite
 * 1967 Includes 1,050 tons anthophyllite
 * 1968 Includes 1,350 tons anthophyllite
 * 1969 Includes 1,500 tons anthophyllite
 + Figures for State of Bahia
 z Crocidolite fibre





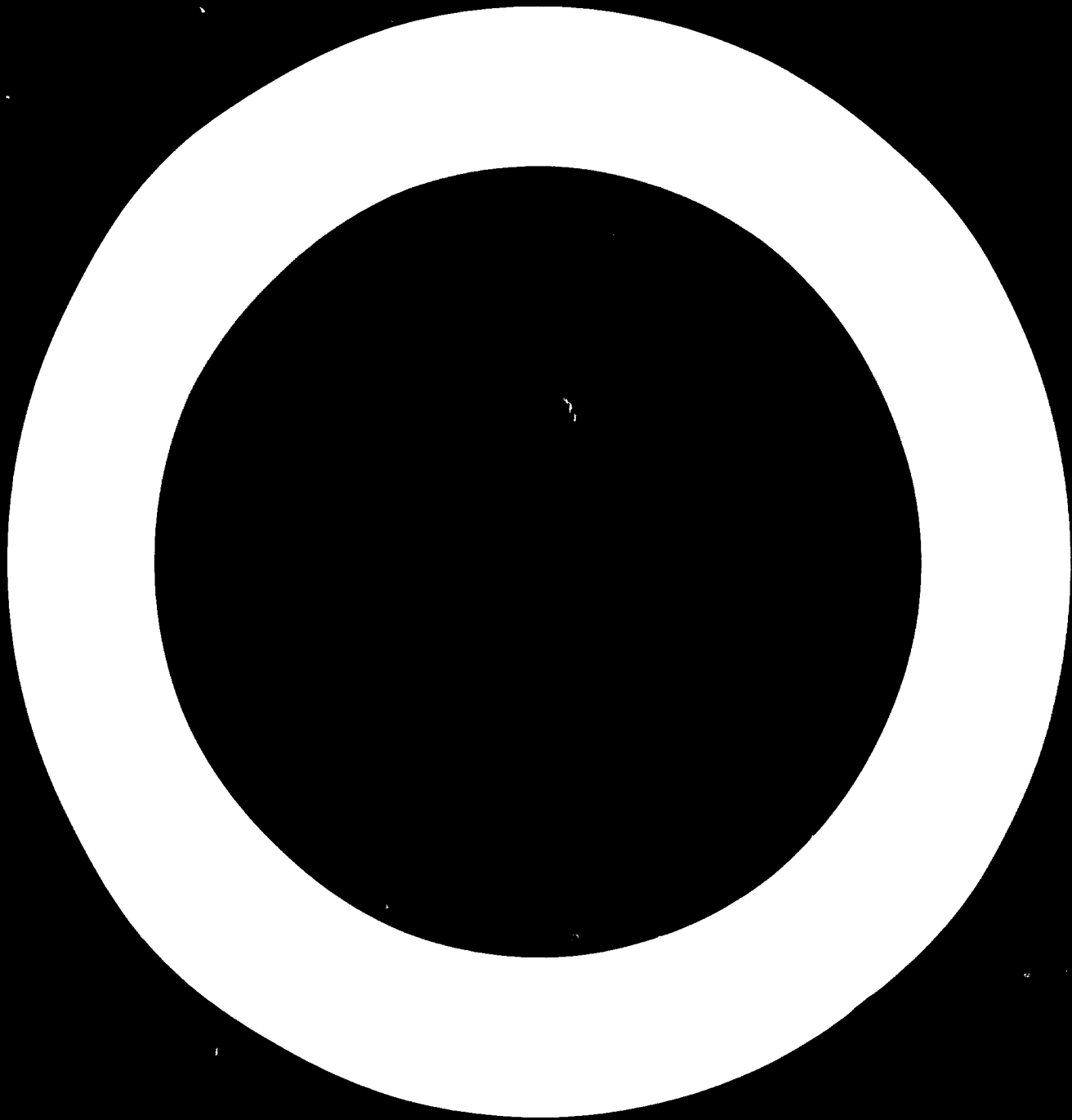


TABLE II

SOURCE OF ASBESTOS IMPORTS - LATIN AMERICA

1962 - 1969

Metric Tons

Country	Year	Country of Origin							Total	Apparent Consumption
		Canada	South Africa	U.K.	U.S.	Rhodesia	Others			
Argentina	1969	10,012	5,811	--	60	53	382	16,318	16,312	
	1968	11,328	4,580	--	185	--	403	16,496	16,492	
	1967	9,616	4,478	--	3	20	201	14,318	14,313	
	1966	11,370	--	--	--	--	2,456	13,826	13,833	
	1965	10,667	2,670	--	--	1,204	839	15,380	15,600	
	1964	9,496	697	--	--	1,517	1,210	12,920	13,412	
	1963	7,063	442	--	39	329	1,822	9,695	10,024	
	1962	--	--	--	--	--	--	--	--	
Brazil	1969	13,546	853	136	1,630	--	1,709	17,876	17,876	
	1968	23,614	1,618	166	973	--	1,215	27,586	27,586	
	1967	15,362	1,291	87	284	--	480	17,504	17,504	
	1966	16,856	1,730	--	--	--	362	18,948	21,448	
	1965	13,201	1,533	--	--	--	1,394	16,128	17,220	
	1964	11,540	1,224	--	360	99	367	13,590	14,890	
	1963	17,751	1,107	--	739	197	408	20,202	21,500	
	1962	18,686	819	--	181	--	--	19,686	24,000	
Chile	1969	6,468	454	148	447	--	314	7,831	7,831	
	1968	7,226	860	105	423	--	4	8,618	8,618	
	1967	7,504	873	6	53	--	168	8,604	8,604	
	1966	9,112	--	--	--	--	--	9,112	9,112	
	1965	5,832	1,135	--	87	10	172	7,236	7,236	
	1964	4,977	816	--	1,079	24	39	6,935	6,935	
	1963	7,353	859	--	745	--	78	9,035	9,035	
	1962	--	--	--	--	--	--	--	--	

* January - September, 1969

TABLE II
(continued)
SOURCE OF ASBESTOS IMPORTS - LATIN AMERICA
1962 - 1969
Metric Tons

Country	Year	Country of Origin						Others	Total	Apparent Consumption
		Canada	South Africa	U.K.	U.S.	Rhodesia				
Colombia	1969	9,094	2,310	73	710	--	--	12,187	12,187	
	1968	7,034	1,682	23	801	--	7	9,547	9,547	
	1967	10,764	2,360	10	615	--	2	13,751	13,751	
	1966	10,517	3,651	--	--	--	1,286	15,454	15,454	
	1965	5,933	948	--	1,239	883	26	9,029	9,073	
	1964	7,223	580	--	69	--	347	8,219	8,255	
	1963	10,049	1,696	--	1,124	--	61	12,930	12,930	
	1962	9,778	952	--	--	--	354	11,084	11,084	
	Costa Rica	1969*	376	--	--	--	--	--	376	376
		1968*	227	--	--	--	--	--	227	227
1967*		195	--	--	--	--	--	195	195	
1966		304	--	--	--	--	--	304	304	
1965		380	--	--	--	--	55	435	435	
1964		127	--	--	--	--	24	151	151	
1963		--	--	--	20	--	12	32	32	
1962		--	--	--	6	--	--	6	6	
* Canadian Imports Only										
Ecuador	1969	900	--	--	--	--	--	900	900	
	1968	1,115	--	5	3	--	2	1,125	1,125	
	1967	680	--	--	16	--	12	708	708	
	1966	453	--	--	--	--	501	954	954	
	1965	549	148	--	--	--	--	697	697	
	1964	657	133	--	--	--	--	790	790	
	1963	308	--	--	6	--	11	325	325	
1962	349	23	--	18	--	--	390	390		

TABLE II
(continued)

SOURCE OF ASBESTOS IMPORTS - LATIN AMERICA

1962 - 1969

Metric Tons

Country	Year	Country of Origin							Total	Asbestos Consumption
		Canada	South Africa	U.K.	U.S.	Rhodesia	Others			
El Salvador	1969	382	--	--	--	--	--	382	382	
	1968	617	--	--	--	--	--	617	617	
	1967	989	--	--	--	--	--	989	989	
	1966	853	--	--	--	--	388	1,241	1,241	
	1965	881	--	--	92	--	100	1,073	1,073	
	1964	481	--	--	--	--	344	825	825	
	1963	840	--	--	--	--	--	840	840	
1962	412	--	--	--	1	--	413	413		
	* Canadian Imports Only									
Guatemala	1969	771	--	--	--	--	--	771	771	
	1968	363	--	--	--	--	--	363	363	
	1967	499	--	--	--	--	--	499	499	
	1966	501	--	--	--	--	183	584	584	
	1965	735	--	--	--	--	2	918	918	
	1964	372	--	--	--	91	--	465	465	
	1963	--	--	--	--	--	--	287	287	
1962	--	--	--	--	--	--	--	--		
	* Canadian Imports Only									
Guyana	1969	--	--	--	--	--	--	--	--	--
	1968	--	--	--	--	--	--	--	--	--
	1967	--	--	--	--	--	--	--	--	--
	1966	--	--	71	--	--	351	402	402	402
	1965	--	--	2,022	--	--	--	2,022	2,022	2,022
	1964	--	--	--	--	--	--	914	914	914
	1963	--	--	870	--	--	479	1,356	1,356	1,356

TABLE II
(continued)

SOURCE OF ASBESTOS IMPORTS - LATIN AMERICA

1962 - 1969

Metric Tons

Country	Year	Country of Origin								Total	Apparent Consumption
		Canada	South Africa	U.K.	U.S.	Rhodesia	Others				
Guyana	1962	--	--	--	--	--	--	--	--	--	--
	* Canadian Imports Only										
Honduras	1969	280	--	--	--	--	--	--	--	280	280
	1968	1,781	--	--	--	--	--	--	--	1,781	1,781
	1967	617	--	--	--	--	--	--	--	617	617
	1966	685	--	--	--	--	--	--	--	685	685
	1965	636	--	--	--	--	--	--	--	636	636
	1964	830	--	--	--	--	--	13	--	969	969
	1963	186	--	--	--	--	--	--	--	186	186
1962	5	--	--	4	21	--	--	--	7	37	37
* Canadian Imports Only											
Mexico	1969	28,153	3,543	--	5,167	--	--	--	107	36,970	36,955
	1968	26,461	2,252	--	4,505	--	--	--	278	33,499	33,499
	1967	22,567	1,977	--	5,567	--	--	--	211	30,322	30,322
	1966	19,025	--	--	--	--	--	--	6,500	25,525	25,525
	1965	16,418	332	--	2,469	--	--	--	54	19,273	19,273
	1964	18,329	705	--	3,951	--	--	--	223	23,208	23,208
	1963	13,815	736	--	3,542	--	--	--	218	18,311	18,311
1962	9,148	504	--	1,947	--	--	--	--	11,599	11,599	
Nicaragua	1969	100	--	--	--	--	--	--	--	100	100
	1968	68	--	--	--	--	--	--	--	68	68
	1967	145	--	--	--	--	--	--	--	145	145
	1966	9	--	11	38	--	--	--	12	70	70
	1965	--	--	--	--	--	--	--	--	--	--

TABLE II
(continued)
SOURCE OF ASBESTOS IMPORTS - LATIN AMERICA
1962 - 1969
Metric Tons

Country	Year	Country of Origin							Total	Apparent Consumption
		Canada	South Africa	U.K.	U.S.	Rhodesia	Others			
Nicaragua	1964	--	--	56	--	--	--	56	56	
	1963	--	--	4	25	--	4	33	33	
	1962	--	--	6	44	--	6	56	56	
	*Canadian Imports Only									
Panama	1969*	181	--	--	--	--	--	181	181	
	1968*	--	--	--	--	--	--	--	--	
	1967*	--	--	--	--	--	--	--	--	
	1966	272	--	--	--	--	--	272	272	
	1965	--	--	--	1	--	--	1	1	
	1964	272	--	--	--	--	--	272	272	
	1963	--	--	--	--	--	--	4	4	
1962	--	--	--	--	--	--	--	--		
	* Canadian Imports Only									
Peru	1969	2,577	--	--	--	--	--	--	4,000 (est.)	
	1968	3,211	551	80	117	--	7	3,966	3,966	
	1967	3,021	415	19	411	--	373	4,239	4,239	
	1966	2,847	--	--	--	--	685	3,532	3,532	
	1965	2,893	851	--	--	--	786	4,530	4,530	
	1964	2,075	583	--	--	136	--	2,794	2,794	
	1963	--	--	--	--	--	--	2,611	2,611	
	1962	1,687	365	--	--	272	91	2,415	2,415	

TABLE II
(continued)

SOURCE OF ASBESTOS IMPORTS - LATIN AMERICA

1962 - 1969

Metric Tons

Country	Year	Country of Origin						Other	Total	Apparent Consumption
		Canada	South Africa	U.K.	U.S.	Rhodesia				
Surinam	1966	--	--	548	--	--	376	926	926	
	1965	--	--	626	713	--	353	1,692	1,692	
	1964	--	--	--	329	--	825	1,154	1,154	
	1963	--	--	--	--	--	--	732	732	
	1962	--	--	--	--	--	--	--	--	
Uruguay	1969*	676	--	--	--	--	--	676	676	
	1968*	860	--	--	--	--	--	860	860	
	1967*	499	--	--	--	--	--	499	499	
	1966	1,796	--	--	--	--	--	1,796	1,796	
	1965	1,096	--	--	--	--	200	1,296	1,296	
	1964	671	--	--	--	--	381	1,052	1,052	
	1963	--	--	--	--	--	--	--	--	
1962	--	--	--	--	--	--	--	--		
* Canadian Imports Only										
Venezuela	1969	4,163	--	--	--	--	--	--	5,600 (est.)	
	1968	5,248	367	--	42	--	6	5,663	5,663	
	1967	4,781	51	--	172	--	7	5,011	5,011	
	1966	4,852	--	--	--	--	465	5,317	5,317	
	1965	4,176	--	--	554	--	381	5,111	5,111	
	1964	4,231	273	--	410	--	--	4,914	4,914	
1963	2,067	46	--	144	--	183	2,624	2,624		
1962	3,356	--	--	65	--	--	3,452	3,452		

TABLE II
(continued)

SOURCE OF ASBESTOS IMPORTS - LATIN AMERICA

1962 - 1969

Metric Tons

	1962	1963	1964	1965	1966	1967	1968	1969
TOTAL IMPORTS	49,138	79,205	79,147	85,691	98,918	97,309	110,413	104,425
TOTAL PRODUCTION	4,640	1,648	1,967	1,534	2,623	4,166	4,540	10,546
TOTAL CONSUMPTION	53,778	80,853	81,114	87,225	101,573	101,505	114,953	114,967

* Canadian imports only for Costa Rica, El Salvador, Guatemala, Guyana, Honduras, Nicaragua, Panama and Uruguay.

** Contains estimates only for Venezuela and Peru, and January to September for Chile.

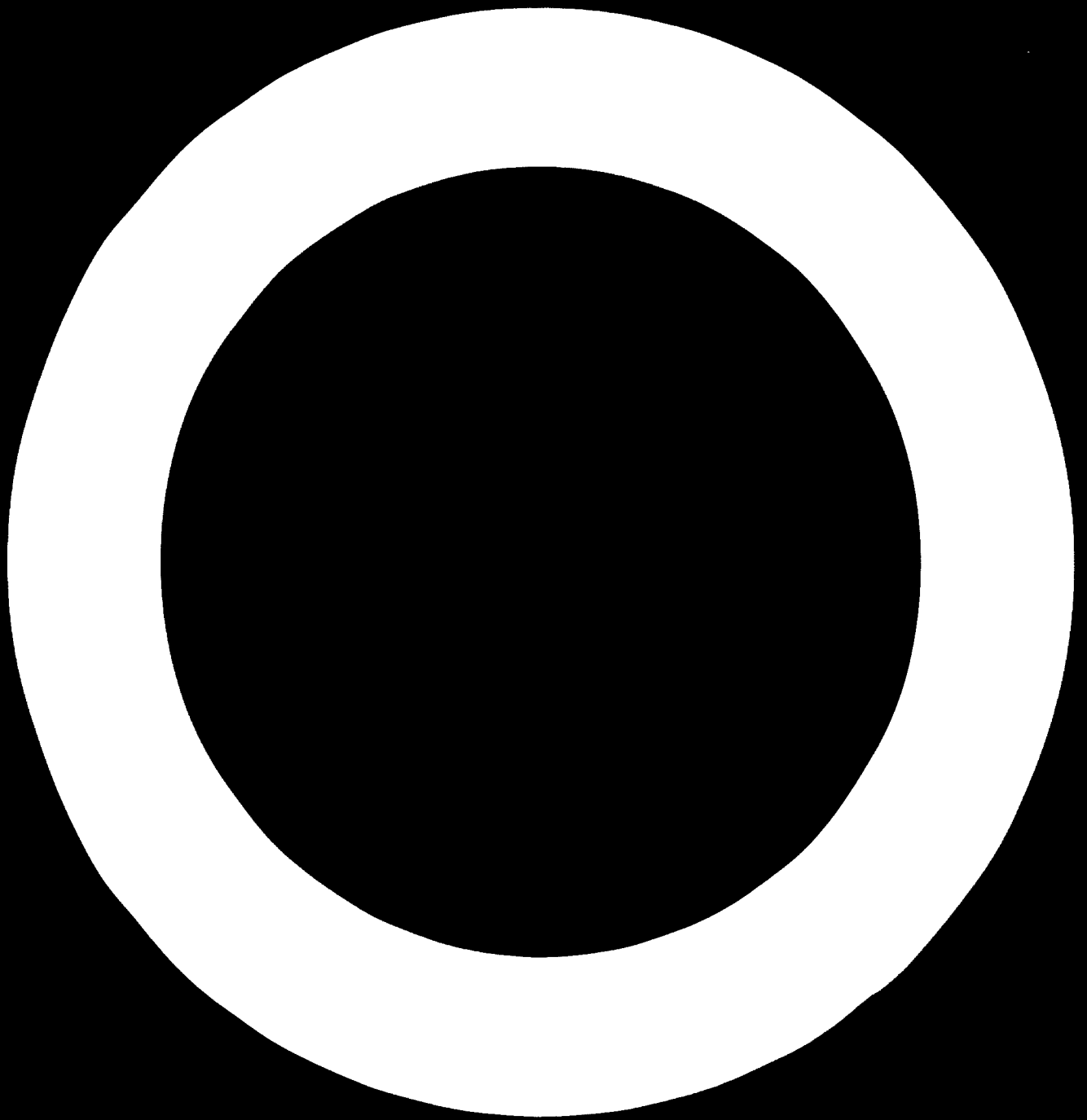


TABLE III

ASBESTOS IMPORTS FROM CANADA BY GRADE

Metric Tons

Country	Group 3	Group 4&5	Group 6-9	Total	Group 3 % of Total	Group 4&5 % of Total	Group 6-9 % of Total
Argentina	'69	4327	-	4344	0.4	99.6	
	'68	5494	-	5507	0.3	99.7	
	'67	5584	3685	9311	0.6	59.9	39.5
	'66	6388	4981	11370	-	56.2	43.8
	'65	6113	4499	10667	0.5	57.3	42.2
	'64	177	5114	4206	9496	1.9	57.8
Brazil	'69	11887	-	11993	0.9	99.1	
	'68	18341	-	18506	0.9	99.1	
	'67	16156	2293	18688	1.3	86.4	12.3
	'66	14048	2594	16856	1.3	83.3	15.4
	'65	11126	1994	13201	0.6	84.3	15.1
	'64	109	8845	2586	11540	0.6	76.7
Chile	'69	6720	-	6720		100	
	'68	5180	-	5180		100	
	'67	6202	1289	7491		82.8	17.2
	'66	6268	2843	9112		68.6	31.2
	'65	4121	1712	5832		70.6	29.4
	'64	3895	1082	4977		78.3	21.7
Colombia	'69	5642	-	5642		100	
	'68	8381	-	8385		99.9	
	'67	10875	1200	12075		90.1	9.9
	'66	9273	1240	10517		88.2	11.7
	'65	5586	345	5933		91.2	8.8
	'64	7038	135	7223		98.1	1.9

TABLE III
(continued)

ASBESTOS IMPORTS FROM CANADA BY GRADE
Metric Tons

Country	Group 3	Group 4&5	Group 6-9	Total	Group 3 % of Total	Group 4&5 % of Total	Group 6-9 % of Total
Ecuador	'69	698		698		100	
	'68	866		866		100	
	'67	603		603		100	
	'66	453		453		100	
	'65	549		549		100	
	'64	657		657		100	
Peru	'69	1183		1183		100	
	'68	1568		1568		100	
	'67	2583	917	3500		73.8	25.2
	'66	2213	634	2847		77.7	22.3
	'65	2222	671	2893		76.8	23.2
	'64	1905	171	2075		91.8	8.2
Uruguay	'69	676		676		100	
	'68	860		860		100	
	'67	340		499		68.2	31.8
	'66	1451		1796		80.8	19.2
	'65	961		1096		87.7	12.3
	'64	589		671		87.8	12.2
Venezuela	'69	2580		2580		100	
	'68	3301		3302	0.1	99.9	
	'67	2959	1246	4205		70.4	29.6
	'66	3670	1091	4852	1.9	75.6	22.5
	'65	3099	1086	4176		73.7	26.5
	'64	3117	1114	4231		73.7	26.3

TABLE III
(continued)

ASBESTOS IMPORTS FROM CANADA BY GRADE

Metric Tons

Country	Group 3	Group 4&5	Group 6-9	Total	Group 3 % of Total	Group 4&5 % of Total	Group 6-9 % of Total	Group 3 % of Total	Group 4&5 % of Total	Group 6-9 % of Total
Mexico	'69	439	20109	20548	2.1	-	-	2.1	97.9	-
	'68	14376	-	37827	38	-	-	38	62	-
	'67	282	23451	4044	1.1	4044	-	1.1	82.6	15.3
	'66	231	16156	2638	1.2	2638	-	1.2	84.9	13.9
	'65	218	14005	2196	1.3	2196	-	1.3	85.3	13.4
	'64	272	15706	2351	18329	1.5	2351	1.5	85.7	12.8
Nicaragua	'69	100	-	100	100	-	-	100	-	-
	'68	68	-	68	100	-	-	100	-	-
	'67	109	-	36	145	75	36	75	75	25
	'66	-	-	9	9	-	9	-	100	-
	'65	-	-	-	-	-	-	-	-	-
	'64	-	-	-	-	-	-	-	-	-
Panama	'69	181	181	181	100	-	-	100	-	-
	'68	-	-	-	-	-	-	-	-	-
	'67	-	-	-	-	-	-	-	-	-
	'66	272	272	272	100	-	-	100	-	-
	'65	-	-	-	-	-	-	-	-	-
	'64	272	272	-	272	100	-	100	-	-
Costa Rica	'69	376	376	376	100	-	-	100	-	-
	'68	227	227	227	100	-	-	100	-	-
	'67	186	-	9	195	95.3	9	95.3	-	2.7
	'66	301	-	-	301	100	-	100	-	-
	'65	380	-	-	380	100	-	100	-	-
	'64	127	-	-	127	100	-	100	-	-

TABLE III
(continued)

ASBESTOS IMPORTS FROM CANADA BY GRADE

Metric Tons

Country	Group 3	Group 4&5	Group 6-9	Total	Group 3 % of Total	Group 4&5 % of Total	Group 6-9 % of Total
El Salvador	'69	382		382		100	
	'68	617		617		100	
	'67	898	91	989		90.8	9.2
	'66	771	82	853		90.4	9.6
	'65	744	136	881	0.2	84.4	15.4
	'64	317	163	481		66	34
Guatemala	'69	771		771		100	
	'68	363		363		100	
	'67	499		499		100	
	'66	502	82	584		86	14
	'65	735		735		100	
	'64	345	27	372		92.7	7.3
Honduras	'69	280		280		100	
	'68	1781		1781		100	
	'67	617		617		100	
	'66	685		685		100	
	'65	636		636		100	
	'64	830		830		100	
Total - Latin America							
'69	567	55912	-	56479	1	99	
'68	14559	70498	-	85058	17	83	
'67	562	68167	14969	83699	1	81	18
'66	540	62451	16530	79521	1	79	20
'65	355	50269	12771	63395	1	79	20
'64	615	48807	11916	61238	1	80	19

TABLE IV

CONSUMPTION OF CROCIDOLITE ASBESTOS
NORTH AND SOUTH AMERICA

Metric Tons

	1963	1964	1965	1966	1967	1968	1969	1970
Argentina	--	--	--	62	--	279	718	599.6
Brazil	760	746	--	--	--	--	--	15.4
Chile	347	221	--	--	--	--	--	--
Colombia	1,669	762	--	--	1,756	454	1,225	2,595.6
Mexico	2,690	500	--	--	--	--	--	--
Peru	227	296	--	--	--	--	--	--
Venezuela	--	--	--	--	--	--	--	--
Canada	1,819	2,544	--	2,976 (est.)	2,927 (est.)	2,740	2,768 (est.)	--
United States	12,729	22,490	21,165	26,995	13,532	12,741	9,800	--
Available Totals	20,247	27,619	21,165	30,033	18,215	16,211	14,512	2,815.4

Except for 1963 and 1964, the totals are only partial, as many countries do not break down their fibre imports according to the type used.

* Used by Eternit Colombiana S.A.

+ Used by the Monofort S.A. Ind. y Comm.

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C

APPENDIX "C"

PROPOSED MINING PROGRAM

SUBMITTED BY BOLIVIA

PLANTA EXPERIMENTAL BENEFICADORA
DE MINERALES DE ASBESTO

COCHABAMBA

--3--

M I N E R I A

1.- PRODUCCION

1.- La planta experimental beneficiadora de minerales de asbesto en la ciudad de Cochabamba (Bolivia), se abastece mediante una serie de minas pequeñas.

2.- En la primera etapa, se plantea una explotación anual de:
35.000 - 40.000 toneladas

de mineral de asbesto, con una ley promedio del 6 %, para llegar a una producción de:

1.500 toneladas

de fibra preparada y clasificada.

Con un porcentaje de recuperación promedio 70 % del mineral.

3.- Para una producción de 1.500 toneladas de fibra preparada y clasificada, se debe explotar (mover) una cantidad de:

70.000 - 80.000 toneladas

de mineral y esteril.

Las capas esteriles, que cubren parcialmente los yacimientos mineralizados, deben ser movidas por intermedio de una topadora. El sistema de trabajo adecuado y rentable es de

rajo abierto

Siendo las condiciones muy favorables para una explotación selectiva, con conservación fácil y sin mayor esfuerzo del asbesto de la roca madre, el proceso de extracción del mineral se debe efectuar en forma selectiva "explotación selectiva".

4.- En la primera fase, para asegurar un abastecimiento de unas 10 - 30 toneladas por día (250 días de trabajo), se sea 2.500 - 7.000 toneladas por año, con una ley de 40 - 95 %, se tendrán dos o tres centros mineros (minas) en explotación y uno o dos yacimientos en preparación.

Producción del mineral con una ley de 40 %	CENTRO MINEROS			TOTAL
	I	II	III	
diario	9	en toneladas 9	10	28
mensual	230	230	240	700
anual	2300	2300	2400	7000
Producción del mineral con una ley de 95 %	I	II	III	TOTAL
diario	3	3	4	10
mensual	75	75	100	250
anual	750	750	1000	2500

II.- CONCENTRACION DEL MINERAL

5.- El proceso de concentración del mineral debe empezar en los mismos yacimientos.

El mineral de asbesto seleccionado en las minas se debe desmenuzar en trozos (30 cm.) y debe ser escogido a mano, rechazándose el material estéril, a fin de lograr mayor concentración posible y así despacharlo a la PLANTA como mineral de alta ley, 40 - 95 %.

III.- SECAO NATURAL

6.- El contenido de humedad del mineral de asbesto que es despachado de las minas es hasta de un 20 % de agua, debido al régimen extremado de lluvias que impera en la región.

El mineral de asbesto seleccionado será sometido a un secado preliminar. Para lo que se pueden aprovechar las condiciones climatológicas, tanto de sequedad como de las corrientes de aire.

El mineral se extenderá en una superficie de cemento, completamente limpia y adecuada para el efecto.

El mineral de asbesto secado preliminarmente (secado natural), en el que el contenido de humedad se reduce (5 - 10 %), se transportará a la PLANTA.

IV.- ESTRUCTURA DEL MINERAL

7.- La Planta será construida en forma que pueda tratar el

mineral de asbesto con una ley de 40 - 95 %.

Los ensayos industriales presentarán varias alternativas conducentes a asegurar el tratamiento de 2500 - 7000 toneladas métricas del mineral de asbesto por año (8 - 25 toneladas del mineral de asbesto diario), para una producción de 1.500 toneladas métricas por año de fibra preparada y clasificada, todo basado en trabajo de un turno de ocho horas durante 300 días al año, ósea, 5 toneladas métricas de producción de fibra de asbesto por día.

- 8.- Además, por la distinta naturaleza mineralógica del mineral de asbesto de los yacimientos, se requiere una existencia apreciable del mineral, por lo menos de dos meses, para preparar la carga de la Planta.

Una cantidad de 250 - 700 toneladas del mineral de asbesto será depositada en los mismos centros mineros y una otra igual de 250 - 700 toneladas será depositada en el depósito central en Cochabamba. Es decir, cada centro minero va a tener su depósito central en Cochabamba (capacidad 250 toneladas).

El mineral de asbesto se almacenará en el depósito dividido en tres tolvas separadas, para diferentes calidades de un centro, en base del contenido de la fibra en el mineral.

- 9.- El mineral de asbesto de diferentes calidades de cada centro minero se transportará a Cochabamba y almacenará en el adecuado depósito central, el cual está también dividido en tres partes separadas, para el mineral de cada uno de los tres centros mineros. Además cada una de las tres partes, estará dividida en tres tolvas separadas por diferentes calidades.
- 10.- El Banco minero realizará una adecuada organización para recibir el mineral de asbesto.
- La entrega del mineral, la recepción del mismo y su precio se arreglará en base de un reglamento y contrato.
- En el contrato se definirá exactamente el precio, plazo de entrega, cantidad mínima, muestreo, impurezas, humedad y calidad.
- 11.- La Planta recibirá solamente un material de adecuada calidad.

En la primera fase de investigaciones sistemáticas, se va a realizar ensayos sistemáticos y valiosos respecto de la calidad, desfibramiento, pureza, comportamiento en el proceso de la fibra, etc.; cuyos resultados constituirán la base para una producción normal y para poder proyectar las instalaciones y equipos de la futura planta de dimensiones industriales (10.000 toneladas).

12.- La carga del mineral escogido, de unas 50 toneladas con una ley aproximadamente del 25 % o una carga de 150 toneladas con una ley aproximadamente del 40 %, se preparará para el procesamiento en la Planta; es decir, una cantidad del mineral para el procesamiento de una semana.

El material se extenderá en una superficie de cemento completamente limpia y adecuada para el efecto.

El material se mezclará mediante palas y será cuarteado en forma que se acostumbra para el muestreo de minerales hasta obtener diez kilos.

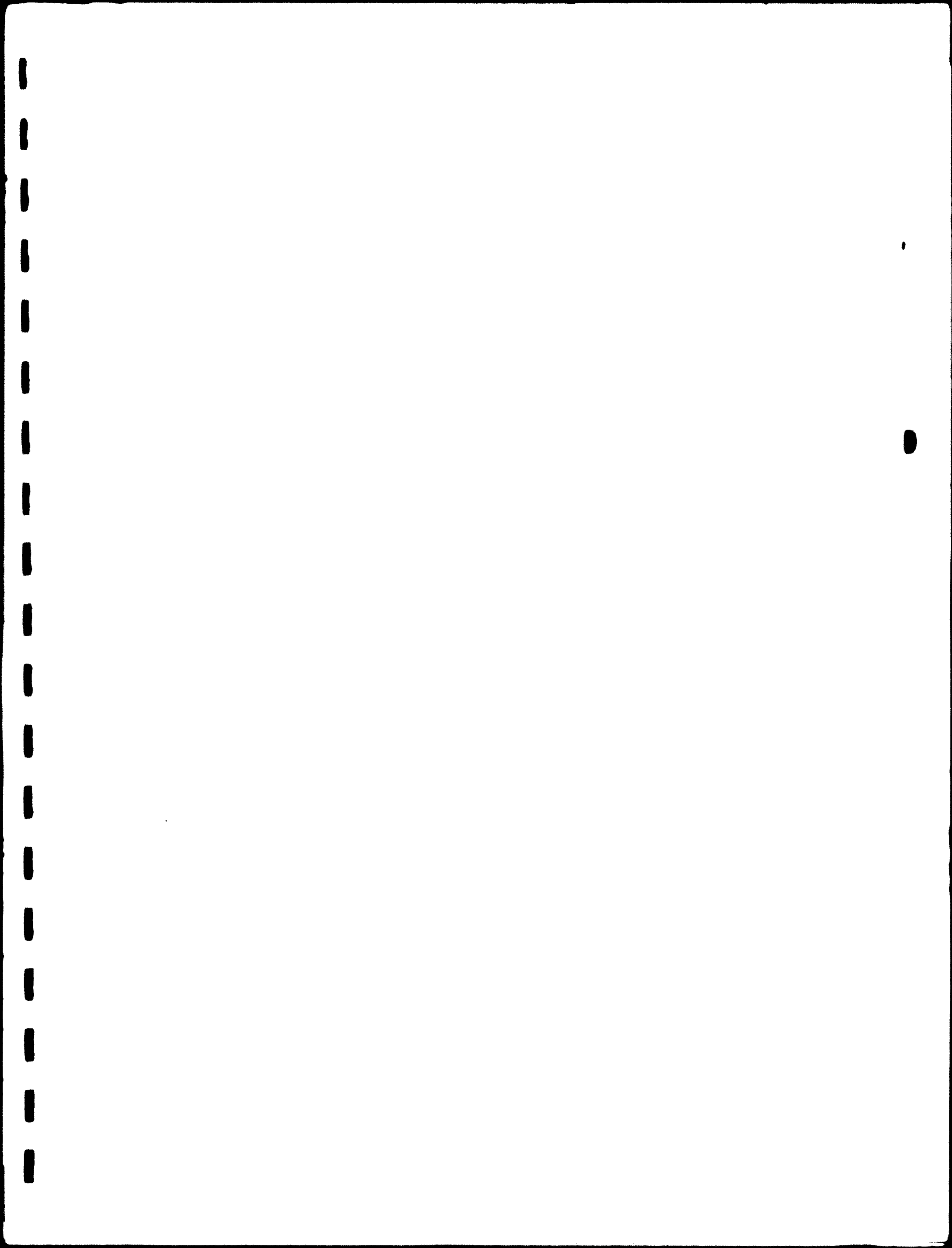
Estas muestras deberán ser investigadas e identificadas en el LABORATORIO, para estimar el valor del mineral del mencionado lote.

13.- El cálculo final para el valor del mineral se realizará después del procesamiento del mineral, (mínimo 6 días), de misma calidad y de los resultados de la producción: estructura de las fibras obtenidas, calidad de las fibras, rendimiento (claramente tomando en cuenta las pérdidas en el tratamiento).

14.- Trabajando de esta manera se alejará cualquier dificultad en la estimación del mineral.

Este método, de acuerdo a la experiencia, se puede modificar ó corregir, según necesidad.

28 de marzo de 1969



APPENDIX "D"
OPERATIONS AT MAXIMUM PRODUCTION CAPACITY
ON ONE AND THREE SHIFTS BASIS

Appendix "D"

OPERATIONS AT MAXIMUM PRODUCTION CAPACITYON ONE AND THREE SHIFTS BASISD.0 INTRODUCTION

The experimental plant not being profitable when producing its 1500 tons per year of fibre, the economics of operating at maximum capacity of 12 tons of fibre per 8 hour shift were studied for one 8 hour shift and on a continuous 3 shift basis.

D.1 SALESa) Forecast One Shift

We assumed that sales would equal to 75% of the capacity during the first year and 100% during the subsequent years, if the plant operates one shift.

b) Three shifts

If the plant operates three shifts, great sales efforts will be required to penetrate the export markets in the countries neighbouring.

We assumed the need of one additional salesman.

Working three shifts requires that 60% of the production would be sold in 80% the second year and 100% in the subsequent years.

D.1 SALES (cont'd)c) Tonnage and Sales Forecast

YEAR	GRADE	ONE SHIFT BASIS		THREE SHIFT BASIS	
		Tonnage	Sales	Tonnage	Sales
FIRST	B	250	\$ 53,750	580	\$ 124,700
	C	1000	175,000	2200	385,000
	D	1450	210,250	3700	536,500
	Combined	2700	439,000	6480	1,046,200
SECOND	B	330	70,950	780	167,700
	C	1200	213,500	2940	514,500
	D	2050	297,250	4920	713,400
	Combined	3600	581,700	8640	1,395,600
FOLLOWING	B	330	70,950	970	208,550
	C	1220	213,500	3680	644,000
	D	2050	297,250	6150	891,750
	Combined	3600	581,700	10800	1,744,300

D.2 OPERATING COST

<u>Items</u>	<u>One Shift Basis</u>	<u>Three Shift Basis</u>
Basic operating cost for one shift at design capacity	\$ 155,333	\$ 155,333
Additional costs:		
Fuel for drying	3,035	13,441
Diesel oil	343	1,519
Oil and greases	1,120	4,960
Jute bags	19,600	86,800
Shipping	2,835	12,550
Maintenance	17,714	66,484
Sales	-	12,000
2 Mill Foremen	-	3,480
6 Floor operators	-	6,240
2 Crusher operators	-	2,080
2 Baggers	-	1,900
2 Palletizers	-	1,900
2 Fork Lift operators	-	2,420
4 Labourers	-	2,080
2 Truck drivers	-	2,420
2 Mechanics	-	5,600
2 Helper mechanics	-	2,780
	<hr/>	<hr/>
TOTAL OPERATING COST	\$ 199,580	\$ 383,987

D.3 CASH FLOWS

1. ONE SHIFT BASIS

	<u>1st Year</u>	<u>2nd Year</u>	<u>3rd Year</u>	<u>4th Year</u>	<u>5th Year</u>
Sales Revenues	\$439,000	\$581,700	\$581,700	\$581,700	\$581,700
Operating Cost	199,580	199,580	199,580	199,580	199,580
Operating Profit	239,420	382,120	382,120	382,120	382,120
Depreciation	98,957	90,461	82,815	75,934	69,740
Interest Charges	57,643	61,643	61,643	61,643	61,643
Net Profit	82,820	230,016	237,662	244,543	250,737
Cumulative Earnings	82,820	312,836	550,498	795,041	1,045,778

2. THREE SHIFT BASIS

	<u>1st Year</u>	<u>2nd Year</u>	<u>3rd Year</u>	<u>4th Year</u>	<u>5th Year</u>
Sales Revenues	1,046,200	1,395,600	1,744,300	1,744,300	1,744,300
Operating Cost	383,987	383,987	383,987	383,987	383,987
Operating Profit	662,213	1,011,613	1,360,313	1,360,313	1,360,313
Depreciation	98,957	90,461	82,815	75,934	69,740
Interest Charges	57,643	61,643	61,643	61,643	61,643
Net Profit	505,613	859,509	1,215,855	1,222,736	1,228,930
Cumulative Earnings	505,613	1,365,122	2,580,977	3,803,713	5,032,643

D.4 PROFITABILITY

The mill rate of return on investment on a discounted cash flow basis would be:

- a) for one shift operation: 16%
- b) for three shift operation: 45%

D.5 MINING COST

The above cash flows do not consider the cost of ore delivered to the plant. Therefore, the amounts shown as "net profit" represent money available to cover the cost of mining and delivery of the concentrate to the plant.

Assuming a concentrate at 30%, money available to mine and deliver the concentrate to the plant would amount to \$18.35 per ton in the case of the one shift operation and \$31.77 per ton in the case of the three shift operation. The difference between these figures and the actual mining cost would be the "True Net Profit" of the combined mining and processing operation.



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E

APPENDIX E

Details of Capital Cost Estimates



JOB NO 3049

CONCRETE - COST/M³

CEMENT - 53.00 US / METRIC TON 2000 #S.
= 0.024 US / # x 94 # SACK = 2.25 US / SACK.

FOR 1 M³ CONCRETE 3000 PSI

ALLOW 6 SACK CEMENT	@ 2.25	13.50	
1650 # SAND	@ 1.90 / M ³	3.10	
2450 # STONE	@ 2.25 / M ³	5.50	
		<u>16.00</u>	BASIC MATERIAL.
(WATER SUPPLY, ADD 1 M ³)		1.00	
		<u>17.00</u>	PER M ³

MIXING CONCRETE -

HAIL SAND 4 HRS. x 2 = 32 MHR @ 50¢
 " GRAVEL 5 HRS x 8 = 40 " @ 50¢
 HANDLE CEMENT 1 x 8 = 8 " @ 50¢
 MIXER OPER 1 HR x 2 = 2 " @ 75¢
 TOTAL COST / HR = 41.50

PRODUCTION @ 10 CYDS / HR OR

TIME M ³ / HR =	5.50 PER M ³
ADD FOR MIXED OPERATION	0.50
<u>CONCRETE COST, MIXED</u>	<u>6.00 PER M³</u>

CONCRETE PLACING - WHEEL & HAND PLACE.

USE BASIC .80 MH / CYD. = 1.00 MH / M³ US. = 8.00 MH, M³ LOCAL.

ASSUME CREW -

2 FOREMAN (HOOKING)	@ .90	1.80
10 CARPENTER	@ .55	5.50
20 LABORER	@ .45	9.00
		<u>16.30 HR.</u>

AVERAGE RATE 55¢ / HR. x 8 MH = 4.40 M³

USE 4.50 M³ PLACED FOUNDATION CONCRETE

CONCRETE FINISHES - SUPERSTRUCTURE

Allow 50% increase in rate of the average for
elevated slabs, etc.

FORMWORK FORMWORK TO FOUNDATIONS

LABOUR - USE AVER. 12 MH/7 = 1.3 MH/11 US x 8 = 10.5 MH/11^F
LOCAL

LABOUR RATE - USE AVERAGE 55¢/HR
10.5 MH x 0.55 = 5.75 CONTRACT

MATERIAL @ 27.00 US/M³ = 130 BF OR 21¢/BF

ALLOW AVERAGE 1.50 BF/CF OR 16 BF/M² = 16 x 21 = 3.36/M²

ALLOW 3 REUSE = 4 TOTAL = 82¢/M² (INCLUDE REPAIR MAT., HW, ETC)

USE 90¢/M² MATERIAL COST ALLOW TOOLS & ETC 10¢

FOUNDATION FORMWORK - 6.00 plus 1.00 = 7.00/M² CONTRACT

REINFORCING MATERIAL PRICE 210.00 US/M.TON
ADD CUTTING WASTE (2.10%) 4.41 = 214.41 TON

LABOUR - UNLOAD 1.75 MH/TON x 8 = 14 @ 50¢ = 7.00

CUT & BEND 2.00 MH " x 8 = 16 @ 60¢ = 9.60

14 @ 45¢/TON

PAPE & TIE BARS - AVERAGE 1.5 MH/TON = 144 MH/TON x 60¢ = 86.40 TON

∴ REIN. IN SLAB - 375 US TON INCLUDING 6 TIE WIRE, CURB STOPS, ETC

<u>STRUCTURAL STEEL</u>		<u>BUS PRICE</u>		<u>210.00 / TON</u>	
UNLOAD	3 IN ABP 12	x 2	=	24 MH = 5.55 [¢]	13.20
	1 1/2 IN IBE	x 2	=	24 MH = 5.55 [¢]	1.70
ERECTOR DUMP	4.00 IN IBEONWORK	x 2	=	32 MH = 8.00	25.60
	2.05 IN IBE	x 2	=	45 MH = 11.25	3.35
BOLT OR WELD	3.0 IN IBEONWORK	x 2	=	32 MH = 8.00	38.40
					<u>82.75</u>

• RAME BENCH 3.425 @ 25[¢] / TON = 85[¢]

ALLOW FOR UNLOADING, ERECTION - 85[¢] LABOUR 20[¢] EQUIP.
 15[¢] SUPPLIES.
 OR 120.00 / TON.

BASE PRICE @ 10.00 PLUS WASTE LOSS = 250[¢] / TON.
 ALLOW FREIGHT FACILE PORT TO SITE = 50[¢] / TON.

FABRICATION - 15 MHR, TON x 8 = 120 MH / TON

120 MH, TON @ 85[¢] = 100[¢] / TON PLUS SHOP OVERHEAD

@ 100[¢] = 200[¢] / TON

USE FABRICATED COST 500[¢] / TON PLUS 180[¢] = 100[¢] / TON

BRICKWORK COST OF BRICK PER 1000 = 27.⁰⁰ US.
ON RATIO OF 13 BRICK/SF FOR 8" WALL x 10.⁷⁰ SF FOR M² -

ALLOW 4.³⁰ / M² OR 4.⁵⁰ / M² INCLUDING MORTAR

LABOUR - 15 MH / SF 4" WALL = 1.6 MH / M² x 2 (8" WALL) 3.2 MH / M²

USE FACTOR OF 5 FOR PRODUCTIVITY. - LOCAL LABOUR MORE ACCUSTOMED TO THIS WORK

∴ USE 16 MH / M² @ 65¢ / HR = $\frac{10.⁵⁰ / M² \text{ plus } 4.⁵⁰ \cdot 15'' / M²$

USE FOR 4" WALLS - 8.⁰⁰ / M²

CARPENTRY - WOOD TRUSSES

USE .05 MH/BF FOR ASSEMBLY & INSTALLATION -
= .40 MH/BF LOCAL @ .55¢/AVEC = 22¢ BF USE 25¢

MATERIAL PRICE - ASPERMWOOD - 25¢ BF ∴ USE 50¢ BF

ASBESTOS ROOFING

MATERIAL PRICE 1.20 US/M² USE 2⁵⁰ TO INCL. RIDGE, FLASHING, ETC.

LABOUR - .04 MH/SF = .32 MH/LOCAL @ 60¢ = 20¢/SF OR 2¢/M²

EQUIPMENT INSTALLATION -

ALLOW 3 SKILLED MILLWRIGHTS - AS CREW LEADERS @ 1500/MO

EACH WITH CREW OF 2 SUPERINTENDENTS @ 150/MO plus 65%
8 MECH/WELDERS. @ 70/MO " "
8 LABORERS. @ 60/MO " "

TOTAL CREW COST PER MONTH = 1500
500
1200
800 OR 4000. / MO.

PRODUCTION = 3240 HRS OR RATE OF $1\frac{25}{100}$ / HR.
18 MEN x 180 HRS = 3240 SAY 3200 EFFECTIVE HRS.

WOULD NEED 3 CREWS TO COMPLETE WORK IN 3 MOS.



SAWYER, RENNER & CO. INC.
 1550 DE MAISONNEUVE BLVD. W.
 TEL 981-2281 CABLE SMC INC
 MONTREAL 18, CANADA

COST ESTIMATE SUMMARY

CLIENT: UNIDO
 PROJECT: PLUT PLUT, SEBESTOS
 LOCATION: BOGOTA, BAMBABA BOLIVIA
 DATE: 16.2.71
 MADE BY: []
 CONT. NO.: 3049
 SUBDIV. NO.: []
 SUBJECT NO.: []
 SHEET B OF []

CODE NO.	ITEM	UNIT	TOTAL QUANTITY	TOTAL MAN HOURS	TOTAL UNIT COST	TOTAL COST			SUBJECT NO.
						AMOUNT	PERCENTAGE	REMARKS	
	SUBDN 1								
	SUBDN 2								
	SUBDN 3								
	SUBDN 5								
	TOTAL								
100	REINFORCEMENT		15500	4650	4650	1500	7500	20300	
200	CONCRETE WORK		10950	85150	85150			26100	
300	STRUCTURAL STEEL		4200	43800	43800	1600		18100	
400	ARCHITECTURAL		36500	13800	13800	1600		51600	
500	MECHANICAL SERVICES		13400	6700	6700	14300		34100	
600	PIPING		800	1600	1600	4600		7000	
700	ELECTRICAL (INCL INSTRUMENTATION)		1500	17700	30300	6500		36800	
	SERVICE EQUIPMENT		34300	47000	47000			21700	
	TOTAL		17000	122500	233000	34500		41700	

	SITE IMPROVEMENTS			TOTAL	ADMINISTRATION & SERVICE BUDGS				TOTAL
	ROADS & PAVING	FENCING	YARD LIGHTING		ADMIN. BUDG	LUNCH & CHANGE	SHOPS & GARAGE	GUARD HOUSE	
100 EARTHWORK	11500	4000		15500	1600	1050	1200	100	4650
200 CONCRETE WORK					5100	2250	4400	100	10450
300 STRUCT. STEEL					-		4200		4200
400 ARCHITECTURAL SERVICE EQUIPT					15000	2500	11200	1500	36500
500 SERVICES					5000	1750	22050		34300
600 PIPING					5400	6000	1200		13400
700 ELECTRICAL			1500	1500		4000	7000	300	17700
CONTINGENCY	11500	4000	1500	17000	36000	22500	59700	2500	102500
	2100	600	300	3000	3400	2300	5800	500	12000

INDUSTRIAL BUILDINGS					GENERAL SERVICES							TOTAL
PRIMARY CRUSHING BINS	STORAGE BINS	MILL BUILDING	FIBRE STORAGE	TAILINGS BIN	LAB. EQUIPT	WELL & PUMP	WATER PIPING	FIRE PROTECTIN	RESERVE TANK	ELECTRICAL DISTRIB	DEWAGE DISPOSAL	TOTAL
1500	1250	1700	300	200		2500	1200			1000	2800	7500
4150	40600	37700	1250	650								
8100	13700	14700	2450	4850		800	800	4700	5700		1400	1600
250	850	10500	2000	200	45000	2500	800		800			14200
		2000										
		6700										
		1600										
1000	1600	27000	700			500	200	800		5000		4600
15500	52000	101900	6700	5900	45000	6300	3000	5500	6500	6000	7200	34500
2000	9000	16000	1000	1000	5000	1000	400	800	900	900	1000	5000

"MARK" FOR 5 5000-11-0



SURVEYOR REMMER & CO. INC.

1550 DE MAISONNEUVE BLVD. W.
 TEL. 931-2261
 MONTREAL 81-20612 CABLE SMC INC
 MONTREAL 28, CANADA

COST ESTIMATE SUMMARY

DESCRIPTION

SITE IMPROVEMENTS

CLIENT UNIDO

PROJECT PLANT-ASBESTOS

LOCATION COCHABAMBA BOLIVIA

MADE BY DATE 16 2. 71

CONT. NO. 3049

SUBDIV. NO. 1

SUBJECT NO.

SHEET 1 OF

CODE NO.	ITEM	UNIT	TOTAL QUANTITY	TOTAL MAN HOURS	TOTAL UNIT COST	TOTAL COST				TOTAL	
						LABOUR	MATERIAL	CONST. SUPPLIES	S.CONTRACT		CONST. EQUIP.
140	PLANT ROADS & PARKING								11500		11500
160	FENCING								4000		4000
170	YARD LIGHTING								1500		1500
	CONTINGENCY 15%								17000		17000
									3000		3000
									20000		20000



SURVEYOR, MEMBER & CHARTERED INC.

151 DE MAISONNEUVE BLVD. W.
 TEL. 931 2281
 TELEF. 01-20612 CABLE SNCINC
 MONTREAL 26, CANADA

CLIENT UNIDO		COST ESTIMATE		CONT NO	SUBDIV NO	SUBJECT NO
PROJECT PLANT ACESBOS		DWG. OR SPEC REFERENCE		3049		
LOCATION COCHABAMBA, BOLIVIA		DESCRIPTION FENCE & EXTERIOR LIGHTING				
		MADE BY				
		DATE 16.2.71				

ITEM	UN	QTY.	PER UN.	MAN HOURS			UNIT COST			TOTAL COST		
				TOTAL	L	M	C.S.S.C.E.	T	LABOUR	MATERIAL	S.CONTR.	CONST. SUPPLIES

160 FENCING.

FENCE 1.5 ACCORD DIAUTAFEA,
 2.0 M HIGH, POST & WIRE MESH.
 LIN. M. 500

8

4000 4000

170 WIRE LIGHTING

ALLOWANCE
 ALLOWANCE

1500

1500

MARK 2 100 3 500-11670



SURVEYER, REMISER & CHEVREY INC

1530 DE MAISONNEUVE BLVD. W.
TEL. 931 2881
15 12 01 2012 CABLE 8NC1MC
MONTREAL 28, CANADA

COST ESTIMATE SUMMARY

CLIENT	LUNIDO	DESCRIPTION	ADMINISTRATION & SERVICES BLDGS	CONT. NO.	3049	SUBDIV. NO.	2	SUBJECT NO.	
PROJECT	PLANT ASBESTOS	MADE BY	DATE 16 2 71	SHEET 4 OF					
LOCATION	QUAHABAMBA BOULVARD								

CODE NO.	ITEM	UNIT	QUANTITY	TOTAL MAN HOURS	TOTAL UNIT COST	LABOUR	MATERIAL	SUPPLIES	CONTRACT	EQUIP.	TOTAL	TOTAL COST	
												CONST.	EQUIP.
910	AIR INTILATION BLDG	M ²	170						36500			36500	
910	LUNCH ROOM & CHANGEHOUSE	M ²	90						25700			25700	
930	SHOPS & GARAGE	M ²	190						31700			31700	
940	GUARD HOUSE	M ²	10						9500			9500	
930	SHOP & GARAGE EQUIPMENT								28000			28000	
	CONTINGENCY 10%								102500			102500	
									12000			12000	
									134510			134510	

1000000000

5. J. J. & CONSULTING INC.

1500 DE MALLONNEUVE BLVD. W.
TEL 911 2261
15 17 RUE 12 CANADA
M0P 1G0A

COST ESTIMATE SUMMARY

CLIENT: J. J. & CONSULTING INC.

PROJECT: J. J. & CONSULTING INC.

LOCATION: J. J. & CONSULTING INC.

DESCRIPTION: ADMINISTRATION BUILDING

MADE BY: DATE 16.2.71

CONT. NO. 200

SUBDIV. NO. 210

SUBJ. NO.

SHEET 5 OF

CODE NO.	ITEM	UNIT	TOTAL QUANTITY	TOTAL MAN HOURS	TOTAL UNIT COST	LABOUR	MATERIAL	CONST. SUPPLIES	TOTAL COST		CONST. EQUIP.	TOTAL
									S-CONTRACT	TOTAL		
100	FRAMEWORK								1600	1600		1600
200	CONCRETE WORK								3200	3200		3200
300	STRUCTURAL STEEL								—	—		—
400	MECHANICAL								15000	15000		15000
500	ELECTRICAL SERVICES								5400	5400		5400
600	PAINTS								—	—		—
700	PLUMBING								6400	6400		6400
800	OFFICE FURNISHING & EQUIP.								5000	5000		5000
	TOTAL DIRECT COST.								36600	36600		36600



SURVEYOR, MEASURER & CONCRETE, INC.

1550 DE MAISONNEUVE BLVD. W.
 TEL. 931-2281
 TELE. 91-2812 CABLE SINCINC
 MONTREAL, P.Q. CANADA

CLIENT UNIDO		COST ESTIMATE		CONT NO	SUBDIV NO	SUBJECT NO
PROJECT <u>ST. PIERRE, ABESTOS</u>		DWG OR SPEC REFERENCE		3049	210	
LOCATION <u>1800 HABANERAS, BOLIVIA</u>		DESCRIPTION <u>ADMINISTRATION BLDG</u>				
		DATE <u>16.2.71</u>		SHEET <u>6</u> OF		

ITEM	UN	QTY.	MAN HOURS					TOTAL COST				
			PER UN.	TOTAL	L	M	C.S.S.C.E.		T	LABOUR	MATERIAL	SUPPLIES

EXCAVATE FOUNDATIONS	M ³	225	4.00					900								1350
BACKFILL	M ³	130	3.00					390								300
GRAVEL UNDER FLOOR	M ³	50	3.00					150								1500
TOTAL ACCOUNT		100														

CONCRETE FOUNDATIONS	M ³	25	7.00					175								1500
FOUNDATIONS & WALLS	M ³	25	7.00					175								1500
FLOOR	M ²	170	6.00					1020								210
FLOOR FINISH	M ²	150	1.35					202.5								850
FOUNDRY	M ²	150														850
DEINFORMING	kg	2200														850

TOTAL ACCOUNT 200

3500 2500



SHRYVER, HENNER & CONWELL INC.
 1500 DE MAISONNEUVE BLVD. W.
 TEL (514) 281-1281 CABLE SHRYVINC
 MONTREAL 28 CANADA

COST ESTIMATE

CLIENT UNIDO	DWG OR SPEC REFERENCE	CONT NO	SUBDIV NO	SUBJECT NO
PROJECT MILITANT ASBESTOS	DESCRIPTION ADMINISTRATION BLDG.	3049	210	
LOCATION BOCHARABABA, BOLIVIA	MADE BY DATE 16.2.71	SHEET 5 OF		

TOTAL COST

ITEM	UN	QTY.	MAN HOURS UN.	TOTAL	L	M	C	S	C	C	E	T	LABOUR	MATERIAL	SUPPLIES	S. CONTR.	CONST. EQUIP.	TOTAL
------	----	------	---------------	-------	---	---	---	---	---	---	---	---	--------	----------	----------	-----------	---------------	-------

SUB TOTAL 3/4

ADVANCE FOR OFFICE FURNITURE
 EQUIPT. & MISC. FURNISHINGS

TOTAL ACCOUNT 400

PLUMBING -
 4 WC. TUBINAL 4 SINKS
 1 HW. HEATER & TANK 2 FLOOR
 DEMOS EQUIV FIXT. - 12

TOTAL ACCOUNT 500

5000 5000

20000 20000

5400 5400

5400 5400



SURVEYOR, MEASUREMENT & CONCRETE INC.

1510 DE MAISONNEUVE BLVD. W.
 TEL 991-2881
 TELE 01-8882 CABLE SINCING
 MONTREAL 28, CANADA

COST ESTIMATE

CLIENT: INIDO	DWG OR SPEC REFERENCE	CONT NO	SUBDIV NO	SUBJECT
PROJECT: LOT PLANT, ASBESTOS	DESCRIPTION: IN H ROOM, CHANGE HOUSE	2147	220	
LOCATION: BORJA BAMBIA BOLIVIA	MADE BY: 16 2 77		SHEET 12 OF	

ITEM	UN	QTY.	MAN HOURS PER UN.	TOTAL COST				TOTAL	
				UN.	L	M	T		CONSTR. EQUIP.
BRICKWORK - EXT WALLS	M ²	125	500MM THICK	15				1875	
- PARTITIONS	M ²	65	100MM "	8				525	2400
ROOF TRUSSES - WOOD									
100 BF EA X 25	EA	25		50				1250	
PIPELINE	BF	1000		80				500	1750
ASBESTOS CEMENT ROOF	M ²	100		4				450	450
FINISHED CEILING	M ²	25		10				250	350
FINISHED FLOOR TILE	M ²	25		7				650	650
WOOD DOORS & SASH	EA.	0		50				400	400
INTERIOR DOORS, COUNTER, TOILET PARTITIONS, ETC	ALLOW.							1000	1000
PAINTING, WALLS, CEILING	M ²	350		8				700	700
ALLOWANCE FOR LOCKERS, BENCHES, FURNITURE								8200	8200
TOTAL ACCOUNT		400						1300	1300
								9500	1500



SURVEYER, MESSENGER & CONVERTER INC.

1500 DE MAISONNEUVE BLVD., W.
TEL 991-2881
TELEX 01 2812 CABLE SNCINC
MONTREAL 21, CANADA

COST ESTIMATE

CLIENT UNIDO	DWG OR SPEC REFERENCE	CONT NO	SUBDIV NO	SUBJECT
PROJECT PILOT PLANT, ASBESTOS	DESCRIPTION LUNCH ROOM, CHANGE HOUSE	3049	500	NO
LOCATION COCHABAMBA, BOLIVIA	MADE BY DATE 16.2.71	SHEET 13 OF		

ITEM	UN	QTY.	MAN HOURS				UNIT COST				TOTAL COST			
			PER UN.	TOTAL	L	M	C.S.	S.C.	E.	T	LABOUR	MATERIAL	SUPPLIES	S.CONTR.

PLUMBING - 2 WC, 1 URINAL,
5 SINKS, 1 SIPSINK, 3 SHOWERS,
FIXTURES, INCLUDING PIPING &
CONDENSATES TO 3" OUTSIDE BLDG.
INCLUDES 1 HW HEATER UNIT & TANK,
ALLOW EQUIV. 15 FIXTURES COMPLETE
INCL FLOOR DRAINS. UNITS 15

TOTAL ACCOUNT 500

ELECTRICAL
LIGHTING - ALLOW 200 M² 06
INCL FIXTURES, WIRING
ALLOW 300 V COVER FOR
HW HEATER & LUNCH ROOM

TOTAL ACCOUNT 100

6800 6800
6800 6800

3000 600 4000

4000 4000

5000-16/6

STHEVER, ROYER & COMPANY INC.
 155 DE MONTMORENCY BLVD. W.
 TEL 931 2251
 TELER 04 2517 CABLE SNC INC
 MONTREAL 28 CANADA

COST ESTIMATE SUMMARY

CLIENT: [BLANK]
 PROJECT: [BLANK]
 LOCATION: [BLANK]

DESCRIPTION: **SHOPS & GARAGE**

MADE BY: [BLANK] DATE: 16.2.71

CONT. NO. 2077 SUBDIV. NO. 230 SHEET 14 OF 14

CODE NO.	ITEM	UNIT	TOTAL QUANTITY	TOTAL MAN HOURS	TOTAL UNIT COST	TOTAL COST				TOTAL	
						LABOUR	MATERIAL	CONST. SUPPLIES	S CONTRACT		
100	LABOUR WORK									1800	1800
100	CONCRETE WORK									4900	4900
300	STRUCTURAL STEEL									4200	4200
400	MECHANICAL									11800	11800
500	PUTTING SERVICES									1200	1200
600	UTILITIES									800	800
700	MECHANICAL									7000	7000
TOTAL DIRECT COST.										31700	31700



SURVEYER, REMOVER & CONCRETE INC.
 1550 DE MAISONNEUVE BLVD., W.
 TEL 931-2281
 TELE 4 01 8812 CABLE INCING
 MONTREAL 28, CANADA

CLIENT LINIDO		COST ESTIMATE		CONT NO	SUBDIV NO	SUBJECT NO
PROJECT LOT DUANT ASBESTOS		DWG OR SPEC REFERENCE		3049	230	
LOCATION CHABAMBA, BOLIVIA		DESCRIPTION SHOPS & GARAGE				
		MADE BY			SHEET 15	OF
		DATE 16.2.77				

ITEM	UN	QTY.	MANHOURS				TOTAL COST						
			PER UN.	TOTAL	L	M	C.S.	S.C.	E.E.	T	LABOUR	MATERIAL	SUPPLIES

EXCAVATE FOUNDATIONS	M ³	250	4.00													1000.	1450
BACKFILL	M ³	150	3.00													450	350
SPAVEL UNDER FLOOR	M ³	60	6.00													1800.	1800
TOTAL ACCOUNT		100															

CONCRETE FOUNDATIONS	M ³	35	4.00													140.	1575
FOOTINGS & WALLS	M ³	30	5.85													1755.	1200
FLOOR	M ²	200	6.00													1200	1575
FORMWORK	M ²	200	6.00													1200	1575
REINFORCING	M	5000	0.355													1775	1575
TOTAL ACCOUNT		200														4900	4900



SURVEYOR, MEMBER & CONSULTANT INC.
 1550 DE MAISONNEUVE BLVD. W.
 TEL 931-2881
 TELEF 91-2812 CABLE SNCINC
 MONTREAL 28, CANADA

CLIENT UNIDO		COST ESTIMATE	
PROJECT PILOT PLANT ASBESTOS		DWG OR SPEC REFERENCE	SUBDIV NO
LOCATION COCHABAMBA BOLIVIA		DESCRIPTION SHOPS & GARAGE	NO 030
MADE BY 16.2.71		DATE	SHEET 16 OF
CONT NO 3049	TOTAL COST		

ITEM	UN	QTY.	MAN HOURS PER UN.	UNIT COST			TOTAL COST
				M	C.S.	S.C.E.E. T	
				LABOUR	MATERIAL	S. CONTR.	TOTAL

STRUCTURAL STEEL							
FABRICATED TRUSSES TO							
SPAN 10.0 M REDD 10							
6" PURLINS	TON	6.0					4200
TOTAL ACCOUNT							4200
BRICKWORK -							
EXTER WALLS 20CM	M ²	300					4500
PIERC ADD 10CM	M ²	30					425
INT. PARTNS. 10CM	M ²	135					1075
ASBESTOS CEMENT DOOR	M ²	100					1000
WOOD DOORS & SASH	EA	10					600
ROLLING ARCHHEAD DOORS							
1.00 x 4.00	EA	2					1000
3.00 x 3.00	"	1					500
INT. DOORS & SASH	EA	8					400



SUPPLIER MEMBER & CONTRACTOR INC.

1575 MAISONNEUVE BLVD. W.
 TEL. 931-2287
 (C.I.B.F. 71 2812) CABLE INCINC
 MONTREAL 28 CANADA

CLIENT UNIDO		DWG OR SPEC REFERENCE		CONT NO	SUBDIV NO	SUBJECT NO
PROJECT PLANT ABESIOS		DESCRIPTION SHOPS & SERVICE		3049	030	
LOCATION SUCHAMBA, BOLIVIA		MADE BY 10 2 71				SHEET 7 OF

ITEM	UN	QTY.	MAN HOURS			TOTAL COST		
			PER UN.	L	M	T	CONST. SUPPLIES	S. CONTR. EQUIP.

ARCHITECTURAL - CONT'D.
 PAINTING - STRUCTURAL TRN 610
 " " WALLS & PARTNS M² 580
 ALLOW BEING SAVED OFFICE M² 20
 TOILET & TOILET

TOTAL ACCOUNT 400

PLUMBING -
 INVERTED BASIN 2 FT.
 SERVICE WATER PIPING ALLOW.

TOTAL ACCOUNT 500
 COMPRESSED AIR PIPING, OUTLETS
 & CONTROL VALVES ALLOW

TOTAL ACCOUNT 600

25'					150						
2"					1150						1300
10'					200						200
					11800						11800
					200						200
					300						300
					1200						1200
					800						800
					800						800



SURVEIL. REMISE & CHERMENT INC.

1557 DR MAISONNEUVE BLVD. W.
TEL 991-2261
TELEX 01 28932 CABLE SNC INC
MONTREAL 28 CANADA

CLIENT UNIDO		COST ESTIMATE		SUBJECT	
PROJECT - ASBESTOS		DWG OR SPEC REFERENCE		NO	
DESCRIPTION SHOPS & GARAGE		DATE 16.2.71		NO	
LOCALITE HABAMBABA, BOUVIA		MADE BY		SHEET 18 OF	
CONTR NO 3049		CONT NO		SUBDIV NO	

ITEM	UN	QTY.	MAN HOURS				TOTAL COST				
			PER UN.	TOTAL	L	M	G.S. & C.G.E.	T	LABOUR	MATERIAL	CONST. SUPPLIES

ELECTRICAL -
 LIGHTING - ALUM PER - M² 190
 INCL. FINISHED WIRING & PANELS
 240V 200V MOTOR WIRING,
 STARTERS & POWER OUTLETS.

TOTAL APPROX 700

30
 5700
 1300
 7000
 7000



SUTER, WHEELER & CO. INC.
 1550 (R) MAISONNEUVE BLVD. W.
 TEL 981-2261
 TELEF 91-2612 CABLE SBCINC
 MONTREAL 25, CANADA

CLIENT LINIDO		COST ESTIMATE		CONT NO	SUBDIV NO	SUBJECT NO
PROJECT PLINT PLINT- ASBESTOS		DWG OR SPEC REFERENCE SHOP & GARAGE		3049	230	
LOCATION SUCHABAMBA, BOLIVIA		DESCRIPTION SERVICE EQUIPMENT		SHEET 19 OF		
MADE BY		DATE 16.2.71				

ITEM	UN	QTY.	MAN HOURS PER UN.	TOTAL COST			TOTAL
				MATERIAL	S. CONTR.	EQUIP.	
SHOP & GARAGE EQUIPMENT							
2-STATION HORIZONTAL HOIST \$		2		5000			20250
1-HAND CRIMM HOIST 1TON		1		225			1500
1/2 TON CAR JACK		1		200			3000
PORTABLE DEIMILIBRICATOR		1		450			1000
BATTERY CHARGER		1		250			
DEDESTAL GRINDER 10"		1		300			
FLUTE DRILL		1		500			
BENCH GRINDER		1		150			
SHAPER (SMALL)		1		1700			
BAND SAW		1		2150			
DOWN HOOK SAW		1		900			
HYDRAULIC PRESS 25T.		1		900			
2RS AIR WELDER		1		450			
BENDING BRAKE		1		1900			
SHEARS UNIT		1		325			
PIPE THREADED		1		1050			
WOOD TABLE SAW 7"		1		250			
PLANE		1		1000			
MISC. SMALL TOOLS		-		1500			
STATIONARY COMPRESSOR		-		2500			
ALLOW OVERSEAS PACKING & FREIGHT.				1500			
RECEIVE, HANDLE & SETUP EQUIPT.				500			
ALLOW PACKING & TRANSIT INSURANCE.				1000			
				2500			
				2500			
				22500			



SURVEYER, MEASURER & CONCRETE INC.
 1550 DE MAISONNEUVE BLVD. W.
 TEL 981-2881 CABLE 88C318C
 MONTREAL 25, CANADA

COST ESTIMATE SUMMARY

CLIENT LUNIDO	DESCRIPTION INDUSTRIAL BUILDINGS	CONT. NO. 3014	SUBDIV. NO. 2	SUBJECT NO.
PROJECT PILOT PLANT ALBERTUS	MADE BY DATE 16 2 7.	SHEET 21 OF		
LOCATION SACHABAHUBA, BOLIVIA				

CODE NO.	ITEM	TOTAL		TOTAL COST		CONST. EQUIP.	TOTAL
		UNIT QUANTITY	MAN HOURS	CONST. SUPPLIES	S/CONTRACT		
310	CORE STORAGE				73500		73500
320	MILL & FIBRE STORAGE				114500		114500
350	LABORATORY EQUIPMENT				45000		45000
					233000		233000
	CONTINGENCY 15%				34000		34000
					267000		267000



SURVEYED, MEASURED & CALCULATED BY:

1550 DE MAISONNEUVE BLVD., W.
 TEL 951-2261
 MONTREAL 26, CANADA

COST ESTIMATE SUMMARY

CLIENT UNIDO	DESCRIPTION ORE STORAGE	COMT. NO. 3047	SUBDIV. NO. 310	SUBJECT NO.
PROJECT PILOT PLANT ASBESTOS	MADE BY 16.2.71	SHEET 22 OF		
LOCATION COCHABAMBA, BOLIVIA	DATE			

CODE NO.	ITEM	TOTAL		TOTAL COST				TOTAL
		UNIT	QUANTITY	CONST. SUPPLIES	SCONTRACT	CONST. EQUIP.		
		MAN HOURS						
311	PRIMAR: MATERIAL HANDLING					15500		15500
310	ORE STORAGE DINS					58000		58000
						73500		73500

5069-16/0

S. J. LEBLANC & COMPANY INC.
 8500 DE MAISONNEUVE BLVD. W.
 TEL 831-2261
 MONTREAL 20, CANADA

CLIENT: ...
 PROJECT: ...
 LOCATION: ...

COST ESTIMATE SUMMARY

DESCRIPTION

PRIMARY MATERIAL HANDLING

MADE BY: ... DATE: 10.2.77

CONT. NO. ...
 SUE DIV. NO. ...
 SUBJE. NO. ...

SHEET 23 OF ...

CODE I.D.	ITEM	UNIT	TOTAL QUANTITY	TOTAL MAN HOURS	TOTAL UNIT COST	LABOUR	MATERIAL	CONST. SUPPLIES	TOTAL COST			
									S-CONTRACT	EQUIP.	TOTAL	
100	REINFORCEMENT								1200		1200	0211
200	CONCRETE WORK								1050		1050	0211
300	STRUCTURAL STEEL								8100		8100	0211
400	MECHANICAL								750		750	0211
500	PAINTING SERVICES											0211
600	WATER											0211
700	ELECTRICAL											0211
	TOTAL DIRECT COST								15500		15500	0211



SURVEYOR, MEASURER & CONCRETEWORK INC.

1550 DE MAISONNEUVE BLVD., W.
 TEL 881-2881
 TELEX 01-28012 CABLE SMCINC
 MONTREAL 22, CANADA

COST ESTIMATE

CLIENT LINIDO	DWG OR SPEC REFERENCE	CONT NO	SUBDIV NO	SUBJECT NO
PROJECT INDY PLANT, ASBESTOS	DESCRIPTION PERM MATERIAL BUILDINGS	349	211	
LOCATION SUCHEAMBA BOLIVIA	MADE BY 16.2.71	SHEET 25 OF		

ITEM	UN	QTY.	MANHOURS PER UN.	TOTAL COST				CONST. EQUIP.	TOTAL
				L	M	C.S.C.C.E.	T		

PLANTS, STAIRS, LINDINGS, ETC. 11 TONS

TOTAL ACCOUNT 400

POWERIZING, MOTOR STARTERS & CONTROLS FOR EQUIP. MOTORS

TOTAL ACCOUNT 700

(50) (50) (50)
 1000 1000
 1000 1000



SURVEYOR, REMAKER & CONVERTER INC.

1550 DE MAISONNEUVE BLVD., W.
 TEL 931-2201
 TELEX 07 2812 CABLE SNCINC
 MONTREAL 28, CANADA

COST ESTIMATE

CLIENT **LINIDO**
 PROJECT **PILOT PLANT ASBESTOS**
 LOCATION **SACHAJINEA, BOLIVIA**

DWG OR SPEC REFERENCE

DESCRIPTION
MILL FIBRE STORAGE & TAILINGS BIN

MADE BY

DATE **16.2.71**

CONT NO **3049**
 SUBDIV NO **320**
 SHEET **29** OF **29**

TOTAL COST

UNIT COST

ITEM	UN	QTY.	MAN HOURS	PER UN.	TOTAL	L	M	C	S	C	E	T	LABOUR	MATERIAL	S	CONTR.	EQUIP.	CONST.	TOTAL		
																				UN.	UN.
321 MILL BUILDING																				101700	101900
322 FIBRE STORAGE																				6700	6700
323 TAILINGS BIN																				5900	5900
																				114500	114500

321 MILL BUILDING
 322 FIBRE STORAGE
 323 TAILINGS BIN

5050 16/6

SWIDERS, INC. 5050 16/6
 1550 LE MAISONNEUVE BLVD. W.
 TEL 5-31-7201
 TELE 01 2-317 CABLE SYNCING
 MONTREAL 23, CANADA

COST ESTIMATE SUMMARY

CLIENT	DESCRIPTION	CONT. NO.	SUBDIV. NO.	SUBJ. NO.
PROJECT	MILL BUILDING	2041	301	
LOCATION	MADE BY	DATE 16.2.71		
		SHEET 30 OF		

CODE NO.	ITEM	UNIT	TOTAL QUANTITY	TOTAL MAN HOURS	TOTAL UNIT COST	TOTAL COST			TOT.
						LABOUR	MATERIAL	CONST. SUPPLIES	
100	CONCRETE WORK							1700	1700
200	STRUCTURAL STEEL							37700	37700
300	MECHANICAL							14700	14700
400	ELECTRICAL							10500	10500
500	PAINTS & SERVICES							6700	6700
600	LABOR							1500	1500
700	INSTRUMENTS & INSTRUMENTATION							27000	27000
800	LIB. & OFFICE FURNISHING							2000	2000
	TOTAL DIRECT COST							101900	101900

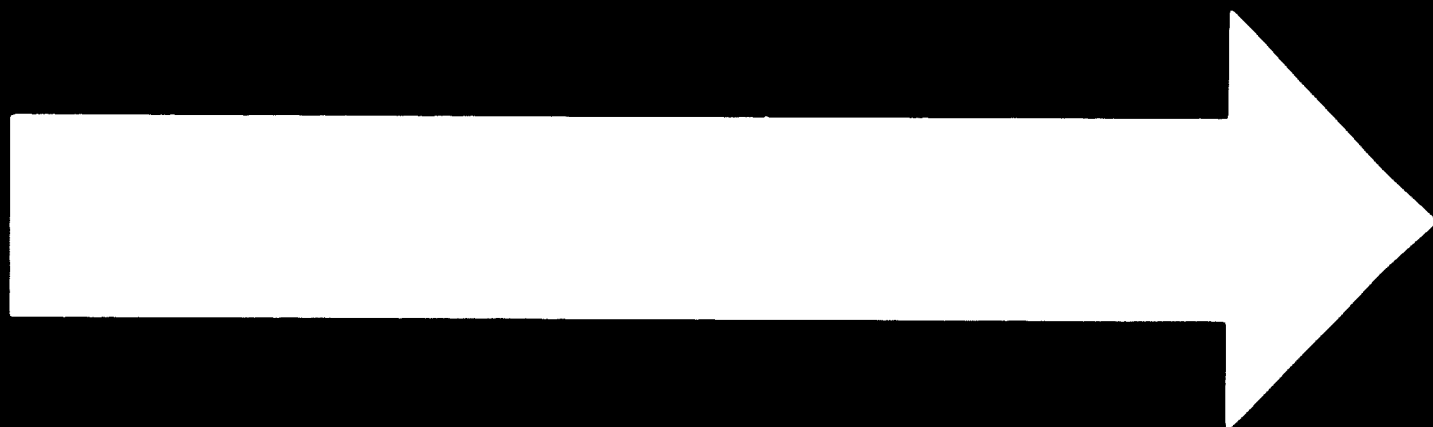


SURVEYER, MEASURER & CONVEYER INC.
 1550 DE MAISONNEUVE BLVD. W.
 TEL 991-2881
 TELEF 01-28812 CABLE SNCINC
 MONTREAL 28 CANADA

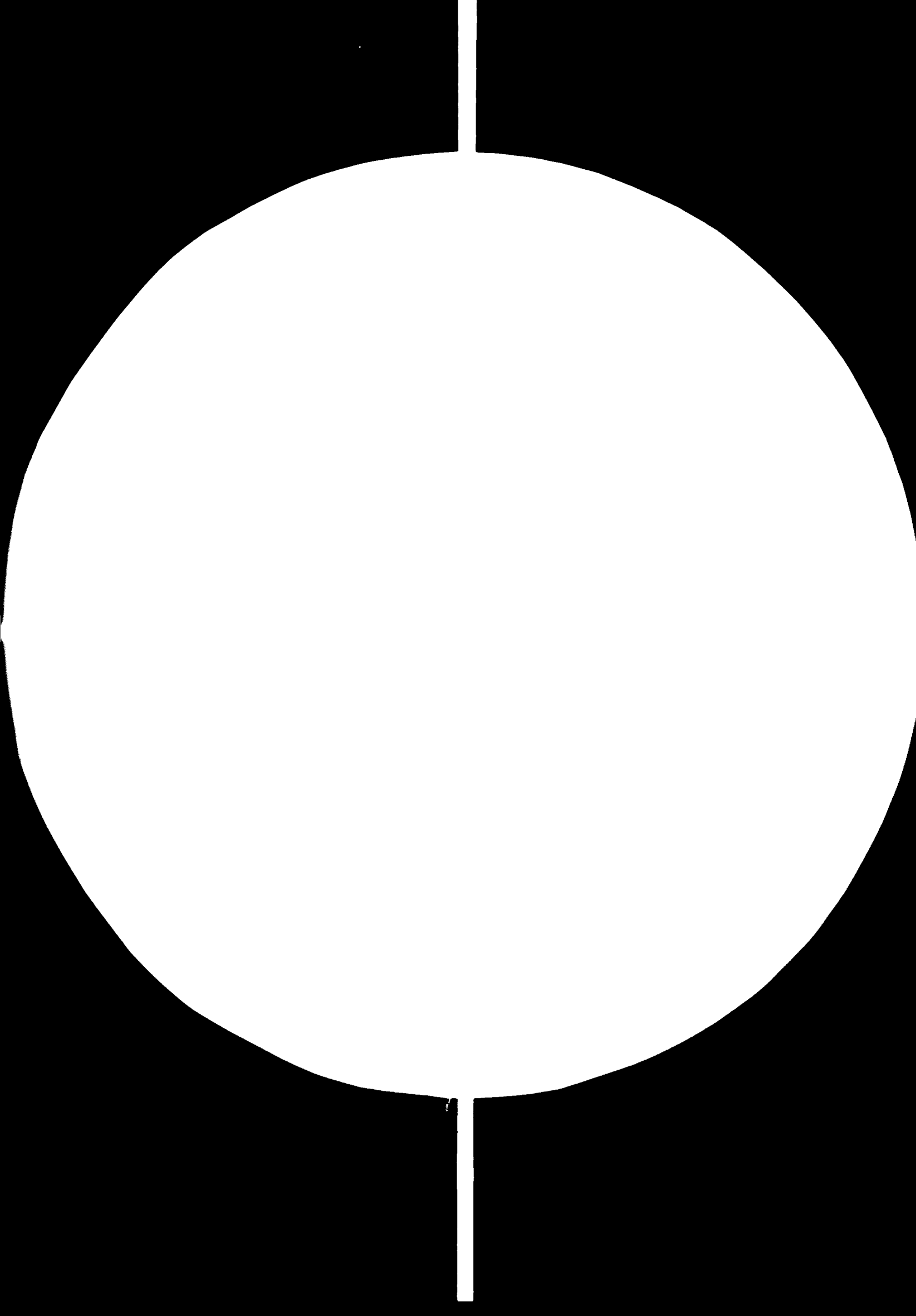
CLIENT		UNIDO		COST ESTIMATE	
PROJECT		SLOT QUART-ASBESTOS		DWG. OR SPEC REFERENCE	
LOCATION		SOCHASABA BLUVID.		DESCRIPTION	
DATE		16.2.71		MILL BUILDING	
MADE BY				CONT NO	
				3049	
				SUBDIV NO	
				321	
				SHEET 31 OF	

ITEM	UN	QTY.	MAN HOURS	TOTAL COST				TOTAL
				PER UN.	L	M	C.S.E.C.E.	
EXCAVATE FOUNDATIONS	M ³	250					1000	1000
BACKFILL - do	M ³	175					550	550
GRAVEL UNDER FLOOR	M ³	25					150	150
TOTAL ACCOUNT	100						1700	1700
CONCRETE WORK:								
FOUNDATIONS (cols)	M ²	32					975	3050
GRADE SLAB & BEAMS	M ²	75					2075	
COLUMNS, BEAMS & SILL PLATES	M ³	160					6400	6675
FLOOR FINISHING (A)	M ²	500					275	
FLOOR WORK							1750	
FOUNDATIONS & FLOOR	M ²	250					9000	15750
COLUMNS & BEAMS	M ²	900					5000	
DEEP SLABS & JOISTS	M ²	500					12000	12000
REINFORCING							225	225
ALL CONC.		141	2000				37700	37700
SET IN B. METAL		141	1000					
TOTAL ACCOUNT	200							

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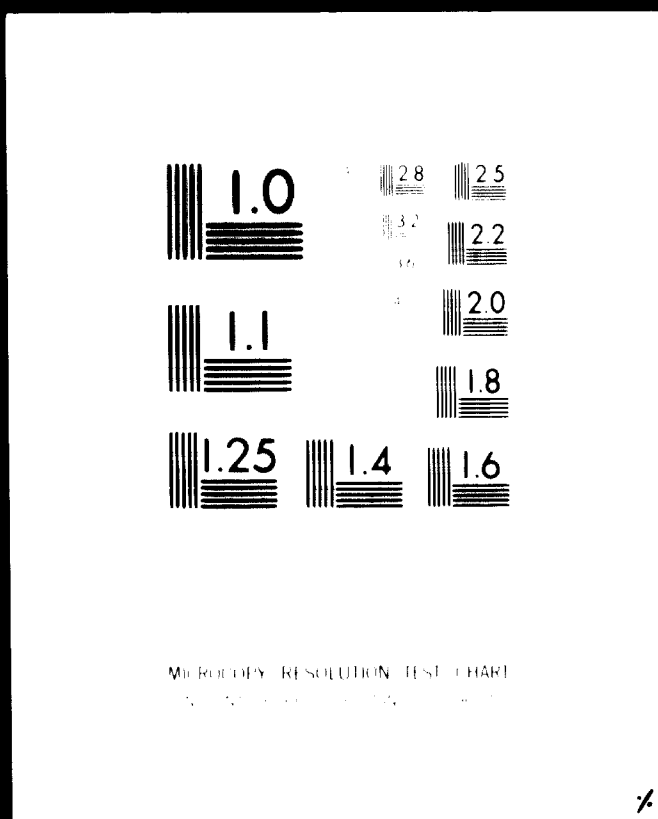
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SURVEYOR, MECHANICAL & CONCRETE INC.

1555 DE MAISONNEUVE BLVD. W.
 TEL 931-2281
 TELEX 01 20812 CABLE INC INC
 MONTREAL 28, CANADA

CLIENT UNIDO		COST ESTIMATE		CONT NO	SUBDIV NO	SUBJECT NO
PROJECT OUTPLANT SUBSTATION		DWG OR SPEC REFERENCE		2077	201	
LOCATION GRAND JARDIN, Q.B.		DESCRIPTION WALL & PIPINGS				
DATE 16.2.77		MADE BY			SHEET 24 OF	

ITEM	UN	QTY.	MAN HOURS PER UN.	TOTAL COST				TOTAL
				L	M	C.S.S.C.C.E.	T	

OIL TANK & COVER HEATING
 OIL TANK TANK ON SUPPORTS,
 ABOVE GALVANIZED,
 ADD FITTING, VALVES,
 & CONTROLS.

1200	0071	1200
800	200	800

TOTAL AMOUNT **5000** **5700** **5700**

PIPINGS FOR COMPRESSOR
 WITH COUPLER STATIONS

1600	1600
1600	1600

TOTAL AMOUNT **6000**



SURVEYER, MEASURER & CONCRETE INC.
 1550 DE MAISONNEUVE BLVD., W.
 TEL. 981-2281
 TELER 97-8885 CABLE SNCINC
 MONTREAL 22, CANADA

COST ESTIMATE

CLIENT: **UNIDO**
 PROJECT: **PILOT PLANT, ASBESTOS**
 LOCATION: **COAHABAMBA, BOLIVIA**
 MADE BY: **16.2.71**
 CONT. NO.: **3049**
 SUBDIV. NO.: **322**
 SUBJECT NO.: **SHEET 38 OF**

ITEM	UN	QTY.	MAN HOURS			UNIT COST	TOTAL COST				TOTAL					
			PER UN.	TOTAL	L		M	C.S.	S.C.	P.E.		T	CONST. SUPPLIES	S.CONTR.	EQUIP.	
ASBESTOS ROOFING & WALL CLADDING		M ²	155			4.50					700				700	
ADD FLASHING AT THE WALL - ROOFING & OVERHEAD DOOR		EA	1			4.00					100				100	
MAN DIVERS - EXT			1								200				200	
EXISTING - EXPOSED STEEL DOORS, ETC.																
TOTAL ACCOUNT							400					2000				2000
ELECTRICAL - LIGHTING																
ENTRANCES, WIRING, CONDUIT, M 55							12					700				700
TOTAL ACCOUNT							700					700				700



SURVEY, MEASUREMENT & CONSTRUCTION INC.
 1550 DE MAISONNEUVE BLVD. W.
 TEL 981-2851
 TELEF 91-2852
 MONTREAL 20, CANADA

COST ESTIMATE

CLIENT	UNIDC	CONTRACT NO.	3049	SUBDIV NO.	323	SUBJECT NO.	
PROJECT	PILOT PLANT - ASBESTOS	DATE	16.2.71	SHEET 28 OF			
LOCATION	BOHARONIPA, BOLIVIA	MADE BY					
DWG OR SPEC REFERENCE	TAUNSS DISPOSAL						

ITEM	UN	QTY.	MAN HOURS			LABOUR	MATERIAL	CONST. SUPPLIES	S. CONTR.	CONST. EQUIP.	TOTAL
			PER UN.	TOTAL	L						
EXCAVATE FOUNDINGS.	M ³	25	4					100			100
BAGGILL do.	M ²	20	3					100			200
TOTAL AMOUNT 100								200			200
FOUNDINGS FOUNDINGS.	M ³	10	65					650			650
INCL FOUNDING CONCRETE								650			650
TOTAL AMOUNT 200								1300			1300
STRUCTURAL STEEL.	Kg	6500	15					4850			4850
COLUMNS & BIN.								4850			4850
TOTAL AMOUNT 300								9000			9000
PAINTING STEEL BIN.	sqm	400						200			200
TOTAL AMOUNT 400								9200			9200
TOTAL DIRECT COST:								5300			5300



SURVEY MEASUREMENT & CONCRETE INC.

1550 DE MAISONNEUVE BLVD., W.
 TEL 881-2811
 CABLE SMCINC
 MONTREAL 28, CANADA

COST ESTIMATE

CLIENT UNIDO	CMG OR SPEC REFERENCE MILL BUILDING	CONT NO. 3049	SUBDIV NO. 350	SUBJECT
PROJECT PILOT PLANT - ASBESTOS	DESCRIPTION LABORATORY EQUIPMENT	DATE 16.2.71 SHEET 10 OF		
LOCATION BUCHABAMBRA BOLIVIA	MADE BY			

ITEM	UN	QTY.	MAN HOURS PER UN.	UNIT COST					LABOUR	MATERIAL	CONST. SUPPLIES	S. CONTR.	TOTAL
				M	C.S.	S.C.	C.E.	T					
CAMERON STANDARD TESTING MACHINE		1							5500				5500
BRASS TUB		2							1400				2800
EMERSON NETT CLASSIFIER		1							4700				4700
BRASS LEVER SHAKER		1							1100				1100
SUBSAMPLER		1							1200				1200
227 INS OVEN - 400 FT.		1							750				750
WET VOLUME - 4 CYLINDERS		1							1150				1150
AIR FLOW TESTER		1							1600				1600
ELCUM WATER KIPHOFF TESTER		1							1600				1600
MOUNTING CONTENT		1							200				200
FELDMASS TESTER		1							600				600
FELDMASS APPARATUS		1							325				325
WATER TAP UNIT		1							600				600
TABLETS, SHELVING, CUP'S		1							1025				1025
MILK SINKS WARE		1							500				500
HOT WATER HEATER & TANK		1							250				250
PIPE & VALVE UNITS		1							300				300
TOTAL COST													23000
LABOUR													2500
MATERIAL													500
CONST. SUPPLIES													1000
S. CONTR.													1000
TOTAL													23000

INSTALLATION CHOCK-UP
 WEIGHT & TRANSPORT
 INSURANCE & MAINTENANCE



SURVEYED, MEASURED & CERTIFIED INC.

1550 DE MAISONNEUVE BLVD. W.
 TEL. 931-2281
 TELEF. 91-2812 CABLE SMCINC
 MONTREAL 20, CANADA

COST ESTIMATE

CLIENT: UNIDO	DWG OR SPEC REFERENCE: MILL BUILDING	CONT. NO.: 3049	SUBDIV. NO.: 220	SUBJECT NO.:
PROJECT: PLANTAS Y BASTOS	DESCRIPTION: CORE MILL EQUIPMENT	SHEET 41 OF		
LOCATION: COCHABAMBA, BOLIVIA	MADE BY: DATE 16.2.71	TOTAL COST		

ITEM	UN	QTY.	MAN HOURS			UNIT COST	LABOUR	MATERIAL	CONST. SUPPLIES	S. CONTR.	EQUIP.	TOTAL
			PER UN.	TOTAL	L							
FIVE (5) STEEL IMPACT CRUSHER					2300							11000
TECHNICAL ASSISTANT					3000							3000
STEEL CYLINDER 30" x 60"					1500							1500
CONDUIT 1/2" TYP. TUBULAR VALVE					1500							1500
1650 MM 20" φ					2000							2000
WHEELS 200MM DUST TUBE BAG					700							700
SCREWDRIVER SIZE 8 1600CEM.												
WELDER - ONE TO 516.												
HANDLING, INSTALLATION & HOUPUP.						3000						3000
DICKINSON'S O.S. FREIGHT & TRANSPORT												
MARINE & TRANSIT INSUR.												
TOTAL CORE MILL EQUIPMENT						3000	11000	2900			100	17000
TOTAL LAB. TESTING EQUIPMENT.						2500	23000	2500				28000
TOTAL LABORATORY EQUIPMENT						5500	34000	5400			100	45000



SULLIVAN, WHEELER & CO. INC.
 1150 DE MAISONNEUVE BLVD., W.
 TEL (514) 231-2301
 TELEX 01-2812 CABLE SANCINC
 MONTREAL 24 CANADA

COST ESTIMATE SUMMARY

CLIENT: LINIDO	DESCRIPTION: GENERAL SERVICES	CONT. NO.: 3049	SUB DIV. NO.: 5	SUBJECT NO.:
PROJECT: PILOT PLANT ABESTOS	DATE: 16 2 77	SHEET 12 OF		
LOCATION: COCHIBAMBA BOLIVIA	MADE BY:			

CODE NO.	ITEM	TOTAL		TOTAL COST				TOTAL
		UNIT QUANTITY	MAN HOURS	LABOUR	MATERIAL	SUPPLIES	CONTRACT	
510	WATER SUPPLY & DISTRIBUTION						21300	21300
540	ELECTRICAL DISTRIBUTION						8000	8000
550	DEWASE CEROSAL						7500	7500
	CONTINGENCY 15%						5000	5000
							34500	34500



SAVYEL, HENNER & GUYERRE ME.
 1550 DE MAISONNEUVE BLVD. W.
 TEL 391-2281
 MONTREAL 91-28915 CABLE SINCINE
 MONTREAL 91, CANADA

COST ESTIMATE SUMMARY

CLIENT UNIDO	DESCRIPTION WATER SUPPLY & DISTRIB.	CENT. NO. 304R	SUBDIV. NO. 510	SHEET 43 OF 43
PROJECT PLANT-ASBESTOS	DATE 16.2.77			
LOCATION COCHABAMBA BOLIVIA	MADE BY			

CODE NO.	ITEM	UNIT	TOTAL QUANTITY	TOTAL MAN HOURS	TOTAL UNIT COST	TOTAL COST					
						LABOUR	MATERIAL	CONST. SUPPLIES	S-CONTRACT	CONST. EQUIP.	TOTAL
511	WELL & SUPPLY PUMP								6300		6300
512	DISTRIBUTION PIPING								3000		3000
513	FIRE PROTECTION								5500		5500
514	RESERVE TANK								6500		6500
									21300		21300

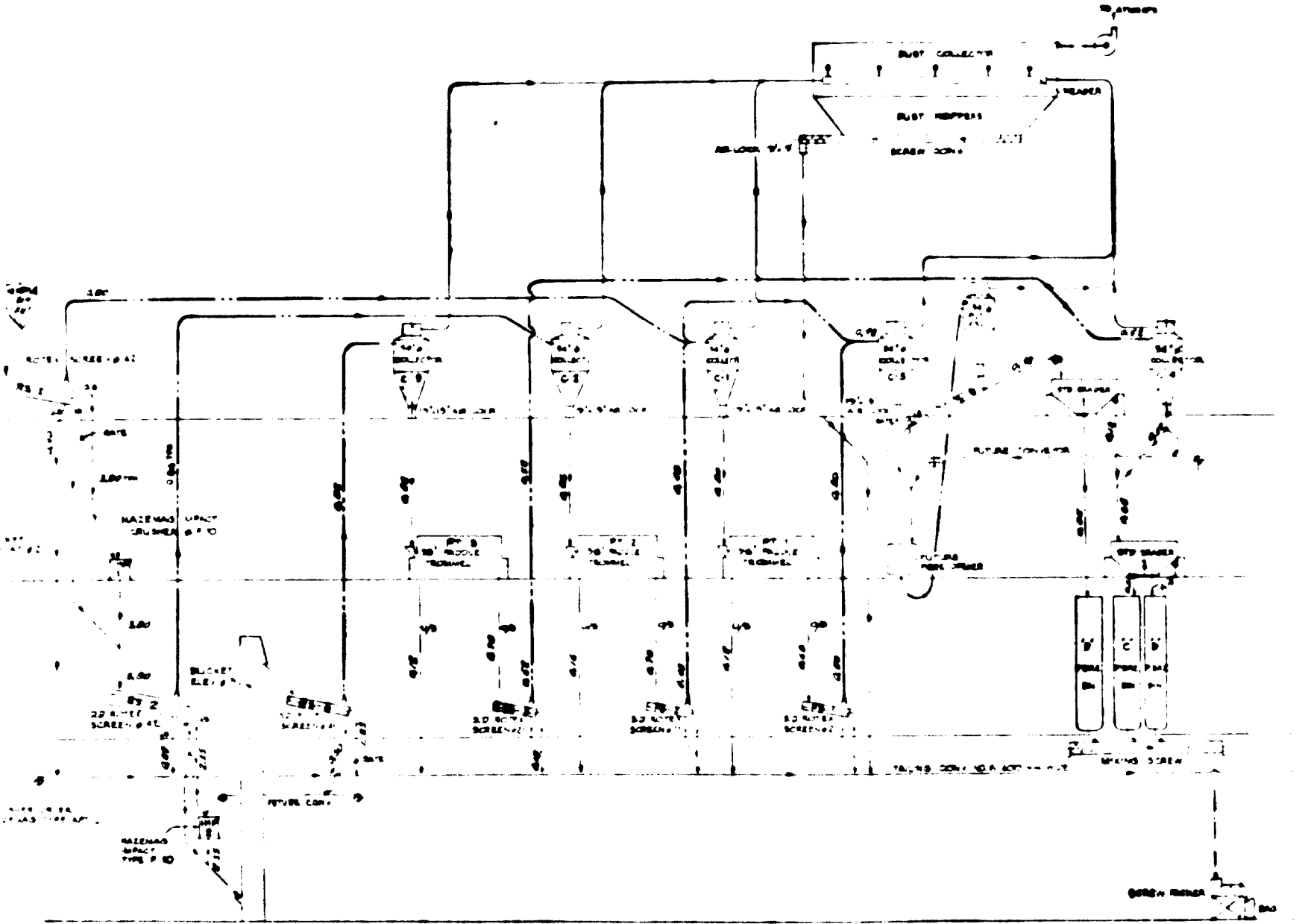


SUROYCO MEMBER & CONTRACTOR INC.

1550 DE MAISONNEUVE BLVD. W.
TEL. 981-2801
TELEX 91-88612
MONTREAL 8, CANADA

CLIENT: UNIDO		COST ESTIMATE		SUBJECT NO.	
PROJECT: PILOT PLANT - ASBESTOS		DWG. OR SPEC REFERENCE		SUBDIV NO.	
LOCATION: COCHABAMBA, BOLIVIA		DESCRIPTION: WATER SUPPLY DISTRIBUTION		CONT NO.	
MADE BY: [Signature]		DATE: 16 2 77		SHEET 44 OF	
DATE: 16 2 77		TOTAL COST		TOTAL	

ITEM	UN	QTY.	MAN HOURS PER UN.				UNIT COST	TOTAL COST													
			TOTAL	L	M	C.S. & C.E.		T	LABOUR	MATERIAL	S. CONTR.	CONST. EQUIP.									
<u>511. WELL SUPPLY PUMP</u>																					
100. DRILL 3 INCH WELL, 6" PIPE x 25 FT. DEEP																				2500	2500
500. WELL PUMP DARLING 100 SPHC ITEM NO. 1500, 1/2"																				2000	2000
6" GASKET & GATE VALVES 200. EA																				500	500
400. 2 IN STAINLESS WELLS																				800	800
200. 2 IN STAINLESS WELLS																				500	500
100. WELLS & CONTROLS																				5300	5300
<u>512. 2 IN - 50 FT. PIPING</u>																					
100. EXCAVATION 10' DIA. WELL M ³ 200																				1200	1200
500. 6" DRAINAGE PIPING																				150	150
4" DRAINAGE PIPING																				150	150
4" DRAINAGE PIPING																				450	450
4" DRAINAGE PIPING																				500	500
300. DRILL 4 IN WATER PUMP EXCAVATION 50 FT. DIA. 600.																				500	500
300. DRILL 4 IN WATER PUMP EXCAVATION 50 FT. DIA. 600.																				200	200
300. DRILL 4 IN WATER PUMP EXCAVATION 50 FT. DIA. 600.																				300	300



NOTE:
 FUTURE EQUIPMENT SHADED

WILL NEED 5 T.P.H. OF 30% CONCENTRATE
 ANNUAL FIBRE PRODUCTION

GRADE B	0.15 T.P.H. x 8 = 300 DAYS = 360 TONS
GRADE C	0.50 T.P.H. x 8 = 300 DAYS = 1200 TONS
GRADE D	0.85 T.P.H. x 8 = 300 DAYS = 2040 TONS
	<u>3600 TONS</u>

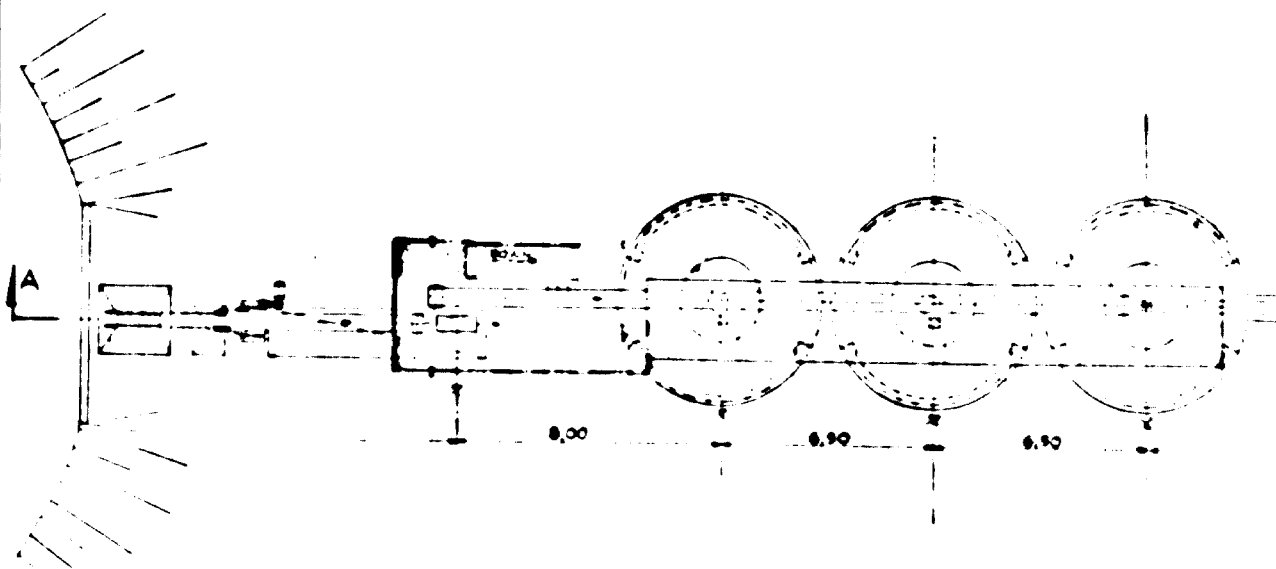
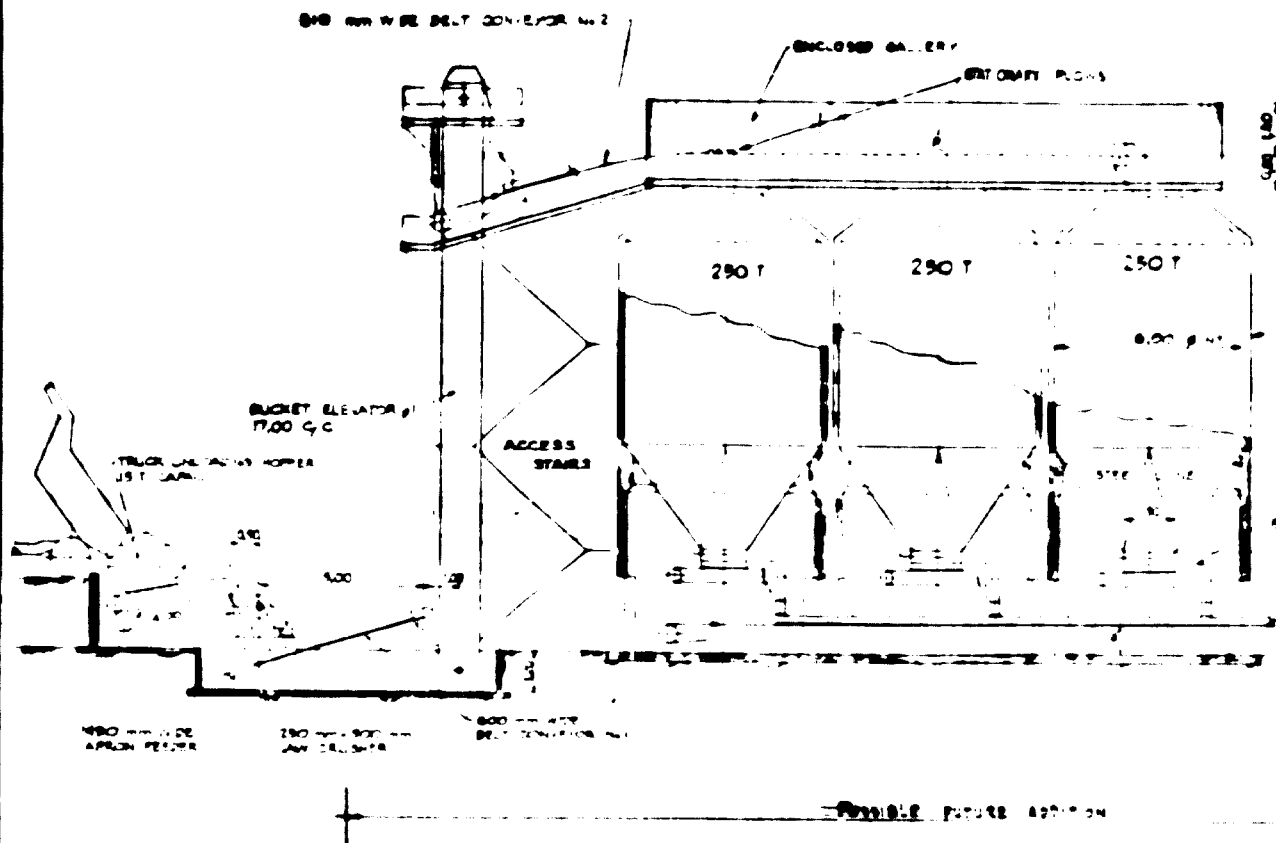
SECTION 2



RECORD OF DWG. ISSUE

DATE ISSUED BY STATUS & DISTRIBUTION

SECTION



SECTION 1

BY TRADE COORDINATION

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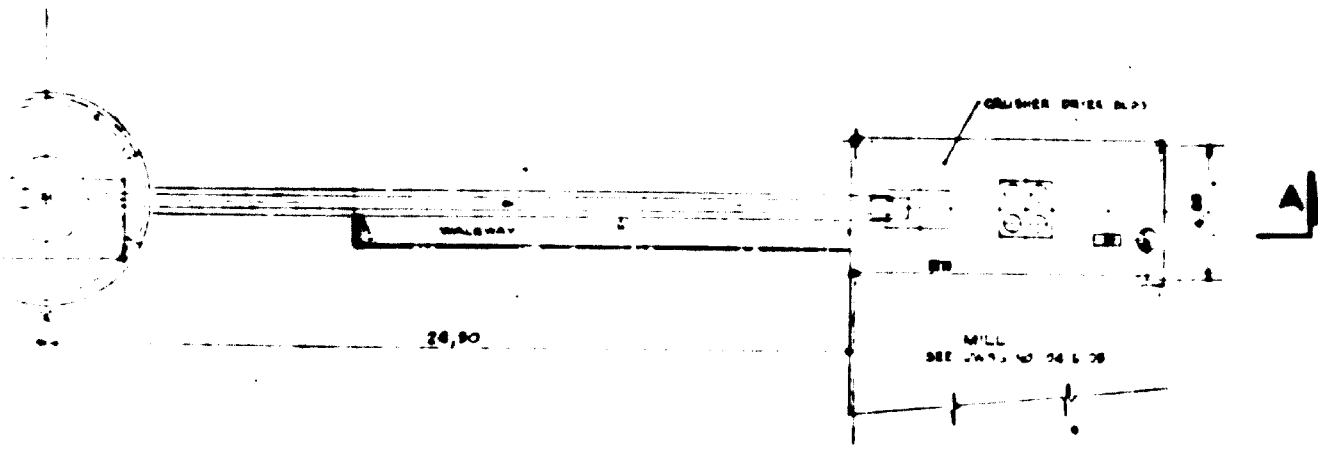
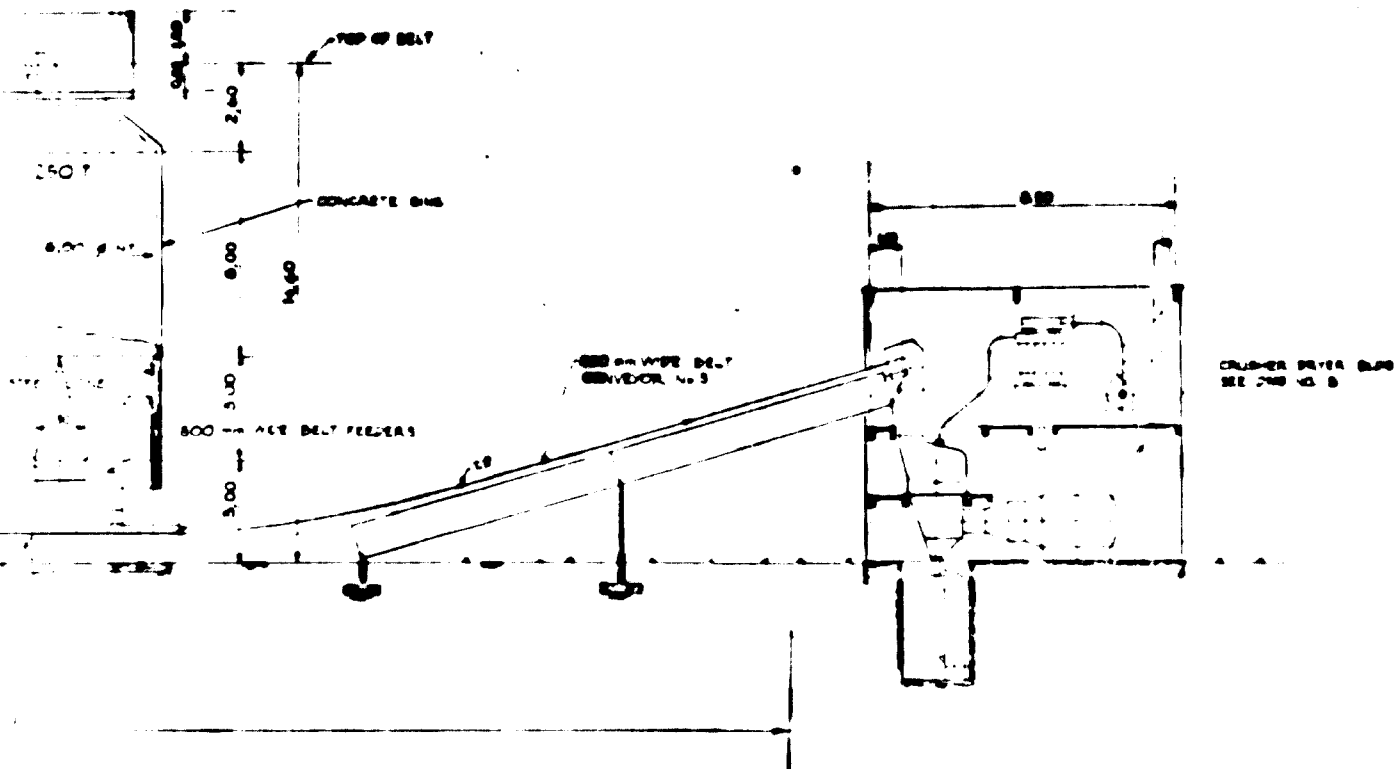
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SECTION A-A

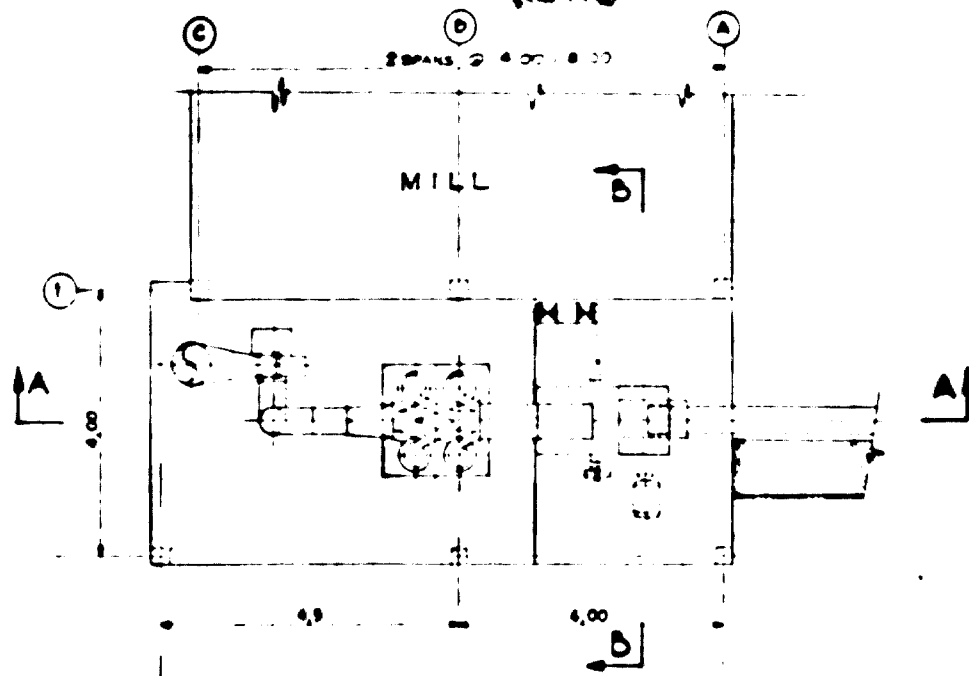
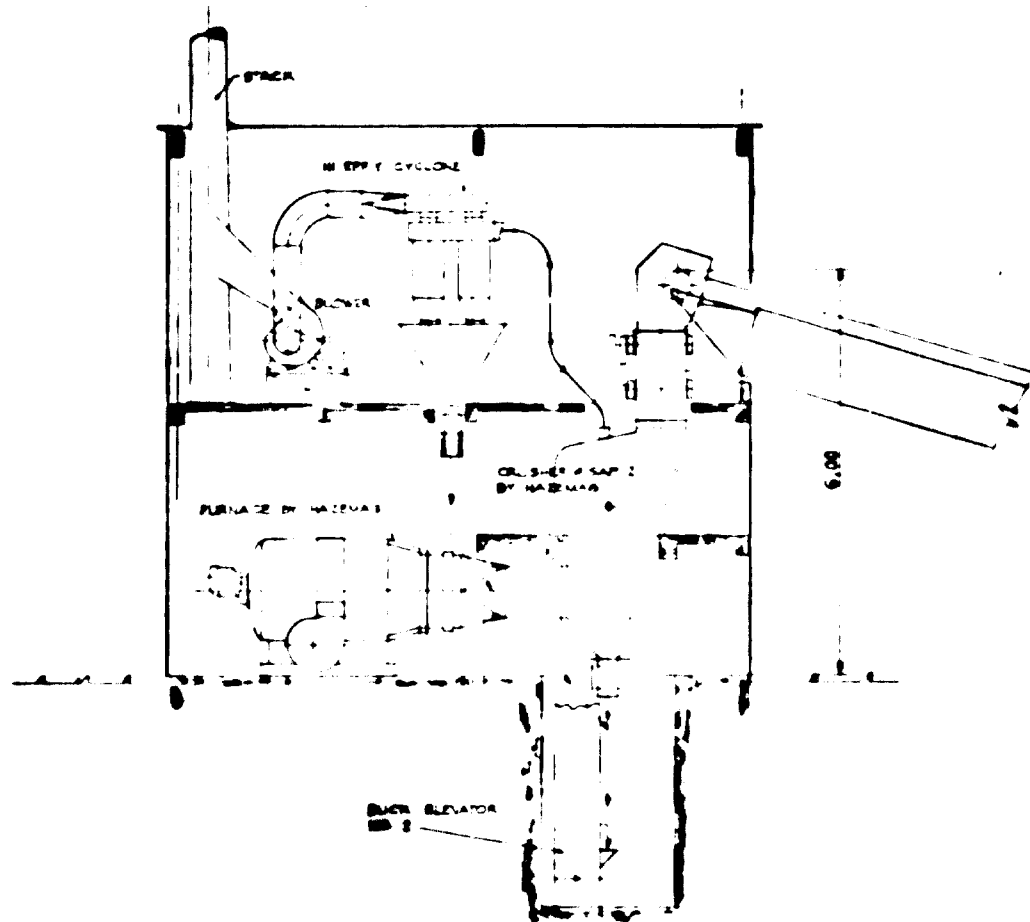


SECTION 2

NOTE: THIS DRAWING WAS MADE IN THE METRIC SYSTEM



SECTION AA

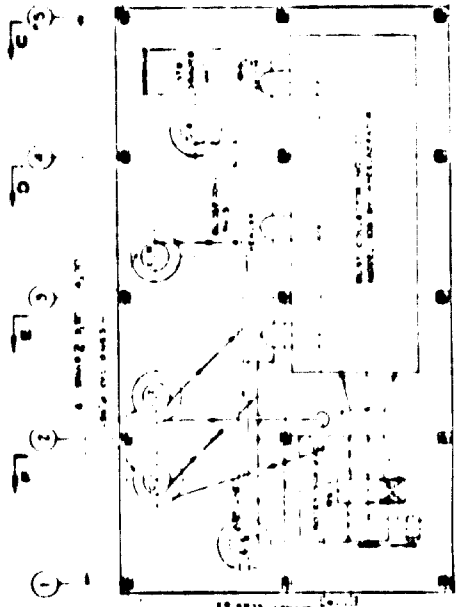


SECTION 1

SECTION AA

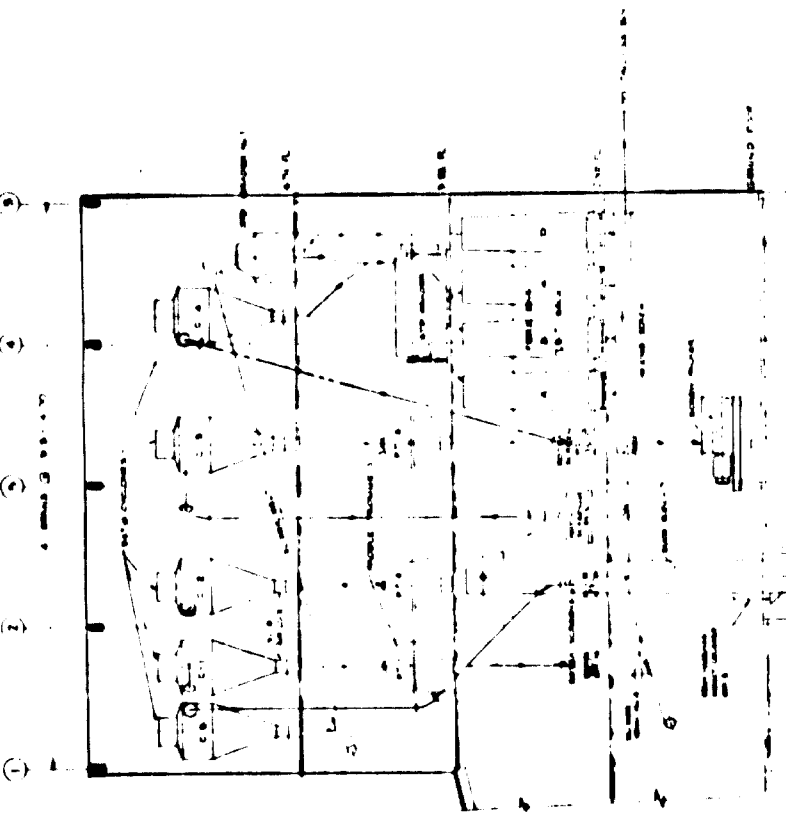


PLAN VIEW OF 4TH FLOOR

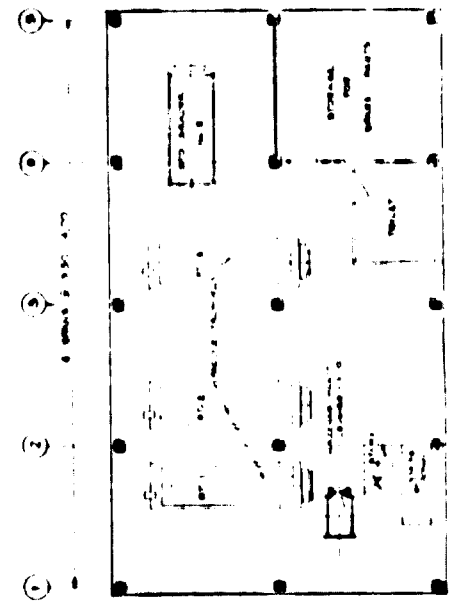


SECTION AA

SECTION DD



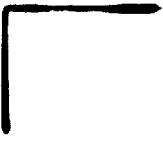
PLAN VIEW OF 3RD FLOOR



SECTION DD

NOTE





DWG. № 4

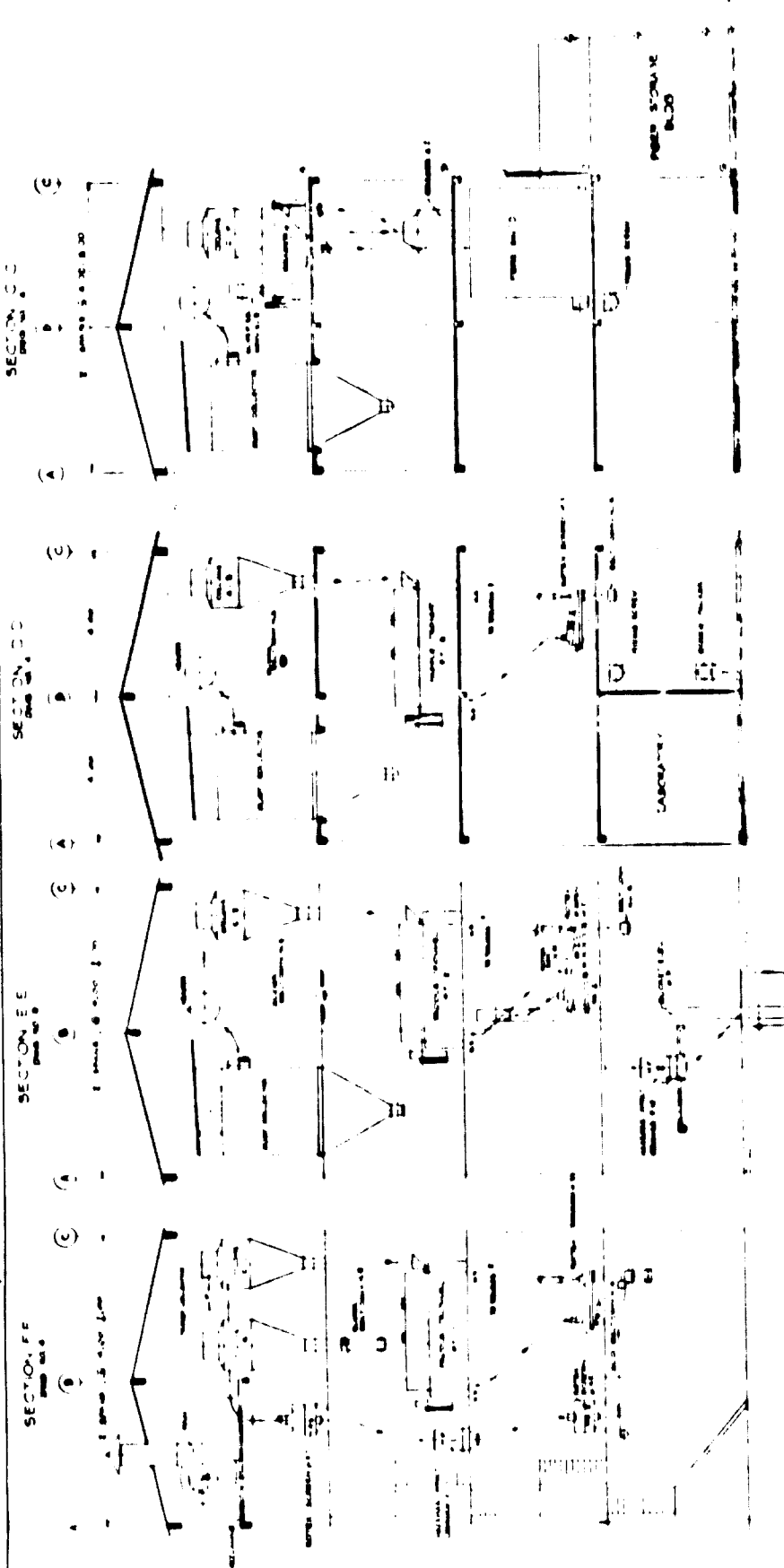


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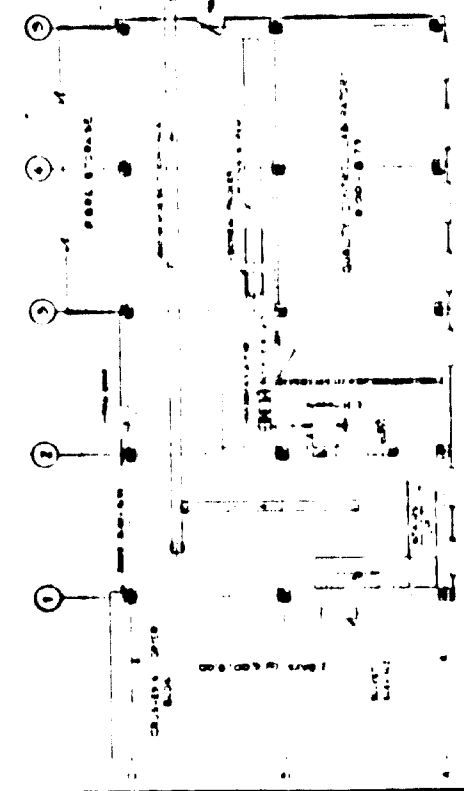


DWG. 5

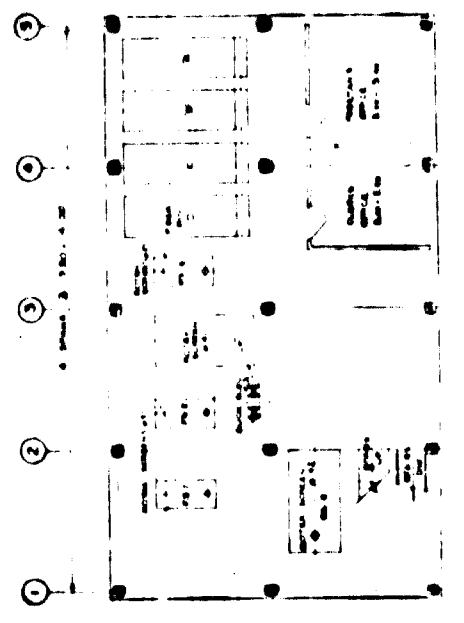
SECTION FF
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 SECTION CC



PLAN VIEW OF GROUND FLOOR



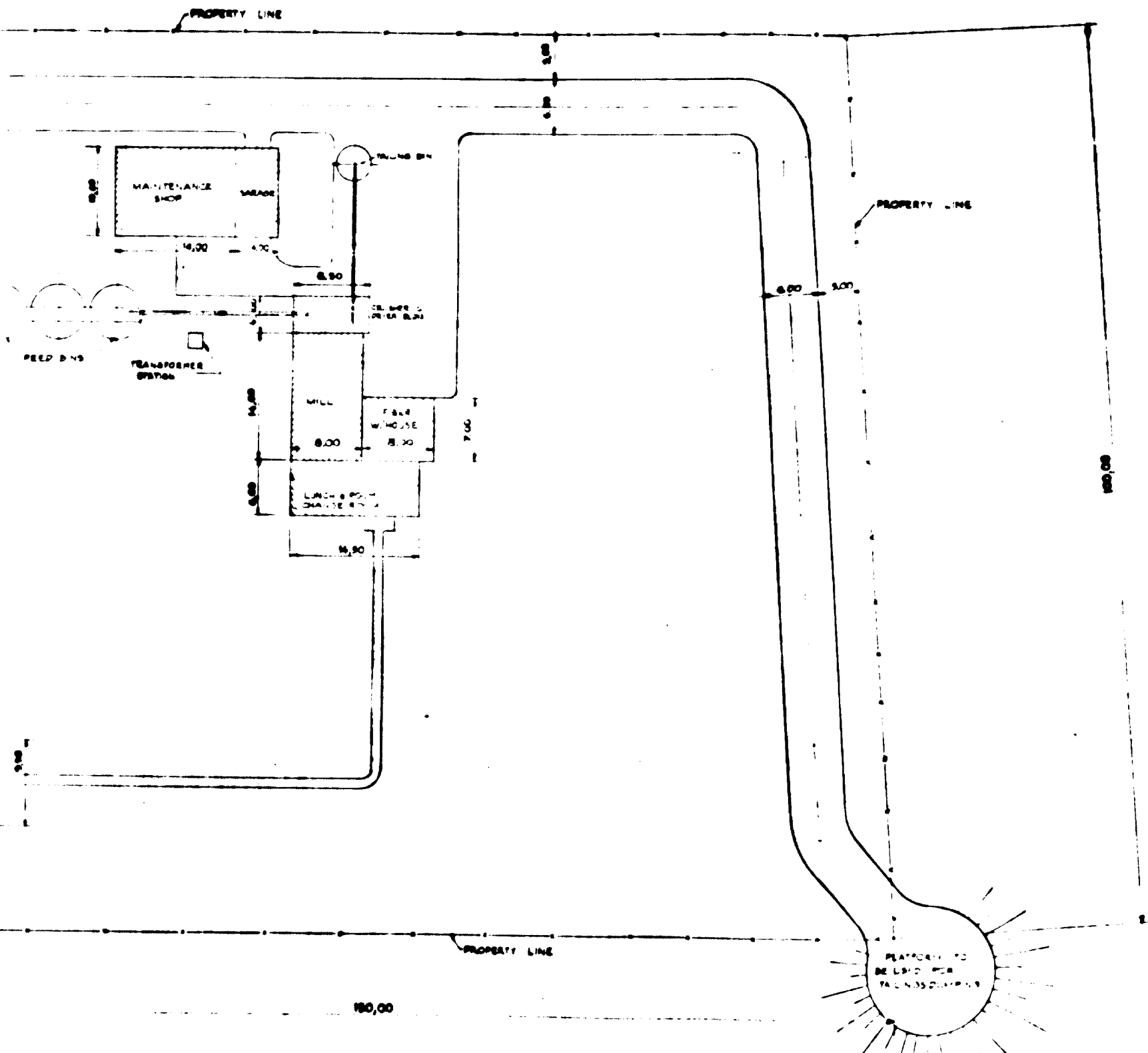
PLAN VIEW OF 2ND FLOOR



NOTE
 THIS PLAN WAS MADE BY THE ARCHITECT

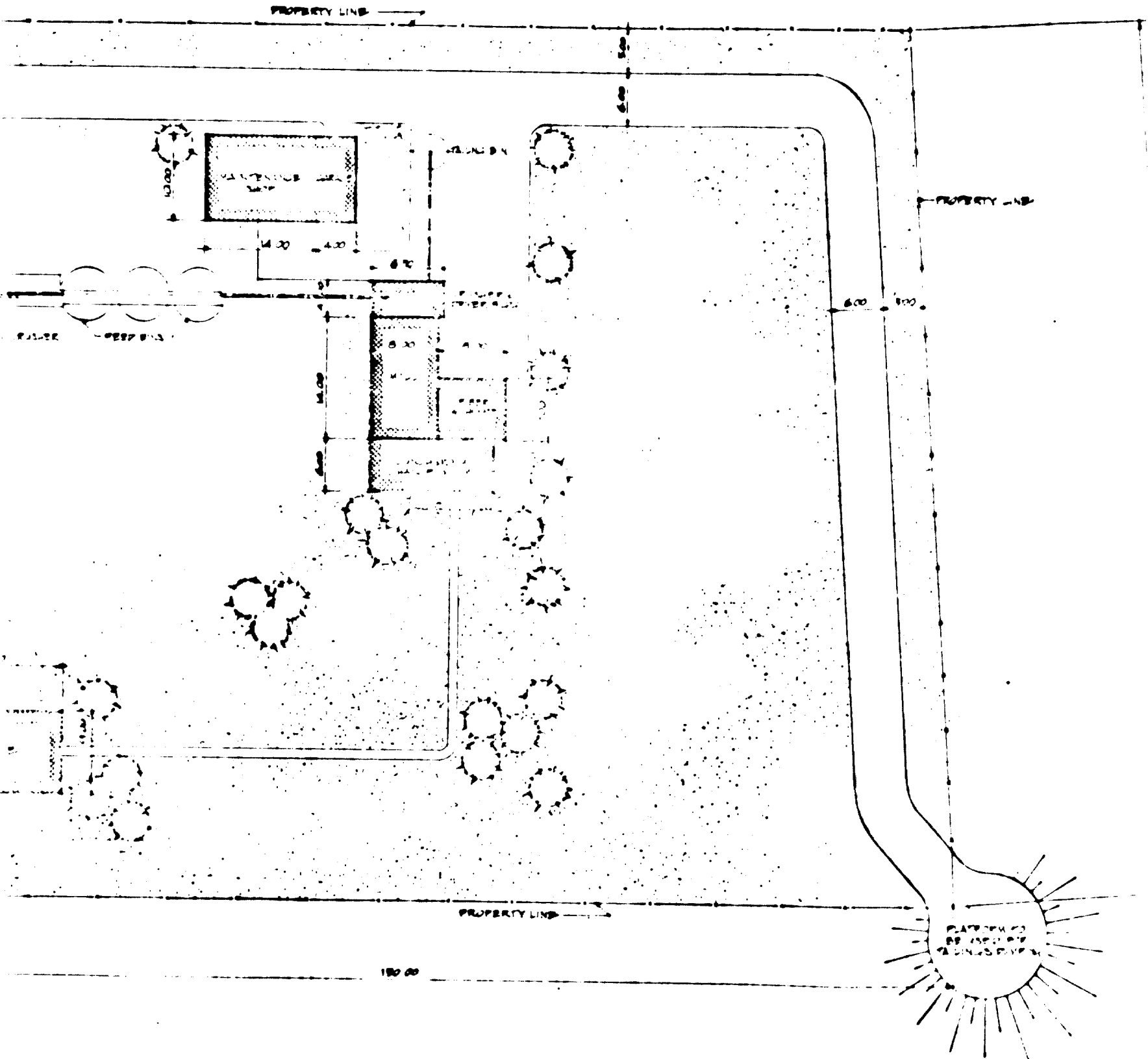


NOTE.
THIS PWD WAS MADE IN THE METRIC SYSTEM

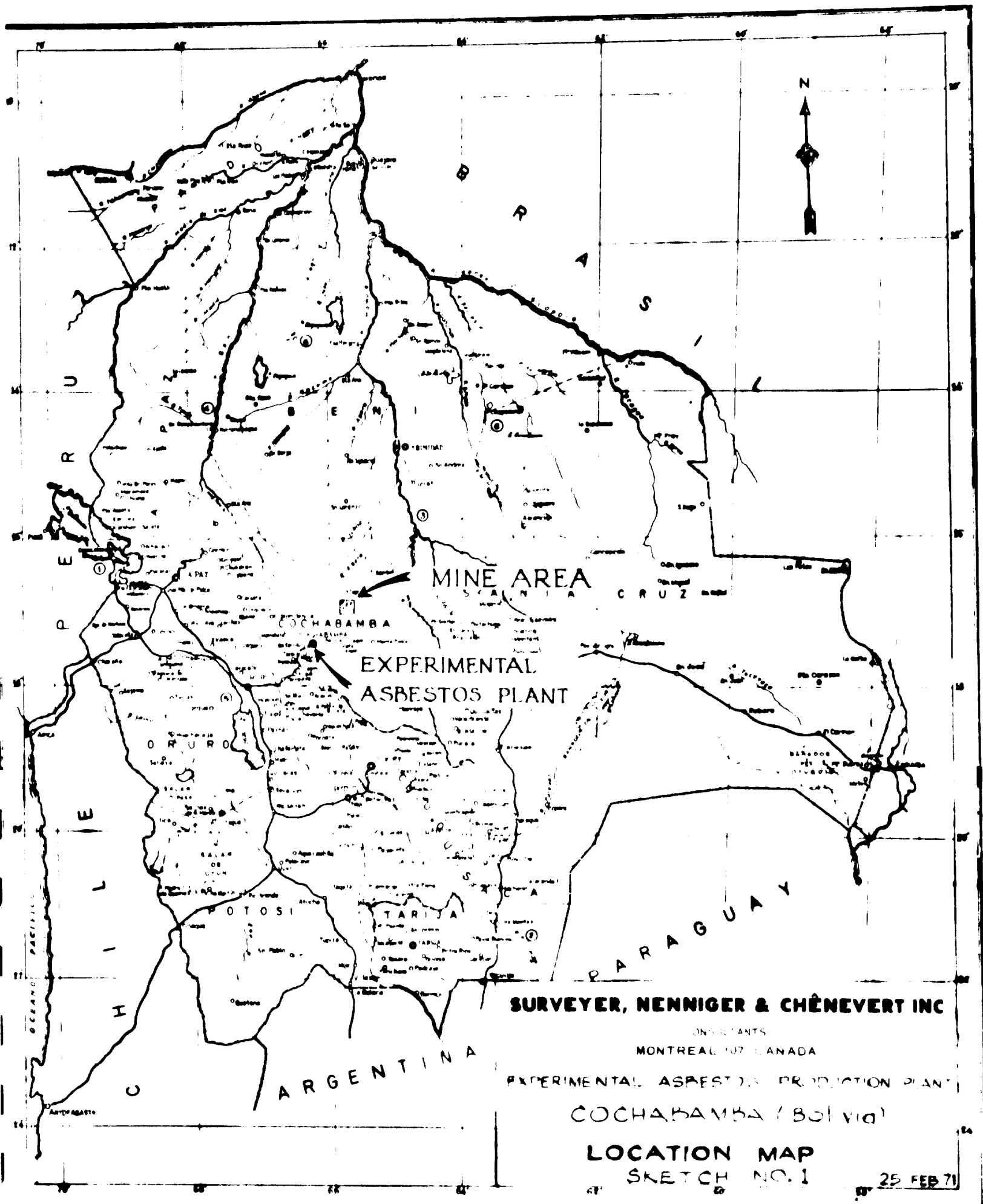


SECTION 2





SECTION 2



MINE AREA

EXPERIMENTAL ASBESTOS PLANT

ARGENTINA

PARAGUAY

SURVEYER, NENNIGER & CHÉNEVERT INC

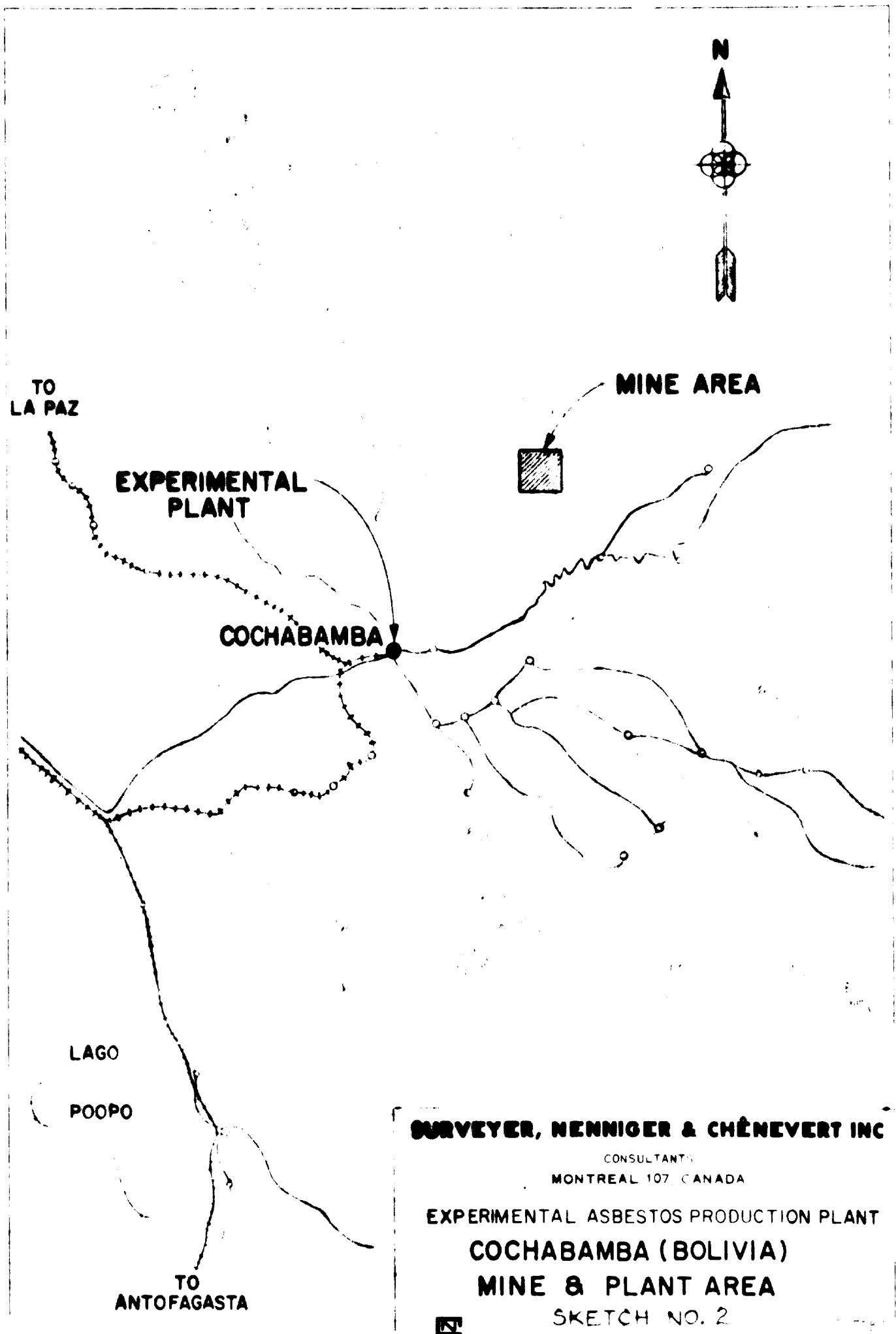
CONSULTANTS
MONTREAL 107 CANADA

EXPERIMENTAL ASBESTOS PRODUCTION PLANT

COCHABAMBA (Bolivia)

LOCATION MAP
SKETCH NO. 1

25 FEB 71



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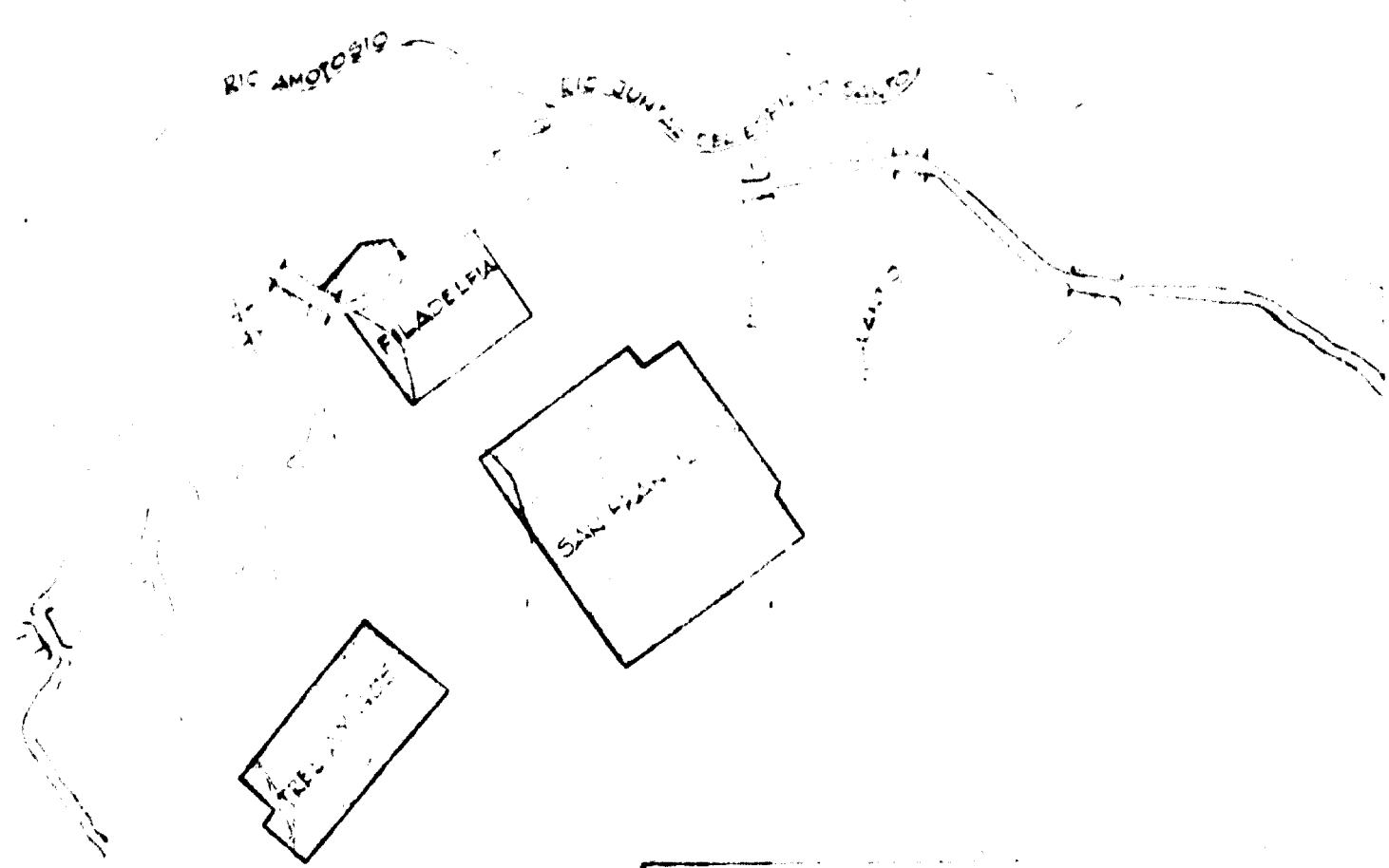
EXPERIMENTAL ASBESTOS PRODUCTION PLANT

COCHABAMBA (BOLIVIA)

MINE & PLANT AREA

SKETCH NO. 2



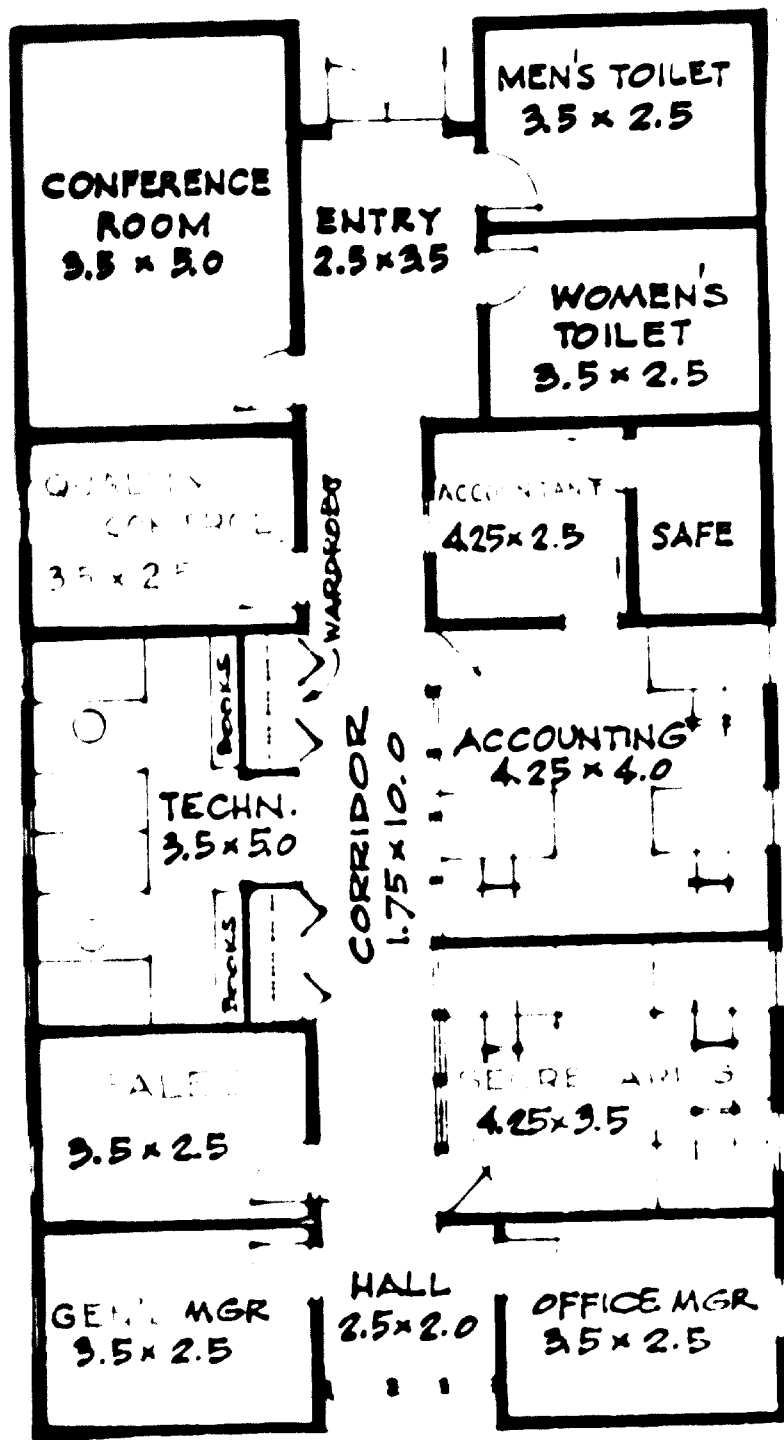


SURVEYER, NENNIGER & CHÉNEVERT INC
CONSULTANTS
MONTREAL 107, CANADA

**ALTO CHAPARE REGION
MINING CONCESSIONS**

SCALE : 1:50,000 25 FEB 71

SKETCH NO. 3



9,5

17,50

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CONSULTANTS

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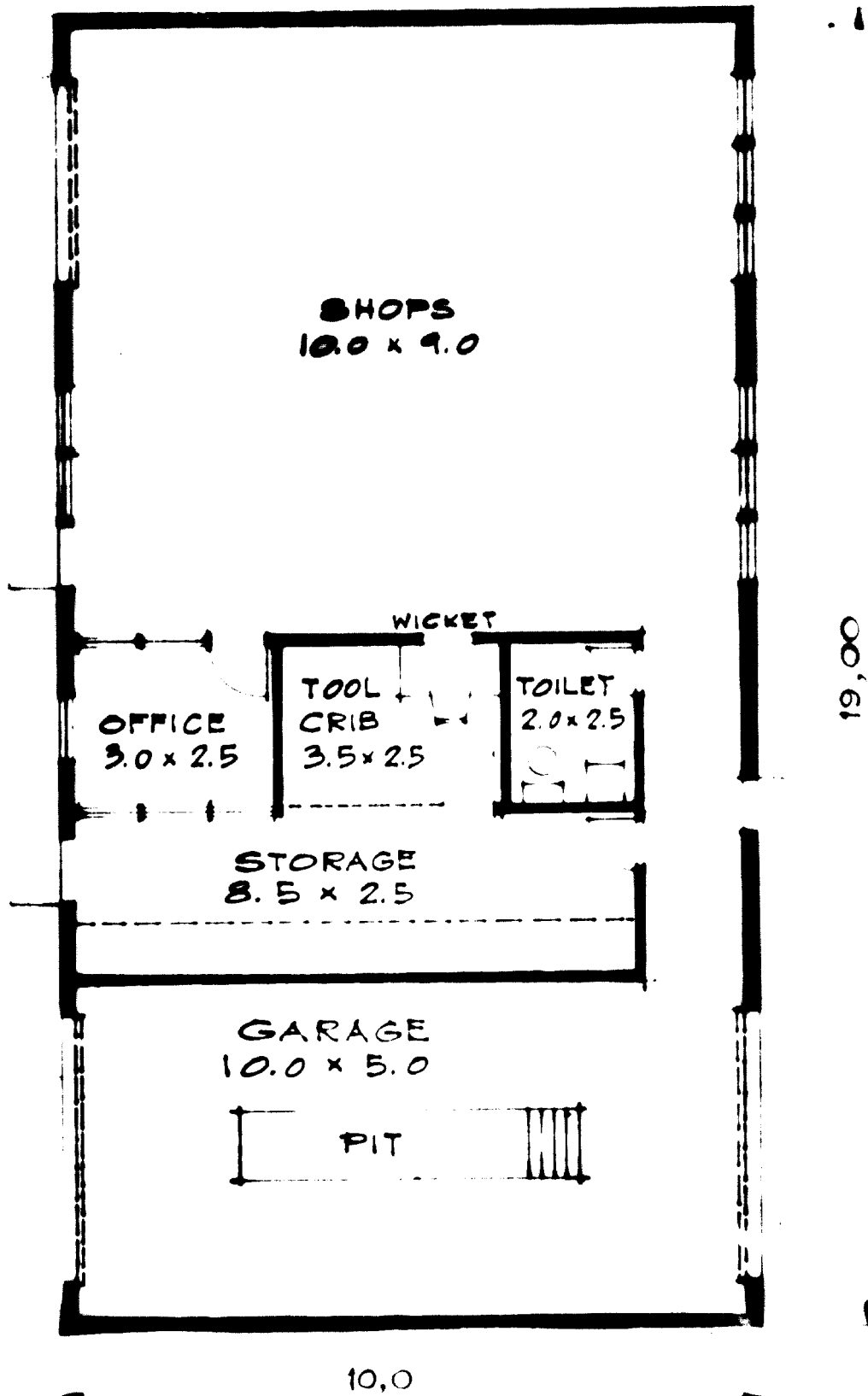
EXPERIMENTAL ASBESTOS PRODUCTION PLANT

COCHABAMBA (Bolivia)

ADMINISTRATION BLDG

SKETCH NO. 5

25 FEB. 71



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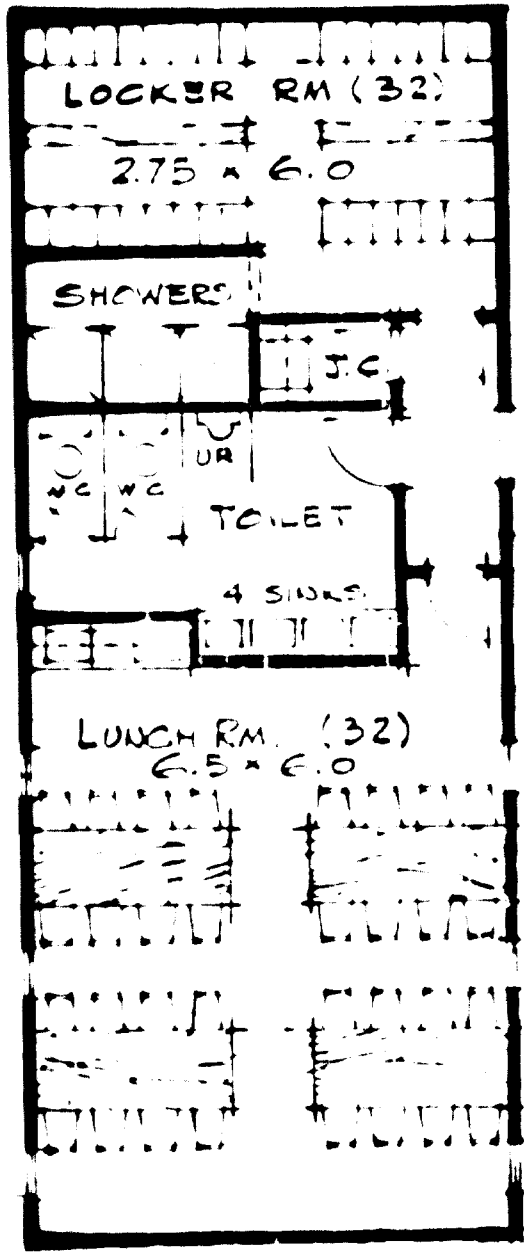
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MONTREAL 107 CANADA

EXPERIMENTAL ASPENITE PROJECTION PLANT
COCHABAMBA (Bolivia)

SHOPS & GARAGE

SKETCH NO. 6

25 FEB 71



14,50

6,00

SURVEYER, HENNIGER & CHÉNEVERT INC
 CONSULTANTS
 MONTREAL 107 CANADA
 EXPERIMENTAL ASBESTOS PRODUCTION PLANT
 COCHABAMBA BOLIVIA
LUNCH ROOM & CHANGE HOUSE
 SKETCH NO. 7 25 FEB 71

01355-E

3

TEPCO FILE COPY

01355
(2 of 3)

**REPORT ON
EXPERIMENTAL PRODUCTION PLANT
FOR ASBESTOS PROCESSING
COCHABAMBA, BOLIVIA, UNDP/SF
SYMBOL: BOL-20
PHASE III
PROCESS DESIGN
SNC CONTRACT NO. 3161**

UNESCO

Prepared for:

**The United Nations Industrial
Development Organization
UNIDO
AUSTRIA**

Prepared by:

**Surveyer, Nenniger & Chenevert Inc.
MONTREAL
CANADA**

DISTRIBUTION:

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DATE: August 14, 1971

SURVEYER, NENNIGER & CHÉNEVERT INC.

CONSULTANTS

OWNED AND OPERATED BY ENGINEERS



TEL 931-2201
CABLE SNCINC
TELEX 01-20612

1550 DE MAISONNEUVE BLVD WEST
MONTREAL 107, CANADA

August 18, 1971

Our Ref: 3161

Mr. D.C. Newton
Chief, Technical Equipment
Procurement and Contracting Office
United Nations Industrial Development Organization
Lerchenfelderstrasse 1
A-1070, Vienna, Austria

Dear Mr. Newton

UNIDO - BOLIVIA - PHASE III

We attach our final report of Phase III of the project "Experimental Production Plant for Asbestos Processing, Cochabamba, Bolivia, UNDP/SF Symbol: BOL 20", Contract No. 70/15. We are quite pleased to have been able to complete this assignment within the short schedule given to us at the meetings of June 7 to 10, 1971 in Vienna. Our preliminary issue of the report was submitted and reviewed at the meetings in Vienna August 2 to 4, 1971.

We are disturbed that the criteria agreed to during the June meetings in Vienna were subsequently challenged at the last minute of our work. Unless we are all committed to the same objectives, including the schedule, similar situations might recur during Phase IV. We strongly recommend that the management of the project, from ore extraction to production of fibre, be under the responsibility of a manager reporting directly to you. Changes and delays during Phase IV could be quite costly.

We would be pleased to revise our contractual obligations for Phase III and to make available the services of our staff and our associates to include the final design of the processing plant as an addendum to Phase III. We await your instructions to proceed with this addendum.

SURVEYER, NENNIGER & CHÉNEVERT INC.

**Mr. D.C. Newton
United Nations**

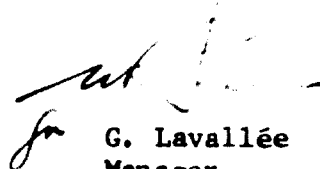
- 2 -

August 18, 1971

We appreciate the opportunity to prepare Phase III of this project and look forward to being of continued service.

Sincerely yours

SURVEYER, NENNIGER & CHÉNEVERT INC.



for **G. Lavallée
Manager
Mining & Metallurgy Department**

LP/amp

encl.

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Appendix C - General Arrangement and Details Drawings	

SUMMARY

An experimental plant to produce 1500 tons per year of asbestos fibre similar to groups 3, 4 and 5 was designed.

Equipment was selected, specifications prepared and bids obtained. The cost of the equipment delivered in Cochabamba is estimated at \$230,100 U.S. The equipment covered by the estimate now includes material handling facilities for the ores, with conveyors and bucket elevators, and dust control facilities as agreed in selection of the process. Equipment cost estimates are based on U.S. dollars and now reflect an increase due to the recent rise in the Canadian dollar.

The minimum geological works required for the Filadelfia mine for planning the experimental plant is indicated following a review of the Geobol proposal.

A method for concentration of asbestos ore from the Filadelfia mine was studied. The cost of the equipment required, not installed, for concentration is estimated at \$75,000 U.S.

1. INTRODUCTION

On March 5, 1970, the United Nations Industrial Development Organization awarded a contract to Surveyer, Nenniger & Chenevert Inc. for testing of asbestos samples, preparation of a feasibility study, selection of a manufacturing process, supply of equipment, spares and designs and provision of services for the erection and commissioning of an experimental production plant for asbestos processing.

Report of Phase I "Experimental Production Plant for Asbestos Processing" was submitted on August 5, 1970.

The report of Phase II "Feasibility Study" was submitted on April 8, 1971.

During a meeting held in Vienna, Austria from June 7 - 10, 1971, with the participation of delegates from UNIDO, UNDP, Government of Bolivia and SNC Inc., it was agreed that Phase III of the project be initiated immediately. SNC was asked and accepted to complete that work prior to July 28, 1971. The scope of work for Phase III, as outlined in the original UNIDO Contract No. 70/15 was modified as follows:

- 1) Prepare all detailed engineering design covering all process sectors and lists of equipment including, but not limited to:
 1. Layout of all equipment and general arrangement drawings of plant building;
 2. Detailed design and specification of conveying equipment, chutes, hoppers, aspirating hoods, bins, aspirating piping, and associated equipment;
 3. Detailed design of all dust control and ventilation equipment;
 4. Technical specifications for:
 - a) the plant buildings and plant equipment referred to, above;
 - b) the quality control and laboratory equipment to be provided by the UNIDO as outlined in Annex E hereof. These shall be suitable for invitation of competitive bids. (Already done)

1. INTRODUCTION (cont'd)

5. Equipment layout and installation drawings including quality control and laboratory equipment showing building loads, power and control requirements as well as other necessary services.

The basic criteria agreed on to guide the plant design were:

1. Mill feed size, 25 mm.
2. Use of the most inexpensive building.

The firm of Watts, Griffis and McOuat Limited was asked by SNC to prepare a conceptual method of concentrating asbestos ore from the Filadelfia deposit.

SNC was verbally authorized to proceed with Phase III on June 10, 1971. Material balance, flowsheet and layout were immediately prepared. As soon as available, sketches or designs were forwarded to Bolivia for comments. On July 14, our asbestos specialist, Mr. Pouliot, visited Cochabamba to review with Mr. Sumbulovic, the UNIDO Project Manager, the material balance, flowsheet and layout of the plant, to clear the way for immediate completion of final design work.

During that meeting, Mr. Sumbulovic stated the following new requirements:

- the feed to the mill would be 30 cm instead of 25 mm as agreed upon in Vienna.
- the building should be multistory instead of basically one floor.

All work was stopped pending clarifications for these basic criteria.

The UNIDO office in Vienna subsequently asked SNC to complete the report of Phase III for July 29 as already scheduled, and to attend a review meeting in Vienna, August 2, 1971. During that meeting and continuation which extended to August 4, 1971 the preliminary report of Phase III was reviewed and accepted with minor modifications. These modifications have been incorporated in this final report on Phase III and include:

- a) the location of the core and quality control laboratories in a separate building not included in the scope of work of SNC;
- b) the deletion of walls in the dryer section of the building;

1. INTRODUCTION (cont'd)

- c) the additions of screening facilities prior to the dryer;
- d) the addition of truck weighing facilities at the gate house.
- e) contractual obligations of SNC for Phase III were to be revised to include final design previously the responsibility of the Government.

These revisions will be presented as an addendum to Phase III report.

2. DESIGN CRITERIA

The following criteria were used in flow sheet preparation and experimental plant design:

Fibre production capacity:	1500 tons per year
Plant operation:	300 days per year 7 productive hours per day
Dryer section:	continuous operation
Mill section:	batch process
Humidity content:	maximum 10%
Plant efficiency:	85%
Plant feed fibre content:	from a minimum of 40% to a maximum of 95% fibre content
Fibre distribution: (based on Phase I results of Philadelphia fine ore)	similar to group 3- 17% similar to group 4- 60% similar to group 5- 23%
Plant feed ore size:	maximum 25 mm
Mine supply size:	70% at minus 25 mm 30% from 25 mm to 300 mm

3. DESIGN3.1 Material balance

The material balance was prepared and submitted for comments to the UNIDO Project Manager on June 18, 1971.

3.1.1 Tonnage required

Wet Ore	4850 tons per year	16.2 tons per day
Dry Ore	4410 tons per year	14.7 tons per day
Fibre	1500 tons per year	5.0 tons per day

3.1.2 Mill balance sheet (per day)

3.1.2.1 Rock Circuit

Feed		14.70 tons	100%
Fibre lift	Group 3:	1.50 tons	
Fibre lift	Group 4:	5.29 tons	
Fibre lift	Group 5:	2.03 tons	
Fibre lift	Total	8.82 tons	60%
Fines	Group 3:	0.88 tons	
Fines	Group 4:	3.08 tons	
Fines	Group 5:	1.18 tons	
Fines	Total	5.14 tons	35%
Rock	Total	0.74 tons	5%

3. DESIGN (cont'd)

3.1.2.2 Fibre Circuit

Feed		8.82 tons	60%
------	--	-----------	-----

Fibre	Group 3: 0.85 tons		
Fibre	Group 4: 3.00 tons		
Fibre	Group 5: 1.15 tons		

Fibre	Total	5.00 tons	34%
-------	-------	-----------	-----

Fines	Group 3: 0.50 tons		
Fines	Group 4: 1.76 tons		
Fines	Group 5: 0.68 tons		

Fines	Total	2.94 tons	20%
-------	-------	-----------	-----

Floats	Group 3: 0.15 tons		
Floats	Group 4: 0.53 tons		
Floats	Group 5: 0.20 tons		

Floats	Total	0.88 tons	6%
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3.2 Flow Sheet

The process flow sheet, submitted on June 18, 1971 is included as drawing 3161-02-3700-1.

3.3 Mill Layout

The mill layout submitted for comments on July 5, 1971 is included as drawing 3161-02-3700-4.

4. GEOLOGICAL WORKS

It has been recommended that a program of geological exploration be carried out to determine the extent of ore reserves on which the experimental plant will be established.

A program of geological works proposed to UNIDO by Geobol was reviewed by SNC at the request of UNIDO, with a view to suggesting minimum requirements to enable a preliminary assessment of ore reserves at the Filadelfia mine.

SNC's comments on the proposed program were transmitted to UNIDO June 15th and were as follows:

- 4.1 The bottom of the existing pit of Filadelfia should be cleaned with a bulldozer, map geologically, and three or four drill holes put down to determine the depth to which fibre is present and whether the fibre is of the same quality as exposed in the walls of the pit. These drill holes would be vertical or inclined depending on the occurrences of asbestos ore. These drill holes would tell if the fibre is present in the pit as previously indicated and if it is of the same type as the fibre present in the wall. It would also reveal if the fibre can be recovered by the same mining and concentration method as the fibre in the wall.
- 4.2 The surface of blocks 1, 2 and 3 should be cleaned with bulldozer to expose the rock, map geologically and then ten to twenty drill holes should be put down from surface to determine the horizontal and vertical extent of the fibre zone. These drill holes would be either vertical or inclined. They would tell us whether there is fibre in the rock or not. They would outline the extent of the fibre content without really being possible to obtain proven reserve. Location of such drill holes would have to be selected on site depending upon ore occurrences.
- 4.3 The success of such drilling program will depend on careful and continuous supervision by geologist experienced in the occurrences of asbestos ores. We would appreciate receiving as soon as possible the curriculum vitae of the engineer presently on site.
- 4.4 It is extremely important to establish procedure for recovery of the cores as drilling progresses. If good procedures are not established before work starts, then samples and the data obtained for them could not* be meaningful.

* Correction to telex text

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4. GEOLOGICAL WORKS (cont'd)

4.5 Adits and cross cuts as proposed in the Geobol results could be done at a much later stage particularly in those areas where long fibre is probable.

4.6 If doubt exists on the experience of present engineer on site, we would recommend supplying from Canada an experienced asbestos geologist to review with him drilling program as soon as the existing Philadelphia pit is cleaned and prior to any drilling start. Geologist could make a second visit to the site at a later date when drilling is finished to review the drilling results, take half of the core samples prior to shipping to Quebec City.

5. DESCRIPTION OF THE FACILITIES

5.1 Truck Scale

A truck scale of a maximum capacity of 14.75 tons will be located at the gate house for weighing the incoming and outgoing haulage trucks. The scale is an addition included as part of Phase III addendum.

5.2 Stockpiling and Reclaiming Facilities

Drawing 3161-02-3700-3, Site Plan gives the overall arrangement of the process facilities.

The ore stockpiling facilities consist of a concrete pad at ground level elevation measuring 20.6 meters long by 15.3 meters wide.

Trucks hauling from the mine will dump the concentrate on concrete pads or on their periphery.

Labourers will shovel, wheelbarrow and feed the ore concentrate onto a vibrating screen that will discard the oversize (plus 25 mm) to be taken away for size reduction by sledge hammering. The undersize (minus 25 mm) will be collected on a 45.7 cm (18 inch) belt conveyor. The conveyor will deliver the ore to the dryer.

The vibrating screen and the oversize conveyor are additions included as parts of Phase III addendum.

5.3 Dryer

The ore will be fed in a parallel flow, oil fired rotary dryer. The moisture content of the ore will be reduced from 10% to 2%.

5.4 Mill Building

See flowsheet drawing 3161-02-3700-1.

The ore discharged from the dryer will be elevated into the mill feed bin. This 15 ton capacity bin will be constructed of concrete. Throughout the day, it will serve as a surge and cooling bin. At the end of each working day, the ore will be transferred into a second bin #RB-1. A vibrating feeder will feed the concentrate to rock screen RS-1.

5. DESCRIPTION OF THE FACILITIES (cont'd)

5.4 Mill Building (cont'd)

Fibre will be lifted to the cyclone collector CC-1. The oversize rock will be elevated into rock bin #RB-2. The undersize discarded to tailings. Middlings accumulated in containers for further processing.

The fibre lifted on screen RS-1 will be cleaned on a fibre screen and aspirated in cyclone CC-2. The undersize will be sent to tailings. The oversize will be accumulated in containers for further processing.

The fibre collected in CC-2 will be gravity fed into a paddle deduster. From the paddle deduster, it will be elevated to a grader. The fibre will be mixed and bagged. The grader undersize will be accumulated for further processing. This first series of operation will produce the longest fibre.

The oversize rock and middlings from screen RS-1 will be fed into an impact mill. Fiber will be liberated and processed as per the previous sequence. Intermediate length fibre will be so produced.

The shorter fibre will be processed similarly. however, the oversize of the rock screen and the middlings of the fibre screen will be discarded tailings, since very short fibre will not be produced in this experimental plant.

6. PROCESS EQUIPMENT6.1 Equipment List

Provided the concentrate supplied to the mill contains a minimum of 40% fibre and 10% maximum humidity content, labour is well trained, proper maintenance is carried out and spare parts kept in stock on the site, we consider the equipment listed below sufficient to produce 1,500 tons per year of asbestos fibre with lengths equivalent to Canadian fibre of Groups 3, 4 and 5.

Process Equipment List

<u>Item</u>	<u>Quantity</u>
Dryer	1
Crusher	1
Rock Screen	1
Fibre Screen	1
Paddle Deduster	1
Standard Grader	1
Live Bottom Bin	1
Fibre Screw Packer	1
Belt Conveyors	2
Bucket Elevator	6
Vibrating Feeders	2
Screw Conveyor	1
Cyclone Collector	2
Rotary Aspirator	1
Aspiration and Dust Control	1

Drawing 3161-02-3700-4 entitled General Layout shows the layout of the equipment.

Process Equipment List for Phase III addendum

<u>Item</u>	<u>Quantity</u>
Vibratory Rock Screen	1
Belt Conveyor	1
Truck Scale	1

6. PROCESS EQUIPMENT (cont'd)

6.2 Estimated Cost

The procurement, supply, packaging, insurance for shipping and delivery of the equipment of Phase III on the site at Cochabamba is estimated at \$230,100 U.S. This list does not include the equipment listed under Phase III addendum.

This experimental plant of Phase III has some characteristics which result in a higher price proposition than previously estimated.

The mill section will be equipped with production size machinery which is commonly used by most of the asbestos producers in the world. It will permit the performance of more realistic experimental work and a better interpretation of results without applying the factor necessary when comparing pilot plant and production plant equipment. Later the equipment could be easily incorporated to a full scale production plant.

The mill building will be a simple design type with all the processing equipment located on a common floor using material handling equipment such as bucket elevators to convey the material through the process rather than being a multistory gravity flow building.

The wet ore will be dried in an autonomous rotary dryer to provide the flexibility in the drying rate due to the adverse climatic conditions of the mine and the wide variation in the moisture content. The interference of drying in the crushing efficiency and the interrelation with subsequent milling operations prevent the utilization of a dual purpose machine, impactor-dryer.

The addition of the mixing operation before bagging will provide a greater stability in the quality control of the fibre. This production feature will also add the possibility of reblending old production fibre with fresh material for a wider range of finished product.

The dust collecting system will be of a greater capacity to provide an ample and up-to-date control of the dust in the process building.

The processing equipment will be supplied with motor starter and stop-start push buttons mounted on the machine.

Since the original estimate was established in 1969, the escalation of prices has been in the order of 15 to 20%.

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7. BUILDING7.1 Description

All processing and associated facilities will be located in one building measuring 15.2 meters wide by 41 meters long. The roof clear height to be 11.5 meters where the process facilities are housed and 3.5 meters where the services are located.

The process equipment will be distributed on two levels with most of the equipment located on the upper floor, 3 meters above the ground floor.

Approximately 720 square meters of floor are required to house the equipment. The services will use 196 square meters divided as follows:

Product Storage	112 sq. meters
Stores	58 sq. meters
Power Substation	26 sq. meters
	<hr/>
	196 sq. meters

7.2 Specification7.2.1 General

The specifications and data to be used in the design and construction of the experimental pilot plant are:

Foundations -

Reinforced concrete spread footings. Piers and grade beams or grade walls.

Superstructure -

Reinforced concrete framing and structural steel.

Floors -

Reinforced concrete.

Roof -

Corrugated asbestos roofing over process plant.

7. BUILDING (Cont'd)

7.2.1 General (cont'd)

Ceilings over Service Area -

Precast concrete.

Walls -

Corrugated asbestos wall cladding, except **dryer section.**

Exterior Walls - Process Plant -

Corrugated asbestos cladding

Exterior Walls - Service Area -

Concrete blocks.

Partition Walls -

Lightweight concrete blocks.

7.2.2 Codes

Latest issues of Bolivian codes and regulations.

7.2.3 Design Loads

Live Load -

Concrete slabs:	Elevated concrete floors 0.75 ton per sq. meter
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Stairs:	0.50 ton per sq. meter
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Ground floor:	1.00 ton per sq. meter
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Ground floor - Fibre storage area:	2.50 ton per sq. meter
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Stockpiling pad:	1 ton per sq. meter.
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Equipment Load -

All equipment loads which exceed the given distributed floor live load will be shown on floor or platform drawings.

Crane -

Not applicable.

7. BUILDINGS (cont 'd)

7.2.3 Design Loads (cont 'd)

Wind Loads -

All buildings and structures shall be designed to resist wind loads specific to the Cochabamba area.

Seismic Load -

All buildings and structures shall be designed to resist earthquake loads according to the earthquake factor of the Cochabamba area.

7.2.4 Soil

Soil bearing capacity obtained from a soil investigation study specific to the site and transmitted by the Director of the Project is 1.38 KG/square centimeter.

7.2.5 Reinforced Concrete

All concrete shall have 3,000 psi compressive strength in 28 days. Reinforcing steel to be deformed intermediate grade.

7.3 Final Design Addendum

The final design of the processing building and associated facilities will be part of Phase III addendum. It will include drawings and specifications of:

- foundations
- concrete storage pads, bins and floors
- structural steel
- architectural work
- mechanical services including piping, fire protection, compressed air, ventilation, water supply, drainage and sewers.

The drawings and specifications will be completed to call tenders for the construction of the processing plant and installation of its mechanical services.

The addendum will also include an estimate of the construction costs of the mechanical services excluding all foundations, concrete, structural and architectural work.

8. DUST CONTROL SYSTEM**8.1 Description**

The experimental plant will be equipped with a dust control system of the highest standard in the asbestos industry and shall under normal operation and maintenance conditions provide a high degree of protection.

Dust control hoods have been provided at every point where dust is liable to be generated. Drawing 3161-02-3700-6 shows the layout of the system.

All air for dust control and aspiration is connected to a main header before entering the bag filter.

The system is automatic in the sense that the bags are cleaned at set intervals and no operators are required for this function.

A more complete description of the system is found in Specification 3161-02-3700-15 - Bag Collector.

8.2 Monitoring of the Dust

Recommendations for the monitoring of the dust in the processing plant will be part of Phase III addendum.

9. POWER DISTRIBUTION AND LIGHTING

9.1 Description

The power distribution system for the process plant and associated services will consist of a 500 KVA, 3 Phase, 50 Cycle indoor type transformer located in the electrical room.

This transformer will be supplied from a 10,000 Volt incoming powerline and the supply to the plant is reduced to 380 Volt level. The transformer will be followed by a 1,000 Amp air circuit breaker. An 800 Amp capacity busbar will distribute the power to four distribution panels.

Distribution panels No. 1 and No. 2 will be used for the process equipment. Distribution panel No. 3 will be used to supply the quality control and core laboratories. Distribution panel No. 4 will serve the lighting and miscellaneous plant services. Drawing 3161-02-3700-7 shows the power distribution design.

9.2 Final Design Addendum

The final design of the electrical power distribution and lighting of the process building and associated services will be part of Phase III addendum. It will include drawings and specifications complete to call tenders for the installation of the electrical services and an estimate of the construction costs of such services.

10. QUALITY CONTROL AND CORE LABORATORIES**10.1 Description**

Drawing 3161-02-3700-5 outlines the general layout for the quality control and core laboratories. All equipment to be supplied in these facilities are shown on this drawing. The area where water is required is indicated.

A separate dust control and aspiration system is included. The type of shelves and tables required is indicated in the notes. The equipment being of light loads, no heavy construction is required.

The core laboratory includes a large floor area to accumulate samples.

The core and quality control laboratories will be located in a separate building which is not included in the scope of work of SNC.

10.2 Addendum

The specification for a dustube collector required in the core laboratory will be part of Phase III addendum.

11. RECOMMENDATIONS

We strongly recommend that:

1. All parties agree and be committed to a set of design criteria.
2. All parties agree and be committed to a master schedule of Phase IV to be prepared before proceeding.
3. The execution of Phase IV be placed under the authority and responsibility of one single person so that mine development, plant construction, equipment delivery and installation be made in accordance with the master schedule.
4. The exploration work of the deposit be accelerated. No additional information became available during Phase III.
5. The concentration plant included in appendix A be implemented.
6. A plan for the mining operation be prepared as was done for the concentration process.
7. Recommended crushing tests be made to predetermine operation factors.

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APPENDIX A

ORE CONCENTRATION

APPENDIX "A"ORE CONCENTRATION1. GENERAL

At our request, the Watts, Griffis and McOuat Limited, Consulting Geologists and Engineers of Toronto, prepared a conceptual method of concentrating the crocidolite asbestos ore of the Filadelfia Deposit.

As per our terms of reference, they restricted themselves solely to the concentration stage and did not consider the mining phase.

Previously, Watts, Griffis and McOuat had assisted SNC in the gathering of samples of ore from several deposits in the Alto Chapare region and in preparing a part of the market study for crocidolite asbestos in North and South America.

2. FILADELFIA DEPOSIT

Plans call for the annual production of 1,500 tons of fibre from the experimental plant. Design of the plant is based on the delivery of a concentrate containing 40 percent fibre from Alto Chapare.

Although there are several crocidolite deposits in the Alto Chapare region, the deposit selected for the study was Filadelfia. It is located within two hundred metres of a new all-weather road presently under construction, between Cochabamba and Villa Tunari.

The deposit has been mined in the past but at a very modest rate. It is difficult to determine the exact amount but one hundred tons of fibre would perhaps have been the maximum ever recovered in any one year. The fibre was concentrated by manually sorting through the rock and picking out the fibre after the rock had been drilled, blasted or loosened with picks and bars. To achieve the proposed output of 1,500 tons per year will require new methods for mining and concentrating.

The assignment we gave to Watts, Griffis and McQuat covered only the design of a proposed method for concentrating of the ore at the Filadelfia mine site and did not include the method for mining of the waste and ore that will be required to be mined.

The Filadelfia mine to-date has been mined entirely by surface methods. The excavation might best be described as a small quarry with very approximate dimensions of 60 meters in length, 30 meters in width and 10 meters in depth. The topography rises as one retreats from the road and there is abundant vegetation, principally in the form of long grass in the area of the present pit.

The geology of the deposit is not completely known but it is understood that a programme is presently in progress to provide further information on the quantity and quality of fibre reserves and the variation in rock types that appears to be indicated from surface.

The crocidolite that is exposed in the walls of the pit is primarily in a cream coloured quartzite that is well fractured. The crocidolite occurs as mass, slip and cross fibre along the fractures. Other material that is exposed in the pit walls includes a black argillaceous shale and a light coloured dolomite. There is much folding and faulting in evidence that has undoubtedly been responsible for the highly fractured nature of the rock exposed.

3. GENERAL DESCRIPTION OF PROPOSED CONCENTRATION METHOD

The principal factors considered to arrive at the proposed method of concentration are:

1. The average fibre content of ore from the mine will be between four and six percent.
2. Fractured quartzite will be the principal waste rock in the ore feed.
3. Due to the rainy season, only seven months of operation is possible.
4. Unskilled labour is in plentiful supply while skilled labour is not.
5. The installation may only be temporary and capital costs should be minimized.

The flowsheet proposed is shown on page 28. It consists of one or two stages of crushing until a desired product size is obtained followed by hand sorting of waste from a slow-moving conveyor belt with the discharge from the conveyor belt going into a concentrate bin to await truck transport.

We considered other alternatives but in view of the factors itemized above, we feel that the proposed concentration method is the most appropriate at this time. As additional information on the ore characteristics becomes available, modifications may be required. It is recommended that some crushing and screening tests be done on the ore before final equipment specifications be established.

The concentration facilities have been designed such that if operated 12 hours per day for 25 days per month during the seven month dry season, that 4,000 tons of product will result with an approximate crocidolite content of 40 percent, provided sufficient ore reserves are available.

Maintenance requirements should be at a minimum in the proposed design, while all positions should be suitable for unskilled labour after a brief training period.

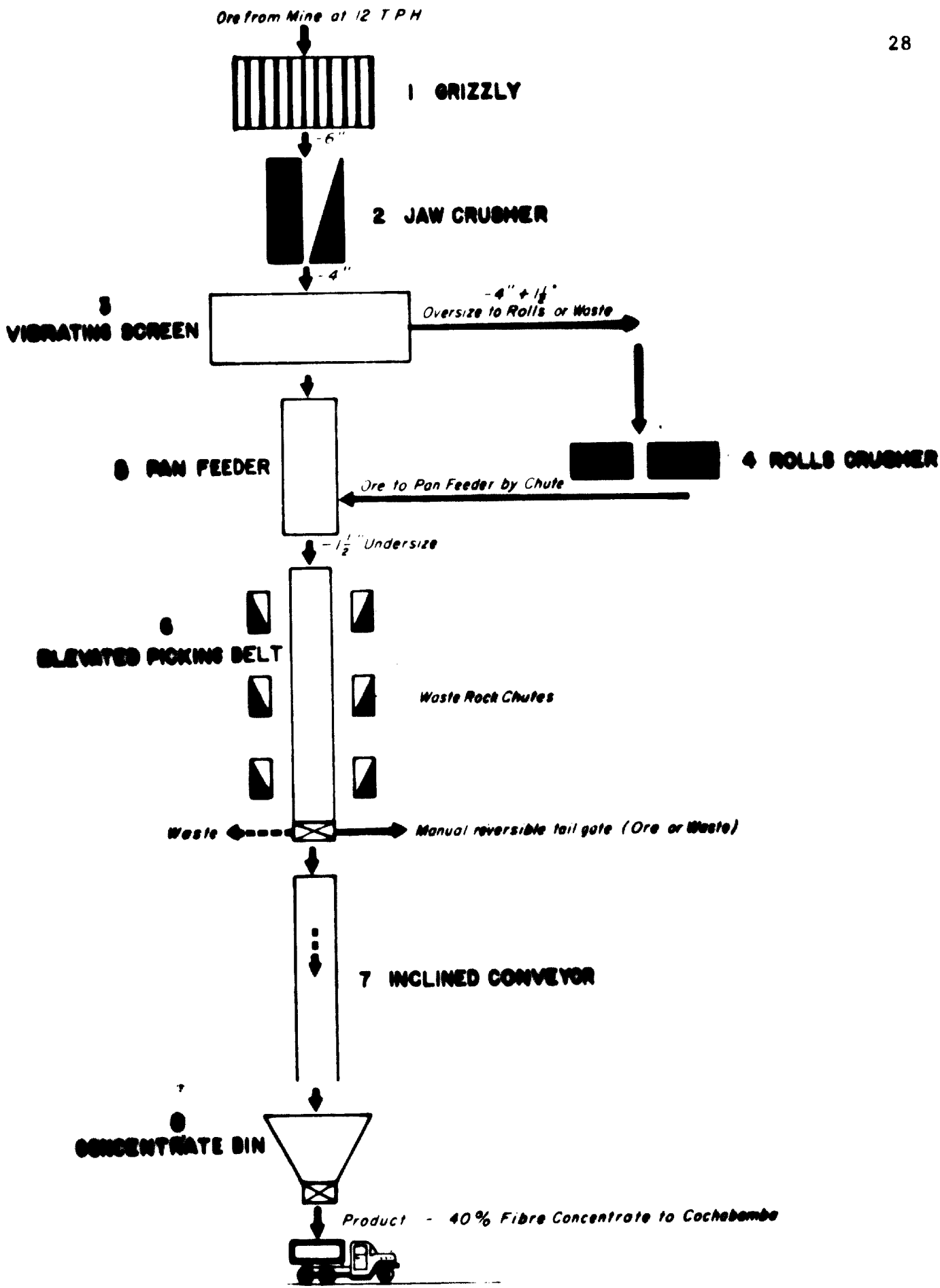
A two-shift operation is envisaged with each shift being of six hours duration. If additional daylight is available or if lighting facilities are installed, then a longer operating day is possible.

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3. GENERAL DESCRIPTION OF PROPOSED CONCENTRATION METHOD (Cont'd)

It is reported that in the pit bottom, hard competent rock exists and that while the crocidolite continues, it occurs in riebeckite, a closely related amphibole. Supporting evidence for this was the existence of a stockpile of such material beside the pit from which the workers had been unable to recover the fibre with the tools and equipment at their disposal. The pit bottom is presently covered with debris and waste rock from the walls of the pit so that examination of the floor is not possible until this material is removed.

In designing the proposed flowsheet for the concentration of crocidolite ore, we have considered treating only the fractured quartzite and not the riebeckite. Concentration of the latter to result in a 40 percent fibre concentrate would necessitate substantially more equipment than we indicate as required for the fractured quartzite. We are not proposing such provision at this time.



PROPOSED FLOWSHEET
FOR
ALTO CHAPARE ORE CONCENTRATION

4. DETAILS OF CONCENTRATION METHOD

4.1 Crushing and Screening

Mine ore would be required to be supplied at the rate of 12 tons per hour, for 12 hours per day. It should be delivered to a grizzly with a 150 millimeter spacing.

Overall dimensions of the grizzly would be approximately two meters square. Construction of the grizzly would require rails or wide flange steel weighing about 30 Kilograms per meter.

Oversize resting on the grizzly would be broken manually with six-kilogram hammers.

The minus 150 millimetre material would drop into a chute positioned to feed a jaw crusher. The chute should be equipped with a chain curtain, so as to control the feed to the jaw crusher. Maximum crushing efficiency is obtained if the jaw crusher has a constant feed.

A jaw crusher, 250 mm by 400 mm, should be adequate for the proposed throughput, and also allow some increased production. We would recommend that initially the closed side setting of the jaw crusher be 50 millimeters. Without having done any crushing tests, we would estimate that seven percent of the jaw crusher product will be greater than 75 millimeters and 31 percent greater than 50 millimeters. The setting of the jaw crusher that is best suited for the proposed concentration method can only be determined once actual operations have started unless some test work is done before equipment is purchased.

We would recommend that serious consideration be given to the shipping of 200 kilograms of representative ore to Canada for crushing and screening tests. These tests would show the optimum crusher setting and screening sizes to achieve maximum fibre recovery and concentrate grade through a hand sorting operation.

Estimated costs for these tests is \$500.

The jaw crusher product would be screened on a single deck vibrating rock screen with 40 millimeter square openings. The size of the opening may be changed if required.

The screen oversize, estimated to be three tons per hour, and having the size range minus 100 millimeters plus millimeters, can be directed towards either a rolls crusher for further crushing or directly to waste if of low fibre content. Testing will be required to determine this.

4. DETAILS OF CONCENTRATION METHOD (Cont'd)

4.1 Crushing and Screening (cont'd)

If the screen oversize has a significant fibre content and can be considered as ore, then it could be reduced in a rolls crusher set at 25 millimeters. This setting should not cause any fibre destruction. The 25-millimeter setting should give a product that is 25 percent greater than the setting size and 75 percent less than 25 millimeters. If the product is too small in size for hand sorting, then the rolls crusher setting should be opened. The product from the rolls crusher should discharge into a chute leading to a hopper ahead of the picking belt.

Screen undersize, minus 40-millimeter, will go directly to the hopper.

4.2 Hand Sorting of Waste

Sized material from the crushing and screening stages will be fed onto a flat, slow-moving, rubber conveyor belt by a pan feeder. The pan feeder is longer than the design normally used so as to result in only one layer of rock on the picking belt. The feeder is adjustable so that the feed rate may match the belt speed.

We have considered other forms of sorting such as the use of metal shaker conveyors but most have been eliminated due to anticipated high maintenance costs. A simple belt conveyor offers the best combination of low maintenance costs together with providing good hand sorting possibilities.

Our estimated specifications for the conveyor belt together with anticipated performance are as follows:

Length of belt	-	15 meters
Width of belt	-	0.75 meters (30 inches)
Speed of belt (adjustable)	-	5 meters per minute
Feed rate to belt	-	12 tons per hour or 200 kilograms per minute
Number of pickers	-	12
Rejects per picker	-	15 kilograms per minute
Total rejects	-	180 kilograms per minute

Thus if an ore had a five percent fibre content when fed to the belt, it would theoretically be upgraded to a 50 percent concentrate if the above performance estimates are achieved.

It is difficult to forecast precise estimates for the performance of this type of operation but two factors are of crucial importance:

4. DETAILS OF CONCENTRATION METHOD (Cont'd)

4.2 Crushing and Screening (cont'd)

- (1) One is the size at which hand sorting can best be done. This can only be determined by actual field testing and trying variations of the crusher settings and screen openings.
- (11) The second factor, not unrelated to the first, is the amount of material that an individual picker can take off the belt per unit of time. However, if the rate of 15 kilograms per minute that we have used cannot be maintained, then it is simply a matter of increasing the number of pickers. The belt that we have specified can accommodate additional pickers.

Each picker can be expected to cover an interval of one-half meter and would be located on alternate sides of the belt. Therefore, on a 15-meter belt and allowing for space requirements at both ends, as many as 20 pickers could be assigned to the belt. The most proficient pickers should be located at the end of the conveyor after easier picking has been done by the least proficient.

The conveyor belt should occupy an elevated position possibly on a mound of crushed rock. This would allow the pickers to drop the waste into chutes that would distribute the waste rock regularly along the belt. It could then be easily picked up and transported away by a front end loader once a day or as necessary.

Periodically, the mine may deliver material that is completely barren and if the belt conveyor is fitted with a reversible tail gate, then this material can be discharged directly on to a waste dump.

4.3 Concentrate Storage

All material not picked off the belt is to be considered as fibre concentrate. One of the principal reasons for rejecting waste in the hand sorting operation, rather than picking out the fibre, is that all short fibre, not easily hand sorted, will be recovered in the concentrate.

The discharge from the sorting belt should fall on to a 300-millimeter belt conveyor with troughed, rather than flat idlers. This belt would be inclined and lead up into a storage bin. The concentrate bin would be situated so as to allow sufficient height for truck loading through a manually operated gate.

The bin should have live capacity for at least 25 tons which is expected to be the amount of concentrate produced per day. If trucks will not be available on a daily basis, then additional storage is required.

5. EQUIPMENT REQUIREMENTS FOR CONCENTRATION

We have listed below the major items of equipment that would be required for the method of concentration that we have proposed.

We have not listed any items of equipment as required by the mining operation but such items as rock drills, an air compressor and a small front end loader will certainly be necessary if the required rate of production is to be attained.

Total connected horsepower for the equipment listed is approximately 50 H.P. or 37 kilowatts. To allow for the additional power drawn during start-up of the motors, we have specified a 60-kilowatt motor generator set. All motors are assumed to be 3-Phase, 60 Cycle, 550 Volt, although this can be changed if this is non-standard in Bolivia and spare parts difficult to procure.

5. EQUIPMENT REQUIREMENTS FOR CONCENTRATION (Cont'd)

<u>Flowsheet Number</u>	<u>Item</u>	<u>Description</u>
1	Grizzly	Mounted over chute leading to jaw. Steel or concrete construction. Rails spaced 150 millimeters apart. Size 2m x 2m. Can be field erected.
2	Jaw Crusher	Denver 250mm x 400mm. Type H. Forced feed. 25 H.P. 1,200 rpm motor. Drives and sheaves included.
3	Vibrating Screen	Denver Dillon type - single deck, heavy duty. 0.7m x 2m size. 2 H.P., 1,700 rpm motor. Drive included, 40mm steel cloth square openings.
4	Rolls Crusher	Denver, 50cm diameter x 30cm wide rolls. Setting 25mm. 2 motors required (10 H.P. - 900 rpm and 3 H.P. - 900 rpm). Motors included.
5	Hopper and Feeder	Syntron type F33 pan feeder, 60cm wide x 100cm. Adjustable rate. Power consumption 3.3 amps at 550 v. Includes liner and all electrical controls. Hopper - self mounted - field erected over feeder.
6	Picking Conveyor	Rubber conveyor 75cm x 15m long with 3 H.P. variable speed drive. Belt speed - 5 mpm. Includes flat belt, frame, idlers, etc. Flap gate - erected in field. Wooden trestle support.
7	Inclined Conveyor	Product belt conveyor to storage bin. 18m long with 7m elevation, 30cm wide belt with troughed rollers. Includes idlers, pulleys, belt, frame, 3 H.P. motor and drive.
8	Concentrate Bin	Steel construction, cone bottom, field erected, 6mm plate, 3.5m diameter x 5m height, with steel legs, 4m above ground. Manual gate.

5. EQUIPMENT REQUIREMENTS FOR CONCENTRATION (Cont'd)

<u>Flowsheet Number</u>	<u>Item</u>	<u>Description</u>
8	Transfer Chutes	Field erected - wood with steel liners, all steel construction preferred.
	Motor Generator	Diesel operated. 60Kw capacity with 90 H.P. diesel motor. Includes all controls and meters.
	Miscellaneous	Electric wires, plates, screening, rods, etc.

TOTAL ESTIMATED COST: \$75,000

6. PERSONNEL REQUIREMENTS

Because of the simplicity of the concentrating method proposed, a minimum of skilled labour is required with only the foreman fitting into this category. All other labour can be readily trained on site.

Personnel requirements are estimated as follows:

Grizzly workers	2
Picking belt workers	12
Foreman	<u>1</u>
Total per shift:	15

For two shifts per day, each of six to eight hours duration, twice this number would be required for a total of 30. Depending on the number of labourers required for picking waste, this number could be decreased or increased. Not included is any administrative or clerical personnel which would be required if a mining and concentrating operation is established at Alto Chapare.

The foreman would be expected to do much of any necessary maintenance and lubrication, as well as attending to the operation of the diesel generator.

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APPENDIX B

PROCESS AND ASSOCIATED EQUIPMENT SPECIFICATIONS

APPENDIX "B"LIST OF SPECIFICATIONS

<u>TITLE</u>	<u>SERIAL NO.</u>
Rotex Screener	1
Hy-Drive Gyrotory Screener and Rotary Aspirator	2
Impact Crusher	3
Paddle Trommel	4
Standard Grader	5
Dryer	6
Vibrating Feeders	7
Rotary Valves	8
Scale	9
Vertical Screw Packer	10
Live Bottom Bin	11
Cyclones	12
Bucket Elevators	13
Belt Conveyors	14
Bag Collector	15
Fabrication and Installation of Aspiration and Dust Control Ductwork	16
Fabrication and Installation of Chutework	17



DEVIS - SPECIFICATION

ROTEX SCREENER

REV. 0 PAGE 1

CONTRAT CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE SERIAL	1

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC



DEVIS - SPECIFICATION

ROTEX SCREENER

REV. 0 PAGE 2

CONTRAT CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE SERIAL	1

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS - SPECIFICATION

REV. 0 PAGE 3

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 1

ROTEX SCREENER

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

ROTEX SCREENER

REV. 0 PAGE 4

CONTRAT /CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE /SERIAL 1

2. SCOPE

2.1 Work Included

Supply of one (1) single deck Rotex screener, complete with motor, motor starter, stop and start push-button and drive.

Electrical wiring from motor to motor starter and push-button.

2.2 Work Excluded

Electrical wiring for site connections
Anchor bolts and chutework
Installation



DEVIS - SPECIFICATION

ROTEX SCREENER

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 1

3. MATERIALS

3.1 Rotex Screener

Equal to standard locker Rotex screener Model 81; 10 ft. (3048 mm) long by 5 ft. (1524 mm) wide; single deck; floor mounted; 3" (76.2 mm) diameter of circular motion; 228 rpm; dust cover; 10" (254 mm) diameter feed opening located at equal distance from each side of the screen box, and close to the back end of the screen box; fitted with a rubber sleeve for 10" (254 mm) diameter feed pipe; 10" (254 mm) diameter discharge openings for unders, fitted with a rubber sleeve for 10" (254 mm) diameter pipe; an extended front end discharge arrangement for lifting free asbestos from overs; complete with drive including V-Belts, sheaves, guard, motor box, motor base, and 3 HP horizontal standard motor 380/3/50 (total enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-button fixed to the screener frame.

The extended front end discharge arrangement for lifting free asbestos from overs is to be made of a 1/16" (1.6 mm) round, staggered opening steel perforated plate, 5 ft. (1524 mm) wide by 2 ft. 609.6 mm) long, with its top flush with the top of the front screen and having the same slope as that of the screens; and a steel pan, with its front end being in the same vertical plan as the front end of the perforated plate, to collect unders below the lifting hood.

3.2 Screens

Four (4) wooden screen frames 5'-0" (1524 mm) by 5'-0" (1524 mm), complete with backing wire, rubber balls for cleaning the wire cloth, and taper, transversal bars to facilitate bouncing of rubber balls.

Two (2) frames must be fitted with 24 square mesh steel wire cloth, 0.0135" (0.343 mm) diameter of wire, 0.0282" (0.72 mm) width of opening; and two spare without any top wire cloth.

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DEVIS - SPECIFICATION

ROTEX SCREENER

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4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS - SPECIFICATION

ROTEX SCREENER

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CONTRAT CONTRACT	3161
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SERIE SERIAL	1

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



DEVIS -- SPECIFICATION

HY-DRIVE GYRATORY SCREENER
AND ROTARY ASPIRATOR

REV. 0 PAGE 1

CONTRAT / CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 2

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC

S

DEVIS - SPECIFICATION

**HY-DRIVE GYRATORY SCREENER
AND ROTARY ASPIRATOR**

REV. 0 PAGE 2

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 2

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.

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DEVIS - SPECIFICATION

HY-DRIVE GYRATORY SCREENER
AND ROTARY ASPIRATOR

REV. 0 PAGE 3

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE /SERIAL 2

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

HY-DRIVE GYRATORY SCREENER
AND ROTARY ASPIRATOR

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CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 2

2. SCOPE

2.1 Work included

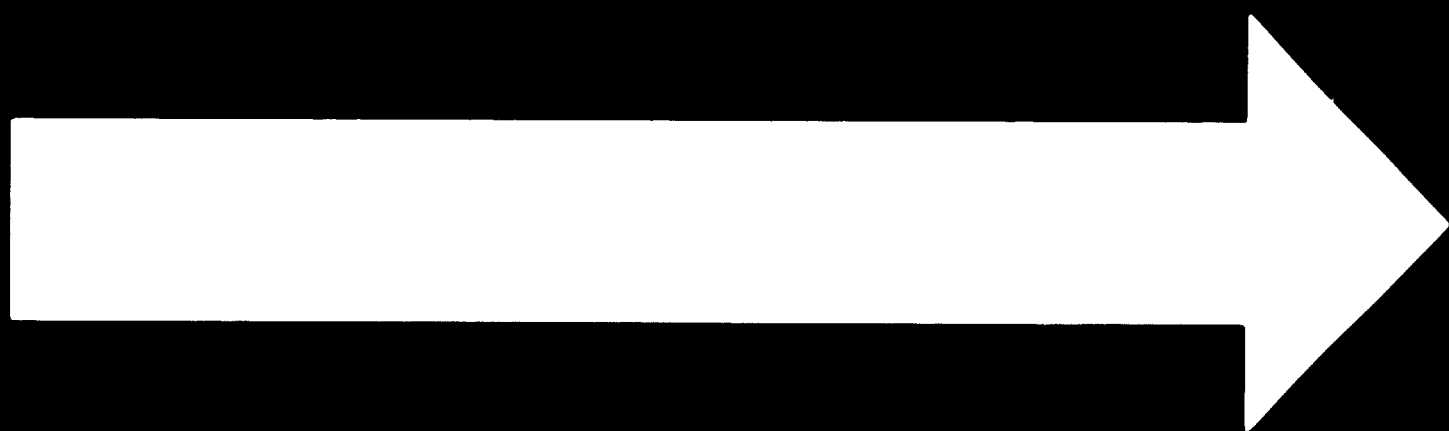
Supply of one (1) double deck hy-drive gyratory screener, fitted with one rotary aspirator, complete with motors, motor starters, stop and start push-buttons and drives.

Electrical wiring from motors to motor starters and push-buttons.

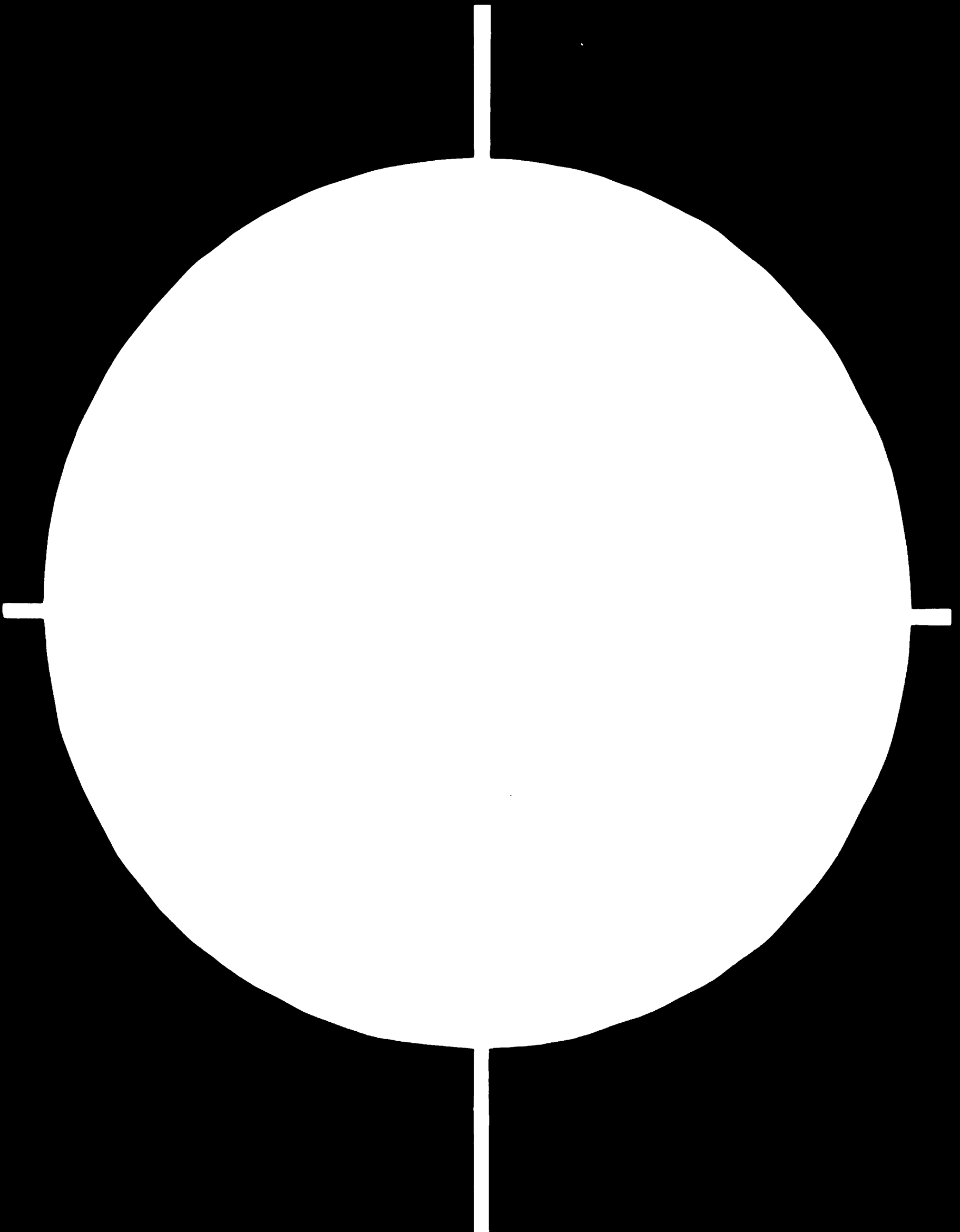
2.2 Work excluded

Electrical wiring for site connections.
Anchor bolts and chute work.
Installation.

B-561



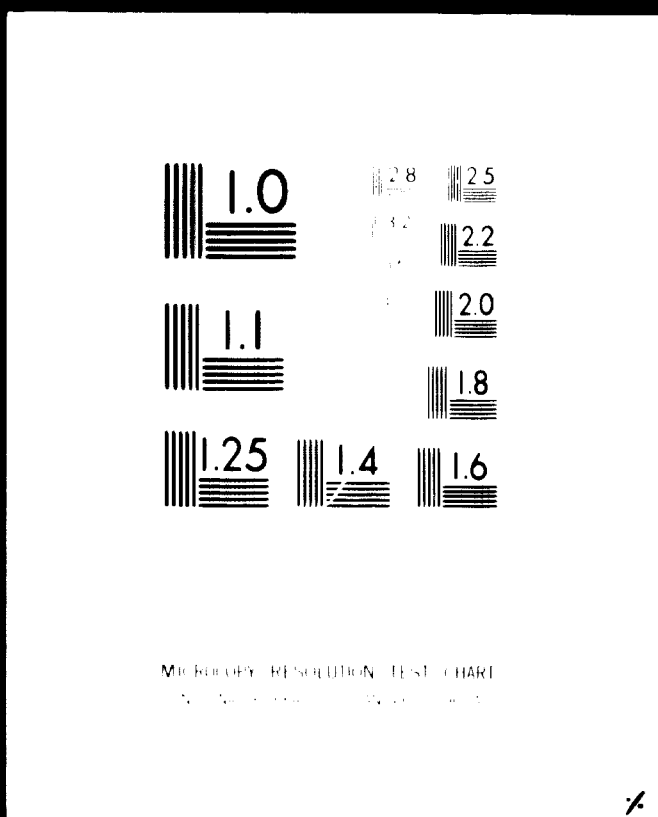
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DEVIS SPECIFICATION

HY-DRIVE GYRATORY SCREENER
AND ROTARY ASPIRATOR

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CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 2

3. MATERIALS

3.1 Hy-Drive Gyratory Screener

Hall design, 10 ft. (3048 mm) long by 5 ft. (1524 mm) wide, double deck, floor mounted, 4" (101.6 mm) stroke, 185.6 rpm, 7.2° slope; clamped dust cover; 24" (609.6 mm) diameter feed opening located at equal distance from each side of the screen box, and at 22" (558.8 mm) from back end of the screen box, having its center line in a vertical position, fitted with an outer, round rim to facilitate holding of transition canvas piece, and having its top at level; one round plate, below the feeding opening for spreading material; adjustable supporting rods for levelling the screen box; (254 mm) diameter unders, and middling discharge openings, having their center lines in a vertical position, fitted with an outer, round rim to facilitate holding of transition canvas pieces, having their bottoms at level and at 24" (609.6 mm) from floor; complete with V-Belt drive including screen box sheave, motor sheave and necessary V-Belts, motor base plate, 5 HP horizontal standard motor 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-button fixed to the screener frame.

3.2 Rotary Aspirator

Rotary aspirator, shaft mounted, 24" (609.6 mm) diameter by 5'-0" (1524 mm) long, covered with 1/16" (1.6 mm) round, staggered opening steel perforated plate, rotating horizontally at 48 rpm, in a sheet metal hopper, complete with V-Belt drive, located on right side, including torque arm speed reducer, rotary aspirator sheave, motor sheave and necessary V-Belts, expended metal drive guard, motor base plate, 1 HP horizontal standard motor 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-button fixed to the hopper.

Hopper dimensions 6'-1" (1854.2 mm) long by 2'-6" (762 mm) wide by 4'-3-1/2" (1308.1 mm) high; discharge opening 2'-0" (609.6 mm) by 1'-0" (304.8 mm), flanged with ten 9/16" (14.3 mm) holes; the taper sides reducing the dimensions of 6'-1" (1854.2 mm) to 2'-0" (609.6 mm) must be at 45°.



DEVIS - SPECIFICATION

HY-DRIVE GYRATORY SCREENER
AND ROTARY ASPIRATOR

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SUBDIVISION 02
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SERIE/SERIAL 2

3. MATERIALS (cont'd)

3.3 Screens

Ten (10) wooden screen frames 5'-0" (1524 mm) by 5'-0" (1524 mm), complete with backing wire, rubber balls for cleaning the perforated plate, and taper, transversal bars to facilitate bouncing of rubber balls.

Two (2) frames must be fitted with 3/8" (9.5 mm) round, staggered opening steel perforated plate; two (2) with 1/8" (3.2 mm) round, staggered opening steel perforated plate; two (2) with 1/16" (1.6 mm) round, staggered opening steel perforated plate; and four (4) spare without any top plate.

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HY-DRIVE GYRATORY SCREENER
AND ROTARY ASPIRATOR

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SERIE SERIAL	2

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS - SPECIFICATION

HY-DRIVE GYRATORY SCREENER
AND ROTARY ASPIRATOR

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SERIE SERIAL	2

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

S

DEVIS SPECIFICATION

IMPACT CRUSHER

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SUBDIVISION	02
SUJET SUBJECT	3700
SERIE SERIAL	3

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC



DEVIS - SPECIFICATION

REV. 0 PAGE 2

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 3

IMPACT CRUSHER

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS - SPECIFICATION

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CONTRAT CONTRACT 3161
SUBDIVISION 02
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SERIE SERIAL 3

IMPACT CRUSHER

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

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CONTRAT / CONTRACT 3161
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SERIE SERIAL 3

IMPACT CRUSHER

2. SCOPE

2.1 Work Included

Supply of one (1) impact crusher, complete with motor, motor starter, stop and start push-button, and drive, designed to crush 20 STPH (18.2 MTPH) of minus 1" (25.4 mm) crocidolite ore, containing some free fibres up to 3" (76.2 mm) in length.

Electrical wiring from motor to motor starter and push-button.

2.2 Work Excluded

Electrical wiring for site connections.
Steel platforms, anchor bolts and chutework.
Installation.



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IMPACT CRUSHER

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 3

3. MATERIALS

3.1 Impact Crusher

Equal to Hazemag APK-20, tip speed 4000-8000 fpm (1220-2440 mpm), complete with V-Belt drive, located on right side when looking from feed end, including impact crusher sheave, motor sheave and necessary V-Belts, expanded metal belt guard, motor base plate, 30 HP. Reeves variable speed motor drive 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B) to operate the impact crusher at the above specified tip speed, motor starter and stop and start push-button fixed to the crusher or the motor base plate.

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DEVIS - SPECIFICATION

IMPACT CRUSHER

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4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.

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DEVIS -- SPECIFICATION

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IMPACT CRUSHER

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



DEVIS - SPECIFICATION

PADDLE TROMMEL

REV. 0 PAGE 1

CONTRAT CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE SERIAL	4

EXPERIMENTAL PRODUCTION PLANT
FOR
ASBESTOS PROCESSING
COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC

S**DEVIS - SPECIFICATION**

REV. 0 PAGE 2

CONTRAT / CONTRACT	3161
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SERIE / SERIAL	4

PADDLE TROMMEL**1. GENERAL****1.1 Tests**

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.

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DEVIS - SPECIFICATION

REV. 0 PAGE 3

PADDLE TROMMEL

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 4

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

PADDLE TROMMEL

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CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 4

2. SCOPE

2.1 Work Included

Supply of one (1) paddle trommel, complete with motors, motor starters, stop and start push-buttons, and drives, for removing dust and small rock particles from crocidolite.

Electrical wiring from motors to motor starters and push-buttons.

2.2 Work Excluded

Electrical wiring for site connections
Anchor bolts and chutework
Installation



DEVIS -- SPECIFICATION

PADDLE TROMMEL

REV. 0 PAGE 5

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 4

3. MATERIAL

3.1 Paddle Trommel

Equal to Forano 36" (914.4 mm) by 100" (2540 mm) paddle duster; right hand unit; aluminum clamped cover; 36" (914.4 mm) diameter horizontal trommel fitted with 20 square mesh steel wire cloth, 0.0135" (0.343 mm) diameter of wire, 0.0365" (0.93 mm) width of opening, and running at 20.4 rpm, containing a co-axially mounted counter rotating shaft carrying 44 paddle arms, and running at 174 rpm; flanged feed chute; two flanged 8" (203.2 mm) by 12" (304.8 mm) suction outlets located at the top of the unit and in its centerline; one flanged 14-1/4" (362 mm) by 15" (381 mm) cleaned fibre discharge opening located on bottom of unit and at the opposite end of feed chute; one screw conveyor for removing small rock particles; one flanged 13" (330.2 mm) by 13" (330.2 mm) screw conveyor discharge opening located at the same end as the feed chute; complete with drive including V-Belts, sheaves, guards, motor bases, horizontal standard motors 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starters and stop and start push-buttons fixed to the paddle trommel frame.



DEVIS - SPECIFICATION

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SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 4

PADDLE TROMEL

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.

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DEVIS - SPECIFICATION

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CONTRAT CONTRACT 3161
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SERIE SERIAL 4

PADDLE TROMMEL

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

S

DEVIS - SPECIFICATION

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CONTRAT CONTRACT	3161
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SUJET SUBJECT	3700
SERIE SERIAL	5

STANDARD GRADER

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC



DEVIS - SPECIFICATION

REV. 0 PAGE 2

CONTRAT / CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE / SERIAL 5

STANDARD GRADER

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS - SPECIFICATION

STANDARD GRADER

REV. 0 PAGE 3

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 5

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS -- SPECIFICATION

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SERIE/SERIAL		5

STANDARD GRADER

2. SCOPE

2.1 Work Included

Supply of one (1) standard grader, complete with motor, motor starter, stop and start push-button, and drive, for grading crocidolite.

Electrical wiring from motor to motor starter and push-button.

2.2 Work Excluded

Electrical wiring for site connections
Anchor bolts and chutework
Installation



DEVIS - SPECIFICATION

REV. 0 PAGE 5

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 5

STANDARD GRADER

3. MATERIALS

3.1 Standard Grader

Equal to Lynn MacLeod 26" (660.4 mm) by 96" (2438.4 mm) standard grader; hinged side panels; 26" (660.4 mm) diameter horizontal trommel fitted with 1/2" (12.7 mm) round, staggered steel perforated plate; fourteen offset double-arm beaters, angled in such a way as to cause movement of the fibre from inlet to outlet of the trommel, mounted on a rotating shaft running at 500 rpm; 6" (153.4 mm) by 11" (279.4 mm) feed chute located on top of unit and at 3-1/2" (88.9 mm) to the right of center line of unit when looking from the feed end; one flanged 36" (914.4 mm) by 10" (254 mm) undersize discharge chute located in the center of the unit; one 8" (203.2 mm) by 14" (355.6 mm) oversize discharge chute located at the opposite end of feed chute and in the centerline of the unit; complete with drive including V-Belts, sheaves, guard, motor base, horizontal standard motor 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-buttons fixed to the standard grader frame.

3.2 Additional Trommel

One (1) 26" (660.4 mm) diameter horizontal trommel fitted with 3/16" (4.8 mm) round, staggered steel perforated plate.



DEVIS - SPECIFICATION

STANDARD GRADER

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CONTRAT-CONTRACT 3161
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SERIE SERIAL 5

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS -- SPECIFICATION

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CONTRAT CONTRACT 3161
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SERIE SERIAL 5

STANDARD GRADER

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

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DEVIS -- SPECIFICATION

DRYER

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CONTRAT CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE SERIAL	6

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

**SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC**

S**DEVIS - SPECIFICATION**

REV. 0 PAGE 2

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 6**DRYER****1. GENERAL****1.1 Tests**

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.

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DEVIS - SPECIFICATION

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 6

DRYER

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.

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DEVIS - SPECIFICATION

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DRYER

2. SCOPE

2.1 Work Included

Supply of one (1) parallel flow rotary dryer capable of drying to a moisture content of 2%, 2.5 MTPH of wet crocidolite ore containing 10% of moisture, complete with oil burner, combustion chamber, cyclone and rotary valve, exhauster, ducts, motors, motor starters, stop and start push-buttons and drives.

Electrical wiring from motors to motor starters and push-buttons.

2.2 Work Excluded

Electrical wiring for site connections
Anchor bolts and chutework
Installation



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SERIE/SERIAL 6

DRYER

3. MATERIALS

3.1 Dryer

One parallel flow rotary dryer 48" (1219.2 mm) diameter by 20'-0" (6096 mm) long, complete with feed head, discharge head with hinged type discharge airlock, drive including V-Belts, sheaves, guards, reducer, gears, motor base, horizontal standard motor 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-button fixed to the motor base.

3.2 Combustion Chamber

The combustion chamber shall operate at a proper temperature to burn Bolivian fuel oil (see page 9 for specifications) without any smoke. The design air temperature entering the dryer shall be 1200°F (649°C). However, the unit shall be capable of continuous operation of 1400°F (760°C). Ore discharge must not exceed 270°F (132°C).

Burner with manual controls, refractory materials, block insulation materials, etc. shall be provided as part of the combustion chamber.

3.3 Cyclone and Rotary Airlock

High efficiency cyclone and high temperature rotary airlock, complete with motor 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-button fixed to the cyclone.

3.4 Exhauster

Dryer exhaust fan shall be designed for outlet gas temperature of 270°F (132°C). Fan shall be installed on clean air side of cyclone. Complete with motor base, motor 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-button fixed to the fan on the motor base.



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DRYER

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3. MATERIALS (cont'd)

3.5 Ducts

From discharge head to cyclone; from cyclone to exhaust fan; from fan to atmosphere, extending 25 ft. (7620 mm) above fan outlet. Ducts shall be made in mild steel and designed for velocity of 4000 fpm (1219 mpm) from discharge head to cyclone, 3000 fpm (914 mpm) from cyclone to exhaust fan and 4000 fpm (1219 mpm) from exhaust fan to atmosphere.



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DRYER

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.

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SERIE SERIAL 6

DRYER

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



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SERIE/SERIAL 6

DRYER

SPECIFICATION FOR
BOLIVIAN FUEL OIL

<u>ANALYSIS</u>	<u>VALUE</u>	<u>UNITY</u>	<u>TEST METHOD</u>
Gravity	40-45	deg. API	D-287
Viscosity SUS/100°F (Max)	35		D-88
Flash point	90	°F	D-93
Total Sulphur (Max)	1.0	% weight	D-1266
Pour point	30	°F	D-97
Corrosion, copper strip (Max)	No. 1		D-130
Carbon residue (Max)	0.5	% weight	D-189
Ashes	Trace		D-482
Color	Coffee/Black		
Distillation at 564 mm. Hg			
10%	292 Min.	°F	
at 760 mm. Hg			
10%	310 Min.		
Heat value	19,500	BTU/lb	



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SERIE SERIAL	7

VIBRATING FEEDERS

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC

S

DEVIS - SPECIFICATION

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
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VIBRATING FEEDERS

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.

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VIBRATING FEEDERS

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

VIBRATING FEEDERS

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2. SCOPE

2.1 Work Included

Supply of two (2) vibrating feeders to feed crocidolite ore, 60 lb./ft.³ (964 kilo/cu.m), at a feed rate of up to 20 MTPH, complete with manual controls and local start and stop push-buttons.

Electrical wiring from feeders to controls which will be installed approximately 4 meters away from feeders.

2.2 Work Excluded

Electrical wiring for site connections
Installation



DEVIS -- SPECIFICATION

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CONTRAT / CONTRACT 3161
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SUJET SUBJECT 3700
SERIE / SERIAL 7

VIBRATING FEEDERS

3. MATERIALS

3.1 Vibrating Feeders

Two (2) vibrating feeders equal to Rex Carrier, Model FS (Drive B), 18" (457.2 mm) by 7'-0" (2133.6 mm) curved bottom removable wear resistant through, supported mounting, 6° down grade slope, complete with manual controls 0-20 MTPH, and start and stop push-buttons. Available power supply 380/3/50.

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DEVIS - SPECIFICATION

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SUJET SUBJECT 3700
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VIBRATING FEEDERS

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.

S

DEVIS - SPECIFICATION

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 7

VIBRATING FEEDERS

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

S

DEVIS - SPECIFICATION

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ROTARY VALVES

**CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 8**

**EXPERIMENTAL PRODUCTION PLANT
FOR
ASBESTOS PROCESSING
COCHABAMBA, BOLIVIA**

Made by:

Approved by:

Date:

**SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC**



DEVIS - SPECIFICATION

ROTARY VALVES

REV. 0 PAGE 2

CONTRAT CONTRACT	3161
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1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS - SPECIFICATION

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 8

ROTARY VALVES

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

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CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 8

ROTARY VALVES

2. SCOPE

2.1 Work Included

Supply of two (2) rotary valves, complete with motors, motor starters, stop and start push-buttons, and drives to accommodate a uniform flow of crocidolite at 150°F (65.5°C).

1/8" (3.2 mm) thick rubber gaskets for inlet and outlet connections.

Electrical wiring from motors to motor starters and push-buttons.

2.2 Work Excluded

Electrical wiring for site connections

Chutework

Installation

S**DEVIS - SPECIFICATION**

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ROTARY VALVES**3. MATERIAL****3.1 Rotary Valves**

Airtight to maintain a negative pressure in the cyclones; 18" (457.2 mm) by 18" (457.2 mm) inlet; 9-1/2" (241.3 mm) by 18" (457.2 mm) outlet; 2'-7" (787.4 mm) high; 24" (609.6 mm) diameter six vane rubber tipped rotor, rotating at constant speed (approximately 21 rpm), hexagonal shaft; complete with drive including V-Belts, sheaves, guard, reducer, motor base, 2 HP motor 380/3/50 (totally enclosed, fan cooled equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-button fixed to the motor supporting plate.

The rotary valve will be attached to a cyclone having a flanged 15" (381 mm) diameter discharge opening.

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ROTARY VALVES

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS - SPECIFICATION

ROTARY VALVES

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5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 9

SCALE

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

**SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC**

S**DEVIS - SPECIFICATION****SCALE**

REV. 0 PAGE 2

CONTRAT CONTRACT	3161
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SUJET SUBJECT	3700
SERIE SERIAL	9

1. GENERAL**1.1 Tests**

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.

S

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 9

SCALE

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

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CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 9

SCALE

2. SCOPE

2.1 Work Included

Supply of one (1) 1000 lb. (455 Kilo) capacity scale for weighing 110 lb. (50 Kilo) bags containing crocidolite.

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DEVIS - SPECIFICATION

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SUJET/SUBJECT 3700
SERIE/SERIAL 9

SCALE

3. MATERIAL

Equivalent to Toledo portable beam scale Model 4180, graduated in Kilos, sensitivity of 0.5 Kilo, mounted on wheels, complete with a set of weights.



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SERIE SERIAL 9

SCALE

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS - SPECIFICATION

SCALE

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5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



DEVIS - SPECIFICATION

VERTICAL SCREW PACKER

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EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC



DEVIS - SPECIFICATION

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CONTRAT / CONTRACT 3161
SUBDIVISION 02
SUJET / SUBJECT 3700
SERIE / SERIAL 10

VERTICAL SCREW PACKER

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS - SPECIFICATION

VERTICAL SCREW PACKER

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SERIE / SERIAL 10

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.

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**CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 10**

VERTICAL SCREW PACKER

2. SCOPE

2.1 Work Included

Supply of one (1) vertical screw packer, complete with motor, motor starter, stop and start push-button, and drive to bag crocidolite up to 3" (76.2 mm) long in jute bags 26" - 30" (660.4 - 762 mm) wide by 36" - 48" (914.4 - 1219.2 mm) long.

Electrical wiring from motor to motor starter and push-button.

2.2 Work Excluded

**Electrical wiring for site connections
Anchor bolts, fibre bin and chutework
Installation**



DEVIS - SPECIFICATION

VERTICAL SCREW PACKER

REV. 0 PAGE 5

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SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 10

3. MATERIAL

3.1 Vertical Screw Packer

A vertical screw packer generally composed as follows: 16" (406.4 mm) diameter screw; 16-1/2" (419.1 mm) outside diameter tube long enough to accommodate 48" (1219.2 mm) long jute bag; up and down moveable table on which bags are set; counter weights to give to the moveable table an ascending force; hand brake to control the downward motion of the moveable table and by then to increase the pressure inside bags; hooks, with counter weights or other devices to hold bags in position along the tube; complete with frame, drive including reducer, motor 380/3/50, (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop and start push-button fixed to the frame of the packer.



DEVIS - SPECIFICATION

VERTICAL SCREW PACKER

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4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS - SPECIFICATION

VERTICAL SCREW PACKER

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5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



DEVIS - SPECIFICATION

LIVE BOTTOM BIN

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CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 11

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC

S

DEVIS - SPECIFICATION

LIVE BOTTOM BIN

REV. 0 PAGE 2
CONTRAT /CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE /SERIAL 11

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves the right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work, supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.



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LIVE BOTTOM BIN

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1. GENERAL (cont'd)

1.6 Guarantee

Provide a two year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

LIVE BOTTOM BIN

REV. 0 PAGE 4

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 11

2. SCOPE

2.1 Work included

Supply of one live bottom bin and one screw conveyor, each complete with motors, motor starters, stop and start pushbuttons and drives designed for handling of loose asbestos fibre with a maximum densit" of 15 lbs. per cu. ft. See sketch on page 12.

Electrical wiring from motor to motor starter and pushbutton.

2.2 Work excluded

Electric wiring for site connections, anchor bolts, walls of the bin and installation.



DEVIS - SPECIFICATION

LIVE BOTTOM BIN

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CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 11

3. MATERIAL

The following mechanical drive, structure and sheet metal work are part of this Specification, which describes one live bottom unit.

3.1 Screws

Four special lengths, 16 inch diameter, sectional flight conveyor screws, two lengths right hand, two lengths left hand, each 11 ft. 6 in. long over flights 1/4 in. thick, with additional bare pipe at discharge end with flights varying from half to full pitch over the full length. Three bolt connections at feed end, two bolt connections at discharge end, complete with couplings, bolts and nuts. Welding of flights to the steel pipe shall be continuous and on both sides to form one unit. All welded joints shall be ground smooth.

3.2 Shafts

Four end shafts, with a minimum diameter of 3 inches, made of cold drawn round steel, jig drilled to ensure perfect fit with screws.

Four drive shafts with a minimum diameter of 3 inches, made of cold drawn round steel, jig drilled to ensure perfect fit with screws, with cut keyways and fitted keys. Shafts shall be smooth, free from blemishes and protected against corrosion with a suitable compound.

3.3 Bearings

Eight self-aligning double row roller bearings in flanged blocks.

Housing shall be made of rugged construction with large grease reservoirs and shall include effective seals to retain lubricant and exclude foreign matter. For grease lubrication, grease valves to be furnished to permit greasing during operation.

3.4 Trough end seals

Trough end felt seals shall be provided between the trough end plates and the bearings to prevent dust, moisture, or dirt contaminating the product handled.



DEVIS - SPECIFICATION

LIVE BOTTOM BIN

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SERIE SERIAL 11

3. MATERIAL (cont'd)

3.5 Drives

One high capacity V-belt drive consisting of two gray iron sheaves and V-belts. Sheaves shall be fitted with quick detachable bushing key-seated and set screws.

One helical gear reducer with high efficiency anti-friction bearings, oil and dust tight housing. Actual load not to exceed the thermal capacity of gear box.

One finished steel collar chain drive consisting of one cut steel sprocket, one semi-steel sprocket and one strand of roller chain and connecting links.

One chain tightener with plain shaft and collars.

One cut steel sprocket.

Four cut steel sprockets, one strand of roller chain with connecting links and tighteners.

Sprockets shall have tooth form thickness and profile conforming to standards.

3.6 Drive guards

Drive guards to be provided to meet prevailing industry standards and legal requirements.

3.7 Drive supports

Speed reducer and motor to be mounted on a table attached to the ground floor and sitting in front of the discharge end.

3.8 Trough

Trough shall be made of 1/4 in. steel plate and will have a rectangular opening at discharge end on its full length and flanged bolt connection to attach the angle-flanged, U-type, 16 in. diameter screw conveyor.



DEVIS - SPECIFICATION

LIVE BOTTOM BIN

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SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 11

3. MATERIAL (cont'd)

3.9 Trough end plates

Individual trough end plates shall be installed on every set of screws.

3.10 Trough discharge end cover

Trough discharge end cover shall be hinged and equipped with a safety locking device.

3.11 Trough support

The trough and live load of the bin (5 metric tons) shall be supported by a steel structure resting on the ground floor.

Screw Conveyor

The following mechanical sheet metal and drive are part of this Specification, which describes one screw conveyor.

3.12 Screw

Screw shall be helicoid or butt welded sectional flight type with flights welded to pipe creating strong one-piece construction. Standard, uniform pitch flighting to be made of 1/4 in. thick (approx.) steel plates.

3.13 Shafts, couplings

Shafts and couplings shall be made of cold drawn round steel, jig drilled to ensure perfect fit with screw.

Drive shaft shall have keyway corresponding to transmission specification.



DEVIS - SPECIFICATION

LIVE BOTTOM BIN

REV. 0 PAGE 8

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 11

3. GENERAL (cont'd)

3.14 Flanged blocks

Bearings shall be of self-aligning, spherical, double row roller type with suitable dynamic load and thrust capacity.

For grease lubrication, grease valves to be furnished to permit greasing during operation.

3.15 Trough end seals

Plate felt seals shall be bolted onto outside of trough end plates to prevent dust, moisture or dirt to contaminate product handled.

3.16 Trough end plates

Trough end plates shall be the outside pattern type, fabricated from 5/16 in. (min.) thick steel plate with bent flanges at top and bottom.

3.17 Trough

Trough shall be the angle-flanged, U-type with heavy fabricated end flanges, all securely jig-welded to ensure perfect alignment and tight connecting joints.

Required minimum thickness of trough is 3/16 in.

3.18 Discharge spout

Stub discharge spout shall be fitted to conveyor trough opening.

Fabricated from 3/16 in. thick (min.) steel plate, flanged for chute connection. Gate is not part of this Specification.

S**DEVIS - SPECIFICATION****LIVE BOTTOM BIN**

REV. 0 PAGE 9

CONTRAT/CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE/SERIAL	11

3. GENERAL (cont'd)**3.19 Drive**

Conveyor shall be supplied complete with drive which shall consist of shaft mounted reducer or screw conveyor drive, motor mount, V-belt drive, belt guard.

3.20 Motors

Motors shall be 380/3/50 totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B with individual starter and stop-start pushbutton fixed to the front of the drive table.

S

DEVIS - SPECIFICATION

LIVE BOTTOM BIN

REV. 0 PAGE 10

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE /SERIAL 11

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS - SPECIFICATION

LIVE BOTTOM BIN

REV. 0 PAGE 11

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 11

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea, transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

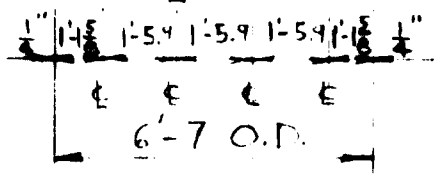
ROLLER BEARING
FLANGE BLOCKS

1 PITCH
1/2 PITCH

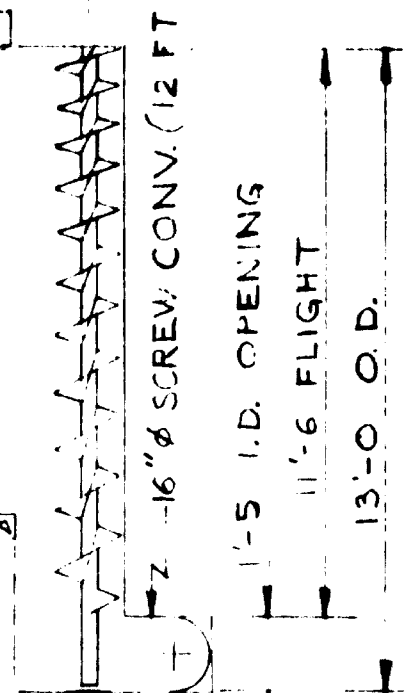
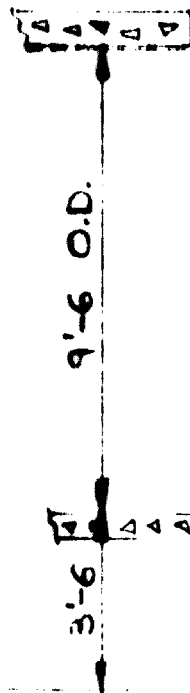
LEFT HAND
RIGHT HAND
LEFT HAND
RIGHT HAND

ROLLER BEARING
FLANGE BLOCKS

SPROCKETS
+ CHAINS
ROLLER BEARING
PILLOW BLOCKS
SPROCKETS



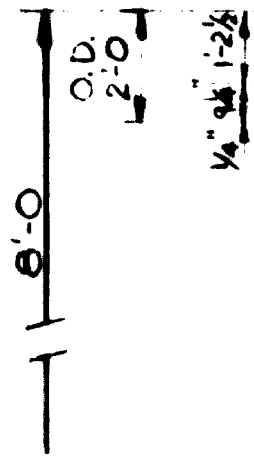
PLAN



12 FT LONG



SIDE



ELEVATION

--WALLS BY OTHERS

TROUGH SUPPORT

LIVE BOTTOM BIN
TROUGH & SCREWS

1/4" = 1'-0"



CYCLONES

DEVIS - SPECIFICATION

REV. 0 PAGE 1

CONTRAT / CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE SERIAL	12

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

**SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC**



DEVIS - SPECIFICATION

REV. 0 PAGE 2

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 12

1. GENERAL

1.1 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.2 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of the shop drawings for approval and (5) copies of approved drawings.

1.3 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.4 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of the shop drawings, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

REV. 0 PAGE 3

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 12

CYCLONES

2. SCOPE

2.1 Work Included

Supply of two (2) cyclones as per the attached sketch, complete with flanged inlet, outlet and bottom discharge.

Cyclone inlet will be connected to screener aspirating hood, handling dust and fibre laden air from asbestos ore processing system. The outlet will be connected to a bag type dust collector. The air temperature may vary from 35° to 110°F (1.7° to 43.3°C).

Cyclone shall be capable of handling 5500 cfm (155.7 cu.m) of air, having a fibre and dust concentration of approximately 1 lb. (454 gm) per 80 cfm (2.26 cu.m), with 95% efficiency and a maximum of 2.7" (68.6 mm) W.G. losses.

2.2 Work Excluded

Rotary valves
Supports and ductwork
Installation



DEVIS - SPECIFICATION

REV. 0 PAGE 4

CYCLONES

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 12

3. MATERIAL

3.1 Cyclones

Made of 10 GA. mild steel plate; 1/8" (3.2 mm) thick rubber gaskets between body flanges, and for inlet, outlet and bottom discharge connections.



DEVIS - SPECIFICATION

CYCLONES

REV. 0 PAGE 5

CONTRAT/CONTRACT	3161
SUBDIVISION	02
SUJET/SUBJECT	3700
SERIE/SERIAL	12

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.

S

DEVIS - SPECIFICATION

REV. 0 PAGE 6

CONTRAT / CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE / SERIAL 12

CYCLONES

5. ASSEMBLY FOR SHIPMENT

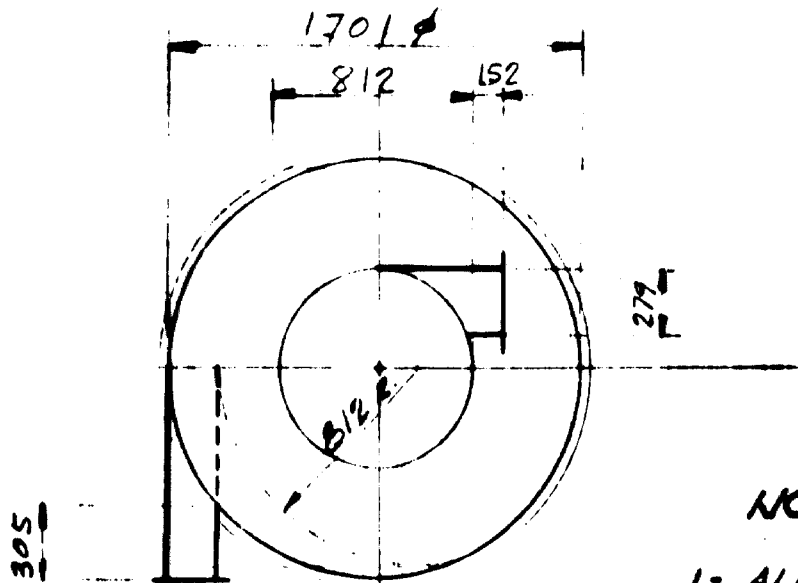
Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



**FEUILLE DE CALCUL
DESIGN SHEET**

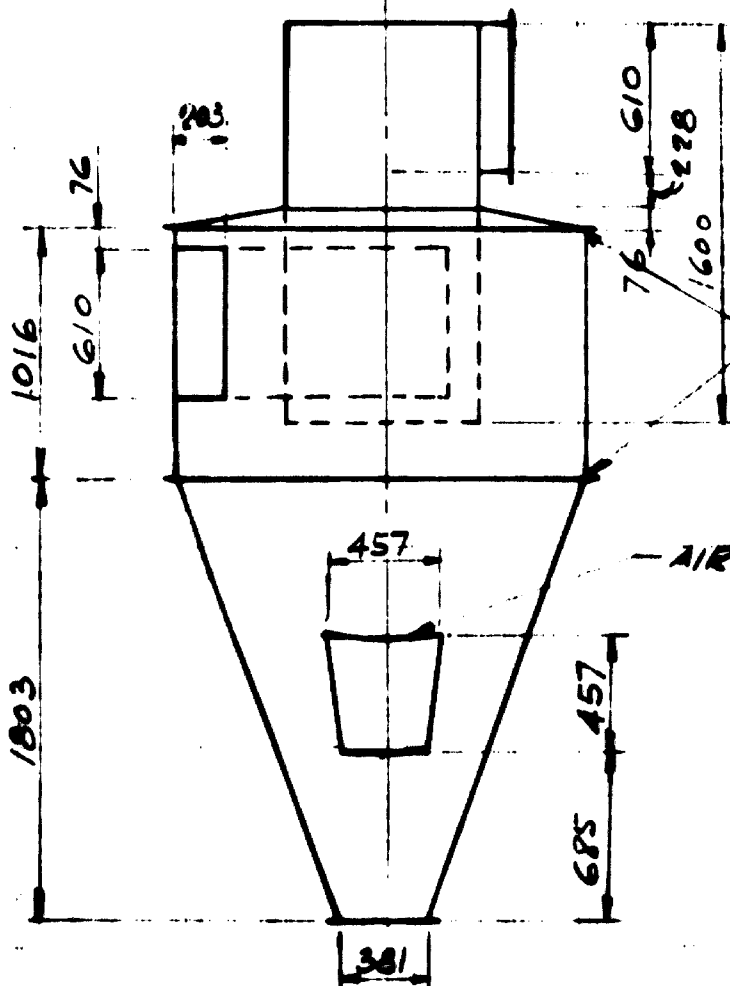
CLIENT	UNIDO BOLIVIA	CONTR.	3161	SUBDIV.	22	SUJ./SUJ.	3700	ACT.	02	LOC.	12
PROJ.	EXPERIMENTAL PRODUCTION PLANT FOR ASB R COCHABAMBA	PAIT/MADE	M.S	APPR.		DATE	30671	PAGE	7		

SUJET
SUBJECT **CYCLONE ASBESTOS HANDLING**



NOTE:

- 1- ALL DIMENSIONS ARE INSIDE DIMENSIONS & IN MILLIM.
- 2- SEE SPECIFICATIONS FOR OTHER INFORMATIONS



FLANGED PARTS

AIR TIGHT INSPECTION DOOR

S

DEVIS - SPECIFICATION

REV. 0 PAGE 1

CONTRAT CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE SERIAL	13

BUCKET ELEVATORS

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC

S

DEVIS - SPECIFICATION

REV. 0 PAGE 2

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE /SERIAL 13

BUCKET ELEVATORS

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.

S

DEVIS - SPECIFICATION

REV. 0 PAGE 3

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE /SERIAL 13

BUCKET ELEVATORS

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

REV. 0 PAGE 4

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 13

BUCKET ELEVATORS

2. SCOPE

2.1 Work Included

Supply of six (6) vertical bucket elevators, continuous enclosed type with single row buckets mounted on chain; capacity based on 75% of buckets theoretical capacity; 45° inlet at 4 ft. (1219 mm) maximum from bottom of elevator; complete with motor, motor starter, stop and start push-button and drive; as shown on drawing No. 3161-02-3700-3 of Surveyer, Nenniger & Chenevert Inc. This drawing indicates the numbers and the locations of elevators in mill buildings.

The required capacity, lift (distance from floor to bottom of discharge spout), type of discharge spout and material to be handled for each elevator are indicated below:

<u>Elevator No.</u>	<u>Capacity</u>	<u>Lift</u>	<u>Type of Discharge Spout</u>	<u>Material to be Handled</u>
1	2.5 MTPH	8.23 m (27'-0")	45°	Minus 1" (25.4 mm) dry ore, 60 lbs./cu.ft. (964 Kilo/cu.m)
2	20 MTPH	10.06 m (33'-0")	Vertical	Minus 1" (25.4 mm) dry ore, 60 lbs./cu.ft. (964 Kilo/cu.m)
3	20 MTPH	12.19 m (40'-0")	45°	Minus 1" (25.4 mm) dry ore, 60 lbs./cu.ft. (964 Kilo/cu.m)
4	1.5 MTPH	7.62 m (25'-0")	Vertical	Dry crocidolite fibre, 5 lbs./cu.ft. (80 Kilo/cu.m).
5	1.5 MTPH	9.75 m (32'-0")	Vertical	Dry crocidolite fibre, 5 lbs./cu.ft. (80 Kilo/cu.m)
6	4 MTPH	9.75 m (32'-0")	Vertical	Dry crocidolite fibre, 5 lbs./cu.ft. (80 Kilo/cu.m)

Electrical wiring from motors to motor starters and push-buttons

2.2 Work Excluded

Electrical wiring for site connections
Anchor bolts, structural steel supports and platforms
Installation



DEVIS - SPECIFICATION

REV. 0 PAGE 5

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 13

BUCKET ELEVATORS

3. MATERIAL

All material must be exchangeable from one elevator to another.

3.1 Casing

Inside dimensions 12" (304.8 mm) by 39" (990.6 mm). Shall be self-supporting, dust tight mild steel construction. Upper head section to be made of 12 GA. (min.) steel plate and split for easy access to head machinery. Shaft seals to be furnished. Lower head section to be made of 12 GA. (min.) steel plate and complete with inspection door. Boot section shall be of 10 GA. (min.) steel plate with removable front and rear access panels for cleanout. Dust seals shall be provided at all flange connections. Discharge spout to be furnished of 10 GA. (min.) steel plate.

3.2 Buckets

Shall be of the continuous medium front type of cast malleable iron or fabricated from 10 GA. (min.) steel plate.

3.3 Chains

Elevator chains as per manufacturer's standard.

3.4 Shafts

Shall be manufactured of cold drawn round steel.

3.5 Pillow Blocks

Shall be of high quality cast or ductile iron, split construction fitted with self-aligning, anti-friction, spherical roller bearings.

3.6 Sprockets

Head and boot sprockets as per manufacturer's standard.

S

DEVIS - SPECIFICATION

BUCKET ELEVATORS

REV. 0 PAGE 6

CONTRAT /CONTRACT 3161
SUDDIVISION 02
SUJET /SUBJECT 3700
SERIE /SERIAL 13

3. MATERIAL (cont'd)

3.7 Take-Ups

Shall be screw type operating on the boot of elevators and furnished with anti-friction bearings.

3.8 Drive

To include helical geared shaft mounted reducer with built-in backstop, coupling, V-belts, sheaves, guard and motor support.

3.9 Motor

300/3/50 totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B, complete with motor base.

**3.10 Motor Starter/
Push-Button**

As per manufacturer's recommendations, fixed to elevator casing.



DEVIS - SPECIFICATION

REV. 0 PAGE 7

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 13

BUCKET ELEVATORS

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS -- SPECIFICATION

REV. 0 PAGE 8

CONTRAT - CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 13

BUCKET ELEVATORS

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

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DEVIS - SPECIFICATION

REV. 0 PAGE 1

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 14

BELT CONVEYORS

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

**SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC**



DEVIS - SPECIFICATION

REV. 0 PAGE 2

CONTRAT / CONTRACT 3161
SUBDIVISION 02
SUJET / SUBJECT 3700
SERIE / SERIAL 14

BELT CONVEYORS

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply to the Purchaser three (3) copies of general arrangement drawings and wiring diagrams for approval.

Before commencing work, supply to the Purchaser five (5) copies of approved general arrangement drawings, and approved wiring diagrams.

1.4 Operating instructions

Upon completion of work supply to the Purchaser five (5) copies of operating and maintenance instructions for the various equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS - SPECIFICATION

BELT CONVEYORS

REV. 0 PAGE 3

CONTRAT CONTRACT 3161
SUDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 14

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply to the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, and weight and volume of crated equipment.



DEVIS - SPECIFICATION

REV. 0 PAGE 4

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 14

BELT CONVEYORS

2. SCOPE

2.1 Work Included

Supply of two (2) belt conveyors, complete with frames, supports, dust covers, motors, motor starters, stop and start push-buttons, and drives, as shown on drawing No. 3161-02-3700-3 of Surveyer, Nenniger & Chenevert Inc.

The required capacity, velocity and material to be handled for each conveyor is indicated below:

<u>Conveyor No.</u>	<u>Capacity</u>	<u>Velocity</u>	<u>Material to be Handled</u>
1	2.5 MTPH	30.5 mpm (100 fpm)	Minus 1" (25.4 mm) wet crocidolite ore 65 lbs./cu.ft. (1042 Kilo/cu.m).
2	2.5 MTPH	30.5 mpm (100 fpm)	Minus 1/4" (6.4 mm) dry tailings, 75 lbs./cu.ft. (1202 Kilo/cu.m).

Electrical wiring from motors to motor starters and push-buttons.

2.2 Work Excluded

Electrical wiring for site connections
Anchor bolts and chutework
Installation

S

DEVIS - SPECIFICATION

REV. 0 PAGE 5

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 14

BELT CONVEYORS

3. MATERIAL

Mechanical and electrical components must be exchangeable from one conveyor to the other, except belting.

3.1 Frames/Supports and Anchor Plates

In mild steel as per manufacturer's recommendations.

3.2 Dust Covers

In mild steel sheet with adjustable rubber strips on both sides of conveyors.

3.3 Conveyor Pulleys

Pulleys shall be of solid welded steel drum type crown face construction, closed ends with taper lock type hubs, 2" (50.8 mm) wider than belt.

3.4 Shafts

Shafts shall be of solid steel, manufactured from cold drawn shafting material.

3.5 Pillow Blocks

Shall be of high quality cast or ductile iron, split construction fitted with self-aligning, anti-friction spherical roller bearings.

3.6 Idlers

3.6.1 Troughing Idlers

20 degree 3 equal roll type troughing idlers shall be used. Rolls to be completely interchangeable.

3.6.2 Troughing Training Idlers

Shall be positive acting type. Pivotal mounting at center of idler frame shall be provided.

S**DEVIS - SPECIFICATION**

REV. 0 PAGE 6

CONTRACT	CONTRACT	3161
SUBDIVISION		02
SUJET	SUBJECT	3700
SERIE	SERIAL	14

BELT CONVEYORS**3. MATERIAL (cont'd)****3.6 Idlers (cont'd)****3.6.3 Return Idlers**

Shall be of single horizontal roll type carried in brackets arranged for suspension from conveyor frame.

3.6.4 Return Training Idlers

Shall be of single horizontal roll type. At the centre of idler frame pivotal mounting shall be provided.

3.7 Take-Ups

Manually adjustable screw take-ups shall be the protected open type equipped with self-aligning ball bearings. Positive bearing seals to retain lubricant and exclude foreign matter.

3.8 Belting

As per manufacturer's recommendations.

3.9 Drives

To include shaft mounted reducers, couplings, sheaves, V-belts, guards, and motor supports.

3.10 Motors

300/3/50 totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B, complete with motor bases.

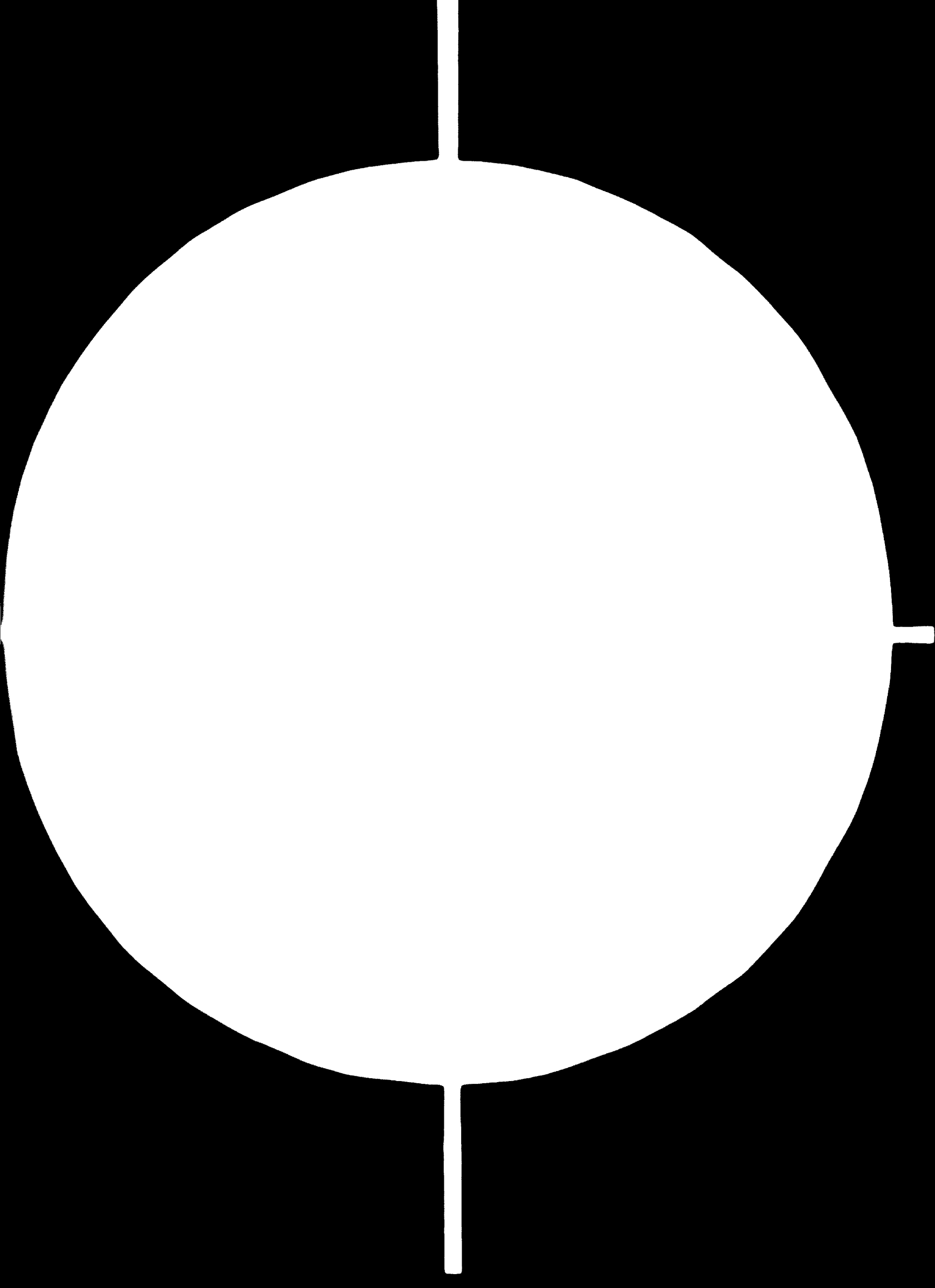
**3.11 Motor Starters/
Push-Buttons**

As per manufacturer's recommendations, fixed to the conveyor frames.

B-561



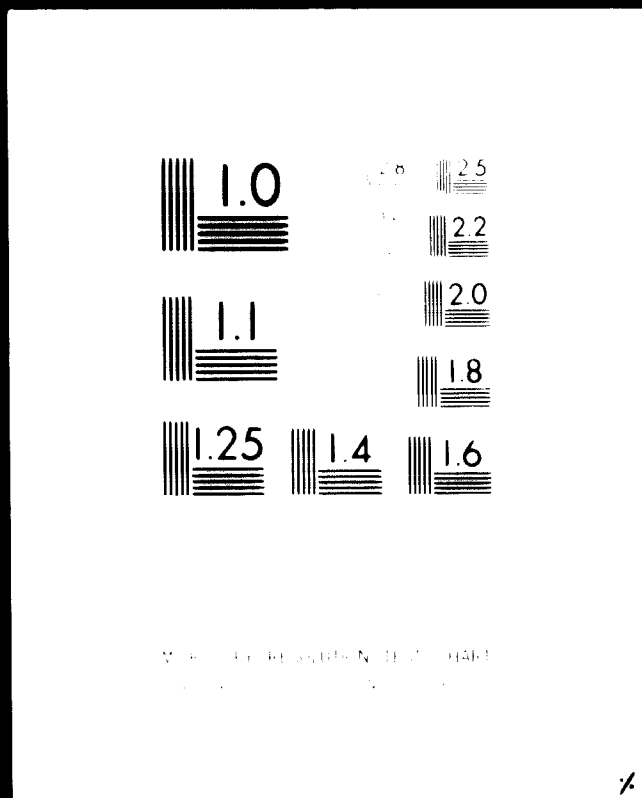
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5 OF 7

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DEVIS . SPECIFICATION

REV 0 PAGE 7

CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 14

BELT CONVEYORS

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS SPECIFICATION

REV 0 PAGE 8

CONTRACT CONTRACT 1161
SUBDIVISION 02
BUJET SUBJECT 3700
SERIE SERIAL 14

BELT CONVEYORS

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

S

DEVIS SPECIFICATION

BAG COLLECTOR

REV 0 PAGE 1

CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 13

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCLSSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

**SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC**



DEVIS SPECIFICATION

BAG COLLECTOR

REV 0 PAGE 2
CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 15

1. GENERAL

1.1 Intent of this Specification

It is not the intent of this Specification to completely specify in detail, the design and construction, nor the various components of all individual equipment and/or units.

For parts thus not specified, it is left to the Vendor to follow his own and/or generally accepted design and practice. Nonetheless, this Specification is intended to provide for all equipment complete in every respect, all capable of performing the service intended, and all conforming in every respect to high standards of design and workmanship.

1.2 Codes and Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, and codes applicable and in force at the time of fabrication.

1.3 Operation Manuals

Before delivery of equipment, supply Owner with three (3) copies of operation and maintenance manuals, which shall include:

- Detailed descriptive data on the equipment.
- Detailed parts lists for all the equipment along with Supplier's name and catalogue number.
- List of applicable drawings.
- Detailed instructions for assembling the equipment, including routine and operating instructions, routine items to check, recommended frequency of overhaul and full instructions for overhaul and re-assembly of equipment.
- Data sheets which include the Manufacturer's job numbers and serial and/or tag numbers of equipment.
- Lubrication schedule.
- Delivery time and re-assembly time on essential components.



DEVIS SPECIFICATION

REV 0 1 1 1
CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUJET 3700
SERIE SERIAL 15

BAG COLLECTOR

1.4 Spare Parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish to the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.

1.5 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship.

Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser or to the Owner.



DEVIS SPECIFICATION

DAG COLLECTOR

REV 0 P. 1 4
CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 15

2. SCOPE OF WORK

2.1 Work Included

The scope comprises the fabrication, testing, supply and delivery to Cochabamba, Bolivia of the Dust Collecting Equipment described hereinafter.

One (1) Dust Collector Unit for asbestos fiber.

Complete with exhaust fan, motors, motor starters, stop/start push buttons, solenoid valves, compressed air, manifold, automatic timers, stand legs, rotary airlock, internal access platforms, painting, etc.

Electrical wiring from motors to motor starters and push buttons.

2.2 Work Excluded

The following related items are not included in the work of this section and shall therefore be supplied by others:

**Foundations, including anchor bolts
Electrical wiring for site connections
Ventilation, piping and ductwork
Installation labour
External access facilities**



DEVIS SPECIFICATION

REV 0 PAGE 5

BAG COLLECTOR

CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 15

3. MATERIALS

3.1 General

The dust collector shall automatically filter dust laden air from asbestos ore working machines. The fan is to be on the clean air side of the bag collector.

3.2 Design Data

Altitude	2500 m above sea level 8,200 ft.
Air temperature	11°C to 28°C 52°F to 85°F
Volume at design temperature	707.9 m ³ /m. 25000 CFM
Dust concentration, estimated gr/cu.ft.	229 mg/m ³ 40 gr. C.F.
Particle size estimated from sub-micron to long fiber	
Pressure drop across bags not to exceed 101.6 mm water.	
Specific gravity of dust	0.5

Structurally, the dust collector shall withstand 355.6mm W. negative pressure and not develop leakage or deflect more than 6mm in any part or component. The gross air ratio shall not exceed 12 to 1.

3.3 General Requirements

3.3.1 Fabrication of Units

Each unit shall be field assembled with each joint on bolted seams sealed with soft felt strips covered and cemented on both sides with plastic cement. Housings shall be bolted construction. Components such as fan, rotary airlock and bag filters may be shipped separately, but if this is the case the Vendor shall state in his tender all the mounting facilities he has provided for the easy installation of same and shall also stipulate the scope of the required field installation labour.

3.3.2 Minimum Clearance Under Rotary Airlock

3 ft. 6 ins. (106.7 cm)

3.3.3 Motors

The fan motor shall be 100 HP, 1750 RPM, 380/3/50 mounted on a sliding base. The screw conveyor and rotary airlock motor shall be 380/3/50 TEFC as per Vendor's generally accepted design and practice.



DEVIS SPECIFICATION

BAG COLLECTOR

REV 0 PAGE 6

CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 18

3.4 Specifications for Dust Collector

3.4.1 Type

Wheabrator Ultra-Jet, Model 100 or equivalent

3.4.2 Bag Filter Section

- | | |
|-----------------------------------|---|
| a) Bag cleaning | High pressure reverse air jet |
| b) Max. normal air to cloth ratio | 12.0: 1 |
| c) Min. filter area sq.ft. | 196 m ² (2120 sq. ft.) |
| d) Bag type | Self cleaning abrasion resistant |
| e) Bag dimensions | 152 mm. dia. (6 ins.) |
| f) Bag clamps | Adjustable |
| g) Retainer material | Carbon steel |
| h) Housing construction | Bolted |
| i) Housing material | 14 GA/353 mm W.G. |
| j) Diaphragm valves | Standard |
| k) Solenoid valves | Electrical control enclosure to be dust and moisture tight |
| l) Internal catwalks | 4 |
| m) Filter access door | - hinged 1.2 m x 0.61 m |
| n) Other common features | Inlet plenums shall be provided with a removable wear plate for even gas distribution |

3.4.3 Storage Hopper Section

- | | |
|-------------------|-----------------------------|
| a) Hopper type | Trough 60° slope |
| b) Material | 12 GA min. |
| c) Inside surface | Smooth |
| d) Access | 457 mm x 762 mm (18" x 30") |

3.4.4 Rotary Airlock

- | | |
|---------|---|
| a) Size | 305 mm (12" dia.) |
| b) Type | The unit shall have 6 vanes, chain driven type complete with motor and gear reducer, replaceable neoprene or rubber seal strips and dust cover. |

3.4.5 Screw Conveyor

12" (30.5 cm) dia. properly designed to convey asbestos dust.

3.4.6 Controls

One solid state automatic timer and one manometer complete with fittings.

All electrical controls supplied with the unit including solenoid valves shall be in accordance with the regulations of the Bolivian electrical code.



BAG COLLECTOR

DEVIS SPECIFICATION

REV. 0 PAGE 7

CONTRAT CONTRACT	3161
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SERIE SERIAL	15

3.4 Specifications for Dust Collector (cont'd)

3.4.7 Fan Discharge

45° BAN CCW

3.5 Specifications for Exhaust Fan

The Vendor shall supply one (1) fan for the collector supplied.

Fan shall be of the industrial SISW type with anti-friction bearings, Class No. III, Arr. No. 1 for V-belt drive complete with motor, motor starter, stop/start push button, electrical wiring from motor to motor starter and push button, V-belt drive with guard, blast gate for volume control.

- a) Type and model Chicago, Type B or equivalent
- b) Air volume Same as collector
- c) Partial S.P. due to ductwork resistance 203 mm W. (8" W.G.)



DEVIS - SPECIFICATION

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CONTRAT / CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 15

BAG COLLECTOR

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of manufacturer's standard primer.



DEVIS - SPECIFICATION

BAG COLLECTOR

REV. 0 PAGE 9

CONTRAT CONTRACT 3161
SUDDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 15

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail or sea transportation as appropriate to the shipping route and shall be pre-assembled to the greatest possible extent.

All unpainted surfaces shall be protected against corrosion.

All components to be re-assembled shall be match marked.

S

DEVIS SPECIFICATION

FABRICATION AND INSTALLATION OF ASPIRATION
AND DUST CONTROL DUCTWORK

REV 0 PAGE 1

CONTRACT CONTRACT	1101
SUBDIVISION	02
HAJST SUBJECT	1700
DEWE SERIAL	10

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by: H. Siquiera

Approved by:

Date: July 1971.

SURVEYER, HENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC.



DEVIS SPECIFICATION

REV 0 PAGE 2

FABRICATION AND INSTALLATION OF ASPIRATION
AND DUST CONTROL DUCTWORK

CONTRACT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 16

1. GENERAL

1.1 Tests

Purchaser reserves the right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply and install materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication and installation.

1.3 Reference drawings

3 ft. Rotary Aspirator Hood

Ductwork Layout

Floorhoist

Ductwork Construction Details, Sheet 1 of 3

Ductwork Construction Details, Sheet 2 of 3

Ductwork Construction Details, Sheet 3 of 3

Rectangular Butterfly Damper

1.4 Cleaning up

Upon completion of the work, the Contractor shall remove all dirt, rubbish and debris, leaving the premises broom clean. At all times and during progress of the work, the Contractor shall keep his work free from accumulation of rubbish by cleaning up periodically.

1.5 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment hereinafter against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser or to the Owner.

1.6 Delivery

Supply to the Purchaser a firm delivery time from date of order, allowing two (2) weeks for approval of shop drawings.



DEVIS - SPECIFICATION

FABRICATION AND INSTALLATION OF ASPIRATION
AND DUST CONTROL DUCTWORK

REV. 0 PAGE 3

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 16

2. SCOPE OF WORK

2.1 Work Included

Fabricate, install and connect to equipment and balance complete dust control systems consisting of ducts, fittings, supports, blast gates, hoods, settling boxes, test openings and inspection doors.

It includes but is not limited to:

- The supply and installation of all ductwork as shown on drawings complete with blast gates, hoods, cleanouts, fittings, etc., as shown on drawings.
- The testing and the balancing of the systems.

2.2 Work Excluded

Fabrication and installation of bag collectors and fans.

Fabrication and installation of covers over vibrating screens.



DEVIS - SPECIFICATION

FABRICATION AND INSTALLATION OF ASPIRATION
AND DUST CONTROL DUCTWORK

REV. 0	PAGE 4
CONTRAT /CONTRACT	3161
SUBDIVISION	02
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SERIE /SERIAL	16

3. DUCTWORK

3.1 General

For dust control ductwork use hot rolled black steel ASTM A-415 or equal of thickness as specified on drawing No. 3161-02-3700-9.

The gauges referred to are U.S. standard gauges.

All duct and pipe dimensions shown on the drawings are inside dimensions unless otherwise specified.

3.2 Dust Control System

The dust control system is intended to exhaust air from screens, conveyors, and bins for the purpose of preventing dust from escaping into the working space and to prevent the pollution of the environs, and to process asbestos fiber by aspiration.

3.3 Construction

All ductwork elbows and fittings shall be airtight construction and smooth on the inside and outside. All burrs, rough spots, projections of welds or turned up edges shall be smoothed out.

Longitudinal pipe joints of all ducts shall be butted together and continuous seam welded on outside.

Girth joints of all ducts shall be butted together and continuous seam welded, except where flanged connections are called for easy removal. Flanges shall be fabricated as shown on detail drawing No. 3161-02-3700-9.

The flanged connections shall be filled with caulking putty before tightening the bolts.



DEVIS - SPECIFICATION

FABRICATION AND INSTALLATION OF ASPIRATION
AND DUST CONTROL DUCTWORK

REV. 0 PAGE 5
CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 16

3. DUCTWORK (cont'd)

3.3 Construction (cont'd)

Fabricate elbows in accordance with detail drawings. The centerline radius of elbows shall not be less than two times the diameter of elbow. Where the geometry does not allow such radius, 1.5 times the diameter is acceptable but only where absolutely necessary.

Branch pipes shall enter at the side or top of the main (never at the bottom).

Branch ducts shall be welded to the duct so that there is no projection into the main.

Branch entries shall enter at 45° or 30°. Angles greater than 45° shall never be used. Two branches entering opposite sides of tapered entry shall be staggered with at least two diameters of the larger duct separating them. Two branches shall not be directly opposed.

Blast gates shall be as per drawing No. 3161-02-3700-10 or equal and flanged. The blast gates shall be mounted in the duct as close to the entry branch in top vertical position, or top 45° inclination.

Pitot tube test openings shall be provided where necessary for balancing the system.

3.4 Supports

All ducts shall be rigidly supported. Supports shall be designed to support the pipes when they are filled with material.



DEVIS -- SPECIFICATION

FABRICATION AND INSTALLATION OF ASPIRATION
AND DUST CONTROL DUCTWORK

REV. 0 PAGE 6

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 16

4. PAINTING

Paint parts made of black sheet steel on the outside only with a shop coat of primer. Clean surfaces before painting.



DEVIS -- SPECIFICATION

REV. 0 PAGE 7

CONTRAT / CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE / SERIAL 16

FABRICATION AND INSTALLATION OF ASPIRATION
AND DUST CONTROL DUCTWORK

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



DEVIS - SPECIFICATION

REV. 0 PAGE 1

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 17

FABRICATION AND INSTALLATION
OF CHUTEWORK

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Date:

Approved by:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC.



DEVIS - SPECIFICATION

REV. 0 PAGE 2

FABRICATION AND INSTALLATION
OF CHUTEWORK

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 17

1. GENERAL

1.1 Codes and Regulations

Supply and install materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication and installation.

1.2 Drawings

1.2.1 Reference drawings

General Layout	3161-02-3700-4
Tailboard for Fibre Screen - Oversize Discharge	3161-02-3700-9
Splitter and By-pass - Construction Details	3161-02-3700-16

1.2.2 Shop drawings

Before commencing work, supply the Purchaser with three (3) copies of the shop drawings for approval and five (5) copies of approved drawings.

1.3 Cleaning-up

On completion of the work, the Contractor shall remove all dirt, rubbish and debris, leaving the premises broom clean. At all times, and during progress of the work, the Contractor shall keep his work free from accumulation of rubbish by cleaning up periodically.

1.4 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.5 Time Schedule

Supply Purchaser with a firm time schedule from date of order, allowing two weeks for approval of shop drawings.



DEVIS - SPECIFICATION

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CONTRAT / CONTRACT 3161
SUBDIVISION 02
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SERIE / SERIAL 17

**FABRICATION AND INSTALLATION
OF CHUTEWORK**

2. SCOPE

2.1 Work included

Design, fabricate and install chutework in the mill, consisting of chutes, tailboards, by-passes, splitter, transition pieces, inspection doors and supports.



DEVIS - SPECIFICATION

REV. 0 PAGE 4

FABRICATION AND INSTALLATION
OF CHUTEWORK

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 17

3. CHUTEWORK

3.1 Steel

Use hot rolled black sheet steel, ASTM A-415 or equal.

3.2 Construction

All chute work will be welded construction and smooth on the inside and outside. All burrs, rough spots, projections of welds or turned up edges shall be smoothed out.

Valley angles shall be at least 45° in rock circuit, and at least 55° in fibre circuit.

All chutes must be square or rectangular, except the feed spout of rock screen RS-1 which shall be round with an inside diameter of 20" (508 mm), and the chutes for middlings and unders of rock screen RS-1 and for feed and unders of fibre screen FS-1 which shall be round with an inside diameter of 10" (254 mm).

3.3 Material thickness

Unless otherwise specified on the reference drawings, the material thickness will be:

3/16" (4.76 mm) for chute work in rock circuit

1/8" (3.18 mm) for chute work in fibre circuit

3.4 Supports

All sloped chute runs longer than 8'-0" (2.44 mm) shall be supported by means of rod hangers hung from I-beams or ceiling as determined by building construction. These rods shall be welded to chute connection flanges.

All vertical chutes to be supported from adjacent columns or floors by means of steel angles welded to chute connection flanges. Support spacing for vertical chutes should never exceed 12'-0" (3.66 mm).



DEVIS - SPECIFICATION

FABRICATION AND INSTALLATION
OF CHUTEWORK

REV. 0 PAGE 5

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 17

4. PAINTING

Paint all chutework on the outside only with one coat of primer. Clean surface before painting.

20

APPENDIX C

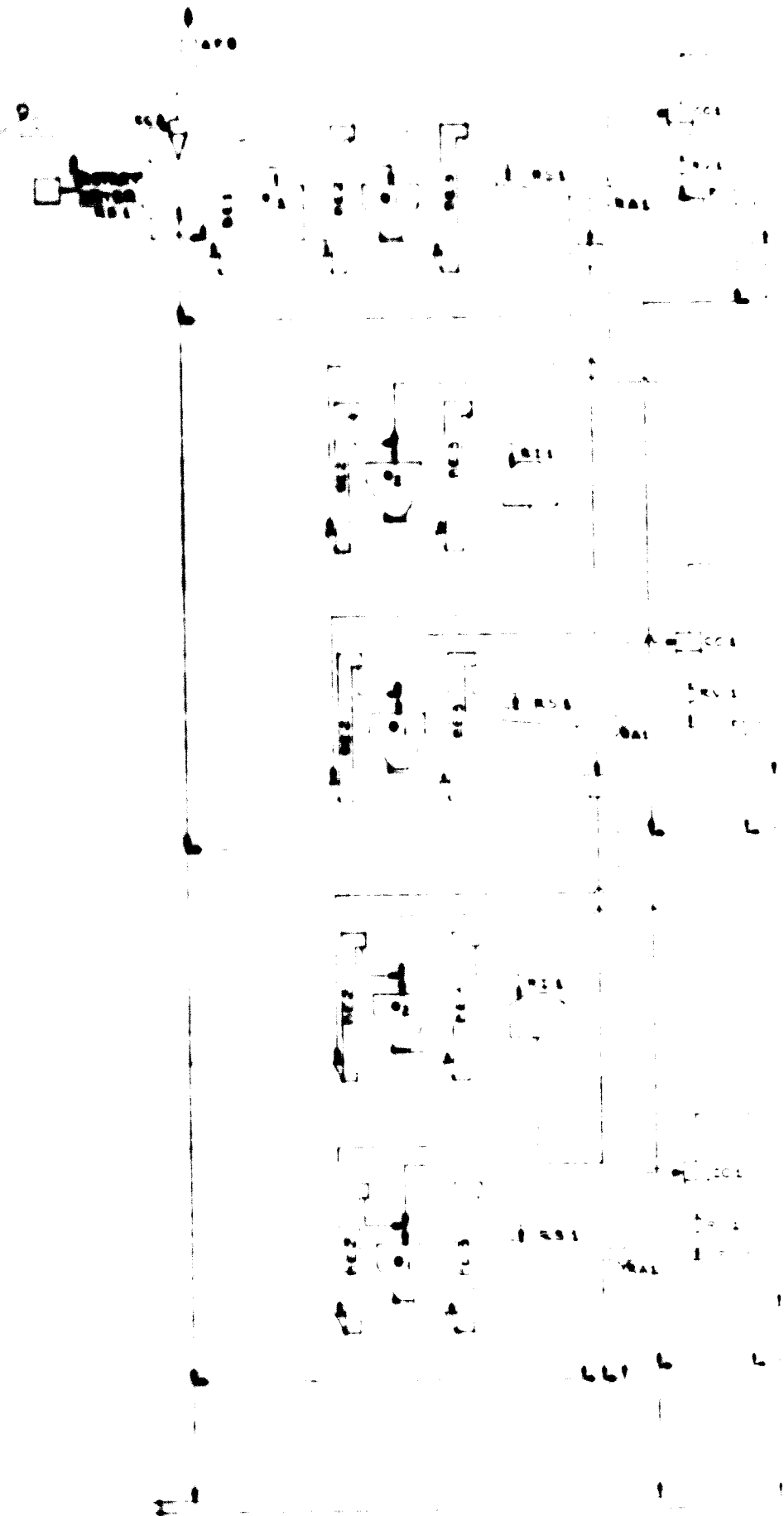
GENERAL ARRANGEMENT AND DETAIL DRAWINGS

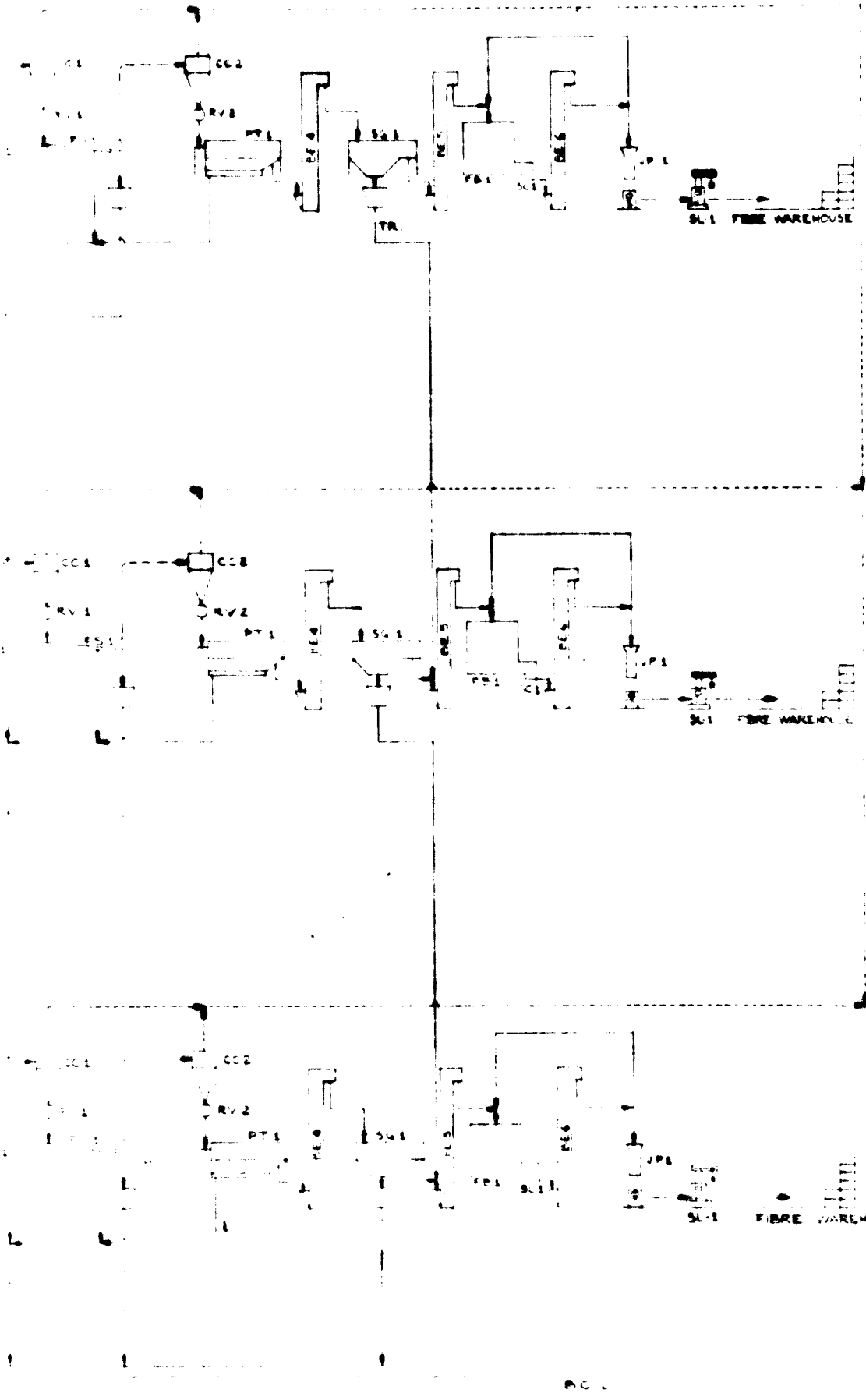
APPENDIX "C"**LIST OF DRAWINGS**

<u>NO.</u>	<u>TITLE</u>
3161-02-3700-1	Flowsheet
3161-02-3700-2	Daily Schedule
3161-02-3700-3	Site Plan
3161-02-3700-4	General Layout
3161-02-3700-5	Core and Quality Control Laboratory - General Layout
3161-02-3700-6	General Layout - Dust Control
3161-02-3700-7	Power Distribution
3161-02-3700-8	5 ft. Rotary Aspirator Hood - Construction Details
3161-02-3700-9	Dust Control Ductwork Construction Details Sheet 1 of 3
3161-02-3700-10	Dust Control Ductwork Construction Details Sheet 2 of 3
3161-02-3700-11	Dust Control Ductwork Construction Details Sheet 3 of 3
3161-02-3700-12	Rectangular Butterfly Damper Construction Details





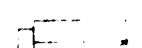
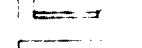
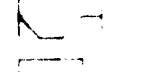

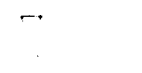
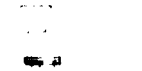
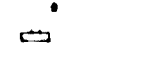
NET ONE FIVE 001

SECTION 1





LEGEND

-  CYCLONE
-  BUCKET ELEVATOR
-  IMPACTOR
-  ORE BIN
-  ROCK SCREENER
-  FIBER SCREENER
-  PADDLE TRANSFER
-  STANDARD GRADER
-  FIBER BIN
-  PACKER
-  CONTAINER
-  SCALE

SECTION 2

TAILINGS

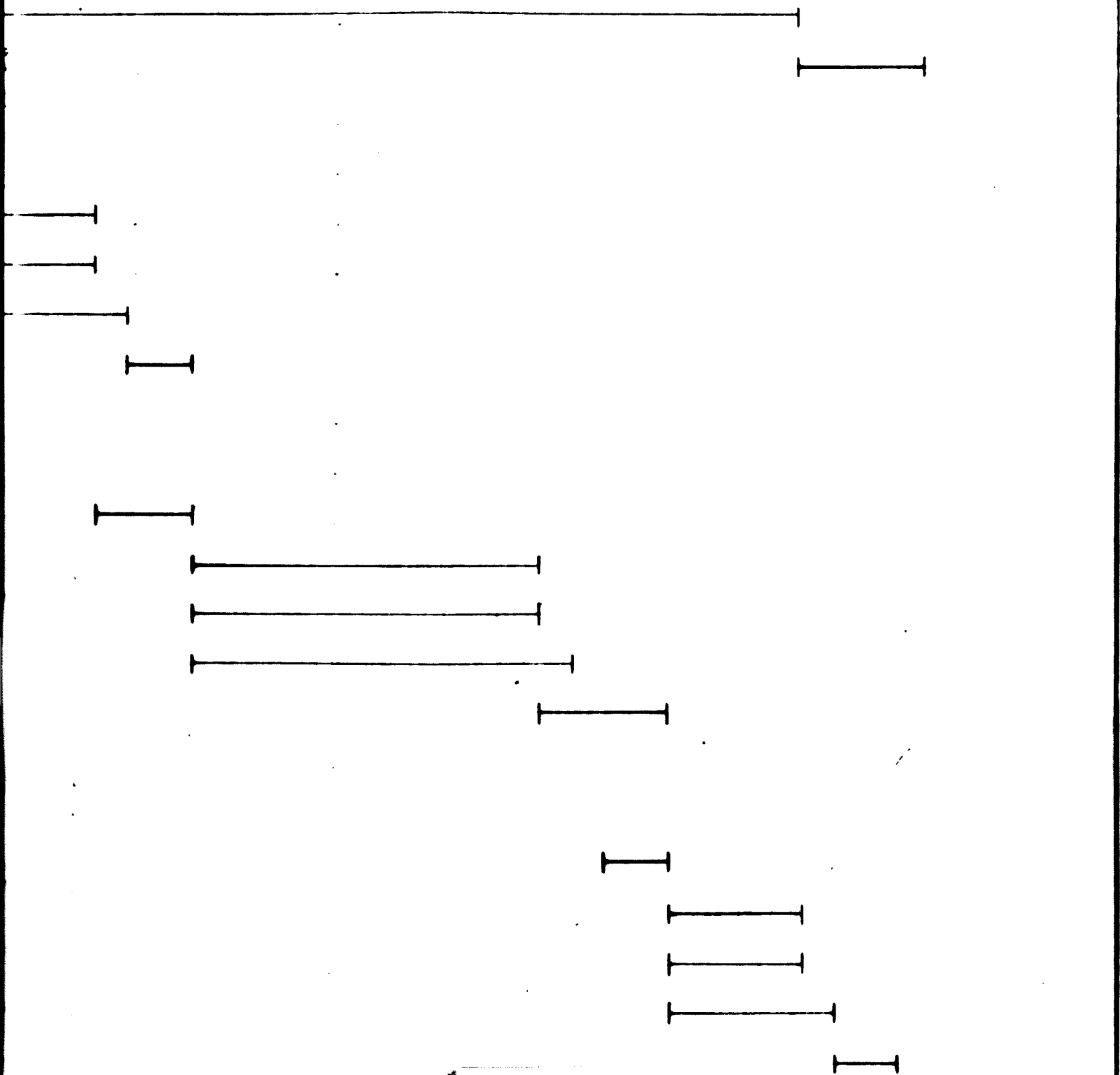
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			0	1
WET ORE	- DRYING	6 - 15	-----	
DRY ORE	- HANDLING	1 - 00		
GROUP 3	- ROCK SCREENING	0 - 45	-----	
-----//-----	- FIBRE TREATMENT	0 - 45	-----	
-----//-----	- FIBRE MIXING	1 - 00	-----	
-----//-----	- FIBRE BAGGING	0 - 30	-----	
GROUP 4	- ROCK IMPACTING	0 - 45	-----	
-----//-----	- ROCK SCREENING	2 - 45	-----	
-----//-----	- FIBRE TREATMENT	2 - 45	-----	
-----//-----	- FIBRE MIXING	3 - 00	-----	
-----//-----	- FIBRE BAGGING	1 - 00	-----	
GROUP 5	- ROCK IMPACTING	0 - 30	-----	
-----//-----	- ROCK SCENING	1 - 00	-----	
-----//-----	- FIBRE TREATMENT	1 - 00	-----	
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-----//-----	- FIBRE BAGGING	0 - 30	-----	

SECTION 1




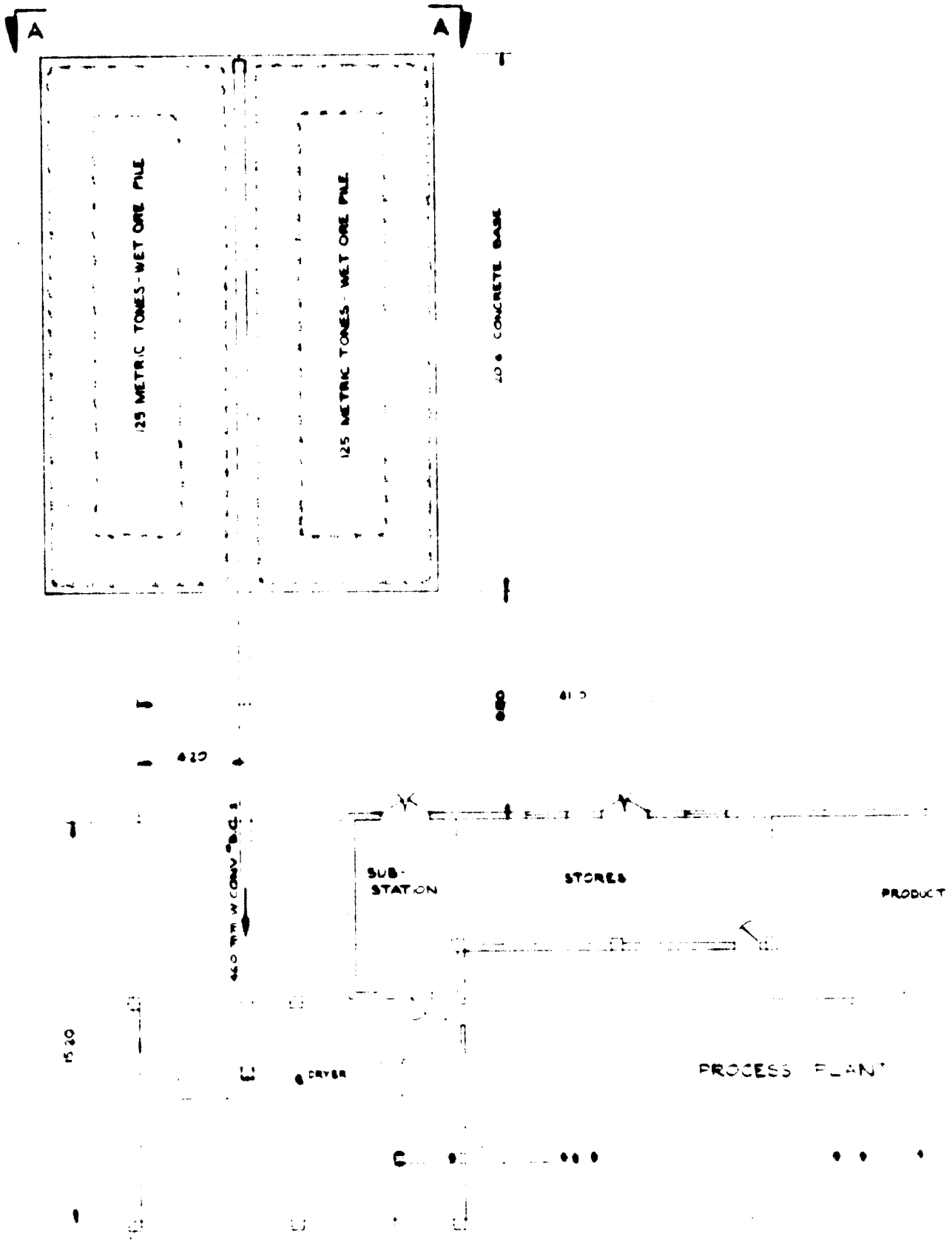
SCHEDULE

1 2 3 4 5 6 7 8 HRS



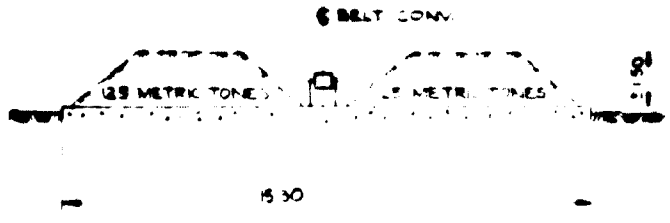
SECTION 2

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	DAILY SCHEDULE	N° 3161	REV. 02	SET. H. M. 3700	2	N° 0

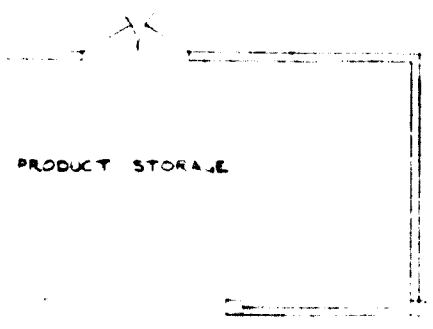


SECTION 1

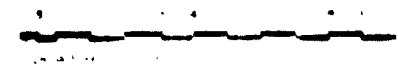
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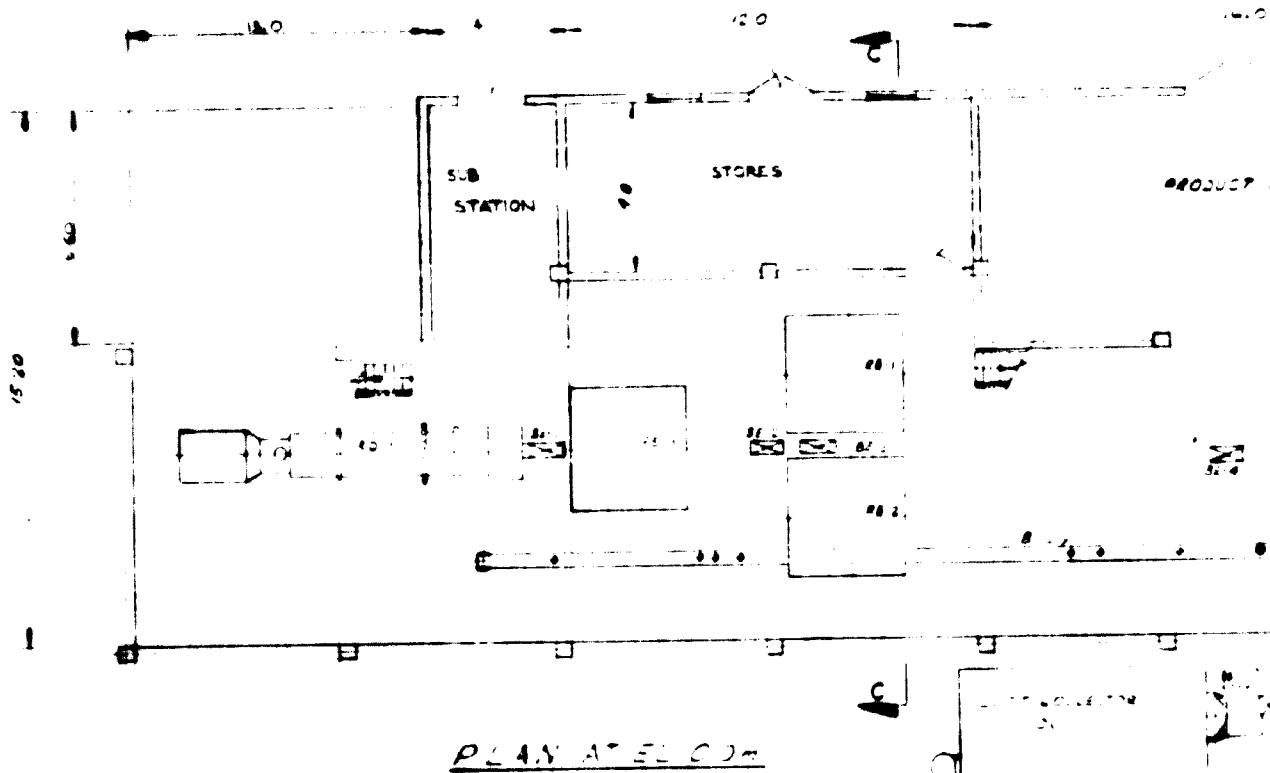
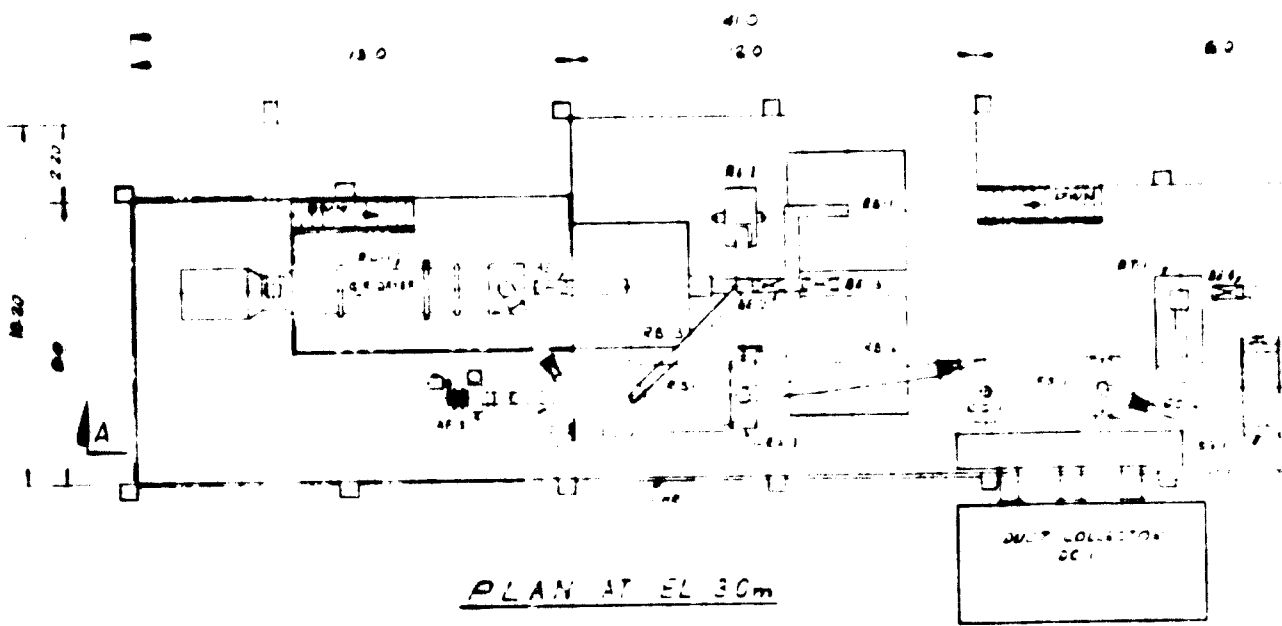


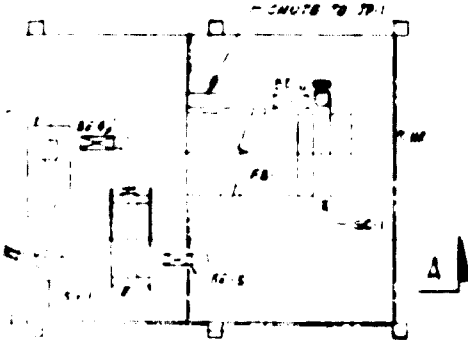
ELEVATION A-A



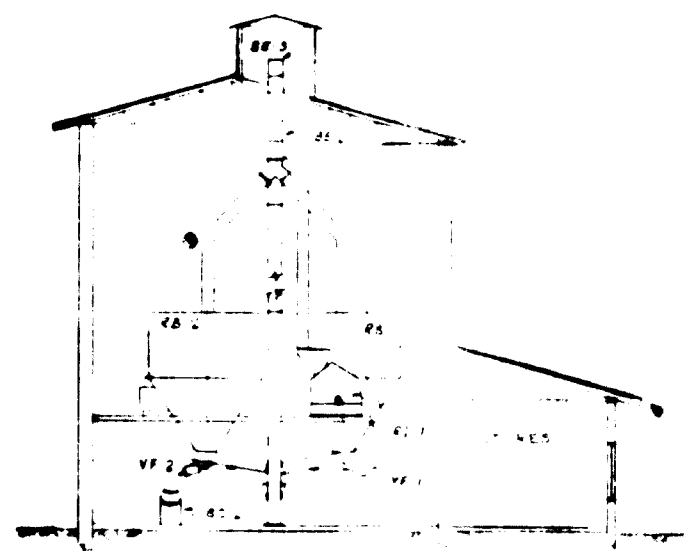
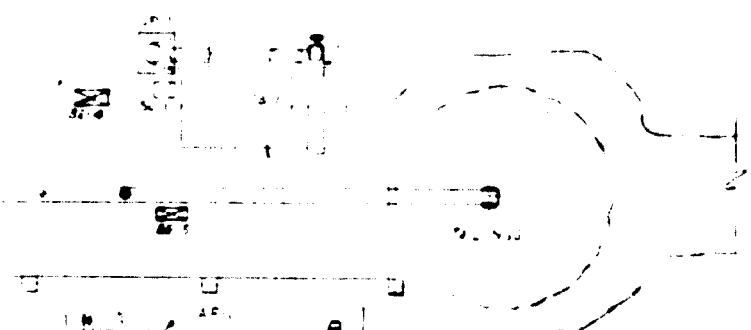
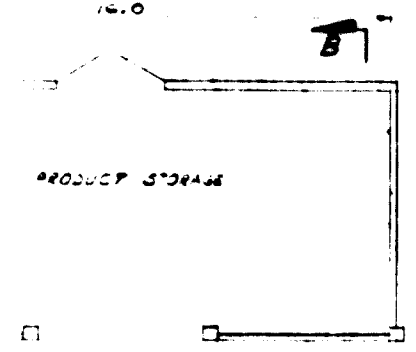
SECTION 2



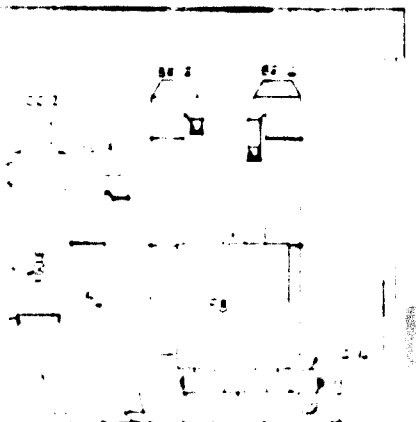




SECTION B-B



SECTION C-C

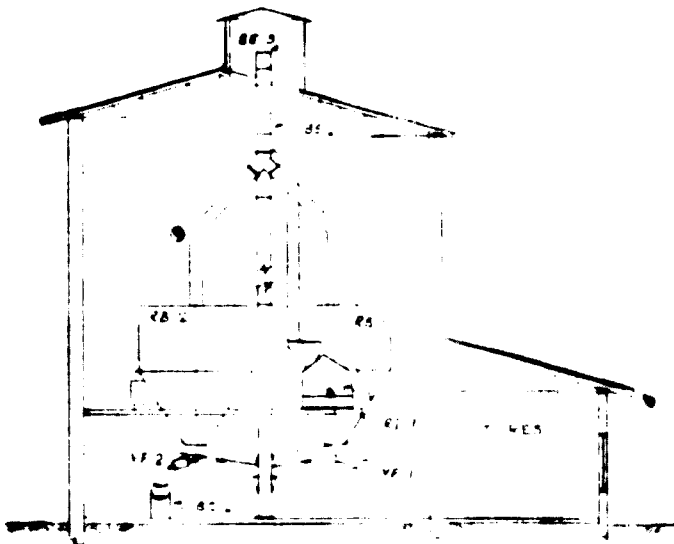


SECTION 2





SECTION B-B



SECTION C-C

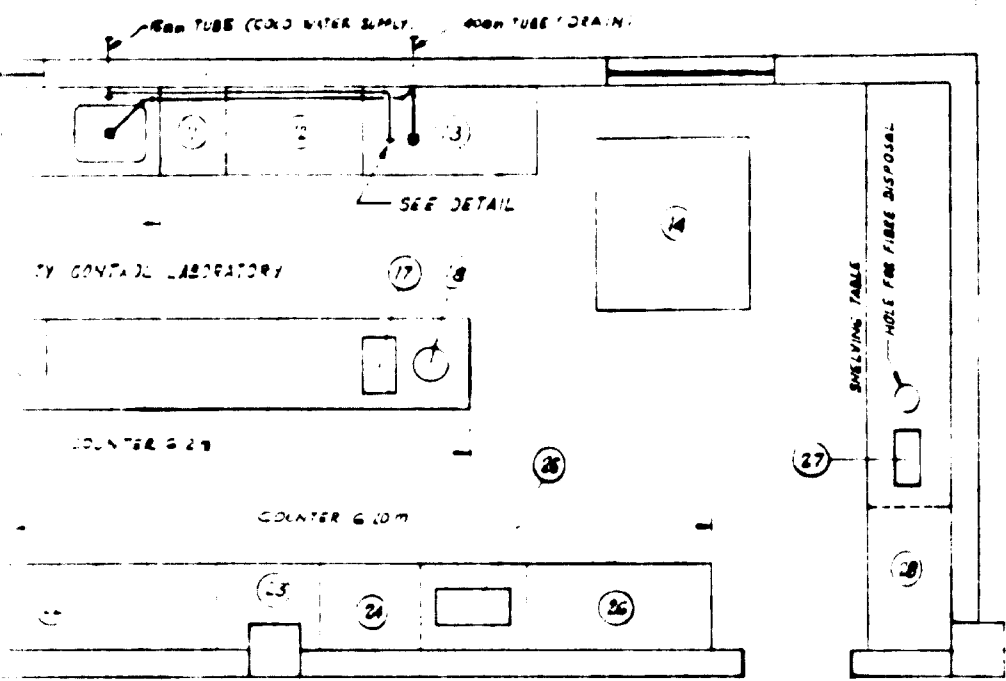
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1	FOUNDATIONS
2	DAILY SCHEDULE
3	SITE LAYOUT
5	LAB - GEN LAYOUT

ISS & DATE BY	REVISIONS
SEE TOP LEFT SIDE FOR ISSUES	
CLIENT	UNICO
PROJECT	LABORATORY BUILDING GENERAL LAYOUT
SURVEYOR: NENNIGER & CHÉNEVERT INC CONSULTANTS OWNED AND OPERATED BY ENGINEERS MONTREAL, QUEBEC	
DESIGNED BY	PAUL H. HAY
DATE	1960

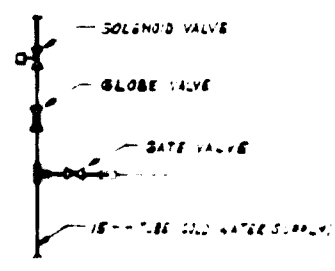
SECTION 3

DWG NO

18'0"m



FLOOR PLAN



WATER SUPPLY DETAIL FOR BAUER-MCNETT GLASS FIBER

LEGEND

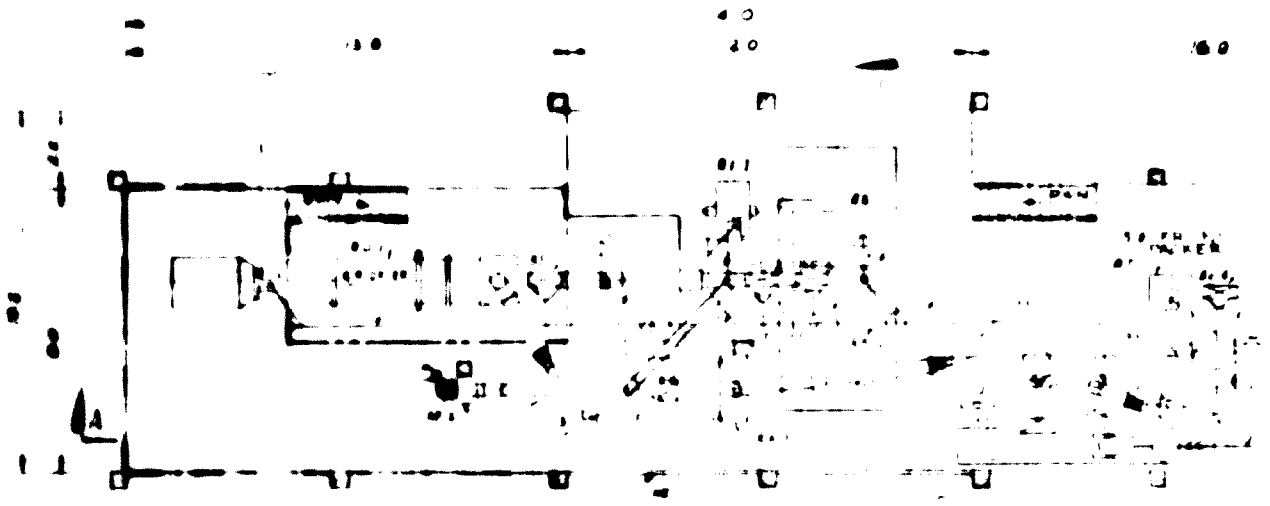
- 1 AREA FOR IMPACT CRUSHER
- 2 SCOOP SCALE
- 3 TABLE
- 4 ROTARY SIEVER
- 5 DUSTYBIE COLLECTOR
- 6 CYCLONE COLLECTOR
- 7 AREA FOR DISINTEGRATOR
- 8 HUMIDITY CABINET
- 9 DRYING OVEN
- 10 SINK
- 11 STANDARD FLEXION TESTER
- 12 BOARD MAKING APPARATUS
- 13 BAUER-MCNETT GLASS FIBER
- 14 GUBBEL STANDARD MACHINE
- 15 HUMIDITY THERMOMETER
- 16 LABORATORY HYDRAULIC PRESS
- 17 PRECISION BALANCE
- 18 REGULATOR
- 19 IGNITION LOSS APPARATUS
- 20 BRANDED THERMOMETER FOR MECHANICAL MIXTURE
- 21 MECHANICAL OVEN THERMOMETER
- 22 ALUMINE BRICK SET
- 23 BLANK SHUT-OFF & PERMEABILITY TESTER
- 24 STEREOLOGIC MANDREL
- 25 ANALYTICAL BALANCE
- 26 SUPERFINE SCUM SORTER
- 27 SCOOP BALANCE
- 28 ROTAP TESTING SIEVE SHAKER

NOTES:

- 1 SHELVING TABLE 35 1/2" HIGH BY 760MM WIDE MADE IN 20MM TUBES ROUNDED THE TOP TO BE COVERED WITH 20 GA GALVANIZED STEEL SHEET
- 2 COUNTERS 35 1/2" HIGH BY 760MM WIDE MADE IN 20MM TUBES ROUNDED THE TOPS TO BE COVERED WITH BLACK ABSOLITE
- 3 SINK 210MM LONG BY 500MM WIDE BY 200MM DEEP MADE IN STAINLESS STEEL
- 4 SAMPLE OF MATERIAL TO BE AND TESTS TO BE PERFORMED

SECTION 2

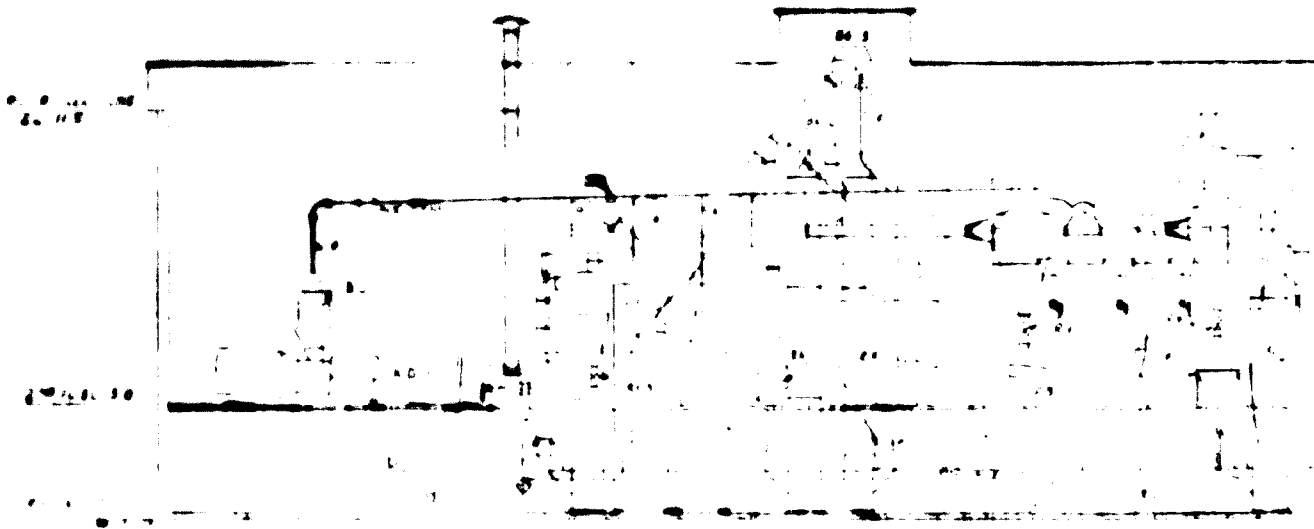
1



PLAN AT 20.30m



PLAN AT 22.00m



SECTION 1

SECTION 1

16.0

17.1

ROUTE TO 701



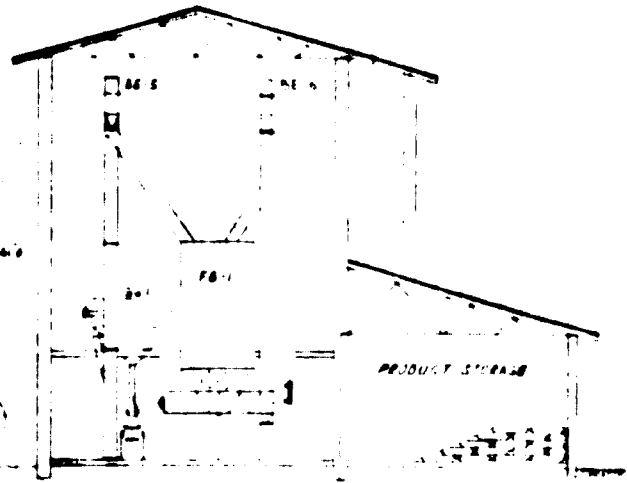
A

41" STACK

12" SAND

6 GRAVEL

DRAIN

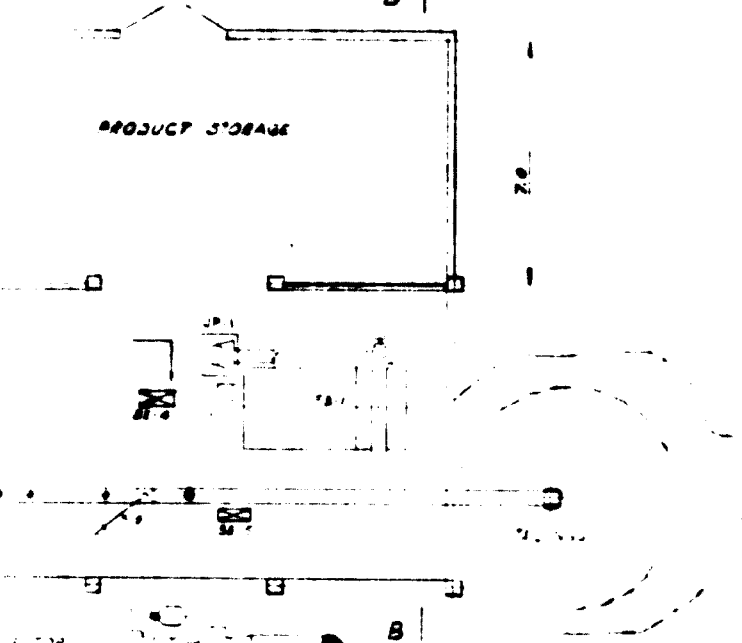


SECTION B-B

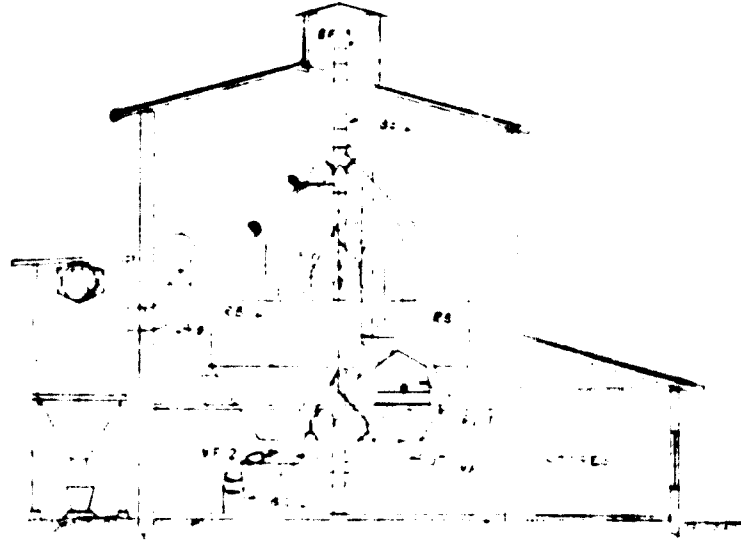
16.0

PRODUCT STORAGE

20.0

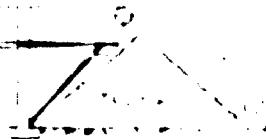
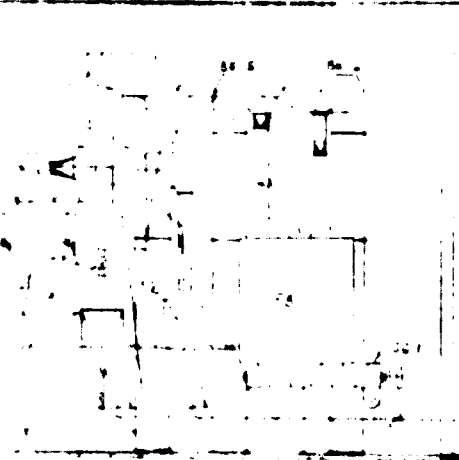


B



SECTION C-C

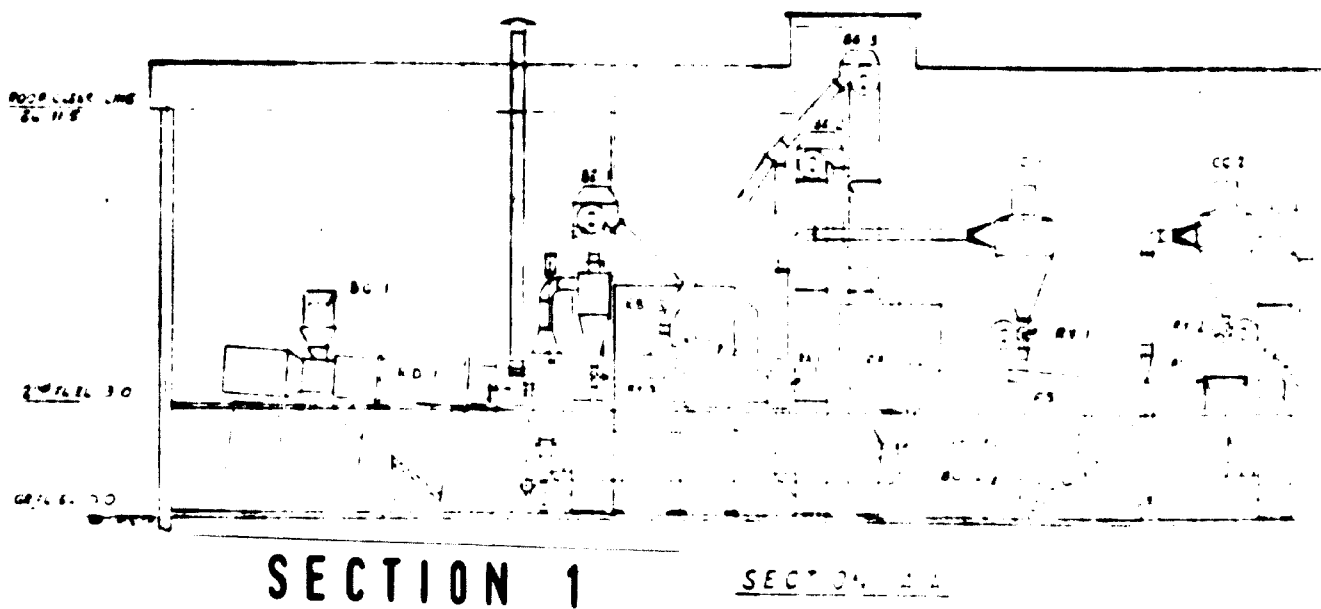
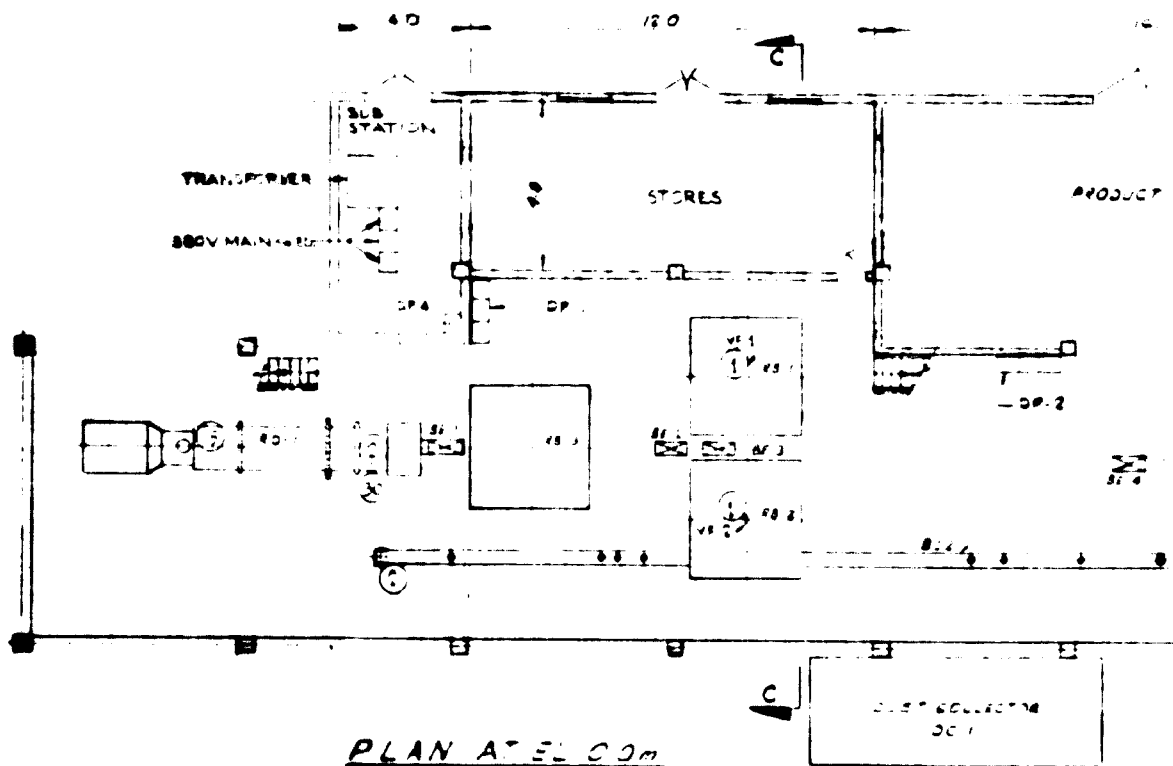
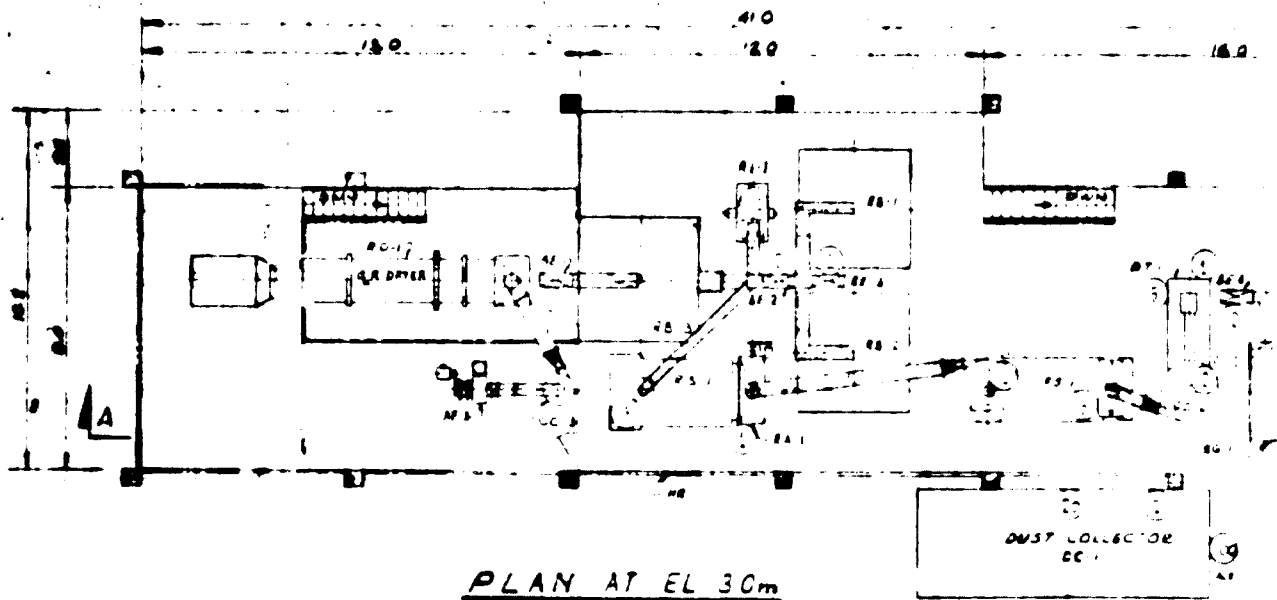
SECTION 2

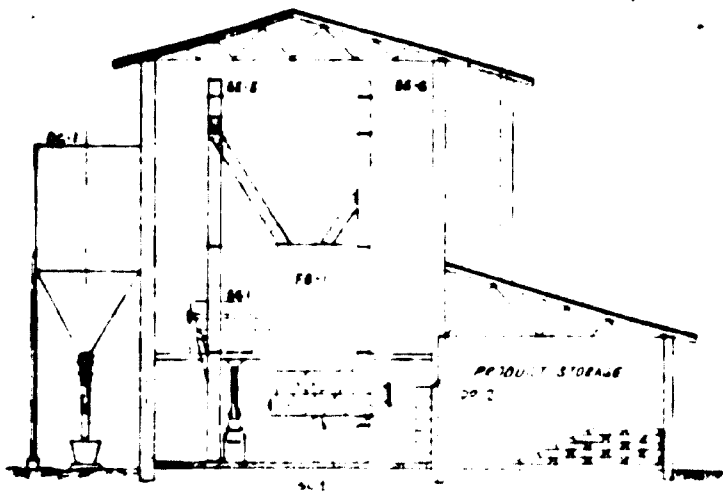
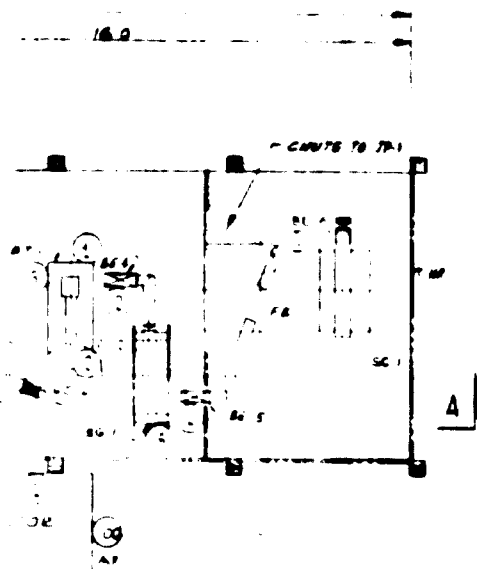


NO.	DESCRIPTION	QTY	UNIT	REMARKS
1	CONCRETE			
2	STEEL			
3	BRICK			
4	GLASS			
5	PAINT			
6	ROOFING			
7	INSULATION			
8	MECHANICAL			
9	ELECTRICAL			
10	PLUMBING			
11	FOUNDATION			
12	DOORS			
13	WINDOWS			
14	CEILING			
15	FLOORING			
16	STAIRS			
17	ELEVATORS			
18	MECHANICAL ROOM			
19	ELECTRICAL ROOM			
20	PLUMBING ROOM			
21	STORAGE ROOM			
22	OFFICE			
23	LABORATORY			
24	RESTROOM			
25	LOCKER ROOM			
26	ENTRY			
27	HALLWAY			
28	STAIRWELL			
29	ELEVATOR SHAFT			
30	MECHANICAL SHAFT			
31	ELECTRICAL SHAFT			
32	PLUMBING SHAFT			
33	STAIR			
34	ELEVATOR			
35	MECHANICAL			
36	ELECTRICAL			
37	PLUMBING			
38	FOUNDATION			
39	DOOR			
40	WINDOW			
41	CEILING			
42	FLOORING			
43	STAIR			
44	ELEVATOR			
45	MECHANICAL			
46	ELECTRICAL			
47	PLUMBING			
48	FOUNDATION			
49	DOOR			
50	WINDOW			
51	CEILING			
52	FLOORING			
53	STAIR			
54	ELEVATOR			
55	MECHANICAL			
56	ELECTRICAL			
57	PLUMBING			
58	FOUNDATION			
59	DOOR			
60	WINDOW			
61	CEILING			
62	FLOORING			
63	STAIR			
64	ELEVATOR			
65	MECHANICAL			
66	ELECTRICAL			
67	PLUMBING			
68	FOUNDATION			
69	DOOR			
70	WINDOW			
71	CEILING			
72	FLOORING			
73	STAIR			
74	ELEVATOR			
75	MECHANICAL			
76	ELECTRICAL			
77	PLUMBING			
78	FOUNDATION			
79	DOOR			
80	WINDOW			
81	CEILING			
82	FLOORING			
83	STAIR			
84	ELEVATOR			
85	MECHANICAL			
86	ELECTRICAL			
87	PLUMBING			
88	FOUNDATION			
89	DOOR			
90	WINDOW			
91	CEILING			
92	FLOORING			
93	STAIR			
94	ELEVATOR			
95	MECHANICAL			
96	ELECTRICAL			
97	PLUMBING			
98	FOUNDATION			
99	DOOR			
100	WINDOW			

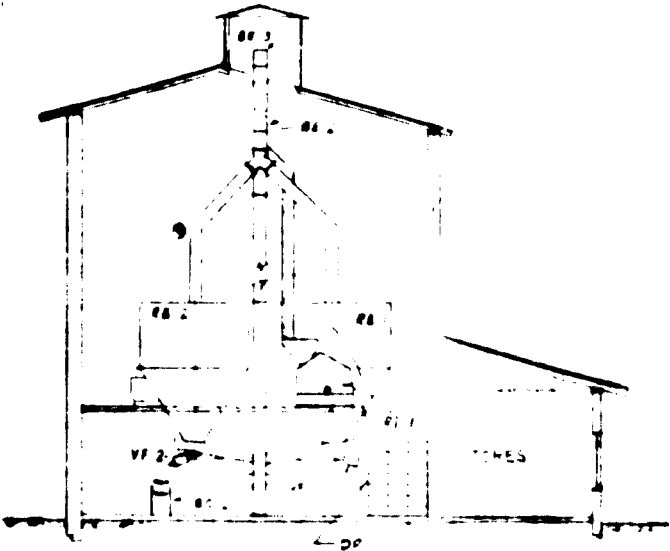
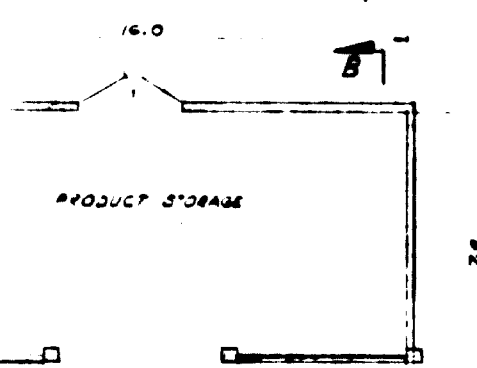
RECORD OF DWG ISSUE

DATE: _____
 DRAWN BY: _____
 CHECKED BY: _____
 APPROVED BY: _____

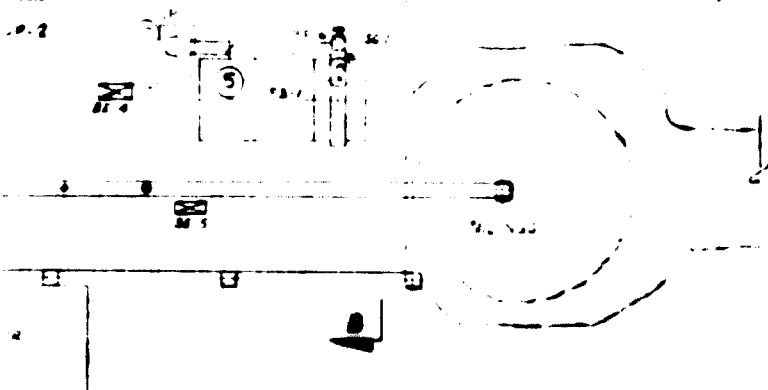




SECTION B-B



SECTION C-C



④ TYPICAL (3-27 M208)

19,000 V. 1000 S

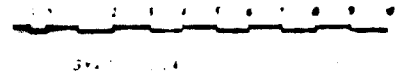
SECTION B-B
 19,000 V. 1000 S
 19,000 V. 1000 S

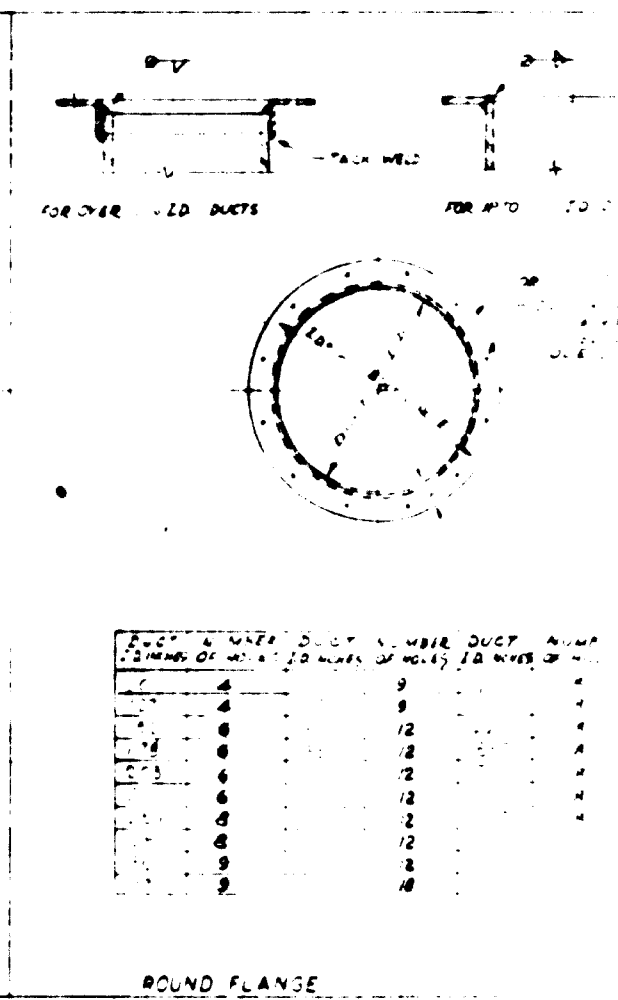
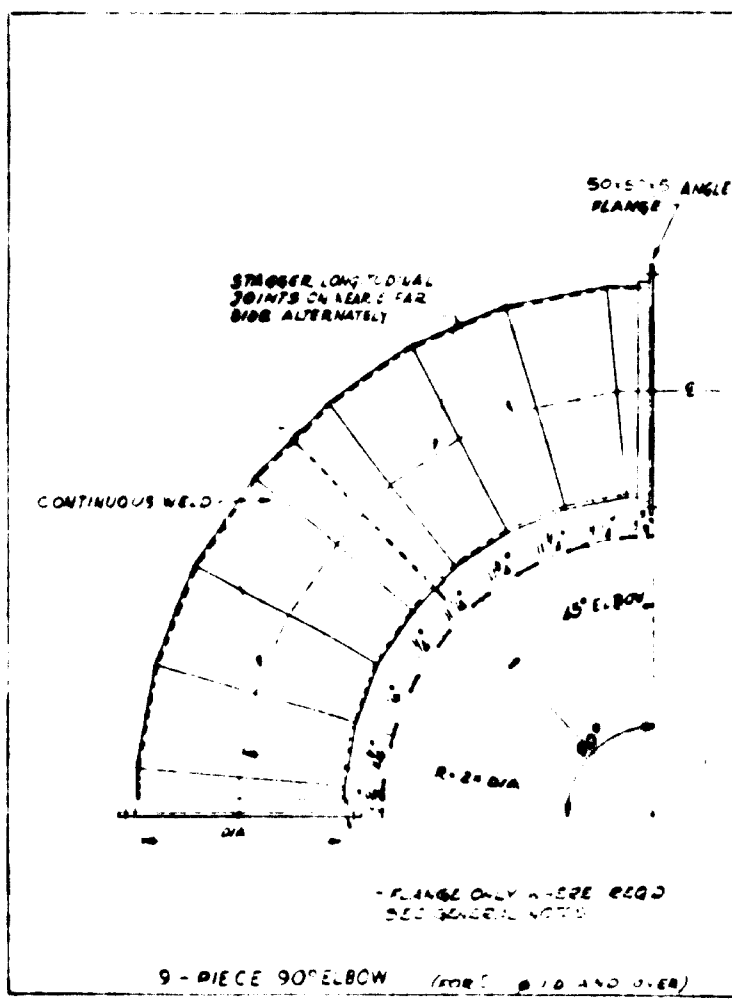
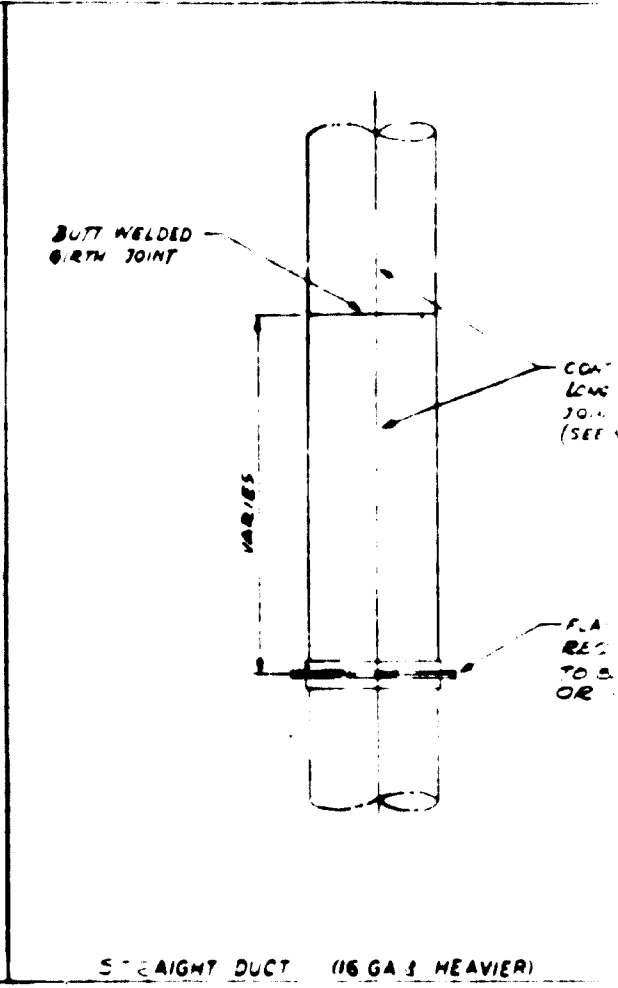
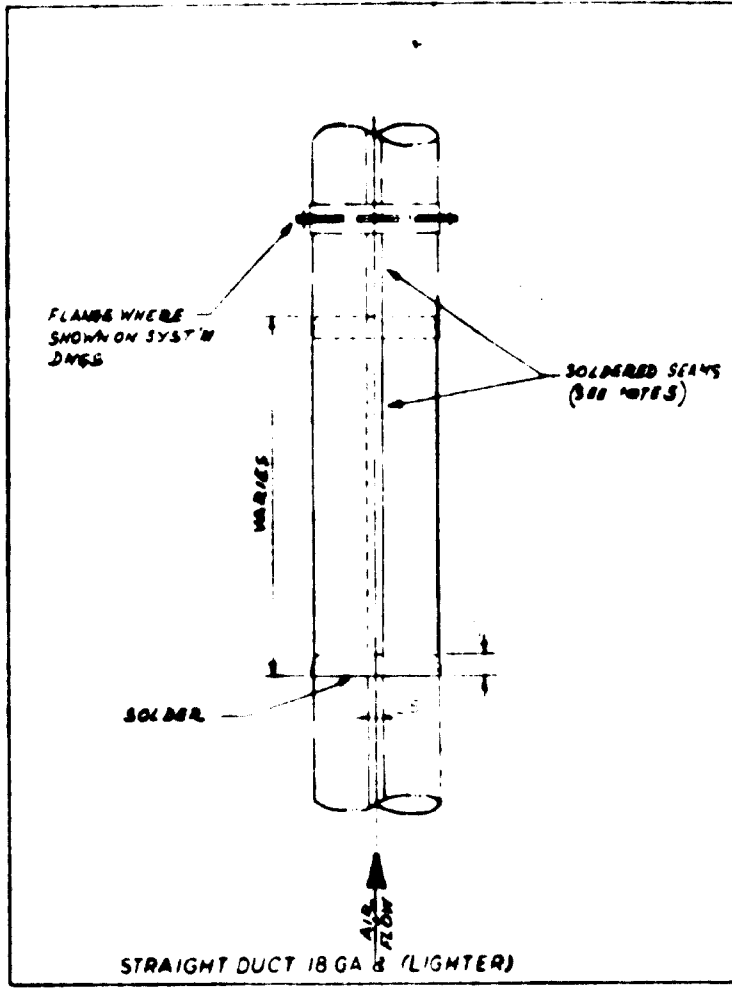
SECTION C-C
 19,000 V. 1000 S
 19,000 V. 1000 S



SECTION 2

2004	9304	2004	9304
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2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
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9	9	9	9
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11	11	11	11
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13	13	13	13
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50	50	50	50

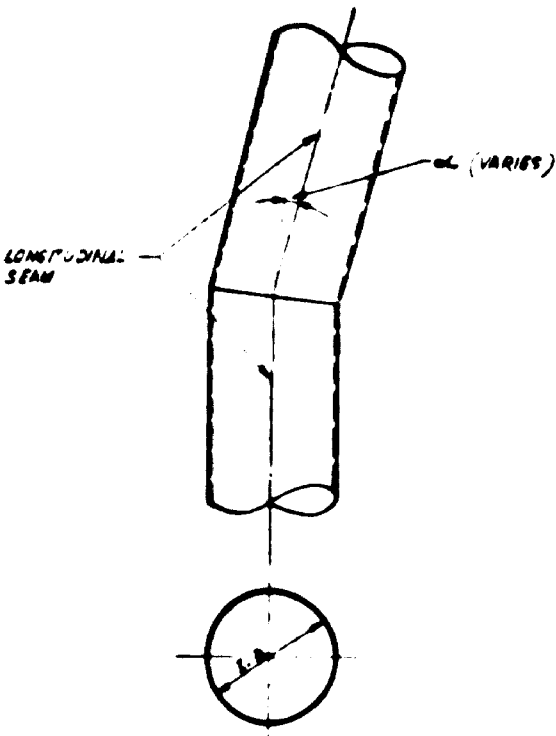




SECTION 1

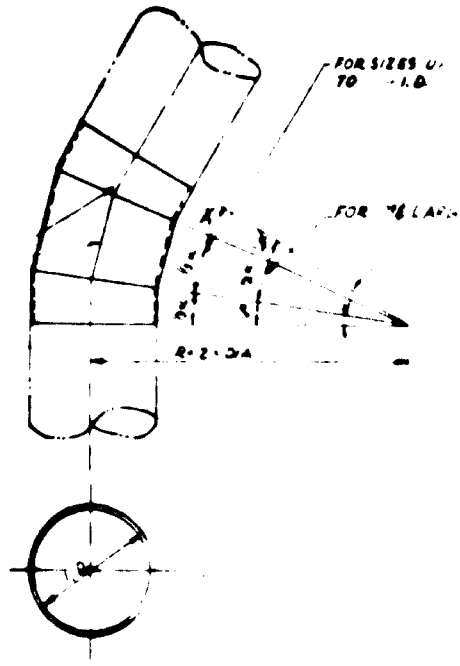
CONT WELDED
LONGITUDINAL
JOINT
(SEE NOTES)

FLANGE WHERE
REQ'D TO CONN
TO BLAST GATE
OR HOOD



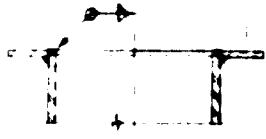
CONNECTION OF DUCTS FROM 6-19 FOR DUCTS UP TO 12.0
--- 0-15 FOR --- OVER 12.0

STAGGER LONGITUDINAL
JOINTS ON NEAR & FAR
SIDES ALTERNATELY



ELBOWS FROM 20° TO 30° UP TO 12.0
--- 16° TO 30° OVER 12.0

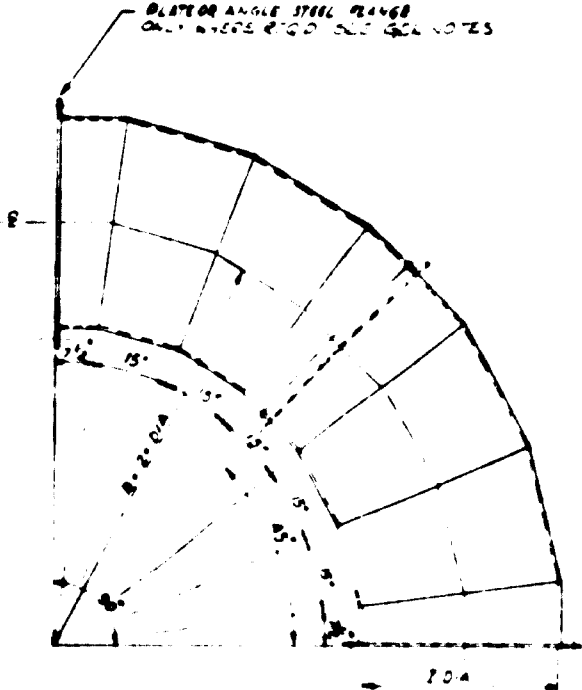
HEAVIER)



FOR UP TO 12.0 DUCTS

ANGLE
OR PLATE FLANGE
IN TEMPLATE
HOLES SHALL
BE 4.0 BOLT
CIRCLE

PLATE OR ANGLE STEEL FLANGE
ONLY WHERE REQ'D SEE SPEC NOTES



PIECE 90° ELBOW (UP TO 12.0)

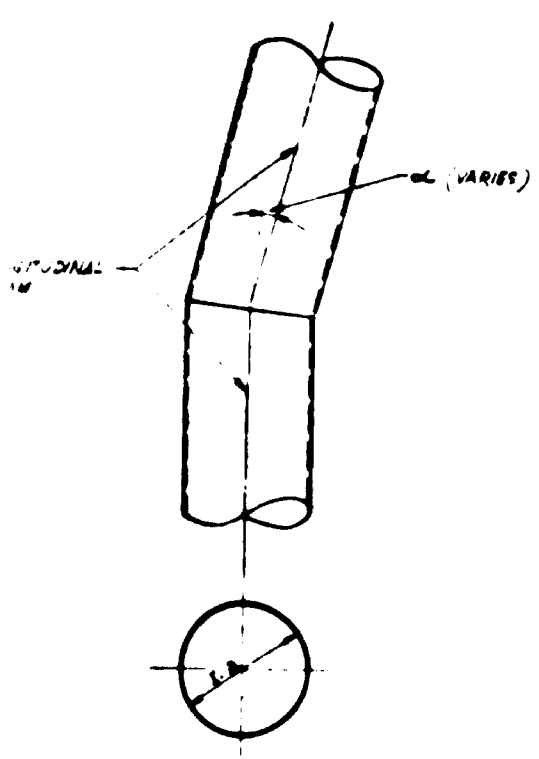
NOTES

1. 45° ELBOW SHALL BE MADE OF 90° ELBOW CUT IN HALF
2. ELBOW BETWEEN 30° & 90° SHALL BE MADE OF SECTIONS OF A 90° ELBOW
3. PIPE MATERIAL STRAIGHT DUCT UP TO 12.0 8 GA
--- FROM 12.0 TO 16.0 16 GA
--- OVER 16.0 4 GA
ELBOWS & FITTINGS UP TO 12.0 14 GA
--- OVER 12.0 2 GA
4. ALL 90° ELBOWS SHALL BE FLANGED OTHER ELBOWS SHALL BE FLANGED WHERE REQ'D TO CONNECT TO BLAST GATE OR HOOD
5. FOR HORIZONTAL RUNS PLACE LONGITUDINAL JOINTS ON TOP OF THE DUCT AND VERTICAL LINE FOR VERTICAL RUNS PLACE JOINT ON OPPOSITE SIDE
6. SEE SPEC FOR INSTALLATION OF DUST CONTROL DUCTWORK

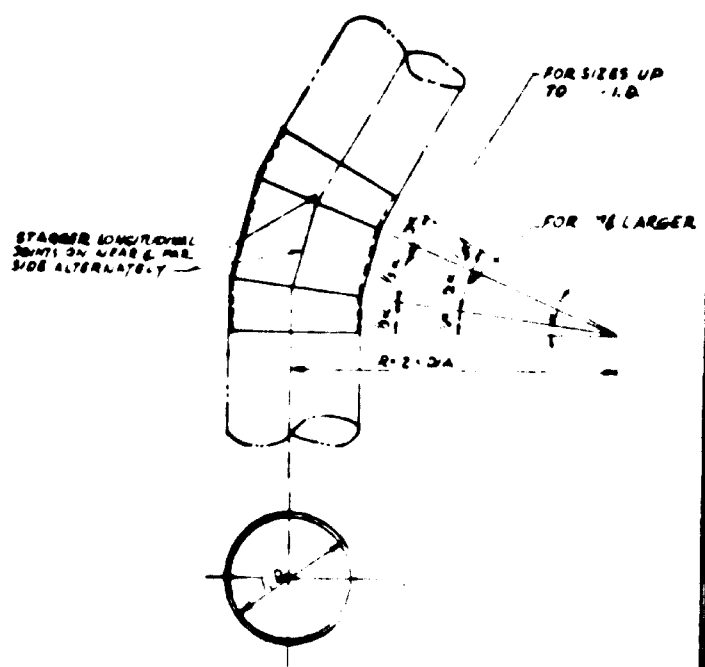
DUCT NUMBER
ID HOLES OF HOLES

A
A
A
A
A
A
A

SECTION 2



CONNECTION OF DUCTS FROM 0°-15° FOR DUCTS UP TO 12" I.D.
 --- 0°-15° FOR --- OVER 12" I.D.



ELBOWS FROM 20° TO 30° UP TO 12" I.D.
 --- 16° TO 30° OVER

PLATE OR ANGLE STEEL FRAMING ONLY WHERE REQ'D SEE GEN. NOTES



PIECE 90° ELBOW (UP TO 30°)

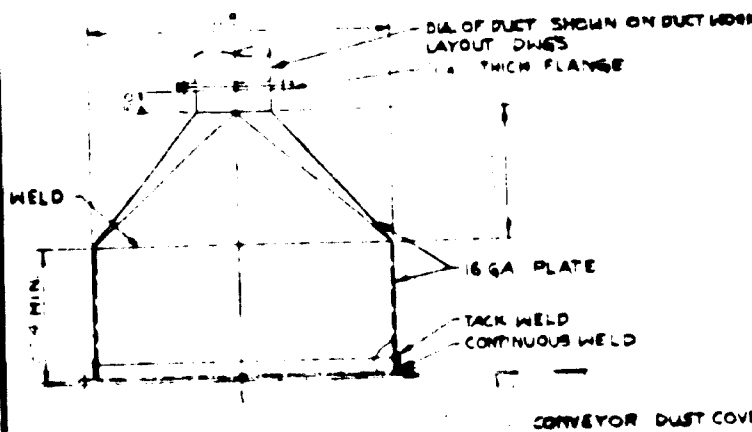
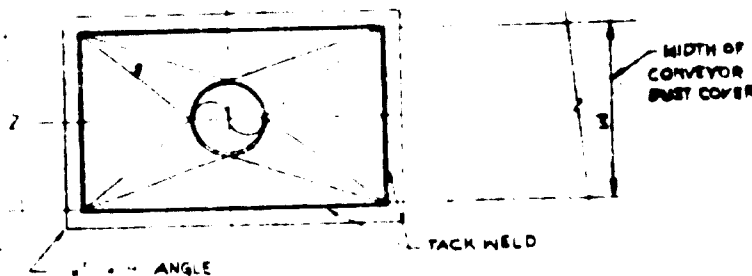
NOTES

1. 45° ELBOW SHALL BE MADE OF 90° ELBOW CUT IN HALF
2. ELBOW BETWEEN 30° & 90° SHALL BE MADE OF SECTIONS OF A 90° ELBOW
3. PIPE MATERIAL STRAIGHT DUCT UP TO 12" I.D. --- 16 GA
 --- FROM 12" TO 24" I.D. --- 16 GA
 --- OVER 24" I.D. --- 14 GA
 ELBOWS & FITTINGS UP TO 12" I.D. --- 14 GA
 --- OVER 12" I.D. --- 12 GA
4. ALL 90° ELBOWS SHALL BE FLANGED OTHER ELBOWS SHALL BE FLANGED WHERE REQ'D TO CONNECT TO PLUMBING OR DUCTS
5. FOR HORIZONTAL RUNS PLACE LONGITUDINAL JOINTS ON TOP OF THE DUCT AND IN LINE FOR VERTICAL RUNS PLACE JOINTS ON OPPOSITE SIDES
6. SEE SPECS FOR DETAILS FOR FABRICATION & INSTALLATION OF DUST CONTROL DUCTWORK

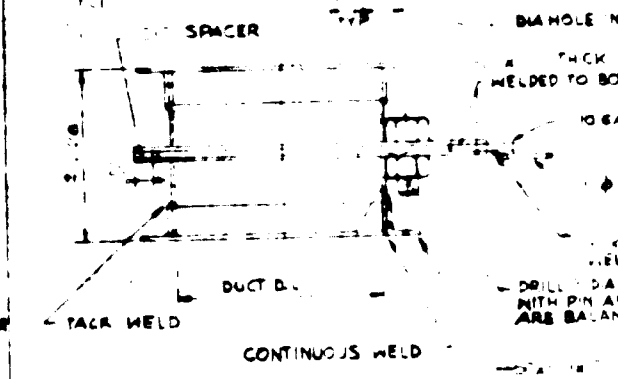
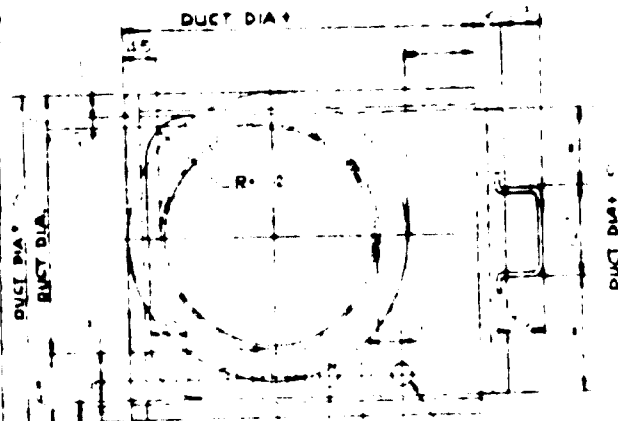
SECTION 3

NO & DATE BY	REVISIONS
SEE TOP LEFT SIDE FOR ISSUES	
CLIENT	
PROJECT	
DUST CONTROL DUCTWORK CONSTRUCTION DETAILS	
SURVEYOR, BENOIST & CHÉNEVERT INC CONSULTANTS MONTREAL 107 QUE	
DESIGNED	CHECKED
RECOMMENDED	APPROVED
SCALE	DATE
CONTRACT NO.	

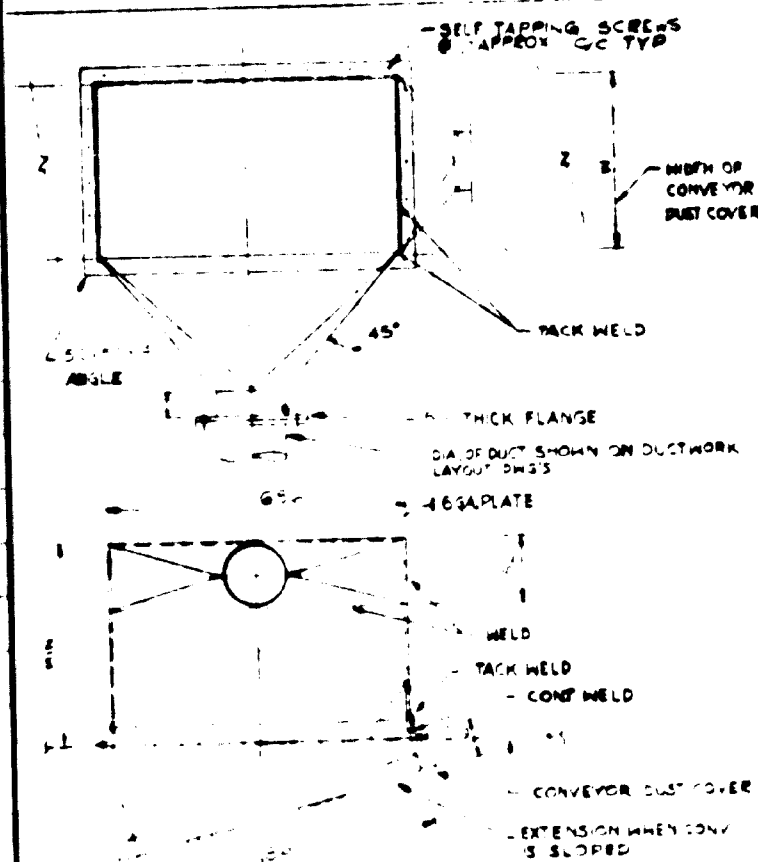
DWG NO



HOOD TYPE

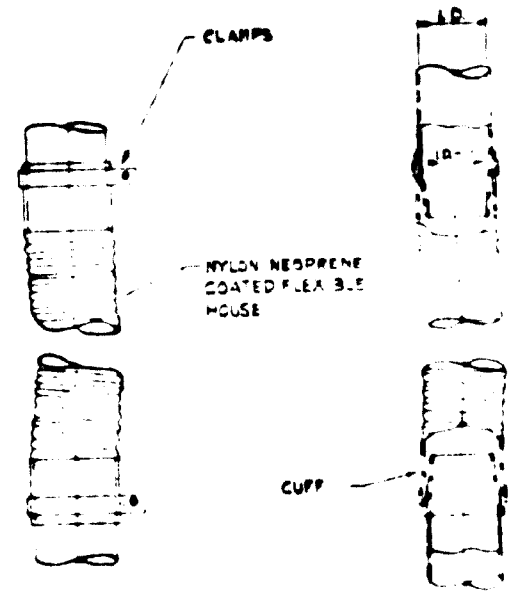


BLAST GATE DETAIL

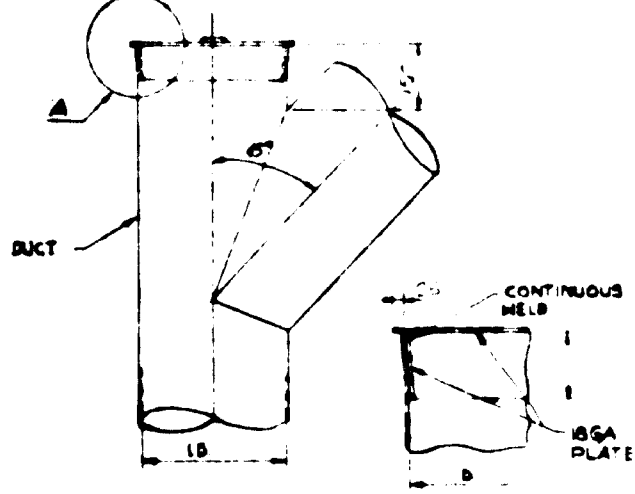
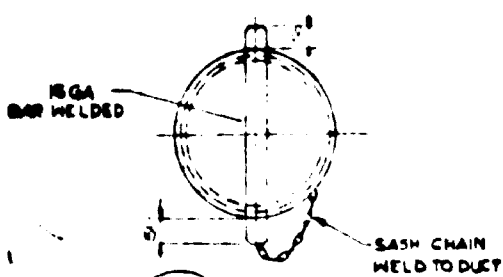
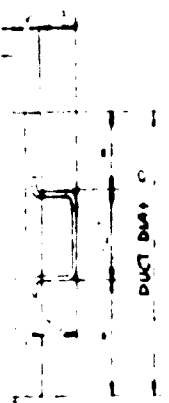


HOOD TYPE

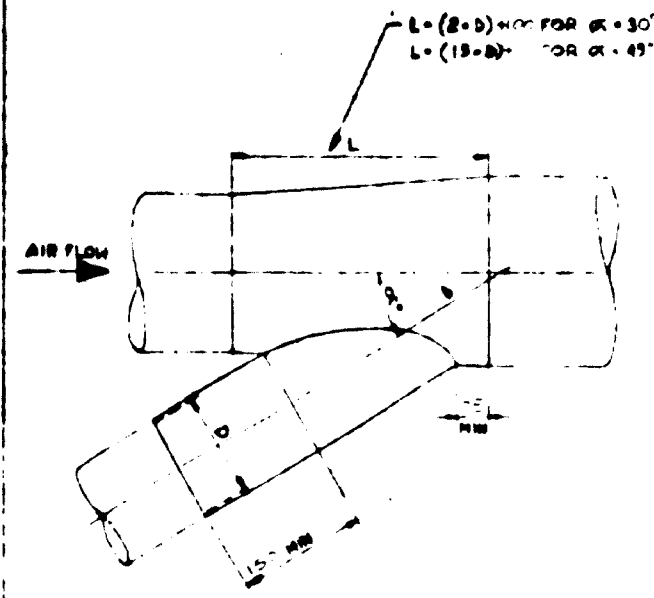
SECTION 1



TYPICAL FLEX BLE HOSE CONNECTION

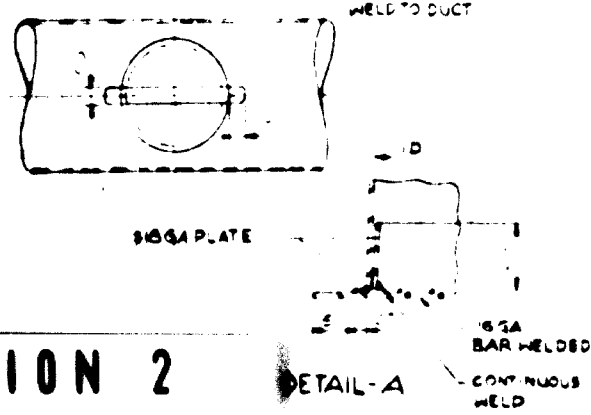
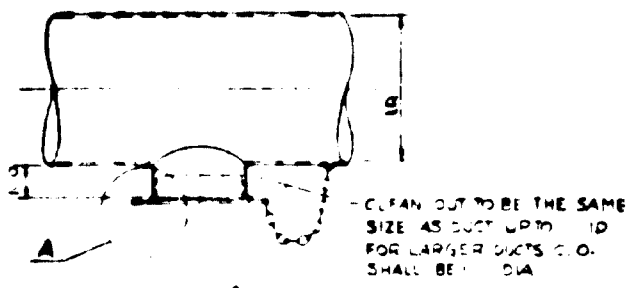
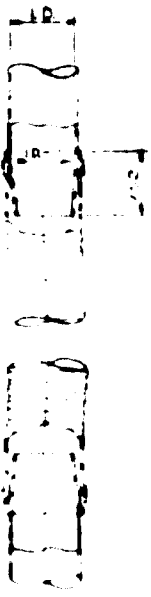


END CLEANOUT



BRANCH ENTRY

- DIA HOLE IN ALL PLS
- 1/4" THICK SPACER WELDED TO BOTH 1/2 GA PLS
- 1/2 GA PLATE
- 1/2" ROD HANDLE
- 1/2" x 1/2" x 1/4" FLAT BAR WELDED
- DRILL 1/4" DIA HOLE & LOCK WITH PIN AFTER SYSTEMS ARE BALANCED
- 1/2" x 1/2" x 1/4" ANGLE FLANGE



SECTION 2

CONNECTION

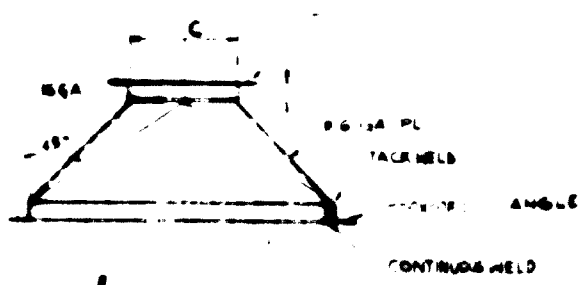
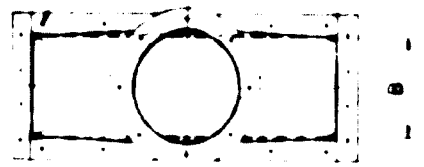
SIDE CLEAN OUT

NOTE:
SEE GENERAL NOTES ON DWG 36-02-3700-2

DIMENSIONS			
HOOD TYPE	A	B	C
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7	12	12	12
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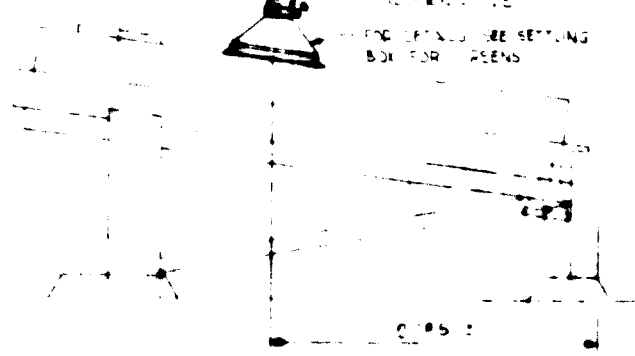
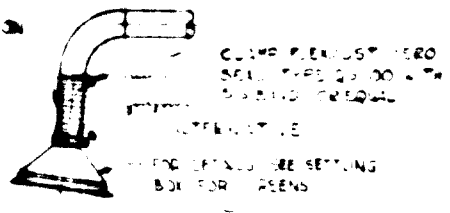
NOTE:
 FOR GENERAL NOTES SEE DWG. B-6-92-3

- SELF TAPPING SCREWS
 @ APPROX 2" C



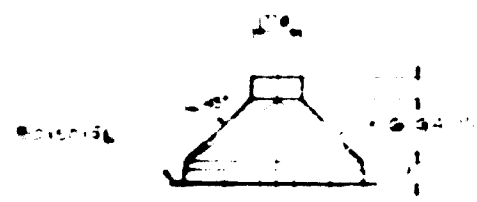
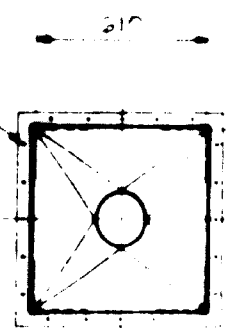
TYP. HOOD FOR 1/2\"/>

FOR TYP FLEXIBLE HOSE CONNECTION
 SEE [unclear]



TYP FLEXIBLE HOSE CONNECTION
 FOR SCREENS

SELF TAPPING SCREWS
 @ APPROX 2" C

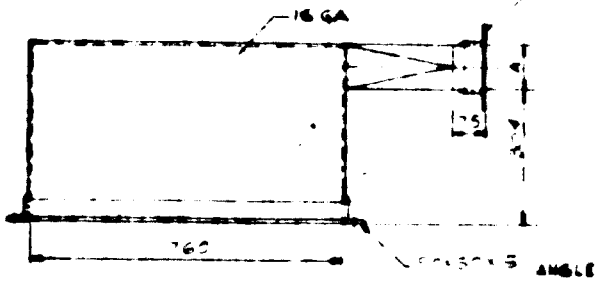
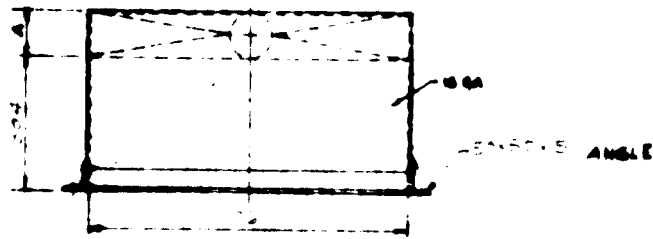
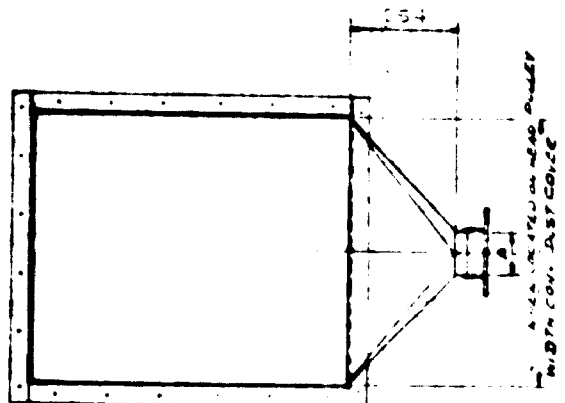
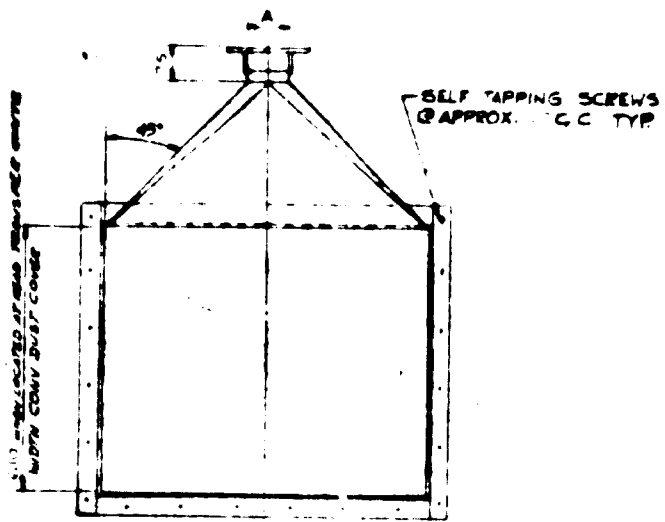


SETTING BOX FOR SCREENS

HOOD TYPE

SECTION 1

201 10-02-3700-4

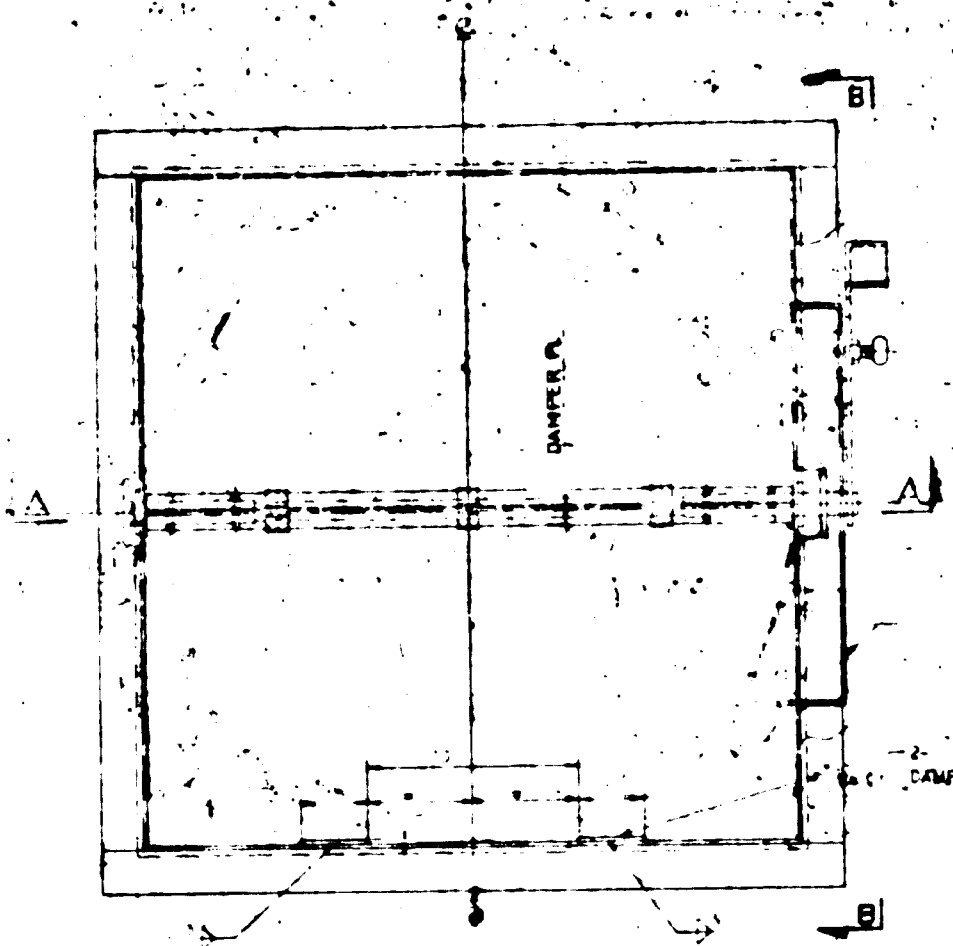


HOOD TYPE FOR HEAD PULLEY CONV. TRANSFER CHUTE & CONVR DUST COVER

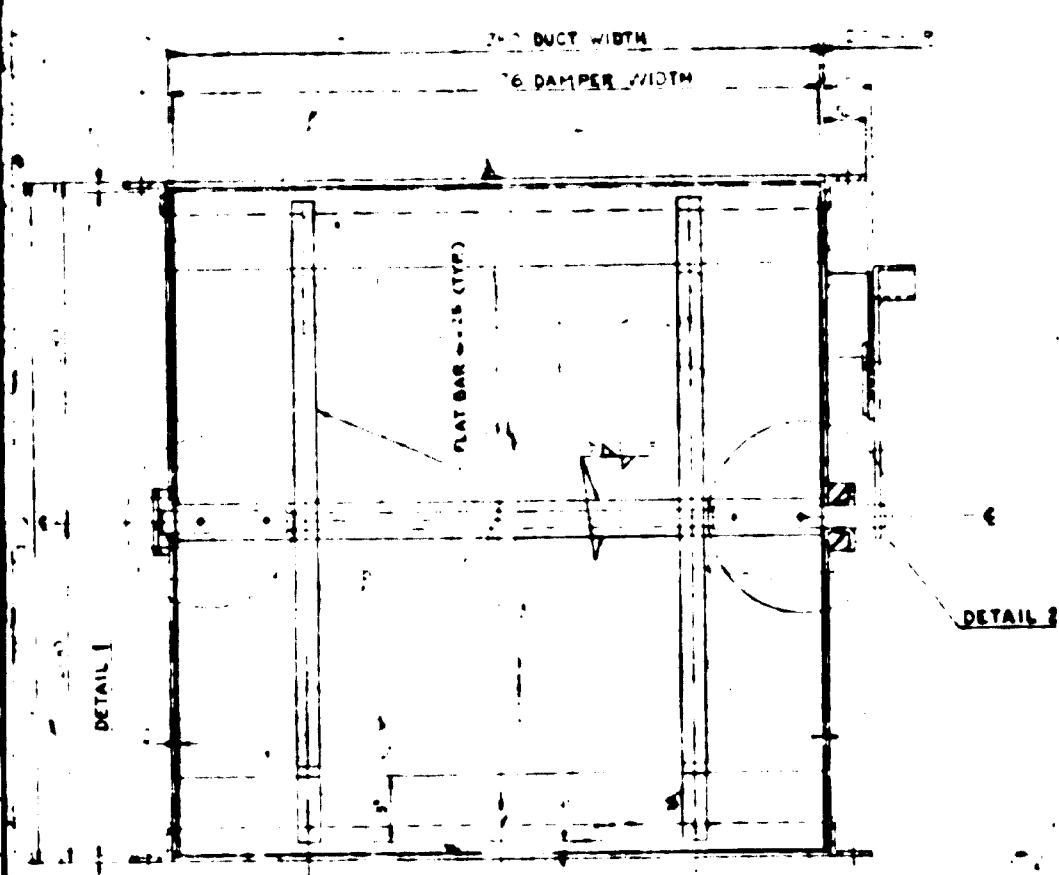
HOOD TYPE FOR HEAD PULLEY CONV. TRANSFER CHUTE & CONVR DUST COVER

SECTION 2

GREENS



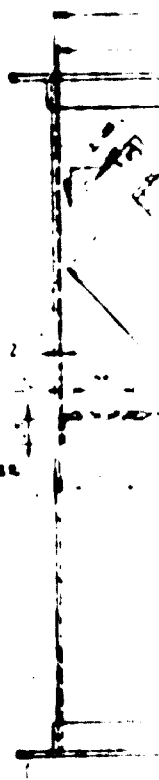
PLAN (DAMPER OPEN)

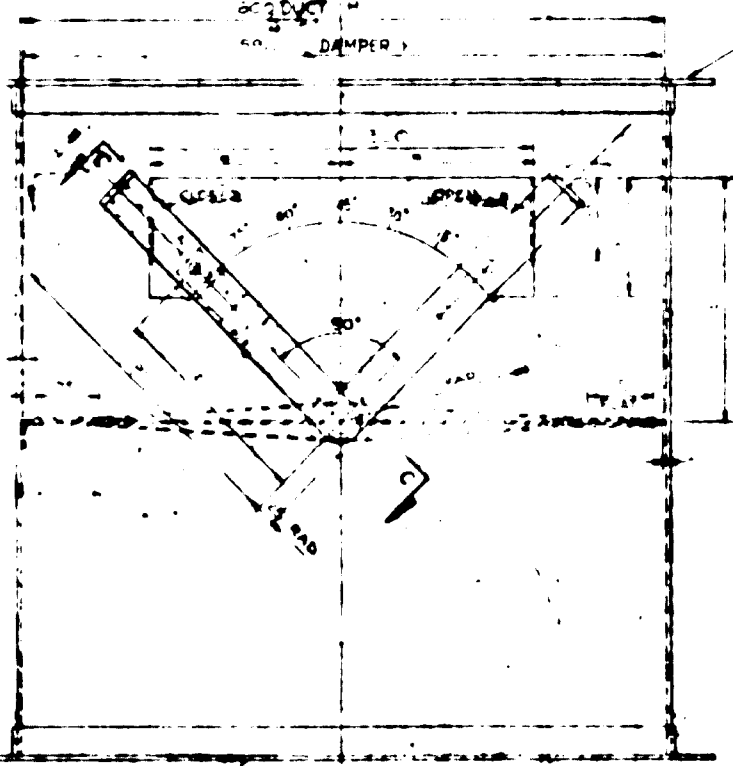
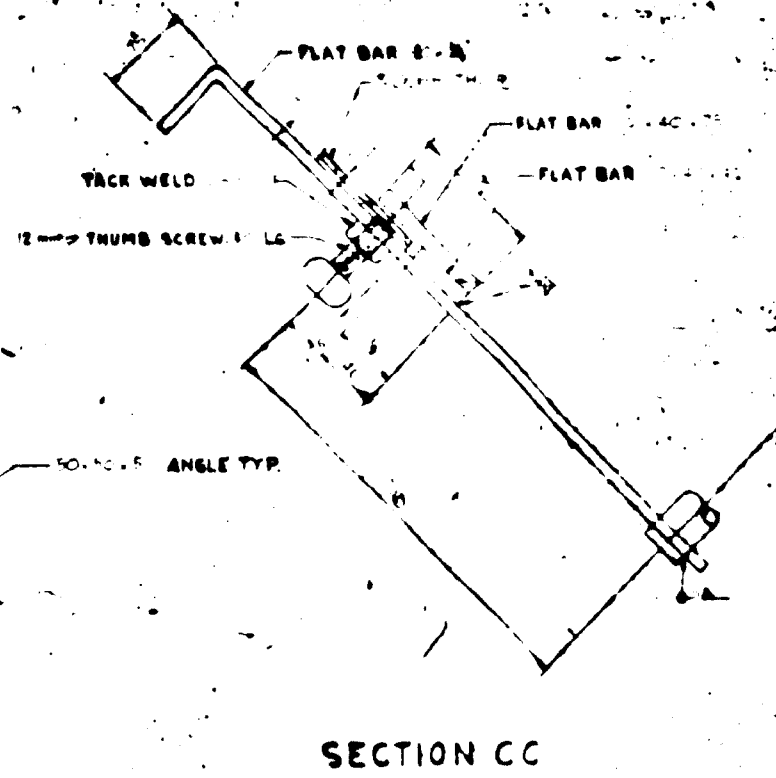
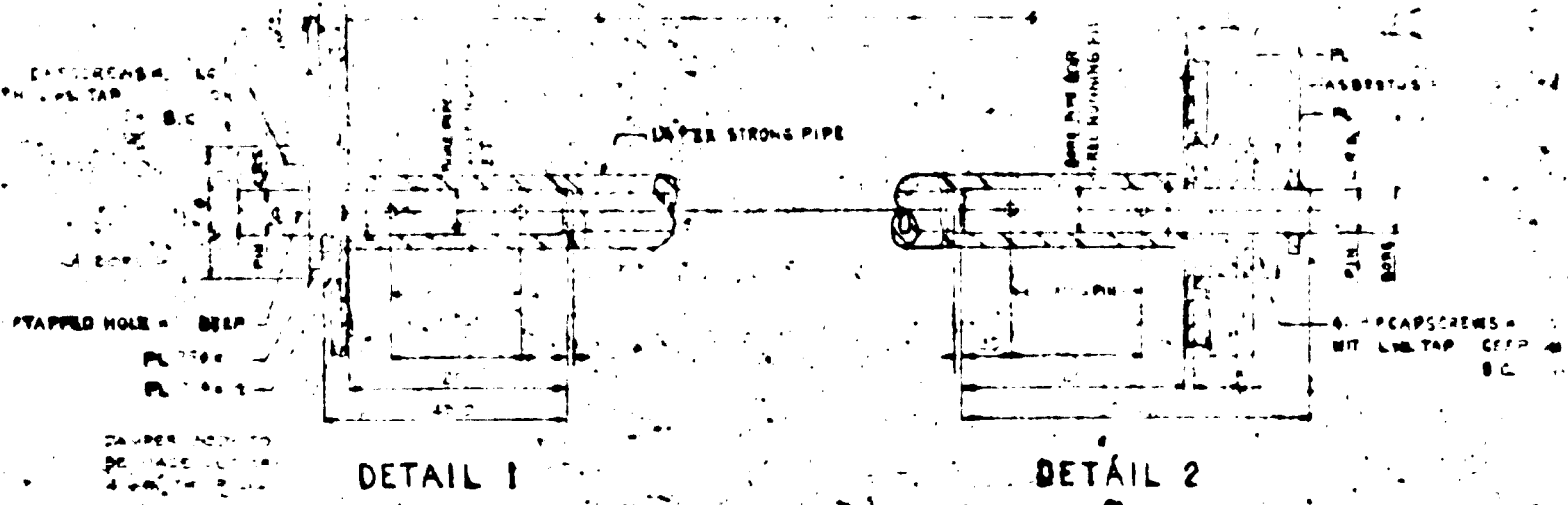


SECTION 1

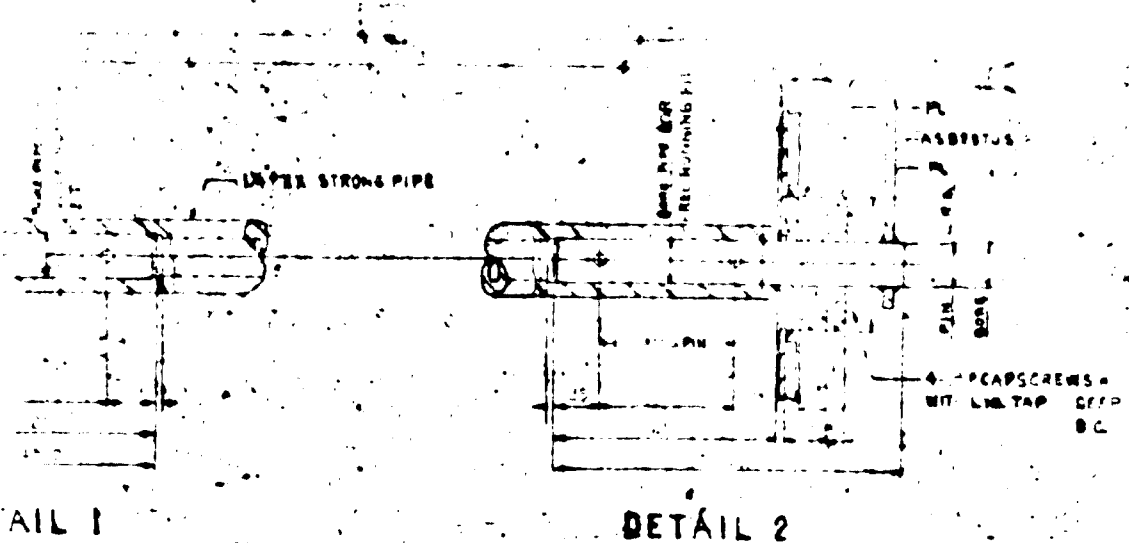
SECTION A-A

SECTION DAMPER STOPPER



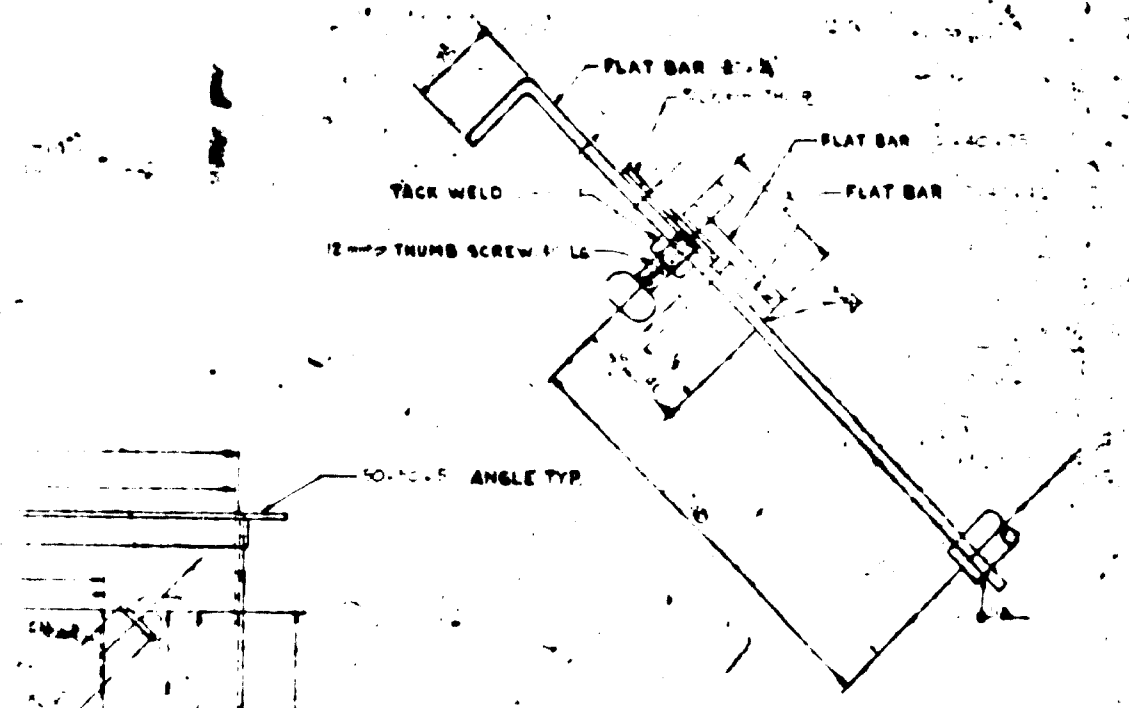


GENERAL NOTE
ALL DIMENSIONS ARE SHOWN



AIL 1

DETAIL 2



SECTION CC

GENERAL NOTE
ALL DIMENSIONS ARE SHOWN

SECTION 3

REVISIONS	
SEE TOP LEFT SIDE FOR ISSUES	
CLIENT	
PROJECT	
RECTANGULAR BUTTERFLY DAMPER CONSTRUCTION DETAILS	
SURVEYOR, HENNINGER & CHEVRETT INC CONSULTANTS OWNED AND OPERATED BY ENGINEERS MONTREAL 25 QTE	
DESIGNED	CHKD
RECORDED	APPROVD
SCALE	DATE
CONTRACT	

01355 - E

SURVEYER, NENNIGER & CHÉNEVERT INC.

CONSULTANTS

OWNED AND OPERATED BY ENGINEERS



TEL 931-2261
CABLE SNCINC
TELEX 01-20612

1550 DE MAISONNEUVE BLVD WEST
MONTREAL 107, CANADA

November 20, 1971

Our Ref: 3196

Mr. D.C. Newton,
Chief,
Technical Equipment Procurement
and Contracting Office
United Nations Industrial
Development Organization
Lerchenfelderstrasse 1
A - 1070
Vienna, Austria

Dear Mr. Newton,

SUBJECT: UNIDO - Bolivia Phase III Addendum

We attach our report on Phase III Addendum "Processing Plant Design" for the project "Experimental Production Plant for Asbestos Processing, Cochabamba, Bolivia, UNDP/SF Symbol: BOL 20", contract No. 70/15.

We retained a local Bolivian consultant firm to prepare the detailed design of the Processing Plant. The drawings and specifications were submitted to us, on schedule, and reviewed with our specialists. These preliminary drawings and specifications are parts of this report.

However, part of the design was not exactly acceptable to us and our Bolivian subcontractor is now revising it. As soon as received and approved, we will issue final copies of these drawings and specifications.

We trust that you will find this report to your satisfaction and repeat our satisfaction of being associated with this challenging project.

We look forward to being of continued service to you for the execution of Phase IV.

Yours very truly,

SURVEYER, NENNIGER & CHÉNEVERT INC.

G. Lavallee
G. Lavallee
Vice-President

Mining & Metallurgy Division

GL/wmp
encl.

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SUMMARY

The detailed concrete, structural and architectural design of the processing plant was done. The electrical design including power distribution, lighting and grounding was done. The design of compressed air, fire protection and drainage facilities was done. The process equipment added at the Vienna meeting was selected, specifications prepared and bids obtained.

The final cost to UNIDO of:

- a) the process equipment selected during Phase III
- b) the process equipment added in Vienna for Phase III Addendum
- c) the electrical equipment and supplies for the processing plant only

and delivered in Cochabamba, will be, if instructed to proceed with procurement before February 1st, 1972, \$ 315,000.00 U.S.

1. INTRODUCTION

- 1.1 On March 5, 1970, the United Nations Industrial Development Organization awarded a contract to Surveyer, Nenniger & Chênevert Inc. for "testing of asbestos samples, preparation of feasibility study, selection of a manufacturing process, supply of equipment, spares, designs and provision of services for the erection and commissioning of an experimental production plant for asbestos processing".
- 1.2 The report of Phase I "Evaluation of Asbestos Mineral Ore" was submitted on August 5, 1970.
- 1.3 The report of Phase II "Feasibility Study" was submitted on April 8, 1971.
- 1.4 During a meeting held in Vienna, Austria on August 2nd to 4th, 1971 the preliminary report of Phase III was reviewed and accepted with minor modifications. The contractual obligations of SNC were revised to include the final design of the processing plant, previously the responsibility of the Bolivian Government.
- 1.5 The final report of Phase III "Process Design" was submitted on August 18, 1971.
- 1.6 On October 4, 1971, the United Nations Industrial Development Organization gave the authorization to proceed with Phase III Addendum.
- 1.7 The scope of work of this Phase III Addendum is to:
- 1.7.1 Select a truck scale. Issue specifications.
- 1.7.2 Select and layout screening facilities prior to dryer. Issue specifications for screener and conveyors.
- 1.7.3 Prepare specifications for dustube collector to be located in core laboratory.
- 1.7.4 Recommend method of monitoring asbestos dust.
- 1.7.5 Provide the final concrete, structural and architectural design of the processing plant. Prepare drawings and specifications.
- 1.7.6 Provide the final electrical design of the processing plant. Prepare drawings and specifications.
- 1.7.7 Provide the final design of piping, fire protection, compressed air and drainage of the processing plant. Prepare drawings and specifications.

2. DESCRIPTION OF THE REVISED PROCESS FACILITIES

2.1 During the revision of the preliminary report of Phase III in Vienna, on August 2nd to 4th, 1971, UNIDO requested the addition of a truck weighing station and a scalping station whose prices are now included in the total cost of process equipment.

2.2 Truck Weighing Station

A truck scale of a maximum capacity of 18 metric tons was located on the east side of the property for weighing the incoming and outgoing ore haulage trucks and the tailing trucks.

The weighbridge will be constructed to support a concrete deck and will be full floating with adjustable bumper bolts. The main beam will be 20,000 K. x 1,000 Kilos and the fractional beam 995 K. x 5 Kilos. The weighing platform will measure 7.3 meters in length and 3.0 meters in width.

2.3 Wet Ore Storage

The ore stockpiling facilities were revised to incorporate the scalping station and maintain the 250 ton storage capacity.

The concrete pad will measure 24.0 meters in length and 18.0 meters in width. On the center line of the storage pad, the scalping station was located in a pit measuring 12.25 meters in length, 2.75 meters in width and 2.5 meters in depth.

The vibrating screener will be a single deck type equipped with a Ty-Rod screen and having a screening area of some 2.5 square meters. Ore haulage trucks from the mine will dump the wet concentrate on the concrete pad or at its periphery. Labourers will shovel, wheelbarrow and feed the ore concentrate onto the vibrating screener. The minus 25 mm will be delivered to the dryer on a second belt conveyor. Another belt conveyor was added to take away the plus 25 mm. Further size reduction will be by sledge hammering.

See Drawings No. 3161-07-4000-1 "Plot Plan", No. 3161-02-3700-3 "Site Plan" and No. 3161-07-4500-1 "Scalping Station".

2.4 Process section

One 30 cm diameter screw conveyor was located on the first floor to convey the rock screener and fibre screener oversizes to bucket elevator BE-2.

2.5 Tailings Pit

The layout of the tailings pit was revised. The pit will measure 8.0 meters in length, 5.30 meters in width and 2.75 meters in depth. An access ramp was located on the north side of the pit to direct the tailings trucks to the weighing station before disposal.

3. PROCESS EQUIPMENT**3.1 Final list of Process Equipment:**

One Rotex screener
One gyratory screener and rotary aspirator
One impact crusher
One paddle trommel
One standard grader
One dryer
Two vibrating feeders
Two rotary valves
One bag scale
One vertical screw packer
One live bottom bin
Two cyclones
Six bucket elevators
Three belt conveyors
One dust collector
One truck scale
One vibrating screener
One screw conveyor

3.2 Final list of auxiliary process equipment

The auxiliary process equipment included is:

- 1) Ductwork for aspiration and dust control
- 2) Chutework for process equipment
- 3) Electric motors for process equipment
- 4) Manual starting switches with stop-start push buttons for electric motors of process equipment
- 5) Electrical distribution panels connected with process equipment
- 6) Wires, cables and conduits running from process equipment to terminal points of electric sub-station.

- 3.3 The estimated cost of equipment selected during Phase III and delivered in Cochabamba was \$230,100 U.S.: this cost now based on firm prices confirmed up to February 1st, 1972 is \$245,000 U.S.
- 3.4 The cost of equipment selected during Phase III Addendum and delivered in Cochabamba, based on firm prices confirmed up to February 1st, 1972 is \$25,500 U.S.
- 3.5 The cost of the electrical power distribution between the processing equipment is \$44,500 U.S. excluding the lighting and grounding.
- 3.6 The local expenses in Bolivia for the supply and delivery of process equipment based on data provided in Phase III and Phase III Addendum is now for a firm price of \$90,000 U.S.

4. MONITORING OF ASBESTOS DUST

- 4.1 There are two methods commonly used in the asbestos industry for the monitoring of the dust: the Membrane Filter method and the Midget Impinger method.
- 4.2 The Membrane Filter method is used for the determination of asbestos dust concentration in Europe. Its application is spreading in Canada and the United States. It is feasible that new legislations might be stipulated according to this method.
- 4.3 The Midget Impinger method is used for the determination of the atmospheric concentration of asbestos particles including rock dusts. This method was developed by the U.S. Bureau of Mines. It is commonly used in the United States and Canada in asbestos mining and manufacturing.
- 4.4 We recommend to adopt the Membrane Filter method for the monitoring of asbestos dust since it is the most promising method to meet future standards.
- 4.5 We estimated the cost to supply the equipment and train the personnel on its application at \$6,000 U.S.

5. FINAL CONCRETE, STRUCTURAL AND ARCHITECTURAL DESIGN OF THE PROCESSING PLANT

- 5.1 The concrete, structural and architectural design of the processing plant was made by Consultores Galindo Ltda, working as a sub-contractor to SNC.
- 5.2 The processing plant consists of: the wet ore storage, the processing building and the tailings pit.
- 5.3 The wet ore storage includes the concrete storage pad and the scalping station.

The concrete storage pad will be made of a concrete slab resting on a bed of rocks.

The floor and wall of the scalping station will be made of concrete. The roof will be built of wooden trusses and corrugated asbestos.

- 5.4 The processing building consists of six sections: the dryer section, the process section, the substation, the store, the product storage and the dust collector section.

The dryer section will consist of an elevated reinforced concrete floor covered with a roof. No exterior wall will be built.

The process section will be a two storey building. Second floor beams and columns will be of reinforced concrete, the first floor will consist of concrete slabs. The roof will be built of wooden trusses with corrugated asbestos roofing. Exterior walls will be concrete blocks for the first floor and corrugated asbestos wall cladding for the second floor. Three rows of windows will be installed; glass on first floor, glass and wire mesh on second floor.

The substation, store and product storage will be located in the back of the main building. Walls will be concrete blocks. Roof will be built of wooden trusses covered with corrugated asbestos. The floors will consist of concrete slabs.

The dust collecting section is located outside and in front of the main building. It will consist of concrete slabs resting on a bed of rocks.

- 5.5 The tailings pit including the access ramp will be concrete floor and walls.

6. FINAL ELECTRICAL DESIGN OF THE PROCESSING PLANT

6.1 The electrical design of the processing plant was made by Consultores Galindo Ltda working as a subcontractor to SNC.

6.2 The final electrical design of the processing plant covers three items: power distribution, lighting and grounding.

6.3 The power distribution of the processing plant will include all feeders from main distribution panel to all secondary panels, wiring, conduit and cable duct up to final destination. Process equipment will be supplied with motors complete with push buttons and starters.

The electrical design excludes the substation and its main transformer, main secondary distribution panel, lighting transformer. It also excludes remote control wiring and instrumentation. These excluded items are to be supplied by others.

6.4 The lighting of the processing plant will include fixtures, lamps, ballast, receptacles, switches, conduits, wiring, junction boxes and hangers for complete system. The supply and installation of lighting is by others.

6.5 The grounding of the processing plant will include grounding of the process building, panels and motors. Grounding is to be supplied by others.

7. FINAL DESIGN OF AUXILIARY SERVICES OF THE PROCESSING PLANT

- 7.1 The design of the auxiliary services of the processing plant was made by Consultores Galindo Ltda working as a subcontractor to SNC.
- 7.2 The design of the auxiliary services covers four items: plumbing, fire protection, water pumps and air compressor. Supply of all these auxiliary services is by others.
- 7.3 Two drinking fountains will be installed in the process section. The water will be supplied from the main water supply of the complex and drained into the main drainage system of the complex.
- 7.4 Four fire extinguishers containing ten pounds of chemical product of type A-B-C will be located in the processing plant for fire protection.
- 7.5 Three sump pumps of individual capacity of 50 GPM (gallons per minute) and 15 ft head will be located in the scalping pit, the tailings pit and the truck scale pit.
- 7.6 An air compressor with a capacity of 25 SCFM (standard cubic feet per minute) at a pressure of 90 psi (pounds per square inch) will be located in the processing plant to serve six different areas.

8. SCHEDULE OF PHASE IV

8.1 A preliminary schedule for Phase IV was prepared. Principal dates are as follows:

January 1st, 1972	:	Initiation of Phase IV Purchase of Equipment
March 19, 1972	:	Beginning of Processing Plant Construction
June 25th, 1972	:	Ocean Shipping of Process Equipment
September 16th, 1972	:	Termination of Processing Plant Construction
October 15, 1972	:	Beginning of Process Equipment Installation
January 27th, 1973	:	Termination of Process Equipment Installation
January 28th, 1973	:	Start of Experimental Plant Operations

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SECTION 2

9. CONCLUSIONS

- 9.1 An experimental plant able to produce 1,500 tons of asbestos fibre from 40% concentrate was designed. Process equipment was selected, specifications issued, bids obtained and prices confirmed.
- 9.2 Concrete, structural, architectural, electrical and auxiliary services design of the processing plant was carried out. Material was selected, specifications completed to call tenders for the construction of the processing plant and the installation of services.
- 9.3 After approval of the Phase III Addendum report, Phase IV of the project can be initiated with a minimum delay.

Respectfully submitted,

SURVEYER, NENNIGER & CHENEVERT INC.



G. Lavallée
G. Lavallée, Eng.
Vice-President
Mining and Metallurgy Division



APPENDIX A

SPECIFICATIONS

APPENDIX AList of Specifications

<u>TITLE</u>	<u>Serial No</u>
Belt Conveyors	SNC - 14
Truck Scale	SNC - 18
Vibrating Screener	SNC - 19
Screw Conveyor	SNC - 20
Dustube Collector	SNC - 20/30
Replanteo	ET - 1
Movimiento de Tierras	ET - 2
Concreto	ET - 3
Fierro de Armadura	ET - 4
Mamposteria de Piedra	ET - 5
Mamposteria de Bloques de Cemento	ET - 6
Revoques de Mortero	ET - 7
Estructuras de Madera	ET - 8
Puertas Y Ventanas	ET - 9
Pinturas	ET - 10
Cubiertas de Asbesto - Cemento	ET - 11
Plomerias	ET - 12
Proteccion Contra El Fuego	ET - 13
Bombas de Desague	ET - 14
Compresora	ET - 15
Instalacion Electrica	ET - 16

S

DEVIS - SPECIFICATION

BELT CONVEYORS

REV. 1 PAGE 1

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 14

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Rev. 1, pages 2R, 3R, 4R
Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC



DEVIS - SPECIFICATION

BELT CONVEYORS

REV. 1 PAGE 2R

CONTRAT/CONTRACT 3161
SUBDIVISION 02
SUJET/SUBJECT 3700
SERIE/SERIAL 14

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply the Purchaser with three (3) copies of general arrangement drawings and wiring diagrams for approval and five (5) copies of approved drawings.

1.4 Operating instructions

Upon completion of work, supply the Purchaser with five (5) copies of operating and maintenance instructions for the equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish the Purchaser with a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS - SPECIFICATION

BELT CONVEYORS

REV. 1 PAGE 3R

CONTRAT - CONTRACT 3161
SUBDIVISION 07
SUJET - SUBJECT 3700
SERIE - SERIAL 14

1. GENERAL (Cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment specified herein against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay at no cost to the Purchaser or to the Owner.

1.7 Delivery

Supply the Purchaser with a firm delivery time from date of order allowing two (2) weeks for approval of general arrangement drawings and wiring diagrams, as well as weight and volume of crated equipment.



DEVIS - SPECIFICATION

BELT CONVEYORS

REV. 1 PAGE 4R
CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE SERIAL 14

2. SCOPE

2.1 Work included

Supply of three (3) belt conveyors, complete with frames, supports, motors, motor starters, stop and start push-buttons, and drives, as shown on drawings No. 3161-02-3700-3, 3161-02-3700-4 and 3161-07-4500-1 of Surveyer, Nenniger & Chênevert Inc.

The required width of belt, capacity, velocity and material to be handled for each conveyor is indicated below:

<u>Conveyor No.</u>	<u>Belt Width</u>	<u>Capacity</u>	<u>Velocity</u>	<u>Material to be handled</u>
1	46 cm (18")	2.5 MTPH	30.5 mpm (100 fpm)	Minus 1" (25.4 mm) wet crocidolite ore, 65 lb/cu.ft. (1042 kilo/cu.m.)
2	46 cm (18")	2.5 MTPH	30.5 mpm (100 fpm)	Minus 1/4" (6.4 mm) dry tailings, 75 lb/cu.ft. (1202 kilo/cu.m.)
3	46 cm (18")	0.1 MTPH	30.5 mpm (100 fpm)	Minus 3" (76.2 mm) plus 1" (25.4 mm) wet crocidolite ore, 85 lb/cu.ft. (1362 kilo/cu.m.)

Electrical wiring from motors to motor starters and push-buttons.

Dust cover for conveyor No. 2.

2.2 Work excluded

Electrical wiring for site connections.
Anchor bolts and chutework.
Installation.



DEVIS - SPECIFICATION

REV. 0 PAGE 5

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 14

BELT CONVEYORS

3. MATERIAL

Mechanical and electrical components must be exchangeable from one conveyor to the other, except belting.

3.1 Frames/Supports and Anchor Plates

In mild steel as per manufacturer's recommendations.

3.2 Dust Covers

In mild steel sheet with adjustable rubber strips on both sides of conveyors.

3.3 Conveyor Pulleys

Pulleys shall be of solid welded steel drum type crown face construction, closed ends with taper lock type hubs, 2" (50.8 mm) wider than belt.

3.4 Shafts

Shafts shall be of solid steel, manufactured from cold drawn shafting material.

3.5 Pillow Blocks

Shall be of high quality cast or ductile iron, split construction fitted with self-aligning, anti-friction spherical roller bearings.

3.6 Idlers

3.6.1 Troughing Idlers

20 degree 3 equal roll type troughing idlers shall be used. Rolls to be completely interchangeable.

3.6.2 Troughing Training Idlers

Shall be positive acting type. Pivotal mounting at center of idler frame shall be provided.



DEVIS - SPECIFICATION

REV. 0 PAGE 6

CONTRAT CONTRACT 3161
SUBDIVISION 02
SUJET SUBJECT 3700
SERIE/SERIAL 14

BELT CONVEYORS

3. MATERIAL (cont'd)

3.6 Idlers (cont'd)

3.6.3 Return Idlers

Shall be of single horizontal roll type carried in brackets arranged for suspension from conveyor frame.

3.6.4 Return Training Idlers

Shall be of single horizontal roll type. At the centre of idler frame pivotal mounting shall be provided.

3.7 Take-Ups

Manually adjustable screw take-ups shall be the protected open type equipped with self-aligning ball bearings. Positive bearing seals to retain lubricant and exclude foreign matter.

3.8 Belting

As per manufacturer's recommendations.

3.9 Drives

To include shaft mounted reducers, couplings, sheaves, V-belts, guards, and motor supports.

3.10 Motors

380/3/50 totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B, complete with motor bases.

3.11 Motor Starters/
Push-Buttons

As per manufacturer's recommendations, fixed to the conveyor frames.



DEVIS - SPECIFICATION

REV. 0 PAGE 7

CONTRAT / CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE / SERIAL	14

BELT CONVEYORS

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.



DEVIS -- SPECIFICATION

BELT CONVEYORS

REV. 0 PAGE 8

CONTRAT CONTRACT	3161
SUBDIVISION	02
SUJET SUBJECT	3700
SERIE SERIAL	14

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



DEVIS - SPECIFICATION

REV. 0 PAGE 1

TRUCK SCALE

CONTRAT/CONTRACT 3161
SUBDIVISION 07
SUJET/SUBJECT 3700
SERIE/SERIAL 18

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC



DEVIS - SPECIFICATION

REV. 0 PAGE 2

CONTRAT / CONTRACT 3161
SUBDIVISION 07
SUJET / SUBJECT 3700
SERIE / SERIAL 18

TRUCK SCALE

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical functions and accuracy.

Purchaser reserves right to have his representatives witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes and regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

At time of purchase supply the Purchaser with five (5) copies of scale foundations.

1.4 Operating instructions

Upon completion of work supply the Purchaser with five (5) copies of operating and maintenance instructions for the equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish the Purchaser a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS - SPECIFICATION

TRUCK SCALE

REV. 0 PAGE 3

CONTRAT/CONTRACT 3161
SUBDIVISION 07
SUJET/SUBJECT 3700
SERIE/SERIAL 18

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment specified herein against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser, or to the Owner.

1.7 Delivery

Supply the Purchaser a firm delivery time from date of order, as well as weight and volume of crated equipment.



DEVIS - SPECIFICATION

REV. 0 PAGE 4

CONTRAT /CONTRACT 3161
SUBDIVISION 07
SUJET /SUBJECT 3700
SERIE /SERIAL 18

TRUCK SCALE

2. SCOPE

2.1 Work included

Supply of one (1) 14.75 metric tons capacity truck scale, sensitivity of 5.0 kilos, and supervise the installation.

2.2 Work excluded

Foundations and reinforcing steel.

Installation.



DEVIS - SPECIFICATION

REV. 0 PAGE 5

CONTRAT/CONTRACT 3161
SUBDIVISION 07
SUJET/SUBJECT 3700
SERIE/SERIAL 18

TRUCK SCALE

3. MATERIALS

3.1 Platform

24 ft. (7.3 m) long by 10 ft. (3.0 m) wide, with concrete deck.

3.2 Weighbridge

As per manufacturer's recommendations.

3.3 Lever system

Of 7 - lever design type, with double parallel link platform suspension, complete with pivots and bearings.

3.4 Anchor bolts

As per manufacturer's recommendations.

3.5 Pit coping steel

As per manufacturer's recommendations.

3.6 Manhole cover

As per manufacturer's recommendations.

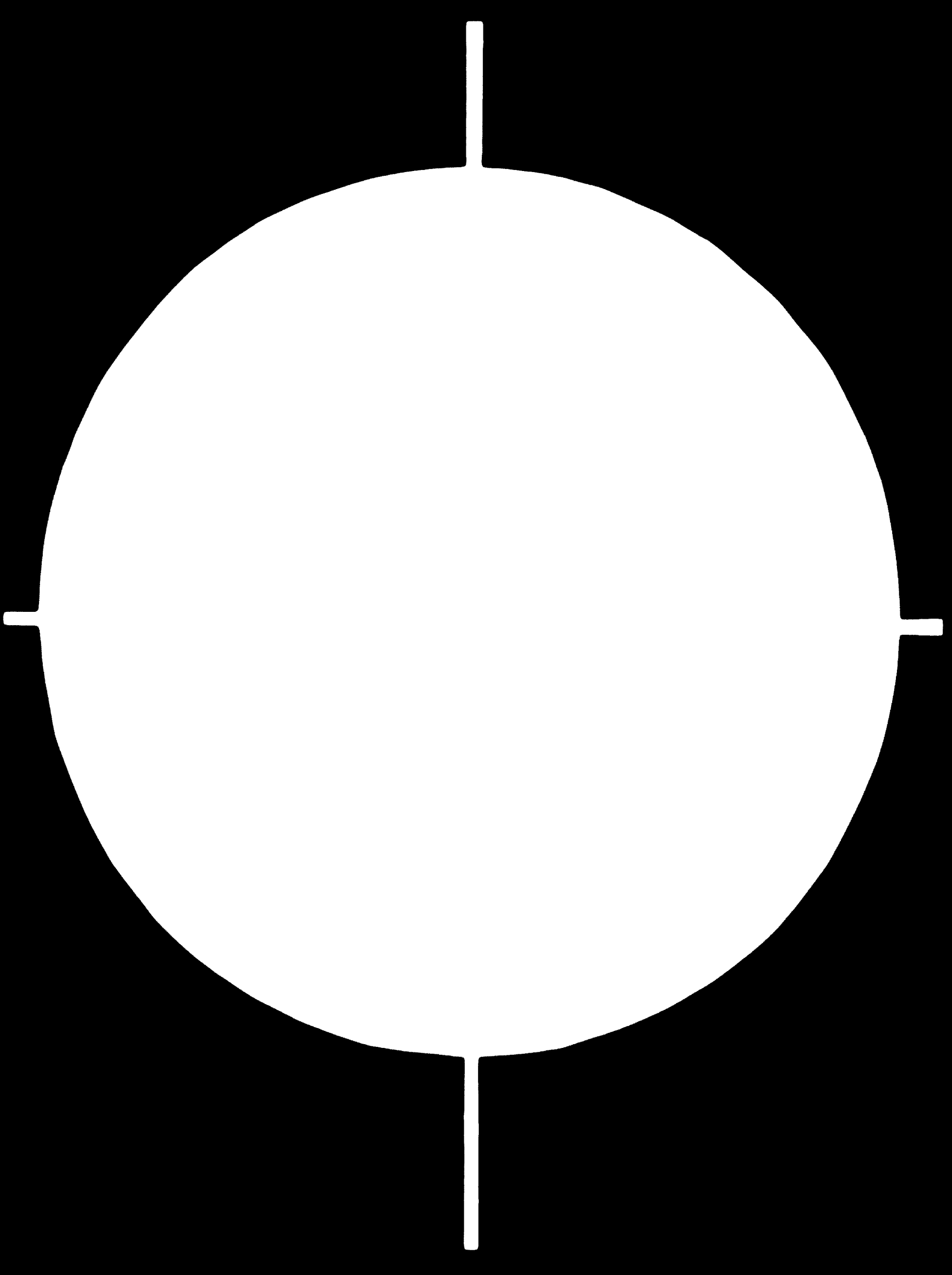
3.7 Beam

Direct reading full capacity beam, complete with a main beam, a fractional beam, and a screw weight at the left end of the main beam to put the scale on zero when foreign accumulations are on the scale platform. No tare beam required.

B-561



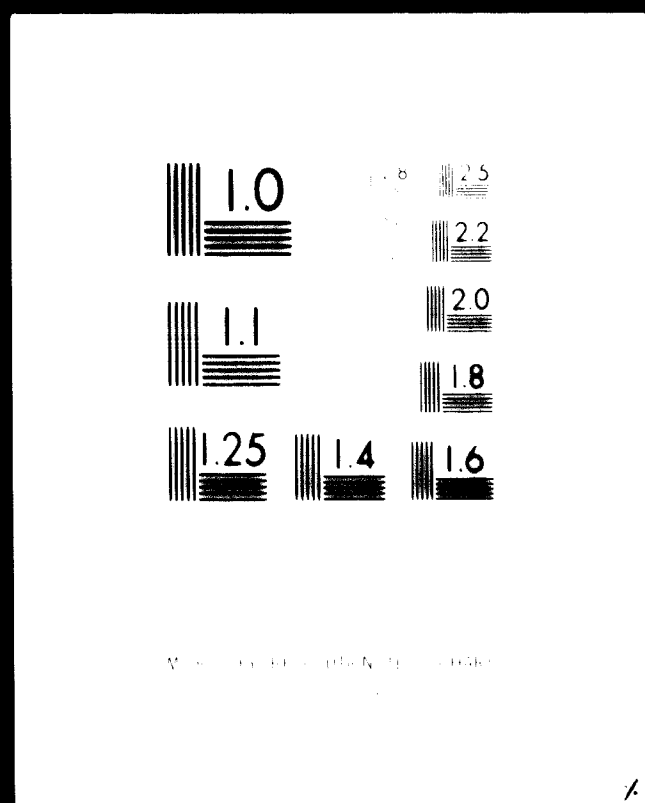
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6 OF 7

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DEVIS - SPECIFICATION

REV. 0 PAGE 6

TRUCK SCALE

CONTRACT CONTRACT 3161
SUBDIVISION 07
SUBJECT SUBJECT 3700
BORNE/SERIAL 18

3. MATERIALS (cont'd)

3.7 Beam (Cont'd)

Beam graduations shall be in 500 kilos for the main beam and 5 kilos for the fractional beam.

The beam shall be located on the left side of scale.



DEVIS SPECIFICATION

TRUCK SCALE

REV. 0 PAGE 7

CONTRACT CONTRACT 3161
SUBDIVISION 07
BLUET SUBJECT 3700
SERIE/SERIAL 10

4. INSTALLATION

4.1 Work included

Supervision of the installation of the platform, weighbridge, lever system and beam.

4.2 Work excluded

Supervision of the construction of the foundations including but not limited to concrete, reinforcing steel, anchor bolts, pit coping steel, manhole and manhole cover.

S

DEVIS - SPECIFICATION

REV. 0 PAGE 8

CONTRACT CONTRACT 3161
SUBDIVISION 07
BLAZET/SUBJECT 3700
CODE/SERIAL 18

TRUCK SCALE

5. PAINTING

5.1 Beam

Gray baked enamel.

5.2 Other parts

All exposed ferrous surfaces not machined shall be thoroughly cleaned and painted in the shop with one coat of manufacturer's standard primer.



DEVIS - SPECIFICATION

TRUCK SCALE

REV 0 PAGE 9

CONTRACT CONTRACT 3161
SUBDIVISION 07
SUBJECT SUBJECT 3700
SERIE/SERIAL 18

6. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.

S

DEVIS SPECIFICATION

VIBRATING SCREENS

REV 0 PAGE 1

CONTRACT NUMBER 1161
SUBVISION 07
DART NUMBER 1700
SERIAL 10

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

**SURVEYER, NENNIGER & CHENEVERT INC.
MONTREAL, QUEBEC**



DEVIS SPECIFICATION

VIBRATING SCREEN

REV 0 PAGE 2

CONTRACT CONTRACT 3161
SUBDIVISION 07
BUDGET SUBJECT 3700
CODE SERIAL 19

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves the right to have his representative witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply the Purchaser with three (3) copies of general arrangement drawings and wiring diagrams for approval and five (5) copies of approved drawings.

1.4 Operating instructions

Upon completion of work, supply the Purchaser with five (5) copies of operating and maintenance instructions for the equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish the Purchaser with a list of recommended spare parts, including prices, that may be required for the first two years of operation.



DEVIS SPECIFICATION

VIBRATING SCREENS

REV 0 PAGE 3

CONTRACT - CONTRACT 1161
SUBDIVISION 07
PROJECT SUBJECT 1700
SERIAL 19

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment specified herein against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser or to the Owner.

1.7 Delivery

Supply the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, as well as weight and volume of crated equipment.



DEVIS SPECIFICATION

REV 0 PAGE 4

VIBRATING SCRENER

CONTRACT CONTRACT 3161
SUBDIVISION 07
SUBJECT SUBJECT 3700
BOMB SERIAL 19

2. SCOPE

2.1 Work included

Supply one (1) single deck vibrating screener, complete with motor, motor starter, stop/start pushbutton and drive to scalp 20 metric tons a day of chromite ore.

Electrical wiring from motor to motor starter and pushbutton.

2.2 Work excluded

Electrical wiring for site connections.
Foundations, support and chutework.
Installation.



DEVIS SPECIFICATION

VIBRATING SCREENER

REV 0 PAGE 5

CONTRACT CONTRACT 3161
SUBDIVISION 07
SUJET SUBJECT 3700
SERIE SERIAL 19

3. MATERIALS

3.1 Vibrating screener

Equal to Link-Belt vibrating screener, size UP 138, 38" (96.5 cm) wide by 100" (254.0 cm) long, 30° slope, single deck, open type, ceiling mounted to suit 40" (101.6 cm) from rear screener connections to bottom of springs, supply with a steel pan having 30° slope and bolted to screener frame, and over and under size discharge arrangement (shown on page 7) bolted to screener frame, complete with drive including V-belts, sheaves, guard, motor base, 1-1/2 HP horizontal standard motor 380/3/50 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation Class B), motor starter and stop/start pushbutton.

The motor starter and pushbutton will be field installed by the Contractor.

3.2 Screen

Ty-Rod screen 1" (25.4 mm) opening, 1/4" (6.35 mm) diameter of wire, with length of slot parallel to the long dimension of the piece.

S

DEVIS -- SPECIFICATION

VIBRATING SCREENER

REV. 0 PAGE 6

CONTRAT CONTRACT 3161
SUDIVISION 07
SUJET SUBJECT 3700
SERIE/SERIAL 19

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed, shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.

5. ASSEMBLY FOR SHIPMENT

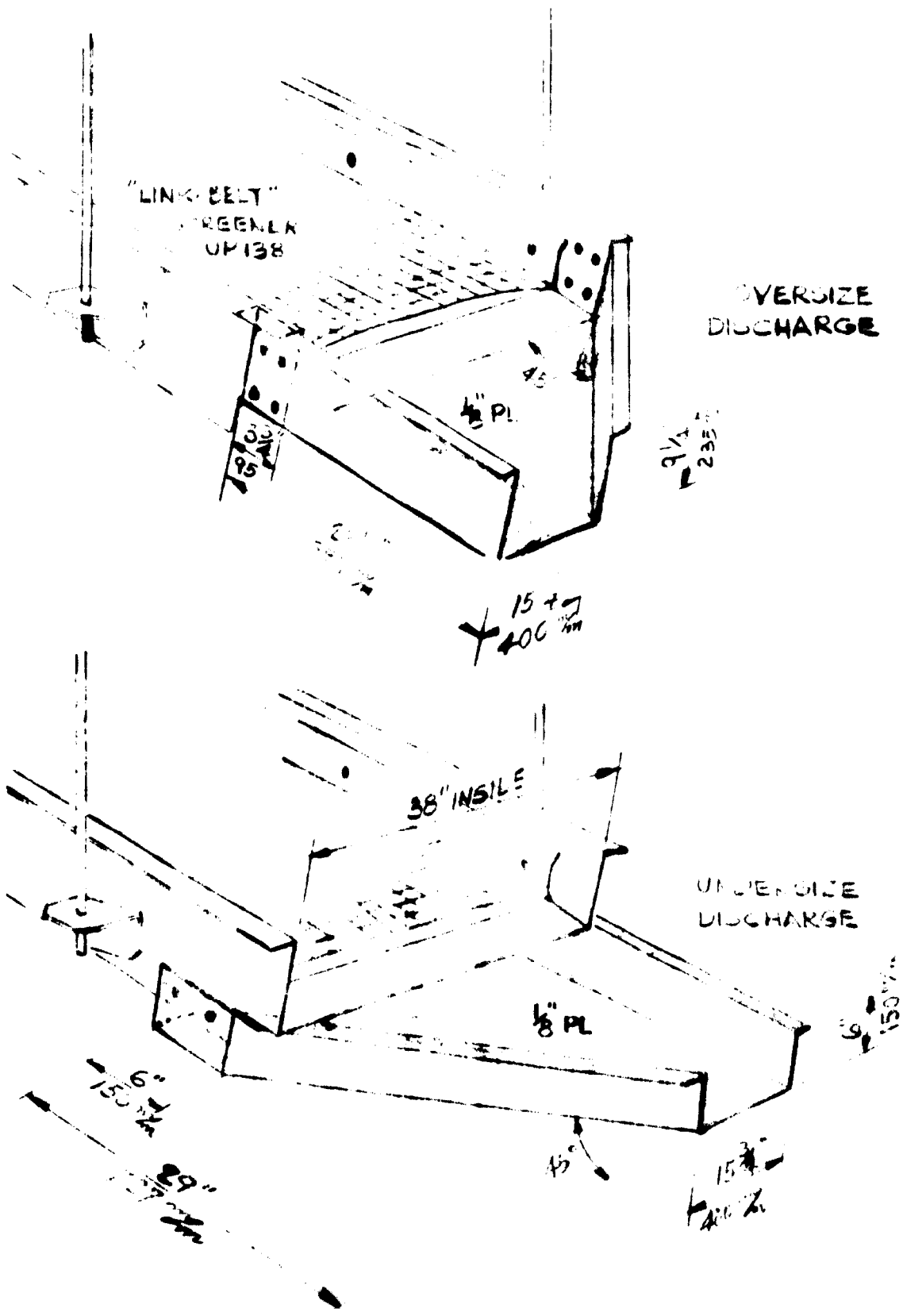
Equipment shall be crated and packaged for road, rail, sea transportation, as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



FEUILLE DE CALCUL - DESIGN SHEET

CLIENT: *CHD*
PROJ. E. *CONCRETE* *INDUSTRIAL*
SUJET: *VIBRATION* *TABLE*

CONTRACT NO. / CONTRAT	SUB-DIV. NO.	SUBJECT NO. / SUJET	ACT.	LOC.
<i>7</i>	<i>7</i>			<i>12</i>
FACT/MODE	APP.	DATE	PAGE	
<i>G.P.</i>		<i>7-27-71</i>	<i>7</i>	



SCALE: NONE

S

DEVIS . SPECIFICATION

SCREW CONVEYOR

REV 0 PAGE 1

CONTRACT CONTRACT 3101
SUBDIVISION 07
DRAFT SUBJECT 3700
DISE SERIAL 20

EXPERIMENTAL PRODUCTION PLANT

FOR

ASBESTOS PROCESSING

COCHABAMBA, BOLIVIA

Made by:

Approved by:

Date:

**BOUYER, MENIGER & CHENEVIER INC.
MONTREAL, QUEBEC**



DEVIS - SPECIFICATION

SCREEN CONVERTER

REV. 0 PAGE 2
CONTRACT CONTRACT 3161
SUBDIVISION 07
SUJET SUBJECT 3700
SERIE SERIAL 20

1. GENERAL

1.1 Tests

Equipment shall be completely shop assembled and tested for mechanical and electrical functions.

Purchaser reserves the right to have his representative witness testing of equipment. Vendor shall advise Purchaser two (2) weeks in advance of testing.

1.2 Codes/Regulations

Supply materials strictly in accordance with Bolivian rules, regulations, ordinances, codes applicable and in force at the time of the fabrication.

1.3 Shop drawings

Before commencing work, supply the Purchaser with three (3) copies of general arrangement drawings and wiring diagrams for approval and five (5) copies of approved drawings.

1.4 Operating instructions

Upon completion of work, supply the Purchaser with five (5) copies of operating and maintenance instructions for the equipment and systems, properly bound in separate covers.

1.5 Spare parts

Guarantee the availability of spare parts for the normal service life of the equipment. Furnish the Purchaser with a list of recommended spare parts, including prices, that may be required for the first two years of operation.

S

DEVIS - SPECIFICATION

SCREW CONVEYOR

REV. 0 PAGE 3
CONTRAT CONTRACT 3161
SUDIVISION 07
SUJET SUBJECT 3700
SERIE SERIAL 20

1. GENERAL (cont'd)

1.6 Guarantee

Provide a two-year guarantee from date of final acceptance covering equipment specified herein against defects of design, materials, construction and workmanship. Should any equipment or material be found defective, repair or replace without delay and at no cost to the Purchaser or to the Owner.

1.7 Delivery

Supply the Purchaser a firm delivery time from date of order allowing two weeks for approval of general arrangement drawings and wiring diagrams, as well as weight and volume of crated equipment.



DEVIS - SPECIFICATION

SCREW CONVEYOR

REV.	0	PAGE	4
CONTRACT/CONTRACT		3161	
SUBDIVISION		07	
SUJET SUBJECT		3700	
SERIE SERIAL		20	

2. SCOPE

2.1 Work included

Supply one (1) screw conveyor 14'-0" (426.7 cm) long, 12" (304.8 mm) diameter, running at 60 rpm, complete with motor, motor starter, stop/start pushbutton and drive to convey, on an inclined plane of 17.5 degrees, 12 metric tons an hour of crocidolite ore weighing 85 lbs./cu. ft. (1362 kilo/cu. m).

Electrical wiring from motor to motor starter and pushbutton.

2.2 Work excluded

Electrical wiring for side connections.

Conveyor supports, chute work and hopper shown on page 9.

Installation.

S

DEVIS - SPECIFICATION

SCREW CONVEYOR

REV. 0 PAGE 5
CONTRAT/CONTRACT 3161
SUBDIVISION 07
SUJET SUBJECT 3700
SERIE/SERIAL 20

3. MATERIALS

3.1 Screw

12" (304.8 mm) helicoid flight screw, 12" (304.8mm) pitch, with flight made of 1/4" (6.35 mm) thick steel plate and welded to pipe creating strong one-piece construction.

3.2 Shafts

Shafts shall be made of cold drawn round steel, jig drilled to ensure perfect fit with screw.

Drive shaft shall have keyway corresponding to transmission specification.

3.3 Bearings

Flanged blocks shall be self-aligning, spherical, with suitable dynamic load and thrust capacity.

Grease valves to be furnished to permit greasing during operation.

3.4 Trough end seals

Plate felt seals shall be bolted onto outside of trough end plates to prevent foreign matter from contaminating product handled.

3.5 Trough end plates

Trough end plates shall be the outside pattern type, with bent flanges at top and bottom. Bottom bent flanges shall be in a horizontal position while conveyor is inclined 17.5 degrees.



DEVIS - SPECIFICATION

SCREW CONVEYOR

REV. 0 PAGE 6
CONTRACT/CONTRACT 3161
SUBDIVISION 07
SUJET SUBJECT 3700
SERIE/SERIAL 20

3. MATERIALS (cont'd)

3.6 Trough

Trough shall be the angle-flanged, U-type with heavy fabricated end flanges, all securely jig-welded to ensure perfect alignment and tight connecting joints.

Required minimum thickness of trough is 3/16" (4.76 mm).

3.7 Discharge spout

Stub discharge spout 13" (330.2 mm) by 13" (330.2 mm) shall be fitted to conveyor trough opening with its centre located at 12 1/2" (317.5 mm) from trough end.

Fabricated from 3/16" (4.76 mm) thick steel plate, flanged for chute connection. No gate required.

3.8 Inlet spout

Opening shall be 13" (330.2 mm) by 13" (330.2 mm).

Hopper shown on page 8 will be field constructed from 3/16" (4.76 mm) thick steel plate and must not be supplied with conveyor.

3.9 Cover

Conveyor shall be supplied without cover.

3.10 Drive

Conveyor shall be supplied complete with drive which shall consist of shaft mounted reducer, sheaves, V-belts and belt guard.



DEVIS - SPECIFICATION

SCREW CONVEYOR

REV. 0 PAGE 7

CONTRAT / CONTRACT 3161
SUBDIVISION 07
SUJET / SUBJECT 3700
SERIE / SERIAL 20

3. MATERIALS (cont'd)

3.11 Motor

2 HP motor 380/3/50 totally enclosed, fan cooled equivalent to NEMA Design B, insulation Class B, with starter and stop/start pushbutton.

Motor shall be mounted on top of conveyor at least 18" (457.2 mm) above it, and starter and stop/start pushbutton installed on motor support.



DEVIS - SPECIFICATION

SCREW CONVEYOR

REV.	0	PAGE	8
CONTRACT	CONTRACT	3161	
SUBDIVISION		07	
SUJET	SUBJECT	3700	
SERIE	SERIAL	20	

4. PAINTING

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of Manufacturer's standard primer.

5. ASSEMBLY FOR SHIPMENT

Equipment shall be crated and packaged for road, rail, sea transportation as appropriate to the shipping route, and shall be pre-assembled to the greatest possible extent. All unpainted surfaces shall be protected against corrosion. All components to be re-assembled shall be match-marked.



FEUILLE DE CALCUL - DESIGN SHEET

CLIENT

PROJ.

SUJET
SUBJECT

CONTRACT
NO.
CONTRAT

SUB-
DIV.
NO.

SUBJECT
NO.
SUJET

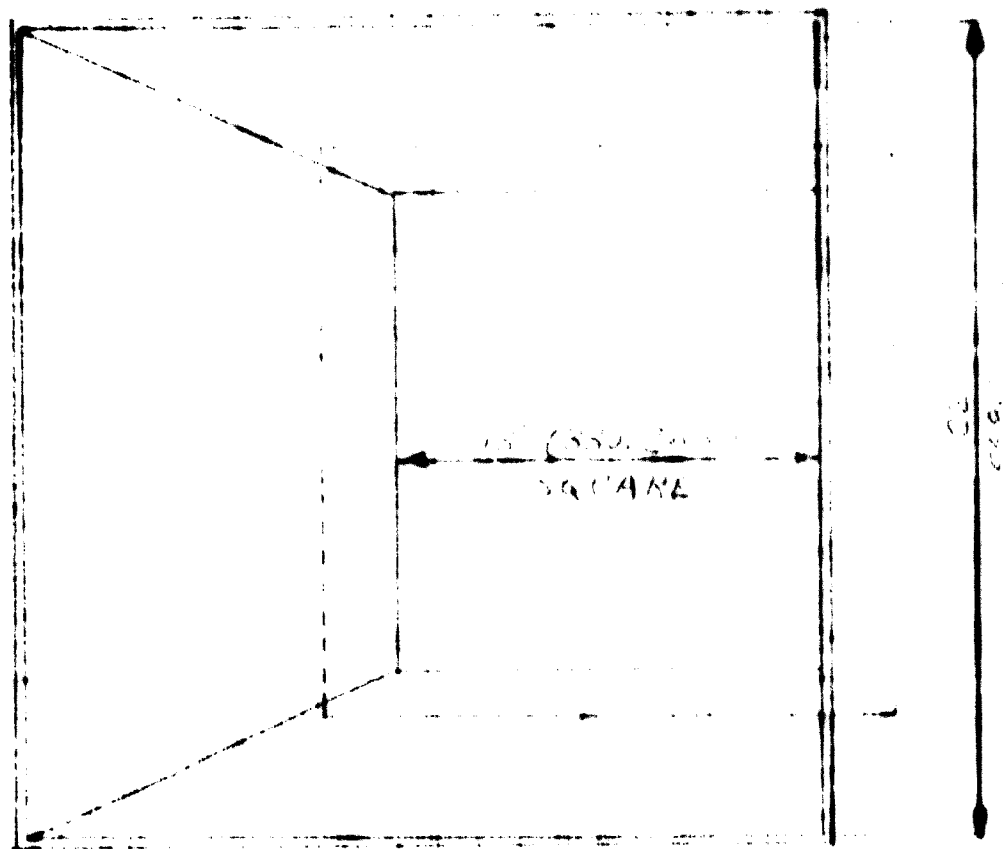
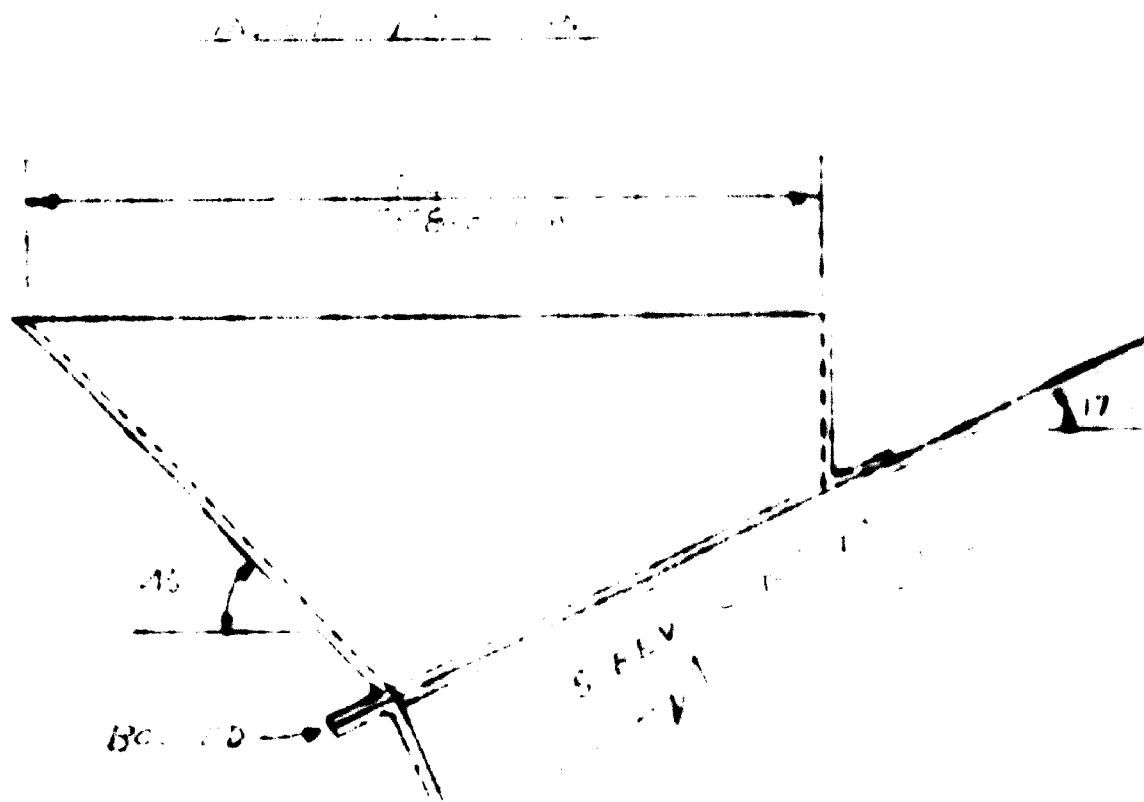
ACT. LOC.

FAIT/MADE

APP.

DATE

POSE



**DEVIS - SPECIFICATION**DUSTTUBE COLLECTOR
#20/30

CONT.	NO. DIV.	QTY. SUBJECT	SERIAL NO. SERIAL	REV.	PAGE
3161	02	1700		0	35

1. GENERAL**1.1 General Requirements**

The supplier for equipment under this section is referred to the general and special conditions of the contract which are hereby part of this Specification.

2. SCOPE**2.1 Work Included**

Supply of one (1) dusttube collector, 800 cfm (22.6 cmm) capacity with an inlet vacuum of at least 1" (25.4 mm) W.G., complete with transmitter, fan, pulleys, belts, guide, motor 360/1750 (totally enclosed, fan cooled, equivalent to NEMA Design B, insulation class B), motor base, motor starter, stop/start push-button, electrical wiring from motor to motor starter and push-button, duct from dusttube collector to fan and from fan to atmosphere. Refer to the attached sketch.

The motor starter and stop/start push-button must be fixed to the dusttube collector as shown on the sketch.

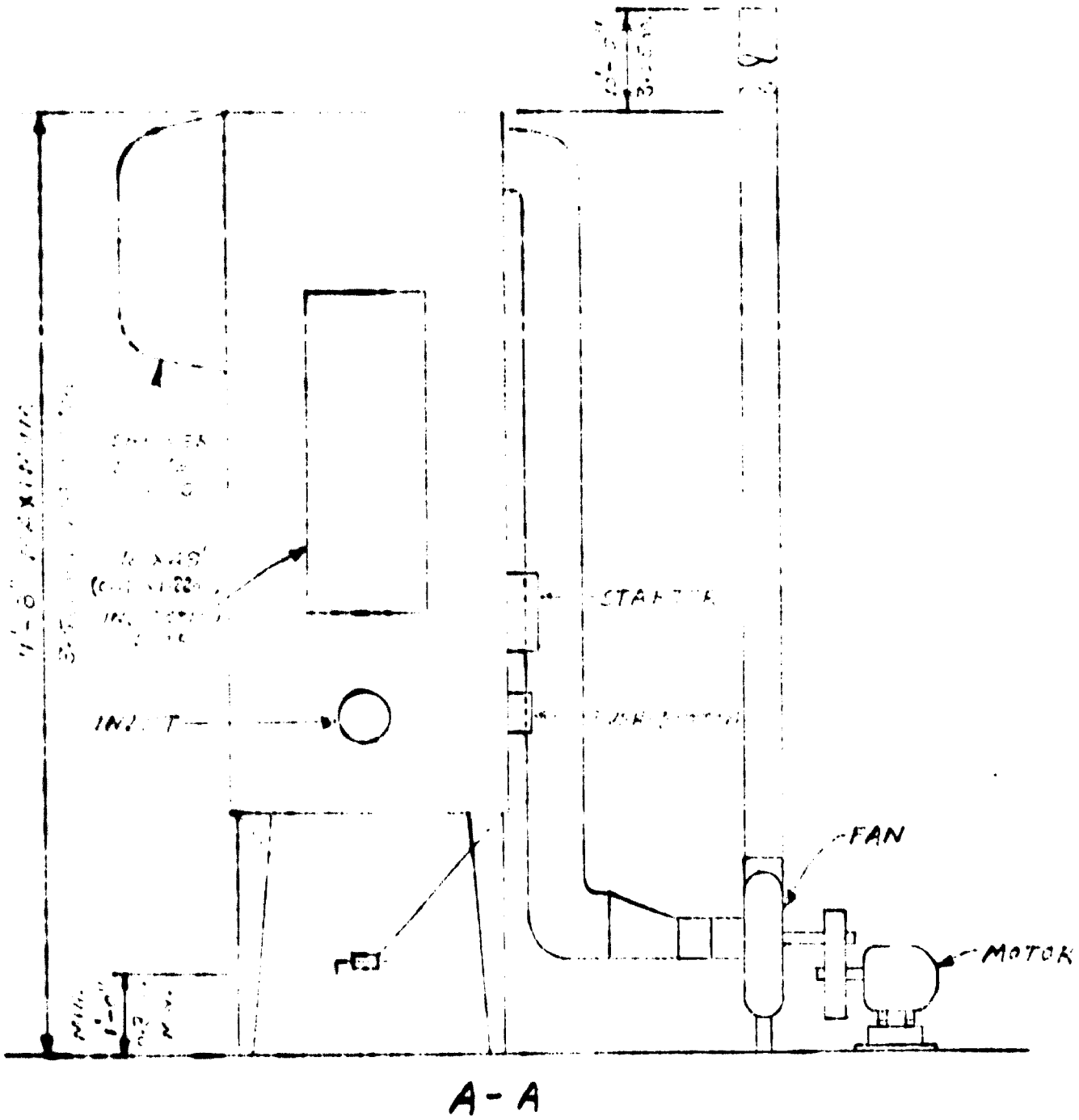
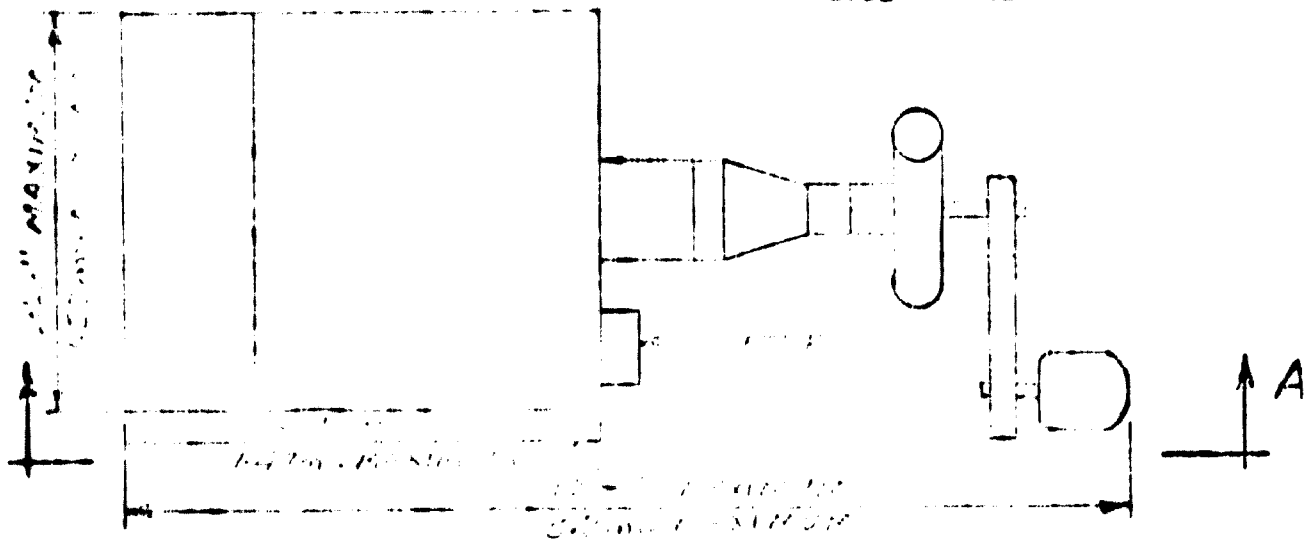
Electrical wiring for site connections
Anchor bolts
Installation

2.2 Work Excluded**2.3 Painting**

All exposed ferrous surfaces not machined and not exposed to the material being processed shall be thoroughly cleaned and painted in the shop with one coat of manufacturer's standard primer.

10-21-51
2075

CONT. 3061
SUG. 02
SUBJECT 5700
REV. 0
PAGE 18



CONSULTORES GALINDO LTDA

COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

ET-1 Replanteo

Noviembre 1971

ESPECIFICACIONES TECNICAS

ET-1 REPLANTEO

Descripción

Este trabajo comprende la provisión de materiales, equipos, energía y mano de obra para la limpieza y nivelación del terreno, la colocación de estacas, caballetas de madera y lienzas sobre los ejes de la estructura, de acuerdo a los planos respectivos y el marcado de líneas y taludes de excavación.

Construcción

El contratista deberá colocar caballetes de madera y lienzas de manera que sea posible la correcta ubicación de las cimentaciones. El ingeniero deberá aprobar el replanteo antes de iniciarse las excavaciones.

Medición

No se hará medición específica de este ítem sino una verificación de que todas las estructuras o excavaciones han sido adecuadamente replanteadas.

Pago

No habrá ítem de pago. El costo del replanteo no será pagado en forma separada.

CONSULTORES GALINDO LTDA

COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

ET-2 Movimiento de Tierras

Noviembre 1971

BT-2 MOVIMIENTO DE TIERRAS

Descripción

Este ítem consta de dos partes

a) Excavación Estructural

Este trabajo comprende la provisión de todos los equipos, materiales y mano de obra para ejecutar las excavaciones necesarias para la fundación de las estructuras o para la construcción de tolvas a nivel bajo terreno natural. Este trabajo comprende también el drenaje, taulaestacas, encofrados y ataguías para la construcción de los cimientos así como también el traslado del material extraído a un lugar cercano indicado por el Ingeniero.

b) Relleno

Comprende el suministro y colocación del material de relleno en zonas excavadas alrededor de las fundaciones y en la planta baja.

Materiales

El material de relleno deberá ser seleccionado del material de excavación y aprobado por el Ingeniero antes de su colocación. En caso de requerirse préstamo el Contratista propondrá el área y el Ingeniero la aprobará. No se reconocerá transporte extra por ningún motivo.

Construcción

Todas las excavaciones se harán de acuerdo a los alineamientos, pendientes y cotas indicadas en los planos. El Ingeniero podrá ordenar por escrito cambios que estime necesarios en las dimensiones o profundidades, para obtener una cimentación satisfactoria. En caso de que el

Contratista se encarga en profundidad de las excavaciones de los cimientos, deberá rellenas con hormigón pobre, por cuenta propia, hasta la cota indicada en los planos o especificada por el Ingeniero. El fondo de toda excavación o nivel final a rasante del suelo natural será compactado a las densidades indicadas en los planos a costo del contratista.

El relleno se hará con material seleccionado y aprobado por el Ingeniero y en capas horizontales a humedad óptima de no más de 20 cms. de espesor, hasta llegar al nivel natural original o final y a las densidades indicadas en los planos.

Excavación

La excavación estructural será cubierta de acuerdo a las dimensiones de la estructura que recibirán o a las líneas finales especificadas en los planos o por escrito por el Ingeniero; toda excavación adicional o de derrumbe corre por cuenta del Contratista sea ésta causada por motivos del suelo, de métodos constructivos o por cualquier otra razón.

Los volúmenes del material de relleno autorizados por el Ingeniero serán medidos en su disposición final.

Pago

La forma de pago de este ítem será:

BT-2 (1) Excavación Estructural, m³

BT-2 (2) Relleno, m³

CONSULTORES GALINDO LTDA

COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

BT-3 Concrete

Noviembre 1971

BT-3 CONCRETO

Descripción

Este trabajo comprende la provisión de todo material, equipos, energía y mano de obra para ejecutar todas las obras de hormigón ya sean armadas o no, en conformidad con las dimensiones, alineamientos y cotas indicadas en los planos u ordenados por escrito por el Ingeniero. Este trabajo comprende también los andamios y moldaje o formas requeridos en la construcción de la obra, lo mismo que los materiales para el curado.

Materiales

Los materiales usados en la elaboración del concreto deberán ajustarse a las siguientes exigencias:

a) Cemento

El cemento a usarse será tipo cemento portland y deberá llenar las exigencias de las especificaciones de la AASHO M-85.

Deberá usarse un solo tipo de cemento en toda la obra, excepto cuando lo autorice por escrito el Ingeniero. Cuando se usen aditivos o retardadores de fraguado, el Contratista deberá presentar certificados basados en ensayos de Laboratorio, con el objeto de probar que el material cumple con las exigencias de resistencia a la compresión exigidas.

b) Agua

Toda el agua utilizada en la elaboración del concreto deberá ser aprobada por el Ingeniero y carecerá de aceites, ácidos, álcalis,

azúcar, impurezas y sustancias vegetales.

c) Agregados Finos

Los agregados finos para el concreto se compondrán de arenas naturales. No podrán contener arcilla, carbón ni impurezas.

Los agregados finos deberán cumplir con la siguiente granulometría.

N° de Tamiz	Porcentaje que pasa en peso
3/8"	100
# 4	95 - 100
# 16	45 - 80
# 50	10 - 30
# 100	3 - 10
# 200	0 - 3

d) Agregados Gruesos

Los agregados gruesos para el concreto se compondrán de piedras trituradas, gravas o ripio natural, escorias de horno de fundición u otro material inerte de características similares. No podrán contener arcillas ni material que pase por el tamiz # 200.

El tamaño máximo de las partículas del agregado grueso será de 1" para vigas y pilares, 3/4" para losas y 1 1/2" para los cimientos.

En los cimientos se podrá usar hormigón ciclópeo previa autorización del Ingeniero.

- 3 -

Las gradaciones serán:

Tamaño de tamiz	Porcentaje en peso que pasa		
	Cimientos	vigas, pilares	losas
1 1/2"	100	-----	-----
1"	90 - 100	100	-----
3/4"	10 - 30	90 - 100	100
1/2"	0 - 10	0 - 30	0 - 30

Tanto el agregado fino como el grueso deberán ser aprobados por el Ingeniero. Antes de su incorporación en la mezcla deberán estar a un nivel de humedad "saturado superficie seca".

Dosificación

En un metro cúbico de concreto se utilizará una dosificación de 7.0 bolsas de cemento portland de 50 Kg c/u, 710 Kg de agregado fino, 900 Kg de agregado grueso y 180 lts. de agua. Estos valores podrán ser transformados a volúmenes o modificados por el Ingeniero con el objeto de lograr la resistencia exigida. Todo concreto deberá tener una resistencia prismática a la compresión a los 28 días de 210 Kg/cm². Para efectuar este control, el Contratista extraerá probetas cilíndricas de concreto usado en la obra cada vez que el Ingeniero lo solicite, debiendo estos ser ensayados para su comprobación. En caso de que el concreto no cumpla las exigencias requeridas, será rechazado por el Ingeniero, debiendo el Contratista rehacer la parte correspondiente por cuenta propia.

El Ingeniero solicitará del Contratista la prueba del (slump) cuando lo vea necesario, la que no podrá dar valores mayores a las 3" (7,- cms) de asentamiento.

Donde los planos especifiquen concreto pobre, este será vaciado con los mismos agregados que el concreto fuerte pero se usará solamente 4 bolsas de cemento y 140 litros de agua. Los pesos de agregados serán los mismos para un metro cúbico.

Construcción

Los andamios usados en la construcción tendrán la resistencia suficiente para soportar las cargas y deberán ofrecer seguridad al operario.

Los encofrados usados serán de madera capillada o acero. Serán diseñados por el Contratista y deben ser construidos de tal modo que puedan ser sacados sin dañar el concreto. Las dimensiones del encofrado serán controladas cuidadosamente y deberán ser tales que el concreto terminado tenga las dimensiones especificadas en los planos. Todos los encofrados serán tratados con aceite o saturados con agua inmediatamente antes del vaciado del concreto. Cada vaciado deberá contar con la aprobación del Ingeniero antes de su realización. Los encofrados serán retirados 14 días después del vaciado para losas y vigas y 4 días para columnas, previa autorización del Ingeniero.

El concreto deberá ser mezclado en una mezcladora de tipo y capacidad aprobados. No se permitirá un mezclado a mano, salvo en casos de emergencia y previa autorización del Ingeniero. La colocación del concreto

se realizará antes del fraguado inicial y deberá hacerse de tal modo que se evite una segregación de las porciones finas o gruesas. El concreto deberá asentarse con barras, pisonos y vibradores de alta frecuencia después de vaciada cada dosis. No se permitirá lanzar el concreto de alturas libres mayores a 1.5 m, ni depositar una gran cantidad en un punto cualquiera, extendiéndola luego sobre los moldes. El concreto en las vigas, losas y pilares se vaciará en forma continua y solo se aceptarán juntas de construcción donde lo indique el Ingeniero.

Las juntas de expansión serán ubicadas donde lo indiquen los planos y construidas de acuerdo con los detalles dados en ellos.

El acabado podrá ser fino o grueso, de acuerdo con los planos o indicaciones del Ingeniero. No se aceptarán vacíos, colmenas, desportilladuras o líneas fuera de ubicación. Si es posible reparar cualquier deficiencia deberá contar con la aprobación escrita del Ingeniero, de otro modo el trabajo defectuoso deberá ser re-hecho a costa del Contratista.

Curado del Concreto

Todas las superficies de hormigón se mantendrán húmedas durante 7 días por lo menos, después de su colocación.

Medición

La cantidad de concreto a pagar será constituido por el número de m³ de dicho material colocado en la obra y aceptado. Las dimensiones usadas para la cubicación serán las fijadas en los planos u ordenadas

per escrito por el Ingeniero. Cualquier trabajo que no cumpla con los requerimientos de los planos, las especificaciones o las instrucciones del Ingeniero será rechazado y re-hecho a costa del Contratista.

Pago

Las cantidades determinadas en la forma antes indicada se pagarán en la siguiente forma:

ET-3 (1) Concreto 210 kg/cm² m³

ET-3 (2) Concreto pobre, m³

CONSULTORES GALINDO LTDA

COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

EE-4 PISO de Armadura

Noviembre 1971

ET-4 FIERRO DE ARMADURA Y ACERO ESTRUCTURAL

Descripción

Este trabajo consistirá en el aprovisionamiento de todos los materiales, equipos, energía y mano de obra requeridos para la colocación de barras de acero de refuerzo de la clase, tipo y tamaño fijados de las planchas y perfiles de acero requeridos, con todos los materiales equipos y mano de obra necesarios para este objeto.

Materiales

Las barras de acero deformado para armaduras deberá cumplir con las exigencias de la especificación AASHTO M-31. El acero estructural estará en conformidad con la especificación ASTM A36. El acero usado deberá tener un punto de fluencia $f'y \geq 2400 \text{ Kg/cm}^2$. Los pernos de anclaje y acero estructural serán lisos y también de por lo menos $f'y \geq 2400 \text{ kg/cm}^2$.

Todos los fierros de armadura y/o pernos de anclaje y acero estructural carecerán de suciedad, aceite, pintura, grasa y óxido antes de su colocación y del vaciado del concreto.

Construcción

Las barras se doblarán en frío de acuerdo a lo especificado en los planos y se colocarán en su posición exacta, de acuerdo a los planos, manteniéndose en esta posición firmemente sujetos, mediante tirantes de alambre, bloques de mortero, tensores, etc. Durante el vaciado del concreto y la compactación.

La colocación, estado y fijación de los fierros en cada sección de la obra deberá ser aprobada por el Ingeniero antes de iniciar el vaciado del concreto.

El acero estructural será fabricado en el campo o en maestranza de acuerdo con planos de taller que el Contratista deberá presentar y el Ingeniero revisar y aprobar. Las soldaduras serán en lo posible de maestranza y serán al arco eléctrico en conformidad con los requerimientos del National Welding Code. El montaje e instalación será realizado con el menor trabajo de campo posible y por personal altamente especializado.

Medición

La cantidad a pagarse por este concepto se calculará sobre el número teórico de kilogramos de acero de armadura más pernos de anclaje indicados en los planos y colocadas en la obra y aceptadas por escrito por el Ingeniero. Los fierros de repartición, abrazaderas, tensores, traslapes, separadores u otros materiales usados para la fijación de las barras de acero en su lugar correrán por cuenta del Contratista y no serán incluidas.

El acero estructural de las tolvas será inspeccionado y revisado en cuanto a líneas, espesores, soldaduras y detalles, sin tomarse en cuenta estructuras de soporte ni otros trabajos conducentes a su fabricación o instalación.

Pago

El ítem de pago de las cantidades arriba especificadas será:

- ET-4 (1) Hierro de Armadura, y/o pernos de anclaje Kg.
- ET-4 (2) Acero estructural. global

CONSULTORES GALINDO LTDA

COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

ET-5 Mamposteria de Piedra

Noviembre 1971

MF-5 MAMPOSTERIA DE PIEDRA

Descripción

Este trabajo comprende la provisión de todos los materiales, equipos, energía y mano de obra para la construcción de mampostería de piedra ya sea pegada con mortero o en forma de solado, donde lo indiquen los planos o lo especifique el Ingeniero por escrito.

Materiales

La piedra deberá ser sana y durable. Deberá tener las dimensiones adecuadas para obtener las características generales y el aspecto indicado en los planos. En soladuras se permitirá rellenar los vacíos con grava y arena limpia para dar una base adecuada al concreto superior.

El mortero estará constituido por una parte de cemento y tres de agregados finos por volumen.

Construcción

Se basará en las normas conocidas en la práctica de la construcción de viviendas y se guiará principalmente de acuerdo a las instrucciones que el Ingeniero dará en el campo.

Medición

Se medirá el volumen neto de mampostería de piedra construido y aprobado por el Ingeniero.

Pago

El tipo de pago será:

BT-3 (1) Inspección de pólizas en tránsito, n^o

BT-3 (2) Inspección de pólizas en tránsito n^o

CONSULTORES CALINDO LTDA
COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

SP-4 Impermeabilización de Bloques de Concreto

Noviembre 1971

BT-6 MAMPONERÍA DE BLOQUES DE CEMENTO

Descripción

Este trabajo comprenderá la provisión de todos los materiales, equipo energía y mano de obra para ejecutar todas las obras de mampostería de bloques de cemento en las paredes exteriores o interiores donde lo indiquen los planos o el Ingeniero y, similarmente, de cielos razos.

Materiales

Para las paredes se utilizarán bloques huecos vibrados y comprimidos de 20 cm. x 20 cm x 40 cm para las paredes exteriores y de 10 cm x 20 cm x 40 cm para las paredes interiores. Serán de fabricados con dosificación de mezcla previamente autorizada por el Ingeniero.

Para los cielos razos se utilizarán locetas prefabricadas huecas de un espesor de 5 cm. Los detalles de soporte e instalación del cielo razo deberán ser aprobados por el Ingeniero.

El mortero que se emplee para unir las juntas tendrá una dosificación por volumen de una parte de cemento una de cal y 3 de arena fina.

Construcción

Se basará en las normas conocidas en la buena práctica de la construcción y será de acuerdo a las líneas y niveles dadas en los planos y a instrucciones impartidas por el Ingeniero. Las uniones verticales serán uniformes y de un grueso de 6 mm. Las uniones horizontales no sobrepasarán un espesor de 1 cm. Las líneas o hileras horizontales

de bloques adyacentes no deberán tener uniones verticales coincidentes. Las uniones entre locetas del cielo raso serán a prueba de polvo.

Medición

Se medirá el área neta de mampostería construido y aprobado por el Ingeniero. No se hará pago separado por mortero, jambas o detalles requeridos por la obra. La estructura de soporte y accesorios requeridos para la instalación del cielo raso será considerada como parte de la mampostería. No se considerará ni medición ni pago separado por este ítem.

Pago

Los ítems de pago por trabajos realizado de acuerdo al contrato y aprobado por el Ingeniero serán

ET-6	(1)	Mampostería de bloques de cemento, pared exterior	m ²
ET-6	(2)	Mampostería de bloques de cemento, pared interior	m ²
ET-6	(3)	Mampostería de locetas de cemento, cielo raso	m ²

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ESPECIFICACIONES TECNICAS

ET-7 Bovoques de Mortero

Noviembre 1971

ME-7 REVOQUES DE MORTERO

Descripción

Este trabajo comprende la provisión de todos los materiales, equipos, energía y mano de obra requeridos para la preparación y la colocación de revoques de mortero en los interiores de las almacenes de productos, del almacén, la subestación eléctrica, en las vigas, pilares, paredes, etc. donde lo indiquen los planos o el Ingeniero por escrito.

Materiales

El mortero para revoques se compondrá de una parte de cemento portland por dos de agregados finos, por volumen, a los cuales se le agregará cal hidratada en una cantidad igual a la del cemento.

La graduación del agregado fino deberá ser la siguiente:

N° de tamis	Porcentaje que pasa en peso
# 8	100
# 50	15 - 40
#100	0 - 10
#200	0 - 5

Construcción

Todos los materiales, excepto el agua se mezclarán en una caja hexaédrica hasta que la mezcla adopte un color uniforme, después de lo cual se agregará el agua y se seguirá mezclando. El mortero será mezclado en cantidades necesarias para su uso inmediato. La renovación del mortero no será permitida. El revoque se aplicará en una capa de espesor

no mayor a los 2 cm. ni menor a 1 cm. La superficie deberá ser perfectamente alineada y el acabado será de acuerdo a las instrucciones del Ingeniero.

Medición

Se medirán los metros cuadrados de superficie revocada y aceptada en proyección vertical u horizontal, sin tener en cuenta jambas, rebordes ni otros detalles.

Pago

El ítem de pago será:

BT-7 (1) Revocación de mortero, m².

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COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

ET-8 Estructuras de Madera

Noviembre 1971

BT-8 ESTRUCTURAS DE MADERA

Descripción

Este trabajo comprende el aprovisionamiento de todos los materiales, equipos, energía y mano de obra y toda la madera, accesorios de conexión y anclaje para la construcción de las estructuras y su instalación y anclaje en el lugar final en la obra de acuerdo a los planos, estas especificaciones y a las instrucciones del Ingeniero.

Materiales

Se utilizará madera Laurel o Pino de Monte (*Podocarpus*) sin ningún daño ni deformaciones mayores a 2 cm. medidas con una regla de 5m. en ninguna dirección o línea. La madera no contendrá más del 18% de humedad y será cortada en las dimensiones indicadas en los planos.

Los accesorios de conexión serán de acero de acuerdo a los detalles de los planos o a variaciones de ellos aprobados por el Ingeniero. Todas las planchas, pernos y anclajes deberán ser de acero y de dimensiones aprobadas. Las juntas serán hechas de modo que la resistencia de la madera sea preservada en flexión y corte y deberán ser aprobadas por el Ingeniero antes de su ejecución.

Toda madera que se use estructuralmente deberá ser cubierta con dos manos de aceite de linasa y dos manos de pintura latex del color que ordene el Ingeniero.

Construcción

Los tijerales o cerchas serán construídos en el lugar de la obra y erigidos por medio de gruas o tacles cuando esto sea posible. Una

vos en su lugar se ajustarán todos los pernos y conexiones. Se instalará los tijerales en perfecta verticalidad y se los anclará dentro las líneas dadas en los planos y/o cambiadas por el Ingeniero.

La construcción de las diagonales de bruceo será hecha de acuerdo con los planos e indicaciones del Ingeniero. Las extensiones tanto verticales como horizontales serán construídas después de instalar y brucear los tijerales principales en conformidad con instrucciones del Ingeniero.

Las capas de pintura serán puestas después que la cubierta del techo y todos los sistemas del entretecho estén completamente terminados. Es decir esta será la operación de acabado.

Medición

Se hará una sola verificación de que todas las cerchas, extensiones, conectores y diagonales de bruceo estén instaladas a satisfacción del Ingeniero en todos los ambientes a techarse, que son:

Sala de procesos

Sección de secado

Sub-estación eléctrica

Almacenes

Almacén de depósitos

Estación de carguío

Pago

El ítem de pago por este trabajo será global y cubrirá todos los

materiales, mano de obra y equipos descritos en esta especificación.

ET - 8 (1) Estructuras de madera global

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COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

ET-9 Puertas Y Ventanas

Noviembre 1971

IT-9 PUEERTAS Y VENTANAS

Descripción

Este trabajo comprende la provisión de todo material, equipos, energía y mano de obra para fabricar e instalar todas las puertas y ventanas de acuerdo con los planos y ordenes del Ingeniero.

Materiales

a) Puertas de una hoja

Serán fabricadas de madera mada seca y sana, La hoja será de 2.5 cm de espesor reforzada por un cuadro de 15 cm de ancho en los costados y arriba, abajo el cuadro será de 30 cm. de ancho. El cuadro será de 5 cm. de espesor. El marco será también de madera mada del ancho adecuado y tendrá 6 anclajes en el muro.

Cada puerta será instalada con 3 visagras de 10 centímetros con cuatro tornillos en cada hoja. En cada puerta se instalará una chapa embutida con cerradura y perilla o manubrio. Cada chapa será entregada con un juego de 2 llaves. La calidad de la chapa será aprobada por el Ingeniero previamente a su instalación.

Los dinteles serán de concreto amado y constituirán parte de la puerta.

b) Puertas de dos hojas o de correr

A opción del Contratista las puertas de dos hojas o de correr

podrán ser metálicas o de madera. En caso de ser metálicas las puertas dobles podrán correr vertical u horizontalmente y podrán tener una sola hoja. Los materiales a emplearse deberán ser como para sustentar un trabajo pesado y servir de protección a la fábrica. El Contratista deberá presentar planos y detalles constructivos y de instalación antes de su fabricación para la aprobación del Ingeniero. Las especificaciones de material para puertas de una hoja dadas en el párrafo anterior serán requerimientos equivalentes mínimos para estas puertas. Los dinteles serán de concreto armado en proporción al vano y constituirán parte de las puertas.

c) Ventanas

A opción del Contratista las ventanas y sus marcos podrán ser de madera maciza, aluminio o acero. Los paneles a ser cubiertos con vidrio serán con vidrio doble de espesor invariable. Los paneles que deban ser abiertos serán cubiertos con tela milimétrica tipo "heavy duty". Las visagras y cremalleras serán de calidad aprobada por el Ingeniero. Los marcos serán firmemente anclados en los muros, columnas o dinteles especiales que se deban construir exclusivamente para este objeto. Las ventanas altas de la sala de proceso serán firmemente ancladas lateralmente y por arriba en las vigas de concreto. Por abajo se las anclará en dinteles que

- 3 -

el Contratista deberá proponer para el tipo de ventana ofertada. El Ingeniero deberá aprobar todos los planos del Contratista antes de que este pueda proceder a la fabricación o erección. Las ventanas altas con hoja movable para abrir y cerrar serán controladas desde abajo por medio de un sistema de palancas que el Contratista deberá proponer para aprobación del Ingeniero. Las hojas que deberán ser movibles corresponderán a las indicadas en los planos y/o ordenadas por el Ingeniero.

Construcción

Todas las puertas y ventanas se construirán de acuerdo con las dimensiones de las aperturas indicadas en los planos o modificadas por el Ingeniero y taparán a estas perfectamente. Las rendijas no deberán ser mayores a 2 mm. en ninguna junta o conexión. Las hojas de las puertas no dejarán más de 5 mm de espacio libre entre su borde inferior y el suelo. Las hojas tanto de puertas como de ventanas mantendrán un solo plano rectilíneo. Todo trabajo de madera será cubierto con dos capas de aceite de linaza. Los vidrios serán anclados con ganchos o clavos y masilla de vidriero. La tela milimétrica tendrá un tapajunta en todo su alrededor. Después de su colocación final tanto las puertas como las ventanas serán cubiertas por dos capas de pintura latex del color que el Ingeniero indique. La operación de pintura será al último de la obra para evitar que se dañe antes de su entrega.

Toda la fabricación e instalación de puertas y ventanas deberá ser he-

sta en conformidad con las mejores prácticas constructivas de esta localidad.

Medición

La medición de puertas tanto de una hoja como dobles será por unidad y de ventanas por metro cuadrado construídas e instaladas de acuerdo con los planos, especificaciones e instrucciones del Ingeniero. Cualquier unidad no aprobada por el Ingeniero será rechazada. No se hará medición ni pago separado por dinteles, estructuras de soporte o anclajes.

Pago

Las cantidades determinadas en la forma antes indicada se pagarán en la siguiente forma:

- | | | | |
|------|-----|----------------------------|----------------|
| ET-9 | (1) | Puertas de una hoja | unidad |
| ET-9 | (2) | Puertas dobles o de correr | unidad |
| ET-9 | (3) | Ventanas | m ² |

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ESPECIFICACIONES TECNICAS

ET-10 Pinturas

Noviembre 1971

ET-10 PINTURAS

Descripción

Este trabajo comprende la provisión de todo material, equipos, energía y mano de obra para imprimir y pintar todas las superficies indicadas en los planos u ordenadas por el Ingeniero y que no estén incluidas como parte integrante de otros items de pago dentro de estas especificaciones.

Materiales

La pintura será tipo latex. Su color será determinado oportunamente por el Ingeniero.

Construcción

Toda superficie a ser pintada será previamente lijada e imprimada con una capa de cola. La pintura será aplicada en dos capas a satisfacción del Ingeniero.

Medición

Se medirán las áreas de pared o cielo raso netas, sin tomar en cuenta jambas, indentaciones o bordes de pared pintadas bajo este item y aprobadas por el Ingeniero. No se medirán pinturas especificadas en otros items de estas especificaciones.

Pago

Las cantidades determinadas en la forma antes indicada serán pagadas bajo el item

ET-10 (1) Pinturas

m²

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ESPECIFICACIONES TECNICAS

ET-11 Cabiernas de Asbesto - Cemento

Noviembre 1971

BT-11 CUBIERTAS DE ASBESTO - CEMENTO

Descripción

Este trabajo comprende la provisión de materiales, equipos, energía y mano de obra para la construcción e instalación de las cubiertas de asbesto cemento tanto en el techo como en las paredes, de acuerdo con los planos, recomendaciones del fabricante y ordenes del Ingeniero.

Materiales

Las cubiertas serán de planchas de asbesto-cemento de largo no menor a los 2,40 m. y no mayor a los 3,05 m. Su espesor será de 6 mm ondulado en el tipo "big-six". Su carga de ruptura no será menor a los 450 kg/cm². El maderamen de soporte será de Laurel o Pino de Monte, seco y en buen estado. Las dimensiones y detalles de la estructura de soporte serán de acuerdo con los planos y ordenes del Ingeniero y estarán cubiertas con dos capas de aceite de linasa y dos de pintura latex del color que el Ingeniero oportunamente ordenará. Los ganchos, clavos y anclajes serán los recomendados por el fabricante.

Construcción

Se efectuará de acuerdo con los planos, recomendaciones del fabricante y ordenes del Ingeniero. Los traslapes transversales serán de por lo menos 20 cm. y los longitudinales 15 cm. Las planchas quedarán firmemente ancladas a su maderamen, el que a su vez será firmemente anclado a los tijerales, vigas o columnas. Las esquinas requeridas serán recortadas en las planchas.

El maderamen será a su vez anclado a las estructuras por medio de per-

ses empotrados en forma aprobada por el Ingeniero.

Medición

En los techos se medirá la proyección horizontal del perímetro del techo de cada unidad techada sin tener en cuenta inclinaciones ni traslapes de planchas. En las paredes se medirá el área neta cubierta en proyección vertical, sin tener en cuenta traslapes de planchas. No se hará medición ni pago separado por el maderamen de soporte ni por los anclajes.

Pago

El trabajo realizado, medido y aprobado bajo este ítem será pagado por

BT - 11 (1) Cielos de asbesto cemento m²

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COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

ET-12 Plomerias

Noviembre 1971

ET-12 PLOMERIAS

Descripción

Este trabajo se refiere a la provisión de todo material, equipo, energía y mano de obra requerido para fabricar e instalar los siguientes sistemas de distribución y/o items.

- a) Cañerías de agua y bebederos
- b) Cañerías de desague
- c) Cañerías de aire comprimido
- d) Canaletas y bajantes de desague pluvial
- e) Pasamanos

La ejecución de las obras deberá realizarse en conformidad con los planos, las especificaciones y las ordenes del Ingeniero.

Materiales

a) Cañerías de agua

El material de las cañerías para agua será fierro galvanizado de 1/2 pulgada de diámetro. Se instalará una llave de paso antes de cada una de las salidas. Serán pintadas con dos capas de pintura latex color azul. Se proveerá un bebedero lavamanos blanco de dos pilas al final de cada cañería de agua.

b) Cañerías de desague

El material de las cañerías de desague será fierro galvanizado de 2 pulgadas de diámetro. Serán pintadas con dos capas de pintura latex color negro.

c) Cañerías de aire comprimido

El material de las cañerías de aire comprimido será fierro gal-

vaciado de 1/2 pulgada de diámetro en el manifold y tubo de bronce de 1/4 de pulgada de diámetro en los distribuidores. Cada distribuidor será provisto de una válvula de cierre en su extremo. Las soldaduras serán de bronce. Todo el sistema de distribución de aire comprimido será probado a una presión de por lo menos 180 psig y será pintado con dos capas de pintura latex color verde.

d) **Canaletas y bajantes de desague pluvial**

Serán fabricados de plancha galvanizada calibre 26. Las canaletas tendrán una sección transversal 15 cm x 15 cm. En cada punto de bajante tendrán una apertura de 15 cm. de largo y una boquilla de 20 cm. de sección 15 cm x 15 cm. Las bajantes comenzarán con un estubo de sección 40 cm x 40 cm ubicado 50 cm debajo del fin de la boquilla. En el piso donde salga el agua de las bajantes se construirá una losa de cemento de 40 cm x 40 cm x 10 cm. de espesor.

Las canaletas y bajantes serán pintadas exteriormente con dos capas de pintura anticorrosiva.

e) **Pasamanos**

Los pasamanos serán contruidos con parantes de tubo de 2 pulgadas firmemente empotrados en el concreto a tiempo de que este sea vaciado, a distancias no mayor a los 2 metros, y dos hileras de tubo horizontal de 1 pulgada entre parantes, la primera a una altura de 45 cm. y la otra a los 100 cm., que será la altura útil

de los parantes. Los pasamanos serán pintados con dos capas de pintura latex de color que oportunamente ordene el Ingeniero.

Construcción

a) Cañerías de agua

Se seguirán los mejores procedimientos conocidos en la localidad. Las juntas serán tarrajeadas y selladas en forma completamente impermeable. Se instalarán las uniones patentes que fueren necesarias. Los tubos y sus conexiones y accesorios estarán al descubierto y serán fácilmente accesibles para su mantenimiento. El bebedero lavamanos será instalado y conectado a las cañerías.

b) Cañerías de desague

En forma similar a cañerías de agua. La salida del bebedero lavamanos será conectada al desague.

c) Cañerías de aire comprimido

En forma similar a cañerías de agua, excepto que las juntas podrán ser soldadas.

d) Canaletas y bajantes de desague pluvial

Se instalarán en traslape favorable al flujo del agua y cada junta será soldada. Serán colgadas al borde de los techos, de cada tijeral en forma interna. Se instalará una bajante en cada arista vertical del edificio de acuerdo con las ordenes del Ingeniero.

e) Pasamanos

Se anclarán los parantes con punta abierta en rosca en su lu-

gar definitivo durante el vaciado del concreto que los soporte. Las juntas podrán ser soldadas o de rosca. Deberán tener perfecta verticalidad y quedar en las líneas que indiquen los planos o lo ordene el Ingeniero.

Medición

a) Cisternas de agua potable

El global de acuerdo a los planos e modificaciones y aceptado por el Ingeniero.

b) Cisternas de desagüe

Similar a cisternas de agua potable.

c) Cisternas de aire comprimido

Similar a cisternas de agua potable

d) Canaletas y bajantes de desagüe pluvial

Similar a cisternas de agua potable

e) Pasadizos

Se medirá los metros lineales construidos de acuerdo con estas especificaciones y las órdenes del Ingeniero.

Pago

Se pagará los siguientes ítems que el Ingeniero apruebe.

ET-12 (1)	Instalación de agua potable	global
ET-12 (2)	Instalación de desagüe	global
ET-12 (3)	Instalación de distribución de aire comprimido	global

ET-12	(4)	Canaletas y bajantes de desagüe pluvial	global
ET-12	(5)	Pasarelos	m.l.

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ESPECIFICACIONES TECNICAS

ET-13 Proteccion Contra El Fuego

Noviembre 1971

ET-13 PROTECCION CONTRA EL FUEGO

Descripción

Este trabajo consiste en la provisión de todos los materiales, equipos, energía y mano de obra requeridos para el aprovisionamiento e instalación en su propio soporte de 4 extinguidores de incendio de acuerdo a estas especificaciones y a las ubicaciones mostradas en los planos o modificadas por el Ingeniero.

Materiales

Los extinguidores contendrán 10 libras de polvo químico del tipo A B C, para combatir fuegos de papel, madera, ropa, combustibles y corriente eléctrica. Ejemplo,

KIDDE de 10 lbs. Americano, o equivalente aprobado por el Ingeniero.

Construcción

Los soportes de los extinguidores serán adecuadamente anclados en las paredes o estructura del edificio de acuerdo a recomendaciones del fabricante e instrucciones del Ingeniero.

Medición

Se contará el número de extinguidores instalados y que funcionen y que hayan sido aprobados por el Ingeniero.

Pago

Se pagará por unidad aprobada.

ET-13 (1) Extinguidores de incendio, **unidad**

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COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

ET-14 Bombas de Desague

Noviembre 1971

ET-14 BOMBAS DE DESAGUE

Descripción

Este trabajo comprende todos los materiales, equipos, energía y mano de obra requeridos para el aprovisionamiento e instalación de 3 bombas de desague en conformidad con los planos, estas especificaciones y las ordenes del Ingeniero.

Materiales

Las bombas serán centrífugas de 400 GPM a 1150 RPM con presión de 15 pies de agua. Su unidad motor será de 2 hp para corriente de 3 fases, 50 ciclos, 220/380 voltios. Las bombas estarán provistas de chupador, válvulas y tubería de salida y entrada. Tanto motor como bomba serán instalados sobre zapatas de concreto de 20 cm. de altura sobre el nivel del piso. Ejemplo,

Worthington Modelo 4QNE-74 o equivalente aprobado.

Construcción

Las zapatas de las bombas serán parte de este ítem y serán construídas de acuerdo a las recomendaciones del fabricante y ordenes del Ingeniero. Las bombas y sus motores serán adecuadamente ancladas, conectadas al sistema eléctrico y probadas con agua. El chupador, tuberías, válvulas y accesorios serán también parte del ítem y serán instalados y anclados de acuerdo a las mejores prácticas de plomería.

Medición

Se contarán las unidades funcionales, probados y aceptadas por el

Ingeniero.

Pago

Se hará el pago por unidades aceptadas por el Ingeniero.

ET-14 (1) Bombas de desagüe unidad

CONSULTORES GALINDO LTDA

COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

BT-15 Compresora

Noviembre 1971

SP-15 COMPRESORA

Descripción

Este trabajo comprende todos los materiales, equipos, energía y mano de obra requeridos para el aprovisionamiento e instalación de una compresora de aire en conformidad con los planos, estas especificaciones y las ordenes del Ingeniero.

Materiales

La compresora será a dos pasos de una capacidad (tanque) de 75 galones a una presión de 90 psi y sustentará un gasto de 25 pies cúbicos por minuto. Contendrá como parte de ella todas las tuberías y sistemas de control para conectarla en la mejor forma posible con el sistema de distribución de aire comprimido. Su unidad motor será de 7 hp para corriente de 3 fases, 50 ciclos, 220/380 voltios.

Ejemplo,

Worthington Tipo C, N° 7 1/2 ADBR o equivalente aprobado.

Construcción

La compresora estará anclada a la losa de acuerdo con las recomendaciones del fabricante. Sus conexiones con el sistema de distribución serán enteramente herméticas y estarán provistas de los adecuados sistemas de control y seguridad. Su conexión con el sistema eléctrico será completa. La compresora será terminada de modo que su funcionalidad y seguridad pueda ser probada y aceptada por el Ingeniero, incluyendo su conexión al sistema de distribución de aire

SP-15 COMPRESORA

Descripción

Este trabajo comprende todos los materiales, equipos, energía y mano de obra requeridos para el aprovisionamiento e instalación de una compresora de aire en conformidad con los planos, estas especificaciones y las ordenes del Ingeniero.

Materiales

La compresora será a dos pasos de una capacidad (tanque) de 75 galones a una presión de 90 psi y sustentará un gasto de 25 pies cúbicos por minuto. Contendrá como parte de ella todas las tuberías y sistemas de control para conectarla en la mejor forma posible con el sistema de distribución de aire comprimido. Su unidad motor será de 7 hp para corriente de 3 fases, 50 ciclos, 220/380 voltios.

Ejemplo,

Worthington Tipo C, N° 7 1/2 ADR o equivalente
aprobado.

Construcción

La compresora estará anclada a la losa de acuerdo con las recomendaciones del fabricante. Sus conexiones con el sistema de distribución serán enteramente herméticas y estarán provistas de los adecuados sistemas de control y seguridad. Su conexión con el sistema eléctrico será completa. La compresora será terminada de modo que su funcionalidad y seguridad pueda ser probada y aceptada por el Ingeniero, incluyendo su conexión al sistema de distribución de aire

comprimido.

Medición

Se hará solamente una verificación de que la unidad ha sido provisoriamente instalada en forma funcional, segura y completa y que merece la aprobación del Ingeniero.

Pago

El pago por este trabajo tal como se lo describe arriba será:

ET-15 (1) Compresora

unidad

CONSULTORES GALINDO LTDA

COCHABAMBA, BOLIVIA

ESPECIFICACIONES TECNICAS

ET-16 Instalacion Electrica

Noviembre 1971

ET-16 INSTALACION ELECTRICA

Descripción

Este trabajo comprende la provisión de todo material, equipos, energía y mano de obra para ejecutar todas las obras de instalación eléctrica en conformidad con los planos, las especificaciones y las ordenes del Ingeniero, adoptando como especificación básica la del National Electric Code de los Estados Unidos. El sistema deberá ser completo, funcional y terminado en todos sus acabados de modo que al terminarlo sea utilizable en toda su amplitud y no signifique un peligro en ningún punto.

a) Servicio Eléctrico

El sistema eléctrico está dividido en un sistema de fuerza de 380V de tensión trifásica, para la alimentación de todos los motores, y de 220V monofásico, para la alimentación del sistema de iluminación y enchufes para uso general.

b) Distribución Eléctrica

Se ha dotado a cada sección, de acuerdo al proceso industrial, de un panel de distribución, para alimentar sus varios motores, esto permite aislar una sección de otra, para cumplir programas de mantenimiento.

La iluminación está alimentada y distribuida independientemente, a través de un panel, ubicado en un área central para que a su vez se pueda prender y apagar las luces desde este panel.

c) Instalación Eléctrica

Los planos eléctricos son:

16/18 Lista de Símbolos, Diagrama Unifilar, Plano de Conjunto.

17/18 Plano de Iluminación.

18/18 Plano de Fuerza.

Los planos eléctricos son en general diagramáticos e indican la posición aproximada de las diferentes salidas y no representan el recorrido forzoso de los diferentes circuitos de distribución o alimentación.

La instalación eléctrica deberá ser hecha de acuerdo a estos planos y en coordinación con los diferentes trabajos, que se realicen en el edificio.

Cualquier conflicto entre los planos eléctricos y otros, relacionados con los diferentes servicios, serán puestos en conocimiento del Ingeniero, para que dé una solución.

El Contratista tendrá en la obra un Juego completo de planos donde indicará tanto el avance de obra, como los diferentes cambios o modificaciones que se tengan que hacer al Proyecto original.

El Contratista no podrá instalar ningún elemento, sin la aprobación del Ingeniero. Los planos y dibujos de Taller que fueran requeridos por estas especificaciones o por el Ingeniero de algunos elementos deberán así mismo tener la aprobación del Ingeniero.

El Ingeniero podrá rechazar la instalación de cualquier material o equipo que no haya sido aprobado previamente o que no cumpla

las especificaciones.

Materiales

a) Cableductos

Serán de forma cuadrada con las dimensiones indicadas en los planos, con tapa embisagrada a un lado y seguro de presión en el otro lado a lo largo de todo el Cableducto, para que asegure la total accesibilidad a los conductores eléctricos, Cada pieza será de 2 metros de largo con orificios semiestampados en 2 caras opuestas, para las secciones donde se alimenten a motores o a luminarias y sin ningún orificio en las secciones que son solo de alimentación. Será fabricado de plancha de hierro de 1/32" de espesor hasta 2 1/2", y de 1/20" de espesor para Cableducto de 4", para dimensiones mayores será de plancha de hierro de 1/16" de espesor.

Cada pieza de Cableducto tendrá a los extremos ranuras, para unir una pieza con otra, por medio de conectores y pernos. El Cableducto será acabado recibiendo un baño Termo-químico tipo Criscoat y será esmaltado color Aluminio al horno. Ejemplo,

FEMCO CAT # CK-42P o similar aprobado

b) Conectores

Serán fabricados de plancha de hierro de 1/16" de espesor en forma de U con ranuras para enjarnar las piezas del Cableducto que se desea unir, serán acabados en idéntica forma que el Cableducto. Ejemplo,

FEMCO CAT # CD-4PC o similar aprobado

e) Soporte

Serán fabricados de plancha de hierro de 1/20" de espesor en forma de C, hecho de perfil U con ranuras de un lado, para empernar el Cableducto en la unión y en el otro lado un agujero para colocar el péndulo de soporte. El acabado igual al Cableducto. Ejemplo,

FEMCO CAT # CD -4 SU o similar aprobado.

d) Tes

Son piezas de conexión en forma de la letra T y serán fabricadas de plancha de hierro de 1/32", para Cableducto de 2 1/2" y de 1/20", para Cableducto de 4", deben tener tapa embisagrada a un lado y con seguro de presión en el otro, las dimensiones y forma deberán ser apropiadas, para la fácil conexión de ramales de Cableductos; y para evitar se dañe el cable que debe llevar.

Las piezas y partes de que fué éste formado, deberán unirse unas a otras por medio de soldadura a punto. El acabado será idéntico al Cableducto. Ejemplo,

FEMCO CAT # CD-4 T o similar aprobado.

e) Codos

Son piezas de conexión en forma de la letra L, que deberán ser fabricadas en forma similar a las T, en cuanto a grosor de plancha y acabado. Ejemplo,

FEMCO CAT # CD-4C o similar aprobado.

f) Reductores

Son piezas que sirven para conectar, por ejemplo, un Cableducto de 4" con otro de 2 1/2" de tal manera que se puede pasar sin dificultad de una dimensión de Cableducto a otra. La pieza será fabricada de plancha de hierro de 1/20" de espesor y llevará tapa embisagrada igual que las otras piezas de conexión. El acabado será también idéntico al del Cableducto. Ejemplo,

FEMCO CAT # CD-42 R. o similar aprobado.

g) Tubos

Los tubos metálicos de acero a usarse soportados de la estructura del techo y en las paredes serán esmaltados y del tipo de pared delgada sin rosca (conduit). No deberán presentar ningún signo de corrosión ni defectos que puedan afectar el pasado de alambres.

Los tubos usados bajo tierras deberán ser del tipo rígido (Rigid Conduit, Heavy Wall). En caso de no conseguirse estos, se podrá utilizar cañería de agua de acero galvanizado protegida con 2 capas de arpillera gruesa cada capa se debe impregnar en alquitrán caliente y aplicado sobre la cañería debe pasarse con brocha alquitrán caliente, la cañería debe ser tipo que tiene una costura interna mínima de tal manera que no llegue a dañar el conducto durante la instalación.

h) Cajas de Juntura o de Derivaciones

Deberán ser fabricadas de plancha de acero laminado en frío con un

espesor mínimo de 1/32" para cajas hasta 4" de dimensión máxima y de 1/20" de espesor para dimensiones mayores de 4". Las juntas deberán ser soldadas con puntos, no se aceptará soldadura o oxígeno por la deformación y debilitamiento que sufre la plancha.

En cada cara se tendrán orificios semiestampados que permitan la instalación de boquillas de distintos diámetros. La cara frontal tendrá perforaciones tarrajadas para la sujeción de las tapas respectivas o de los artefactos eléctricos que suponen alojar o soportar. Las cajas no deberán tener partes filas que puedan dañar los conductores. Todo este material deberá ser galvanizado o estar pintado con pintura a base de resinas plásticas hornada a alta temperatura de tal manera que evite toda posible corrosión.

La construcción deberá ser de primera calidad, capaz de resistir los esfuerzos mecánicos producidos por la instalación de los tubos.

Las cajas para los artefactos de iluminación mayores de 3" de dimensión máxima, deberán estar equipadas con adaptadores para reboque de yeso o tapas redondas (Round Plaster Rings) y deberán tener dispositivos para soportar los artefactos de acuerdo a los requerido por el artefacto a ser instalado.

Las cajas de juntura en general serán del tamaño indicado especificado en las listas de símbolos, y forzosamente deberán ser de una dimensión que esté de acuerdo al número de alambres que pasen a dicha caja como establece el "NEC", se deberá usar un adaptador para revoque de yeso o tapa rectangular para el montaje de interrup-

- 7 -

teses o enchufes en paredes revocadas, cuando las cajas que se usan son mas grandes que las normales para este montaje (2" x 4"). Ejemplo,

FEMCO CAT # 4C, 3C, 2R o similar aprobado

i) Tipos o Adaptadores

Deberán ser estampadas y las normas de fabricación serán iguales a las de "NEMA plaster rings" las normas de acabado serán las mismas que las utilizadas para las cajas. Estos elementos deberán adaptar las cajas de dimensión mayor a 3" para montaje de los diferentes artefactos de iluminación en los cielos rasos, y las cajas de dimensión mayor a 2" x 4" para interruptores y enchufes para montaje empotrado en paredes acabadas con revoques finos o materiales de recubrimiento. Ejemplo,

FEMCO CAT # A-4C, A-4R o similar aprobado.

j) Boquillas y Conectores

Las boquillas deberán ser construidas de tubo metálico esmaltado de diámetro tal que pueda recibir interiormente el tubo metálico del tamaño indicado en los planos. Este estará sujetado a la boquilla por medio de un tornillo que tenga por lo menos 3 hilos de rosca en la boquilla; de esta manera se asegura la continuidad eléctrica entre la boquilla y el tubo. La boquilla deberá a su vez tener la punta roscada y llevar tuerca y contratuerca para su fijación a la caja.

La parte final de la boquilla no esté en contacto con los alambres de la instalación eléctrica, debiéndose acatar de tal manera que no se produzcan deterioros en la aislación del alambre. Las tuercas y contratueras deberán ser de metal estampado con dientes para ajustar las tuercas y morder la caja, tendrán por lo menos dos hilos y medio de rosca para asegurar la continuidad eléctrica entre la boquilla y la caja.

Los conectores serán contruidos de tubo esmaltado con dos tornillos. Deberán tener 3 hilos de rosca en el conector que permitan asegurarlo firmemente a los tubos que tenían que ser unidos.

Las boquillas y los conectores, que deberán ser de óptima calidad en su construcción, deberán cumplir la función de soporte mecánico entre caja y tubo y entre tubos, y garantizar la continuidad eléctrica a través de todo el sistema metálico para establecer con potencial a tierra cero en el mismo. Ejemplo,

FEMCO CAT # B-13, B-16, C-13, C-16 o similar aprobado.

k) Interruptores Empotrados

los interruptores deberán ser del tipo balancin o tecla de mejor tipo que se encuentren en el mercado normal.

l) Tomacorrientes Empotrados

Los tomacorrientes deberán ser de baquelita o plástico, dobles (Duplex), del tipo de ranuras paralelas para clavijas planas y redon-

das.

Su construcción debe ser tal que la planchuela de montaje debe estar solidamente fijada al toma corriente por dos remaches o pernos que no permitan mover al tomacorriente una vez fijado en la caja.

ll) Placas

Las placas para interruptores y tomacorrientes serán de Baquelita.

m) Conductores Eléctricos

Todos los conductores deberán ser de cobre electrolítico de 99% de pureza recocido para su mejor maniobrabilidad, con aislación termoplástica tipo TW clasificada por fabricante por lo menos para 600 V.

Los conductores del N° 14 al N° 8 serán de cobre sólido y, del N° 6 a mayores serán de cobre cableado de 7 o más hebras. Como los fabricados por Plasmar S.A. o similar aprobado.

n) Paneles de distribución

Los paneles de distribución serán del tipo FEMCO ED-XIC monofásicos de 220 V. de 2 hilos y FEMCO TIPO ET-XIC trifásicos de 380 V. de 3 hilos de acuerdo a lo indicado en los planos. Las cajas serán metálicas para adosar en la pared y construídas de plancha de acero de 1/20" de espesor laminada en frío, con marco de montaje de barras y corta circuitos removible y para trifásicos con puerta embisagrada con seguro y chapa con 2 llaves. Las cajas y marco de monta-

je y todo el panel serán acabadas con pintura gris a base de resinas sintéticas y horneado a alta temperatura para evitar corrosión.

Las Tapas de los Paneles Trifásicos serán del tipo montado con pernos y de mecanismo de garras que, permita la colocación de la tapa en posición perfectamente vertical aún en caso de estar la caja mal colocada.

La instalación estará protegida por corta circuitos automáticos, tipo EQP de enchufar, montados simétricamente en los paneles de distribución. Estos elementos deberán cumplir con las normas de NEMA.

El número de circuitos por panel y la capacidad y número de polos de cada corta circuito, estará de acuerdo con lo especificado en las planillas respectivas de paneles señaladas en los planos.

Las barras colectoras y puentes serán de cobre electrolítico, dimensionadas para la capacidad requerida con la carga de cada circuito.

Los gabinetes de los paneles serán del tipo protegido contra polvo o sea llevarán empaquetaduras de espuma de goma en las puertas y en la tapa que ajusta contra la caja. Los orificios semiestapados deberán estar a nivel de la plancha de la caja o sea aplanados después de estampar y tapada toda ranura atrás.

Construcción e Instalación

a) Excavaciones

El contratista ejecutará las excavaciones necesarias para el tendi-

de la tubería destinada a las instalaciones de todos los cables, de acuerdo a los planos respectivos. Estos canales serán ejecutados con las dimensiones mínimas que permitan la instalación correcta de la tubería, a una profundidad no menor a 60 cm.

b) Relleno

El relleno de las excavaciones será hecho con material apropiado, aprobado por el Director de obra y será ejecutado en capas apisonadas cada 15 cm.

c) Picado de paredes, losas de concreto, perforación de muros, columnas etc.

Será responsabilidad del contratista la ejecución de todos los calados necesarios para el empotramiento de tubos, cajas, paneles, etc. necesarios para la instalación de los sistemas de distribución de energía.

El contratista deberá obtener instrucciones específicas del Director de Obra para la ubicación de los diferentes elementos, así como de la ubicación y profundidad de calado en paredes y elementos estructurales del edificio.

El contratista deberá proveer todos los soportes necesarios para la instalación de los diferentes elementos.

d) Instalación de tubos y soportes de tubos

Con excepción de aquellos casos en que se indique o especifique lo contrario, la tubería destinada a alojar los conductores eléctricos

será instalada de la siguiente manera:

Empotrada directamente en paredes donde sea posible, asegurada a los elementos estructurales del techo o soportados de las losas de concreto por medio de abrazaderas estampadas y del diámetro adecuado al tubo; las abrazaderas serán atornilladas a vigas de madera o cuñadas con taquetes de fibra en agujeros perforados en el concreto para este efecto.

Para el caso de vigas de hierro serán aseguradas por medio de abrazaderas especiales de presión.

En todo caso, los puntos de sujeción deberán ser hechos en cada viga y no deberán estar separados entre sí por más de 3 metros, y no más de 50 cm. a cada lado de un conector.

Las siguientes precauciones y procedimientos deberán tomarse en cuenta al instalar la tubería. Las curvas serán hechas con herramientas apropiadas, y sus radios no serán menores a 12 veces el diámetro de los tubos. La separación entre tubos no podrá ser menor a 7 cm. La separación entre tubos destinados al sistema eléctrico y otros requeridos para diferentes sistemas (teléfonos, señales, parlantes, etc.) no será menor a 30 cm. Los extremos de los tubos deberán ser escariados en tal forma que el aislamiento del conductor no sea dañado durante su instalación. Toda melladura proveniente del uso de herramientas será pintada con pintura duralux negra para evitar corrosión.

e) Instalación del cableducto

Deberá ser soportado de la estructura del techo por medio de pedúnculos de 1.50 m. de largo fabricados de tubo de 1/2" con rosca y tuerca a un extremo que asegure el pedúnculo al soporte tipo C del cableducto y con brida y grampa en el otro para colgar de la estructura metálica o para atornillar a la estructura de madera. Deberá llevar un pedímetro a cada unión de cableducto entre sí o con codos, Tees o reducciones. En las bajantes próximas a la pared será soportado por elementos en forma de Z atornillado un lado a la pared y el otro a la unión del cableducto.

f) Instalación de conductores

Los siguientes procedimientos y precauciones deberán tomarse en cuenta para la instalación de los conductores:

Los revoques deberán estar concluidos en los ambientes que se tengan que alumbrar. Los tubos deberán ser limpiados, y cualquier presencia de humedad deberá ser eliminada con métodos aprobados por el Ingeniero. Las cajas paneles, y todo elemento utilizado en las instalaciones eléctricas deberá ser limpiado y sacado con métodos aprobados por el Ingeniero,

Para el pasado de los conductores por los tubos, solamente será permitido utilizar talco puro u otra substancia especial aprobada por el Ingeniero. Los empalmes o conexiones de conductores se los hará con los siguientes elementos:

Para conductores N° 6 AWG: o mayores conectores de cobre a presión a instalarse con herramientas apropiadas de compresión, o mediante pernos que garanticen un contacto perfecto entre los conductores a emplearse. Toda conexión hecha con elementos no aislados de fábrica, deberá estar protegida con cintas especiales (3-M o similares), aprobadas por el Ingeniero. Los métodos empleados deberán estar de acuerdo con las mas altas normas. Cualquier o todos los empalmes que no están hechos en forma apropiada, o con los elementos no aprobados por el Ingeniero, podrán ser rechazados por este.

Las conexiones a los corta circuitos y demás elementos de los paneles deberán hacerse en forma ordenada, doblándose los conductores en ángulos rectos.

g) Instalación de cajas

Las cajas de salidas deberán ser instaladas en las posiciones indicadas en los planos y las requeridas por el equipo que alimentan de acuerdo a catálogos o dibujos de taller.

h) Artefactos de Iluminación

Los artefactos de iluminación fluorescente o incandescente, en su parte metálica, deberán estar fabricadas de plancha de hierro laminada en frío de un espesor no menor a 1/40", en su fabricación deberá usarse, para el estampado de formas matrices y herramientas que permitan un montaje uniforme, y en el doblado deberán usarse siquinas y herramientas que garanticen la perfección en el acabado, el soldado de las partes de todo el artefacto deberá ser hecho

con soldador a puntos que deje una huella mínima de herramienta.

Antes de proceder al pintado, deberá someterse la plancha a un proceso de decapado, desgrasado y cubierta de capa anticorrosiva tal como se obtiene con el proceso criscoat o bondarite.

Se pintará a soplete con pintura especial para hornear y se la cocerá en horno a la temperatura indicada por el fabricante. El alambrado interior de los artefactos será hecho con alambre especial para una temperatura de 105° C.

Los tipos de artefactos serían como se indica en los dibujos fabricados por FEMCO o similar aprobado.

i) Ballastas

Los artefactos fluorescentes llevarán ballastas del tipo de precalentamiento con arrancador de alto factor de potencia, 0,9 o más que garanticen un rendimiento luminoso de cerca a 2900 lumens para lámpara de 40 W, color luz de día así como también protejan la vida del tubo fluorescente dentro del número de horas de vida normal de 12000 hrs. con 3 encendidos en 24 horas.

j) Tubos Fluorescentes

Serán del color luz de día de marca conocida y del tipo Preheat y Rapid Start con una vida de 12000 hrs. publicada en los catálogos de Fabricante. Los tubos fluorescentes deberán ser de fabricación Americana o Europea.

h) Montaje

Los artefactos de iluminación tipo industrial serán soportados de la estructura del techo por medio de pedúnculos de tubo de 1/2" de diámetro de 1.50 m. de largo similares a los usados para el montaje del cableducto.

Medición

Se hará solamente una verificación de que todas las obras eléctricas estén construídas de acuerdo con los planos, especificaciones y recomendaciones de fabricantes y que el Ingeniero las haya aprobado. No se hará medición de ni conteo de materiales por separado. El Contratista será responsable de que el sistema sea funcional, seguro y completo.

Pago

Se pagará por este ítem en forma global, de acuerdo a la aprobación del Ingeniero.

EE-16 (1) Instalación Eléctrica global

APPENDIX B

DRAWINGS

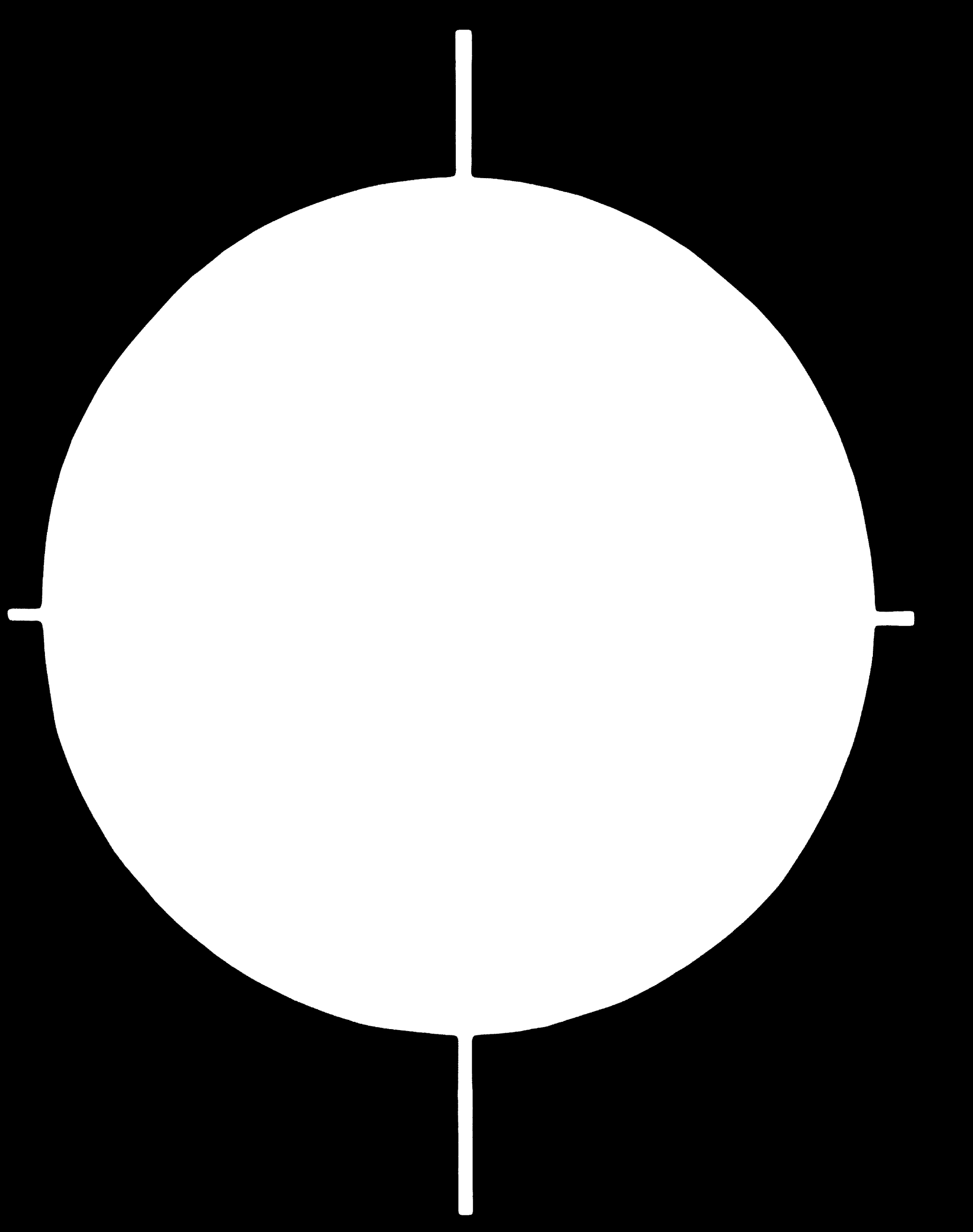
APPENDIX BList of Drawings

<u>Title</u>	<u>Number</u>
Flow Sheet	3161-02-3700-1-2
Plot Plan	3161-07-4000-1-1
Site Plan	3161-02-3700-3-3
Scalping Station	3161-07-4500-1-1
Process Building General Arrangement	3161-02-3700-4-5
Floor Openings, - Beam Locations Second Floor	3161-07-4500-2-2
Process Building - Dust Control General Arrangement	3161-02-3700-6-1
Process Building Electric Motors	3161-02-3700-7-1
Presentacion	3161 - 1/18
Sumario de Cantides	3161 - 2/18
Plano General	3161 - 3/18
Arquitectura y Materiales de Fachada	3161 - 4/18
Fundaciones	3161 - 5/18
Losas Planta Baja	3161 - 6/18
Planta Primer Piso	3161 - 7/18
Planta Segundo Piso	3161 - 8/18
Losas Segundo Piso	3161 - 9/18
Armadura Vigas Longitudinales Segundo Piso	3161 - 10/18
Vigas Franso. Segundo Piso y Columnas Primer Piso	3161 - 11/18
Vigas Techo y Columnas Segundo Piso	3161 - 12/18
Archas y Detalles Techos	3161 - 13/18
Detalle Paredes y Ubicacion Bombas	3161 - 14/18

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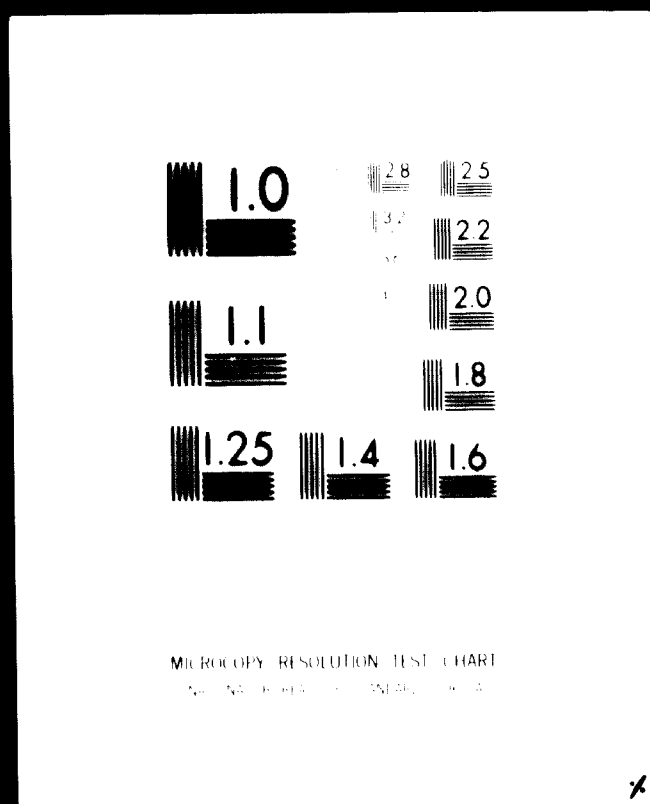
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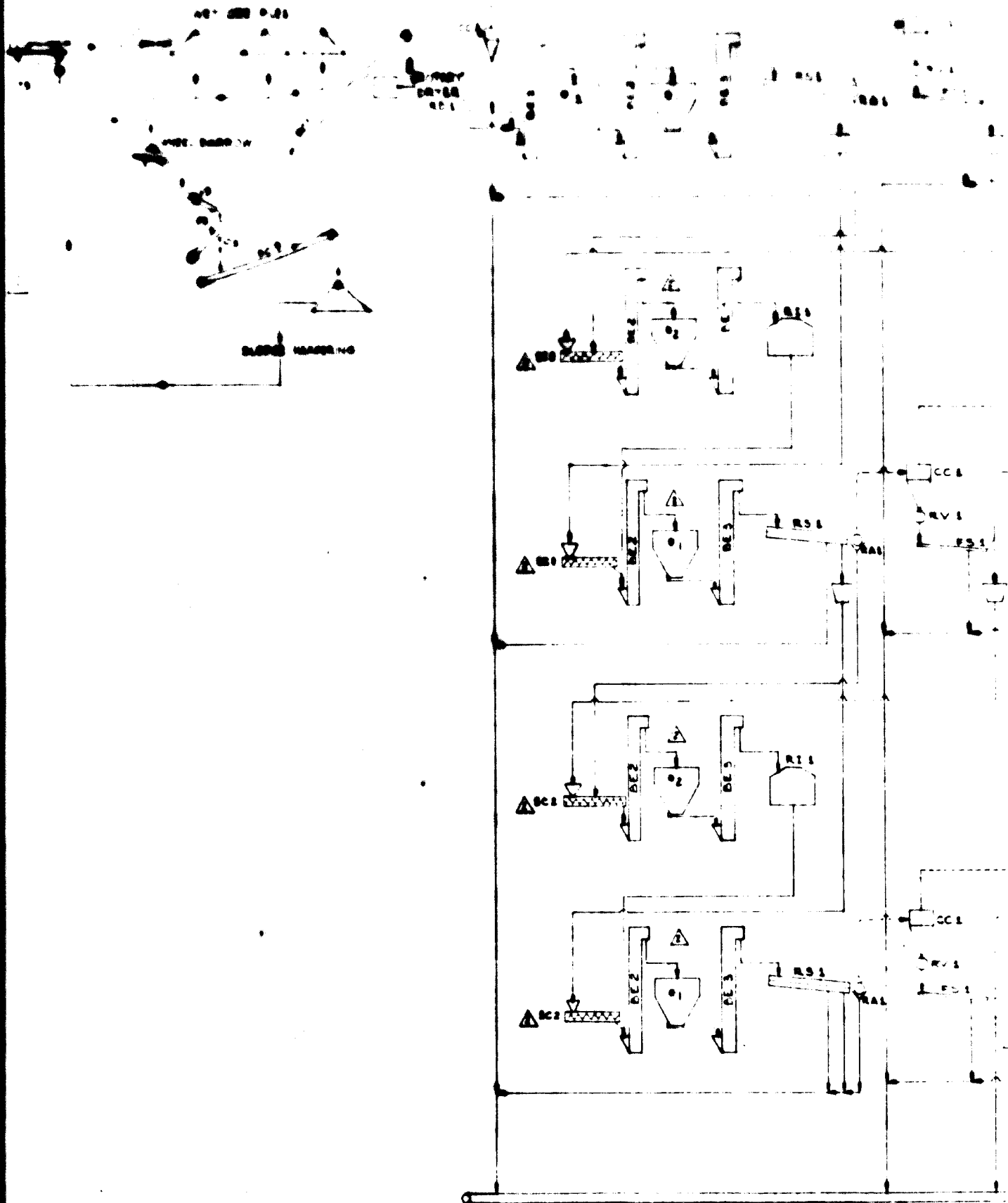
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List of Drawings (cont'd)















Title	Number
Plano Mecanica	3101 - 15/10
Lista de Simbolos Diagrama Unifilar, Plano de Conjunto y Planilla de Paneles	3101 - 16/10
Plano de Iluminacion	3101 - 17/10
Plano de Fuerza	3101 - 18/10

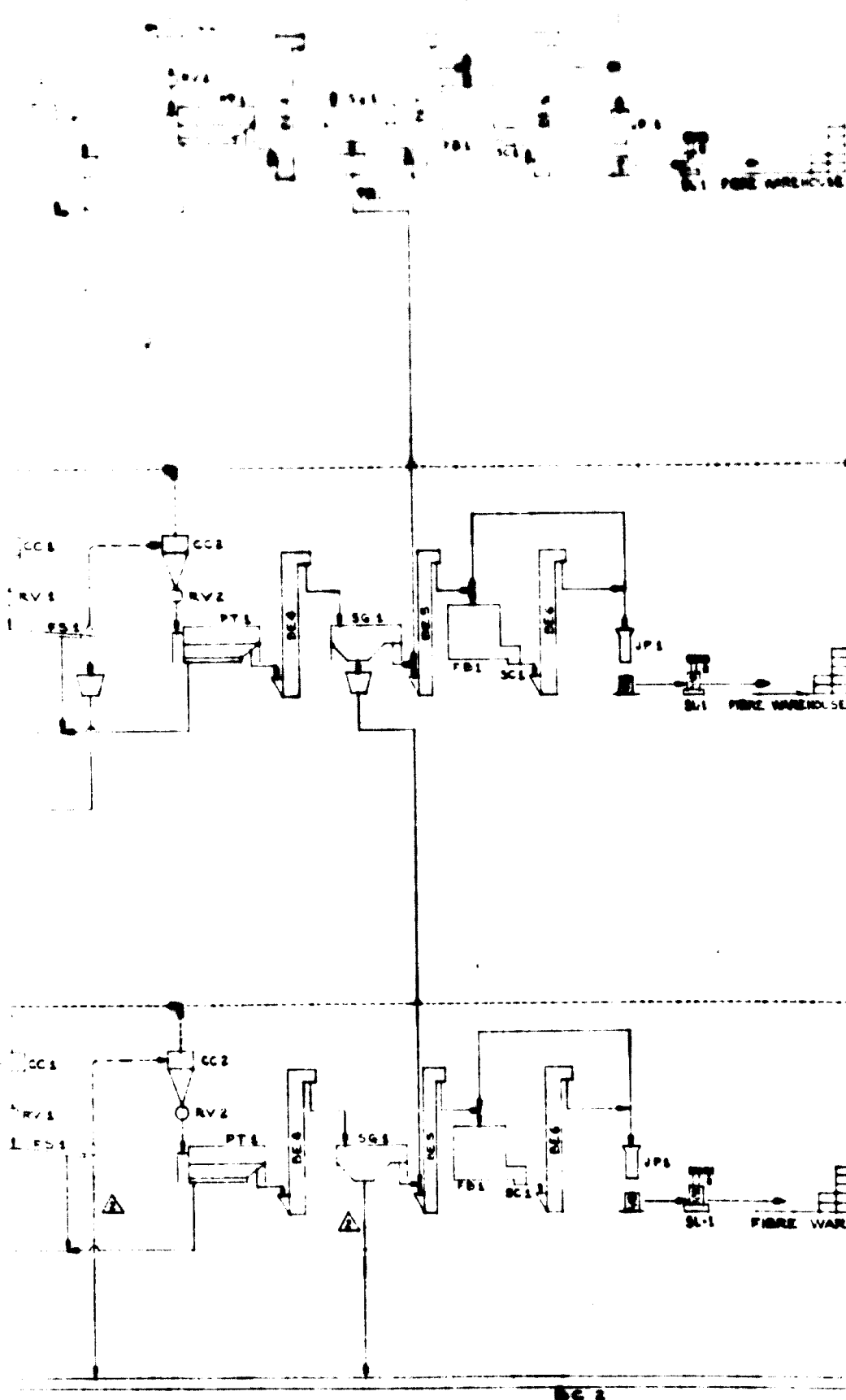
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SECTION 1

LEGEND















-  CYLINDERS
-  PNEUMATIC ELEVATOR
-  IMPACTOR
-  ORE BIN
-  ROCK SCREENER
-  FIBER SCREENER
-  PADDLE TROUGH
-  STANDARD GRACER
-  FIBRE BIN
-  PACKER
-  CONTAINER
-  SCALE
-  TRUCK SCALE
-  VIBRATING SCREEN

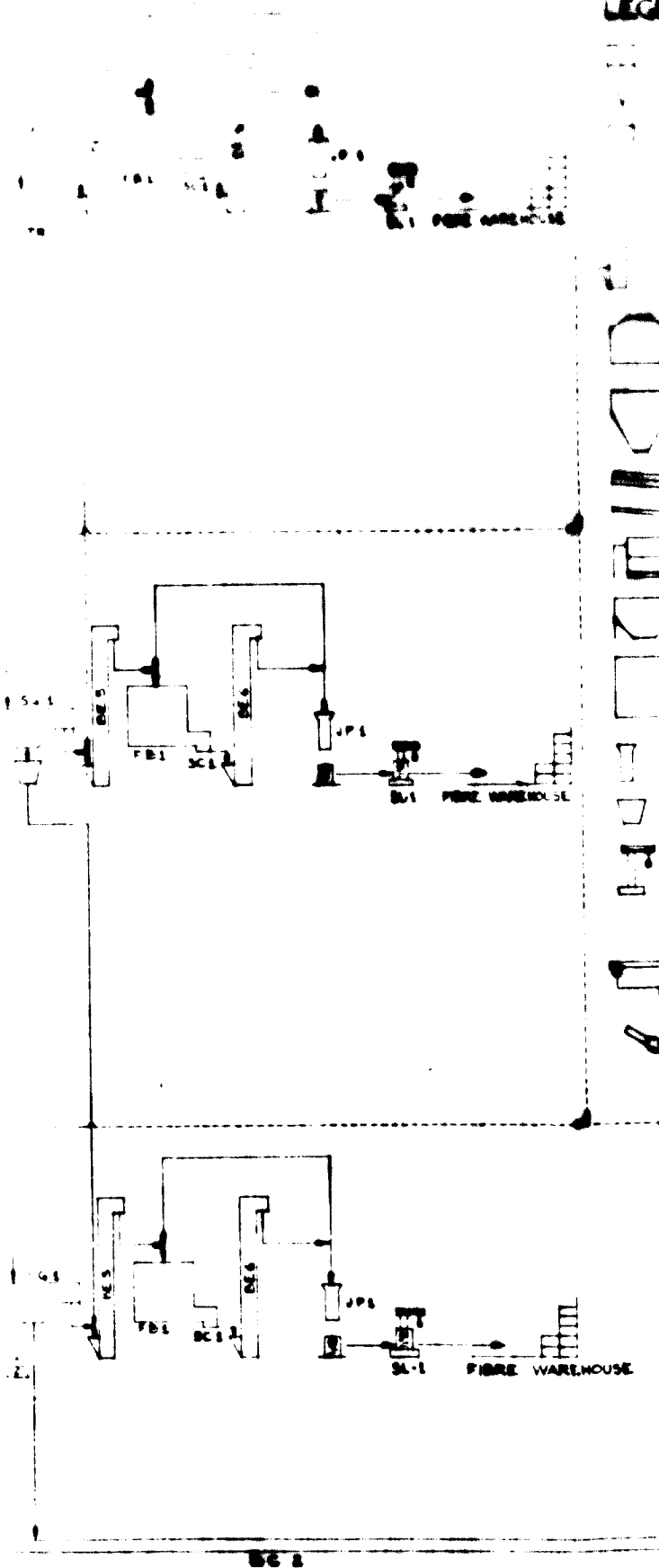


SECTION 2



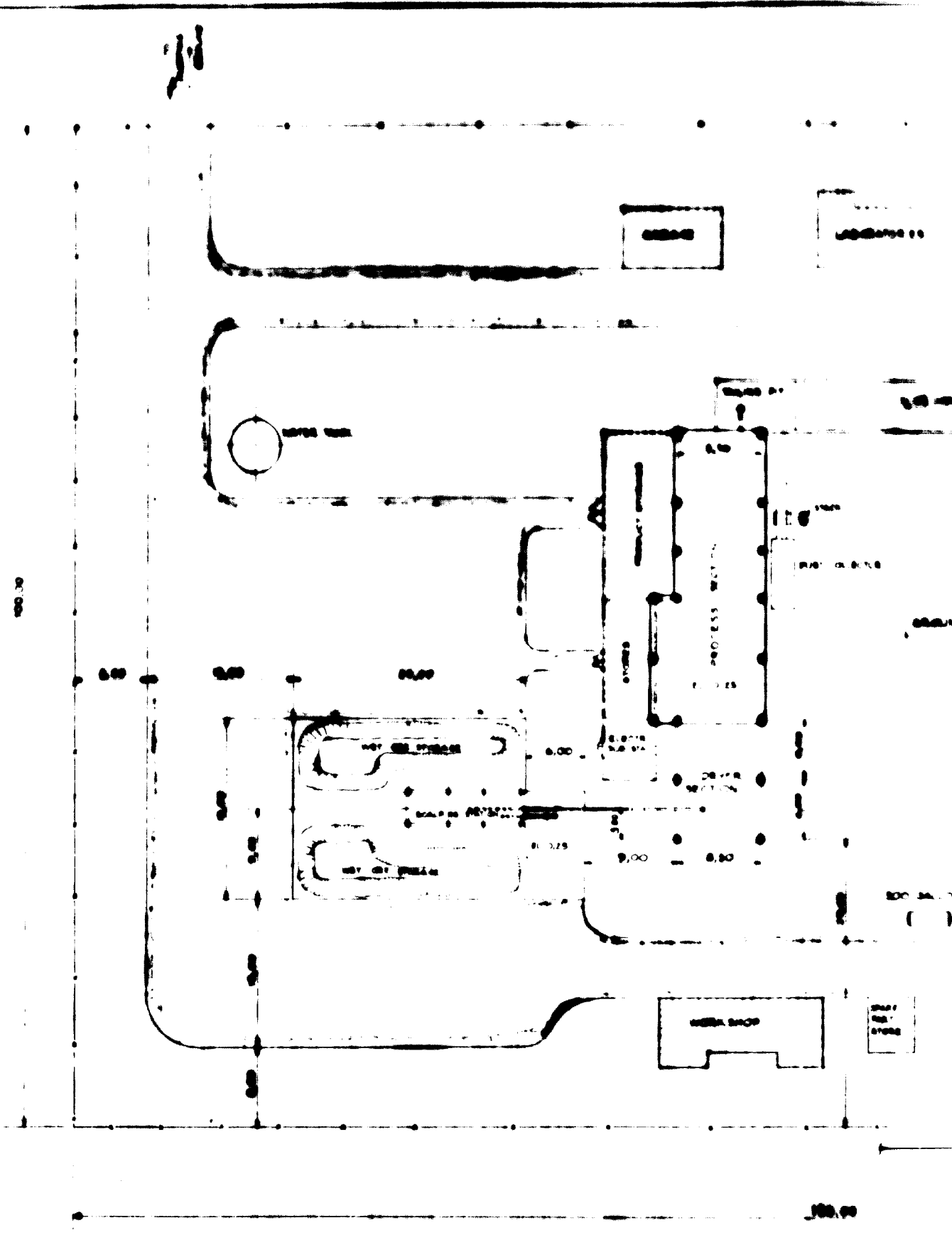
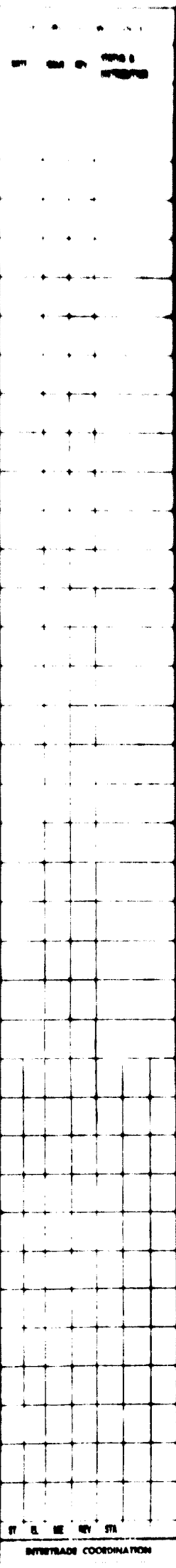
LEGEND

-  CYLINDER
-  PALLET
-  DIRECTOR
-  ORE BIN
-  ROCK SCREENER
-  FIBER SCREENER
-  PADDLE TROUGH
-  STANDARD GRACER
-  FIBRE BIN
-  PACKER
-  CONTAINER
-  SCALE
-  TRUCK SCALE
-  VIBRATING SCREEN

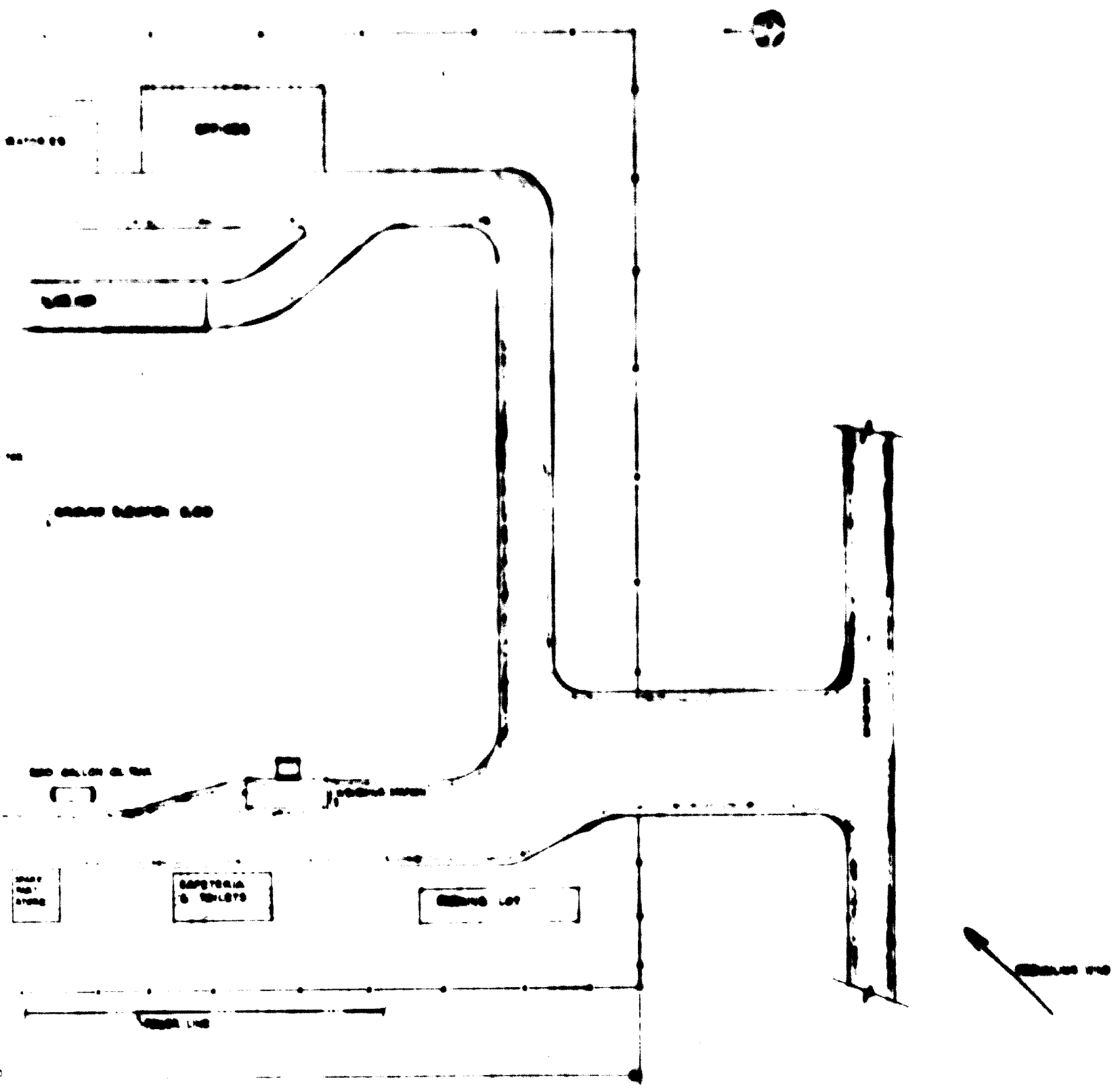


SECTION 3

NO. 00		REVISIONS	
NO. & DATE BY		REVISIONS	
SEE TOP LEFT SIDE FOR ISSUES			
CLIENT		UNION	
PROJECT: ENFERO CAL PRODUCTOR: ENFERO CAL COCHABAMBA BOLIVIA			
FLOW SHEET			
SURVEYOR: MENNIGER & CHENEVEY INC. CONSULTANTS OWNED AND OPERATED BY ENGINEERS MONTREAL QUE			
DESIGNED	RAWA	HECK	
RECOMMENDED	APPROVED	CLIENT	
SCALE		DATE	
CONTRACT	SUBJECT	PROJECT NO.	REV. NO.



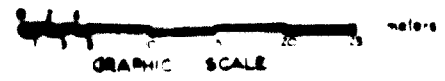
SECTION 1

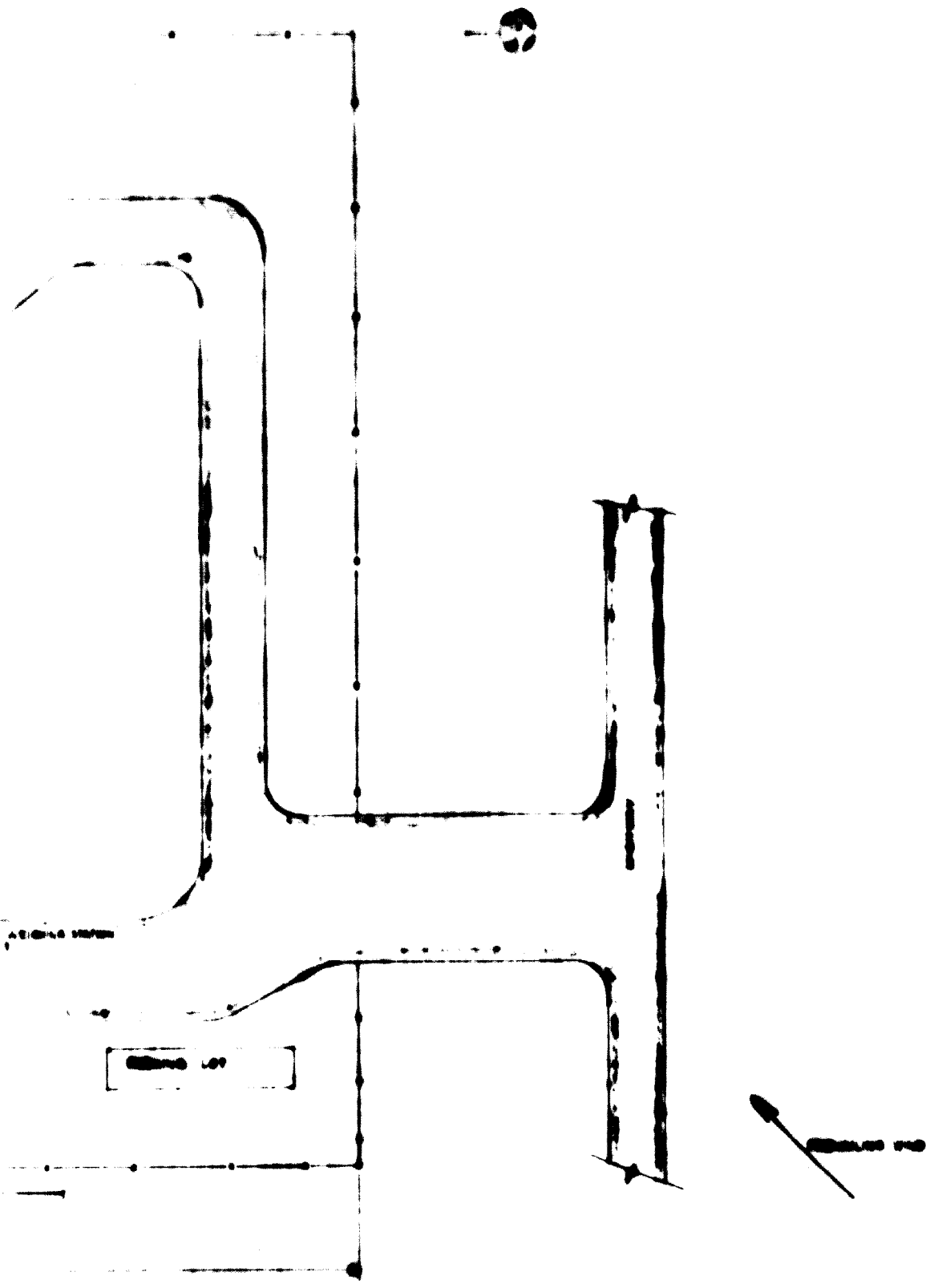


GENERAL NOTES

1. LOCATION OF AUXILIARY BUILDINGS AS PER SOLUTION
 PLAN DISPOSED ON THE EAL OF LAS CONSTRUCCIONES
 EXCEPT WATER TANK
2. SITE DRAINAGE PIPE ARRANGED SO THAT SURFACE WATER
 FLOWS TOWARDS DITCHES

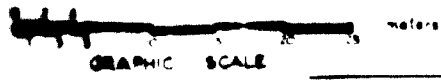
SECTION 2





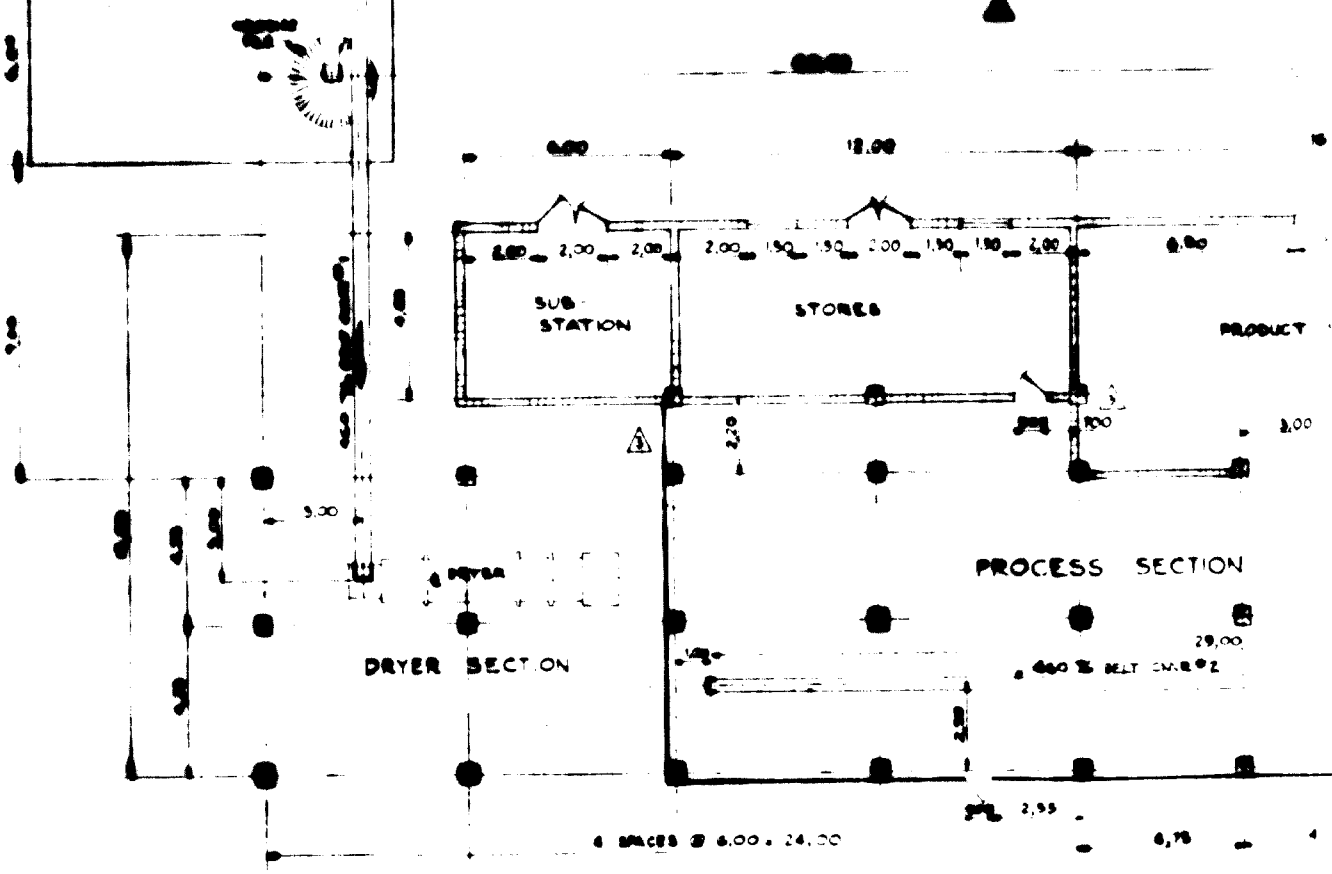
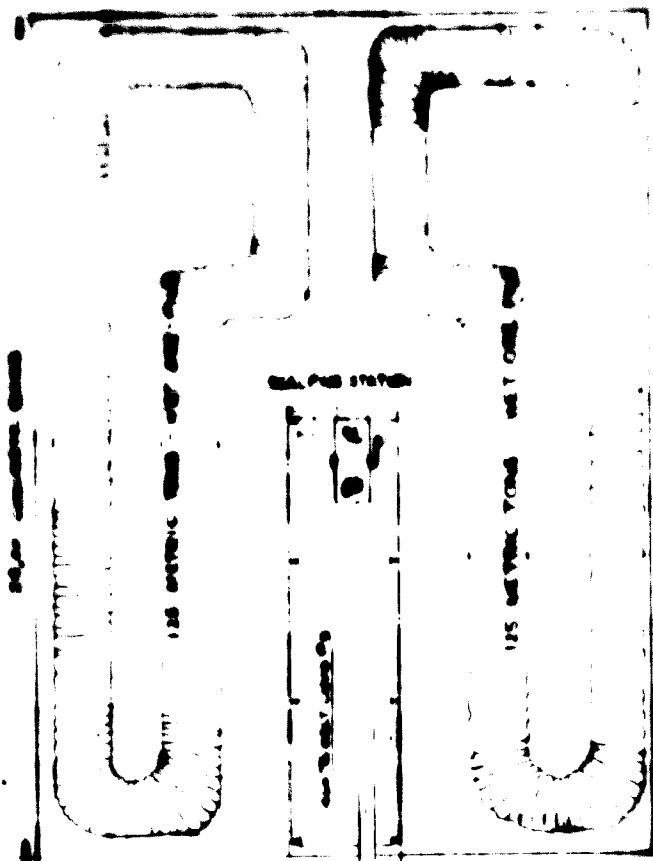
GENERAL NOTES

1. LOCATION OF AUXILIARY BUILDINGS AS PER BOLIVIAN PLOT PLAN "DISPOSICION GENERAL DE LAS CONSTRUCCIONES" EXCEPT WATER TANK
2. SITE DRAINAGE TO BE ARRANGED SO THAT SURFACE WATER FLOWS TOWARDS DITCHES



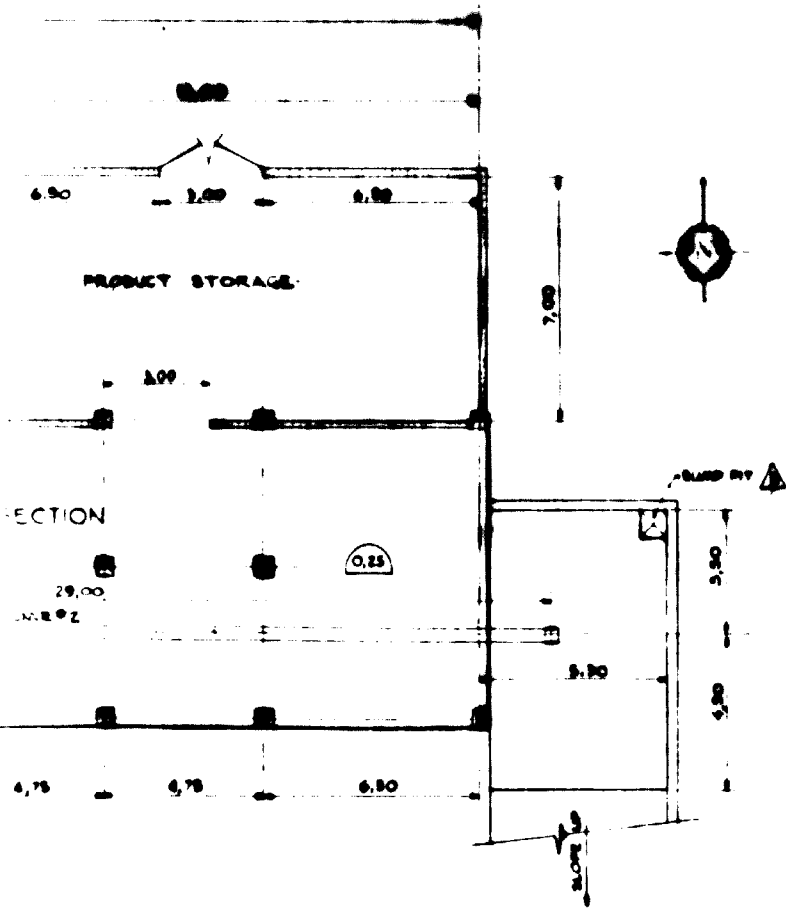
SECTION 3

<p>DATE: 1968</p> <p>SCALE: 1:4000</p>	
<p>CLIENT: UNDO</p>	
<p>PROJECT: EXPERIMENTAL PRODUCTION PLANT COCHABAMBA - BOLIVIA</p>	
<p>PLOT PLAN</p>	
<p>S SURVEYOR</p>	<p>H HENNIGER & C CHENEVERTIN</p>
<p>DESIGNED BY: [] CHECKED BY: [] DRAWN BY: [] APPROVED BY: []</p>	<p>DATE: []</p>
<p>CONTRACT NO. []</p>	<p>DATE: []</p>

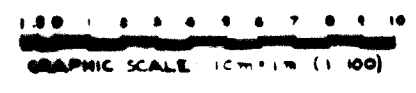


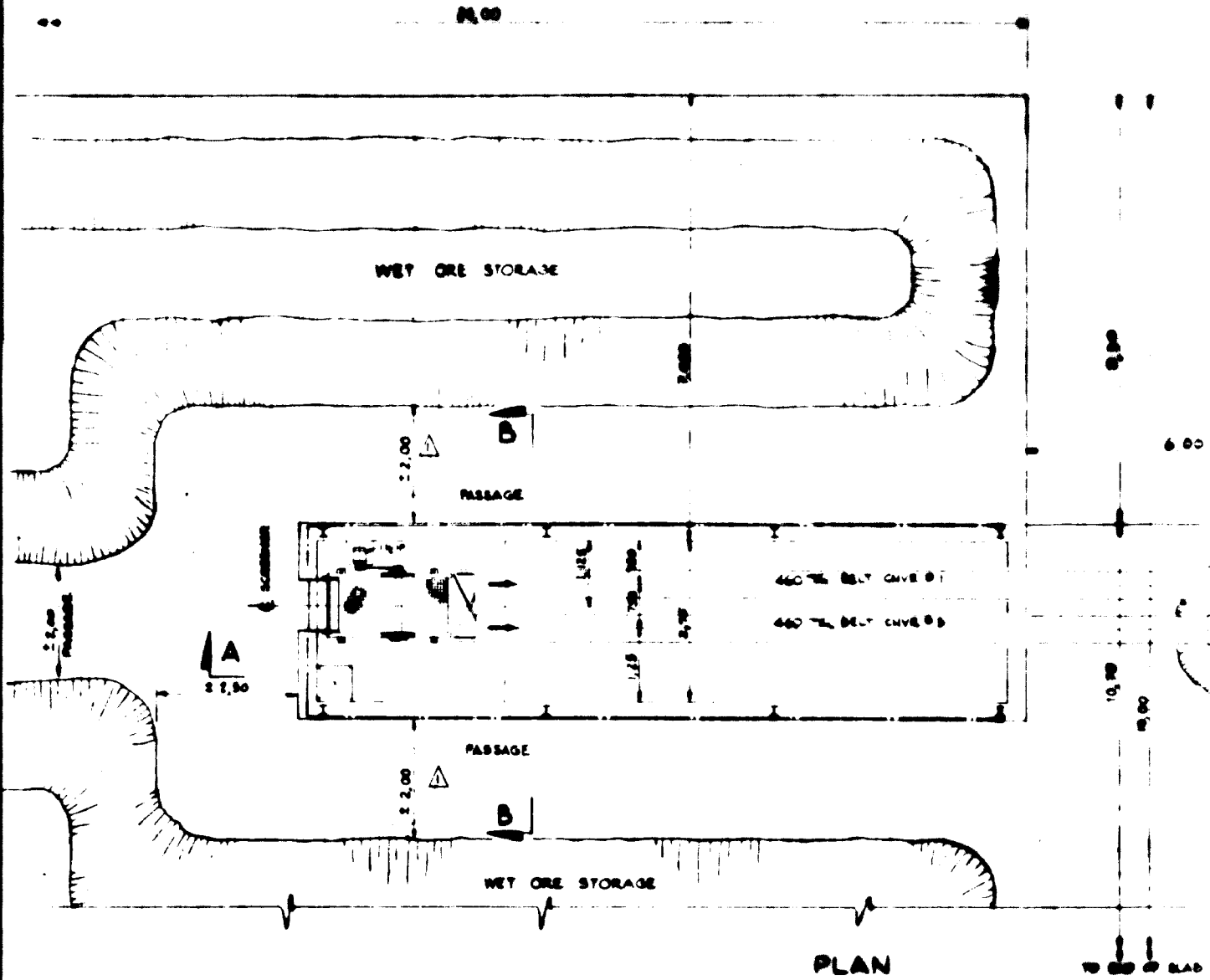
SECTION 1

PLAN

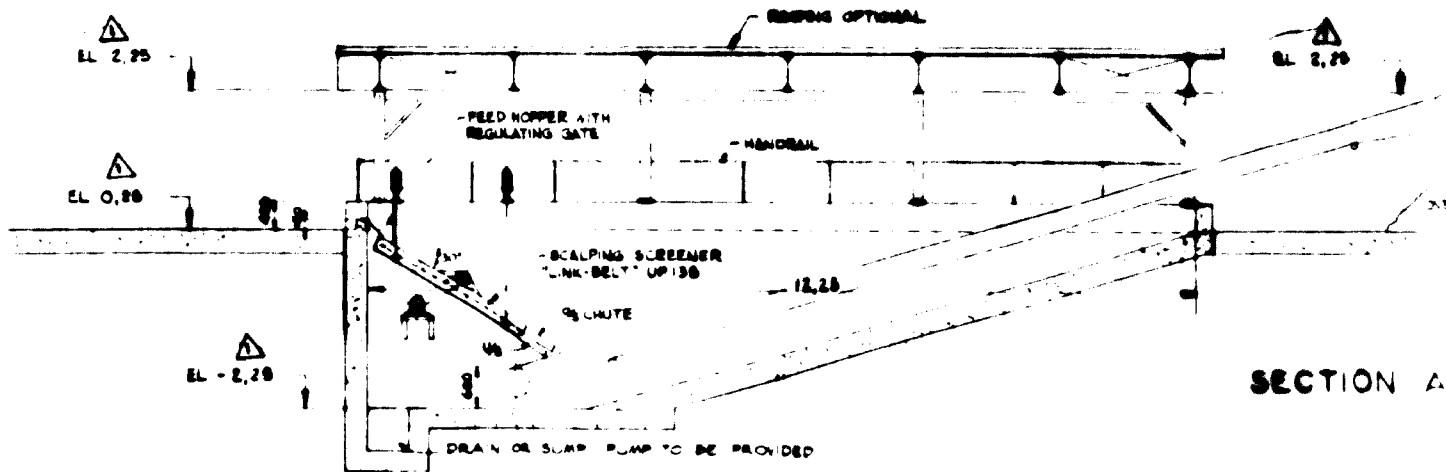


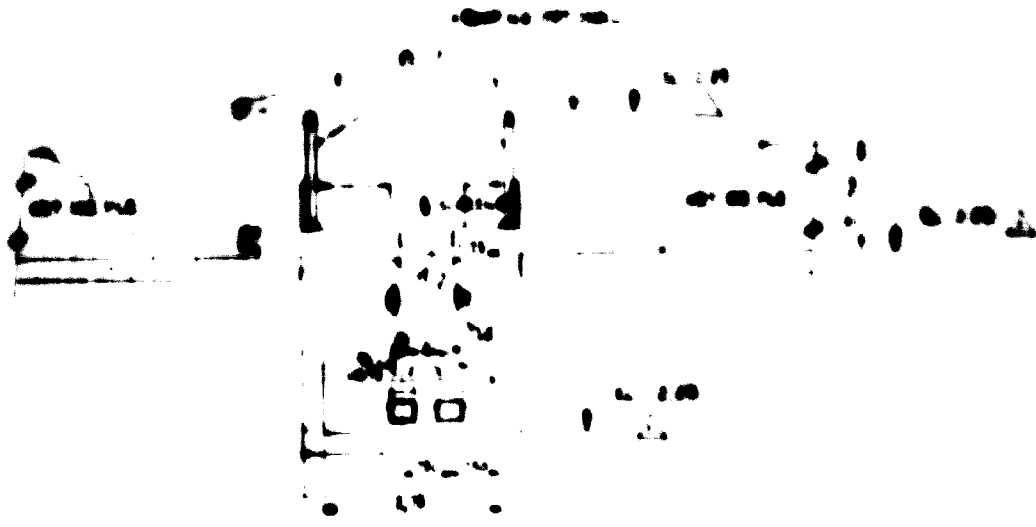
SECTION 2



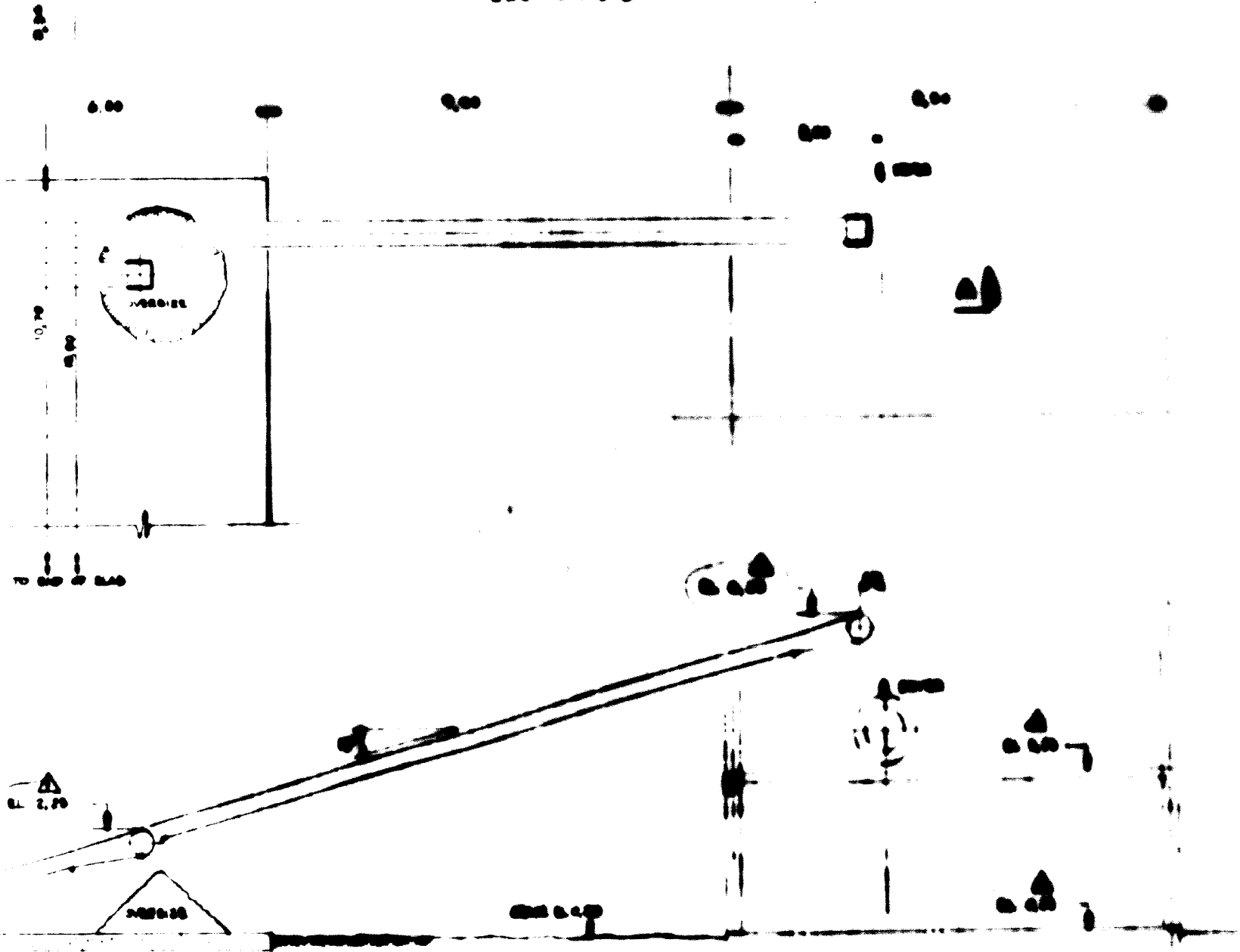


SECTION 1





SECTION 9-9



SECTION A-A

7

SECTION 2



SECTION 2-2

SECTION 3

NO REFERENCE DWG

REVISIONS

SEE TOP LEFT SIDE FOR ISSUES

CLIENT

PROJECT EXPERIMENTAL
PLANT IN PLANT
SARAPANSA BUKA

SCALPING STATION

 SURVEYER
 MENTZER'S
 CRESWELL'S

 C.B.A.S.
 S.M.
 S.M.
 S.M.

 S.M.
 S.M.
 S.M.
 S.M.
 S.M.
 S.M.

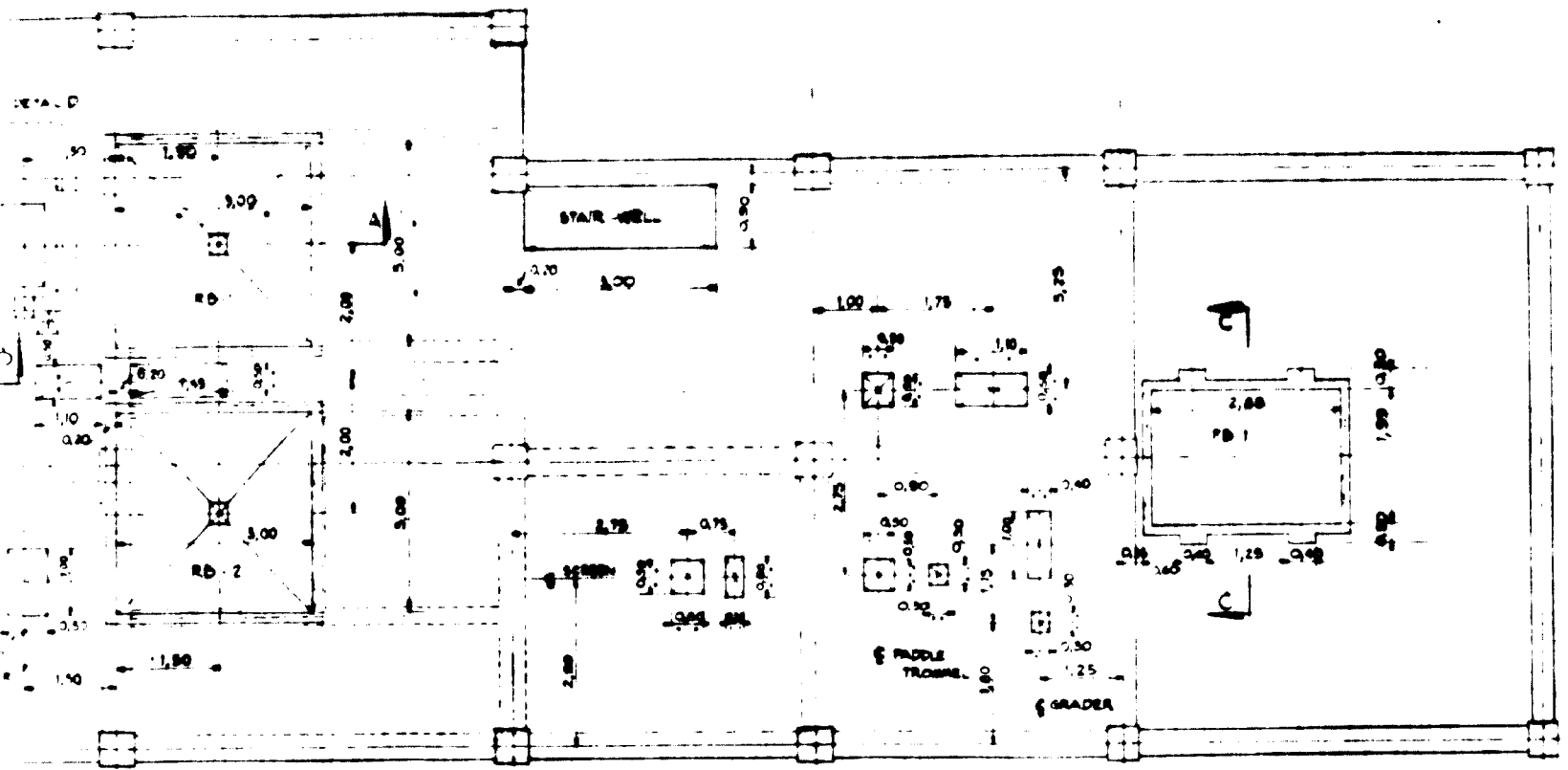
40,00

6,00

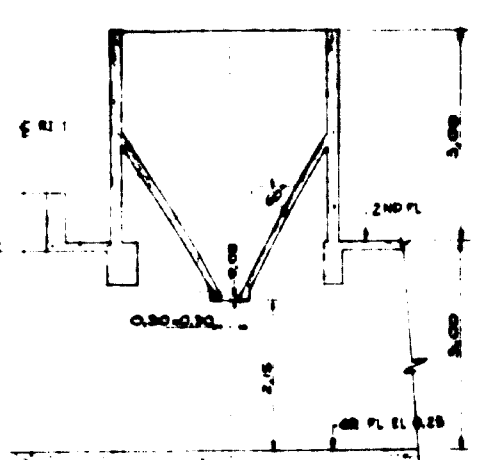
4,75

4,75

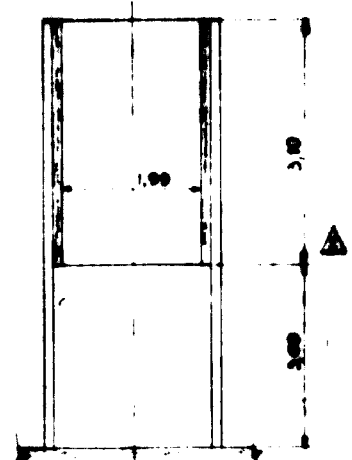
6,00



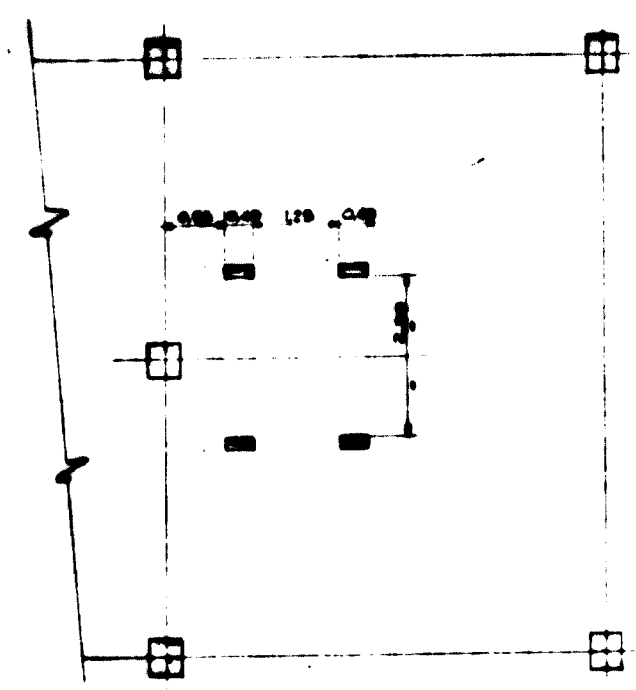
PLAN VIEW OF 2 ND FL



SECTION A-A



SECTION C-C



PARTIAL PLAN VIEW OF GR FL

B. EQUIPMENT LOADS (SHIPPING WEIGHT)

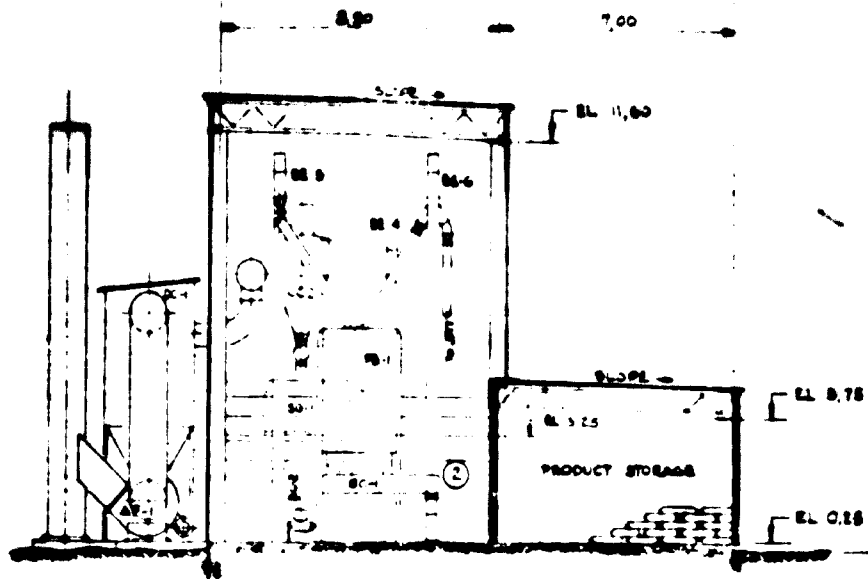
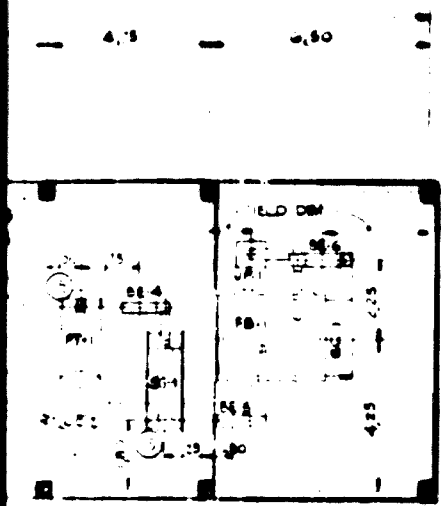
RD-1	DUST COLLECTOR	6,5 T
RD-1	ROTARY DRYER	6,5 T
RD-1	ROCK BRACKET	4,0 T

- 0,75 T m²
- 0,90 T m²
- 1,00 T m²
- 2,50 T m²

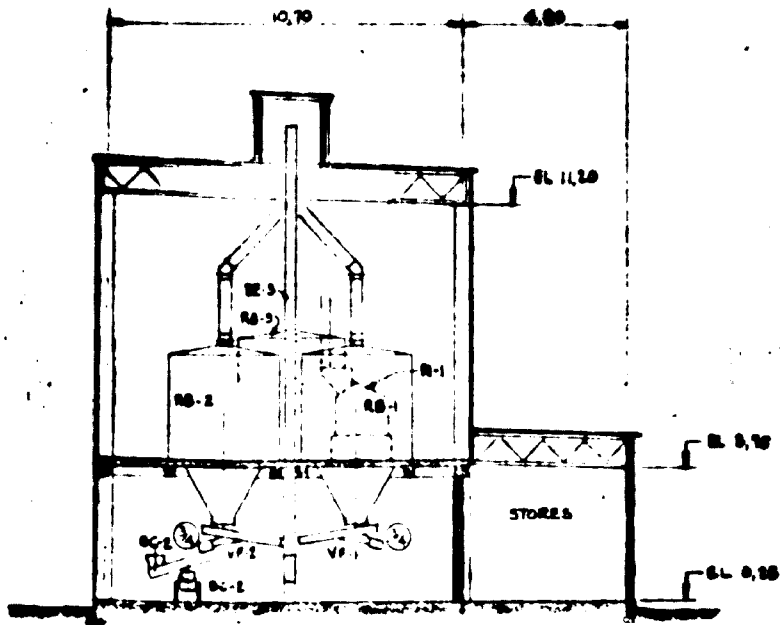
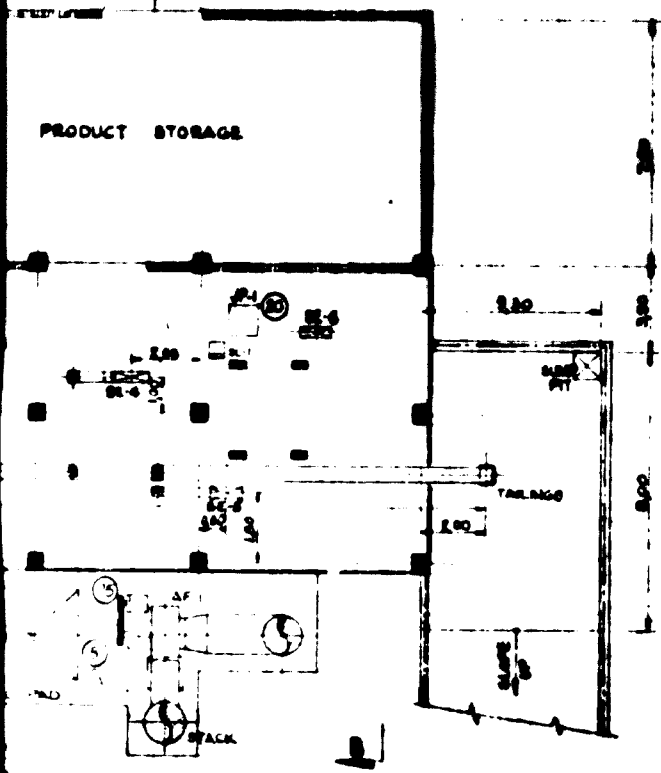
LOADS SHOWN ABOVE

26 kg/cm²
 250
 250
 250

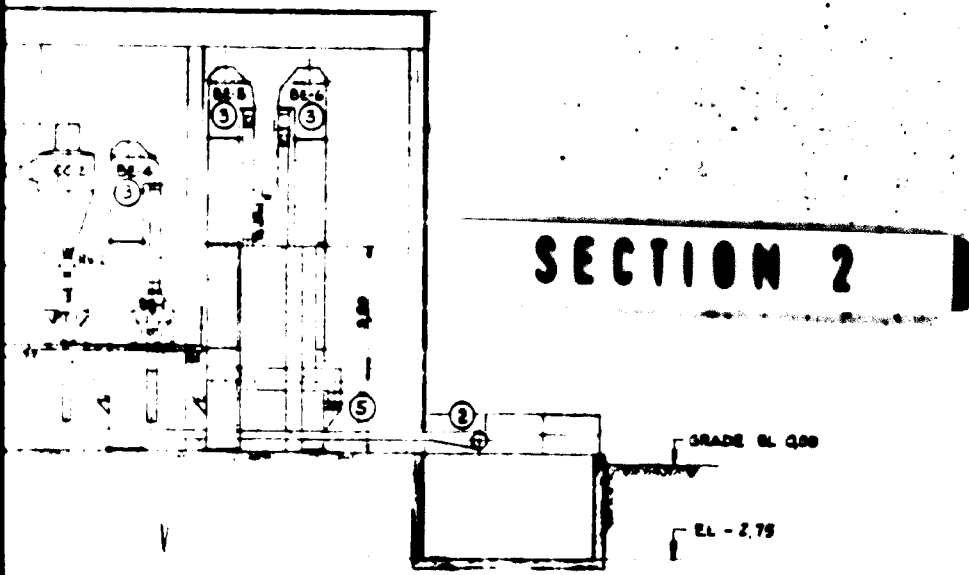
SECTION 2



SECTION B-B

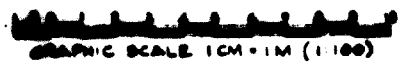


SECTION C-C



NOTE

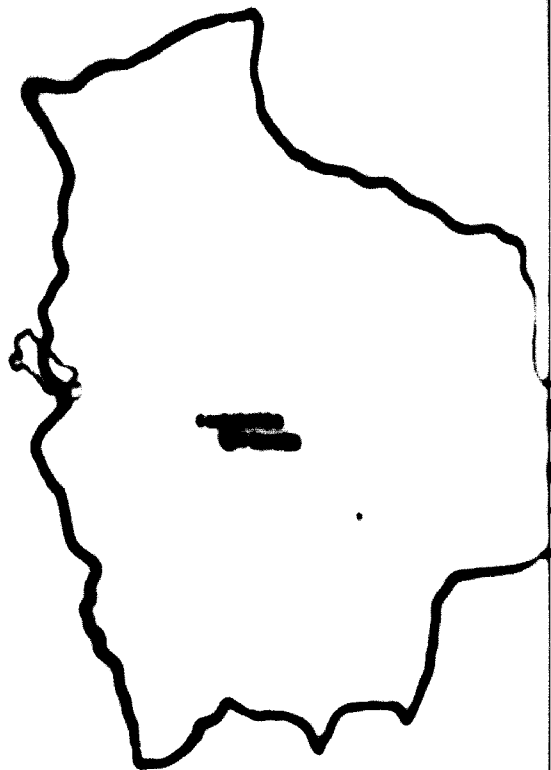
- ① TYPICAL (SIP MOTOR)
- SCALPING STATION - BEATING SCREEN NO. 1 1/2 @ MOTOR
- " " BELT CONVEYOR NO. 3 1/2 @ MOTOR



SURVEYER, NENNIGER & CHEN

PLANOS PARA LA CONE SOPORTE INDUS

PLANTA PILOTO CLASIFICADORA D



Proyecto financiado por:
Republica de Bolivia (fondos Presidenciales de Emergencia)
Naciones Unidas, UNIDO

CONSULTORES GALINDO Ltd.
INGENIERIA Y ADMINISTRACION

SECTION 1

R & CHENEVERT, INC.

CONSTRUCCION DEL INDUSTRIAL

ADORA DE ASBESTO

PRELIMINARY

BOEING MANUFACTURING CO.

SECTION 2

ALINDO Ltda.

ADMINISTRACION

Bolivia
Noviembre 1971

INDICE DE PLANOS

1	TITULO
2	SUMARIO DE CANTIDADES
3	PLANO GENERAL
4	ARQUITECTURA Y DETALLES DE PACHADA
5	FUNDACIONES
6	LOSAS PLANTA BAJA
7	PLANTA PRIMER PISO
8	PLANTA SEGUNDO PISO
9	LOSAS SEGUNDO PISO
10	VIGAS LONGITUDINALES SEGUNDO PISO
11	VIGAS TRANSVERSALES SEGUNDO PISO Y COLUMNAS PRIMER PISO
12	VIGAS TECHO Y COLUMNAS SEGUNDO PISO
13	CERCHAS Y DETALLES TECHOS
14	DETALLES PAREDES Y UBICACION BOMBAS
15	PLANO MECANICO
16	CONJUNTO ELECTRICO
17	ILUMINACION
18	FUERZA ELECTRICA

SUMARIO

ITEM	Estructura estructural	Batanes	Concreto 210 kg/m ³	Concreto pobre	
CANTIDAD	700	240	300	-	
UNIDAD	m ³	m ³	m ³	m ³	
ESPECIFICACION	ET-2	ET-2	ET-3	ET-3	

ITEM	Puertas acero	Ventanas	Pinturas	Cubiertas albañal, concreto	
CANTIDAD	3	155	650	1,220	
UNIDAD	unidades	m ²	m ²	m ²	
ESPECIFICACION	ET-9	ET-6	ET-10	ET-11	

SECTION 1

SUMARIO DE CANTIDADES

Concreto pobre	Pierre de madera	Acero estructural	Mamposteria piedra con mortero	Mamposteria piedra seca	Bloques cemento aliger	Coleo resaca	Revoque	Estructuras de madera	Puertas simbico
-	88,717	5,000	40	121	528	802	830	Total	8
m ³	kg	kg	m ³	m ³	m ²	m ²	m ²	global	unidad
ET-3	ET-4	ET-6	ET-8	ET-9	ET-5	ET-8	ET-7	ET-8	ET-9

Cubiertas asfalto, cemento	Pisieria que potable	Pisieria de agua	Pisieria de cemento	Concretos y balcones	Pasamanos	Estalajeos	Bombos de escape	Compuercas	Isolacion acustica
1,220	Total	Total	Total	Total	100	0	3	1	Total
m ²	global	global	global	global	m	unidad	unidad	unidad	global
ET-11	ET-12	ET-12	ET-12	ET-12	ET-12	ET-13	ET-14	ET-15	ET-16

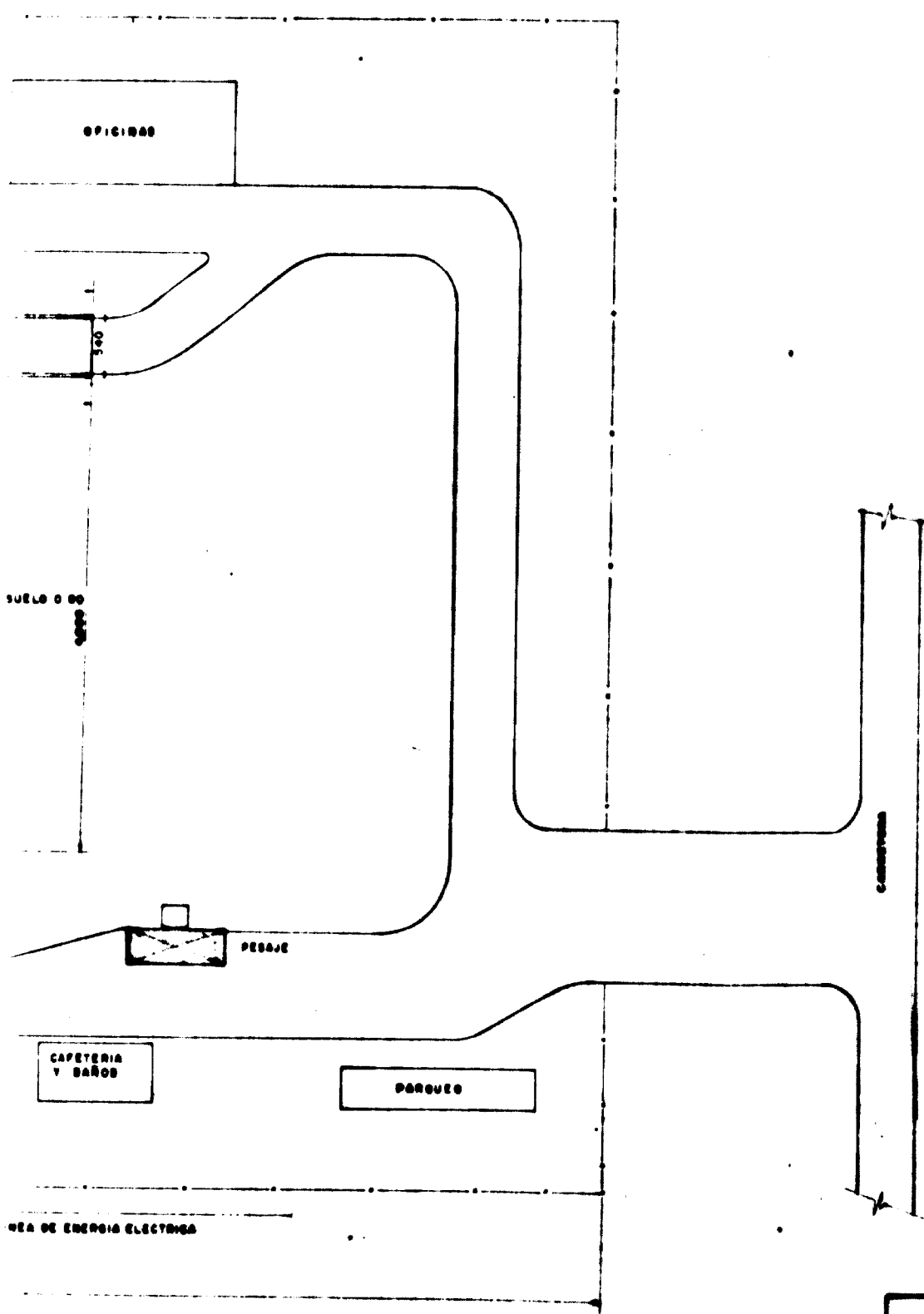
PRELIMINAR

1974

PROYECTO DE CONSTRUCCION DE LA PLANTA DE ASBESTO

SECTION 2

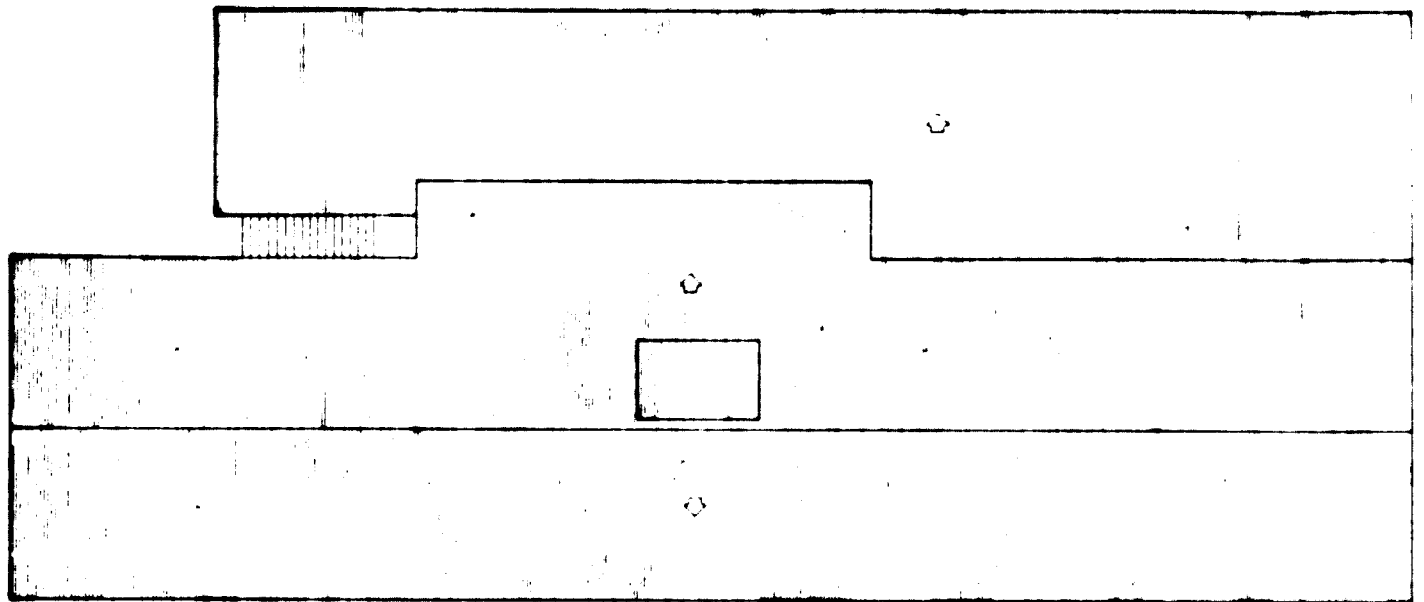
PLANTA ASBESTO	
SUMARIO DE CANTIDADES	
CONSULTORES GALINDO LTDA	
	25



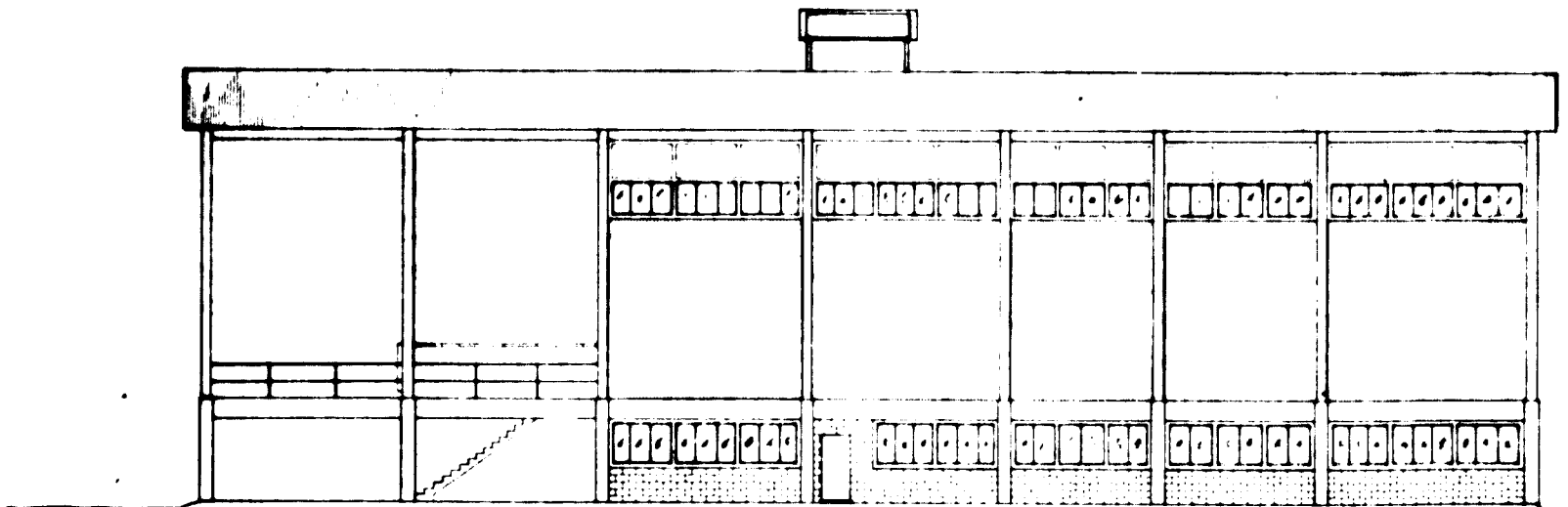
LIBRARY
 1971
 ENGINEERING PROJECT INC.

SECTION 2

	<p>PLANTA ASBESTO</p> <p>PLANO GENERAL</p>
	<p>CONSULTORES GALINDO LTDA</p>
	<p>3/8</p>



VISTO DE ARRIBA

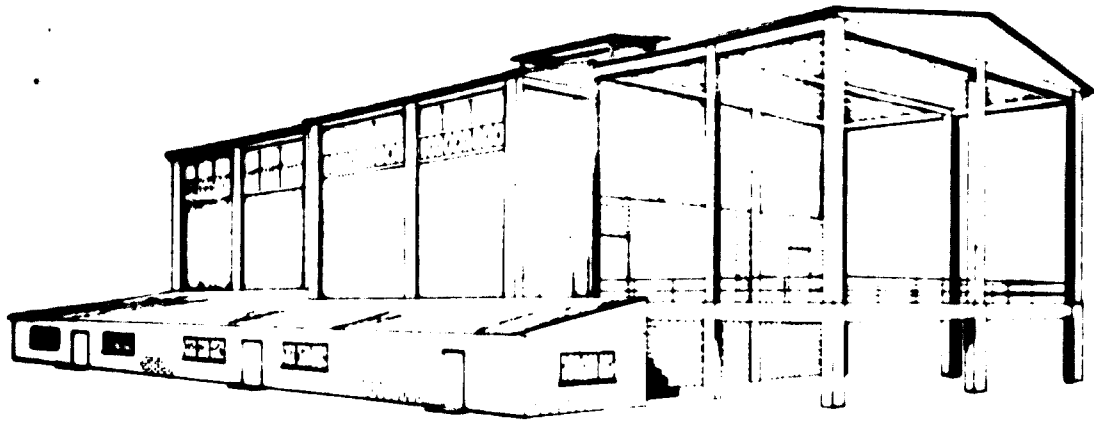


VISTO DE FRENTE

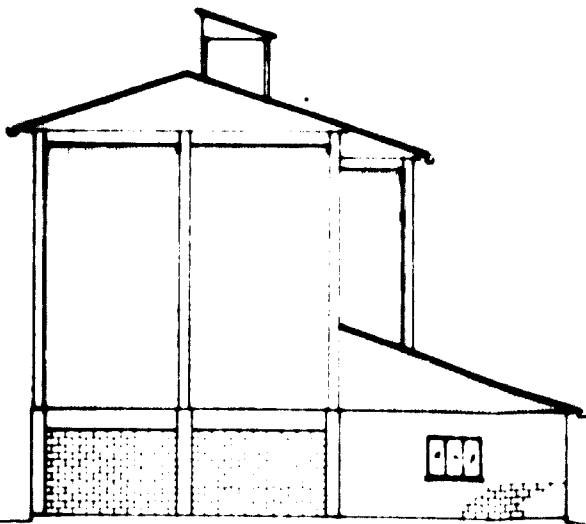
SECTION 1

LISTA DE CUBICACIONES APROXIMADAS

Techos a c	795 m ²	Paradas a c	485 m ²
Paradas a c 20 cm	326 m ²	Paradas a c 10 cm	— m ²
Puertas de línea	5 unid	Puertas dobles	3 unid
Área ventanosa vidrio	90 m ²	Área ventanosa alambre	85 m ²
Cableados y tuberías	80 m		



PERSPECTIVA



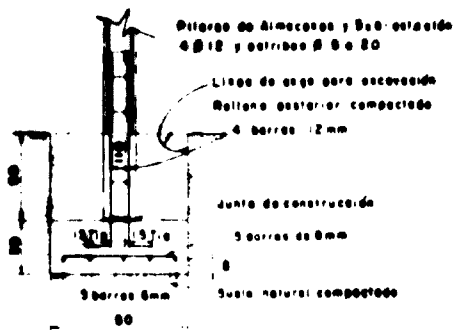
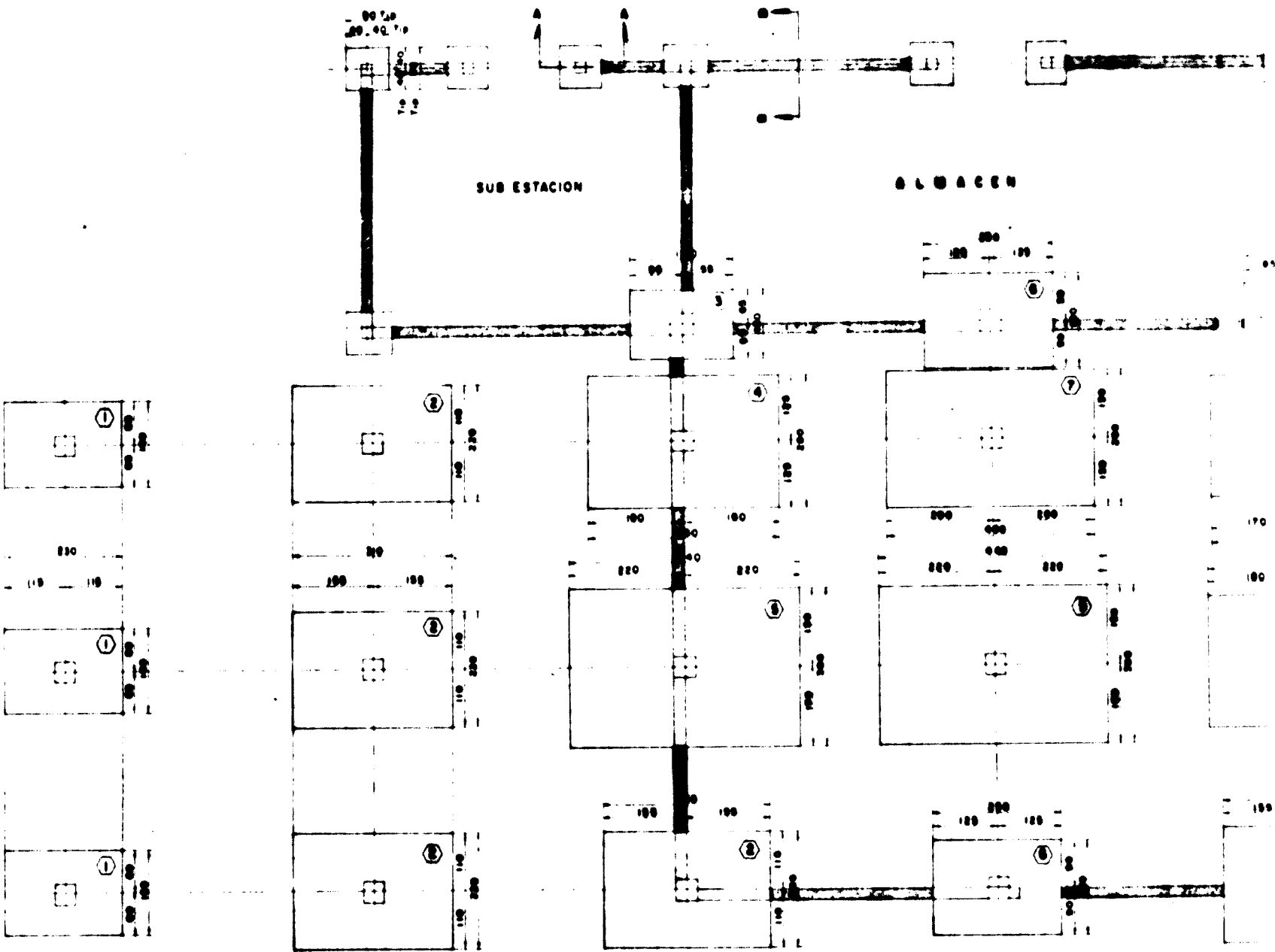
VISTO DE COSTADO

- 1 - **Detalles**
- Bloque cemento, 20
- Cubiertas esbeto cemento, a c
- Ventanas con vidrio
- Ventanas con tela milimétrica
- 2 - En las ventanas con vidrio un panel de cada tres debe ser embrogado para abrir y cerrar

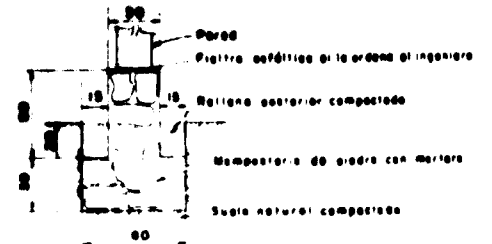
SECTION 2

PLANTA ASBESTO
ARQUITECTURA Y
MATERIALES DE FACHADA

CONSULTORES GALINDO LTDA



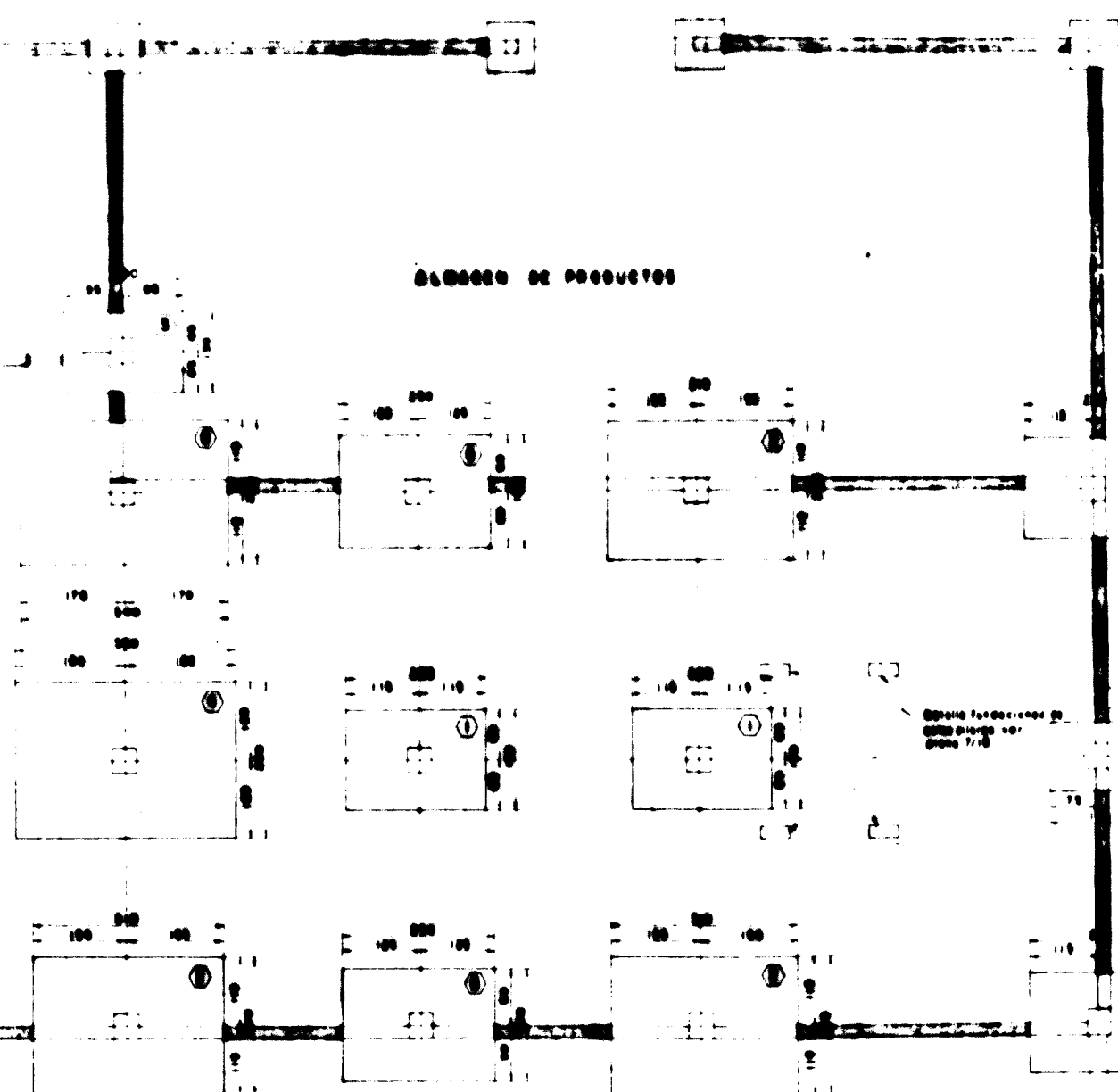
CORTE A-A
 SECCION TIPICA ZAPATAS SECUNDARIAS



CORTE B-B
 SECCION TIPICA CIMENTOS MUROS

SECTION 1

BLOQUE DE PRODUCTOS

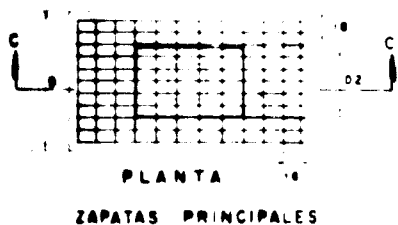
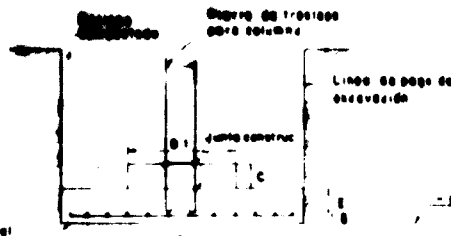


LEYENDA

- 1. Zonas de obra
- 2. Zonas de obra
- 3. Zonas de obra
- 4. Cimentación de muros
- 5. Las bases de carga por estructura de concreto con acero por debajo de las zapatas de cada estructura de fundación.
- 6. El fondo de cada zapata en concreto será compactado al 95% de su densidad estándar.
- 7. El elevación inferior de zapatas:
 - a) 150 mm
 - b) 100 mm
 - c) 50 mm
 - d) 0 mm
- 8. Estas zapatas serán completamente en concreto estructural con 3% de acero y 10% de arena con un máximo de estructura al 95% de su densidad estándar.
- 9. Las zapatas serán continuas con los muros hasta el fondo de los cimientos.
- 10. Se colocarán vigas de acero para fundaciones y se las indicará el ingeniero.
- 11. El largo de los muros será de 30 centímetros de la barra.
- 12. Las juntas de construcción serán aprobadas por el ingeniero.

Espacio para fundaciones de grupo 7/18

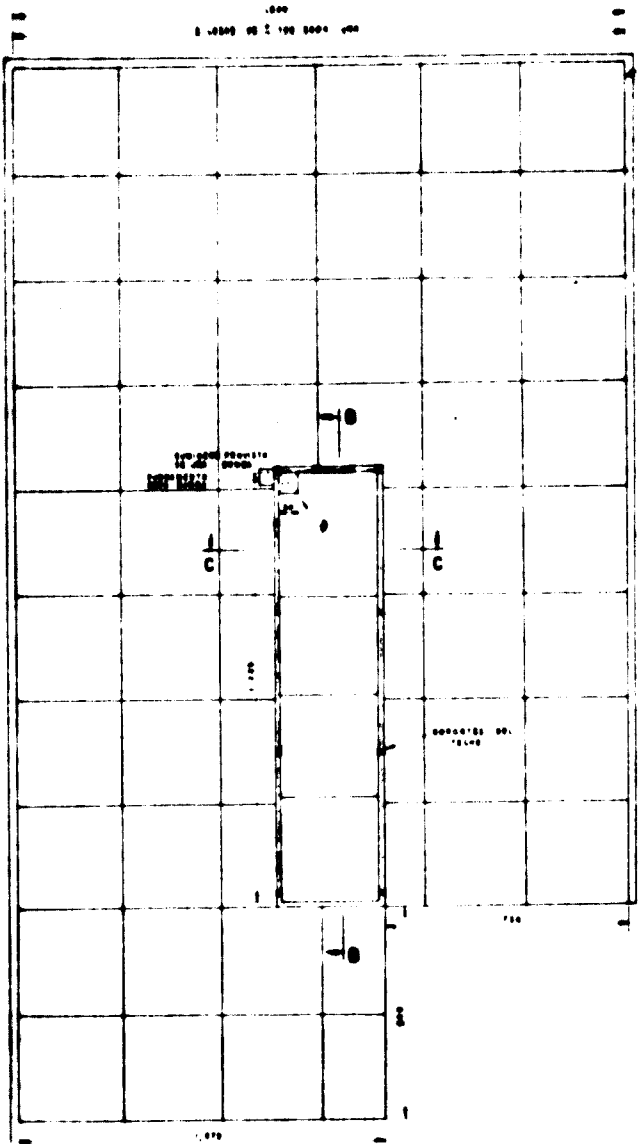
ITEM	DIMENSIONES		REVEST.		ENFERRO LONGIT.		ENFERRO TRANSV.		PESO UNIT.		PEQ. TOTAL		
	W	H	D	C	Diám.	Conc.	Diám.	Conc.	Long.	Trans.			
1	230	180	0	0	5	22	4	8	0	20	0	06	24
2	80	220	0	0	20	22	2	20	0	4	15	60	252
3	80	150	0	0	5	18	3	3	0	20	0	58	21
4	380	150	20	80	25	20	6	45	0	4	18	88	48
5	480	300	30	80	25	22	8	55	22	2	25	50	87
6	250	80	0	0	20	22	18	15	0	8	11	55	27
7	400	280	30	80	25	22	8	50	0	2	2	117	50
8	340	230	10	75	25	22	3	3	0	2	2	99	27
9	380	110	0	0	5	14	4	8	2	14	0	17	08
Dimensiones en cm. Diámetro en mm. Peso en Kg.											2,490	587	



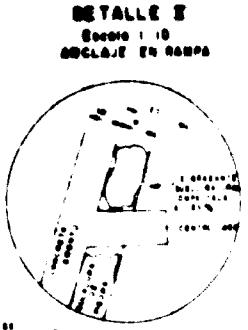
SECTION 2

PLANTA ASBESTO FUNDACIONES

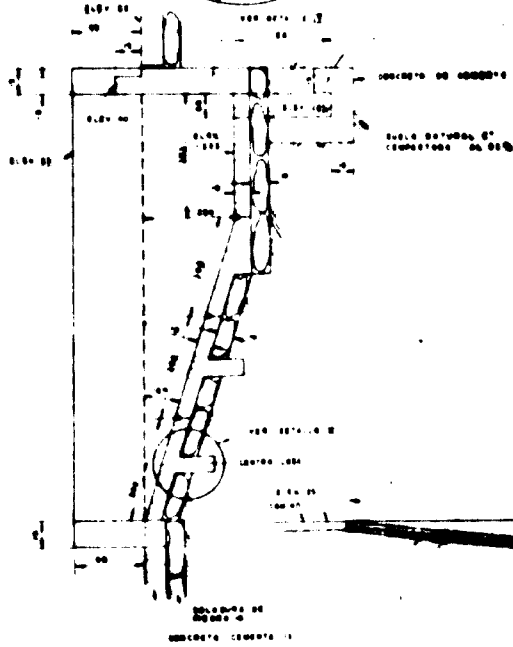
CONSULTORES GALINDO LTDA



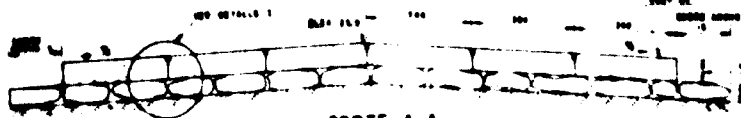
PLANTA
Escala 1/100



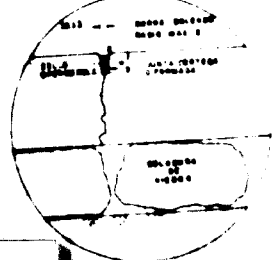
DETALLE I
Escala 1/5
ANCLAJE EN RAMPA



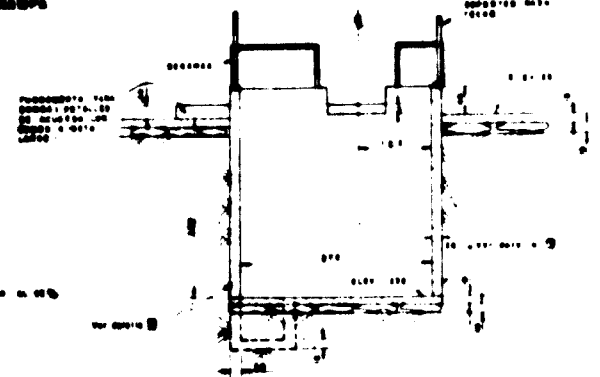
CORTE B-B
Escala vertical 1/20
RAMPA



CORTE A-A
Escala vertical 1/20



DETALLE II
Escala 1/5
SECCION TYPICA PARA
TODAS LAS JUNTAS



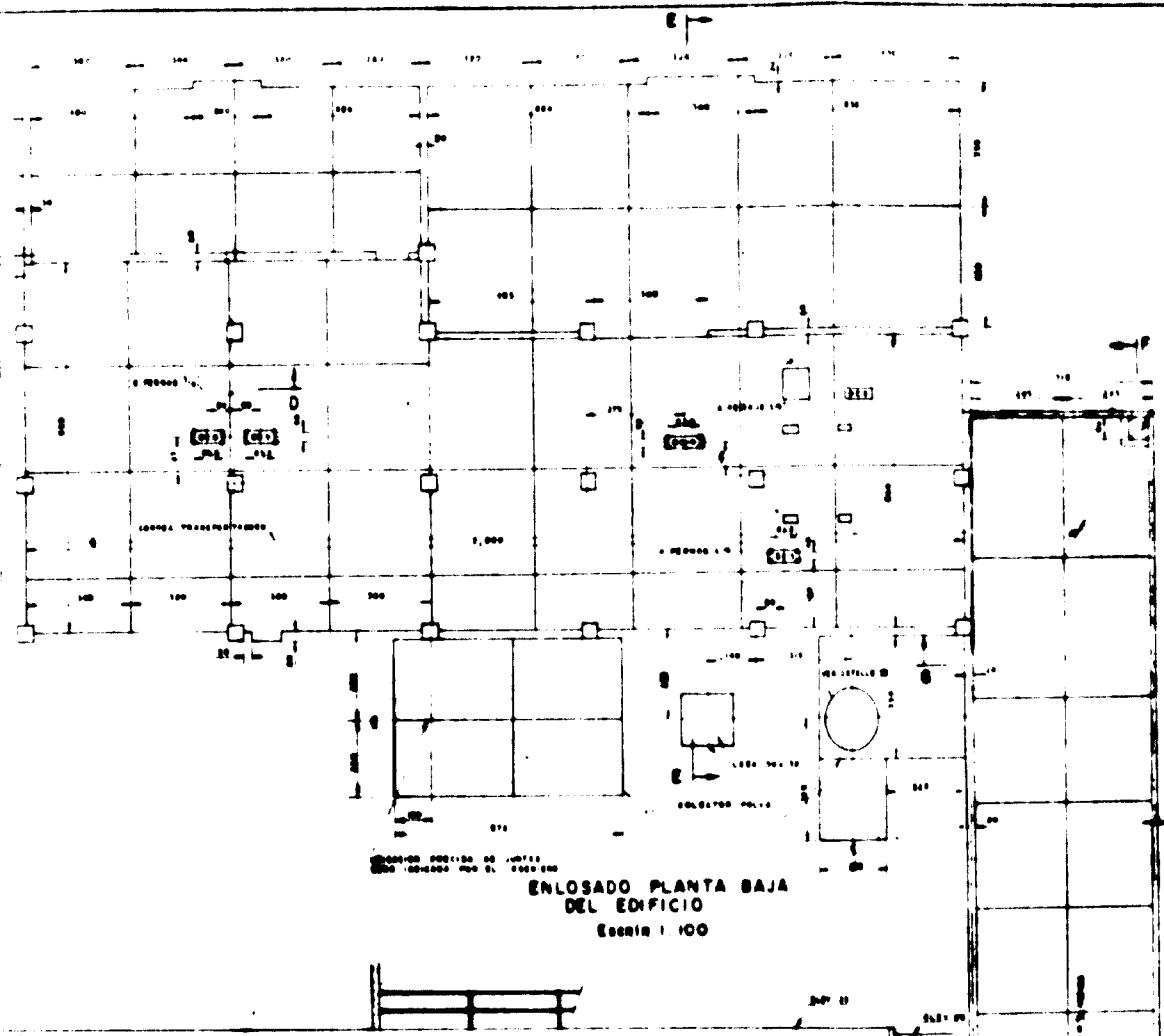
CORTE C-C
Escala 1/50



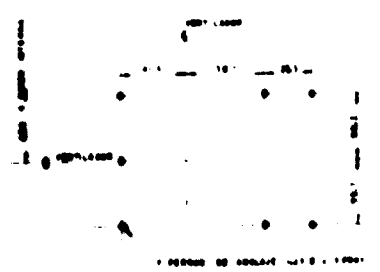
CORTE D-D
Escala vertical
SECCION TYPICA DEL
CONCRETO
SECCION PROCESO

SECTION 1

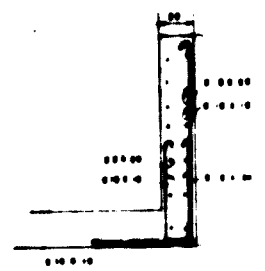
PLATAFORMA DE ALMACENAMIENTO DE
MATERIA PRIMA



ENLOSADO PLANTA BAJA DEL EDIFICIO
Escala 1:100

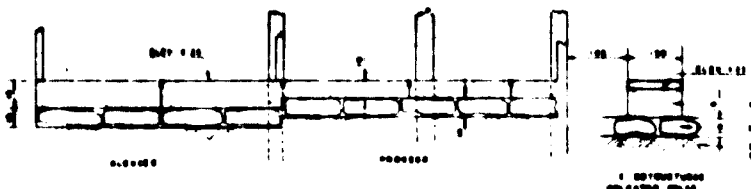


DETALLE III
Escala 1:25
PERNOS ANCLAJE DEL VENTILADOR

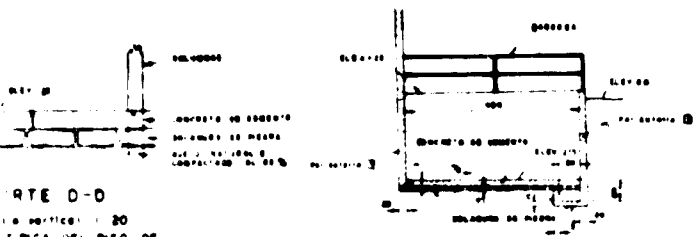


DETALLE IV
Escala 1:20

CORTE F-F
Escala 1:100
RAMPA DE SALIDA



CORTE E-E
Escala horizontal 1:100
Escala vertical 1:20
SECCIONES TÍPICAS DE LOS PISOS DE CONCRETO
ALMACENES, PROCESO Y COLECTOR DE POLVO



CORTE D-D
Escala vertical 1:20
TIRICA DEL PISO DE CONCRETO EN PROCESO

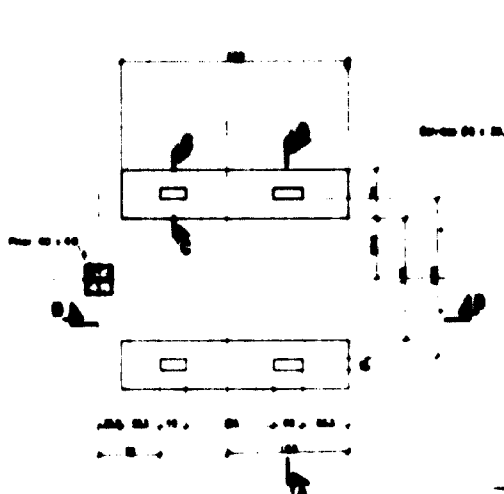
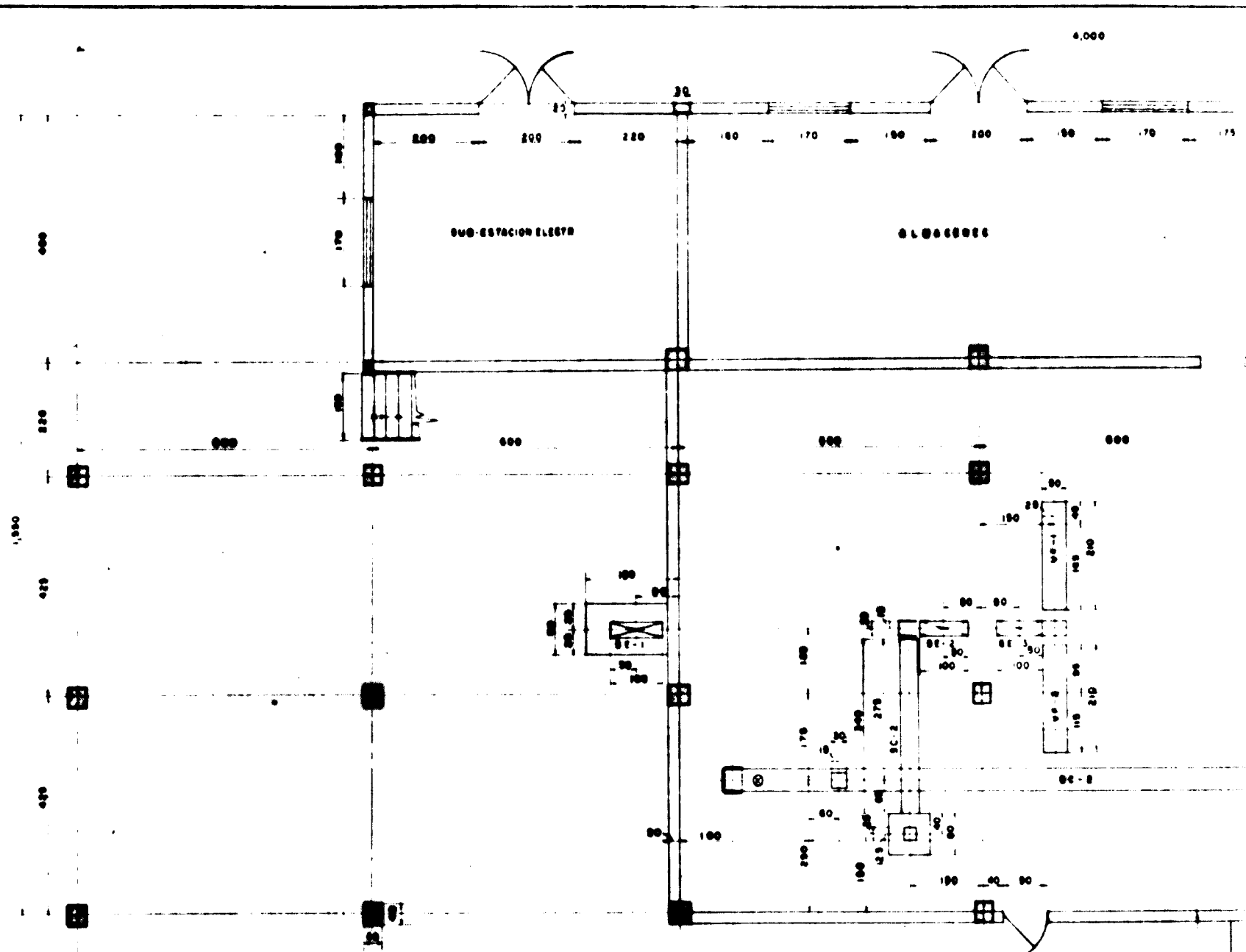
CORTE G-G
Escala 1:100
RAMPA DE SALIDA

PLATAFORMAS EN PLANTA BAJA

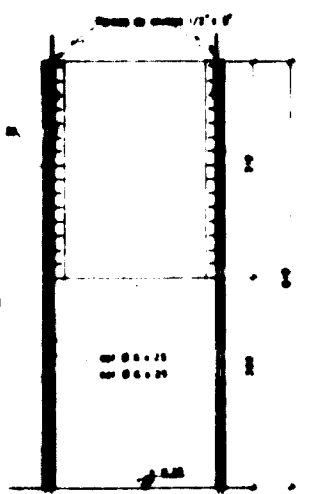
SECTION 2

PLANTA ASBESTO
LOSAS PLANTA BAJA

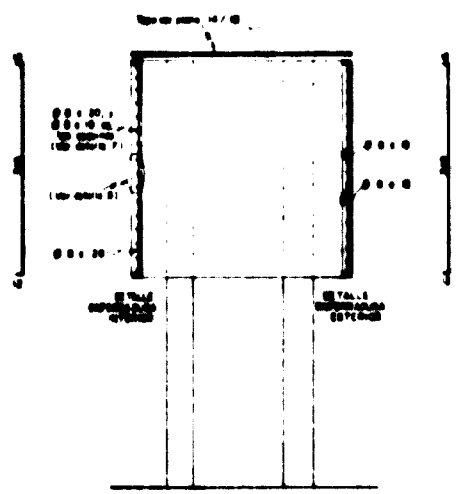
CONSULTORES GALINDO LTDA.



DETALLE FUNDACIONES
ESTANQUE DE FIRRA



CORTE A-A

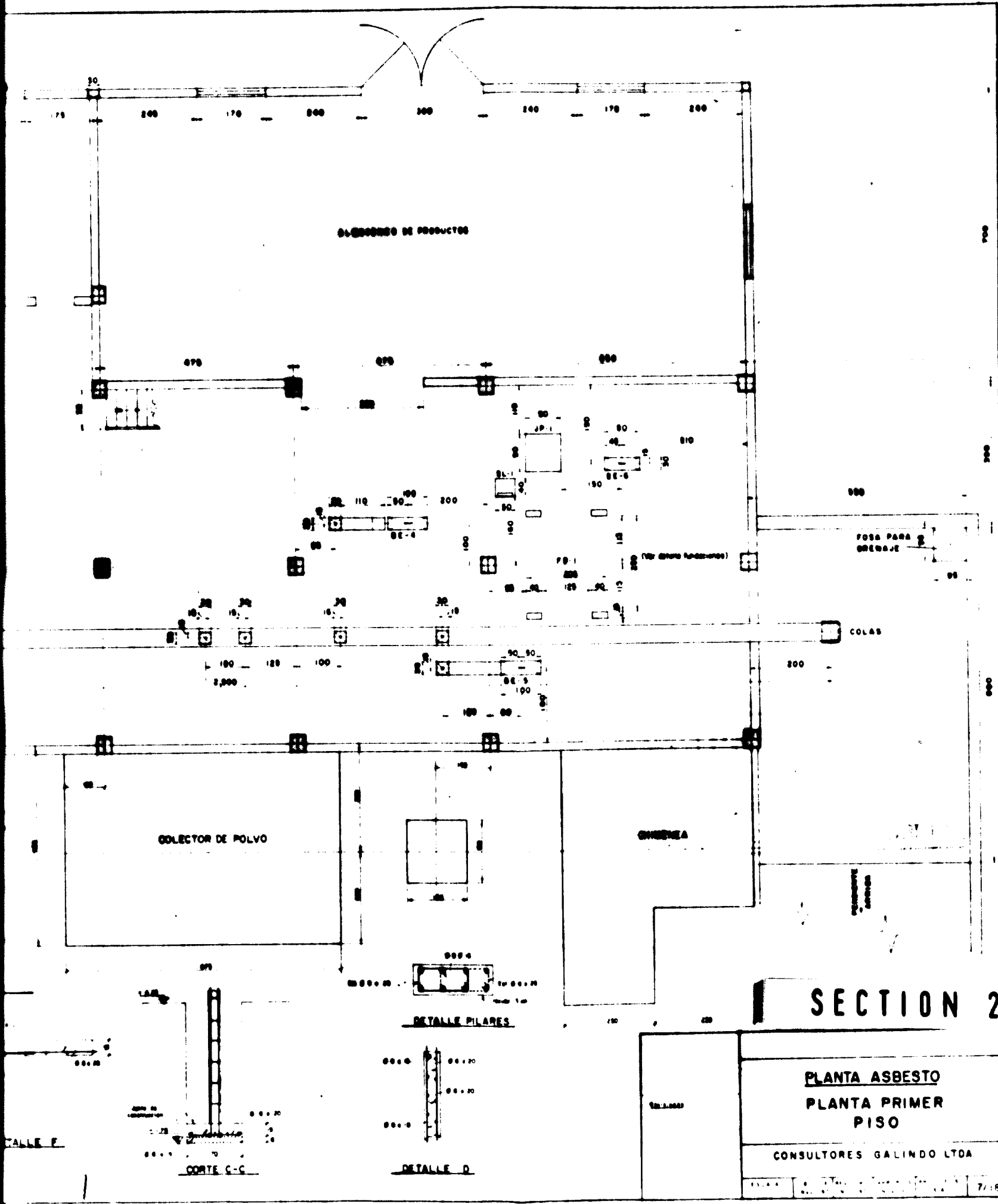


CORTE B-B



DETALLE F

SECTION 1



ALMACEN DE PRODUCTOS

COLECTOR DE POLVO

CINEREA

SECTION 2

PLANTA ASBESTO
PLANTA PRIMER
PISO

CONSULTORES GALINDO LTDA

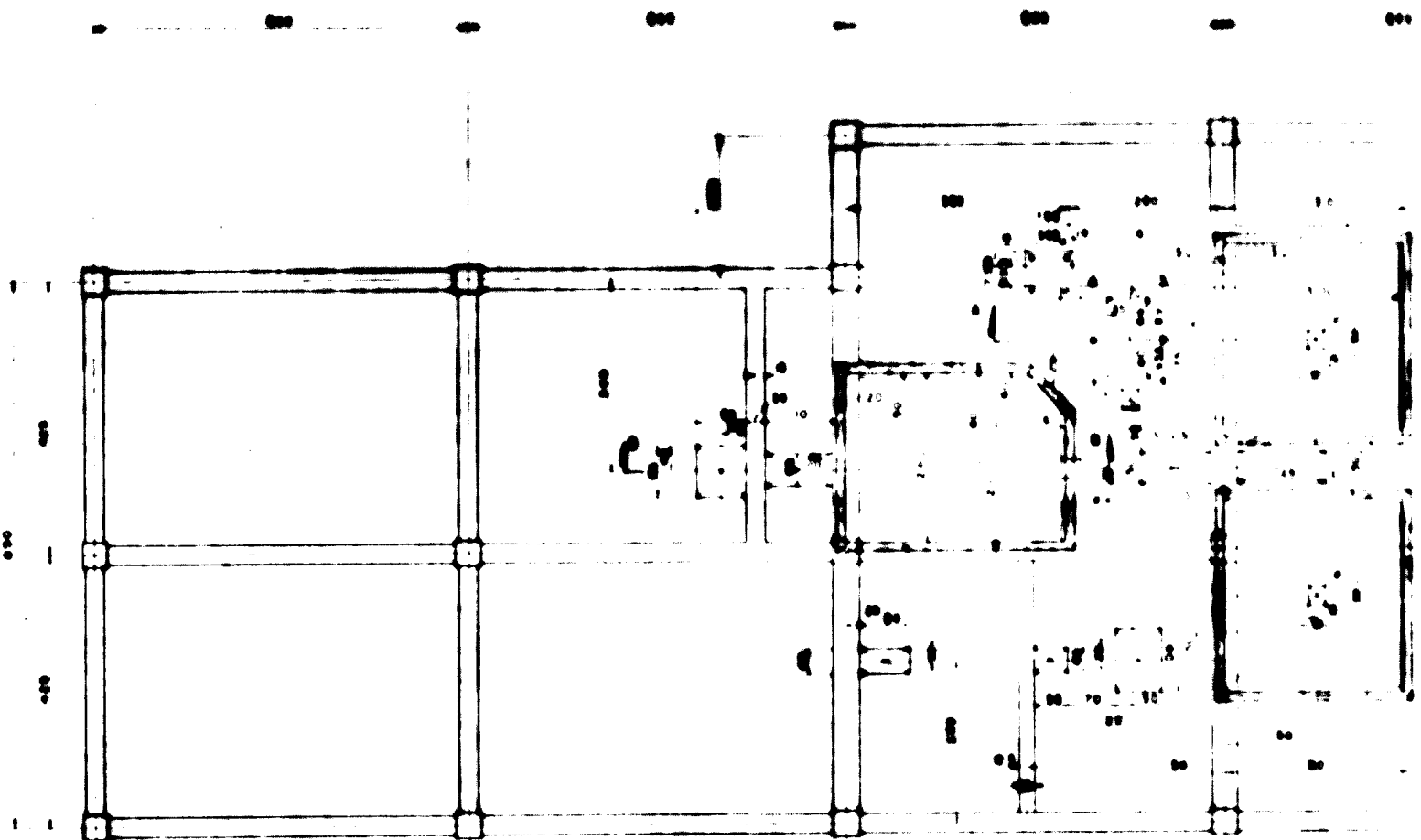
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DETALLE PILARES

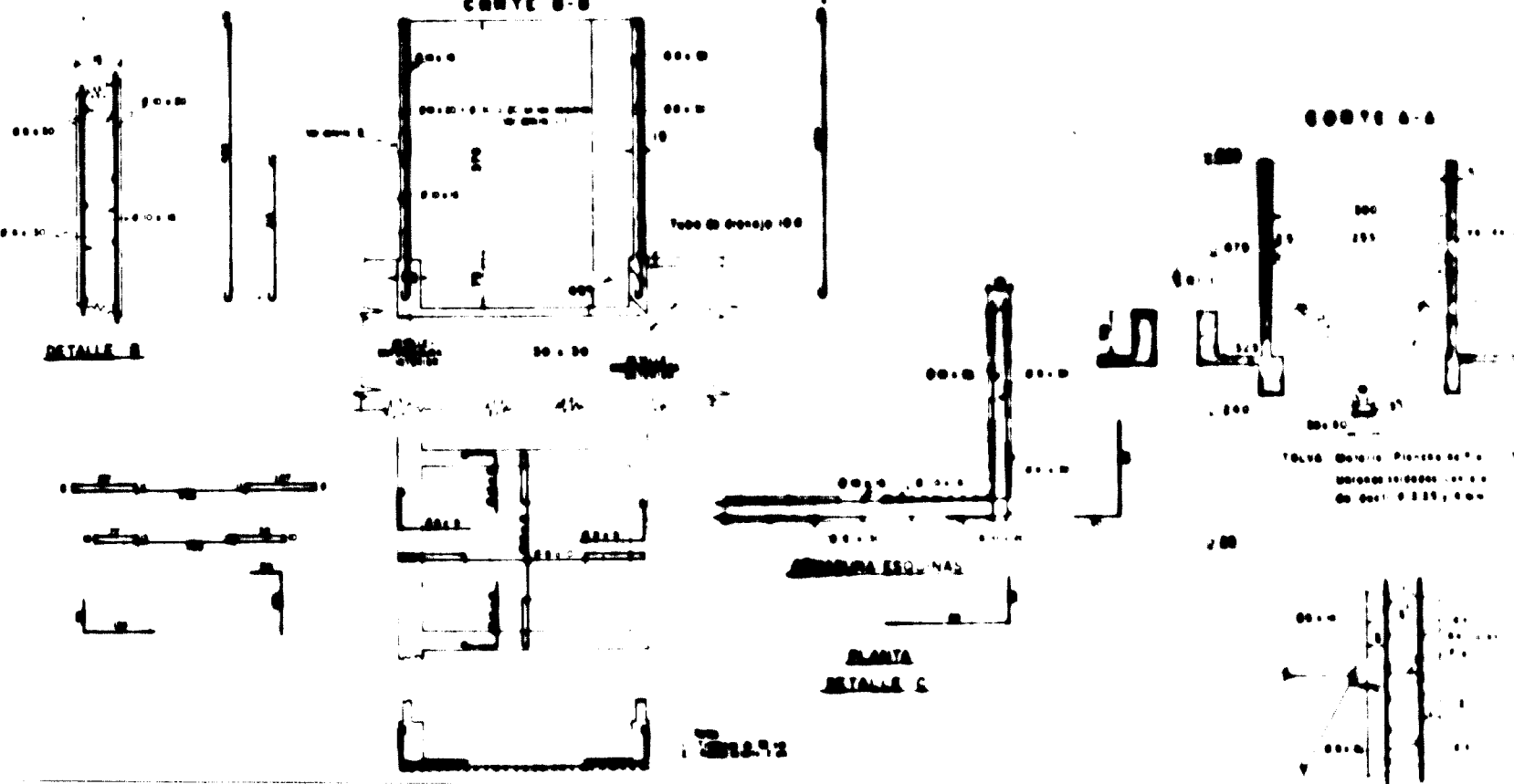
DETALLE D

CORTE C-C

CALLE F



CORTE B-B

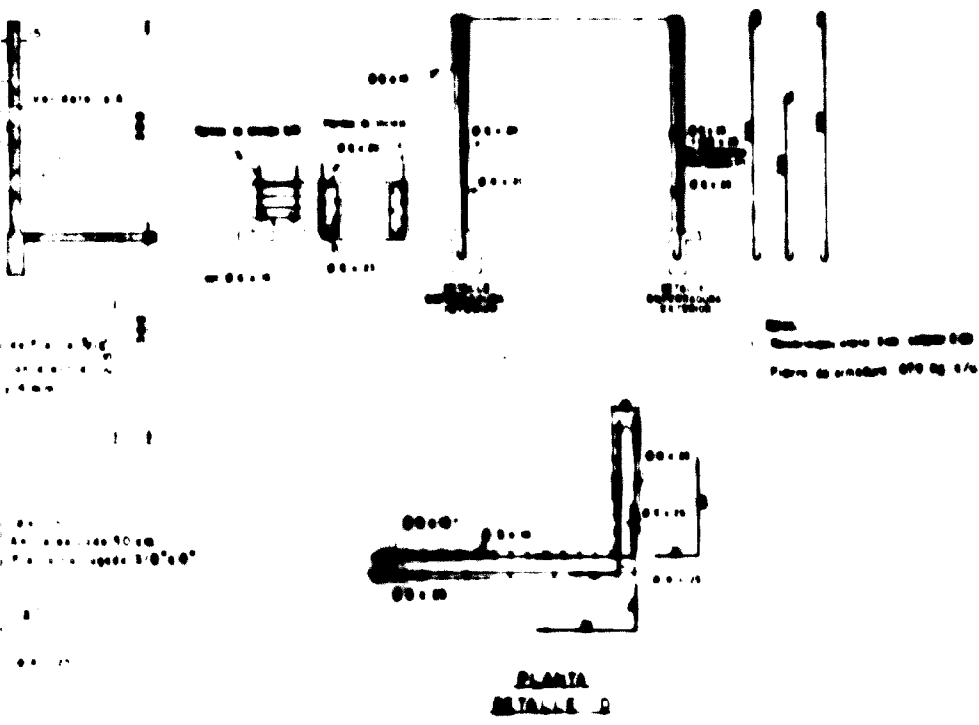
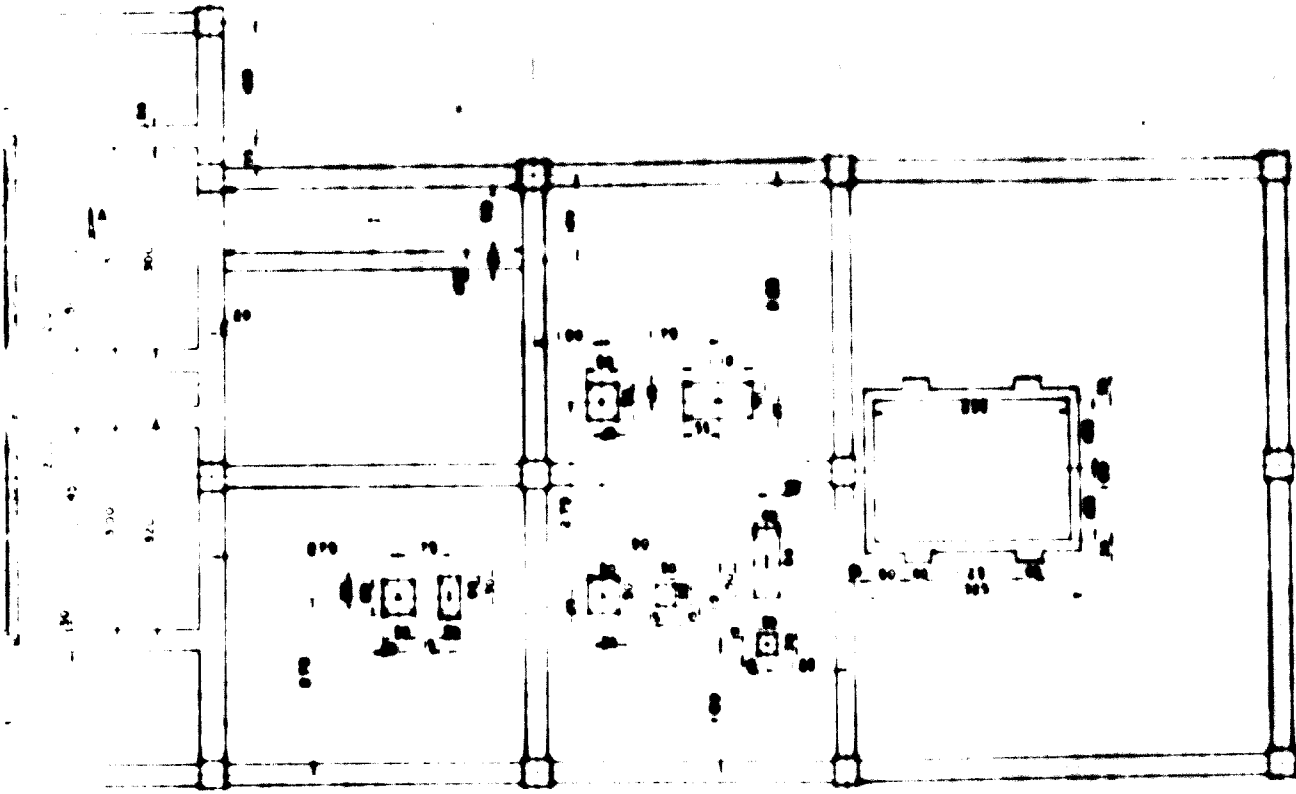


SECTION 1

Folio de planos 57/12

DETA F A

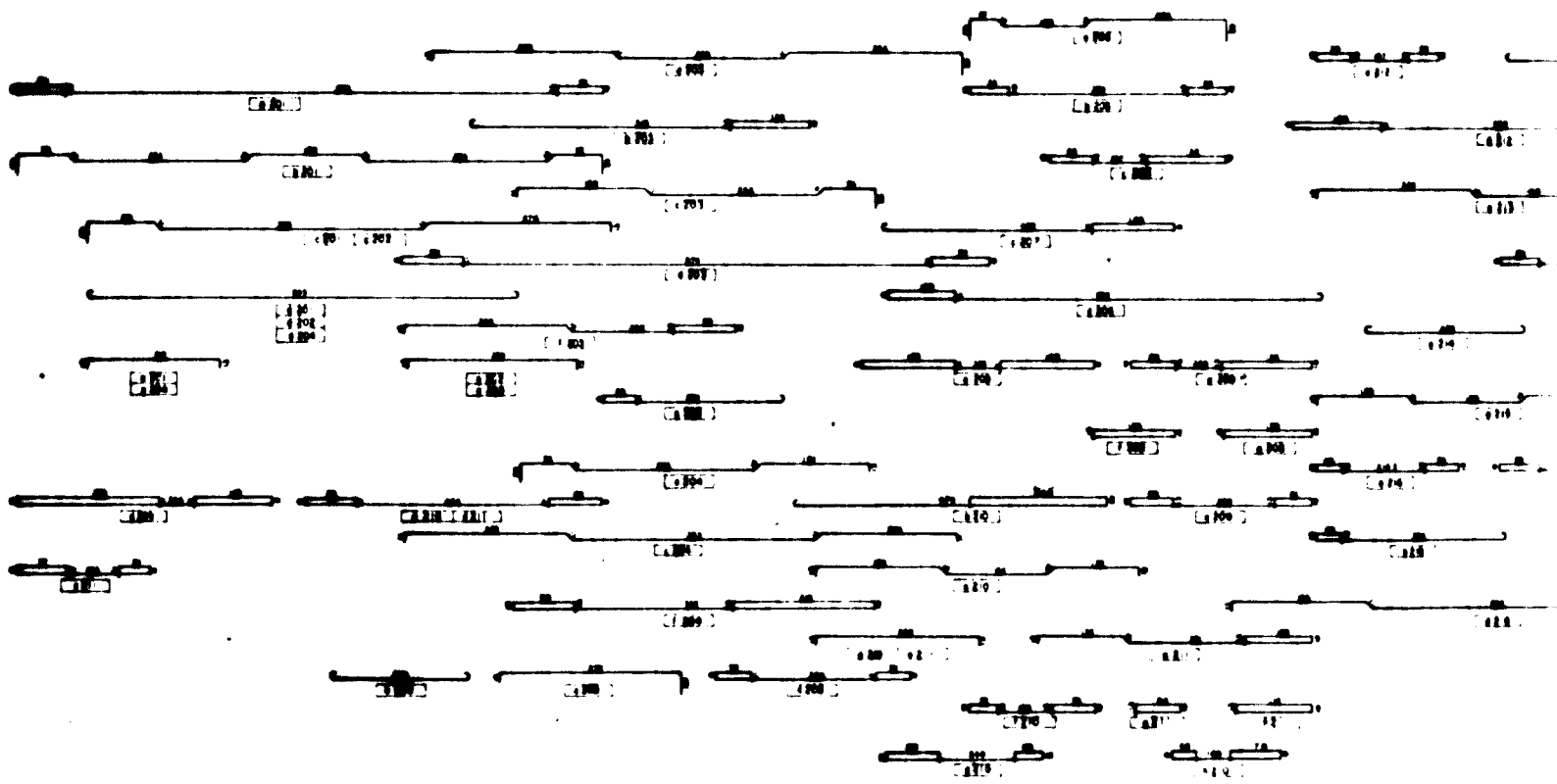
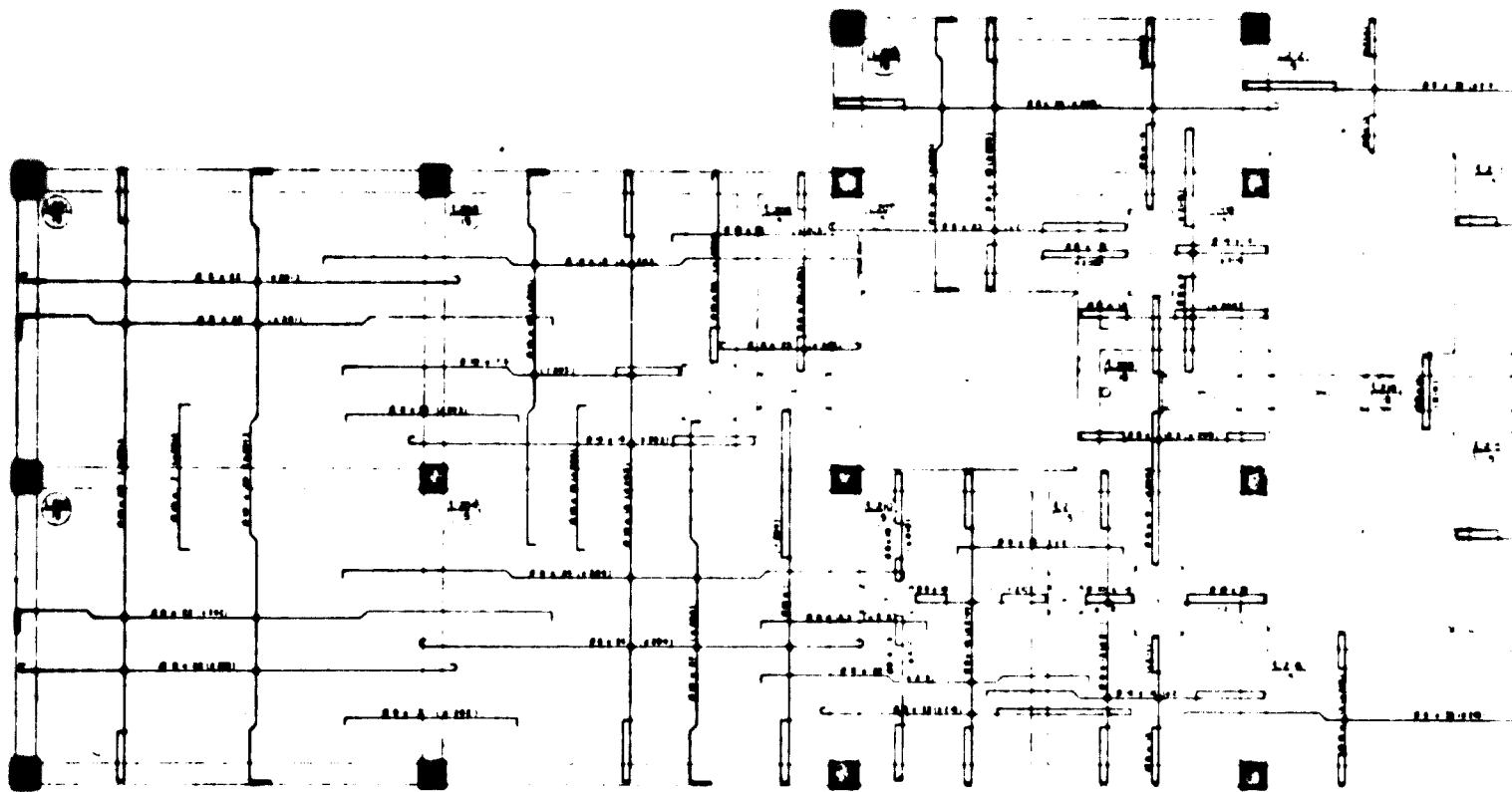
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ARCHITECTURE
 1971
 CONSULTORES GALINDO LTDA

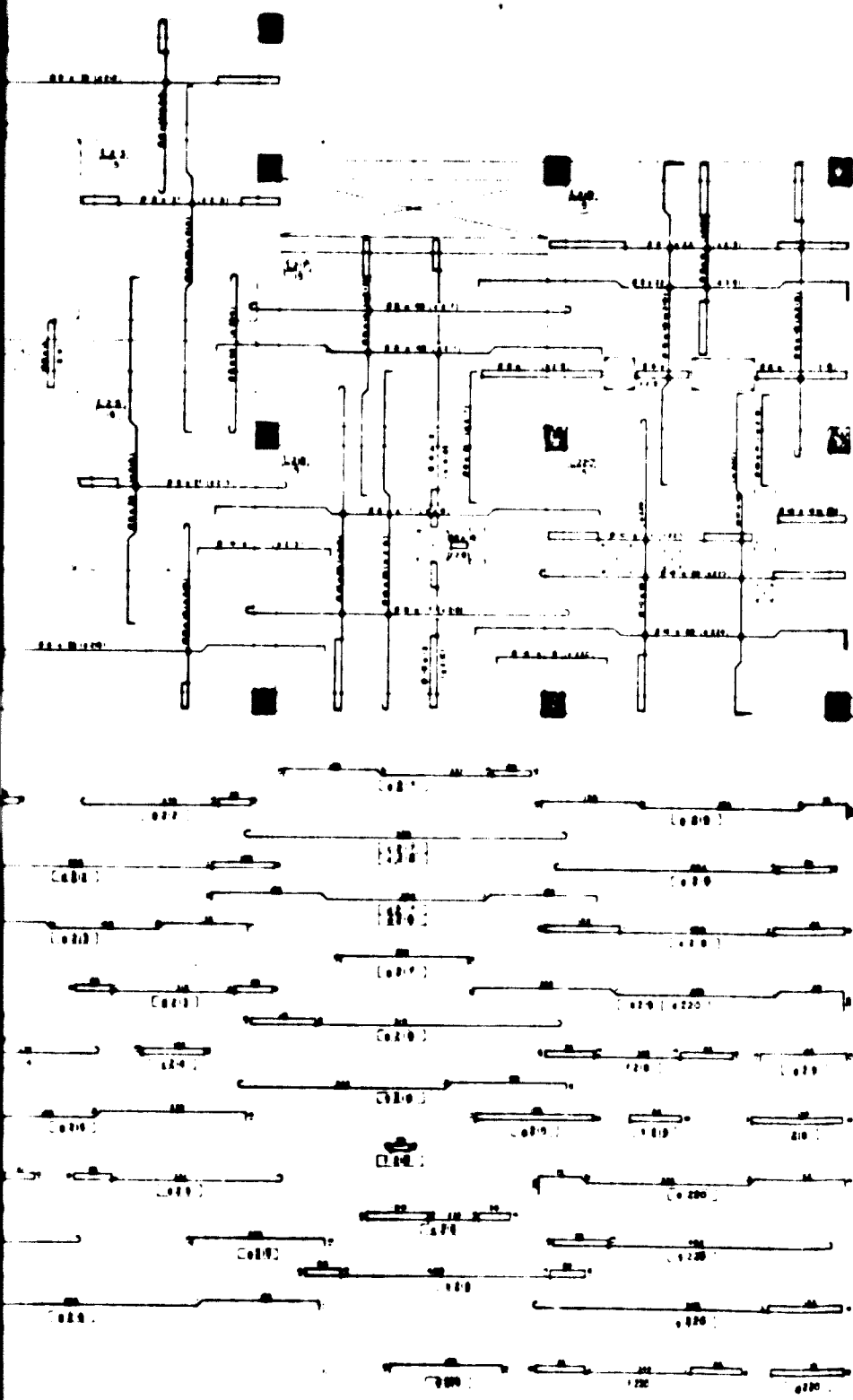
SECTION 2

—	PLANTA ASBESTO
	PLANTA SEGUNDO PISO
	CONSULTORES GALINDO LTDA
8/18	



ARMADURA LOSA

SECTION 1



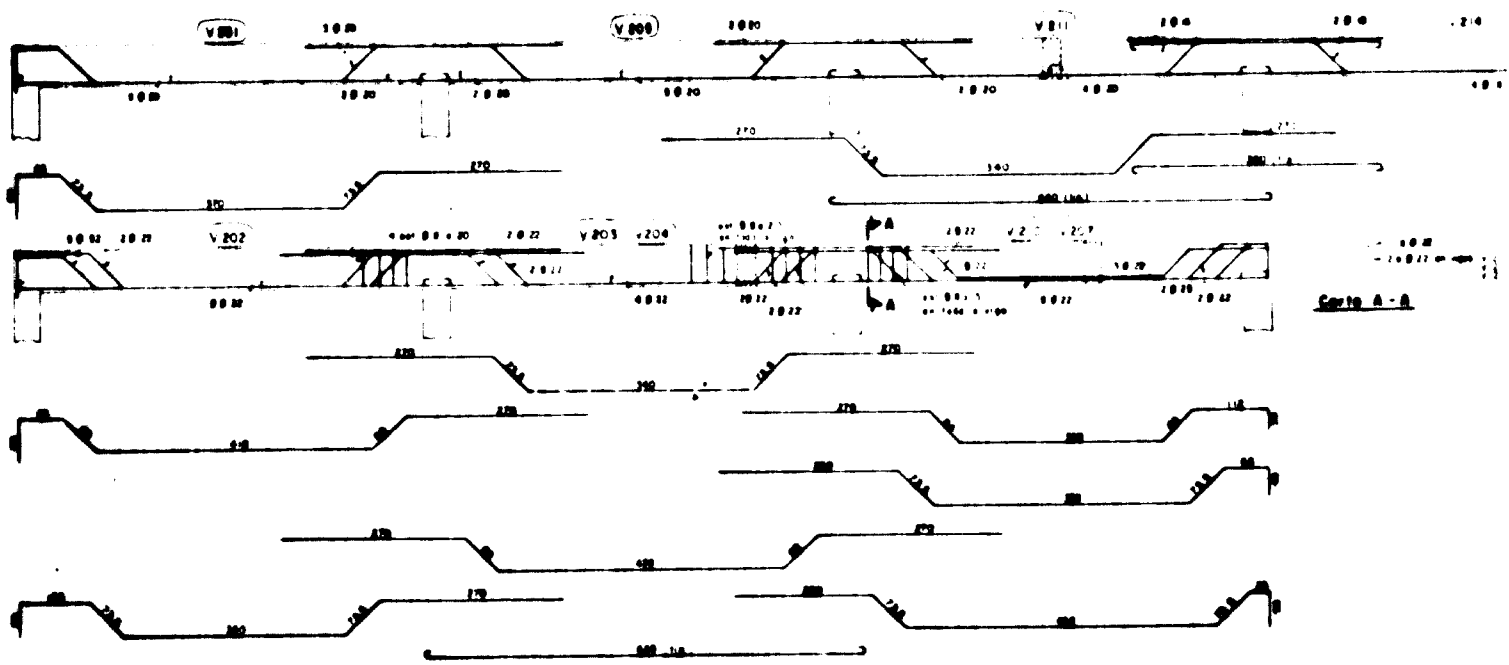
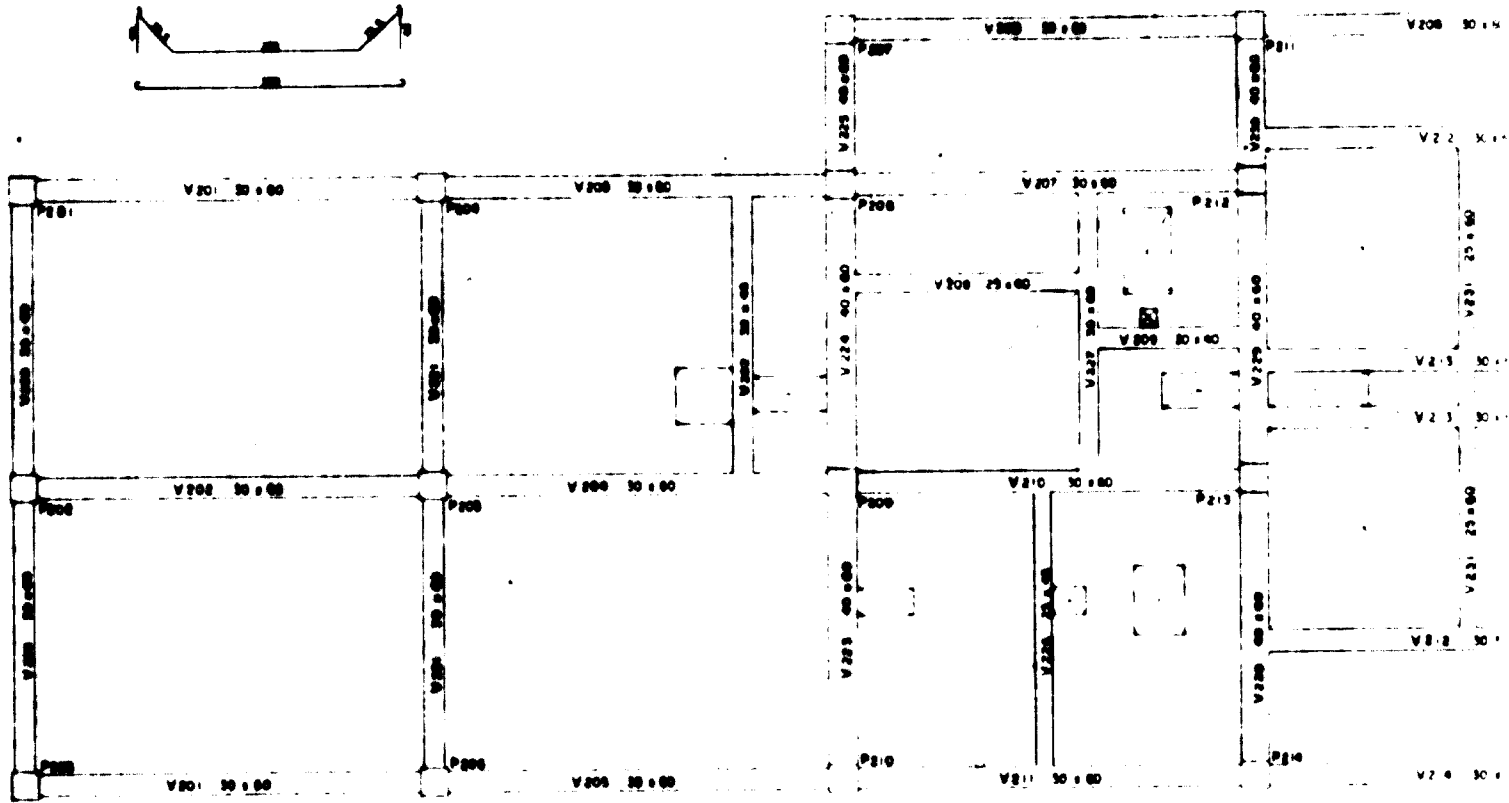
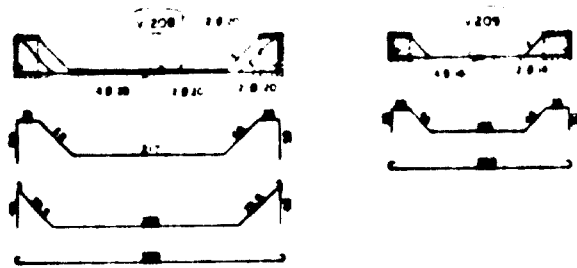
REINFORCADO
 — Armadura inferior
 — Armadura superior
 Ø 8 a 18 Diámetro 8mm cada 9cm
 Lazo Nº 210 de 13cms espesor

DETALLE DE FIERROS				
Nº	Longitud	Diámetro	Superficie	Volumen
424	21	10	334	9858
425	21	10	334	9858
426	21	10	334	9858
427	21	10	334	9858
428	21	10	334	9858
429	21	10	334	9858
430	21	10	334	9858
431	21	10	334	9858
432	21	10	334	9858
433	21	10	334	9858
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449	21	10	334	9858
450	21	10	334	9858
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582	21	10	334	9858
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584	21	10	334	9858
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600	21	10	334	9858

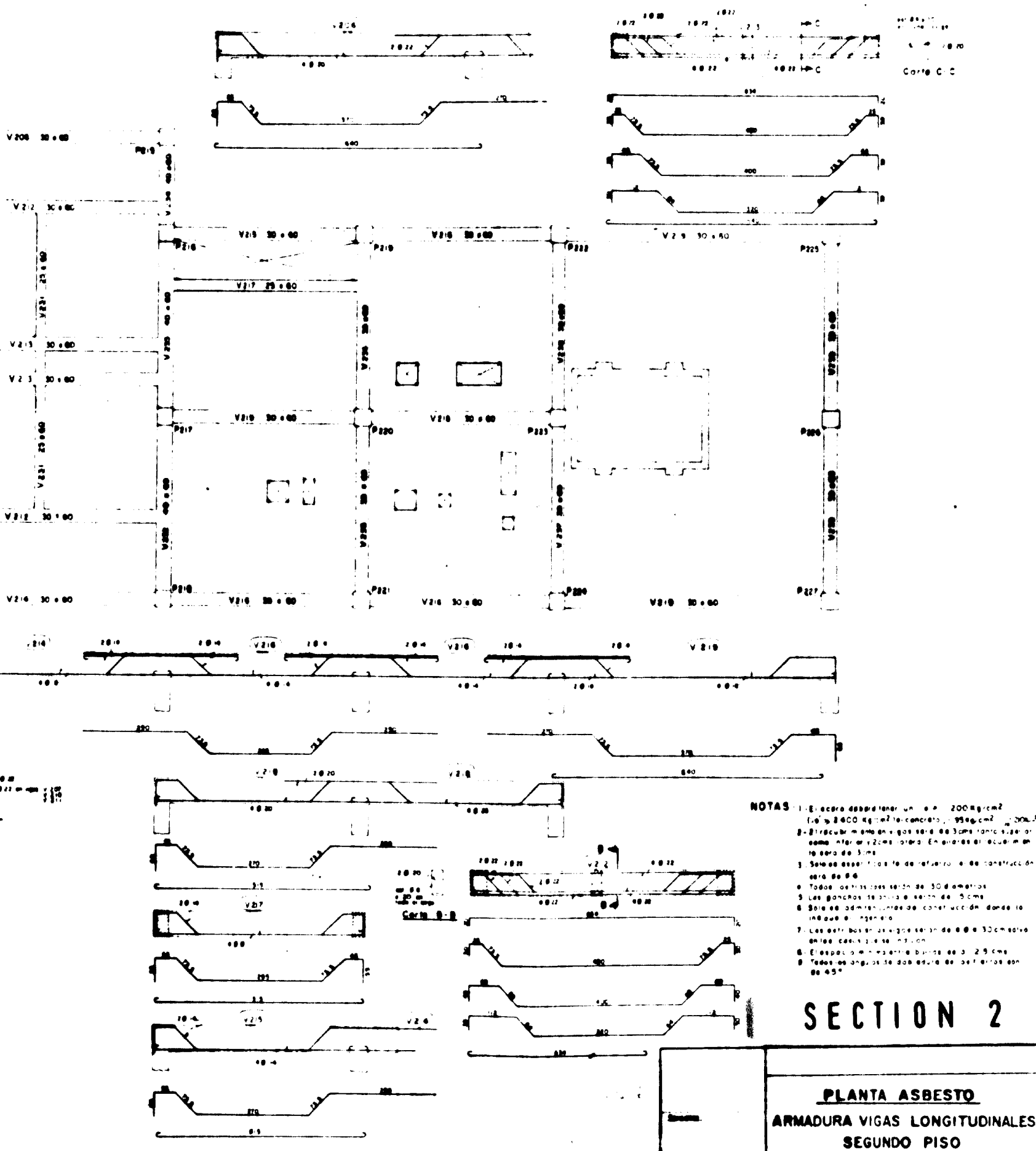
SECTION 2

- NOTAS**
1. Todo el fierro debe tener Ø > 200kg/cm² (Ø > 2000kg/cm²) y el concreto de 214kg/cm² (Ø > 2140kg/cm²).
 2. Recubrimiento superior e inferior en todas las barras 2 cm.
 3. Solo se especifica el tipo de refuerzo en la construcción para de Ø 8.
 4. Todos los tramos deben ser de 50 cm de longitud.
 5. Los gancho de anclaje serán de 5 cms.
 6. Solo se dan los puntos de construcción, cuando no se indique.
 7. Todos los ángulos de curvatura de los fierros son de 45°.

SNC, INC	
PLANTA ASBESTO	
LOSAS SEGUNDO PISO	
CONSULTORES GALINDO LTDA	
11.2.2	9/8



SECTION 1



Escala: 1/20
 Corro C-C

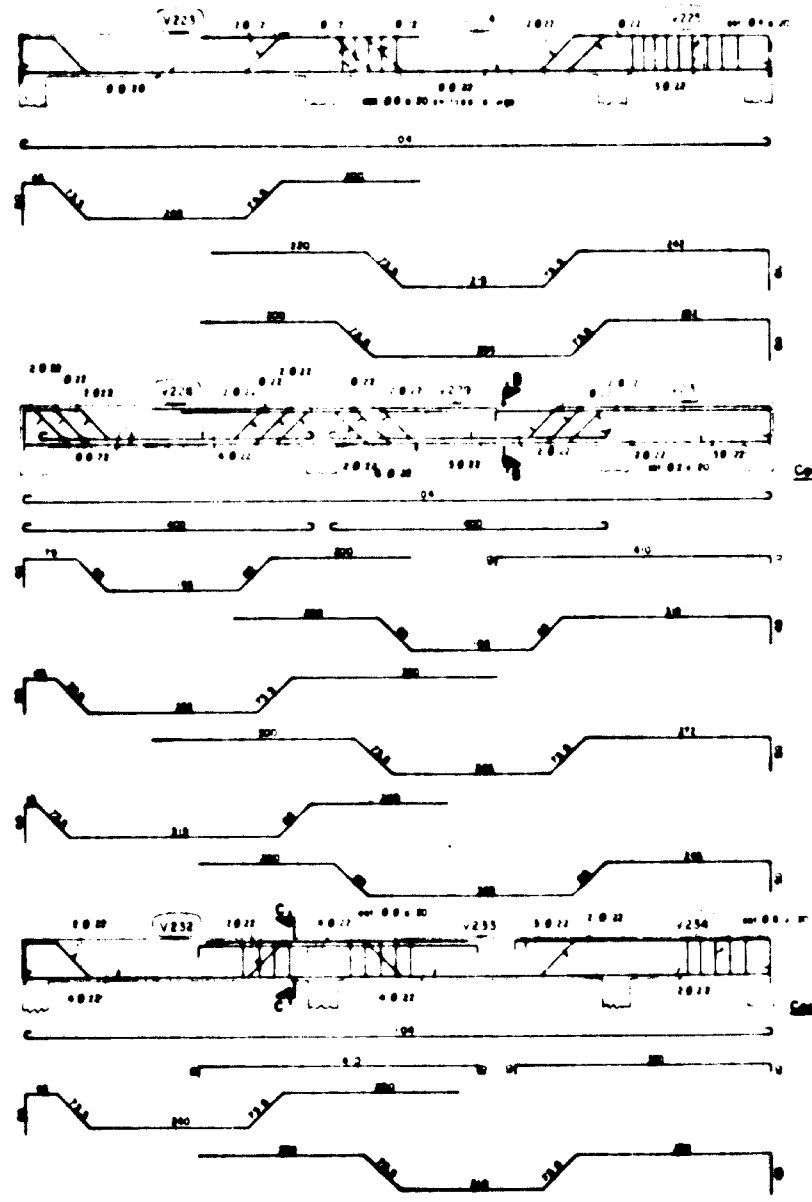
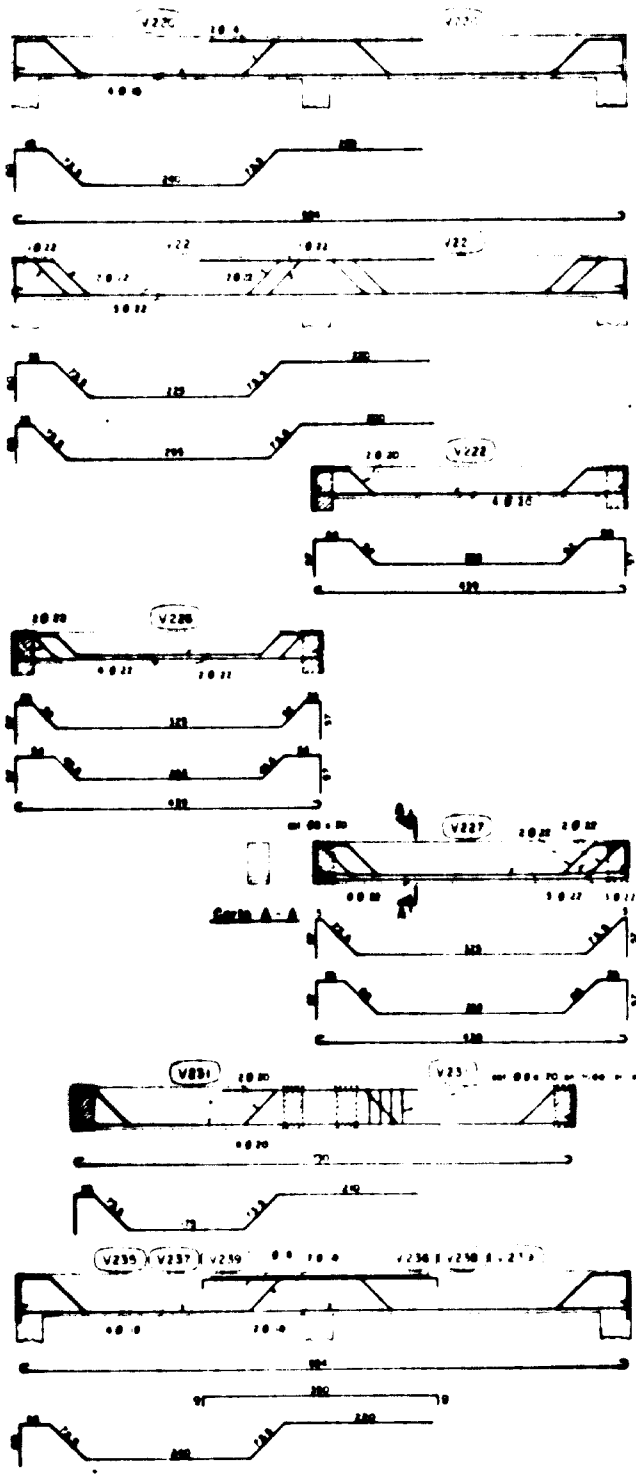
- NOTAS**
1. El acero debe tener un $f_y = 200 \text{ kg/cm}^2$ ($f_c = 2400 \text{ kg/cm}^2$) el concreto $f_c = 95 \text{ kg/cm}^2$ ($f_c = 200 \text{ kg/cm}^2$)
 2. El recubrimiento en vigas será de 3 cms tanto exterior como interior y 2 cms lateral. En áreas de columna el recubrimiento será de 5 cms.
 3. Se usará aserrín de tipo de refuerzo y de construcción será de 8/6.
 4. Todos los diámetros serán de 30 diámetros.
 5. Las ganchos de barra serán de 5 cms.
 6. Se usará admisión de construcción donde lo indique el ingeniero.
 7. Las estribos en vigas serán de 8/6 y 30 cms alto antes de castar la fundición.
 8. El espacio mínimo entre barras será de 2.5 cms.
 9. Todos los ángulos de las barras de refuerzo serán de 45°.

SECTION 2

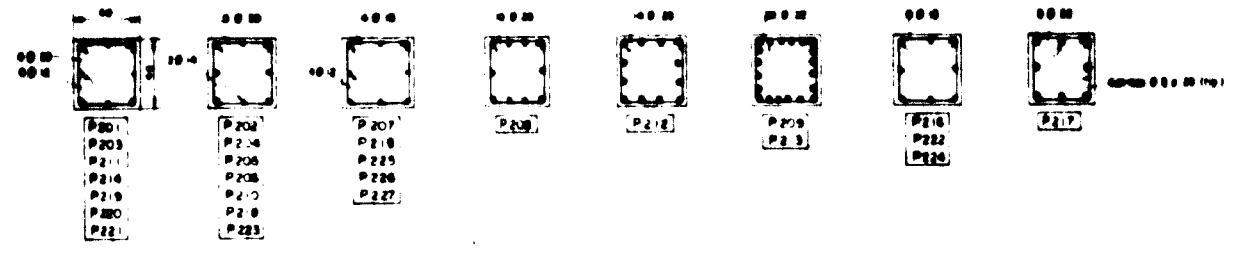
PLANTA ASBESTO
ARMADURA VIGAS LONGITUDINALES
SEGUNDO PISO

CONSULTORES GALINDO LTDA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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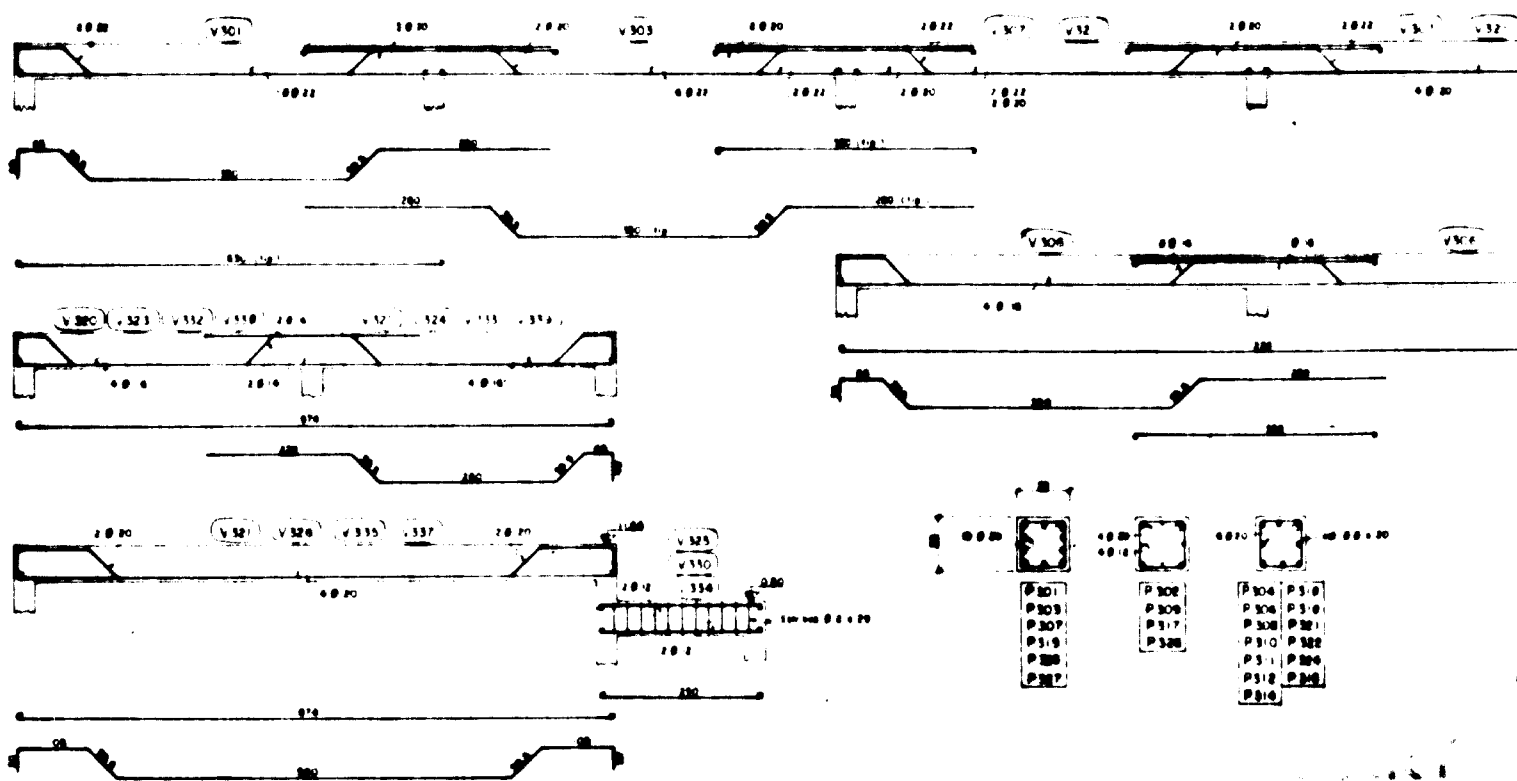
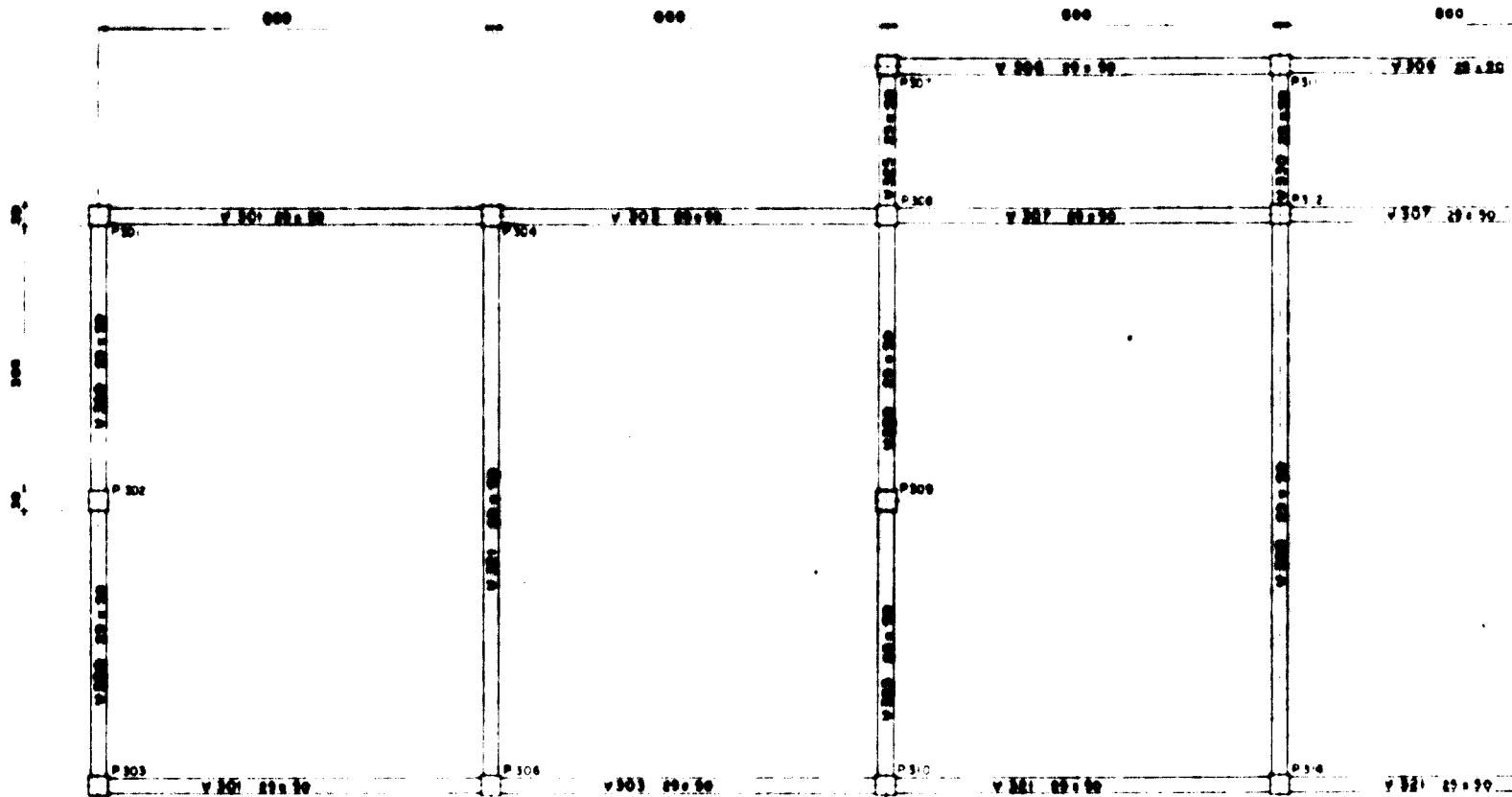


DETALLES DE ARMADURA VIGAS TRANSVERSALES



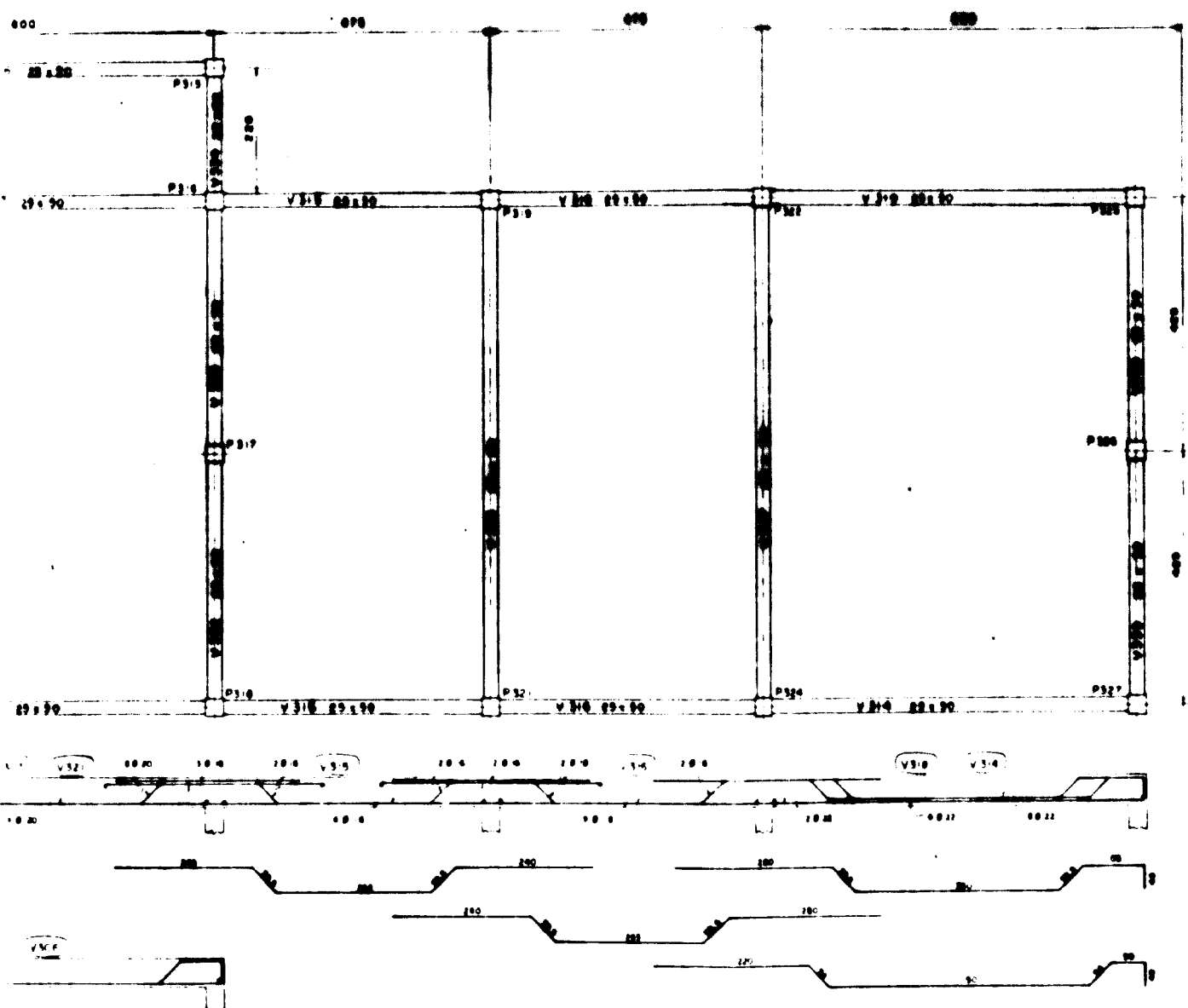
SECTION 1

REFERRADURA COLUMNAS PRIMER PISO



DETALLES DE ARMADURA

SECTION 1

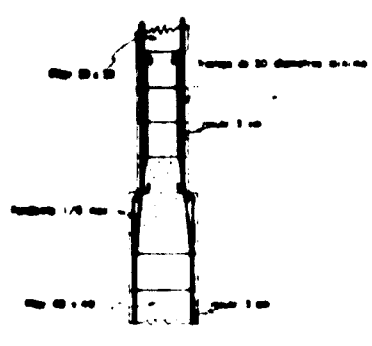


SECTION 2

DETALLE DE FIERROS

Fig. No.	Diámetro mm	Longitud cm	Nº de varillas	Peso kg	Peso Total kg
V 300	22	844	2	7.9	15.8
V 301	22	844	2	7.9	15.8
V 302	22	844	2	7.9	15.8
V 303	20	410	1	3.9	3.9
V 304	8	274	2	0.8	1.6
V 305	8	180	1	0.7	0.7
V 306	8	180	1	0.7	0.7
V 307	8	180	1	0.7	0.7
V 308	22	79	2	3.9	7.8
V 309	22	79	2	3.9	7.8
V 310	22	79	2	3.9	7.8
V 311	22	79	2	3.9	7.8
V 312	22	79	2	3.9	7.8
V 313	22	79	2	3.9	7.8
V 314	22	79	2	3.9	7.8
V 315	22	79	2	3.9	7.8
V 316	22	79	2	3.9	7.8
V 317	22	79	2	3.9	7.8
V 318	22	79	2	3.9	7.8
V 319	22	79	2	3.9	7.8
V 320	22	79	2	3.9	7.8
V 321	22	79	2	3.9	7.8
V 322	22	79	2	3.9	7.8
V 323	22	79	2	3.9	7.8
V 324	22	79	2	3.9	7.8
V 325	22	79	2	3.9	7.8
V 326	22	79	2	3.9	7.8
V 327	22	79	2	3.9	7.8
V 328	22	79	2	3.9	7.8
V 329	22	79	2	3.9	7.8
V 330	22	79	2	3.9	7.8
V 331	22	79	2	3.9	7.8
V 332	22	79	2	3.9	7.8
V 333	22	79	2	3.9	7.8
V 334	22	79	2	3.9	7.8
V 335	22	79	2	3.9	7.8
V 336	22	79	2	3.9	7.8
V 337	22	79	2	3.9	7.8
V 338	22	79	2	3.9	7.8
V 339	22	79	2	3.9	7.8
V 340	22	79	2	3.9	7.8
V 341	22	79	2	3.9	7.8
V 342	22	79	2	3.9	7.8
V 343	22	79	2	3.9	7.8
V 344	22	79	2	3.9	7.8
V 345	22	79	2	3.9	7.8
V 346	22	79	2	3.9	7.8
V 347	22	79	2	3.9	7.8
V 348	22	79	2	3.9	7.8
V 349	22	79	2	3.9	7.8
V 350	22	79	2	3.9	7.8
V 351	22	79	2	3.9	7.8
V 352	22	79	2	3.9	7.8
V 353	22	79	2	3.9	7.8
V 354	22	79	2	3.9	7.8
V 355	22	79	2	3.9	7.8
V 356	22	79	2	3.9	7.8
V 357	22	79	2	3.9	7.8
V 358	22	79	2	3.9	7.8
V 359	22	79	2	3.9	7.8
V 360	22	79	2	3.9	7.8
V 361	22	79	2	3.9	7.8
V 362	22	79	2	3.9	7.8
V 363	22	79	2	3.9	7.8
V 364	22	79	2	3.9	7.8
V 365	22	79	2	3.9	7.8
V 366	22	79	2	3.9	7.8
V 367	22	79	2	3.9	7.8
V 368	22	79	2	3.9	7.8
V 369	22	79	2	3.9	7.8
V 370	22	79	2	3.9	7.8
V 371	22	79	2	3.9	7.8
V 372	22	79	2	3.9	7.8
V 373	22	79	2	3.9	7.8
V 374	22	79	2	3.9	7.8
V 375	22	79	2	3.9	7.8
V 376	22	79	2	3.9	7.8
V 377	22	79	2	3.9	7.8
V 378	22	79	2	3.9	7.8
V 379	22	79	2	3.9	7.8
V 380	22	79	2	3.9	7.8
V 381	22	79	2	3.9	7.8
V 382	22	79	2	3.9	7.8
V 383	22	79	2	3.9	7.8
V 384	22	79	2	3.9	7.8
V 385	22	79	2	3.9	7.8
V 386	22	79	2	3.9	7.8
V 387	22	79	2	3.9	7.8
V 388	22	79	2	3.9	7.8
V 389	22	79	2	3.9	7.8
V 390	22	79	2	3.9	7.8
V 391	22	79	2	3.9	7.8
V 392	22	79	2	3.9	7.8
V 393	22	79	2	3.9	7.8
V 394	22	79	2	3.9	7.8
V 395	22	79	2	3.9	7.8
V 396	22	79	2	3.9	7.8
V 397	22	79	2	3.9	7.8
V 398	22	79	2	3.9	7.8
V 399	22	79	2	3.9	7.8
V 400	22	79	2	3.9	7.8
P 319	20	815	2	21.6	43.2
P 320	20	815	2	21.6	43.2
P 321	20	815	2	21.6	43.2
P 322	20	815	2	21.6	43.2
P 323	20	815	2	21.6	43.2
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P 325	20	815	2	21.6	43.2
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P 329	20	815	2	21.6	43.2
P 330	20	815	2	21.6	43.2
P 331	20	815	2	21.6	43.2
P 332	20	815	2	21.6	43.2
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P 385	20	815	2	21.6	43.2
P 386	20	815	2	21.6	43.2
P 387	20	815	2	21.6	43.2
P 388	20	815	2	21.6	43.2
P 389	20	815	2	21.6	43.2
P 390	20	815	2	21.6	43.2
P 391	20	815	2	21.6	43.2
P 392	20	815	2	21.6	43.2
P 393	20	815	2	21.6	43.2
P 394	20	815	2	21.6	43.2
P 395	20	815	2	21.6	43.2
P 396	20	815	2	21.6	43.2
P 397	20	815	2	21.6	43.2
P 398	20	815	2	21.6	43.2
P 399	20	815	2	21.6	43.2
P 400	20	815	2	21.6	43.2

- NOTAS:**
- El acero debe tener un f_{yk} 1200 kg/cm² (f_{yk} 2400 kg/cm²).
 - El recubrimiento en signo será de 3 cm tanto superior como inferior y 2 cm lateral. En pilares el recubrimiento será de 5 cm.
 - Solo se especifica el tipo de refuerzo, el de construcción será de 8 @ 8.
 - Todos los huecos serán de 50 centímetros.
 - Los juntas de arriba serán de 10 cm.
 - Solo se admiten juntas de construcción dando la capataje al mismo lado.
 - Los rebajes en las vigas serán de 8 a 50 cm.
 - Todos los ángulos de subatura de los fierros son de 45°.



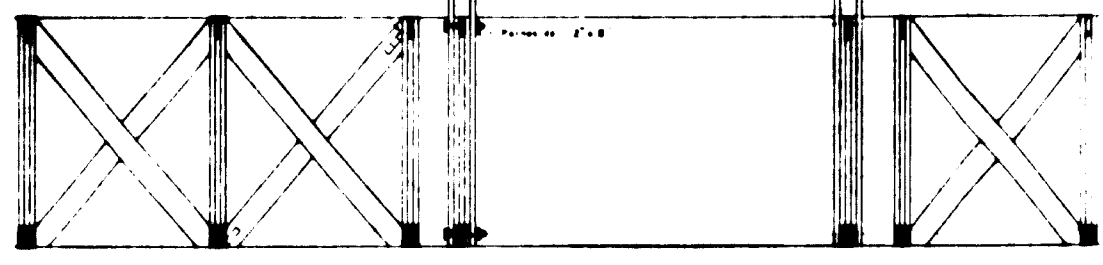
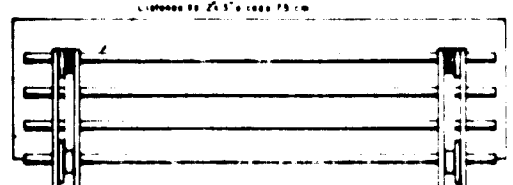
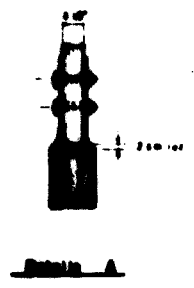
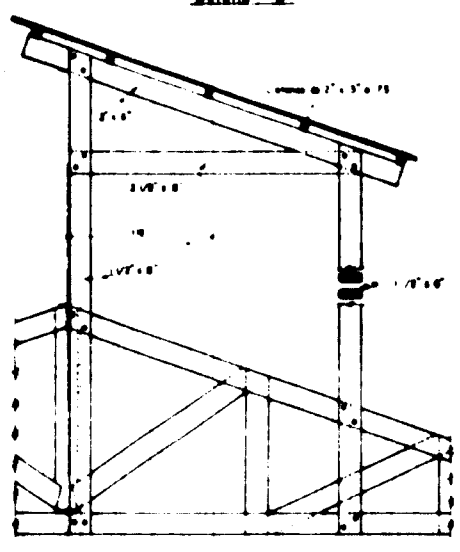
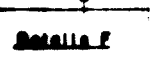
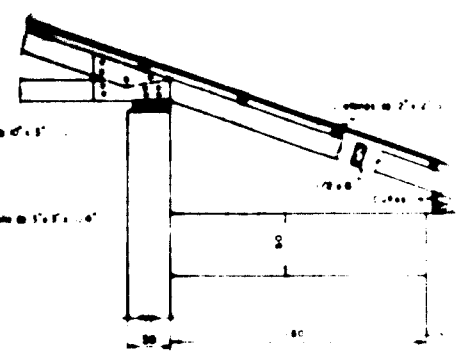
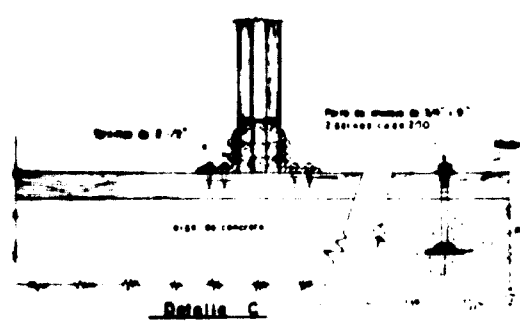
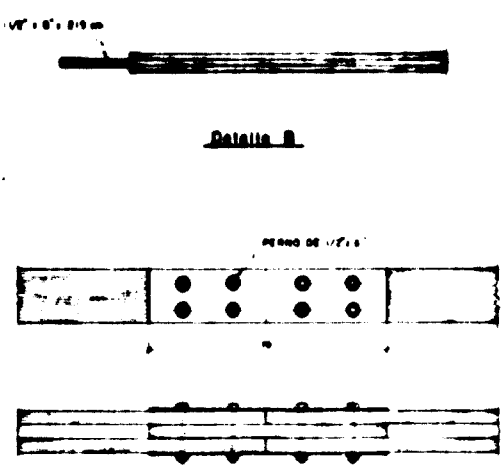
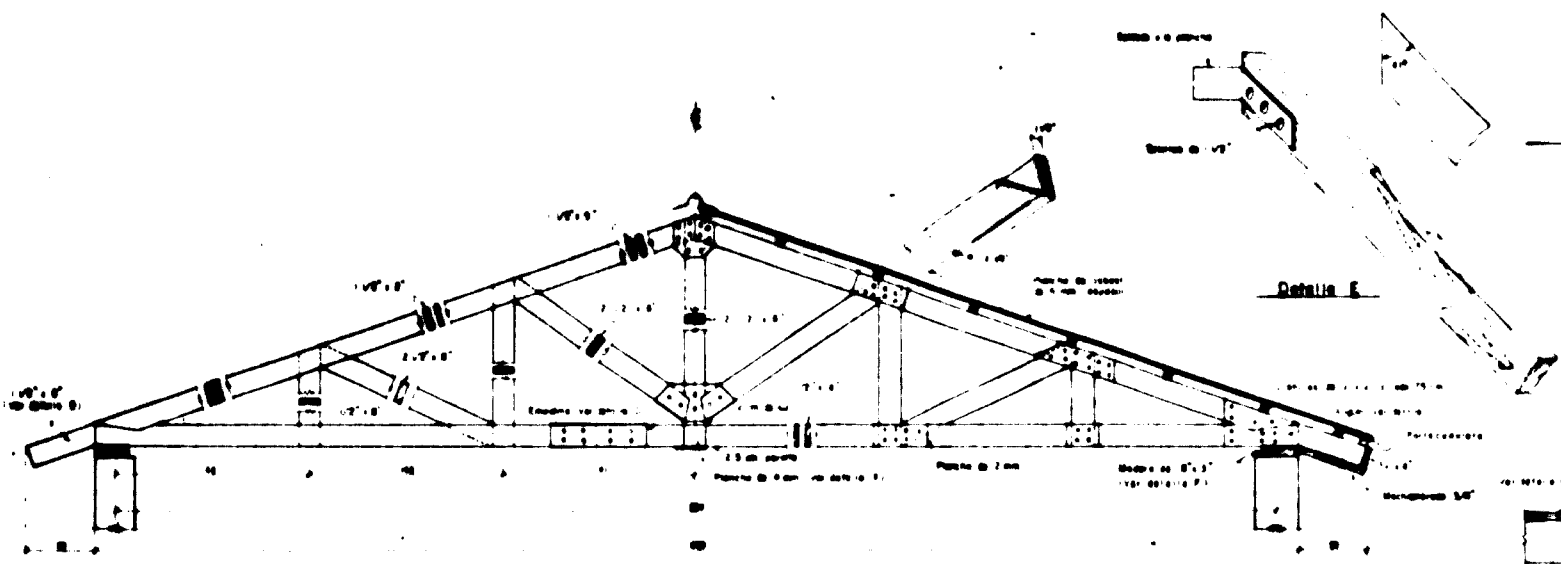
DETALLE UNION DE PILARES

PLANTA ASBESTO

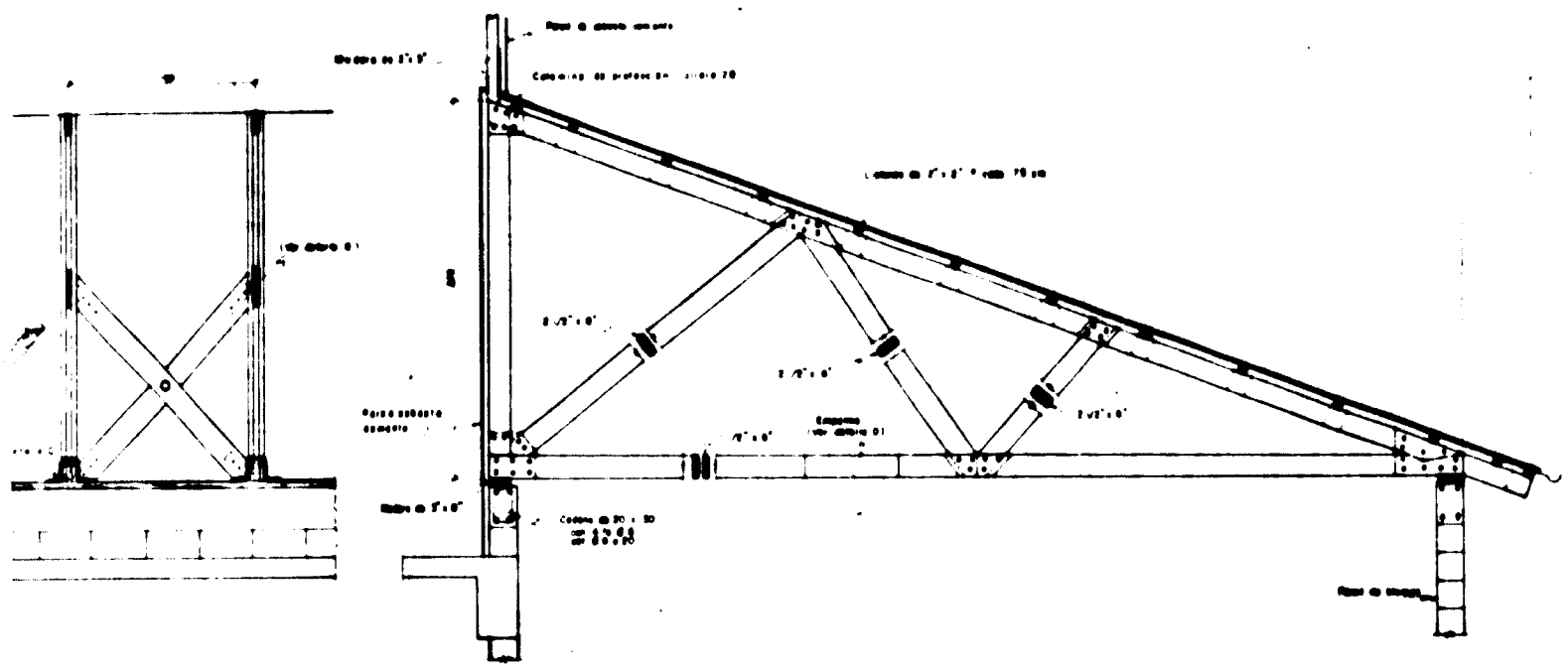
VIGAS TECHO Y

COLUMNAS SEGUNDO PISO

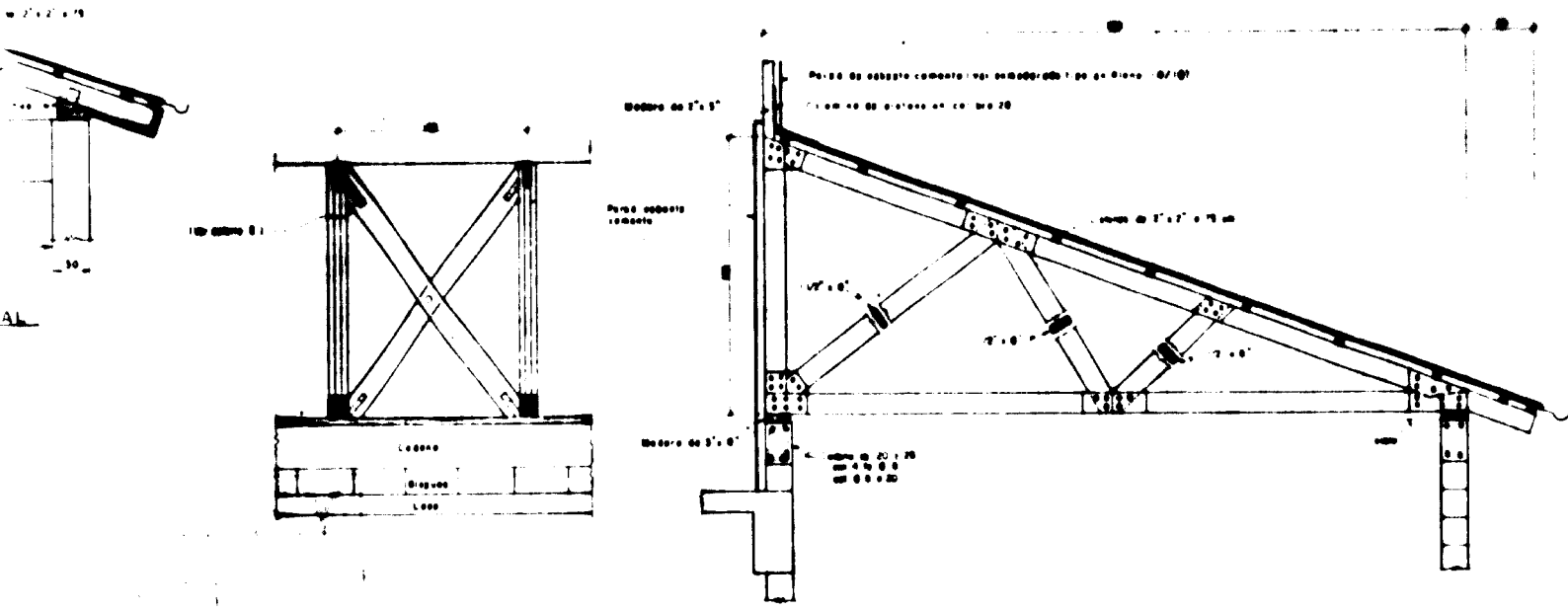
CONSULTORES GALINDO LTDA



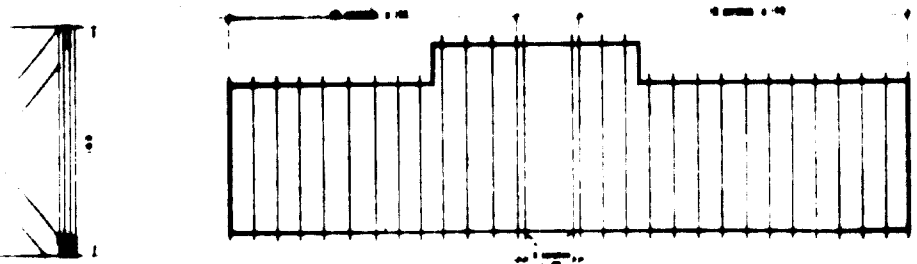
SECTION 1



SISTEMA ALMACENES



SISTEMA SUB-ESTACION ELECTRICA

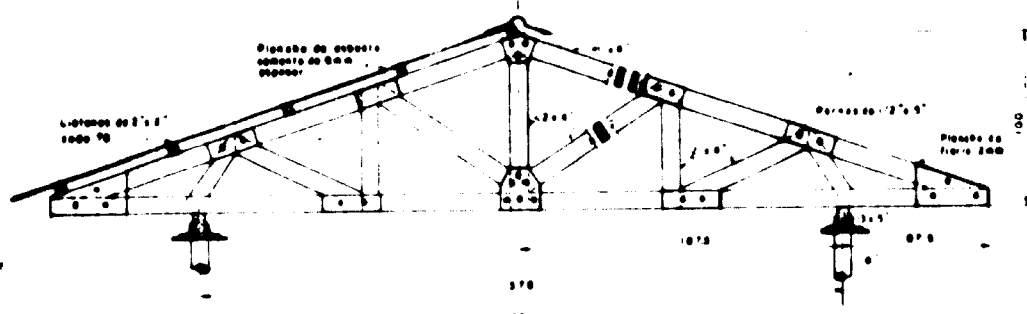
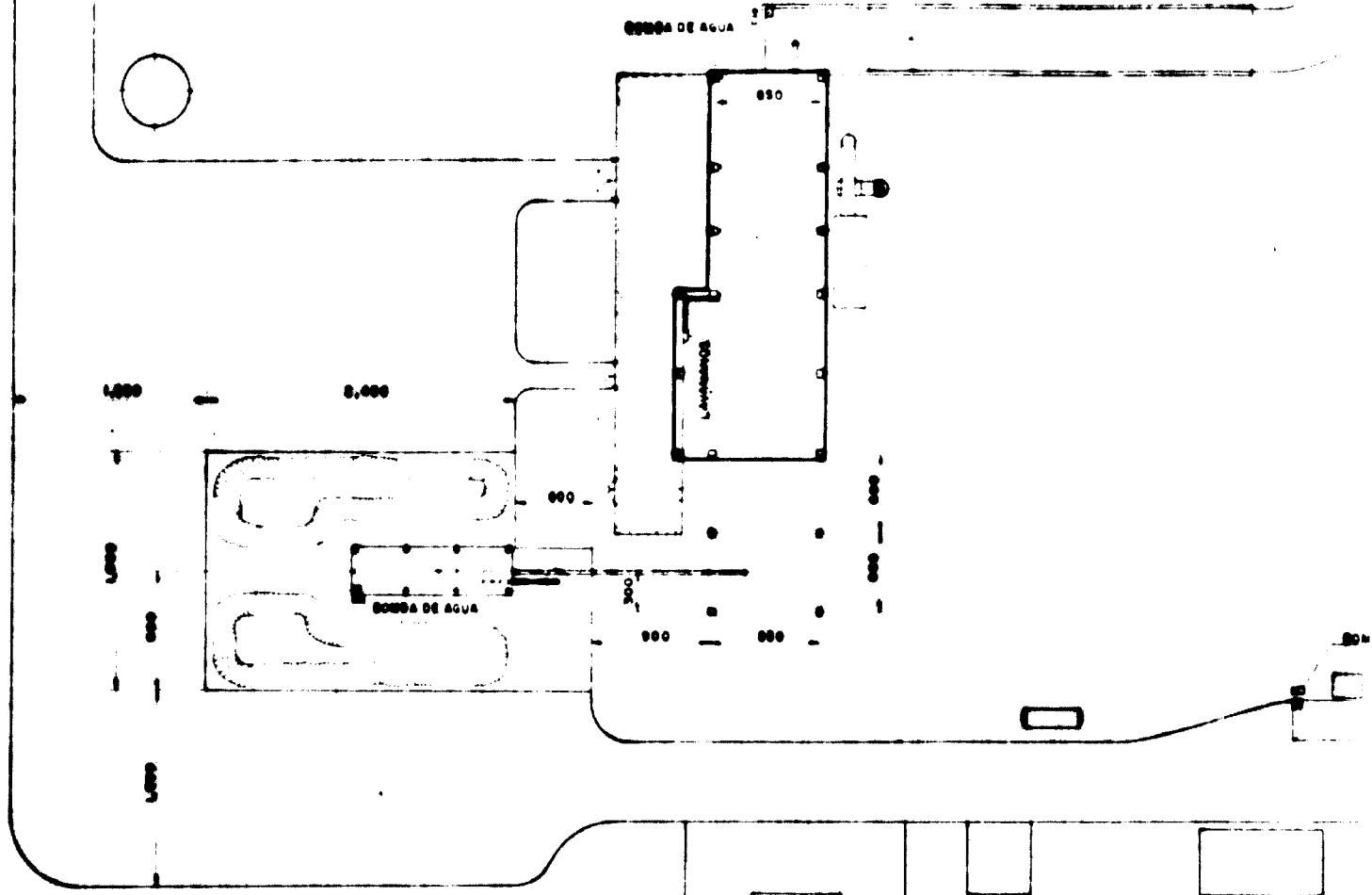


UBICACION CERCHAS

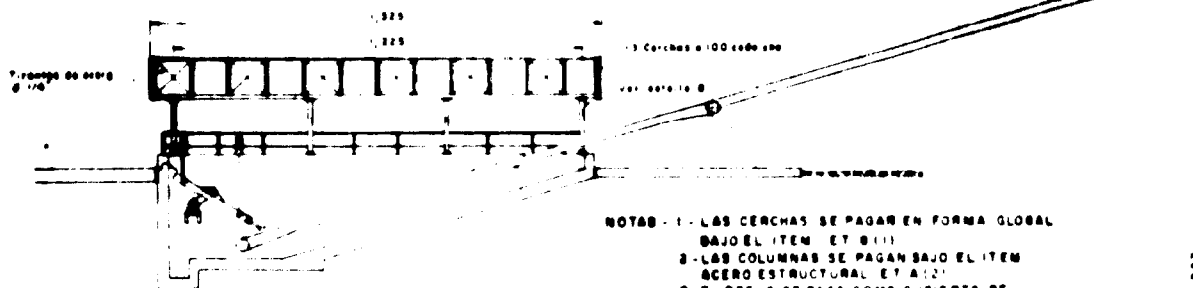
- NOTAS**
- 1.- El lugar de los empalmes deberá ser autorizado por el ingeniero
 - 2.- Los listones entre cerchas de luz 280 serán de 3" x 2"
 - 3.- Todos los pares de anillo, serán colocados antes de efectuarse el vaciado
 - 4.- Las cerchas exteriores serán forradas con abasto cemento

SECTION 2
PLANTA ASBESTO
CERCHAS Y DETALLES
TECHOS

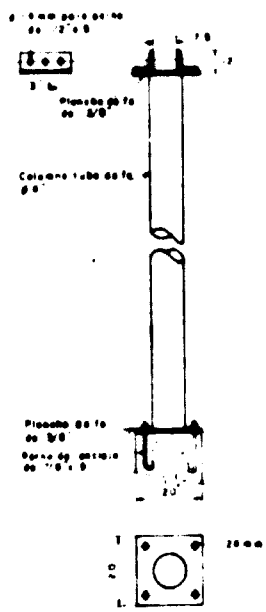
CONSULTORES GALINDO LTDA



DETALLE CERCHA

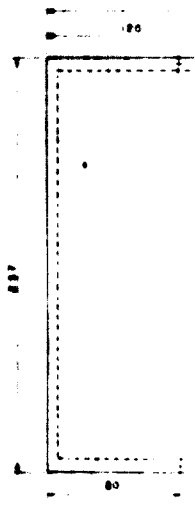


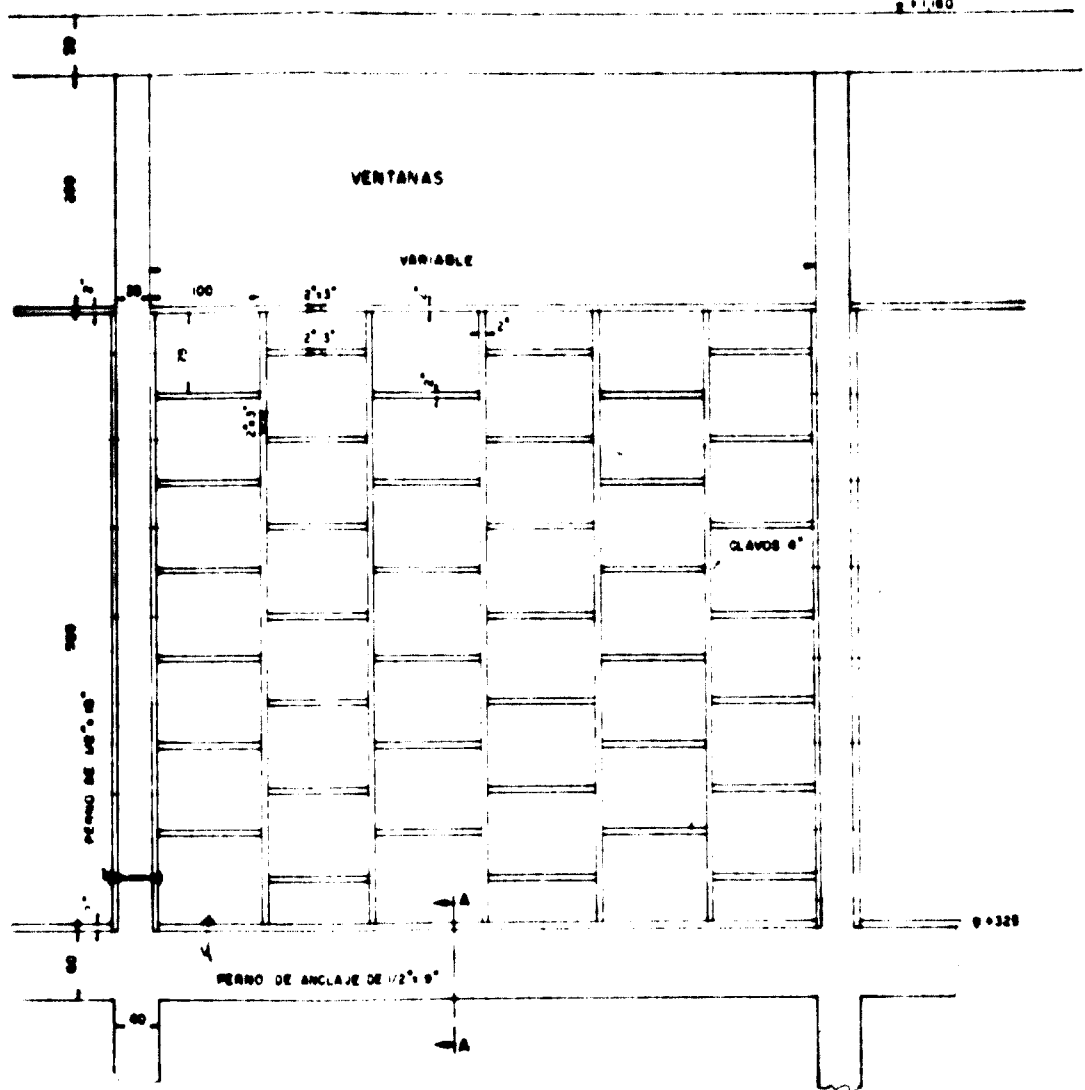
NOTAS - 1- LAS CERCHAS SE PAGAN EN FORMA GLOBAL BAJO EL ITEM ET B (1)
 2- LAS COLUMNAS SE PAGAN BAJO EL ITEM ACERO ESTRUCTURAL ET A (2)
 3- EL TECHO SE PAGA COMO CUBIERTA DE ASBESTO CEMENTO ITEM ET (11)



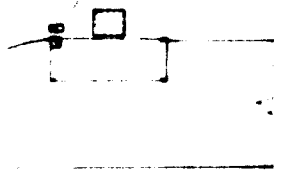
DETALLE B

SECTION 1





BOMBA DE AGUA 1200 GPM, 150' TÍPICO



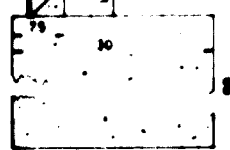
HOJAS DE ASBESTO CEMENTO 6" x 6" MM



MADERA DE 2" x 3"

PERNOS DE ANCLAJE DE 1/2" x 9"

MADERA DE 2" x 3"



SECCION A-A

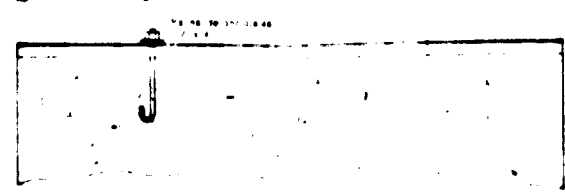
NOTAS

AL VACIAR EL CONCRETO DEBEN INSTALARSE LOS PERNOS DE ANCLAJE Y DEJAR EL ESPACIO PARA LOS PERNOS QUE ATRAVIESAN LOS PLARES

TODO EL MADERA EN ES DE 2" x 3"

PARA LA COLOCACION DE LAS PLANAS DE ASBESTO CEMENTO GUIARSE ESTRICTAMENTE POR LAS RECOMENDACIONES DE FABRICANTE

ENMADERADO TIPO PARA PAREDES DE ASBESTO CEMENTO



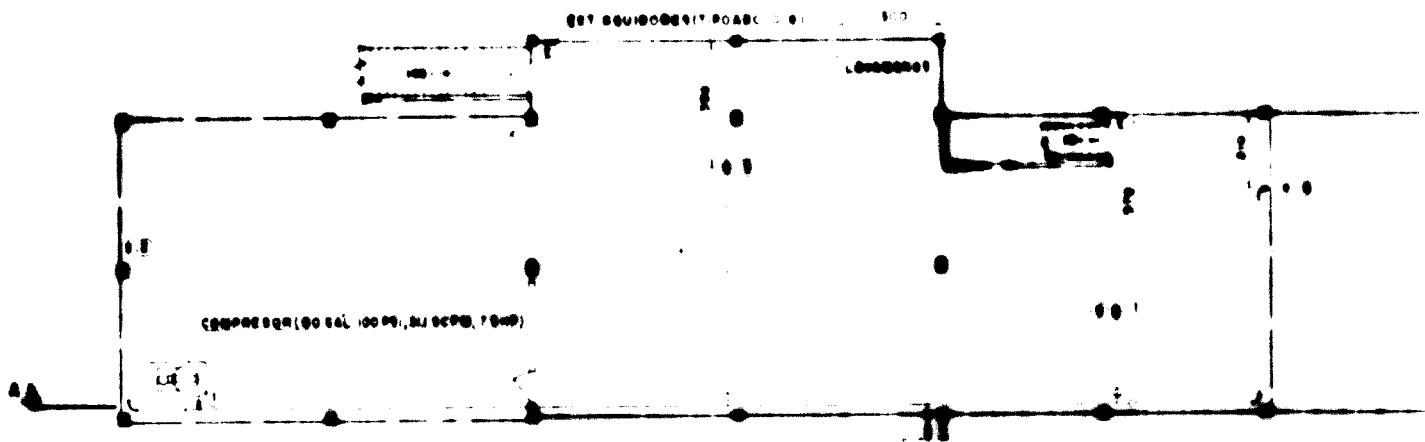
DETALLE A (Elevacion)

SECTION 2

**PLANTA ASBESTO
DETALLE PAREDES Y
UBICACION BOMBAS**

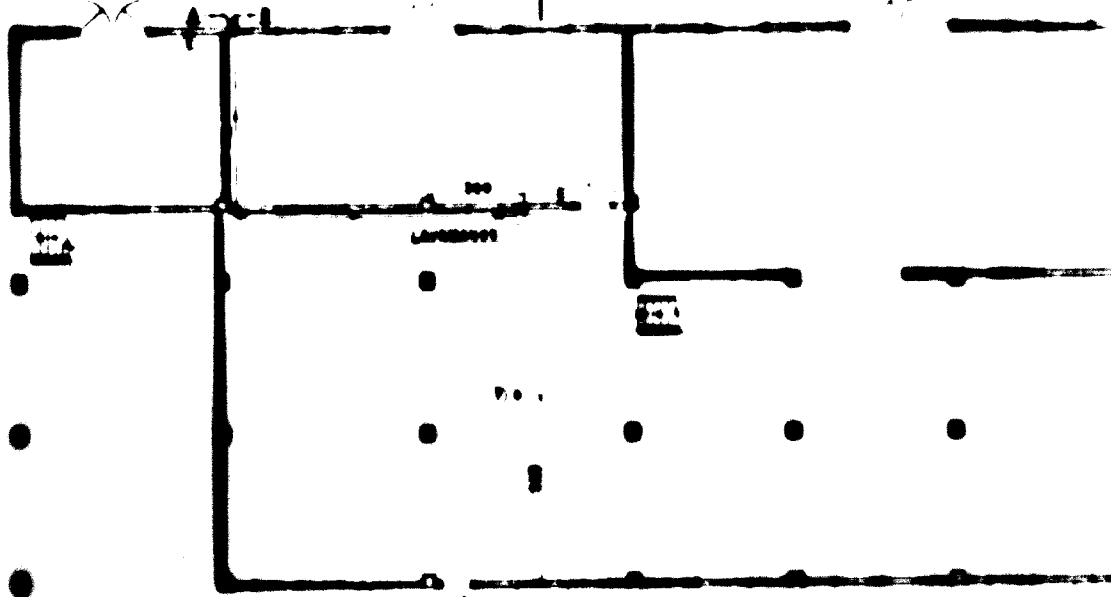
CONSULTORES GALINDO LTDA

MADERADO PARA TAPA DE FB-1

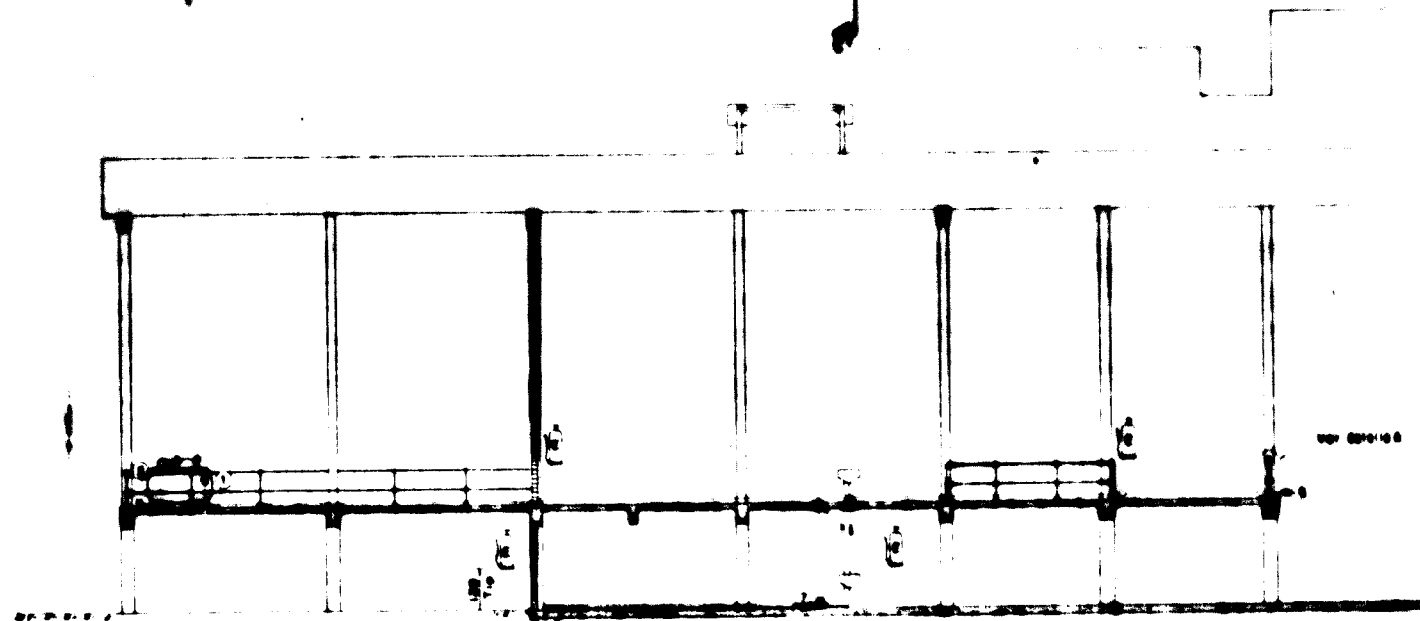


PLANTA ELEV. 3.22

- ▲ DEL SISTEMA DE AGUA DE LA FABRICA
CAÑERIA GALVANIZADA (1/2")
- AL SISTEMA DE OXIGENO DE LA FABRICA
CAÑERIA GALVANIZADA (2")

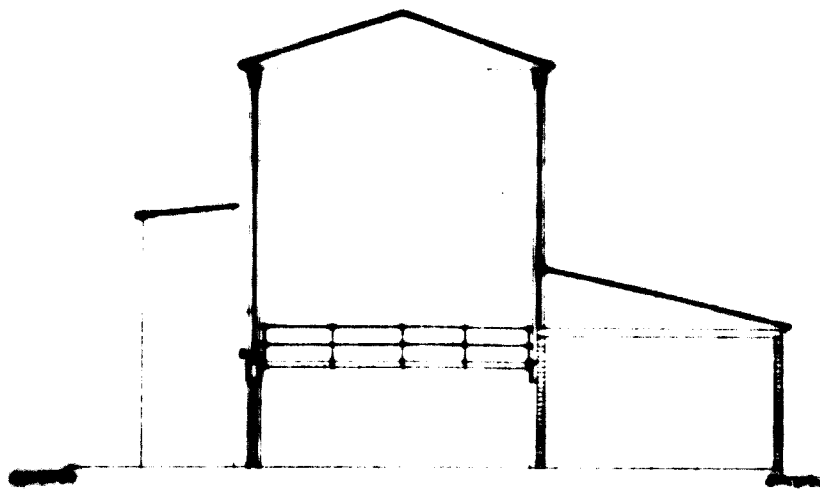


PLANTA B.M.A. ELEV. 0.22

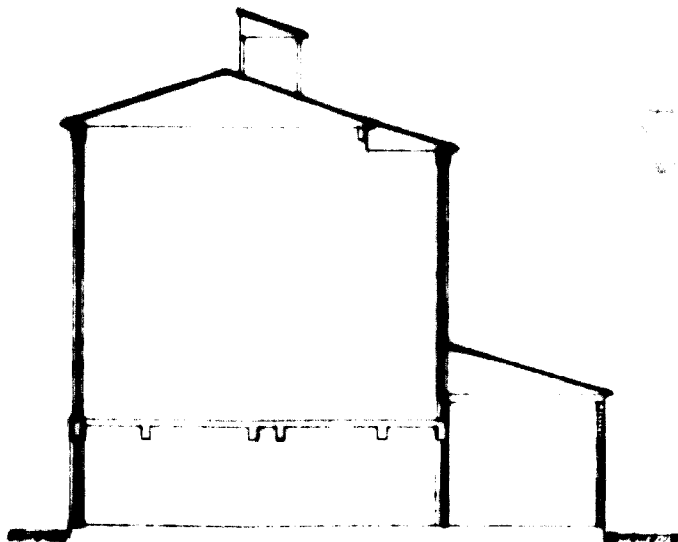


SECTION 1

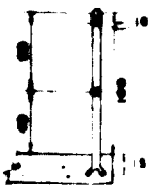
CORTE A-A



SECCION A-A



SECCION B-B



DETALLE A Anclaje pasamanos

REFERENCIAS

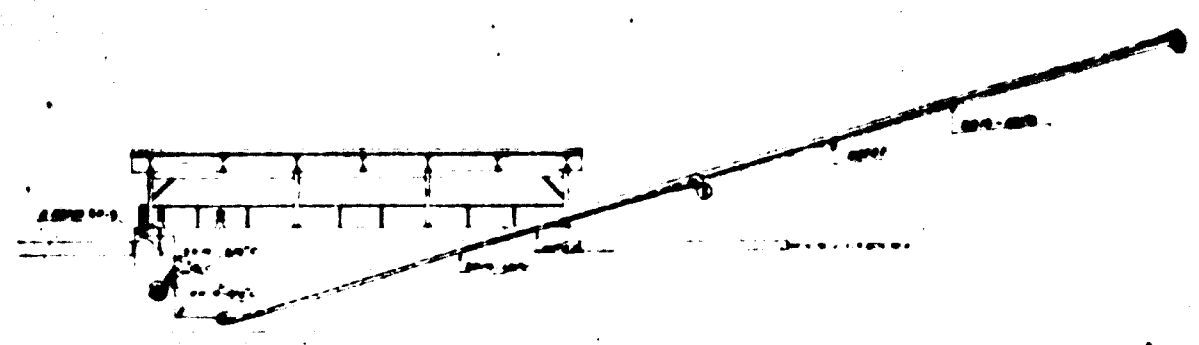
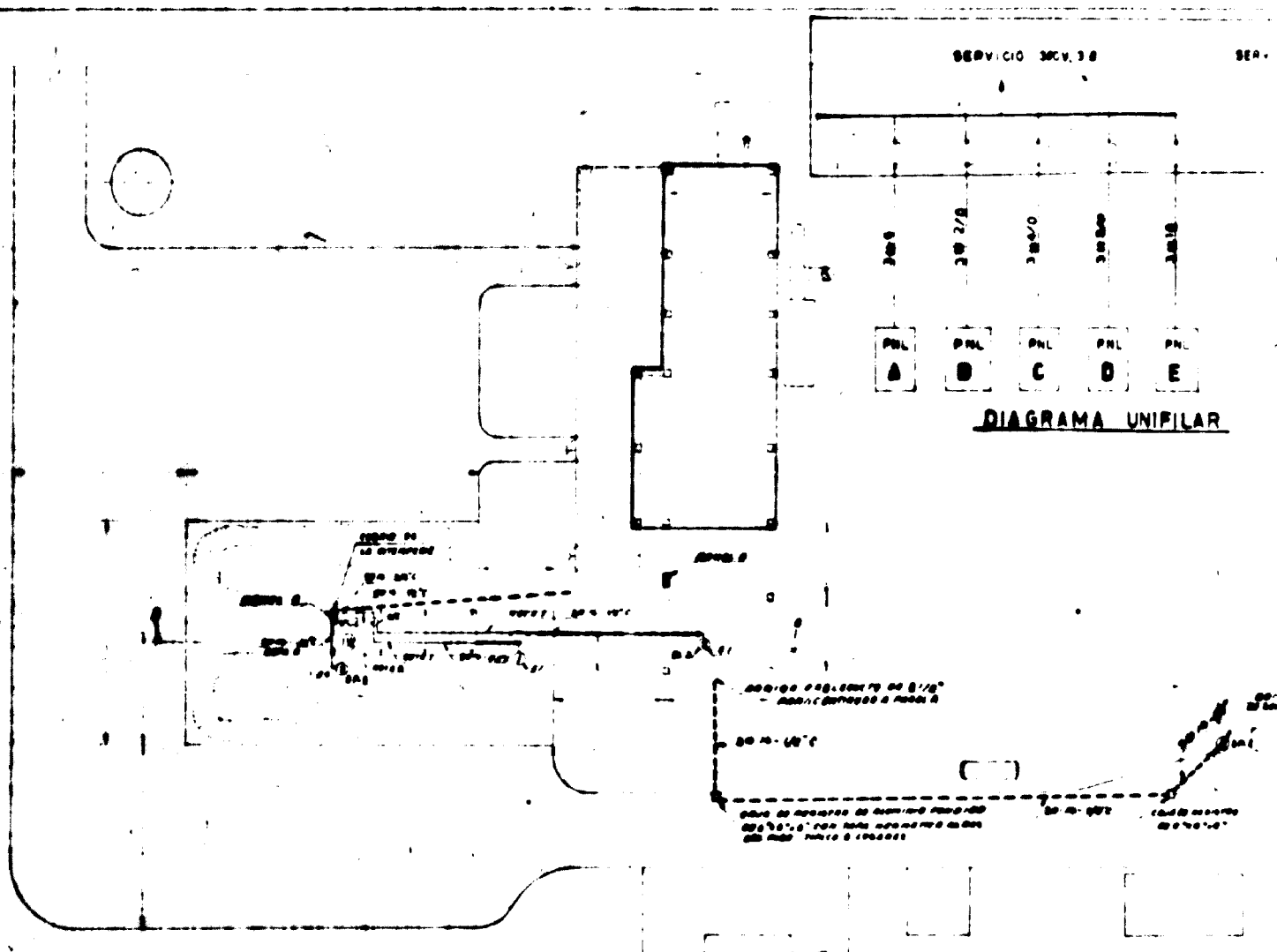
- CÁRTERA GALVANIZADA 6 1/2"
- TUBO DE BRONCE 6 1/4"
- PASAMANOS

SECTION 2

BOQUA DE AGUA (2MP, 000000, 1911)
 COLOCAR EN OBRA PROTECCION
 CONTRA LA LLUVIA

CHUFRON

SNC, INC	
PLANTA ASBESTO	
PLANO MECANICO	
CONSULTORES GALINDO LTDA	
15.8	15.8



SECTION 1

SERVICIO 230V1Ø

PLANILLA DEL PANEL D

UBICACION: ...
 VOLTAGE: 230V1Ø
 CIRCULO: ...
 TOTALES: 1455 80 AMP

PLANILLA DEL PANEL A

UBICACION: ...
 VOLTAGE: 230V1Ø
 CIRCULO: ...
 TOTALES: 485 80 AMP

LISTA DE SIMBOLOS

- 1. INTERRUPTOR DE CARGA...
- 2. INTERRUPTOR DE CARGA...
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- 97. INTERRUPTOR DE CARGA...
- 98. INTERRUPTOR DE CARGA...
- 99. INTERRUPTOR DE CARGA...
- 100. INTERRUPTOR DE CARGA...

PLANILLA DEL PANEL E

UBICACION: ...
 VOLTAGE: 230V1Ø
 CIRCULO: ...
 TOTALES: 228 80 AMP

PLANILLA DEL PANEL B

UBICACION: ...
 VOLTAGE: 230V1Ø
 CIRCULO: ...
 TOTALES: 330 160 AMP

PLANILLA DEL PANEL F

UBICACION: ...
 VOLTAGE: 230V1Ø
 CIRCULO: ...
 TOTALES: 10000 70 AMP

PLANILLA DEL PANEL C

UBICACION: ...
 VOLTAGE: 230V1Ø
 CIRCULO: ...
 TOTALES: 1970 80 AMP

PLANILLA DE ARTEFACTOS DE ILUMINACION ELECTRICA

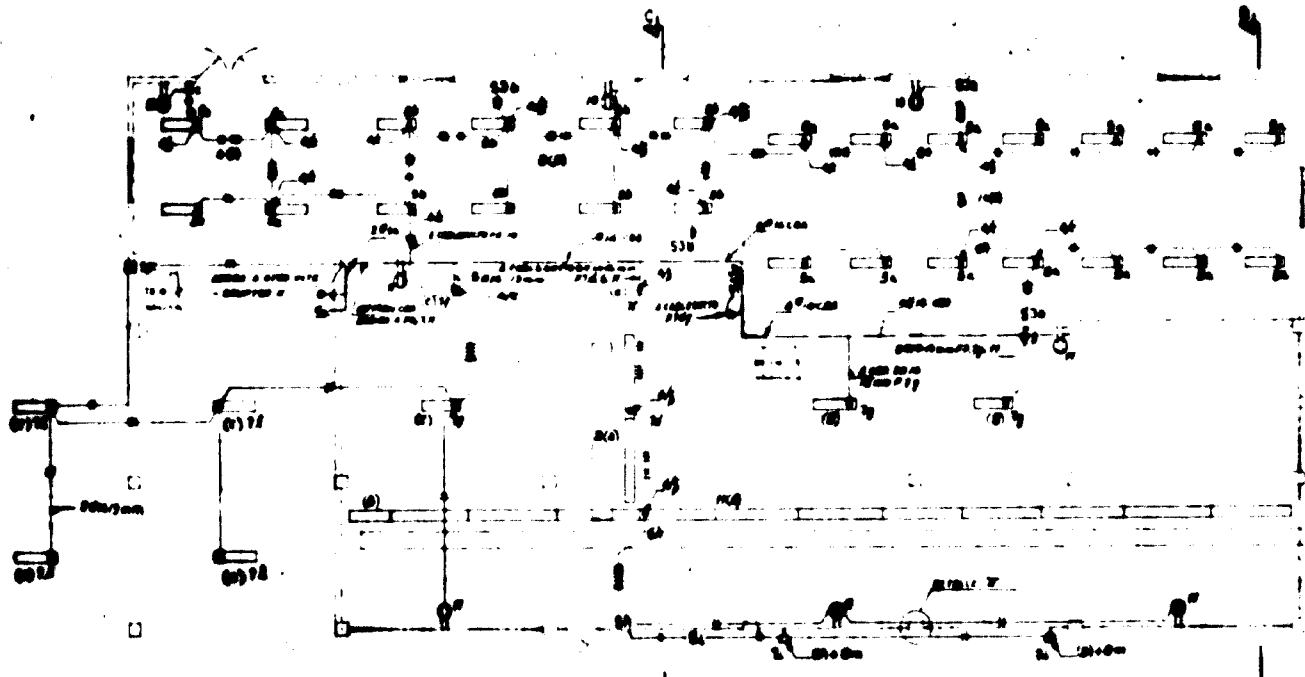
TIPO	VOLTAJE	AMPERAJE	DESCRIPCION	MONTAJE
A	230V	100W	RECESADO	FOR 100
B	230V	100W	RECESADO	FOR 100
C	230V	100W	RECESADO	FOR 100
D	230V	100W	RECESADO	FOR 100

SECTION 2

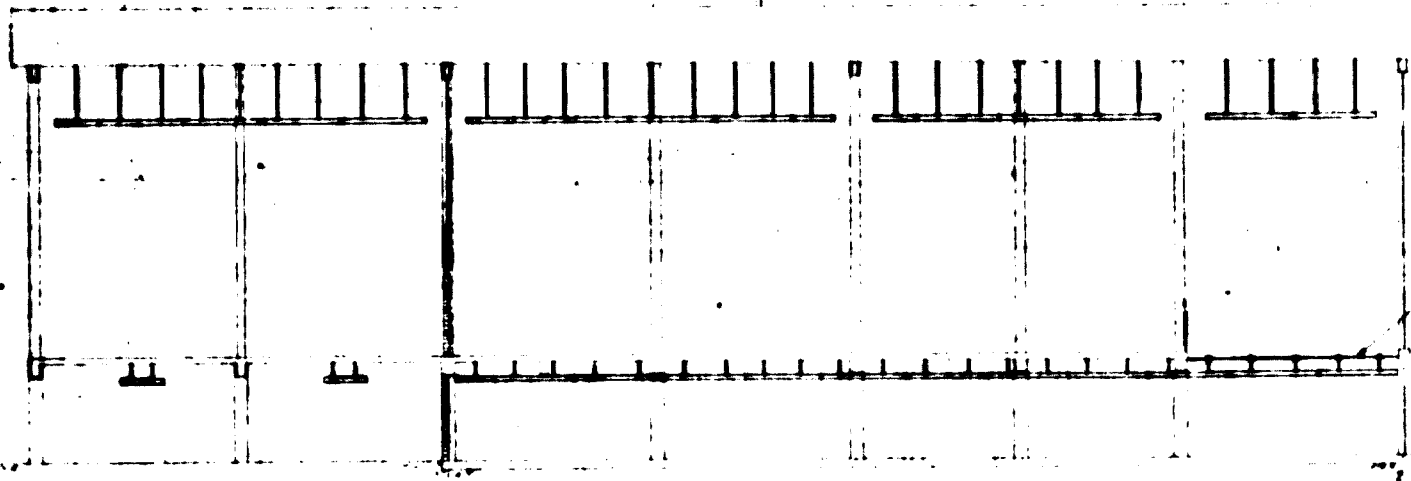
S.N.C.
 PLANTA DE ARRESTO
 LISTA DE MATERIALES E DIAGRAMA
 UNIFILAR PLANO DE CONJUNTO Y
 PLANILLA DE PANELES
 CONSULTORES GALINDO LTDA



PLANTA ELEV. 229

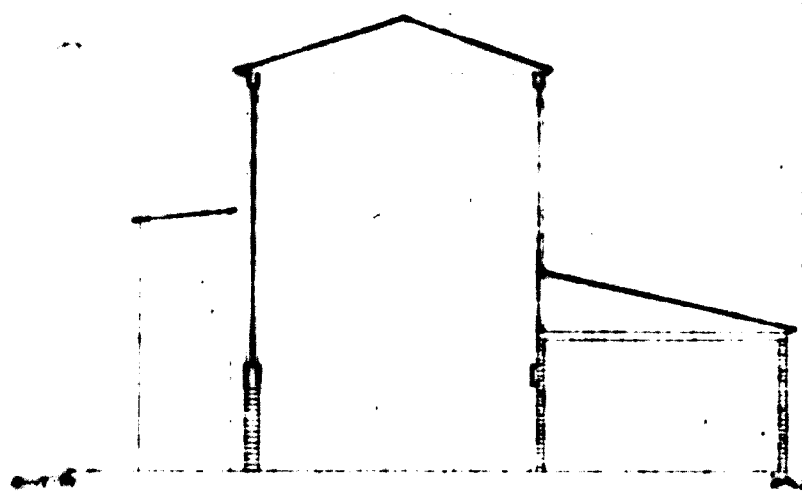
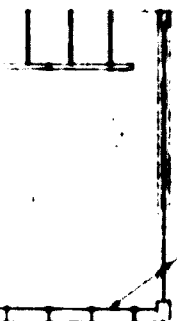
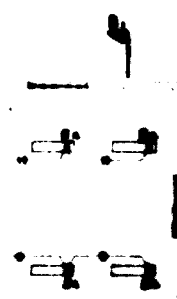
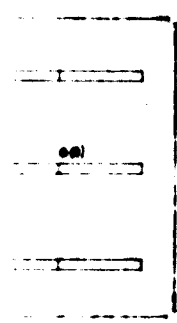


PLANTA BAJA ELEV. 229

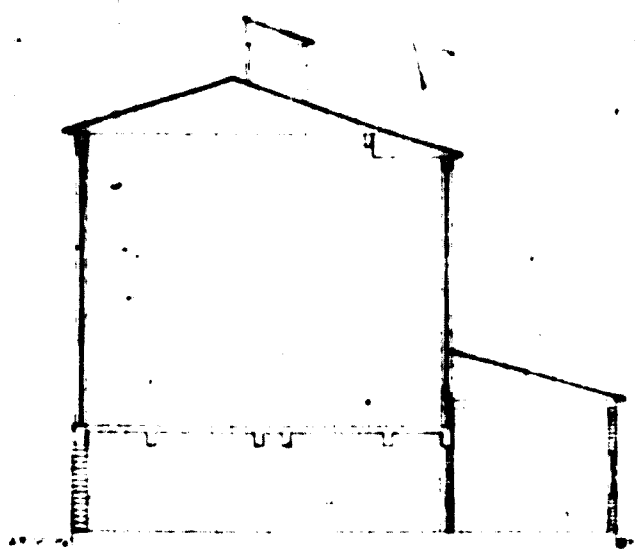


CORTE A-A

SECTION 1



CORTE B-B



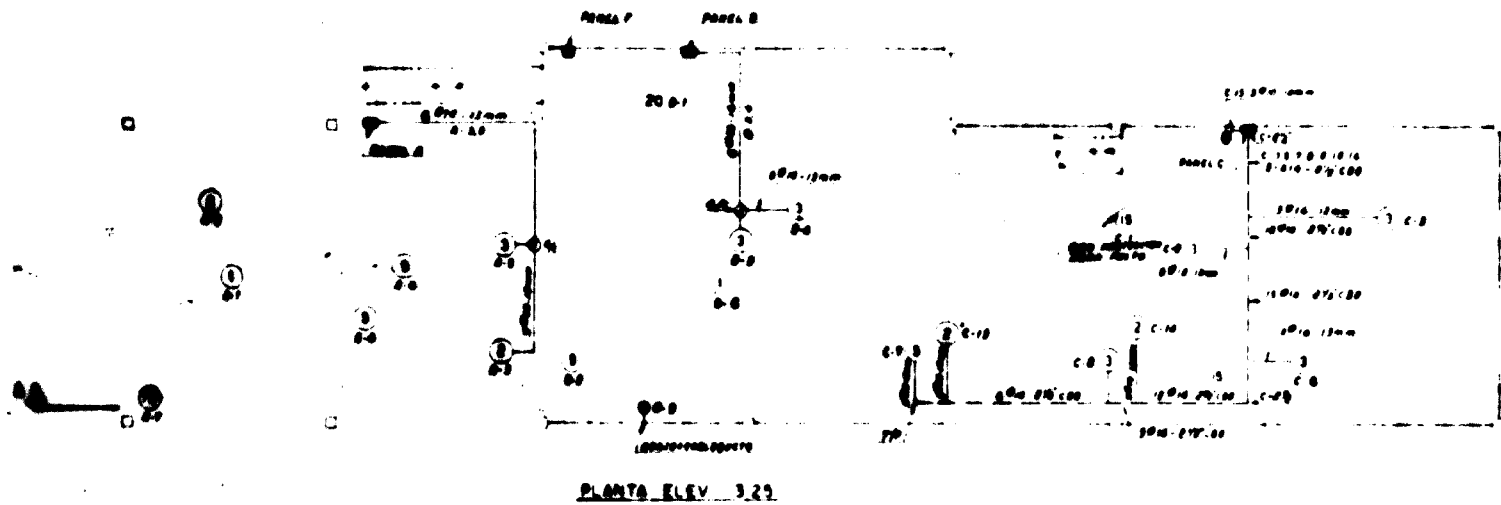
CORTE C-C

NOTA - SE TIENE LA COLUMNA DE CONCRETO DESECHO DEJADA SIN
 TUBO A 4.00MS Y A 5.00MS ANTES DE LA REMEDIACION
 PARA DESEMPEÑARSE A TRAVES DE LA COLUMNA
 EN EL PISO DE INSTALACION ELECTRICA CON LOS
 CABLES EN LA CUBA

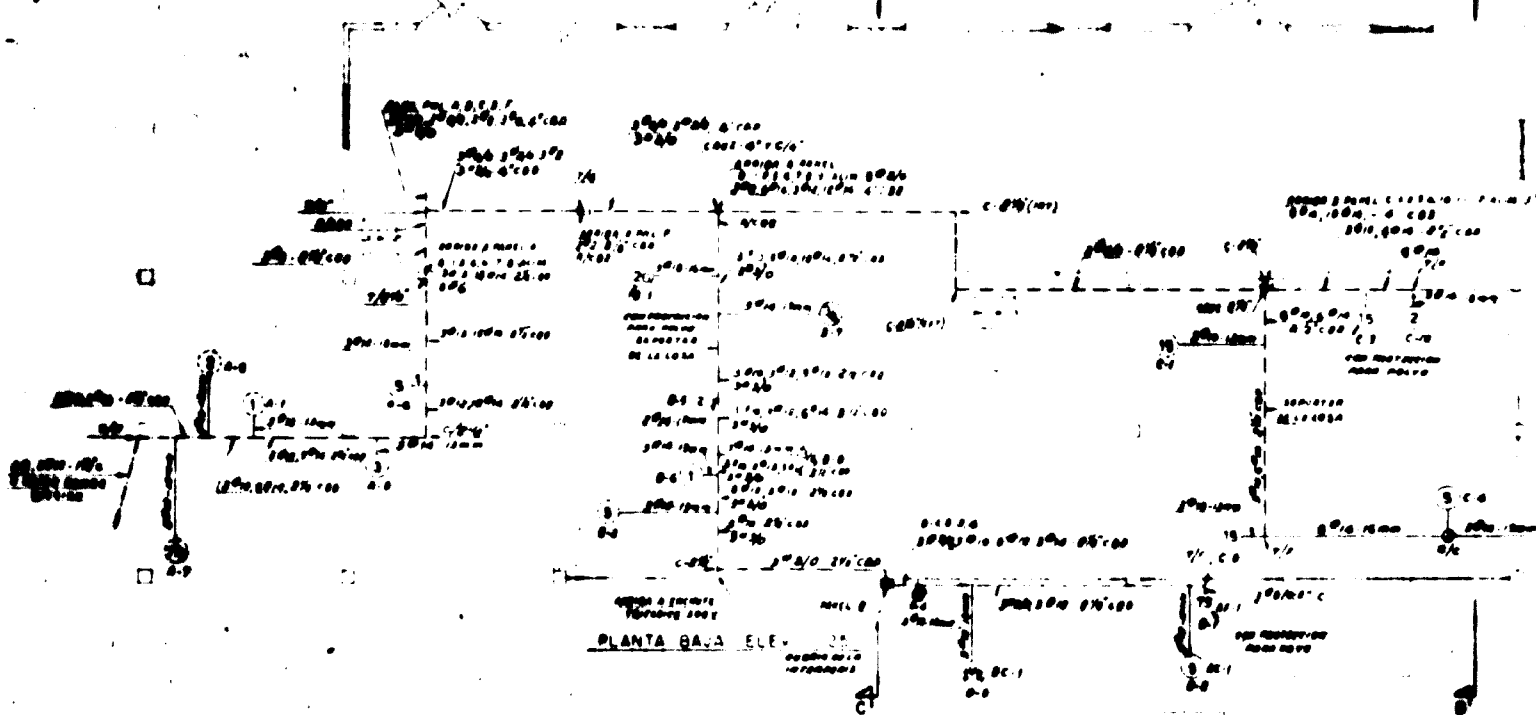


SECTION 2

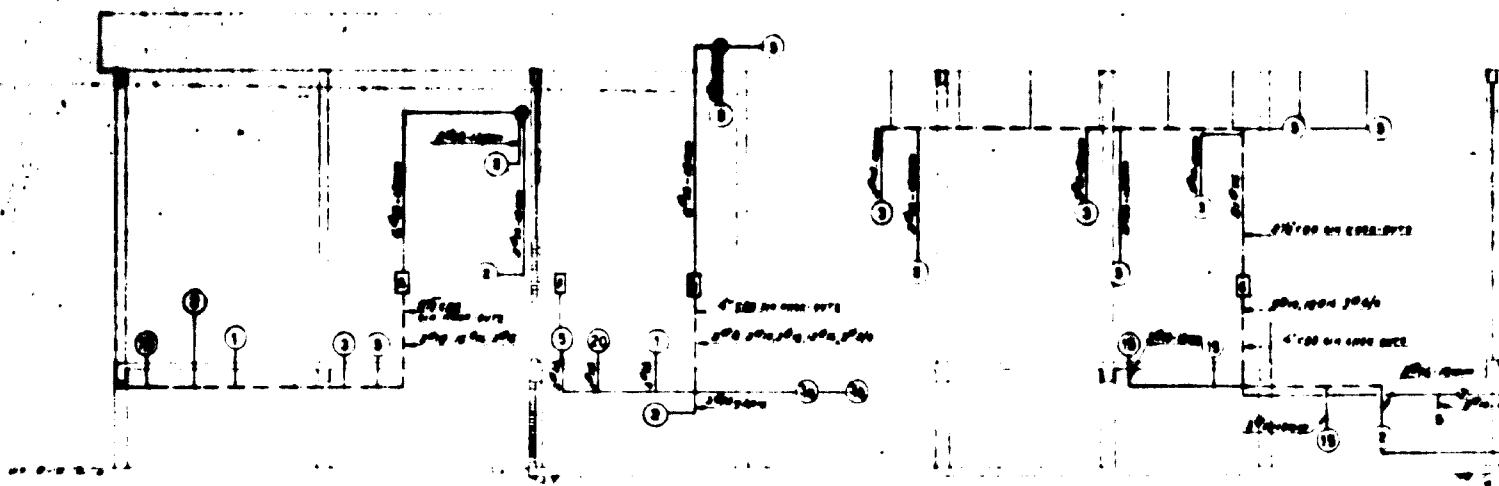
SNC, INC
PLANTA DE ASBESTO
PLANO DE ILUMINACION
CONDUCTOR RES GALINDO LTDA
1:00



PLANTA ELEV. 3.29

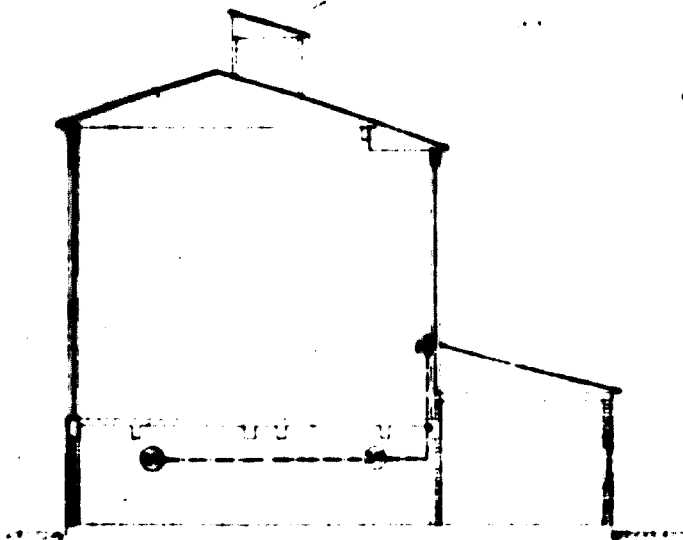
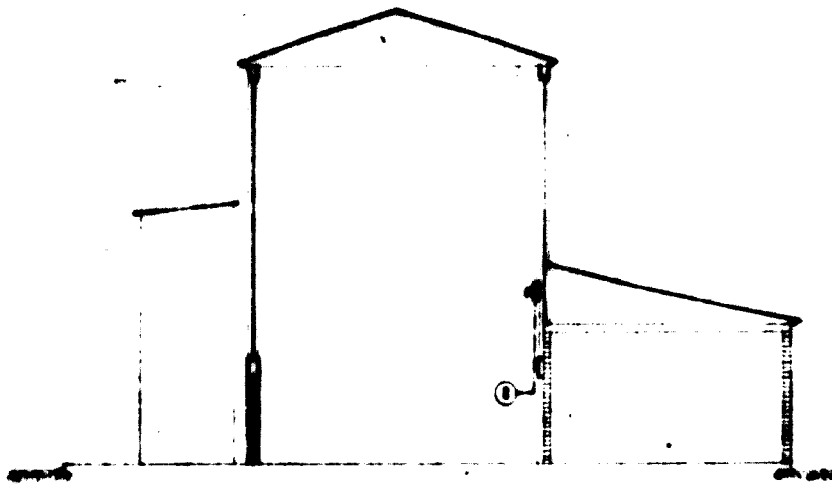


PLANTA BAJA ELEV. 3.28



SECTION 1

CORTE A-A



ARCHITECTURE
 1978
 CONSULTORES

SECTION 2

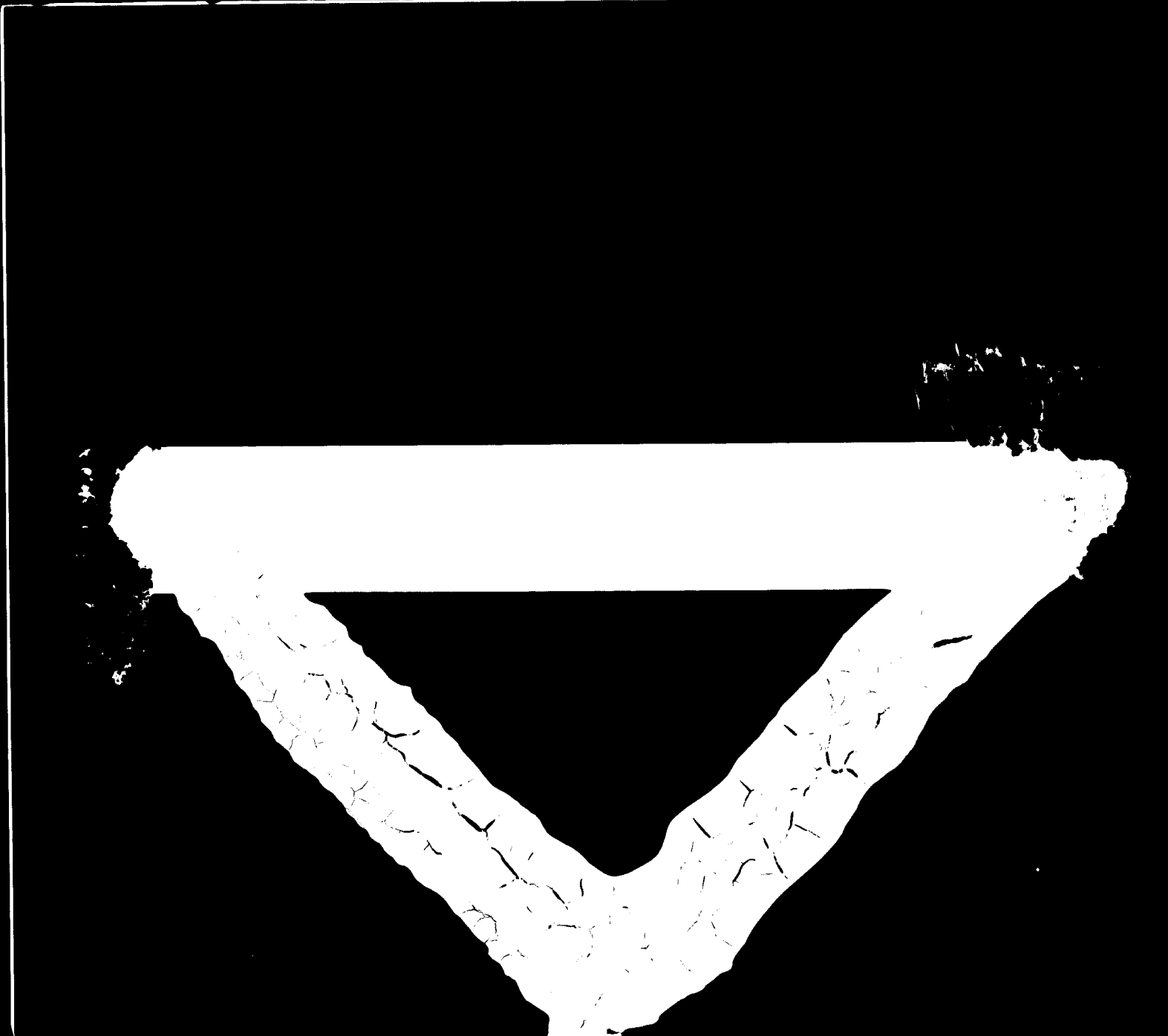
SNC, INC

PLANTA DE ASBESTO
 PLANO DE FUERZA

CONSULTORES CALINDO LTDA

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche

B-561



81.08.27