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UNIDO Contract № 85/108
Project № DP/IRA/85/003

FEASIBILITY REPORT ON CONSTRUCTION OF ALUNITE BASED ALUMINA PLANT IN ISLAMIC REPUBLIC OF IRAN

Final Report

Volume I

General Explanatory Note

VAMI

V/O TECHNOEXPORT

Leningrad
1988

COMPOSITION OF FEASIBILITY REPORT ON CONSTRUCTION OF ALUNITE BASED ALUMINA PLANT IN ISLAMIC REPUBLIC OF IRAN

Volume I — General Explanatory Note

Volume II — Drawings

Volume III — Equipment Specifications

INTRODUCTION

In accordance with the UNIDO Contract No 85/108 the Final Feasibility Report on construction of Alunite based Alumina Plant in Islamic Republic of Iran is prepared based on the results of the tripartite discussion of the above Draft Report taking place in UNIDO (Vienne) and Tehran from 11 to 23 of July.

During the preperation of the Final Report the Subcontractor has taken into account the proposals and comments expressed by the Customer during the discussion of the Draft Report being a constituent part of the Protocol of its tripartite discussion (Tehran, July, 22, 1988).

S U M M A R Y

List of schedules

I. EXECUTIVE SUMMARY

1.1. General initial data and Conditions (Chapter 2)

Nowadays aluminium industry of the Islamic Republic of Iran is presented by the existing Aluminium Plant set up by IRALCO with annual capacity of 45 thou.tons of aluminium in Arak.

The Alumina for this plant as well as potassium sulphate for agriculture are imported.

At the same time large investigated deposits of raw materials containing aluminium (in form of alunites and bauxite) are available in Iran, This fact creates favourable prerequisites for development of aluminium industry based on its own raw material resources, i.e. alunite ore.

The Programme of Development of Iran elaborated within the framework of the country's economic policy for the 20-year period envisages realization of first priority measures which are aimed at meeting the production requirements based on the internal sources for currency saving. For the realization of the Programme special attention is paid to availability of potentially rich raw material sources and necessity to encrease the variety of products.

For economic evaluation of alunite ore processing normal feasible annual capacity of the plant is assumed in the Feasibility Study equal to - 200 thou.t/year of alumina.

Production of potassium sulphate and sulphurous gas will be determined by calculation based on the quality of initial ore.

From the Iranian side the State Iranian company ARMP (Aluminium Raw Material Programme) established in 1982/83 is considered as Promoter (Tehran, 15, Southern Aban, Shahid Hassan Azadi, 15986, Iran).

The range of Company's activities comprises the elaboration of possible production of alumina from domestic raw materials and investigations connected with its processing for production of aluminium.

In compliance with provisions of Contract No.85/108 signed between UNIDO and V/O "Tsvetmetpromexport" the Project is intrusted to the All-Union Research and Design Institute of Aluminium, Magnesium and Electrode Industry - VAMI of the Ministry of Nonferrous

metallurgy of the USSR (Leningrad, V.O. Sredniy Prospect, 86).

1.2. Market and plant capacity (Chapter 3)

According to the development plans of the Iranian aluminium industry IRALCO plans to increase capacity of the aluminium smelter in Iran up to 65-70 thou.tpy, which would require 125-130 thou.tpy of alumina.

At prcsent alumina for this plant is imported.

Meanwhile large investigated reserves of alunite ore in Iran allow establishment on their basis of alumina production with co-production of potassium sulphate and sulphurous gas.

Based on the proposed development plan of aluminium production in Iran, forecast of potassium and phosphate fertilizers demand, as well as considering the Subcontractor's industrial experience the plant in question is designed for capacity of 200,000 tpy of alumina. The plant will co-produce 216,000 tpy of potassium sulphate and 140,000 tpy of sulphurous gas (in terms of 100% sulphur).

All products except 136,000 tpy of potassium sulphate will be consumed in the Iranian market.

Potassium sulphate in quantity of 136,000 tpy shall be exported. According to available data demand in potassium sulphate in the 90-ies will grow at a rate of 3% per year (average) which will favour the producers of this product.

On the basis of the clarified data of ARMP presented during the tripertite meeting, the Ministry of Agriculture of Iran is confirming the possibility to consume the complete quantity of potassium sulphate inside Iran.

1.3. Materials and inputs (Chapter 4)

Alunite ore from deposit in Takestan is the raw material estimated at 600 mln.t. The ore from Haftsanduk region with alunite content 49,1% is proposed for calculation.

Sulphur and Potassium hydroxide are used as auxiliary materials for process. Fuel oil is used as a process fuel.

Annual demand of the plant

alunite ore	- 139 0000 t
Sulphur	- 80000 t
Potassium hydroxide	- 90000 t
Fuel	- 80000 t convent.fuel

1.4. Location and site of the plant (Chapter 5)

Jointly with ARMP the following regions were considered for alumina plant location: Takestan, Karadja, Rudeshur Salafchegon and Arak.

Plant site is situated:

- 13 km from raw material deposit of the plant-Haftsandooq region;
- in the region of railway station Siabah.

1.5. Project engineering (Chapter 6).

1.5.1. The following units are included in the scope of FS:

- alumina plant (process, repair and Support facilities)
- alunite mine
- infrastructure facilities (external power supply, water supply, railways and motor roads, HPP).

Alunite mine and infrastructure facilities are elaborated by the Iranian side.

1.5.2. Process

Alcaline - reduction processing of alunite ore is assumed in FS. This method allows to produce alumina, potassium sulphate and sulphuric gas for production of sulphuric acid or sulphur.

This method is developed in the URSS on industrial scale.

1.6. Plant management and Overheads (Chapter 7)

Organizational structure of the alumina plant based on the Iranian alunite was developed with in the framework of production organization, management and support of the integrated alumina refining cycle with co-production of potassium sulphate and sulphurous gas.

External infrastructure facilities of the plant, utilization of sulphurous gas and elaboration of TPP are included in the scope of work to be implemented by the Iranian side and are not covered by the organizational structure to be developed by the Subcontractor.

Overheads within the framework of total production costs cover the following:

- plant general overheads (salaries of plant general personnel, repair and maintenance, illumination, ventilation, potable water);

- administrative overheads (salaries of management and service personnel, stationary goods, potable water, illumination, ventilation of non-production buildings);

- depreciation;

- financing costs (bank charges and payment of interest on short-term bank loans for the working capital).

1.7. Personnel (Chapter 8)

Labour requirements of the alumina plant (less TPP) are 1450 persons, including:

- management	- 13 persons
- engineers and technicians	- 91 persons
- administrative personnel	- 59 persons
- foremen	- 48 persons
- clerks	- 27 persons
- workers	- 1212 persons

1.8. Project implementation (Chapter 9)

Considering Iranian conditions and ARMP information of possible project implementation schedule the following deadlines are proposed:

- total plant construction period is 6 years. The eingineering design will be prepared during first 2 years as well as construction of the external infrastructure facilities. Alumina plant units will be built over a period of subsequent 4 years;

- supply and installation of the equipment within the last 2 years of construction period;

- commissioning of the alumina production facilities at the end of the 4th year of plant construction (the 6th year from the start of the engineering design preparation);

- product output starting from the 5th year from the start of construction of the alumina plant units and mastering commissioned capacities within two years.

1.9. Financial and economic evaluation (Chapter 10)

Financial evaluation of the project has been prepared on the basis of 20 years of operation of the plant.

Calculations have been prepared on the basis of prices at the end of 1987 without escalation.

The foreign exchange component has been estimated on the basis of exchange rate of US $ = Rls 66.

For the estimation of the Feasibility Stady the normal attainable capacity is assumed equal to 200000 tpy of alumina.

Financial analysis has been prepared for above capacity on the basis of current Iranian prices of finished products of processing as well as the production expenses:

S/N	Description	Unit	Value	
			FEAS	At zero cost of sulphurous gas
1	Total investment costs	Rls million	41622	41622
	including:			
1.1	Fixed capital	do	40563	40563
1.2	Working capital	do	1059	1059
2	Average after-tax revenue per year during 20-year operation period	do	2840	1718
	including:			
2.1	Net profit	do	1050	-72
2.2	Depreciation	do	1790	1790
3	Average profit on capital after reaching break-even point	%	6.0	4.7
4	Payback period	years	13.5	22.7
5	Break-even level			
	- 5th year of operation	thou.t	184	—
		%	92	
	- 10th year of operation	"	118	163
			59	82
	- 15th year of operation	"	72	98
			36	49
6	Internal rate of return	%	3.4	-

Project financial evaluation was also executed according to COMFAR system. IRR calculated in this system based on 15 year operation period amounts to 1.8%. The difference in IRR level proves the rise of production efficiency after compensation for project implementation costs and covering the losses of first years of operation.

1.9.1. Total investment costs

The total investment costs for construction of the 200 ths.t/y plant will amount to Rls.40,934 mln, distributed as follows:

	Rls.mln.
1. Buildings and structures	16,488
2. Technology (know-how)	665
3. Equipment, including:	
3.1. Imported	11,629
3.2. Local	106
3.3. Installation	1,313
3.4. Insurance and taxes	1,008
4. Project implementation, including land	9,354
Sub-total, fixed capital	40,563
5. Working capital (credited)	348
6. Interest on working capital during construction period	23
TOTAL:	40,934
Out of the total amount of costs:	
- Local costs	23,139 (56,5%)
- Foreign exchange component	17,795 (43.5%)

1.9.2. Project financing

According to the financing arrangements, a total amount of the fixed capital (Rls.40,563 mln) to be allocated by the Iranian government as state subsidies.

A total amount of the working capital (Rls.1,010 mln) will be provided as a short-term loan (commercial bank) at 13% annual interest to ensure the needs of the first year of operation.

1.9.3. Total production costs

The total production costs on an average annual basis for a total plant operation period at a feasible normal capacity (200 ths.t/y) are Rls. 9,176 mln.

A break-down of the costs is as follows:	Rls.mln
1. Raw materials	3,342
including:	
1.1. Alunite ore	1,265
1.2. Sulphur	800
1.3. Potassium hydroxide	1,277
2. Auxiliary materials and utilities	1,495
3. Wages and salaries	2,079
4. Maintenance and repair	465
Sub-total, operating costs	7,381
5. Depreciation	1,790
6. Financing costs	5
Total, production costs	9,176
Including:	
- local costs	7,889
- foreign costs	1,287

The cost of production of 1 tonne of alumina is as follows:

	Foreign	Local	Total
1. Total costs, Rls.mln	1,287	7,889	9,176
2. Excluding:			
- potassium sulphate	-	5,292	5,292
- sulphurous gas	-	1,400	1,400
3. Alumina cost of production	1,287	1,197	2,484
4. Same, calculated per 1 tonne of alumina, Rls.	6,435	5,985	12,420

1.9.4. Conclusion

On the basis of the prepared Feasibility Study the following conclusion can be drawn:

1. Construction of an alunite alumina plant in Iran will make it possible to create an indigenous source of aluminium raw materials and to give up importing the corresponding amount of alumina and potassium sulphate.

The calculations show that the alumina plant construction will make it possible to increase currency inflow to Iran by US Dollars 112 mln. (at official prices level).

2. Commercial efficiency of processing alunite into alumina depends on its integrated processing and producing potassium sulphate and sulphurous gas as by-products.

It follows from a market analysis that sulphuric acid produced from sulphurous gas (400 thous.t/year) cannot be sold in the local market in Iran during the nearest 10 to 15 years. One of the major uses of sulphuric acid is production of phosphate fertilizers. According to the Geological Survey of Iran there are several low-grade phosphate ore deposits in the country, the ore requiring beneficiation prior to processing. But it requires carrying out the geological prospecting works at these deposits for evaluating the reserves and quality of the ore, followed by the bench-scale and pilot testing of the material. A feasibility study is to be prepared for construction of the ore beneficiation plants.

One can assume as one of the alternatives that Iran will show interest in exporting sulphuric acid as a compensation, for example, for KOH supply needed for the alumina production or in processing SO_3 into elementary sulphur.

An assessment of utilizing SO_3 obtained in the process is not specified in the contract for preparation of the Feasibility Study and to be performed by the Iranian side.

A total volume of potassium sulphate produced (about 100 thous.t/year) is to be sold in the world market.

3. The internal rate of return which is equal to 3.4% is due to the high investment costs involving local funds for financing the construction works at a low production capacity which is limited by a market for the co-products.

4. The ratio of foreign currency replacement due to the implementation of project (without taking into account the sulphuric acid production) is: 1 US $ = 303 Rls.

5. The Feasibility Study is prepared in full volume according to the contract and the "Manual for the Preparation of Industrial Feasibility Studies" (United Nations, New York, 1978).

2. GENERAL INITIAL DATA

2.1. General Background Information

Nowadays aluminium industry of Islamic Republic of Iran is represented by the existing Aluminium Plant set up by IRALCO with annual capacity of 45 thou.tons of aluminium in Arak.

The Alumina for this plant as well as potassium sulphate for agriculture are imported.

By the end of the current decade IRALCO intends to increase aluminium production up to 120 thou.tpy. It will entail increase of alumina import up to about 240 thou.tpy. And these demands for aluminium will be met for about 30-40%.

At the same time vast investigated deposits of raw materials containing aluminium (in form of alunite and bauxite) are available in Iran. This fact creates favorable prerequisites for development of aluminium industry based on its own raw material resources, i.e. alunite ore.

The survey prospecting works, carried out by the Geological Survey of Iran, ensure the estimation of the reserves of these deposits under category C_2 (category R-2 in accordance with the International Classification of mineral raw material reserves) in quantity exceeding 1 bln.tons, including 600 mln.tons of Taykand deposit, with average alunite content from 38 to 48% in the ore.

2.2. Project Idea

The Programme of Development of Iran compiled within the framework of the country's economic policy for the 20-year period envisages primary realization of the measures aimed at meeting the industrial production requirements based on the internal sources for currency saving. For realization of this Programme special attention is paid to utilization of potentially rich raw material resources and the necessity to increase the variety of manufactured products.

Proceeding from the tasks and goal of the afore-mentioned Programme, the setting-up of aluminium industry on the basis of national raw material sources (alunite and bauxite) within the framework of National economic policy of Iran will ensure:

- development of independent economy due to expansion of self-provision in raw material and industrial products;

- industrial development of vast scarcely populated region in north-western part of the country;

- cessation of alumina import, which will result in foreign currency saving.

In case of integrated processing of alunite ore the sulphuric acid and potassium sulphate are produced besides the alumina.

According to information available with Subcontractor the potassium sulphate is a valuable potassium fertilizer, and taking into account its high demand in the world market, it can be one of export items.

2.3. Aim of the Project

The main aim of the Project No.DP/IRA/85/003 is the preparation of the Feasibility Study and the carrying-out of pilot testing of technological and reference samples of alunite ore. In December 1985 UNIDO and V/O "Tsvetmetpromexport" signed Contract No.85/108 for the elaboration of the above Feasibility Study.

2.4. Plant Capacity

For economic evaluation of alunite ore processing feasible normal capacity of the plant is assumed in the Feasibility Study equal to - 200 thou.t/year of alumina.

Production of potassium sulphate and sulphurous gas is calculated proceeding from the quality of initial ore and shall amount to : potassium sulphate - 216 ths.tpy, sulphurous gas - 140 ths. tpy. (100% S).

2.5. Project Implementation Schedule

The construction of the Alumina plant can be implemented during 6 years taking into consideration the Iranian conditions.

2.6. Project Promoter

From the Iranian side the State Iranian company ARMP (Aluminium Raw Material Programme) established in 1982/83 is considered as Promoter (Tehran, 15, Southern Aban, Shahid Hassan Azadi, 15986, Iran).

The range of Company's activities comprises production of alumina from domestic resources and investigations connected with its processing for production of aluminium.

2.7. Project Subcontractor

In compliance with provisions of Contract No. 85/108 signed between UNIDO and V/O "Tsvetmetpromexport" the Project is intrusted to the All-Union Research and Design Institute of Aluminium, Magnesium and Electrode Industry - VAMI of the Ministry of Nonferrous metallurgy of the USSR (Leningrad, V.O. Sredniy Prospect, 86).

The USSR is the sole country which has brought alunite ore wasteless processing to industrial level (Kirovabad aluminium plant commissioned in 1966).

3. MARKET AND PLANT CAPACITY

3.1. Demand and Market Study

IRALCO plans to increase the capacity of the operating aluminium plant up to 65,000 tpa by 1990-91 which would mean annual import of 125,000-135,000 tons of alumina.

Iran's demand in aluminium toward the end of running decade is expected to be 160-185,000 tpy.

According to Iranian information toward the year 2000 the country's demand in aluminium will increase up to 300-400,000 tpy. In case the Iranian government adopts a decision to create own proper capacities to meet the said demand it will be necessary to import 600-800,000 tpy.

At the same time Iran possesses the favourable possibilities to develop aluminium industry on the basis of their own raw material resources-alunite ores. Vast reserves of these ores (over 1 mlrd tonnes) are found in Nonthern regions of the country.

Subcontractor's experience of industrial processing of similar raw materials (Kirovabad aluminium plant in the USSR) shows that high economic efficiency of using alunite ore as raw material for production of aluminium is ensured due to manufacturing of sulphurous gas and potassium sulphate along with alumina.

SO_3 is the raw material for the production of sulphuric acid. There are two Iranian sulphuric acid manufacture using the elementary sulphur after treatment of crude oil with high sulphur content.

According to the information available there are no other sulphuric acid manufacturers among Persian Gulf countries.

The additional amount of sulphuric acid after processing of alunite ores could be used in production of phosphate fertilizers or to meet demands of other countries of this region provided the appropriate favourable conditions for development of economic and trade relations between Iran and other countries of this region are created.

Presently some Arab oil producing countries meet their demands in sulphuric acid by treating their sulphur in other countries (for example, India) on the basis of compensation for extra services.

Great volumes of sulphurous acid are used in reaction with phosphates for production of superphosphate and phosphoris acid.

The availability of large deposits of phosphates in Iran (Dalir, Shemshak, Bekbahan) creates favourable prerequisites for organisation of further stages of the project of the phosphate fertilizers production using the excess of sulphuric acid obtained as a by-product of alunite ore processing. According to "Chemical Fertilizers Distribution Co" the whole amount of fertilizers to be produced could be consumed by Iranian agriculture.

As for potassium sulphate market actual worls consumption of potassium fertilizers is estimated to be approximately 26 mln tons. Potassium sulphate covers 1,3 mln tons (recalculated on K_2O) or 5% of overall consumption.

By "British Sulphur Co's" estimate in the 90-ies the demand for potassium sulphate is expected to be characterized by high rates of its consumption increase (average by 3% per year) mainly due to growing demand for this product in developing countries with arid climate. These climatic conditions cause big problems mainly salty soil and in this case the potassium sulphate is more preferable than other potassium fertilizers in providing soil with potassium. The annual consumption of potassium sulphate is expected to attain 1,8 mln tons by 1996.

The world level of potassium sulphate consumption is as follows:

	1985/86*	
	ths.t	%
Asia	271,1	22,1
Africa	120,9	9,9
N.America	114,9	9,4
Latin Amercia	50,8	4,1
Australia & Oceania	5,5	0,4
W.Europe	558,2	45,5
Others	106,0	8,6
Total	1227,4	100

* "Phosphorus and potassium", No.151, 1987.

As potassium sulphate is widely used for raising tobacco, grapes, citric plants its main consumers are the countries specialized in production of such. In Western Europe the main consumers of potassium sulphate are Mediterranean countries (Italy, France).

The share of potassium sulphate used in North Africa amounts to 70% of the total quantity of all potassium fertelizers.

It is in great demand in SAP and Zimbabwe for raising tobacco. In Latin America potassium sulphate is used in Cuba, Mexico and Brazil.

The said countries meet their demand for this kind of fertilizer mainly by importing it.

China is becoming on of the largest consumers of potassium sulphate due to great amount of agricultural production and high rates of its development; China plans to purchase this year 40 00 tons of this fertilizer. China may be considered as a great importer of this product in the nearest 10-15 years for it has no domestic production of potassium sulphate.

Actually Pakistan imports about 50,000 t of potassium sulphate and by 1991 this amount is expected to double. To our knowledge neither Pakistan nor other countries of this region plan to organize such a production.

Leading exporters of potassium sulphate are West European countries. The world main producer of potassium sulphate is the West German company "Kali und Salz" with its annual capacity 500,000 tons which means about 30% of the world capacity.

West European producers of potassium sulphate sell it mainly to North African countries.

It is expected that in the 90-ies Israel, Tunisia, Canada and Jordan will join the number of potassium sulphate producers. The latter is the world biggest phosphate supplier at present.

In Iran by 1992-93 potassium sulphate consumption shall increase upto 100,000 tpy. Presently the country has no domestic production of this product. The availability of large deposits of alunite ores offers possibilities to organize the production of potassium sulphate in parallel with alumina production, as well as its export in nearest Asian countries which would be

attractive for these countries because of lower transport costs compared with import from West European countries or Canada.

3.2. Sales forecast and marketing of products and by-products

Taking into consideration the demand for potassium fertilizers, prospects of phosphates mining development and plans for expansion of aluminium smelter in Arak the FS is based on the assumption that all alumina produced by processing alunite ores (200,000 tpy) will be consumed by Arak aluminium smelter.

80,000 typ of potassium sulphate obtained as a by-product will be consumed in the country, the remaining 136,000 tpy are to be exported.

The utilization for production of sulphuric acid will probably depend on the development of base for phosphate raw materials mining.

The alternative of its utilization for the period before phosphates mining is the production of elementary sulphur. For calculations in the FS the evaluation of SO_3 was made proceeding from the cost of elementary sulphur contained in it.

Schedule 3-1 contains the estimate of sales revenues made on the basis of ARMP data concerning the price of manufactured products, outlined programmes of their production and sales.

3.3. Production programme

For calculation in the FS it is assumed that all production (main and by-products) except alunite mud is to be sold to the consumer.

The level of production is determined by the capacities of alumina production already commissioned.

The calculation of production capacity commissioning based on Subcontractor's industrial experience is shown in Schedule 3-2.

Schedule 3-1

Estimate of sales revenues

Products	Unit price Rls/t	1-st year				2-nd year				3-rd year & so on			
		Sales, thou.t			Sales revenues	Sales, thou.t			Sales revenues	Sales, thou.t			Sales revenues
		Export	Local	Total	Rls.thou	Export	Local	Total	Rls.thou	Export	Local	Total	Rls.thou
Alumina	20000	-	70	70	1,400,000	-	181	181	3,620,000	-	200	200	4,000,000
Potassium sulphate (52% K_2O)	24500	-	75	75	1,837,500	115	80	195	4,777,500	136	80	216	5,292,000
Sulphurous gas (100% S)	10000	-	40	40	400,000	-	120	120	1,200,000	-	140	140	1,400,000
Total					3,637,500				9,597,500				10,692,000

Alumina production capacity commissioning schedule

Schedule 3-2

Years from starting-up	1				2				3 and so on			
Quarter	I	II	III	IV	I	II	III	IV	I	II	III	IV
Alumina, ths. t	7.5	10	22.5	30	39.5	45.0	46.5	50	50	50	50	50

Schedule 3-3 shows production programme calculated on the basis of commissioning schedule and the data on by-products yield.

Schedule 3-3

Production programme

Production	Amount at 100% capacity ths. t	I-st year		II-nd year		III-rd and so on	
		ths. t	capacity, %	ths. t	capacity, %	ths. t	capacity, %
1. Alumina	200	70	35	181	90.5	200	100
2. Potassium sulphate	216	75	34.7	195	90.3	216	100
3. SO_3 (100% s)	140	40	28.6	120	85.7	140	100

3.4. Plant capacity

The normal plant capacity 200,000 tpy of alumina is determined in the FS proceeding from:

- industrial experience of Subcontractor;
- availability of alunite ore reserves;
- possibility of marketing of all by-products;
- provision of existing aluminium capacities taking into consideration their further development on the basis of their own raw materials

The variation of normal capacity within the range of ± 70000 tpy and its effect on project performances are studied in sensibility analysis (chapter 10.5).

3.5. Alumina Quality

Provided the design desilication, security filtration, pregnant liquor precipitation and aluminium hydroxide calcination processes are observed, physico-chemical characteristics of the alumina prduced from alunite ore will correspond to the following specifications:

Type	Content of major impurities, wt. % max			L.O.I., % max	alpha-Al_2O_3, % min
	SiO_2	Fe_2O_3	Sum of Na_2O and K_2O in terms of Na_2O		
1	0.02	0.03	0,4	0.8	30
2	0.03	0.05	0.5	1.0	25

Notes: 1. Content of aluminium oxide in finished alumina is determined as difference between 100% and sum of contents of impurities listed in Table, which shall be at least 98%.

2. Content of P_2O_5 shall not exceed 0.002%.

3. Content of impurities and L.O.I. is determined with alumina dried at 300°C.

4. Content of minus 40-micron fraction shall not exceed 40%, which corresponds to European type alumina.

4. MATERIALS AND INPUTS

4.1. Material Base of Alumina Plant

The following industrial inputs will be used for alumina production:

- raw material: alunite ore;
- industrial products: sulphur, potassium hydroxide, sodium hydroxide;
- auxiliary materials: filter cloth, flocculant;
- fuel: fuel oil, natural petroleum gas;
- utilities: electric power, heat (steam), industrial water, potable water, compressed air.

4.2. Specifications of Raw Materials, Fuel, Utilities

4.2.1. Alunite ore

To be processed by the alkaline-reduction method alunite ore must meet the following specifications:

- alunite content in the ore 43% minimum.

The higher the alunite content in the ore, the lower is the consumption of raw materials, fuel, power, etc.;

- content of non-alunite alumina (kaolin) 2.0% max.

These conditions ensure minimal losses of caustic with alunite mud, as well as reduce consumption of caustic potash used for make-up of caustic losses;

- molar ratio of potassium in ore to total content of alkalis $K_2O + Na_2O$ shall be 65% min. Under such conditions part of caustic losses for treatment of reduced ore may be compensated by caustic soda which is cheaper and readily available, as compared to caustic potash;

- size of lumps of alunite ore delivered to the plant shall be 150 to 0 mm.

4.2.1.1. Chemical analysis of alunite ore used as a basis for calculations in FS:

Components	Ore, 49.1% of alunite
SO_3	19.31
Al_2O_3 common	19.85
K_2O	3.32
Na_2O	1.55
SiO_2	45.68
L.O.I.	7.00
Others	3.99
Al_2O_3 of alunite	18.44
Al_2O_3 on non-alunite	1.41

4.2.2. Sulphur

Sulphur is used as a reagent for reduction of alunite ore. In this process it oxidises to SO_2 without losses and along with SO_3 reduced from alunite is fed to the acid plant for production of sulphuric acid.

Sulphur shall be free from ogranics or impurities which may negatively affect operation of the acid plant.

4.2.3. Potassium hydroxide

Caustic potash is used for compensation of loss of caustic alkali in production of alumina.

At the same time it is used for production of 1 t of potassium sulfate per ton of finished alumina. Commercial-grade potassium hydroxide may be delivered in solid or liquid from, produced by any method, including a diaphragm process.

There are no special specifications concerning its purity. Content of KOH in liquid caustic shall be 50% min.

4.2.4. Sodium hydroxide

Caustic soda may be partially used in place of caustic

potash in processing alunite ore with relatively high potassium content with respect to the sum of alkalis in the ore. Commercial-grade caustic soda is required, there are no special specifications for its purity.

4.2.5. Filter cloth

Filter cloth is used for filtration of various slurries and liquors containing fine impurities.

Filter cloth must be resistant to hot alkaline liquors with alkali content (as Na_2O up to 150 g/l).

All types of synthetic cloth used in the Bayer process are suitable for this process.

4.2.6. Flocculant

Both synthetic flocculant (for example, Alclar-500, Great Britain) and commercial flour may be used.

4.2.7. Fuel

Process fuel is used for roasting and reduction of alunite ore, calcination of alumina, and if required, for drying of potassium sulfate.

Fuel oil with low heat value of Q_H^P = 9500-9800 kcal/kg and natural gas with low heat value of 8000-8300 kcal/kg may be used as a process fuel. Sulphur content in the fuel shall not exceed 1%.

For the FS estimations the fuel oil is adopted as the main fuel because of its lower cost as compared with natural gas.

4.2.8. Steam

Superheated steam is used for process needs at pressure of 7 bar. Steam is required continuously, 365 d/yr according to operation of the plant.

4.2.9. Compressed air

Compressed air for process needs is used for agitation of slurry in precipitators, for roasting and reduction, in pneumatic conveyors, and instrumentation.

Air used for instrumentation shall be chemically dry. Air for process needs shall be freed from water mechanically.

Air parameters: pressure 6 bar.

Supply: continuous, 365 d/yr.

Compressor station shall be provided with two independent electric power supply sources.

4.2.10. Water (industrial)

Clean fresh water is used for make-up of the water recirculating system. Chlorination or other water treatment is not required.

4.2.11. Potable water

According to Iranian norms.

4.3. Selection of the Supply Programme

All above industrial inputs except caustic potash and filter cloth are available in Iran.

FS provides for import of caustic potash and filter

FS considers the following potential sources of main inputs.

4.3.1. Alunite ore

Potential sources of alunite ore supply are the deposits in the region of Takestan (Haftsanduk, Taikanu, Bash-Kul) as the best deposits in respect of reserves and ore quality.

Reserves of alunite ores of these deposits are estimated at 600 mln.t (category R_2) with average content of alunite in ore 38-45%.

Depcsit Haftsanduk located 10-12 km from the plant site is proposed as a main deposit. The ropeway is proposed for ore delivery to the plant.

4.3.2. Sulphur

According to ARMP data the required quantity of sulphur may be supplied by the Hangiran oil refinery (town of Saraks) or by "Rasi Petrochemical Co." from the island of Hark.

4.3.3. Potassium and sodium hydroxides

At present Iran has no source of caustic potash or soda.

Considering relatively low content of potassium as compared to sum of alkalis in the initial ore, FS provides only for imports of caustic potash by rail via Julfa station.

The USSR may be one of potential suppliers of caustic potash. However, this requires negotiations between the Iranian and Soviet organizations at a later stage, as well as with other potential world suppliers.

Under the condition that the Iranian side would resolve the the problems related to the utilization of chlorine, the alternative source of potassium hydroxide supplies may be the setting-up of its captive production unit within the framework of the Plant, based on the processing of potassium chloride, supplied from the USSR. Taking into consideration the small requirements of potassium hydroxide this variant can be more economically viable

4.3.4. Filter cloth

According to ARIP information, Iran has no local source of filter cloth of required quality, so FS provides for imports of this cloth.

Decision on selection of a supplier of filter cloth will be taken by the Iranian side during implementation of the project.

4.3.5. Flocculant

Since industrial flour may be used as a flocculant, FS provides for supply of this material by local manufactures.

4.2.6. Fuel oil

According to ARIP the required quantity of fuel oil may be supplied from Teheran or Tebris oil refineries by rail.

4.3.7. Natural gas

The gas source is a gas pipe line Kazvin-Zinjan being built 5 km away from the site of the plant. FS provides for use of natural gas as reserve source of fuel.

4.3.8. Electric power

The main source of electric power supply to the plant is the 230-kV and 400-kV transmission line Teheran-Zinjan of the Iranian electric power grid in the vicinity of the plant. Partially power demand will be met by TPP the construction of which is forseen by FS on the plant territory.

4.3.9. Steam

TPP is considered the source of providing process needs of the plant in steam and is located on the plant site.

4.3.10. Water

Provision of the plant production and service needs with water water is proposed from the underground sources. In winter the

river Abhar-Roud may be used as a source of industrial water supply. At later stages of the project a survey may be required for assessment and confirmation of reserves of ground waters.

4.3.11. Compressed air

The plant compressor station is adopted as a source of compressed air.

Based on the potential sources of industrial inputs and materials revealed PS assumes the following supply programme:

S/N	Item	Source	Distance to plant, km	Delivery method
1	Alunite ore	Haftsanduk	25	ropeway
2	Sulphur	Saraks	190-195	railway
3	Caustic potash	Imports		
4	Filter cloth	Imports		
5	Fuel oil	Teheran	250	railway
6	Natural gas	Gas mains	5	gas pipeline
7	Electric power	Power grid	25	transmission line
8	Steam	TPP	-	pipeline
9	Water	Underground sources	5-7	ditto
10	Compressed air	Compressor station	-	ditto

4.4. Supply Programme

The following supply programme is proposed on the basis of process data on current demand in materials and inputs for production purposes, creating the required stock and inventory in conformity with the production programme of the plant.

S/N	Item	Unit of meas.	Current production	Inventory (work-in-progress)	Stocks	Total
1	Alunite ore	1000 t	1390	120	100	1610
2	Sulphur	t	80000	-	100	81000
3	Caustic potash	t	90000	2800	1200	94000
4	Filter cloth	m^2	60000	-	-	60000
5	Fuel oil	t	59500	-	10000	69500
6	Electric power	1000 kWh	270000	-	-	270000
7	Steam	1000 t	1346	-	-	1346
8	Water	1000 m^3	3000	-	-	3000
9	Aluminium hydroxide (100% Al_2O_3)	t	-	4570	-	4570

4.5. Cost estimate

Costs of raw materials, supplies, fuel and utilities are estimated on the basis of the supply programme and unit rates for these materials and inputs at prices on the end of 1987 (according to ARMP). Exchange rate for estimation of cost of imported materials is US $ 1 = RI66.

Estimates of annual production expenses for materials and other production inputs are shown in Schedule 4-1

For summary of production expenses for materials, fuel and utilities refer to Schedule 4-1.

Foreign exchange components of the costs are given in brackets in Schedule 4-1 .

Schedule 4-1

Production Cost Estimate

Materials and inputs

1. Main production units

S/N	Qty	Unit of meas.	Facility and cost item	Unit price, rials	Total cost, 1000 rials
1	2	3	4	5	6
1			Ore receiving unit, secondary and fine crushing, blending storage, loading		
1.1	10150	1000 kWh	Electric power	2900	29435
			Total of 1		29435
2			Dry grinding		
2.1	3460	t	Grinding bodies	600	2076
2.2	47500	1000 kWh	Electric power	2900	137750
2.2	5300	m^3	Potable water	4	21
			Total of 2		139847
3			Roasting and reduction with blower station		
3.1	1390000	t	Alunite ore	910	1264900
3.2	80000	t	Sulphur	10000	800000
3.3	1400	t	Refractories	40000	56000
3.4	10	%	Miscellaneous	1551000	155100
3.5	40000	t	Fuel (oil)	1300	52000
3.6	40000	1000 kWh	Electric power	2900	116000
3.7	6900	m^3	Potable water	4	28
			Total of 3		2444028

1	2	3	4	5	6
4			Sulphur and caustic potash storages		
4.1	16490	t	Steam	283	4667
4.2	2640	1000 kWh	Electric power	2900	7656
4.3	3700	m^3	Potable water	4	15
			Total of 4:		12338
5			Digestion, desilication and mud washing		
5.1	30000	m^2	Filter cloth	167.5	(5025)
5.2	506970	t	Steam	283	143473
5.3	40500	1000 kWh	Electric power	2900	117450
5.4	6500	m^2	Potable water	"	26
			Total of 5:		265974 (5025)
6			Evaporation and potassium sulphate production		
6.1	10000	m^2	Filter cloth	167.5	(1675)
6.2	90000	t	Caustic potash	14190	(1277100)
6.3	22000	1000 kWh	Electric power	2900	63800
6.4	632680	t	Steam	283	179048
6.5	4800	m^3	Potable water	4	19
			Total of 6:		1521642 (1278775)
7			Precipitation, hydrate handling, hydrate storage		
7.1	20000	m^2	Filter cloth	167.5	(3350)
7.2	96860	t	Steam	283	27411
7.3	29400	1000 kWh	Electric power	2900	85260

1	2	3	4	5	6
7.4	4400	m^3	Potable water	4	18
			Total of 7:		116039 (3350)
8			Calcination, finished alumina storage		
8.1	200	t	Refractories	40000	8000
8.2	18000	t	Fuel oil	1300	23400
8.3	5280	1000 kWh	Electric power	2900	15312
8.4	4000	m^3	Potable water	4	16
			Total of 8:		46823
9			Potassium sulphate drying, potassium sulphate storage		
9.1	20	t	Refractories	40000	800
9.2	1500	t	Fuel oil	1300	1950
9.3	1300	1000 kWh	Electric power	2900	3770
			Total of 9:		6520
			Grand total of main production units		4582651 (1287150)

Schedule 4-1 (cont'd)

Materials and inputs					
2. Power facilities					
S/N	Qty	Unit of meas.	Facility and cost item	Unit price, rials	Total 1000 rials
1	2	3	4	5	6
1			Transformer oil facility, main stepdown substation, electric substation, gas distribution station, fuel oil facility		
1.1	15585	t	Steam and hot water	283	4411
1.2	1600	1000 kWh	Electric power	2900	4640
1.3	5100	m^3	Potable water	4	20
			Total of 1		9071
2			Compressor and oxygen stations		
2.1	27150	1000 kWh	Electric power	2900	78735
2.2	195	t	Heat (in terms of steam)	283	55
2.3	2000	m^3	Potable water	4	8
			Total of 2		78798
			Grand Total of power facilities		87869

Schedule 4-1 (Cont'd)

Materials and inputs

3. Water supply and sewerage units

S/N	Qty	Unit of meas.	Facility and cost item	Unit price, rials	Total cost, 1000 rials
1			Water recirculating unit, water rank		
1.1	28000	1000 kWh	Electric power	2900	81200
1.2	2893770	m^3	Industrial water	7.34	21260
1.3	4800	m^3	Potable water	4	19
			Total of 1:		102479
			Grand Total of water supply and sewerage systems		

Schedule 4-1 (Cont'd)

Materials and inputs

4. Repair and storage facilities

S/N	Qty	Unit of meas.	Facility and cost item	Unit price, rials	Total 1000 rials
1			Repair shop complex		
1.1	3850	1000 kWh	Electric power	2900	11165
1.2	20500	m^3	Potable water	4	82
1.3	77220	t	Heat (in terms of steam)	283	21853
			Total of 1:		33100
2			Material storages complex		
2.1	340	1000 kWh	Electric power	2900	986
2.2	9200	m^3	Potable water	4	37
			Total of 2:		1023
			Grand Total of repair and storage facilities		34123

Schedule 4-1 (Cont'd)

Materials and inputs					
5. Transport facilities					
S/N	Qty	Unit of meas.	Facility and cost item	Unit price, rials	Total cost, 1000 rials
1			Special vehicles garage		
1.1	160	1000 kWh	Electric power	2900	464
1.2	1400	m^3	Potable water	4	6
			Total of 1		470
2			Fire-fighting station		
2.1	150	1000 kWh	Electric power	2900	435
2.2	6000	m^3	Potable water	4	24
			Total of 2		459
			Grand Total of transport facilities		929

Schedule 4-1 (Cont'd)

Materials and inputs					
6. Administration and services					
S/N	Qty	Unit of meas.	Facility and cost item	Unit price, rials	Total cost, 1000 rials
1			Plant administration		
1.1	400	1000 kWh	Electric power	2900	1160
1.2	4930	m^3	Potable water	4	20
1.3	82	person	Materials	2000	164
			Total of 1		1344
2			Technical building with telephone exchange		
2.1	4200	1000 kWh	Electric power	2900	12180
2.2	7900	m^3	Pltable water	4	32
2.3	21	person	Materials	2000	42
			Total of 2		12254
3			Laboratories		
3.1	3850	1000 kWh	Electric power	2900	11165
3.2	6800	m^3	Potable water	4	27
3.3	20	person	Materials	2000	40
			Total of 3		11232
4			Personnel service facilities		
4.1	1530	1000 kWh	Electric power	2900	4437
4.2	2000	m^3	Potable water	4	8
			Total of 4		4445
			Grand Total of administration and services		29275

Schedule 4-2

Summary sheet - production costs

S/N	Unit of facility	Total production costs, 1000 rials		
		foreign	local	Total
1	Main production units	1287150	3295501	4582651
2	Power facilities	-	87869	87869
3	Water supply and sewerage	-	102479	102479
4	Repair and storage facilities	-	34123	34123
5	Transport facility	-	929	929
6	Administration and services	-	29275	29275
	Grand Total:	1287150	3550176	4837326

When the natural gas is used as a process fuel the operating costs are estimated in amount of 4870536 thou.Rls which is 33210 thou.Rls (0.7%) higher than the utilization of fuel oil.

5. LOCATION AND SITE

5.1. Choice of Location

5.1.1. Selection of possible locations for alumina plant site is made taking into consideration the following factors:

- location of alunite ore deposit n the north of Iran;
- availability of sufficient land area;
- proximate location of consumer of alumina, which is the main finished product;
- availability and proximate location of phosphate deposits which is the main component for production of phosphate fertilizer using sulphuric acid on the basis of sulphurous gas produced as by-product of alunite reduction.

5.1.2. Evaluation of possible alumina plant site location was carried out jointly with ARMP. Iranian consultant company "Madancav" was also involved in this work.

The following factors were taken into consideration:

- provision for minimum transportation cost for supply of raw materials, materials and finished products;
- availability of required infrastructure units and provision for the lowest investment costs for their construction.

Taking into consideration the above mentioned the following alternative sites were considered:

- Takestan region (taking into consideration close proximation of alunite ore deposit);
- Region of Karaj, Rudeshur, Salafchegon (taking into consideration availability of phosphate deposits in this region and possibility of their transportation with minimum traneport cost);
- Arak region (as main consumer of alumina).

5.1.3. Evaluation of Location

Evaluation of the locations for alumina plant on the basis of raw materials, materials, finished products transportation cost, availability of infrastructure units, civil engineering contractors, provision with adequate amount of fuel and energy and manpower was carried out jointly with ARMP and Madancav.

MAP OF IRAN.


USSR
USSR
CASPIAN SEA
PERSIAN GULF
OMAN SEA
BAZARGAN
ARDABIL
ASTARA
SARAB
TABRIZ
MARAGHEH
MIANEH
MAHABAD
SAQQEZ
ZANJAN
BIJAR
MARIVAN
QORVEH
PAVEH
SONQHOR
BAKHTARAN
NAHAVAND
ESLAMABAD
KHORAMABAD
LAHIJAN
LANGROUD
RAMSAR
ASHAR
ALUMINA PLANT
KARAJ
SAVEH
GARMSAR
SEMNAN
DAMGHAN
SARI
GONBADE-GHABOOS
GHUCHAN
SARAKHS
BOJNOURD
DAREGAZ
SABZEVAR
TORBAT-E-HEYDARIEH
KASHMAR
GONABAD
BOSHROYEH
FERDOS
TABAS
BIRJAND
ZABOL
ZAHEDAN
KHASH
SARAVAN
IRANSHAHR
BAM
SIRJAN
BAFT
SABZEVARAN
BOZMAN
RAFSANJAN
KERMAN
YAZD
ESFAHAN
NAJAFABAD
DEZFUL
SHUSHTAR
IZEH
SHAHREZA
BORUJEN
ABADEH
ZARAND
KASHAN
ARAK
TUYSERKAN
MALAYER
SALAFCHEGAN
GOLPAYEGAN
DARAN
NAEEN
ARDESTAN
ALIGOODARZ
MAHALAT
KHORAMSHAHR
ABADAN
BANDAR-E-MAHSHAHR
GENAVEH
KAZEROON
KHARK
BANDAR RIG
BORAZJAN
BUSHEHR
SHIRAZ
ESTAHBANAT
FASA
FIROOZABAD
DARAB
JAHROM
LAR
BANDAR-E-ASALU
BANDAR-E-ABBAS
MINAB
BANDAR LENGEH
QESHM
BAHREIN
QATAR
MUSCAT AND OMAN
BANDAR-E-CHABAHAR
BANDAR-E-GOVATR
EXISTING ROADS
EXISTING RAIL WAYS
GAS PIPE LINE

Comparative evaluation of transportation cost is carried out on the basis of changeable transportation scheme for every location under consideration based on the volumes of cargoes to be transported and data of 1 tkm transportation cost by railway.

Calculation has shown that minimum transportation costs are provided in case of plant location in Takestan region. In this case in comparison with other regions transportation cost is 1.1-4.8 times less. Priority of plant location regions according to indeces of transportation cost variation is given in Table 5-1.

VARIATION OF TOTAL TRANSPORTATION COSTS DEPENDING ON ALUMINA PLANT LOCATIONS,%

Variants of phosphate deposits	Location regions				
	Takestan	Karaj	Rudishur	Salafchekan	Arak
Variant I - Dalir	100	125.4	221.1	380.6	479.7
Variant II - Shemshak	100	118.4	132.9	248.6	320.5
Variant III - Behbahan or import	100	110.7	119.1	134.4	143.4

All the regions under consideration are located near large towns with population over 40 thou.people and have widely developed network of motor roads.

There are already existing or planned for construction power transmission lines of 230 and 400 KV and main gas pipelines. The regions are inter connected by railway line Djulfa-Tehran-Arak and 1-st class motor road.

Taking into consideration investigation level of the region and availability in the regions under consideration of infrastructure units (existing motor roads and railways, power transmission lines and main gas pipelines, large towns, sources of water supply) at this stage estimation of capital investment costs for construction of infrastructure units is accepted the same for all regions.

5.1.4. Conclusions:

Taking into consideration that:

- most of land suitable for construction of alumina plant in Karaj region is private;
- free land for location of alumina plant in Arak region is not available;
- and also based on transportation costs, Takestan, Rudishur and Salafchegon regions are considered for plant site location.

5.2. Requirements and Plant Site Selection

5.2.1. Requirements for selection of alumina plant construction site

5.2.1.1. The plant site should be located as close to the raw material basis (or raw material delivery points) or to the consumer centers of finished product (aluminium smelter) as possible.

5.2.1.2. When the infrastructure facilities (power transmission lines, gas pipelines, railways and motor roads, water supply units, etc.) are available in the region, the plant site should be located with maximum utilization of these facilities. This ensures the reduction of capital investment costs.

5.2.1.3. The sanitary zone is to be provided between the plant site and existing (proposed) urban communities.

According to Subcontracton's norms the width of this zone should be 3 km minimum.

5.2.1.4. The wind roze and the reports of the nearest meteorological station should be taken into consideration while selecting the plant site.

5.2.1.5. The plant site should not be located on karst rocks and in active earthquake zones.

5.2.1.6. The elevation of the plant site should not be lower than the elevation of the mud disposal.

5.2.1.7. When the large reserves of raw materials are available, it is recommended to select the plant site taking into consideration the possibility of future expansion.

5.2.2. The area of the site for the proposed alumina plant processing alunite ore

The area required for the site of the alumina plant with capacity of 200 thou.t/y of alumina, expandable to 400 thou.tpy of alumina, is about 600 hectares.

The following units are located on this area:

- alumina plant (including mud disposal);
- potassium sulphate production;
- sulphuric acid plant.

5.2.3. Requirements for water and power supply sources

5.2.3.1. Two power supply sources are required for normal operation of the alumina plant.

At the Subcontractor's existing alumina plants the heat-and-power plants (located on plant industrial site) are used as the second power supply sources.

5.2.3.2. When the alumina plant uses the underground water reserves, it is required to have the confirmation of these reserves by appropriate authorities of the Customer.

The second alternative variant of plant industrial water supply should be considered during preparation of the Feasibility Report.

5.2.4. Variants of plant site location

In accordance with selected plant locations three variants of plant site are under consideration:

- Takestan area: site is in the nearest proximity to Siahbah railway station. Site is located 10-12 km far from proposed raw materials basis of the plant, i.e. Haftsandooq deposit;
- Rudeshur area: site is located in the nearest proximity to Rudeshur railway station. This site is the nearest to phosphates deposit. Phosphate ores can be processed in future for production of phosphate fertilizers based on the sulphuric acid produced at plant;
- Salafchegon area: site is located in the nearest proximity to Salafchegon railway station, 100 km far from Arak aluminium plant.

The sites for alumina plant construction were selected by ARMP, Subconstructor's experts, with participation of MADANCAV.

5.2.5. Selection of site in Takestan area

5.2.5.1. Site is located in the nearest proximity to alunite ore deposit Haftsandook to the north of Siahbah railway station, 15 km to tne west of Takestan.

Sufficient land for plant construction is available. Land belongs to Government, at present it is not used for agriculture. Price of one hectare of land is about 100 thou. Rials. Terrain of the site is calm, inclination is about 4-5° from north to south. Elevation above the sea level is 1430 m. Earthworks for site levelling are minimum. Soils are presented by secondary rock (sandy clay with gravel), underground waters up to the depth of 6 m are not present. Seismicity is up to 7 points in Richter scale.

5.2.5.2. Climate - dry sub-tropics

Climatic data:
Maximum annual temperature + 41.4°C
Minimum annual temperature - 18.3°C
Average daily temperature + 13°C
Average annual maximum temperature + 20°C
Average annual minimum temperature - 5.9°C

Precipitation
Average annual 281.1 mm
Maximum daily 17.2 mm
Number of sunshine hours per year - 2505.2 hours.

5.2.5.3. Site is located at the distance of about 3 km from national highway Tehran - Tebriz. Soil road connecting plant site with the town of Takestan is in the nearest proximity to the site.

One way railway Tehran - Julfa (railway station Siahbah) is adjacent to the site. Railway gauge is 1435 mm.

5.2.5.4. Passenger transportation syst...

Personnel can be transported to the plant site by railway and motor roads.

5.2.5.5. Water supply

Water demand of the plant can be met from underground water sources located to the south of the site. Underground water reserves are not confirmed (not investigated). In winter water can

be supplied from Abhar Roud river. Authorization of Ministry of Energy of Iran is required for utilization of above water supply sources. Specifications of water are given in ARMP report.

5.2.5.6. Power Supply

Power transmission lines (230 kV and 400 kV) Tehran-Zanjan passes close to the plant site. Required power (320 mln.kWh per year) can be supplied from these lines. Conditions to connect plant power system to the main line should be agreed upon with the Ministry of Energy.

5.2.5.7. Fuel Gas pipeline Gazvin-Zanjan passes at a distance of 5 km from the plant site. Conditions of plant tie-in to the main gas line should be agreed upon with the Ministry of Energy. Fuel oil will be supplied by railway from Tehran.

5.2.5.8. Manpower

Main part of manpower for alumina plant is available in the town of Takestan. Training of this personnel should be foreseen mainly during the plant construction period. Population of Takestan is 40 thou.people. Hospitals, primary and secondary schools, municipality, police stations, governor's office are available in this city.

5.2.6. Selection of the site in Rudeshur region

5.2.6.1. This site is located in the nearest proximity to Rudeshur railway station, approximately 60 km to the south-west of Tehran. The distance from Haftsandooq alunite deposit is 260 km. It is located near Shemshak phosphate deposit. Area of land sufficient for construction of the plant is available. Land belongs to the Government, it is not used for agrifulture. Price of one hectare is 100 thou rials. Terrain of the site is calm. Soils are represented by secondary rock (sandy clay).

Rudeshur river is passing 1 km far from the site. Water in the river is salty. Seismicity of the area is about 7 points in Richter scale.

5.2.6.2. Climate

Climate is dry subtropical

Maximum annual temperature + 41.2°C

Minimum annual temperature - 9.8°C

Average annual temperature + 17.9°C

Average annual maximum + 22.6°C
Average annual minimum + 12.6°C
Average annual precipitation 210.8 mm
Maximum precipitation per day 26 mm
Number of cold days per year - 34

5.2.6.3. Roads

Site is adjacent to the Tehran - Arak railway.

Motor road Tehran - Arak is passing 2 km far from the site.

5.2.6.4. Passenger transportation systems

Personnel can be brought to the plant site by railway and buses from Tehran and closely located towns and villages.

5.2.6.5. Water supply

Water supply data are not available. Proposed source is underground water. Hydrological investigations are required.

5.2.6.6. Power supply

Regional substation of Ministry of Energy is located 3 km far from the plant site. To solve the problem of plant power supply it is necessary to agree upon the conditions of plant connection with power grid of the Ministry of Energy of Iran.

5.2.6.7. Fuel

Gas pipe line is passing less than 10 km far from the site.

Conditions of plant connection to the gas pipe line should be agreed upon with Ministry of Energy of Iran.

Fuel oil will be supplied to the plant from Tehran.

5.2.6.8. Manpower

Most of manpower for the plant will be supplied from Tehran (population about 6 mln.people) and Islam Shahr (population about 100 thou.people) and nearest townships.

5.2.6.9. Environmental control

Sanitary zone of 3 km from populated areas is available. But special permission of sanitary inspection of Tehran is required for location of alumina plant on this site.

5.2.7. Selection of the site in Salafchegon region

5.2.7.1. This site is located in the nearest proximity to Salafchegon railway station of Tehran-Arak railway. The distance from Haftsandooq alunite deposit is 425 km. The distance to Arak where aluminium plant is located is 100 km. Area of land suffi-

cient for plant construction is available. Land belongs to Government. It is not used for agriculture. Price of one hectare is 100 thou.rials. Terrain of the site is calm.

Soil is represented by secondary rocks (sandy clay with high content of rock fragments).

Seismicity is 7 points in Richter scale.

5.2.7.2. Climate is dry subtropical

Maximum annual temperature + 40°C

Minimum annual temperature - 17°C

Average annual temperature + 13.6°C

Average annual maximum temperature + 21.3°C

Average annual minimum temperature + 5.8°C

Average annual precipitation 284 mm

Maximum precipitation per day 32.6 mm

Number of cold days per year 95

5.2.7.3. Roads

The site is adjacent to Tehran-Arak railway.

Motor roads Tehran-Arak and Qom-Arak are passing 1 km far from the site. Distance to Qom is about 50 km.

5.2.7.4. Passenger transport system

Personnel can be brought to the plant site by automobile transport from Qom and closely located towns and villages.

5.2.7.5. Water Supply

Water supply data are not available. Proposed source is underground water. Hydrological investigations are required.

5.2.7.6. Power Supply

State power transmission line is passing several km far from the site. It is necessary to agree upon the conditions of connection of the plant power lines with Ministry of Energy.

5.2.7.7. Fuel

Gas pipe line is passing 2 km far from the site.

Conditions of plant connection to the gas pipe line should be agreed upon with Ministry of Energy.

Fuel oil will be supplied to the site from Tehran.

5.2.7.8. Manpower

Most of manpower for the plant will be supplied from Qom with population 400 thou. people and nearby towns and villages.

5.2.7.9. Environmental control.

3 km sanitary zone is available.

5.2.8. Summarized table of comparative evaluation of plant site location variants

SRL No.	Description of Evaluated parameters	Alumina plant sites		
		Takestan	Rudeshur	Salfchegon
1	Distance between site and alunite ore deposit, km	15	262	423
2	Distance to alumina consumer (Arak aluminium plant), km	513	261	100
3	Site			
3.1	Size, hectares	600	600	600
3.2	Landowner	Government		
3.3	Price, rials/hectare	100thou.Rls	100thou.Rls	100thou. Rls
4	Seismicity, points in Richter scale	7	7	7
5	Availability of infrastructure units (power transmission lines, gas pipe line, railway and motor road)	yes	yes	yes
6	Conditions of utilization of infrastructure units	Approximately the same from capital investment point of view		
7	Water supply	Underground water sources are available. Confirmation of water reserves is required	Water sources data are not available	
8	Distance to populated areas	4 km	more than 3 km	more than 3 km
9	Size of sanitary zone	3 km	3 km	3 km
10	Comparative transportation costs/mln Rls/year*	382	917	1370

5.2.9. Conclusions

5.2.9.1. All three sites of the alumina plant location (Takestan, Rudeshur and Salafchegon) are equal from the point of view of following factors:

- availability of land and conditions of its aquisition;
- availability of existing infrastructure facilities, which could be used for the alumina plant.

5.2.9.2. Only two sites - Takestan and Salafchegon - can be recommended from the point of view of supply of the Alumina plant with industrial water. For these two sites the alternative sources of industrial water supply of alumina plant are available:

for the Takestan site - Abhar Roud river;

for Salafchegon site - Qom river.

5.2.9.3. Environmental control.

The Rudeshur site can not be recommended from the environment protection point of view as this site is located within the 100 km zone of Tehran. The construction of industrial plants with harmful emmissions to the atmosphere is not recommended in this zone.

5.2.9.4. The Takestan site is the most advantageous site from the point of view of transportation costs as it is located in the region of Haftsandooq alunite ore deposit.

5.2.9.5. Taking into consideration the above mentioned the location of the alumina plant is assumed in the Feasibility Report at Takestan site.

Salafchegon site is assumed as a reserve site for location of alumina plant, which can be considered at the next engineering stages of the alumina plant, if required.

5.3. General Layout and Transport

5.3.1. General Layout (drawing No 1389973-ПЛ)

Alumina plant, including production of potassium sulphate and proposed sulphuric acid production, is located on the site mentioned above extended from east to west with sizes 600 by 1300 m with drop of terrain levels from 1405-1408 m close to northern boundary to 1394-1396 - at southern boundary.

The General layout on the above site was worked out based on following conditions:

- receiving of alunite raw material supplied from the northern side of the site by motor road transport or by ropeway,
- shipment of finished product alumina, by railway,
- technological sequence of alunite raw material processing to alumina,
- local conditions - dominating winds, terrain of area and location of infrastructure facilities.

Based on the conditions listed above, all the units on general layout are oriented from west to east, and two functional zones are singled out-northern and southern zones:

- main technological and power facilities, including heat and power plant, as well as the preplant area are located in northern zone;
- in the southern zone mainly the repair and storage facilities and insite railways are located.

The facilities for receiving and treatment of run-of-mine alunite ore are located close to the boundary of the northern zone, and commercial alumina storage with the equipment for its shipment are located on railway tracks in southern zone. The main insite motor road passes between the above zones, close to which the rack of process and heat pipelines is located, as well as the main water supply, sewerage and mud removal pipelines. Based on the terrain conditions with a gradient from north to south of 0.025 to 0.03, the site levelling provides for partial escavation of soil in northern part of the site in volume of about 500000 m^3, and for back filling in the southern part in volume of 600000 m^3. As a result the drop of levels from northern site boundary to southern boundary will be 7.5 m, and the average gradient of levelled area will be 0.012.

As a result of the decisions taken on the general layout its characteristics are expressed by the following values:

Srl. No	Characteristic description	Unit of measure	Quantity
1	Total surface area inside the plant fence	hectares	72.0
2	Area built-up with buildings and structures (without sulphuric acid production)	hectares	22.0
3	Building density	%	34
4	Length of insite motor roads	km	14.0
5	Surface area of motor road pavement	hectares	12.5
6	Length of insite railways	km	4.0
7	Levelling		
	- soil escavation	m^3	500,000
	- back filling	m^3	600,000

Besides the alumina plant site the present Feasibility Report provides for the mud field with the area of about 40 hectares (taking into account the mechanical protecting dyke and rain water settling pond - 55 hectares), located in 1.5 km south-west of the plant. The characteristic of mud field is given in Chapter 6.6.

5.3.2. Transport

The concepts of transport are assumed based on the following annual freight quantities of raw materials and finished products.

Srl No	Freight description	Consigner	Consignee	Type of transport	Type of packing	Quantity, thou.t
1	2	3	4	5	6	7
	I. Arrival					
1.1	Alunite	mine	plant	dump truck		1610

1	2	3	4	5	6	7
1.3	Sulphur	Sorahs	plant	railway		81
1.4	Caustic potash	Julfa	-do-	-do-	-do-	94
1.5	Filter cloth			-do-		60
1.6	Fuel (fuel oil)	Tehran	plant	railway	tank car	69.5
	Total of incomming freight					1914.5
	2. Shipment					
2.1	Alumina	From plant to the aluminium Smelter in Arak		railway	tank car	200
2.2	Potassium sulphates	from plant		railway		216
	TOTAL shipped freights					416
GRAND	TOTAL volume of freight					2330.5
	including:					
	railway transportation					720.5
	motor road transportation (or ropeway)					1610

To implement cargo shipment in above volumes it is required to construct the following structures to be designed by ARMP:

- access railway road about 4 km long;
- access motor road, as well as a motor road or ropeway to handle alunite ore from the mine to the plant.

Schedule 5-1

Estimate of Investment Cost

Land

Project component Land Rent

No	Quantity	Unit	Item description	Local	Foreign	Unit cost Rls thou.	Cost Rls thou. Foreign	Local	Total
1	127	ha	Land rent	+	-	100.0	-	12700	12700
			Total				-	12700	12700
			Rounded to Rls million					12.7	12.7

VI. PROJECT ENGINEERING

6.1. Project layouts

6.1.1. Initial Data

Main initial data for preparation of process calculations, drawings and general layout of the plant are assumed as follows:

- plant capacity - 200 thou.tpy of alumina
- production program;
- technology of alunite-based alumina production;
- operating conditions of process production areas;
- Initial data for elaboration of the Feasibility Study for alunite based alumina plant, handed-over by ARMP in October 1987.

612. Scope of design documentation

In accordance with UNIDO contract No. 85/108 (Appendices 1,2 and 3) the Subcontractor should elaborate the Feasibility Report of the Alumina plant construction.

The Iranian partner - ARMP - should prepare the following materials for the Feasibility Report:

- alunite mine, including transportation system from the mine to the Alumina plant;
- infrastructure facilities of the Alumina plant;
- Sulphuric acid production;
- processing of mud for mud disposal.

6.2. Scope of project

The following units and facilities are included in the scope of the project:

- alunite mine;
- alumina plant (process, repair and Support facilities) - drawing No 1389973-ГП ;
- infrastructure facilities:
  external power supply, sewerage, railways and motor roads,
  heat-and-power plant (HPP).

The proposals for the Heat-and-power plant are elaborated by the Subcontractor in addition to the Feasibility Report of the Alumina plant with in the framework of rendering technical assistance to the Iranian side.

6.3. Technology

For processing of Iranian alunites in the Feasibility study technology for which there is an industrial experience is assumed. Processing method realized at Kirovabad aluminium plant in 1966 is called alkaline-reduction process.

An alternative process for Iranian alunites can be realized in alkaline method of processing of raw alunite without preliminary thermal roasting and reduction. This method is developed in the USSR on bench scale.

6.3.1. Alkaline-reduction process.

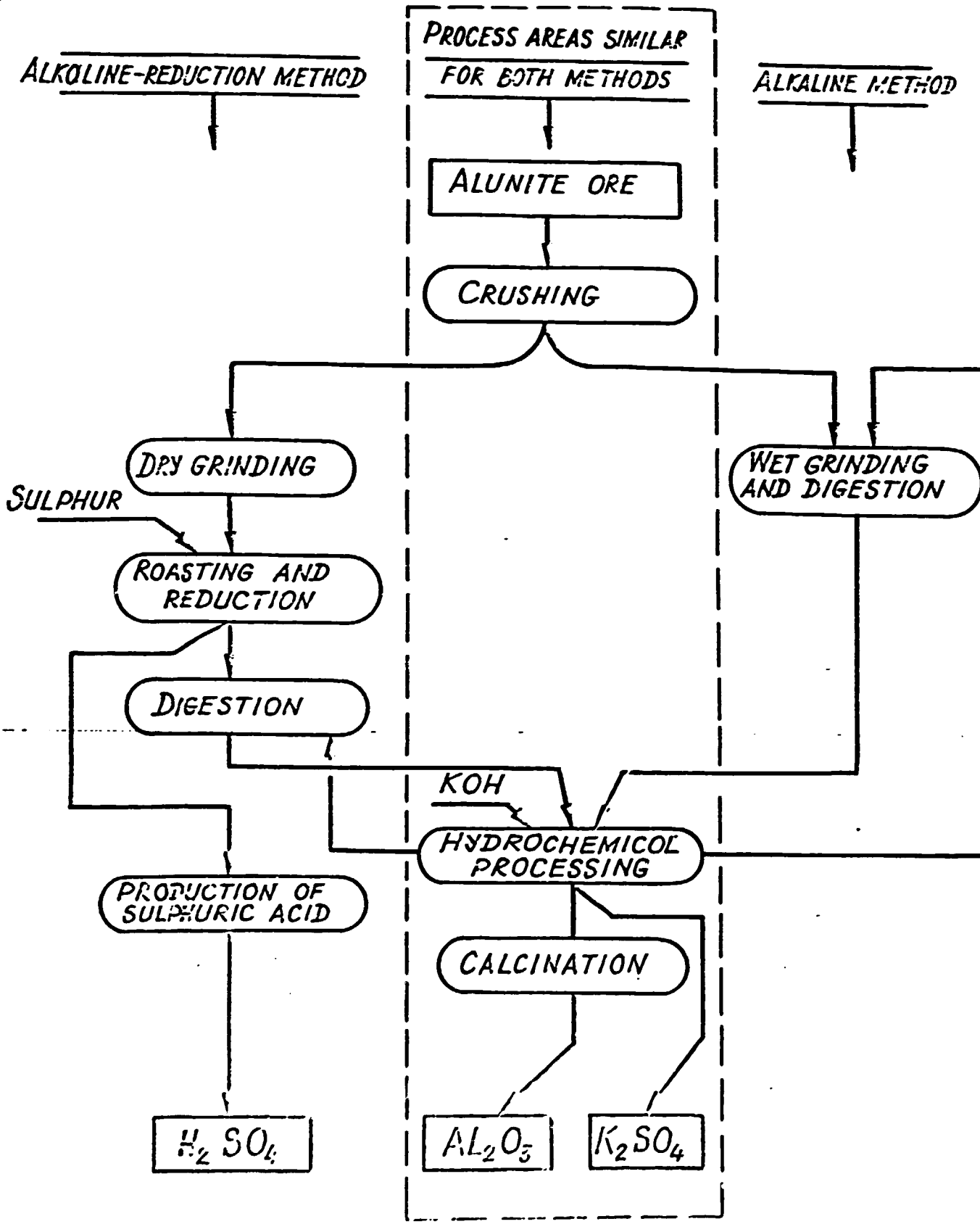
According to this method alunite ore crushed up to - 20 mm coarse is sent for dry grinding in ball mills up to the coarseness of - 0.15 mm. Ground ore is roasted and then reduced in fluid bed apparatus. Fuel oil and natural gas is used as fuel. Natural sulphur without any organic impurities is used as reducing agent. Sulphurous gas from fluid bed apparatus in which reduction of alunite takes place, after purification from dust is sent for production of sulphuric acid. Production of sulphuric acid is arranged based on conventional method of its production from natural sulphur.

Reduced alunite is sent for digestion under atmospheric pressure by spent alkaline liquor. Mud and aluminate liquor is obtained as a result of digestion. Alunite alumina, potassium and sodium sulphates are transferred to the aluminate liquor from the ore.

All silica is transferred to the mud, as well as non-alunite alumina, iron and other impurities. Part of caustic alkali is transferred to the mud from the liquor in the form of alkaline hydroalumosilicates, part is bound in sulphate due to interaction with not fully reduced aluminium sulph-e from alunite ore. All the lossed of caustic alkali are compensated by potassium hydroxide.

Alunite mud is separated in the hydroseparator into coarse and fine fractions. Coarse fraction is filtered and washed on filters and fine fraction is thickened and washed by counter-current method in washers (settling tanks) similar to mud,

PRINCIPAL PROCESS FLOWSHEET OF ALUNITE ORE PROCESSING BASED ON TWO METHODS



obtained in processing of bauxites by Bayer process. Washed mud is sent by hydrotransport to mud disposal. After separation from mud aluminate liquor is sent for desilication and evaporation. In the process of desilication silica in the form of alkaline hydroalumosilicate is removed from the liquor. Evaporation is required for maintaining of alumina production balance in water and for extraction of potassium and sodium sulphate salt mixture from aluminate liquor. This salt mixture is treated with potassium alkali which is brought from outside. As a result of it wasteless potassium sulphate (not containing chlorine) with 52% content of potassium oxide and alkaline liquor enriched by sodium are produced. Alkaline liquor is sent back to alumina production for compensation of caustic alkali losses in the process. Concentrated by evaporation aluminate liquor after extraction of sulphate salts of potassium and sodium is diluted by washing waters obtained after mud washing and sent for precipitation similar to Bayer process. Obtained aluminium hydroxide is filtered and washed at drum vacuum-filters and then it is calcined in fluid bed kilns with production of commercial metallurgical alumina.

After separation of aluminium hydroxide mother liquor is mixed with alkaline liquor from potassium sulphate production and used as spent alkaline liquor at digestion of reduced alunite.

Based on this process the following products are produced:

- metallurgical alumina
- potassium sulphate
- sulphuric acid.

6.3.2. Alkaline method of alunite ore processing without preliminary thermal roasting and reduction.

This method is developed on bench scale in the USSR. It is not used on the industrial scale.

Concept of this method is the following:

Alunite ore crushed up to - 20 mm coarse is sent to wet grinding in ball or rod mills. Spent alkaline liquor is used as liquid phase. Process of grinding is combined with digestion of alumina and sulphate salts of potassium and sodium. After that mud is separated and washed as it is described in para 6.1.1. Further processing of aluminate liquor is also carried out by

the process, described in para 6.1.1.

Alkaline method does not require dry grinding, thermal roasting and reduction of ore and sulphuric acid production.

But in processing of raw alunite ore by alkaline method increased quantity of potassium caustic alkali is required in comparison with alkaline-reduction method due to its interaction with aluminium sulphate of alunite ore and formation of potassium sulphate.

Due to higher content of sulphate ions in aluminate liquor its concentration is decreased in order to provide solubility of sulphate salts, i.e. process flow of aluminate liquor is increased by 20% compared to alkaline-reduction process.

Based on the alkaline method of raw alunite ore processing the following products are produced:

- metallurgical alumina
- potassium sulphate.

6.3.3. Comparison of considered variants of technology

6.3.3.1. Capital investment

On the attached principal flowsheet differences in technological variants by main process areas are shown. Process areas which are similar for both technological variants are shown in the middle of the flowsheet. Separating borders are shown by dotted lines.

In processing of raw alunite ore without thermal process areas of roasting and reduction by alkaline process the following process areas are excluded:

- dry grinding
- thermal roasting and reduction
- sulphuric acid plant.

Instead of this process areas wet grinding of raw alunite combined with digestion should be constructed.

Other production areas remain practically the same. The only exception is sulphate processing areas which are 2.4 times more that in alkaline-reduction variant.

According to the expert estimation total capital investment for raw alunite processing based on alkaline method amounts to

70% of capital investment required for alkaline-reduction process.

6.3.3.2. Operating costs

In Table specific norms of consumption of raw materials, other inputs, fuel and utilities required for production of 1 t of alumina from alunite ore by two considered methods are given.

Specific consumption of alunite ore in its processing by alkaline method is 15% less that in processing of ore by alkaline-reduction method.

Specific consumption of potassium alkali in alkaline method is 3 times higher than in alkaline-reduction process.

Specific consumption of fuel and $\frac{el.}{}$power in alkaline method is approximately 2,5 times lower in comparison with alkaline-reduction process.

Specific sonsumption of steam in alkaline method is 25% higher than in alkaline-reduction process.

Based on the prices existing in Iran by the end of 1987 total cost of consumed ore, potassium hydroxide, fuel, $\frac{el.}{}$power and steam per 1t of alumina in alkaline process is approximately 5000 Rials higher than in alkaline-reduction method. The reason of this in high specific consumption of potassium hydroxide.

Table

Specific consumption parameters per 1t of alumina for both process methods considered

Category of expenses	Unit of measurement	Alkaline-reduction method of alunite processing	Alkaline method of raw alunite processing
1	2	3	4
1. Consumption of raw materials and other materials:			
- alunite ore	t	6.95	5.95
- potassium hydroxide	t	0.45	1.26
- sulphur	t	0.42	-
2. Fuel and energy:			

1	2	3	4
- fuel	t of conven. fuel	0.4	0.17
- el. power	KWH	1350	500
- steam	Gcal	4.0	5.0
3. Commercial products:			
- alumina	t	1.0	1.0
- potassium sulphate	t	1.08	2.4
- sulphuric acid	t	2.0	-

6.3.3.3. Dependence of processes on import supplies.

In both methods potassium hydroxide is used for hydrochemical processing of alunite and production of potassium sulphate. Potassium hydroxide is not produced in Iran and should be imported.

According to the technology of alunite processing by alkaline-reduction method in case of plant capacity of 200 thou tpy of alumina it is required to import 90 thou t of KOH per year. It will cost 19.3 mln dollars per year.

According to the technology of raw alunite ore processing by alkaline method in case of same capacity of the plant it is required to import 252 thou t of KOH, which will cost 54.18 mln dollars.

All this show that alkaline method of raw alunite ore processing suffers more influence from import supplies than alkaline-reduction method.

6.3.3.4. Comparison of assortment and cost of produced commercial products

Srl Nos.	Description of products	Alkaline-reduction process		Alkaline process	
		Quantity of product per-year, thou t	Cost of product mln Rls	Quantity of product per year, thou t	Cost of product mln Rls.
1	Alumina	200	4000	200	4000
2	Potassium sulphate	216	4900	480	II760
3	Sulphuric acid	400	I400	-	-
	Total	816	I0300	680	I5760
4	Difference in cost of products				+ 5460
5	Products consumed at local market:				
	- alumina	200	4000	200	4000
	- Potassium sulphate	100	2450	100	2450
	Total		6450		6450
6	Exported products:				
	- potassium sulphate	116	2450	380	93I0
	- sulphuric acid	400	I400	-	-
	Total		3850		93I0

6.3.3.5. Equisition of technology

For utilization of both processes license for know-how should be purchased.

There is industrial experience in alkaline-reduction method of alunite ore processing in the USSR.

There is experience of short-term industrial testing of technology of raw alunite processing with production of alumina and potassium sulphate at Kirovabad aluminium plant based on alkaline method. It was based on the utilization of know-how of hydrochemical processing of reduced alunite.

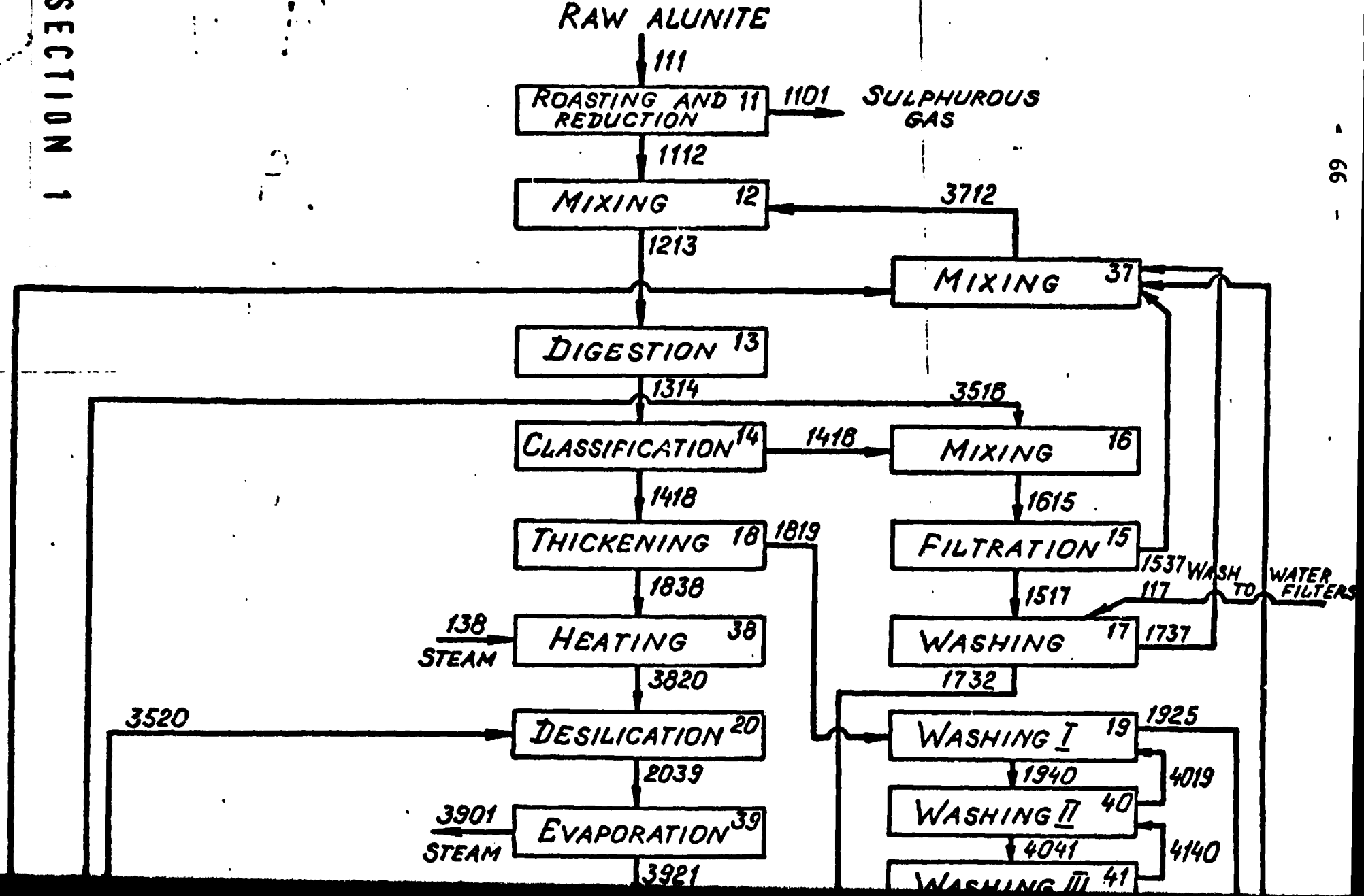
Price of know-how for this process will amount to 70% of know-how price for alkaline-reduction method.

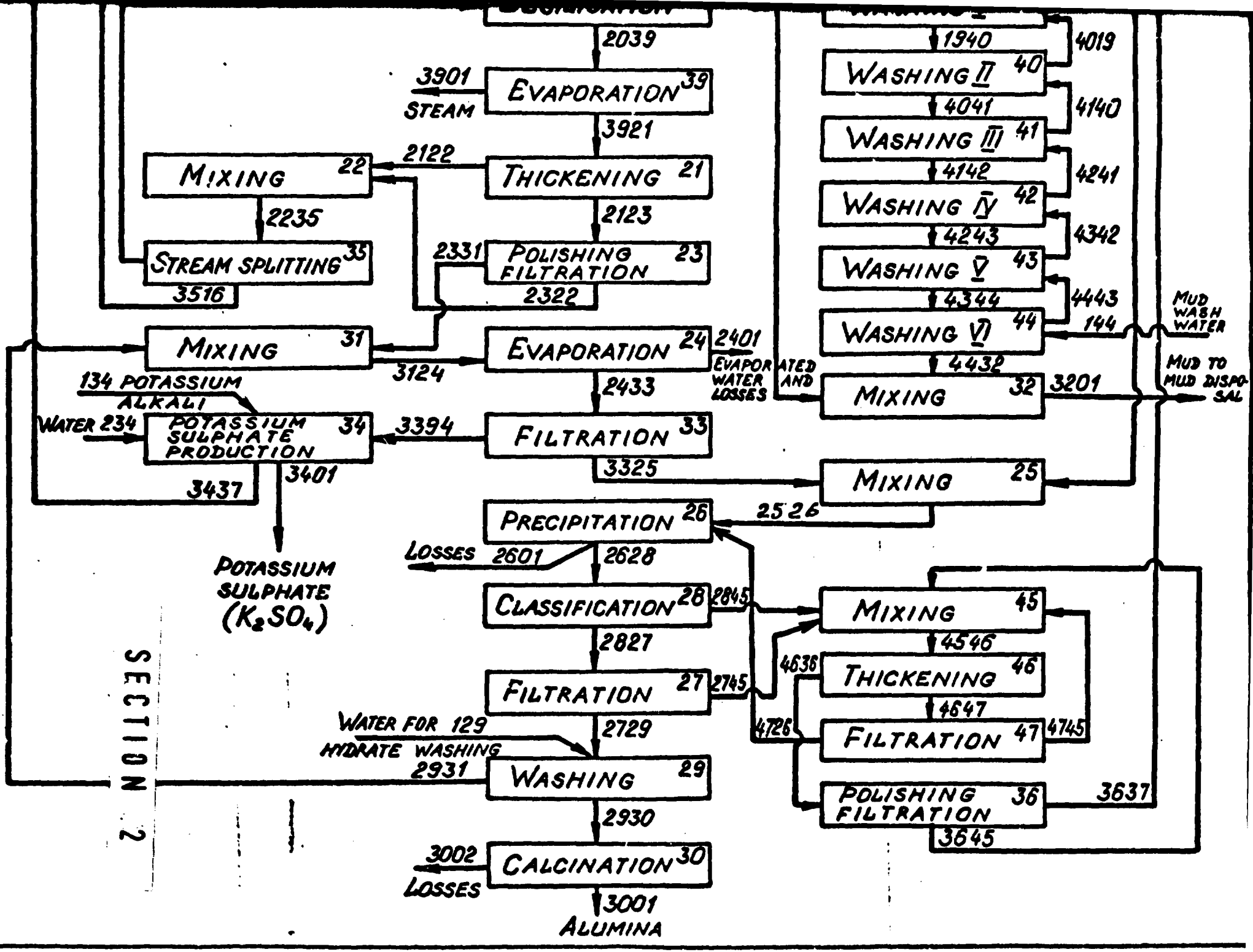
6.3.3.6. Reliability

All the process and techno-economical parameters assumed in the design for the technology of alkaline-reduction method of alunite ore processing will be guaranteed by 20 years experience of industrial processing of alunite ore at Kirovabad aluminium plant.

As far as alkaline method of raw alunite ore processing is concerned according to Subcontractor's oppinion at first stage it is reasonable to construct a Demonstraction Unit with capacity of 30-40 thou tpy of alumina. After long-term testing of this process at Demonstration Unit it is possible to start extension of plant capacity up to 200-300 thou tpy of alumina.

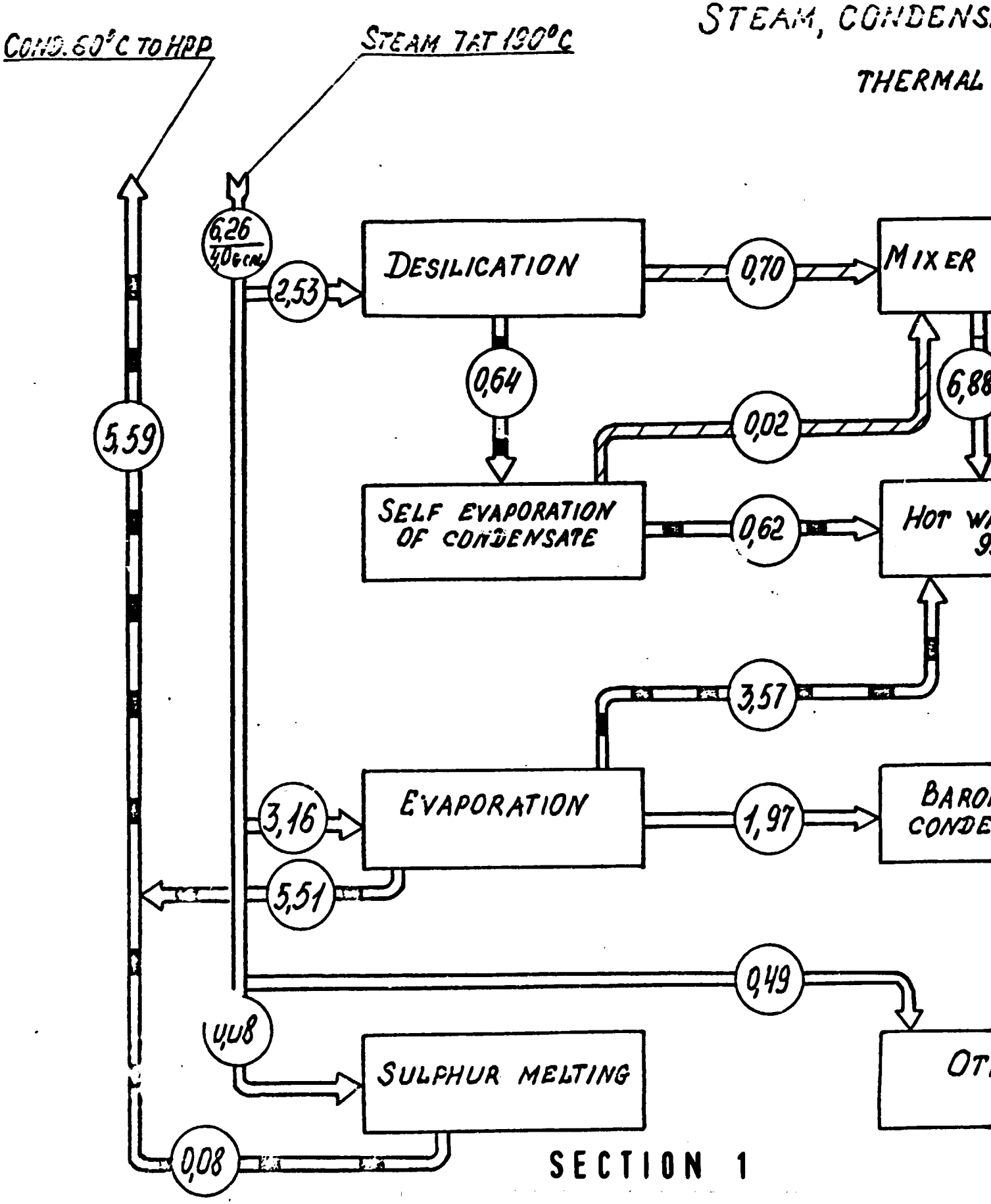
FLOWSHEET FOR CALCULATION OF ALUMINA PLANT MATERIAL BALANCE




2039
3901
STEAM
EVAPORATION 39
3921
2122
MIXING 22
THICKENING 21
2123
2235
STREAM SPLITTING 35
2331
POLISHING FILTRATION 23
3516
2322
MIXING 31
3124
EVAPORATION 24
2401
EVAPORATED AND WATER LOSSES
2433
134 POTASSIUM ALKALI
WATER 234
POTASSIUM SULPHATE PRODUCTION 34
3394
FILTRATION 33
3437
3401
3325
MIXING 25
POTASSIUM SULPHATE (K_2SO_4)
PRECIPITATION 26
2526
LOSSES 2601
2628
CLASSIFICATION 28
2845
2827
FILTRATION 27
2745
WATER FOR 129 HYDRATE WASHING
2729
2931
WASHING 29
2930
3002
LOSSES
CALCINATION 30
3001
ALUMINA
1940
4019
WASHING II 40
4041
4140
WASHING III 41
4142
4241
WASHING IV 42
4243
4342
WASHING V 43
4344
4443
WASHING VI 44
144
MUD WASH WATER
4432
MIXING 32
3201
MUD TO MUD DISPOSAL
MIXING 45
4546
4636
THICKENING 46
4647
4726
FILTRATION 47
4745
POLISHING FILTRATION 36
3637
3645
SECTION 2

STEAM, CONDENS

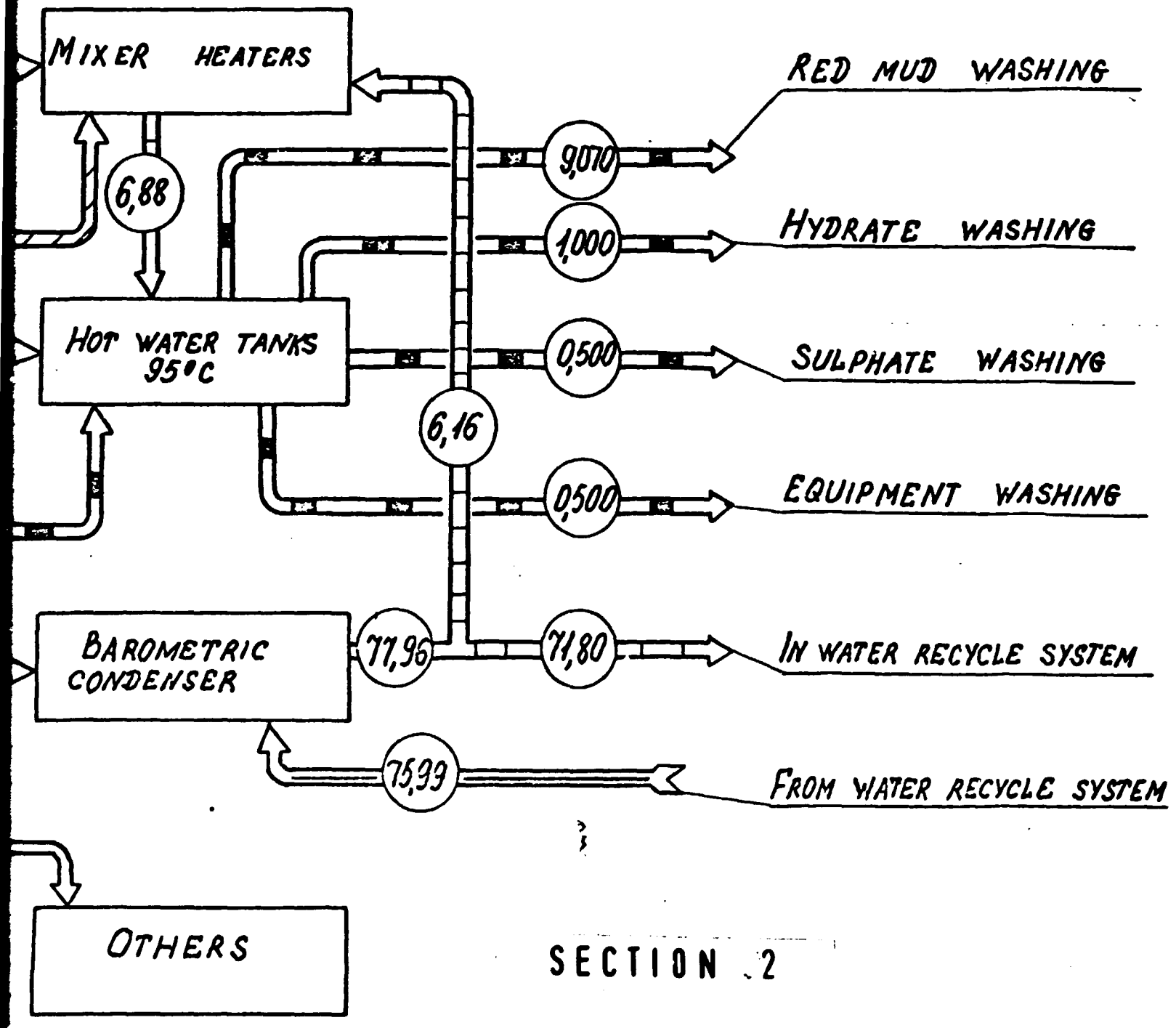
THERMAL



SECTION 1

ONDENSATE AND WATER CONSUMPTION T/T ALUMINA

THERMAL BALANCE OF HYDROCHEMICAL STAGES



SECTION 2

ALUMINA

SECTION 3

MUD WASHING

TE WASHING

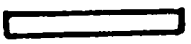
ATE WASHING

MENT WASHING

R RECYCLE SYSTEM

ATER RECYCLE SYSTEM

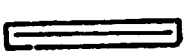
LEGEND



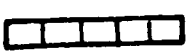
STEAM

CONDENSATE

SECONDARY STEAM



COOL RECYCLING WATER



HOT RECYCLING WATER

6.4. Selection of main process equipment

Plant for production of alumina and potassium sulphate as well as sulphurous gas for sulphiric acid production from alunite is a complicated continuous production including the following process operations:

- receiving of ore
- crushing of ore
- blending of ore at store
- grinding of the ore
- roasting and reduction of ore
- digestion of reduced ore
- separation of mud from aluminate liquor and mud washing
- removal of mud
- desilication of aluminate liquor
- evaporation of aluminate liquor with extraction of sulphate salts
- processing of sulphate salts with production of potassium sulphate
- potassium sulphate drying
- precipitation of aluminate liquor
- processing of aluminium hydroxide
- alumina calcination
- storage of potassium sulphate.

Main process equipment is selected based on ensuring normal feasible capacity of alumina production equal to 200 thou tpy.

Equipment is selected for every process area in accordance with:

- estimated material balande;
- duration of equipment operation;
- specific capacity of the equipment. Under the conditions of continuous operation of all installed equipment maximum achievable capacity of 230 thou. tpy of alumina is provided.

6.4.1. Receiving unit and ore crushing
(Drwgs.Nos.1339545-TM, 1339547-TM, 1339548-TM)

Ore (- 150 mm coarse) is transported to the plant by ropeway. Operation is arranged in two shifts, 7 hours per shift.

Number of working days per year is 250.

Receiving unit is a bin, in which alunite ore is unloaded. Apron feeder (heavy-type) is installed under the bin for unloading of the ore from the bin. Estimated average flow of ore per hour is the following;

$$\frac{6.95 \times 200.000}{250 \times 14} = 397 \text{ t/h or } 400 \text{ t/h}$$

where: 6.95 - specific consumption of alunite (t)
200.000 - plant capacity in alumina (t)
250 - number of working days per year
14 - operation hours per day.

At the plant the ore is crushed in two steges.

For secondary crushing 1 cone crusher is assumed, dia.2200, which crushes the ore from - 150 mm to - 80 mm.

Inertia screen which provides for screening of - 80 mm lumps is installed before the crusher.

Fine crushing of the ore from - 80 mm to - 12 mm is carried out in three short cone crushers 2200 mm dia. which are operated in closed cycle. 2 inertia screens are installed before every crusher. Circulating flow of ore is assumed equal to 1200 t/h.

6.4.2. Ore blending storage (drg.No 1339549-TM)

Ore is sent to the storage after fine crushing (- 12 mm). Store is in operation 24 hours per day according to the operation conditions of the alumina plant.

Store is closed-type to reduce the dusting of the environment.

Two piles of ore, 100000 t each, are foreseen at the store. One pile is formed with ore blending, from another one the ore is consumed. Store is equipped with stacker for formation of piles. Unloading from piles is foreseen by bucket-wheel excavator. For provision of its repair one stand-by excavator is foreseen. One pile provides for the reserve of crushed ore for 25 days, and the possibility of stacker capital repair.

6.4.3. Dry grinding (drg.No 1339551-TM)

Due to the reason that the ground ore is sent for thermal roasting and reduction dry method of ore grinding is assumed to

reduce the fuel consumption.

Grinding of ore takes place in ball mills in closed cycle. Similar to preparation of coal dust for burning. Classification of ground ore is arranged in air flow in separator and cyclone subsequently.

For disposal of excess air its purification in electrostatic precipitator (ESP) is foreseen.

Coarseness of finished product is as follows:

- 0.065 mm - 50-55%; + 0.147 mm - less than 5%.

Alunite flow per hour for dry grinding is 180 t/h (for provision of three operating roasting and reduction furnaces).

Based on the experience of Kirovabad aluminium plant operation and due to high abrasiveness of alunite ore and high labour requirement for repair of dust system and mills, utilization factor of grinding unit is assumed as 0.7.

Number of required mills is equal to:

$$\frac{180}{60 \times 0.7} = 4.3 \text{ pcs,}$$

where 60 is the capacity of one mill, t/hr

5 mills are to be installed.

6.4.4. Roasting and reduction (drg.No 1390368-TK)

For provision of normal capacity (200 thou tpy of alumina) it is required to process the following average quantity of alunite ore:

$$\frac{6.95 \times 200.000}{8760} = 158 \text{ t/h}$$

Roasting furnaces 10 m dia. and reduction furnaces 6 m dia. are assumed to be installed. Optimum velocity of furnace gases in fluid bed is 0.27 m/sec. Capacity of one roasting and reduction unit is 60 t/h (for raw alunite). Similar furnaces are under operation on industrial scale at Kirovabad aluminium plant in the USSR. Utilization factor k = 0.88 Required number of units is equal to:

$$\frac{158}{6.95 \times 0.88} = 3.0 \text{ pcs.}$$

In case of simultaneous operation of three units maximum achievable capacity for alumina will be equal to:

$$\frac{3 \times 60 \times 8760}{6.95} = 227000 \text{ t/y}$$

Due to the fact that this process area is the most capital consumable, maximum achievable capacity is determined by throughput capacity of this particular process area.

6.4.5. Digestion (drg.No 1339552-TM)

Digestion of reduced alunite is carried out in chain agitators under atmospheric pressure and temperature of 80°C. Slurry flow through the digestion agitators should provide for alunite processing coming from three operation units of roasting and reduction, It amounts to:

$$\frac{180 \times 25.52}{6.95} = 660 \text{ m}^3/\text{h}$$

where:
180 - quantity of raw alunite ore processed per hour, t/h
6.95 - specific quantity of alunite ore per 1 t of alumina, t/t
25.52 - specific flow of slurry for digestion per 1 t of alumina, m^3/t

Required capacity of digestion agitators in case of digestion period of 40 min is equal to:

$$\frac{660 \times 40}{60} = 440 \text{ m}^3$$

2 batteries of 5 agitators 4.5 x 6 m dia. in each battery are assumed to be installed. Working capacity of one battery is 250 m^3. To separate the mud from aluminate liquor hydroseparators, rotary filters and thickeners are used.

6.4.6. Hydroseparators (drg.No 1339552-TM)

For classification of slurry after digestion cone hydroseparators of settling type without agitating unit are used. For extraction of sandy fraction (70% of mud) velocity of over flow from hydroseparators is 2.6 m/h.

Hydroseparators of 10 m dia. are assumed to be installed. Settling area is 78.5 m^2.

Estimated rate of overflow per hour is:

$$\frac{180 \times 22.51}{6.9} = 583 \text{ m}^3/\text{h}$$

where: 22.51 - is a specific rate of over flow of hydroseparators per 1 t of alumina based on the material balance, m^3/t

$\frac{180}{6.95}$ = 25.9 - estimated capacity in alumina, t/h

Estimated number of hydroseparators in operation is:

$\frac{583}{2.6 \times 78.5}$ = 2.85 pcs.

4 hydroseparators are assumed, among them 3 are working and 1 is stand-by for cleaning and repair.

6.4.7. Rotary filters (drg.No. 1339552-TM)

For filtration and washing of sandy fraction of mud vacuum rotary-type filters are used due to the reason that drum filters can not be operated with these slurries because of clogging of filter tray. Filters with 50 m^2 filtration area are assumed for installation.

Required number of filters amounts to:

$\frac{2.765 \times 25.9}{50 \times 0.8 \times 0,3}$ = 6 pcs.

where: 2.765 - specific quantity of mud per 1 t of alumina, t/t

25.9 - estimated capacity of the plant per hour in alumina, t/h

0.8 - utilization factor of filters

0.3 - specific capacity of the filter in mud filtration and washing, $t/m^2.h$.

6 filters are assumed for installation.

6.4.8. Thickners for clarification of aluminate liquor and washing of fine slurry (drg.No 1339552-TM)

For purification of the liquor from fine fraction of mud single-chamber thickners with central unloading and cone angle of the bottom equal to 10° are assumed. Thickning area is selected based on the rate of over-flow, which is equal to 0.35 m/h. Required thickening area is equal to:

$\frac{19.86 \times 25.9}{0.35}$ = 1470 m^2,

where: 19.86 - specific rate of thickeners overflow per 1 t of alumina, m^3/t

Ratio between the area of thickening and the area of washing is assumed as 2:1.

There are 6 stages of washing.

Single-chamber thickeners of 32 m dia. with thickening area of 800 m^2 are assumed for installation. There are 9 pcs. including 2 thickeners, 6 washers, and 1 common stand-by for cleaning and repair.

6.4.9. Desilication (drg.No 1339552-TM)

Desilication of aluminate liquor is carried out in autoclaves under the temperature 135°C.

Desilication period is 1.7 hours. Required working capacity of autoclave is equal to:

$$22.46 \times 25.9 \times 1.7 = 989 \ m^3$$

where: 22.46 - specific quantity of desilicated slurry per 1 t of alumina, m^3/t

3 desilication batteries, 9 autoclaves in each, 63 m^3 capacity each are assumed for installation. One of them is heating, the other 8 - reactional. The operating capacity of one battery is 504 m^3. From 3 installed batteries 2 are working, 1 - stand-by. Cleaning of autoclave batteries takes place once in 4 months. Operation of each battery is continuous with two-stage pulp flashing for decreasing of pressure to atmospheric.

The first stage flash steam is used for preliminary heating of aluminate liquor through the surface of shell-and-tube heater. The second stage flash steam is used for heating of water used for process needs.

6.4.10. Thickening of white mud (drg.No 1339552-TM)

For clarification of liquor after desilication single-chamber thickeners with cone angle of 20° are used.

Liquor flowrate per hour is:

$$20.72 \times 25.9 = 537 \ m^3/h$$

where: 20,72 - specific rate of thickener over flow of white mud per 1 t of alumina, m^3/t

Based on the experience the overflow rate is equal to 0.6 m/h.

Required thickening area is:

$\frac{537}{0.6} = 895\ m^2$

4 single-chamber thickeners of 20 m dia. including 3 working and one stand-by are assumed. Area of every thickener is 314 m^2.

6.4.11. Filters for after filtration of aluminate liquor and washing water of mud (drg.No 1339552-TM)

For after filtration of overflow from white mud thickeners and washing water of alunite mud the automatic leaf filters under pressure are used.

Liquor flow rate per hour is 537 m^3/h.

Flow rate of washing water per hour 5.58 x 25.9 = 145 m^3/h, where 5.58 - specific quantity of washing water from washers per 1 t of alumina, m^3/t.

Filters are assumed with total surfece is 225 m^2.

For filtration of the liquor the number of filters are calculated: $\frac{537}{225 \times 0.8 \times 0.8} = 3.73$ pcs.

For filtration of washing water the number of filters are calculated: $\frac{145}{225 \times 0.6 \times 0.8} = 1.34$ pcs.

where 0.8 - utilization factor of filters

0.8 - specific capacity of filtration of aluminate liquor after desilication, m^3/m^2xh.

0.6 - specific capacity of filtration of alunite mud washing water.

7 filters are assumed (4 for filtration of aluminate liquor and 2 for washing water filtration , 1 - stand-by for regeneration of filter cloth and repair) for installation.

6.4.12. Evaporation (drg.No 1339553-TM)

For evaporation of aluminate liquor with simultaneous extraction of sulphate salts of potassium and sodium evaporation batteries are used. They consist of evaporation units with natural circulation. Multiplicity of fresh steam utilization is equal to 4.

Quantity of evaporated water is equal to (7.06 + 0.5) x x 25.9 = 196 t/h.

where: 7.06 - specific quantity of evaporated water per 1 t of

alumina based on material balance, t/t

0.5 - specific quantity of water after washing of evaporation batteries from sulphates, t/t.

Evaporation batteries consisting of 1000 m^2 units are assumed for installation. Capacity of four-block battery amounts to 75 t/h in evaporated water.

$\frac{196}{75}$ = 2.6 pcs.

4 batteries (3 working and 1 stand-by) are assumed for installation.

6.4.13. Thickening of sulphate salts (drg.1339553-TM)

For separation of sulphate salts from concentrated aluminate liquor after evaporation single-chamber thickeners with cone angle of 20° are used.

Overflow from the thickeners per hour:

14.28 x 25.9 = 370 m^3/h

where 14.28 - specific flow of strong liquor after evaporation per 1 t of alumina, m^3/t.

In case of over flow velocity is equal to 0.7 m/h required settling area is

$\frac{370}{0.7}$ = 528 m^2

Three thickeners of 20 m dia. (2 working and 1 stand-by) are assumed. with surface of 314 m^2 each.

6.4.14. Filtration of sulphate salts (drg.1339553-TM)

For filtration of sulphate salts drum vacuum filters are used. F = 40 m^2.

Flow rate of sulphate salts per hour amounts to:

1.01 x 25.9 = 26.2 t/h

where: 1.01 - specific flow of sulphate salts mixture extracted at evaporation per 1 t of alumina, t/h.

Specific productivity of filtration is 0.5 t/m^2

Required filtration area at every filtration stage is:

$\frac{26.2}{0.5}$ = 52.4 m^2

The following 8 filters are assumed for installation:

2 filters at the 1st stage of filtration
2 filters at the 2nd stage of filtration
2 filters at the 3d stage of filtration
2 filters at the 4th stage of filtration.

6. 4.15. Filtration centrifuges (drg.1339553-TK)

In order to decrease the moisture content before drying of production potassium sulphate filtration centrifuges (periodical-type) with drum diameter 2200 are used.

Flow rate of production potassium sulphate per hour is:
1.08 x 25.9 = 28 t/h

where 1.08 - specific flow rate of potassium sulphate per 1 t of alumina, t/t.

Average hour capacity of one centrifuge is 7.0 t/h.

Required number of centrifuges is equal to: $\frac{28}{7 \times 0.8}$ = 5 pcs.

where: 0.8 - utilization factor

5 centrifuges are assumed for unstallation.

Drum size is 2200.

6. 4.16. Sulphate drying (drg.1390369-TK)

Potassium sulphate before packing into bags is sent for drying for elimination of residual moisture (from 5% to 1%).

Fluid bed kilns are used as driers. They are the most fuel-saving units.

Capacity of every drier is 11.5 t/h.

Required number of driers amounts to:

$$\frac{28}{11.5 \times 0.85} = 2.86 \text{ pcs}$$

Three driers are assumed.

6. 4.17. Precipitation (drg. No 1339554-TK)

Cylindrical tanks with agitators or cylinder-cone tanks with air agitation can be used.

In this Feasibility Study precipitators with air agitation are assumed. They need less maintenance and are more reliable in operation.

Capacity of one precipitator is 3000 m^3. Specific flow rate of slurry of aluminate liquor with the seed is 24.52 m^3. Flow rate per hour is: 24.52 x 25.9 = 635 m^3/h.

Precipitation period is 60 hours. Required number of precipitators is:

$$\frac{635 \times 60}{3000} = 12.7 \text{ pcs.} \quad 13 \text{ pcs}$$

15 precipitators are to be installed (13 working and 1 standby for cleaning and maintenance, 1 for storage of hydrate slurry.

6.4.18. Aluminium hydroxide classification

The cone hydroseparators working on principle of settling are used for classification.

The overflow rate from hydroseparator is 2.5 m/h.

The hour overflow from hydroseparator is:

22.66x 25.9 = 587 m^3/hr,

where 22.66 - specific overflow from hydroseparator per 1 t of alumina, m^3/h.

10 m dia hydroseparators with surface area of 78.5 m^2 are adopted.

Estimated number of hydroseparators:

$$\frac{587}{78.5 \times 2.5} = 3 \text{ pcs}$$

3 hydroseparators are assumed for installation.

6.4.19. Thickening of aluminium hydroxide (drg. 1339554-TK)

For thickening aluminium hydroxide single-chamber thickeners with cone angle of the bottom equel to 20° are used.

Velocity of over flow from the thickeners is 0.4 m/h. Over flow rate per hour is:

18.65 x 25.9 = 483 m^3/h,

where 18.65 - specific over flow (of mother liquor) per 1 t of alumina, m^3/t

Required thickening area is:

$$\frac{483}{0.4} = 1207 \text{ m}^2$$

5 thickeners of 20 m dia. with thickening area equal to

314 m^2 each are assumed for installation, including 4 working and 1 stand-by.

6.4.20. Filters for seed filtration (drg.No 1339554-TM)

For seed filtration drum vacuum-filters are used. Quantity of hydroxide seed per hour is:

7.67 x 25.9 = 199 t/h per 1 t of alumina

7.67 - specific quantity of hydroxide seed, t/t

Specific capacity of filtration is: 2.5 $t/m^2.h$.

Estimated area of filtration is: $\frac{199}{2.5} = 79.6\ m^2$

3 filters with filtration area of 40 m^2 each are assumed for installation, one of them is stand-by, two- in operation.

6.4.21. Filters for filtration and washing of production aluminium hydroxide (drg.No 1339554-TM)

Drum vacuum-filters are used for filtration and washing of aluminium hydroxide. Filtration productivity per hour is:

25.9 x 1.53 = 39.6 t/h

where 1.53 - factor for calculation of Al_2O_3 to $Al(OH)_3$.

6 filters with filtration area of 20 m^2 are assumed for installation.

Among them:

2 filters - as 1st filtration

1 filter - at 1st washing

1 filter - at 2nd washing

2 filters - at the last stage of washing.

6.4.22. Calcination (drg.No 1390367-TM)

For calcination 1 fluid-bed kiln of 30 t/h of alumina capacity is assumed. For the period of kiln repair hydroxide store of 15 thou t capacity is foreseen.

6.4.23. Commercial alumina storage (drg.No 1390371-TM)

Commercial alumina storage consists of 2 silos 3000 m^3 of holding capacity each, ensuring the inventory for 7 days. The alumina is shipped in railway tank cars.

6.4.24. Potassium sulphate storage (dwg. 1390372-TM)

The potassium sulphate storage consists of 2 silos, 3000 m^3 capacity each to ensure a 7-day stock.

The storage will have a facility for bagging potassium sulfate. The facility will comprise 4 pneumatic bagging machines, 200 bags/h capacity each.

Bags are placed on pallets and loaded into rail cars by forktrucks.

Area will be provided at the storage for stacking the pallets with bags in two tiers.

6.4.25. Sulphur storage (dwg. 1390370-TM)

Sulphur is delivered to the storage in rail cars. The storage with a grab crane has capacity 3,500 m^3 to ensure a 10-day stock. Bins for sulphur melting are provided at the storage. The grab crane is used for loading the bins with sulphur. Molten sulfur is fed by centrifugal pumps to the roasting and reduction section.

6.4.26. Caustic storage (drwg. 1339555-TM)

Caustic is delivered to the plant in liquid form in rail tank cars. NaOH is supplied for the starting period of the plant, KOH - for normal operation.

To receive caustic provision is made for a receiving rail track for 10 tank cars. Storage of caustic is in two tanks, 3000 m^3 capacity each.

6.4.27. Major process equipment characteristics

To convert alunite ore into alumina, potassium sulphate and sulphurous gas for production of sulphuric acid or elementary sulphur, provision is basically made for the general-purpose equipment.

This equipment includes: stackers, bucket-wheel excavators, cone crushers, belt conveyors, feeders, handling equipment (cranes hoists), tanks with agitators, centrifugal pumps, mud settlers, filters, autoclaves, evaporators, fluid-bed calciners for alumina calcination (similar to that of "Lurgi", FRG).

In addition to the above equipment the alunite processing requires special equipment as described below.

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6.4.27.1. Dry grinding

For dry alunite grinding the use is made of the units similar to those used for preparation of pulverised coal for combustion.

The unit consists of a ball mill, separator, cyclone, mill fan.

The ball mill is used for grinding alunite ore in air stream.

The mill is a horizontally-arranged drum 3.7 m in diameter and 8.5 m in length.

The drum is lined with rubber to minimise wear-out.

Grinding balls charge is placed inside the mill. The ball charge is 100 t. The mill is driven by a 1600 kW motor. Ground alunite is entrapped by air stream and fed to the separator provided for separation of oversized particles of alunite ore.

The separator of air-swept type is a cylindrical and conic unit 4.75 m in diameter, fitted with bottom and top connections. Size separation is ensured by variation of speed of air stream.

The cylone is used for separation of ground alunite dust from air stream. Cyclone is 3.75 m in diameter.

The mill fan creates air stream passing through the grinding system.

The fan of radial-cantilever type has capacity of 170000 m^3/h, pressure 920 kg/m^2, motor is rated for 800 kW.

6.4.27.2. Alunite ore roasting

To roast alunite ore the use is made at the first stage of a cylindrical fluid-bed roaster with a shaft heat exchanger and at the second stage- the fluid-bed roaster with a controlled movement of materials.

The stage I fluid-bed roaster is fitted with connections for supply of fuel combustion products to the gas distribution grid and fuel burners located in the fluid bed.

The shaft heat exchanger is provided with one constriction unit with ratio of sectional areas in the wide and narrow units within 4-6 and is fitted with a connection for supply of heating gas from the stage II roaster.

The loading device is located above the constriction unit,

the height of which is 0.5-0.6 of its diameter.

Controlled movement of material in the stage II roaster is ensured by designing the roaster in such a way that its length is 5 to 15 times larger than its width, and by fitting vertical partitions in the fluid bed with openings, alternatively connected with the opposite sides of the casing, The partitions are located at the level of the fluid bed and the discharge connection.

The stage II roaster is provided with connections for supply of fuel combustion products to the gas distribution grid.

6.4.27.3. Reduction of alunite ore

The unit for reduction of the roasted alunite ore in the fluid bed is fitted with the gas distribution grid in its lower part, with the connection for supply of heated air (or other heat carrier) located below the plate.

Devices for injection of the reductant (liquid sulfur) are arranged above the gas distribution grid in the fluid bed. For complete burning of remaining reductant the unit is fitted with connections for supply of 30-35% of excess air, with bulk fed to the top of the fluid bed and the rest to the settling zone of the unit above the fluid bed.

6.4.27.4. Reduced ore cooling

The unit for cooling reduced alunite in the fluid bed with controlled movement of material comprises an air distribution plate, air and water heat exchangers pipe arranged in series within the fluid bed, connections for supply of reduced alunite and dust from the pollution control equipment of the alunite roasters and reducers.

The hot air connection is linked to the roaster. The heat exchanger includes the air pipes which ensure cooling speed of 8-10° per minute in the moving bed of alunite ore.

6.4.27.5. Fire boxes of fluid-bed units

The fire boxes are fitted with devices for combustion of fuel and air supply connections.

Located inside the fire box there is a combustion chamber, which is separated from the casing by the ring chamber for air supply

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for dilution of combustion products.

6.4.27.6. Potassium sulphate drier

The unit for drying potassium sulphate in the fluid bed consists of a cylindrical casing, gas distribution grid, connection for material charge and discharge.

The drier is fitted with a fire box for fuel combustion and dilution of combustion products to a preset temperature.

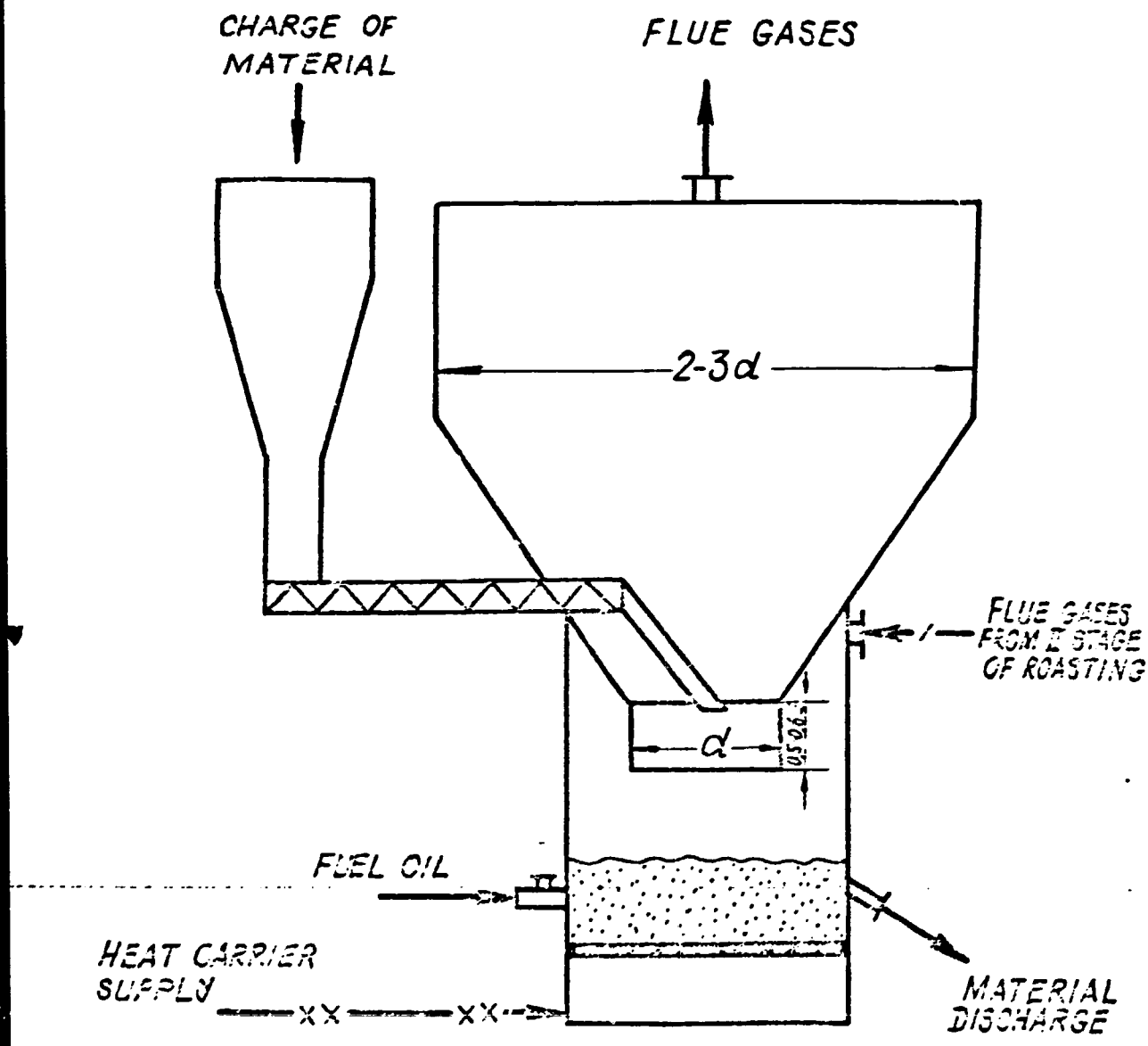
6.4.27.7. Potassium sulphate cooler

The unit for cooling dried potassium sulphate consists of a cylindrical casing, air distribution grid, water heat exchangers located in the fluid bed, connections for material charge and dischange.

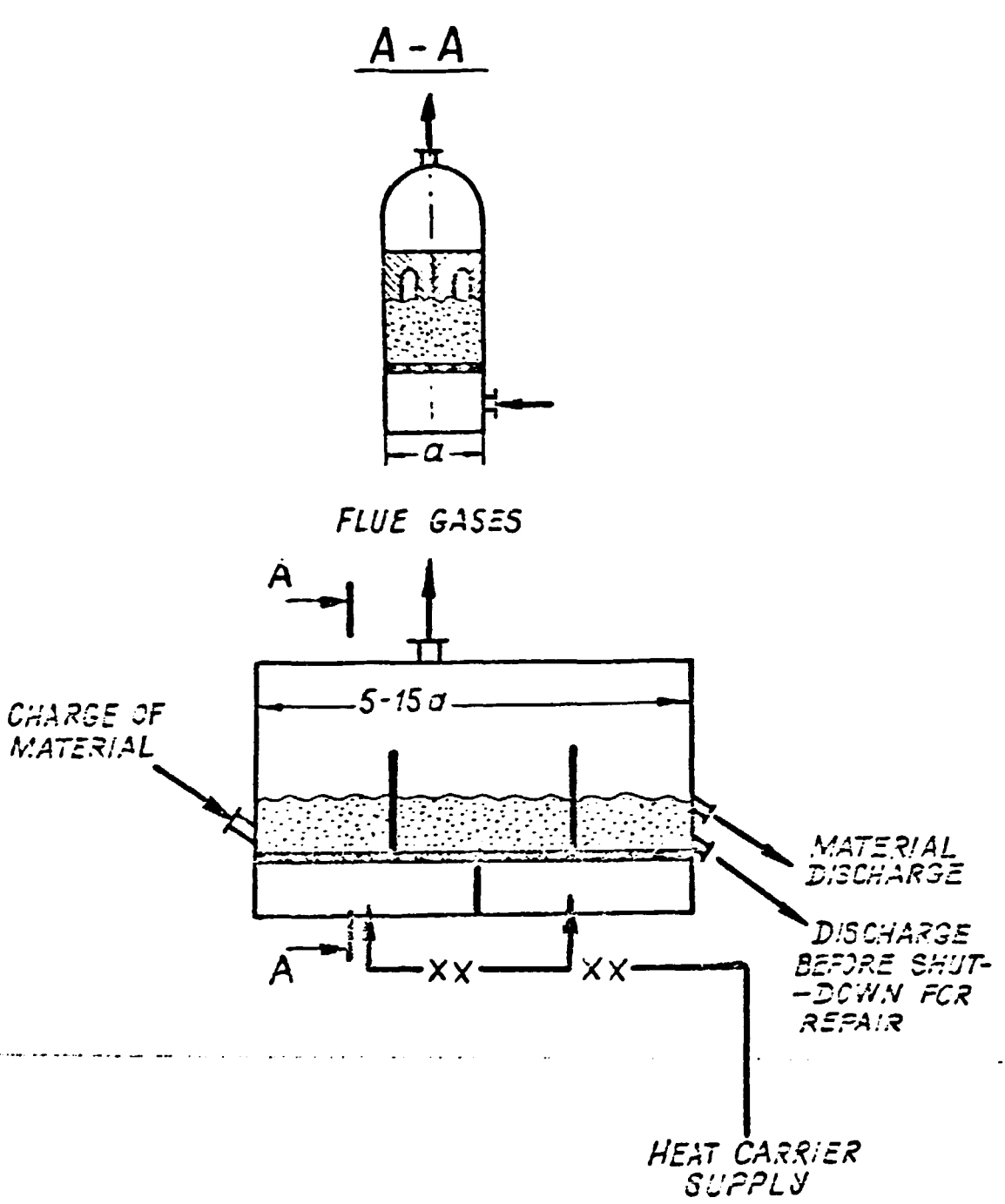
The cooler is fitted with a connection for supply ofheated ai to the potassium sulphate drier.

6.4.27.8. Precipitator

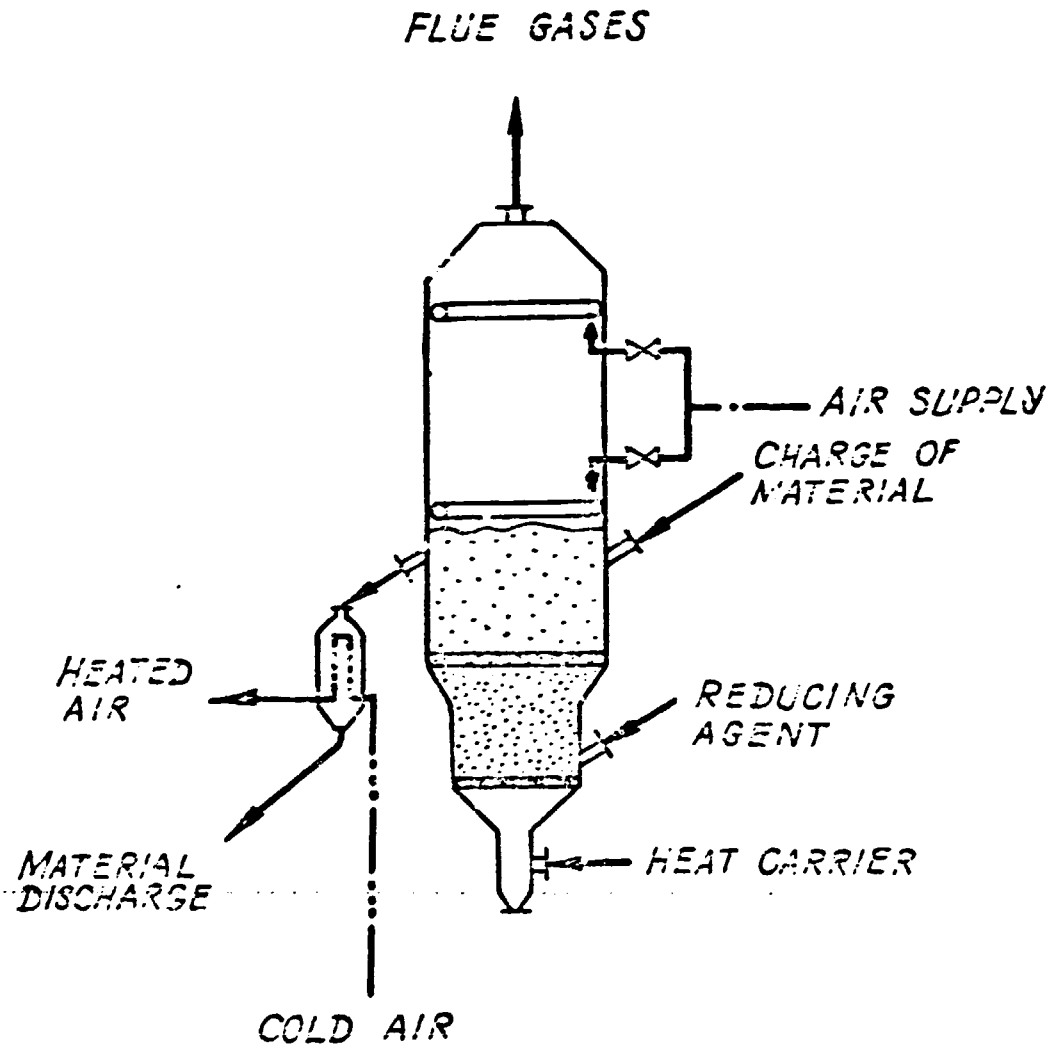
The precipitator is designed for hydraulic decomposition of pregnant liquor to precipitate eluminium hydroxide. The unit consists of a cylindrical shell with a tepered bottom.
The water-jacketed airlift pipe is fitted along the unit centreline. Slurry mixing and trersfer is by compressed air. Slurry cooling is by water fed to the water jacket.



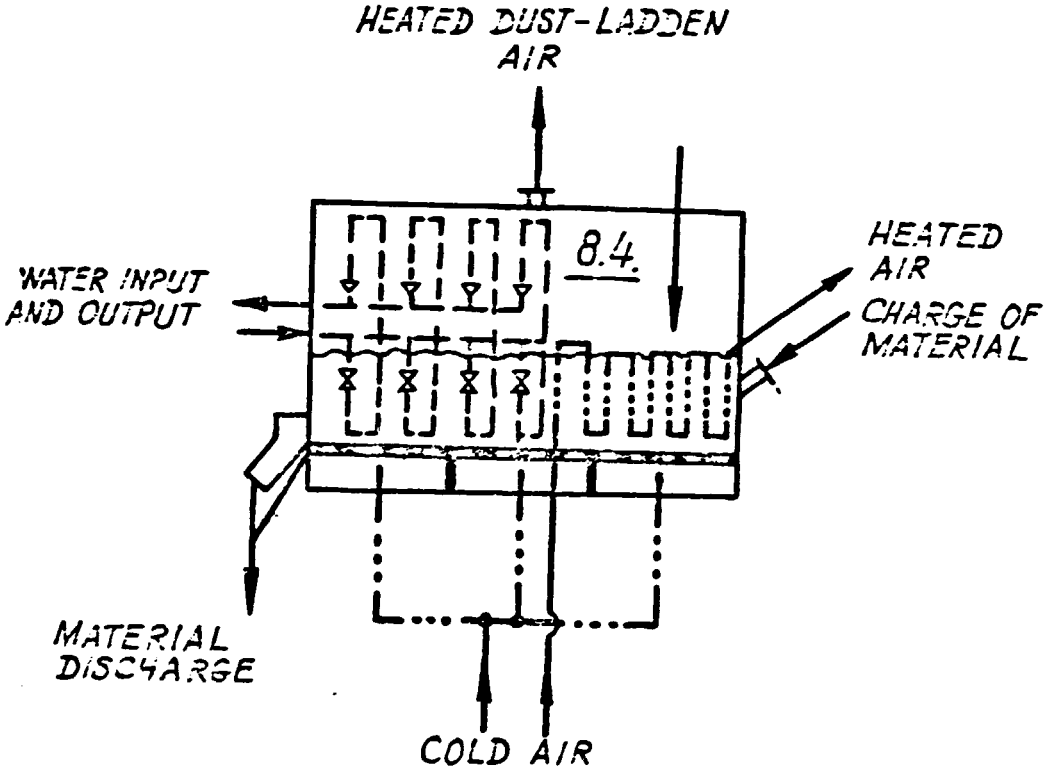
I STAGE FLUID BED ROASTER.



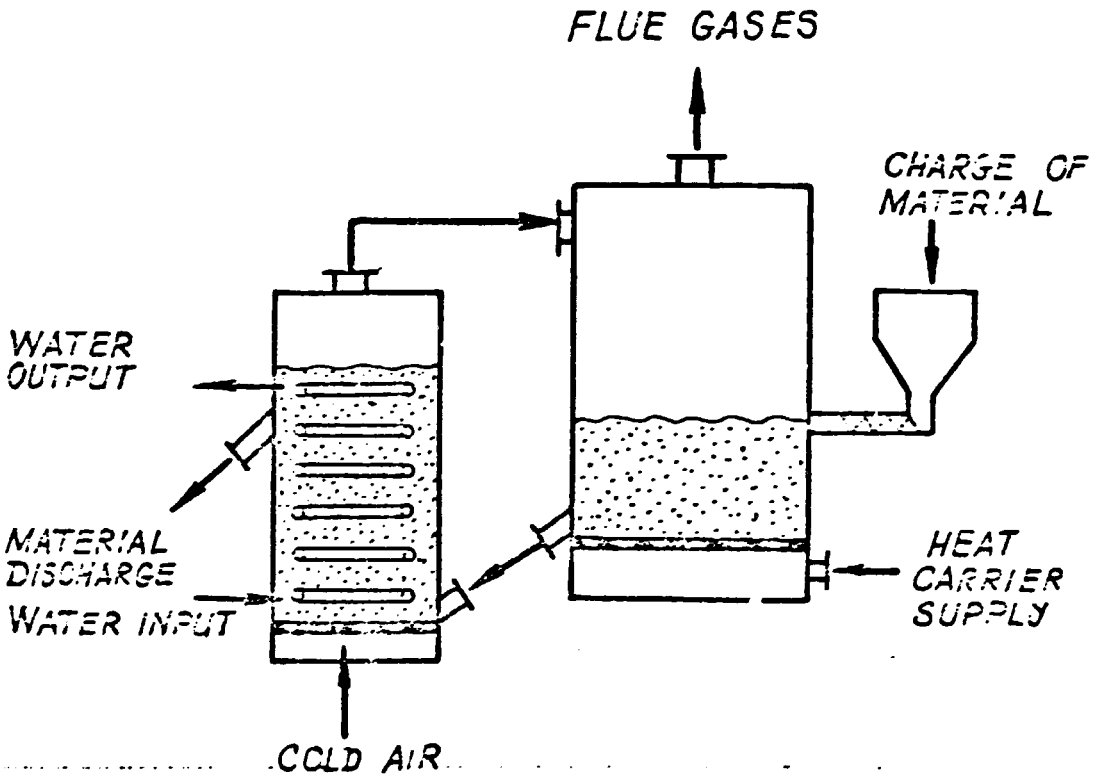
II STAGE FLUID BED ROASTER.



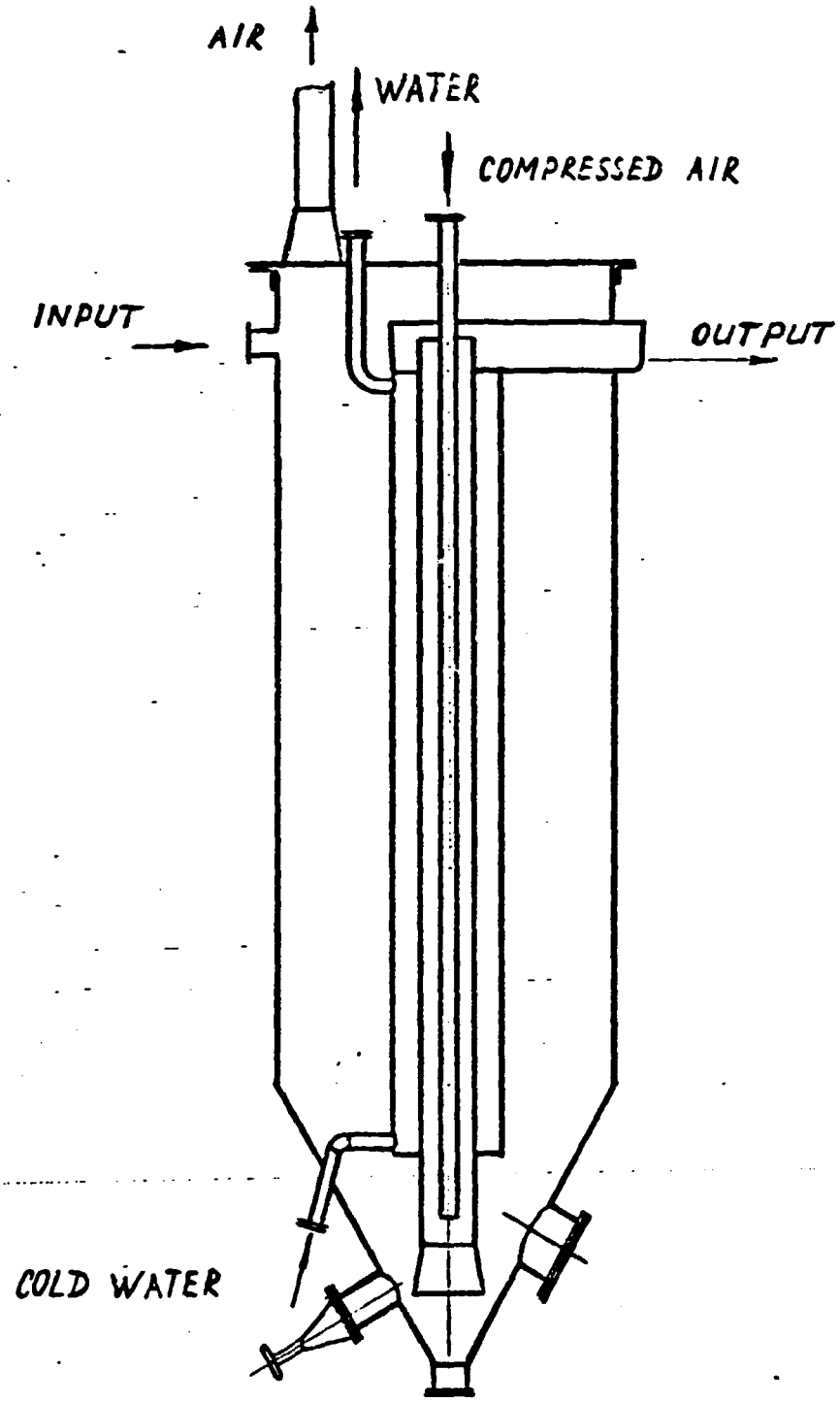
FLUID BED REDUCING UNIT.



FLUID BED COOLER



FLUID BED SALTS DRYER WITH FLUID BED COOLER.



PRECIPITATOR

6.5. Power supply and automation, communication

6.5.1. Power supply

6.5.1.1. Initial data

- maximum electrical load in plant - 44,2 MW;
- annual energy consumption - 270 mln kW.h/year.

Break-down of energy consumption by separate plant units is given in the following table.

Srl. No	Description	Maximum power demand kW	Annual power consumption mln kW.h
1	2	3	4
	1. Main production units		
1.1	Ore receiving device	100	0.35
1.2	Secondary and fine crushing	1800	6.5
1.3	Ore blending storage and conveyor galleries	500	1.7
1.4	Transfer stations	500	1.6
1.5	Dry grinding	5600	47.5
1.6	Roasting and reduction	5000	40
1.7	Sulphur storage	180	0.54
1.8	Digestion, desilication and mud washing	6600	40
1.9	Evaporation	3100	22
1.10	Precipitation	360	1.8
1.11	Hydrate handling	3900	27.6
1.12	Calcination	850	5.04
1.13	Commercial alumina storage	80	0.24
1.14	Potassium sulphate drying	350	1.05
1.15	Potassium sulphate storage	60	0.18
1.16	Caustic soda storage	700	2.1
	Total:	29680	198.20

1	2	3	4
2	Energy facilities	6100	28.75
3	Water supply, sewerage and mud disposal facilities	4100	28.55
4	Repair and storage facilities	1300	4.19
5	Service facilities	2800	9.5
6	Transportation facilities	100	0.31
7	External lighting	125	0.5
	Total for plant	44200	270.0

For reliable operation of alumina plant there are to be two independent el. power sources.

It has to be born in mind that the power consumers in alumina plant can be devided in two cat_egories by their reliability. The first cat_egory (5 MW) permits no intervals in supply for it can cause the disturbance of the process or the failure of the process equipment.

The second cat_egory include consumers for which the disrupture in the power supply means only the decrease of production.

6.5.1.2. Power supply diagram (drg. No.1247955- ЭП)

The FS foresees two independent power supply sources for the plant:

- existing power system in the plant area,
- 18 MW HPP designed for alumina plant.

The connection with the area's power system is planned to be realized by erection of two power lines 25 km each (from the existing Abhar substation to the main step-down substation to be build at the plant).

The main step-down substation contains two transformers 230/10 KV and 63 MW each.

The following loads are considered:

- from the mine - 4,5 MW;
- from external water supply - 2 MW;
- from sulphuric acid production - 2,5 MW.

Electric loads balance

Description	Unit of measure	Quantity
1. Maximum load	MW	44.2
2. Outside consumers	-"-	10
3. Power consumption at plant	mln kW.h	270
Normal mode of operation of the HPP		
4. Power production at the HPP	mln kW.h	105
5. HPP proper demand	-"-	15
6. Supply of power from the HPP	-"-	90
7. Consumption of Power from system for plant	-"-	180
8. Contract power from the system	MW	31.2
9. Ditto, taking into account outside consumers	-"-	41.2
Emergency mode of HPP operation:		
10. Production at the HPP	mln kW.h	35
11. Proper demand of the HPP	-"-	5
12. Power from the HPP	-"-	30
13. Consumption of power by the plant from system	-"-	240
14. Maximum contract power capacity from the system for the plant	MW	39.2
15. Ditto, taking into account the outside consumers	-"-	49.2

The plant consumers are supposed to be provided from 5 distribution substations 10 kV each located at the plant site.

The supply for the substations for consumers of the first and the second categories is designed to be carried out from two independent sources - from two bar sections of the main step-down substation.

Three independent sources - two bar sections of the main step-down substation and the 10 kV bars of the HPP main distribution device.

The plant is supposed to be equipped with the alternate current circuits of the following voltages:

- 10 kV for supply of the shop transformer substations and big motors (above 1000 kW)
- 6 kV for the supply of medium capacity motors (320-800 kW);
- 380/220 V for electric motors under 320 kW and for lighting.

6.5.1.3. Power equipment and motors control

The power equipment is supposed to be supplied from the low voltage transformer substation panels through the three phase alternate current circuits and earthed neutral with 380/220 V. The starting protection devices placed on the control station panels of industrial erection are located in the electric rooms in control stations. The loads of the same process flow are fed from one control station panel, which allows the inspection of electric equipment without disturbing the other process flows.

The electric motors are controlled locally through the local control cabinet. The crushing and raw material feeding equipment (crushers, conveyors etc.) are combined into flow transport systems having three control modes:

- centralized, interlocked with the operator panels;
- local, for repairs and adjustment,
- local, interlocked for adjustment and for the case of failure of centralized control.

To guarantee a smooth run and secure operation of flow - transport systems the following kinds of warning singnals are provided for:

- prestart warning, about coming start of mecanisms;
- response to operator on mecanisms readiness to centrali ed start,
- report on mecanisms' state;
- emergency alarm.

Feeding circuits and distribution circuits in production rooms are equipped with cables consisting of aluminium conductor and PVC covering. The control and alarm circuits are supposed to be made of copper conductor cables. Within production rooms the cables are laid openly on the cable support, troughs and ducts.

6.5.1.4. Lighting

Lighting circuits voltage is to be:

- ordinary and emergency lighting 380/220 V of alternating current;
- emergency lighting 24 V.

6.5.2. Automation

Control and regulation of the process of alumina production from alunites provides for automation instruments manufactured in the USSR.

The alunite roasting and reduction area has to be equipped with pneumatic branch of instrument system which together with primary transducers measures the following parameters:

- material and flue gases temperature;
- compressed air pressure;
- pressure drop inside apparatuses;
- material layer thickness;
- rarefaction at the apparatus exit before exhaust fans
- dry material levels in apparatuses.

Further processing of alunite raw materials and process is controlled by automation devices of electrical branch of instrument system which are designed for control, alarm and regulation of necessary process parameters: temperature, pressure, levels, consumptions, densities of slurries and liquors.

The primary transducers are located on instrumentation panels of operator rooms as well as on spot depending on the process control requirements.

Regulation and control panels are installed with pneumatic tubes and one conductor copper cables.

To connect the primary transducers with secondary instruments and pneumoelectric supply pneumatic and electric cables with copper and aluminium conductors are used depending on the number and quality of signals.

All ordinarily current-free metal parts of instruments, automation devices and panels bearing instruments and control regulation devices are earthed for electric safety.

6.5.3. Communication

The following communication systems are provided at the alumina plant:

- administrative communication system based on a quasi-electronic 1024-line telephone exchange;

- operative telephone system of the alumina plant administration based on 70-line and 110-line intercom sets;

- operative telephone system of engineering administration based on 25-line intercom sets;

- electric clock system with provision of master clocks and pulse repeaters, and slave clocks in the plant premises and territory;

- production public address system for communication with the alumina plant units based on the use of selective 20, 10, 5, 3 and 1 line PA systems;

- fire alarm system based on receivers of signals from automatic and manual fire annunciators, operation of optic and acoustic alarm system, output of signal to the alarms and operation of fire sprinklers. 20-line units are used, as well as radio-isotope fire annunciators for receiving signals from radio-isotope fire alarms;

- burgler alarm system based on alarm units with capacity up to 50 lines including the circuits for security of the windows and doors of the secured premises.

For connection of the above communication systems to the on-site devices provision will be made for installation of the telephone networks by laying telephone cables in telephone conduits, on cable racks or in ground trenches. Connection of the plant telephone exchange to the off-site communication networks is designed by ARMP.

6.6. Mud Removal (drawing No.1370388-TM)

The processing of alunite ore into alumina results in generation of alunite mud (waste of alumina production).

The Feasibility Report provides for stacking of mud to mud disposal pond. Hydraulic transport is used for transportation of mud from the alumina plant to the mud disposal pond.

Mud characteristics -

Particle sizes:

- 70% - 0.05 to 1.0 mm
- 30% - less than 0.05 mm

Chemical composition, %

Al_2O_3 - 8.9; Na_2O - 1.8; K_2O - 0.8; SiO_2 - 79.4; H_2O - 3.1; SO_3 - 0.3; others - 5.7.

Specific density of dry mud - 2.7 t/m^3. Bulk weight of dry deposited mud - 1.2 t/m^3.

6.6.1. Initial data for estimation of mud facilities

Quantity of mud - 780 000 tpy. Continuous operation, 365 days Slurry - solid to liquid ratio 1:6. Slurry hourly flow rate - 600-900 m^3/hr.

6.6.2. Composition of mud removal facilities

The complex of mud removal facilities includes construction of following units and structures:

- mud hydraulic transportation system with mud pump station in digestion department;
- mud stacking system at mud disposal pond;
- return system of decant liquor from mud disposal pond to the alumina plant with booster pump station.

The characteristics of units and structures of above mentioned main systems for mud removal are listed below on the basis of specified capacity and operating conditions:

- mud pump station is equipped with three soil pumps (first in operation, second-under repair and third-stand-by) with capacity 900 m^3/hr each;

- main mud pipelines from digestion department to mud disposal pond are assumed of two lines of steel pipes 350 mm dia (first-operating, second-stand-by), laid on rack with a length of about 2.5 km;

- distributing mud pipelines of steel pipes 100-350 mm dia laid along the perimeter of mud disposal pond for homogeneous deposition of mud;

- depositing type mud disposal pond of 48 hectares surface area, dimensions of sides 600x800 m, located in 1.5 km south-west from the plant on the site with level drop from 1380 m to 1387 m;

- booster pump station intended for return of decant liquor from the mud disposal pond to the plant with a rate of up to 800 m^3/hr as well as for return of drain and rain waters back to the mud disposal pond. The pump station is located close to the mud disposal pond and it is equipped with three centrifugal pumps with a rate of 500 m^3/hr each for pumping of decant liquor and two drain pumps of 40 m^3/hr capacity;

- main pressure pipelines for decant liquor of two lines of steel pipes 400 mm dia. The pipes are laid on rack with main mud removal pipelines.

6.6.2. Main concepts of mud removal

The mud disposal pond with dimensions given above will be a single section area with holding capacity of 3.6 mln.m^3 designed for an operating period of 5 years. After this period the second section should be constructed, which will be located close to the first one. Based on the experience of the USSR Kirovabad plant, the mud from the first section after drying can be supplied to the consumers for production of construction materials or for road construction.

The following facilities are provided for setting-up of mud stacking in above mentioned quantities in the mud disposal pond:

- protecting dikes made of local soil along the perimeter of mud disposal pond 1.0 m high for establishing of controlled discharge of drain and rain waters;

- pioneer (initial) dike along the perimeter of mud disposal pond made of local soil, 2-4 m high due to the natural slope of the site, and 5 m large (the top of the dike). The above dikes

are required to set-up the mud pond basin with useful area of 40 hectares ensuring the hydraulic filling of mud disposal pond up to the level of 1382 m during 5 years.

- for collecting and return of decant liquor to the plant, inside the mud pond basin two water receiving wells are provided (one-in operation, second-stand-by). These wells are connected with booster pump station of decant liquor through gravity underground pipelines.

To preventi the pollution of ground water located in the mud disposal region at a depth of 6.0 m the following steps are provided for:

- setting-up of a clay screen against seepage with protecting layer of local soil under the bottom of the mud pond. The water drainage zones 8-10 m large formed along the perimeter of mud disposal pond between the protecting dikes and initial (pioneer) dikes are also insulated against the infiltration of water into the soil. The hillside berm ditch is provided for intersepting of rain water.

6.6.3. Operating conditions and measures for protecting of ground water

Operating conditions

The mud removal process in an integral part of the technological process of alumina production, and it is operating continuously during the whole year.

Due to the big difference between the value of average annual evaporation in this region - 1980 mm, and the value of average annual precipitations - 281.1 mm, the water balance of the mud disposal pond will be negative, that is the quantity of water with mud fed to the mud pond will be greater by about 100 m^3 as compared with the quantity of decant liquor, returned to the plant. This deficiency will be compensated by the water intake from the recirculating system of technological process.

6.6.4. Measures for protecting of ground water

As it was noted in the above chapter to prevent the pollution of ground waters with decant liquor, the provision is made for the

screen (its construction is given above) under the bottom of the mud disposal pond. Besides the steps are provided for the controlled discharge of rain water by setting-up of a hillside berm ditch from the elevated part of mud disposal terrain and system of drainage pipelines.

6.7. Heat, Gas and Water Supply

6.7.1. Heat Supply

Demand of the alumina plant in process steam is 184.0 t/h at pressure 0.61 MPa and temperature t = 250°C, that for hot water at t = 150÷70°C for space heating, ventilation and air conditioning - 18 Gcal/h.

Proposed as a heat source of the plant is a captive thermal power plant (TPP).

6.7.2. Gas Supply

Natural gas is proposed as a standby fuel for the plant. Gas will be fed over the gas main line.

A gas distribution station will be built at the plant (for gas pressure regulation).

6.7.3. Compressor station

Demand of the plant for compressed air (with air network losses of abt 15%) is 900 m^3/min. To cope with the above demand provision is made in the compressor station for:

- two centrifugal compressors, 500 Nm^3/min capacity each;
- two centrifugal compressors, 250 Nm^3/min capacity each.

To ensure continuous supply of the plant process sections with compressed air provision is made for one compressor (500 Nm^3/min) as a standby unit.

6.7.3.1. Oxygen Station

The plant will include an oxygen station for generation of oxygen (in cylinders). Oxygen is required for installation and repair operations. Capacity of the station is abt 100,000 m^3/yr.

6.7.4. Fuel Oil Facility

The main fuel for the plant is fuel oil and the standby - natural gas.

Calculations are based on assumption of the lowest heat capacity of fuel oil - Q_H^P = 9500 kcal/kg.

The fuel oil facility includes:

- three steel tanks, 5000 m^3 capacity each;
- fuel oil pump station;
- fuel oil receiving track station;

Stock of oil in three tanks (abt 15,000 t) ensures operation of the plant during 20 days.

6.7.5. Water Supply and Sewerage

6.7.5.1. General concepts

Water supply and sewerage systems of the plant are closed type, recirculating circuits.

Water from the external source is fed to the following cast iron pipes networks;

- fresh industrial water pipeline;
- general service and fire water pipeline.

6.7.5.2. Industrial water supply

Fresh water for the industrial purposes at the plant will be used for make-up of losses in the water recirculating systems and for the process needs in the following quantities:

Item	Flowrates of fresh industrial water	
	m^3/d	m^3/h
Process losses make-up	3668	153
Reccirculating systems make-up	4295	164
Total	7963	317

The recirculating water systems will include three industrial water systems: one alkaline and two clean water circuits with the following characteristics:

System	Water	Capacity of water recirculating system		Water uses
		m^3/d	m^3/h	
Recirculating water system No.1	alkaline	82790	3450	Equipment cooling at digestion, evaporation and precipitation
Recirculating water system No.2	clean	57200	2380	Cooling compressor, dryer and roaster, etc.

Each recirculating water system includes the following units:

- recirculating pump station;
- pressure mud filters in the pump station for clarification of recycle water;
- fan-cooled, sectional water towers of total area of 1344 m^2

6.7.5.3. General service, potable and fire water supply

The general service and fire water pipeline is provided for meeting general service and potable water needs of the personnel, and fire needs. Potable grade water demand is 290 m^3/d, 95 m^3/h. Flow rate for fire fighting is 60l/sec., low pressure network.

Fresh industrial and potable water at the plant territory will be received into water storage tanks with booster pump stations.

6.7.5.4. Sewerage

The following sewerage networks of asbestos-cement and reinforced concrete pipes will be provided at the plant (no industrial sewage is discharged from the plant):

- rain water sewerage;

- household sewage system.

Rain water (11500 m^3/d) will be discharged to the surge pond and later used for make-up of the recirculating water systems. of the plant.

6.7.5.5. Off-site water supply and sewerage

The off-site units, and water supply and sewerage systems are designed by the Iranian Side according to the Annex 3 of the Contract No 85/108. Battery limits are the plant fence. For major design data refer to Tables below.

Design data for off-site water supply networks and units

S/N	Item	Unit of meas.	Rating	
			fresh industrial water pipeline	service and fire water pipeline
1	Water supply	mln.m^3/yr	2.91	0.11
		m^3/d	7960	290
		m^3/h	320	95
2	Head at battery limits	MPa	5	5
3	Number and diameter of pipeline	pc	2	2
		mm	⌀400	⌀250
4	Water quality			As per Iranian norms
	turbidity	mg/l	20 max	
	pH		6.5-8.5	
	dissolved salts	mg/l	800 max	
	chloride	mg/l	150 max	
	sulphate	mg/l	250 max	
	iron		0.5 - 1	
	hardness: total	mg.equiv/l	4.0 max	
	carbonate	mg.equiv/l	0.5 max	
	permanganate oxidation	mgO/l	20 max	

According to analysis of water from the well No.3Dand the Abhar Rud river released by ARIP quality of water from these sources does not fully meet the specifications for industrial water, in particular for total and carbonate hardness. In this connection provision will be made for softening fresh industrial water at the water treatment unit designed by the Iranian side.

Fresh water pipelines are connected to the on-site networks at the southern side of the plant.

Design data for off-site household sewage networks and units

S/N	Item	Unit	Rating
1	Household sewage discharge	mln.m^3/yr	0.11
		m^3/d	290
		m^3/h	95(max)
2	Hourly fluctuation factor		3
3	Depth of collector at battery limits	m	7
4	Collector diameter	mm	500
5	Sewage characteristics		
	turbidity	mg/l	140
	BOD_{total} of sewage	mg/l	160
	BOD_{total} of clarified sewage	mg/l	85
	Nitrogen ammonia, N	mg/l	17
	Phosphates, P_2O_5	mg/l	7
	including those of detergents	mg/l	3
	Chloride	mg/l	19
	Surface active matter	mg/l	5

by gravity

Household sewage is dischaged from the eastern side of the site to the sewerage of the township and pumped to the sewage treatment unit.

Water Consumption and Discharge Balance for Iranian Alunite-based Alumina Plant

S/N	Water users	Water consumption								Water discharge							
		Fresh industrial water		Recirculating water systems				Potable water		Process losses		Recirculating water systems				Household sewage system	
				No.1 (alkaline)		No.2 (clean)						No.1 (alkaline)		No.2 (clean)			
		m^3/d	m^3/h	m^3/d	m^3/h	m^3/d	m^3/h	m^3/d	m^3/h	m^3/d	m^3/h	m^3/d	m^3/h	m^3/d	m^3/h	m^3/d	m^3/h
	Raw materials receiving, storing and preparation units					5250	219	18.0	5.1					5250	219	18.0	5.1
	Roasting and reduction, sulfate drying					18650	777	33.0	9.2	48	2			18170	775	33.0	9.2
	Calcination					2180	91			380	16			1800	75		
	Digestion, desilication, mud washing			5760	240			15.8	4.4	3240	135	2520	105			15.8	4.4
	Evaporation and potassium sulfate production			54960	2290			15.1	4.2			54960	2290			15.1	4.2
	Precipitation			22070	920			16.5	4.8			22070	920			16.5	4.8
	Compressor station					28600	1190	2.5	0.7					28600	1190	2.5	0.7
	Oxygen station					600	25	3.1	0.8					600	25	3.1	0.8
	Utilities, water supply, repair and storage facilities					1920	80	89.1	25.1					1920	80	89.1	25.1
	Support facilities							47.6	14.2							47.6	14.2
	Transport facilities							46.0	13.0							46.0	13.0
	Total			82790	3450	57200	2380	290.0	95.0	3668	153	79550	3315	56340	2364	290.0	95.0
	Losses in cooling towers									4295	164						
	Shortage of recirculating systems											3240	135	860	18		
	Make-up of recirculating systems	7960	320														
	Grand Total	7960	320	82790	3450	57200	2380	290	95	7960	320	82790	3450	57200	2380	290	95

6.8. Buildings and Structures

6.8.1. The following data was used when designing the buildings and structures:

- characteristics of the process for producing alumina from alunite for a plant with the proposed capacity;
- specifications of the process equipment required;
- transportation conditions for supplying the plant with the raw materials and other materials and for shipping the finished product;
- site conditions (climate, geotechnical characteristics);
- local building materials;
- project construction stages.

6.8.2. List of buildings and structures and their characteristics

On the basis of a design work covered in the process, electrical, civil engineering and in other sections of the present report, the list of the plant main buildings and structures was compiled, together with their characteristics which are given in Table

6.8.3. Architectural and civil concepts of the buildings and structures

The architectural and civil concepts of the alumina plant units were developed taking into account the following:

- Subcontractor's experience in designing similar alumina plants as per the USSR standards and norms;
- local conditions (climate, soil characteristics);
- earthquake activity (according to the data supplied by the Iranian side a value of 7 points in Richter scale was adopted).

Characteristics of buildings and structures

Item No	Description	Built-up area, m^2	Usable area, m^2	Structural volume, m^3
1	2	3	4	5
1	Main Production Units			
1.1	Ore receiving unit (drg.No 1350784-AC, sheet 1)	442	504	5192
1.2	Secondary and fine crushing (drg.No 1350784-AC, sheet 2)	1555	3400	40300

1	2	3	4	5
1.3	Blending ore storage and conveyor galleries (drg. No 1350784-AC, steet 3)			
	Blending ore storage	32300	34800	635020
	ГК-1	450	-	1800
	ГК-2	600	-	2400
	ГК-3	600	-	2400
	ГК-4	1100	-	4400
	ГК-5	1600	-	6400
1.4	Transfer stations (drg. No 1350784-AC, sheet 4)			
	ПУ-1	703	1350	29700
	ПУ-2	250	330	3300
	ПУ-4	250	330	3300
	НС-1	260	220	1350
	НС-2	260	220	1350
	ПС	169	144	1010
1.5	Dry grinding (drg. No 1350784-AC, sheet 5)	3970	8772	85600
1.6	Roasting and reduction (drg. No 1350784-AC, sheet 6)	4745	-	-
	Blower station	300	252	2700
	Electrical rooms (drg. No 1350784-AC, sheet 6)	470	580	2620
	Process control building	1310	1840	9800
1.7	Sulphur storage (drg. No 1350784-AC, sheet 7)	1830	2160	31030
1.8	Digestion, desilication and mud washing, electrostatic precipitators (drg. No 1350784-AC, sheet 8)	24600 360	6375 -	108100 -
1.9	Evaporation and potassium sulphate production (drg. No 1350784-AC, sheet 9)	8700	15300	105300
1.10	Precipitation (drg. No 1350784-AC, sheet 10)	4810	12500	3870

1	2	3	4	5
1.11	Hydrate processing with hydrate store site (drg. No 1350784-AC, sheet 10)	8000	22100	99130
1.12	Alumina calcination (drg. No 1350784-AC, sheet 11)	640	447	3560
1.13	Commercial alumina storage (drg. No 1350784-AC, sheet 12)	900	1100	12020
1.14	Potassium sulphate drying (drg. No 1350784-AC, sheet 13)	410	810	3020
1.15	Potassium sulphate storage (drg. No 1350784-AC, sheet 14)	900	1100	12020
1.16	Caustic store (drg. No 1350784-AC, sheet 15)	820	216	2500
2	Power facilities			
2.1	TPP			
	Main building (drg. No 1350784-AC, sheet 16)	6480	5060	66630
	Chemical water purification (drg. No 1350784-AC, sheet 17)	2920	1900	17900
	Personnel facilities	410	681	4900
2.2	Transformer repair and oil regeneration facility	1320	1152	14300
2.3	MSDS	430	357	2300
2.6	Gas distribution station	130	108	540
2.7	Fuel oil facility	8000	730	5800
2.8	Compressor station (drg. No 1350784-AC, sheet 18)	2080	3600	31200
2.9	Oxygen station	720	810	6480
3	Water supply, sewerage and mud removal systems			
3.1	Pumping station of water recycle centre No 1, 3 m below grade	1700	-	15500

1	2	3	4	5
3.2	Pumping station of water recycle centre No 2, 3 m below grade	1300	-	12000
3.3	Pumping station of water recycle centre No 3, 3 m below grade	1300	-	12000
4	Repair and storage facilities			
4.1	Repair shops building	9625	7210	141649
4.2	Material storages building	9310	8250	100400
4.3	Oils and chemical materials storage	1056	963	2420
5	Plant servicing facilities			
5.1	Plant management building	3420	14060	48300
5.2	Technical building with automatic telephone exchange	970	4230	28550
5.3	Laboratory			
5.4	Personnel services (three buildings)	1760 (per building)	4930 (per building)	19750 (per building)
6	Transportation facilities			
6.1	Special trucks garage	2830	3258	20240
6.2	Fire station	1030	3330	6620

6.8.3.1. Architectural design concepts

The configuration and size of the buildings and structures were adopted taking into account the maximum use of natural ventilation and the necessity to protect the buildings against a high level of exposure to sunlight.

As a rule, the auxiliary and service facilities are located inside the main buildings or outside forming annexes to the buildings.

Spans for all the buildings to be multiples of 6.0 m and for some service buildings-multiples of 3.0 m. A column spacing for all the buildings to be 6.0 m.

The height of the single-storey production buildings up to the bottom of the load-carrying elements to be a multiple of 200 mm, and a floor-to-floor distance of the multistorey buildings to be a multiple of 600 mm, but not less that 4.2 m.

In all the buildings a finished floor elevation of the ground floor to be 150 mm above the grade, and an apron along an outside perimeter of the buildings to be 1.0 to 1.3 m wide.

A natural lighting of the rooms is through the unobstructed openings or openings filled with single-row glazing or sun-protecting grids, as well as through the roof skylights providing for both lighting and ventilation. A transparent corrugated plastic is used for the purpose.

6.8.3.2. Civil design concepts

The foundations of all the main production buildings and structures as well as the retaining walls over 1.0 m high to be of monolithic reinforced concrete, brand 150-200.

The foundations to be buried into the ground to approximately 1.5 m.

The foundations for the small-size equipment and the concrete strip foundations for the walls to be of concrete.

The columns, trusses, crane beams, elements of the framework, ties and window frames in all the production buildings to be of steel.

In the administrative and personnel services buildings and electrical rooms the columns, floors and roofs to be of in-situ

reinforced concrete, brand 200. The columns in the alumite roasting and reduction facility to be of in-situ reinforced concrete.

The roofs of the production buildings to be of AC sheets laid on the roof steel framing at a 1/4 fall, in the administrative and personnel services buildings the roofs to be flat, with a bituminous felt covering, with parapets. In the electrical rooms the roofs to be of a ventilated type, made of AC corrugated sheets laid on timber beams.

The external walls of the production buildings to be of AC corrugated sheets laid on the steel framework, with a plinth wall 0.8 m high and 230 mm thick.

The external walls of the administrative and personnel services buildings and of the electrical rooms to be of brick using reinforced concrete. The walls and partitions of the rooms inside the buildings to be of brick.

The floors in the production buildings to be, as a rule, of concrete laid on a sand-gravel bed.

The floors in the administrative and personnel services buildings and in the electrical rooms to be of a terrazzo type on a concrete bed, as well as of ceramic tiles and linoleum.

6.8.3.3. Finishing

All the external and internal surfaces of the brick walls to be plastered and painted in light colours.

For protection against corrosion the steelwork to be painted with four coats of a special compound, the total thickness being 140 µm .

The external surfaces of the walls and bottoms of the underground structures buried to a depth over 5.5 m to be covered with a waterproof membrane made of a material in a roll form.

6.8.4. Ventilation, heating and air conditioning

According to the initial data for the contract No 85/108, item 5.2.52, the climate of a Takestan area, 15 km south-west of the site where the alumina plant to be located is a dry subtropical one with the following temperatures:

- the maximum yearly temperature + 41.4°C;
- the minimum yearly temperature - 18.3°C.

Based on this (as it was the case for the Kirovabad plant) the following design temperatures of the air are adopted:

- in a cold period, for heating and ventilation - 8°C;
- in a hot period, for ventilation + 30°C;
- do , for air conditioning + 35°C

6.8.4.1. Main design concepts

Dust generation occurs in the equipment employed for receiving the ore, its transportation, crushing, grinding and blending. The dusting points to be equipped with the air suction means.

Taking into account that all these buildings and structures to be constructed of light elements and are not to be heated during a cold period, a natural draught ventilation to be provided for, through the windows and transportation doors of the buildings.

The quantity and capacity of the dust suction systems are selected for a 200,000 tpy plant. The following aspiration equipment is used for the purpose: the dust centrifugal fans, I.D. fans; the wet coagulation centrifugal dedusters using a service water are employed for removing dust from the air.

A total water consumption of the dedusters (8 pieces) operating simultaneously is 40 m^3/hr. A solids content in the resultant slurry is 33 kg/m^3.

As per the operation conditions no heating is required in the hydrochemical production units. Ventilation is a natural one. A hydrate storage building is an exception. It is heated to maintain the temperature not less than + 5°C. In the storage a natural ventilation is provided for.

In the roasting section the conditioned air outlets with moistening to be provided for in the areas where personnel is exposed to high temperature.

A mechanically forced ventilation to be provided for the following:

- for a centralized air supply to the above air outlets;
- when there are special process requirements on cleanliness of the air supplied and for developing an excess pressure in the electrical rooms;
- in the underground areas of the buildings with no natural ventilation.

For the process control rooms, instrumentation rooms, computer rooms, offices and laboratories conditioned air supply

to be provided for, using the self-contained and household air conditioners.

The total quantities of heat, electric power, service and drinking water for the heating, air conditioning and ventilation purposes are as follows:

- heat consumption for the heating and ventilation - 1,900,000 kcal/hr;
- power consumption - 735 kW;
- service water consumption for air dedusting - 40 m^3/hr;
- drinking water consumption for air conditioning - 30 m^3/hr.

6.8.5. Internal water supply and sewerage

Networks of industrial and potable water supply and sewerage to be connected with the corresponding networks designed at the plant site are envisaged in almost all the buildings and structures to ensure process performance, to provide for the equipment cooling, for ventilation and air conditioning as well as for the needs of the personnel.

6.9. Brief Information on Infrastructure

All infrastructure facilities (including the engineering networks located outside the plant site are designed by the Iranian Side.

Subcontractor's responsibility includes the mud lake with hydraulic mud pumping only.

For the present FS (according to the ARMP initial data) the following make-up of the infrastructure was proposed:

- alunite transport from the Haftsanduk deposit to the plant site over a distance of about 25 km;

- off-site heat supply source (TPP) and power supply with installation of the 230 KV transmission line from the regional substation of Abhar to the plant over a distance abt 25 km;

- off-site telephone and radio communication networks and units between the plant and the town of Takestan 15-20 km in length;

- off-site water supply networks and units

estimated length of the lines - 5 to 7 km;

- off-site sewerage networks and units;

- off-site railway transport including an access road 2.5-3.0 km in lenth from the plant to the rail head on the existing railway Teheran-Julfa;

- off-site access motor road from the plant to the city of Takestan 15 to 20 km in length (the existing road may be used if paved with all-weather pavement);

- personnel is recommended to be settled in the region of Takestan town.

6.10. Cost Estimates

6.10.1. The initial investment cost of construction of the alumina plant (in vicinity of the town of Takestan) has been assessed on the basis of the following data:

- Initial data released by ARMP;
- V/O "Technoexport" data;
- drawings and calculations prepared by the Subcontractor for the Feasibility Study (FS);

The investment cost on equipment is estimated on the basis of:

- equipment prices (according to V/O "Technoexport" data);
- ARMP data;
- transport charges for equipment transportation to the plantsite at Rls 2150/t;
- insurance of equipment while in transit at 0.2% of equipment and materials cost;
- tax on imported equipment at 7.5% of equipment cost;
- Red Crescent tax at 0.2% of equipment cost;
- insurance of the plant units at 1% of equipment cost.

6.10.2. Installation of equipment

Estimation of investment costs for installation of the equipment are based on the following data:

- the process equipment - 10% of equipment cost;
- el.equipment, instrumentation and automatic control - 15% of equipment cost.

Summary sheet of investment costs on equipment is stated in Schedule 6-3.

6.10.3. Cost of buildings, structures and other civil works

The estimated cost of the buildings is estimated on the basis of cost of 1 m^3 of volume, that of other civil works - on the basis of unit rates.

The following cost items are included in the calculations of estimated cost of buildings and civil works:

1) Site preparation and development - site levelling;

2) Buildings and special civil works - civil works connected with construction of buildings and structures, special civil works inside the buildings and structures; equipment foundations, ventilation chamber, pits and trenches, etc.

Summary sheet of investment costs on civil engineering is stated in Schedule 6-5.

Schedule 6-1

Estimate of Technology Costs

Technology	Foreign (Rls.mln)	Local (Rls.mln)	Total (Rls.mln)
Know-how cost	664.6	-	664.6
TOTAL: Estimated	664.6	-	664.6

Schedule 6-3

Summary sheet - investment cost				
Equipment				
No	Description	Investment cost carried over (Rls.mon)		
		Roreign	Local	Total
1	2	3	4	5
1	Ore receiving unit	30.9	6.4	37.3
2	Secondary and fine crushing	602.5	118.9	721.4
3	Ore blending storage and conveyor galleries	193.6	38.9	232.5
4	Transfer stations	102.1	21.3	123.4
5	Dry grinding	1107.1	216.2	1323.3
6	Roasting and reduction with blower station and gas cleaning plant	I9I9,5	42I,0	2340,5
7	Sulphur storage	39.3	7.9	47.2
8	Digestion, desilication and mud washing. Electrostatic precipitators	1868.8	393.9	2262.7
9	Evaporation and potassium sulphate production	1025.8	223.3	1249.0
10	Precipitation	1375.5	279.2	1654.7
11	Hydrate treatment with hydrate storage	511.1	106.1	617.2
12	Alumina calcination	219.5	49.2	268.7
13	Commercial alumina storage	34.5	7.5	42.0
14	Potassium sulphate drying	63.3	13.1	76.4
15	Potassium sulphate storage	18.3	4.2	22.5
16	Caustic storage	148.5	30.2	178.7
17	Repair shop complex	379.1	75.2	454.3
18	Material storage complex	43.4	9.0	52.4

1	2	3	4	5
19	Oils and chemicals storage	6.1	1.5	7.6
20	Plant administrative building with technical building and telephone exchange	96.7	19.8	116.5
21	Laboratory	84.7	15.4	100.1
22	Personnel service rooms	21.1	5.1	26.2
23	Transformer and oil facilities	27.6	5.6	33.2
24	Main step-down substation (MSDS)	265.4	63.7	329.1
25	Bus-bars and cable networks	98.9	24.2	123.1
26	Racks, process pipelines and heat service lines	113.3	33.1	146.4
27	Gas distributing station	6.8	1.6	8.4
28	Fuel oil facilities	142.0	29.4	171.4
29	Compressor station	170.8	35.2	206.0
30	Oxygen station	43.0	8.4	51.4
31	Railway tracks	208.6	18.6	227.2
32	Fire-fighting station	26.3	3.2	29.5
33	Special vehicles garage	120.6	12.0	132.6
34	Communication and signalling	107.8	25.7	133.5
35	Water recirculating unit for industrial water supply	216.0	48.5	264.5
36	Industrial and potable water tanks with booster pump station	16.3	3.6	19.9
37	Insite water supply and sewerage systems with pump stations	33.4	8.0	41.4
38	Mud removal system with pump station	113.8	32.2	146.0
39	Mud disposal	18.3	4.3	22.6
40	External lighting	11.7	3.0	14.7
	TOTAL:	II632,0	2423,5	I4055,5

Schedule 6-5

SUMMARY SHEET. INVESTMENT COST

Civil engineering works

Alumina plant in Iran		Investment cost carried over (Rls.mln)		
No	Description	Foreign	Local	Total
1	2	3	4	5
1	Site levelling	-	647,I	647,I
2	Ore receiving unit	-	48,9	48,9
3	Secodary and fine crushing	-	335,4	335,4
4	Ore blending storage and conveyor galleries	-	572,I	572,I
5	Transfer stations	-	346,2	346,2
6	Dry grinding	-	905,3	905,3
7	Roasting and reduction with blower station and gas cleaning plant	-	II40,9	II40,9
8	Sulphur storage	-	232,3	232,3
9	Digestion, desilication and mud washign. Electrostatic precipitators	-	I348,7	I348,7
10	Evaporation and potassium sulphate production	-	I052,2	I052,2
11	Precipitation	-	29I,8	29I,8
12	Hydrate treatment with hydrate storage	-	979,I	979,I
13	Alumina calcination	-	225,7	225,7
14	Commercial alumina storage	-	90,2	90,2
15	Potassium sulphate drying	-	22,9	22,9
16	Potassium sulphate storage	-	7I,6	7I,6
17	Caustic storage	-	48,9	48,9

1	2	3	4	5
18	Repair shop complex	-	737,9	737,9
19	Material storage complex	-	5I0,9	5I0,9
20	Oils and chemicals storage	-	I9,0	I9,0
21	Plant administrative building with technical building and telephone exchange	-	680,5	680,5
22	Laboratory	-	424,6	424,6
23	Personnel service rooms	-	I020,3	I020,3
24	Transformer and oil facilities	-	III,6	III,6
25	Main step-down sub-station (MSDS)	-	27,I	27,I
26	Bus-bars and cable networks	-	3I,2	3I,2
27	Racks, process pipelines and heat service lines	-	344,5	344,5
28	Gas distributing station	-	6,4	6,4
29	Fuel oil facilities	-	I2I,7	I2I,7
30	Compressor station	-	420,4	420,4
31	Oxygen station	-	84,9	84,9
32	Motor roads	-	562,3	562,3
33	Railway tracks	-	95,4	95,4
34	Fire-fighting station	-	54,3	54,3
35	Special vehicles garage	-	I66,3	I66,3
36	Water recirculating unit for industrial water supply	-	86I,5	86I,5
37	Industrial and potable water tanks with booster pump station	-	258,I	258,I
38	Insite water supply and sewerage systems with pumps stations	-	567,6	567,6
39	Settling pond for min sewers with pump station: for pumping of clarified liquor	-	3I,9	3I,9
40	Mud removal system with pump station	-	273,3	273,3

1	2	3	4	5
41	Mud disposal	-	260,2	260,2
42	Site development and greenery	-	4I9,8	4I9,8
43	External lighting	-	4,4	4,4
44	Plant fencing	-	32,9	32,9
	Total:	-	I6488,3	I6488,3

6.11. Air Pollution Control

6.11.1. The alumina plant is a source of emission into the atmosphere of some contaminants.

The following is envisaged for reducing amount of contaminants discharged into the air:

- removing the contaminants from the process emissions;
- sealing the joints in the process equipment and pipelines to prevent an escape of the contaminants into the production rooms atmosphere;

6.11.2. A total gross emission from the point sources of the alumina plant is as follows:

- dust - 485 t/year,
- sulphur dioxide - 115 t/year,
- nitrogen oxides - 853 t/year,
- carbon monoxide - 375 t/year
- vanadium pentoxide - 1.3 t/year

6.11.3. A buffer zone is to be established around the plant to protect the housing area against the harmful emissions.

For the plant under consideration the buffer zone should to be 1,100 m wide.

7. PLANT MANAGEMENT AND OVERHEADS

7.1. Cost centres

The proposed alumina plant belongs to category of the refining industry plants.

The main production costs are incurred in the following process sections:

- alunite receiving, crushing, blending, grinding:
- roasting and reduction;
- digestion, desilication, mud washing;
- evaporation and potassium sulphate production;
- precipitation and hydrate handling;
- alumina calcination and storage;
- potassium sulphate drying and storage.

The auxiliary costs required to secure continuous operation of the main production units are the costs related to operation of:

- power facilities;
- water supply and sewerage networks;
- repair facilities, storages and transport.

The administrative costs cover the expenses on personnel of:

- plant administration;
- laboratory;
- technical building;
- personnel service facilities;
- security guards and fire extinguishing brigade.

The above cost structure has been formulated from the Sub-contractor's experience in preparation of the designs for similar plants in Greece and India, as well as operation of the Kirovabad alumina plant (USSR).

7.2. Overheads

Main centers of production overhead costs include:

- general of the plant;
- administrative;
- depreciation charges;
- financial costs;
- taxes.

As part of overheads in included in Sections 4 and 8 (stationary, welfare services, wages and salaries of workers and employees not connected with the main production units), this Section covers the remaining overheads - general of the plant and administrative costs (current repair and maintenance of buildings, structures and equipment), average annual rate of depreciation on starting fixed capital.

The estimations in PS are based on operation period of 20 years.

7.2.1. General overheads of the plant

According to the initial data the costs of repair and maintenance of buildings and structures are adopted at 0.7% of their value, those of the equipment - 2.5% of the equipment value.

The appropriate amounts of annual deductions for repair and maintenance are as follows:

	in ths.Reals
- buildings and structures (0.007 x 16488.3)	113505
- equipment (0.025 x 14055.5)	351388
Total	464893

Annual amounts of the plant overheads are as follows:

	in ths.Reals
- welfare services (illumination, potable water, services), Chapter 4	27128
- current repair of buildings, structures, equipment, Chapter 7	464893
Total	492021

7.2.2. Administrative overheads

Annual amount of administrative overheads are estimated to be as follows:

	ths.Reals
- illumination, potable water (Chapter 4)	29460
- stationary goods (Chapter 4)	246
- salaries and wages (Chapter 8)	1246969
Total	1276675

7.2.3. Depreciation charges

Estimation of average annual depreciation rate according to a straightline method is carried out using COMFAR system on the basis of data on the initial accordance with the Iranian taxation lows. Amounts of charges are determined by the following conservative norms for the main types of equipment installed and other expenses:

Cost item	Depreciation rates, design service life
1. Buildings and structures	10% of salvage cost
2. Equipment	
2.1. Crushing, grinding equipment	35% of salvage cost
2.2. Process equipment	8 years
2.3. Chemical equipment	6 years
2.4. Transformers, electrical equipment	15 years
2.5. Tanks, pumps	12 years
2.6. Transport equipment	10 years
3. Preliminary costs	4 years

In accordance with this estimate the average depreciation rate is found to be 4.5% of the total amount of initial fixed capital investments.

7.2.4. Financing costs

The financing costs include interest on short-term bank loans (working capital) at 13% per annum.

The calculations of the financing costs are shown in Chapter 10.

7.2.5. Income tax

The Iranian system of income taxation is based on a sliding tax scale. According to the taxation laws the following rates in per cents are adopted for calculation of income tax:

Income, RI thousand	Income tax, %
up to 400	15
401-800	20
801-1500	25
1501-3000	30
3001-6000	35
6001-9000	40
9001-12000	45
12001-15000	50
15001-20000	55
20001-30000	65
30001 and above	75

8. PERSONNEL

Personnel requirement for the alumina plant in Iran is determined for the plant units to be designed by the Subcontractor (except the TPP) and is equal to 1450 people.

A number of people employed at the alumina plant is determined in accordance with technical conceptes on alumina production from alunites, norms and standards for servicing the equipment, production structure and from subconstractor's experience of operating similar.

For calculating the required personnel for the plant the plants existing Iranian standards on working time for the industrial enterprises, were adopted:

- a number of working days per year	- 278
- a number of days-off	- 52
- a number of religious and national holidays	- 23
- annual leave, days	- 12
- a number of working shifts	- 3
- duration of the working shift, hrs	- 8

The personnel on payroll is determined on the basis of the above mode of operation and adopted production schedule. This chapter gives an organization chart of the alumina plant specifying a number of those employed for each plant section.

8.1. Labour

In accordance with the adopted structure Schedule 8-1 presents a summary sheet for 1,212 men. Out ofthis number 423 men (35%) - skilled workers, 616 men (51%) - semiskilled workers, 173 men (14%) - unskilled workers.

Out of the total number of labourers 330 (27%) people are engaged in the main production.

Costs estimate on wages is shown in Schedule 8-2.

Schedule 8-1

Summary Sheet

Manning Table - Labour persons

Ser.-No	Description	Wage category			Total
		skilled	semis-killed	unskil-led	
1	Main Production				
1.1	Ore preparation	25	31	-	56
1.2	Roasting and reduction	45	13	-	58
1.3	Leaching and desilication	56	17	-	73
1.4	Evaporation and potassium sulphate production	64	4	-	68
1.5	Precipitation hydrate, thickening and filtration	63	-	-	63
1.6	Calcination, potassium sulphate drying	42	19	3	64
1.7	General personnel	10	27	26	63
	Sub-total, item 1	305	111	29	445
2	Power facilities and services				
2.1	Transformer repair and oil regeneration facilities	-	2	1	3
2.2	Fuel oil facilities	-	4	4	8
2.3	Compressor station	-	8	1	9
2.4	Oxygen station	-	14	-	14
2.5	Ventilation and air conditioning	-	14	-	14
	Sub-total, item 2	-	42	6	48

Schedule 8-1 (contd)

Ser. No	Description	Wage category			Total
		skilled	semis-killed	unskil-led	
3	Water supply and sewerage				
3.1	Heat and water supply	3	32	34	69
3.2	Mud removal	-	20	-	20
	Sub-total, item 3	3	52	34	89
4	Repair, storage and transport facilities				
4.1	Repair shop	40	78	36	154
4.2	Electrical repairs shop	3	37	19	59
4.3	Civil work shop	3	29	11	43
4.4	Transportation and storages	11	78	15	104
	Sub-total, item 4	57	222	81	360
5	Management and serciving				
5.1	Laboratory	24	32	2	58
5.2	Technical inspection and environmental control	4	29	-	33
5.3	Technical building with automatic telephone exchange	30	47	5	82
5.4	Plant management	-	-	4	4
5.5	Guards	-	11	12	23
5.6	Fire fighting	-	70	-	70
	Sub-total, item 5	58	189	23	270
	Total for the plant	423	616	173	1212

Schedule 8-2

Production costs estimate

Ser. No	Description	Unit of	Wages category			Total
			skilled	semi-skilled	unskilled	
1	Main production	men	305	111	29	445
2	Power facilities and services	do	-	42	6	48
3	Water supply and sewerage systems	do	3	52	34	89
4	Repair facilities and storages	do	46	144	66	256
5	Transportation facilities	do	11	78	15	104
6	Management and servicing	do	58	189	23	270
	Total:		423	616	173	1212
7	Annual average wages	R.thous	960	600	480	-
8	Annual wages	do	406080	369600	83040	858720
9	Bonus (two months wages)	do	67680	61600	13840	143120
10	Premium	20% of annual	81220	73920	16610	171750
11	Money for food, clothes and welfare	8% of annual	32490	29570	6640	68700
12	Additional wages (taking into accoung a shift rotation coefficient)	30% of annual	121820	110880	24910	257610
	Total wages, items 8-12		709290	645570	145040	1499900
	including:					
	- production personnel	R.thous	499665	186546	36100	722311

Ser. No.	Description	Unit of measure	Wates categofy			Total
			skilled	semis-killed	unskil-led	
	- general plant personnel	R.thous.	112359	260952	89666	462977
	- administrative personnel	do	97266	192072	192072	314612

8.2. Managerial, supervisory staff and clerks

The number and professional composition of management, administration and specialists are presented in Schedule 8-3.

The categories below are given on the basis of the initial data on wages and salaries:

Ser. No	Category	Monthly salary, R.thous.
1	Management	250-300
2	Supervision (engineering and technical personnel)	150-250
3	Foremen	80-150
4	Administrative	40-100
5	Clerks	40-80

Operations of the plant will be run by the management, including the senior staff and required functional staff, the total being 89 men.

A required supervision and technical staff is provided for in the production and servicing units.

The total number of the managerial & supervisoty staff is 238 men (14% of the total number of employees). Out of this managerial staff is 13 men, supervision - 90 men, foremen - 48 men, clerks - 27 men, administrative - 59 men.

For salaries of the managerial and supervisory staff see Schedule 8-4.

Schedule 8-3

Summary Sheet
Manning table - staff

persons

Ser. No.	Description	Category of salary					Total
		managerial	supervisory	administrative	foremen	clerks	
1	Main Production						
1.1	Ore preparation	-	1	-	3	-	4
1.2	Roasting and reduction	-	1	-	4	-	5
1.3	Leaching and desilication	-	1	-	4	-	5
1.4	Evaporation and potassium sulphate production	-	1	-	4	-	5
1.5	Precipitation hydrate thickening and filtration	-	1	-	4	-	5
1.6	Calcination, potassium sulphate drying	-	1	-	4	-	5
1.7	General personnel	1	9	2		2	14
	Sub-total, item 1	1	15	2	23	2	43
2	Power Facilities and Services						
2.1	Transformer repair and oil regeneration facilities	-	-	-	1	-	1
2.2	Fuel oil facilities	-	1	-	1	-	2
2.3	Compressor station	-	-	-	1	-	1
2.4	Oxygen station	-	-	-	1	1	2
2.5	Ventilation and air conditioning	-	-	-	1	-	1
	Sub-total, item 2	-	1	-	5	1	7

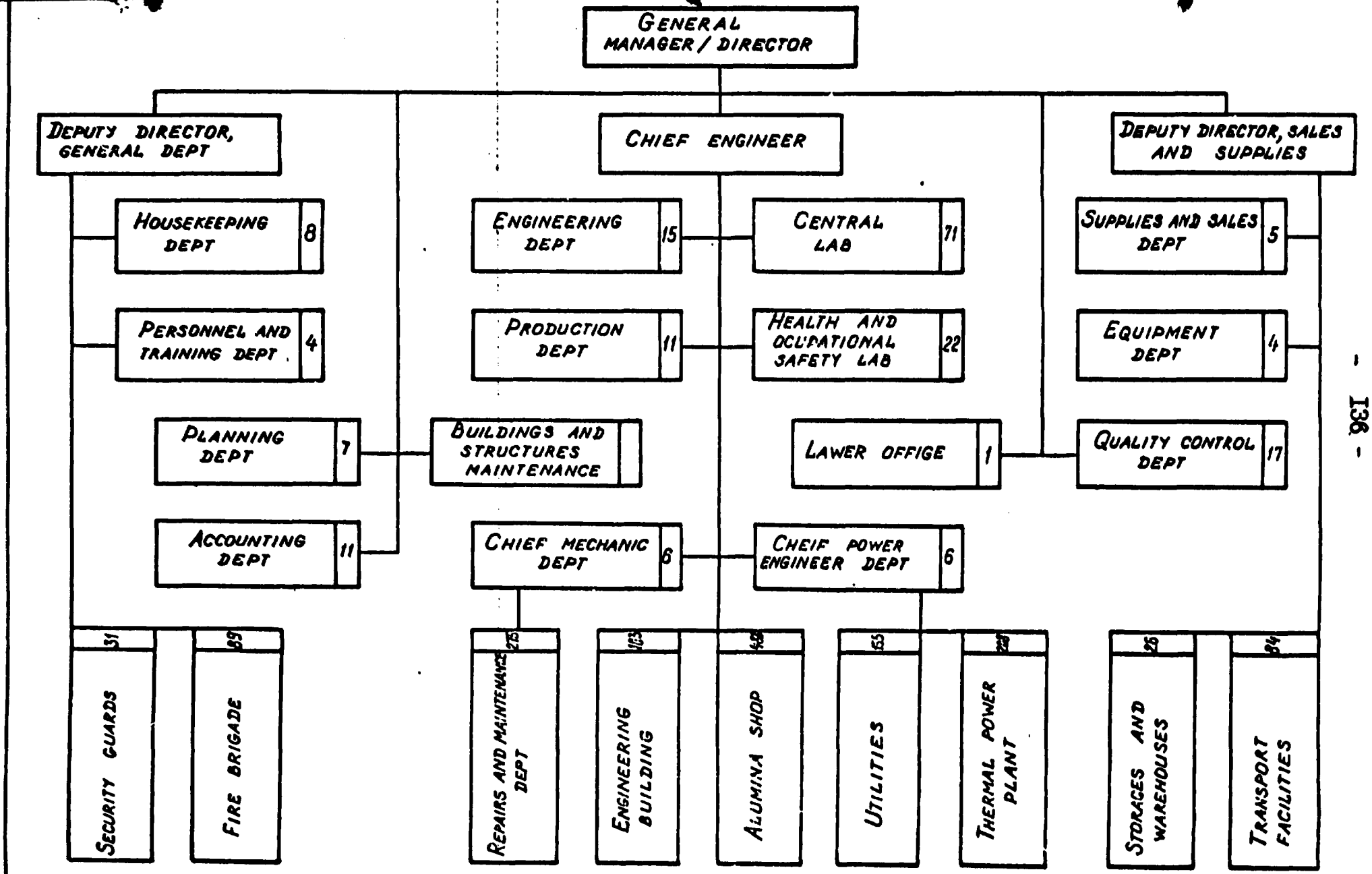
Schedule 3-3 (contd)

Ser. No	Description	Category of salary					Total
		managerial	supervisory	administrative	foremen	clerks	
3	Water Supply and Sewerage						
3.1	Heat and water supply	-	1	6	1	1	9
3.2	Mud removal	-	1	-	1	-	2
	Sub-total, item 3	-	2	6	2	1	11
4	Repair and Storage Facilities						
4.1	Repair shop	1	3	1	5	2	12
4.2	Electrical repair shop	-	1	-	2	1	4
4.3	Civil work shop	-	1	-	2	-	3
4.4	Transportation and storages	-	1	-	2	3	6
	Sub-total, item 4	1	6	1	11	6	25
5	Management and Servicing						
5.1	Laboratory	-	10	1	1	1	13
5.2	Technical inspection and environmental control	-	4	-	2	-	6
5.3	Technical building and automatic exchange	-	11	4	4	2	21
5.4	Plant management	11	41	21	-	12	85
5.5	Guards	-	-	6	-	2	8
5.6	Fire fighting	-	1	18	-	-	19
	Sub-total, item 5	11	67	50	7	17	152
	Total for the plant	13	91	59	43	27	238

Schedule 8-4

Production costs: salaries

Ser. No	Description	Unit of measure	Category of salary					Total
			managerial	supervisory	administrative	foremen	clerks	
1	Main production	persons	1	15	2	23	2	43
2	Power facilities and services	do	-	1	-	5	1	7
3	Water supply and sewerage	do	-	2	6	2	1	11
4	Repair and storage facilities	do	1	5	1	9	3	19
5	Transport facilities	do	-	1	-	2	3	6
6	Management and servicing	do 3	11	67	50	7	17	152
	Total:	do	13	91	59	48	27	238
7	Annual average salary	R. thous	3600	2400	840	1380	720	-
8	Annual salary	do	46800	218400	49560	66240	19440	400440
9	Bonus (two months salary)	do	7800	36400	8260	11040	3240	66740
10	Insurance premium	20% of annual	9360	43680	9910	13250	3890	80090
11	Money for food, clothes and welfare	8% of annual	3740	17470	3970	5300	15550	32030
	Total, items 8-11		67700	315950	71700	95830	28120	579300
	Including:							
	- production personnel	R. thous.	-	31246	14595	59902	4177	109920
	- general plant personnel	do	10416	52080	3645	21956	8328	96425
	- administrative personnel	do	57284	232624	53460	13972	15613	372955


GENERAL MANAGER / DIRECTOR
DEPUTY DIRECTOR, GENERAL DEPT
CHIEF ENGINEER
DEPUTY DIRECTOR, SALES AND SUPPLIES
HOUSEKEEPING DEPT 8
PERSONNEL AND TRAINING DEPT 4
PLANNING DEPT 7
ACCOUNTING DEPT 11
ENGINEERING DEPT 15
PRODUCTION DEPT 11
BUILDINGS AND STRUCTURES MAINTENANCE
CHIEF MECHANIC DEPT 6
CENTRAL LAB 71
HEALTH AND OCUPATIONAL SAFETY LAB 22
LAWER OFFIGE 1
CHEIF POWER ENGINEER DEPT 6
SUPPLIES AND SALES DEPT 5
EQUIPMENT DEPT 4
QUALITY CONTROL DEPT 17
SECURITY GUARDS 31
FIRE BRIGADE 89
REPAIRS AND MAINTENANCE DEPT 215
ENGINEERING BUILDING 183
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UTILITIES 153
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STORAGES AND WAREHOUSES 26
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9. PROJECT IMPLEMENTATION

9.1. Data for project implementation

Expenses of project implementation, including:

- construction management, consultant services,
- basic and detailed engineering,
- feasibility study,
- contingencies.

As agreed with ARMP Subcontractor's data will be used to determine the amount of expenses for elaboration of design and detailed documentation.

9.2. Project implementation programme

Taking into consideration Iranian conditions, the plant construction together with engineering works can be fulfilled within 6 years. Earth works and infrastructure facilities construction will be executed simultaneously with engineering work during the first two years. Alumina production facilities will be constructed during next four years.

For estimation purposes of the project the following is assumed:

- construction period of alumina plant is 4 years.

All expenses on project implementation sustained before construction commencement are written off to the account of the first year of construction.

- Break-down of investment of civil works by years of construction:

1st year	- 20%
2nd year	- 40%
3d year	- 30%
4th year	- 10%

- Delivery and erection of alumina production equipment is effected within last two years of construction, including:

3d year	- 40%
4th year	- 60%

- Alumina production facilities will start-up by the end of the 4th year of construction;

- Commissioning and beginning of alumina production are to be on the fifth year of construction period.

9.3. Cost estimate for project implementation

Investment costs for project realization are estimated according to "Initial data" and Subcontractor's estimates.

Investment cost estimate is given in Schedule 9-1.

Schedule 9-1

Investment cost estimate

Project implementation

Srl Nos	Q-ty	Unit of measure	Description of expenses	Cost, Rials, mln.	Expenses, Rials mln.
1	5	%	Construction management, consultant services	29380.8	1469.0
2			Basic and detailed engineering	Subcontr's calculation	4609.8 (4271.3)
3			Feasibility study	"	66.5 (66.5)
4	10	%	Contingencies	31970.0	3197.0 (1162.9)
			Total:		9342.3 (5500.7)

Note: 1) Figures in brackets show foreign exchange component

2) Contingencies are not included in cost of land, Know-How, preparation of design documentation and FS.

10. FINANCIAL AND ECONOMIC EVALUATION

The financial evaluation of alumina plant project using Iranian alunites is done on assumption of its twenty years of operation.

The profitability performances of project are based on:

- alumina and by-products cost according to ARMP data;
- investment and production expensesdetermined in previcus Chapters ;
- financing and taxation conditions adopted in accordance with "Initial data";
- depreciation rates on buildings, structures and operated equipment, according to norms and standards in force in Iran.

Evaluation is done in end 1987 prices not considering their excalation.

Foreign exchange component is determined proceeding from the rat of 1 US $ = 66 Rials

The income tax is imposed after the first years' losses are covered by gross profit (after 15 years of the plant operation).

Financial evaluation using COMFAR system was also prepared.

As these calculations are based on a 15-year operating period, given below are comparative results of calculations prepared by VAMI (based on assumption of a 20-year operation period in conformity with the "Initial data") and those according to the COMFAR system (for a 15-year operation period)

The financial evaluation prepared in accordance with the COMFAR system is a supplement to this Report shown in Annex to the General explanatory note in English.

Paremeter	Unit of means	VAMI calculations (20-year operation)	Computation to COMPAR system (15-years operation)
1. Corporate profit before taxation	Rl,mln	25361	8843
2. Total amount of tax	"	4367	-
3. Corporate net profit after tax	"	20994	8843
4. Annual average net profit after taxation, including:	"	2840	2984
- net profit	"	1050	523
- depreciation	"	1790	2461
5. Net profit/(capital, ratio			
- the 5th year of operation	"	1.0	1.0
- the 10th year of operation	"	5.1	5.0
- the 15th year of operation	"	8.0	7.9
6. Pay-back period	year	13.5	13.5
7. Break-even level:			
- the 5th year of operation	ths.t	184	184
	%	92	92
- the 10th year of operation	"	118	118
		59	59
- the 15th year of operation	"	72	-
		36	
8. Internal rate of return	%	3.4	1.8

10.1. Total investment costs

Total demand in capital stated as the summary of fixed assets and working capital is 40934.2 mln rials, namely;

- fixed assets	40563.5 mln rials
- working capital (incl.interest)	370.8 mln rials

The fixed assets comprise:

- buildings and structures (site preparation, civil works)	16488.3 mln rials
- equipment	14055.5 mln rials (11629.3)

Including:

foreign exchange expenses	11629.3 mln rials
local expenses	2426.2 mln rials
- preliminary expenses (engineering and survey, FS elaboration, know-how, management up-keep, reserve)	10019.7 mln.rials (6165.3)
Total	40563.6 mln rials
including foreign currency	(17794.6)

Schedule 10-1 shows the main investment expenses.

The working capital comprises the money necessary for creation of material reserve, work in process, reserve of finished products in storage, money for paying pending debts and running debts.

The necessary working capital is determined according to technological calculations of necessary amounts of production resources and demand on them to create the work in progress.

The cash is determined in an amount ensuring payment of 2 weeks salaries and wages and covering overheads.

The calculation of demand in working capital is shown in Schedules 10-2 and 10-3.

It was assumed for the purpose of calculations that part of the working capital (Rls 370.8 million or about 30%) is provided at the expense of main investments. The rest of the working capital is provided by cash inflow from operations.

The amount of total investment costs by years of construction according to project implementation programme is shown in Schedules 10-4 and 10-5.

10.2. Project financing

According to ARMP information the financing of fixed assets (fully) in the PS is supposed to be done by state subsidies (Iranian government) without repayment.

Bank charges for financial operation is not taken into account.

The financing of working capital in amount for the 1st year (Rls.370.8 mln) of operation is to be done through the short term bank credit at 13% annual interest.

Distribution of money by financing sources is shown in Schedule 10-6.

10.3. Total production costs.

Annual production costs are determined on the basis of corresponding cost estimates as the summary of operating costs (Schedule 10-2), depreciation costs and financial expenses.

The calculation of the production costs by years of operation is shown in Schedule 10-7.

10.4. Financial evoluation

The following is adopted as criteria of industrial profitability:

- return on fixed assets;
- pay-back period;

- breakeven point;

- internal rate of return.

These economic performances are determined basing on profits and losses calculations as well as cash flow by years of construction and operation.

10.4.1. Profitability analysis

The level of profitability is characterized by the relation of annual net profit after taxation to fixed assets (simple rate of return).

The calculation of simple rate of return indeces is given in the table of profits and losses (table 10-8).

According to calculation of rate of return after profitability level is reached and after the first years losses are covered is on the 8% level (without tax payment) and 6% level (after payment of tax).

10.4.2. Payback period

Main capital investments payback period is determined by the time during which initial sum of fixed assets is compensated by net cash. Here the net cash is the sum of net profit and depreciation costs.

Thus, the payback period shown on graph at the end of this chapter is 13.5 years from the beginning of operation.

10.4.3. Breakeven point

Breakeven point is the level of utilization of production capacity of operation in the representative year which guarantees the breakeven running of the plant when sales revenues are equal to production costs.

As it is seen from the breakeven point graph given at the end of the Chapter , this operation is ensured under the following conditions:

- 92% of capacity in the 5th year of operation;

- 59% of capacity in the 10th year of operation;

- 36% of capacity in the 15th year of operation,

which corresponds to production output of 184, 118 and 72 thousand tons of alumina per annum, respectively, at the assumed price level.

For the determination of break-even levels the total production cost are devided as follows:

	5-th year	10-th year	15-th year
1. Variable costs			
1.1. Raw materials, inputs, utilities	5612.7	5612.7	5612.7
2. Fixed costs			
2.1. Factory and administrative overhead costs	1768.7	1768.7	1768.7
2.2. Depreciation	2888.4	1237.0	39.7
Total of 2	4657.1	3005.7	1808.4
Grand total	10269.8	8618.4	7421.1

10.4.4. Internal rate of return

Internal rate of return at which the sum of future incomes is equal to discounted current expenses and amounts to 3.4%.

The calculation of internal rate of return is given in the graph at the end of this chapter.

10.5. Sensitivity analysis

According to "Initial data" the sensitivity analysis examines the effect on internal rate of return variations of:

- sales revenue;
- investments amount;
- operating costs.

Analysis prepared on the basis of 15 and 20 years of the operating period showed:

- an increase of the sales revenue by 15-20% results in rise of the IRR from 1.8% to 6.5%;
- an increase in investment by over 20-25% or production costs by over 8-10% in respect of the calculated figures makes the Project unprofitable.

The curves of effect of the above parameters on the IRR is shown at the end of the Chapter.

The Tables below show the alternatives of invesment and production costs estimated for different Plant capacities in the range of ± 80000 tpy of alumina.

The effect of the capacity on the variation of these alternatives is shown on the curves at the end of the Chapter.

10.5.1. Alternatives of the main investment costs

Rls. mln

No	Investment category	120 thou.t			180 thou.t			200 thou.t (Basic)		
		Foreign currency	Local currency	Total	Fireign currency	Local currency	Total	Foreign currency	Local currency	Total
1.	Buildings & structures									
1.1.	Civil works	-	12789.6	12789.6	-	15661.9	15661.9	-	16325.1	16325.1
1.2.	Insurance	-	127.9	127.9		156.6	156.6	-	163.2	163.2
	Total of 1	-	12917.5	12917.5	-	15818.5	15818.5	-	16488.3	16488.3
2.	Equipment									
2.1.	Equipment & erection	8589.8	1036.2	9626.0	11077.7	1349.5	12427.2	11629.3	1418.8	13048.1
2.2.	Taxes & charges	-	648.5	648.5	-	836.4	836.4	-	854.8	854.8
2.3.	Insurance	-	95.5	95.5	-	123.3	123.3	-	152.6	152.6
	Total of 2	8589.8	1780.2	10370.0	11077.7	2309.2	13386.9	11629.3	2426.2	14055.5
3.	Preliminary expenses									
3.1.	Recruitment & keep-up of management	-	1120.7	1120.7	-	1404.5	1404.5	-	1469.0	1469.0
3.2.	Engineering, FS , Know-how, lend rent	5002.4	351.2	5353.6	5002.4	351.2	5353.6	5002.4	351.2	5353.6
3.3.	Contingencies	958.9	1469.8	2328.7	1107.8	1812.8	2920.6	1162.9	2034.1	3197.0
	Total of 3	5861.3	2941.7	8803.0	6110.2	3568.5	9678.7	6165.3	3854.3	10019.6
	Grand total	14451.1	17639.4	32090.5	17187.9	21696.2	38884.1	17794.6	22768.8	40563.4

10.5.1. Alternatives of the main investment costs (Cont'd)

Rls. mln

No	Investment category	220 thou.t			260 thou. t			280 thou. t		
		Foreign currency	Local currency	Total	Foreign currency	Local currency	Total	Foreign currency	Local currency	Total
1.	Buildings & structures									
1.1.	Civil works	-	18375.7	18375.7	-	21234.9	21234.9	-	22025.0	22025.0
1.2.	Insurance	-	183.8	183.8	-	212.3	212.3	-	220.3	220.3
	Total of 1	-	18559.5	18559.5	-	21447.2	21447.2	-	22245.3	22245.3
2.	Equipment									
2.1.	Equipment & erection	13305.5	1631.1	14936.6	15255.2	1874.3	17129.5	15908.0	1954.0	17862.0
2.2.	Taxes & charges	-	1004.6	1004.6	-	1151.8	1151.8	-	1201.0	1201.0
2.3.	Insurance	-	158.2	158.2	-	169.9	169.9	-	177.2	177.2
	Total of 2	13305.5	2793.9	16099.4	15255.2	3196.0	18451.2	15908.0	3332.2	19240.2
3.	Preliminary expenses									
3.1.	Recruitment & keep-up of management	-	1665.6	1665.6	-	1918.2	1918.2	-	1994.4	1994.4
3.2.	Engineering, FS, Know-how, lend rent	5002.4	351.2	5353.6	5002.4	351.2	5353.6	5002.4	351.2	5353.6
3.3.	Comtingencies	1330.5	2134.3	3464.8	1525.5	2464.3	3989.8	1590.8	2557.8	4148.6
	Total of 3	6332.9	4151.1	10484.0	6527.9	4733.7	11261.6	6593.2	4903.4	11496.6
	Grand total	19638.4	25504.5	45142.9	21783.1	29376.9	51160.0	22501.2	30480.9	52982.1

10.5.2. Alternatives of production costs

Rls. mln

No	Category	120 thou.t	180 thou.t	200 thou.t (basic)	220 thou.t	260 thou.t	280 thou.t
1.	Direct expenses						
1.1.	Raw material	758.9	1138.4	1246.9	1391.4	1644.4	1770.9
1.2.	Materials	1385.5 (772.3)	2078.2 (1158.4)	2309.1 (1287.1)	2540.0 (1415.8)	3001.8 (1673.2)	3232.7 (1801.9)
1.3.	Fuel oil	46.4	69.7	77.4	85.1	100.6	108.4
1.4.	Energy	826.2	1085.1	1129.1	1317.7	1504.0	1560.4
1.5.	Wages	692.2	814.9	832.2	1028.3	1127.8	1142.7
	Total of 1	3709.2 (772.3)	5186.3 (1158.4)	5612.7 (1287.1)	6362.5 (1415.8)	7378.6 (1673.2)	7815.1 (1801.9)
2.	Factory overheads						
2.1.	Maintenance & repairment	349.7	445.4	464.9	532.1	611.4	636.7
2.2.	Service	27.1	27.1	27.1	27.1	27.1	27.1
	Total of 2	376.8	472.5	492.0	559.2	638.5	663.8
3.	Administrative overheads costs						
3.1.	Salaries	1096.3	1228.4	1247.0	1458.1	1565.2	1581.3
3.2.	Materials & service	29.7	29.7	29.7	29.7	29.7	29.7
	Total of 3	1126.0	1258.1	1276.7	1487.8	1594.9	1611.0
	Total operating costs	5212.0	6916.9	7381.4	8409.5	9612.0	10089.9
4.	Depreciation	1444.0	1749.8	1790.0	2031.4	2302.2	2384.2
5.	Financial costs	4.0	4.9	5.0	5.7	6.4	6.7
	Total production costs	6660.0 (772.3)	8671.6 (1158.4)	9176.4 (1287.1)	10446.6 (1415.8)	11920.6 (1673.2)	12480.8 (1801.9)
6.	Excluding						
6.1.	Potassium sulphate	3175.2	4762.8	5292.0	5821.2	6879.6	7408.8
6.2.	Sulphurous gas	840.0	1260.0	1400.0	1540.0	1820.0	1960.0
	Total of 6	4015.2	6022.8	6692.0	7361.2	8699.6	9368.8
7.	Annual alumina production costs	2644.8	2648.8	2484.4	3085.4	3221.0	3112.0
8.	Same, calculated per 1 tonne of alumina, Rls.thou	22.0	14.7	12.4	14.0	12.4	11.1

Note: In brackets foreign currency is given.

Schedule 10-1

Initial main investment costs

Rls million

N	Kind of expense	Foreign currency	Local currency	Total
1	**Buildings and structures**			
1.1	Site preparation	-	640.7	640.7
1.2	Civil works	-	15684.4	15684.4
1.3	Insurance	-	163.2	163.2
	Total:	-	16488.3	16488.3
2	**Equipment**			
2.1	Equipment	11629.3	105.5	11734.8
2.2	Erection	-	1313.3	1313.3
2.3	Imported equipment tax	-	831.5	831.5
2.4	Insurance	-	152.6	152.6
2.5	Red Crescent charges	-	23.3	23.3
	Total:	11629.3	2426.2	14055.5
3	**Preliminary expenses**			
3.1	Recruitment and keep-up of management	-	1469.0	1469.0
3.2	Engineering and survey	4271.3	338.5	4609.8
3.3	PS preparation	66.5	-	66.5
3.4	Know-how	664.6	-	664.6
3.5	Land rent	-	12.7	12.7
3.6	Reserve for incontingency	1162.9	2034.1	3197.0
	Total:	6165.3	3854.3	10019.6
	Grand total:	17794.6	22768.8	40563.4

Schedule 10-2

Annual production-cost estimate

in ths. rials

Period	Start-up and commissioning		Full capacity operation
Years from beginning of construction	7	8	9
Production programme, %	34	89.8	100
1. Direct production costs			
1.1. Raw materials and materials			
1.1.1. Alunite ore	430000	1135800	1264900
1.1.2. Sulphur	272000	718400	800000
1.1.3. Potassium hydroxide	434214	1146836	1277100
Total:	1118214	3001036	3342000
1.2. Auxiliary materials	71006	187364	232026
1.3. Fuel oil	26299	69460	77350
1.4. Energy resources	383899	1013946	1129116
1.5. Production personnel salary	282959	747343	832231
Total:	1882377	5019149	5612723
2. Total plant's overheads			
2.1. Maintenance and running repair	464893	464893	464893
2.2. Service	27128	27128	27128
Total:	492021	492021	492021
3. Administration overheads			
3.1. Managing and service personnel salaries	1246969	1246969	1246969
3.2. Materials	246	246	246
3.3. Service	29460	29460	29460
Total:	1276675	1276675	1276675
TOTAL production costs	3651073	6787845	7381419

Schedule 10-3

Calculation of working capital

ths.rials

	Minimum days of coverage	Coefficient of turnover	Start-up and commissioning		Full capacity
			7	8	9
1. Accounts receivable	15	24.0	86484	228419	254364
2. Inventory					
2.1. Alunite ore	26	13.8	31160	82310	91660
2.2. Sulphur	5	72.0	3778	9978	11111
2.3. Potassium hydroxide	5	72.0	6031	15928	17738
2.4. Fuel oil	60	6.0	4383	11577	12892
Total of 2:	-	-	45352	119793	133401
3. Work-in-progress					
3.1. Alunite ore	32	11.3	38050	100520	111938
3.2. Potassium hydroxide	11	32.7	13279	35071	39055
3.3. Hydroxide	8	45.0	31076	82077	91400
3.4. Others	32	11.3	68323	180452	200949
Total of 3:	-	-	150728	398120	443342
4. Finished products	7	51.4	40380	106650	118760
5. Cash-in-hand	15	24.0	85486	104835	108656
Total of working capital	-	-	408430	957817	105852
Increase in working capital	-	-	408430	549387	100706

Schedule 10-4

Total investment costs

Rls.million

No	Cost	Foreign currency	Local currenc.	Total
1	Fixed assets			
1.1	Buildings & structures	-	16488.3	16488.3
1.2	Equipment	11629.3	2426.2	14055.5
1.3	Preliminary expenses	6165.3	3854.3	10019.6
	Total:	17794.6	22768.8	40563.4
2	Working capital	56.8	1001.7	1058.5
	TOTAL:	17851.4	23770.5	41621.9

Schedule 10-5

Breakdown of Total Investment Cost by Years

Rls million

Period	Construction											
Years from start of construction	1			2			3			4		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
1. Buildings and and structures	-	3428.3	3428.3	-	6530.0	6530.0	-	4897.5	4897.5	-	1632.5	1632.5
2. Equipment	-	-	-	-	-	-	4651.7	970.5	5622.2	6977.6	1455.7	8433.3
3. Initial costs	6165.3	3854.3	10019.6	-	-	-	-	-	-	-	-	-
4. Working capital	-	-	-	-	-	-	-	-	-	-	-	348.2
5. Interest during construction	-	-	-	-	-	-	-	-	-	-	-	22.6
TOTAL:	6165.3	7282.6	13447.9	-	6530.0	6530.0	4651.7	5868.0	10519.7	6977.6	3459.0	10436.6

Schedule 10-5 (Cont'd)
Rls million

Years from start of construction	Start-up, commissioning									Grand total		
	5			6			7					
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
1. Buildings and structures	-	-	-	-	-	-	-	-	-	-	16488.3	16488.
2. Equipment	-	-	-	-	-	-	-	-	-	11629.3	2426.2	14055.
3. Initial costs	-	-	-	-	-	-	-	-	-	6165.3	3854.3	10019.
4. Working capital	19.3	315.6	334.9	31.7	243.0	274.7	5.8	94.9	100.7	56.8	1001.7	1058.5
5. Interest during construction	-	-	-	-	-	-	-	-	-	-	- 22.6	22.6
TOTAL	19.3	315.6	334.9	31.7	243.0	274.7	5.8	94.9	100.7	17851.4	23793.1	41644.

Schedule 10-6

Financing Sources

Rls million

S/N	Financing sources	Foreign currency	Local currency	Total
1	State subsidies	-	40563.4	40563.4
2	Bank loans	-	370.8	370.8
	TOTAL	-	40934.2	40934.2

Production Costs

Schedule 10-7

Rls million

S/N	Years from start of construction	5	6	7	8	9	10	11	12	13	14	15	16
	Production programme, %	34.0	89.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1	Direct production costs	1882.4	5019.1	5612.7	5612.7	5612.7	5612.7	5612.7	5612.7	5612.7	5612.7	5612.7	5612.
2	General overheads of the plant	492.3	492.0	492.0	492.0	492.0	492.0	492.0	492.0	492.0	492.0	492.0	492.0
3	Administrative overheads	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	1276.
	Total of operating costs	3651.1	6787.8	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.
4	Depreciation	6580.8	6147.3	5837.7	5599.8	2888.4	2876.7	1874.5	1495.8	1237.0	1237.0	927.9	110.0
5	Financing costs	45.3	39.6	17.0	-	-	-	-	-	-	-	-	-
	Total production costs with:	10257.2	12974.4	13236.1	12981.2	10269.8	10258.1	9255.9	8877.7	8618.4	8618.4	8309.3	7491.
	- foreign currency	437.6	1155.8	1287.1	1287.1	1287.1	1287.1	1287.1	1287.1	1287.1	1287.1	1287.1	1287.
	- local currency	9819.6	11818.9	11949.0	11694.1	8982.7	8971.0	7968.8	7590.1	7331.3	7331.3	7022.2	6204.

S/N	Years from start of construction	17	18	19	20	21	22	23	24	Total
	Production programme, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
1	Direct production costs	5612.7	5612.7	5612.7	5612.7	5612.7	5612.7	5612.7	5612.7	107930.1
2	General overheads of the plant	492.0	492.0	492.0	492.0	492.0	492.0	492.0	492.0	9840.0
3	Administrative overheads	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	1276.7	25534.0
	Total of operating costs	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	143304.1
4	Depreciation	45.9	42.5	39.7	1.1	0.7	0.5	0.3	0.2	36923.8
5	Financing costs	-	-	-	-	-	-	-	-	401.9
	Total of production costs	7427.3	7423.9	7421.1	7382.5	7382.1	7381.9	7381.7	7381.6	180329.8
	With:									
	- foreign currency	1287.1	1287.1	1287.1	1287.1	1287.1	1287.1	1287.1	1287.1	24761.2
	- local currency	6140.2	6136.8	6134.0	6095.4	6095.0	6094.8	6094.6	6094.5	155568.6

Schedule 10-8

Profit and Loss Account

Years from start of construction	5	6	7	8	9	10	11
Sales revenue	3637.5	9597.5	10692.0	10692.0	10692.0	10692.0	10692.0
Production costs	10257.2	12974.7	13236.1	12981.2	10269.8	10258.1	9255.9
Profit before tax	-6619.7	-3377.2	-2544.1	-2289.2	422.2	433.9	1436.1
Income tax	-	-	-	-	-	-	-
Net profit (+) loss (-)	-6619.7	-3377.2	-2544.1	-2289.2	422.2	433.9	1436.1
Accumulated net profit (+), losses (-)	-6619.7	-9996.9	-12541.0	-14830.2	-14408.0	-13974.1	-12538.0
Ratio of net profit to fixed assets, %	-	-	-	-	1.0	1.1	3.5

Schedule 10-8 (Cont'd)

Rls million

Years from start of construction	12	13	14	15	16	17	18
1. Sales revenue	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0
2. Production costs	8877.2	8618.4	8618.4	8309.3	7491.4	7427.3	7423.9
3. Profit before tax	1814.8	2073.6	2073.6	2382.7	3200.6	3264.7	3268.1
4. Income tax	-	-	-	-	-	-	-
5. Net profit (+) loss (-)	1814.8	2073.6	2073.6	2382.7	3200.6	3264.7	3268.1
6. Accumulated net profit (+) losses (-)	-10723.8	-8649.6	-6576.0	-4193.3	-992.7	2272.0	5540.1
7. Ratio of net profit to fixed assets, %	4.4	5.1	5.1	5.8	7.8	8.9	8.0

Schedule 10-8 (Cont'd)

Rls million

Years from start of construction	19	20	21	22	23	24	Total
1. Sales revenue	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	205691.0
2. Production costs	7421.1	7382.5	7382.1	7381.9	7381.7	7381.6	180329.8
3. Profit before tax	3270.9	3309.5	3309.9	3310.1	3310.3	3310.4	25361.2
4. Income tax	-	873.3	873.5	873.5	873.6	873.6	4367.5
5. Net profit (+) loss (-)	3270.9	2436.2	2436.4	2436.6	2436.7	2436.8	20993.7
6. Accumulated net profit (+), losses(-)	8811.0	11247.2	13683.6	16120.2	18556.9	20993.7	-
Ratio of net profit to fixed assets , %	8.0	6.0	6.0	6.0	6.0	6.0	

Schedule 10-9

Cash-Flow

Rials, mln

Years from start of construction	1	2	3	4	5	6	7	8	9
1. Inflow	13447.9	6530.0	10519.7	10436.6	4031.3	9597.5	10692.0	10692.0	10692
1.1. Sales revenue	-	-	-	-	3637.5	9597.5	10692.0	10692.0	10692
1.2. Financi..g gources	13447.9	6430.0	10519.7	10436.6	-	-	-	-	-
1.3. Short-term bank loans	-	-	-	-	393.8	-	-	-	-
2. Outflow	13447.9	6530.0	10519.7	10436.6	4031.3	7721.1	7673.3	7381.4	7381.
2.1. Capital investment	13447.9	6530.0	10519.7	10436.6	334.9	274.7	100.7	-	-
2.2. Operating costs	-	-	-	-	3651.1	6787.8	7381.4	7381.4	7381.
2.3. Financing expenses	-	-	-	-	45.3	213.6	191.2	-	-
2.4. Repayment of short-term loans	-	-	-	-	-	393.8	-	-	-
2.5. Interest on short-term loans	-	-	-	-	-	51.2	-	-	-
2.6. Income tax	-	-	-	-	-	-	-	-	-
3. Net cash	-	-	-	-	-	1876.4	3018.7	3310.6	3310.
4. Accumulated cash	-	-	-	-	-	1876.4	4895.1	8205.7	11516

Schedule 10-9 (Cont'd)

Rls million

Years from start of construction	10	11	12	13	14	15	16	17	18
1. Inflow	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10691.0	10692.0
1.1. Sales revenue	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0
1.2. Financing sources	-	-	-	-	-	-	-	-	-
1.3. Short-term bank loans	-	-	-	-	-	-	-	-	-
2. Outflow	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381,4
2.1. Capital investment	-	-	-	-	-	-	-	-	-
2.2. Operating costs	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4
2.3. Financing costs	-	-	-	-	-	-	-	-	-
2.4. Repayment of short-term loans	-	-	-	-	-	-	-	-	-
2.5. Interest on short-term loans	-	-	-	-	-	-	-	-	-
2.6. Income tax	-	-	-	-	-	-	-	-	-
3. Net cash	3310.6	3310.6	3310.6	3310.6	3310.6	3310.6	3310.6	3310.6	3310.6
4. Accumulated cash	14826.9	18137.5	21448.1	24758.7	28069.3	31379.9	34690.5	38001.1	41311.7

Schedule 10-9 (Cont'd)

Rls million

Year from start of construction	19	20	21	22	23	24	Salvage value	Total
1. Inflow	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	-	247019.0
1.1. Sales revenue	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	-	205691.0
1.2. Financing sources	-	-	-	-	-	-	-	40934.2
1.3. Short-term bank loans	-	-	-	-	-	-	-	393.8
2. Outflow	7381.4	8254.7	8254.9	8254.9	8255.0	8255.0	-4720.7	185490.5
2.1. Capital investment	-	-	-	-	-	-	-4720.7	36923.8
2.2. Operating costs	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	-	143304.1
2.3. Financing costs	-	-	-	-	-	-	-	450.1
2.4. Repayment of short-term loans	-	-	-	-	-	-	-	393.8
2.5. Interest on short-term loans	-	-	-	-	-	-	-	51.2
2.6. Income tax	-	873.3	873.5	873.5	873.6	873.6	-	4367.5
3. Net cash	3310.6	2437.3	2437.1	2437.1	2437.1	2437.1	4720.7	61528.5
4. Accumulated cash	44622.3	47059.6	49496.7	51933.8	54370.8	56807.8	-	-

Schedule 10-10

Rls million

IRR Calculation

Years from start of construction	1	2	3	4	5	6	7	8	9
1. Inflow									
1.1. Sales revenue	-	-	-	-	3637.5	9597.5	10692.0	10692.0	10692.0
2. Outflow	13447.9	6530.0	10519.7	10088.4	3696.4	7446.4	7572.6	7381.4	7381.4
2.1. Investment costs	13447.9	6530.0	10519.7	10088.4	-	-	-	-	-
2.1.1. State subsidies	13447.9	6530.0	10519.7	10088.4	-	-	-	-	-
2.1.2. Financing costs	-	-	-	-	45.3	213.6	191.2	-	-
2.1.3. Repayment of short-term loans	-	-	-	-	-	393.8	-	-	-
2.1.4. Interest on short-term loans	-	-	-	-	-	51.2	-	-	-
2.2. Operating costs	-	-	-	-	3651.1	6787.8	7381.4	7381.4	7381.4
2.3. Income tax	-	-	-	-	-	-	-	-	-
3. Net payments (-) revenue (+)	-13447.9	-6530.0	-10519.7	-10088.4	-58.9	2151.1	3119.4	3310.6	3310.6
4. Current discounted value: at 2%	-13184.3	-6276.6	-9912.7	-9319.7	-53.3	1910.2	2715.7	2825.6	2770.3
at 3.5%	-12993.4	-6095.8	-9487.7	-8791.0	-49.6	1749.9	2451.8	2514.1	2429.0

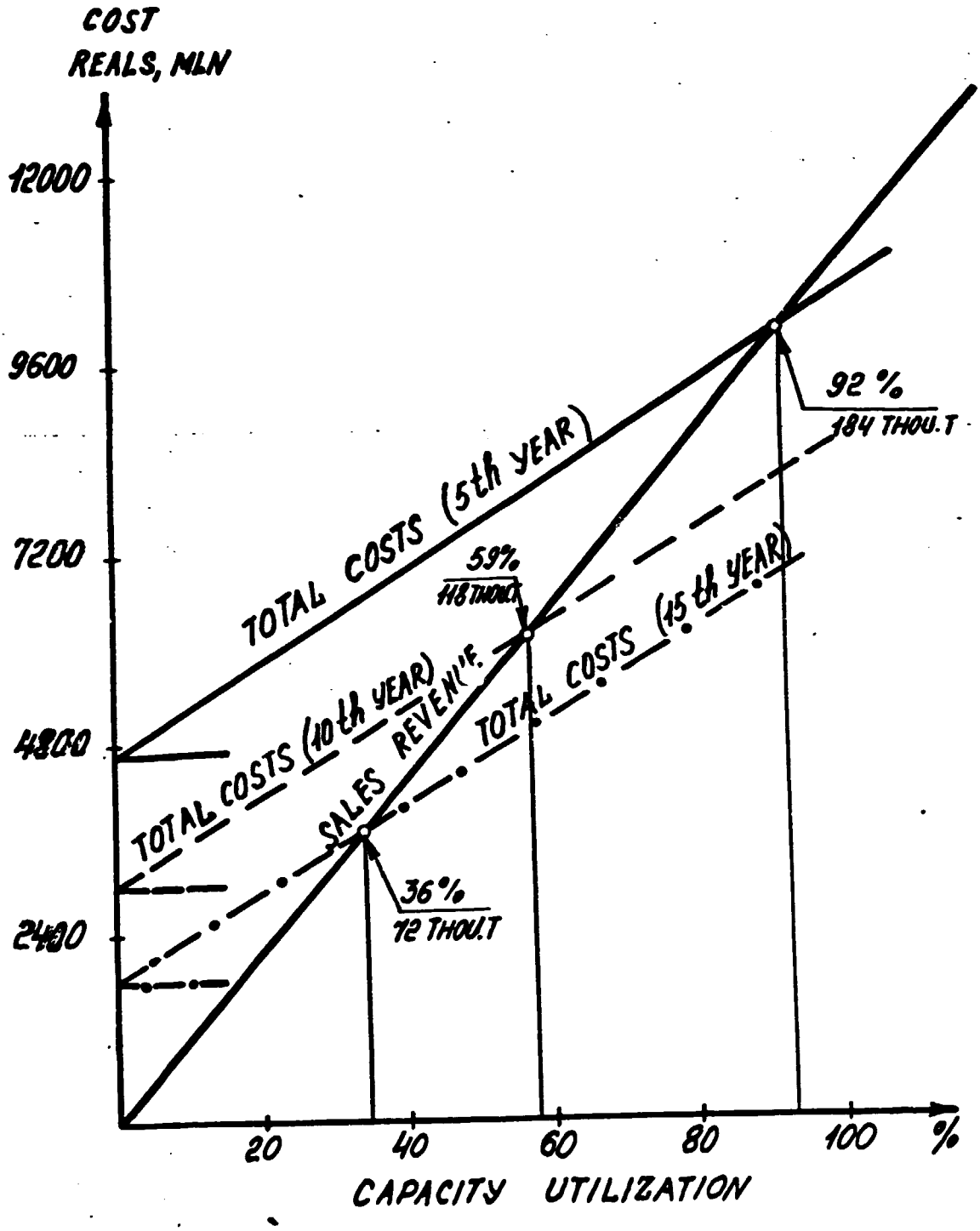
Schedule 10-10 (Cont'd)
Rls million

Years from start of construction	10	11	12	13	14	15	16	17	18
1. Inflow									
1.1. Sales revenue	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	10692.
2. Outflow	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4
2.1. Investment costs	-	-	-	-	-	-	-	-	-
2.1.1. State subsidies	-	-	-	-	-	-	-	-	-
2.1.2. Financing costs	-	-	-	-	-	-	-	-	-
2.1.3. Repayment of short-term loans	-	-	-	-	-	-	-	-	-
2.1.4. Interest on short-term loans	-	-	-	-	-	-	-	-	-
2.2. Operating costs	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4
2.3. Income tax	-	-	-	-	-	-	-	-	-
3. Net payments (-), revenue (+)	3310.6	3310.6	3310.6	3310.6	3310.6	3310.6	3310.6	3310.6	3310.6
4. Current discounted value :									
at 2%	2715.7	2662.7	2610.7	2559.1	2509.1	2459.8	2411.8	2318.1	2272.4
at 3.5%	2346.9	2267.4	2191.0	2116.8	2045.3	1976.1	1909.2	1844.7	1782.

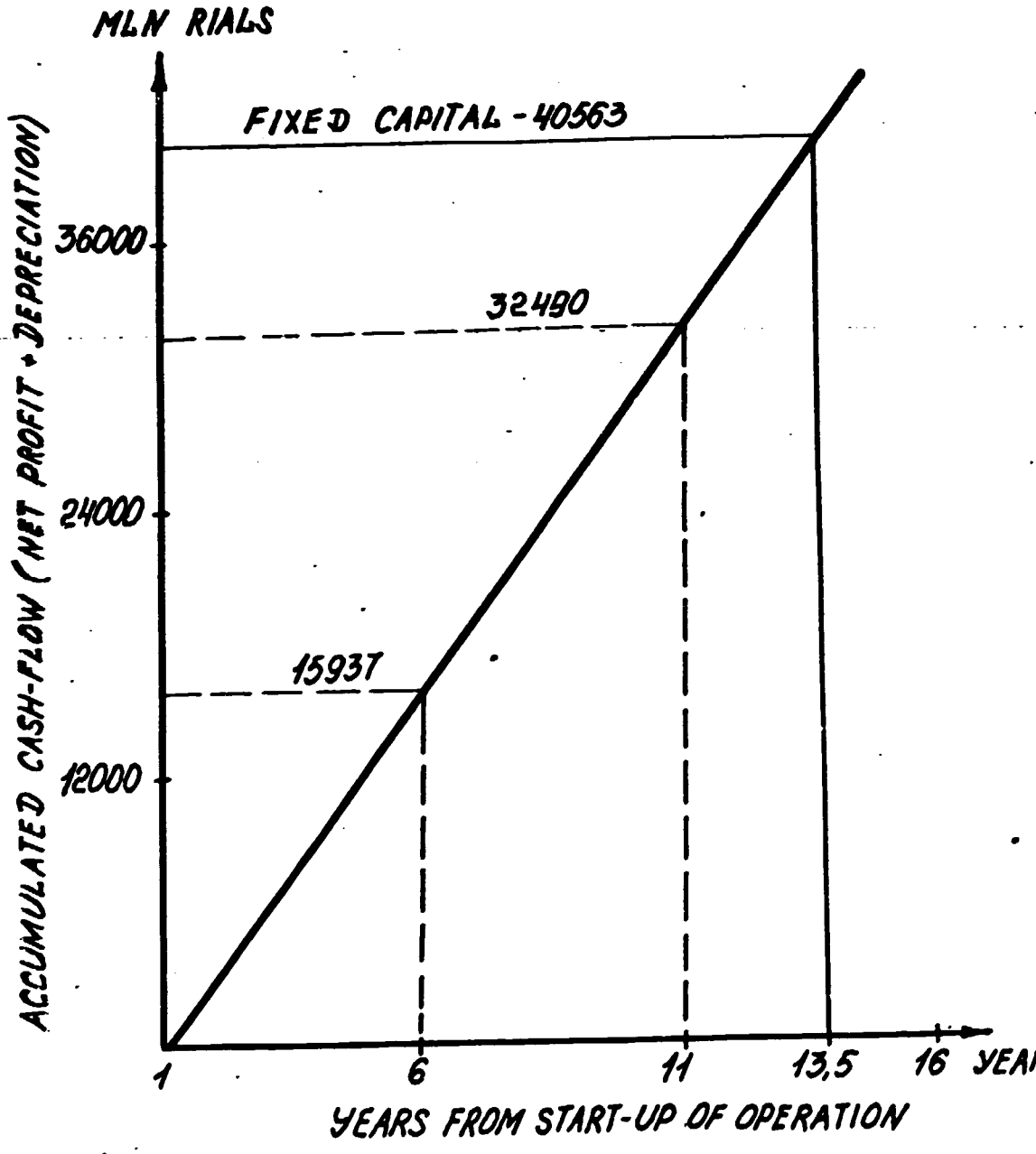
Schedule 10-10 (Cont'd)
Rls million

Years from start of construction	19	20	21	22	23	24	Salvage value	Total
1. Inflow								
1.1. Sales revenue	10692.0	10692.0	10692.0	10692.0	10692.0	10692.0	-	205691.0
2. Outflow	7381.4	8254.7	8254.9	8254.9	8255.0	8255.0	-4720.7	184432.0
2.1. Investment costs	-	-	-	-	-	-	-4720.7	36760.4
2.1.1. State subsidies	-	-	-	-	-	-	-4720.7	35865.3
2.1.2. Financing expenses	-	-	-	-	-	-	-	450.1
2.1.3. Repayment of short-term loans	-	-	-	-	-	-	-	393.8
2.1.4. Interest on short-term loans	-	-	-	-	-	-	-	51.2
2.2. Operating costs	7381.4	7381.4	7381.4	7381.4	7381.4	7381.4	-	143304.1
2.3. Income tax	-	873.3	873.5	873.5	873.6	873.6	-	4367.5
3. Net payments (-), revenue (+)	3310.6	2437.3	2437.1	2437.1	2437.0	2437.0	4720.7	21259.0
4. Current discounted value:								
at 2%	2228.0	1608.1	1576.3	1545.6	1515.1	4362.6	-	+6829.6
at 3.5%	1722.2	1225.0	1183.5	1143.8	1104.7	3135.1	-	-279.2

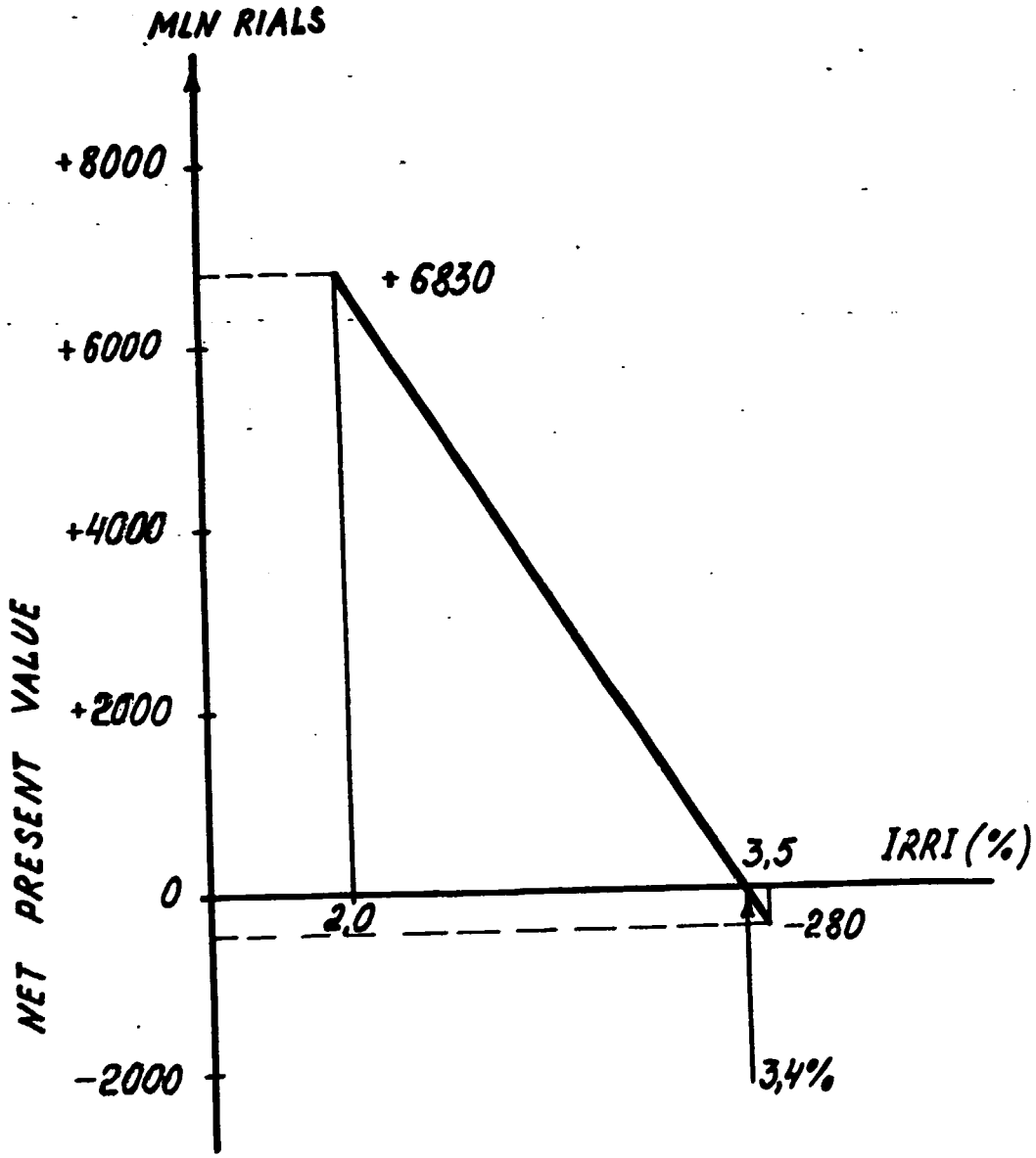
BREAK-EVEN POINT



PAY-BACK PERIOD

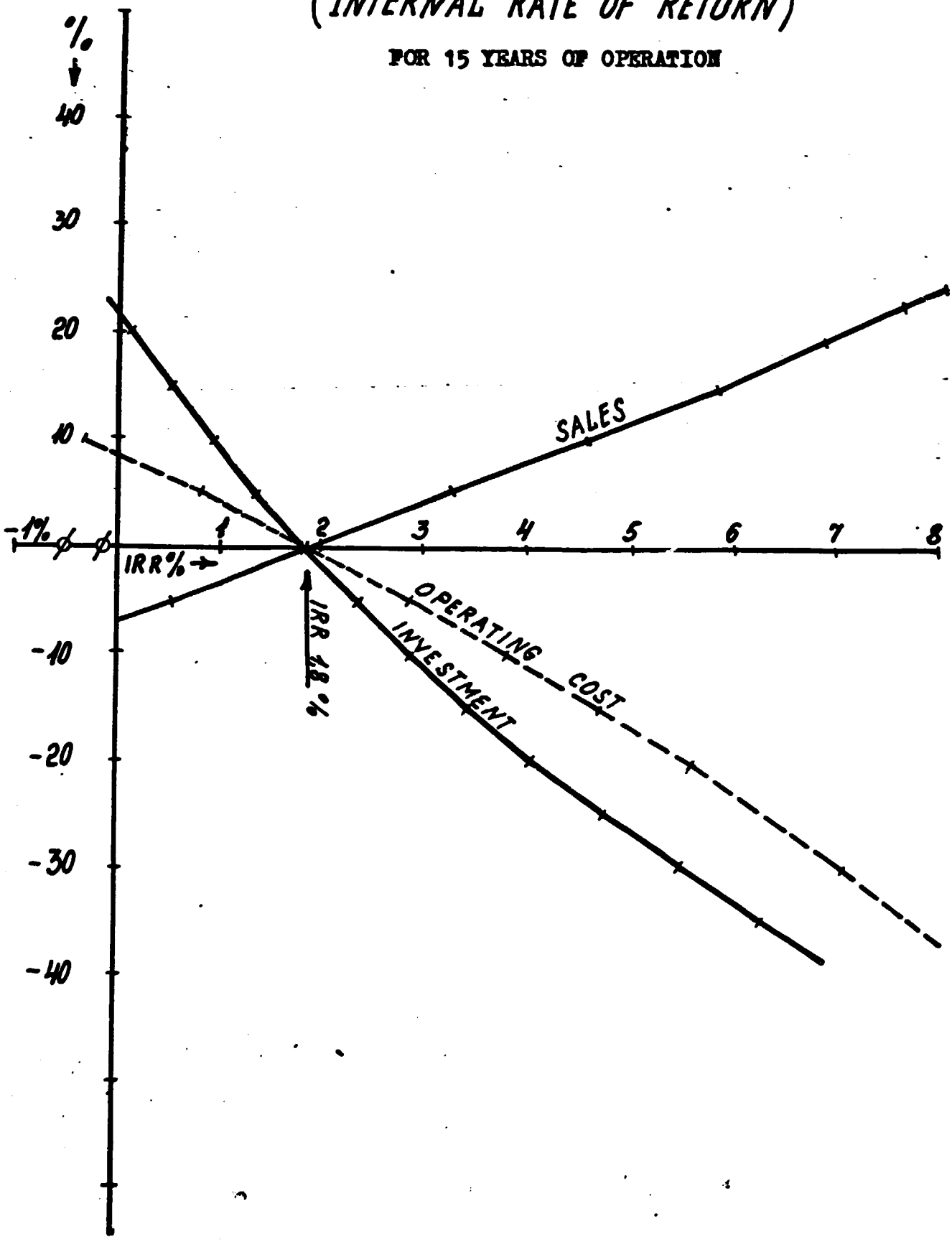


INTERNAL RATE OF RETURN ON INVESTMENT



SENSITIVITY OF IRR %
(INTERNAL RATE OF RETURN)

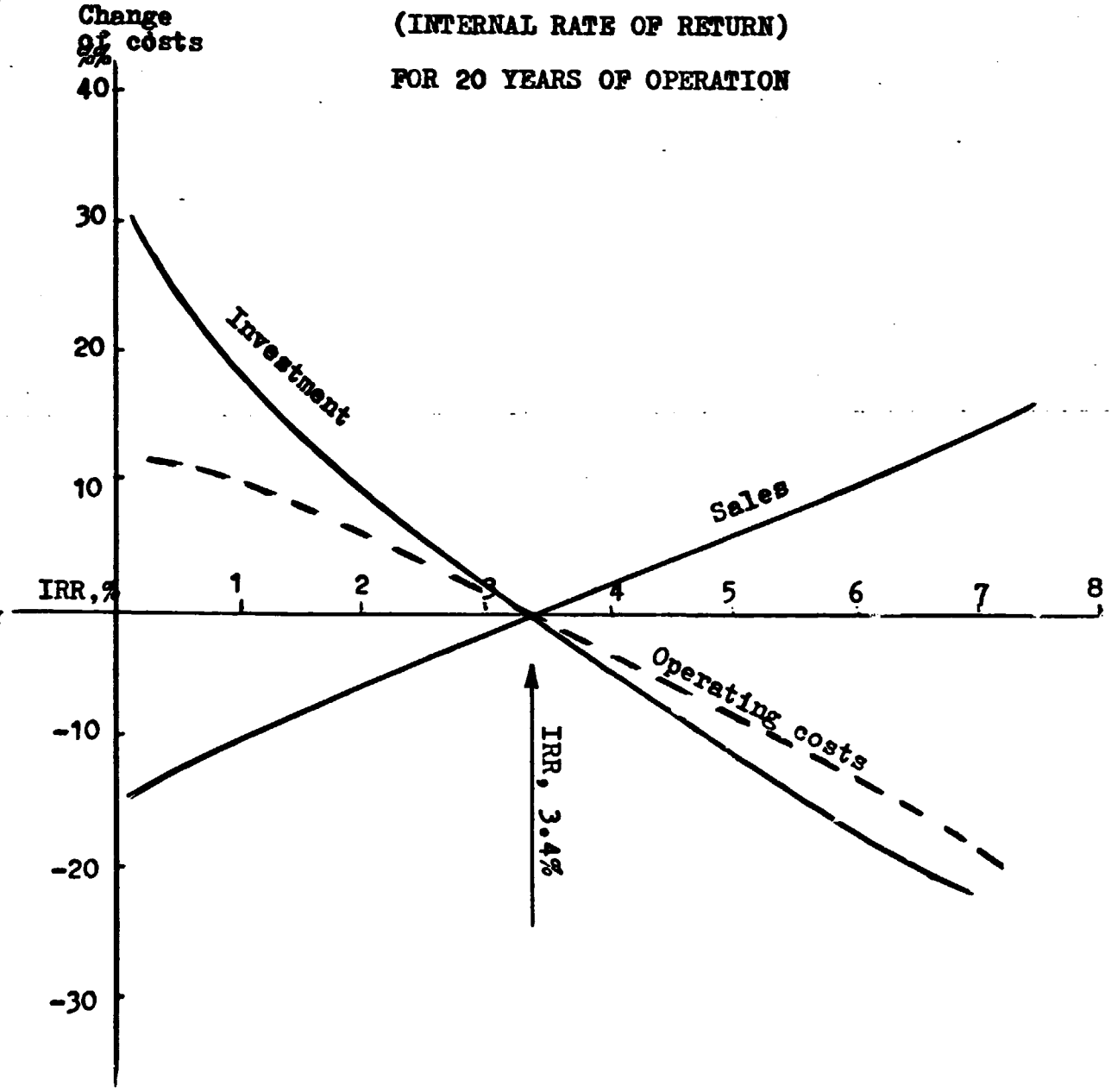
FOR 15 YEARS OF OPERATION



SENSITIVITY OF IRR

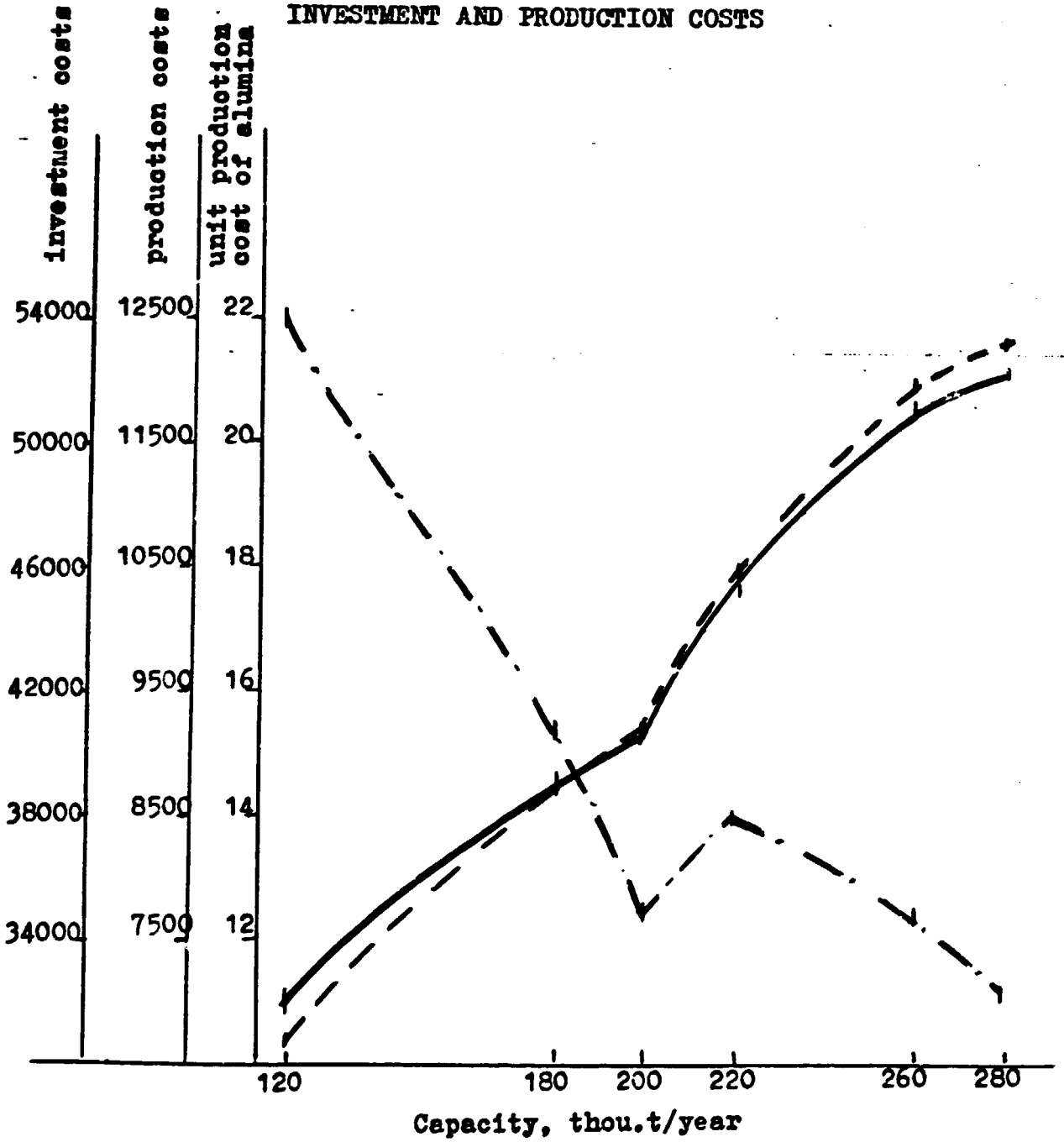
(INTERNAL RATE OF RETURN)

FOR 20 YEARS OF OPERATION



SENSITIVITY ANALYSIS

EFFECT OF PLANT CAPACITY ON
INVESTMENT AND PRODUCTION COSTS



——— capital investment, Rls.mln

— — — annual production expenses, Rls.mln

—.—.— unit production cost per 1 tonne of alumina, Rls.thou

A N N E X E S

ANNEX 1

MATERIAL BALANCE

EXTERNAL MATERIAL BALANCE

IN

NUMBER	NAME OF FLOW	PHASE	MASS	AL2O3	NA2O	K2O	CO2	S
111	RAW ALUNITE	S.	6949.2	1379.4	107.7	230.7	0.0	13
111	RAW ALUNITE	L.	27.8	0.0	0.0	0.0	0.0	
117	WATER FOR WASHING ON FILTER	L.	2760.0	0.0	0.0	0.0	0.0	
144	WATER FOR WASHING OF MUD	L.	6307.3	0.0	0.0	0.0	0.0	
138	STEAM	L.	2353.7	0.0	0.0	0.0	0.0	
134	POTASSIUM ALKALI	L.	895.9	0.0	0.0	375.9	0.0	
234	WATER	L.	500.0	0.0	0.0	0.0	0.0	
126	CARBON DIOXIDE	L.	1.0	0.0	0.0	0.0	1.0	
129	WATER FOR HYDRATE WASHING	L.	1000.0	0.0	0.0	0.0	0.0	
TOTAL		S.	6949.2	1379.4	107.7	230.7	0.0	13
		L.	13845.7	0.0	0.0	375.9	1.0	
		TOTAL	20795.0	1379.4	107.7	606.6	1.0	13

OUT

NUMBER	NAME OF FLOW	PHASE	MASS	AL2O3	NA2O	K2O	CO2	S
1101	LOSSES	S.	660.7	20.7	1.6	3.5	0.0	
1101	LOSSES	L.	753.1	0.0	0.0	0.0	0.0	7
3901	STEAM	L.	1366.1	0.0	0.0	0.0	0.0	
2401	EVAPORATED WATER AND LOSSES	L.	7060.2	2.0	3.8	1.1	0.0	
3401	POTASSIUM SULPHATE	S.	1083.7	0.0	15.6	566.2	0.0	5
3401	POTASSIUM SULPHATE	L.	57.0	0.0	0.0	0.0	0.0	
2601	LOSSES	S.	9.3	3.0	4.3	0.7	0.0	
3201	RED MUD TO MUD DISPOSAL	S.	3939.7	348.8	71.1	32.2	1.0	
3201	RED MUD TO MUD DISPOSAL	L.	4145.6	7.3	8.0	2.3	0.0	
3001	COMMERCIAL ALUMINA	S.	1000.0	987.6	3.4	0.6	0.0	
3002	LOSSES	S.	720.0	10.0	0.0	0.0	0.0	
TOTAL		S.	7413.5	1370.1	95.9	603.2	1.0	5
		L.	13382.0	9.3	11.8	3.4	0.0	7
		TOTAL	20795.5	1379.4	107.7	606.6	1.0	13

SECTION 1

EXTERNAL MATERIAL BALANCE

IN

MASS	AL2O3	NA2O	K2O	CO2	SO3	SIO2	FE2O3	CAO	H2O	MISC
6949.2	1379.4	107.7	230.7	0.0	1341.9	3174.4	0.0	0.0	486.4	228.6
27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	0.0
2760.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2760.0	0.0
6307.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6307.3	0.0
2353.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2353.7	0.0
895.9	0.0	0.0	375.9	0.0	0.0	0.0	0.0	0.0	520.0	0.0
500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	500.0	0.0
1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
1000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1000.0	0.0
6949.2	1379.4	107.7	230.7	0.0	1341.9	3174.4	0.0	0.0	486.4	228.6
13845.7	0.0	0.0	375.9	1.0	0.0	0.0	0.0	0.0	13468.8	0.0
20795.0	1379.4	107.7	606.6	1.0	1341.9	3174.4	0.0	0.0	13955.2	228.6

OUT

MASS	AL2O3	NA2O	K2O	CO2	SO3	SIO2	FE2O3	CAO	H2O	MISC
660.7	20.7	1.6	3.5	0.0	69.7	47.6	0.0	0.0	514.2	3.4
753.1	0.0	0.0	0.0	0.0	753.1	0.0	0.0	0.0	0.0	0.0
1366.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1366.1	0.0
7060.2	2.0	3.8	1.1	0.0	0.0	0.0	0.0	0.0	7053.3	0.0
1083.7	0.0	15.6	566.2	0.0	501.9	0.0	0.0	0.0	0.0	0.0
57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.0	0.0
9.3	3.0	4.3	0.7	0.0	1.3	0.0	0.0	0.0	0.0	0.0
3939.7	348.8	71.1	32.2	1.0	11.2	3126.8	0.0	0.0	123.5	225.2
4145.6	7.3	8.0	2.3	0.0	3.7	0.0	0.0	0.0	4124.2	0.0
1000.0	987.6	3.4	0.6	0.0	0.0	0.0	0.0	0.0	8.4	0.0
720.0	10.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	708.9	0.0
7413.5	1370.1	95.7	603.2	1.0	585.2	3174.4	0.0	0.0	1355.1	228.6
13382.0	9.3	11.8	3.4	0.0	756.8	0.0	0.0	0.0	12600.6	0.0
20795.5	1379.4	107.7	606.6	1.0	1342.0	3174.4	0.0	0.0	13955.7	228.6

SECTION 2

NAME OF FLOW	FLOW NUMBER	PHASE	TOTAL MASS KG	ALUMINA KG	SODIUM CAUST. KG	SODIUM CARB. KG	SODIUM OXIDE SULPH. KG
11 ALUNITE ROASTING							
IN							
RAW ALUNITE	111	S	6949.2	1379.4	0.0	0.0	107.7
		L	27.8	0.0	0.0	0.0	0.0
OUT							
REDUCED ALUNITE	1112	S	5563.2	1358.7	0.0	0.0	106.1
LOSSES	1101	S	660.7	20.7	0.0	0.0	1.6
		L	753.1	0.0	0.0	0.0	0.0
12 GRINDING							
IN							
REDUCED ALUNITE	1112	S	5563.2	1358.7	0.0	0.0	106.1
RECYCLED LIQUOR	3712	L	29209.5	1258.2	2488.4	1.2	682.0
OUT							
RAW PULP	1213	S	5563.2	1358.7	0.0	0.0	106.1
		L	29212.9	1258.4	2488.5	1.2	682.1
13 DIGESTION							
IN							
RAW PULP	1213	S	5563.2	1358.7	0.0	0.0	106.1
		L	29212.9	1258.4	2488.5	1.2	682.1
OUT							
PULP AFTER DIGESTION	1314	S	3854.0	308.4	52.9	1.1	6.7
		L	30921.8	2308.7	2239.7	0.0	977.3
14 CLASSIFICATION							
IN							
PULP AFTER DIGESTION	1314	S	3854.0	308.4	52.9	1.1	6.7
		L	30921.8	2308.7	2239.7	0.0	977.3
OUT							
SAND OF CLASSIFICATION	1416	S	2697.8	215.9	37.0	0.8	4.7
		L	2697.8	201.4	195.4	0.0	85.3
CLASSIFICATION OVERFLOW	1418	S	1156.2	92.5	15.9	0.3	2.0
		L	28224.0	2107.2	2044.3	0.0	892.0
16 FLOW MIXING							
IN							
SAND OF CLASSIFICATION	1416	S	2697.8	215.9	37.0	0.8	4.7
		L	2697.8	201.4	195.4	0.0	85.3
WHITE MUD	3516	S	67.6	22.3	10.9	0.0	0.0
		L	67.3	6.8	4.7	0.0	2.9
OUT							
MIXED MUD	1615	S	2765.5	238.2	47.5	0.8	4.7
		L	2765.2	208.2	200.1	0.0	87.3

SECTION 1

O D I U M OXIDE			POTASSIUM OXIDE			CARBON	SULPHUR	SILICA	IRON	CALCIUM	BO
UST. CARB.	SULPH.	CAUST.	CARB.	SULPH.	DIOXIDE	TRIOXIDE		OXIDE	OXIDE	WA
KG KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	
0.0 0.0	107.7	0.0	0.0	230.7	0.0	1341.9	3174.6	0.0	0.0	
0.0 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0 0.0	106.1	0.0	0.0	227.3	0.0	519.1	3126.8	0.0	0.0	
0.0 0.0	1.6	0.0	0.0	3.5	0.0	69.7	47.6	0.0	0.0	
0.0 0.0	0.0	0.0	0.0	0.0	0.0	753.1	0.0	0.0	0.0	
0.0 0.0	106.1	0.0	0.0	227.3	0.0	519.1	3126.8	0.0	0.0	
8.2 1.2	682.0	596.2	0.2	133.0	1.0	993.1	14.0	0.0	0.0	
0.0 0.0	106.1	0.0	0.0	227.3	0.0	519.1	3126.8	0.0	0.0	
8.2 1.2	682.1	596.1	0.2	133.0	1.0	993.3	14.0	0.0	0.0	
0.0 0.0	106.1	0.0	0.0	227.3	0.0	519.1	3126.8	0.0	0.0	
8.2 1.2	682.1	596.1	0.2	133.0	1.0	993.3	14.0	0.0	0.0	
2.9 1.1	6.7	23.9	0.5	3.0	1.0	11.2	3104.5	0.0	0.0	1
9.7 0.0	977.3	646.8	0.0	282.2	0.0	1501.3	36.4	0.0	0.0	
2.9 1.1	6.7	23.9	0.5	3.0	1.0	11.2	3104.5	0.0	0.0	1
9.7 0.0	977.3	646.8	0.0	282.2	0.0	1501.3	36.4	0.0	0.0	
7.0 0.8	4.7	16.8	0.3	2.1	0.7	7.8	2173.1	0.0	0.0	
5.4 0.0	85.3	56.4	0.0	24.6	0.0	131.0	3.2	0.0	0.0	
5.9 0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
4.3 0.0	892.0	590.4	0.0	257.6	0.0	1370.3	33.2	0.0	0.0	
7.0 0.8	4.7	16.8	0.3	2.1	0.7	7.8	2173.1	0.0	0.0	
5.4 0.0	85.3	56.4	0.0	24.6	0.0	131.0	3.2	0.0	0.0	
0.4 0.0	0.0	4.7	0.0	0.0	0.0	0.0	22.3	0.0	0.0	
4.7 0.0	2.1	1.3	0.0	0.6	0.0	3.2	0.0	0.0	0.0	
7.5 0.8	4.7	21.5	0.3	2.1	0.7	7.6	2195.5	0.0	0.0	
0.1 0.0	87.3	57.8	0.0	25.2	0.0	134.1	3.2	0.0	0.0	

SECTION 2

SECTION 3

ON XIDE G	CALCIUM OXIDE KG	BOUND WATER KG	MISC KG	FREE WATER KG	VOLUME M^3	DENSITY T/M^3	ALUMINA G/L	CAUSTIC(IN CAUST. G/L	SODIUM CARB. G/L	OX SU
0.0	0.0	486.4	228.6	0.0	2.085	2.650				
0.0	0.0	0.0	0.0	27.8	0.0	1.000	0.0	0.0	0.0	
0.0	0.0	0.0	225.2	0.0	2.099	2.650				
0.0	0.0	514.2	3.6	0.0	0.249	2.650				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	0.0	0.0	225.2	0.0	2.099	2.650				
0.0	0.0	0.0	0.0	23042.4	23.592	1.238	53.3	122.1	0.1	
0.0	0.0	0.0	225.2	0.0	2.099	2.650				
0.0	0.0	0.0	0.0	23045.1	23.595	1.238	53.3	122.1	0.1	
0.0	0.0	0.0	225.2	0.0	2.099	2.650				
0.0	0.0	0.0	0.0	23045.1	23.595	1.238	53.3	122.1	0.1	
0.0	0.0	115.6	225.2	0.0	1.285	3.000				
0.0	0.0	0.0	0.0	22929.5	24.239	1.276	95.2	110.0	0.0	
0.0	0.0	115.6	225.2	0.0	1.285	3.000				
0.0	0.0	0.0	0.0	22929.5	24.239	1.276	95.2	110.0	0.0	
0.0	0.0	80.9	157.6	0.0	0.899	3.000				
0.0	0.0	0.0	0.0	2000.5	2.115	1.276	95.2	110.0	0.0	
0.0	0.0	34.7	67.6	0.0	0.385	3.000				
0.0	0.0	0.0	0.0	20929.0	22.124	1.276	95.2	110.0	0.0	
0.0	0.0	80.9	157.6	0.0	0.899	3.000				
0.0	0.0	0.0	0.0	2000.5	2.115	1.276	95.2	110.0	0.0	
0.0	0.0	7.9	0.0	0.0	0.031	2.200				
0.0	0.0	0.0	0.0	50.[illegible]	0.053	1.266	90.0	104.5	0.0	
0.0	0.0	88.8	157.6	0.0	0.930	2.976				
0.0	0.0	0.0	0.0	2051.3	2.168	1.275	95.1	109.9	0.0	

SECTION 4

	FREE WATER KG	VOLUME M^3	DENSITY T/M^3	ALUMINA G/L	CAUSTIC (IN SODIUM OXIDE) CAUST. G/L	CARB. G/L	SULPH. G/L	CAUSTIC RATIO	FLOW NUMBER
.6	0.0	2.085	2.650						111
.0	27.8	0.0	1.000	0.0	0.0	0.0	0.0	0.0	
.2	0.0	2.099	2.650						1112
.4	0.0	0.249	2.650						1101
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
.2	0.0	2.099	2.650						1112
.0	23042.4	23.592	1.238	53.3	122.1	0.1	32.6	3.767	3712
.2	0.0	2.099	2.650						1213
.0	23045.1	23.595	1.238	53.3	122.1	0.1	32.6	3.767	
.2	0.0	2.099	2.650						1213
.0	23045.1	23.595	1.238	53.3	122.1	0.1	32.6	3.767	
.2	0.0	1.285	3.000						1314
.0	22929.5	24.239	1.276	95.2	110.0	0.0	48.0	1.900	
.2	0.0	1.285	3.000						1314
.0	22929.5	24.239	1.276	95.2	110.0	0.0	48.0	1.900	
.6	0.0	0.899	3.000						1416
.0	2000.5	2.115	1.276	95.2	110.0	0.0	48.0	1.900	
.6	0.0	0.385	3.000						1418
.0	20929.0	22.124	1.276	95.2	110.0	0.0	48.0	1.900	
.6	0.0	0.899	3.000						1416
.0	2000.5	2.115	1.276	95.2	110.0	0.0	48.0	1.900	
.0	0.0	0.031	2.200						3516
.0	50.7	0.053	1.266	90.0	104.5	0.0	45.9	1.911	
.6	0.0	0.930	2.976						1615
.0	2051.3	2.168	1.275	95.1	109.9	0.0	47.9	1.900	

SECTION 1

NAME OF FLOW	FLOW NUMBER	PHASE	TOTAL MASS KG	ALUMINA KG	SODIUM CAUST. KG	SODIUM CARB. KG	OXIDE SULPH. KG	CA
15 FILTRATION								
IN								
MIXED MUD	1615	S	2765.5	238.2	47.5	0.8	4.7	
		L	2765.2	206.2	200.1	0.0	87.3	
OUT								
MIXED MUD AFTER FILTERING	1517	S	2765.5	238.2	47.5	0.8	4.7	
		L	1877.9	140.0	135.9	0.0	59.3	
FILTRATE AFTER MUD FILTER	1537	L	887.4	66.2	64.2	0.0	28.0	
17 WASHING								
IN								
MIXED MUD AFTER FILTERING	1517	S	2765.5	238.2	47.5	0.8	4.7	
		L	1877.9	140.0	135.9	0.0	59.3	
WATER FOR WASHING ON FILTER	117	L	2760.0	0.0	0.0	0.0	0.0	
OUT								
RED MUD AFTER FILTERING	1732	S	2765.5	238.2	47.5	0.8	4.7	
		L	1210.1	6.2	4.4	0.0	1.9	
LIQUOR AFTER WASHING OF MUD	1737	L	3427.7	133.8	131.5	0.0	57.4	
18 THICKENING								
IN								
CLASSIFICATION OVERFLOW	1418	S	1156.2	92.5	15.9	0.3	2.0	
		L	28224.0	2107.2	2044.3	0.0	892.0	
OUT								
RED MUD	1819	S	1156.2	92.5	15.9	0.3	2.0	
		L	2890.5	215.8	209.4	0.0	91.4	
ALUMINATE LIQUOR	1838	L	25333.5	1891.4	1834.9	0.0	800.7	
19 WASHING STAGE								
IN								
RED MUD	1819	S	1156.2	92.5	15.9	0.3	2.0	
		L	2890.5	215.8	209.4	0.0	91.4	
RED MUD WASHING II	4019	L	6307.3	91.3	96.7	0.0	42.2	
OUT								
RED MUD TO WASHING II	1940	S	1174.2	110.5	15.9	0.3	2.0	
		L	2935.5	92.4	97.8	0.0	42.7	
RED MUD WASHING I	1925	L	6244.3	196.7	208.4	0.0	90.9	
40 WASHING STAGE								
IN								
RED MUD TO WASHING II	1940	S	1174.2	110.5	15.9	0.3	2.0	
		L	2935.5	92.4	97.8	0.0	42.7	
RED MUD WASHING III	4140	L	6307.3	41.4	43.8	0.0	19.1	
OUT								
RED MUD TO WASHING III	4041	S	1174.2	110.5	15.9	0.3	2.0	
		L	2935.5	42.5	45.0	0.0	19.6	
RED MUD WASHING II	4019	L	6307.3	91.3	96.7	0.0	42.2	

U M CARB. KG	OXIDE SULPH. KG	POTASSIUM CAUST. KG	OXIDE CARB. KG	OXIDE SULPH. KG	CARBON DIOXIDE KG	SULPHUR TRIOXIDE KG	SILICA KG	IRON OXIDE KG	CALCIUM OXIDE KG	BOUND WATER KG
SECTION 2										
0.8	4.7	21.5	0.3	2.1	0.7	7.8	2195.5	0.0	0.0	88.8
0.0	87.3	57.8	0.0	25.2	0.0	134.1	3.2	0.0	0.0	0.0
0.8	4.7	21.5	0.3	2.1	0.7	7.8	2195.5	0.0	0.0	88.8
0.0	59.3	39.2	0.0	17.1	0.0	91.1	2.2	0.0	0.0	0.0
0.0	28.0	18.5	0.0	8.1	0.0	43.0	1.0	0.0	0.0	0.0
0.8	4.7	21.5	0.3	2.1	0.7	7.8	2195.5	0.0	0.0	88.8
0.0	59.3	39.2	0.0	17.1	0.0	91.1	2.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.8	4.7	21.5	0.3	2.1	0.7	7.8	2195.5	0.0	0.0	88.8
0.0	1.9	1.3	0.0	0.6	0.0	3.0	0.0	0.0	0.0	0.0
0.0	57.4	38.0	0.0	16.6	0.0	88.1	2.2	0.0	0.0	0.0
0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	34.7
0.0	892.0	590.4	0.0	257.6	0.0	1370.3	33.2	0.0	0.0	0.0
0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	34.7
0.0	91.4	60.5	0.0	26.4	0.0	140.3	3.4	0.0	0.0	0.0
0.0	800.7	529.9	0.0	231.2	0.0	1229.9	29.8	0.0	0.0	0.0
0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	34.7
0.0	91.4	60.5	0.0	26.4	0.0	140.3	3.4	0.0	0.0	0.0
0.0	42.2	27.9	0.0	12.2	0.0	64.8	1.6	0.0	0.0	0.0
0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	34.7
0.0	42.7	28.2	0.0	12.3	0.0	65.6	1.6	0.0	0.0	0.0
0.0	90.9	60.1	0.0	26.2	0.0	139.6	3.4	0.0	0.0	0.0
0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	34.7
0.0	42.7	28.2	0.0	12.3	0.0	65.6	1.6	0.0	0.0	0.0
0.0	19.1	12.7	0.0	5.5	0.0	29.4	0.7	0.0	0.0	0.0
0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	34.7
0.0	19.6	13.0	0.0	5.7	0.0	30.2	0.7	0.0	0.0	0.0
0.0	42.2	27.9	0.0	12.2	0.0	64.8	1.6	0.0	0.0	0.0

SECTION 3

N DE	CALCIUM OXIDE KG	BOUND WATER KG	MISC KG	FREE WATER KG	VOLUME 3 M	DENSITY 3 T/M	ALUMINA G/L	CAUSTIC(IN CAUST. G/L	SODIUM CARB. G/L	OXID SUL G/
0.0	0.0	88.8	157.6	0.0	0.930	2.974				
0.0	0.0	0.0	0.0	2051.3	2.168	1.275	95.1	109.9	0.0	4
0.0	0.0	88.8	157.6	0.0	0.930	2.974				
0.0	0.0	0.0	0.0	1393.0	1.472	1.275	95.1	109.9	0.0	4
0.0	0.0	0.0	0.0	658.3	0.696	1.275	95.1	109.9	0.0	4
0.0	0.0	88.8	157.6	0.0	0.930	2.974				
0.0	0.0	0.0	0.0	1393.0	1.472	1.275	95.1	109.9	0.0	4
0.0	0.0	0.0	0.0	2760.0	2.760	1.000	0.0	0.0	0.0	
0.0	0.0	88.8	157.6	0.0	0.930	2.974				
0.0	0.0	0.0	0.0	1192.7	1.196	1.011	5.2	4.4	0.0	
0.0	0.0	0.0	0.0	2960.3	3.008	1.160	44.5	52.0	0.0	2
0.0	0.0	34.7	67.6	0.0	0.385	3.000				
0.0	0.0	0.0	0.0	20929.0	22.124	1.276	95.2	110.0	0.0	4
0.0	0.0	34.7	67.6	0.0	0.385	3.000				
0.0	0.0	0.0	0.0	2143.4	2.266	1.276	95.2	110.0	0.0	4
0.0	0.0	0.0	0.0	18785.6	19.858	1.276	95.2	110.0	0.0	4
0.0	0.0	34.7	67.6	0.0	0.385	3.000				
0.0	0.0	0.0	0.0	2143.4	2.266	1.276	95.2	110.0	0.0	4
0.0	0.0	0.0	0.0	5970.7	5.997	1.052	15.2	19.2	0.0	
0.0	0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	0.0	2594.9	2.625	1.118	35.2	44.3	0.0	1
0.0	0.0	0.0	0.0	5519.2	5.584	1.118	35.2	44.4	0.0	1
0.0	0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	0.0	2594.9	2.625	1.118	35.2	44.3	0.0	1
0.0	0.0	0.0	0.0	6156.7	6.177	1.021	6.7	8.4	0.0	
0.0	0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	0.0	2778.8	2.791	1.052	15.2	19.2	0.0	
0.0	0.0	0.0	0.0	5970.7	5.997	1.052	15.2	19.2	0.0	

SECTION 4

	FREE WATER KG	VOLUME M^3	DENSITY T/M^3	ALUMINA G/L	CAUSTIC (IN SODIUM OXIDE) CAUST. G/L	CARB. G/L	SULPH. G/L	CAUSTIC RATIO	FLOW NUMBER
.6	0.0	0.930	2.974						1615
.0	2051.3	2.168	1.275	95.1	109.9	0.0	47.9	1.900	
.6	0.0	0.930	2.974						1517
.0	1393.0	1.472	1.275	95.1	109.9	0.0	47.9	1.900	
.0	658.3	0.696	1.275	95.1	109.9	0.0	47.9	1.900	1537
.6	0.0	0.930	2.974						1517
.0	1393.0	1.472	1.275	95.1	109.9	0.0	47.9	1.900	
.0	2760.0	2.760	1.000	0.0	0.0	0.0	0.0	0.0	117
.6	0.0	0.930	2.974						1732
.0	1192.7	1.196	1.011	5.2	4.4	0.0	1.9	1.388	
.0	2960.3	3.008	1.160	44.5	52.0	0.0	22.7	1.924	1737
.6	0.0	0.385	3.000						1418
.0	20929.0	22.124	1.276	95.2	110.0	0.0	48.0	1.900	
.6	0.0	0.385	3.000						1819
.0	2143.4	2.266	1.276	95.2	110.0	0.0	48.0	1.900	
.0	18785.6	19.858	1.276	95.2	110.0	0.0	48.0	1.900	1838
.6	0.0	0.385	3.000						1819
.0	2143.4	2.266	1.276	95.2	110.0	0.0	48.0	1.900	
.0	5970.7	5.997	1.052	15.2	19.2	0.0	8.4	2.073	4019
.6	0.0	0.391	3.000						1940
.0	2594.9	2.625	1.118	35.2	44.3	0.0	19.4	2.073	
.0	3519.2	5.584	1.118	35.2	44.4	0.0	19.4	2.073	1925
.6	0.0	0.391	3.000						1940
.0	2594.9	2.625	1.118	35.2	44.3	0.0	19.4	2.073	
.0	6156.7	6.177	1.021	6.7	8.4	0.0	3.7	2.073	4140
.6	0.0	0.391	3.000						4041
.0	2778.8	2.791	1.052	15.2	19.2	0.0	8.4	2.073	
.0	5970.7	5.997	1.052	15.2	19.2	0.0	8.4	2.073	4019

SECTION 1

NAME OF FLOW	FLOW NUMBER	PHASE	TOTAL MASS KG	ALUMINA KG	SODIUM CAUST. KG	SODIUM CARB. KG	OXIDE SULPH. KG	PO CAUS KG
41 WASHING STAGE								
IN								
RED MUD TO WASHING III	4041	S	1174.2	110.5	15.9	0.3	2.0	7
		L	2935.5	42.5	45.0	0.0	19.6	13
RED MUD WASHING IV	4241	L	6307.3	18.2	19.3	.0,0	8.4	5
OUT								
RED MUD TO WASHING IV	4142	S	1174.2	110.5	15.9	0.3	2.0	7
		L	2935.5	19.3	20.4	0.0	8.9	5
RED MUD WASHING III	4140	L	6307.3	41.4	43.8	0,0	19.1	12
42 WASHING STAGE								
IN								
RED MUD TO WASHING IV	4142	S	1174.2	110.5	15.9	0.3	2.0	7
		L	2935.5	19.3	20.4	0,0	8.9	5
RED MUD WASHING V	4342	L	6307.3	7.4	7.8	0.0	3.4	2
OUT								
RED MUD TO WASHING V	4243	S	1174.2	110.5	15.9	0.3	2.0	7
		L	2935.5	8.5	9.0	0,0	3.9	2
RED MUD WASHING IV	4241	L	6307.3	18.2	19.3	0.0	8.4	5
43 WASHING STAGE								
IN								
RED MUD TO WASHING V	4243	S	1174.2	110.5	15.9	0.3	2.0	7
		L	2935.5	8.5	9.0	0,0	3.9	2
RED MUD WASHING VI	4443	L	6307.3	2.3	2.5	0.0	1.1	0
OUT								
RED MUD TO WASHING VI	4344	S	1174.2	110.5	15.9	0.3	2.0	
		L	2935.5	3.4	3.9	0,0	1.6	
RED MUD WASHING V	4342	L	6307.3	7.4	7.8	0,0	3.4	2
44 WASHING STAGE								
IN								
RED MUD TO WASHING VI	4344	S	1174.2	110.5	15.9	0.3	2.0	
		L	2935.5	3.4	3.9	0,0	1.6	
WATER FOR WASHING OF MUD	144	L	6307.3	0.0	0.0	0.0	0.0	
OUT								
RED MUD	4432	S	1174.2	110.5	15.9	0.3	2.0	
		L	2935.5	1.1	1.2	0,0	0.5	
RED MUD WASHING VI	4443	L	6307.3	2.3	2.5	0,0	1.1	
38 HEATING								
IN								
ALUMINATE LIQUOR	1838	L	25333.5	1891.4	1834.9	0.0	800.7	52
STEAM	138	L	2353.7	0.0	0.0	0.0	0.0	
OUT								
ALUMINATE LIQUOR	3822	L	27687.2	1891.4	1834.9	0.0	800.7	52

SODIUM OXIDE AUST. KG	SODIUM CARB. KG	SODIUM OXIDE SULPH. KG	POTASSIUM CAUST. KG	POTASSIUM CARB. KG	POTASSIUM OXIDE SULPH. KG	CARBON DIOXIDE KG	SULPHUR TRIOXIDE KG	SILICA KG	IRON OXIDE KG	CALCIUM OXIDE KG	W
15.9	0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
45.0	0.0	19.6	13.0	0.0	5.7	0.0	30.2	0.7	0.0	0.0	
19.3	0.0	8.4	5.6	0.0	2.4	0.0	12.9	0.3	0.0	0.0	
15.9	0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
20.4	0.0	8.9	5.9	0.0	2.6	0.0	13.7	0.3	0.0	0.0	
43.8	0.0	19.1	12.7	0.0	5.5	0.0	29.4	0.7	0.0	0.0	
15.9	0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
20.4	0.0	8.9	5.9	0.0	2.6	0.0	13.7	0.3	0.0	0.0	
7.8	0.0	3.4	2.3	0.0	1.0	0.0	5.2	0.1	0.0	0.0	
15.9	0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
9.0	0.0	3.9	2.6	0.0	1.1	0.0	6.0	0.1	0.0	0.0	
19.3	0.0	8.4	5.6	0.0	2.4	0.0	12.9	0.3	0.0	0.0	
15.9	0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
9.0	0.0	3.9	2.6	0.0	1.1	0.0	6.0	0.1	0.0	0.0	
2.5	0.0	1.1	0.7	0.0	0.3	0.0	1.7	0.0	0.0	0.0	
15.9	0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
3.6	0.0	1.6	1.0	0.0	0.5	0.0	2.4	0.1	0.0	0.0	
7.8	0.0	3.4	2.3	0.0	1.0	0.0	5.2	0.1	0.0	0.0	
15.9	0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
3.6	0.0	1.6	1.0	0.0	0.5	0.0	2.4	0.1	0.0	0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
15.9	0.3	2.0	7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	
1.2	0.0	0.5	0.3	0.0	0.1	0.0	0.8	0.0	0.0	0.0	
2.5	0.0	1.1	0.7	0.0	0.3	0.0	1.7	0.0	0.0	0.0	
834.9	0.0	800.7	529.9	0.0	231.2	0.0	1229.9	29.8	0.0	0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
836.4	0.0	800.7	529.9	0.0	231.2	0.0	1229.9	29.8	0.0	0.0	

SECTION 2

SECTION 3

CALCIUM OXIDE KG	BOUND WATER KG	MISC KG	FREE WATER KG	VOLUME M3	DENSITY T/M3	ALUMINA G/L	CAUSTIC (IN CAUST. G/L	SODIUM OXIDE) CARB. G/L	SULPH. G/L
0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	2778.8	2.791	1.052	15.2	19.2	0.0	3.4
0.0	0.0	0.0	6240.3	6.258	1.008	2.9	3.7	0.0	1.6
0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	2864.4	2.875	1.021	6.7	8.4	0.0	3.7
0.0	0.0	0.0	6154.7	6.177	1.021	6.7	8.4	0.0	3.7
0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	2864.4	2.875	1.021	6.7	8.4	0.0	3.7
0.0	0.0	0.0	6280.1	6.300	1.001	1.2	1.5	0.0	0.4
0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	2904.3	2.913	1.008	2.9	3.7	0.0	1.6
0.0	0.0	0.0	6240.3	6.258	1.008	2.9	3.7	0.0	1.6
0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	2904.3	2.913	1.008	2.9	3.7	0.0	1.6
0.0	0.0	0.0	6298.7	6.307	1.000	0.4	0.5	0.0	0.2
0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	2922.8	2.932	1.001	1.2	1.5	0.0	0.4
0.0	0.0	0.0	6280.1	6.300	1.001	1.2	1.5	0.0	0.4
0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	2922.8	2.932	1.001	1.2	1.5	0.0	0.4
0.0	0.0	0.0	6307.3	6.307	1.000	0.0	0.0	0.0	0.0
0.0	34.7	67.6	0.0	0.391	3.000				
0.0	0.0	0.0	2931.5	2.935	1.000	0.4	0.5	0.0	0.2
0.0	0.0	0.0	6298.7	6.307	1.000	0.4	0.5	0.0	0.2
0.0	0.0	0.0	18785.6	19.858	1.276	95.2	110.0	0.0	45.0
0.0	0.0	0.0	2353.7	2.354	1.000	0.0	0.0	0.0	0.0
0.0	0.0	0.0	21139.3	22.152	1.250	85.4	98.6	0.0	40.5

	FREE WATER KG	VOLUME M^3	DENSITY T/M^3	ALUMINA G/L	CAUSTIC (IN CAUST. G/L	SODIUM CARB. G/L	OXIDE) SULPH. G/L	CAUSTIC RATIO	FLOW NUMBER

SECTION 4

.6	0.0	0.391	3.000						4041
.0	2778.8	2.791	1.052	15.2	19.2	0.0	8.4	2.073	
.0	6240.3	6.258	1.008	2.9	3.7	0.0	1.6	2.073	4241
.6	0.0	0.391	3.000						4142
.0	2864.4	2.875	1.021	6.7	8.4	0.0	3.7	2.073	
.0	6154.7	6.177	1.021	6.7	8.4	0.0	3.7	2.073	4140
.6	0.0	0.391	3.000						4142
.0	2864.4	2.875	1.021	6.7	8.4	0.0	3.7	2.073	
.0	6280.1	6.300	1.001	1.2	1.5	0.0	0.6	2.073	4342
.6	0.0	0.391	3.000						4243
.0	2904.3	2.913	1.008	2.9	3.7	0.0	1.6	2.073	
.0	6240.3	6.258	1.008	2.9	3.7	0.0	1.6	2.073	4241
.6	0.0	0.391	3.000						4243
.0	2904.3	2.913	1.008	2.9	3.7	0.0	1.6	2.073	
.0	6298.7	6.307	1.000	0.4	0.5	0.0	0.2	2.073	4443
.6	0.0	0.391	3.000						4344
.0	2922.8	2.932	1.001	1.2	1.5	0.0	0.6	2.073	
.0	6280.1	6.300	1.001	1.2	1.5	0.0	0.6	2.073	4342
.6	0.0	0.391	3.000						4344
.0	2922.8	2.932	1.001	1.2	1.5	0.0	0.6	2.073	
.0	6307.3	6.307	1.000	0.0	0.0	0.0	0.0	0.0	144
.6	0.0	0.391	3.000						4432
.0	2931.5	2.935	1.000	0.4	0.5	0.0	0.2	2.073	
.0	6298.7	6.307	1.000	0.4	0.5	0.0	0.2	2.073	4443
.0	18785.6	19.858	1.276	95.2	110.0	0.0	48.0	1.900	1838
.0	2353.7	2.354	1.000	0.0	0.0	0.0	0.0	0.0	138
.0	21139.3	22.150	1.750	85.4	98.6	0.0	43.2	1.900	3820

SECTION 1

NAME OF FLOW	FLOW NUMBER	PHASE	TOTAL MASS KG	ALUMINA KG	SODIUM CAUST. KG	SODIUM CARB. KG	SODIUM SULPH. KG	POTASSIUM OXIDE CAUST KG
20 THERMAL DESILICATION								
IN								
ALUMINATE LIQUOR	3820	L	27687.2	1891.4	1834.9	0.0	800.7	529.
SEED WHITE MUD	3520	S	269.3	88.8	41.0	0.0	0.0	18.
		L	268.2	19.1	18.6	0.0	8.2	5.
OUT								
SLURRY AFTER DESILICATION	2039	S	336.9	111.1	52.0	0.0	0.0	23.
		L	27887.7	1888.2	1843.1	0.0	808.9	530.
39 FLASHING								
IN								
SLURRY AFTER DESILICATION	2039	S	336.9	111.1	52.0	0.0	0.0	23.
		L	27887.7	1888.2	1843.1	0.0	808.9	530.
OUT								
SLURRY AFTER DESILICATION	3921	S	336.9	111.1	52.0	0.0	0.0	23.
		L	26521.5	1888.2	1843.1	0.0	808.9	530.
STEAM	3901	L	1366.1	0.0	0.0	0.0	0.0	0.
21 THICKENING								
IN								
SLURRY AFTER DESILICATION	3921	S	336.9	111.1	52.0	0.0	0.0	23.
		L	26521.5	1888.2	1843.1	0.0	806.9	530.
OUT								
WHITE MUD SLURRY	2122	S	332.8	109.7	51.4	0.0	0.0	23.
		L	332.8	23.7	23.1	0.0	10.1	6.
ALUMINATE LIQUOR	2123	S	4.1	1.4	0.6	0.0	0.0	0.
		L	26188.8	1864.5	1820.0	0.0	798.7	523.
22 FLOW MIXING								
IN								
WHITE MUD SLURRY	2122	S	332.8	109.7	51.4	0.0	0.0	23.
		L	332.8	23.7	23.1	0.0	10.1	6.
WHITE MUD SLURRY	2322	S	4.1	1.4	0.6	0.0	0.0	0.
		L	2.7	0.2	0.2	0.0	0.1	0.
OUT								
WHITE MUD	2235	S	336.9	111.1	52.0	0.0	0.0	23.
		L	335.5	23.9	23.3	0.0	10.2	6.
23 FILTRATION								
IN								
ALUMINATE LIQUOR	2123	S	4.1	1.4	0.6	0.0	0.0	0
		L	26188.8	1864.5	1820.0	0.0	798.7	523
OUT								
WHITE MUD SLURRY	2322	S	4.1	1.4	0.6	0.0	0.0	0
		L	2.7	0.2	0.2	0.0	0.1	0
ALUMINATE LIQUOR	2331	L	26186.0	1864.3	1819.5	0.0	798.6	523

SECTION 2

OXIDE SULPH. KG	POTASSIUM CAUST. KG	OXIDE CARB. KG	SULPH. KG	CARBON DIOXIDE KG	SULPHUR TRIOXIDE KG	SILICA KG	IRON OXIDE KG	CALCIUM OXIDE KG	BOUND WATER KG	MISC KG
800.7	529.9	0.0	231.2	0.0	1229.9	29.8	0.0	0.0	0.0	
0.0	18.8	0.0	0.0	0.0	0.0	88.6	0.0	0.0	31.3	
8.2	5.4	0.0	2.4	0.0	12.6	0.1	0.0	0.0	0.0	
0.0	23.5	0.0	0.0	0.0	0.0	111.1	0.0	0.0	39.2	
808.9	530.5	0.0	233.6	0.0	1242.5	7.6	0.0	0.0	0.0	
0.0	23.5	0.0	0.0	0.0	0.0	111.1	0.0	0.0	39.2	
808.9	530.5	0.0	233.6	0.0	1242.5	7.6	0.0	0.0	0.0	
0.0	23.5	0.0	0.0	0.0	0.0	111.1	0.0	0.0	39.2	
808.9	530.5	0.0	233.6	0.0	1242.5	7.6	0.0	0.0	0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	23.5	0.0	0.0	0.0	0.0	111.1	0.0	0.0	39.2	
808.9	530.5	0.0	233.6	0.0	1242.5	7.6	0.0	0.0	0.0	
0.0	23.3	0.0	0.0	0.0	0.0	109.7	0.0	0.0	38.7	
10.1	6.7	0.0	2.9	0.0	15.6	0.1	0.0	0.0	0.0	
0.0	0.3	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.5	
798.7	523.9	0.0	230.7	0.0	1226.9	7.5	0.0	0.0	0.0	
0.0	23.3	0.0	0.0	0.0	0.0	109.7	0.0	0.0	38.7	
10.1	6.7	0.0	2.9	0.0	15.6	0.1	0.0	0.0	0.0	
0.0	0.3	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.5	
0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	
0.0	23.5	0.0	0.0	0.0	0.0	111.1	0.0	0.0	39.2	
10.2	6.7	0.0	3.0	0.0	15.7	0.1	0.0	0.0	0.0	
0.0	0.3	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.5	
798.7	523.9	0.0	230.7	0.0	1226.9	7.5	0.0	0.0	0.0	
0.0	0.3	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.5	
0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	
798.6	523.8	0.0	230.6	0.0	1226.8	7.5	0.0	0.0	0.0	

MISC KG	FREE WATER KG	VOLUME 3 M	DENSITY 3 T/M	ALUMINA G/L	CAUSTIC (IN CAUST. G/L	SODIUM CARB. G/L	OXIDE) SULPH. G/L	CAUSTIC RATIO	FLOW NUMBER
				SECTION 3					
0.0	21139.3	22.150	1.250	85.4	98.6	0.0	43.0	1.900	3820
0.0	0.0	0.122	2.200						3520
0.0	201.9	0.212	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	0.0	0.153	2.200						2039
0.0	21333.3	22.312	1.250	84.6	98.3	0.0	43.2	1.911	
0.0	0.0	0.153	2.200						2039
0.0	21333.3	22.312	1.250	84.6	98.3	0.0	43.2	1.911	
0.0	0.0	0.153	2.200						3921
0.0	19967.2	20.988	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	1366.1	1.366	1.000	0.0	0.0	0.0	0.0	0.0	3901
0.0	0.0	0.153	2.200						3921
0.0	19967.2	20.988	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	0.0	0.151	2.200						2122
0.0	250.5	0.263	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	0.0	0.002	2.200						2123
0.0	19716.6	20.725	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	0.0	0.151	2.200						2122
0.0	250.5	0.263	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	0.0	0.002	2.200						2322
0.0	2.1	0.002	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	0.0	0.153	2.200						2235
0.0	252.6	0.266	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	0.0	0.002	2.200						2123
0.0	19716.6	20.725	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	0.0	0.002	2.200						2322
0.0	2.1	0.002	1.264	90.0	104.5	0.0	45.9	1.911	
0.0	19716.6	20.723	1.264	90.0	104.5	0.0	45.9	1.911	2331

SECTION 1

NAME OF FLOW	FLOW NUMBER	PHASE	TOTAL MASS KG	ALUMINA KG	SODIUM CAUST. KG	SODIUM CARB. KG	OXIDE SULPH. KG	POTA CAUST.
35 FLOW DIVISION								
IN								
WHITE MUD	2235	S	336.9	111.1	52.0	0.0	0.0	23.5
		L	335.5	23.9	23.3	0.0	10.2	6.7
OUT								
SEED WHITE MUD	3520	S	269.3	88.8	41.6	0.0	0.0	18.8
		L	268.2	19.1	18.9	0.0	8.2	5.4
WHITE MUD	3516	S	67.6	22.3	10.4	0.0	0.0	4.7
		L	67.3	4.8	4.7	0.0	2.1	1.3
24 EVAPORATION								
IN								
LIQUOR BEFORE EVAPORATION	3124	L	27268.1	1876.5	1842.2	0.0	804.9	527.7
OUT								
SULPHATE PULP	2433	S	1011.4	0.0	0.0	0.0	155.6	0.0
		L	19196.5	1874.5	1974.1	0.0	513.6	321.0
EVAPORATED WATER AND LOSSES	2401	L	7060.2	2.0	3.8	0.0	0.0	1.1
31 FLOW MIXING								
IN								
ALUMINATE LIQUOR	2331	L	26186.0	1864.3	1819.8	0.0	798.6	523.8
WATER AFTER HYDRATE WASHING	2931	L	1082.1	12.1	22.5	0.0	6.2	3.9
OUT								
LIQUOR BEFORE EVAPORATION	3124	L	27268.1	1876.5	1842.2	0.0	804.9	527.7
33 FILTRATION								
IN								
SULPHATE PULP	2433	S	1011.4	0.0	0.0	0.0	155.6	0.0
		L	19196.5	1874.5	1974.1	0.0	513.6	321.0
OUT								
FILTERED SULPHATE SALTS	3334	S	1011.4	0.0	0.0	0.0	155.6	0.0
		L	394.3	38.5	40.5	0.0	10.5	6.6
STRONG ALUMINATE LIQUOR	3325	L	18802.2	1836.0	1933.5	0.0	503.1	314.4
34 POTASSIUM SULPHATE PRODUCT.								
IN								
FILTERED SULPHATE SALTS	3334	S	1011.4	0.0	0.0	0.0	155.6	0.0
		L	394.3	38.5	40.5	0.0	10.5	6.6
POTASSIUM ALKALI	134	L	895.9	0.0	0.0	0.0	0.0	375.9
WATER	234	L	500.0	0.0	0.0	0.0	0.0	0.0
OUT								
POTASSIUM SULPHATE	3401	S	1083.7	0.0	0.0	0.0	15.6	0.0
		L	57.0	0.0	0.0	0.0	0.0	0.0
CAUSTIC LIQUOR	3437	L	1660.9	38.5	180.9	0.0	10.5	170.3
25 FLOW MIXING								
IN								
STRONG ALUMINATE LIQUOR	3325	L	18802.2	1836.0	1933.5	0.0	503.1	314.4
RED MUD WASHING 1	1925	L	6244.3	196.7	208.2	0.0	90.9	60.1
OUT								

POTASSIUM OXIDE CAUST. KG	CARB. KG	SULPH. KG	CARBON DIOXIDE KG	SULPHUR TRIOXIDE KG	SILICA KG	IRON OXIDE KG	CALCIUM OXIDE KG	BOUND WATER KG	MISC KG
SECTION 2									
23.5	0.0	0.0	0.0	0.0	111.1	0.0	0.0	39.2	0.0
6.7	0.0	3.0	0.0	15.7	0.1	0.0	0.0	0.0	0.0
18.8	0.0	0.0	0.0	0.0	88.8	0.0	0.0	31.3	0.0
5.4	0.0	2.4	0.0	12.6	0.1	0.0	0.0	0.0	0.0
4.7	0.0	0.0	0.0	0.0	22.3	0.0	0.0	7.9	0.0
1.3	0.0	0.6	0.0	3.2	0.0	0.0	0.0	0.0	0.0
527.7	0.0	231.8	0.0	1235.8	7.6	0.0	0.0	0.0	0.0
0.0	0.0	353.9	0.0	501.9	0.0	0.0	0.0	0.0	0.0
321.0	0.0	83.5	0.0	733.8	7.6	0.0	0.0	0.0	0.0
1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
523.8	0.0	230.6	0.0	1226.8	7.5	0.0	0.0	0.0	0.0
3.9	0.0	1.1	0.0	9.0	0.1	0.0	0.0	0.0	0.0
527.7	0.0	231.8	0.0	1235.8	7.6	0.0	0.0	0.0	0.0
0.0	0.0	353.9	0.0	501.9	0.0	0.0	0.0	0.0	0.0
321.0	0.0	83.5	0.0	733.8	7.6	0.0	0.0	0.0	0.0
0.0	0.0	353.9	0.0	501.9	0.0	0.0	0.0	0.0	0.0
6.6	0.0	1.7	0.0	15.1	0.2	0.0	0.0	0.0	0.0
314.4	0.0	81.8	0.0	718.8	7.6	0.0	0.0	0.0	0.0
0.0	0.0	353.9	0.0	501.9	0.0	0.0	0.0	0.0	0.0
6.6	0.0	1.7	0.0	15.1	0.2	0.0	0.0	0.0	0.0
375.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	566.2	0.0	501.9	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.2	0.0	1.7	0.0	15.1	0.2	0.0	0.0	0.0	0.0
314.4	0.0	81.8	0.0	718.8	7.4	0.0	0.0	0.0	0.0
60.1	0.0	26.2	0.0	139.6	3.6	0.0	0.0	0.0	0.0

SECTION 3

SC KG	FREE WATER KG	VOLUME M3	DENSITY T/M3	ALUMINA G/L	CAUSTIC (IN SODIUM OXIDE) CAUST. G/L	CARB. G/L	SULPH. G/L	CAUSTIC RATIO	FLOW NUMBER
0.0 0.0	0.0 252.6	0.153 0.266	2.200 1.264	90.0	104.5	0.0	45.9	1.911	2235
0.0 0.0	0.0 201.9	0.122 0.212	2.200 1.264	90.0	104.5	0.0	45.9	1.911	3520
0.0 0.0	0.0 50.7	0.031 0.053	2.200 1.264	90.0	104.5	0.0	45.9	1.911	3516
0.0	20741.6	21.729	1.255	86.4	100.8	0.0	44.1	1.920	3124
0.0 0.0	0.0 13688.3	0.417 14.583	2.427 1.321	128.5	149.9	0.0	39.0	1.918	2433
0.0	7053.3	7.060	1.000	0.3	0.6	0.0	0.0	3.725	2401
0.0	19714.6	20.723	1.264	90.0	104.5	0.0	45.9	1.911	2331
0.0	1027.0	1.027	1.054	11.8	24.4	0.0	6.8	3.398	2931
0.0	20741.6	21.729	1.255	86.4	100.8	0.0	44.1	1.920	3124
0.0 0.0	0.0 13688.3	0.417 14.583	2.427 1.321	128.5	149.9	0.0	39.0	1.918	2433
0.0 0.0	0.0 281.1	0.417 0.300	2.427 1.321	128.5	149.9	0.0	39.0	1.918	3334
0.0	13407.2	14.283	1.321	128.5	149.9	0.0	39.0	1.918	3325
0.0 0.0	0.0 281.1	0.417 0.300	2.427 1.321	128.5	149.9	0.0	39.0	1.918	3334
0.0	520.0	0.636	0.0	0.0	389.8	0.0	0.0	0.0	136
0.0	500.0	0.500	1.000	0.0	0.0	0.0	0.0	0.0	234
0.0 0.0	0.0 57.0	0.452 0.057	2.400 1.000	0.0	0.0	0.0	0.0	0.0	3401
0.0	1244.1	1.264	1.314	30.4	231.6	0.0	9.2	12.514	3437
0.0	13407.2	14.283	1.321	128.5	149.9	0.0	39.0	1.918	3325
0.0	5519.2	5.584	1.118	35.2	44.4	0.0	19.4	2.073	1925

SECTION 1

NAME OF FLOW	FLOW NUMBER	PHASE	TOTAL MASS KG	ALUMINA KG	SODIUM CAUST. KG	SODIUM CARB. KG	SODIUM SULPH. KG	POTASSIUM CAUST. KG
26 PRECIPITATION								
IN								
PREGNANT LIQUOR	2526	L	25046.6	2032.7	2141.7	0.0	593.9	374.6
SEED	4726	S	7665.5	5012.0	0.0	0.0	0.0	0.0
		L	2290.1	100.5	208.2	0.1	57.8	36.4
CARBON DIOXIDE	126	L	1.0	0.0	0.0	0.0	0.0	0.0
OUT								
HYDRATE PULP	2628	S	9191.2	6009.6	0.0	0.0	0.0	0.0
		L	25802.5	1132.5	2345.4	1.3	650.8	410.2
LOSSES	2601	S	9.3	3.0	3.5	0.0	0.9	0.6
28 CLASSIFICATION								
IN								
HYDRATE PULP	2628	S	9191.2	6009.6	0.0	0.0	0.0	0.0
		L	25802.5	1132.5	2345.4	1.3	650.8	410.2
OUT								
PRODUCTION HYDRATE	2827	S	1525.7	997.6	0.0	0.0	0.0	0.0
		L	1525.7	67.0	138.7	0.1	38.5	24.3
SEED HYDRATE	2845	S	7665.5	5012.0	0.0	0.0	0.0	0.0
		L	24276.7	1065.6	2206.7	1.3	612.3	385.9
45 FLOW MIXING								
IN								
SEED HYDRATE	2845	S	7665.5	5012.0	0.0	0.0	0.0	0.0
		L	24276.7	1065.6	2206.7	1.3	612.3	385.9
SPENT LIQUOR	2745	L	1249.4	54.8	113.6	0.1	31.5	19.9
SEED HYDRATE	3645	S	9.3	6.1	0.0	0.0	0.0	0.0
		L	3.2	0.1	0.3	0.0	0.1	0.1
SPENT LIQUOR	4745	S	3.7	2.4	0.0	0.0	0.0	0.0
		L	9213.6	404.4	837.5	0.5	232.4	146.5
OUT								
SEED HYDRATE	4546	S	7678.5	5020.6	0.0	0.0	0.0	0.0
		L	34742.8	1524.9	3158.1	1.8	876.3	552.3
46 THICKENING								
IN								
SEED HYDRATE	4546	S	7678.5	5020.6	0.0	0.0	0.0	0.0
		L	34742.8	1524.9	3158.1	1.8	876.3	552.3
OUT								
SEED HYDRATE	4647	S	7669.2	5014.5	0.0	0.0	0.0	0.0
		L	11503.7	504.9	1045.7	0.6	290.2	182.9
SPENT LIQUOR	4636	S	9.3	6.1	0.0	0.0	0.0	0.0
		L	23239.0	1020.0	2112.4	1.2	586.1	369.4
47 FILTRATION								
IN								
SEED HYDRATE	4647	S	7669.2	5014.5	0.0	0.0	0.0	0.0
		L	11503.7	504.9	1045.7	0.6	290.2	182.9
OUT								
SEED	4726	S	7665.5	5012.0	0.0	0.0	0.0	0.0
		L	2290.1	100.5	208.2	0.1	57.8	36.4
SPENT LIQUOR	4745	S	3.7	2.4	0.0	0.0	0.0	0.0
		L	9213.6	404.4	837.5	0.5	232.4	146.5

POTASSIUM OXIDE CAUST. KG	CARB. KG	SULPH. KG	CARBON DIOXIDE KG	SULPHUR TRIOXIDE KG	SILICA KG	IRON OXIDE KG	CALCIUM OXIDE KG	BOUND WATER KG	MISC KG	F W
						SECTION 2				
374.6	0.0	108.1	0.0	858.3	10.8	0.0	0.0	0.0	0.0	18
0.0 36.4	0.0 0.0	0.0 10.5	0.0 0.1	0.0 83.5	0.0 1.1	0.0 0.0	0.0 0.0	2653.4 0.0	0.0 0.0	1
0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0 410.2	0.0 0.2	0.0 118.4	0.0 1.1	0.0 940.5	0.0 11.9	0.0 0.0	0.0 0.0	3181.6 0.0	0.0 0.0	20
0.6	0.0	0.2	0.0	1.3	0.0	0.0	0.0	0.0	0.0	
0.0 410.2	0.0 0.2	0.0 118.4	0.0 1.1	0.0 940.5	0.0 11.9	0.0 0.0	0.0 0.0	3181.6 0.0	0.0 0.0	20
0.0 24.3	0.0 0.0	0.0 7.0	0.0 0.1	0.0 55.6	0.0 0.7	0.0 0.0	0.0 0.0	528.1 0.0	0.0 0.0	1
0.0 385.9	0.0 0.2	0.0 111.4	0.0 1.0	0.0 884.9	0.0 11.2	0.0 0.0	0.0 0.0	2653.4 0.0	0.0 0.0	18
0.0 385.9	0.0 0.2	0.0 111.4	0.0 1.0	0.0 884.9	0.0 11.2	0.0 0.0	0.0 0.0	2653.4 0.0	0.0 0.0	18
19.9	0.0	5.7	0.1	45.5	0.6	0.0	0.0	0.0	0.0	
0.0 0.1	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.1	0.0 0.0	0.0 0.0	0.0 0.0	3.2 0.0	0.0 0.0	
0.0 146.5	0.0 0.1	0.0 42.3	0.0 0.4	0.0 335.8	0.0 4.2	0.0 0.0	0.0 0.0	1.3 0.0	0.0 0.0	7
0.0 552.3	0.0 0.3	0.0 159.4	0.0 1.5	0.0 1266.4	0.0 16.0	0.0 0.0	0.0 0.0	2657.9 0.0	0.0 0.0	27
0.0 552.3	0.0 0.3	0.0 159.4	0.0 1.5	0.0 1266.4	0.0 16.0	0.0 0.0	0.0 0.0	2657.9 0.0	0.0 0.0	27
0.0 182.9	0.0 0.1	0.0 52.8	0.0 0.5	0.0 419.3	0.0 5.3	0.0 0.0	0.0 0.0	2654.7 0.0	0.0 0.0	9
0.0 369.4	0.0 0.2	0.0 106.6	0.0 1.0	0.0 847.1	0.0 10.7	0.0 0.0	0.0 0.0	3.2 0.0	0.0 0.0	18
0.0 182.9	0.0 0.1	0.0 52.8	0.0 0.5	0.0 419.3	0.0 5.3	0.0 0.0	0.0 0.0	2654.7 0.0	0.0 0.0	9
0.0 36.4	0.0 0.0	0.0 10.5	0.0 0.1	0.0 83.5	0.0 1.1	0.0 0.0	0.0 0.0	2653.4 0.0	0.0 0.0	1
0.0 146.5	0.0 0.1	0.0 42.3	0.0 0.4	0.0 335.8	0.0 4.2	0.0 0.0	0.0 0.0	1.3 0.0	0.0 0.0	7

SECTION 3

C	FREE WATER KG	VOLUME M3	DENSITY T/M3	ALUMINA G/L	CAUSTIC (IN SODIUM OXIDE) CAUST. G/L	CARB. G/L	SULPH. G/L	CAUSTIC RATIO	FLOW NUMBER
0.0	18926.4	19.767	1.267	102.8	120.8	0.0	33.7	1.933	2526
0.0	0.0	3.167	2.420						4726
0.0	1792.0	1.838	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	126
0.0	0.0	3.798	2.420						2628
0.0	20190.2	20.720	1.245	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	0.0	0.0						2601
0.0	0.0	3.798	2.420						2628
0.0	20190.2	20.720	1.245	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	0.630	2.420						2827
0.0	1193.9	1.225	1.245	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	3.167	2.420						2845
0.0	18996.3	19.495	1.245	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	3.167	2.420						2845
0.0	18996.3	19.495	1.245	54.7	126.3	0.1	35.2	3.800	
0.0	977.6	1.003	1.265	54.7	126.3	0.1	35.2	3.800	2745
0.0	0.0	0.004	2.420						3645
0.0	2.5	0.003	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	0.002	2.420						4745
0.0	7209.5	7.394	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	3.173	2.420						4546
0.0	27185.8	27.883	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	3.173	2.420						4546
0.0	27185.8	27.883	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	3.169	2.420						4647
0.0	9001.6	9.232	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	0.004	2.420						4636
0.0	18184.3	18.650	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	3.169	2.420						4647
0.0	9001.6	9.232	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	3.167	2.420						4726
0.0	1792.0	1.838	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	0.002	2.420						4745

SECTION 1

NAME OF FLOW	FLOW NUMBER	PHASE	TOTAL MASS KG	ALUMINA KG	SODIUM CAUST. KG	SODIUM CARB. KG	SODIUM SULPH. KG	POTASSIUM OXIDE CAUST. KG
36 FILTRATION								
IN								
SPENT LIQUOR	4636	S	9.3	6.1	0.0	0.0	0.0	0.0
		L	23239.0	1020.0	2112.4	1.2	586.1	369.4
OUT								
SEED HYDRATE	3645	S	9.3	6.1	0.0	0.0	0.0	0.0
		L	3.2	0.1	0.3	0.0	0.1	0.1
SPENT LIQUOR	3637	L	23235.8	1019.9	2112.1	1.2	586.1	369.4
32 FLOW MIXING								
IN								
RED MUD AFTER FILTERING	1732	S	2765.5	238.2	47.5	0.8	4.7	21.5
		L	1210.1	4.2	4.4	0.0	1.9	1.3
RED MUD	4432	S	1174.2	110.5	15.9	0.3	2.0	7.2
		L	2935.5	1.1	1.2	0.0	0.5	0.3
OUT								
RED MUD TO MUD DISPOSAL	3201	S	3939.7	348.8	63.5	1.1	6.7	28.7
		L	4145.6	7.3	5.6	0.0	2.4	1.6
37 FLOW MIXING								
IN								
CAUSTIC LIQUOR	3437	L	1660.9	38.5	180.6	0.0	10.5	170.2
SPENT LIQUOR	3637	L	23235.8	1019.9	2112.1	1.2	586.1	369.4
FILTRATE AFTER MUD FILTER	1537	L	887.4	66.2	64.2	0.0	28.0	18.5
LIQUOR AFTER WASHING OF MUD	1737	L	3427.7	133.8	131.5	0.0	57.4	38.0
OUT								
RECYCLED LIQUOR	3712	L	29209.5	1258.2	2488.2	1.2	682.0	596.2
27 FILTRATION								
IN								
PRODUCTION HYDRATE	2827	S	1525.7	997.6	0.0	0.0	0.0	0.0
		L	1525.7	67.0	138.7	0.1	38.5	24.3
OUT								
PRODUCTION HYDRATE	2729	S	1525.7	997.6	0.0	0.0	0.0	0.0
		L	276.4	12.1	25.1	0.0	7.0	4.4
SPENT LIQUOR	2745	L	1249.4	54.8	113.6	0.1	31.5	19.9
29 WASHING								
IN								
PRODUCTION HYDRATE	2729	S	1525.7	997.6	0.0	0.0	0.0	0.0
		L	276.4	12.1	25.1	0.0	7.0	4.4
WATER FOR HYDRATE WASHING	129	L	1000.0	0.0	0.0	0.0	0.0	0.0
OUT								
PRODUCTION HYDRATE (WASHED)	2930	S	1525.7	997.6	0.2	0.0	0.0	0.0
		L	194.5	0.0	2.7	0.0	0.7	0.5
WATER AFTER HYDRATE WASHING	2931	L	1082.1	12.1	22.5	0.0	6.2	3.9

POTASSIUM CAUST. KG	OXIDE CARB. KG	OXIDE SULPH. KG	CARBON DIOXIDE KG	SULPHUR TRIOXIDE KG	SILICA KG	IRON OXIDE KG	CALCIUM OXIDE KG	BOUND WATER KG	MISC KG	FRE WAT KG
						SECTION 2				
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	
369.4	0.2	106.6	1.0	847.1	10.7	0.0	0.0	0.0	0.0	1818
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	
0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	
369.4	0.2	106.6	1.0	846.9	10.7	0.0	0.0	0.0	0.0	1818
21.5	0.3	2.1	0.7	7.8	2195.5	0.0	0.0	88.8	157.6	
1.3	0.0	0.6	0.0	3.0	0.0	0.0	0.0	0.0	0.0	119
7.2	0.1	0.9	0.3	3.4	931.3	0.0	0.0	34.7	67.6	
0.3	0.0	0.1	0.0	0.8	0.0	0.0	0.0	0.0	0.0	295
28.7	0.5	3.0	1.0	11.2	3126.8	0.0	0.0	123.5	225.2	
1.6	0.0	0.7	0.0	3.7	0.0	0.0	0.0	0.0	0.0	412
170.2	0.0	1.7	0.0	15.1	0.2	0.0	0.0	0.0	0.0	12
369.4	0.2	106.6	1.0	846.9	10.7	0.0	0.0	0.0	0.0	1818
18.5	0.0	8.1	0.0	43.0	1.0	0.0	0.0	0.0	0.0	6
38.0	0.0	16.6	0.0	88.1	2.2	0.0	0.0	0.0	0.0	29
596.2	0.2	133.0	1.0	993.1	14.0	0.0	0.0	0.0	0.0	230
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	528.1	0.0	
24.3	0.0	7.0	0.1	55.6	0.7	0.0	0.0	0.0	0.0	11
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	528.1	0.0	
4.4	0.0	1.3	0.0	10.1	0.1	0.0	0.0	0.0	0.0	2
19.9	0.0	5.7	0.1	45.5	0.6	0.0	0.0	0.0	0.0	9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	528.1	0.0	
4.4	0.0	1.3	0.0	10.1	0.1	0.0	0.0	0.0	0.0	2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	528.1	0.0	
0.5	0.0	0.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	1
3.9	0.0	1.1	0.0	9.0	0.1	0.0	0.0	0.0	0.0	10

MISC KG	FREE WATER KG	VOLUME M^3	DENSITY T/M^3	ALUMINA G/L	CAUSTIC (IN CAUST. G/L	SODIUM CARB. G/L	OXIDE) SULPH. G/L	CAUSTIC RATIO	FLOW NUMBER
0.0	0.0	0.004	2.420						4636
0.0	18184.3	18.650	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	0.004	2.420						3645
0.0	2.5	0.003	1.246	54.7	126.3	0.1	35.2	3.800	
0.0	18181.8	18.648	1.246	54.7	126.3	0.1	35.2	3.800	3637
157.6	0.0	0.930	2.974						1732
0.0	1192.7	1.196	1.011	5.2	4.4	0.0	1.9	1.388	
67.6	0.0	0.391	3.000						4432
0.0	2931.5	2.935	1.000	0.4	0.5	0.0	0.2	2.073	
225.2	0.0	1.321	2.981						3201
0.0	4124.2	4.139	1.002	1.8	1.6	0.0	0.7	1.490	
0.0	1244.1	1.264	1.314	30.6	231.6	0.0	9.2	12.514	3637
0.0	18181.8	18.648	1.246	54.7	126.3	0.1	35.2	3.800	3637
0.0	658.3	0.696	1.275	95.1	109.9	0.0	47.9	1.900	1537
0.0	2960.3	3.008	1.140	44.5	52.0	0.0	22.7	1.924	1737
0.0	23042.4	23.592	1.238	53.3	122.1	0.1	32.6	3.767	3712
0.0	0.0	0.630	2.420						2827
0.0	1193.9	1.225	1.245	54.7	126.3	0.1	35.2	3.800	
0.0	0.0	0.630	2.420						2729
0.0	216.3	0.222	1.245	54.7	126.3	0.1	35.2	3.800	
0.0	977.6	1.003	1.245	54.7	126.3	0.1	35.2	3.800	2745
0.0	0.0	0.630	2.420						2729
0.0	216.3	0.222	1.245	54.7	126.3	0.1	35.2	3.800	
0.0	1000.0	1.000	1.000	0.0	0.0	0.0	0.0	0.0	129
0.0	0.0	0.630	2.420						2930
0.0	189.2	0.189	1.029	0.0	15.7	0.0	4.6	0.0	
0.0	1027.0	1.027	1.056	11.3	24.4	0.0	6.8	3.398	2931

SECTION 3

NAME OF FLOW	FLOW NUMBER	PHASE	TOTAL MASS KG	ALUMINA KG	SODIUM CAUST. KG	SODIUM CARB. KG	SODIUM SULPH. KG	POTASSIUM CAUST. KG
30 CALCINATION								
IN								
PRODUCTION HYDRATE (WASHED)	2930	S	1525.7	997.6	0.0	0.0	0.0	0.0
		L	194.3	0.0	2.7	0.0	0.7	0.5
OUT								
COMMERCIAL ALUMINA	3001	S	1000.0	987.6	3.4	0.0	0.0	0.6
LOSSES	3002	S	720.0	10.0	0.0	0.0	0.0	0.0

SECTION 1

POTASSIUM OXIDE CAUST. KG	CARB. KG	SULPH. KG	CARBON DIOXIDE KG	SULPHUR TRIOXIDE KG	SILICA KG	IRON OXIDE KG	CALCIUM OXIDE KG	BOUND WATER KG	MISC KG	FR WA K
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	528.1	0.0	
0.5	0.0	0.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	1
0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	
0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	708.9	0.0	

SECTION 2

MISC KG	FREE WATER KG	VOLUME 3 M	DENSITY 3 T/M	ALUMINA G/L	CAUSTIC(IN CAUST. G/L	SODIUM OXIDE) CARB. G/L	SULPH. G/L	CAUSTIC RATIO	FLOW NUMBER
0.0	0.0	0.630	2.420						2930
0.0	189.2	0.189	1.029	0.0	15.7	0.0	4.4	0.0	
0.0	0.0	0.274	3.650						3001
0.0	0.0	0.0	0.0						3002

SECTION 3

A N N E X 2

FINAL REPORT OF THE FINANCIAL AND ECONOMICAL CALCULATIONS USING THE UNIDO COMFAR SYSTEM

FINAL REPORT

summarizing the results and findings of the
financial and economical calculations
using the UNIDO COMFAR 2.1 system and
provided for the project:

CONSTRUCTION OF ALUNITE BASED ALUMINA PLANT IN ISLAMIC REPUBLIC OF IRAN

UNIDO CONTRACT NO. 85/108
PROJECT DP/IRA/85/003

Prepared by
Mr. Rudolf DEMZSKY, Msc. Econ. specialist
consultant in computer application to
project preparation and evaluation.

March 1988

CONTENTS

In the present Final Report are summarised the results of the provided consultancy services put in Chapters and Schedules as follows:

A. Executive Summary

- The scope of the project involves the alunite processing plant proposed to be established in Takestan (Iran) with a normal capacity of 200,000 tpy of alumina and product only, but due to the applied technology 216,000 tpy of Potassium sulphate (used as fertilizers) and 140,000 tpy of sulphurous gas (to be processed downstreams into Sulphur and Sulphur acid) will be produced yearly.

- The preliminary Draft Feasibility Study was prepared by VAMI, Leningrad and was fully used as the background for the present financial calculations. The Consultant made the necessary computations to evaluate the financial profitability of the project called the Version III according to UNIDO methodology and with the use of the COMFAR programme. It included the computations and printing of the COMFAR Report, Schedules and Graphics Charts. Based on the results and by using the graphics chart the financial analysis including sensitivity and break-even point analysis of the project under different investment, operating cost and sales prices conditions, were accomplished.

The financial analysis of the alunite processing plant shows the following low profitability by indicators:

IRR (Internal Rate of Return) on total investment (equity) including profit and depreciation 1.86 %

IRR on total investment including only profit - 6.76 %

The net cashflow of the project is positive as of the second year of operation but there are operating losses during the first four years of production.

The net balance of the foreign exchange effect is positive by implementing the project the yearly foreign exchange income plus is US$ 113,06 million.

This means that the Import part of the total investment cost will be covered in two and half years.

It should be noted that presently the financial analysis could not take into account the other national economic and social benefits of the project. These should be taken into consideration in the later stages of the development of the project.

The consultant estimates that the most effective ways to increase the financial profitability of the plant are a more complex use of the alunite ore and the reduction of local investment and operation costs.

A further note: The present report and the financial and economical calculations had been carried out without any appraisal by UNIDO, or by the Consultant of the data quoted in Chapter B and obtained from the "VAMI" subcontractor expert-team during the briefing session held in UNIDO, Vienna on 14-19 March 1988.

B. The Input Data

The input data presented in the preliminary draft feasibility study were partly modified as per Protocol signed in Teheran on 8 March 1988. These modifications are listed herebelow:

- The civil engineering costs shall be reduced by 22.5% (this result in a total reduction of the fixed investment cost by 15.44%).

- The purchase price of alunite ore shall be modified to 910 Rials per tonne (these results in an increase of the operating costs by plus 18,97%).

- The whole sum for the fixed investment will be provided for the project without any financial charges (interests, repay).

- Practically no income tax shall be computed.

These modificaitons were taken into account when updating the original Version II and setting-up the present Version III of the project .

The remaining input data were taken from the preliminary draft feasibility study.

The newly compounded main data :

Fixed assets	40,586 Billion Rials
Total sales revenues	10,692 Billion Rials
Operating production costs	7,381 Billion Rials

C. Recapitulation, financial evaluation and summary of the computed results figuring in the Schedules and Charts

This report is based mainly on Version III with the new modified input data but for comparison some indicators are taken from the previously computed Version II as well.

The Schedules: "Investment Costs", "Production Costs, "Source of Finance" contain the summarized input data.

The Schedules: "Cash Flow Tables", "Cash Flow Discounting", "Net Income Statement", "Projected Balance Sheets" contain all the exactly computed indicators, figures, revealed functions, etc. which are documenting the financial situation of the project for 15 years of production life time (the preliminary draft feasibility study had counted 20 years of production life time of the project).

The Graphs are indicating the same as mentioned above but in a graphical presentation.

SUMMARY OF THE MAIN FINANCIAL INDICATORS

		Version III (New)	Version II (original)
C.1	Cashflow Tables		
C.1.1	IRR (Internal Rate of Return) on total investment (equity)	1.86%	1.09%
C.1.2	IRR1 on equity including only profit	-6.76%	-7.9%
C.1.3	Cummulated cash balance in the 15th year of production Billion Rials	44,756	48,486
C.1.4	Cummulated net cashflow in the 15th year of production Billion Rials	4,294	0,489

C.2 Net Income Statement

		Version III
C.2.1	Net profit percentage of sales (see pages 14-16)	
	in the years 1-4	between: (-)182% - (-)21%
	in the years 5-6	" 3,95% - 4,06%
	in the years 7-15	" 13,43% - 30,59%
	(see also pages 22, Net Profit Total Sales)	

C.2.2 The accumulated cashflow turns to positive value in the 14th year of production

D. SENSITIVITY ANALYSIS

- The provided sensitivity analysis show the impact of the assessed alterations of some important variable costs on the profitability of the project.

  Because by definition the exact or the overall profitability is represented by the IRR (Internal Rate of Return) for the present evaluation and for the computation of the graphics charts the:

  IRR on total investment

  was chosen as the dependent variable (shown on X-axes from 0% to 8%, see page 24).

  The IRR (Internal Rate of Return) is the discounting rate that reduces the net present value of a project to zero.

  Major parameters (variable costs) affecting the net cashflow are sales and costs of operation and investments.

RESULTS OF THE PRESENT COMPUTATIONS

- Variations in the cost of initial fixed investment have considerable impact on the IRR, a 21% increase in cost would bring the project to the dynamic break-even point (0% IRR),

  and a decrease of 15% of the cost, gives an increase of the IRR by about 100% (from 1,8% to 3,5%) or a decrease of 35% of the cost gives an increase of the IRR by 247% (from 1,8% to 6,25%).

- an increase of the operating costs by 8% leads the project to the dynamic break-even point (0%) IRR,

- and a decrease of 15% would have an impact of 155% increase (from 1,8 to 4,75% IRR), etc.

- The most sensitive variable is the one in respect of the sales price: a reduction of 7% would lead to the DBEP (break-even point) and by an increase of 10% the IRR would reach 4,6% (160% increase).

- Similar results are given on Pages 26-27 where the discounted cashflow on investment is shown in variation of the initial investment costs and the operating costs.

  These charts represent the present values of the annual net cashflows discounted at a given rate (shown on the X-axes). In our case the present value is positive by the discount rate of 1,7% only. The discounting rate at which the present value is zero corresponds to the Internal Rate of Return.

B. BREAK EVEN ANALYSIS

Two types of Break Even Points (BEP) were computed for the present project evaluation:

the "S"-BEP/"static" type of break-even point/defined as the point at which sales revenues equal to production cost in a chosen specific year (s) of production and;

the "D"-BEP/"dynamic" type of break-even point/defined as the point at which the nominal sum of net cashflows cummulated during the projects life time equal to the total initial and current investment costs, or put in another way: the point at which the IRR on total investment equal zero% (find the "D"-BEP values in Chart Sensitivity Analysis, page 24.

The "S"-BEP of capacity utilization in:

-the 5th year is: 92%
-the 10th year is: 59%

The "D"-BEP counted for the total life of the project (15 years)

in terms of sales prices	=	93%
in terms of investment cost	=	121%
in terms of operating cost	=	108%

F. FINDINGS AND RECOMMENDATIONS

1. The verbal descriptions of the pre-conditions and arguments in the Draft Preliminary Feasibility Study would suggest a positive recommendation regarding the establishment of the proposed alunite processing plant as a very feasible and viable project.

   Some of these arguments are listed below:

   - Steadily growing market demand on ready made aluminium products and the self reliance policy of the Government;
   - Planned projects for the establishment of new aluminium processing plants for which,
   - alumina (as raw material) is still being imported and without this project will continue to be imported in the future (import substitution)
   - Beside the main production of alumina the produced Potassium sulphate will be exported in a yearly value of US$ 51,000,000 thus substituting US$ 30,000,000 Import (positive impact on food production).
   - The big reserves on investigated alunite ore deposits are very close to the proposed plant site.
   - The Government gives highest priority in developing the region of the plant site.
   - Abundant quantity and cheap energy resources.

2. When putting these arguments into money terms and while analysing the figures from financial viability point of view then it looks disappointing since the IRR (Internal Rate of Return) value of 1.86% seems to be low. Despite of this discouraging result the policy makers could take into consideration the above listed arguments and decide on the eventual execution of the project.

2.1 One of the positive arguments could have been quantified namely the project's foreign exchange impact (import substitution):

THE CALCULATION

Import of Alumina - 200,000 tpy	US$ 60,61 Million
Import of Potassium sulphate - 80,000 tpy	US$ 29,07 Million
Total Import Substitution	US$ 89,68 Million
Plus Export 136,000 tpy Potassium sulphate	US$ 50,48 Million
Sub-total	US$140,16 Million
Less Import Caustic Soda - 90,000 tpy	US$ 19,35 Million
Sub-total	US$120,81 Million
Less cost of applied oil which could be exported - 80,000 tpy	US$ 8,38 Million
Net Foreign Exchange Gain	US$112,43 Million

3. However there are points, suggestions which could highlight the causes of the described low results and initiate the recommended steps leading to better indicators for the project.

3.1 The part of the civil engineering works in the total cost of investment is still very high, it looks very realistic to reduce this cost at further 20% which would increase the IRR to 4%.

(For example: one tonne steel structure constructed, originally was calculated at a very high cost of US$ 9,756 and after the present deduction it is still US$ 7,366 or the main $ per m^3 price calculated for the whole construction of the buildings was put at US$ 1,451 and it may be now US$ 1,125 and these costs take the total sum of US$ 227 million !!!

The example shows that the construction prices are very much over valued.

3.2 The eventual decrease of the operating cost by 20% seems also to be realistic goal although the purchase price increase for alunite ore which happened lately (as mentioned in the Input Data Chapter B) almost eliminated the positive impact of the reduction of the investment cost.

3.3 A promising step to improve the viability of the project would be the change in sales revenue. It seems that the costs of inputs were duly inflated by AKMP (the investor) for the project calculations, but the output prices were not raised at the same level and consequently a 15% increase in sales revenue would not be exagerated.

3.4 Should the above three suggestions for change materialize IRR could raise to 6-7%. This rate is then internationally comparable and would be quite acceptable (for example in India in 1982/83 the Rates of Return on Capital Employed by the Minerals-Metal Manufacturing Enterprises was 5,2%).

3.5 To improve the viability of the project a further step could be taken in the direction of a more complex use of alunite ore for example as the utilization of the affluent mud etc. However this possibility is within the framework of some other project.

COMFAR 2.1 UNIDO

Alumina Plant,Iran
March,1988
Version:updated,00+30

4 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 66.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Mill.Rial

Total initial investment during construction phase

fixed assets:	40586.08	43.846 % foreign
current assets:	348.17	-4.436 % foreign
total assets:	40934.24	43.435 % foreign

Source of funds during construction phase

equity & grants:	40586.10	43.846 % foreign
foreign loans :	0.00	
local loans :	348.14	
total funds :	40934.24	43.474 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	3636.27	6775.80	7381.50
depreciation :	6560.84	6147.28	5837.65
interest :	45.26	39.60	16.97
production costs	10242.37	12962.68	13236.12
thereof foreign	38.50 %	34.37 %	33.68 %
total sales :	3637.47	9603.38	10692.01
gross income :	-6604.90	-3359.31	-2544.11
net income :	-6604.90	-3359.31	-2544.11
cash balance :	-392.19	2352.63	3069.06
net cashflow :	-346.94	2565.30	3260.11

Net Present Value at: 10.00 % = -19208.79
Internal Rate of Return: 1.86 %
Return on equity1: -6.76 %
Return on equity2: 1.83 %

Index of Schedules produced by COMFAR

COMFAR 2.1 UNIDO

Initial Investment in Mill.Rial

	1990	1991	1992	1993
investment costs	7.70	0.00	0.00	0.00
, site preparation, development	3265.00	6530.00	4897.50	1632.50
dings and civil works	0.00	0.00	2043.39	0.00
liary and service facilities	0.00	0.00	3578.79	6985.45
rporated fixed assets	0.00	0.00	0.00	1448.30
t machinery and equipment				
fixed investment costs	3272.70	6530.00	10519.68	10066.25
reuction capital expenditures	10174.82	0.00	0.00	22.63
ing capital	0.00	0.00	0.00	348.17
initial investment costs	13447.52	6530.00	10519.68	10437.04
foreign, in %	45.85	0.00	44.22	66.71

B

1 Current Investment in Mill.Rial

	1994	1995	1996
vestment costs			
ite preparation, development	0.00	0.00	0.00
gs and civil works	0.00	0.00	0.00
y and service facilities	0.00	0.00	0.00
rated fixed assets	0.00	0.00	0.00
achinery and equipment	0.00	0.00	0.00
ed investment costs	0.00	0.00	0.00
ction capitals expenditures.	0.00	0.00	0.00
capital	348.14	261.28	50.41
rrent investment costs	348.14	261.28	50.41
reign, %	0.00	0.00	0.00

1 Production Costs in Mill.Rial

. . . . .	1994	1995	1996	1997	1998	1999
. capacity (single product).	33.27	89.21	100.00	100.00	100.00	100.00
rial 1	845.81	2267.68	2542.00	2542.00	2542.00	2542.00
materials	383.41	920.72	1032.10	1032.10	1032.10	1032.10	
s	375.69	1007.25	1129.10	1129.10	1129.10	1129.10
. . . . .	25.75	69.05	77.40	77.40	77.40	77.40
direct	276.90	742.39	832.20	832.20	832.20	832.20
maintenance	464.90	464.90	464.90	464.90	464.90	464.90
. . . . .	0.00	0.00	0.00	0.00	0.00	0.00
overheads	27.10	27.10	27.10	27.10	27.10	27.10
costs	2359.57	5499.10	6104.80	6104.80	6104.80	6104.80
trative overheads	1276.70	1276.70	1276.70	1276.70	1276.70	1276.70
costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
tion	6560.84	6147.28	5837.65	5599.75	2868.36	2876.74
l costs	45.26	39.60	16.97	0.00	0.00	0.00
roduction costs	10242.36	12962.68	13236.12	12981.25	10269.86	10258.24
unit (single product) .	55.36	26.13	25.81	23.35	18.47	18.45
reign, %	38.50	34.37	33.68	33.66	27.05	26.99
ariable,%	18.23	38.63	42.41	43.24	54.65	54.72
abour	1523.90	1989.39	2079.20	2079.20	2079.20	2079.20

Production Costs in Mill.Rial

	2000	2001	2002	2003	2004	2005
...n. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
...terial 1	2542.00	2542.00	2542.00	2542.00	2542.00	2542.00
raw materials	1032.10	1032.10	1032.10	1032.10	1032.10	1032.10
...ies	1129.10	1129.10	1129.10	1129.10	1129.10	1129.10
...	77.40	77.40	77.40	77.40	77.40	77.40
..., direct	832.20	832.20	832.20	832.20	832.20	832.20
..., maintenance	464.90	464.90	464.90	464.90	464.90	464.90
...	0.00	0.00	0.00	0.00	0.00	0.00
...y overheads	27.10	27.10	27.10	27.10	27.10	27.10
...costs	6104.80	6104.80	6104.80	6104.80	6104.80	6104.80
...strative overheads	1276.70	1276.70	1276.70	1276.70	1276.70	1276.70
... costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
... costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
...iation	1874.53	1495.84	1237.02	1237.09	927.90	110.02
...ial costs	0.00	0.00	0.00	0.00	0.00	0.00
...production costs	9256.03	8877.33	8618.52	8618.59	8309.40	7491.52
...r unit (single product)	16.65	15.97	15.50	15.50	14.94	13.47
...foreign, %	20.88	17.67	16.31	16.31	16.59	18.41
...variable,%	60.64	63.23	65.12	65.12	67.55	74.92
...labour	2079.20	2079.20	2079.20	2079.20	2079.20	2079.20

Production Costs in Mill.Rial

	2006	2007	2008
.....			
...n. capacity (single product).	100.00	100.00	100.00
...terial 1	2542.00	2542.00	2542.00
... raw materials	1032.10	1032.10	1032.10
...ties	1129.10	1129.10	1129.10
.....	77.40	77.40	77.40
..., direct	832.20	832.20	832.20
..., maintenance	464.90	464.90	464.90
.....	0.00	0.00	0.00
...y overheads	27.10	27.10	27.10
..., costs	6104.80	6104.80	6104.80
...istrative overheads	1276.70	1276.70	1276.70
..., costs, sales and distribution	0.00	0.00	0.00
...% costs, sales and distribution	0.00	0.00	0.00
...ciation	45.94	42.50	39.66
...cial costs	0.00	0.00	0.00
...production costs	7427.44	7424.00	7421.16
...er unit (single product) .	13.36	13.35	13.35
...foreign, %	17.85	17.82	17.79
...variable,%	75.57	75.60	75.63
...labour	2079.20	2079.20	2079.20

rce of Finance, construction in Mill.Rial

.....	1990	1991	1992	1993
, ordinary ..	13447.72	6530.00	10519.68	10066.38
, preference.	22.32	0.00	0.00	0.00
ies, grants .	0.00	0.00	0.00	0.00
A, foreign .	0.00	0.00	0.00	0.00
B, foreign..	0.00	0.00	0.00	0.00
C, foreign .	0.00	0.00	0.00	0.00
A, local....	0.00	0.00	0.00	348.14
B, local....	0.00	0.00	0.00	0.00
C, local....	0.00	0.00	0.00	0.00
loan	0.00	0.00	0.00	348.14
t liabilities	0.00	0.00	0.00	0.00
verdraft	0.00	0.00	0.00	0.00
funds	13470.04	6530.00	10519.68	10414.52

COMFAR 2.1 UNIDO

rce of Finance, production in Mill.Rial

.....	1994	1995	1996
, ordinary ..	0.00	0.00	0.00
, preference.	0.00	0.00	0.00
ies, grants .	0.00	0.00	0.00
A, foreign .	0.00	0.00	0.00
B, foreign..	0.00	0.00	0.00
C, foreign .	0.00	0.00	0.00
A, local....	0.00	-174.07	-174.07
B, local....	0.00	0.00	0.00
C, local....	0.00	0.00	0.00
loan	0.00	-174.07	-174.07
t liabilities	157.30	209.30	40.38
verdraft	392.19	-392.20	0.00
funds	549.50	-356.96	-133.69

COMFAR 2.1 UNIDO

Working Capital in Mill.Rial

. . . . .			1994	1995	1996	1997-2008
. . . . .	mdc	coto				
assets &						
nts receivable . . .	15	24.0	133.67	234.48	253.93	253.93
tory and materials .	17	21.7	383.29	442.32	453.71	453.71
. . . . .	60	6.0	4.29	11.51	12.90	12.90
. . . . .	0	---	0.00	0.00	0.00	0.00
in progress	28	13.0	184.76	421.83	467.56	467.56
ed products . . .	7	51.4	62.38	109.42	118.50	118.50
hand	15	24.0	85.23	104.63	106.37	106.37
rrent assets			853.61	1324.19	1414.98	1414.98
liabilities and						
s payable	24	15.0	157.30	366.61	406.99	406.99
king capital			696.30	957.58	1007.99	1007.99
e in working capital			348.14	261.28	50.41	0.00
king capital, local			727.22	1014.49	1069.92	1069.92
king capital, foreign			-30.91	-56.91	-61.93	-61.93

mdc = minimum days of coverage ; coto = coefficient of turnover .

hflow Tables, construction in Mill.Rial

.....	1990	1991	1992	1993
cash inflow . .	13470.04	6530.00	10519.68	10414.52
cial resources .	13470.04	6530.00	10519.68	10414.52
s, net of tax . .	0.00	0.00	0.00	0.00
cash outflow . .	13447.52	6530.00	10519.68	10437.04
assets	13447.52	6530.00	10519.68	10414.41
ting costs . . .	0.00	0.00	0.00	0.00
st finance . . .	0.00	0.00	0.00	22.63
t	0.00	0.00	0.00	0.00
rate tax . . .	0.00	0.00	0.00	0.00
dends paid . . .	0.00	0.00	0.00	0.00
s (deficit) .	22.52	0.00	0.00	-22.52
ted cash balance	22.52	22.52	22.52	-0.01
, local	7304.32	6530.00	5868.00	3436.34
local	7282.00	6530.00	5868.00	3474.44
s (deficit) .	22.32	0.00	0.00	-38.10
, foreign . . .	6165.72	0.00	4651.68	6978.18
, foreign . . .	6165.52	0.00	4651.68	6962.60
s (deficit) .	0.20	0.00	0.00	15.58
shflow	-13447.52	-6530.00	-10519.68	-10414.41
ted net cashflow	-13447.52	-19977.52	-30497.20	-40911.62

COMFAR 2.1 UNIDO

shflow tables, production is Mill.Rial

.....	1994	1995	1996	1997	1998	1999
cash inflow . .	3794.77	9812.68	10732.39	10692.01	10692.01	10692.01
ncial resources .	157.30	209.30	40.38	0.00	0.00	0.00
s, net of tax . .	3637.47	9603.38	10692.01	10692.01	10692.01	10692.01
cash outflow . .	4186.97	7460.05	7663.33	7381.50	7381.50	7381.50
assets	505.44	470.58	90.79	0.00	0.00	0.00
ating costs . . .	3636.27	6775.80	7381.50	7381.50	7381.50	7381.50
of finance . . .	45.26	39.60	16.97	0.00	0.00	0.00
ent	0.00	174.07	174.07	0.00	0.00	0.00
rate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
dends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
us (deficit) .	-392.19	2352.63	3069.07	3310.51	3310.51	3310.51
ted cash balance	-392.20	1960.43	5029.49	8340.01	11650.52	14961.04
, local	3766.22	6941.20	7384.06	7352.94	7352.94	7352.94
w, local	3745.59	6289.76	6371.88	6094.30	6094.30	6094.30
(deficit) .	20.63	651.44	1012.18	1258.64	1258.64	1258.64
, foreign . . .	28.55	2871.48	3348.33	3339.07	3339.07	3339.07
w, foreign . . .	441.38	1170.29	1291.44	1287.20	1287.20	1287.20
s (deficit) .	-412.83	1701.19	2056.89	2051.87	2051.87	2051.87
shflow	-346.94	2566.30	3260.11	3310.51	3310.51	3310.51
ted net cashflow	-41258.55	-38692.25	-35432.15	-32121.63	-28811.12	-25500.60

COMFAR 2.1 UNIDO

shflow tables, production in Mill.Rial

.....	2000	2001	2002	2003	2004	2005
cash inflow ..	10692.01	10692.01	10692.01	10692.01	10692.01	10692.01
cial resources .	0.00	0.00	0.00	0.00	0.00	0.00
s, net of tax ..	10692.01	10692.01	10692.01	10692.01	10692.01	10692.01
cash outflow ..	7381.50	7381.50	7381.50	7381.50	7381.50	7381.50
assets	0.00	0.00	0.00	0.00	0.00	0.00
ting costs ...	7381.50	7381.50	7381.50	7381.50	7381.50	7381.50
of finance ...	0.00	0.00	0.00	0.00	0.00	0.00
nt	0.00	0.00	0.00	0.00	0.00	0.00
rate tax ...	0.00	0.00	0.00	0.00	0.00	0.00
dends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
s (deficit) .	3310.51	3310.51	3310.51	3310.51	3310.51	3310.51
ted cash balance	18271.55	21582.07	24892.58	28203.10	31513.61	34824.13
, local	7352.94	7352.94	7352.94	7352.94	7352.94	7352.94
, local	6094.30	6094.30	6094.30	6094.30	6094.30	6094.30
(deficit) .	1258.64	1258.64	1258.64	1258.64	1258.64	1258.64
, foreign ...	3339.07	3339.07	3339.07	3339.07	3339.07	3339.07
, foreign ...	1287.20	1287.20	1287.20	1287.20	1287.20	1287.20
s (deficit) .	2051.87	2051.87	2051.87	2051.87	2051.87	2051.87
shflow	3310.51	3310.51	3310.51	3310.51	3310.51	3310.51
ted net cashflow	-22190.09	-18879.57	-15569.06	-12258.54	-8948.03	-5637.51

COMFAR 2.1 UNIDO

sh flow tables, production is Mill.Rial

.....	2006	2007	2008
cash inflow ..	10692.01	10692.01	10692.01
ncial resources .	0.00	0.00	0.00
s, net of tax ..	10692.01	10692.01	10692.01
cash outflow ..	7381.50	7381.50	7381.50
l assets	0.00	0.00	0.00
ating costs ...	7381.50	7381.50	7381.50
of finance ...	0.00	0.00	0.00
ent	0.00	0.00	0.00
rate tax ...	0.00	0.00	0.00
dends paid ...	0.00	0.00	0.00
ns (deficit) .	3310.51	3310.51	3310.51
ted cash balance	38134.64	41445.16	44755.68
, local	7352.94	7352.94	7352.94
w, local	6094.30	6094.30	6094.30
(deficit) .	1258.64	1258.64	1258.64
, foreign ...	3339.07	3339.07	3339.07
w, foreign ...	1287.20	1287.20	1287.20
s (deficit) .	2051.87	2051.87	2051.87
shflow	3310.51	3310.51	3310.51
ted net cashflow	-2327.00	983.52	4294.03

COMFAR 2.1 UNIDO

shflow Discounting:

uity paid versus Net income flow:

Net present value	-38700.54 at	10.00 %
Internal Rate of Return (IRRE1) ..	-6.76 %	

t Worth versus Net cash return:

Net present value	-19241.25 at	10.00 %
Internal Rate of Return (IRRE2) ..	1.83 %	

ternal Rate of Return on total investment:

Net present value	-19208.79 at	10.00 %
Internal Rate of Return (IRR) ..	1.86 %	

rth = Equity paid plus reserves

COMFAR 2.1 UNIDO

t Income Statement in Mill.Rial

. . . . .	1994	1995	1996	1997	1998
l sales, incl. sales tax	3637.47	9603.38	10692.01	10692.01	10692.01
: variable costs, incl. sales tax.	1867.57	5007.10	5612.80	5612.80	5612.80
able margin	1769.90	4596.27	5079.21	5079.21	5079.21
of total sales	48.66	47.86	47.50	47.50	47.50
variable costs, incl. depreciation	8329.54	7915.98	7606.35	7368.45	4657.06
rational margin	-6559.64	-3319.70	-2527.13	-2289.24	422.15
% of total sales	-180.34	-34.57	-23.64	-21.41	3.95
t of finance	45.26	39.60	16.97	0.00	0.00
ss profit	-6604.90	-3359.31	-2544.11	-2289.24	422.15
nances	0.00	0.00	0.00	0.00	0.00
able profit	-6604.90	-3359.31	-2544.11	-2289.24	422.15
. . . . .	0.00	0.00	0.00	0.00	0.00
profit	-6604.90	-3359.31	-2544.11	-2289.24	422.15
idends paid	0.00	0.00	0.00	0.00	0.00
istributed profit	-6604.90	-3359.31	-2544.11	-2289.24	422.15
mulated undistributed profit . . .	-6604.90	-9964.20	-12508.31	-14797.55	-14375.40
ss profit, % of total sales	-181.58	-34.98	-23.79	-21.41	3.95
profit, % of total sales	-181.58	-34.98	-23.79	-21.41	3.95
. Net profit, % of equity	-16.27	-8.28	-6.27	-5.64	1.04
. Net profit+interest, % of invest.	-15.90	-8.00	-6.08	-5.51	1.02

Income Statement in Bill.Rial

	1999	2000	2001	2002	2003
sales, incl. sales tax	10692.01	10692.01	10692.01	10692.01	10692.01
variable costs, incl. sales tax.	5612.80	5612.80	5612.80	5612.80	5612.80
ble margin	5079.21	5079.21	5079.21	5079.21	5079.21
of total sales	47.50	47.50	47.50	47.50	47.50
riable costs, incl. depreciation	4645.44	3643.23	3264.54	3005.72	3005.79
tional margin	433.78	1435.98	1814.68	2073.49	2073.42
of total sales	4.06	13.43	16.97	19.39	19.39
of finance	0.00	0.00	0.00	0.00	0.00
profit	433.78	1435.98	1814.68	2073.49	2073.42
nces	0.00	0.00	0.00	0.00	0.00
le profit	433.78	1435.98	1814.68	2073.49	2073.42
	0.00	0.00	0.00	0.00	0.00
fit	433.78	1435.98	1814.68	2073.49	2073.42
ends paid	0.00	0.00	0.00	0.00	0.00
tributed profit	433.78	1435.98	1814.68	2073.49	2073.42
ulated undistributed profit	-13941.62	-12505.64	-10690.96	-8617.47	-6544.05
profit, % of total sales	4.06	13.43	16.97	19.39	19.39
rofit, % of total sales	4.06	13.43	16.97	19.39	19.39
Net profit, % of equity	1.07	3.54	4.47	5.11	5.11
Net profit+interest, % of invest.	1.04	3.45	4.37	4.99	4.99

COMFAR 2.1 UNIDO

Income Statement in Mill.Rial

	2004	2005	2006	2007	2008
sales, incl. sales tax	10692.01	10692.01	10692.01	10692.01	10692.01
riable costs, incl. sales tax.	5612.80	5612.80	5612.80	5612.80	5612.80
le margin	5079.21	5079.21	5079.21	5079.21	5079.21
f total sales	47.50	47.50	47.50	47.50	47.50
riable costs, incl. depreciation	2696.60	1878.72	1814.64	1811.20	1808.36
inal margin	2382.61	3200.50	3264.58	3268.02	3270.85
f total sales	22.28	29.93	30.53	30.57	30.59
f finance	0.00	0.00	0.00	0.00	0.00
profit	2382.61	3200.50	3264.58	3268.02	3270.85
nces	0.00	0.00	0.00	0.00	0.00
e profit	2382.61	3200.50	3264.58	3268.02	3270.85
	0.00	0.00	0.00	0.00	0.00
ofit	2382.61	3200.50	3264.58	3268.02	3270.85
nds paid	0.00	0.00	0.00	0.00	0.00
ributed profit	2382.61	3200.50	3264.58	3268.02	3270.85
lated undistributed profit	-4161.43	-960.94	2303.64	5571.66	8842.51
profit, % of total sales	22.28	29.93	30.53	30.57	30.59
ofit, % of total sales	22.28	29.93	30.53	30.57	30.59
et profit, % of equity	5.87	7.89	8.04	8.05	8.06
et profit+interest% of invest.	5.73	7.70	7.85	7.86	7.87

jected Balance Sheets, construction is Mill.Rial

	1990	1991	1992	1993
assets	13476.04	20000.04	30519.72	40934.24
assets, net of depreciation	0.00	13447.52	19977.52	30497.20
uction in progress	13447.52	6530.00	10519.68	10088.88
t assets	0.00	0.00	0.00	348.17
bank	0.00	0.00	0.00	0.00
urplus, finance available	22.52	22.52	-22.52	0.00
carried forward	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
liabilities	13470.04	20000.04	30519.72	40934.24
y capital	13470.04	20000.04	30519.72	40586.10
ves, retained profit	0.00	0.00	0.00	0.00
t	0.00	0.00	0.00	0.00
nd medium term debt	0.00	0.00	0.00	348.14
t liabilities	0.00	0.00	0.00	0.00
verdraft, finance required	0.00	0.00	0.00	0.00
debt	0.00	0.00	0.00	348.14
y, % of liabilities	100.00	100.00	100.00	99.15

COMFAR 2.1 UNIDO

COMFAR 2.1 - Feasibility Studies Branch, UNIDO Vienna

ojected Balance Sheets, Production in Mill.Rial

.....	1994	1995	1996	1997	1998	1999
assets	41483.74	41126.78	40993.09	40993.09	41415.24	41426.86
assets, net of depreciation	34025.24	27877.96	22040.31	16440.56	13552.19	10675.45
truction in progress	0.00	0.00	0.00	0.00	0.00	0.00
nt assets	768.38	1219.56	1306.61	1306.61	1306.61	1306.61
bank	85.23	104.63	108.37	108.37	108.37	108.37
surplus, finance available .	0.00	1960.43	5029.50	8340.01	11650.52	14961.04
carried forward	0.00	6604.90	9964.20	12506.31	14797.55	14375.40
.....	6604.90	3359.31	2544.11	2289.24	0.00	0.00
liabilities	41483.74	41126.78	40993.09	40993.09	41415.24	41426.86
y capital	40586.10	40586.10	40586.10	40586.10	40586.10	40586.10
ves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
it	0.00	0.00	0.00	0.00	422.15	433.78
and medium term debt	348.14	174.07	0.00	0.00	0.00	0.00
nt liabilities	157.30	366.61	406.99	406.99	406.99	406.99
overdraft, finance required.	392.20	0.00	0.00	0.00	0.00	0.00
debt	897.64	540.68	406.99	406.99	406.99	406.99
y, % of liabilities	97.84	98.69	99.01	99.01	98.00	97.97

Alumina Plant,Iran --- March,1988

COMFAR 2.1 - Feasibility Studies Branch, UNIDO Vienna

ected Balance Sheets, Production in Mill.Rial

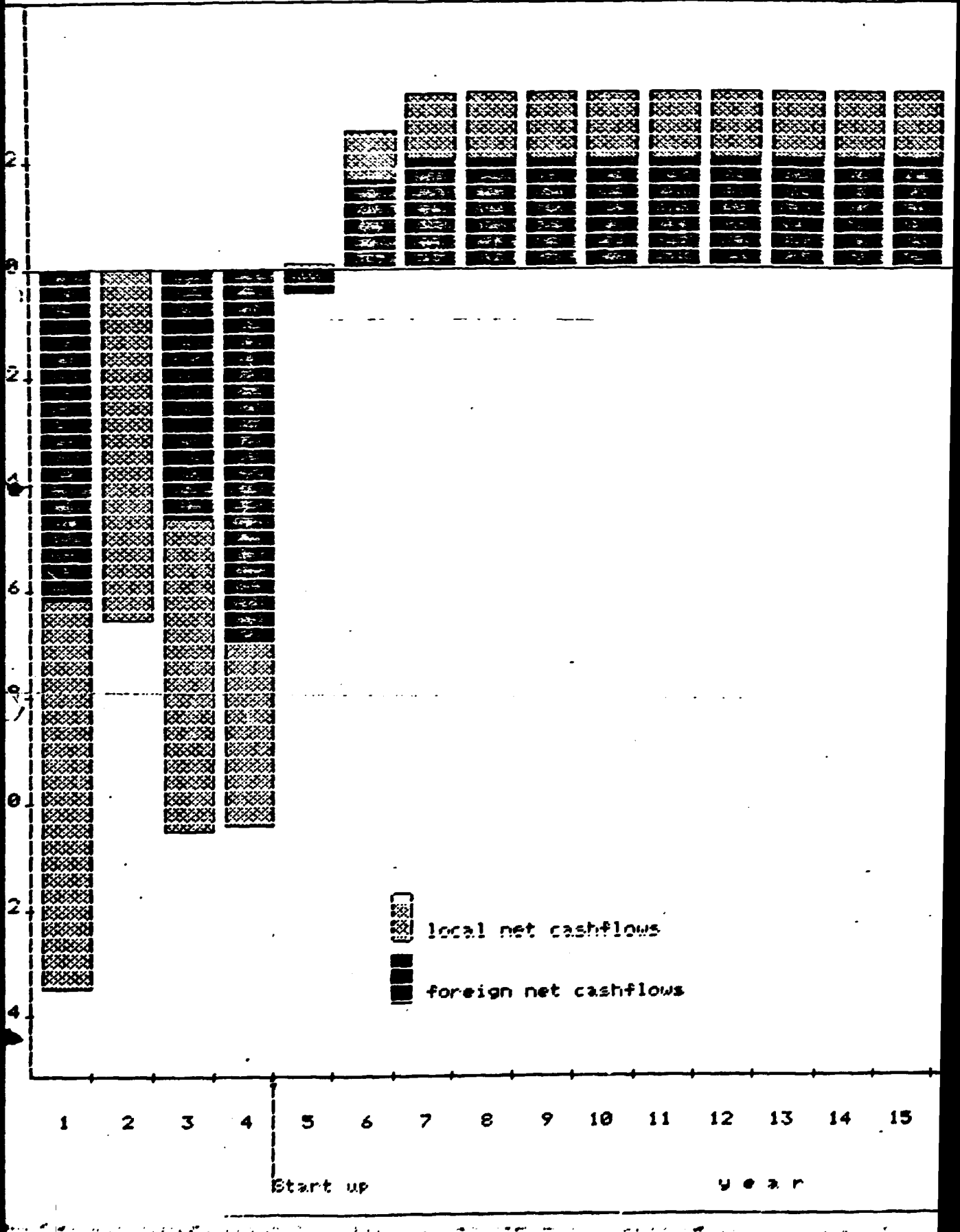
.....	2000	2001	2002	2003	2004	2005
assets	42429.07	42807.77	43066.58	43066.51	43375.70	44193.59
assets, net of depreciation	8800.92	7305.09	6068.06	4830.97	3903.07	3793.05
truction in progress	0.00	0.00	0.00	0.00	0.00	0.00
nt assets	1306.61	1306.61	1306.61	1306.61	1306.61	1306.61
bank	108.37	108.37	108.37	108.37	108.37	108.37
surplus, finance available .	18271.55	21582.07	24892.58	28203.09	31513.61	34824.12
carried forward	13941.62	12505.64	10690.96	8617.47	6544.05	4161.43
.....	0.00	0.00	0.00	0.00	0.00	0.00
liabilities	42429.07	42807.77	43066.58	43066.51	43375.70	44193.59
y capital	40586.10	40586.10	40586.10	40586.10	40586.10	40586.10
ves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
it	1435.98	1814.68	2073.49	2073.42	2382.61	3200.50
and medium term debt	0.00	0.00	0.00	0.00	0.00	0.00
nt liabilities	406.99	406.99	406.99	406.99	406.99	406.99
overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
.....	406.99	406.99	406.99	406.99	406.99	406.99

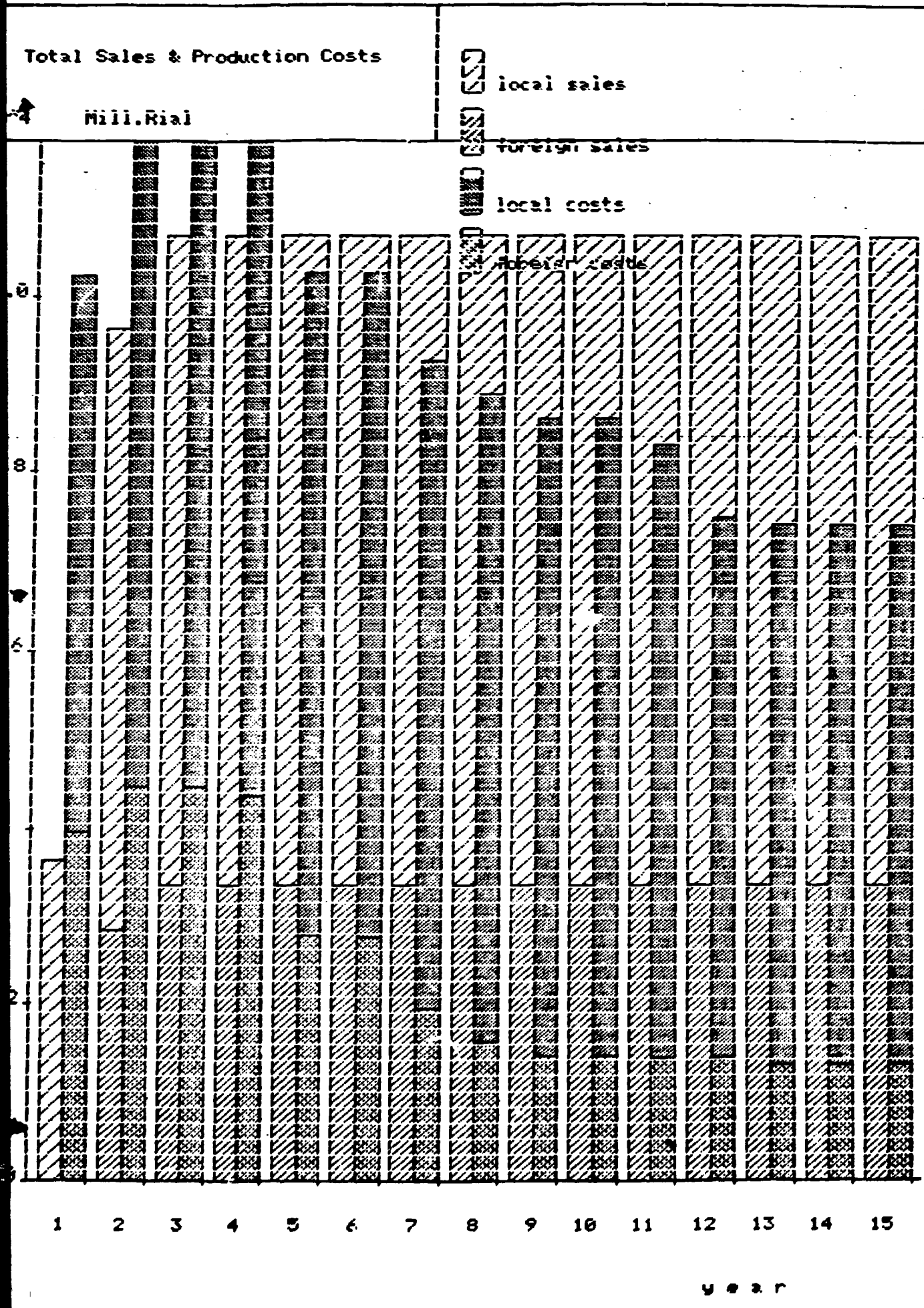
jected Balance Sheets, Production in Mill.Rial

	2006	2007	2008
ssets	44257.67	46564.75	49835.60
ssets, net of depreciation	3747.12	3704.62	3664.96
ction is progress	0.00	0.00	0.00
t assets	1306.61	1306.61	1306.61
ank	108.37	108.37	108.37
rplus, finance available	38134.64	41445.15	44755.66
rried forward	960.94	0.00	0.00
	0.00	0.00	0.00
iabilities	44257.67	46564.75	49835.60
capital	40586.10	40586.10	40586.10
s, retained profit	0.00	2303.64	5571.66
	3264.58	3268.02	3270.85
d medium term debt	0.00	0.00	0.00
t liabilities	406.99	406.99	406.99
rdraft, finance required	0.00	0.00	0.00
ebt	406.99	406.99	406.99
, % of liabilities	91.70	87.16	81.44

Annual CF, operation

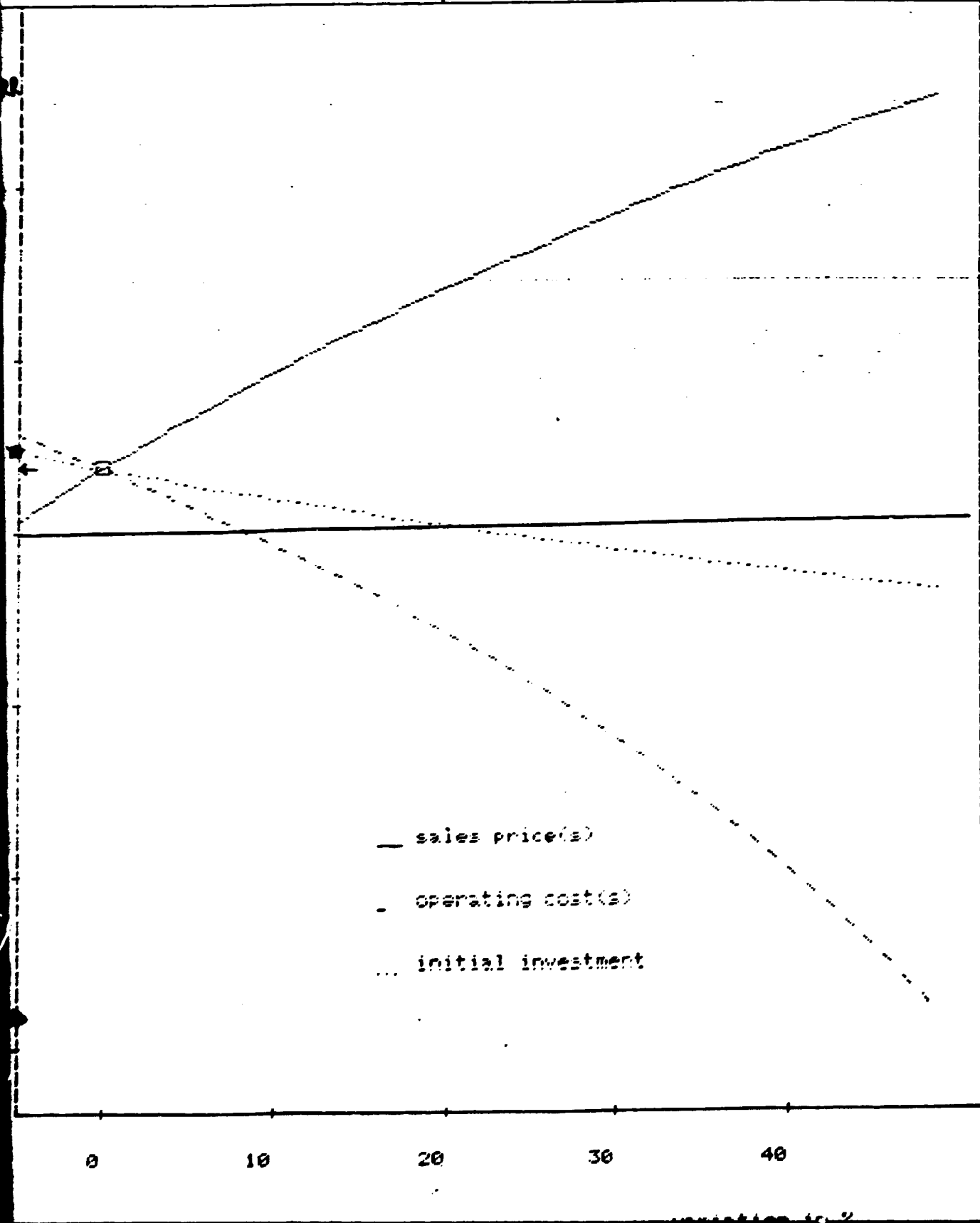
Mill.Rial



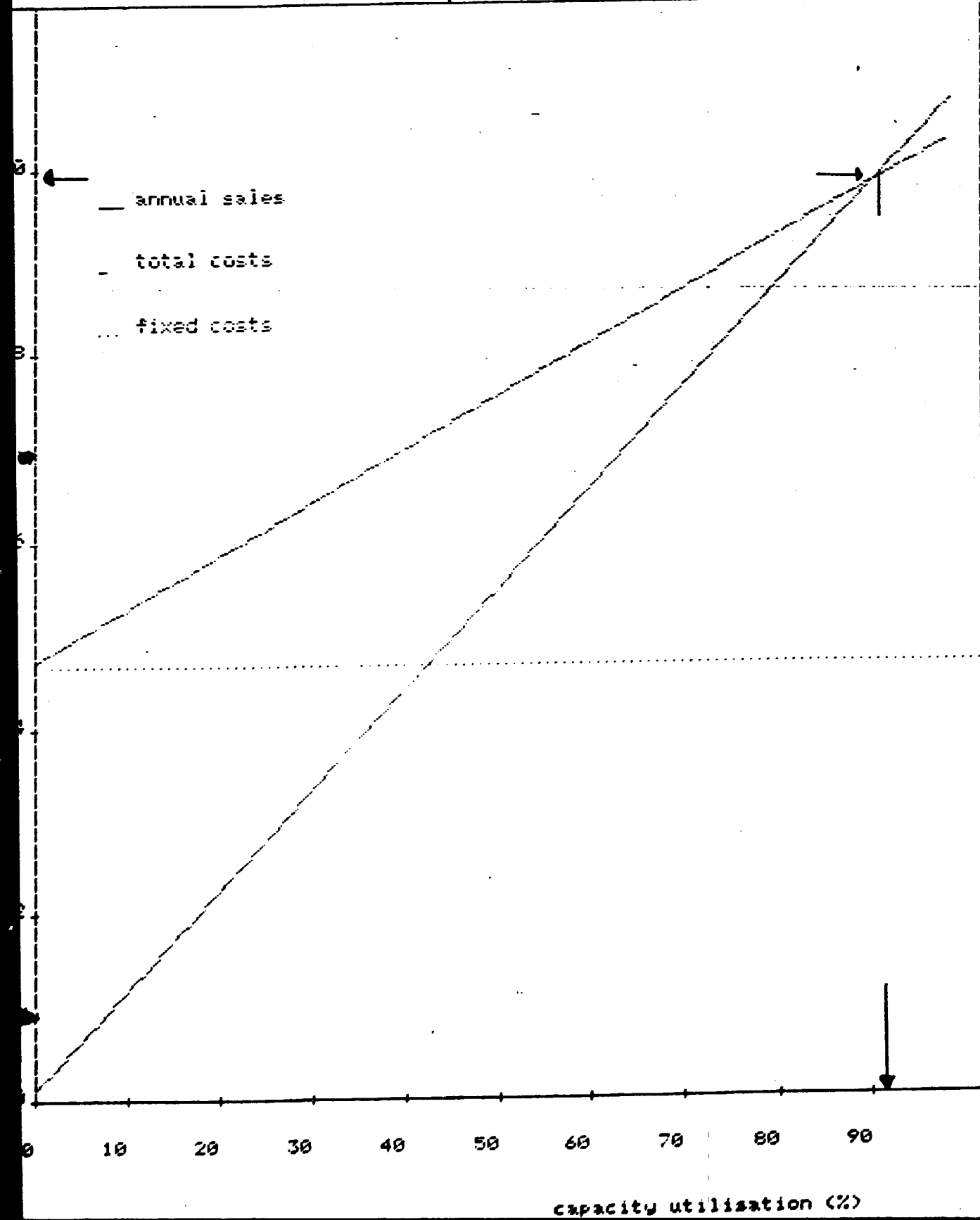

Total Sales & Production Costs
Mill.Rial
local sales
foreign sales
local costs
foreign costs
8
6
2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
year

Sensitivity of IRR

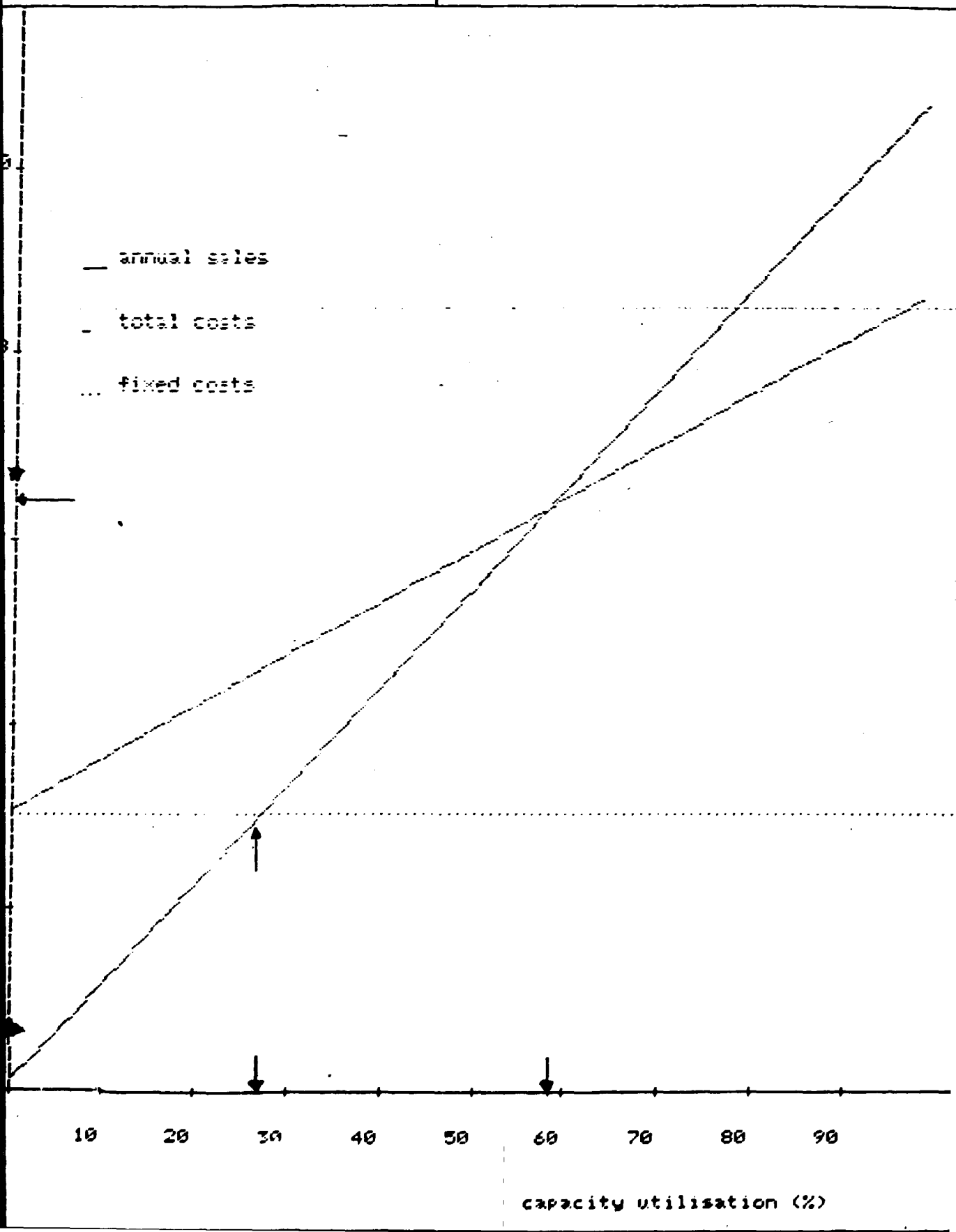
internal rate of return



Break even chart excl. finance	5th year of production
4 Mill.Rial	



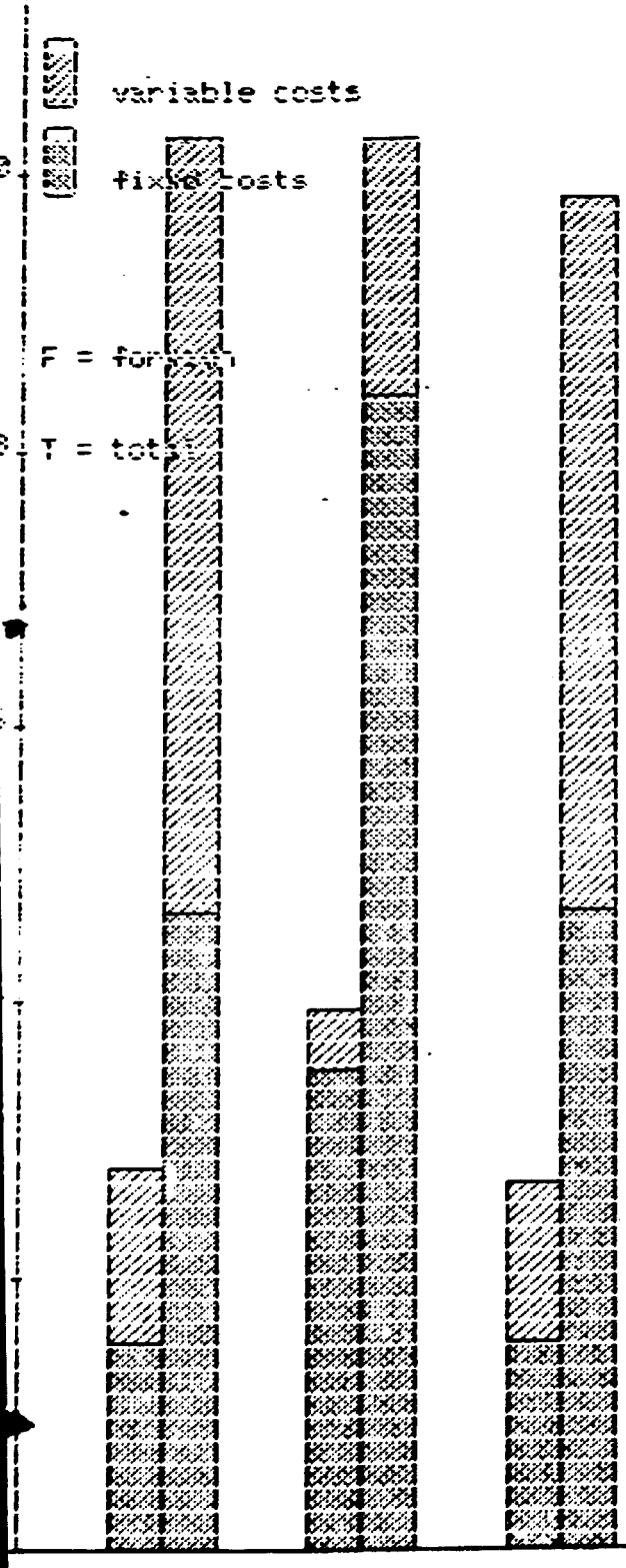
Break even chart excl. finance	10th year of production



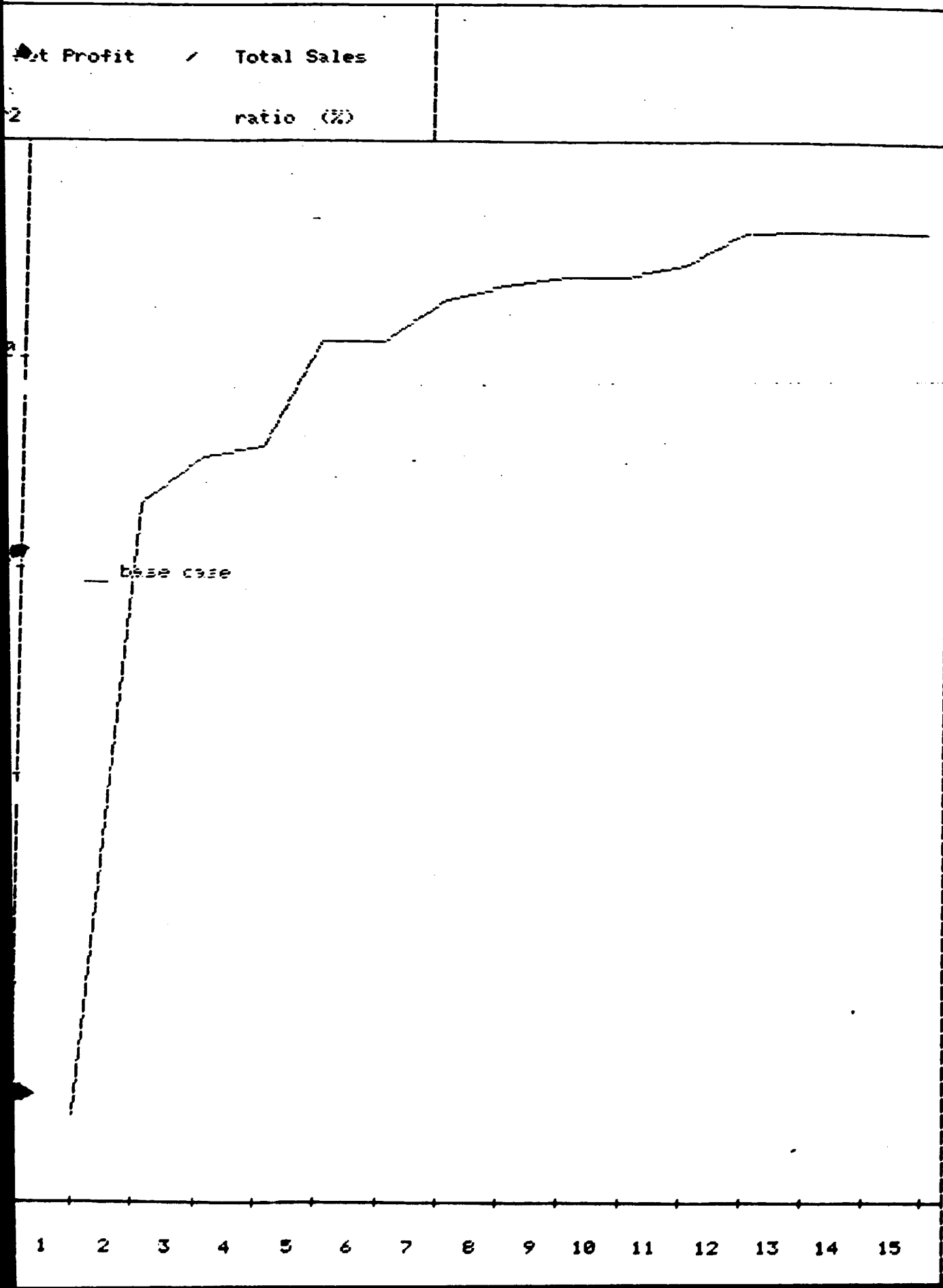
Structure of Production Costs

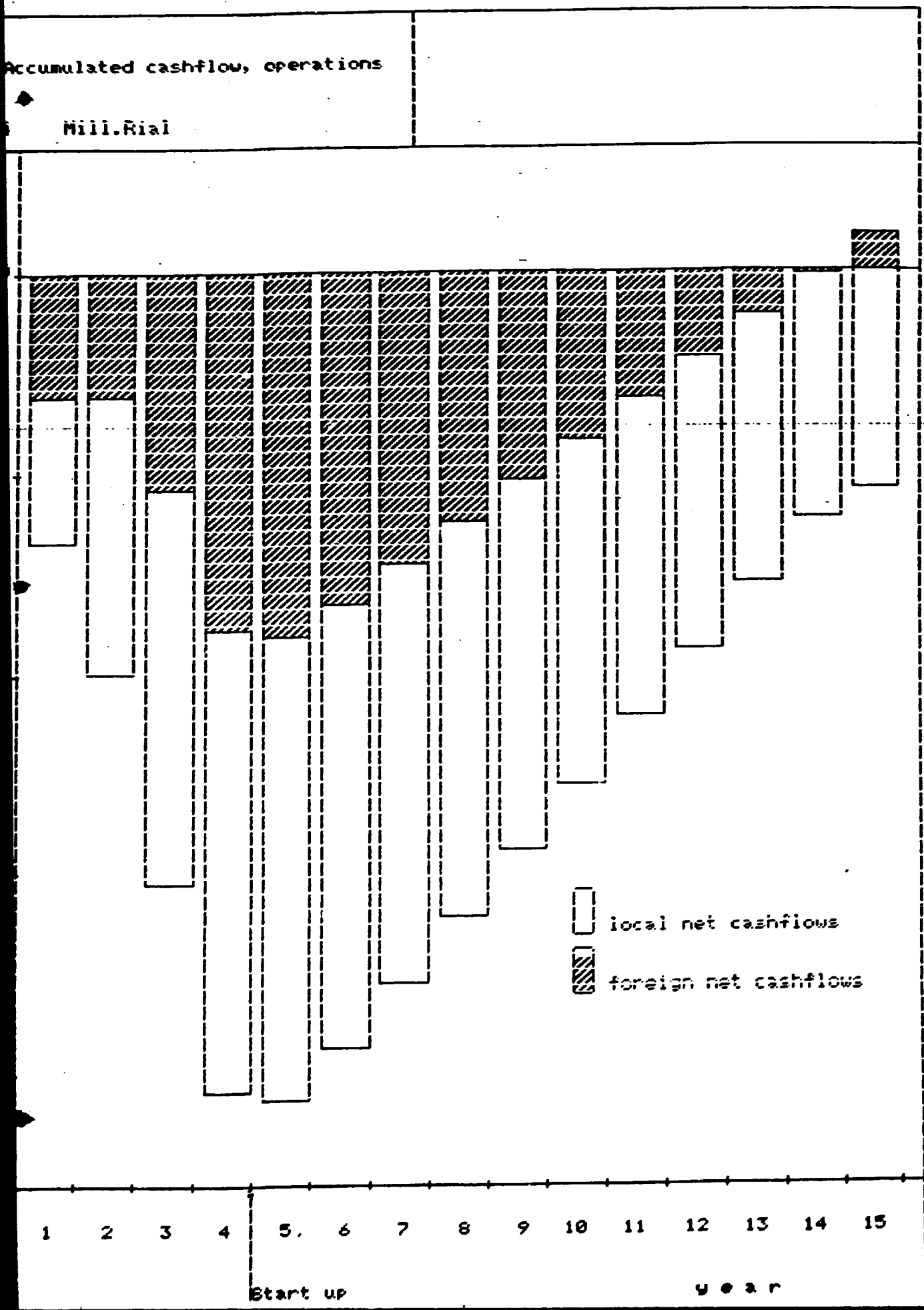
5th year of production

4 Mill.Rial



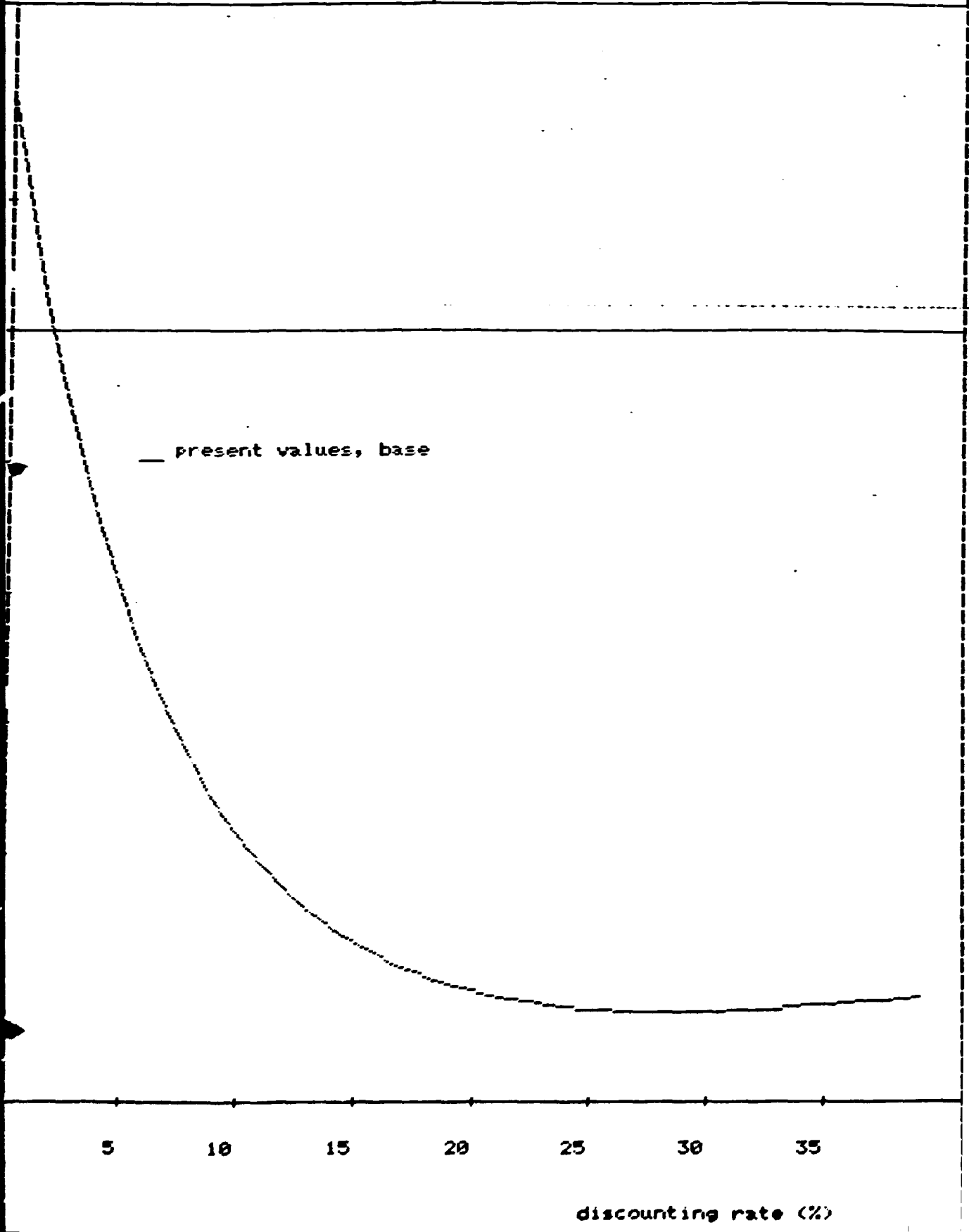
Nominal	Start up	
24.75	8.26	raw material
10.05	3.35	other RM
10.99	3.67	utilities
0.75	0.25	energy
8.10	2.70	labour
4.53	4.54	maintenance
0.00	0.00	spares
12.70	12.73	overheads
28.12	64.06	depreciation
0.00	0.44	interest
100.00	100.00	Total Prod C.


Net Profit / Total Sales
ratio (%)
base case
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15


Accumulated cashflow, operations
Mill.Rial
local net cashflows
foreign net cashflows
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Start up
year

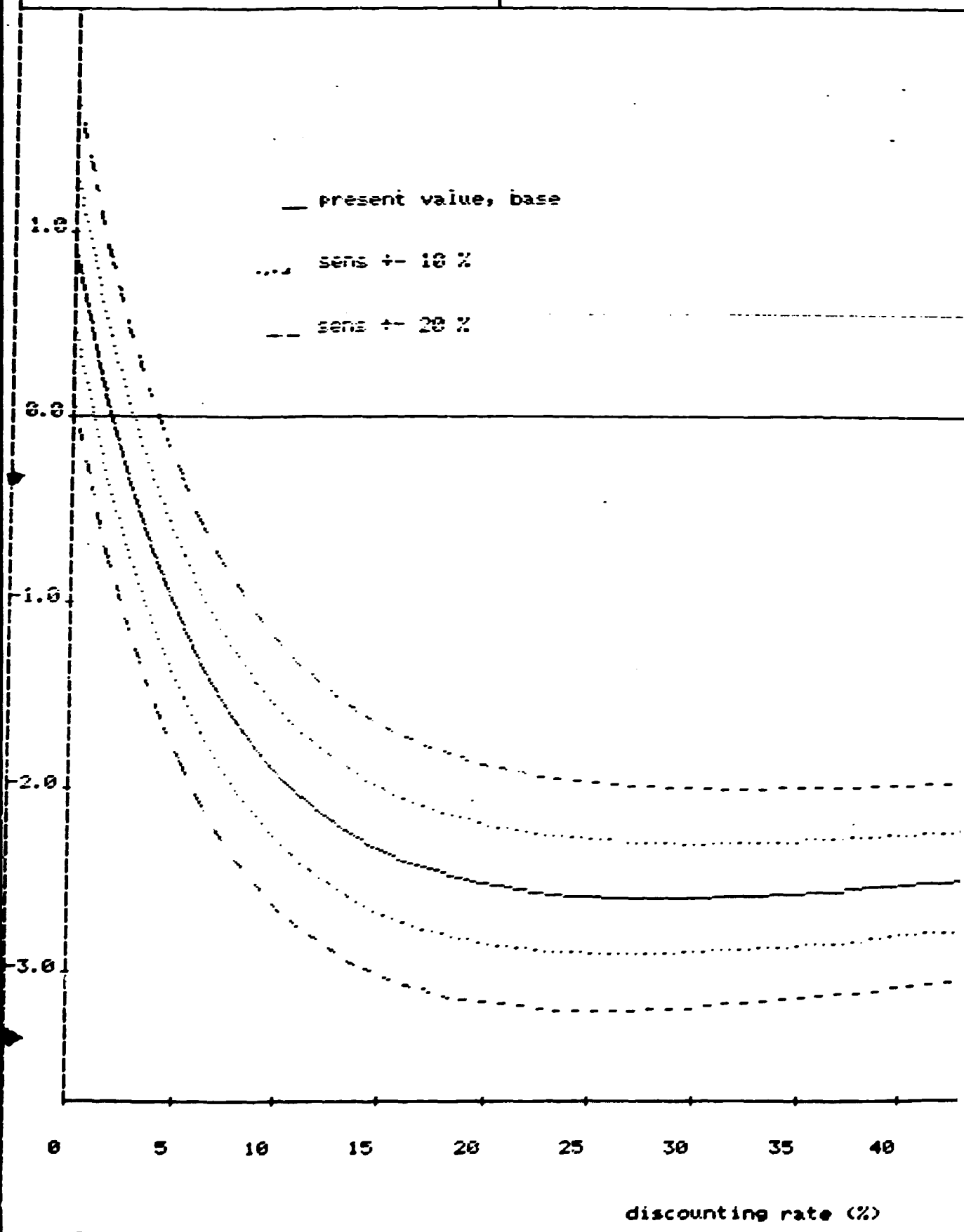
NPV of netCF, total investment

Mill.Rial

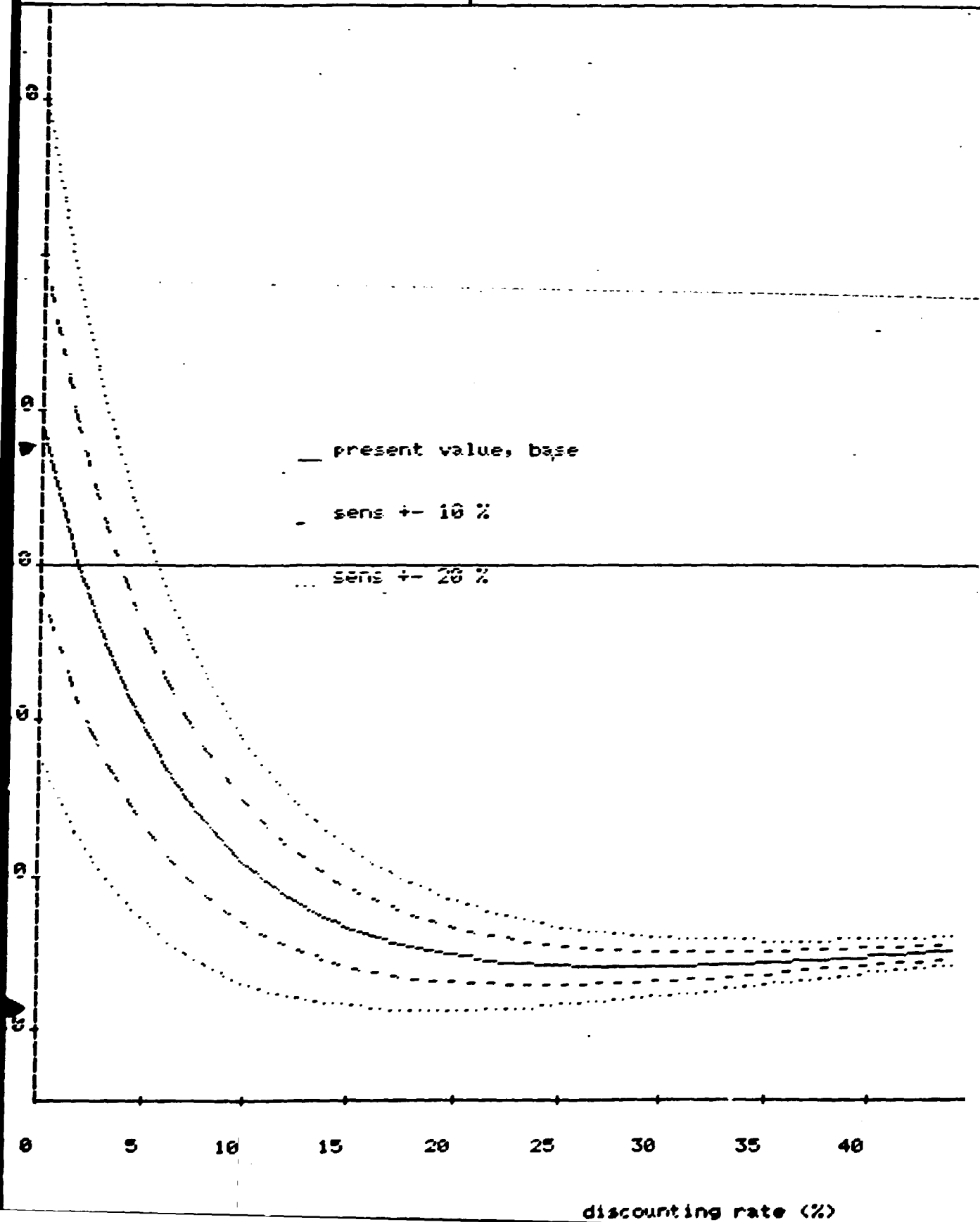


Discounted CF, Investment variation of

10^4 Mill.Rial initial investment costs



Discounted CF, Investment	variation of operating costs
4 Mill.Rial	

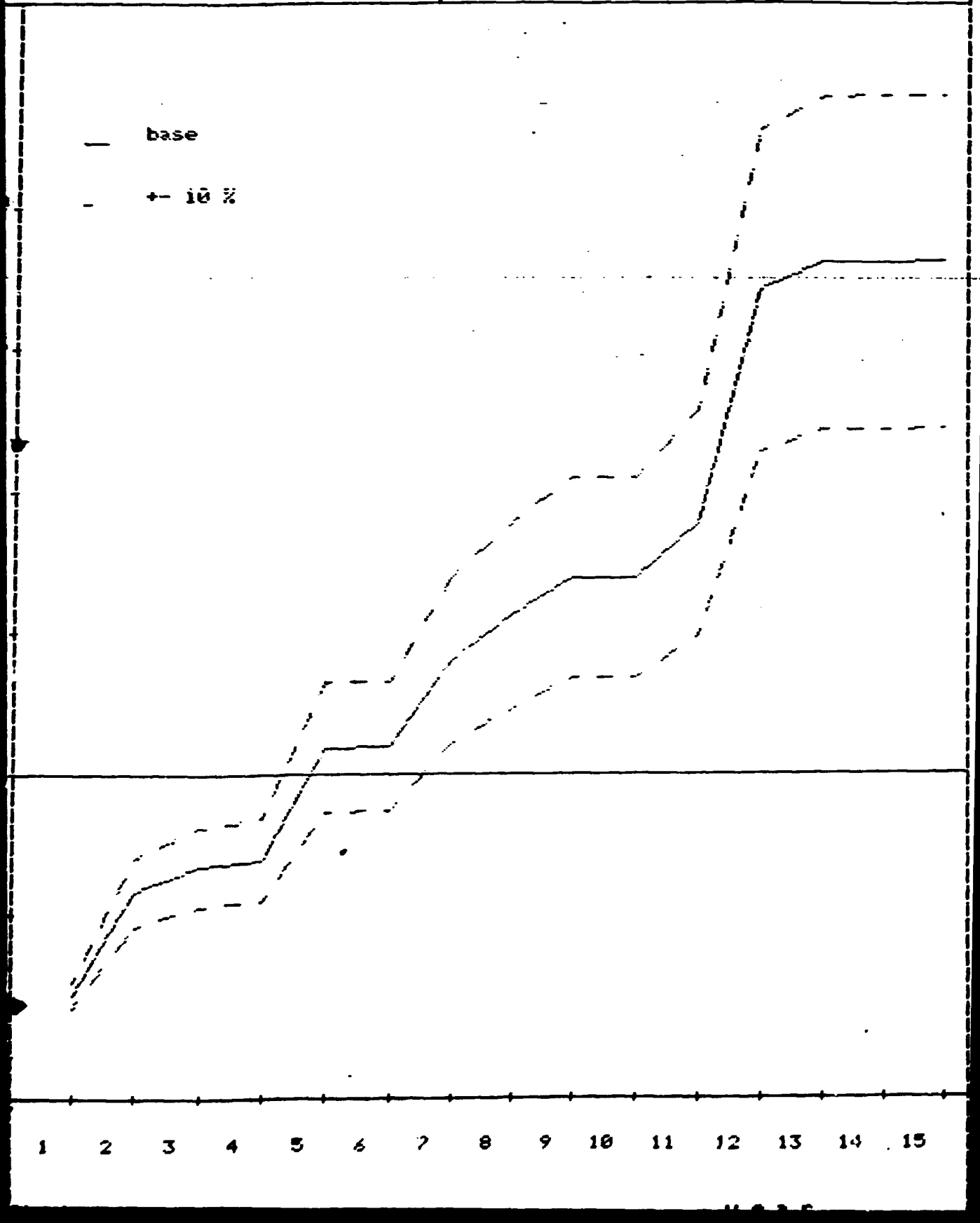


Fixed costs coverage ratio

by year, including finance

sensitivity analysis:

varying sales prices

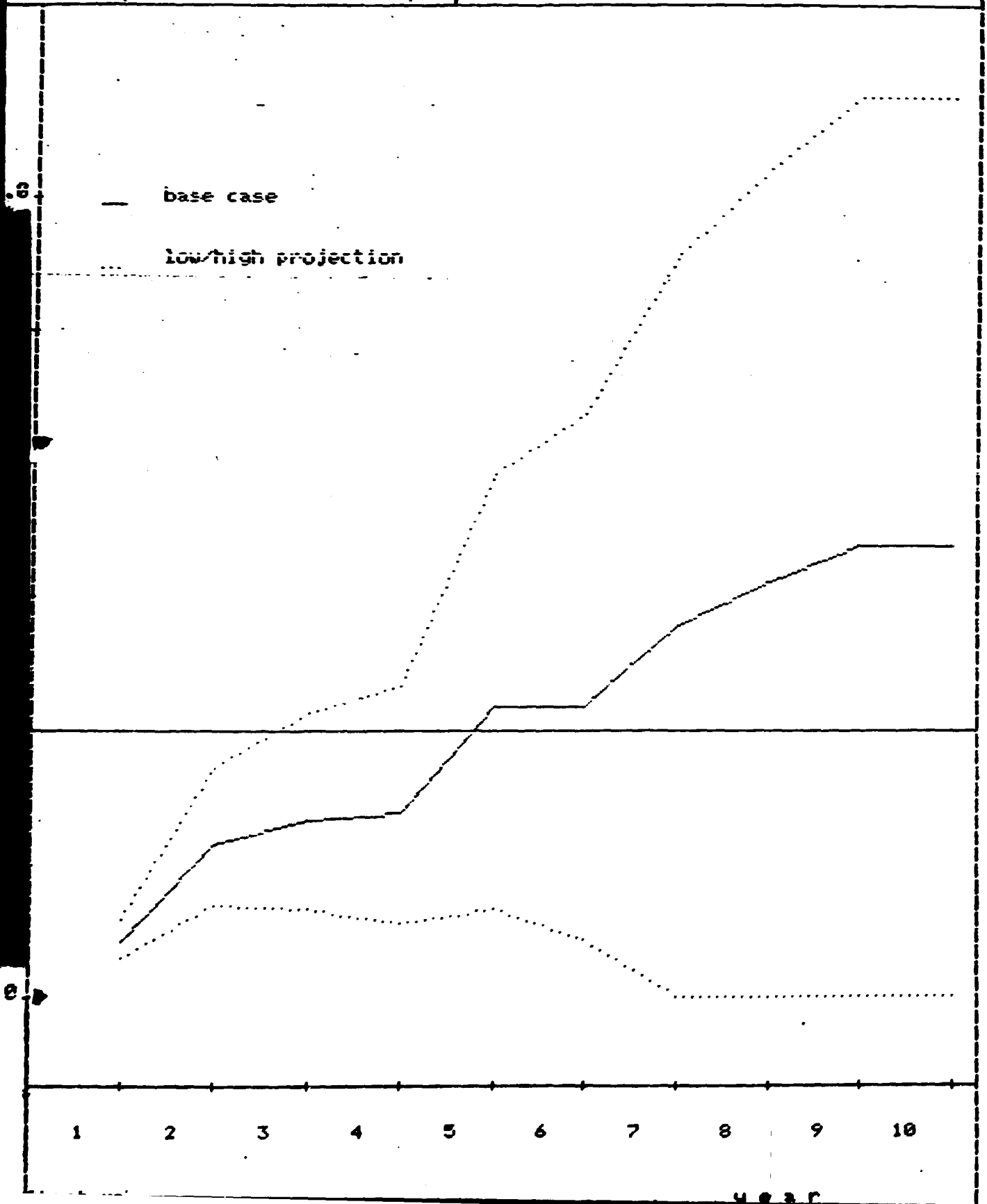


Fixed costs coverage ratio

by year, including finance

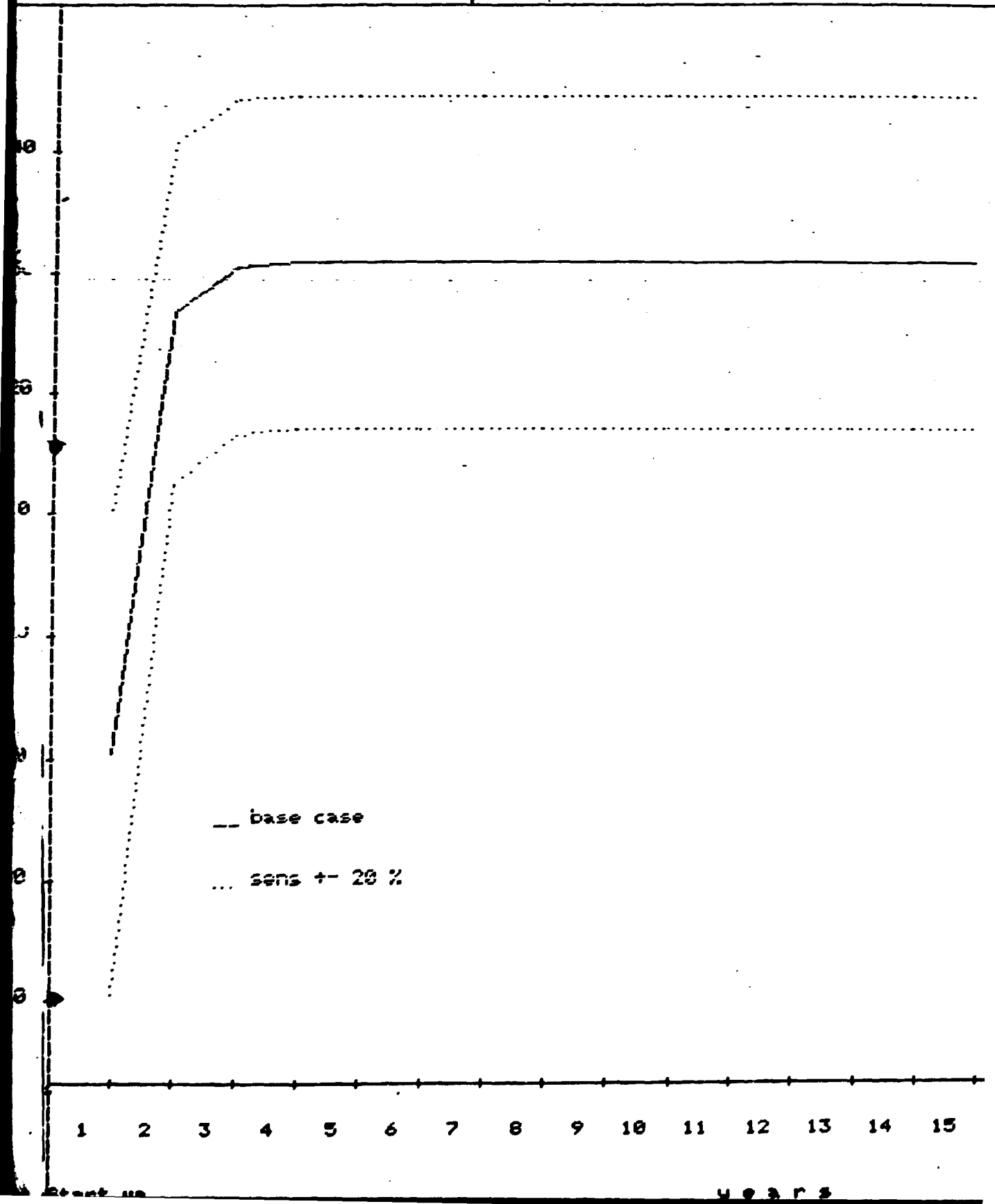
sensitivity analysis

varying the production volume

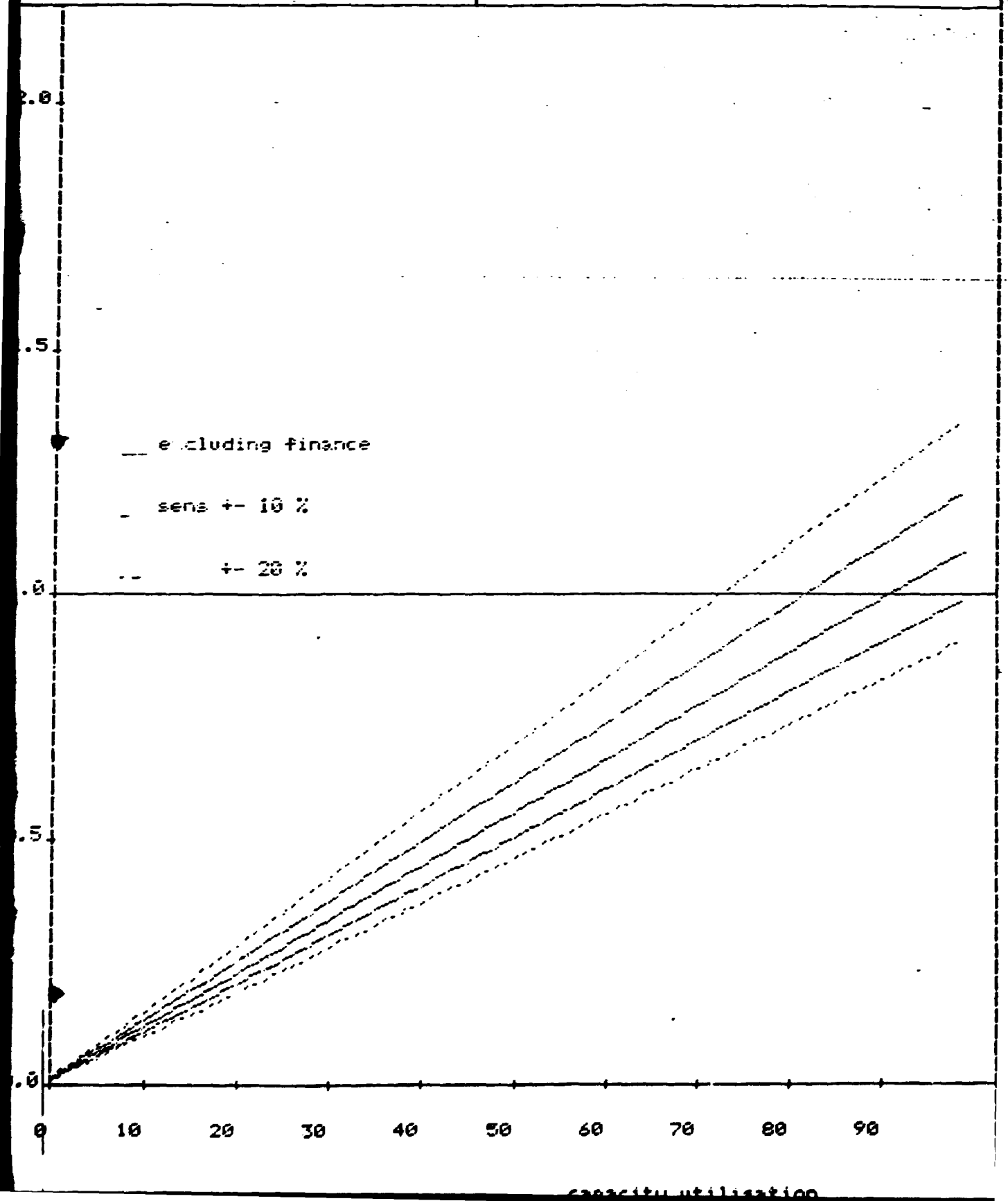


Net Cashflow / Total Sales ratio (%)

variation of operating costs



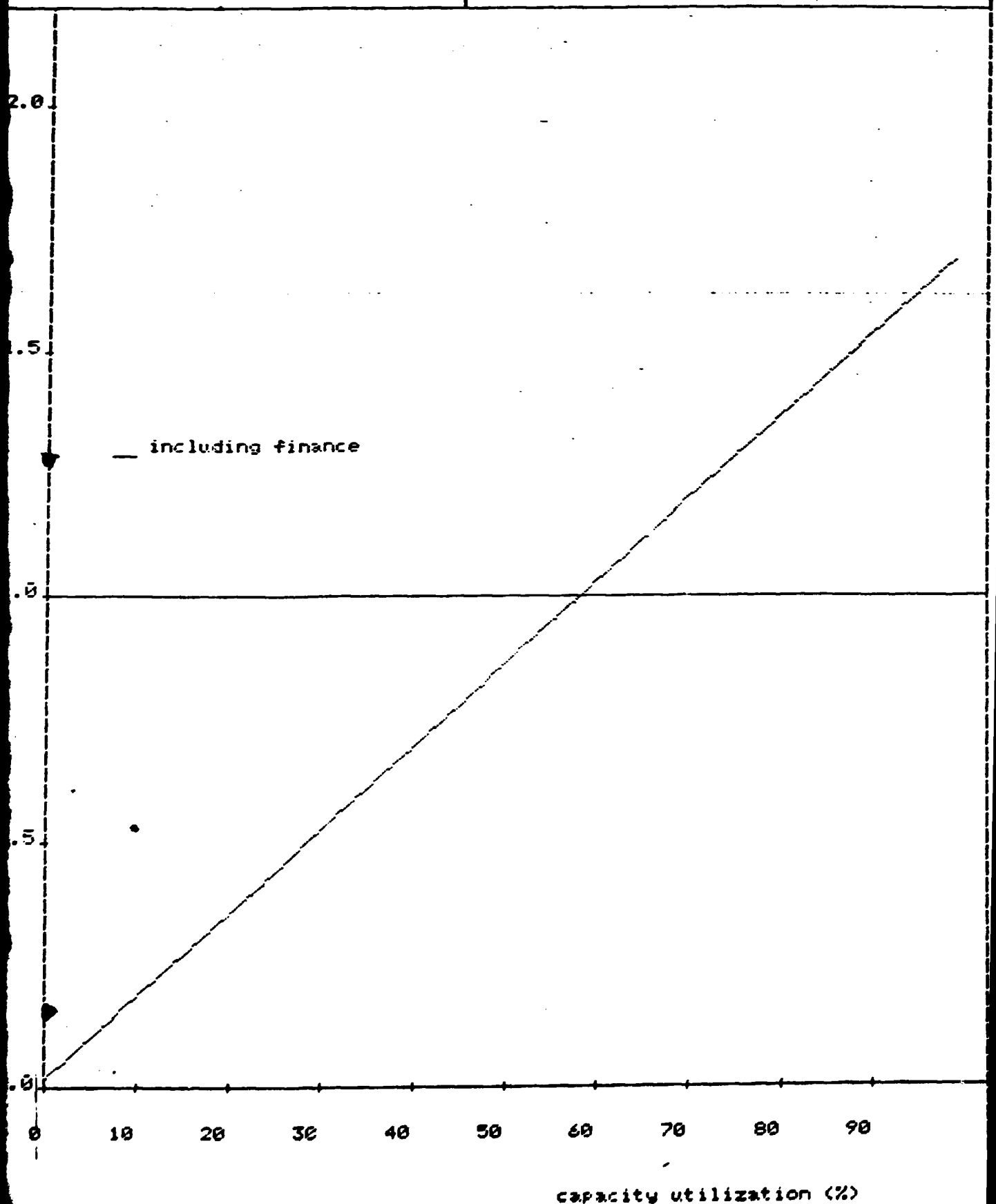
Fixed Costs Coverage, ratio variable margin/fixed cost	variation of fixed costs 5th year of production



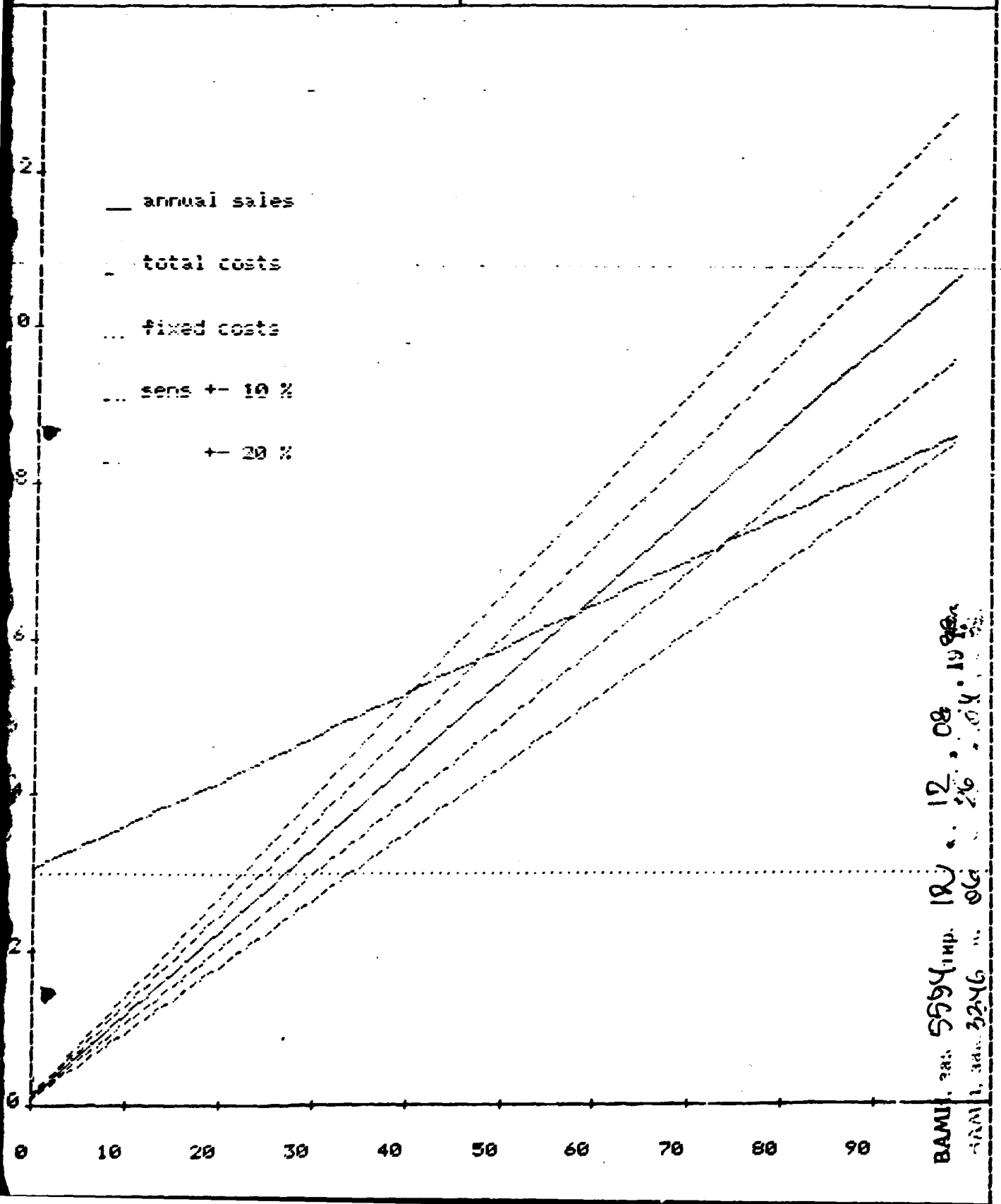
Fixed Costs Coverage, ratio

variable margin/fixed cost

10h year of production



Break Even Chart excl. finance	variation of sales prices
4 Mill.Rial	10th year of production



UNIDO Contract № 85/108
Project № DP/IRA/85/003

FEASIBILITY REPORT ON CONSTRUCTION OF ALUNITE BASED ALUMINA PLANT IN ISLAMIC REPUBLIC OF IRAN

Final Report

Volume II

Drawings

VAMI

V/O TECHNOEXPORT

Leningrad
1988

COMPOSITION OF FEASIBILITY REPORT ON CONSTRUCTION OF ALUNITE BASED ALUMINA PLANT IN ISLAMIC REPUBLIC OF IRAN

Volume I — General Explanatory Note

Volume II — Drawings

Volume III — Equipment Specifications

LIST OF DRAWINGS

Item	Drawing description	Drawing No
	TECHNOLOGICAL DRAWINGS	
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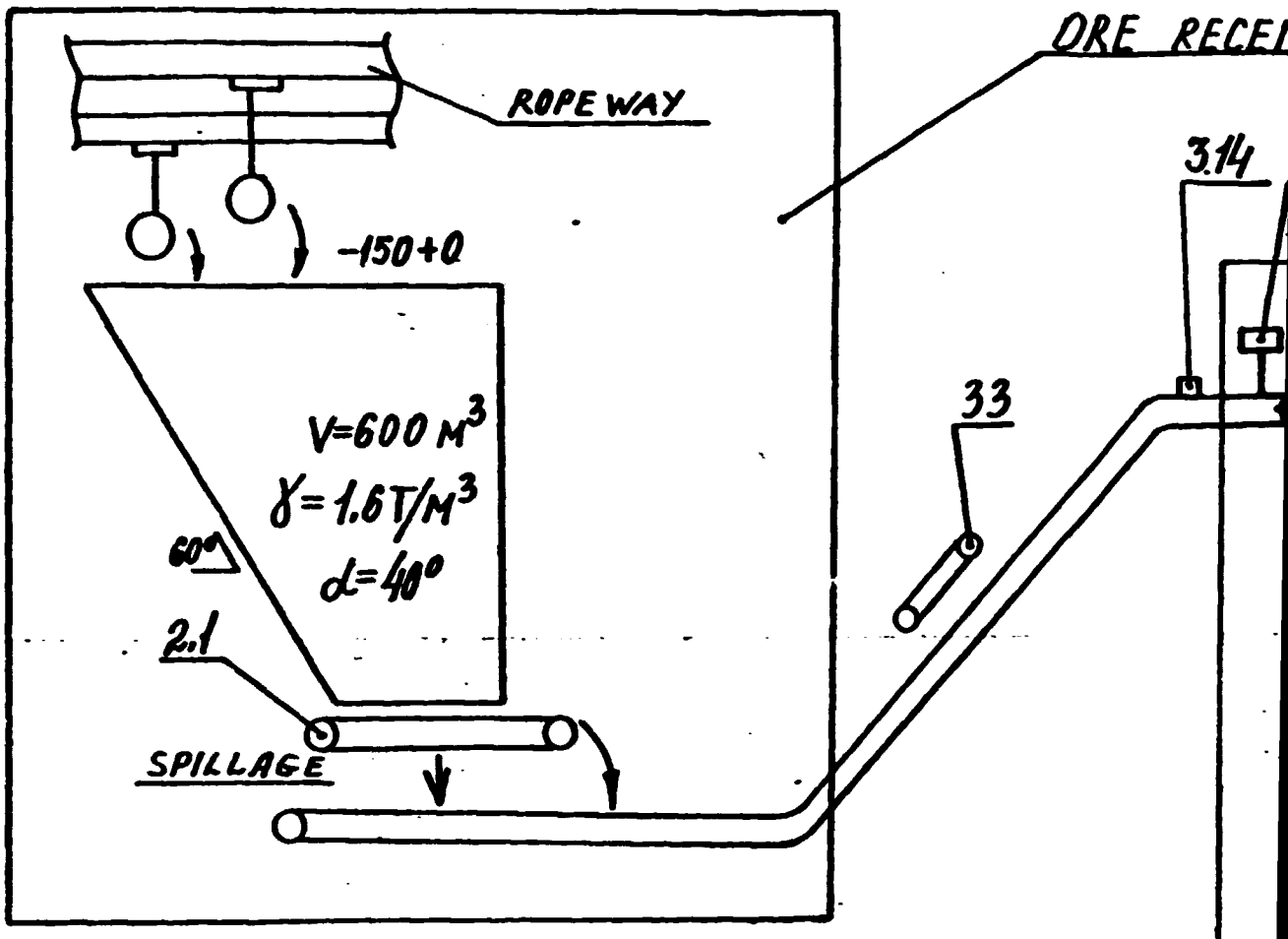
1.1	Ore receiving unit Sheet 1. Plans and sections	1339547-TM
1.2	Medium and fine crushing Sheet 1. Plans and section 3-3 Sheet 2. Sections 1-1; 2-2	1339548-TM
1.3	Blending storage conveyor galleries Sheet 1. Lay-out, sections 1-1+4-4	1339549-TM
1.4	Transfer units Sheet 1. Plans and section 1-1 Sheet 2. Plan and sections	1339550-TM
1.5	Dry grinding Sheet 1 - Process flowsheet Sheet 2 - Plan at el 0,000 Sheet 3 - Plans at el +10,800 and 21.600 Sheet 4 - Section 1-1	1339551-TM
1.6 1.7	Roasting and reduction with blower station and sulphur storage Process flowsheet	1390351-TM
1.6	Roasting and reduction with blower station (on two sheets) Sheet 1. Sections A-A, B-B Sheet 2. Plan at el + 12.600	1390368-TM
1.7	Sulphur storage Plans at el. 3.500; 3.600; 7800 Sections A-A, B-B	1390370-TM
1.8	Digestion desilication and mud washing Sheet 1 - Process flowsheet (contd)	1339552-TM

Item	Drawing description	Drawing No
	Sheet 2 - Process flowsheet	
	Sheet 3 - Plan at el 0.000	
	Sheet 4 - Plan at upper elevations	
	Sheet 5 - Sections 1-1, 2-2; 3-3; 4-4	
	Sheet 6 - Electrostatic precipitator plan and section	
1.9	Evaporation and potassium sulfate production	1339553-TM
	Sheet 1 - Process flowsheet	
	Sheet 2 - Process flowsheet	
	Sheet 3 - Plans at elevations 0.000 and 7.200	
	Sheet 4 - Plan at upper elevations	
1.10 1.11	Precipitation hydrate processing with hydrate store	1339554-TM
	Sheet 1 - Process flowsheet	
	Sheet 2 - Plan at el 0.000	
	Sheet 3 - Plan at upper elevation	
	Sheet 4 - Sections	
1.12; 1.13	Alumina calcination with commercial alumina storage	
	Process flowsheet	1390353-TM
1.12	Alumina calcination	1390367-TM
	Sheet 1. Plan of calciner. Sections A-A, B-B, C-C	
	Sheet 2. Sections D-D, E-E	
1.13	Commercial alumina storage	1390371-TM
	Plans at el.0.000; 6.000; 41.500 Sections A-A; B-B	
1.14 1.15	Potassium sulphate Drying with potassium Sulphate storage	
	Process flowsheet	1390352-TM
1.14	Potassium sulphate	
	Drying	1390369-TM
	Plans at el.0.000, 3.600 13.200. Section A-A	

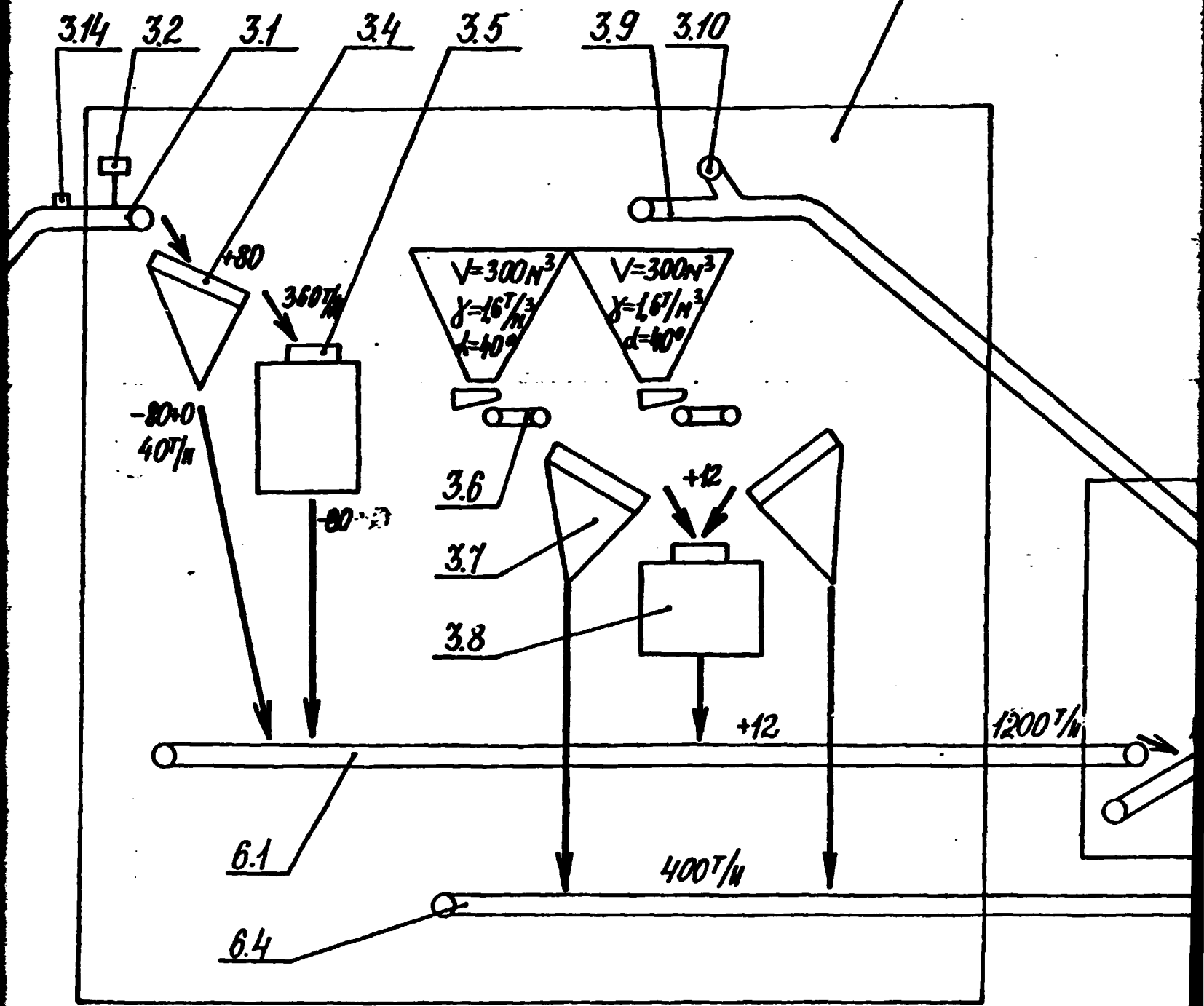
1	2	3
1.15	Potassium sulphate Storage Plan at el.0.000; 6.000; 41.500. Section A-A	1390372-TM
1.16	Caustic store Sheet 1. Flowsheet Sheet 2. Plan and section	1339555-TM
	2. DRAWINGS OF ENERGY FACILITIES	
2.1	LSDS and MSG of TPP electric supply diagram	1247955-ЭМ
2.2	Compressor station	1236755-TM
2.3	Balance diagram of water demand and sewerage	1370409-ТВК
2.4	Mud remouve, Plan	1370388-TM
	3. JCB SITE	
3.1	Lay-out	1389972-ГП
3.2	General lay-out	1389973-ГП
3.3	General lay-out (alternativ variant)	1389982-ГП


ORE RECEI
ROPE WAY
3.14
-150+0
33
V=600 M3
γ=1.6T/M3
60°
α=40°
2.1
SPILLAGE

SECTION 1

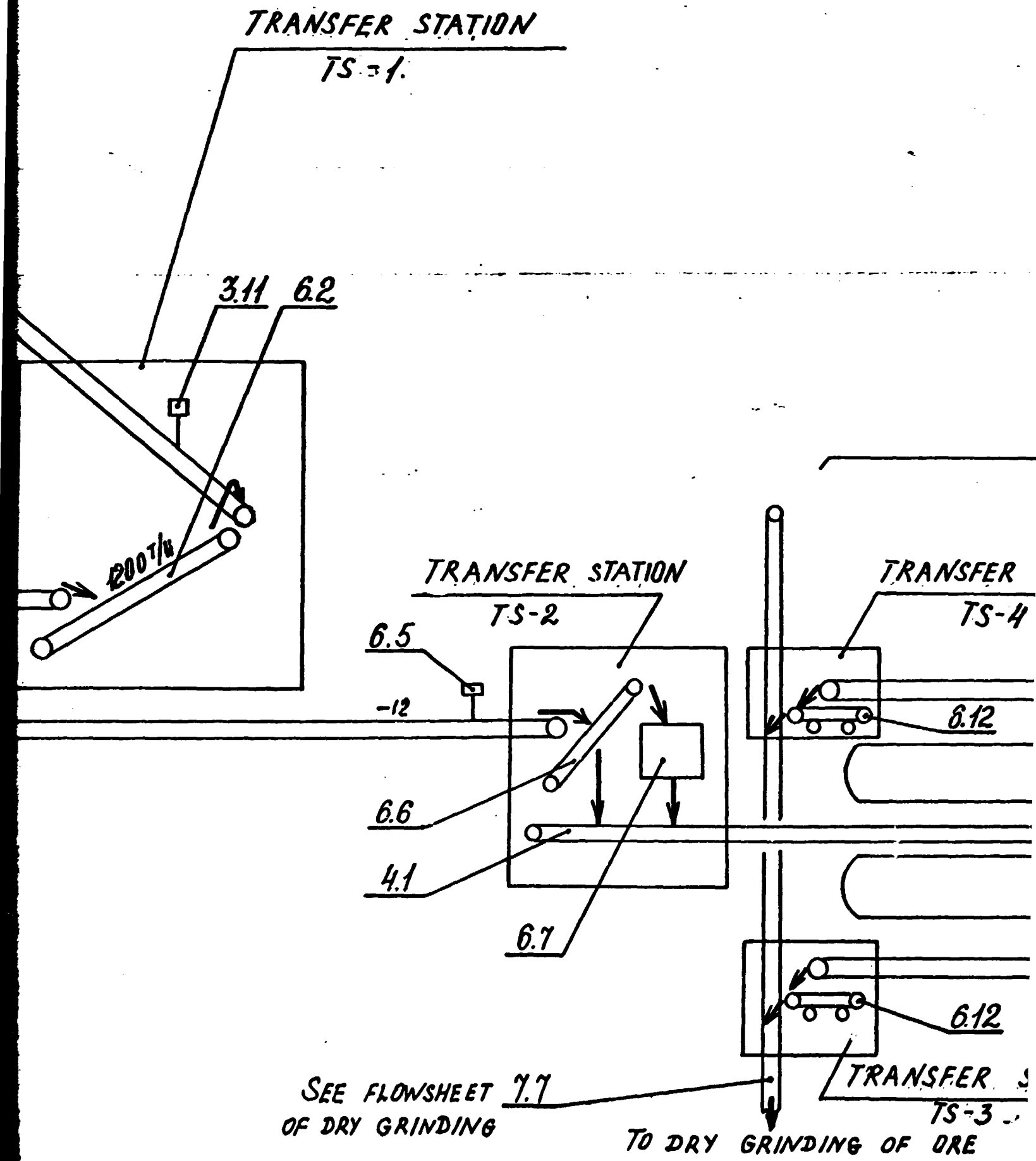
F RECEIVING UNIT

INTERMEDIATE AND



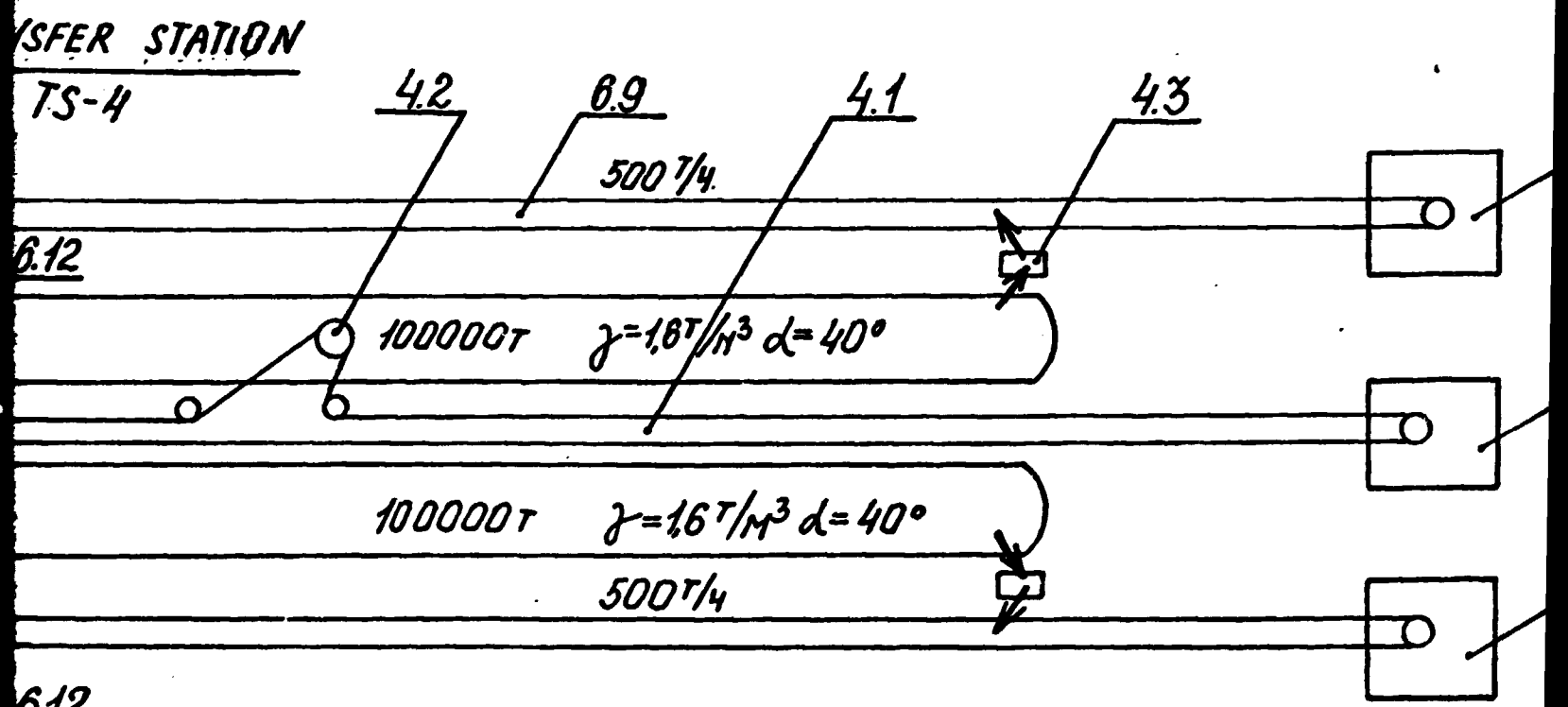
SECTION 2

SECTION 3


TRANSFER STATION
TS-1.
3.11
6.2
1200 T/h
TRANSFER STATION
TS-2
6.5
-12
6.6
4.1
6.7
TRANSFER
TS-4
6.12
6.12
SEE FLOWSHEET 7.7
OF DRY GRINDING
TRANSFER
TS-3
TO DRY GRINDING OF ORE

SECTION 4

BLENDING STORE



SECTION 5

ITEM	DESCRIPTION	SPECIFICA
	ORE RECEIVING UNIT AND COARSE WITH RESERVE STORE	
2.1	APRON FEEDER	B=1800MM
2.2	ELECTRICAL SUSPENDED CRANE	CAPACITY
	INTERMEDIATE AND FINE CR	
3.1.	BELT CONVEYER	B=100
3.2.	BELT WEIGHER	B=10
3.3.	IRON SEPARATOR	B=100
3.4.	INERTIAL SINGLE-SCREEN	SIEVE
		1750×
3.5.	CONIC CRUSHER FOR INTEAME-	
	DIATE CRUSUING	D_{CONE} =
3.6.	WEIGHING DEVICE	Q=320
3.7.	INERTIAL SCREEN	SIEVE S 2500 x
3.8.	CONIC CRUSHER FOR FINE CRUSHING	D_{CONE} =
3.9.	STATIONARY BELT CONVEYER	
	WITH DISCHARGE TROLLEY	B=14

TAKE-UP STATION No1

DRIVING STATION

TAKE-UP - STATION No2

SPECIFICATION	NUMBER	NU
OARSE CRUSHING RE		
B=1800MM L=18M	1	
CAPACITY 3,2T	1	
FINE CRUSHING		
B=1000MM	1	
B=1000MM	1	
B=1000MM	1	
SIEVE SIZE		
1750×3860	1	
DCONE=2200MM	1	
Q=320T/HR	6	
SIEVE SIZE 2500×6400	6	
DCONE=2200MM	3	
B=1400MM	1	

NOTE	ITEM	DESCRIPTION	SPECIFICATION
	3.10.	DISCHARGE TROLLEY	B=1400 MM
	3.11.	BELT WEIGHER	B=1400MM
	3.12	ELECTRICAL BRIDGE CRANE	CAPACITY 20/5
	3.13	ELECTRICAL BRIDGE CRANE	CAPACITY 16/3,2
	3.14	IRON INDICATOR МП-2С	
	3.15	ELECTRICAL BRIDGE CRANE	CAPACITY 20/5
		ORE BLENDING STORE	
	4.1	BELT CONVEYER	B=1000; L=50
	4.2.	STACKER	Q=500 T/HR
	4.3.	BUCKET WHEEL EXCAVATOR, TRACK-	
		MOUNTED	Q=500 T/HR
	4.4.	ELECTRICAL SUSPENDED CRANE	CAPACITY 5T
		TRANSFER STATION TS-1	
	6.1.	BELT CONVEYER	B=1400; L=1
	6.2.	BELT CONVEYER	B=1400; L=12
	6.3.	ELECTRICAL SUSPENDED CRANE	CAPACITY 5T

SECTION 7

	SPECIFICATION	NUMBER	NOTE
	B=1400 MM	1	
	B = 1400MM	1	
	CAPACITY 20/5T	1	
	CAPACITY 16/32T	1	
		1	
	CAPACITY 20/5T	1	
RE			
	B=1000; L=500	1	
	Q=500 T/HR	1	
ACK-			
	Q = 500 T/HR	2	
NE	CAPACITY 5T	1	
ON TS-1			
	B=1400; L=130	1	
	B = 1400; L=12M	1	
NE	CAPACITY 5T	1	

ITEM	DESCRIPTION	SPECIFICAT
	TRANSFER STATION TS-2	
6.4.	BELT CONVEYER	B=1000MM L
6.5	BELT WEIGHER	B=1000 M
6.6.	AUTOMATICAL SAMPLER, BUCKET	
6.7.	SAMPLE PREPARATION MACHINE	Q = 2,2 T/H
6.8.	ELECTRICAL SUSPENDED CRANE	CAPACITY
	TRANSFER STATIONS TS-3 AND	
6.9.	BELT CONVEYER	B=1000MM
6.10.	SASPENDED ELECTRICAL CRANE	CAPACITY
6.12	MOVABLE BELT CONVEYER	B=1000M

UNIDO CONTRACT NO

133954

IRAN. ALUNITE BASED

ORE RECEIVING UNIT INTERMEDIATE AND FINE CRUSHING. ORE BLENDING STORE. TRANSFER STATIONS TS-1,2,3,4

APPARATUS-PROCESS FLOWSHEET

SECTION 8

NUMBER	NOTE	ITEM	DESCRIPTION	SPECIFICATION	NUMBER	NOTE
			TRANSFER STATION TS-2			
1		6.4.	BELT CONVEYER	B=1000MM L=100M	1	
1		6.5	BELT WEIGHER	B=1000MM	1	
1		6.6.	AUTOMATICAL SAMPLER, BUCKET		1	
1						
1		6.7.	SAMPLE PREPARATION MACHINE	Q=2,2 T/HR	1	
		6.8.	ELECTRICAL SUSPENDED CRANE	CAPACITY 5T	1	
1			TRANSFER STATIONS TS-3 AND TS-4			
1		6.9.	BELT CONVEYER	B=1000MM L=500M	2	
		6.10.	SASPENDED ELECTRICAL CRANE	CAPACITY 5T	2	
2		6.12	MOVABLE BELT CONVEYER	B=1000MM	2	
1						
1						
1						
1						

UNIDO CONTRACT NO 85/108

1339545-TM

IRAN. ALUNITE BASED ALUMINA PLANT

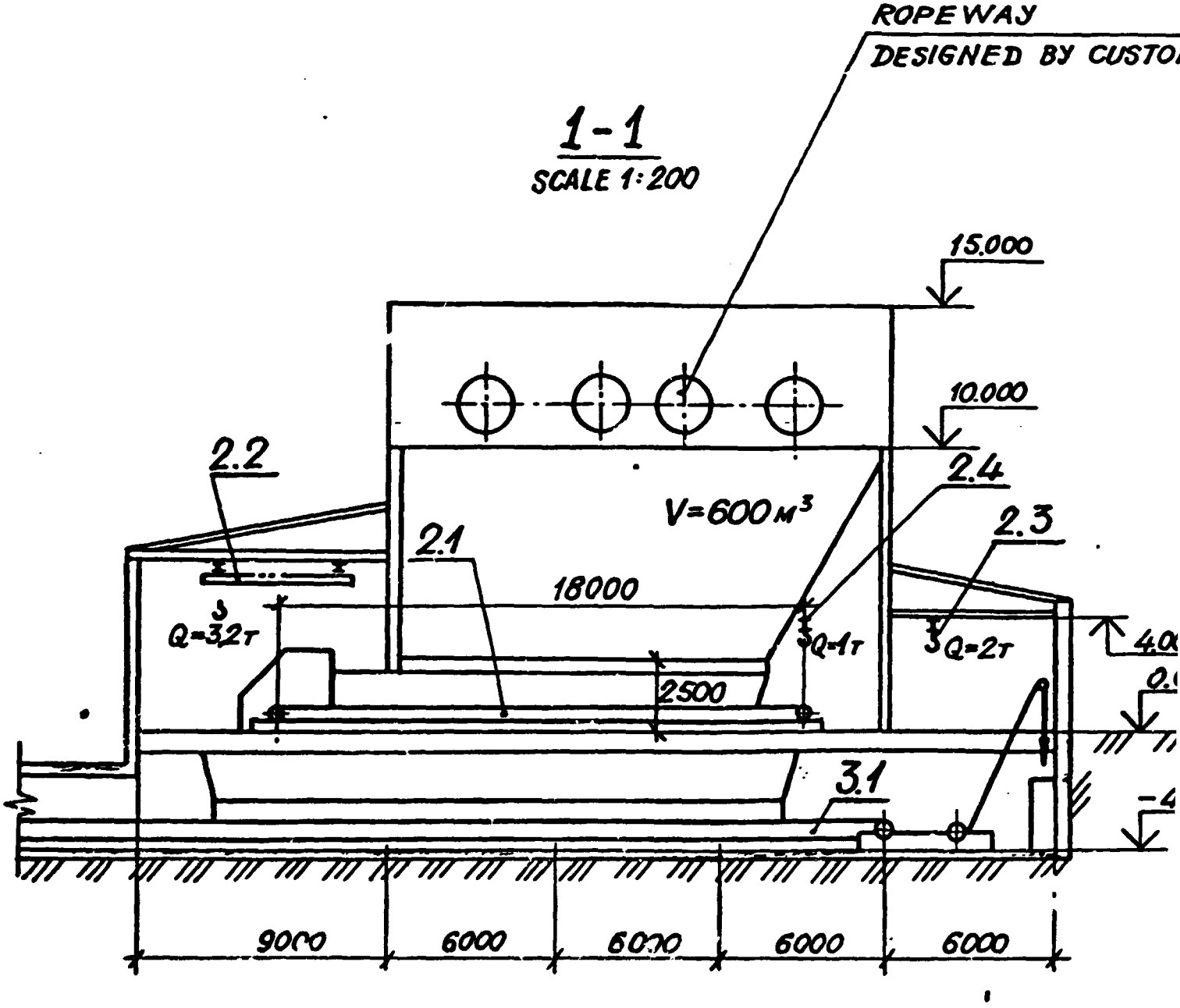
ORE RECEIVING UNIT INTERMEDIATE AND FINE CRUSHING, ORE BLENDING STORE, TRANSFER STATIONS TS-1,2,3,4

STAGE	SHEET	SHEETS
FEASIBILITY		1

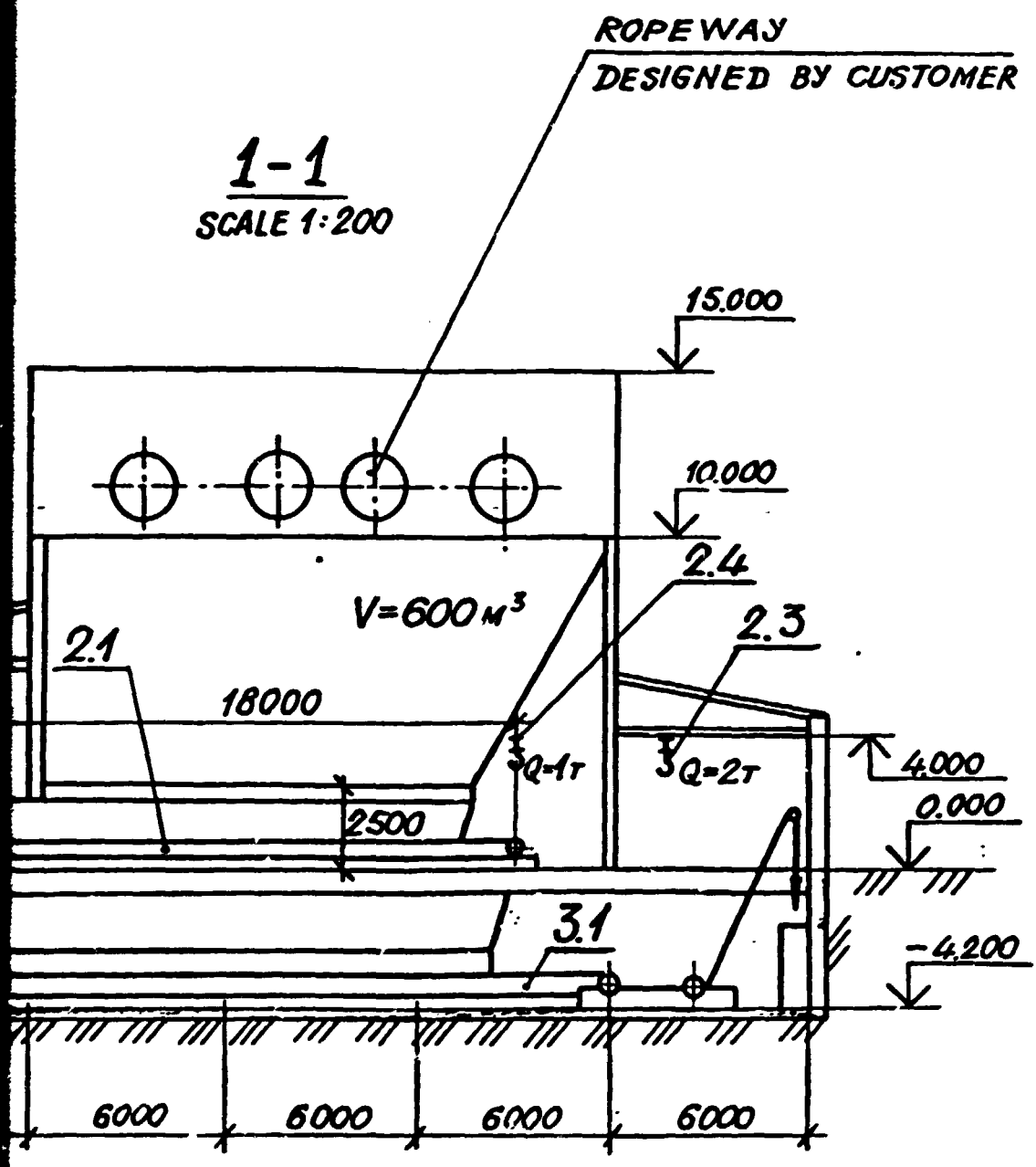
APPARATUS-PROCESS FLOWSHEET

VAMI

SECTION 1


ROPEWAY
DESIGNED BY CUSTO
1-1
SCALE 1:200
15.000
10.000
2.2
2.4
2.3
2.1
V=600 м³
18000
Q=3,2т
Q=1т
Q=2т
2500
3.1
9000
6000
6000
6000
6000

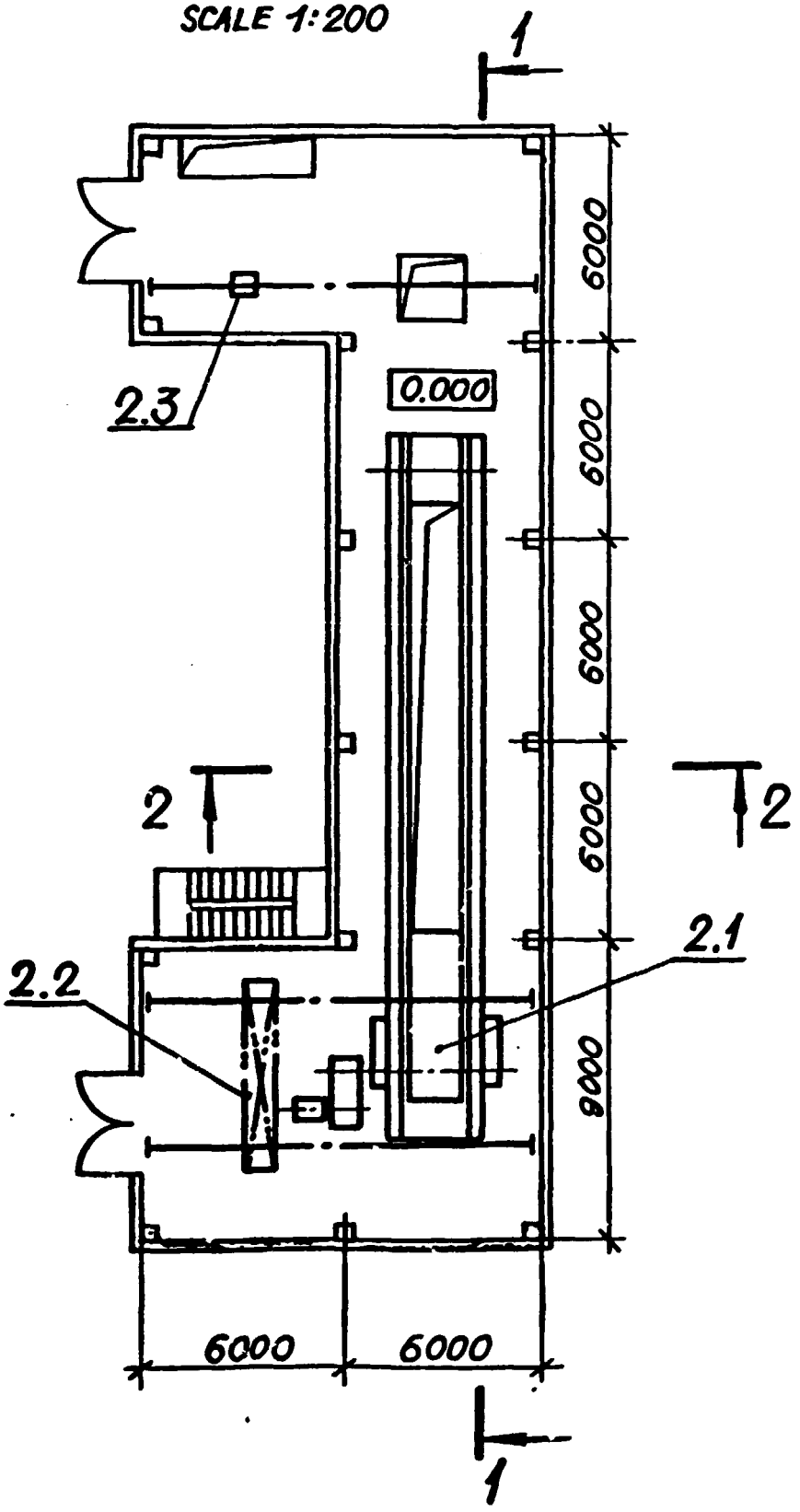
SECTION 2


ROPEWAY
DESIGNED BY CUSTOMER
1-1
SCALE 1:200
15.000
10.000
2.4
V=600 м³
2.3
2.1
18000
Q-1т
Q=2т
4.000
0.000
2500
3.1
-4.200
6000
6000
6000
6000

SECTION 3

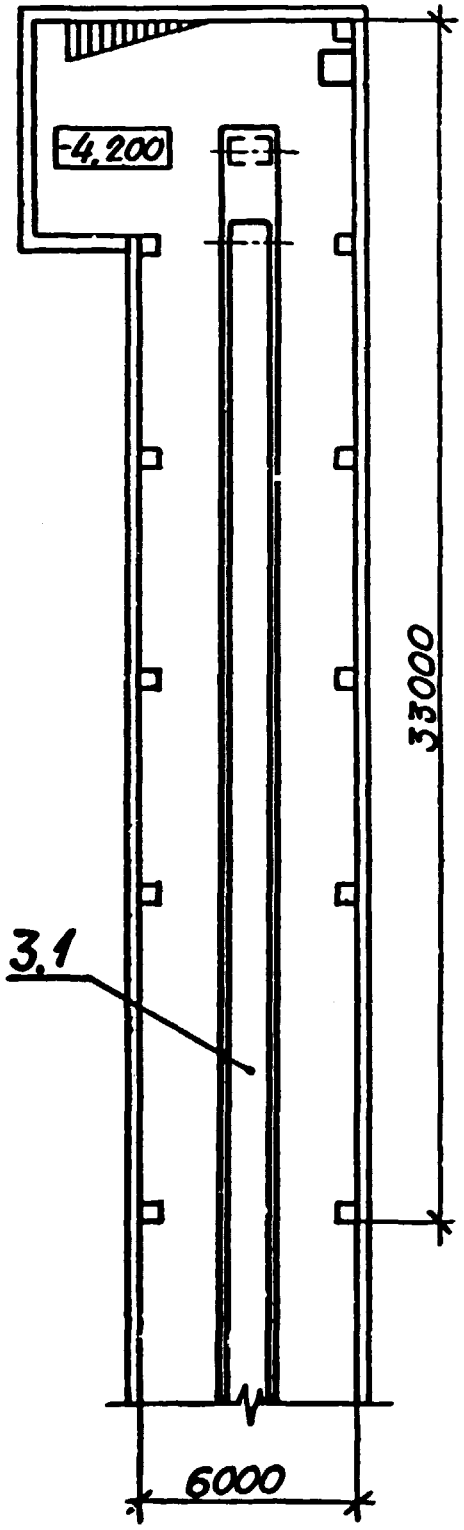
PLAN AT EL. 0.000

SCALE 1:200

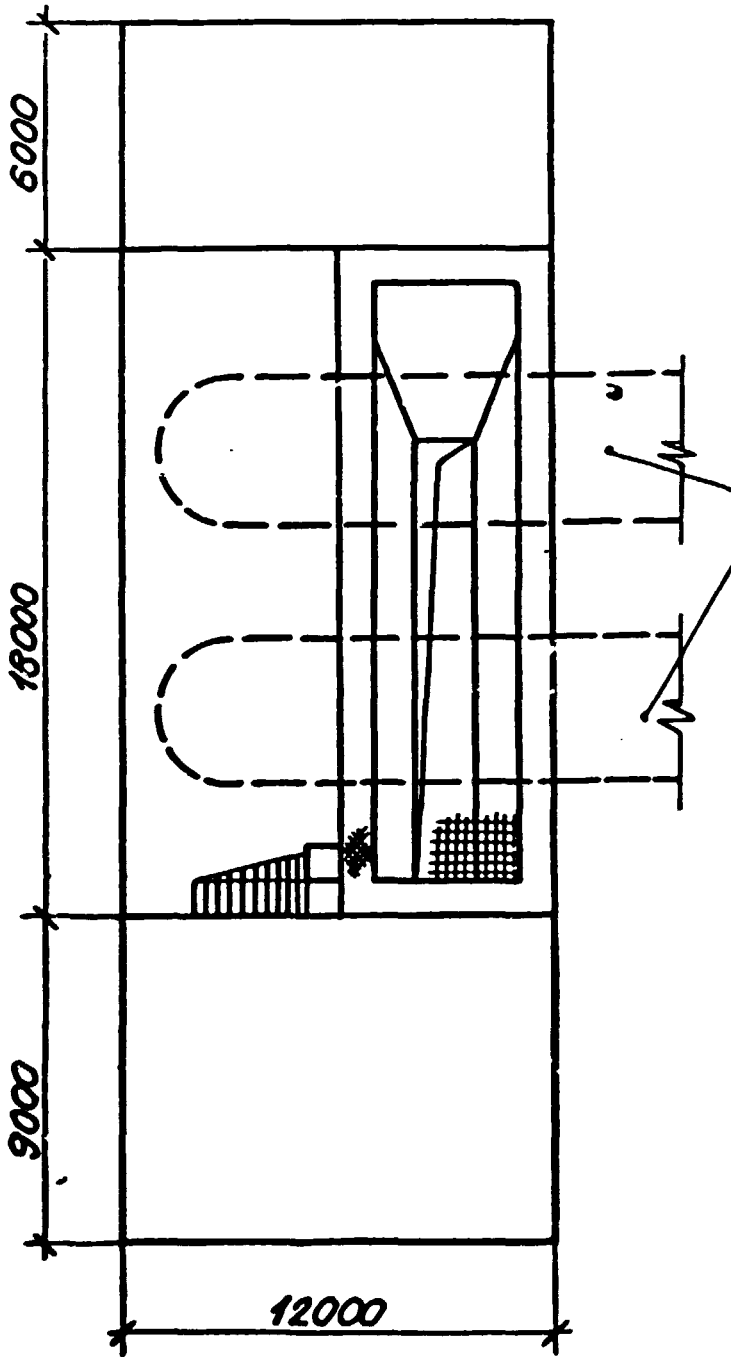


SECTION 4

PLAN AT EL. 4.200
SCALE 1:200

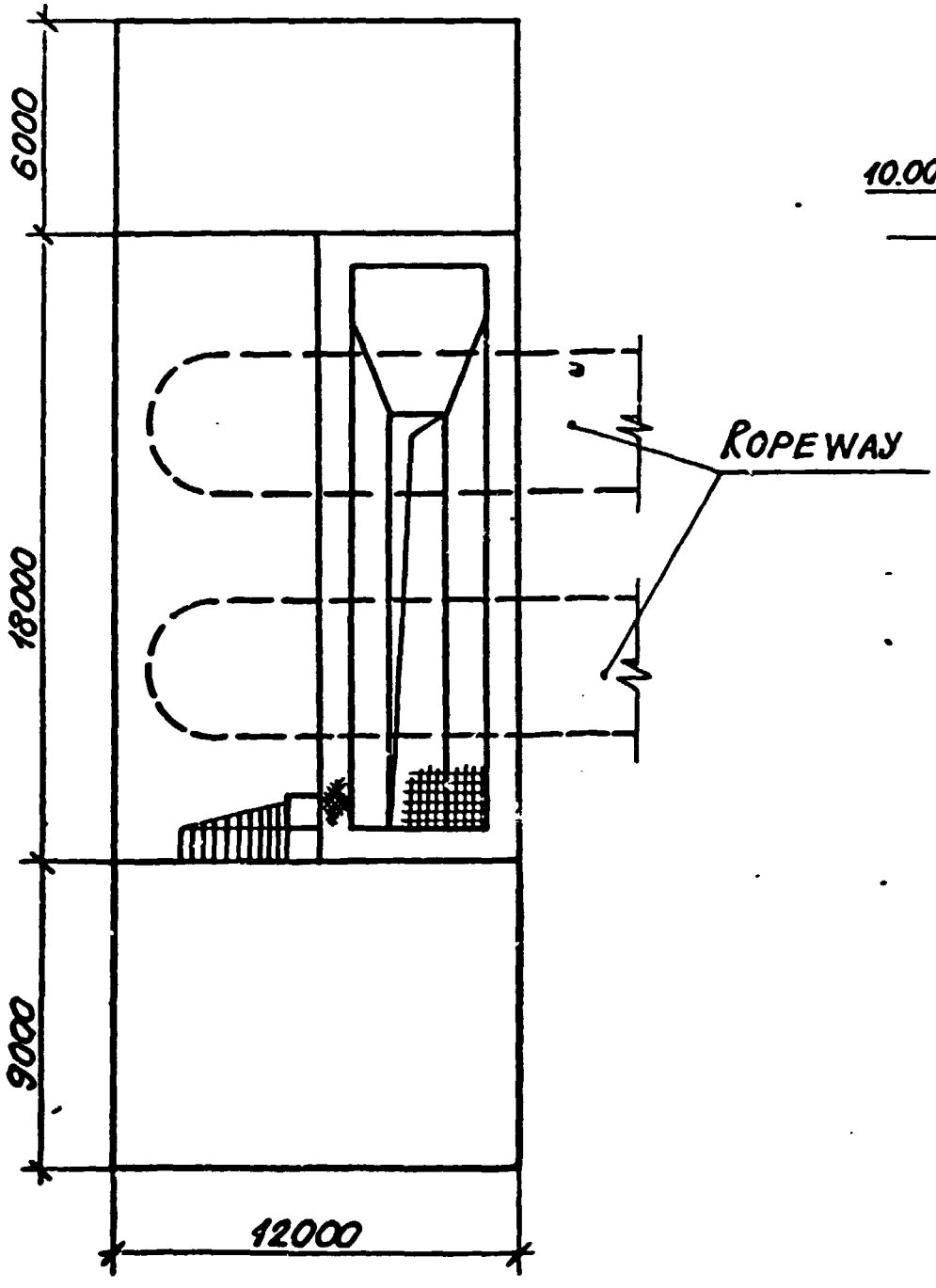


PLAN AT EL. 10.000
SCALE 1:200

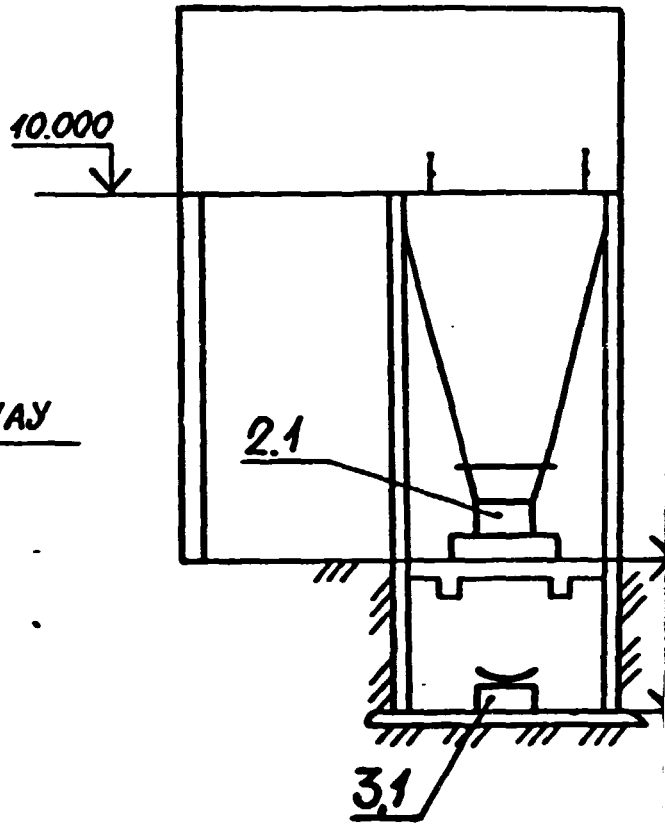


SECTION 5

PLAN AT EL. 10.000
SCALE 1:200

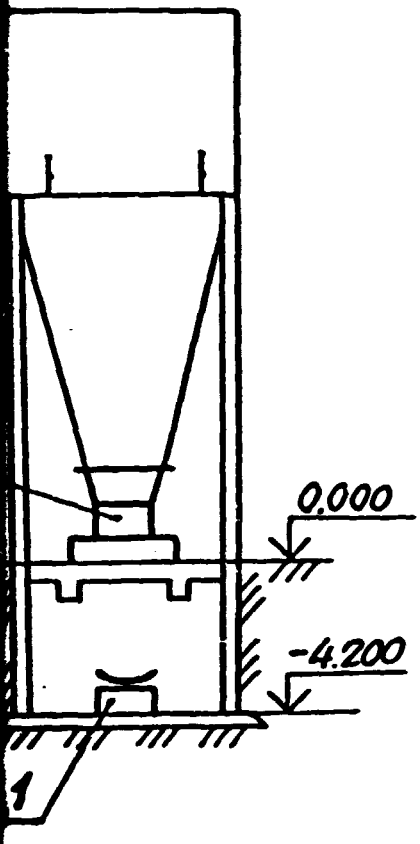


2-2
SCALE 1:2



SECTION 6

2-2
SCALE 1:200



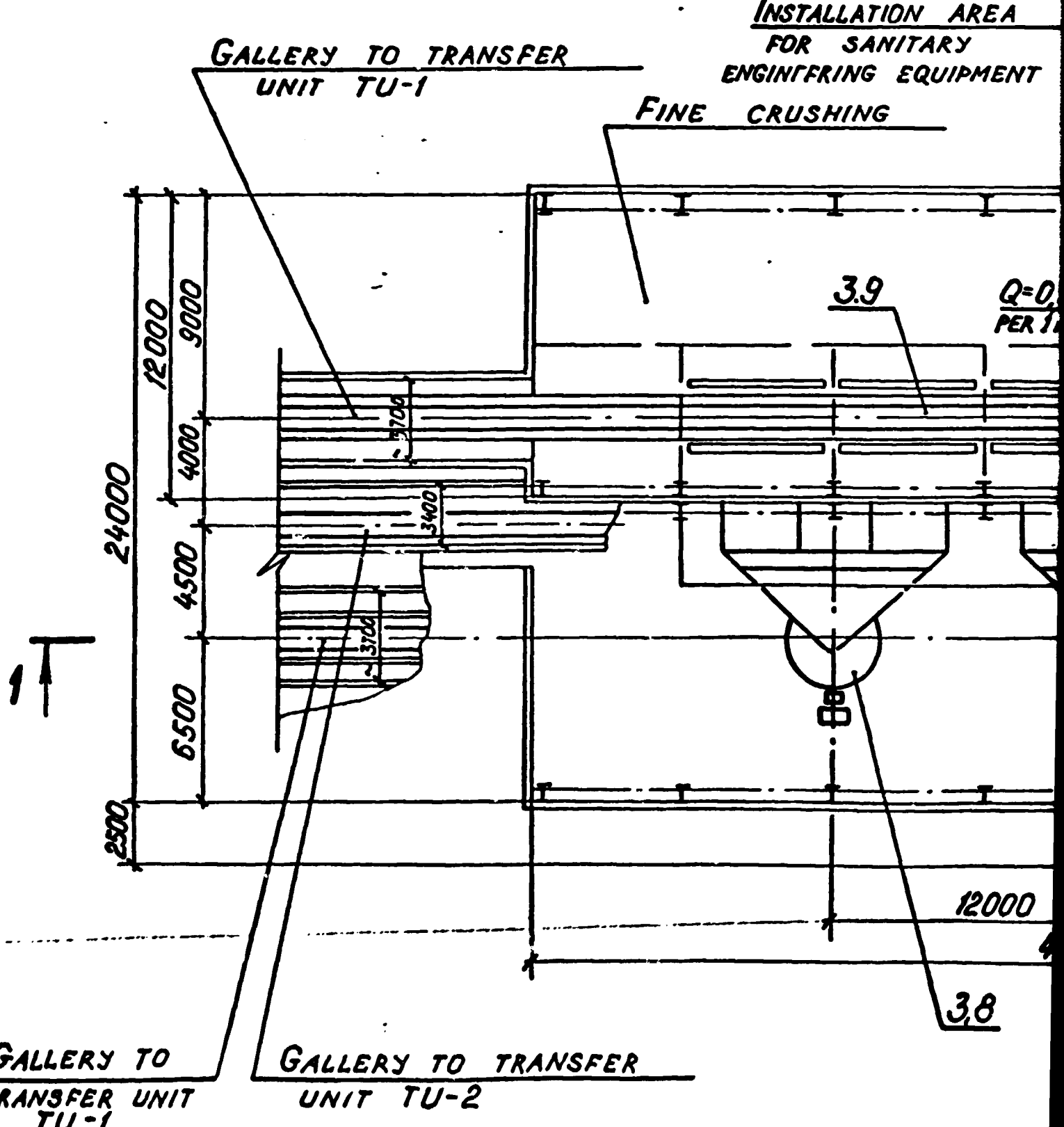
1339545 - PROCESS EQUIPMENT FLOWSHEET

UNIDO CONTRACT NO 85/108

1339547-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
ORE RECEIVING UNIT	STAGE	SHEET	SHEETS
	FEASIBILITY		1
PLANS AND SECTIONS	VAMI LENINGRAD		

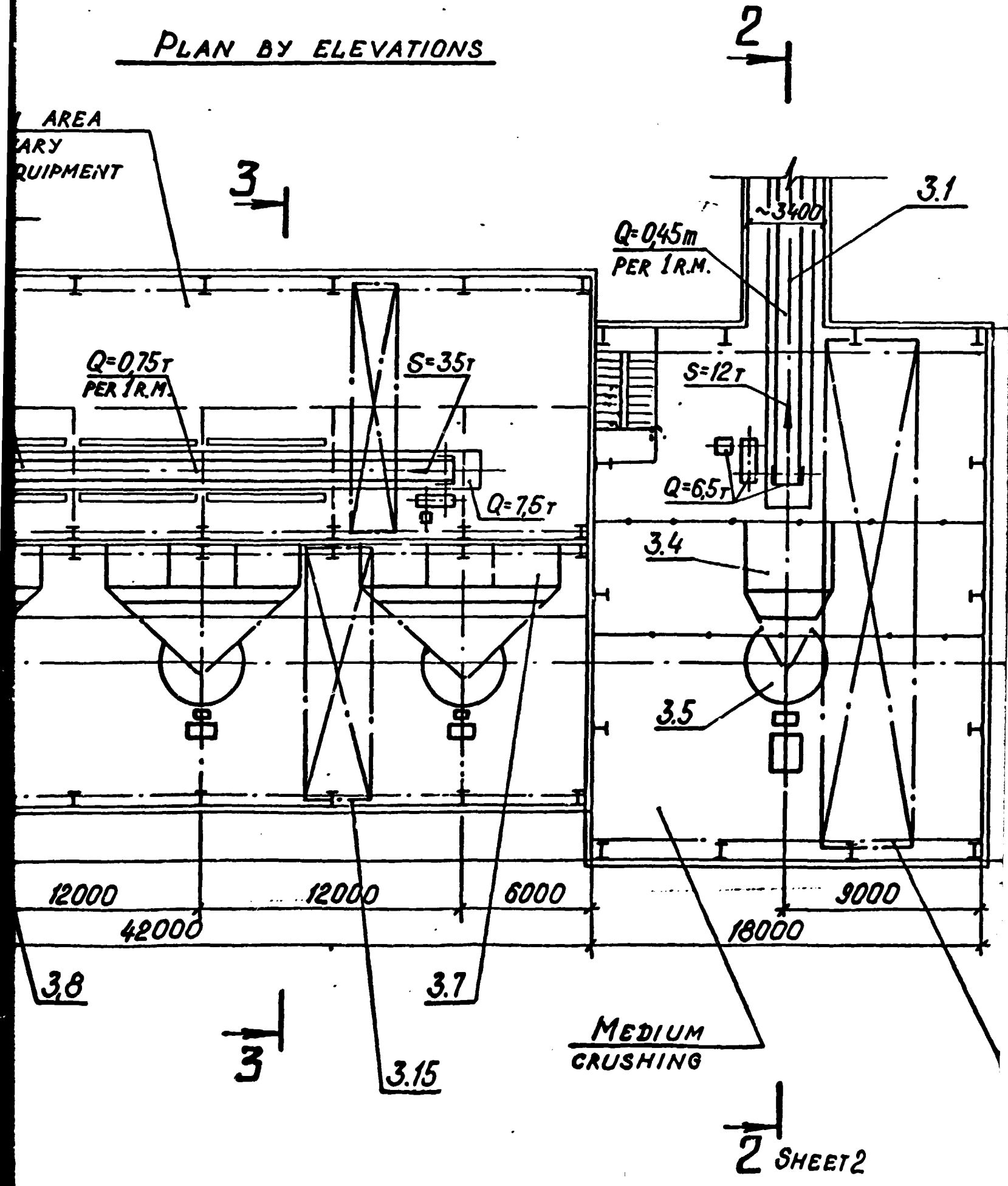
SIZE A4x5

SECTION 1

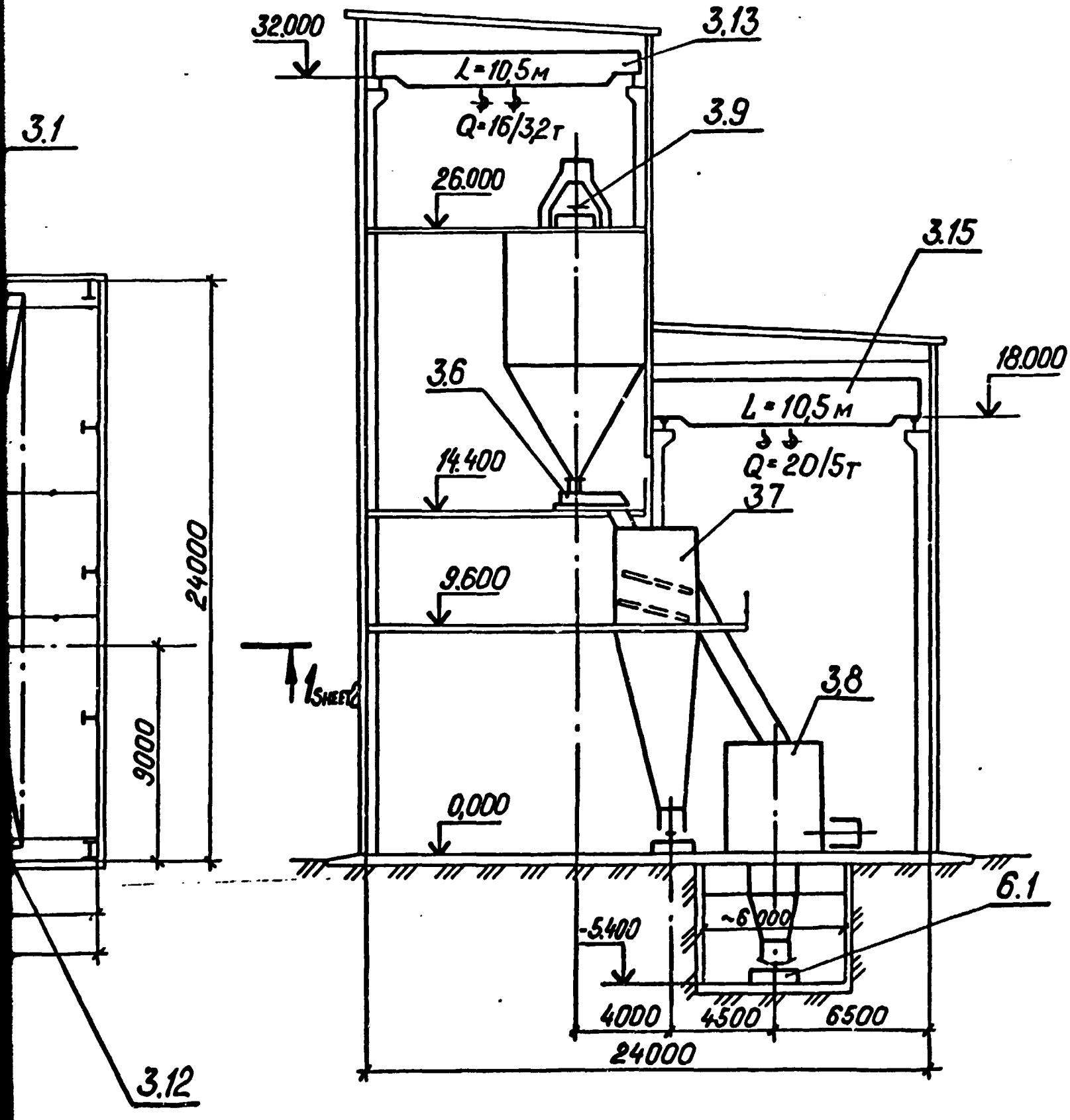

INSTALLATION AREA
FOR SANITARY
ENGINEERING EQUIPMENT
GALLERY TO TRANSFER
UNIT TU-1
FINE CRUSHING
3.9
Q=0,
PER 1
12000
9000
4000
4500
6500
2500
24000
3700
3400
3700
1
1
12000
3.8
GALLERY TO
TRANSFER UNIT
TU-1
GALLERY TO TRANSFER
UNIT TU-2

SECTION 2

PLAN BY ELEVATIONS



SECTION 3 3-3


32.000
3.13
L=10,5м
Q=16/3,2т
3.9
26.000
3.1
3.15
18.000
3.6
L=10,5м
Q=20/5т
14.400
37
9.600
24000
9000
1 SHEET 2
3.8
0.000
6.1
-5.400
~6.000
4000
4500
6500
24000
3.12

SECTION 4

18.000

1339545 EQUIPMENT FLOWSHEET

6.1

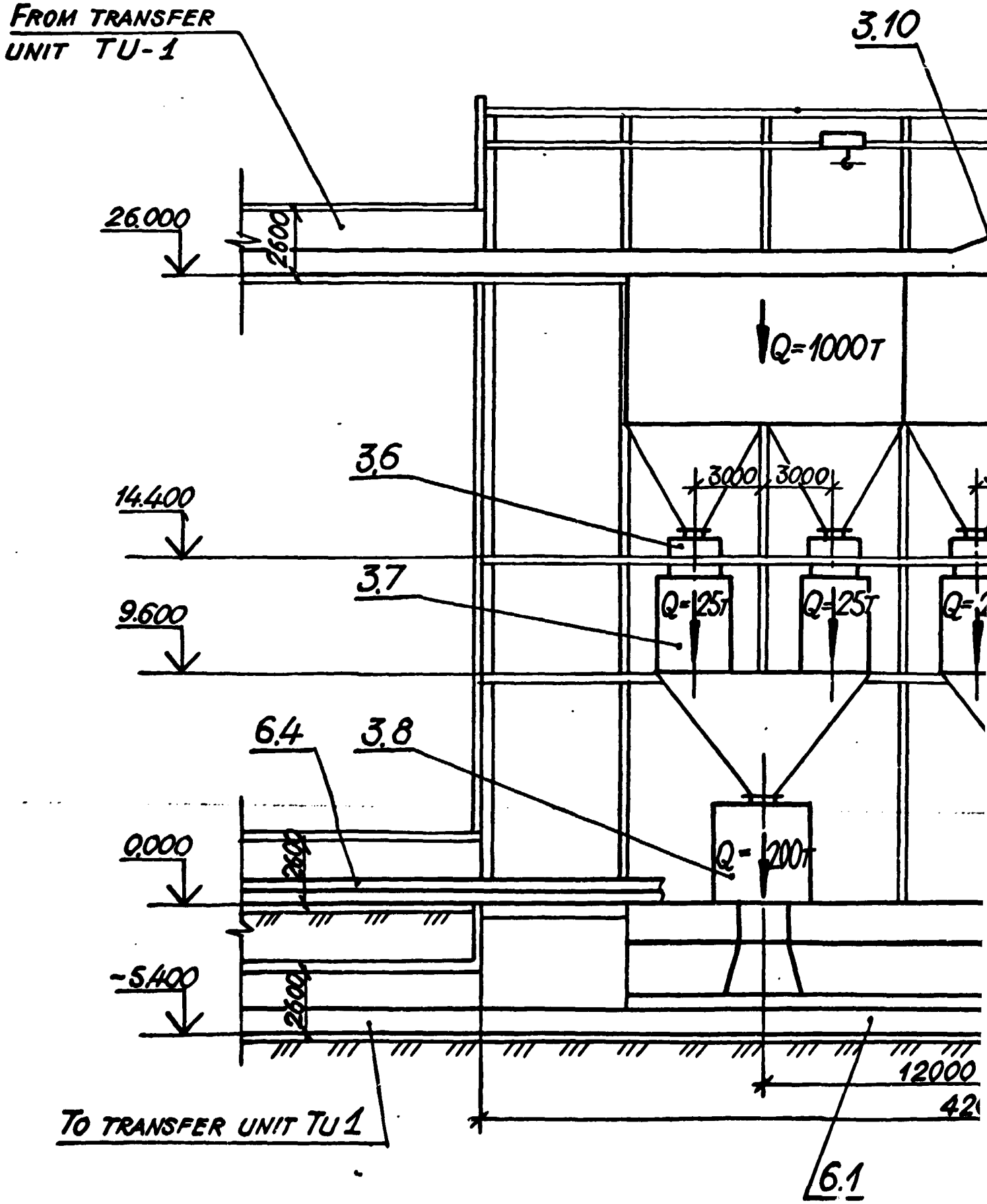
UNIDO CONTRACT NO 85/108

1339548-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
MEDIUM AND FINE CRUSHING	STAGE	SHEET	SHEETS
	FEASIBILITY	1	2
PLAN AND SECTION 3-3	VAMI LENINGRAD		

Size A1x1

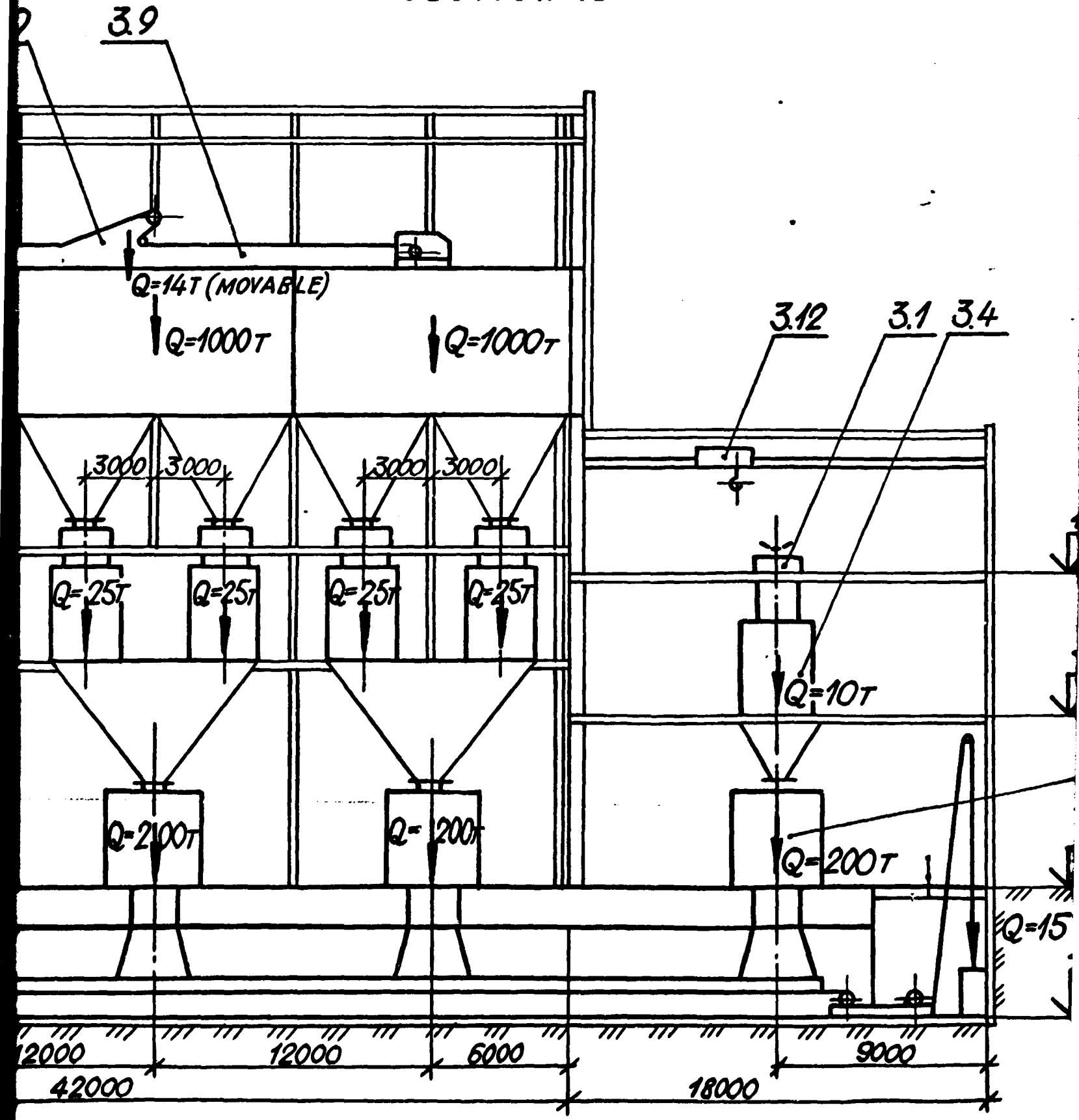
SECTION 1

1-1


FROM TRANSFER UNIT TU-1
3.10
26.000
2600
Q=1000T
3.6
3000
3000
14.400
3.7
Q=25T
Q=25T
9.600
6.4
3.8
Q=200T
0.000
2800
-5.400
2800
12000
TO TRANSFER UNIT TU 1
6.1

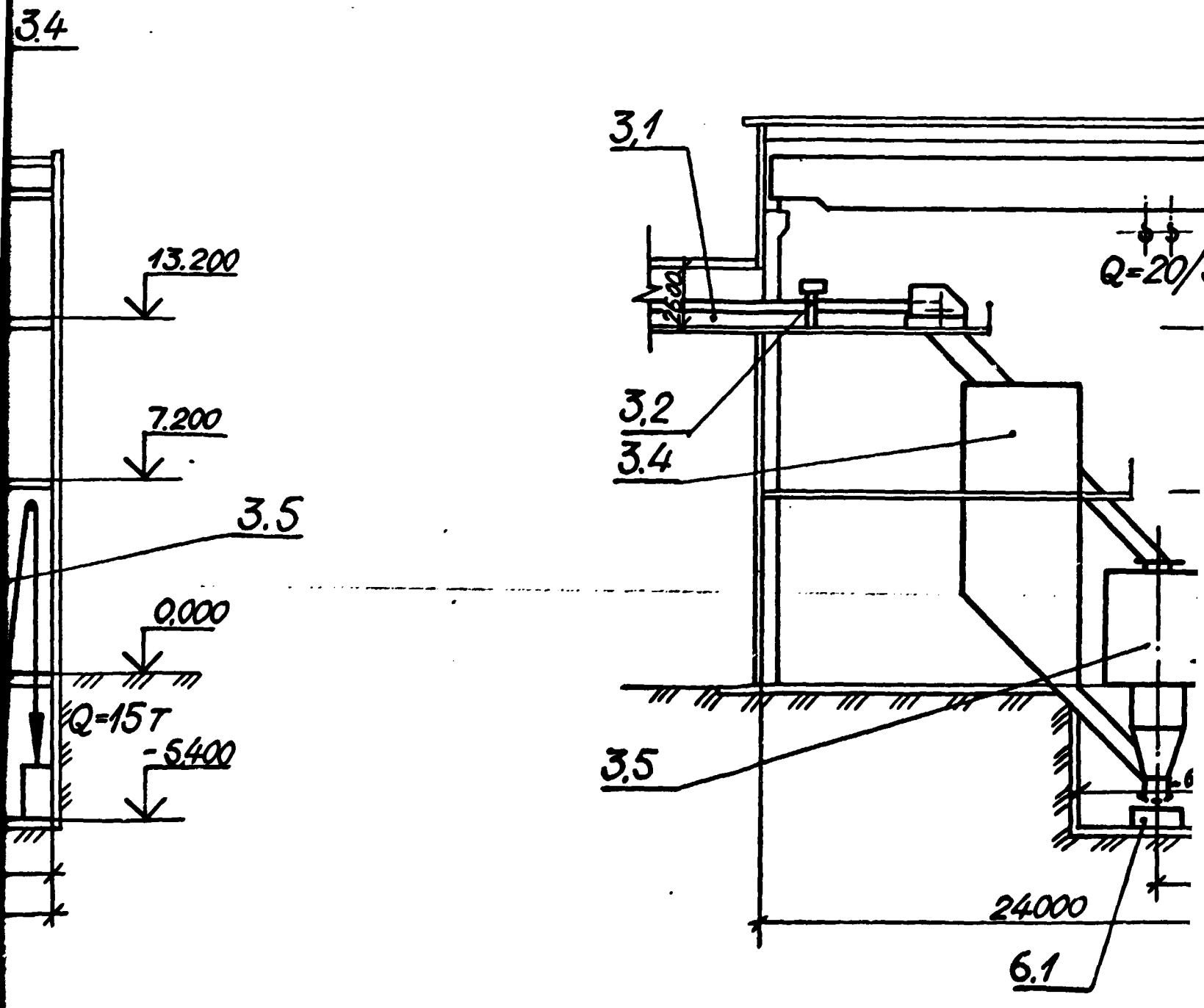
1-1

SECTION 2


3.9
Q=14T (MOVABLE)
Q=1000T
Q=1000T
3.12
3.1
3.4
3000
3000
3000
3000
Q=25T
Q=25T
Q=25T
Q=25T
Q=10T
Q=200T
Q=200T
Q=200T
Q=15
12000
12000
6000
9000
42000
18000

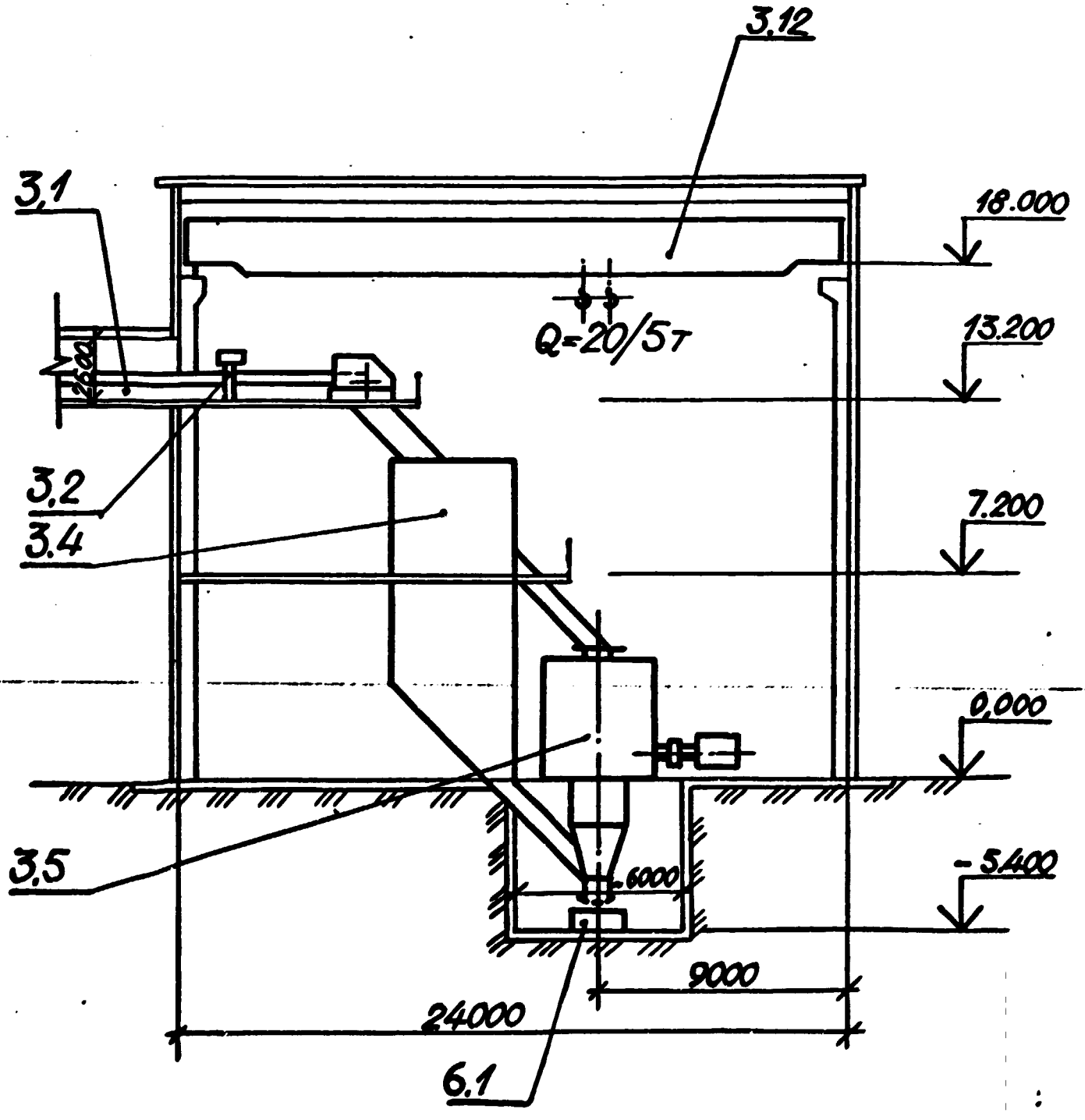
SECTION 3

2-2



SECTION 4

2-2


3.12
3.1
18.000
Q=20/5т
13.200
3.2
3.4
7.200
0.000
3.5
-5.400
6000
9000
24000
6.1

SECTION 5

UNIDO CONTRACT NO 85/108

1339548-TM

IRAN. ALUNITE BASED ALUMINA PLANT

MEDIUM AND FINE CRUSHING

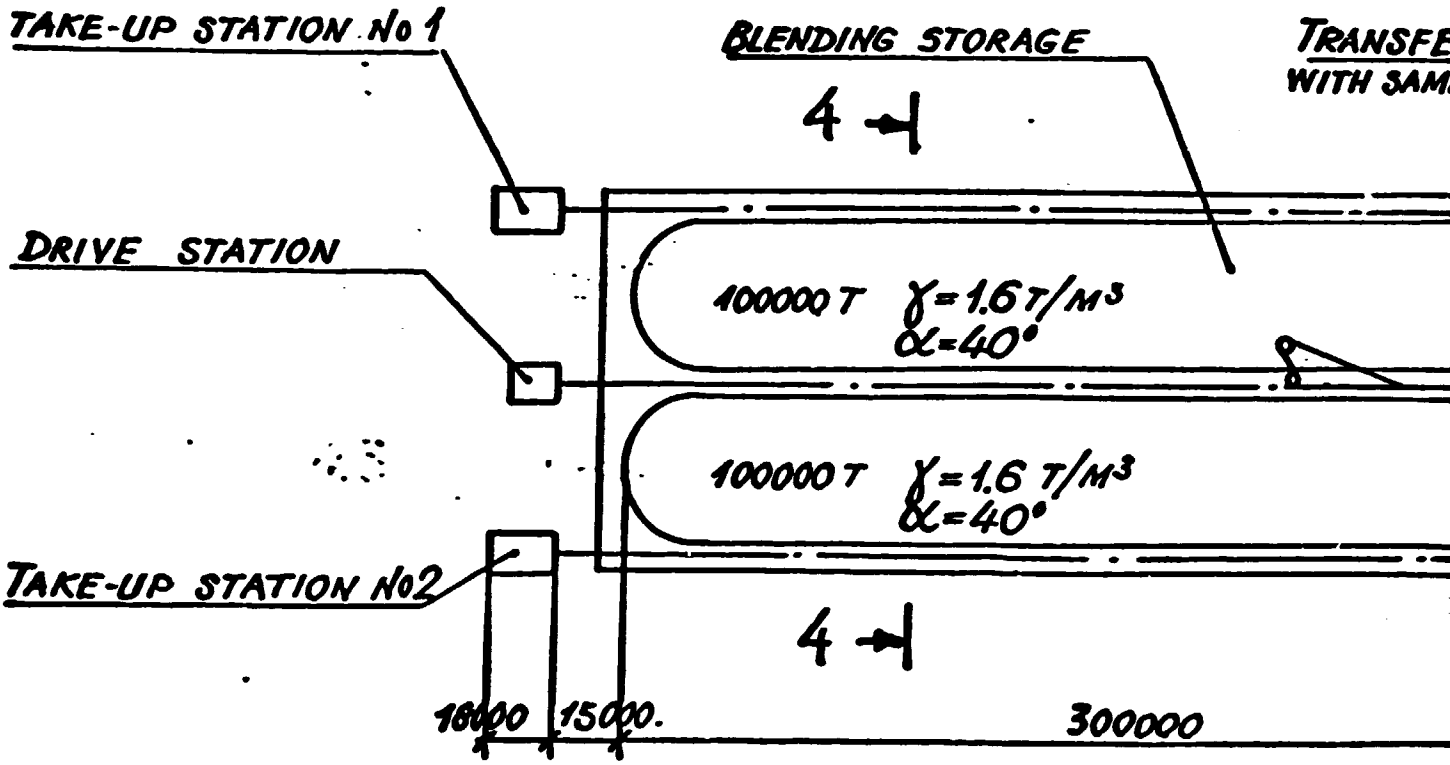
STAGE	SHEET	SHEETS
FEASIBILITY	2	

SECTIONS 1-1; 2-2

VAMI

LA

M 1 :



TRANS

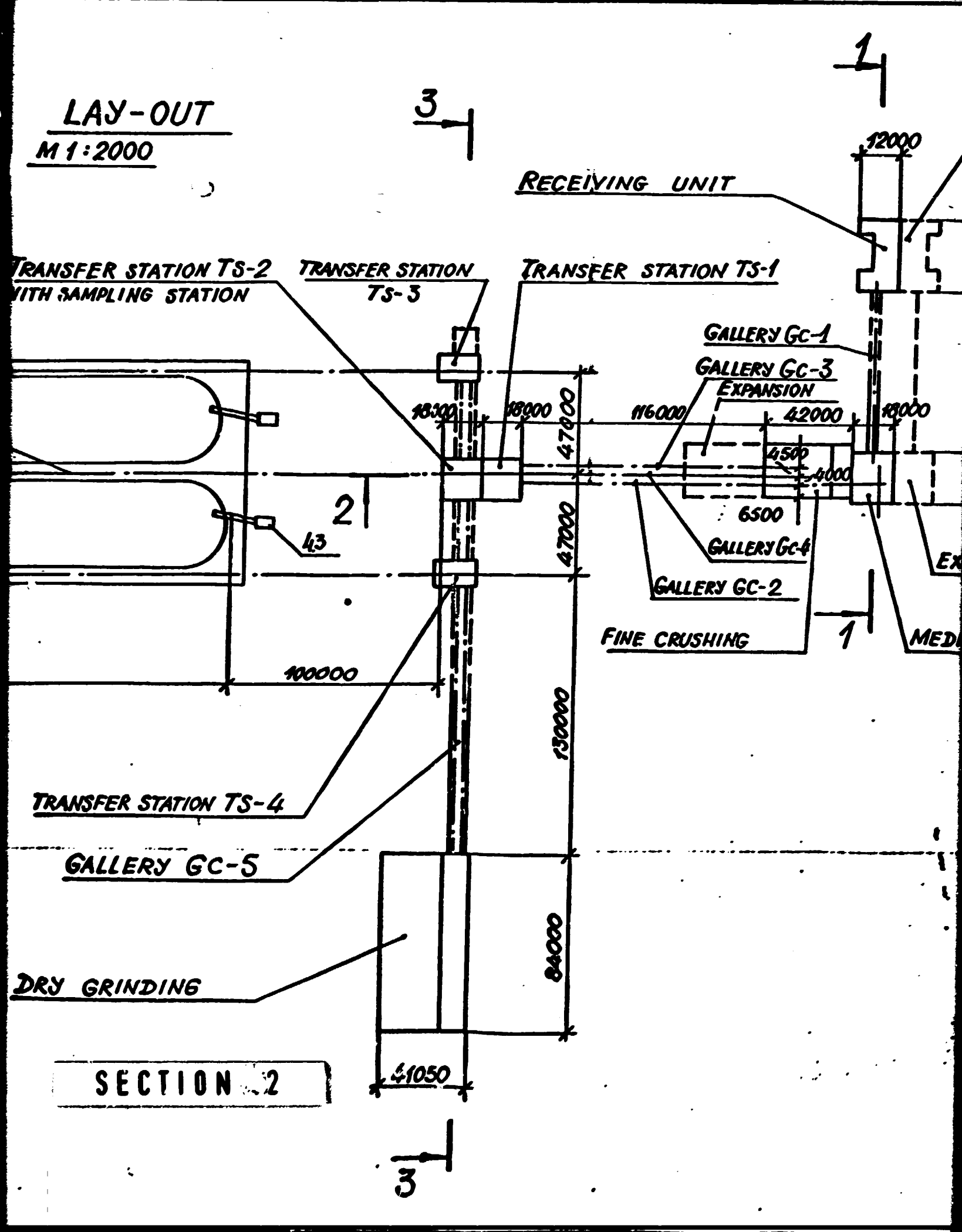
GA

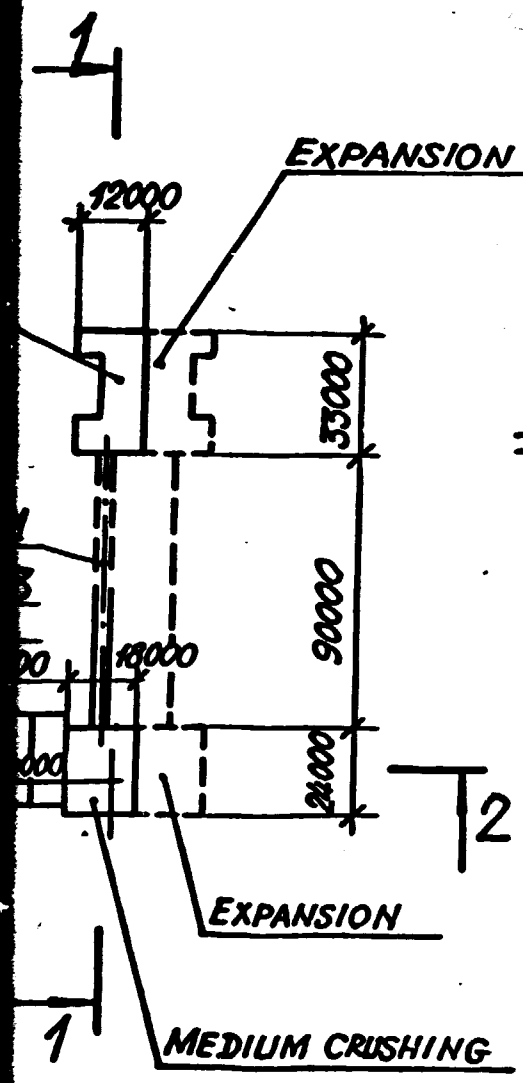
DRY G

SECTION 1

LAY-OUT

M 1:2000

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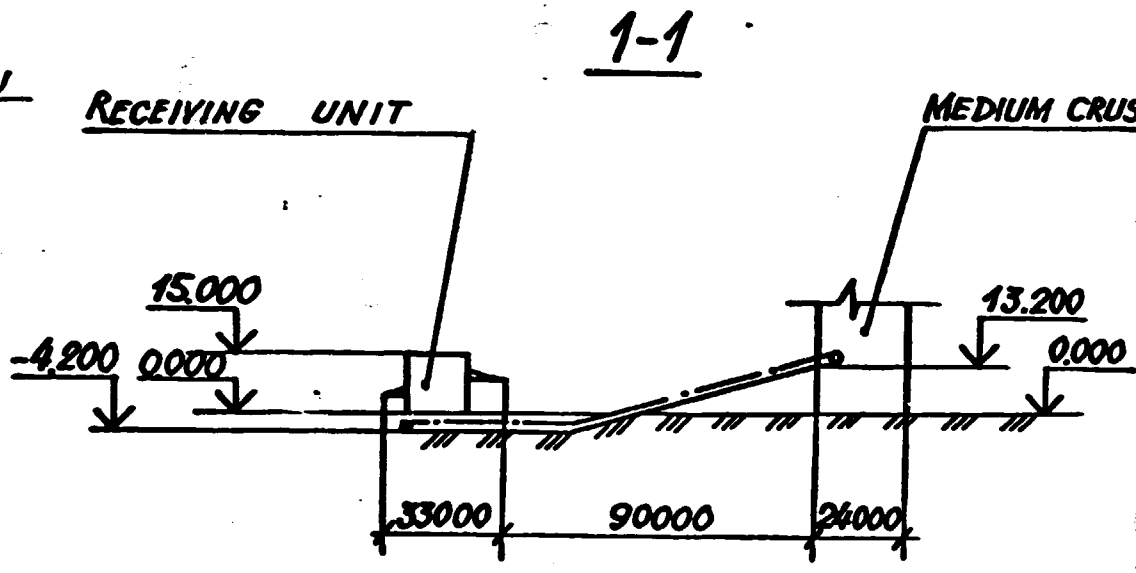
EXPANSION
12000
33000
90000
18000
24000
2
EXPANSION
1
MEDIUM CRUSHING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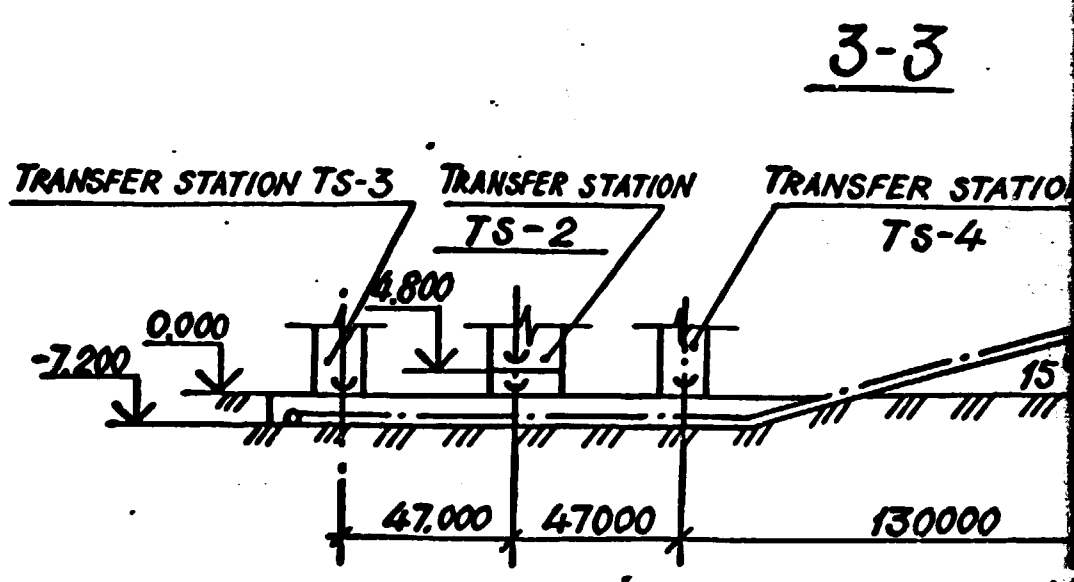
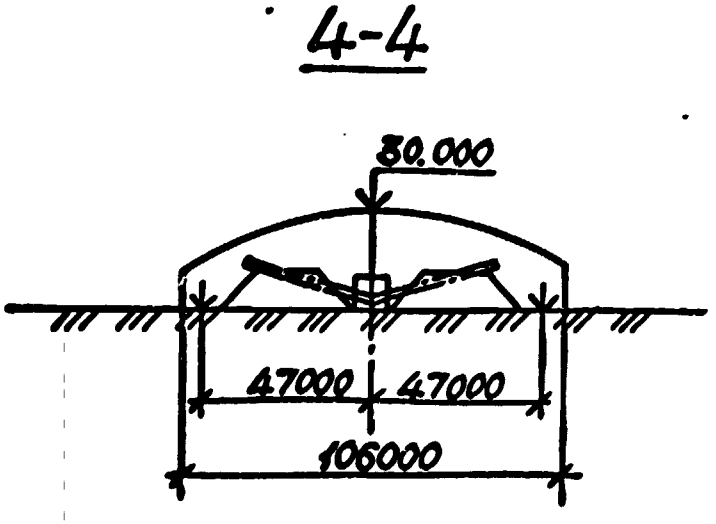
RECEIVING UNIT
MEDIUM CRUS
15.000
-4.200
0.000
13.200
0.000
33000
90000
24000


3-3
TRANSFER STATION TS-3
TRANSFER STATION
TS-2
TRANSFER STATIO
TS-4
4.800
0.000
-7.200
15
47.000
47000
130000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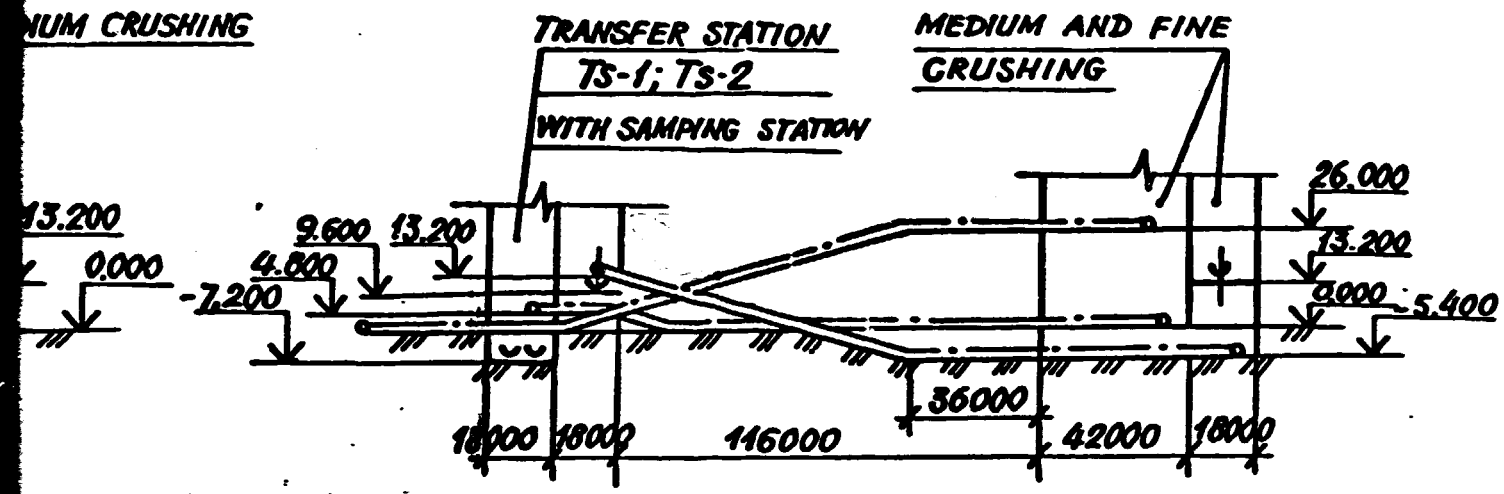
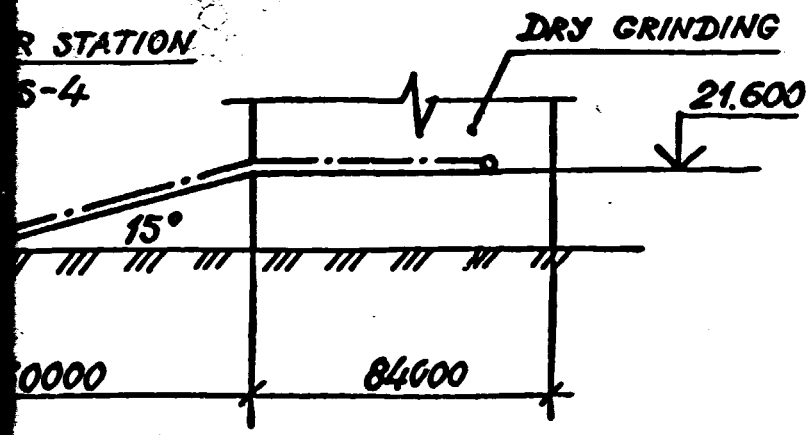
30.000
47000
47000
106000

SECTION 3

2-2





SECTION 4

1339545- PROCESS EQUIPMENT FLOWSHEET

UNIDO CONTRACT NO 85/108

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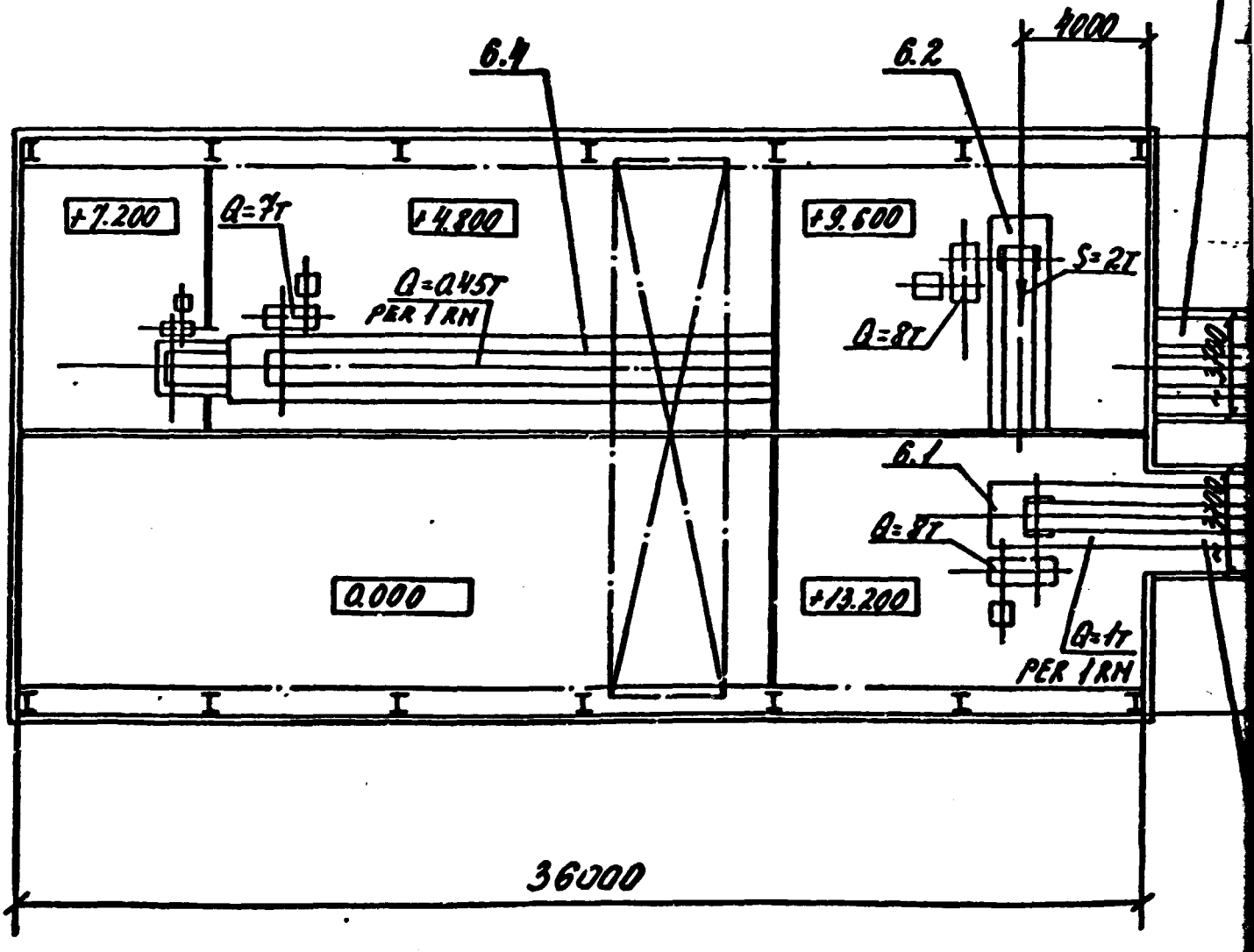
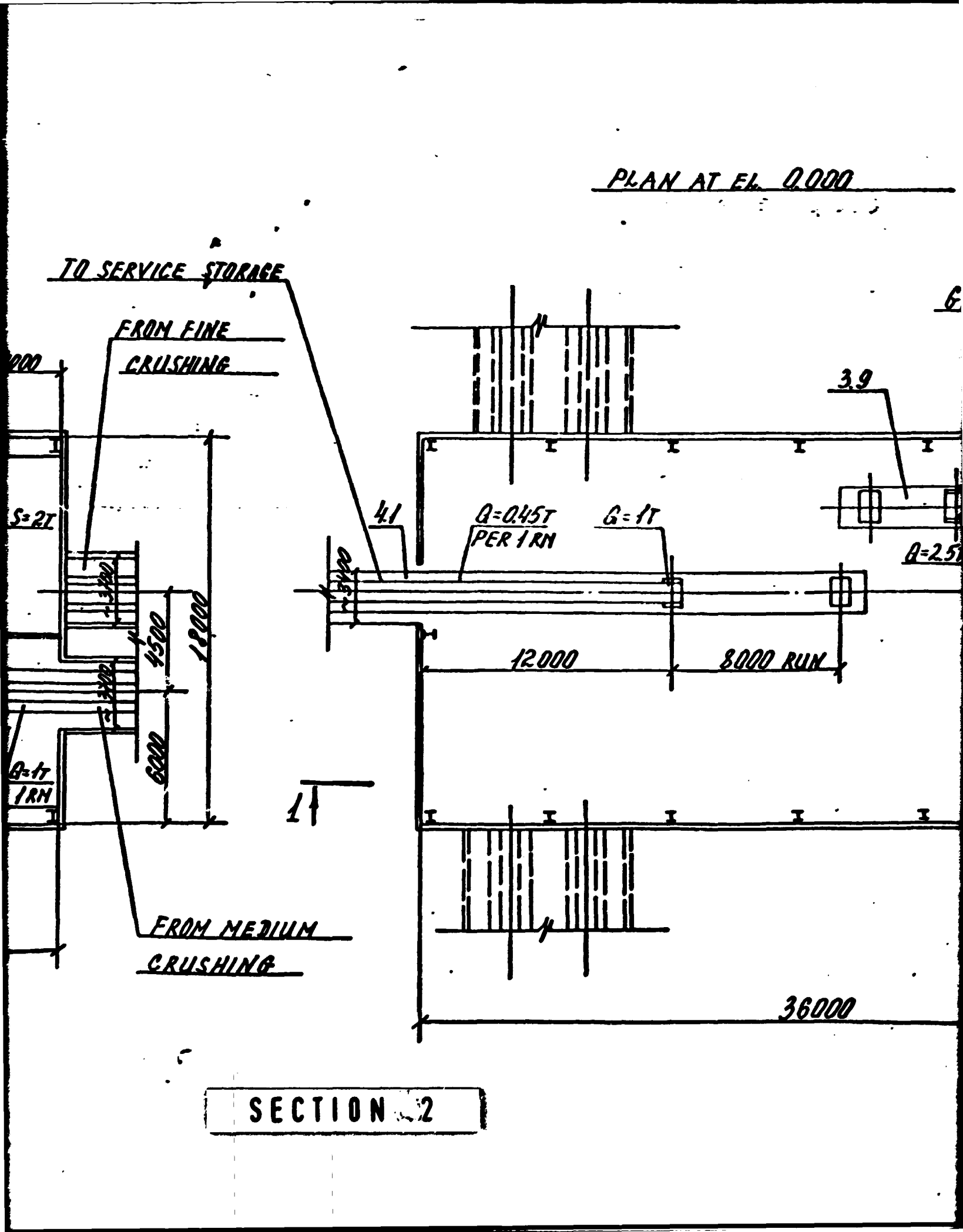
1339549-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
BLENDING STORAGE CONVEYOR GALLERIES	STAGE	SHEET	SHEETS
	FEASIBILITY		1
LAY-OUT SECTIONS 1-1÷4-4	VAMI LENINGRAD		

PLAN AT EL. 4.800; 7.200
9.600; 13.200

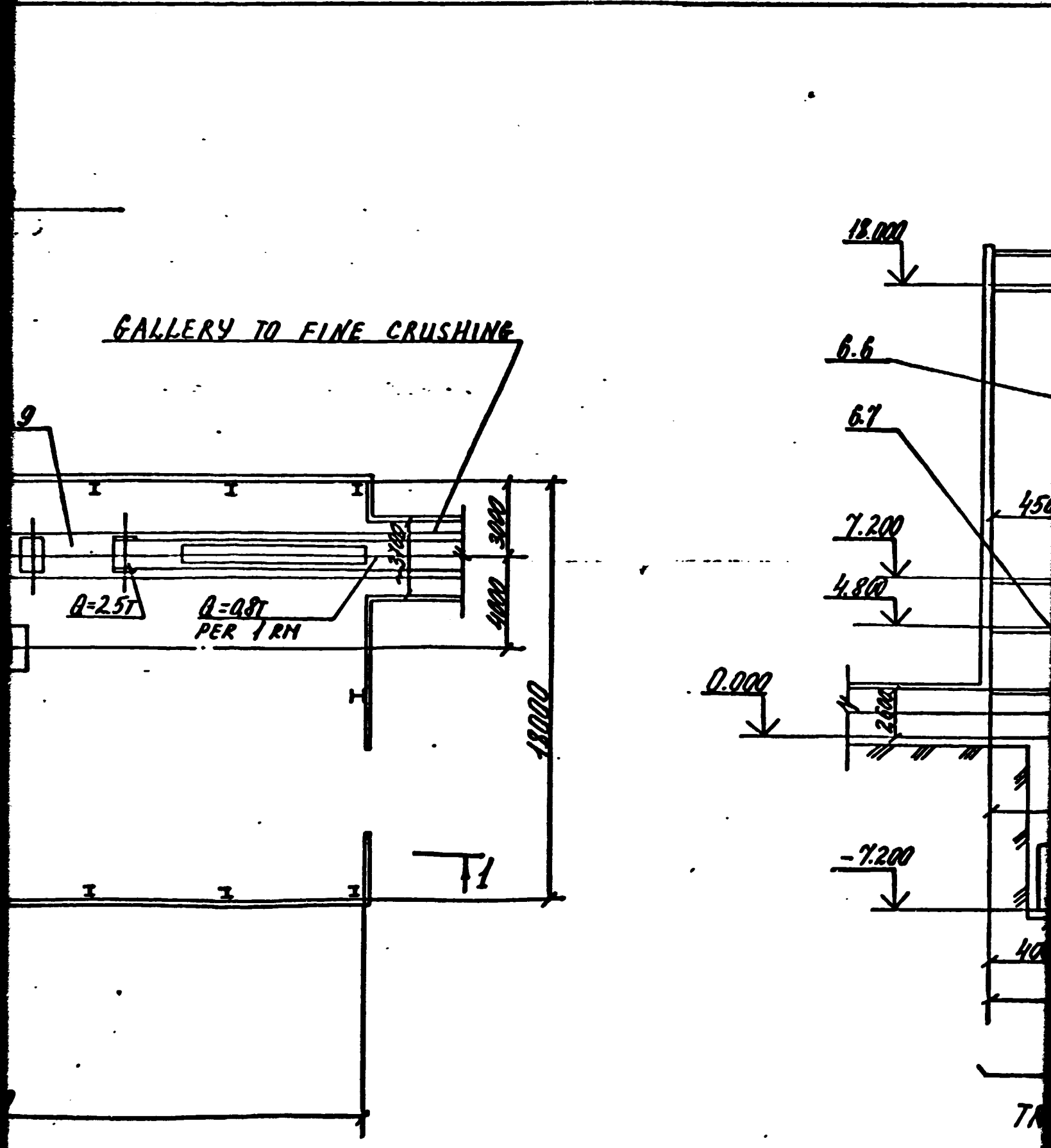
TO SE



SECTION 1

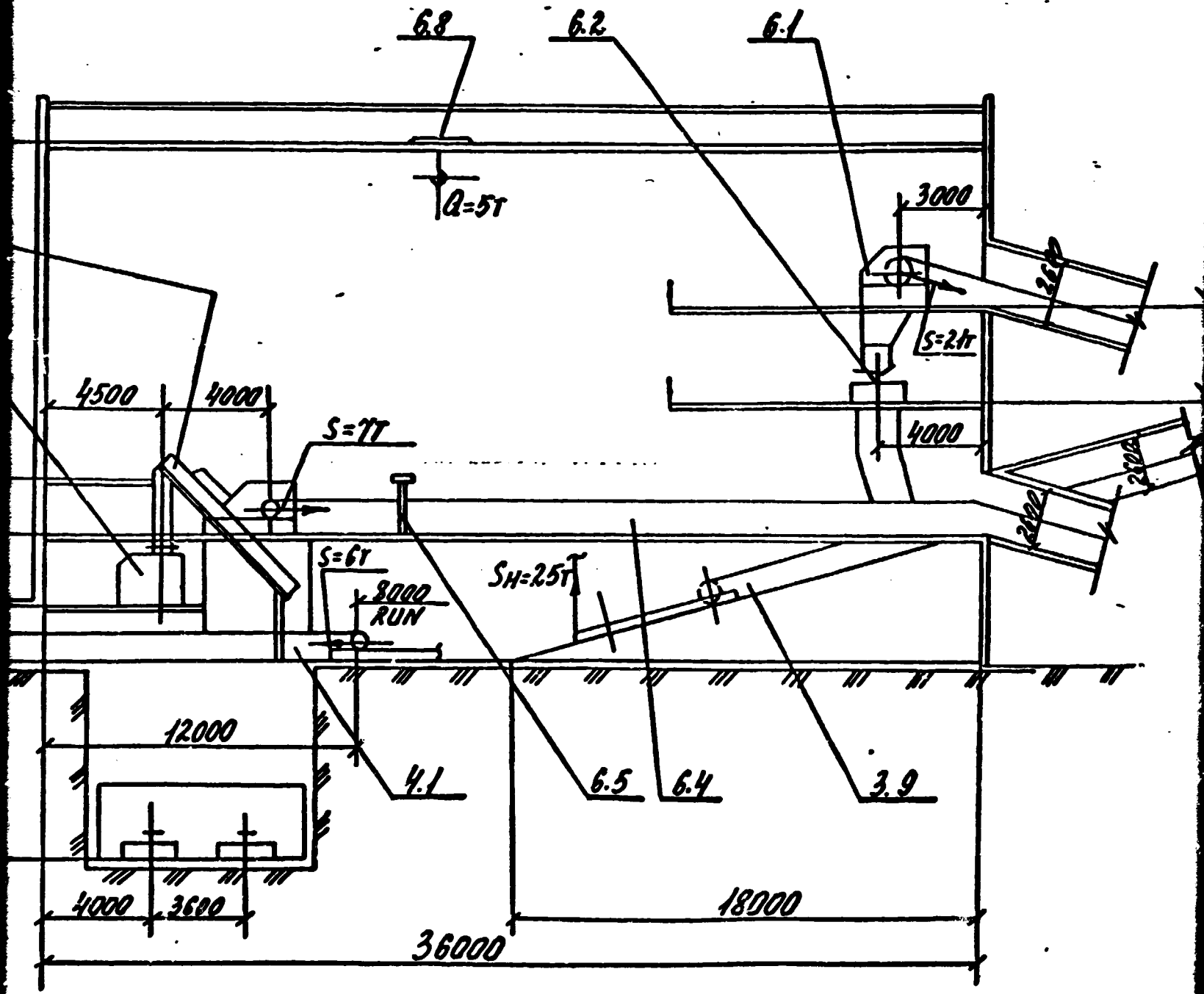

PLAN AT EL. 0.000
TO SERVICE STORAGE
FROM FINE CRUSHING
S=2T
Q=1T 1RM
4500
18000
6000
4.1
Q=0.45T PER 1RM
G=1T
3.9
Q=2.5
12000
8000 RUN
36000
1
1
FROM MEDIUM CRUSHING

SECTION 2


GALLERY TO FINE CRUSHING
9
Q=2.5T
Q=0.8T
PER 1 RM
3000
4000
18000
1
18.000
6.6
6.7
7.200
4.800
0.000
2600
-7.200

SECTION 3

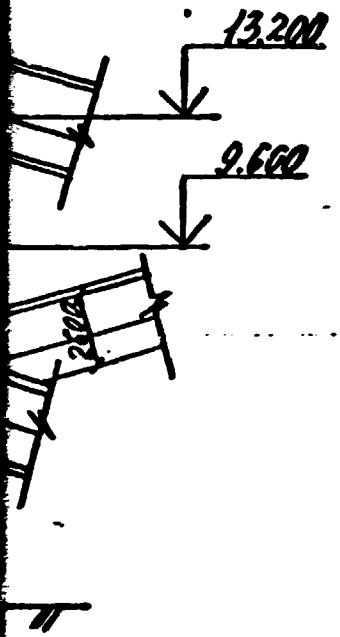
1-1



TRANSFER UNIT TU-2

TRANSFER UNIT TU-1
WITH SAMPLING STATION

SECTION 4



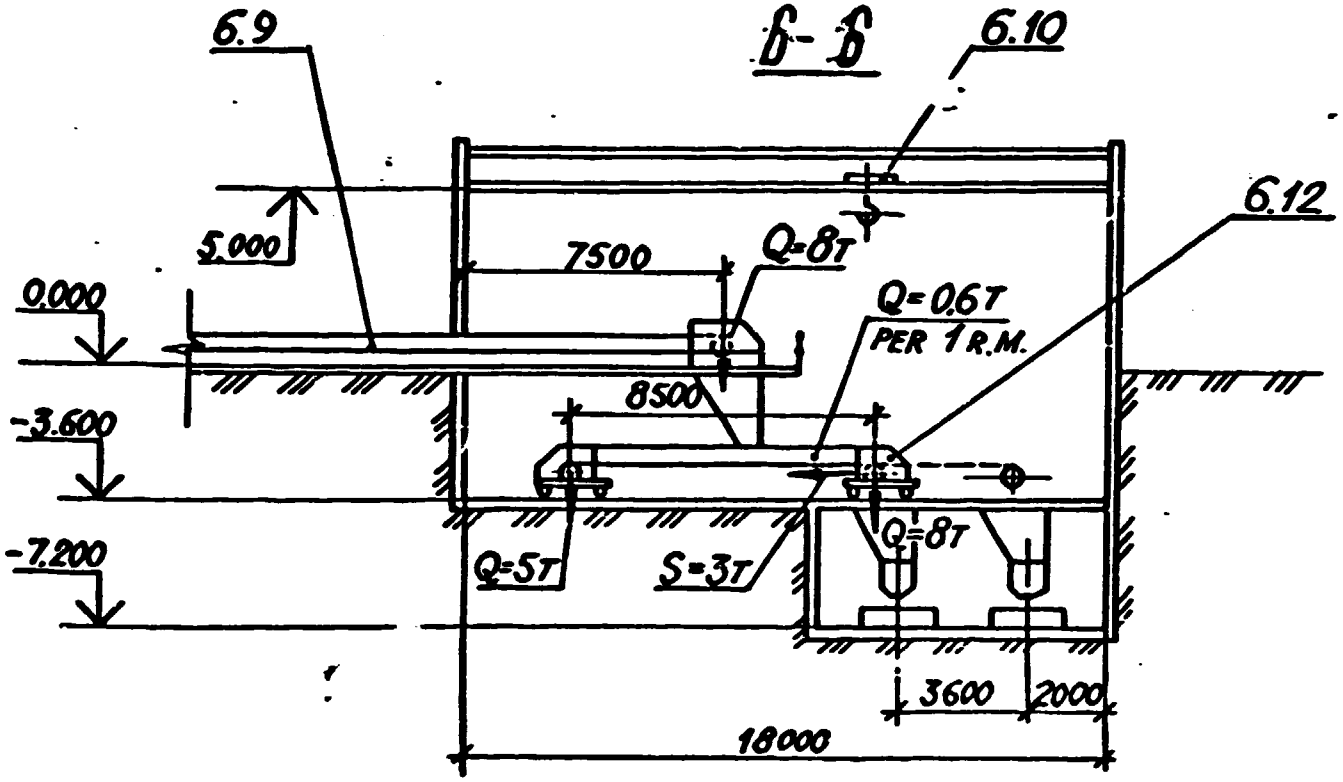
SECTION 5

1339545-TM EQUIPMENT FLOWSHEET

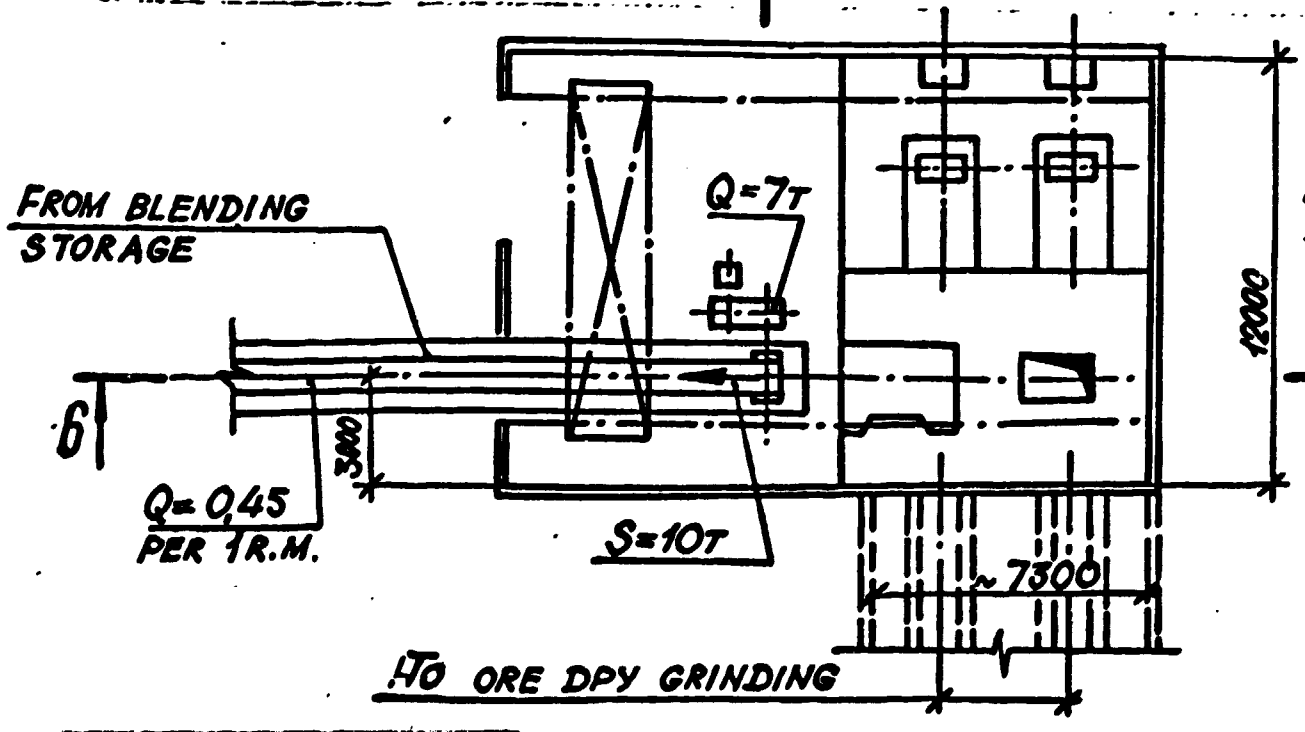
UNIDO CONTRACT NO 85/108

1339550-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
TRANSFER UNITS	STAGE	SHEET	SHEETS
	FEASIBILITY	1	2
PLANS AND SECTION 1-1	VAMI LENINGRAD		

TRANSFER UNIT TU-3



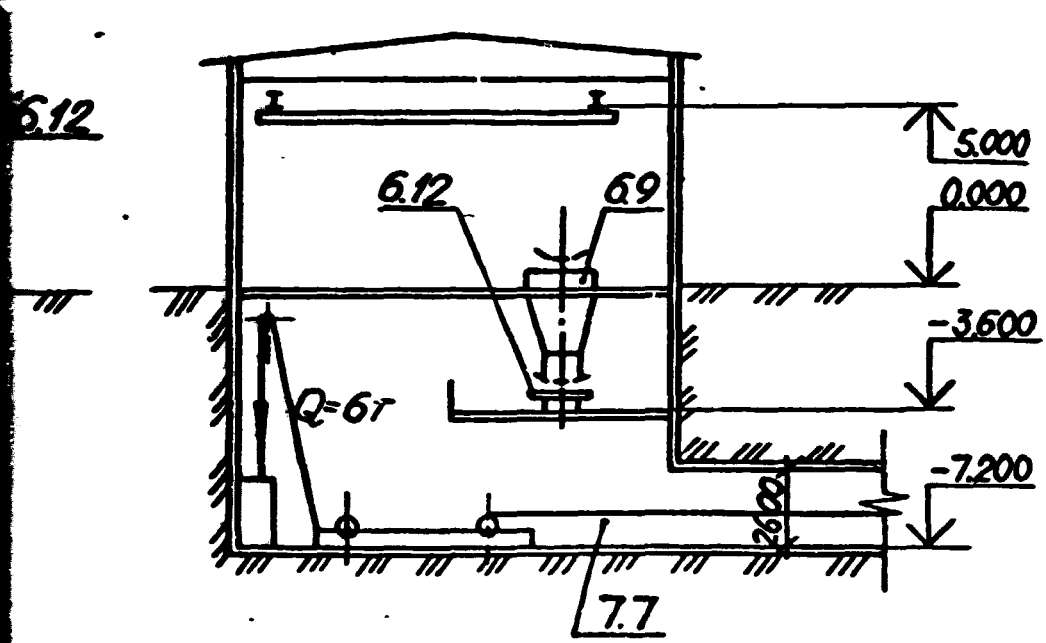
PLAN



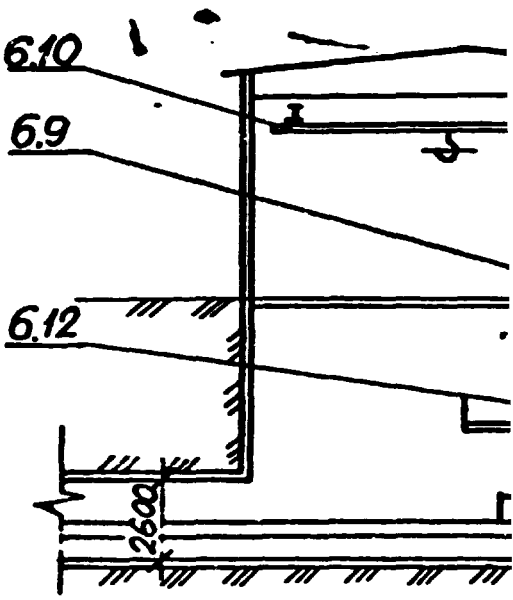
SECTION 1

2

2-2



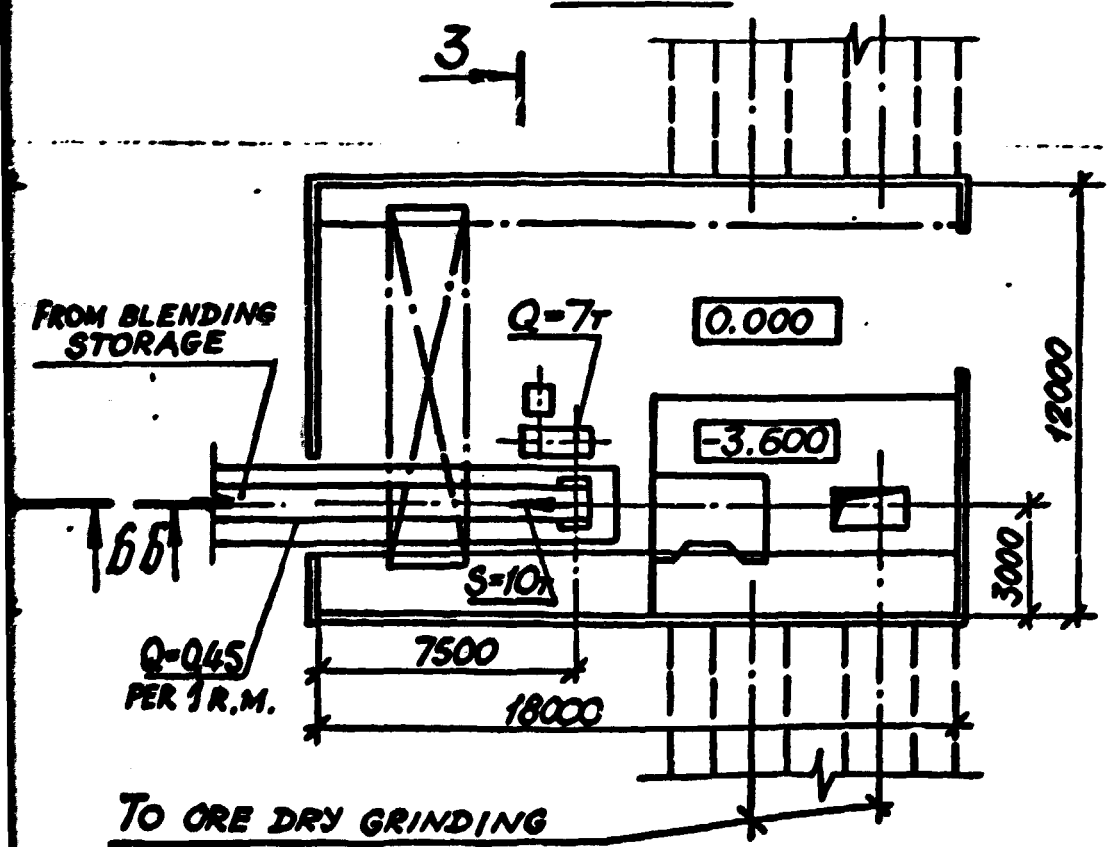
3-3

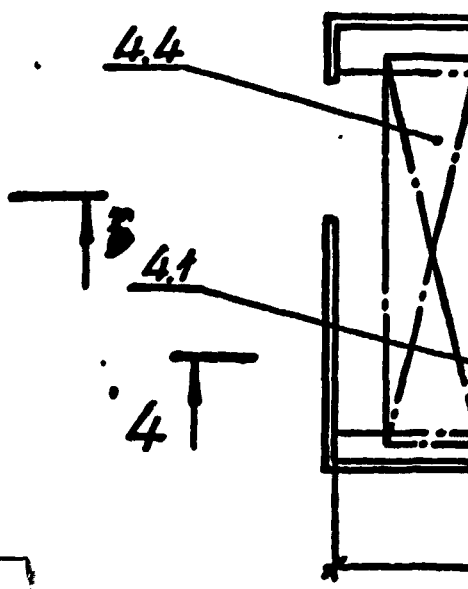


DRIV

TRANSFER UNIT TU-4

PLAN

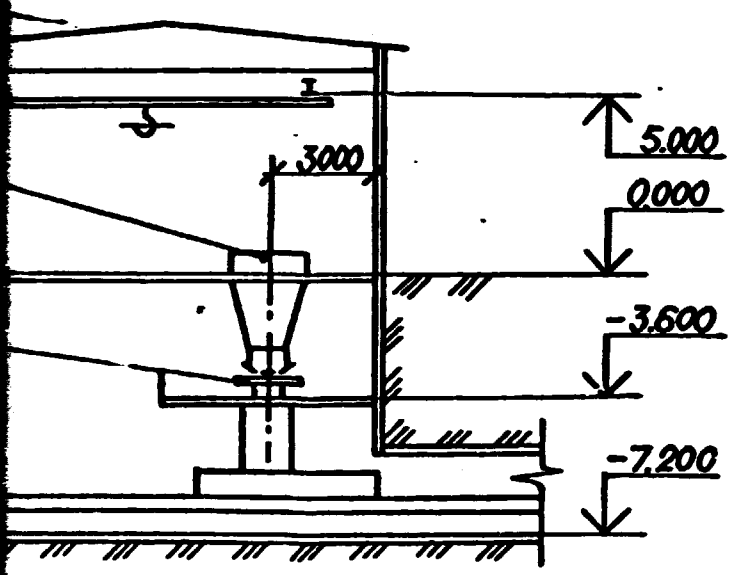




SECTION 2

TAKE-UP STATION
NO 1 AND 2

3-3



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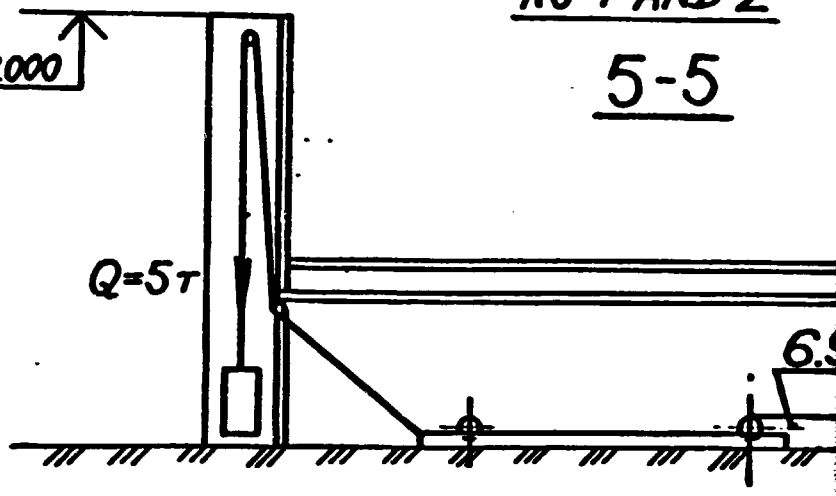
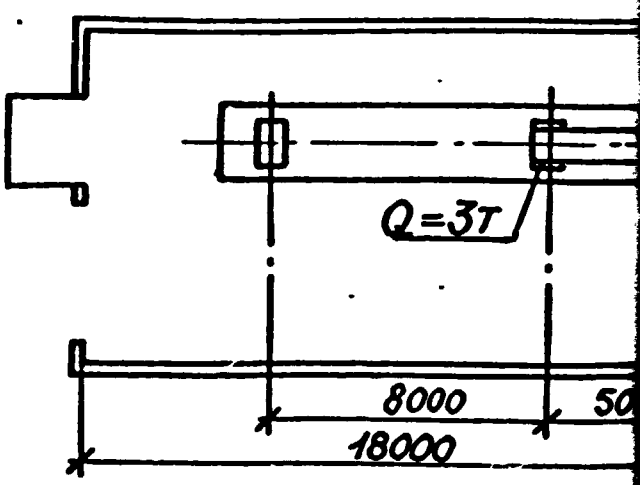
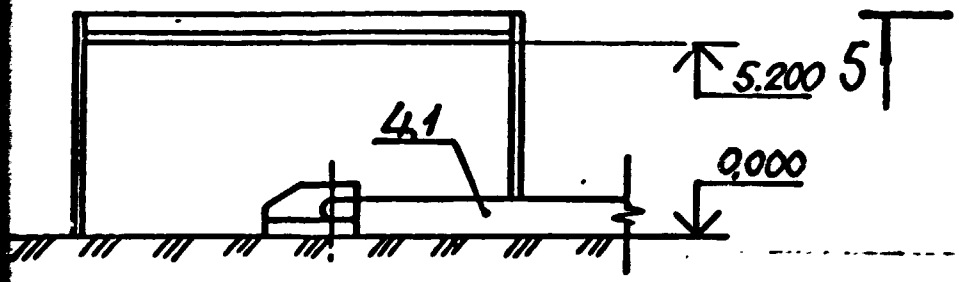
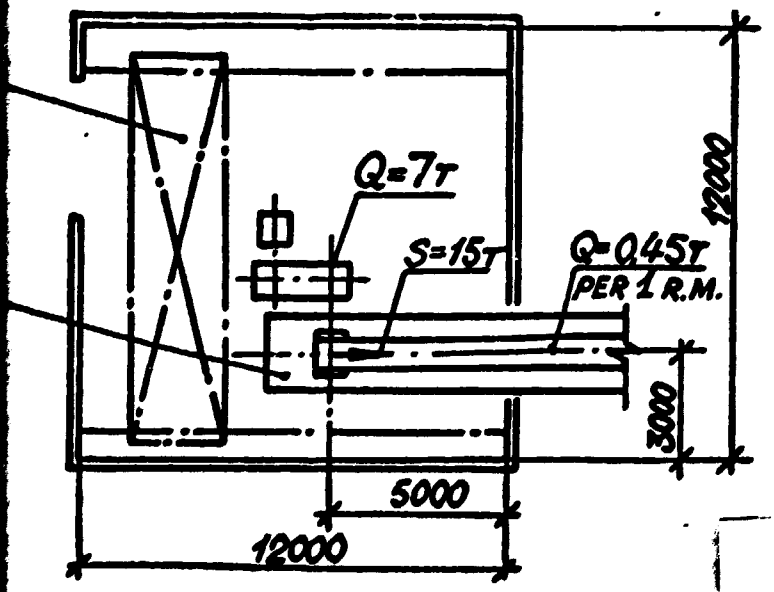


PLAN



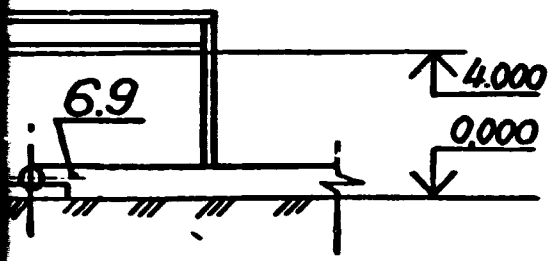
DRIVE STATION
4-4

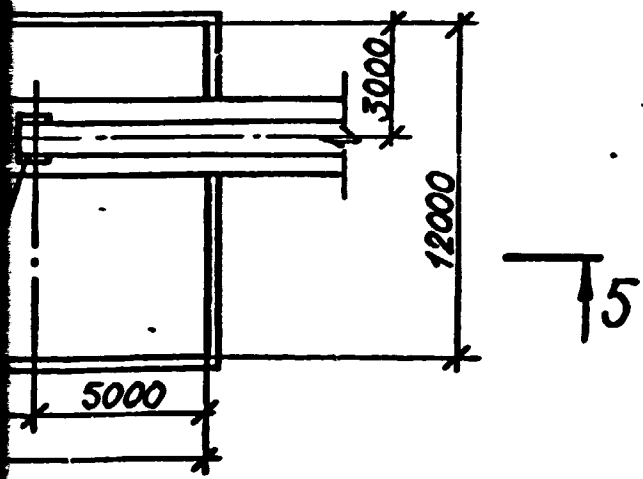




SECTION 3

TION
2



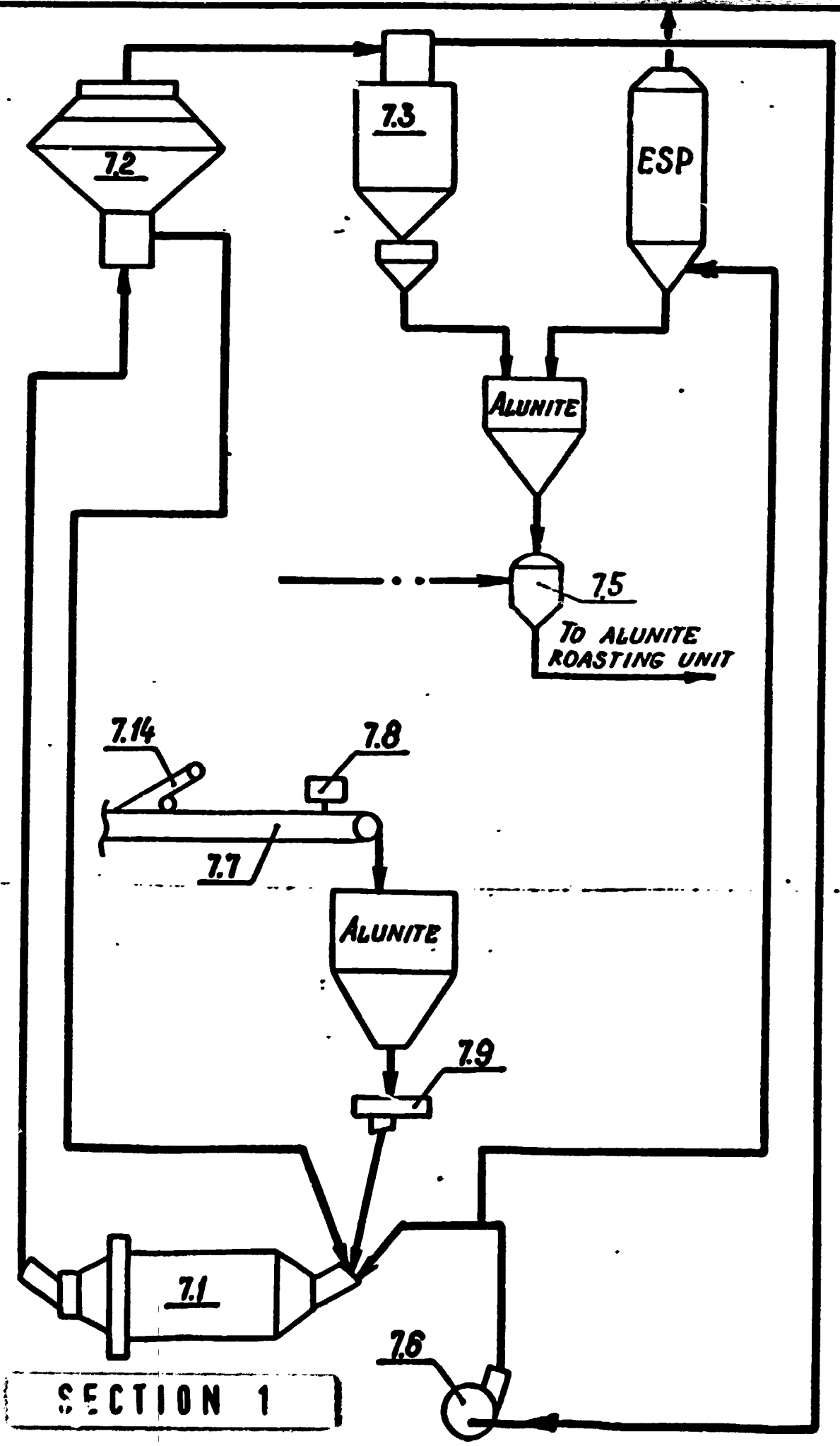


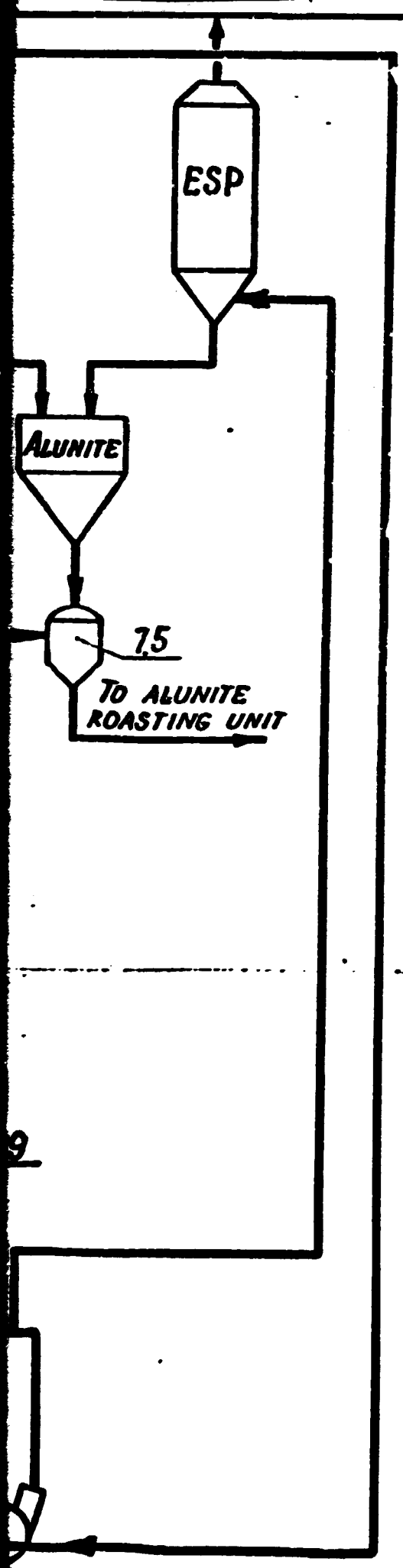
SECTION 4

1339545-TM EQUIPMENT FLOWSHEET

UNIDO CONTRACT No 85/108

1339550-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
TRANSFER UNITS	STAGE	SHEET	SHEETS
	FEASIBILITY	2	
PLAN AND SECTIONS	VAMI LENINGRAD		


7.2
7.3
ESP
ALUNITE
7.5
TO ALUNITE ROASTING UNIT
7.14
7.8
7.7
ALUNITE
7.9
7.1
7.6
SECTION 1



LEGEND

—•— COMPRESSED AIR

SECTION 2

ITEM	DESCRIPTION	SPECIFICATION	NUMBER	NOTE
7.1.	DRUM-TYPE BALL MILL	CAPACITY 60T/HR	5	
7.2.	AIR-PASS SEPARATOR	Φ4750	5	
7.3.	CYCLONE	Φ3750	5	
7.5.	PNEUMATIC CHAMBER-PUMP	Φ1600	5	
7.6	OVERHANGING CENTRIFUGAL	CAPACITY 100000 M^3/HR	5	
	FAN			
7.7.	BELT CONVEYER WITH DIS-	B=1000 MM	2	
	CHARGE TROLLEY			
7.8.	BELT WEIGHER	B=1000 MM	2	
7.9	CONTINUOUS PROPORTIONER	CAPACITY 60T/HR	5	
7.10.	ELECTRICAL BRIDGE CRANE	CAPACITY 15T	1	
7.11.	ELECTRICAL BRIDGE CRANE	CAPACITY 20/5T	1	
7.12.	BRIDGE CRANE	CAPACITY 4T; H=72M	1	
7.13	ELECTRICAL BRIDGE CRANE, SINGLE-GIRDE	CAPACITY 5T	1	
7.14.	UNLOADING TROLLEY		2	

SECTION 3

UNIDO CONTRACT NO 85/108

1339551-TM

IRAN. ALUNITE BASED ALUMINA PLANT

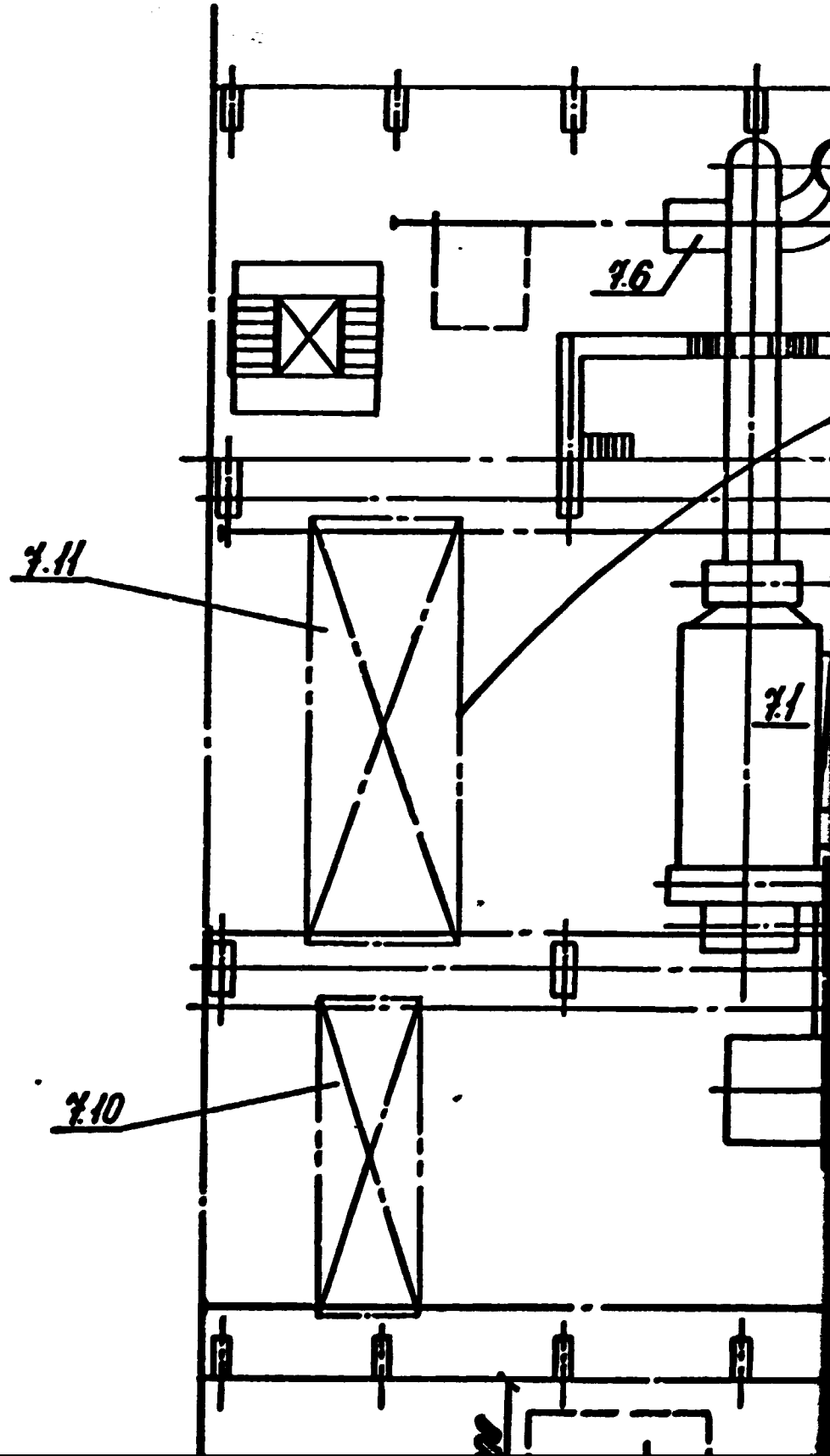
DRY GRINDING

STAGE	SHEET	SHEETS
FEASIBILITY	1	4

APPARATUS-PROCESS FLOWSHEET

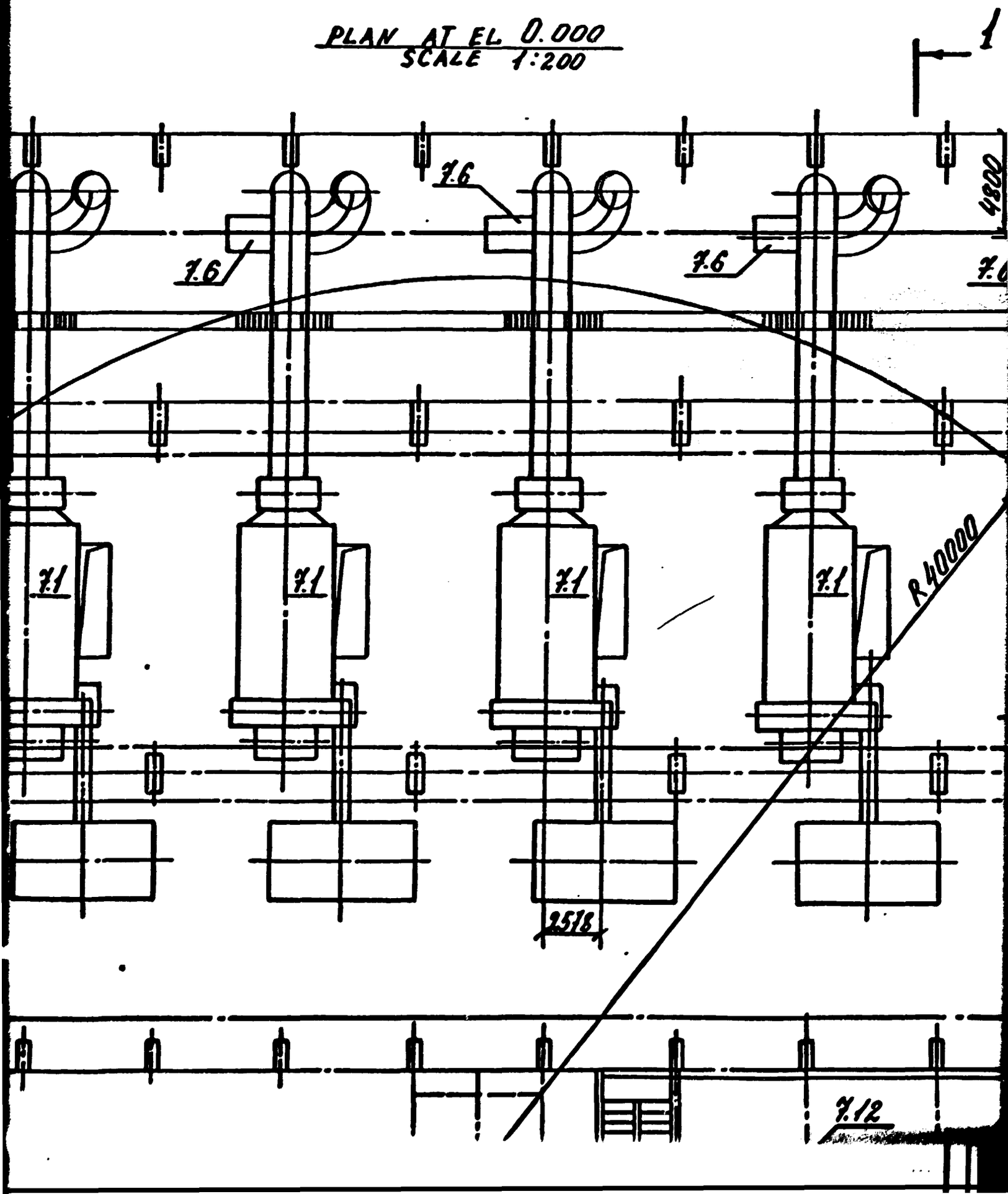
VAMI LENINGRAD

SECTION 1

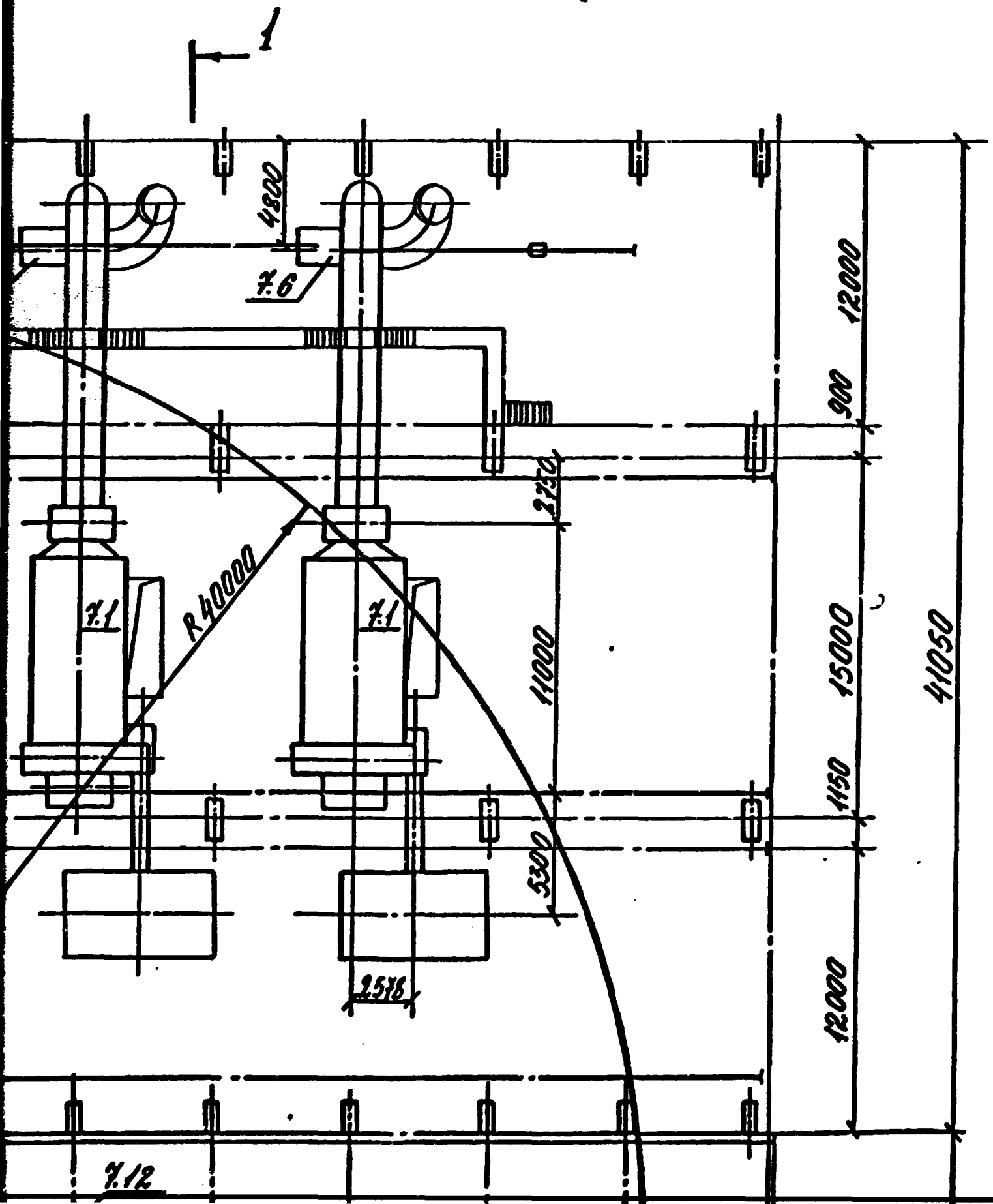


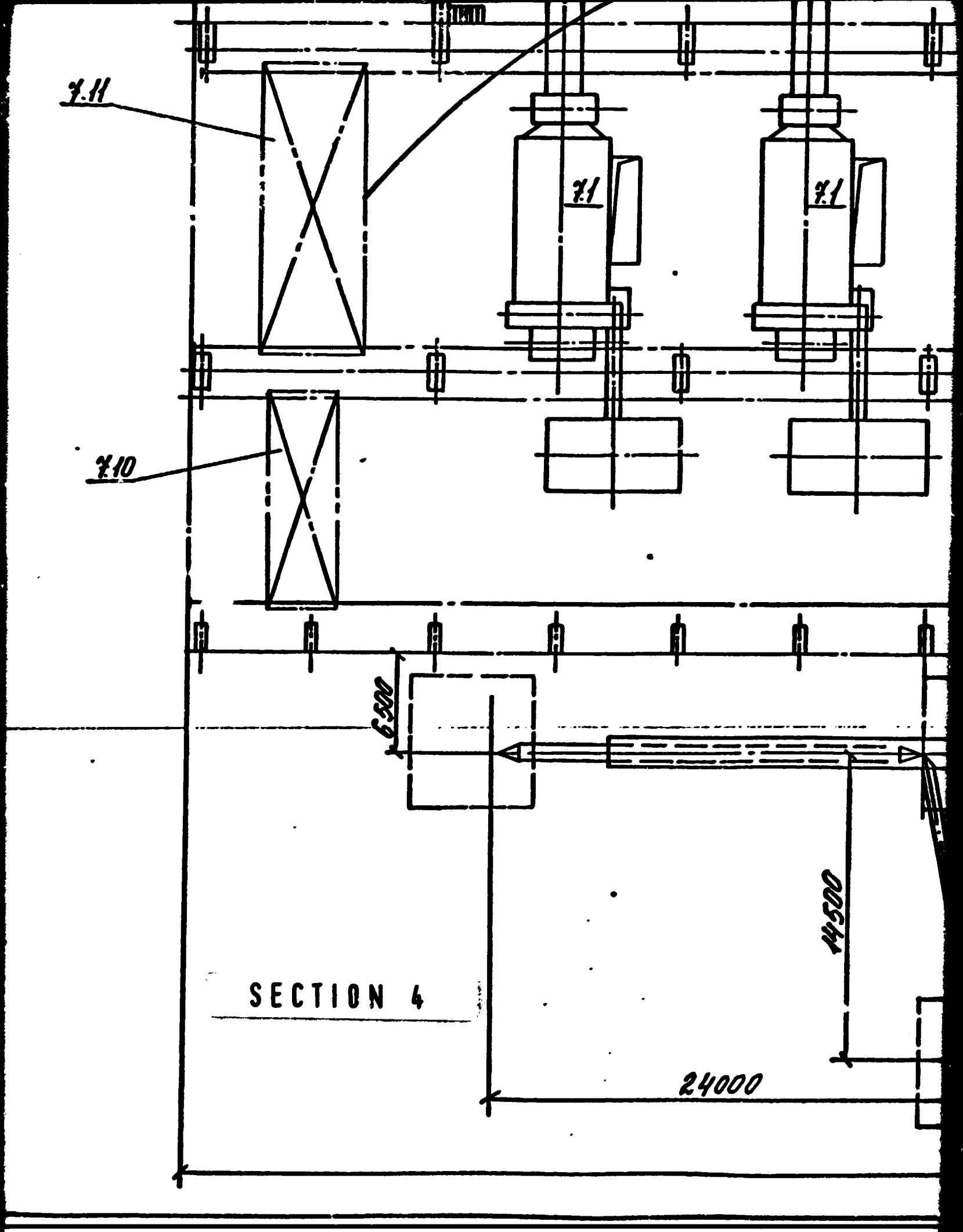
SECTION 2

PLAN AT EL 0.000
SCALE 1:200

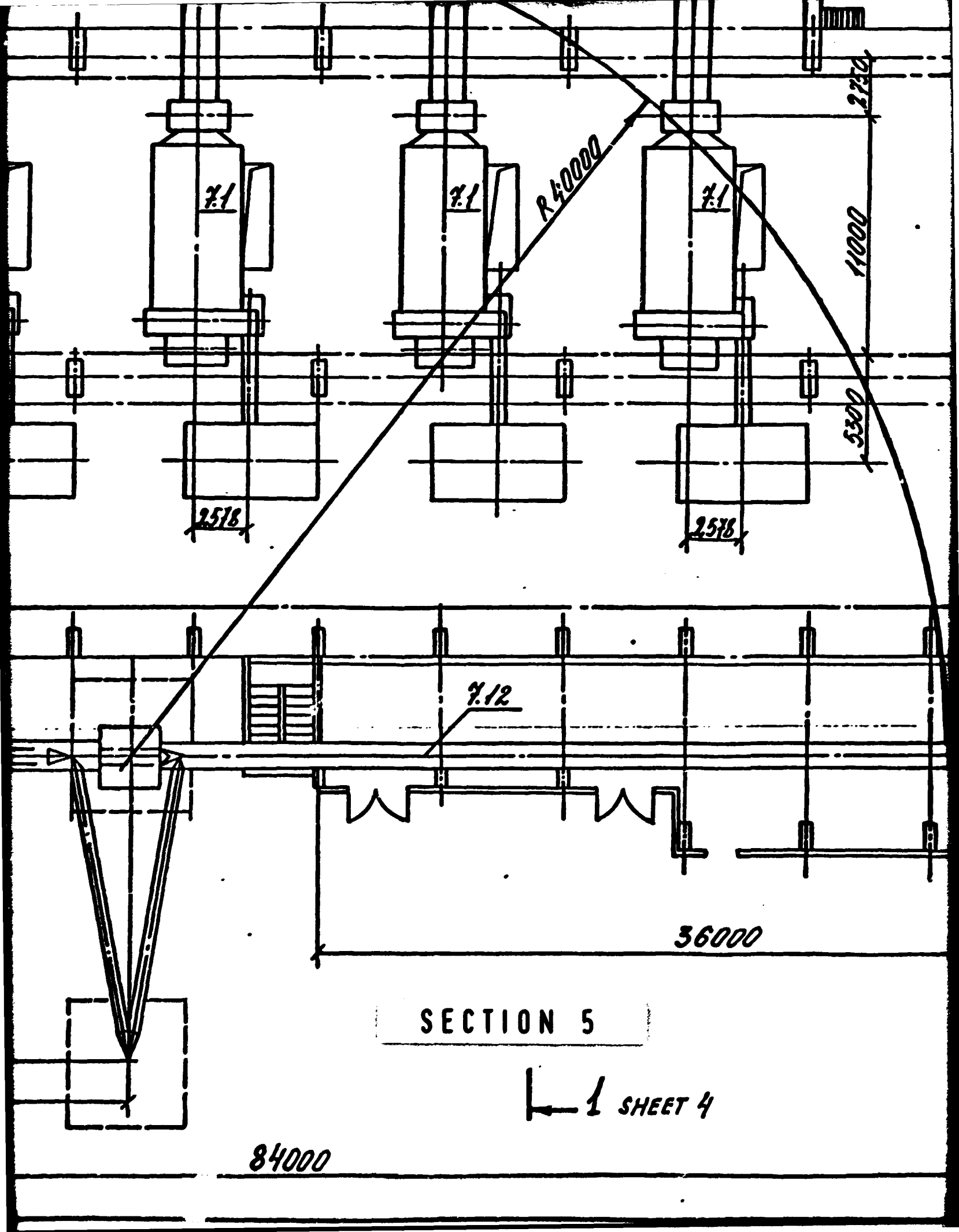


SECTION 3


1
4800
7.6
12000
900
2730
R40000
7.1
7.1
11000
15000
41050
1150
5300
2576
12000
7.12

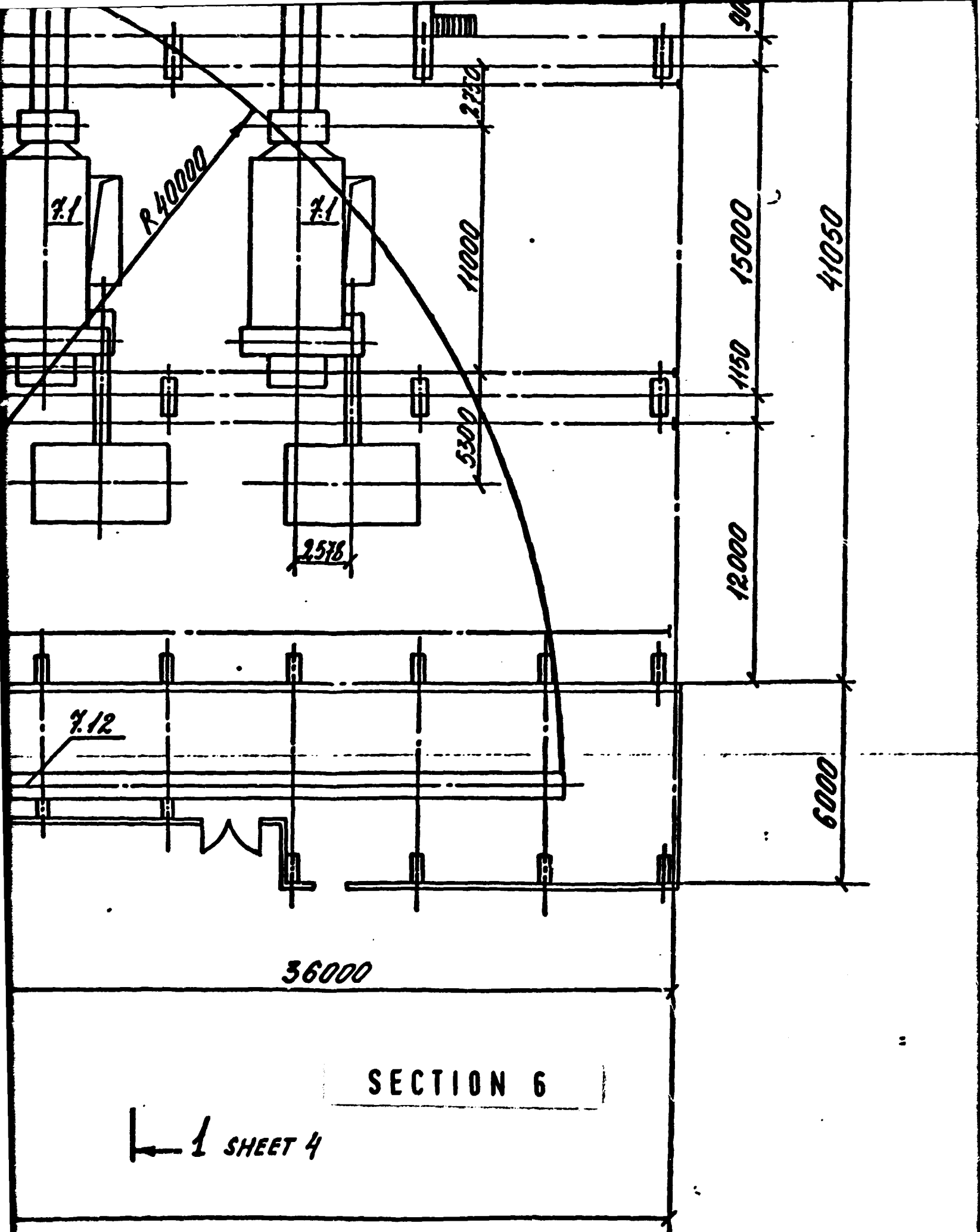


SECTION 4



SECTION 5

1 SHEET 4



SECTION 6

1 SHEET 4

SECTION 7

UNIDO CONTRACT NO 85/108

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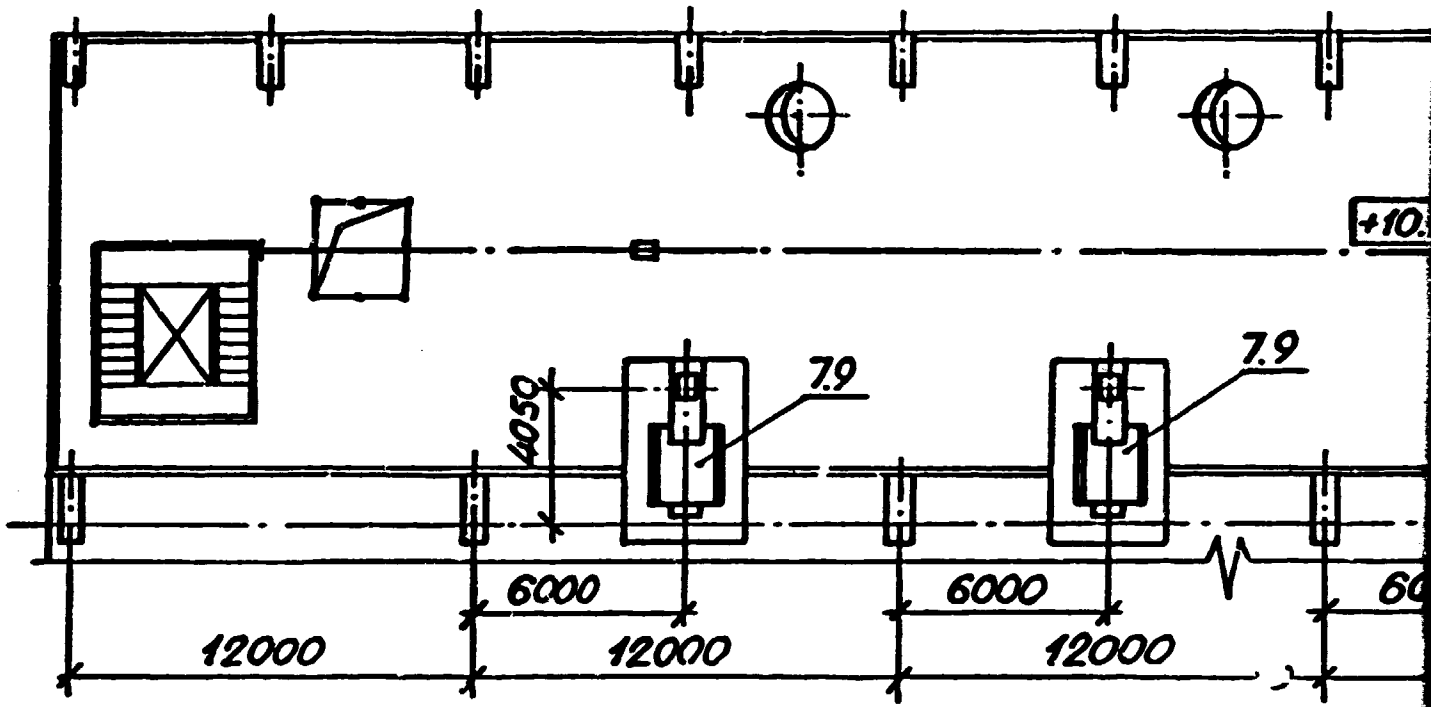
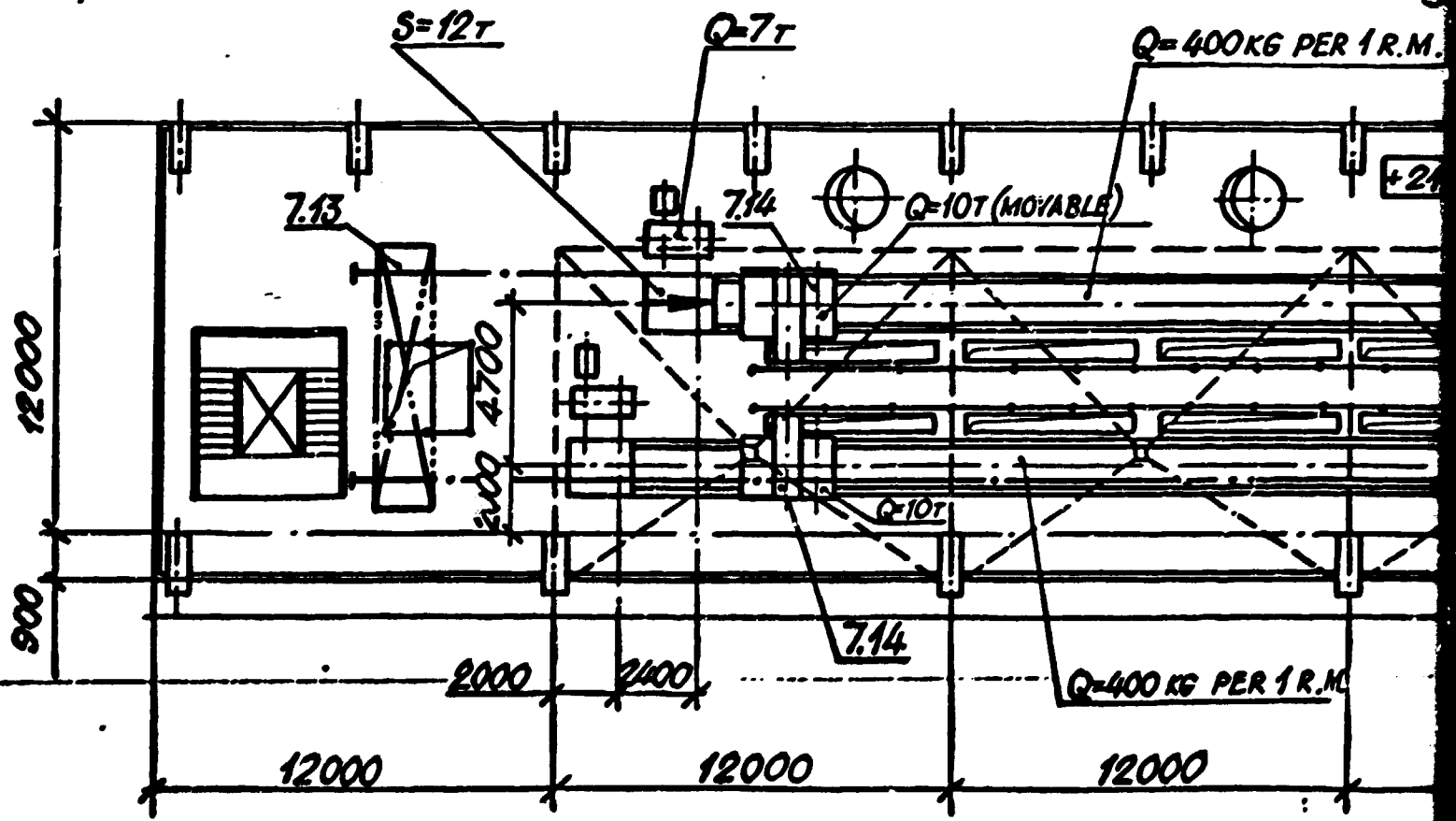
	IRAN. ALUNITE BASED ALUMINA PLANT		
	DRY GRINDING	STAGE: PRELIMINARY	SHEET: 2. / SHEETS:
	PLAN AT EL. 0.000	VAMI LENINGRAD	

PL
S

SECTION 1



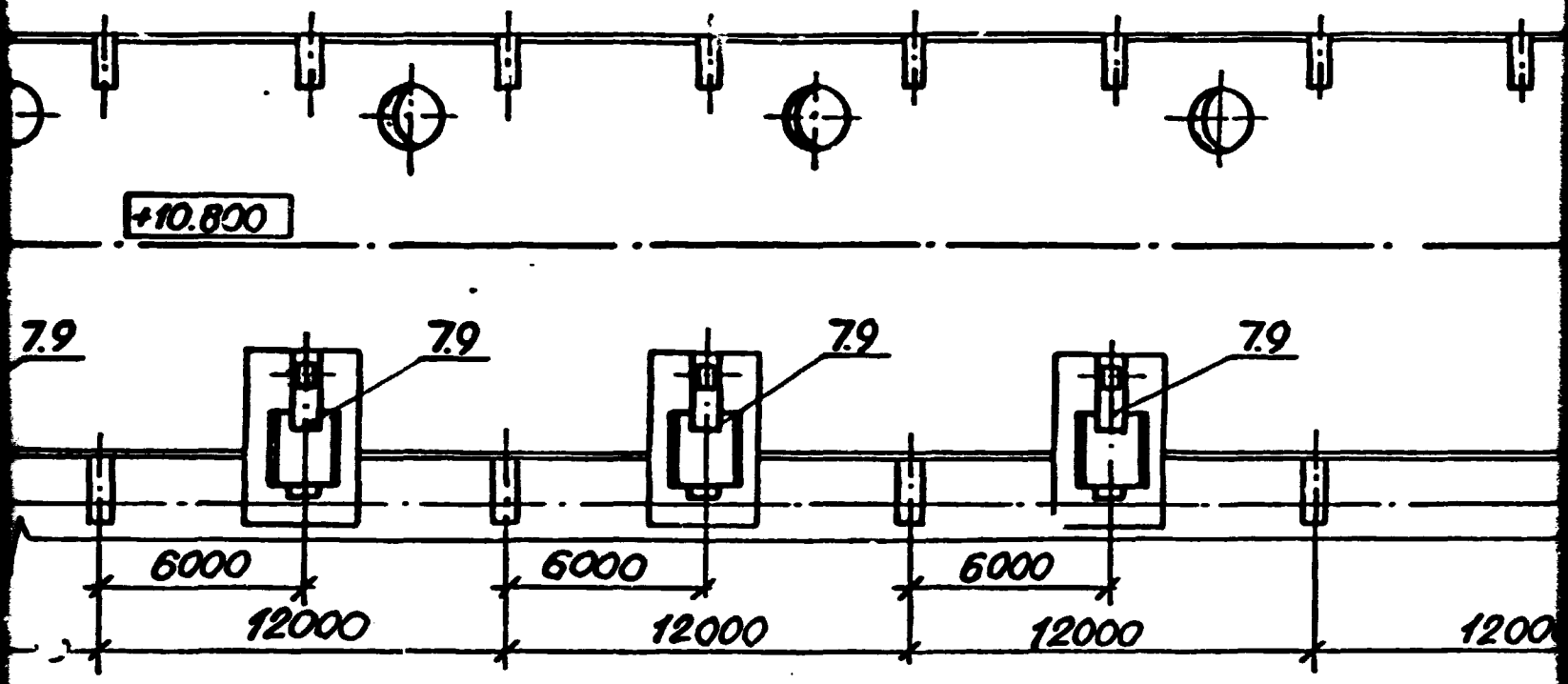
PL
S



PLAN AT EL. 10.800

SCALE 1:200

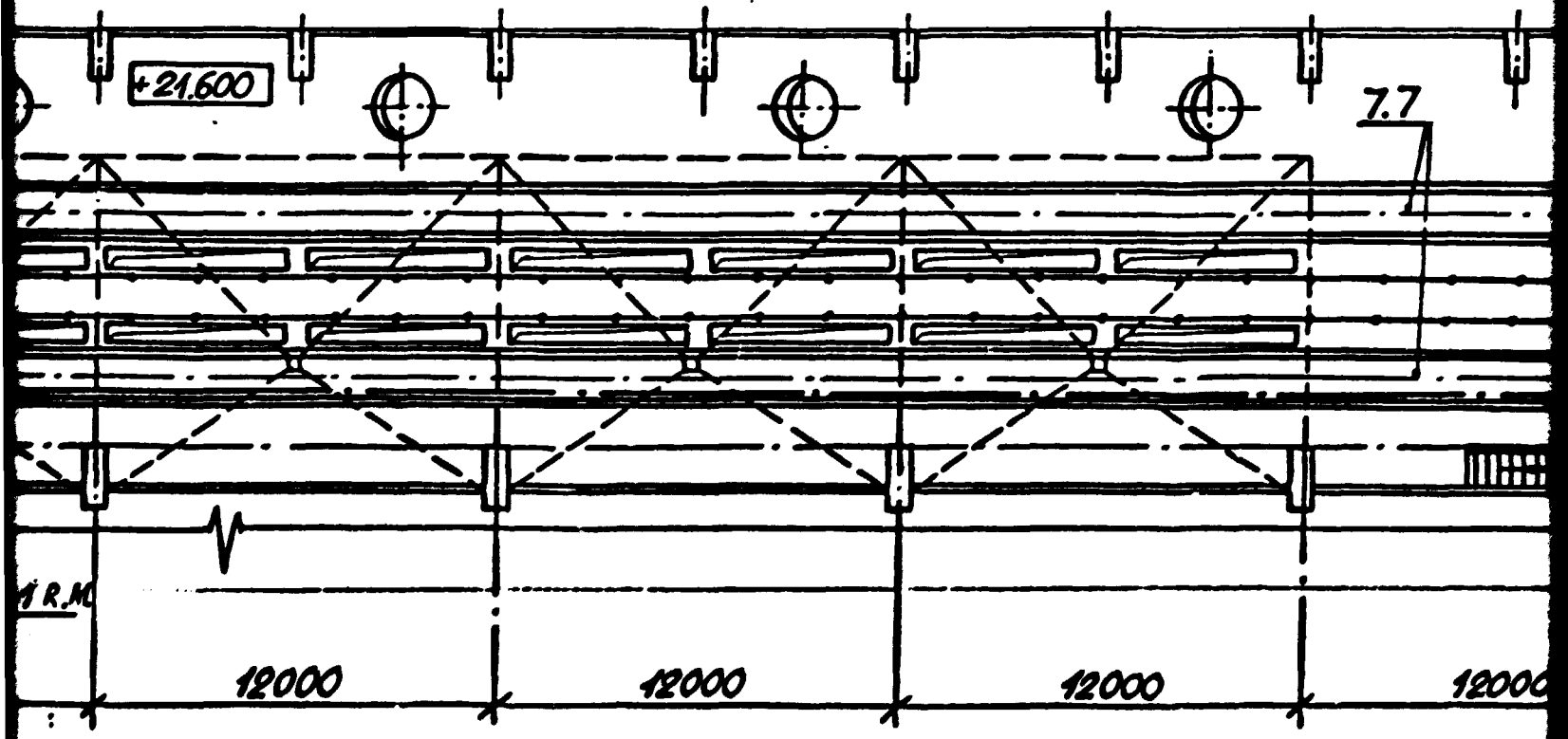
SECTION 2



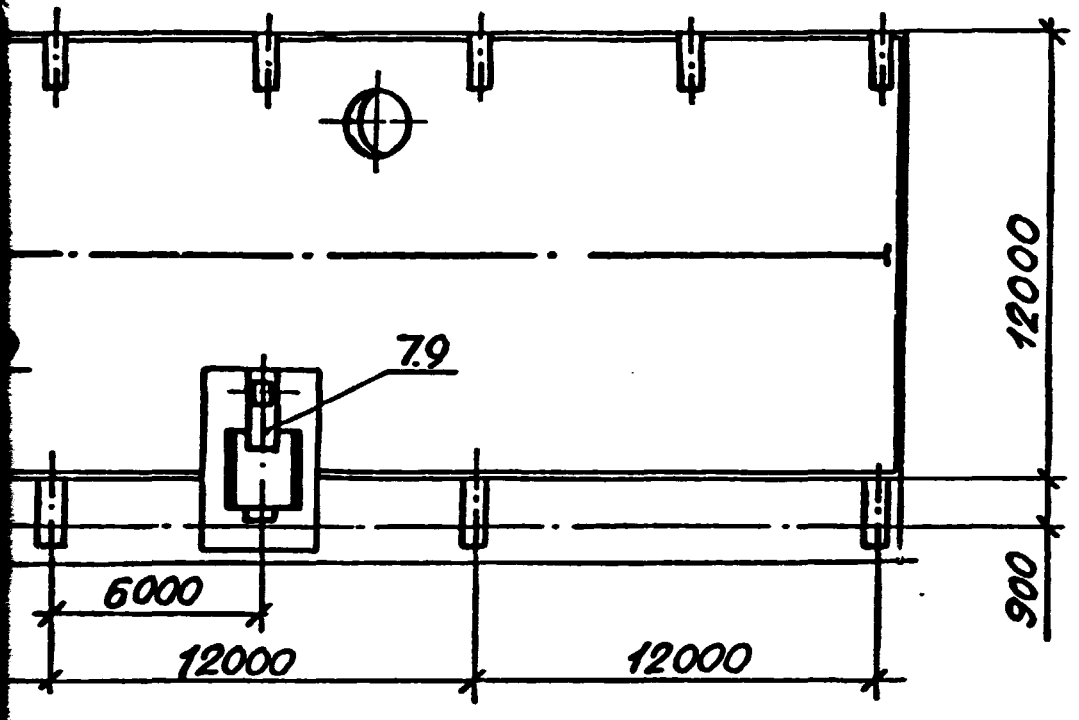
PLAN AT EL. 21.600

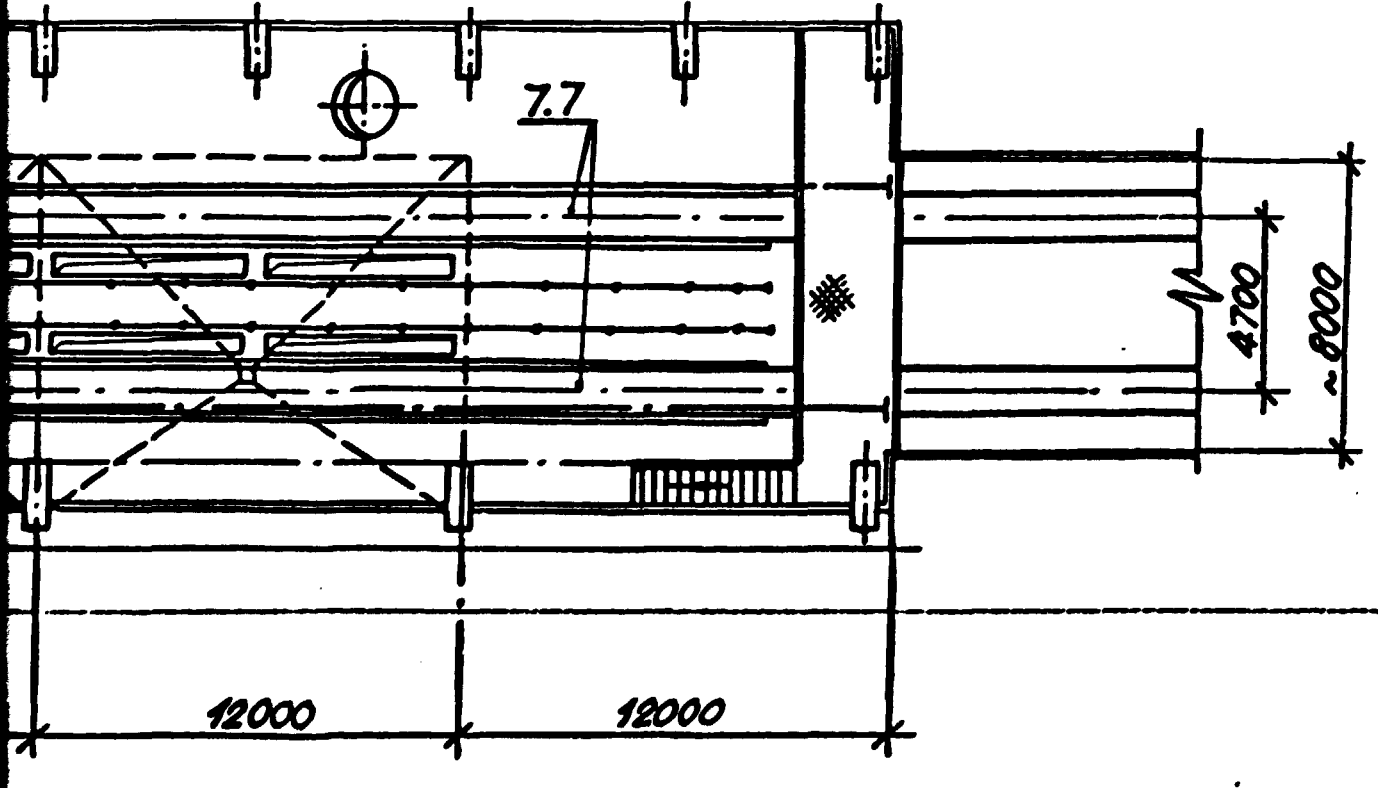
SCALE 1:200

S PER 1 R.M.



SECTION 3





SECTION 4

UNIDO CONTRACT NO 85/108

1339551-TM

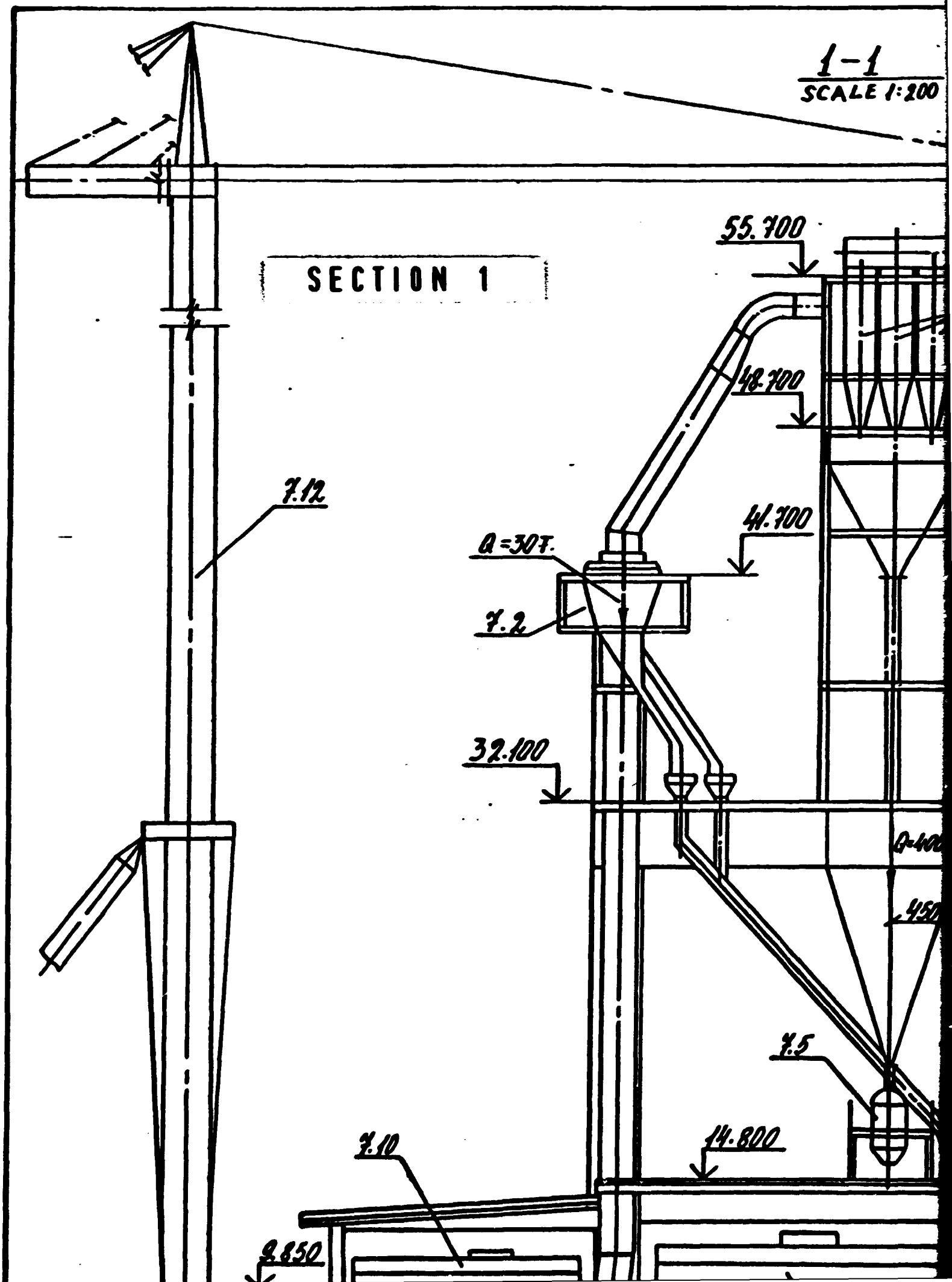
IRAN. ALUNITE BASED ALUMINA PLANT

DRY GRINDING

STAGE	SHEET	SHEETS
FEASIBILITY	3	

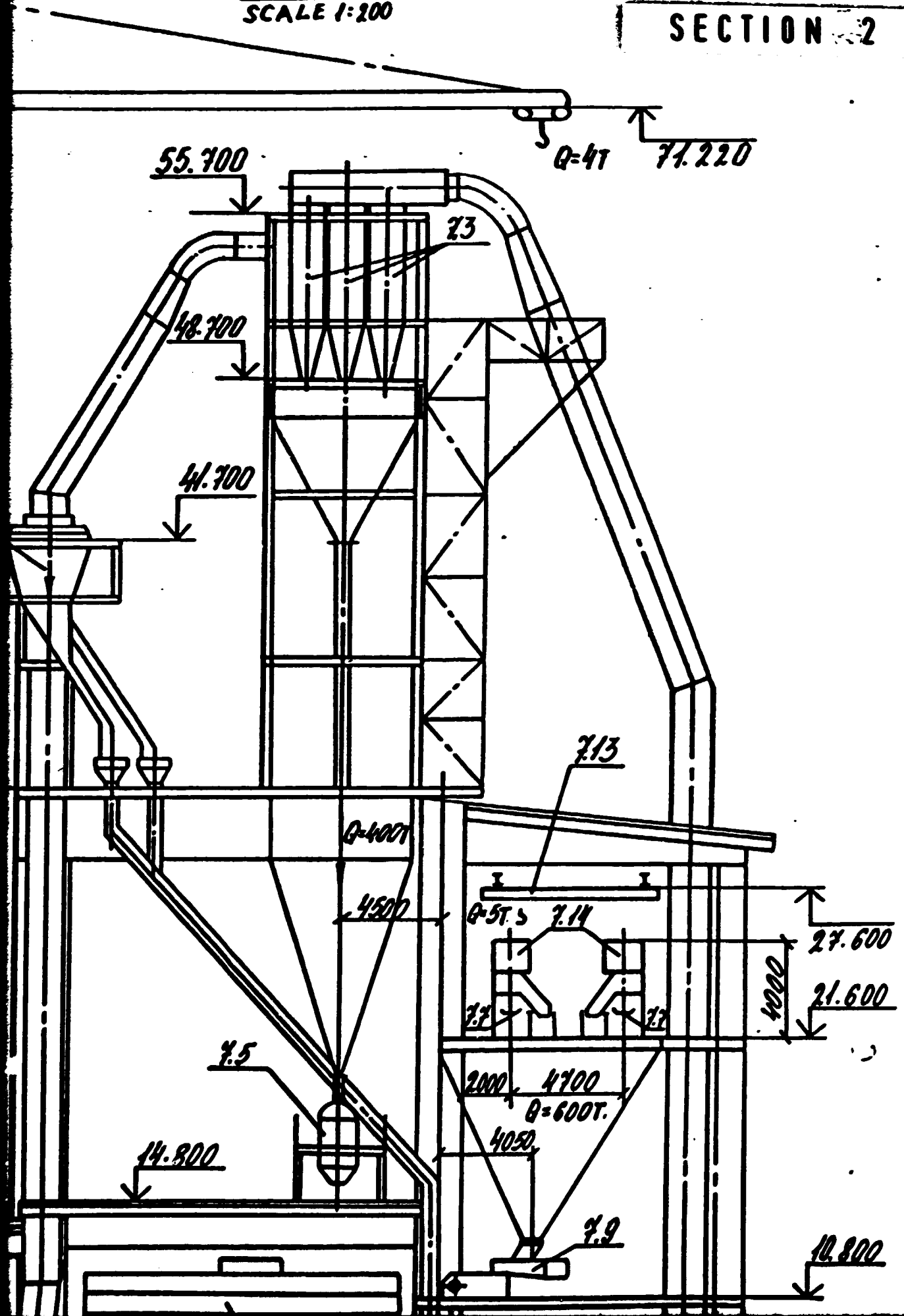
PLANS AT EL. 10.800 AND 21.600

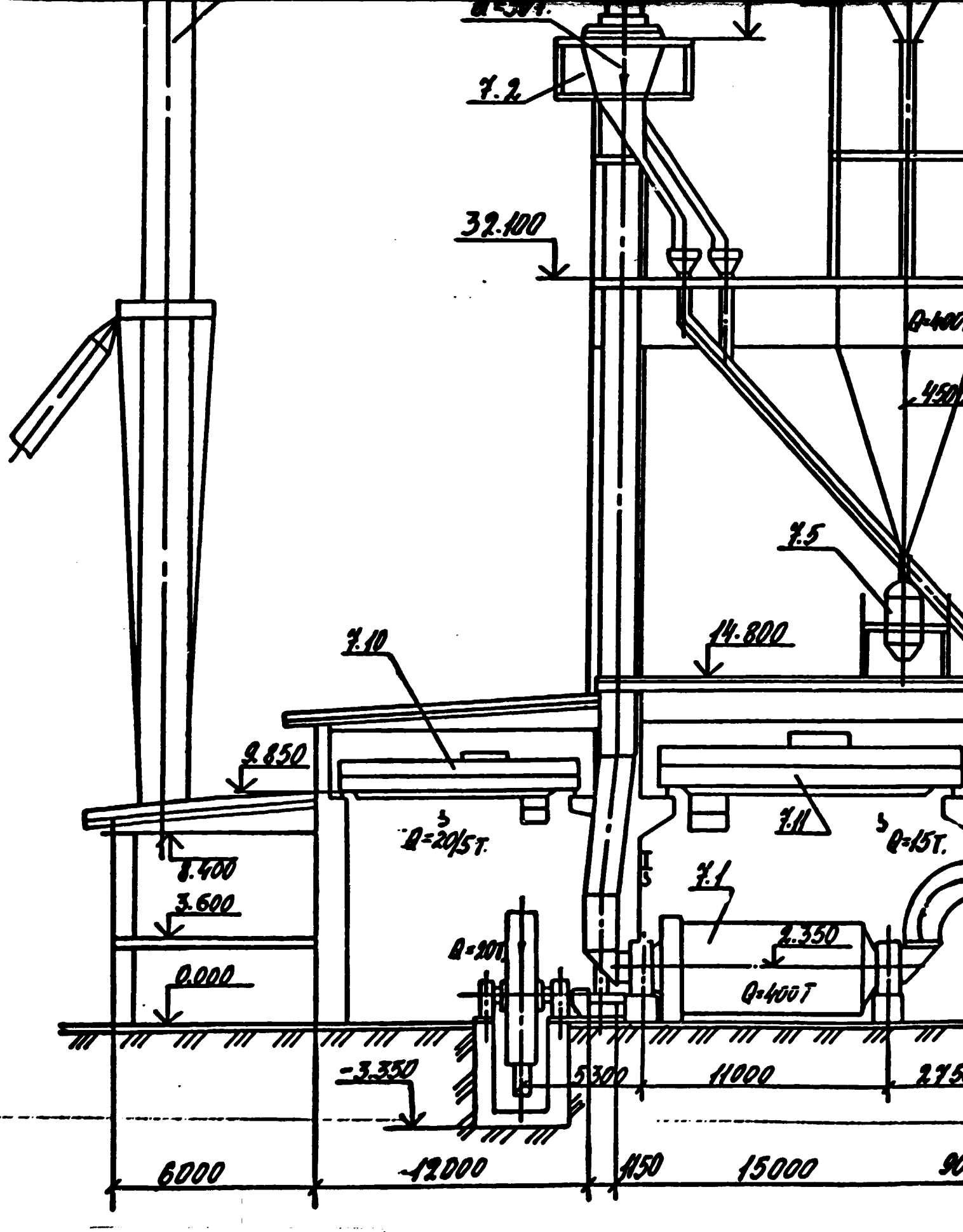
VAMI LENINGRAD


1-1
SCALE 1:200
SECTION 1
55.700
48.700
41.700
32.100
14.800
9.850
Q=30T.
7.12
7.2
7.5
7.10

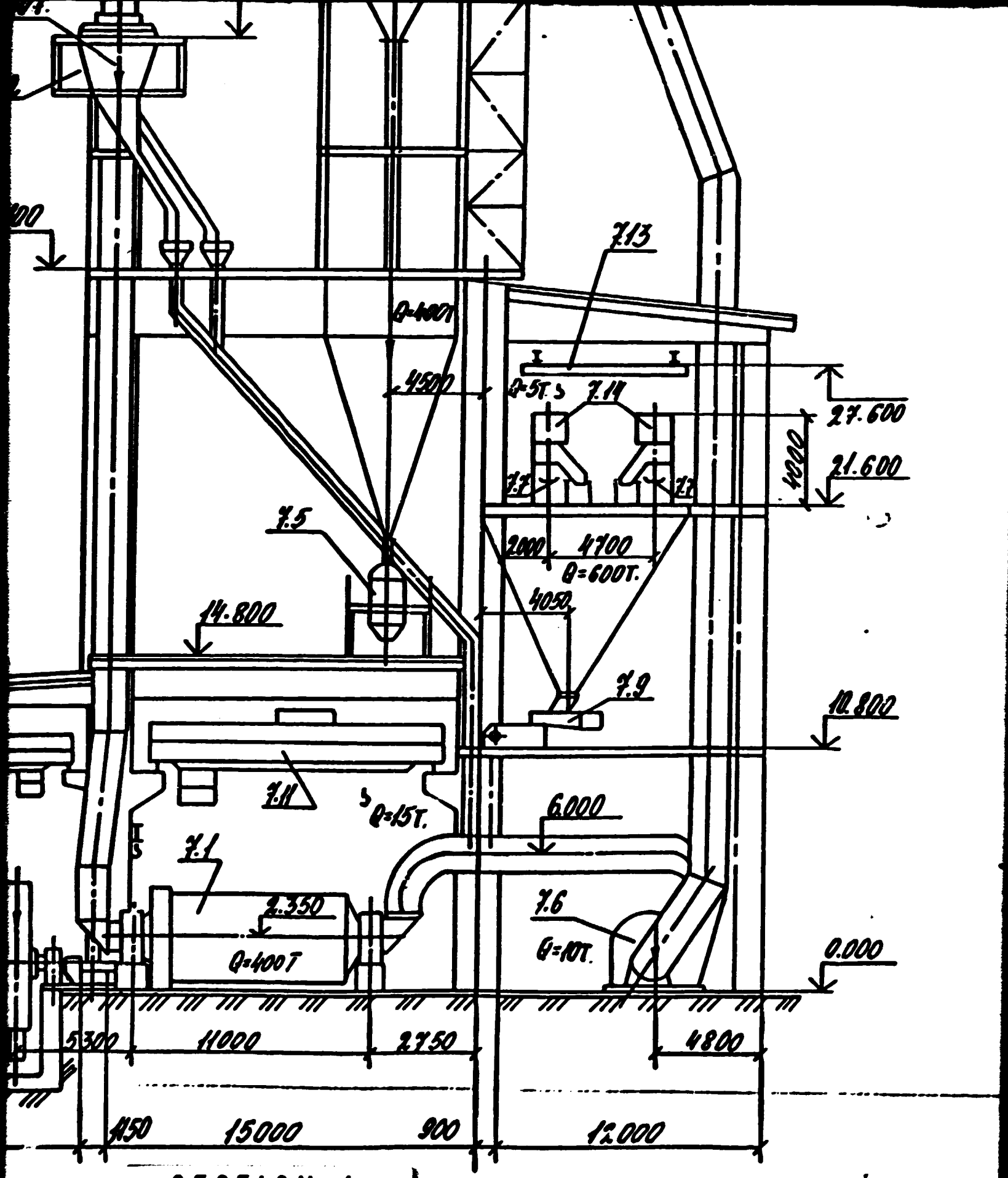
1-1
SCALE 1:200

SECTION 2




7.2
32.100
7.5
14.800
7.10
9.850
7.11
Q=20/5T.
Q=15T.
8.400
3.600
7.1
2.350
Q=20T
Q=400T
0.000
-3.350
5300
11000
6000
12000
1150
15000

SECTION 3


7.13
Q=400T
4500
Q=5T.
7.14
27.600
21.600
4000
7.5
2000
4700
Q=600T.
4050
14.800
7.9
10.800
7.11
Q=15T.
6.000
7.1
2.350
Q=400T
7.6
Q=10T.
0.000
5300
11000
2750
4800
450
15000
900
12000

SECTION 4

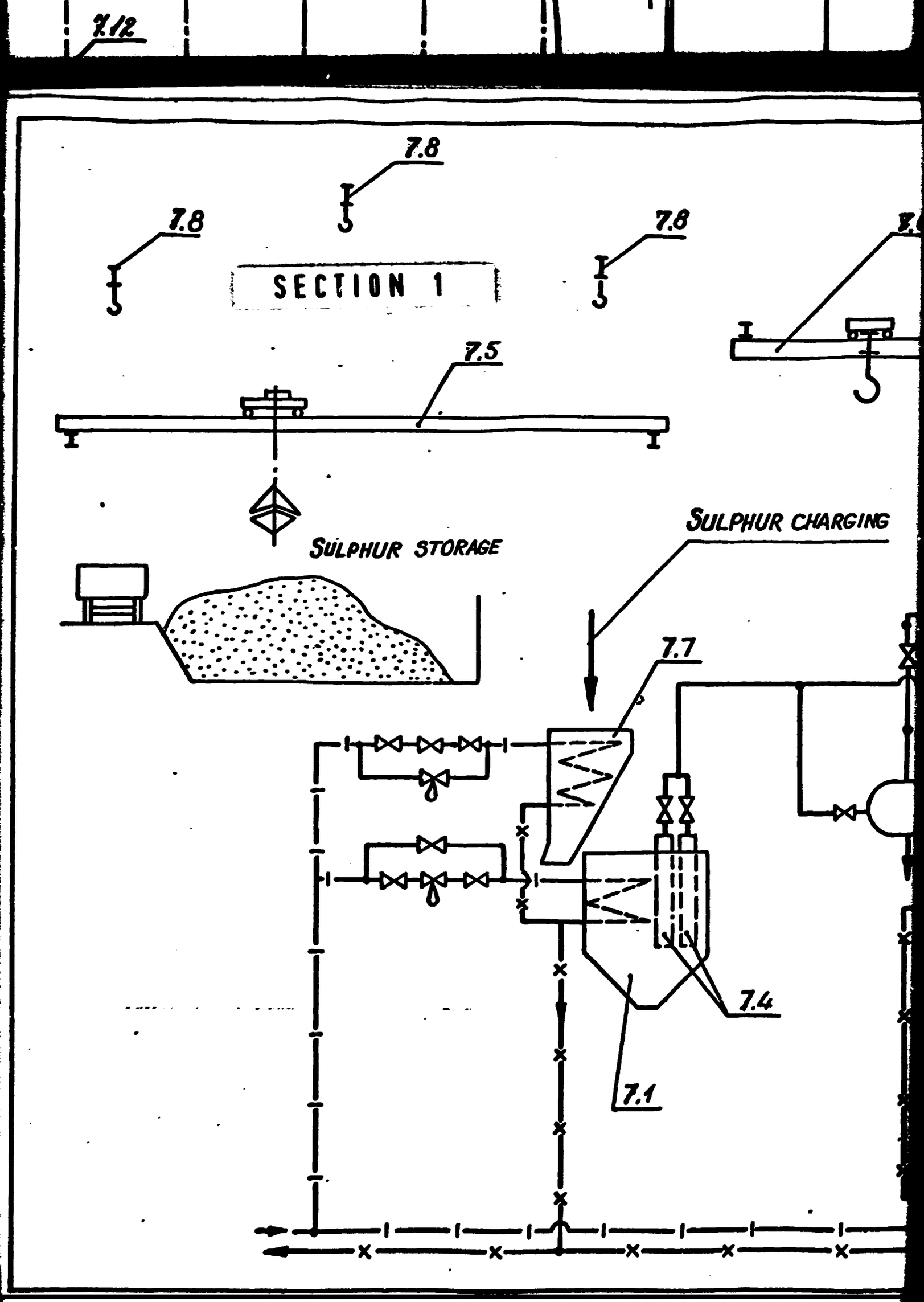
SECTION 5

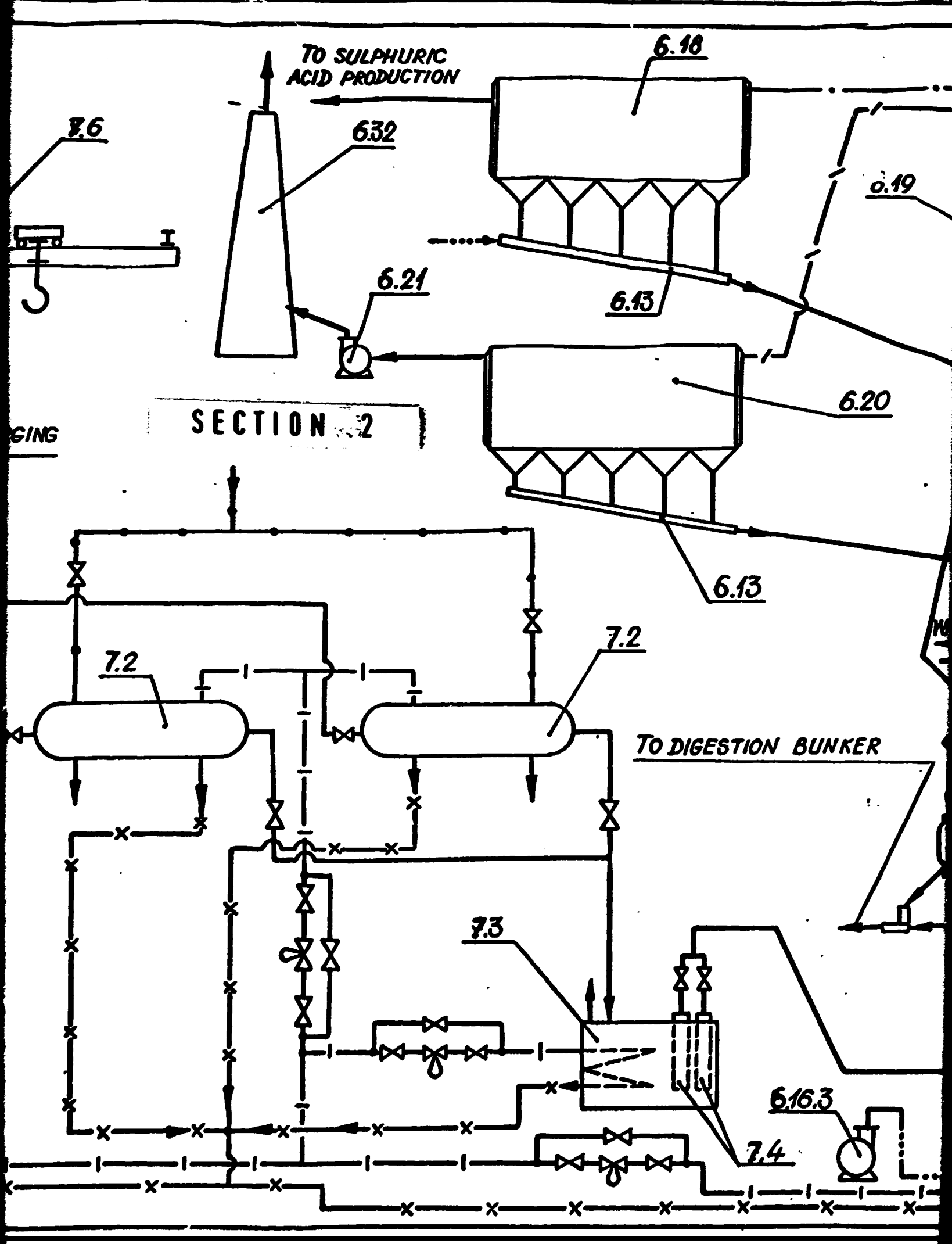
UNIDO CONTRACT NO 85/108

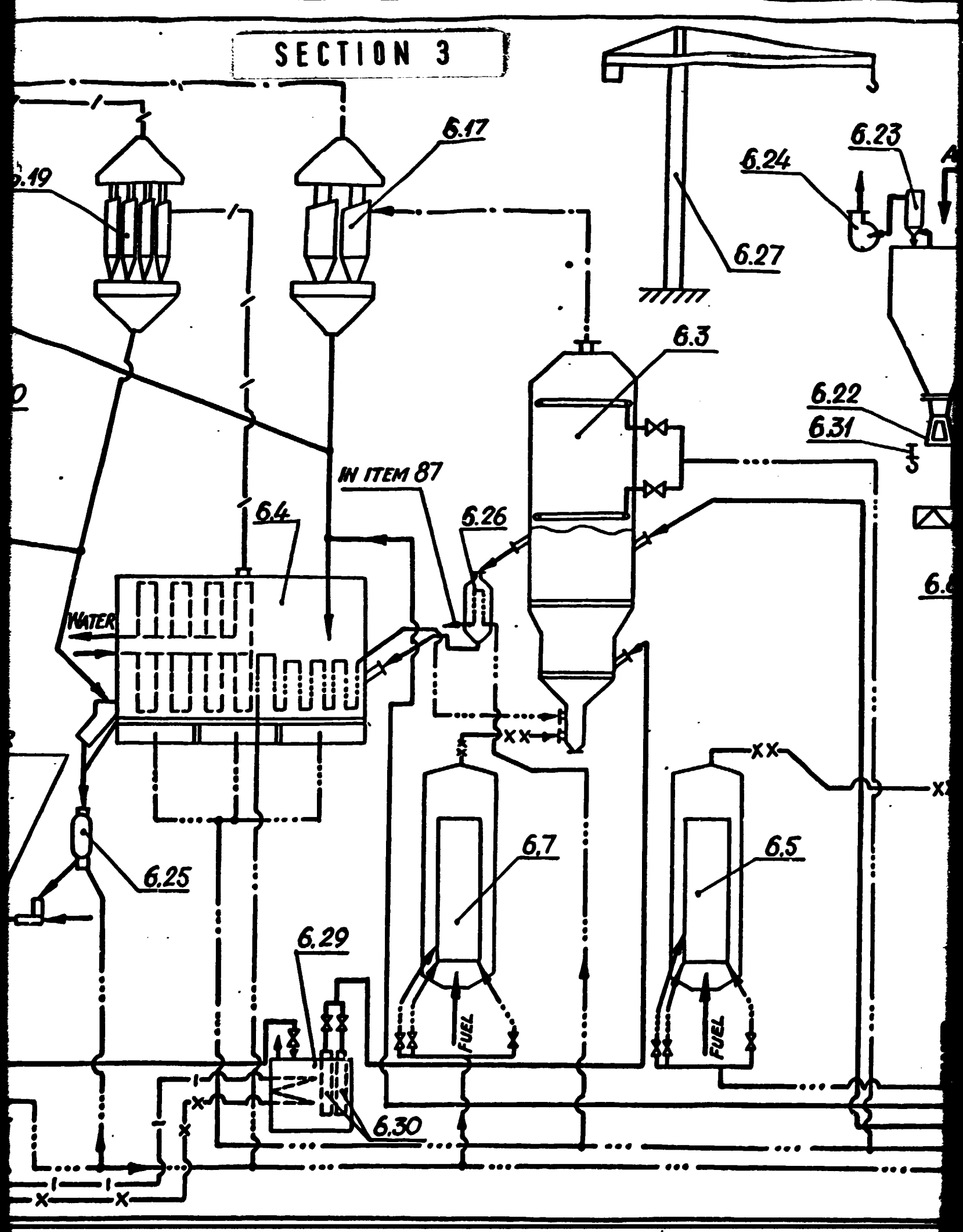
1339551-TM

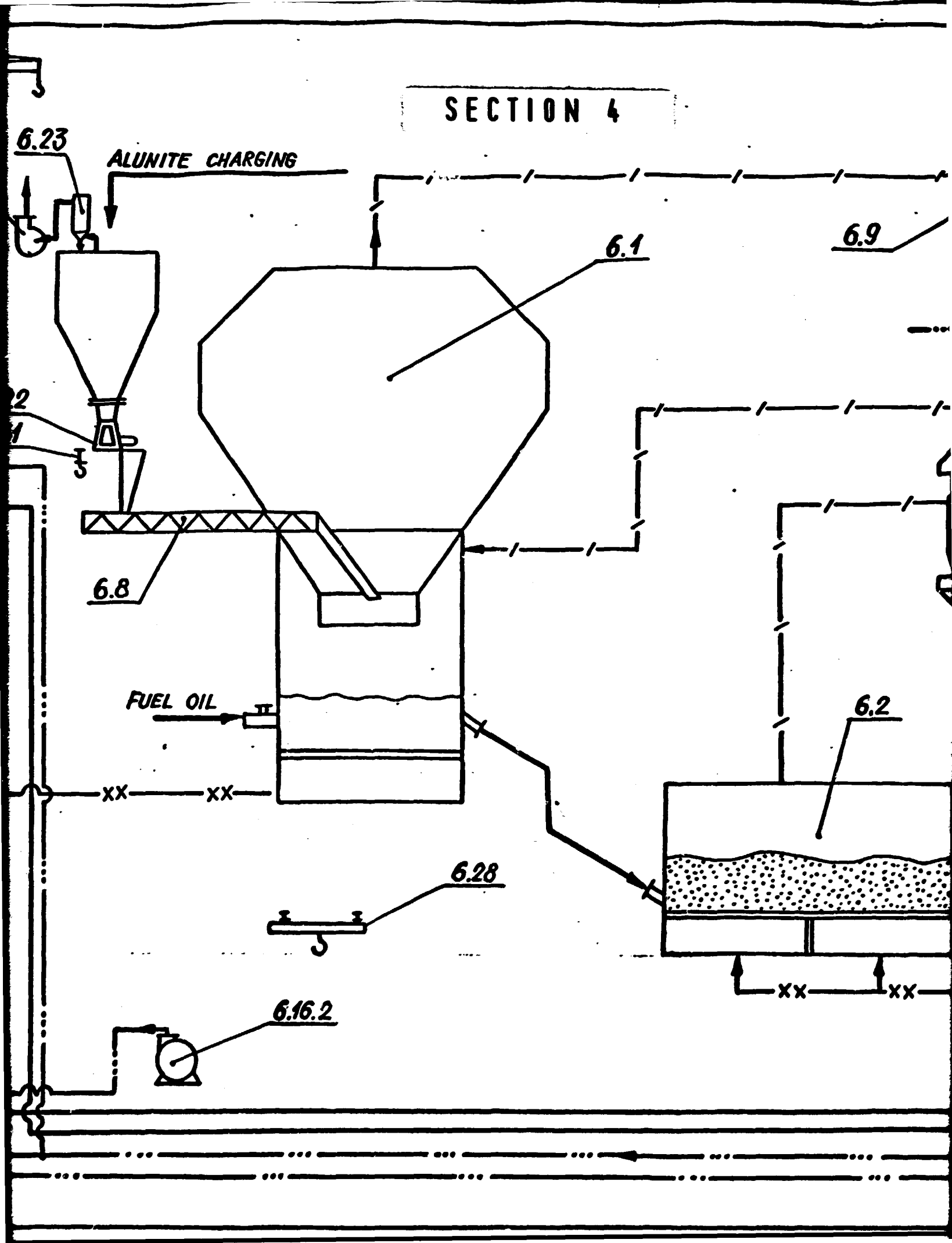
IRAN. ALUNITE BASED ALUMINA PLANT

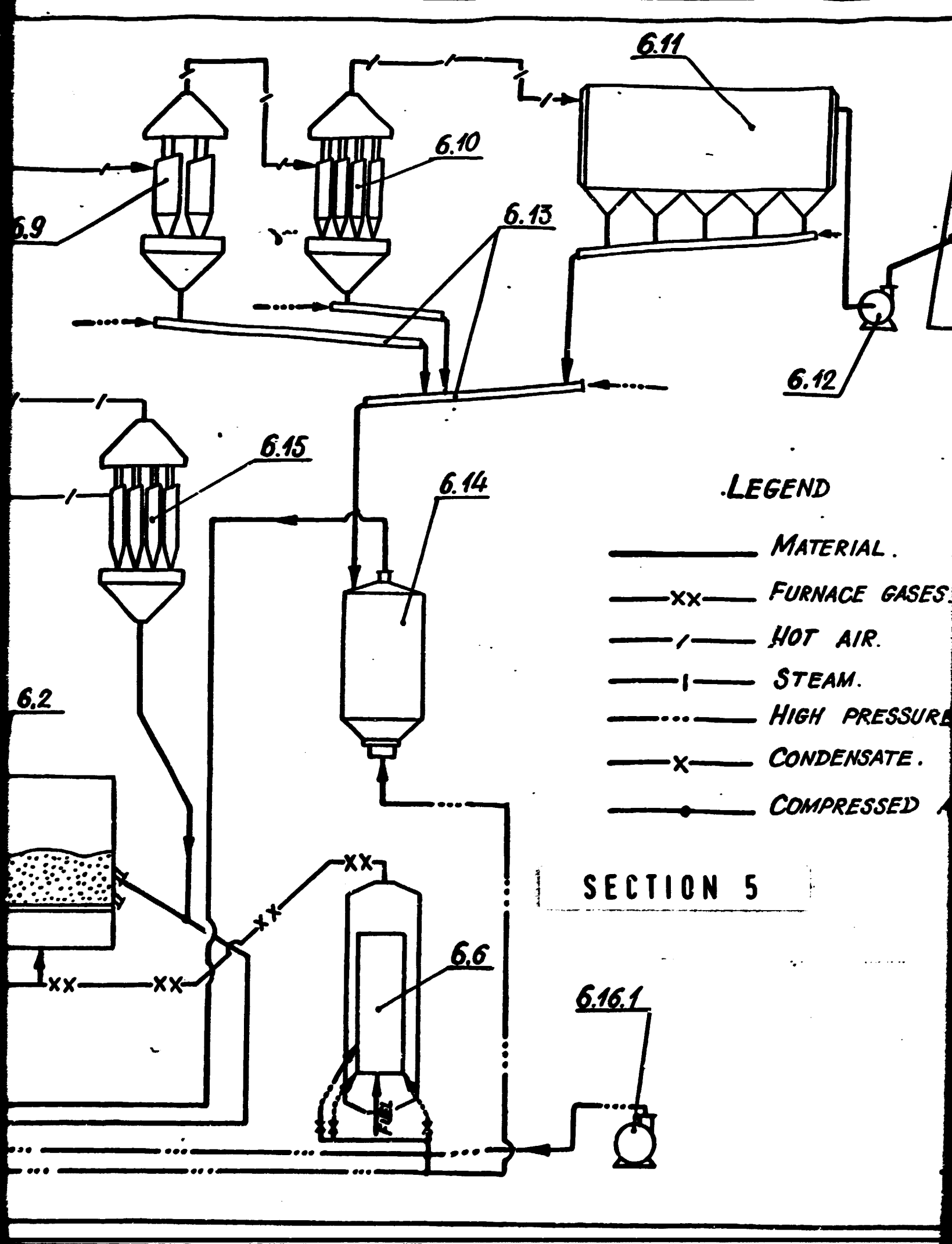
	STAGE	SHEET	SHEETS
DRY GRINDING	PLASSBAUTB	4	
SECTION 1-1	VAMI LENINGRAD		

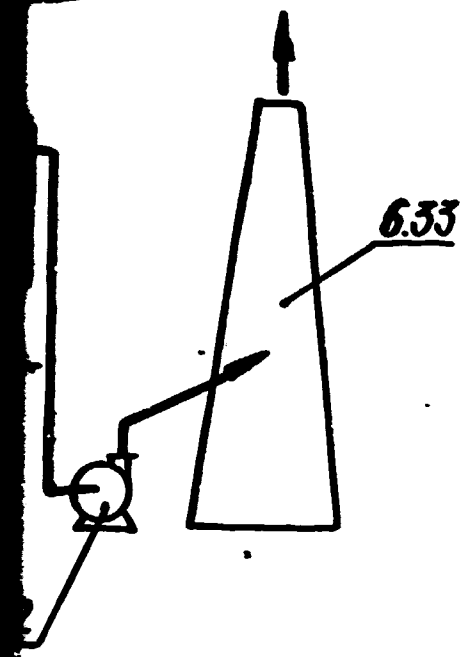

7.12
7.8
7.8
7.8
SECTION 1
7.5
SULPHUR STORAGE
SULPHUR CHARGING
7.7
7.4
7.1


TO SULPHURIC ACID PRODUCTION
6.18
6.32
6.19
6.21
6.13
6.20
SECTION
6.13
7.2
7.2
TO DIGESTION BUNKER
7.3
6.16.3
7.4


SECTION 3
6.17
6.19
6.23
6.24
6.27
6.3
6.22
6.31
IN ITEM 87
6.4
6.26
WATER
6.25
6.7
6.5
6.29
FUEL
FUEL
6.30


SECTION 4
6.23
ALUNITE CHARGING
6.1
6.9
6.8
FUEL OIL
6.2
XX
XX
6.28
6.16.2
XX
XX


6.11
6.10
6.9
6.13
6.12
6.15
6.14
6.2
6.6
6.16.1
XX
XX
XX
XX
.LEGEND
MATERIAL.
FURNACE GASES.
HOT AIR.
STEAM.
HIGH PRESSURE
CONDENSATE.
COMPRESSED
SECTION 5



RIAL.

ACE GASES.

AIR.

AM.

PRESSURE AIR.

ENSATE.

PRESSED AIR.

ITEM	DESCRIPTION	SPECIFICATION
	ALUNITE ROASTING AND	REDUCTION
6.1	I STAGE ROASTER	ϕ12.4/10.05; H=42 м
6.2	II STAGE ROASTER	16.2×6м; H=10.5 м
6.3	REDUCTION UNIT	ϕ6/4.6/20; H=30.15 м
6.4	FLUID BED COOLER	F=50 м²
6.5	FURNACE OF I STAGE ROASTER	ϕ3.2; H=10.25 м
6.6	FURNACE OF II STAGE ROASTER	ϕ3.2; H=11.6 м
6.7	FURNACE OF REDUCTION UNIT	ϕ3.2; H=11.6 м
6.8	SCREW FEEDER	ϕ 320
6.9	BANK OF 2 CYCLONES	ϕ 2200
6.10	BANK OF 4 CYCLONES	ϕ 1600
6.11	ELECTROSTATIC PRECIPITATOR	F=30 м²
	ЭГТ2-4-2.5-30	
6.12	I.D. FAN DH-19.5	Q=100000 м³/HR; H=2.5 кРа
6.13	AIR SLIDE	ϕ 273
6.14	PNEUMATIC ELEVATOR	ϕ 1.4 м
6.15	BANK OF 4 CYCLONES	ϕ 1200
6.16.1	TURBO-AIR BLOWER	Q=50000 нм³/HR; H=14 кРа
6.16.2	TURBO-AIR BLOWER	Q=30000 нм³/HR; H=25 кРа

SECTION 6

IFICATION	QTY	REMARK
TION		
2.05; H=42 M	3	
M; H=10,5 M	3	
20; H=30,15 M	3	
M²	3	
=10,25 M	3	
H=11,6 M	3	
H= 11,6 M	3	
	3	
	3	
	3	
M²	6	
0 M³/HR; H=2,5 KPa	3	
	15	
	3	
	3	
NM³/HR; H=14 KPa	4	
NM³/HR; H=25 KPa	4	

ITEM	DESCRIPTION	SPECIFICATION
6.16.3	TURBO-AIR BLOWER	Q=20000 NM³/HR; H=100 KP
6.17	BANK OF 6 CYCLONES	ϕ 900
6.18	ELECTROSTATIC PRECIPITATOR ОГП-4-16	F=16 M²
6.19	BANK OF 4 CYCLONES	ϕ 800
6.20	ELECTROSTATIC PRECIPITATOR УГ-1-3-15	F=15 M²
6.21	I.D. FAN DH-11,2	Q=29000 M³/HR; H=3,6 KPa
6.22	WEIGHER СБ-111	Q=50-80 T/HR
6.23	BAG FILTER ФРКИ-90A	F=90 M²
6.24	FAN ЦП-7-40-6-01	N=10 KW; Q=10000 M³/HR
6.25	FLUID BED LOCK	ϕ 1000
6.26	HEAT EXCHANGER	ϕ 1400
6.27	TOWER CRANE	H_0=37.54 M; Q=4/8 T
6.28	SUSPENDED ELECTRIC CRANE	Q=5 T; H_{LIFT}=6 M
6.29	COLLECTOR OF PURE SULPHUR	V=8 M³
6.30	CENTRIFUGAL IMMERSION	Q=8 NM³/HR; H=40 MM H_2O GAUGE
	PUMP АХП0-8/40	
6.31	ELECTRIC HOIST	Q=2 T; H=36 M
6.32	CHIMNEY STACK	H=65 M, ϕ 1,4 M
6.33	CHIMNEY STACK	H=70 M, ϕ 1,6 M

SECTION 7

REMARK	ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
	6.16.3	TURBO-AIR BLOWER	$Q=20000^{NM^3}/_{HR}$; $H=100\,kPa$	4	
	6.17	BANK OF 6 CYCLONES	ϕ 900	3	
	6.18	ELECTROSTATIC PRECIPITATOR ОГП-4-16	$F=16\,M^2$	8	
	6.19	BANK OF 4 CYCLONES	ϕ 800	3	
	6.20	ELECTROSTATIC PRECIPITATOR УГ-1-3-15	$F=15\,M^2$	4	
	6.21	I.D. FAN ДН-11,2	$Q=29000^{M^3}/_{HR}$; $H=3.6\,kPa$	6	
	6.22	WEIGHER СБ-111	$Q=50-80\,T/_{HR}$	3	
	6.23	BAG FILTER ФРКИ-90А	$F=90\,M^2$	3	
	6.24	FAN ЦП-7-40-6-01	$N=10\,kW$; $Q=10000^{M^3}/_{HR}$	3	
	6.25	FLUID BED LOCK	ϕ 1000	3	
	6.26	HEAT EXCHANGER	ϕ 1400	3	
	6.27	TOWER CRANE	$H_0=37.54\,M$; $Q=4/8\,T$	1	
	6.28	SUSPENDED ELECTRIC CRANE	$Q=5\,T$; $H_{LIFT}=6\,M$	1	
	6.29	COLLECTOR OF PURE SULPHUR	$V=8\,M^3$	3	
	6.30	CENTRIFUGAL IMMERSION	$Q=8^{MM^3}/_{HR}$; $H=40\,MM\ H_2O\ GAUGE$	6	
		PUMP АХПО-8/40			
	6.31	ELECTRIC HOIST	$Q=2\,T$; $H=36\,M$	4	
	6.32	CHIMNEY STACK	$H=65\,M$, ϕ 1,4 M	1	
	6.33	CHIMNEY STACK	$H=70\,M$, ϕ 1,6 M	3	

ITEM	
7.1	R
	N
7.2	D
	F
7.3	C
7.4	IM
7.5	CL
7.6	SI
	CL
7.7	M
7.8	M

SECTION 8

ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
	SULPHUR STORAGE			
7.1	RECEIVING STORAGE FOR	$V=22\,M^3$, $S_{HEAT}=40\,M^2$	3	
	MELTED SULPHUR			
7.2	DISK HORIZONTAL FILTER	$Q=70\,T/DAY$	6	
	FOR MELTED SULPHUR	$S_{FILTER}=6\,M^3$		
7.3	COLLECTOR FOR PURE SULPHUR	$V=8\,M^3$	3	
7.4	IMMERSION PUMP AXN0-8/40	$Q=8\,M^3/HR$; $H_{HEAD}=40\,M\ H_2O$ GAUGE	12	
7.5	CLAMSHELL E.O.T. CRANE	$Q=5\,T$	1	
7.6	SINGLE GIRDER ELECTRIC	$Q=5\,T$	1	
	CRANE			
7.7	MELTING BUNKER FOR SULPHUR	$V=28\,M^3$	3	
7.8	MOVABLE ELECTRIC HOIST	$Q=3.2\,T$	3	

SECTION 9

UNIDO CONTRACT NO 85/108

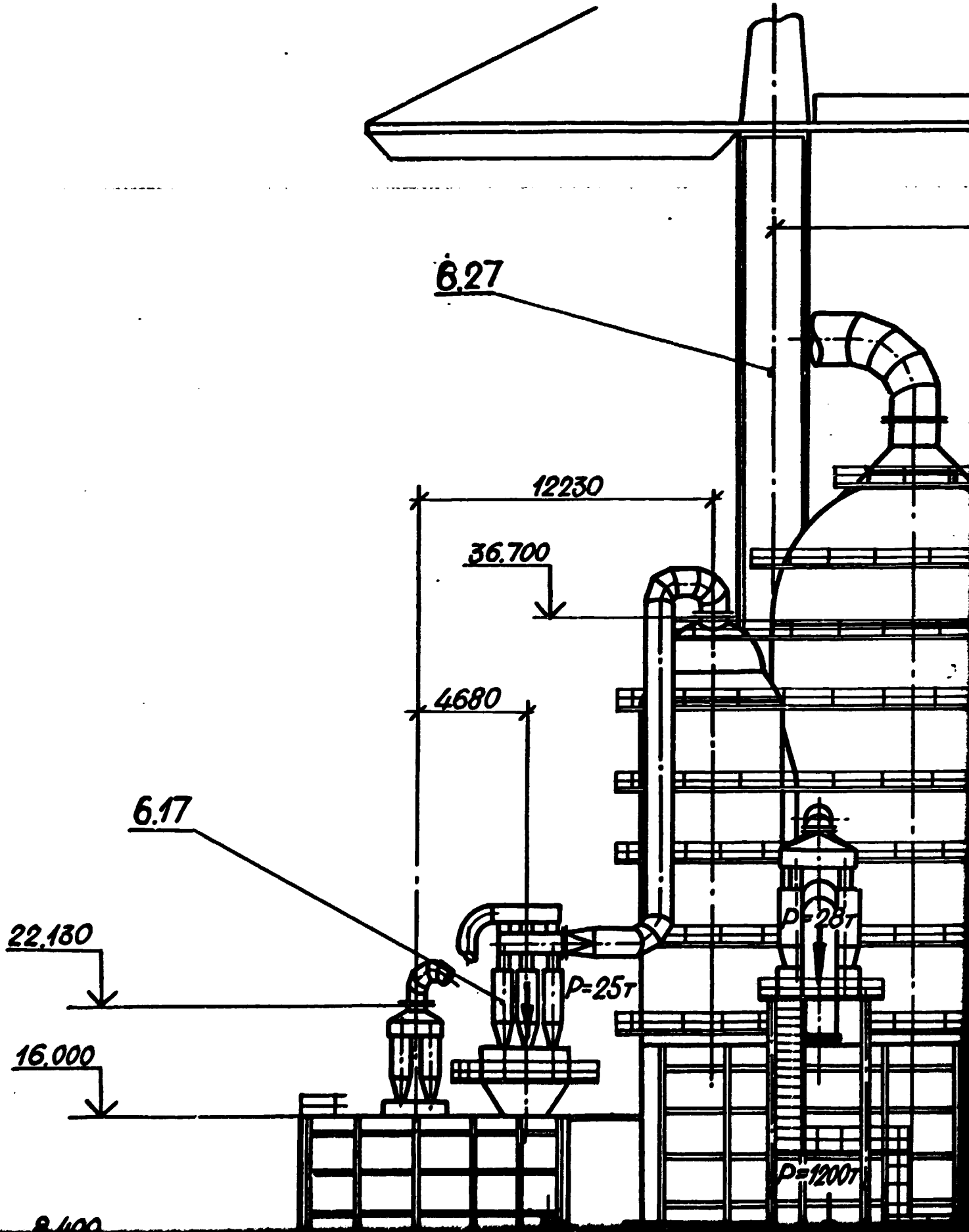
1390351-TM

IRAN. ALUNITE BASED ALUMINA PLANT

ROASTING AND REDUCTION WITH BLOWER STATION AND SULPHUR STORAGE	STAGE	SHEET	SHEETS
	FEASIBILITY		1
EQUIPMENT PROCESS FLOWSHEET	VAMI. LENINGRAD.		

SIZE A4x8

SECTION 1

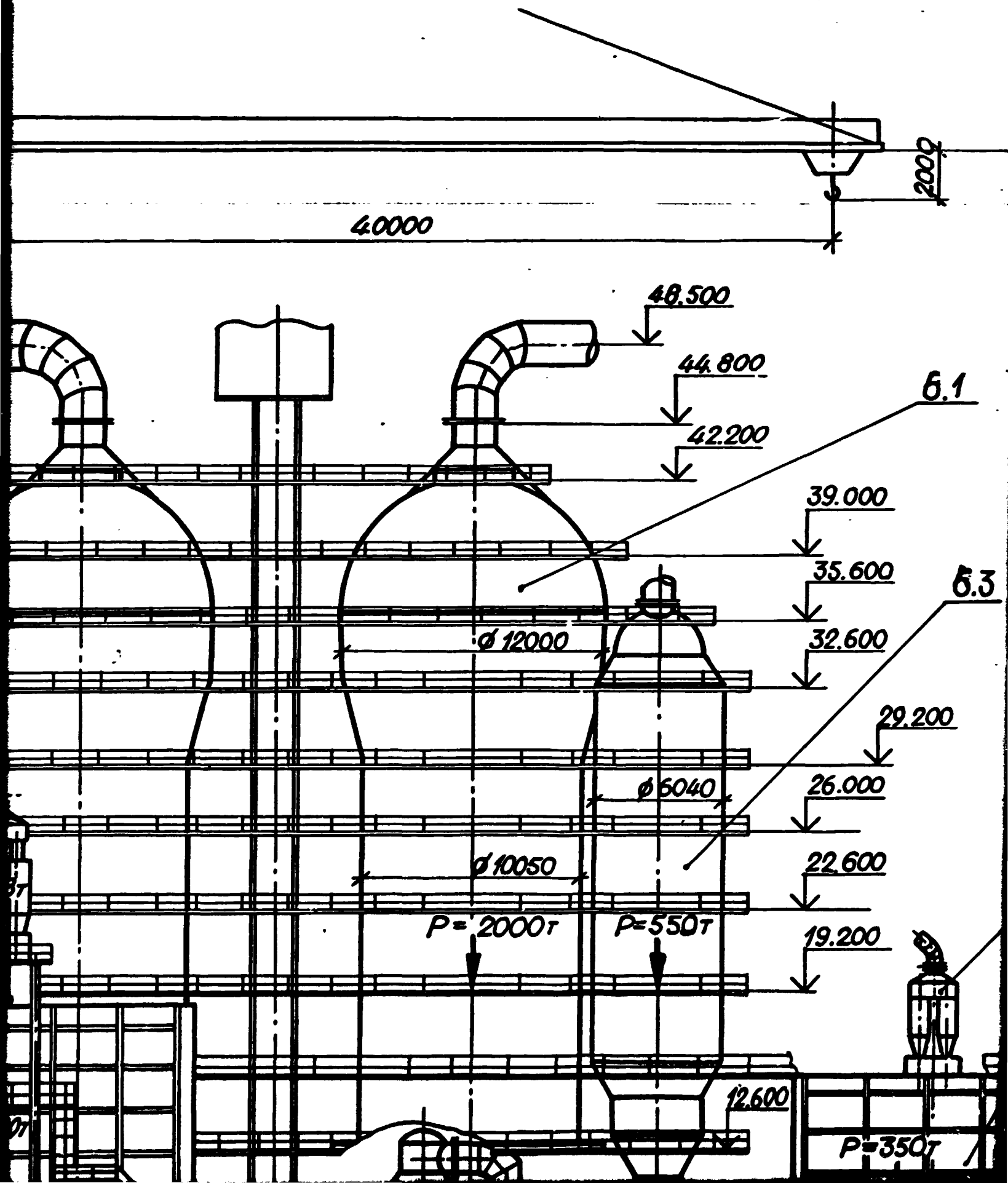


A – A

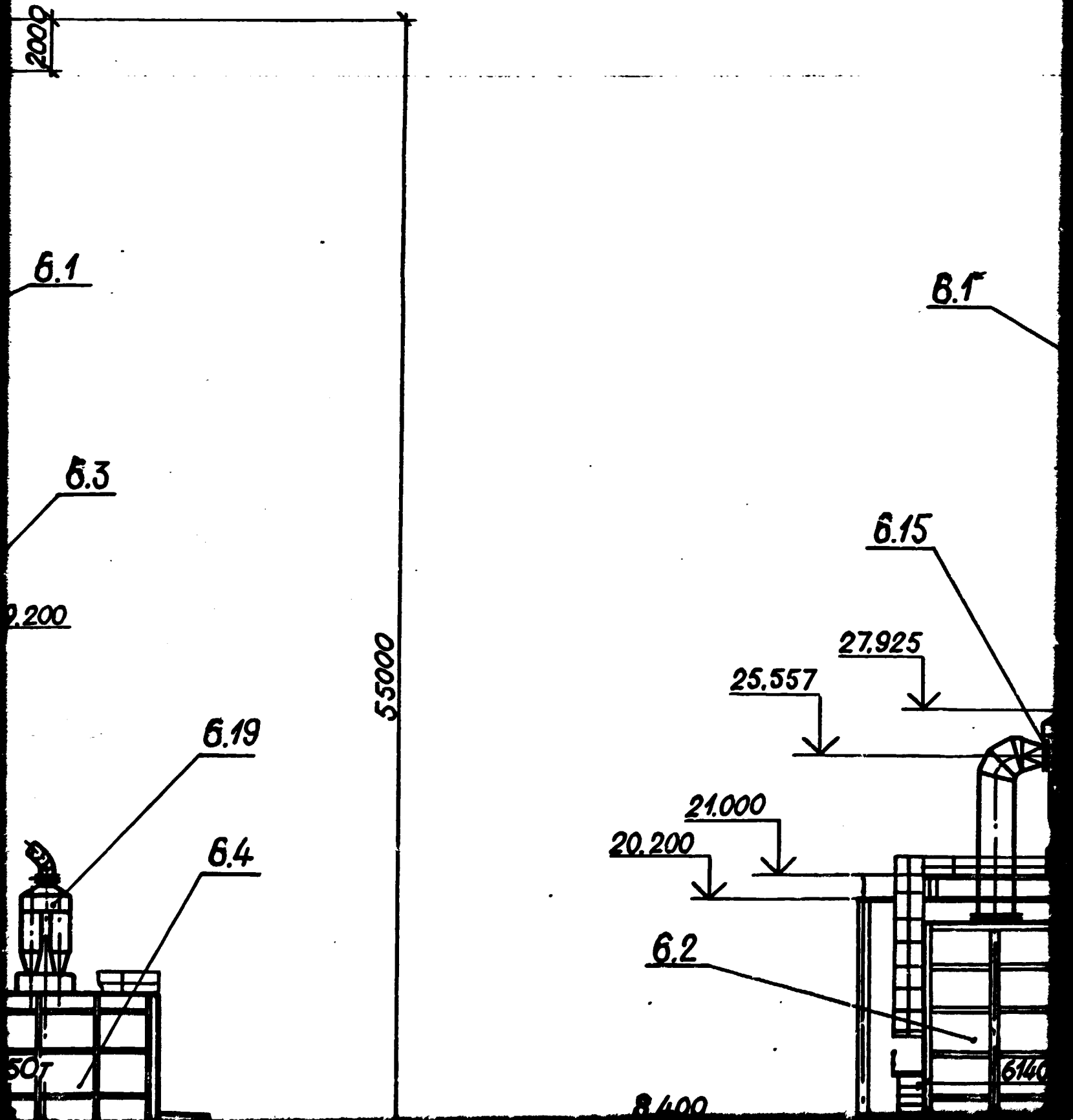
SCALE 1:200

SHEET 2

SECTION 2

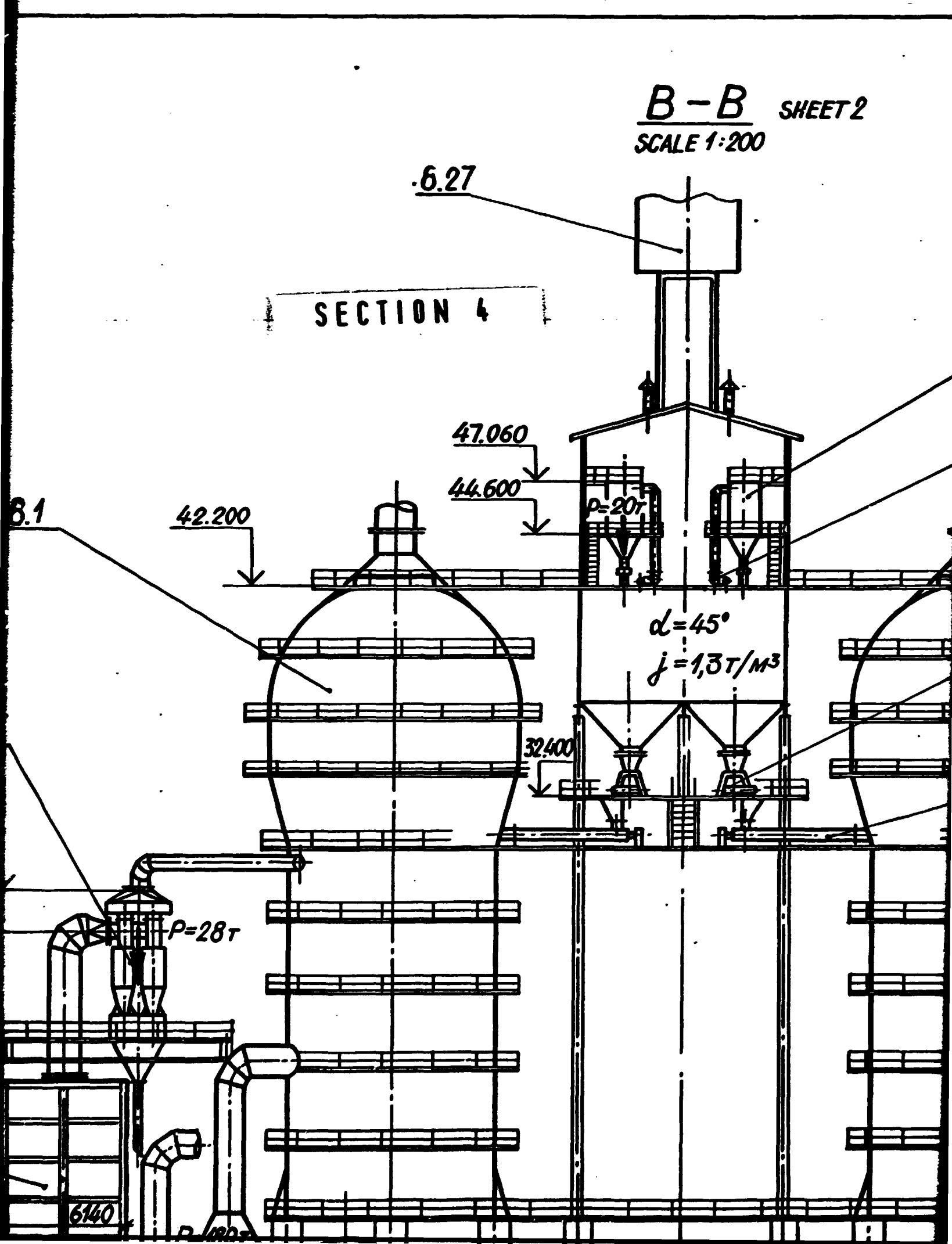


SECTION 3


2000
6.1
6.1
6.3
6.15
.200
27.925
25.557
55000
6.19
21.000
20.200
6.4
6.2
6140
8400

B – B SHEET 2

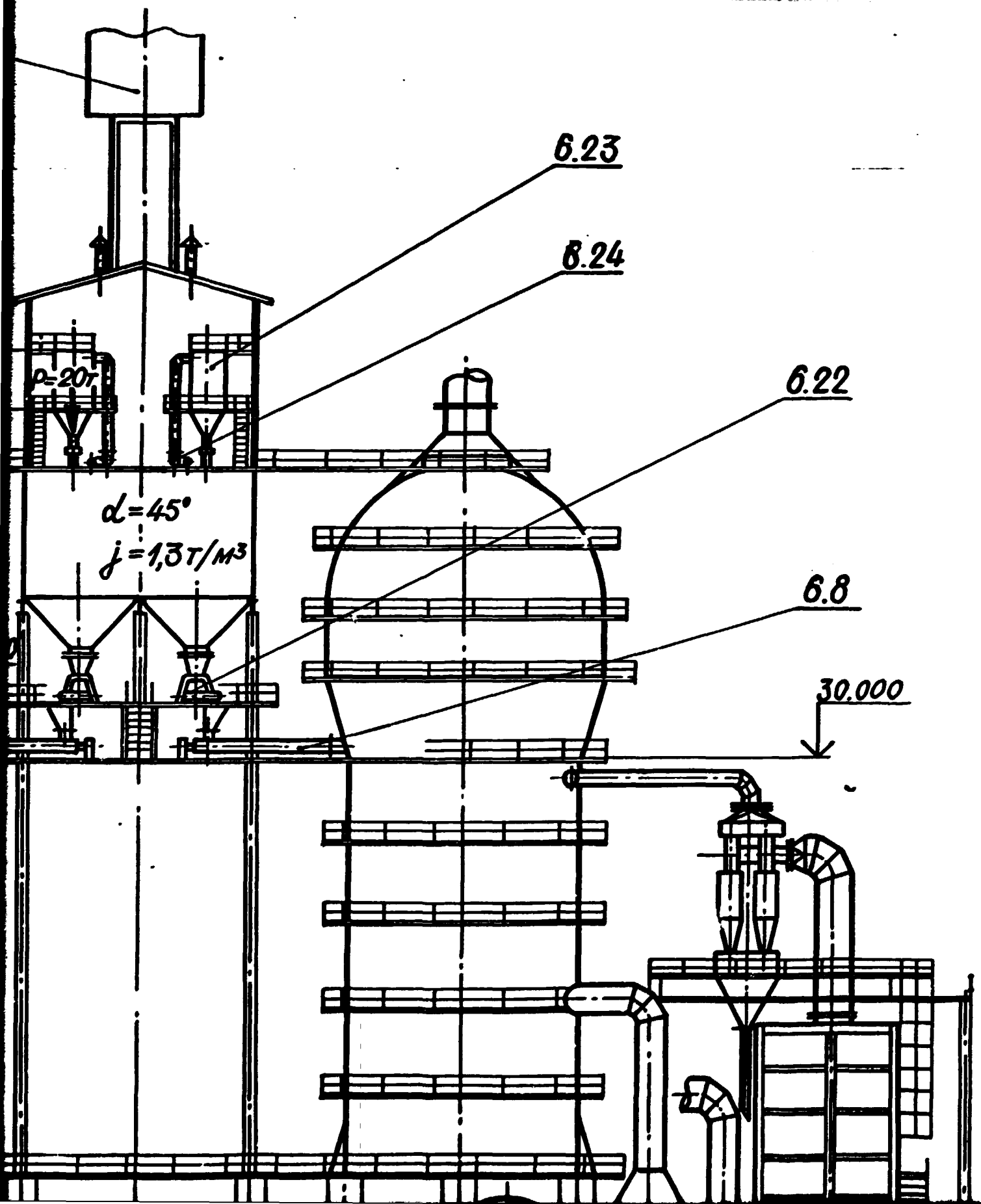
SCALE 1:200

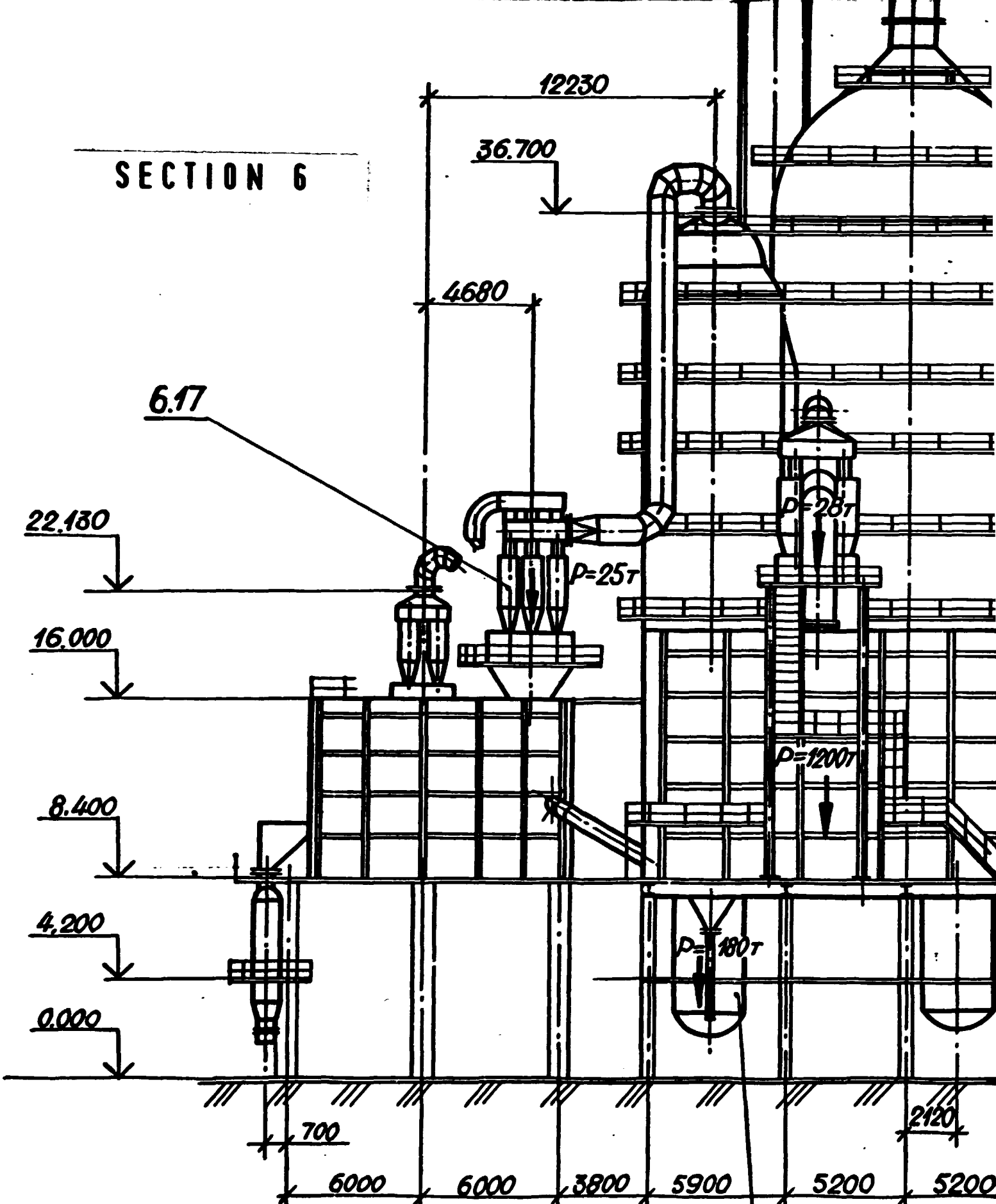


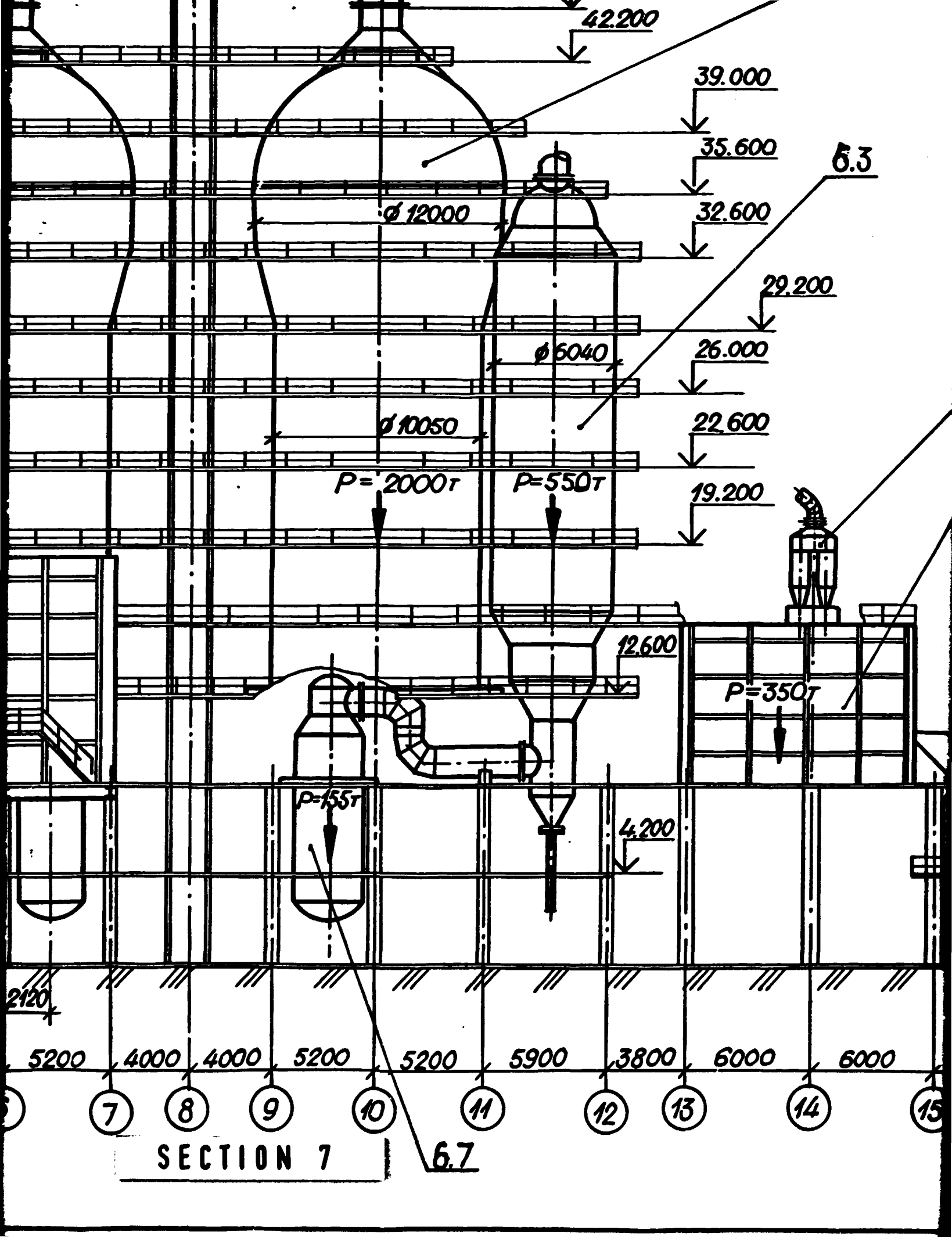
B – B SHEET 2

SCALE 1:200

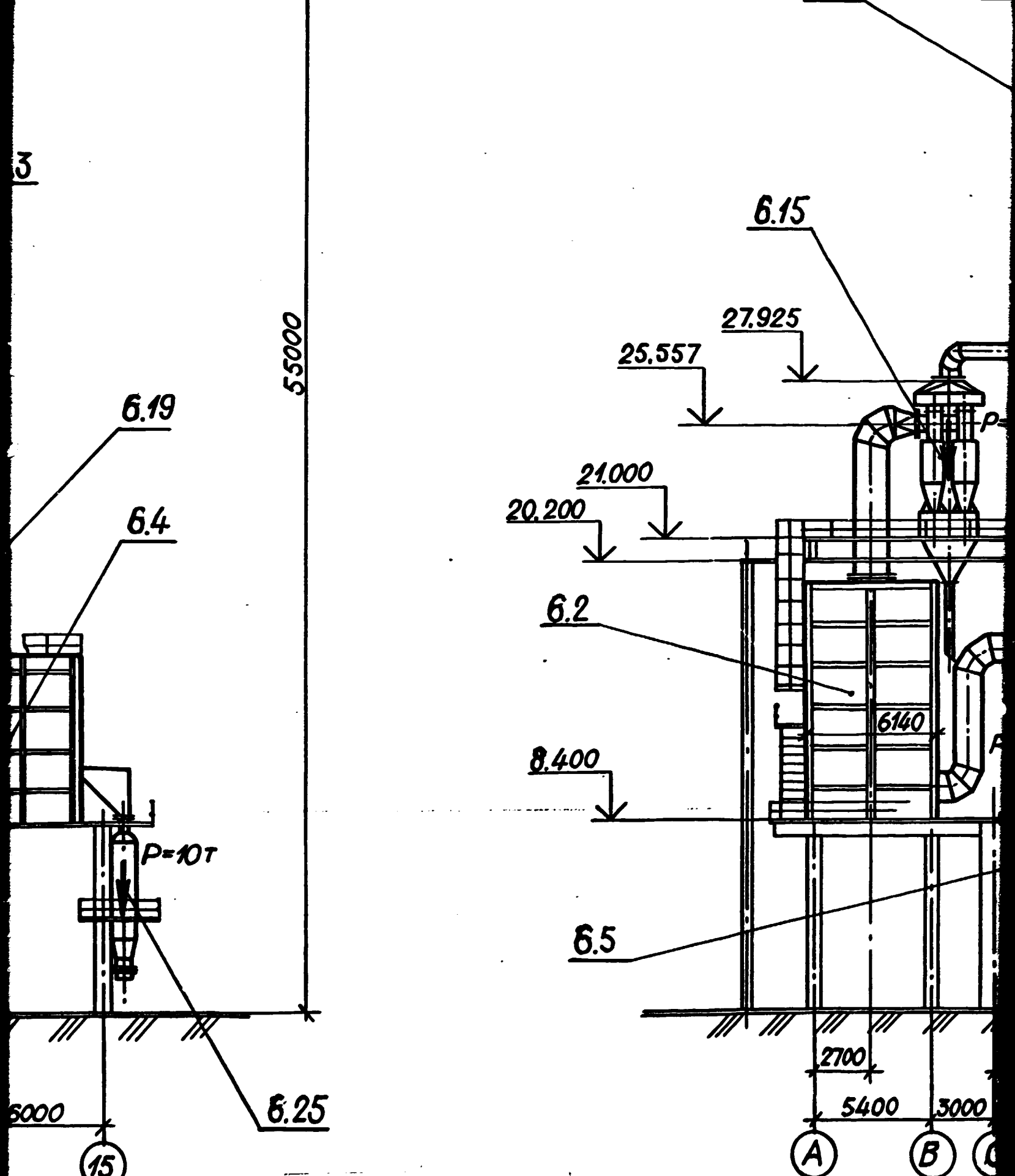
SECTION 5



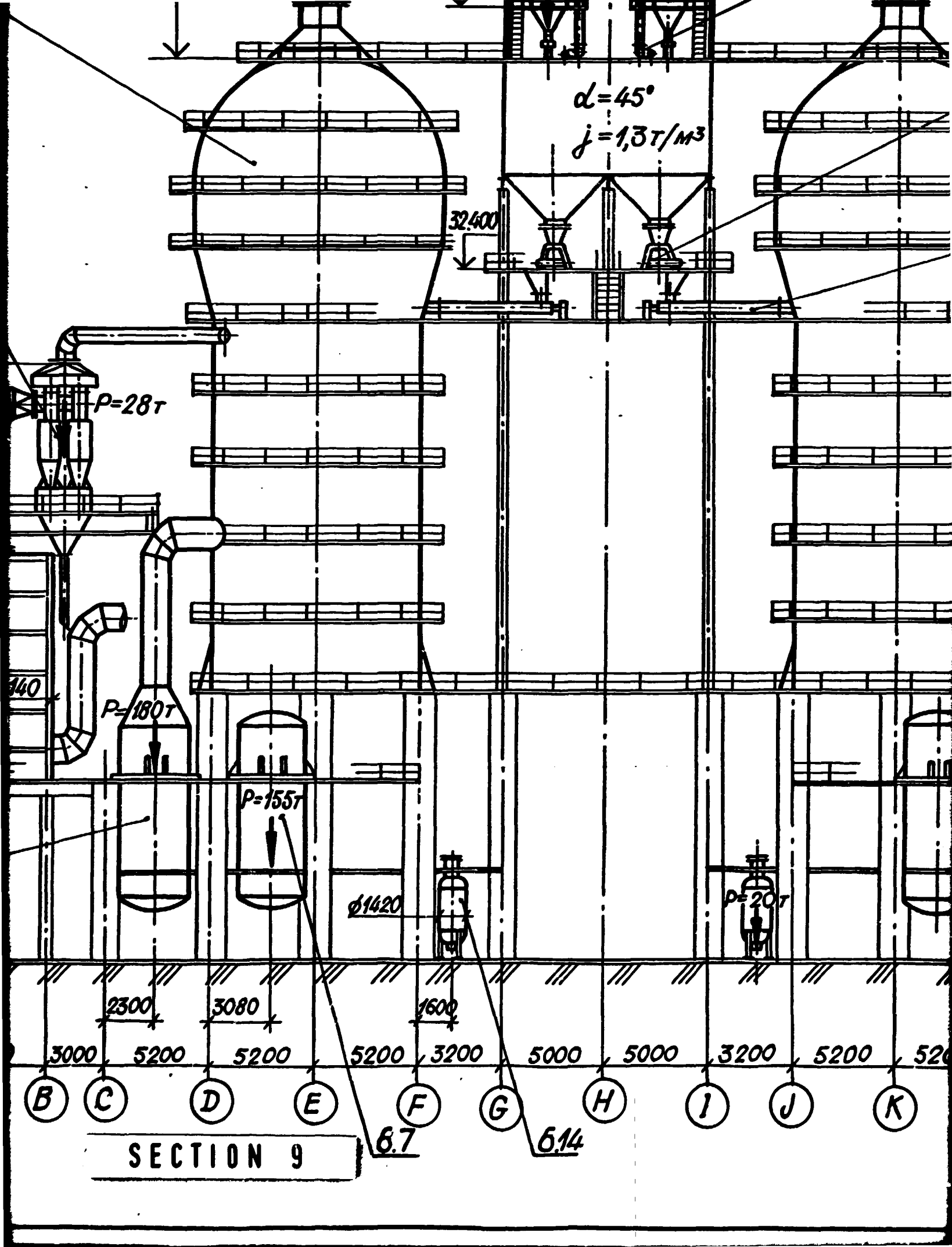

SECTION 6
12230
36.700
4680
6.17
22.130
16.000
8.400
4.200
0.000
P=25т
P=28т
P=1200т
P=180т
700
2120
6000
6000
3800
5900
5200
5200
1
2
3
4
5
6
6.6


42.200
39.000
35.600
32.600
29.200
26.000
22.600
19.200
12.600
4.200
2120
Ø 12000
Ø 6040
Ø 10050
P= 2000т
P=550т
P=350т
P=155т
6.3
6.7
5200
4000
4000
5200
5200
5900
3800
6000
6000
7
8
9
10
11
12
13
14
15

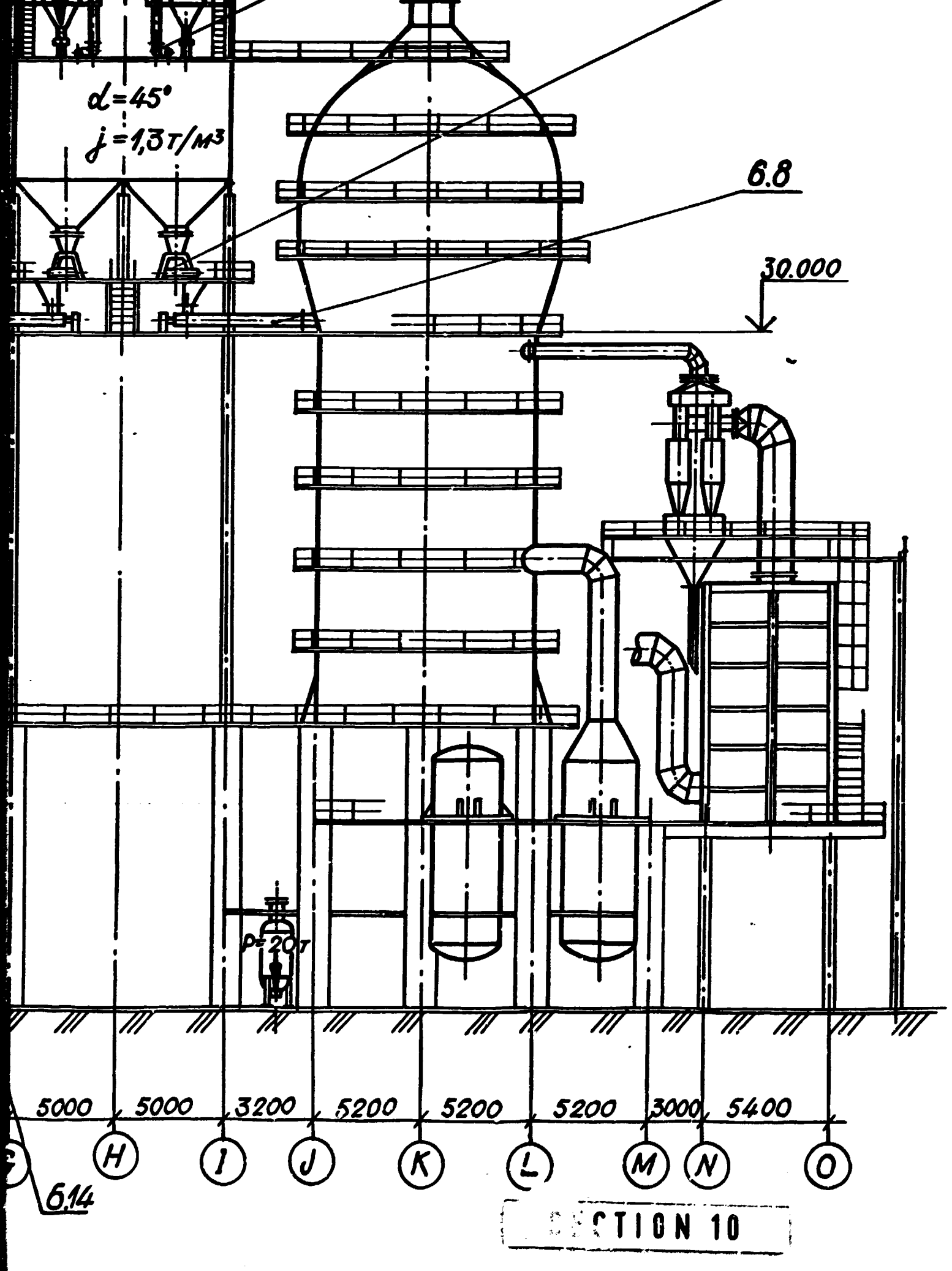
SECTION 7


3
55000
6.19
6.4
P=10т
6.25
6000
15
6.15
27.925
25.557
21.000
20.200
6.2
6140
8.400
6.5
2700
5400
3000
A
B

SECTION 8


α=45°
j=1,3т/м³
32.400
P=28т
P=180т
P=155т
ϕ1420
P=20т
2300
3080
1600
3000
5200
5200
5200
3200
5000
5000
3200
5200
B
C
D
E
F
G
H
I
J
K
6.7
6.14

SECTION 9


α=45°
ρ=1,3т/м³
6.8
30.000
P=20т
5000
5000
3200
5200
5200
5200
3000
5400
H
I
J
K
L
M
N
O
6.14

SECTION 10

SECTION 11

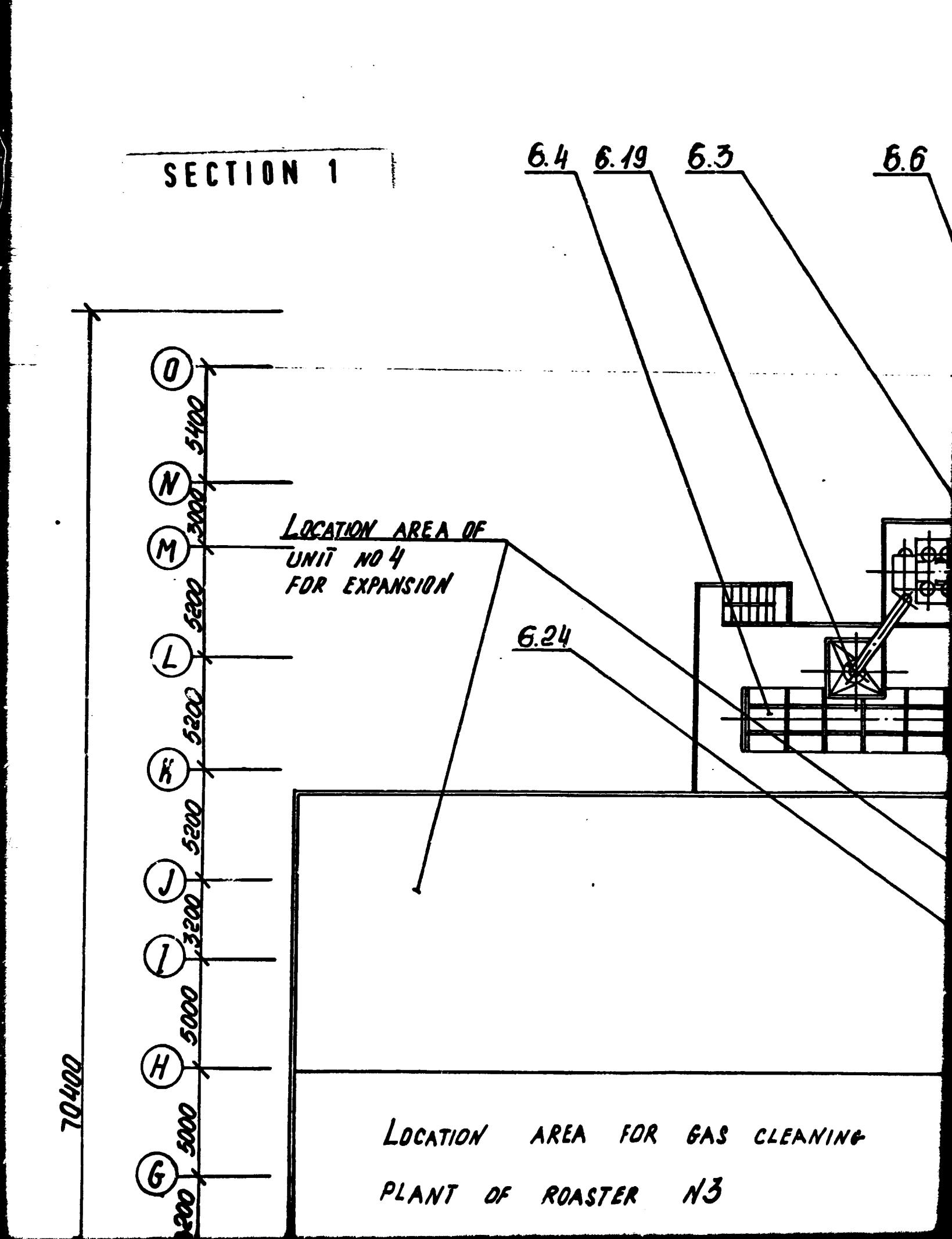
UNIDO CONTRACT NO 85/108

1390368 - TM

IRAN. ALUNITE BASED ALUMINA PLANT

ROASTING AND REDUCTION WITH BLOWER STATION	STAGE	SHEET	SHEETS
	FEASIBILITY	1	2
SECTIONS А-А, Б-Б	VAMI LENINGRAD		

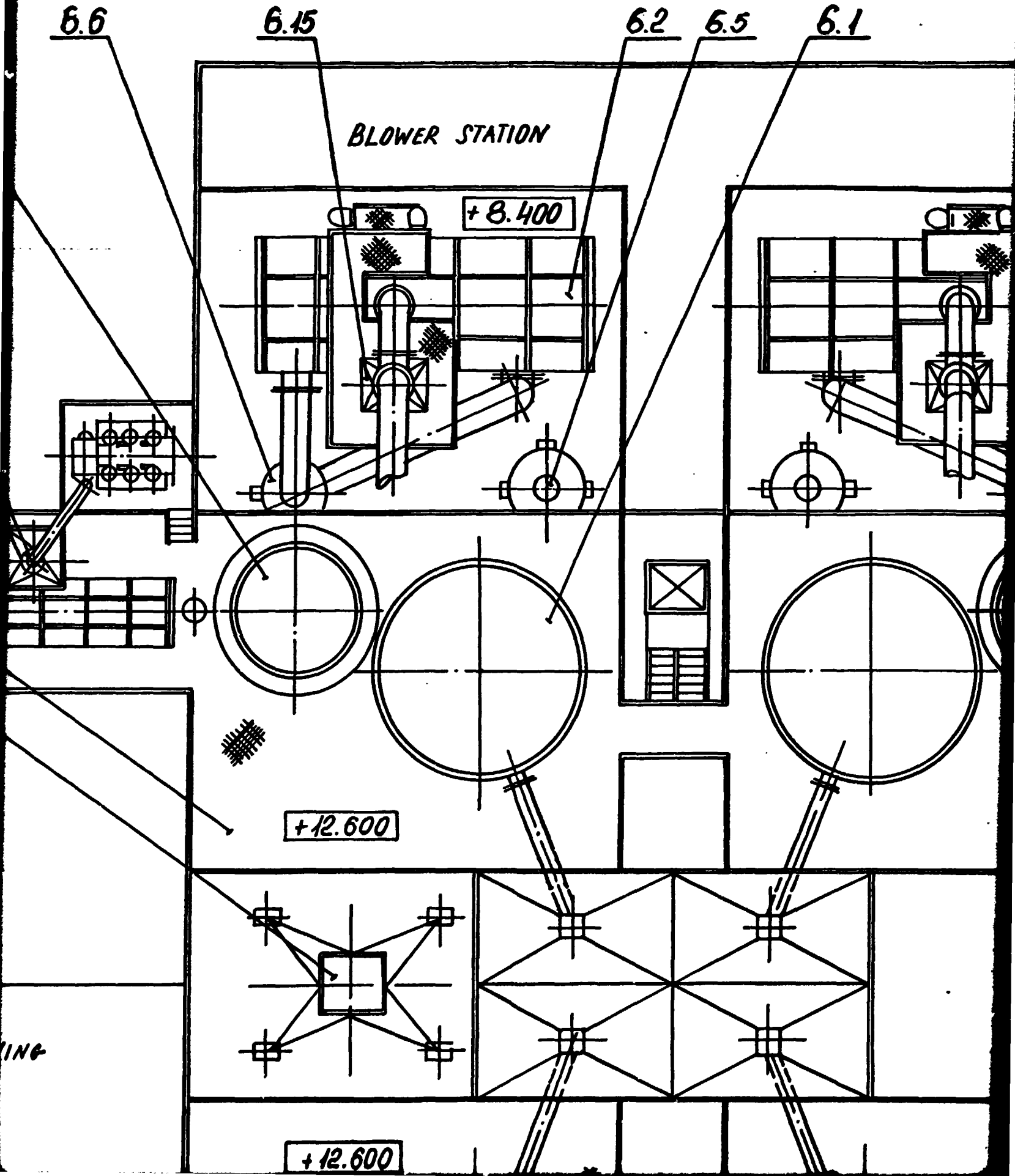
SIZE A3×4


SECTION 1
6.4
6.19
6.3
6.6
O
N
M
L
K
J
I
H
G
5400
3000
5200
5200
5200
3200
5000
5000
70400
LOCATION AREA OF
UNIT NO 4
FOR EXPANSION
6.24
LOCATION AREA FOR GAS CLEANING
PLANT OF ROASTER N3

SCALE 1:200

SECTION 2

B

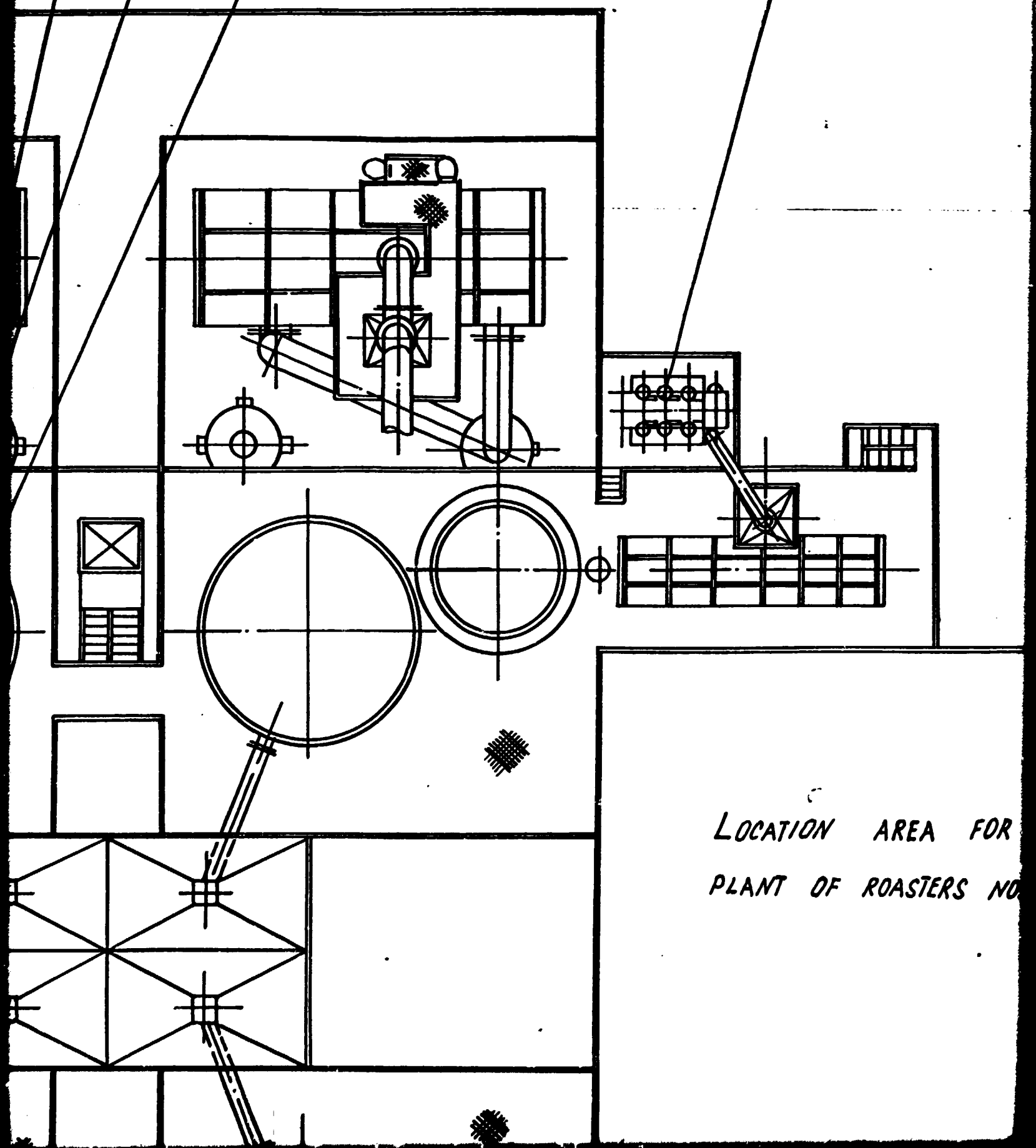


SCALE 1:200

B

SECTION 3

6.2 6.5 6.1 6.17

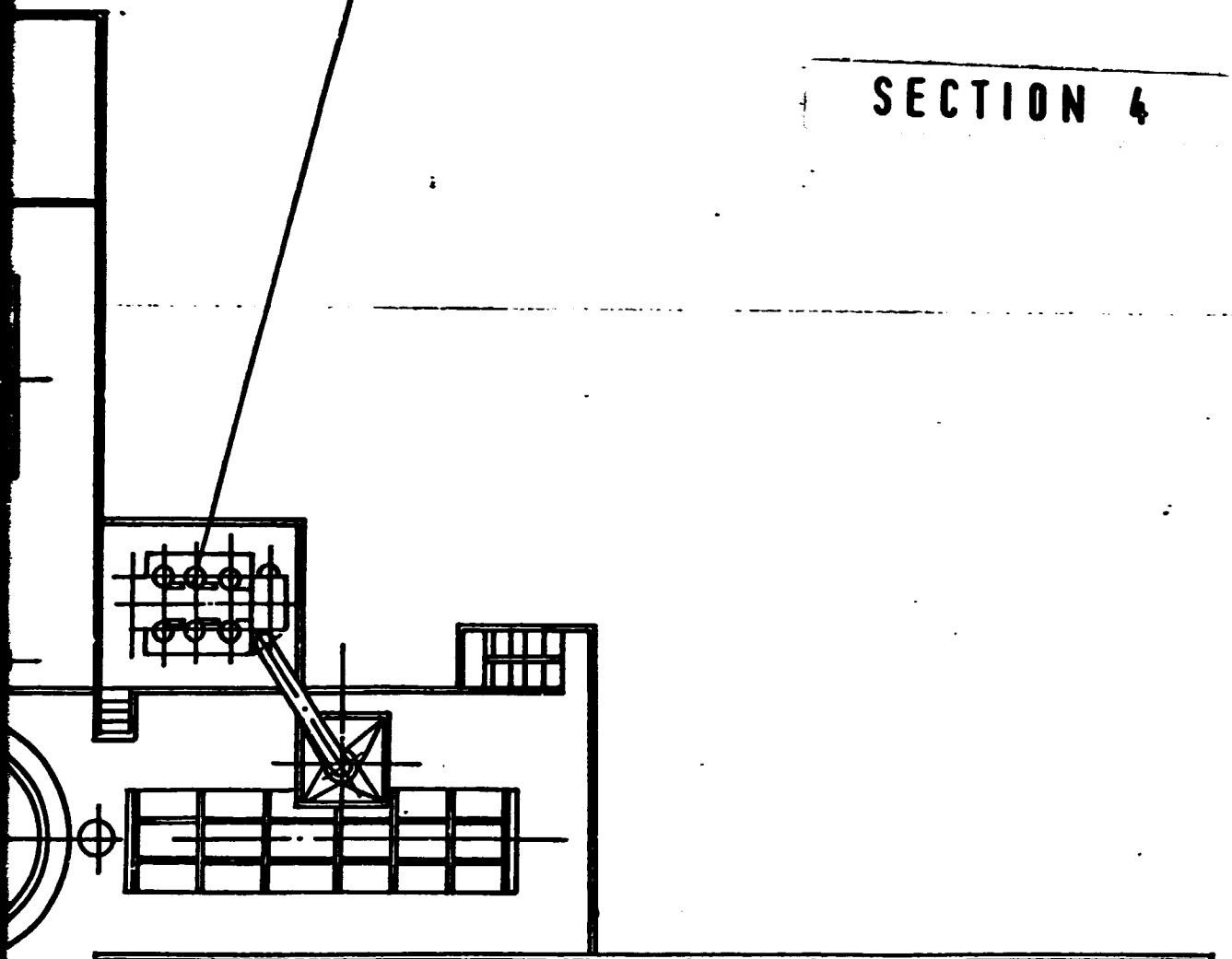


LOCATION AREA FOR

PLANT OF ROASTERS NO

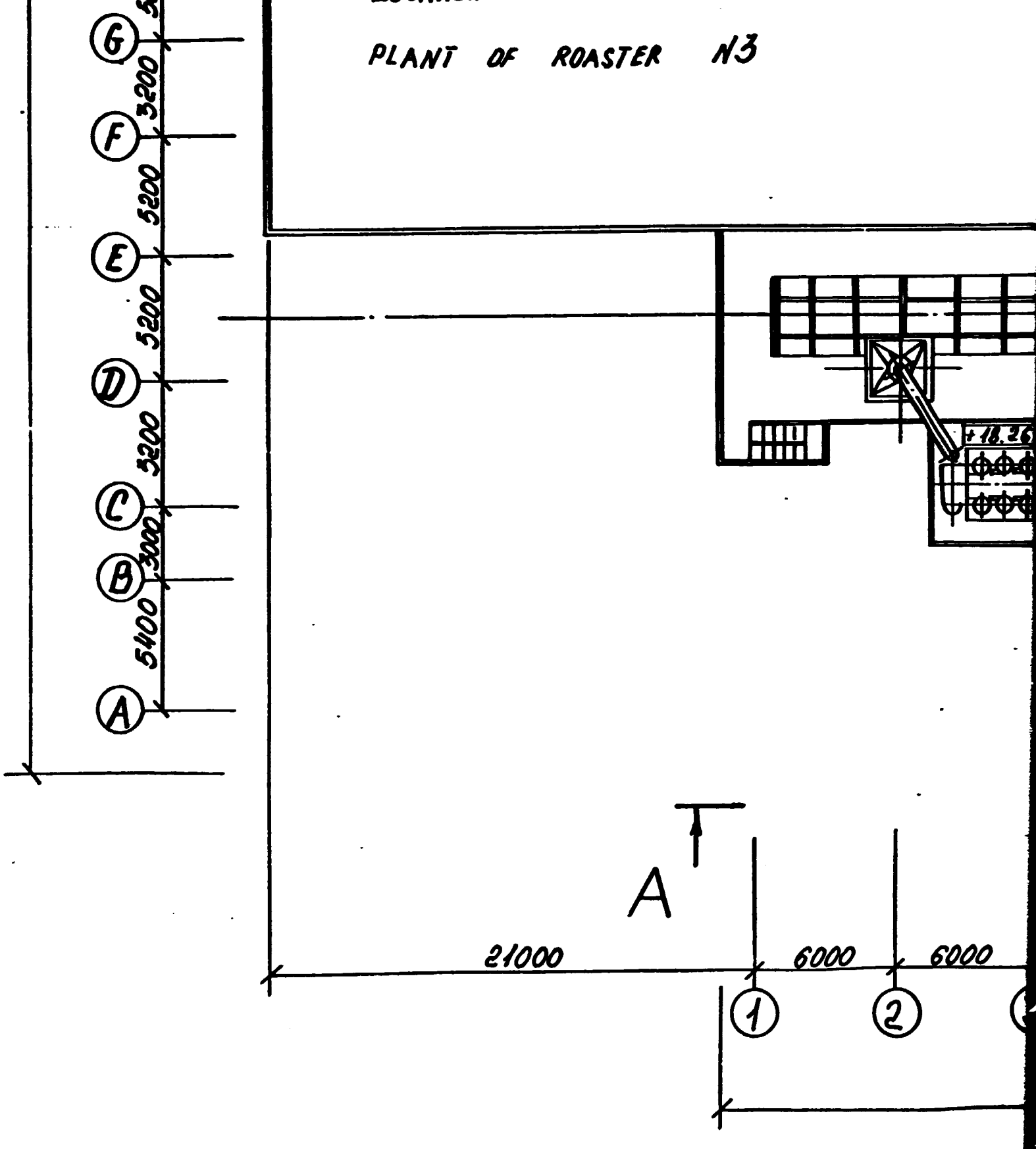
6.17

SECTION 4

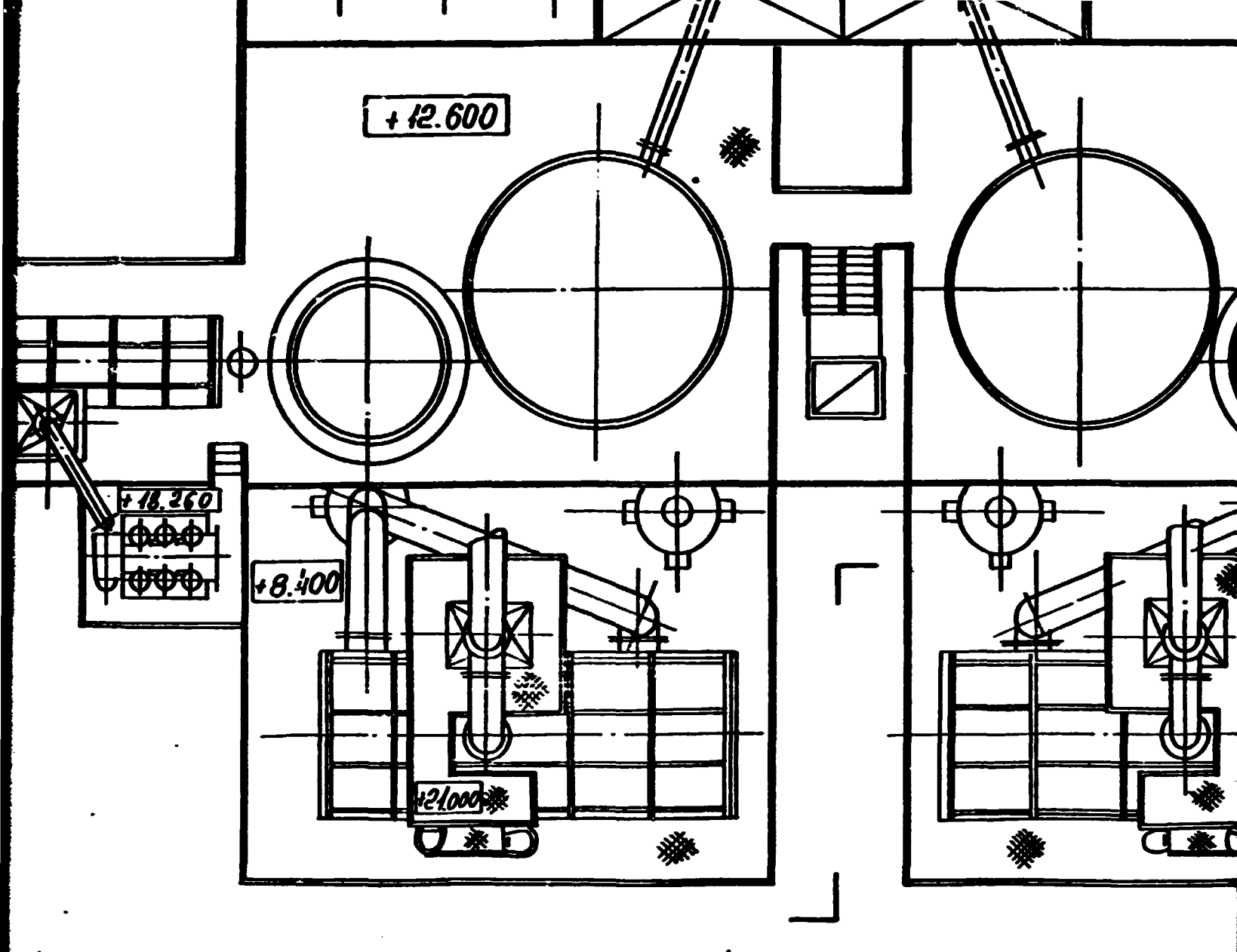


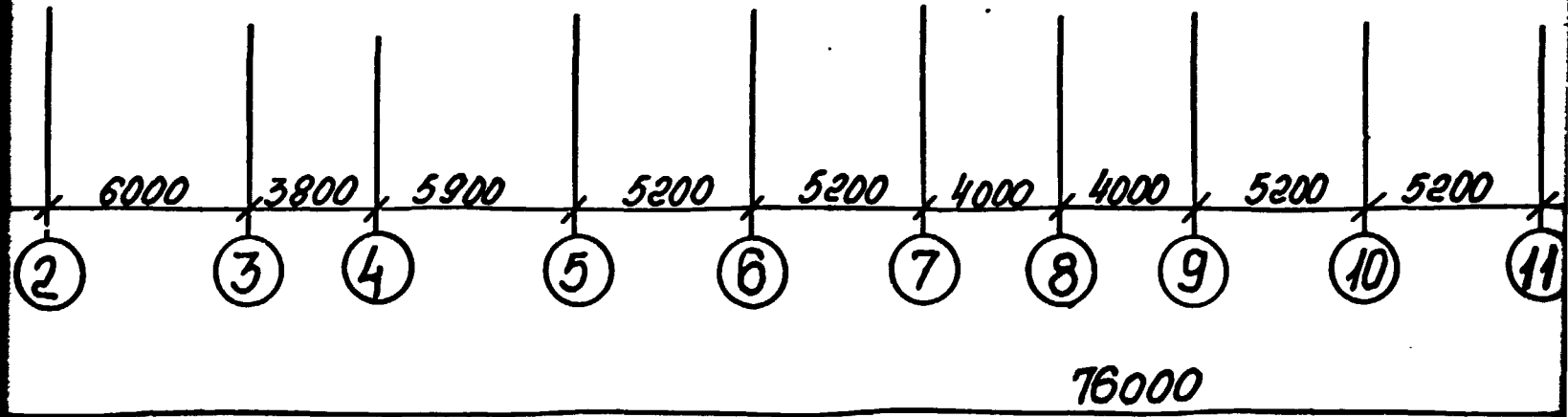
LOCATION AREA FOR GAS CLEANING PLANT OF ROASTERS NOS. 1 AND 2

PLANT OF ROASTER N3



SECTION 5

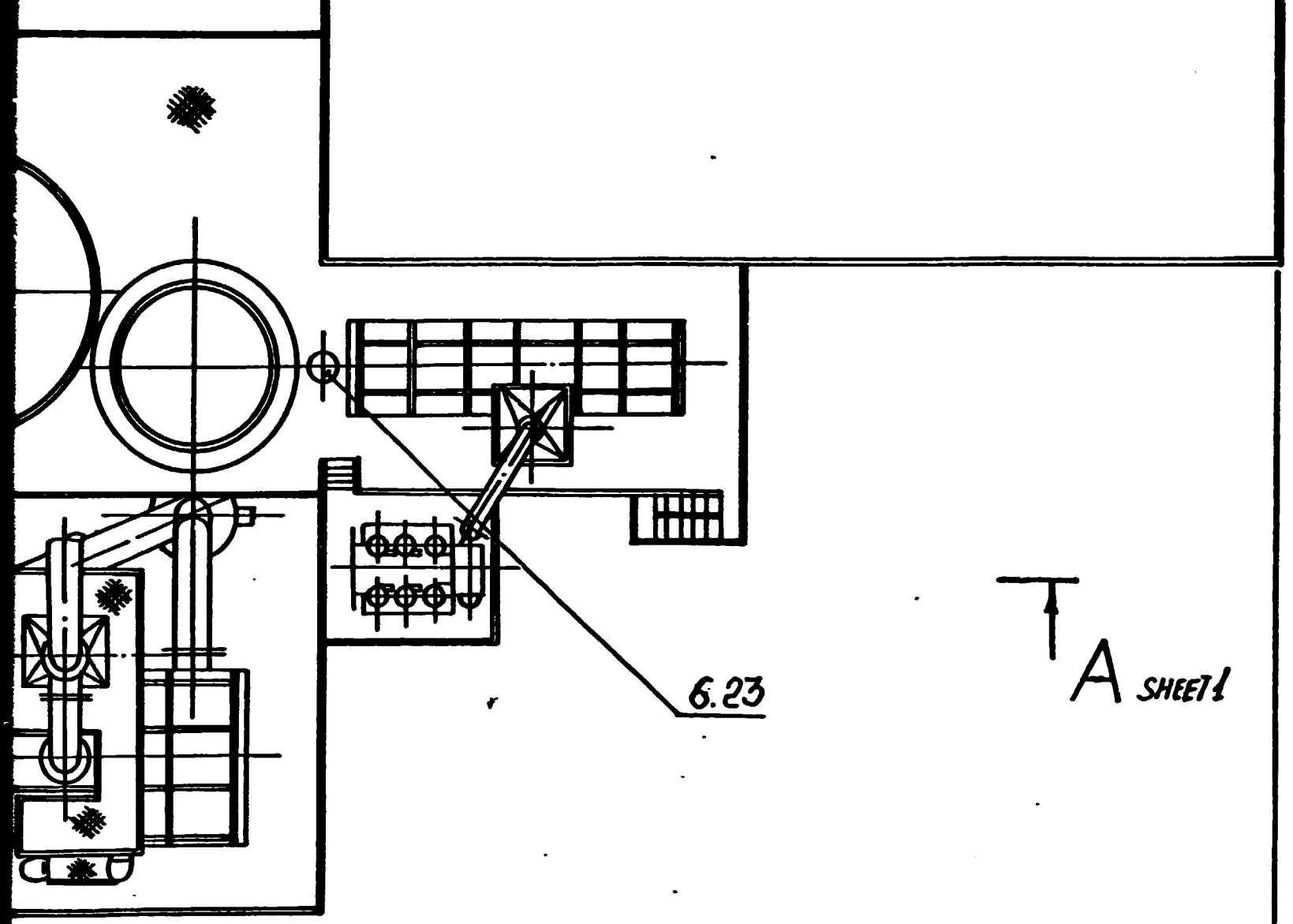


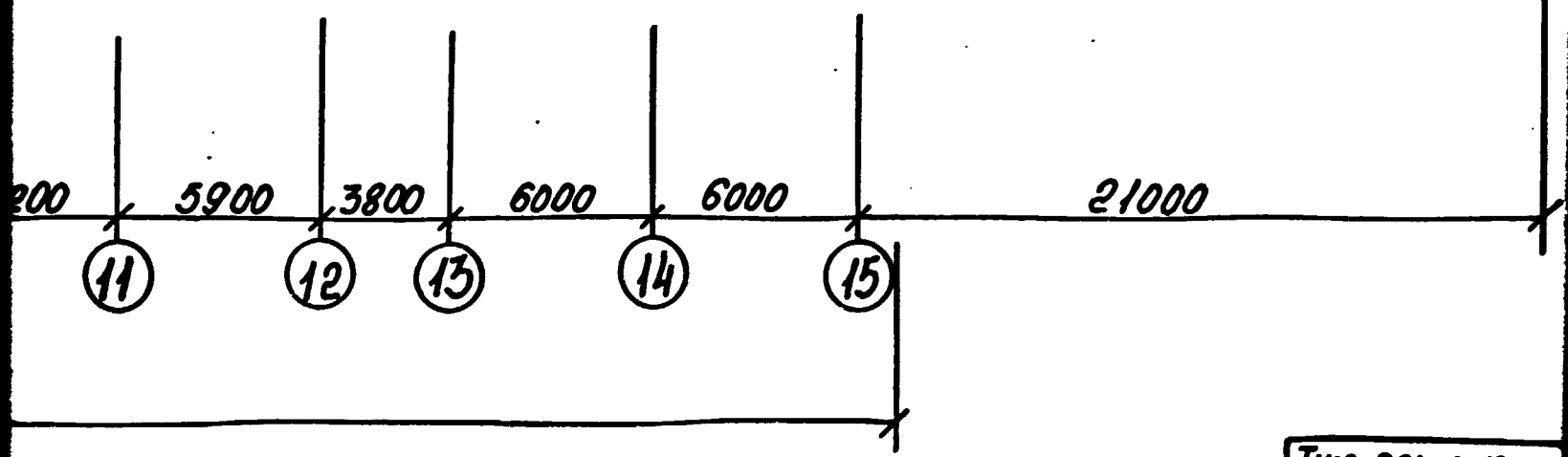


76000

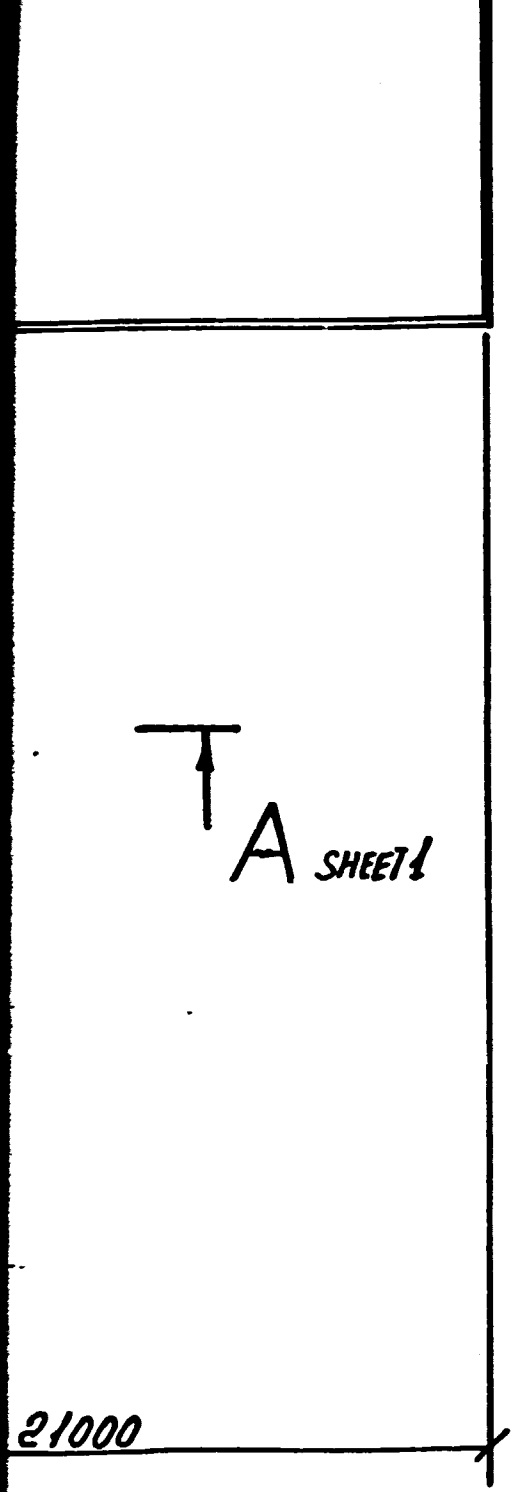
SECTION 6

B SHEET 1





SECTION 7



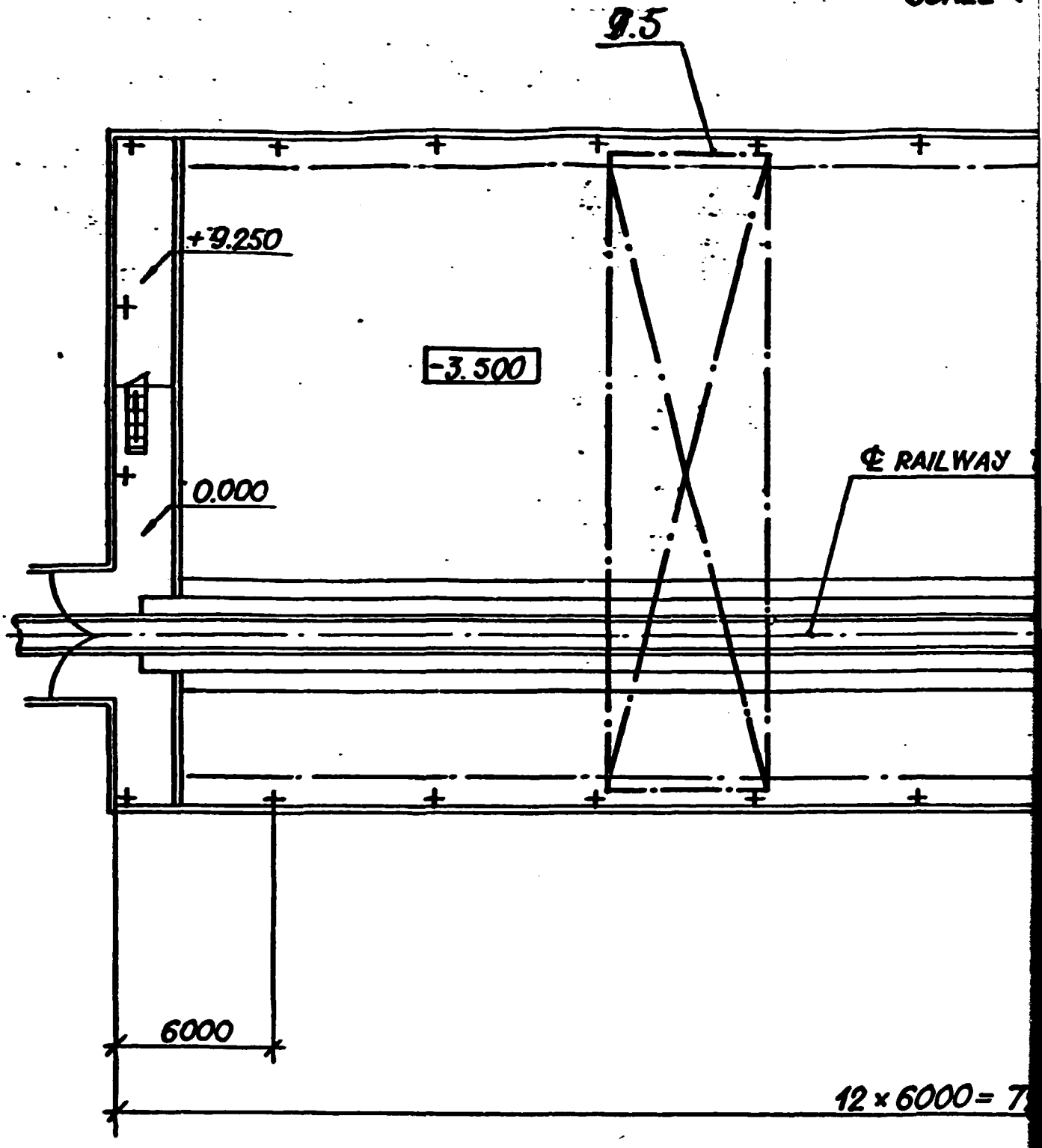
SECTION 8

1390368-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
ROASTING AND REDUCTION WITH BLOWER STATION	STAGE: FEASIBILITY	SHEET: 2	SHEETS:
PLAN AT EL + 12.600	VAMI LENINGRAD		

Size A1

PLAN AT EL. 3.50

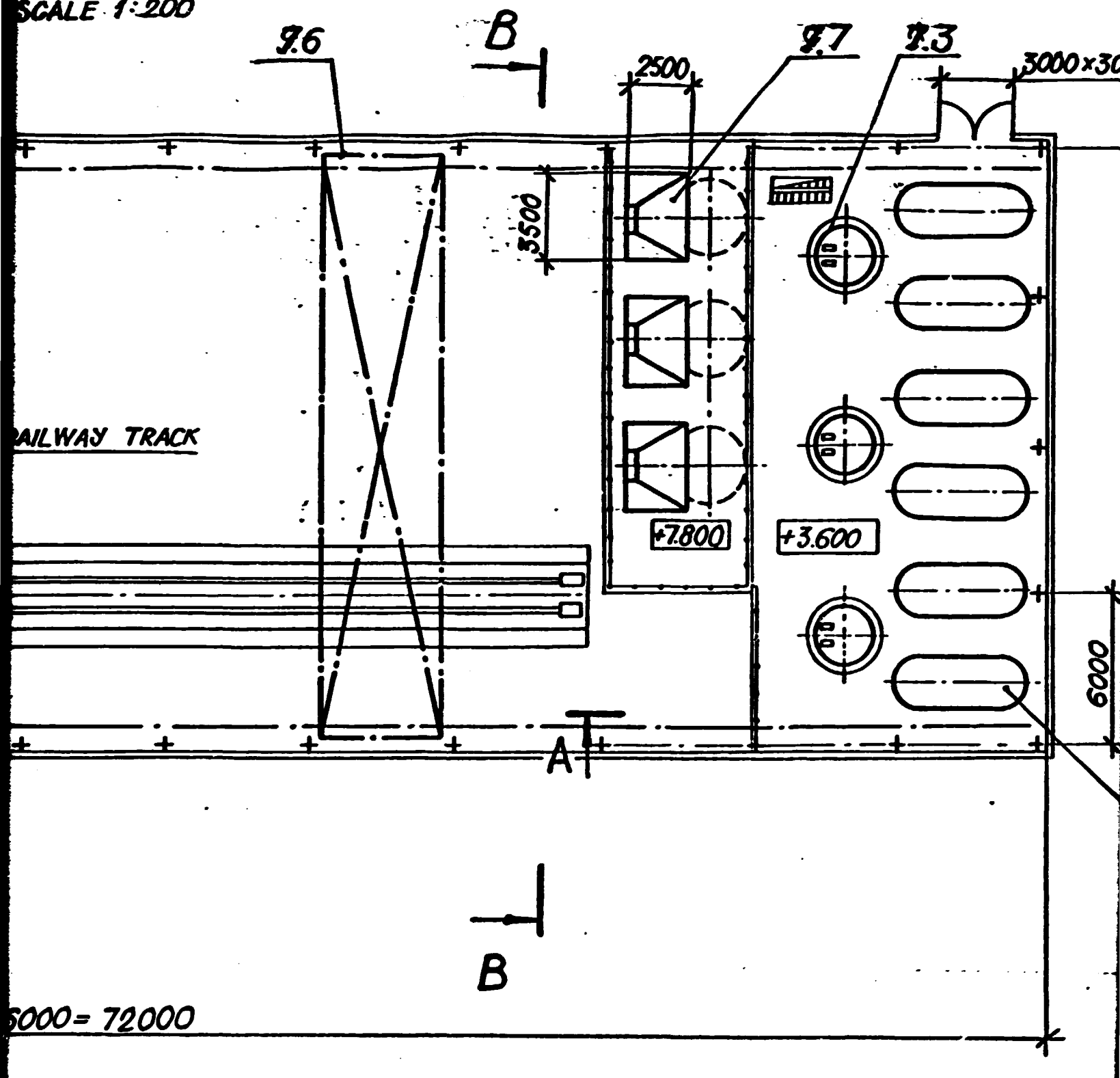
SCALE 1



SECTION 1

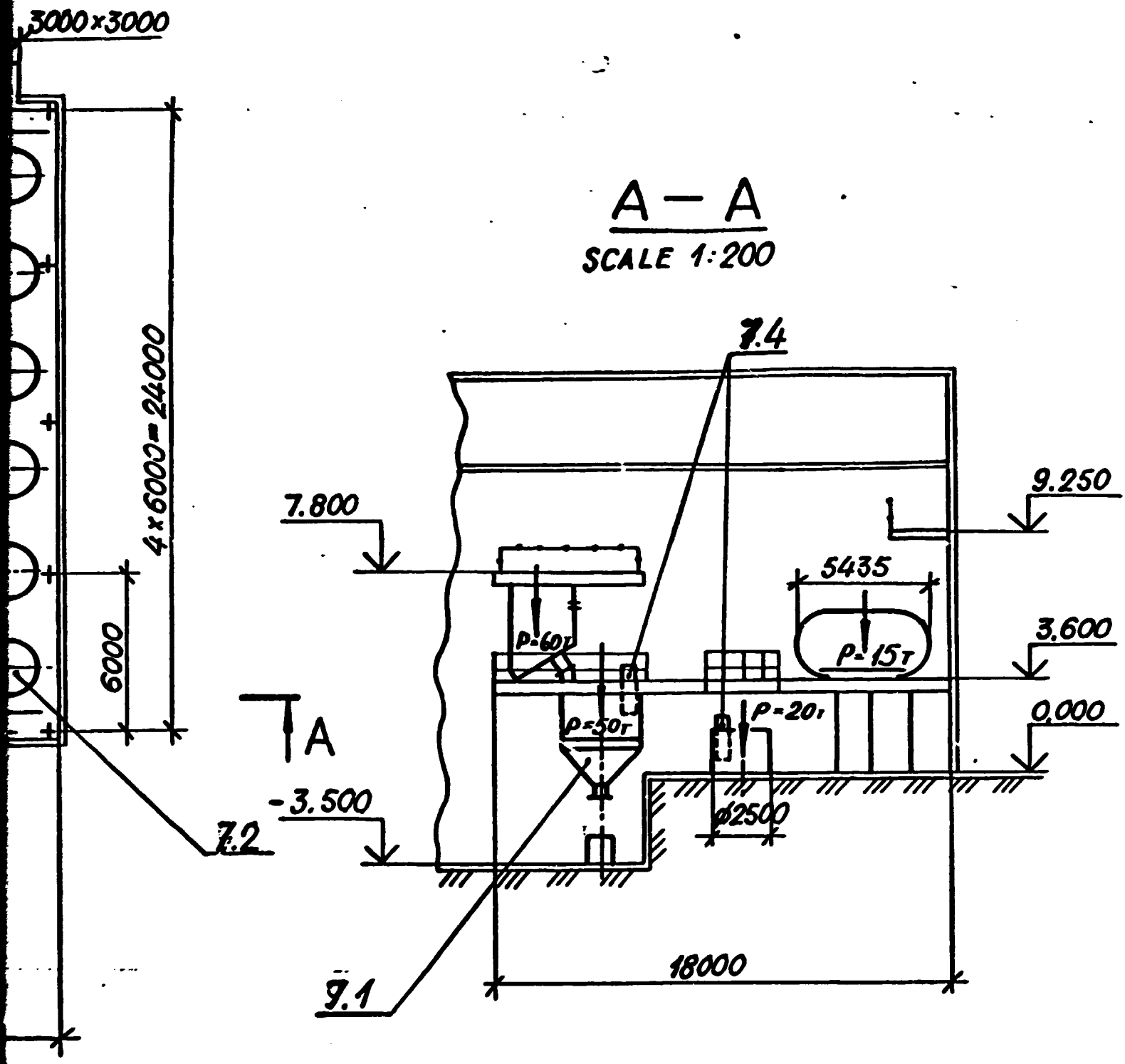
..3.500;3.600; 7.800

SCALE 1:200



6000= 72000

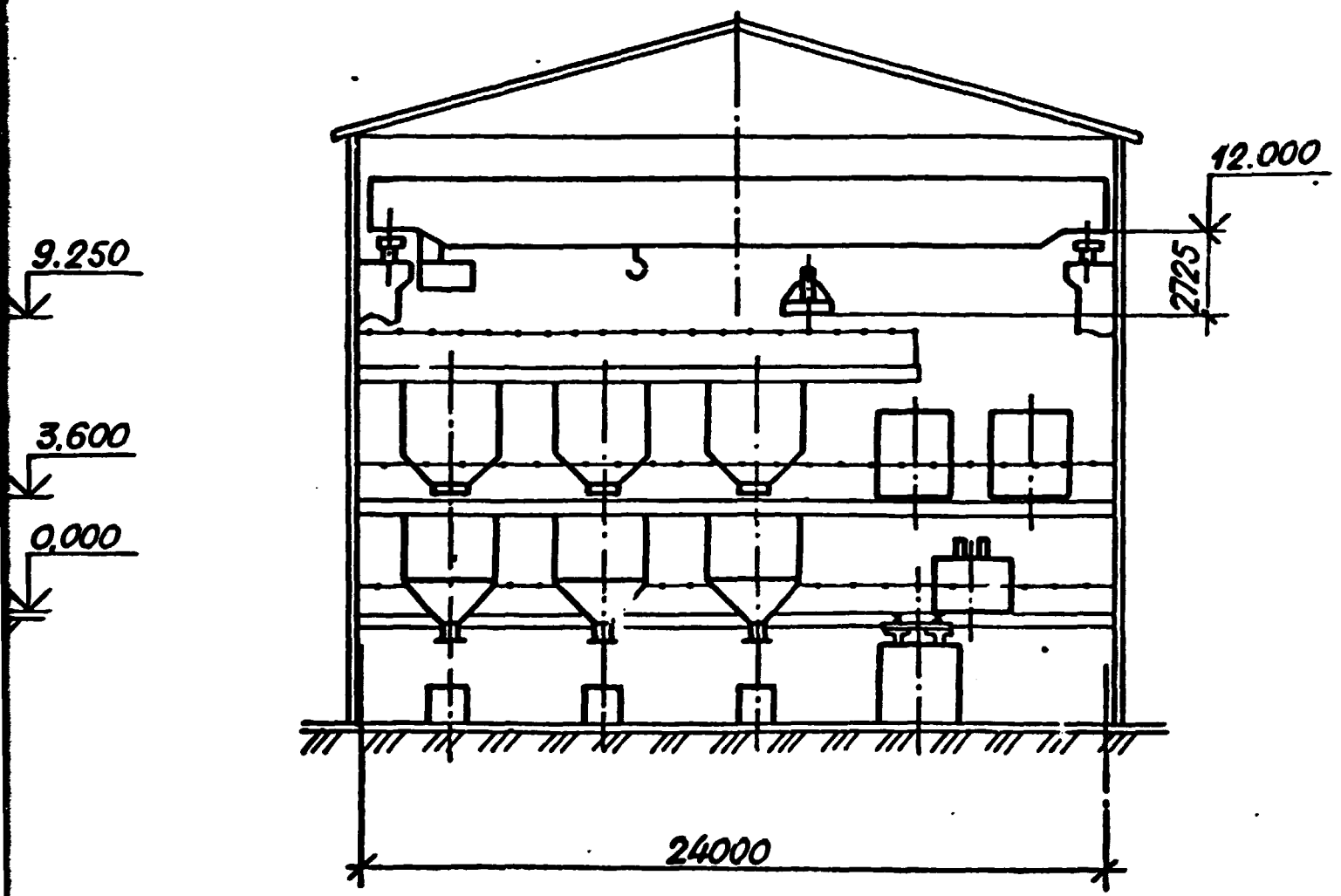
SECTION 2


3000×3000
4×6000=24000
6000
A
A — A
SCALE 1:200
7.4
7.800
9.250
5435
3.600
P-60т
P-15т
P-20т
P-50т
0.000
-3.500
7.2
ø2500
18000
7.1

SECTION 3

B — B

SCALE 1:200



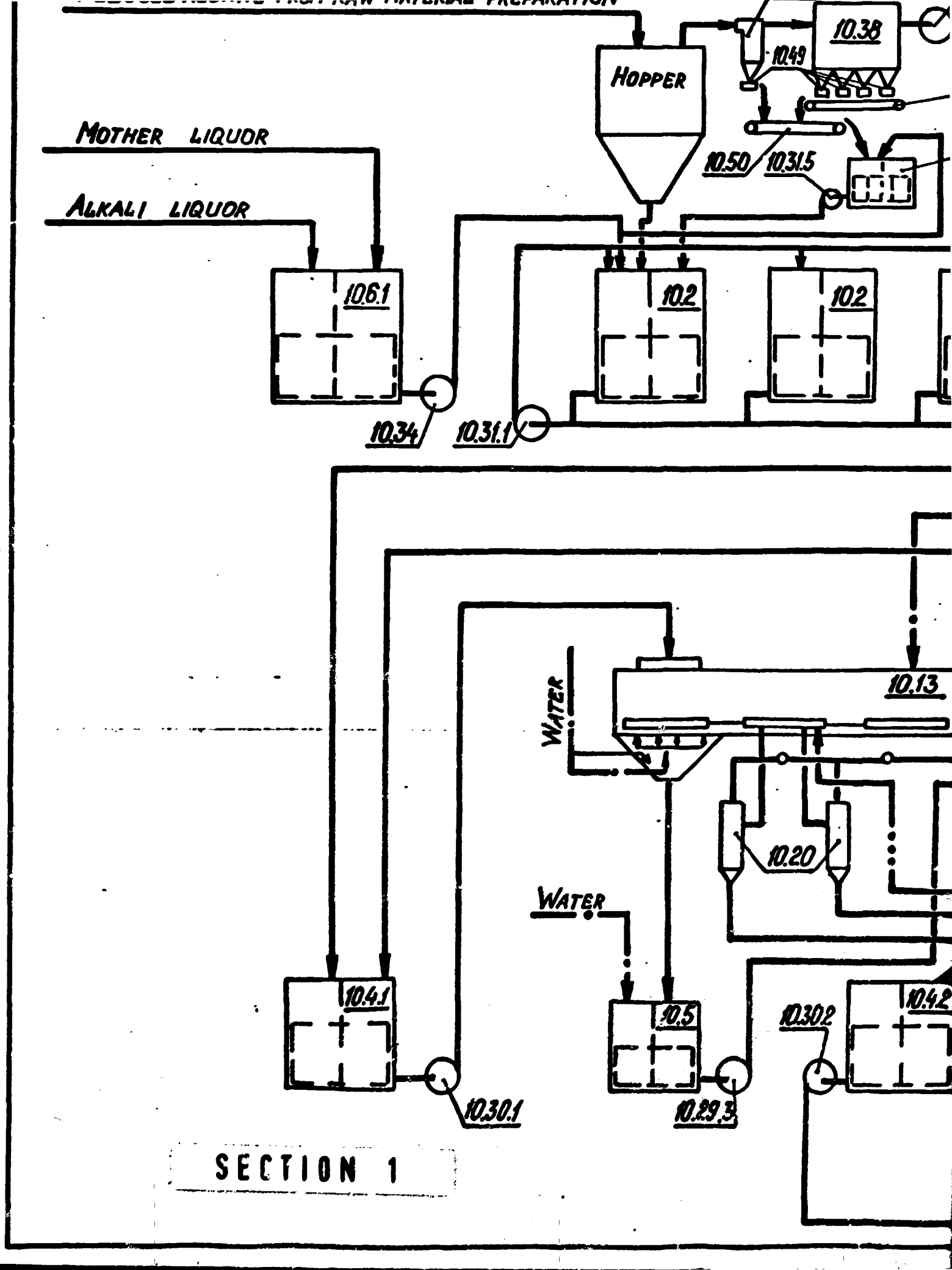
SECTION 4

SECTION 5

UNIDO CONTRACT NO 85/108

1390370-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
SULPHUR STORAGE	STAGE: FEASIBILITY	SHEET	SHEETS: 1
PLANS AT EL. 3.500; 3.600; 7.800. SECTIONS A-A, B-B	VAMI LENINGRAD		

SIZE A4x5


PREPARATION OF RAW MATERIAL PREPARATION
HOPPER
10.38
10.49
MOTHER LIQUOR
ALKALI LIQUOR
10.50
10.31.5
10.6.1
10.2
10.2
10.34
10.31.1
10.13
WATER
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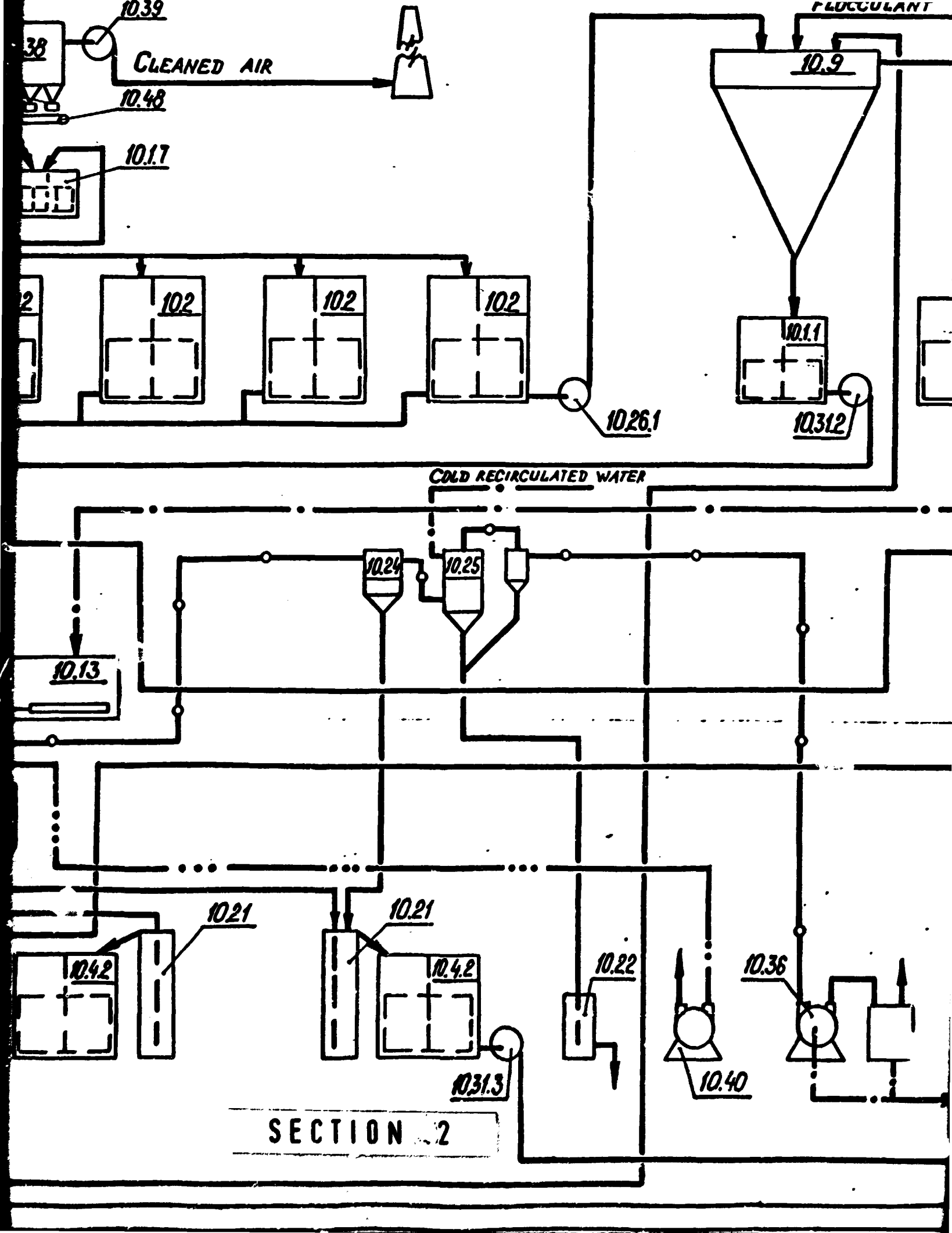
WATER
10.4.1
10.5
10.30.2
10.42
10.30.1
10.29.3
SECTION 1


10.39
38
CLEANED AIR
10.48
10.1.7
FLOCCULANT
10.9
10.2
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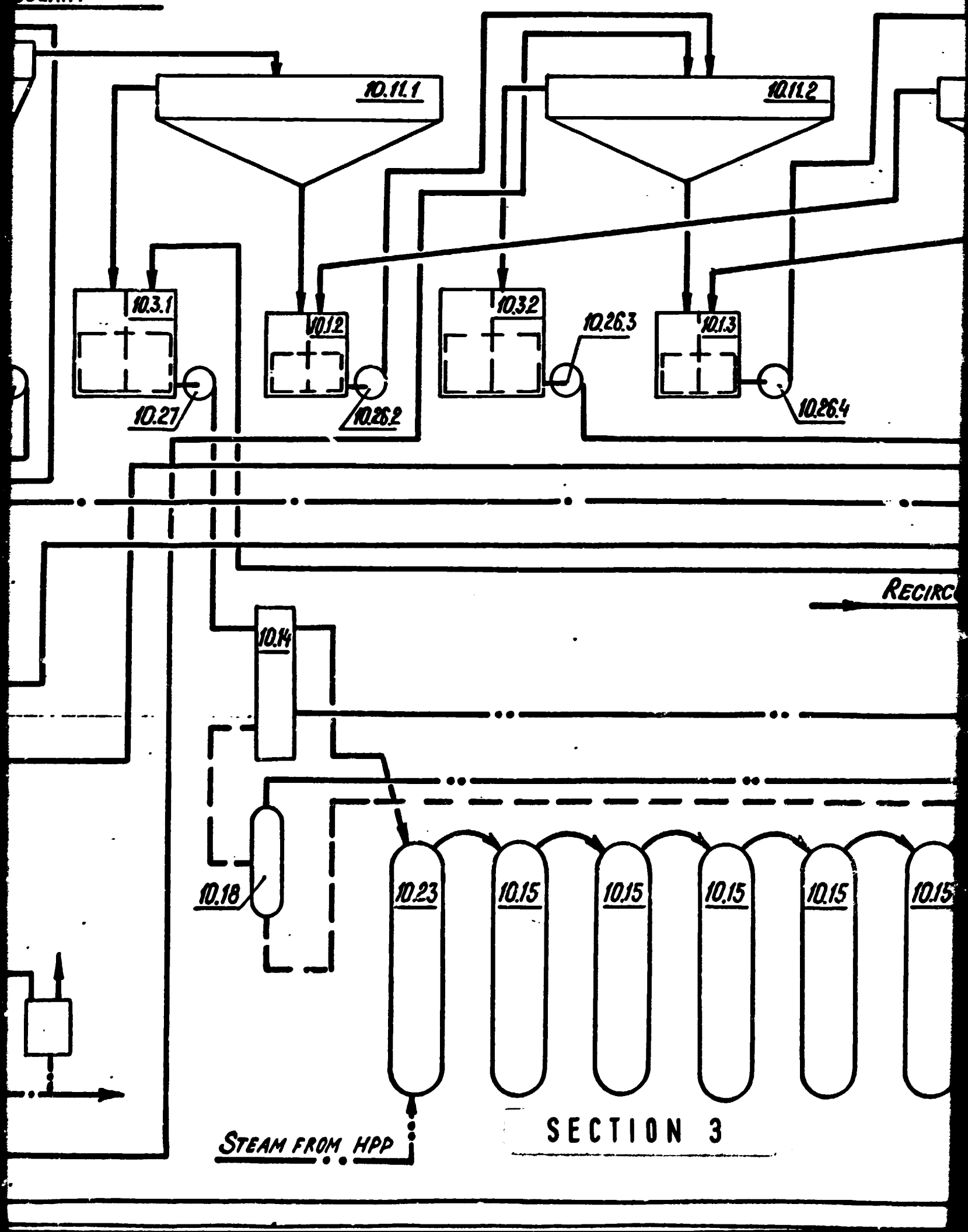
10.2
10.1.1
10.26.1
10.31.2
COLD RECIRCULATED WATER
10.24
10.25
10.13
10.21
10.21
10.4.2
10.4.2
10.22
10.36
10.40
10.31.3
SECTION 2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10.3.1
10.12
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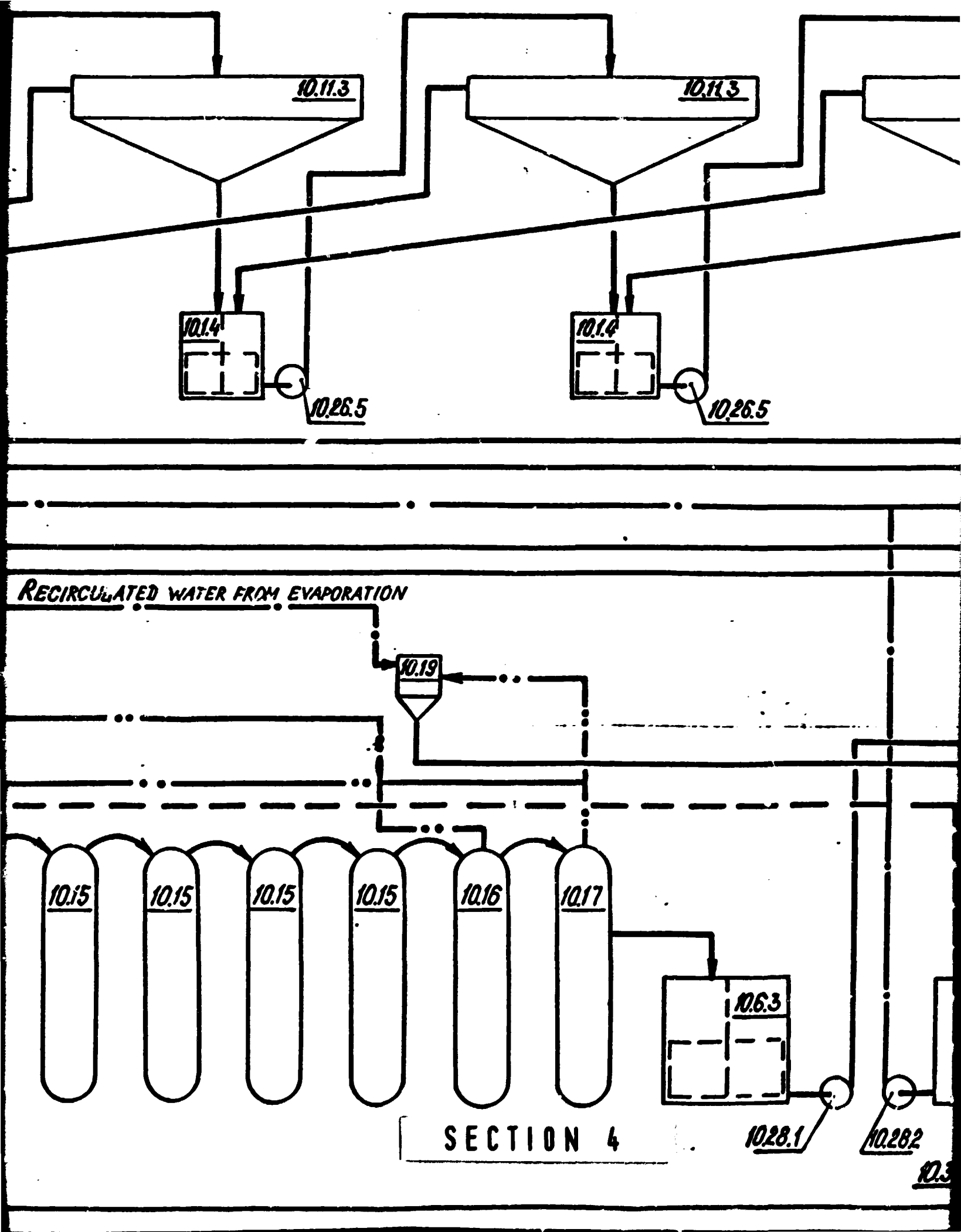
10.26.3
10.1.3
10.27
10.26.2
10.26.4
RECIRC
10.14
10.18
10.23
10.15
10.15
10.15
10.15
10.15
STEAM FROM HPP
SECTION 3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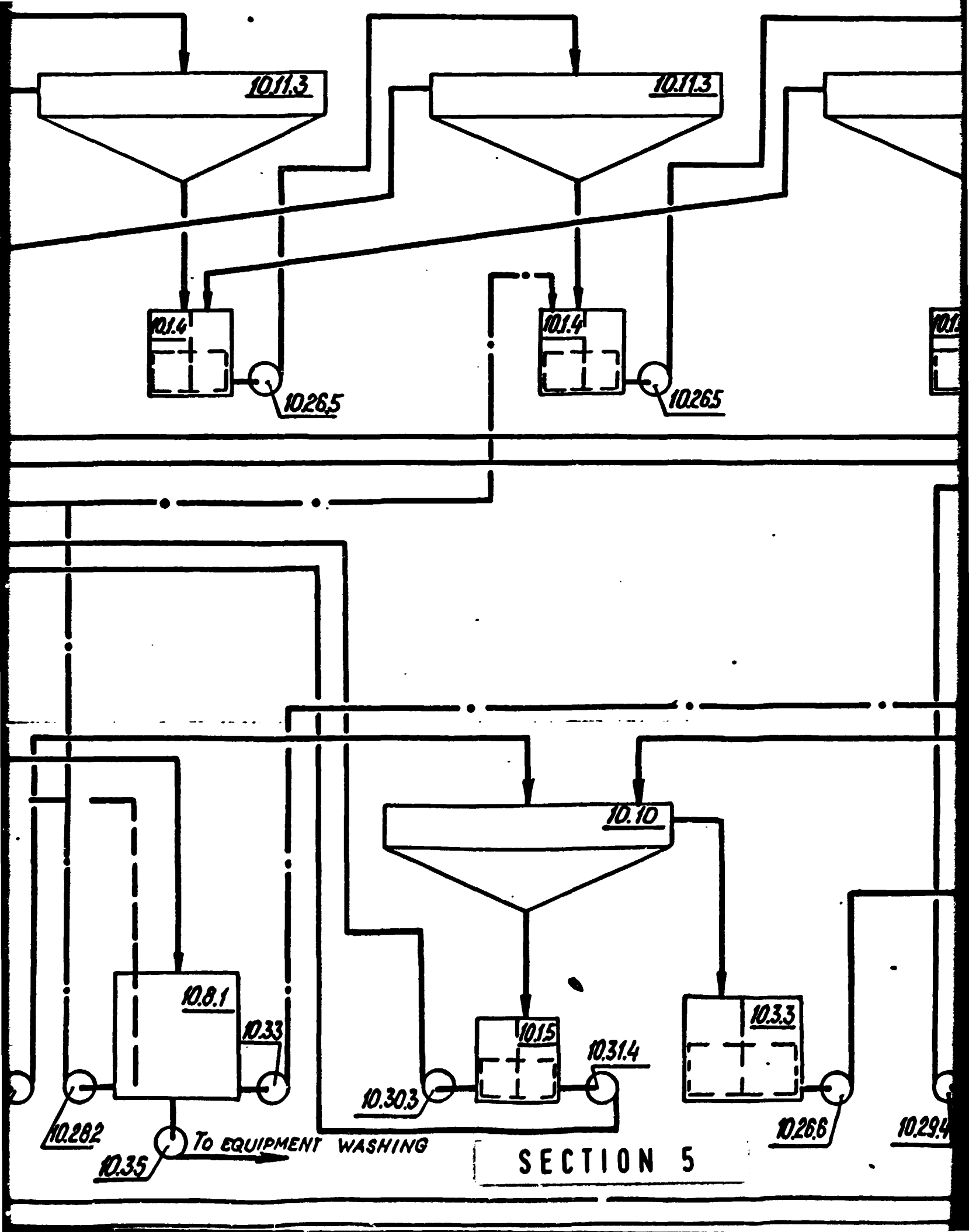
10.1.4
10.1.4
10.26.5
10.26.5
RECIRCULATED WATER FROM EVAPORATION
10.19
10.15
10.15
10.15
10.15
10.16
10.17
10.6.3
10.28.1
10.28.2
SECTION 4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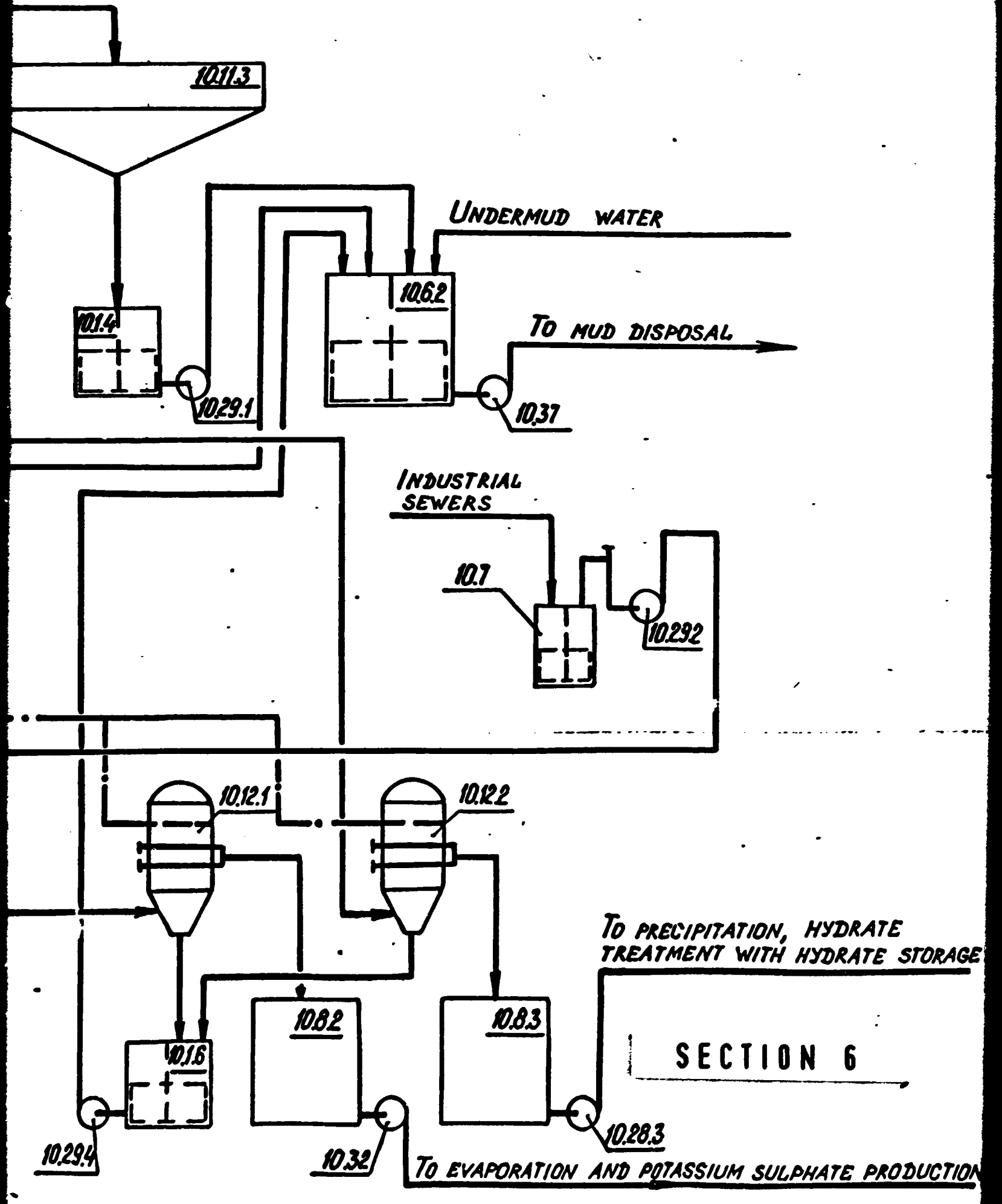
10.1.4
10.26.5
10.1.4
10.26.5
10.10
10.8.1
10.33
10.15
10.31.4
10.3.3
10.28.2
10.35
To EQUIPMENT WASHING
10.30.3
10.26.6
10.29.4
SECTION 5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UNDERMUD WATER
10.6.2
10.1.4
TO MUD DISPOSAL
10.29.1
10.37
INDUSTRIAL SEWERS
10.7
10.29.2
10.12.1
10.12.2
TO PRECIPITATION, HYDRATE TREATMENT WITH HYDRATE STORAGE
10.8.2
10.8.3
10.1.6
SECTION 6
10.29.4
10.32
10.28.3
TO EVAPORATION AND POTASSIUM SULPHATE PRODUCTION

LEGEND

SLURRY, LIQUOR

WATER

CONDENSATE

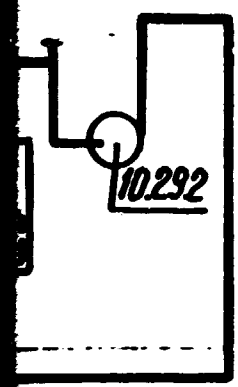
COMPRESSED AIR

STEAM

VACUUM

WATER

UD DISPOSAL



SECTION 7

TO PRECIPITATION, HYDRATE TREATMENT WITH HYDRATE STORAGE

AND POTASSIUM SULPHATE PRODUCTION

UNIDO CONTRAC

13

IRAN. ALUNITE B

DIGESTION, DESILIC AND MUD WASH

EQUIPMENT PROCES FLOWSHEET

LEGEND

SLURRY, LIQUOR

WATER

CONDENSATE

COMPRESSED AIR

STEAM

VACUUM

SECTION 8

UNIDO CONTRACT No 85/108

1339552-TM

IRAN. ALUNITE BASED ALUMINA PLANT

DIGESTION, DESILICATION AND MUD WASHING

STAGE	SHEET	SHEETS
FEASIBILITY	1	6

EQUIPMENT PROCESS FLOWSHEET

VAMI LENINGRAD

SIZE A4x1

SECTION 1

ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK	ITEM	DE
10.1.1	CHAIN AGITATOR	Φ4500 x 3000	4		10.16	I STA
10.1.2	CHAIN AGITATOR	Φ4500 x 3000	2		10.17	II STA
10.1.3	CHAIN AGITATOR	Φ4500 x 3000	2		10.18	FLAS
10.1.4	CHAIN AGITATOR	Φ4500 x 3000	5		10.19	MIXIN
10.1.5	CHAIN AGITATOR	Φ4500 x 3000	4		10.20	VACU
10.1.6	CHAIN AGITATOR	Φ4500 x 3000	2		10.21	HYDRA
10.1.7	CHAIN AGITATOR	Φ4500 x 3000	2		10.22	HYDR
10.2	CHAIN AGITATOR	Φ4500 x 6000	10		10.23	HEATI
10.3.1	CHAIN AGITATOR	Φ 7500 x 4500	2		10.24	TRAP
10.3.2	CHAIN AGITATOR	Φ 7500 x 4500	2		10.25	BARON
10.3.3	CHAIN AGITATOR	Φ7500 x 4500	4		10.26.1	CENTRI
10.4.1	CHAIN AGITATOR	Φ4500 x 4500	2		10.26.2	CENTRI
10.4.2	CHAIN AGITATOR	Φ4500 x 4500	4		10.26.3	CENTRI
10.5	CHAIN AGITATOR	Φ3000 x 3000	6		10.26.4	CENTR
10.6.1	CHAIN AGITATOR	Φ7500 x 7500	2		10.26.5	CENTR
10.6.2	CHAIN AGITATOR	Φ7500 x 7500	2		10.26.6	CENTR
10.6.3	CHAIN AGITATOR	Φ7500 x 7500	2		10.27	CENTR
10.7	SUMP AGITATOR	Φ2000 x 2500	10		10.28.1	CENTR
10.8.1	TANK	Φ 7500 x 7500	2		10.28.2	CENTR
10.8.2	TANK	Φ7500 x 7500	2		10.28.3	CENTR
10.8.3	TANK	Φ 7500 x 7500	1		10.29.1	CENTR
10.9	HYDROSEPARATOR	Φ 10000	4		10.29.2	CENTR
10.10	SINGLE-CHAMBER THICKENER	Φ 20000	4		10.29.3	CENTR
10.11.1	SINGLE-CHAMBER THICKENER	Φ 32000	2		10.29.4	CENTR
10.112	SINGLE-CHAMBER THICKENER	Φ32000	2		10.30.1	CENTR
10.11.3	SINGLE-CHAMBER THICKENER	Φ32000	5		10.30.2	CENTR
10.12.1	LEAF FILTER	F = 225 M²	4		10.30.3	CENTR
10.122	LEAF FILTER	F = 225 M²	3		10.31.1	CENTR
10.13	ROTARY PAN FILTER	F = 50 M²	6		10.312	CENTR
10.14	HEAT EXCHANGER	F = 180 M²	6		10.31.3	CENTR
10.15	REACTION AUTOCLAVE	Φ2400 x 14300	24		10.31.4	CENTR
	V = 63 M³					

SECTION 2

ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
10.16	I STAGE SEPARATOR	Φ 2600	3	
10.17	II STAGE SEPARATOR	Φ 3600	3	
10.18	FLASH TANK	Φ 1000	3	
10.19	MIXING HEATER	Φ 1000	3	
10.20	VACUUM-RECEIVER	Φ 1200	12	
10.21	HYDRAULIC SEAL	Φ 1000 x 3600	2	
10.22	HYDRAULIC SEAL	Φ 1500 x 2500	2	
10.23	HEATING AUTOCLAVE	Φ 2400 x 14300	3	
10.24	TRAP	V = 1 M³	3	
10.25	BAROMETRIC CONDENSER	Φ 800	3	
10.26.1	CENTRIFUGAL PUMP	315 M³/HR 40 M	6	
10.26.2	CENTRIFUGAL PUMP	315 M³/HR 40 M	4	
10.26.3	CENTRIFUGAL PUMP	315 M³/HR 40 M	3	
10.26.4	CENTRIFUGAL PUMP	315 M³/HR 40 M	4	
10.26.5	CENTRIFUGAL PUMP	315 M³/HR 40 M	8	
10.26.6	CENTRIFUGAL PUMP	315 M³/HR 40 M	4	
10.27	CENTRIFUGAL PUMP	315 M³/HR 56 M	4	
10.28.1	CENTRIFUGAL PUMP	250 M³/HR 28 M	3	
10.28.2	CENTRIFUGAL PUMP	250 M³/HR 28 M	3	
10.28.3	CENTRIFUGAL PUMP	250 M³/HR 28 M	2	
10.29.1	CENTRIFUGAL PUMP	160 M³/HR 20 M	2	
10.29.2	CENTRIFUGAL PUMP	160 M³/HR 20 M	10	
10.29.3	CENTRIFUGAL PUMP	160 M³/HR 20 M	12	
10.29.4	CENTRIFUGAL PUMP	160 M³/HR 20 M	2	
10.30.1	CENTRIFUGAL PUMP	100 M³/HR 31,5 M	6	
10.30.2	CENTRIFUGAL PUMP	100 M³/HR 31,5 M	2	
10.30.3	CENTRIFUGAL PUMP	100 M³/HR 31,5 M	4	
10.31.1	CENTRIFUGAL PUMP	100 M³/HR 16 M	2	
10.31.2	CENTRIFUGAL PUMP	100 M³/HR 16 M	8	
10.31.3	CENTRIFUGAL PUMP	100 M³/HR 16 M	2	
10.31.4	CENTRIFUGAL PUMP	100 M³/HR 16 M	4	

ITEM	DES
10.31.5	CENTRIF
10.32	CENTRIF
10.33	HIGH-P
10.34	CENTRI
10.35	CENTRI
10.36	VACUU
10.37	CENTRI
10.38	ELECTROS
10.39	I. D.
10.40	FAN
10.41	SINGLE-G
	ELECTRI
10.42	SINGLE-
	ELECTI
10.43	SINGLE-G
	ELECTRI
10.44	SINGLE-G
	ELECTRI
10.45	SINGLE-G
	ELECTRI
10.46	ELECTRI
10.47	DIRECT G
10.48	IMMERSE
10.49	SCREW

K	ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK	ITEM	DESC
	10.31.5	CENTRIFUGAL PUMP	100 M^3/HR 16 M	3		10.50	IMMERSE
	10.32	CENTRIFUGAL PUMP	400 M^3/HR 40 M	2			CONVEYO
	10.33	HIGH-PRESSURE PUMP	200 M^3/HR 95 M	2			
	10.34	CENTRIFUGAL PUMP	400 M^3/HR 20 M	3			
	10.35	CENTRIFUGAL PUMP	90 M^3/HR 30 M	3			
	10.36	VACUUM-PUMP	50 M^3/MIN	7			
	10.37	CENTRIFUGAL PUMP	1250 M^3/HR 71 M	3			
	10.38	ELECTROSTATIC PRECIPITATOR	F = 53 M^3	2			
	10.39	I. D. FAN	100000 M^3/HR	2			
	10.40	FAN	11,5 M^3/HR	6			
	10.41	SINGLE-GIRDER SUSPENDED	2 T CAPACITY	4	NOT SHOWN		
		ELECTRIC CRANE			ON FLOW-SHEET		
	10.42	SINGLE-GIRDER SUSPENDED	2 T CAPACITY	2	NOT SHOWN		
		ELECTRIC CRANE			OF FLOW-SHEET		
	10.43	SINGLE-GIRDER SUSPENDED	2T CAPACITY	1	NOT SHOWN		
		ELECTRIC CRANE			ON FLOW-SHEET		
	10.44	SINGLE-GIRDER SUSPENDED	2T CAPACITY	1	NOT SHOWN		
		ELECTRIC CRANE			ON FLOW-SHEET		
	10.45	SINGLE-GIRDER SUSPENDED	2T CAPACITY	2	NOT SHOWN		
		ELECTRIC CRANE			ON FLOW SHEET		
	10.46	ELECTRIC HOIST	2T CAPACITY	4	NOT SHOWN ON FLOWSHEET		
	10.47	DIRECT CURRENT CYCLONE	ϕ 1600	2			
	10.48	IMMERSED SCRAPER CONVEYOR	11 M/HR, LENGTH-20M	2			
	10.49	SCREW FEEDER	ϕ250 6T/HR	10			

SECTION 3

REMARK	ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
	1050	IMMERSED SCRAPER	22 T/HR. LENGTH-115M	1	
		CONVEYOR			

NOT SHOWN ON FLOW-SHEET

NOT SHOWN OF FLOW-SHEET

NOT SHOWN ON FLOW-SHEET

NOT SHOWN ON FLOW-SHEET

NOT SHOWN ON FLOW SHEET

NOT SHOWN ON FLOWSHEET

SECTION 4

UNIDO CONTRACT NO 85/108

1339552-TM

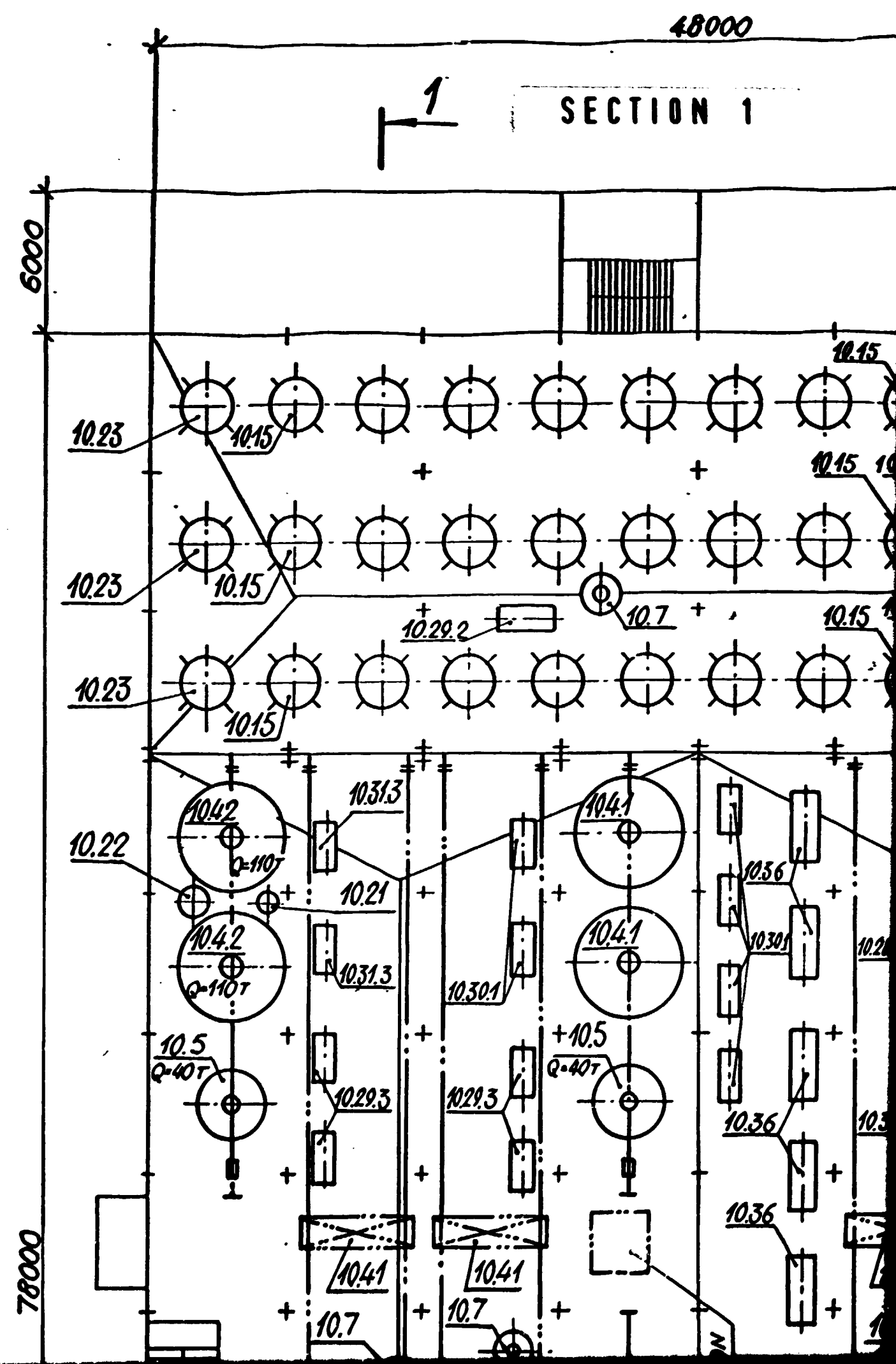
IRAN. ALUNITE BASED ALUMINA PLANT

DIGESTION, DESILICATION AND MUD WASHING

STAGE	SHEET	SHEETS
FEASIBILITY	2	

EQUIPMENT PROCESS FLOWSHEET

VAMI LENINGRAD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1
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6000
78000
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10.23
10.15
10.15
10.23
10.15
10.7
10.29.2
10.15
10.23
10.15
10.42
Q=110т
10.31.3
10.22
10.21
10.4.2
Q=110т
10.31.3
10.30.1
10.4.1
10.4.1
10.36
10.30.1
10.5
Q=40т
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Q=40т
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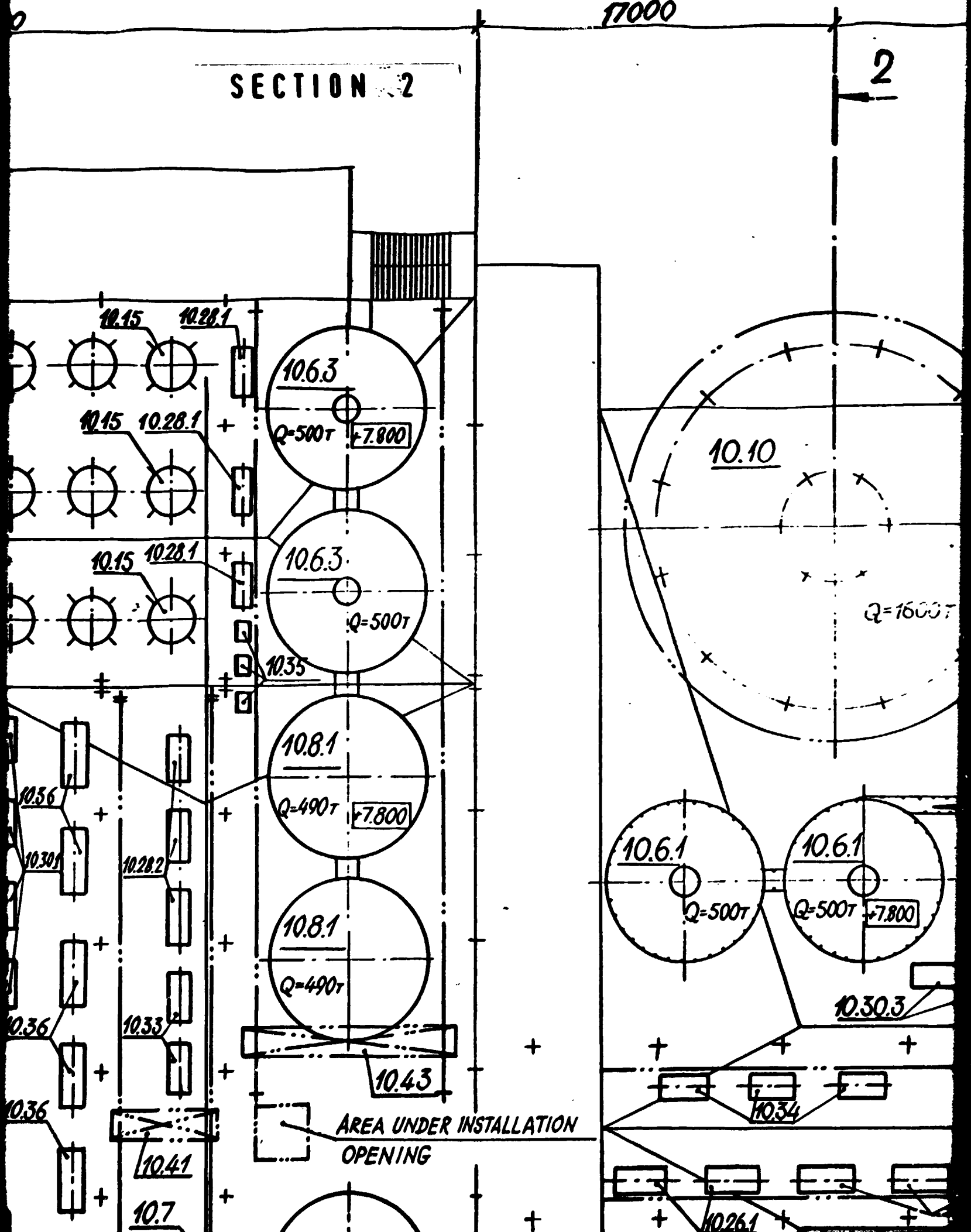
10.41
10.7
10.7


17000
SECTION 2
2
10.15
10.28.1
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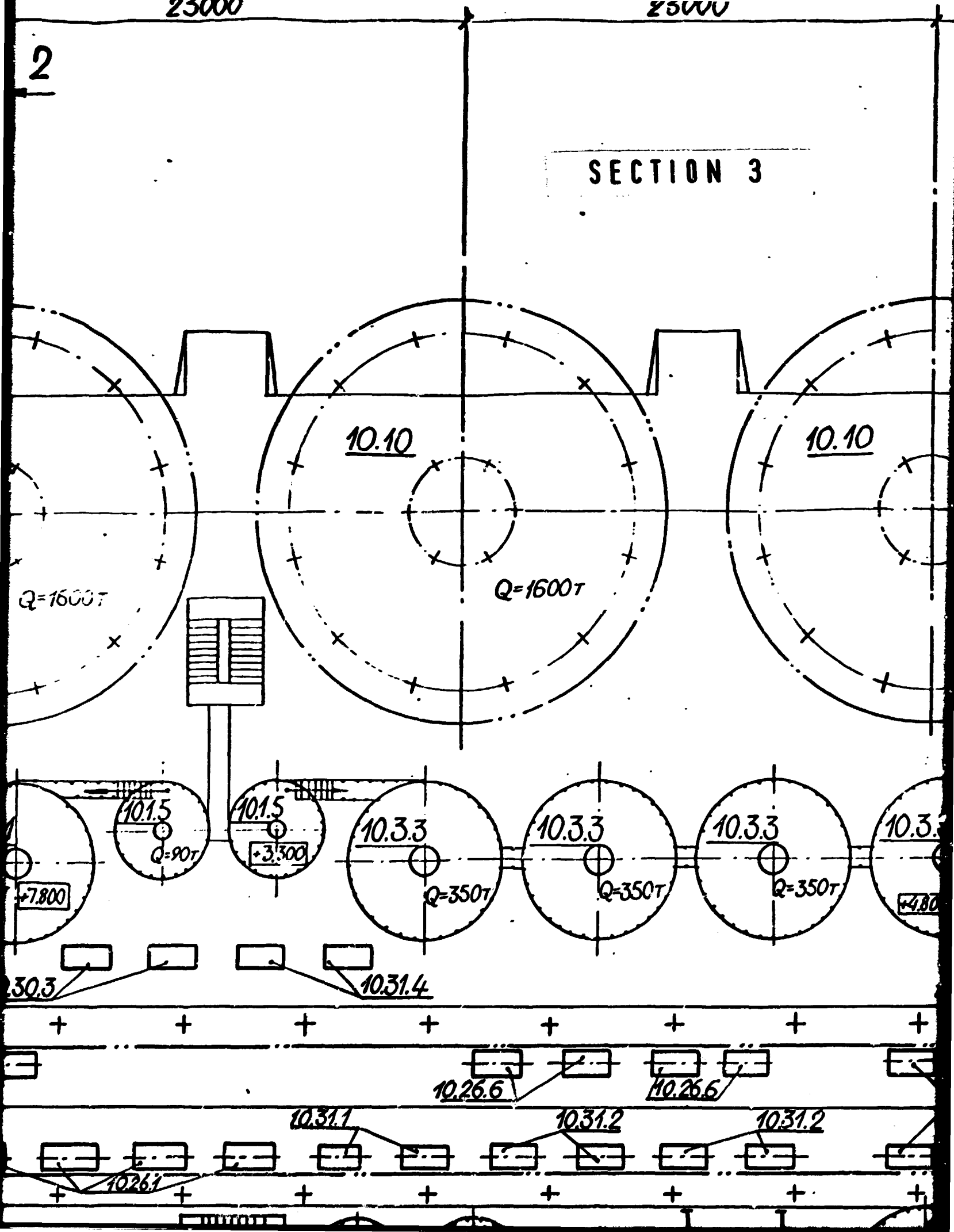
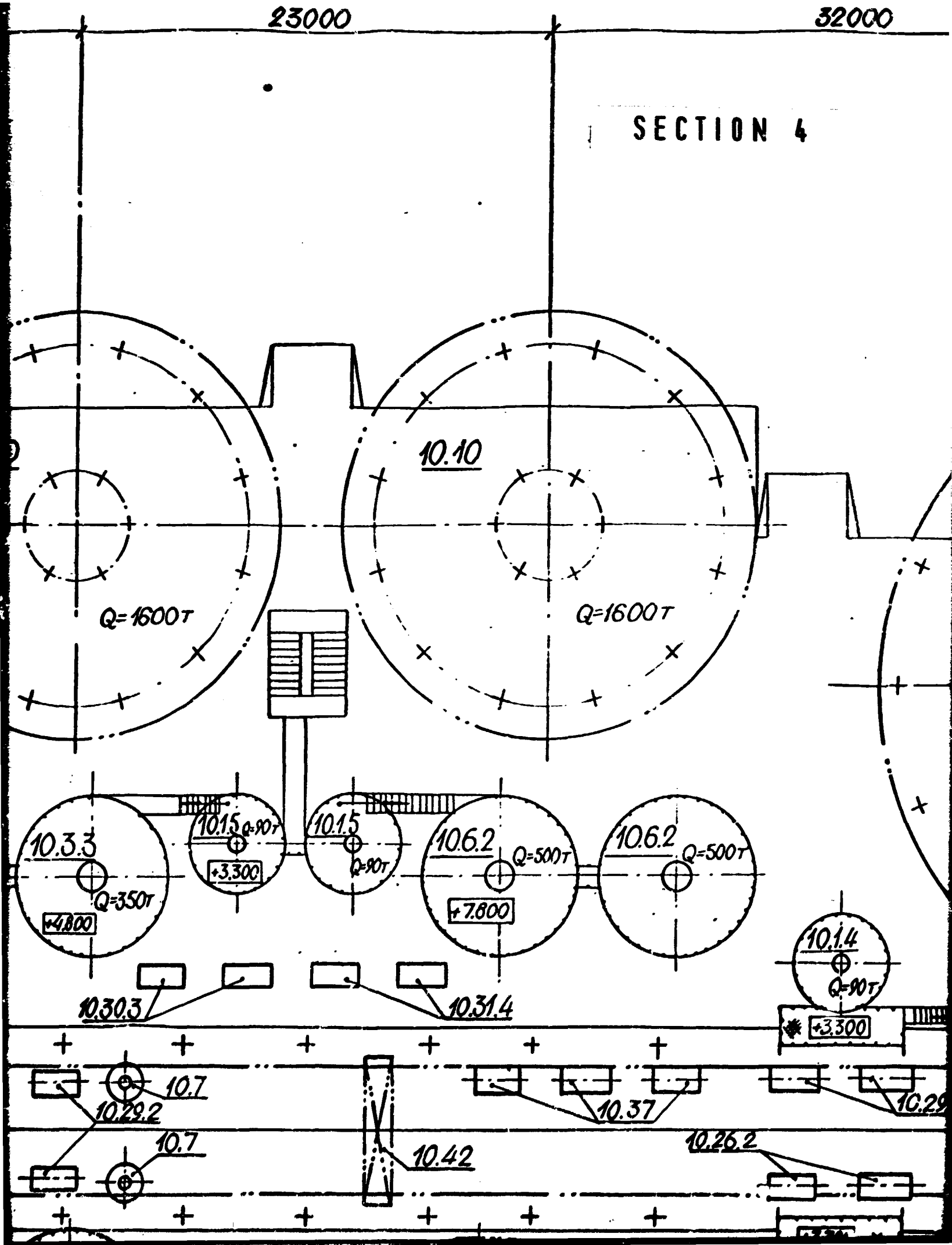
Q=500т
+7.800
10.10
Q=1600т
10.35
10.8.1
Q=490т
10.36
10.30.1
10.28.2
10.6.1
10.30.3
10.33
10.43
10.34
AREA UNDER INSTALLATION
OPENING
10.41
10.7
10.26.1

23000 23000

2

SECTION 3




23000
32000
SECTION 4
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Q=1600т
Q=1600т
10.3.3
Q=350т
+4.800
10.1.5
Q=90т
+3.300
10.1.5
Q=90т
10.6.2
Q=500т
+7.800
10.6.2
Q=500т
10.1.4
Q=90т
+3.300
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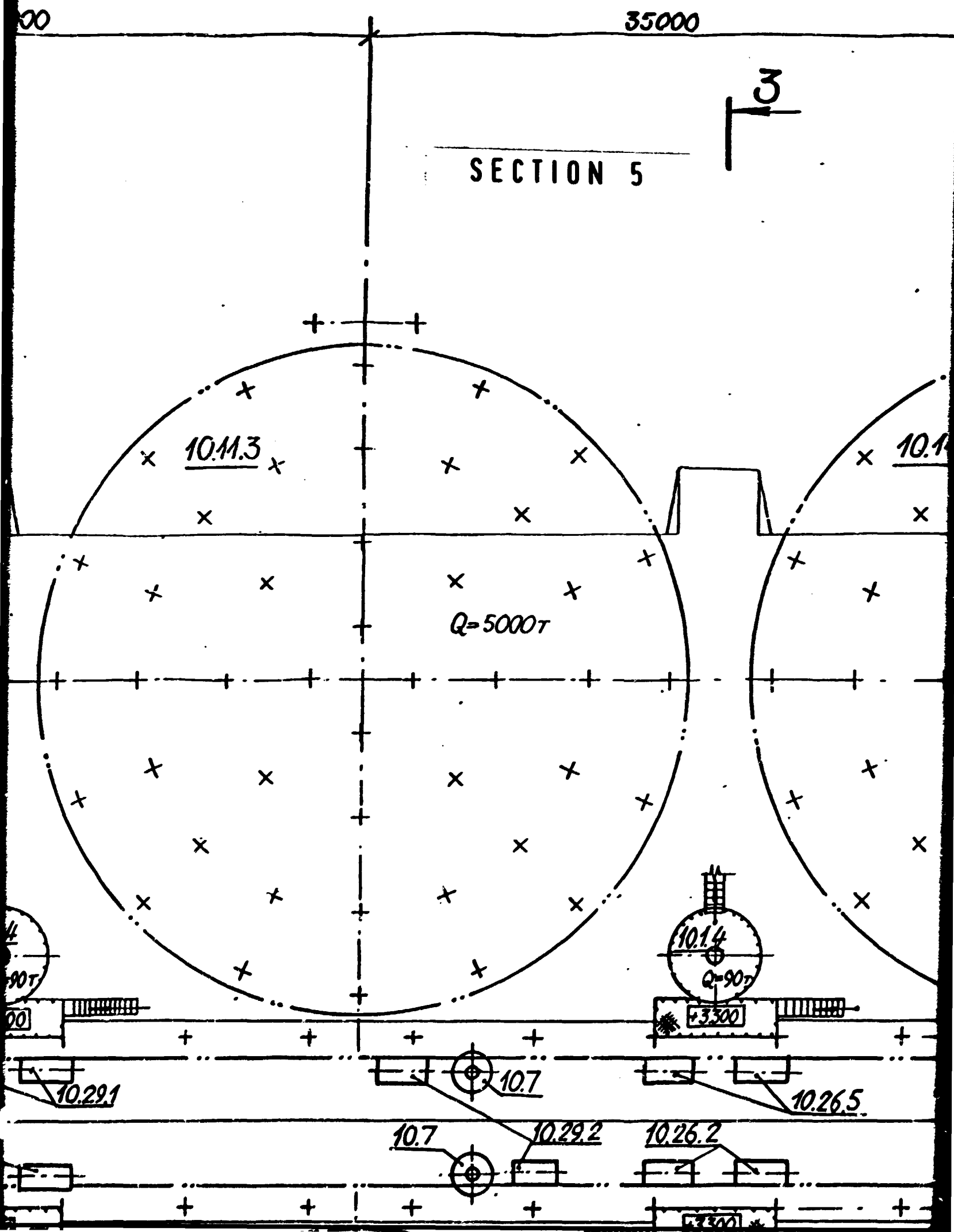
10.26.2
10.29


35000
3
SECTION 5
10.11.3
Q=5000т
10.1.4
Q=90т
+3.300
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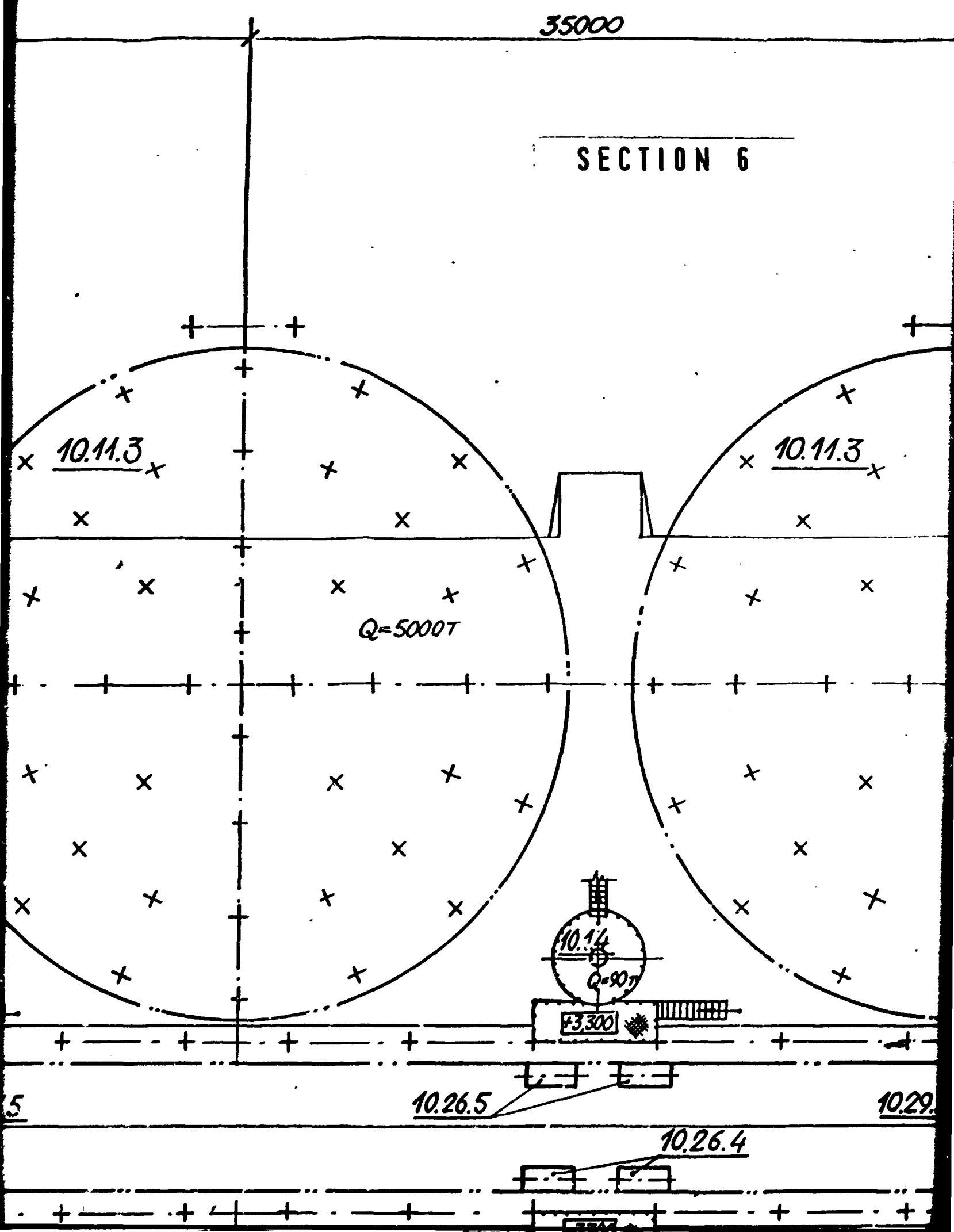
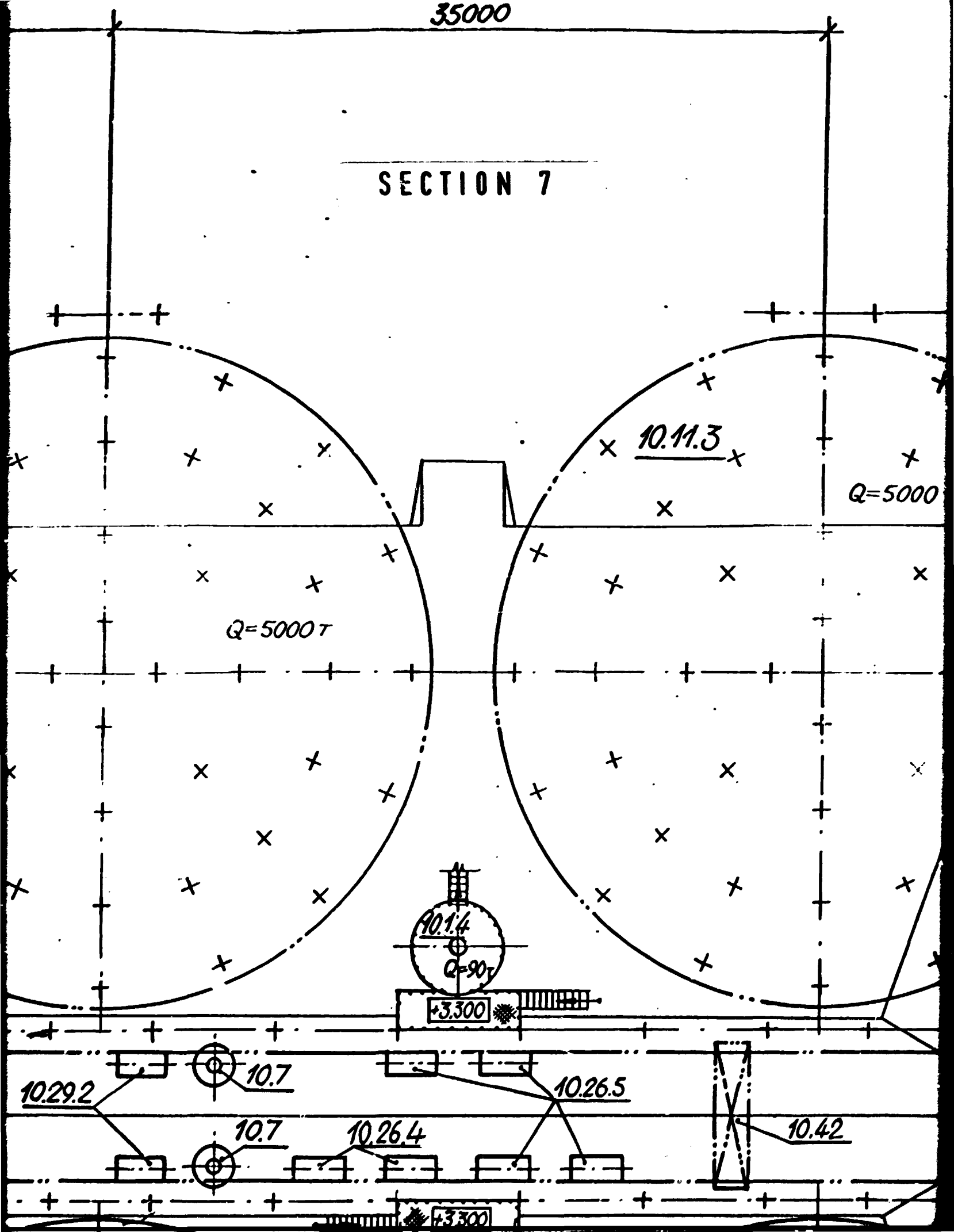
10.7
10.26.5
10.7
10.29.2
10.26.2
+3.300

35000

SECTION 6




35000
SECTION 7
10.11.3
Q=5000
Q=5000т
10.1.4
Q=90т
+3.300
10.7
10.29.2
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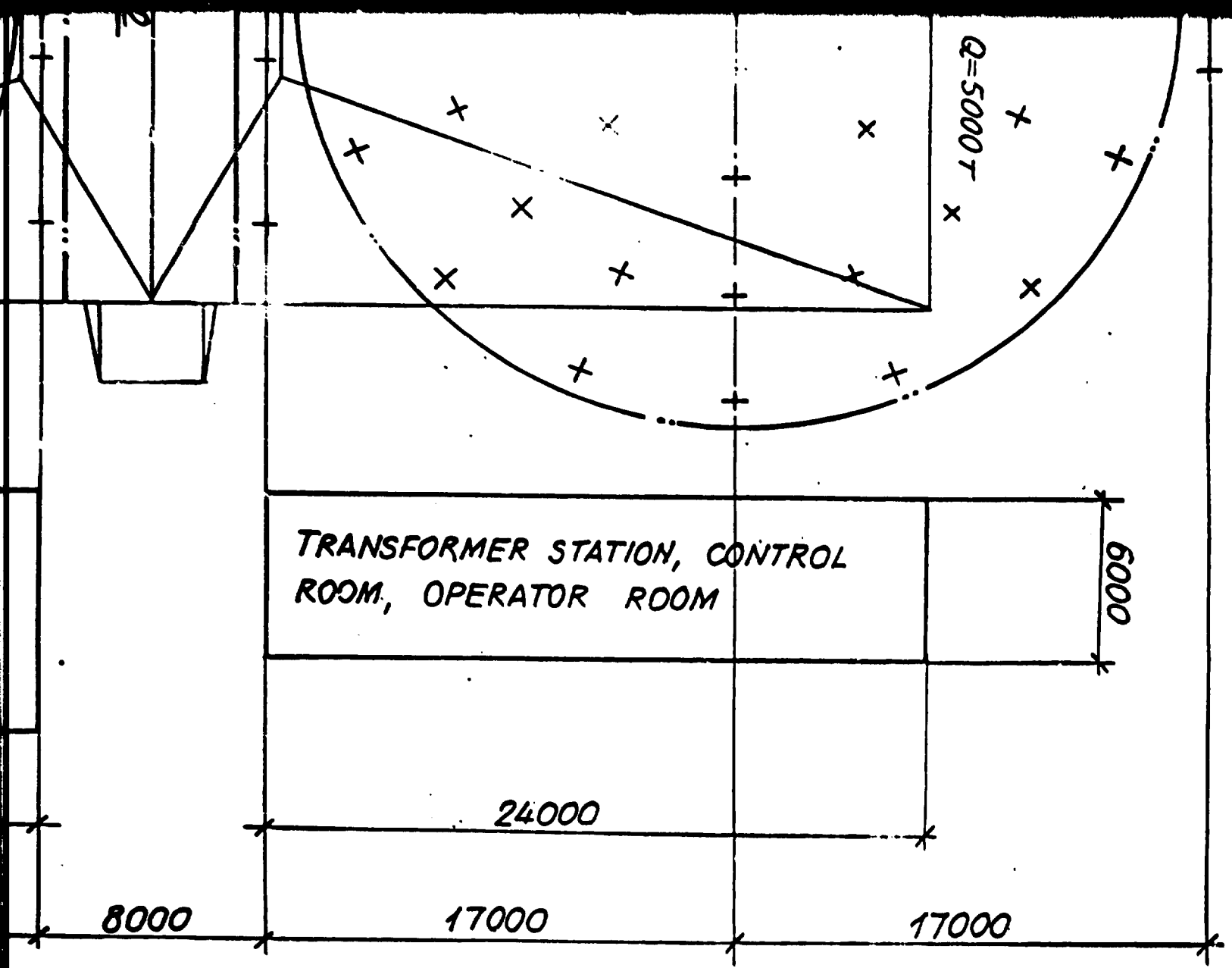
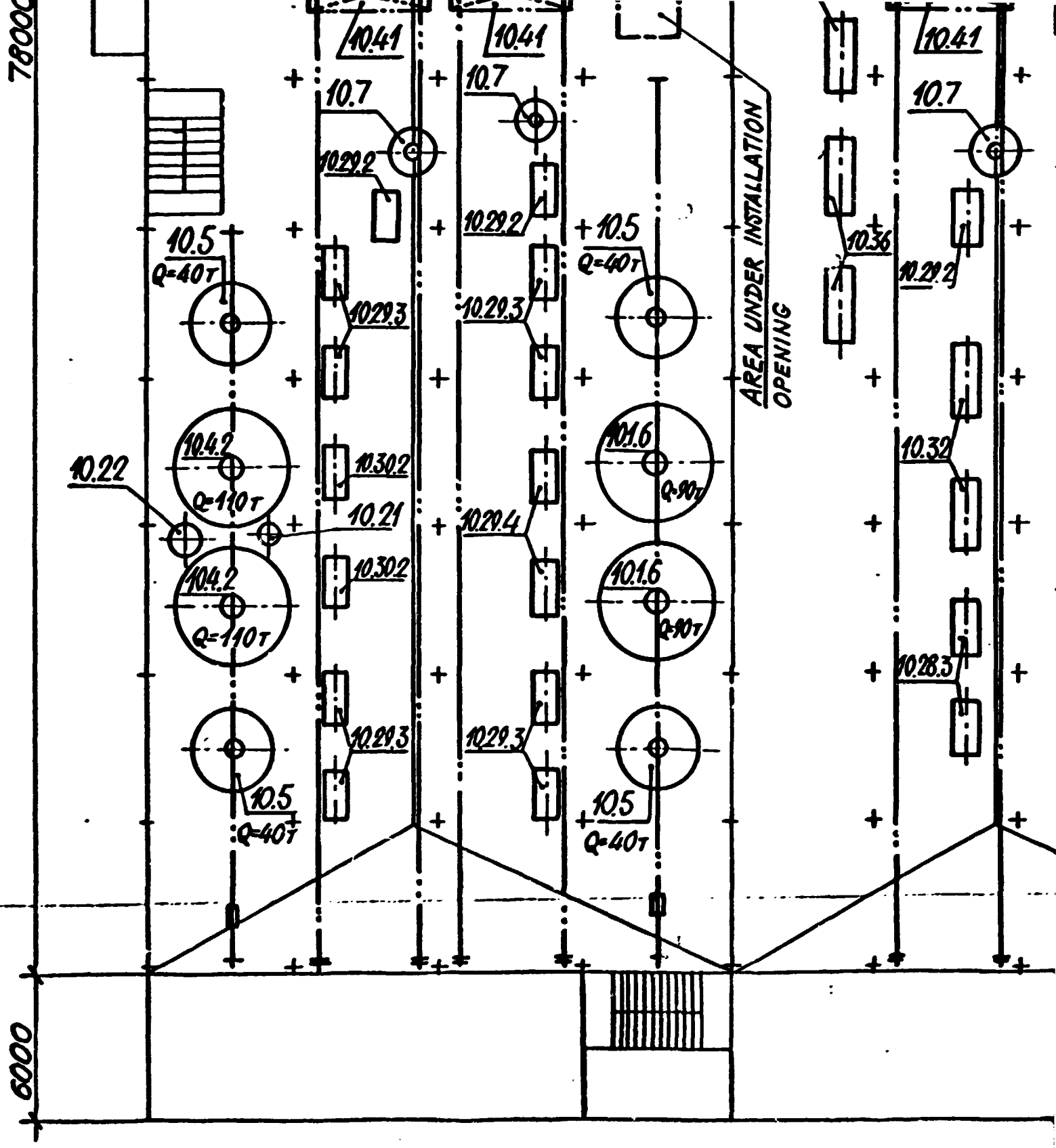
10.7
10.26.4
10.42
+3.300

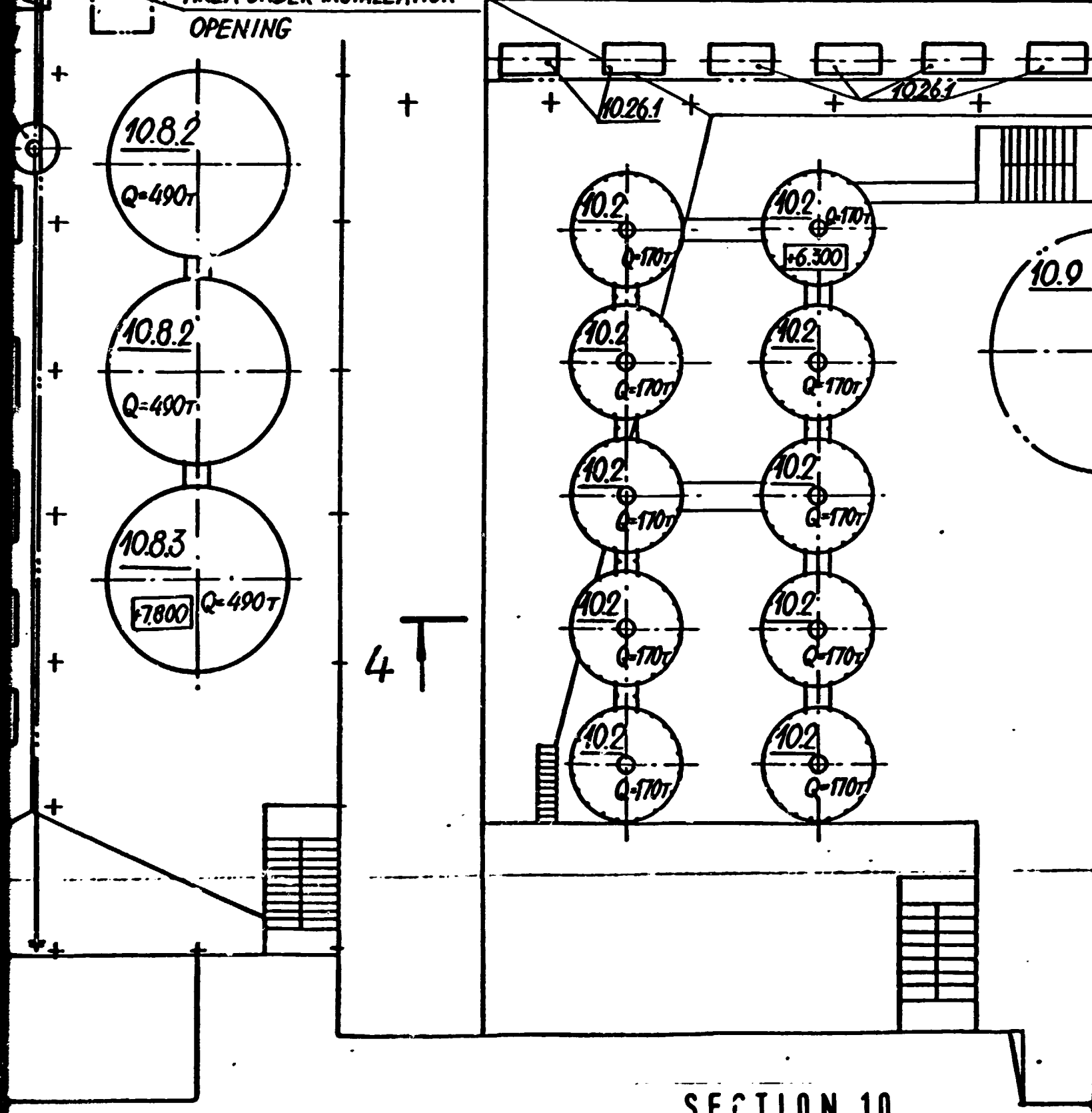

TRANSFORMER STATION, CONTROL ROOM, OPERATOR ROOM
6000
24000
8000
17000
17000

SECTION 8



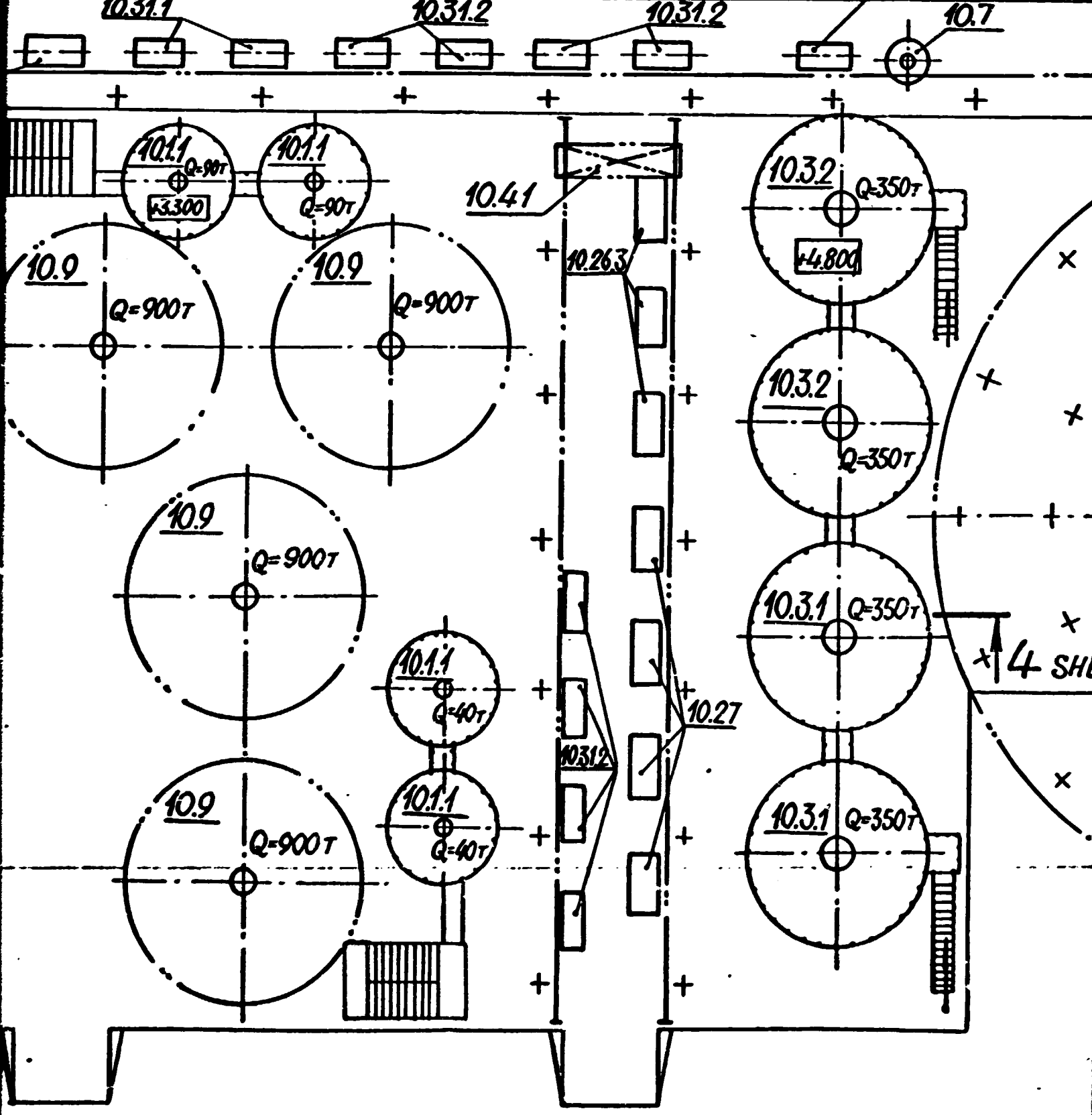
SECTION 9

1 SHEET 5

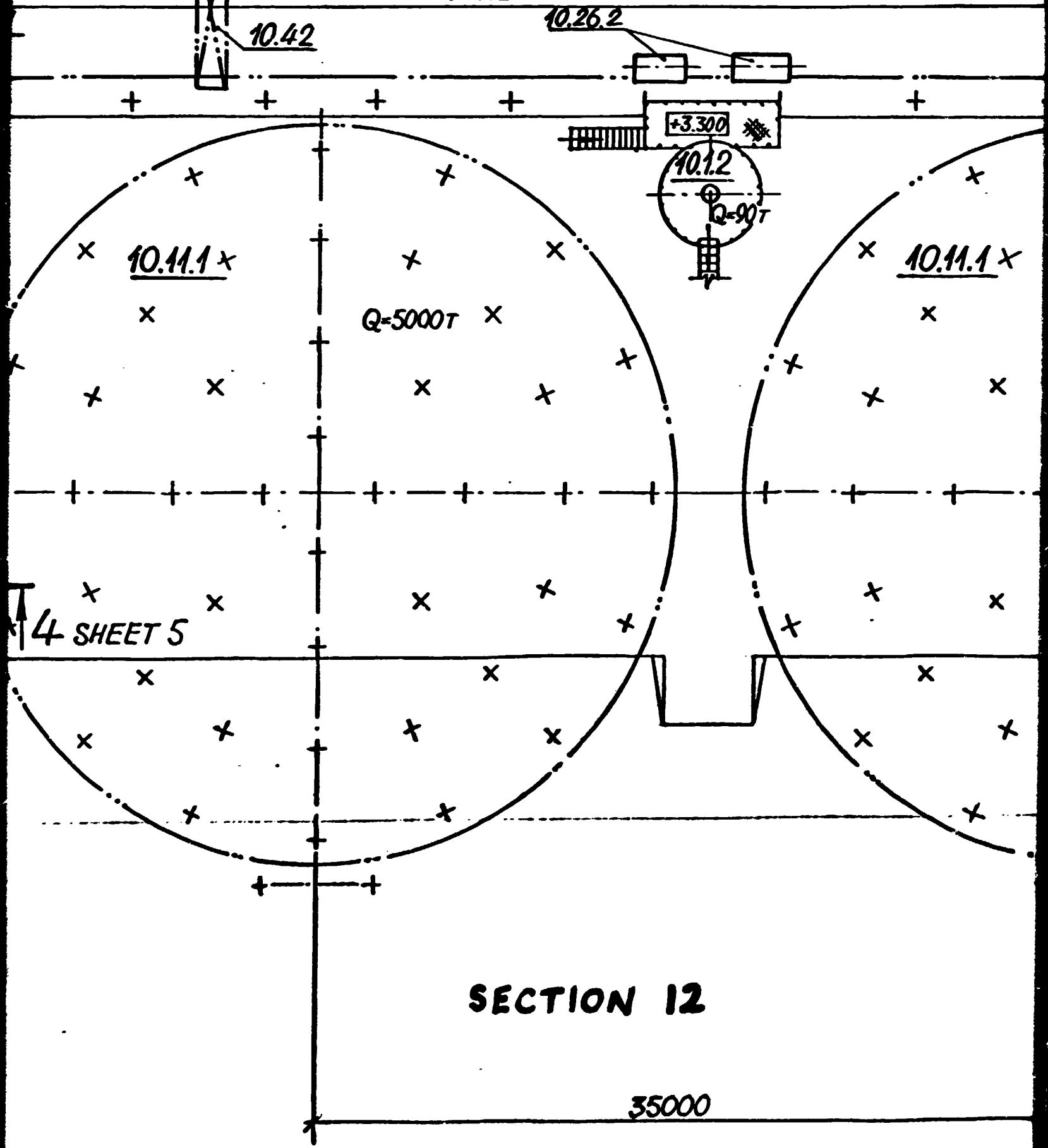


SECTION 10

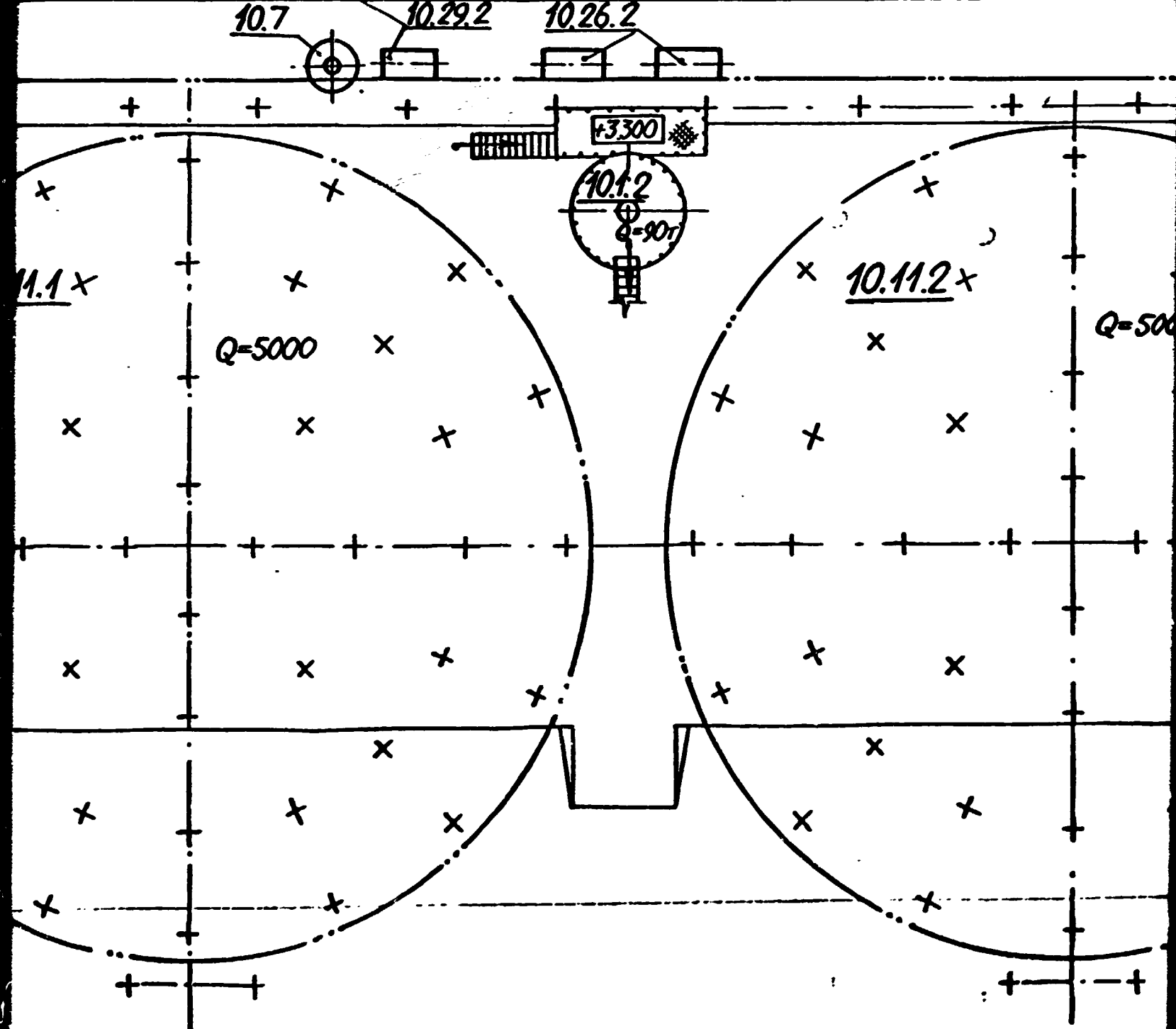
2 SHEET 5


10.31.1
10.31.2
10.31.2
10.7
10.1.1
Q=90т
+3.300
10.1.1
Q=90т
10.41
10.3.2
Q=350т
+4.800
10.9
Q=900т
10.9
Q=900т
10.26.3
10.3.2
Q=350т
10.9
Q=900т
10.3.1
Q=350т
10.1.1
Q=40т
10.27
10.31.2
10.1.1
Q=40т
10.9
Q=900т
10.3.1
Q=350т

SECTION 11

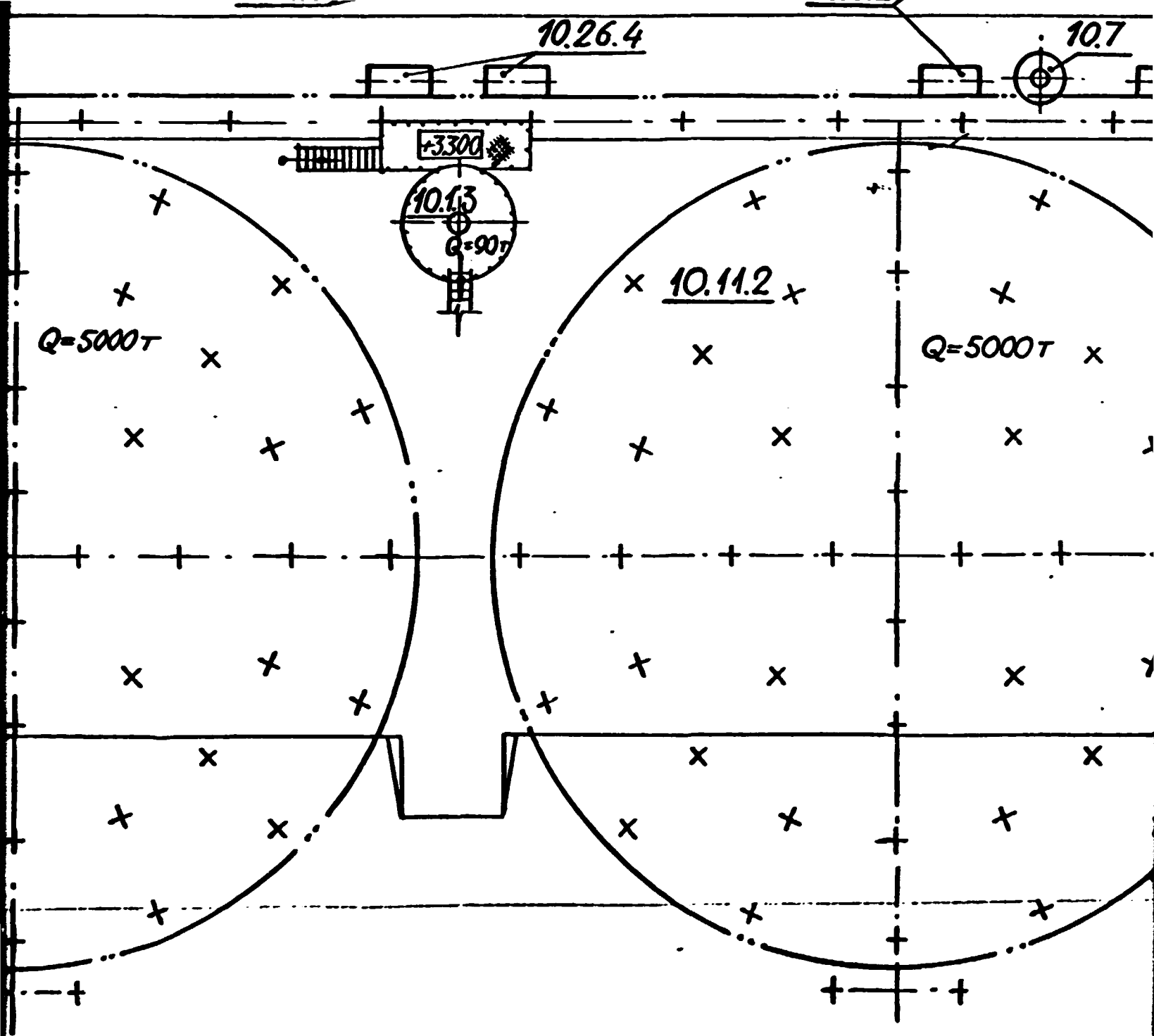


SECTION 12



SECTION 13

3 SHEET 5



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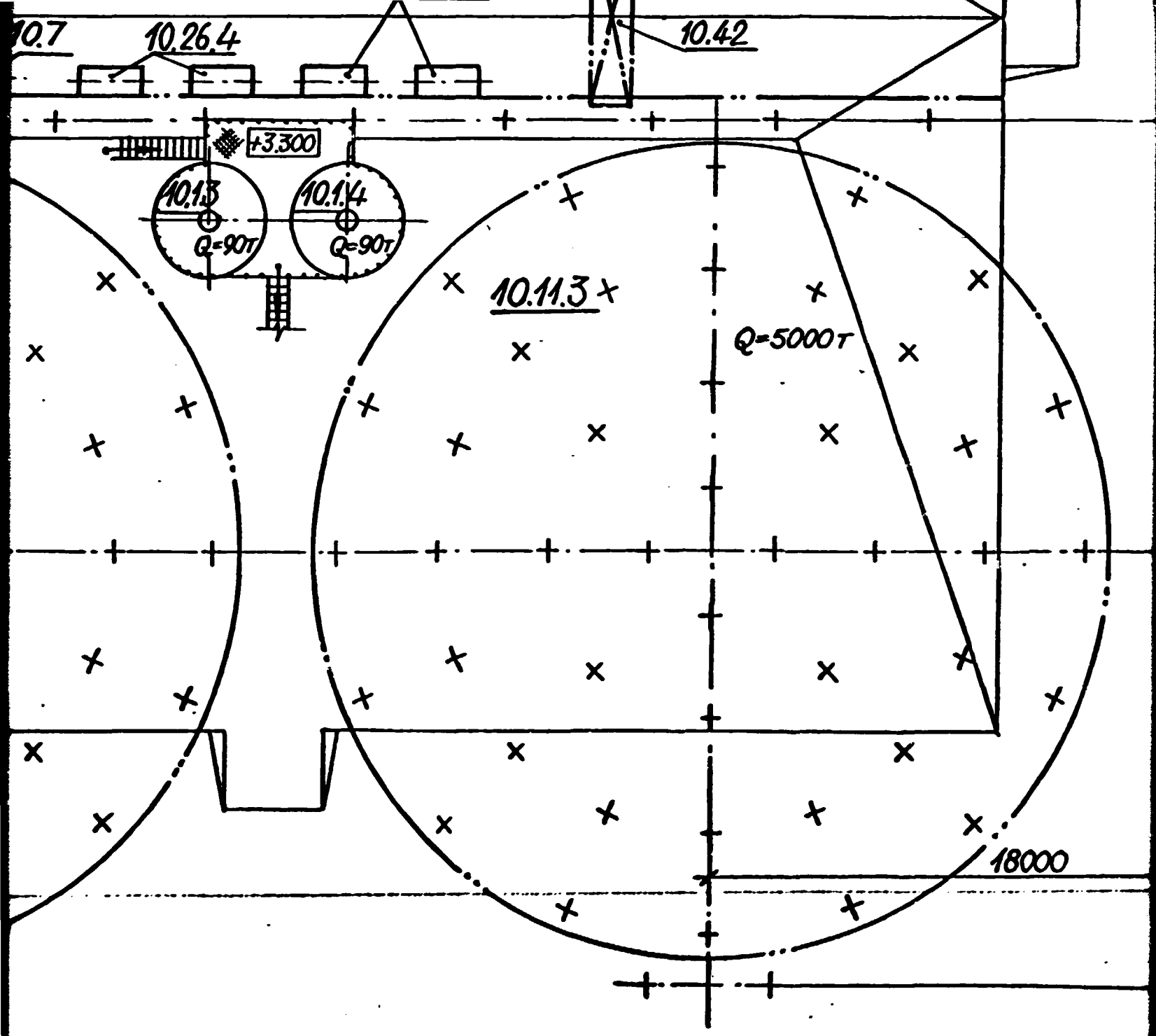
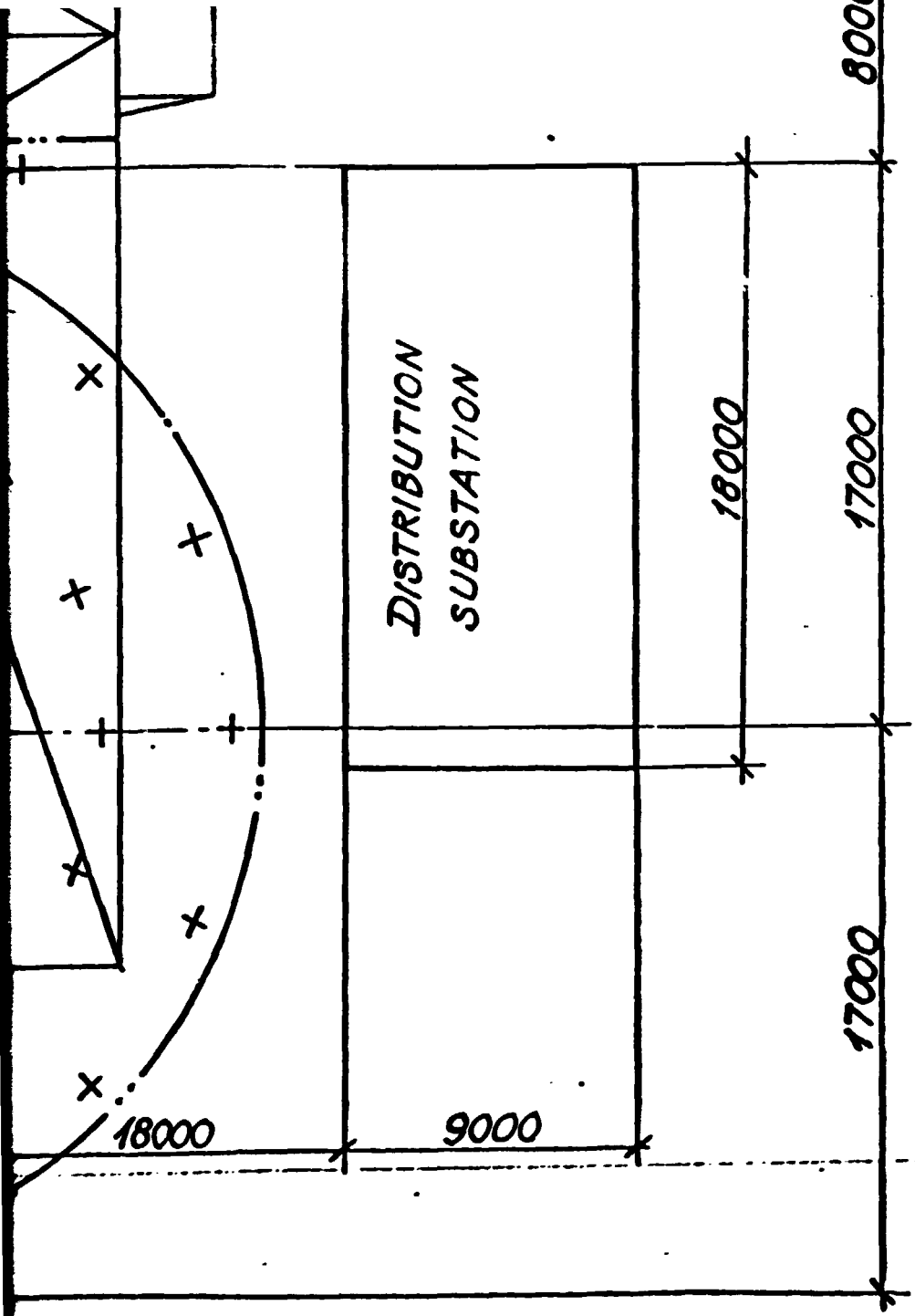


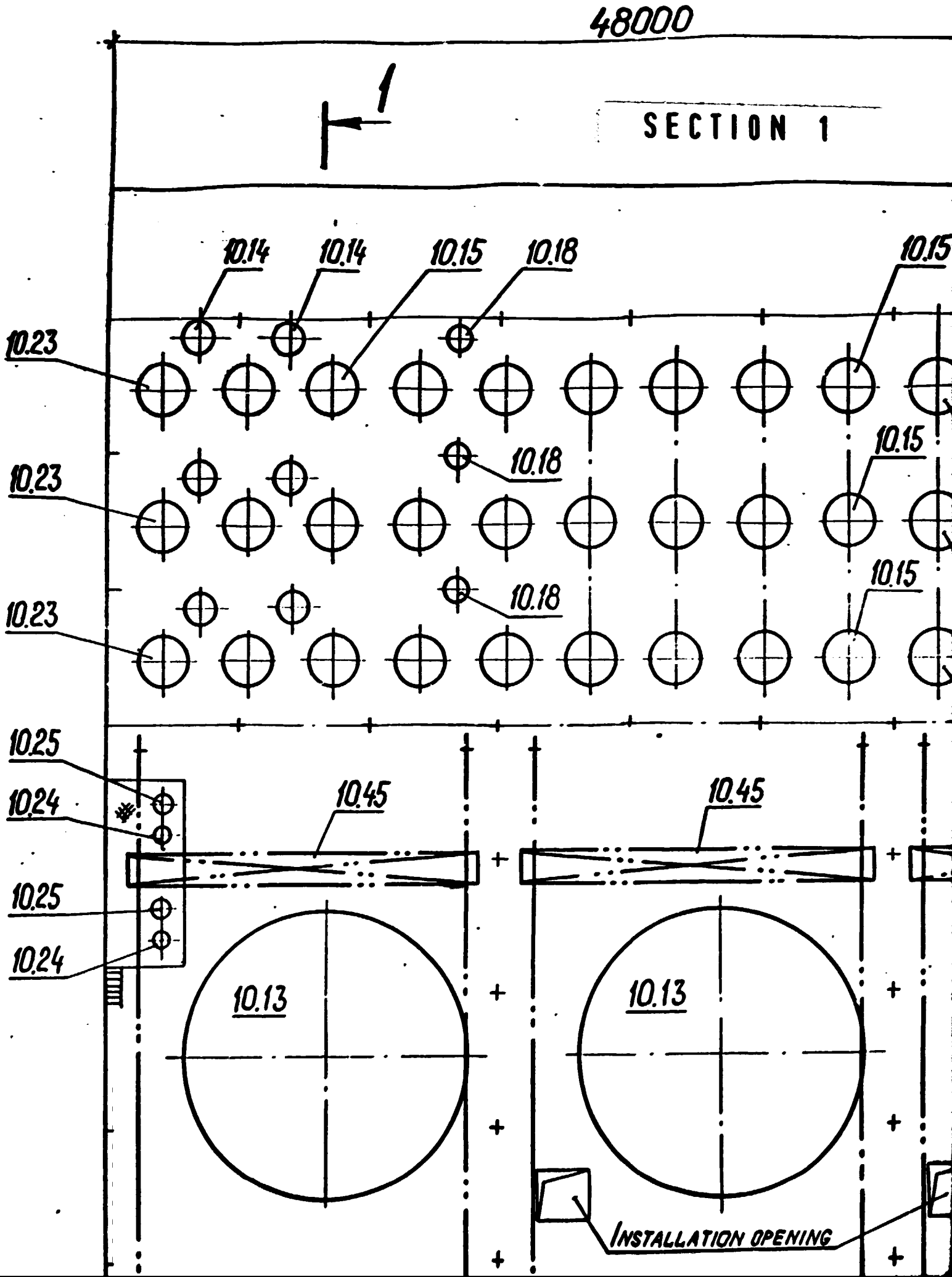
SECTION 15



SECTION 16

UNIDO CONTRACT NO 85/108

1339552-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
DIGESTION DESILICATION AND MUD WASHING	STAGE	SHEET	SHEETS
	FEASIBILITY	3	
PLAN AT EL. 0.000	VAMI LENINGRAD		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10.14
10.14
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10.45
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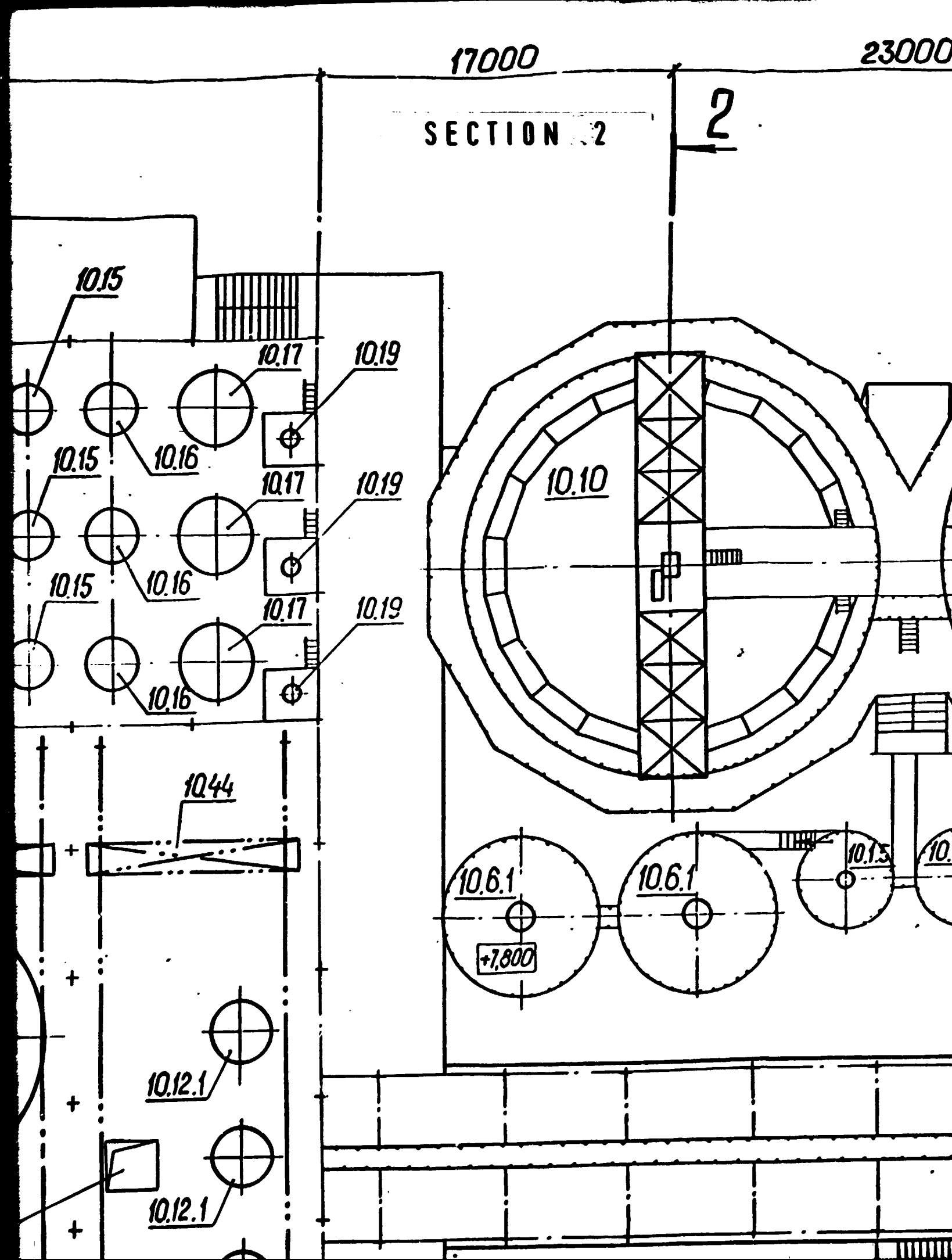
10.25
10.24
10.13
10.13
INSTALLATION OPENING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2
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10.19
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10.15
10.17
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10.16
10.10
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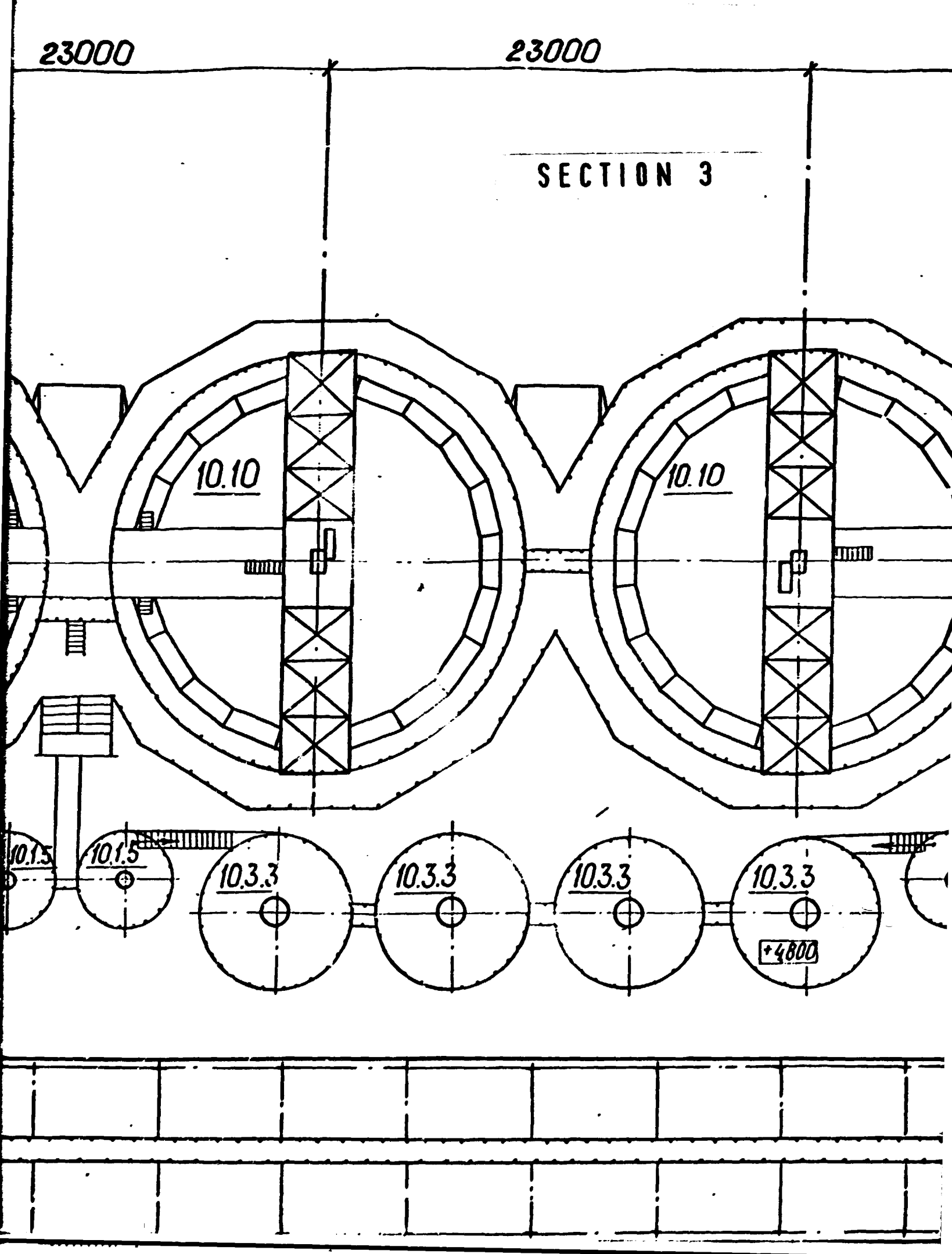
10.12.1
10.12.1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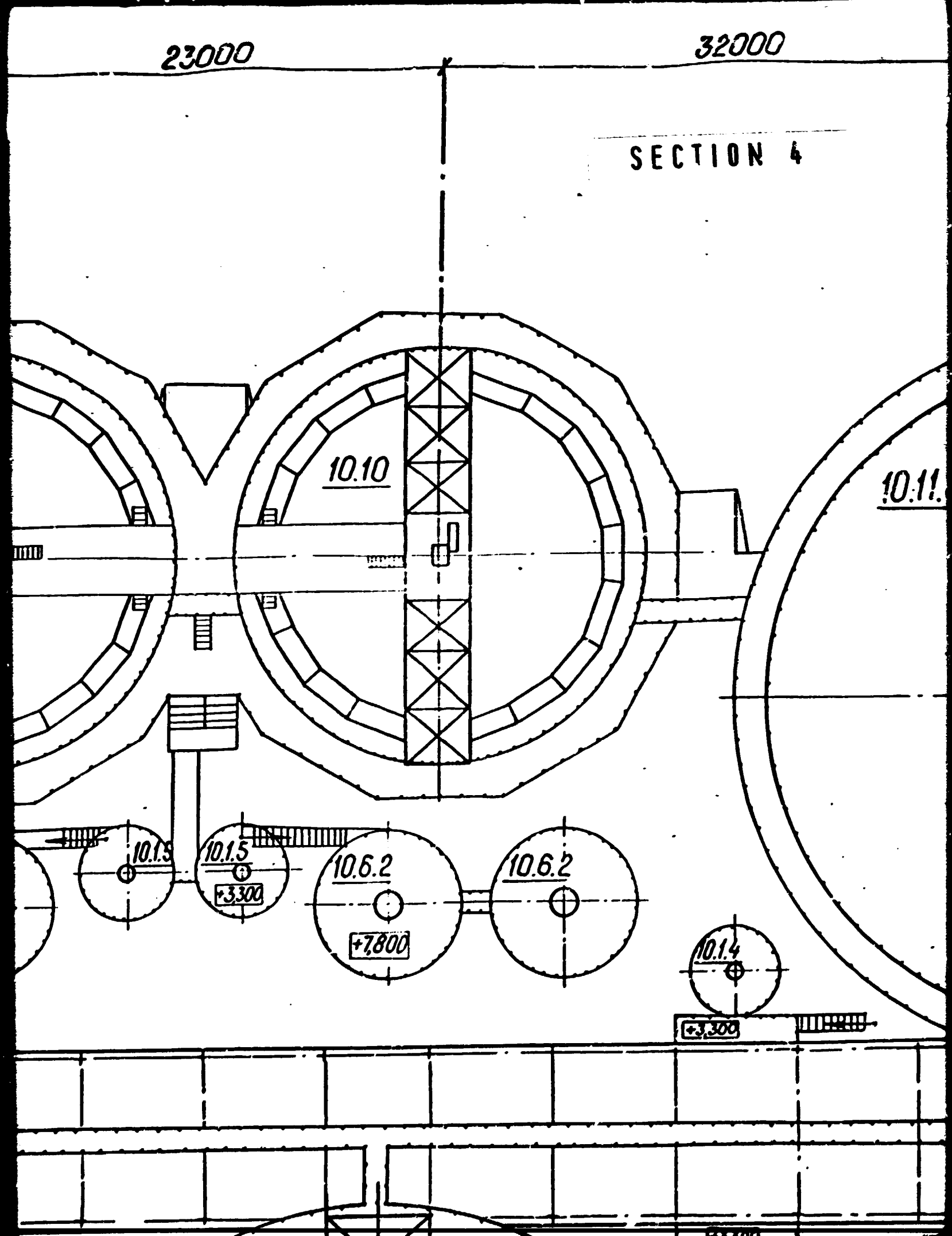
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SECTION 4
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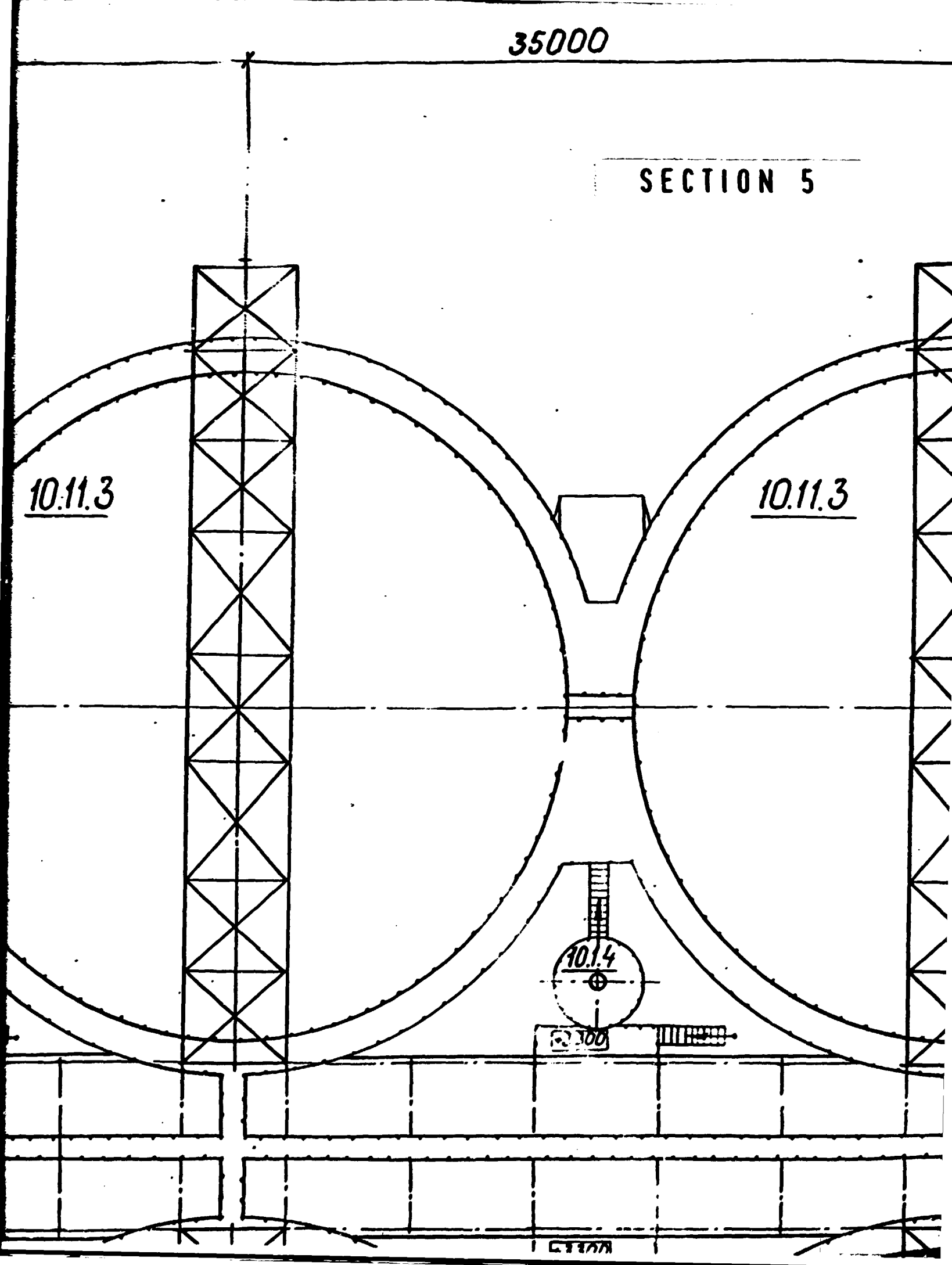
10.6.2
10.6.2
+7.800
10.1.4
+3.300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10.1.4
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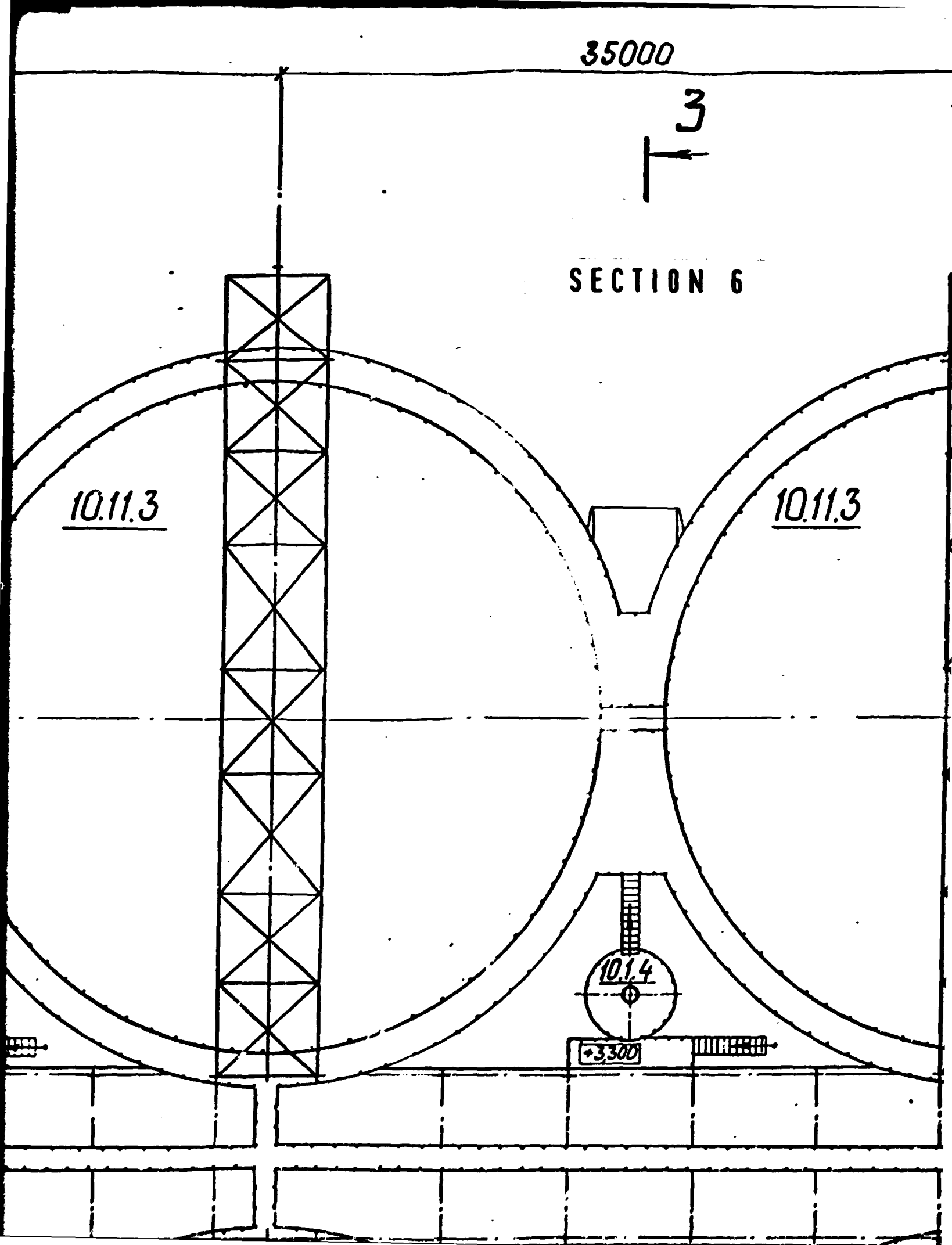
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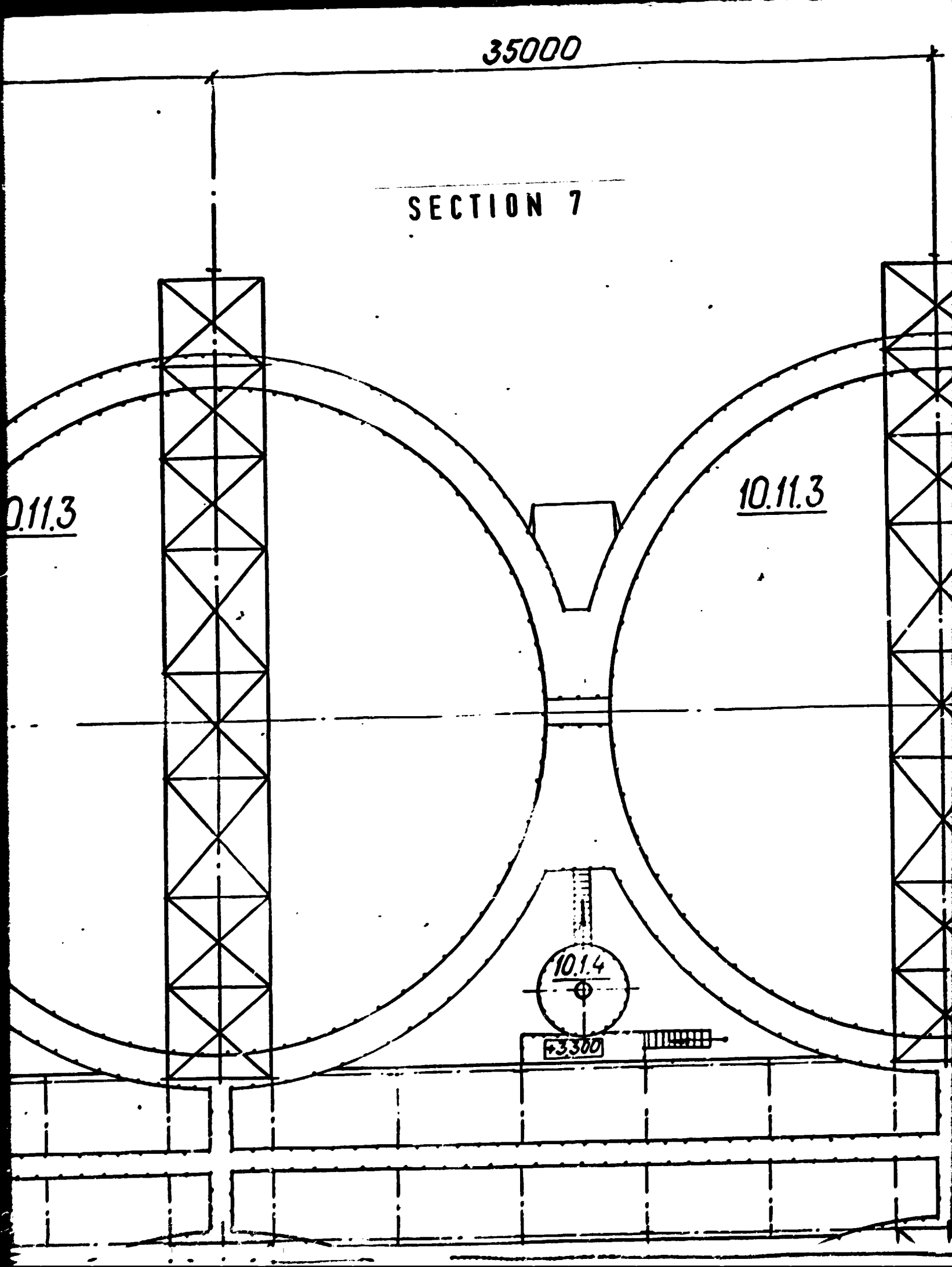
10.1.4
+3.300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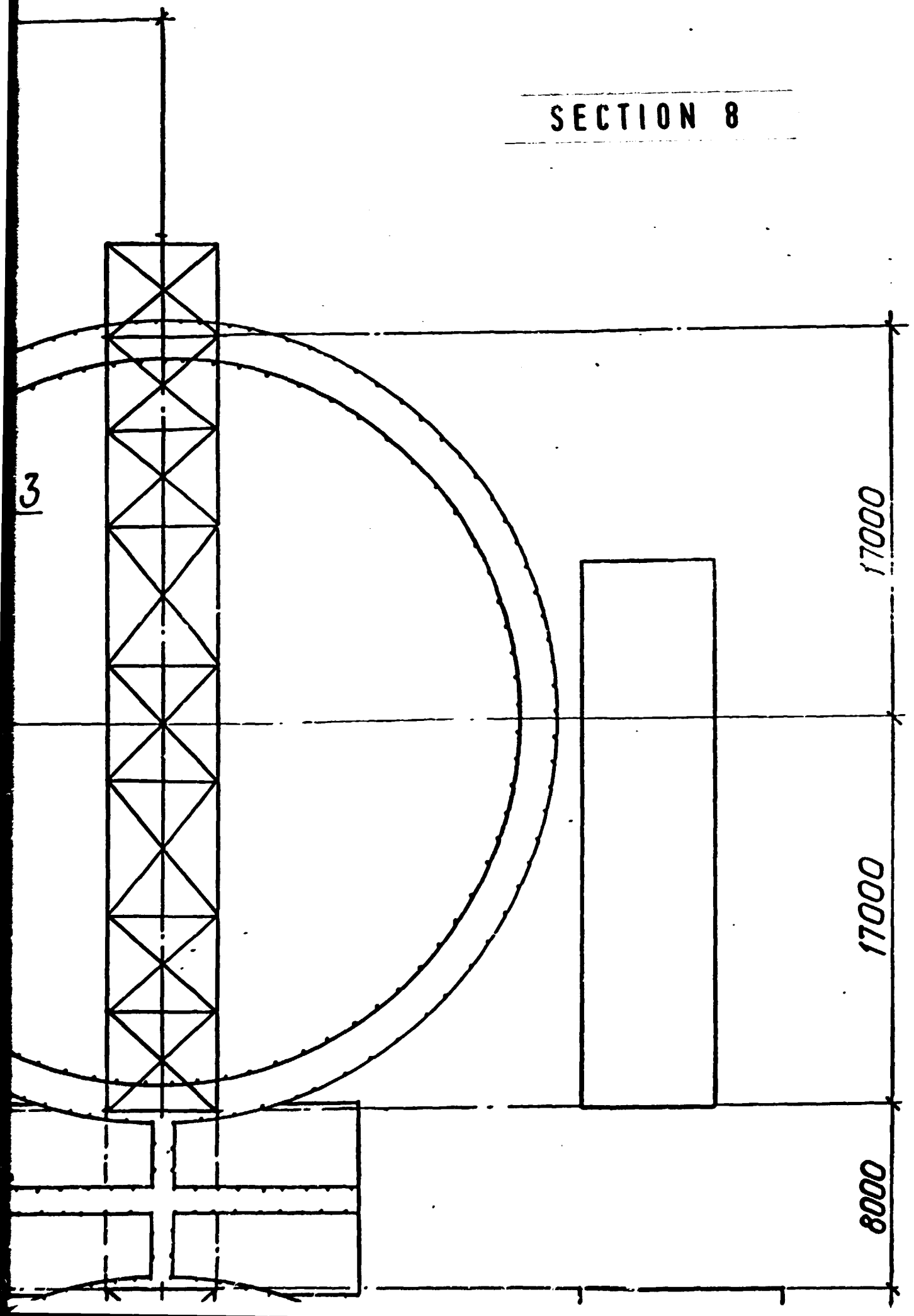
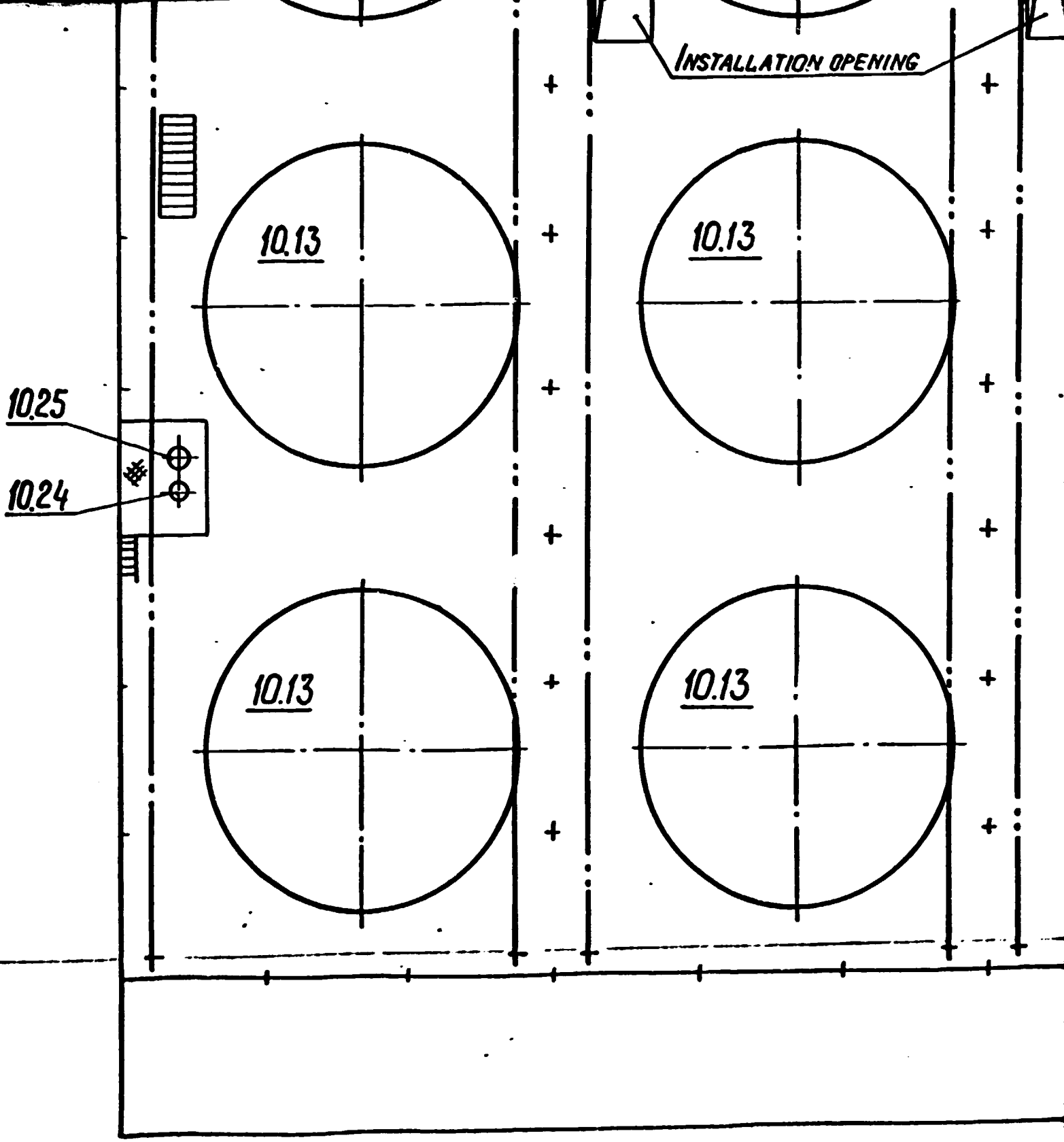
10.1.4
+3.300

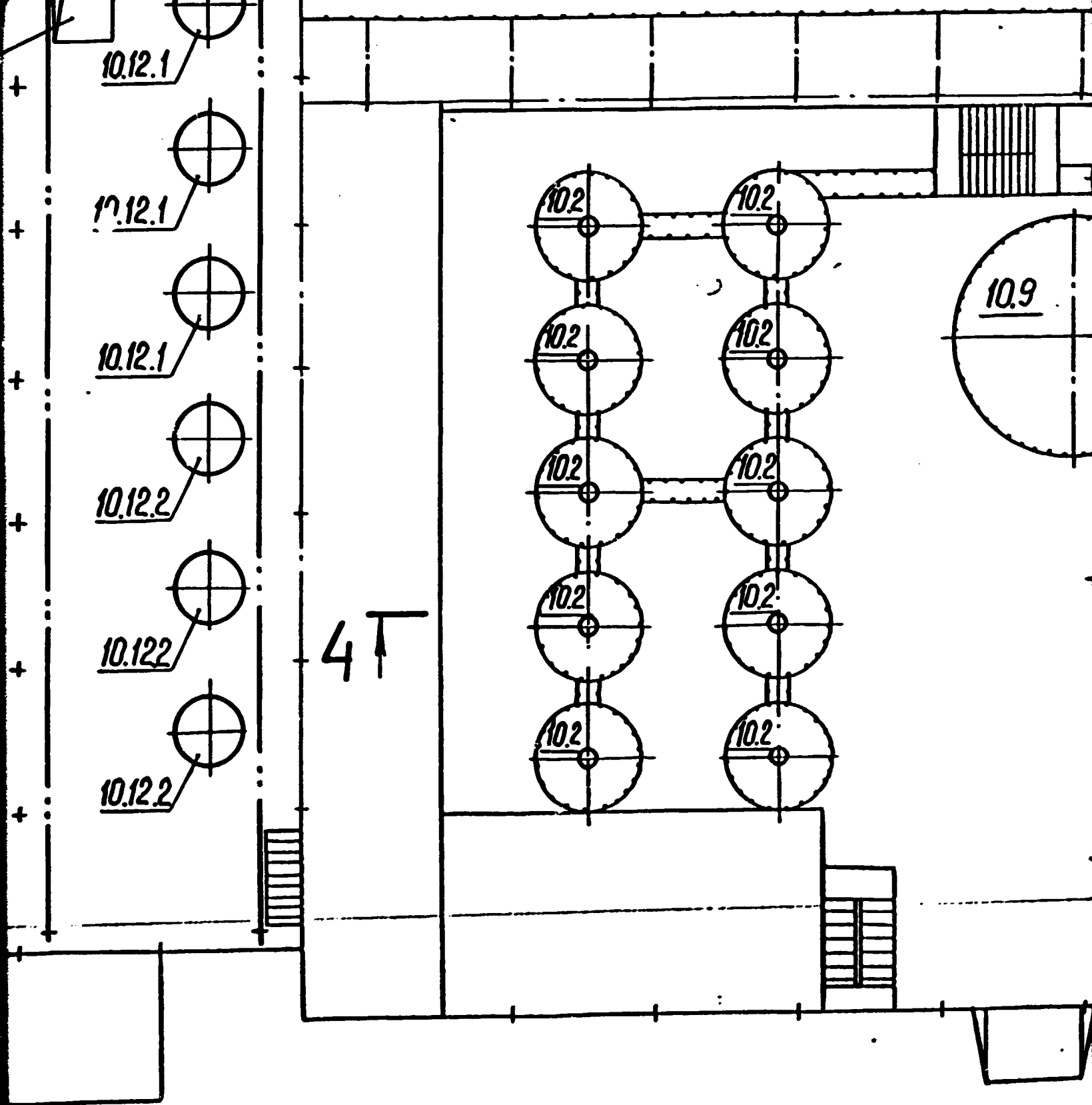
SECTION 8





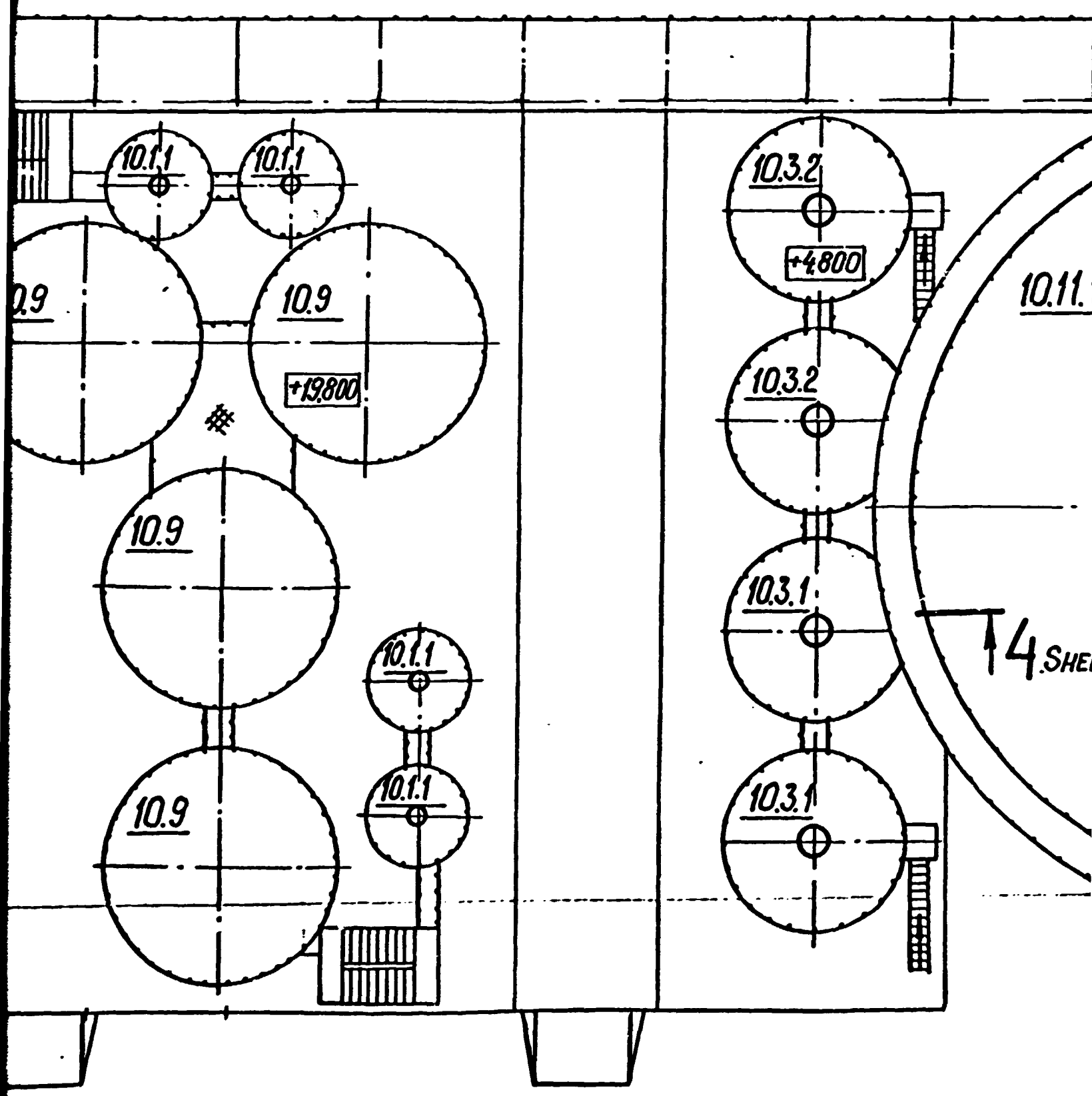
SECTION 9

1 SHEET 5

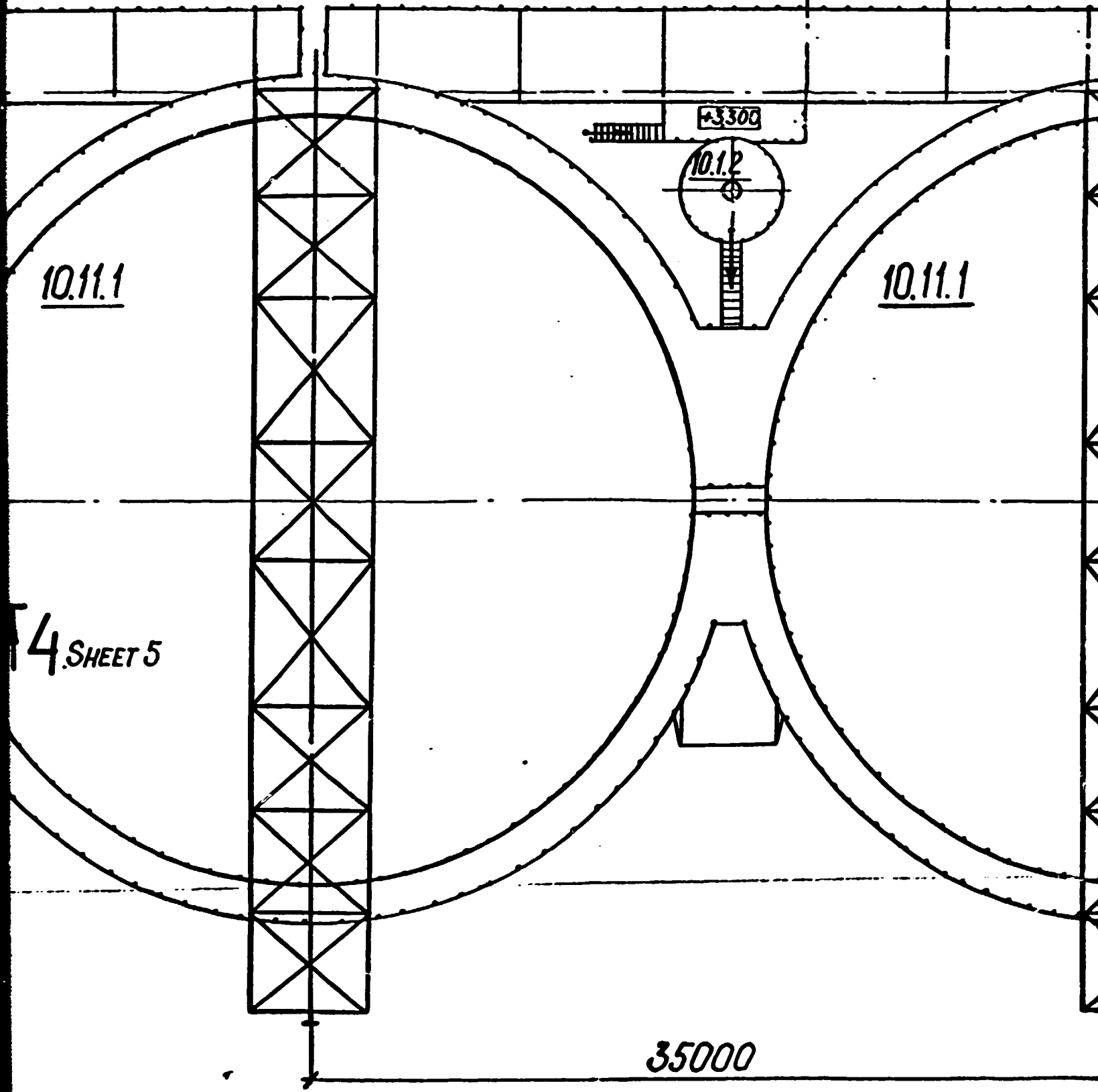


SECTION 10

2 SHEET 5


10.1.1
10.1.1
10.9
10.9
+19.800
10.9
10.9
10.1.1
10.1.1
10.3.2
+4.800
10.3.2
10.3.1
10.3.1
10.11.
4.SHE

SECTION 11



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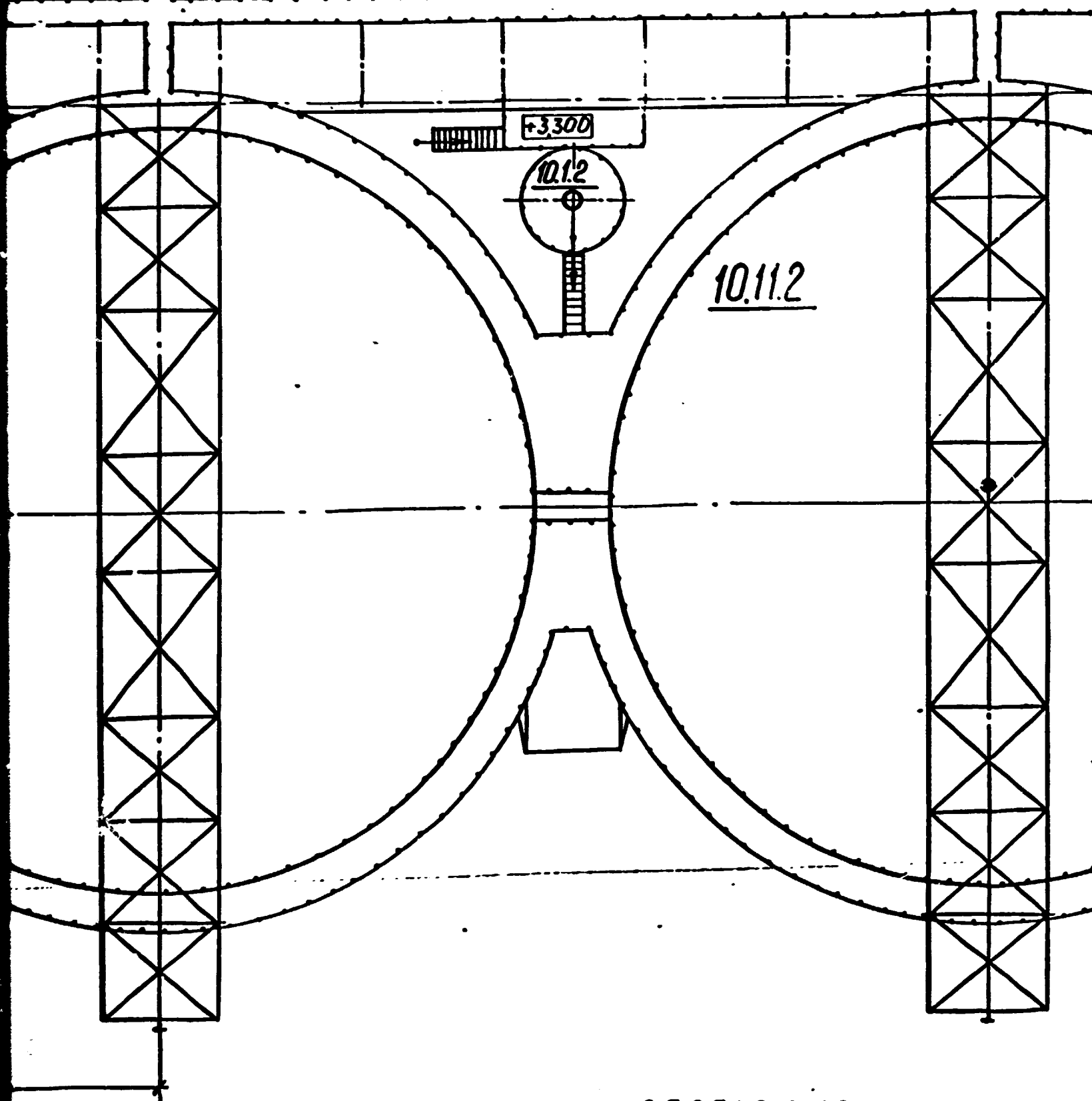

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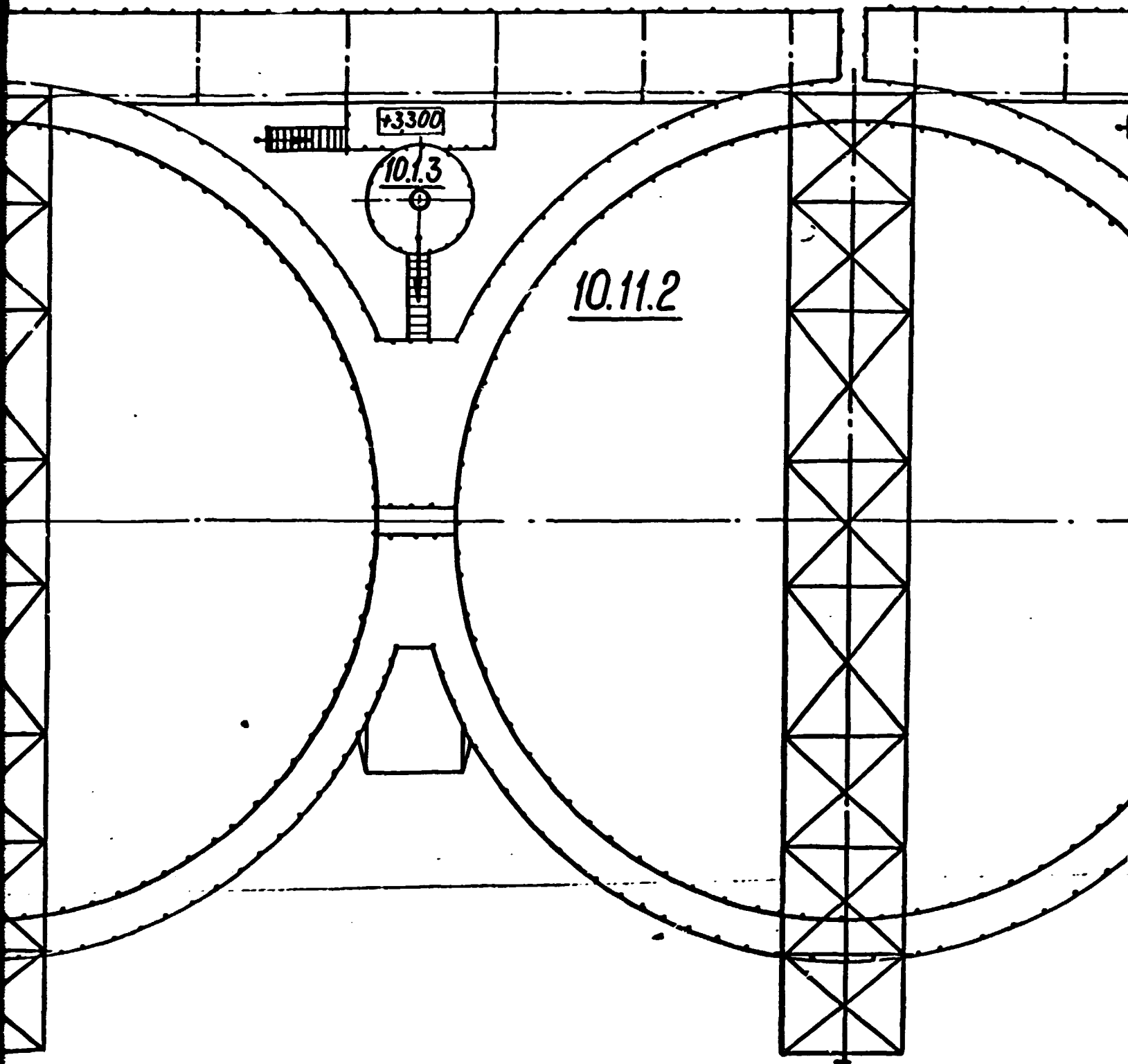
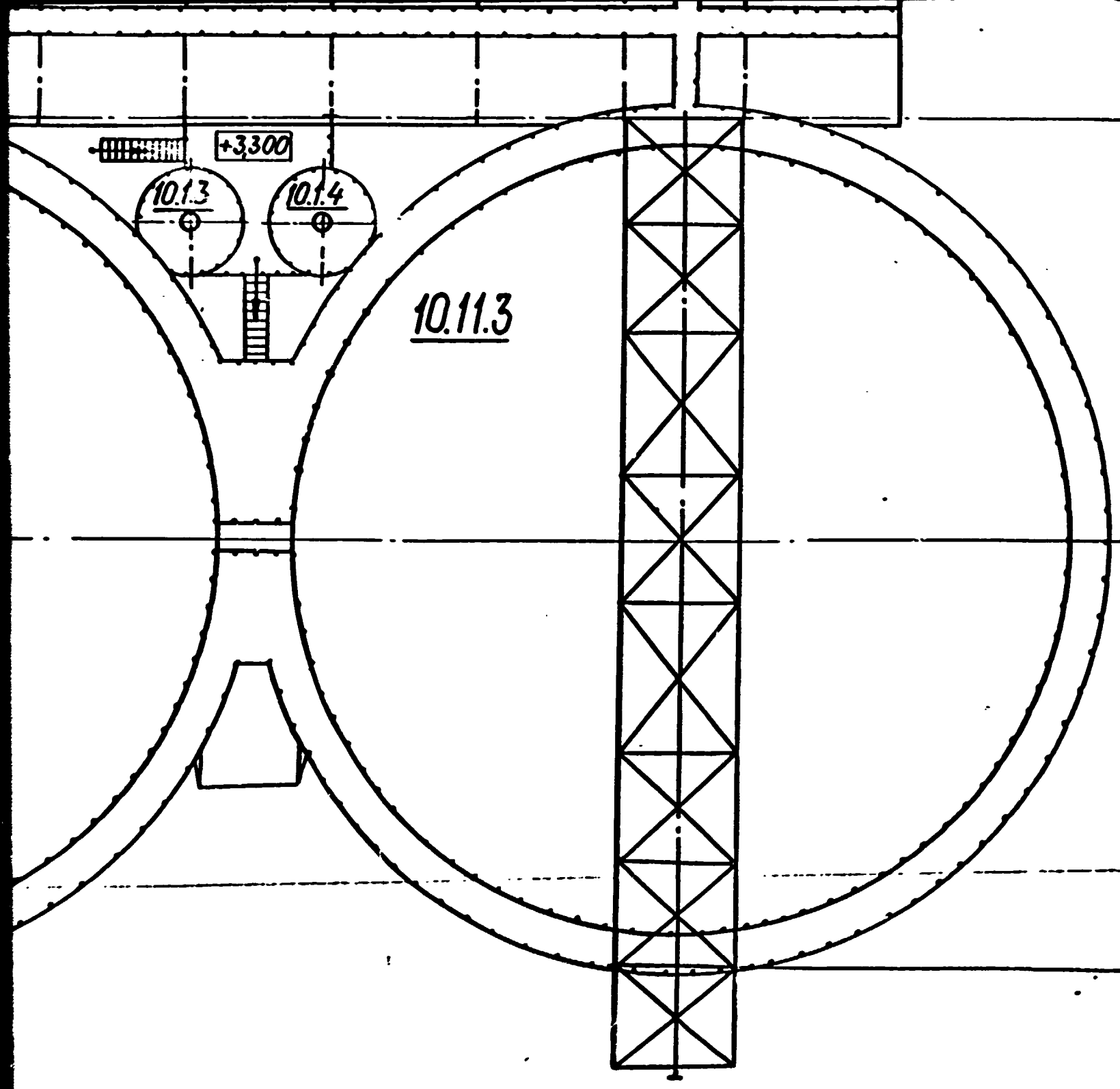
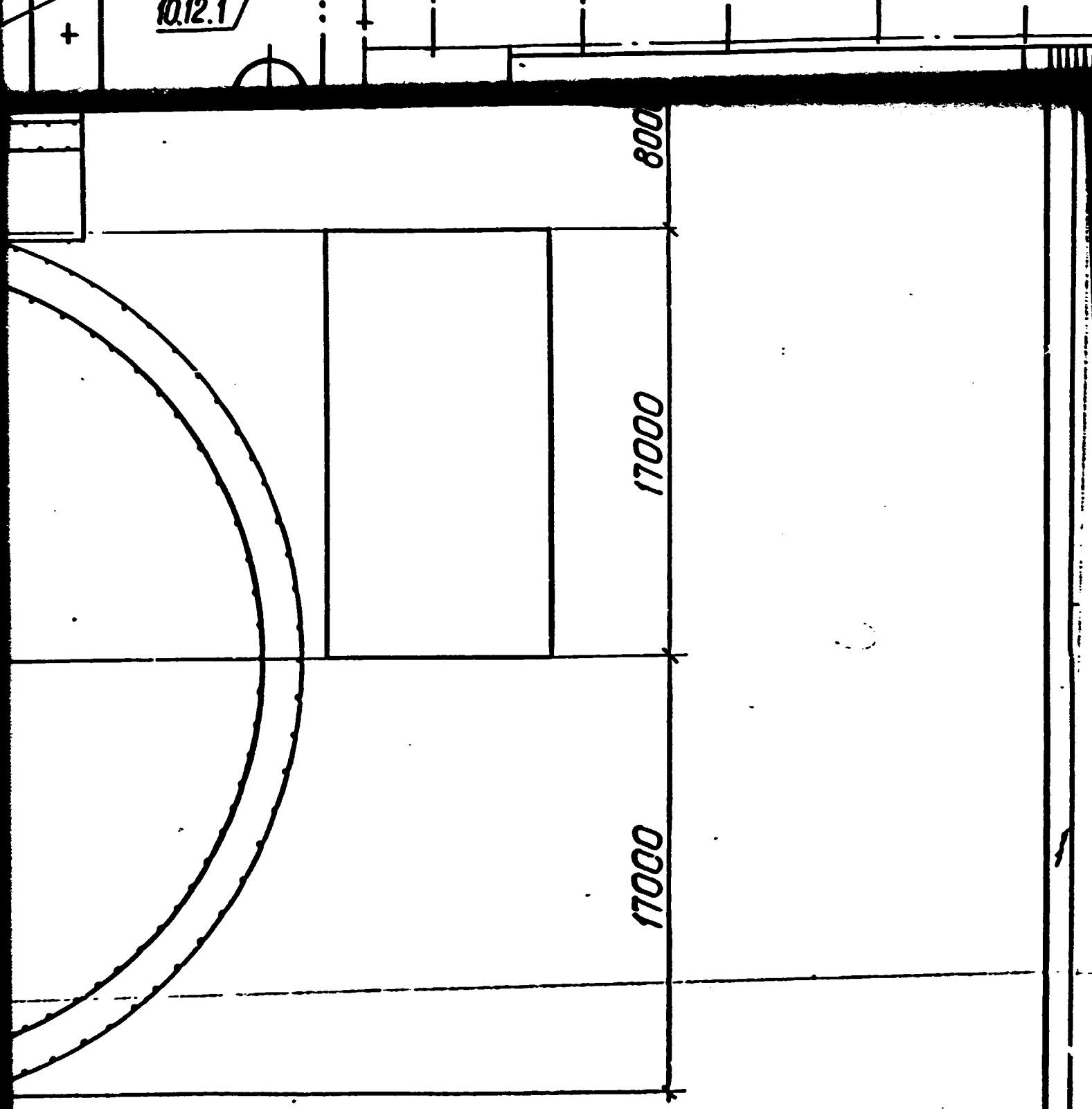


SECTION 14

3 SHEET 5



SECTION 15



SECTION 16

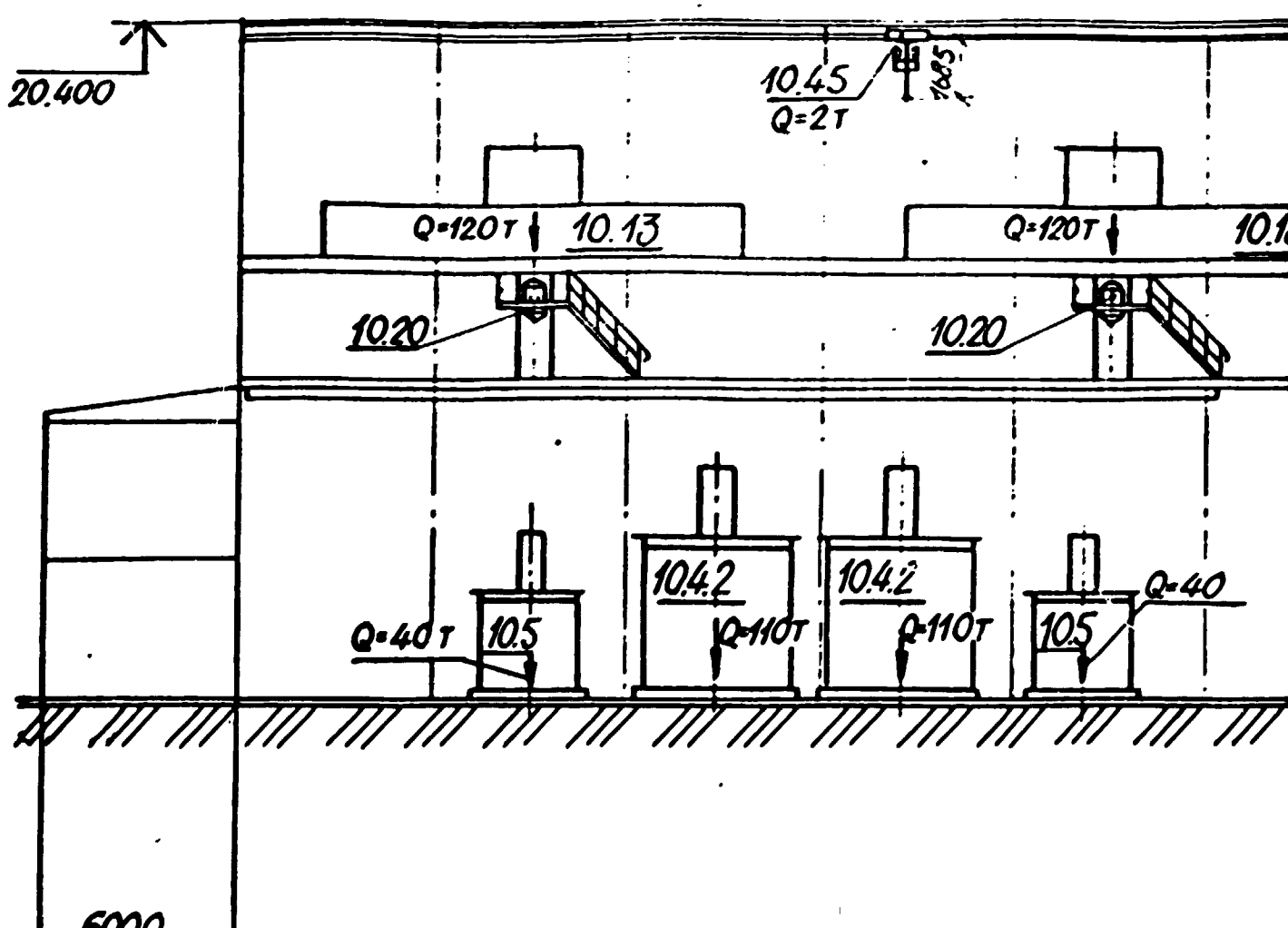
UNIDO CONTRACT No 85/108

1339552-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
DIGESTION. DESILICATION MUD WASHING	STAGE	SHEET	SHEETS
	FEASIBILITY	4	
PLAN AT UPPER ELEVATIONS	VAMI LENINGRAD		

SECTION 1

1-

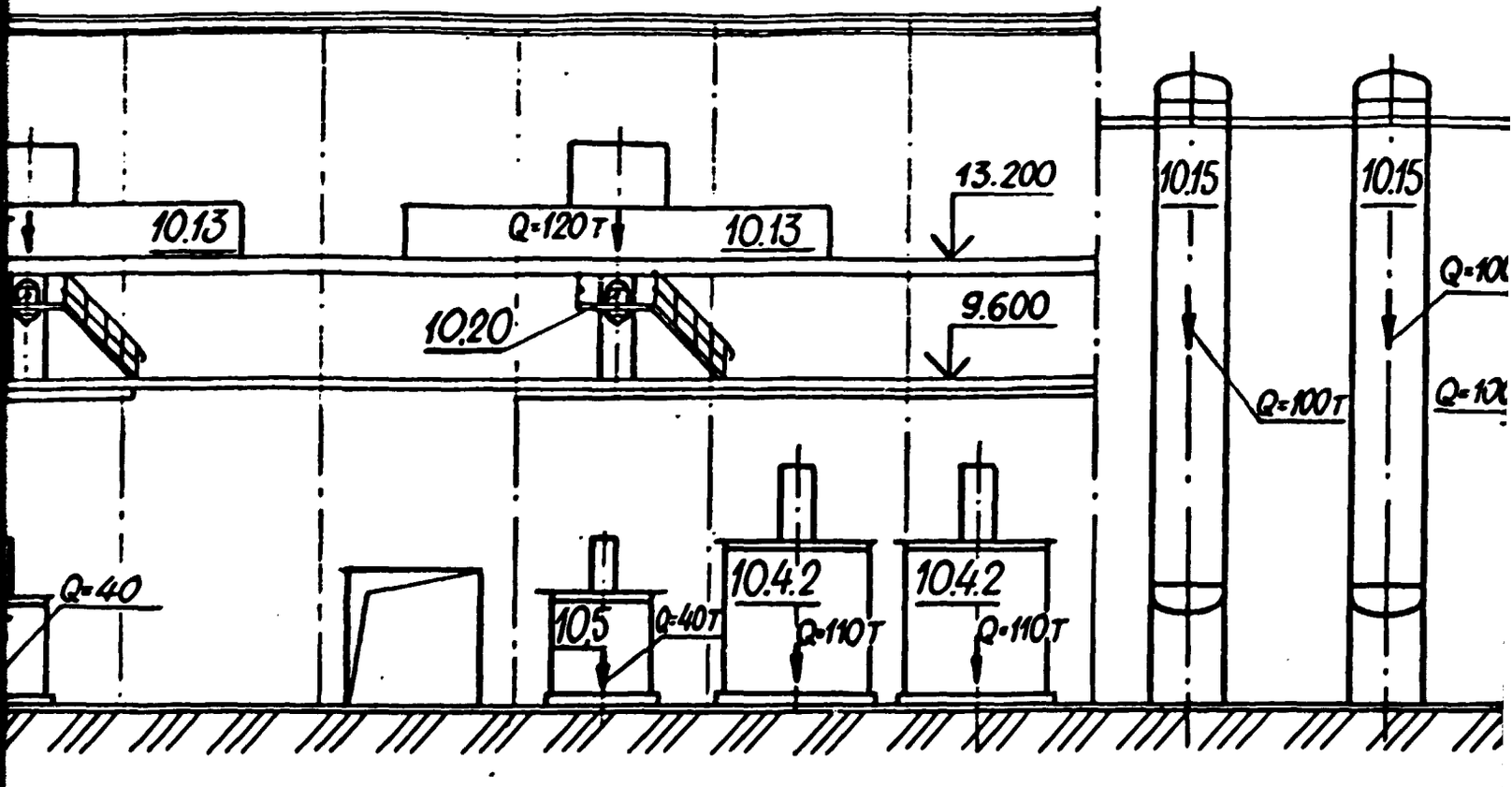
SCAL



1-1

SCALE 1:200

SECTION 2



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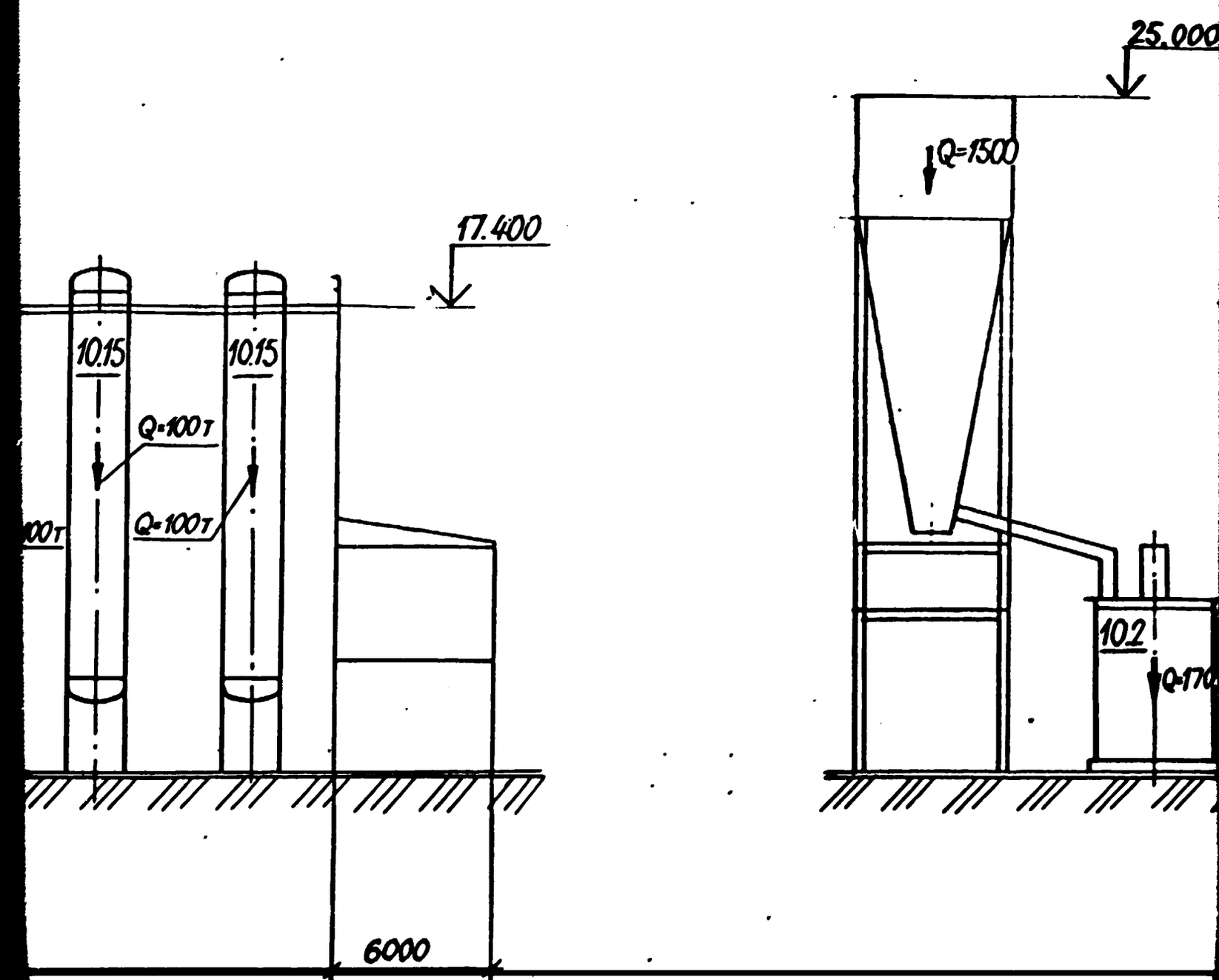
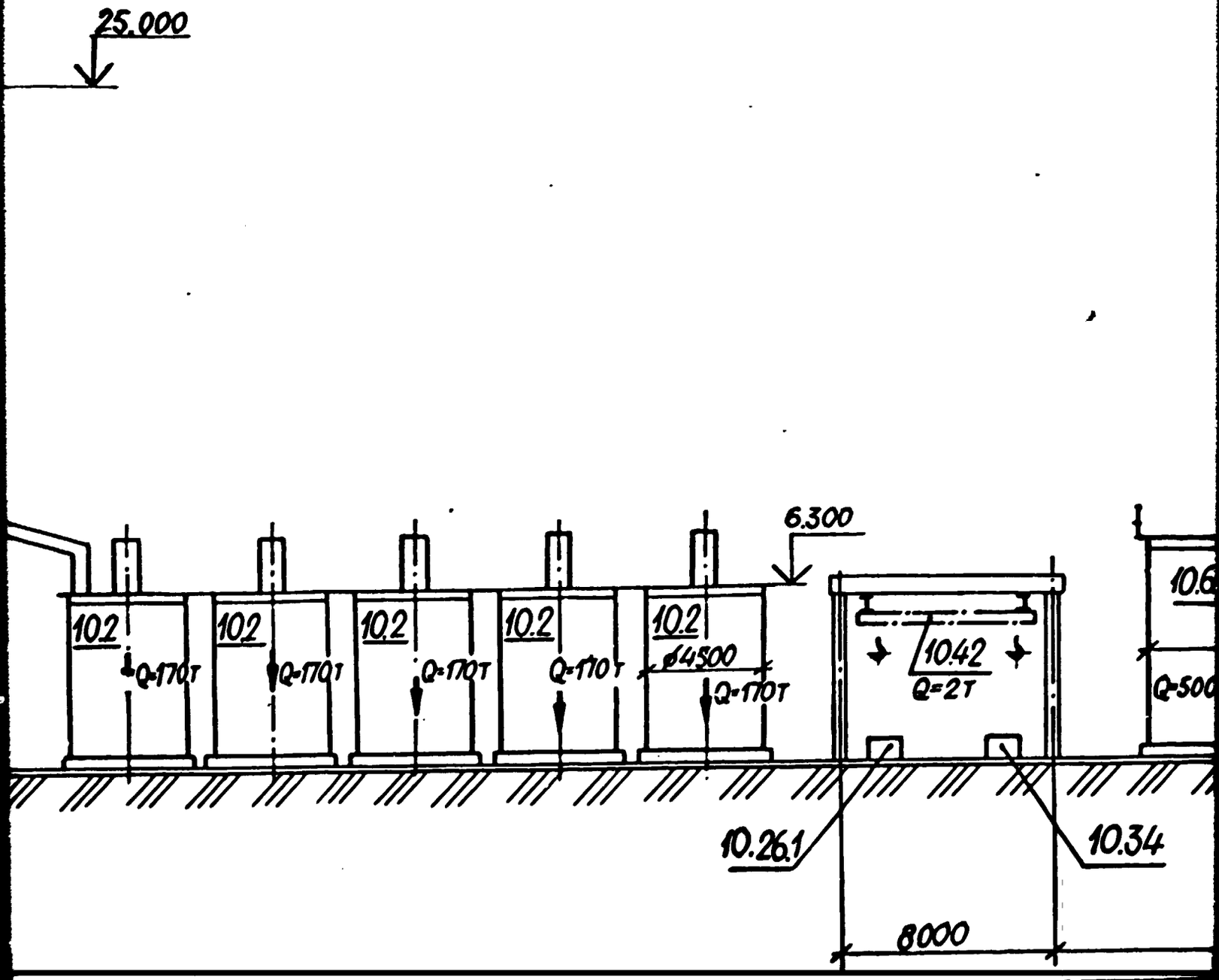
SECTION 3



SECTION 4

2-2

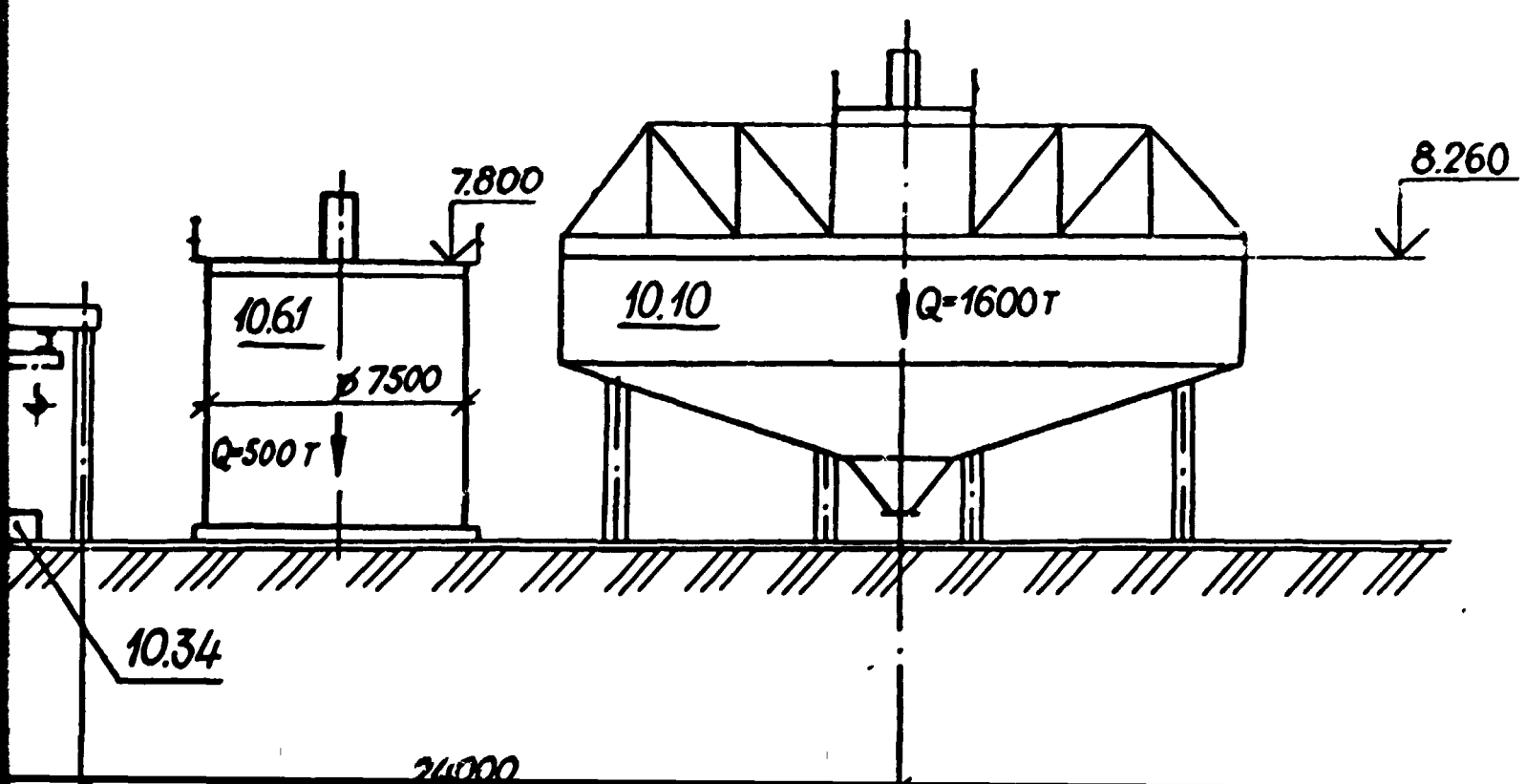
SCALE 1:200



2

1:200

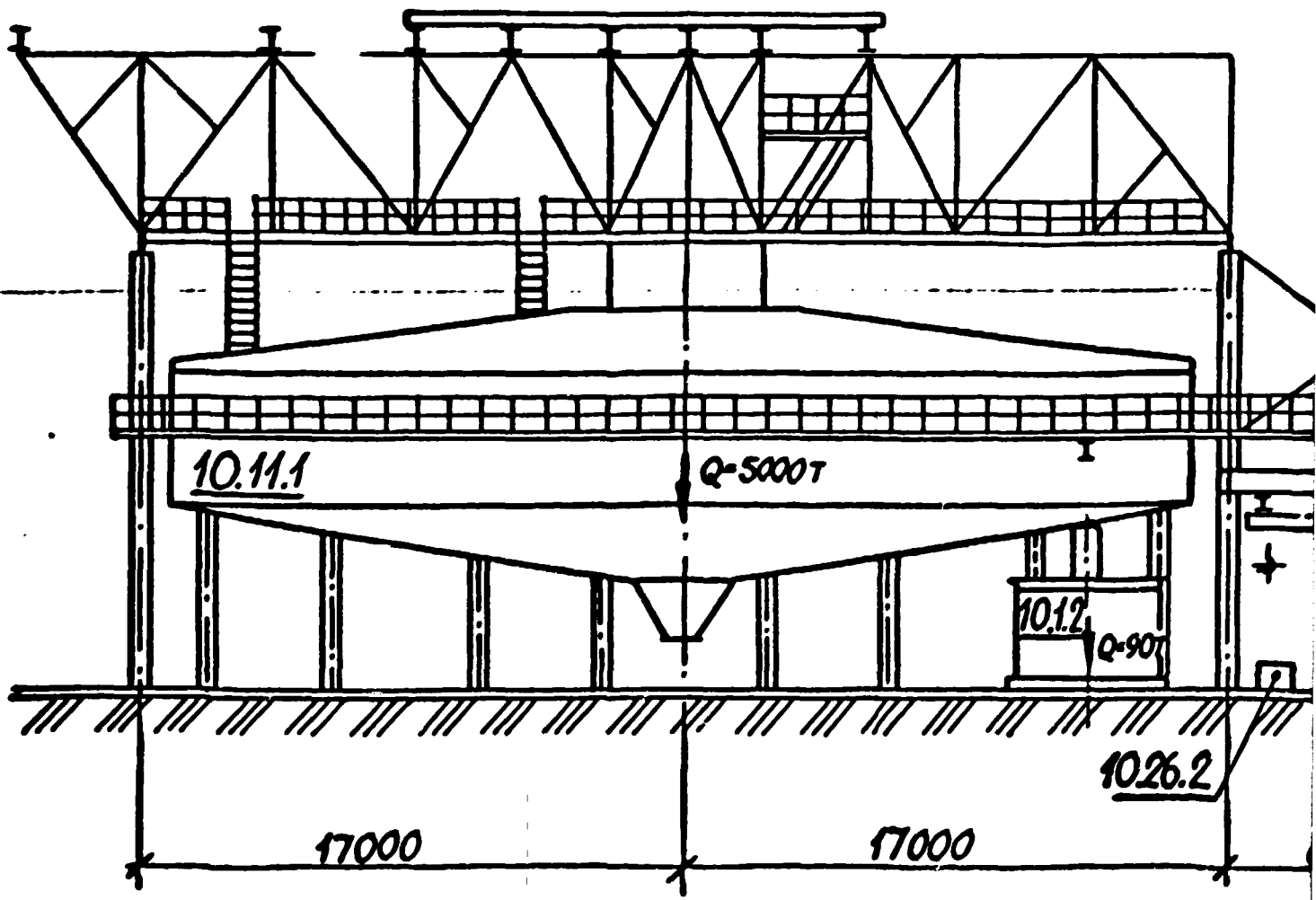
SECTION 5



SECTION 6

3

SCALE



SECTION 7

3-3

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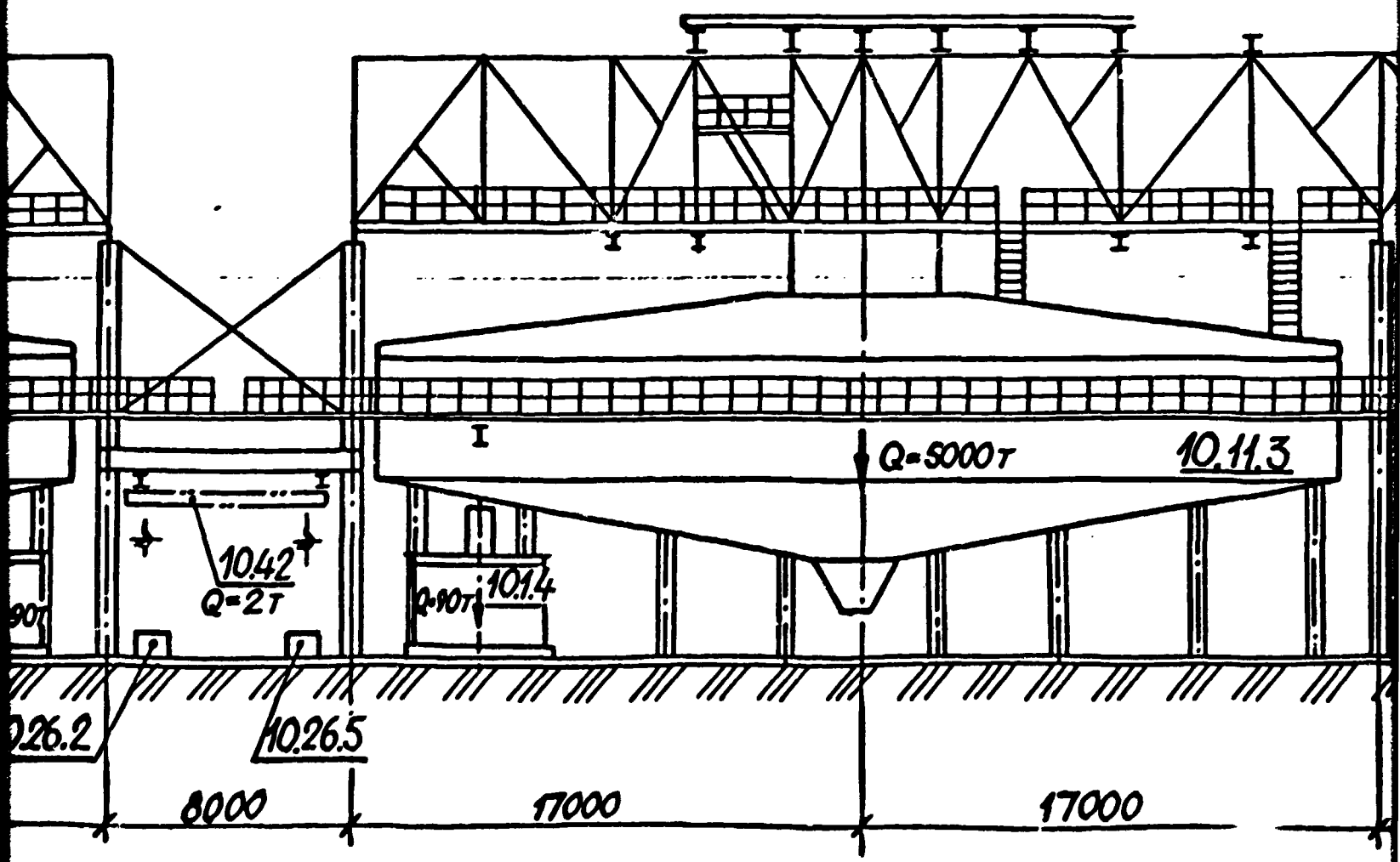
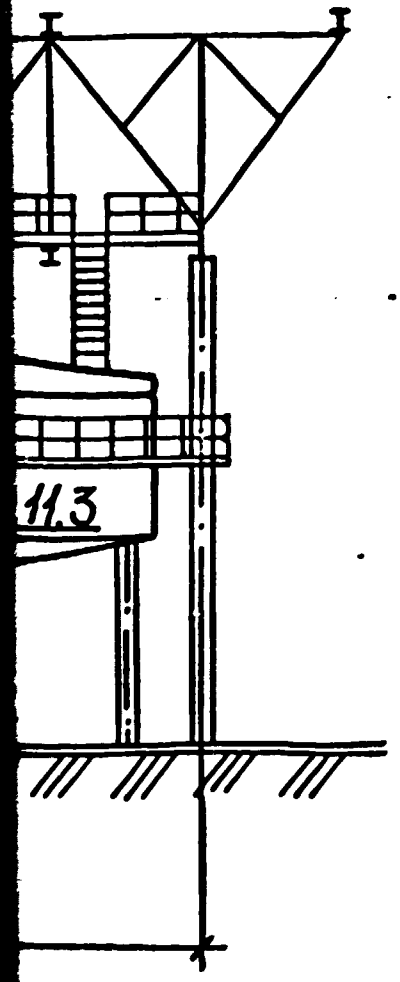
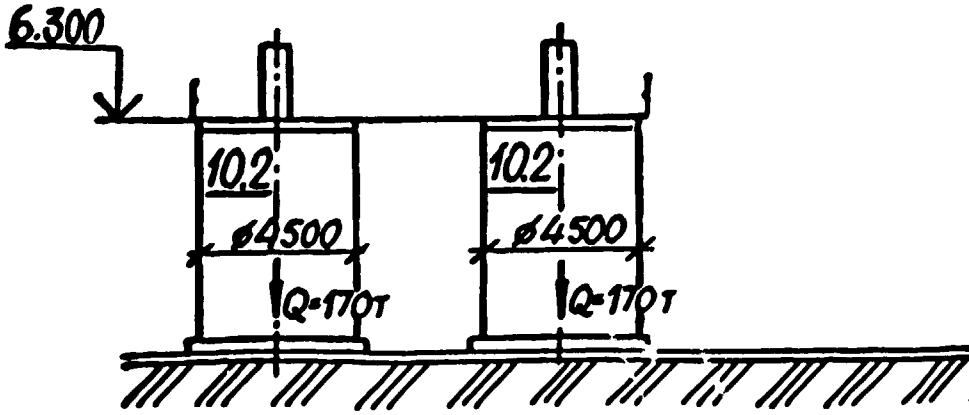


SECTION 8

4-4

SCALE 1:200

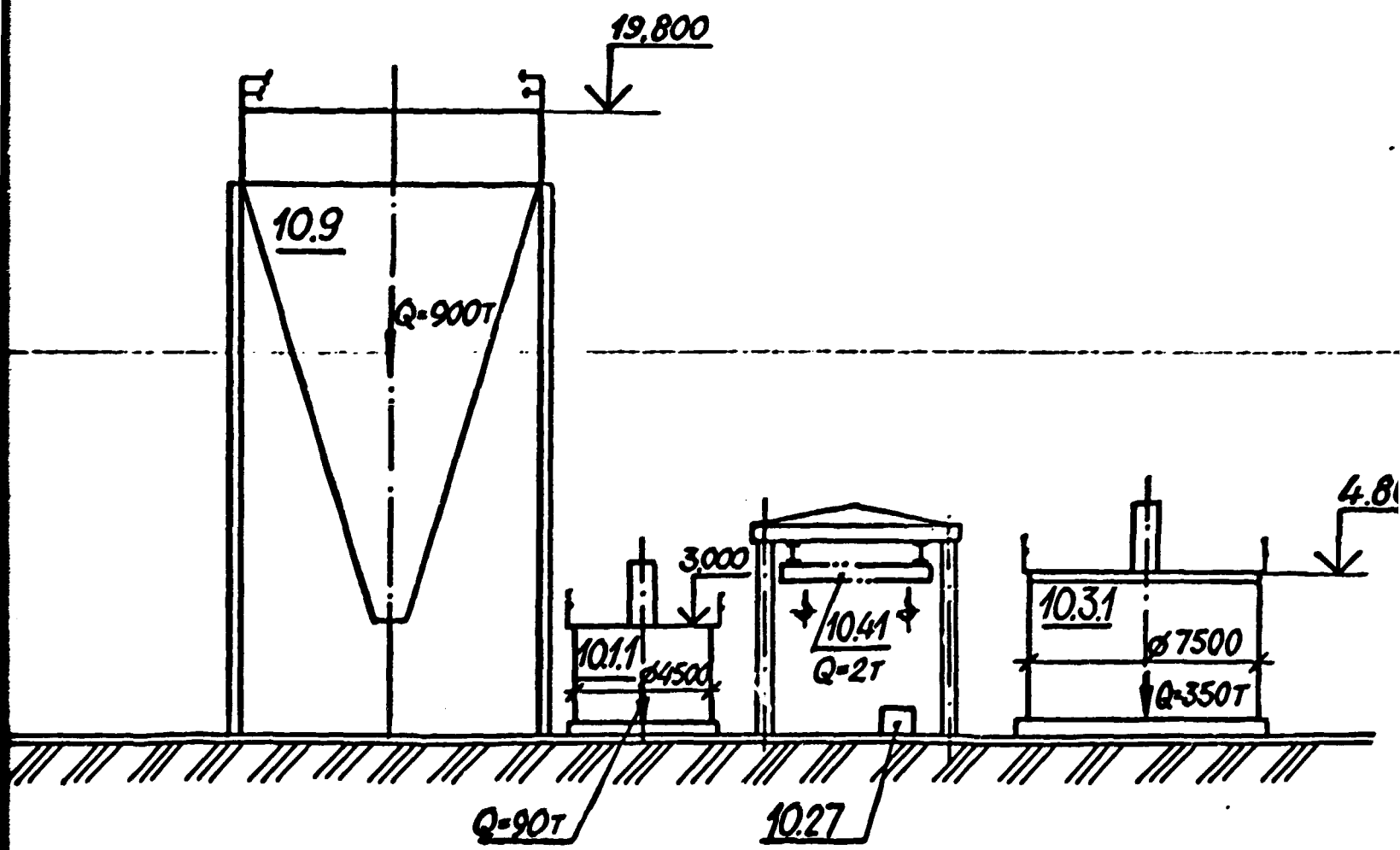




SECTION 9

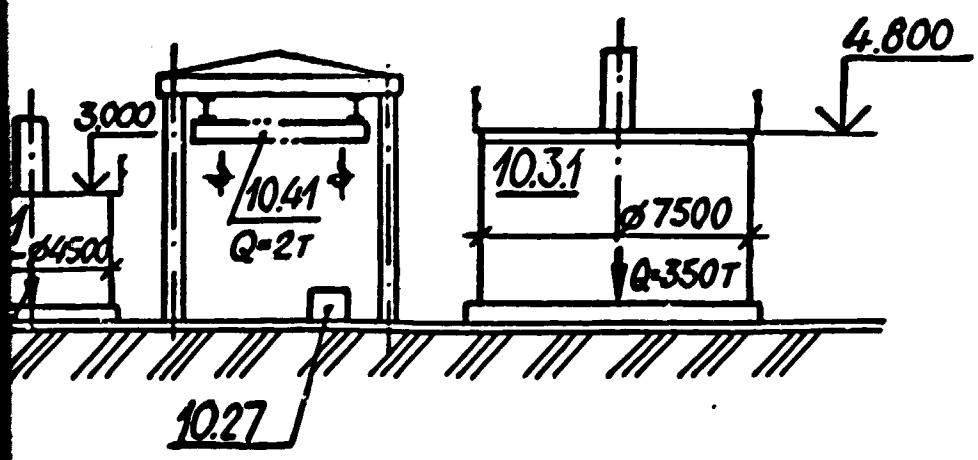
4-4

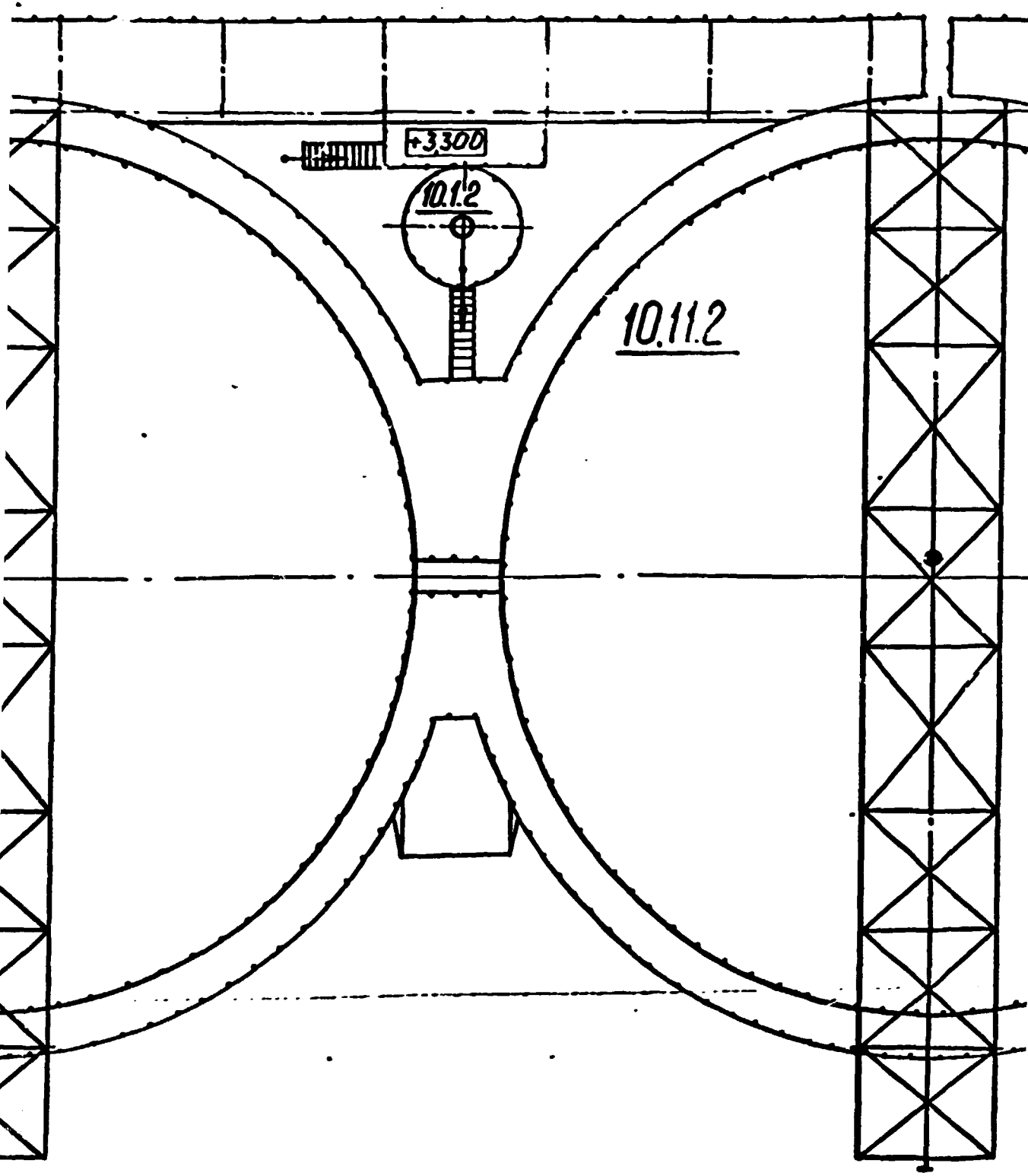
CALE 1:200



9.800

SECTION 10





SECTION 13

SECTION 11

UNIDO CONTRACT NO 85/108

1339552-TM

IRAN. ALUNITE BASED ALUMINA PLANT

DIGESTION, DESILICATION AND MUD WASHING	STAGE	SHEET	SHEETS
	FEASIBILITY	5	

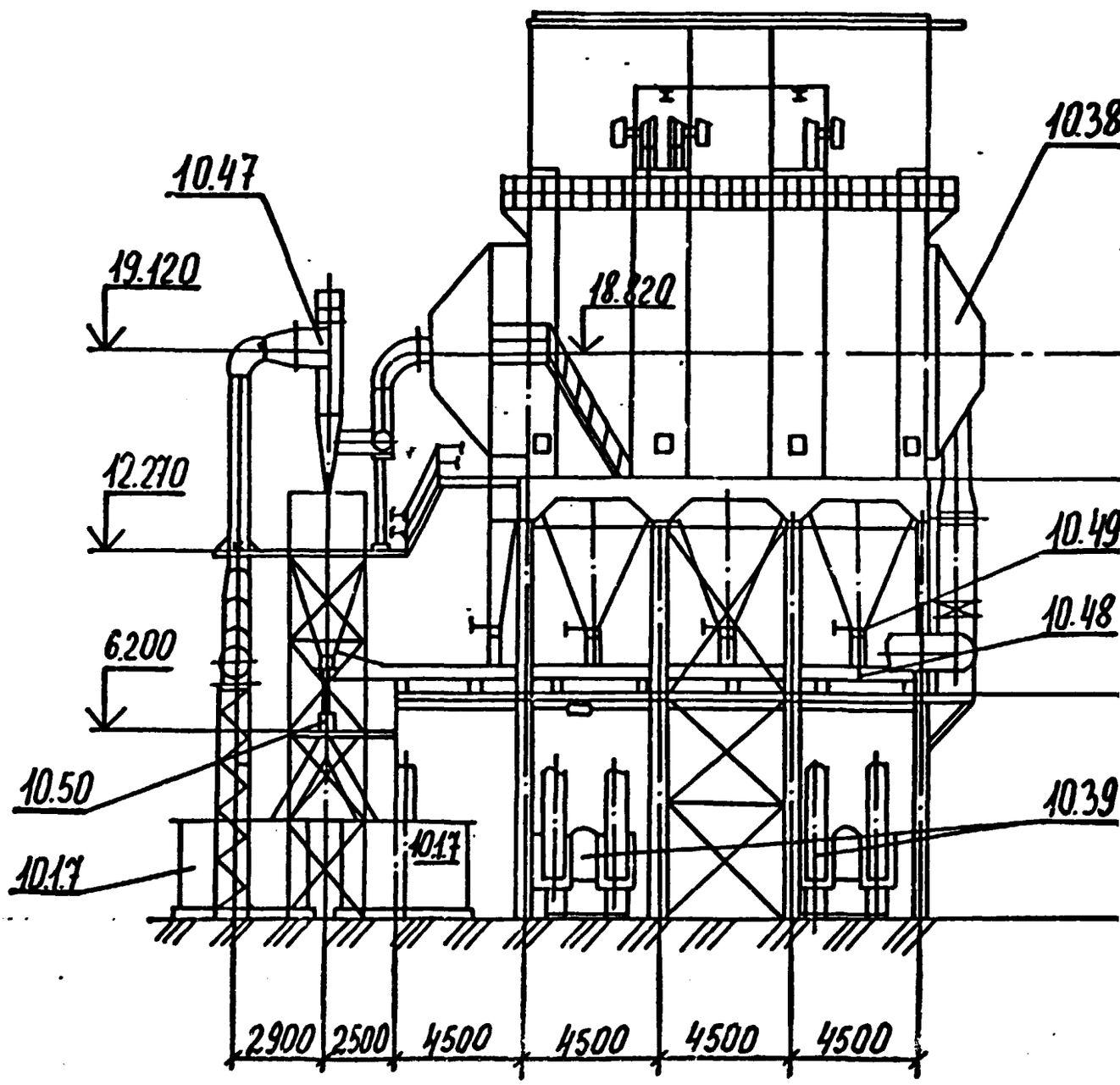
SECTIONS 1-1, 2-2, 3-3, 4-4

VAMI LENINGRAD

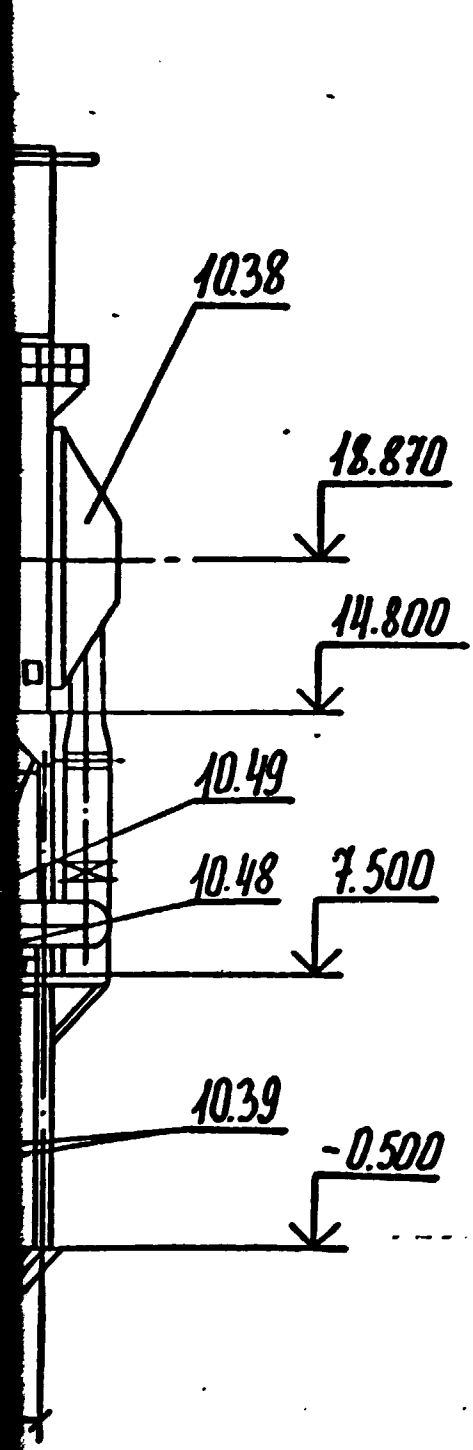
SECTION 1

5-5

SCALE 1:200



SECTION 2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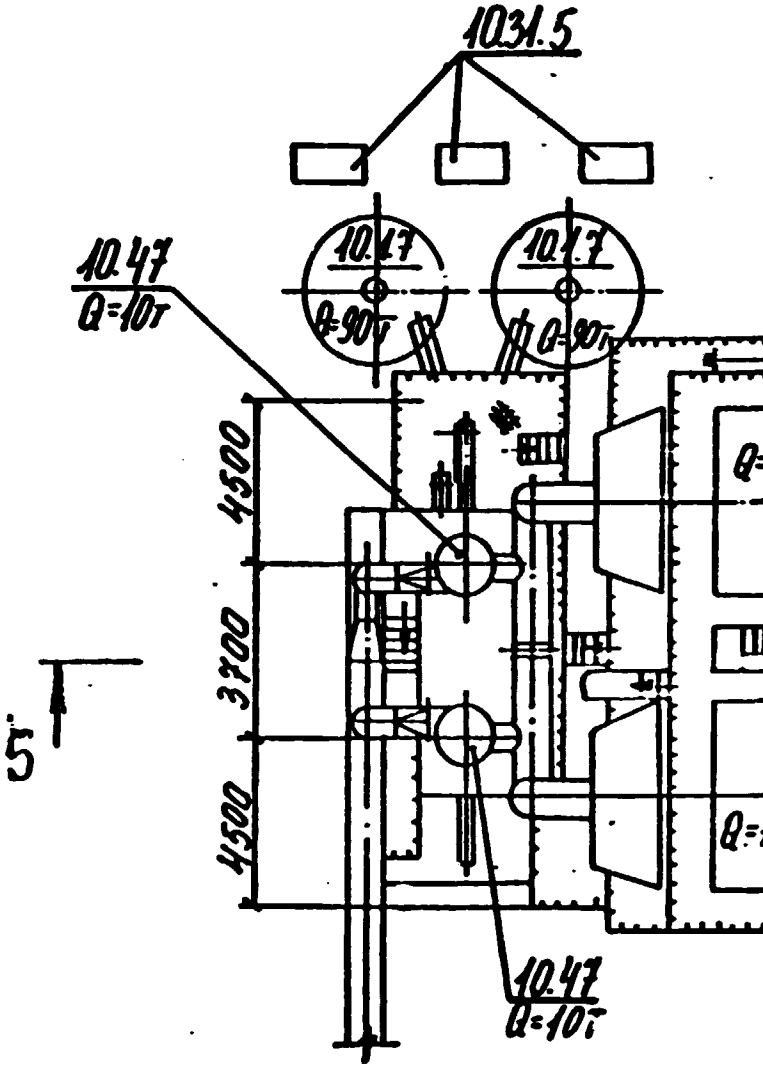
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10.47
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10.47
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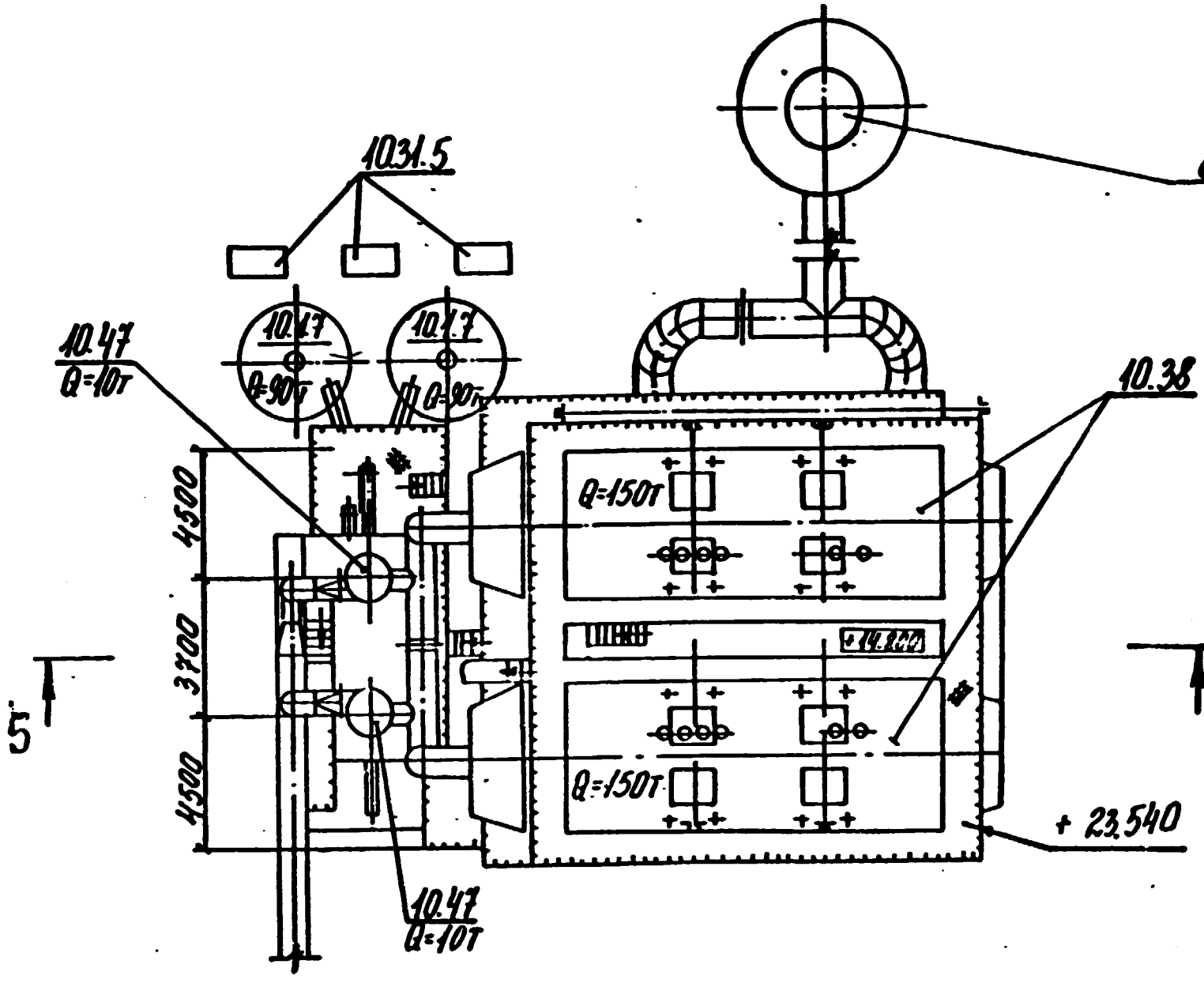
4500
10.47
Q=10т

5



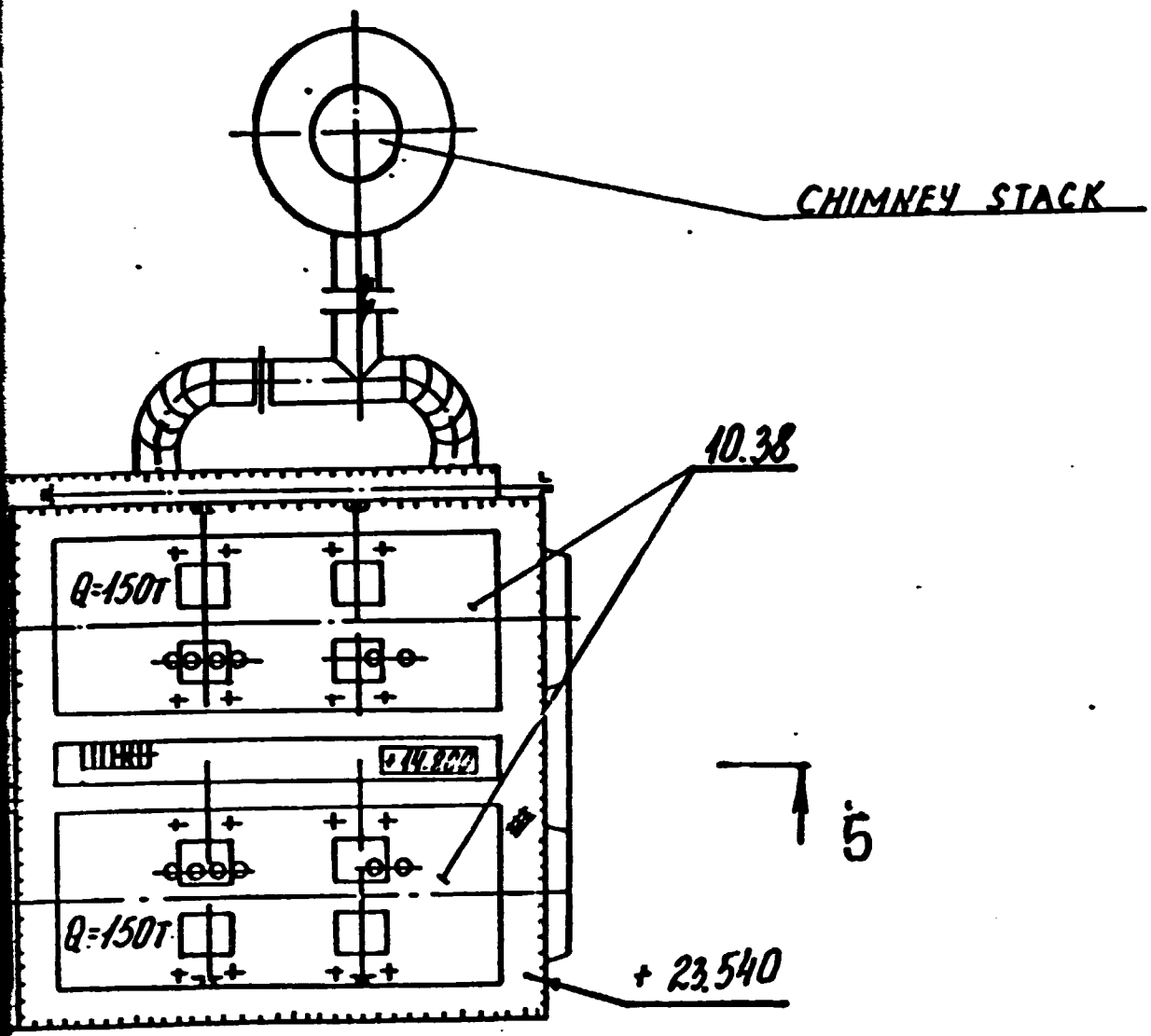
SECTION 3

UNIDO C

IRAN. ALU

DIGESTION, D
AND MUD WAS

ELECTROSTAR
PLAN A



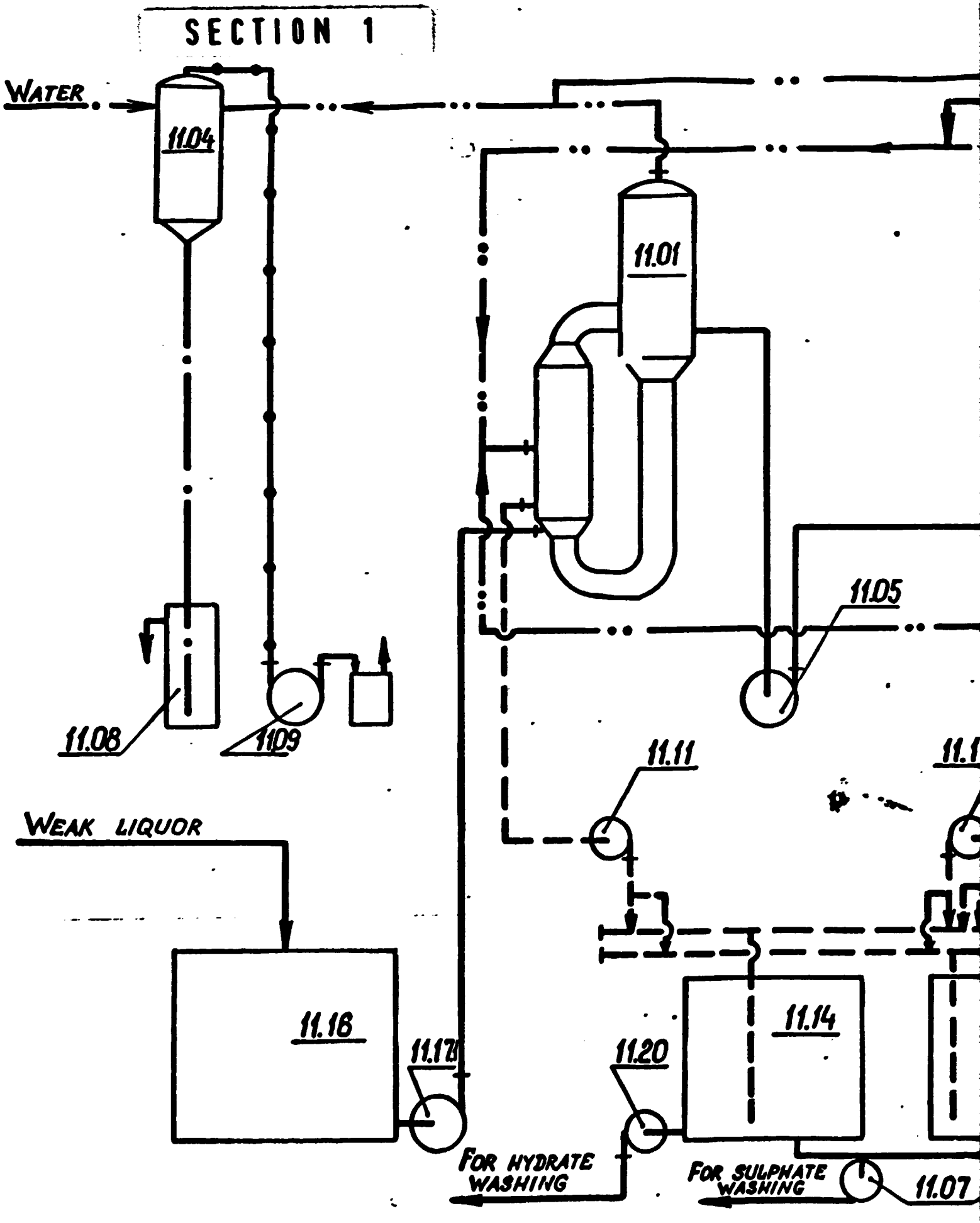
SECTION 4

UNIDO CONTRACT NO 85/108

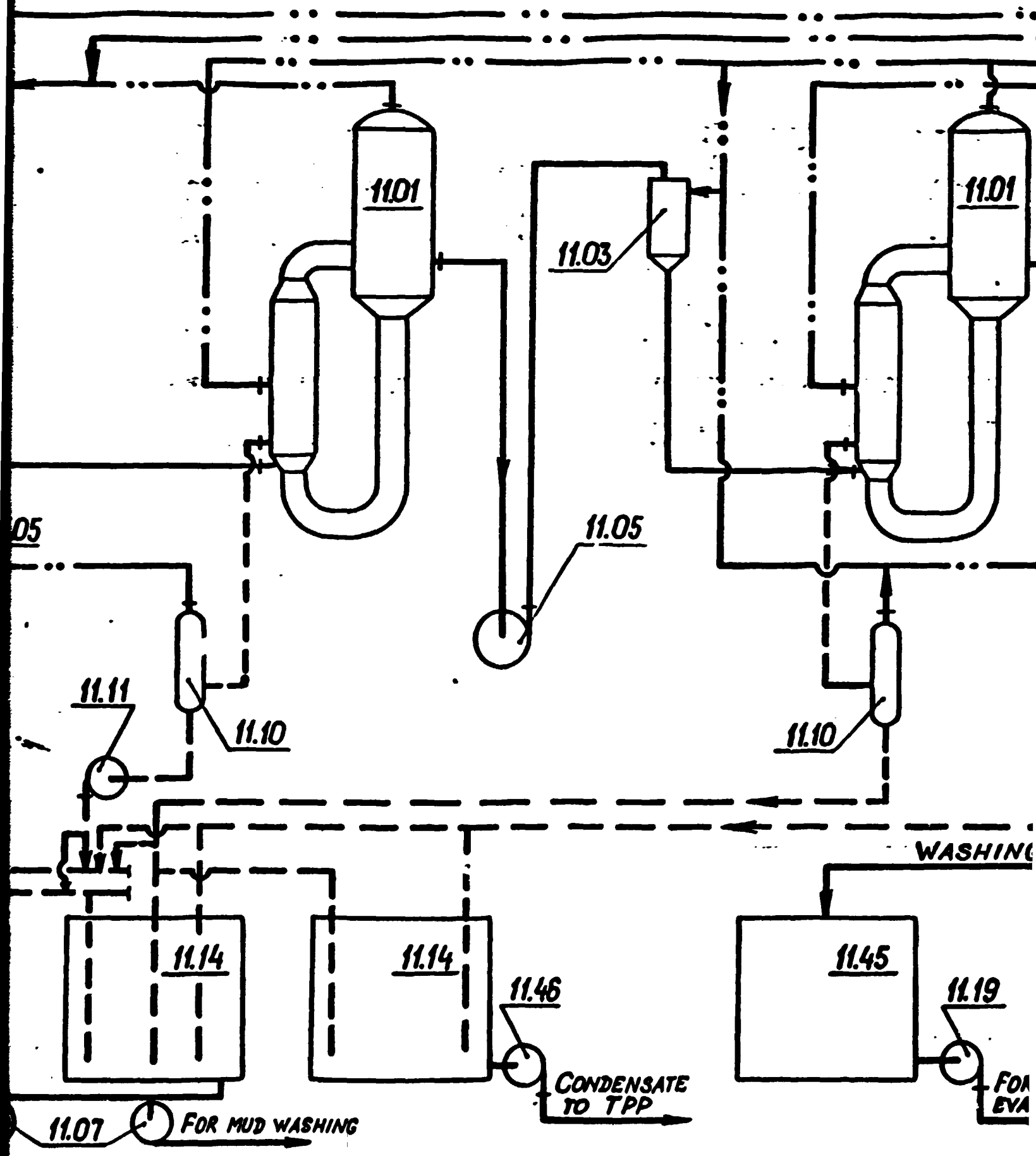
1339552-TM

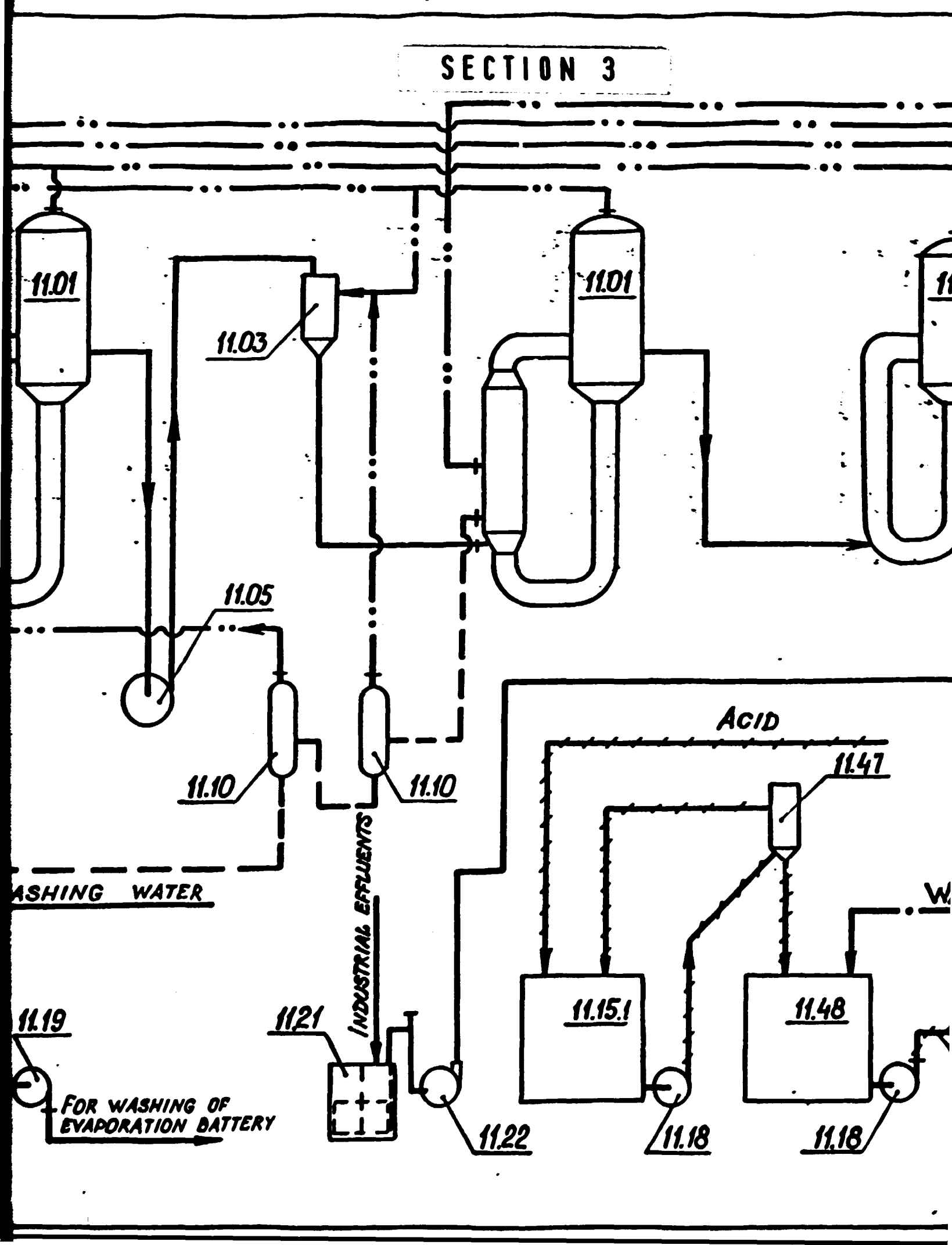
IRAN. ALUNITE BASED ALUMINA PLANT

DIGESTION, DESILICATION AND MUD WASHING	STAGE	SHEET	SHEETS
	PEASIBILITY	6	
ELECTROSTATIC PRECIPITATOR PLAN AND SECTION	VAMI LENINGRAD		

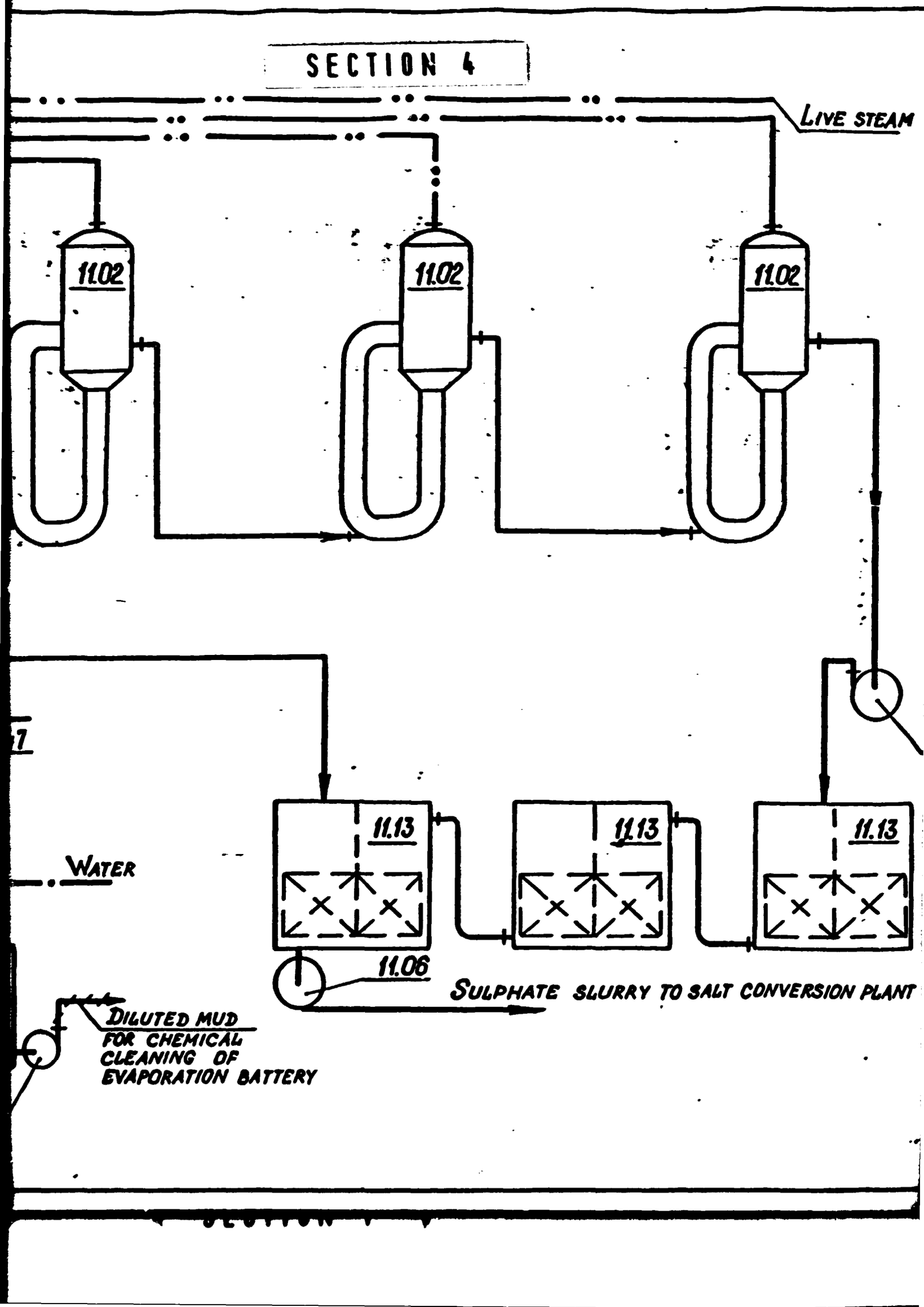

SECTION 1
WATER
11.04
11.01
11.05
11.08
11.09
11.11
WEAK LIQUOR
11.16
11.17
11.20
11.14
FOR HYDRATE WASHING
FOR SULPHATE WASHING
11.07

SECTION 2


11.01
11.03
11.01
11.05
11.11
11.10
11.10
WASHING
11.14
11.14
11.46
11.45
11.19
CONDENSATE TO TPP
11.07
FOR MUD WASHING


SECTION 3
11.01
11.03
11.01
11.05
11.10
11.10
ACID
11.47
ASHING WATER
INDUSTRIAL EFFLUENTS
11.19
11.21
11.15.1
11.48
FOR WASHING OF EVAPORATION BATTERY
11.22
11.18
11.18

SECTION 4


LIVE STEAM
11.02
11.02
11.02
WATER
11.13
11.13
11.13
11.06
SULPHATE SLURRY TO SALT CONVERSION PLANT
DILUTED MUD FOR CHEMICAL CLEANING OF EVAPORATION BATTERY

SECTION 5

SEC N°	DESCRIPTION	SPECIFICATION	NUMBER	NOTE
11.01	EVAPORATION UNIT	1000 M³	16	
11.02	FLASH TANK OF LIQUOR	Φ3000	12	
11.03	CONTACT HEAT EXCHANGER	Φ1000	8	
11.04	BAROMETRIC CONDENSER	Φ2200	4	
11.05	CENTRIFUGAL PUMP	250 M³/HR, 28 M	24	
11.06	CENTRIFUGAL PUMP	250 M³/HR, 28 M	2	
11.07	CENTRIFUGAL PUMP	45 M³/HR, 30 M	3	
11.08	HYDROLOCK	Φ3000×3000	4	
11.09	VACUUM PUMP	25 M³/MIN	6	
11.10	CONDENSATE FLASH TANK	Φ1000	16	
11.11	CENTRIFUGAL PUMP	20 M³/HR, 18 M	16	
11.12	CENTRIFUGAL PUMP	100 M³/HR, 16 M	8	
11.13	UNIT WITH CHAIN AGITATOR	Φ7500×9000	3	
11.14	CONDENSATE TANK	Φ6000×6000	3	
11.15	STRONG ACID TANK	Φ4500×4500	1	

E STEAM

11.12

11.13

ON PLANT

LEGEND

- ALUMINATE UGUOR
- CONDENCATE
- STEAM
- WATER
- VACUUM
- ACID

NOTE	SRC N°	DESCRIPTION	SPECIFICATION	NUMBER	NOTE
	11.16	WEAK LIQUOR TANK	Φ9000×9000	2	
	11.17	CENTRIFUGAL PUMP	250 M³/HR, 28M	5	
	11.18	CENTRIFUGAL PUMP	100 M³/HR, 32M	2	
	11.19	CENTRIFUGAL PUMP	250M³/HR, 28M	2	
	11.20	CENTRIFUGAL PUMP	45 M³/HR, 30M	2	
	11.21	UNIT WITH CHAIN AGITATOR	Φ2000×2500	9	
	11.22	CENTRIFUGAL PUMP	100 M³/HR, 31M	9	
	11.43	ELECTRICAL SUSPENDED SINGLE CANTILIVER CRANE	CAPACITY 2T	3	NOT SHOWN
	11.44	AUTOMOBILE CRANE (DEMAG TYPE)	CAPACITY 120T	1	NOT SHOWN
	11.45	WASHING WATER TANK	Φ6000×6000	2	
	11.46	CENTRIFUGAL PUMP	160 M³/HR, 30M	2	
	11.47	BATEN MEETER	Φ1000×1500	1	
	11.48	LINED TANK	Φ4500×4500	1	
	11.49	CENTRIFUGAL SHAPING PUMP	90M³/HR, 85M	1	

SECTION 6

UNIDO CONTRACT NO 85/108

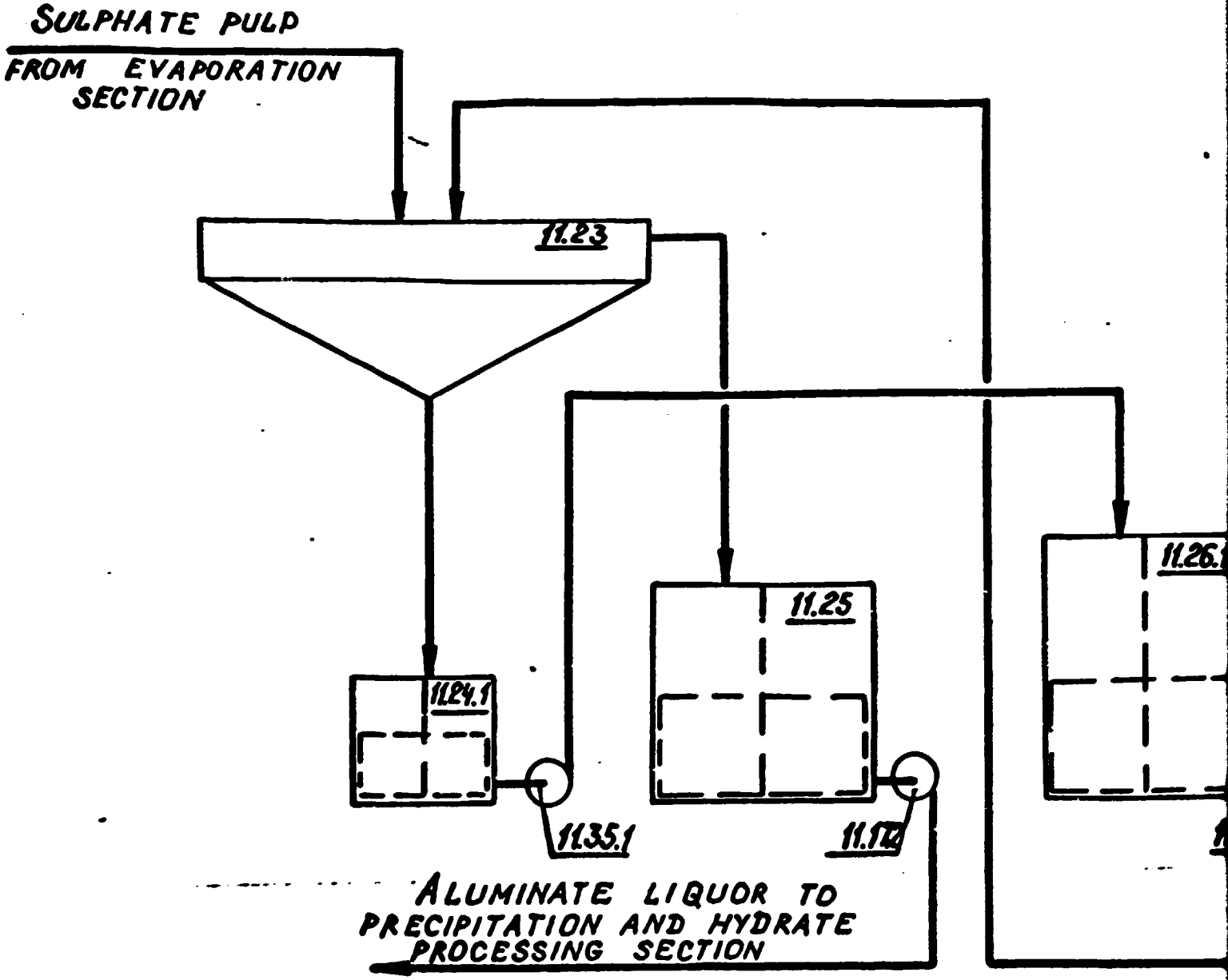
1339553-TM

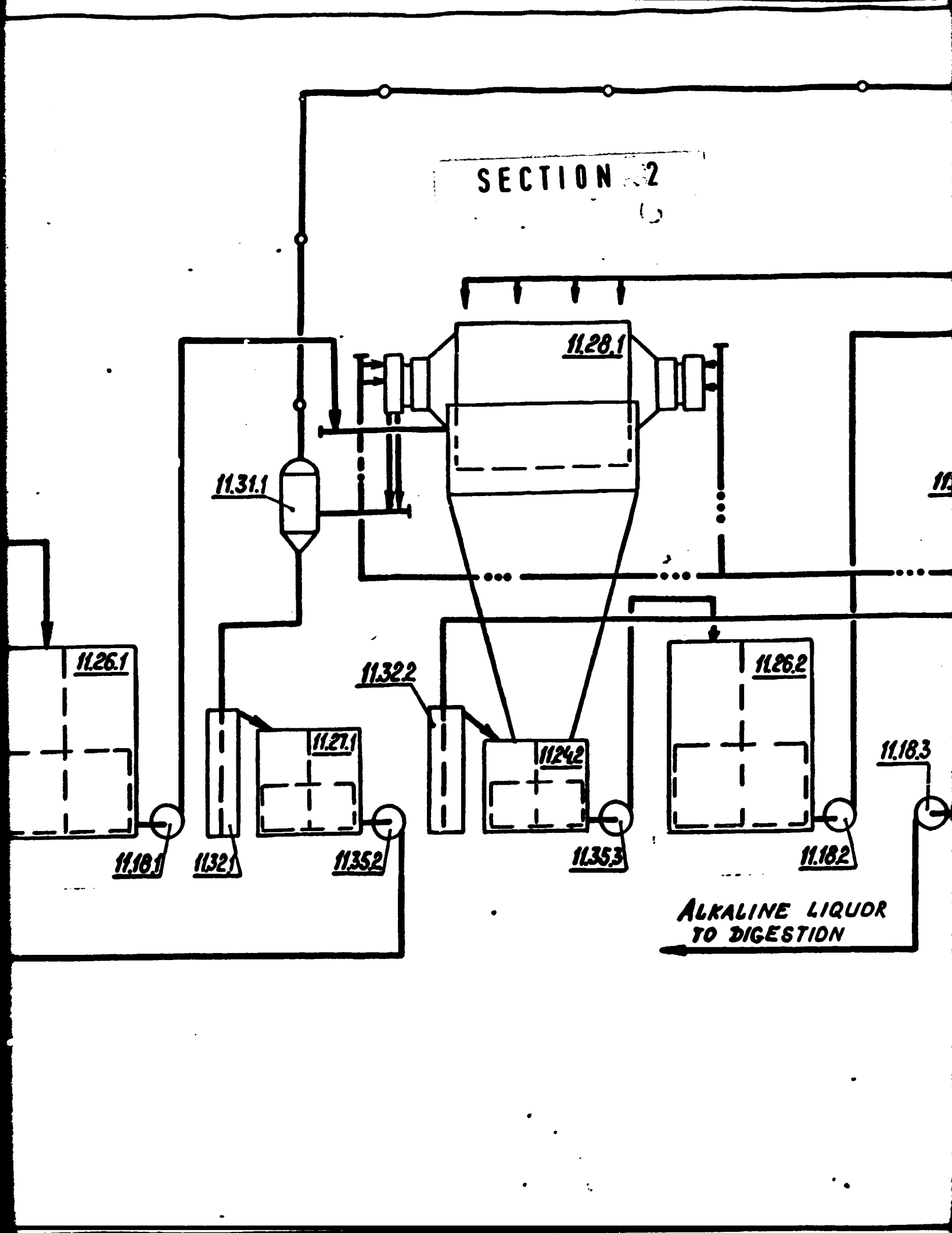
IRAN. ALUNITE BASED ALUMINA PLANT

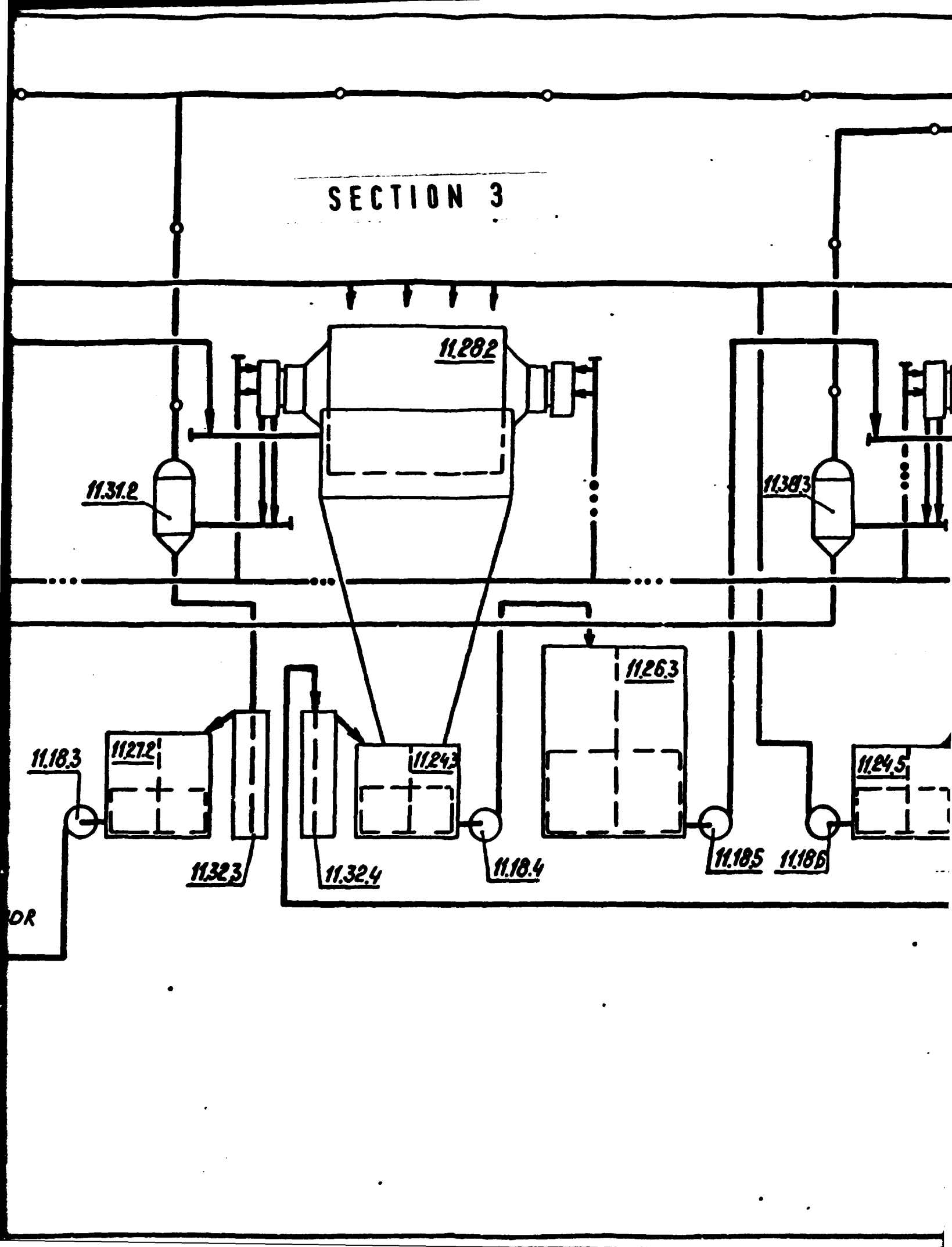
	STAGE	SHEET	SHEETS
EVAPORATION AND SALT CONVERSION UNIT EVAPORATION SECTION	FEASIBILITY	1	4
APPARATUS - PROCESS FLOWSHEET	VAMI - LENINGRAD		

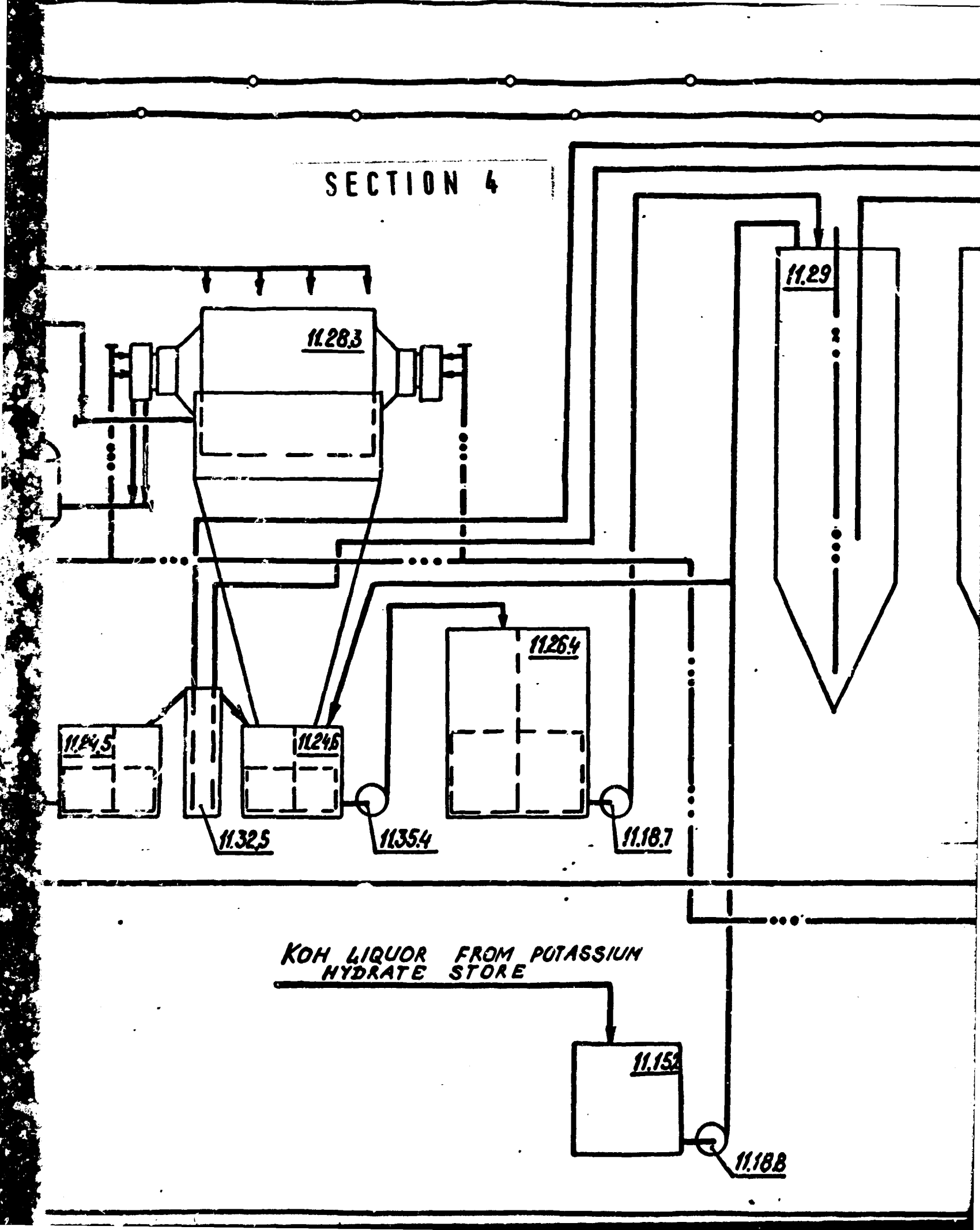
Size A4x3

SECTION 1


SULPHATE PULP
FROM EVAPORATION SECTION
11.23
11.24.1
11.25
11.35.1
ALUMINATE LIQUOR TO PRECIPITATION AND HYDRATE PROCESSING SECTION


SECTION 2
11.28.1
11.31.1
11.26.1
11.32.2
11.26.2
11.27.1
11.24.2
11.18.3
11.18.1
11.32.1
11.35.2
11.35.3
11.18.2
ALKALINE LIQUOR
TO DIGESTION


SECTION 3
11.282
11.31.2
11.38.3
11.26.3
11.18.3
11.27.2
11.24.3
11.24.5
11.32.3
11.32.4
11.18.4
11.18.5
11.18.6
OR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11.28.3
11.26.4
11.24.5
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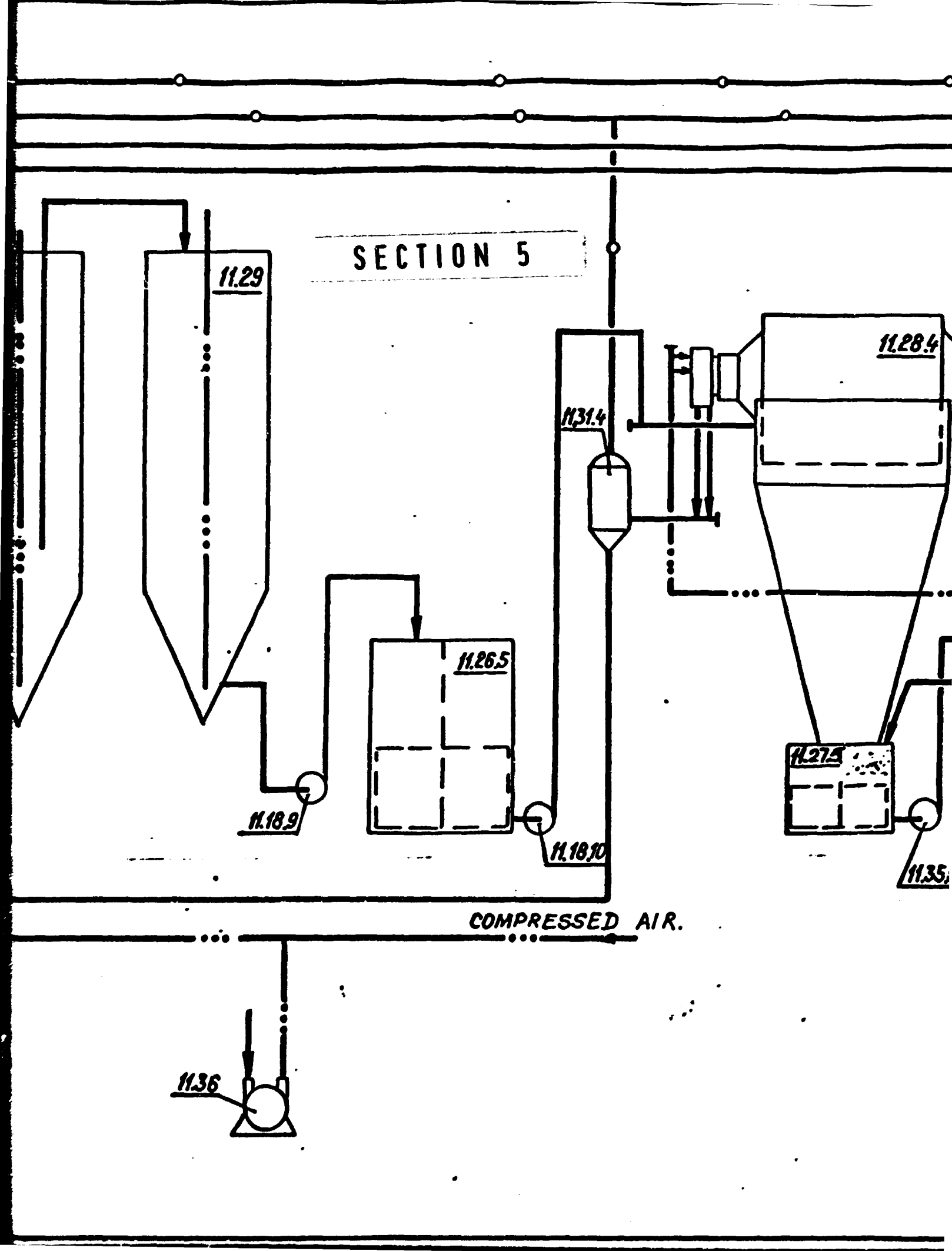
11.35.4
11.18.7
KOH LIQUOR FROM POTASSIUM HYDRATE STORE
11.15.2
11.18.8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11.28.4
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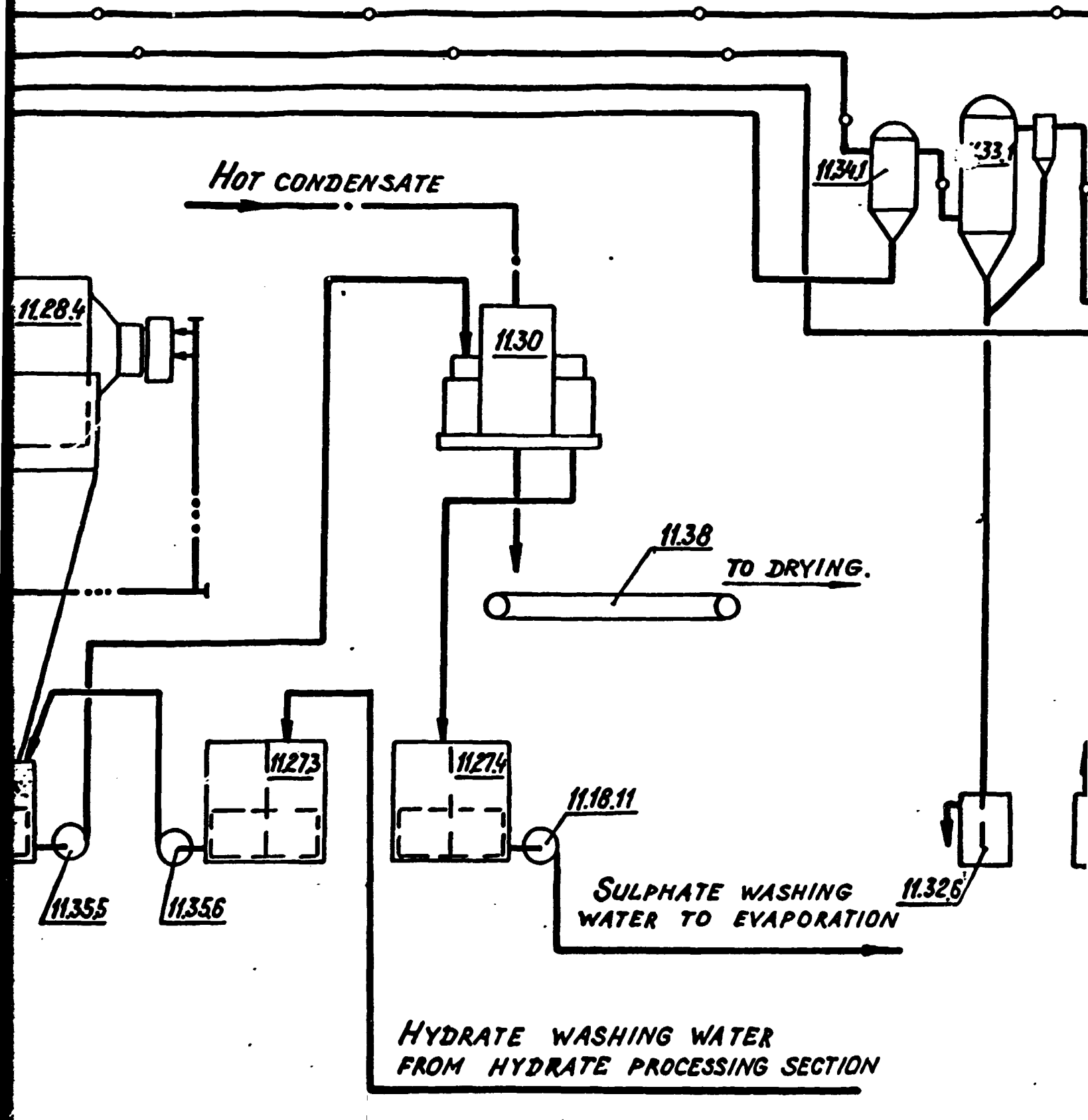
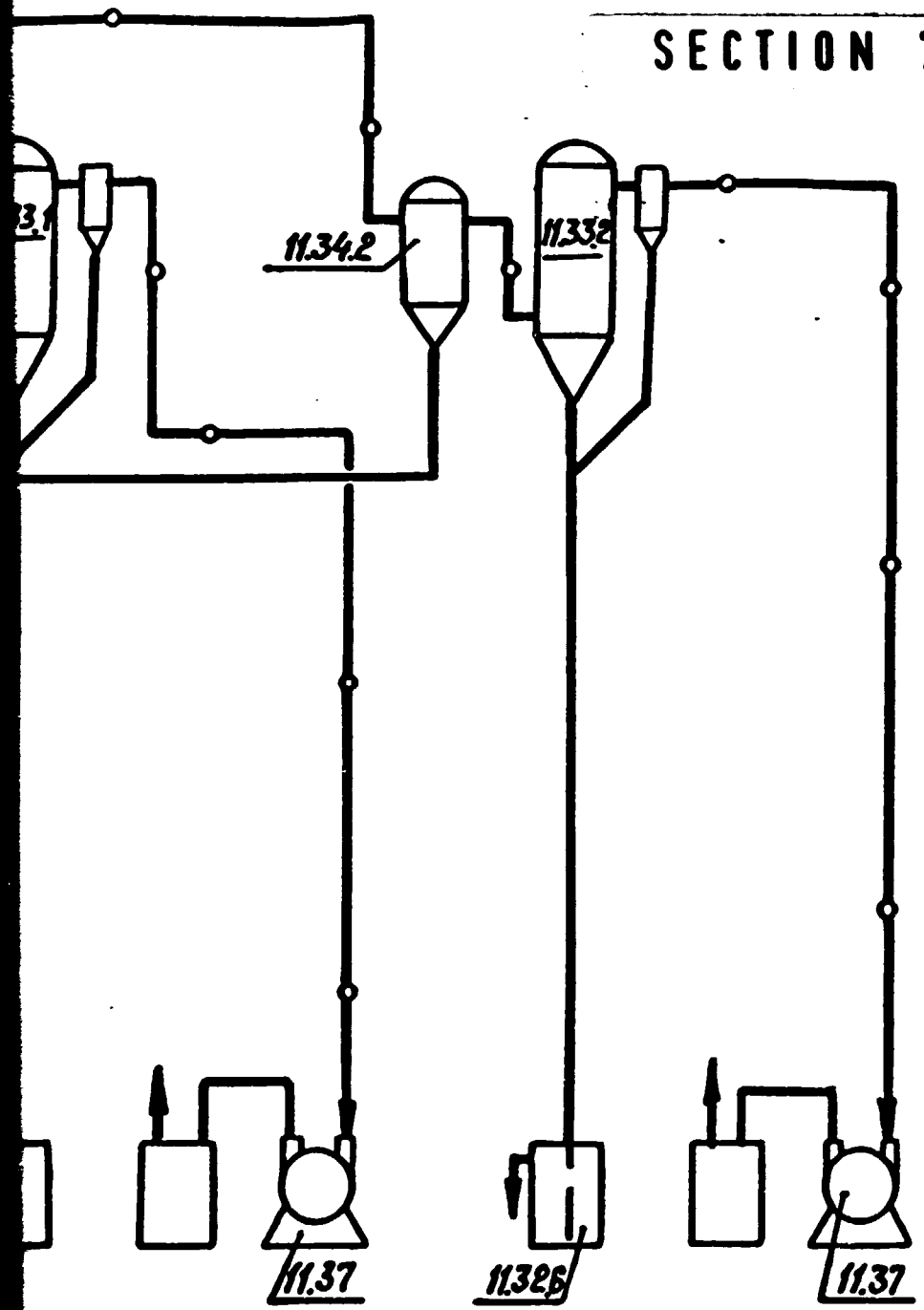
11.18.9
11.18.10
11.35
COMPRESSED AIR.
11.36

SECTION 6


HOT CONDENSATE
11.34.1
11.28.4
11.30
11.38
TO DRYING.
11.27.3
11.27.4
11.18.11
11.35.5
11.35.6
11.32.6
SULPHATE WASHING WATER TO EVAPORATION
HYDRATE WASHING WATER FROM HYDRATE PROCESSING SECTION

SECTION 7



LEGEND

PULP,

COMPRES

VACUUM

CONDENS

LEGEND

- PULP, LIQUOR
- COMPRESSED AIR.
- VACUUM
- CONDENSATE

SECTION 8

ITEM	DESCRIPTION
11.15.2	TANK
11.17.2	CENTRIFUGAL PUMP
11.18.1	CENTRIFUGAL PUMP
11.18.2	CENTRIFUGAL PUMP
11.18.3	CENTRIFUGAL PUMP
11.18.4	CENTRIFUGAL PUMP
11.18.5	CENTRIFUGAL PUMP
11.18.6	CENTRIFUGAL PUMP
11.18.7	CENTRIFUGAL PUMP
11.18.8	CENTRIFUGAL PUMP
11.18.9	CENTRIFUGAL PUMP
11.18.10	CENTRIFUGAL PUMP
11.18.11	CENTRIFUGAL PUMP
11.23	SINGLE-CHAMBER THICKE
11.24.1	CHAIN AGITATOR
11.24.2	CHAIN AGITATOR
11.24.3	CHAIN AGITATOR
11.24.4	CHAIN AGITATOR
11.24.5	CHAIN AGITATOR
[illegible]	[illegible] AGITATOR
11.25	CHAIN AGITATOR
11.26.1	CHAIN AGITATOR
11.26.2	CHAIN AGITATOR
11.26.3	CHAIN AGITATOR
11.26.4	CHAIN AGITATOR
11.26.5	CHAIN AGITATOR
11.27.1	CHAIN AGITATOR
11.27.2	CHAIN AGITATOR
11.27.3	CHAIN AGITATOR
11.27.4	CHAIN AGITATOR
11.27.5	CHAIN AGITATOR
11.28.1	VACUUM - FILTER

SECTION 9

ITEM	DESCRIPTION	SPECIFICATIONS	NUMBER	NOTE
11.15.2	TANK	ϕ 4500; H= 4500	1	
11.17.2	CENTRIFUGAL PUMP	250 m^3/hR: 28 m	2	
11.18.1	CENTRIFUGAL PUMP	100 m^3/hR: 31.5 m	2	
11.18.2	CENTRIFUGAL PUMP	100 m^3/hR: 31.5 m	4	
11.18.3	CENTRIFUGAL PUMP	100 m^3/hR; 31.5 m	2	
11.18.4	CENTRIFUGAL PUMP	100 m^3/hR; 31.5 m.	4	
11.18.5	CENTRIFUGAL PUMP	100 m^3/hR; 31.5 m	2	
11.18.6	CENTRIFUGAL PUMP	100 m^3/hR: 31.5 m	2	
11.18.7	CENTRIFUGAL PUMP	100 m^3/hR: 31.5 m	2	
11.18.8	CENTRIFUGAL PUMP	100 m^3/hR: 31.5 m	2	
11.18.9	CENTRIFUGAL PUMP	100 m^3/hR: 31.5 m	2.	
11.18.10	CENTRIFUGAL PUMP	100 m^3/hR : 31.5 m	4	
11.18.11	CENTRIFUGAL PUMP	100 m^3/hR; 31.5 m	2	
11.23	SINGLE-CHAMBER THICKENER.	ϕ 20000.	3	
11.24.1	CHAIN AGITATOR	ϕ 4500: H= 3000	3	
11.24.2	CHAIN AGITATOR	ϕ 4500; H= 3000	2	
11.24.3	CHAIN AGITATOR	ϕ 4500: H= 3000	2	
11.24.4	CHAIN AGITATOR	ϕ 4500: H= 3000	2	
11.24.5	CHAIN AGITATOR	ϕ 4500 : H= 3000	1	
[illegible]	[illegible]	[illegible]	[illegible]	
11.25	CHAIN AGITATOR	ϕ 9000 : H= 6000	2	
11.26.1	CHAIN AGITATOR	ϕ 6000: H= 9000	2	
11.26.2	CHAIN AGITATOR	ϕ 6000: H= 9000	2	
11.26.3	CHAIN AGITATOR	ϕ 6000; H= 9000	1	
11.26.4	CHAIN AGITATOR	ϕ 6000: H= 9000	1.	
11.26.5	CHAIN AGITATOR	ϕ 6000; H= 9000	2	
11.27.1	CHAIN AGITATOR	ϕ 4500; H= 4500	2	
11.27.2	CHAIN AGITATOR	ϕ 4500; H= 4500	1	
11.27.3	CHAIN AGITATOR	ϕ 4500 : H= 4500	1	
11.27.4	CHAIN AGITATOR	ϕ 4500; H= 4500	2	
11.27.5	CHAIN AGITATOR	ϕ 4500: H= 4500	2	
11.28.1	VACUUM - FILTER	F= 40 m^2	2.	

ITEM	DES
11.28.2	VACUU
11.28.3	VACUUM
11.28.4	VACUU
11.29	CRYSTA
11.30	CENTRI
11.31.1	RECEIV
11.31.2	RECEIV
11.31.3	RECEIV
11.31.4	RECEIV
11.32.1	HYDRO
11.32.2	HYDRO
11.32.3	HYDRO
11.32.4	HYDR
11.32.5	HYDRO
11.32.6	HYDRO
11.33.1	BAROM
11.33.1	BAROM
11.34.1	TRAP
11.34.2	TRAP
11.35.1	CENTRI
11.35.2	CENTRI
11.35.3	CENTRI
11.35.4	CENTRI
11.35.5	CENTRI

ITEM	DESCRIPTION	SPECIFICATIONS.	NUMBER	NOTE.
11.28.2	VACUUM- FILTER	$F=40M^2$	2	
11.28.3	VACUUM- FILTER	$F=40M^2$	2	
11.28.4	VACUUM - FILTER	$F=40M^2$	2	
11.29	CRYSTALIZER	ϕ7750: H=24000	2	
11.30	CENTRIFUGE		5	
11.31.1	RECEIVER	$V=4M^3$	2	
11.31.2	RECEIVER	$V=4M^3$	2	
11.31.3	RECEIVER	$V=4M^3$	2	
11.31.4	RECEIVER	$V=4M^3$	2	
11.32.1	HYDROLOCK	ϕ 1000	2	
11.32.2	HYDROLOCK	ϕ 1000	2.	
11.32.3	HYDROLOCK	ϕ 1000	1	
11.32.4	HYDROLOCK	ϕ 1000	2	
11.32.5	HYDROLOCK	ϕ 1000	2	
11.32.6	HYDROLOCK	ϕ 1000	2	
11.33.1	BAROMETRIC CONDENSER	ϕ 800	1.	
11.33.2	BAROMETRIC CONDENSER	ϕ 800	1	
11.34.1	TRAP	$V=2.5M^3$	1	
11.34.2	TRAP	$V=2.5M^3$	1	
11.35.1	CENTRIFUGAL PUMP	$100M^3/HR$: 16 m	6	
11.35.2	CENTRIFUGAL PUMP	$100M^3/HR$: 16 m	2	
11.35.3	CENTRIFUGAL PUMP	$100M^3/HR$: 16m	4	
11.35.4	CENTRIFUGAL PUMP	$100M^3/HR$: 16m	2	
11.35.5	CENTRIFUGAL PUMP	$100M^3/HR$: 16m	4	

ITEM.	
11.35.6	CENTRIFU
11.36.	AIR - BL
11.37	VACUUM
11.38	BELT C
11.39.	ELECTRI
	SINGLE
11.40	ELECTRIC
	SINGLE-
11.41	ELECTRIC
	SINGLE-
11.42	ELECTRIC
	SINGLE
11.50	ELECTRI
	SINGLE
11.51	ELECTRI

SECTION 10

NOTE.	ITEM.	DESCRIPTION	SPECIFICATIONS	NUMBER	NOTE
	11.35-6	CENTRIFUGAL PUMP	100 M^3/HR ; 16m	2	
	11.36.	AIR-BLOWER	5000 M^3/HR	2	
	11.37	VACUUM-PUMP	50 M^3/MIN UNDER 70% VACUUM	5	
	11.38	BELT CONVEYER	B=1000	2	
	11.39.	ELECTRICAL SUSPENDED CRANE,			
		SINGLE - CIRDER	CAPACITY - 2T	1	
	11.40	ELECTRICAL SUSPENDED CRANE,	CAPACITY- 2T	2	
		SINGLE- GIRDER			
	11.41	ELECTRICAL SUSPENDED CRANE,			
		SINGLE-GIRDER.	CAPACITY 1T	1	
	11.42.	ELECTRICAL SUSPENDED CRANE,			
		SINGLE-GIRDER	CAPACITY 5T	1	
	11.50	ELECTRICAL SUSPENDED CRANE,	CAPACITY- 5T	1	
		SINGLE-GIRDER.			
	11.51	ELECTRICAL HOIST	CAPACITY 2T	1	

SECTION 11

UNIDO CONTRACT NO 85/108.

1339553-TM

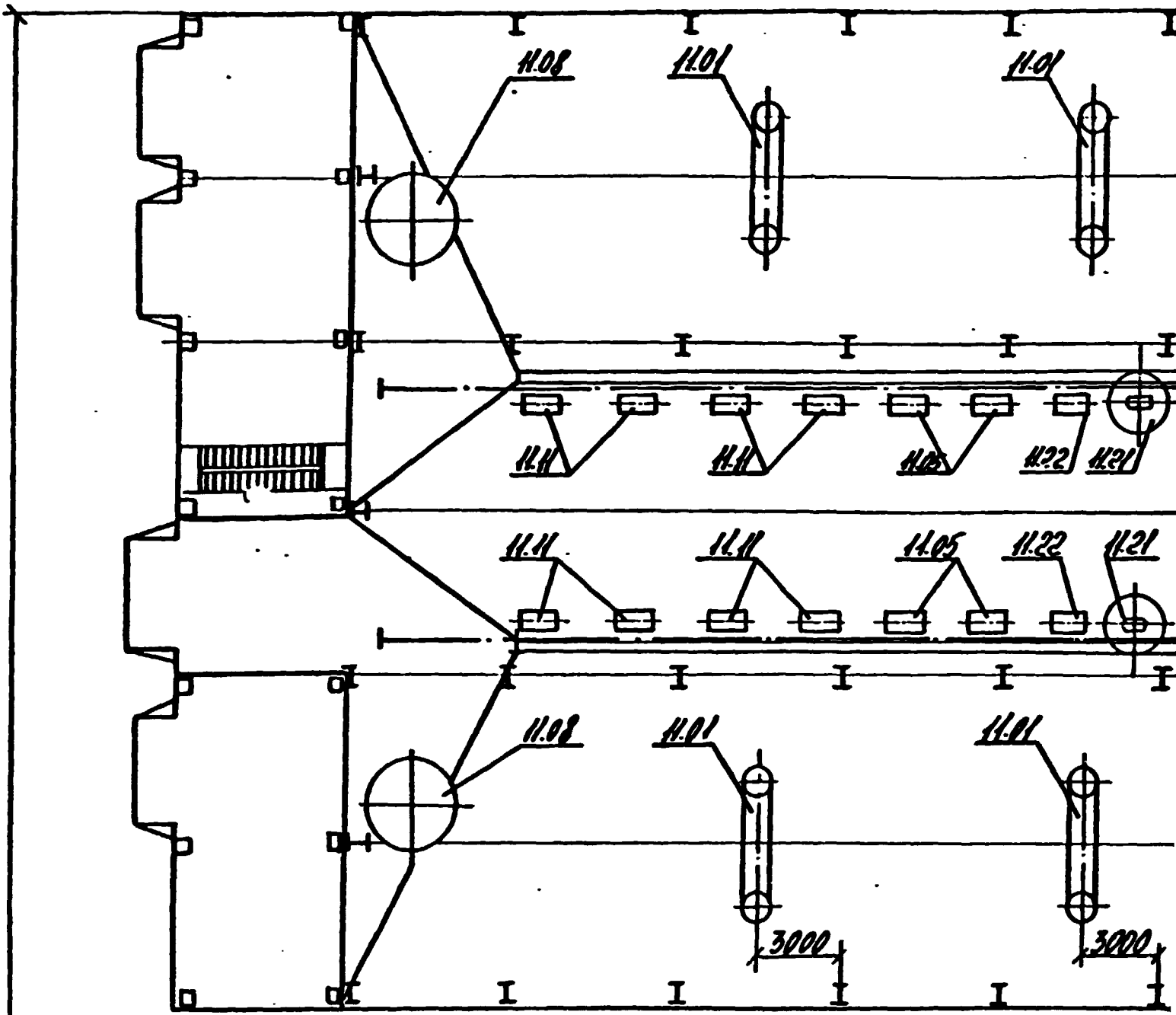
IRAN. ALUNITE BASED ALUMINA PLANT.

EVAPORATION AND PRODUCTION OF POTASSIUM SULPHATE POTASSIUM SULPHATE

STAGE	SHEET	SHEETS
FEASIBILITY	2.	

APPARATUS PROCESS FLOW SHEET.

VAMI LENINGRAD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11.01
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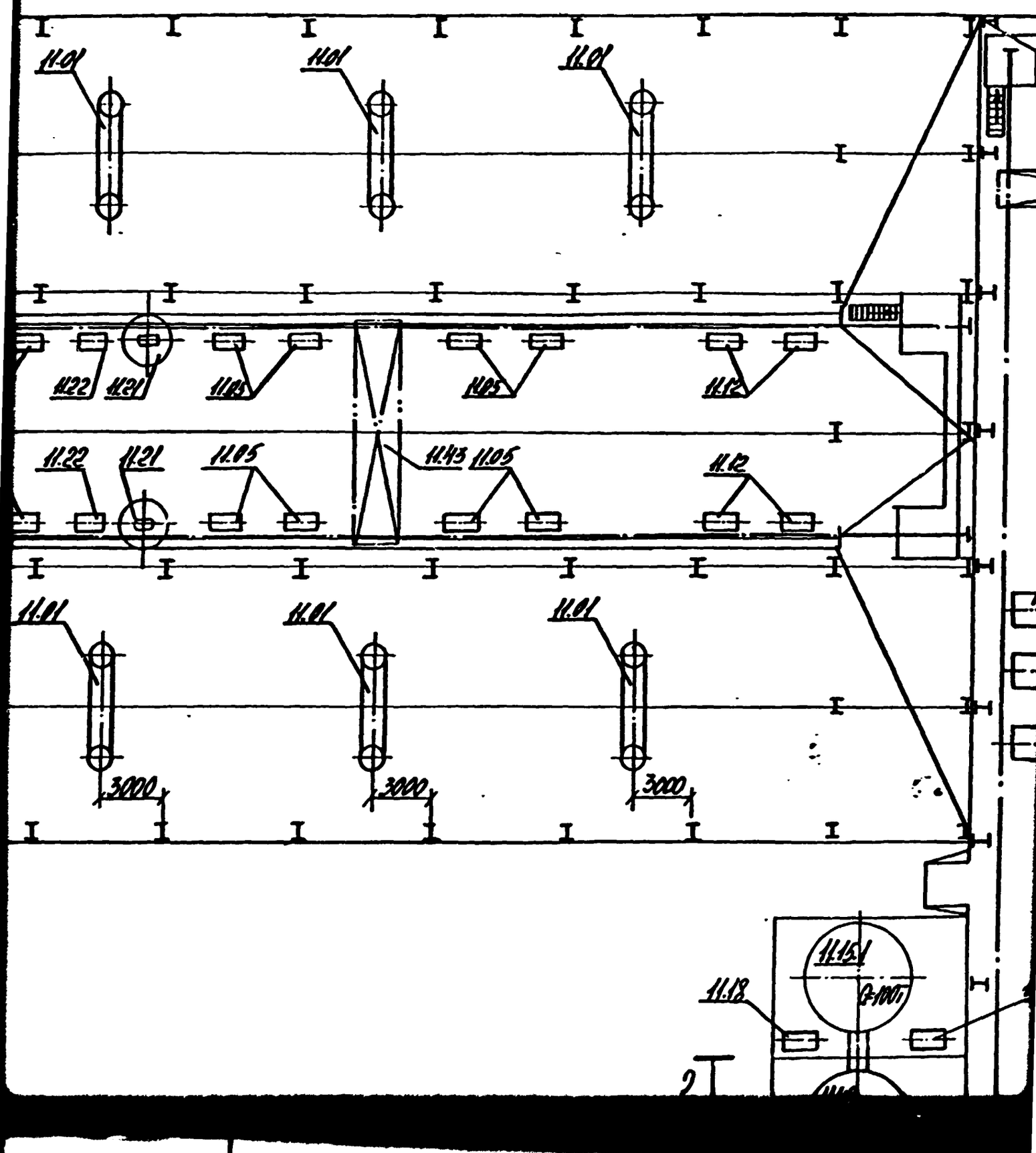
11.08
11.01
11.01
3000
3000

90000

SECTION 2


1
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11.01
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11.05
11.05
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11.43
11.05
11.12
11.01
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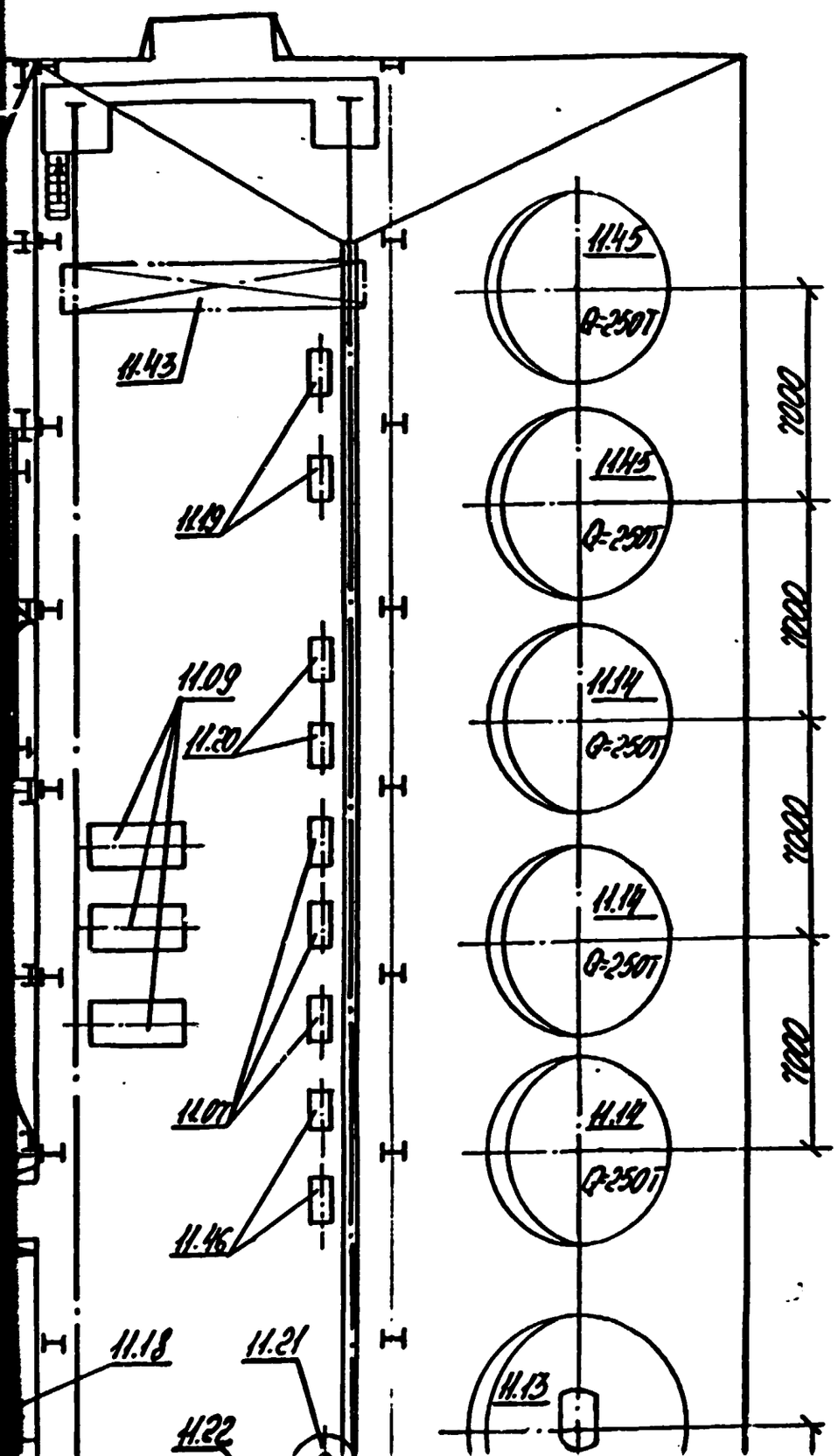
11.01
3000
3000
3000
11.15.1
11.18
2

PLAN AT ELEV. 0.000
SCALE 1:200

SECTION 3



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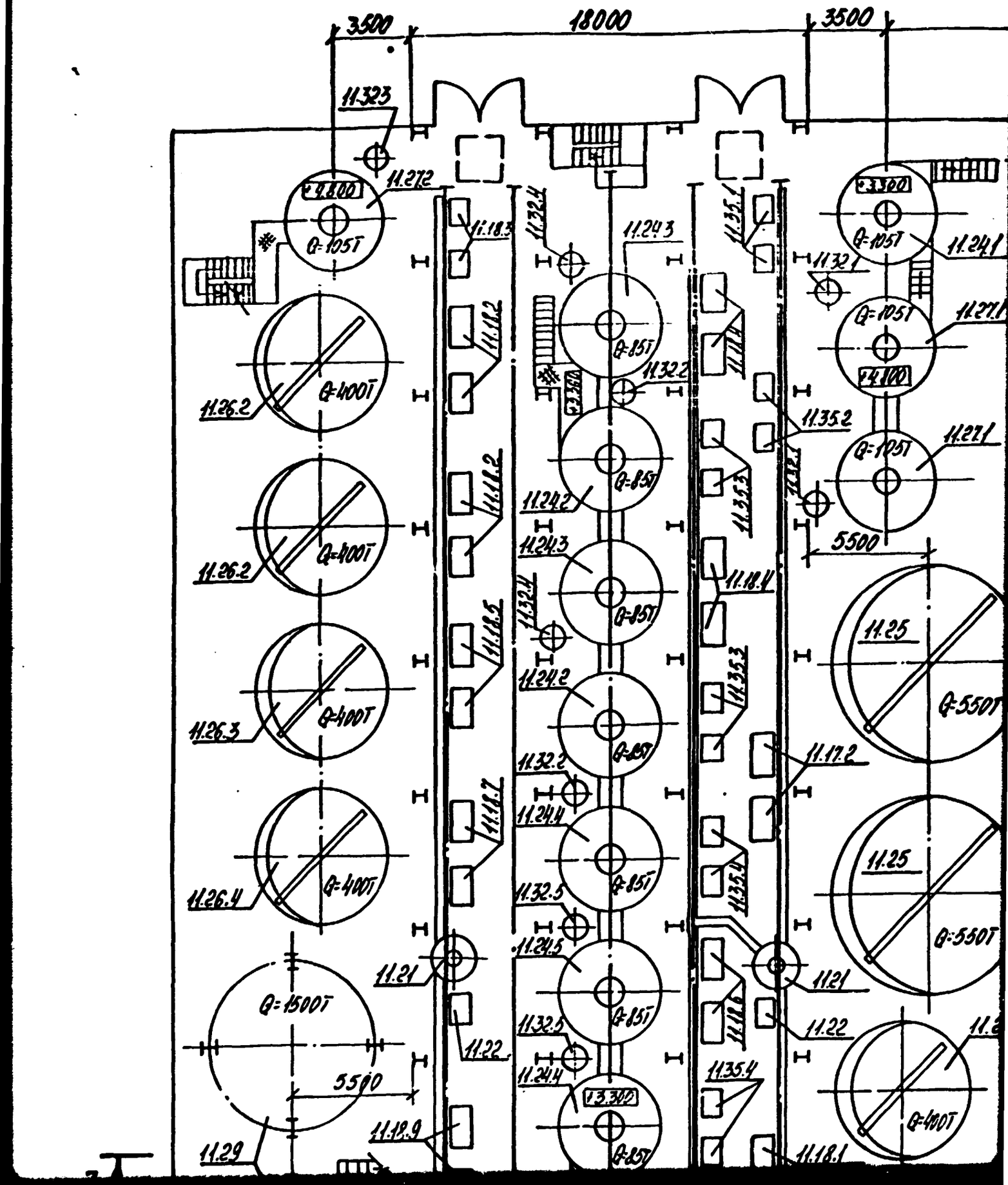
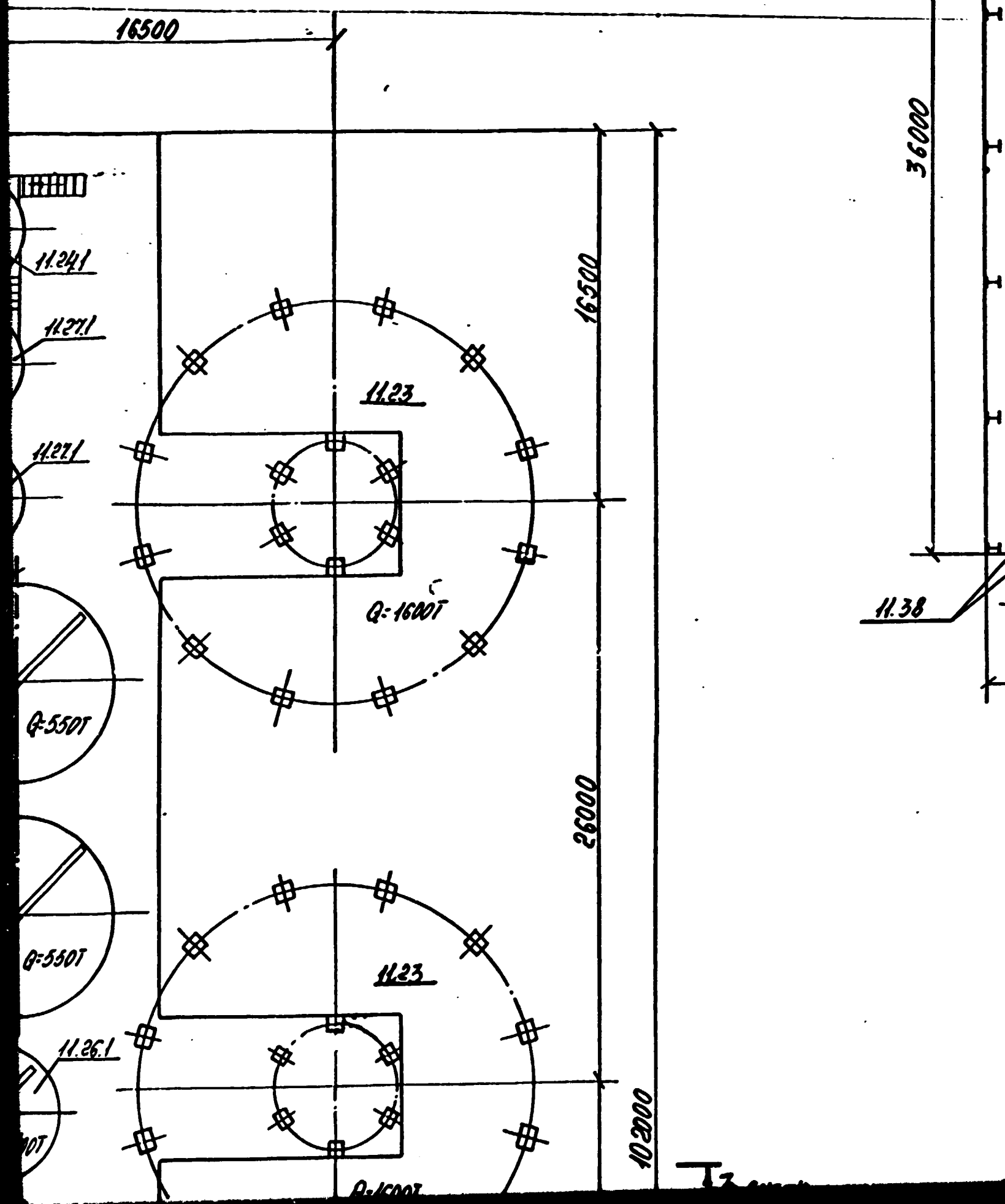


SECTION 1

SECTION 5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36000
16500
11.24.1
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11.23
11.27.1
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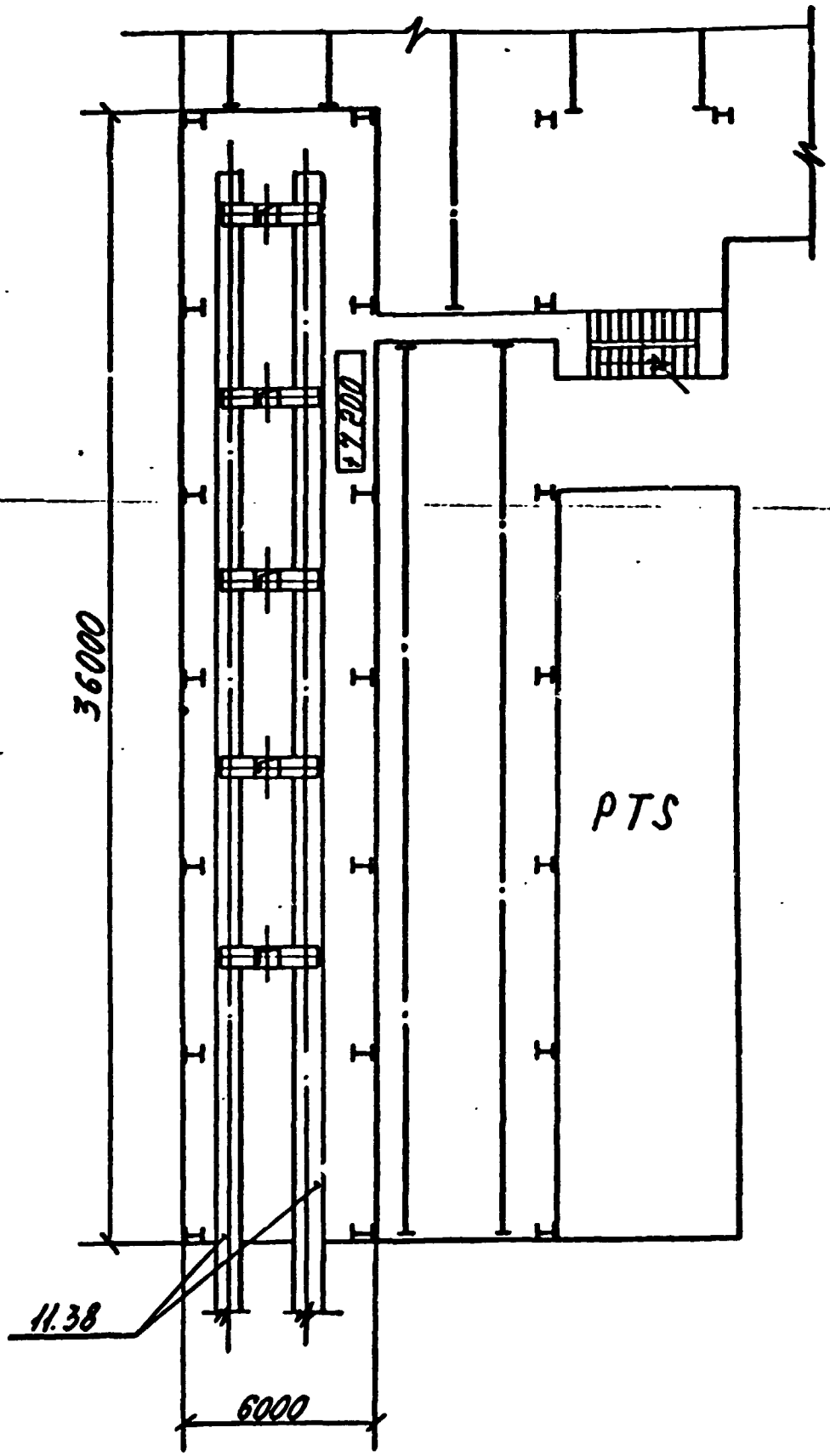
11.38
Q=550T
26000
Q=550T
11.23
11.26.1
102000
Q=1600T

SECTION 6

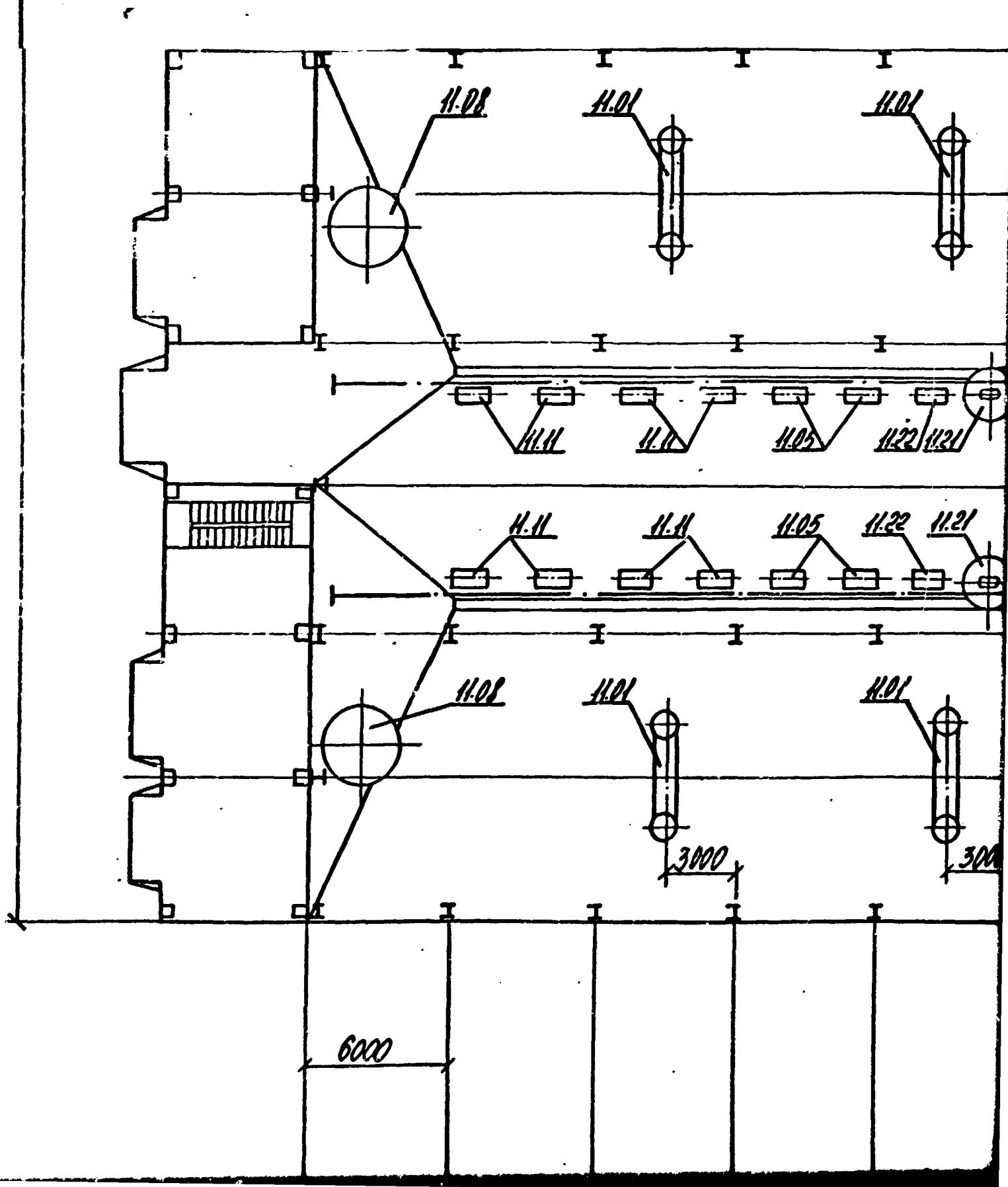
PLAN AT ELEVATION 7.200

SCALE 1:200



90000

SECTION 7



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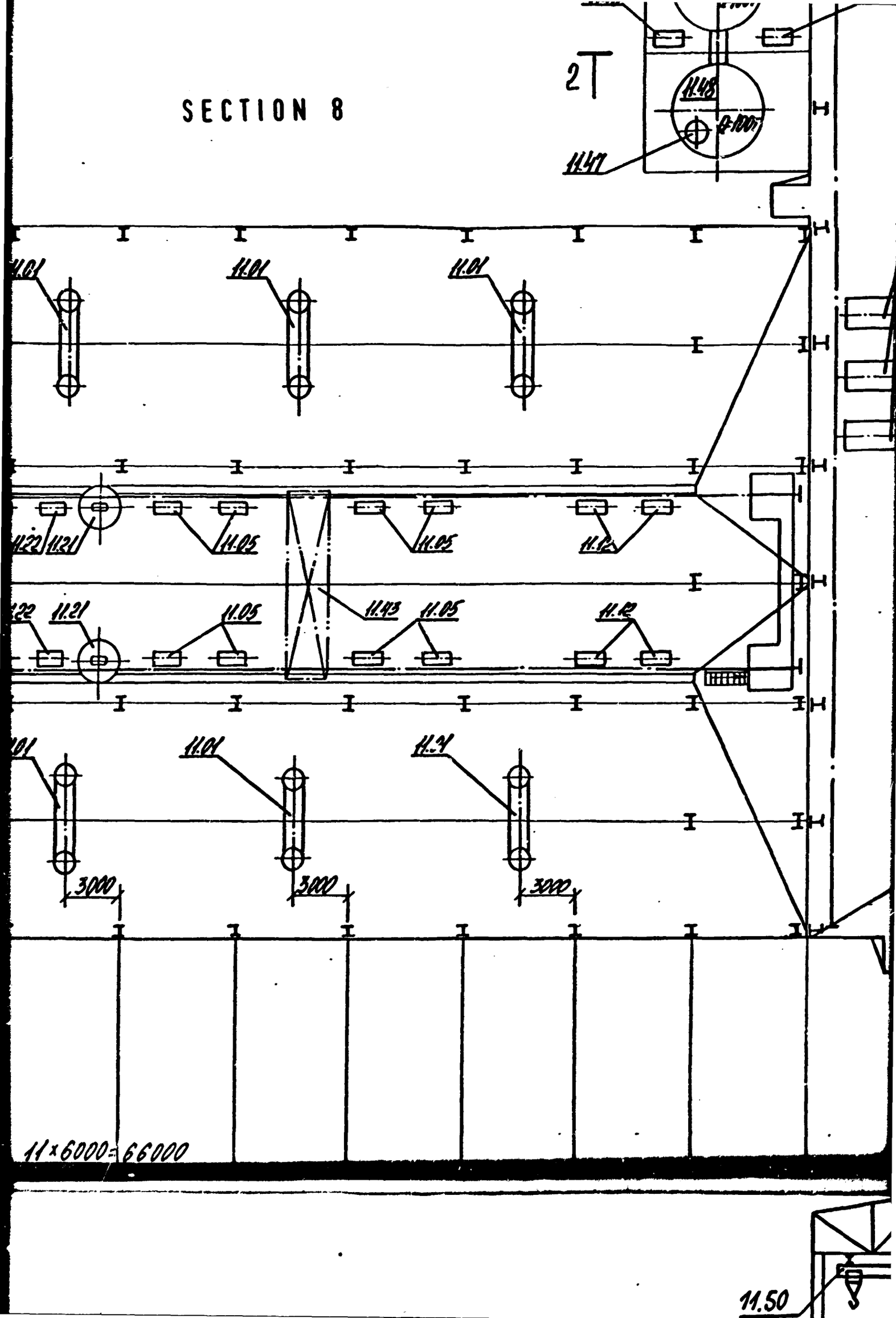
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11.01
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11.21
11.05
11.05
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11.05
11.12
11.01
11.01
11.24
3000
3000
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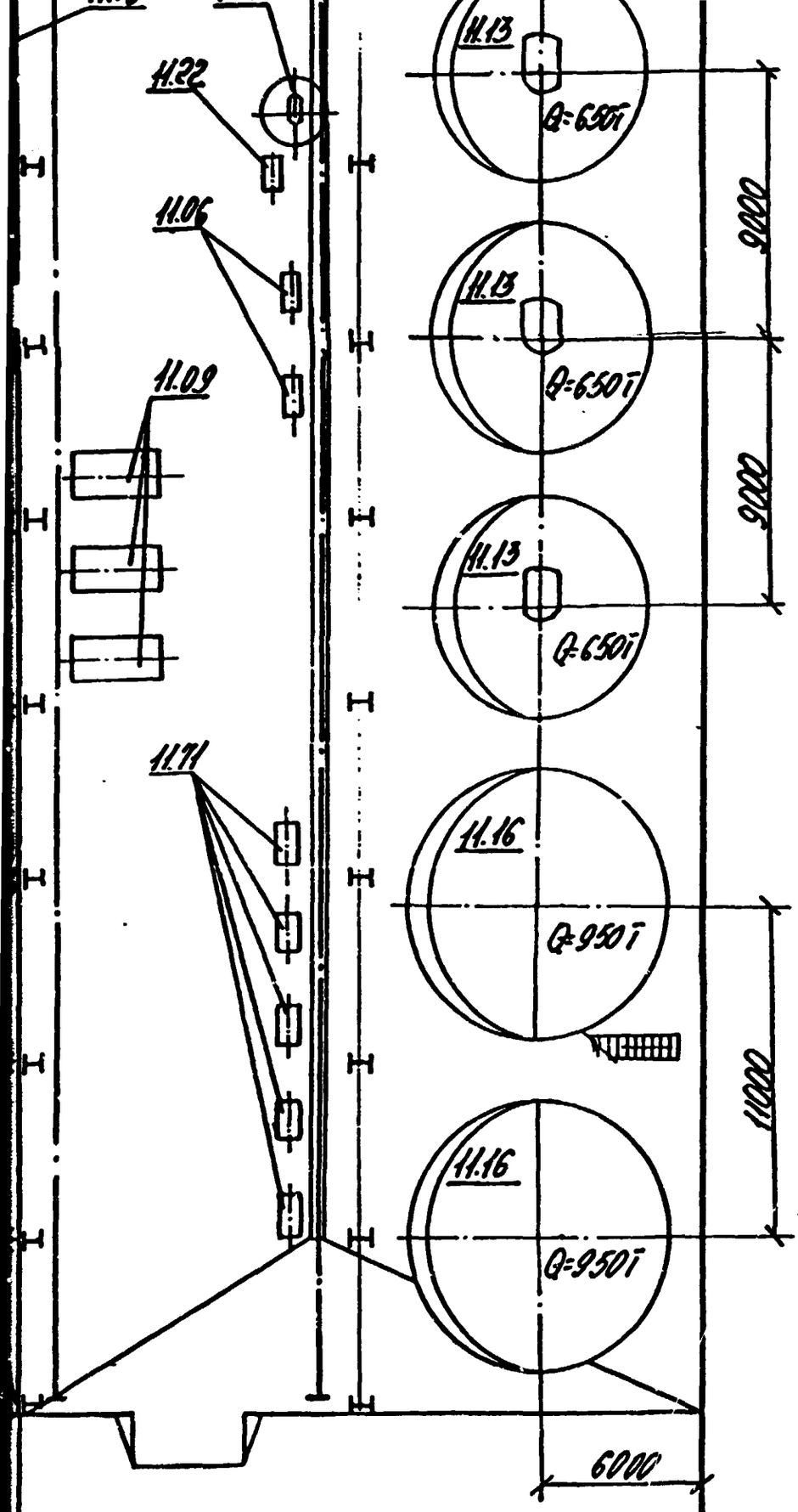
11.50



SECTION 9

T2 SHEET 4

3

4

4-4

SCALE 1:200

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11.26.5
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11.18.10
11.26.5
Q=400T
11.18.10
11.27.5
Q=165T
11.27.5
Q=102T
14.100
Q=100T
11.15.2
11.27.3
Q=102T
11.51
11.42
11.27.4
14.800
Q=105T
11.27.4
Q=105T
11.18.11
11.21
11.22
11.37
11.37
11.36
PTS
11.35.5
11.35.1
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11.32.6
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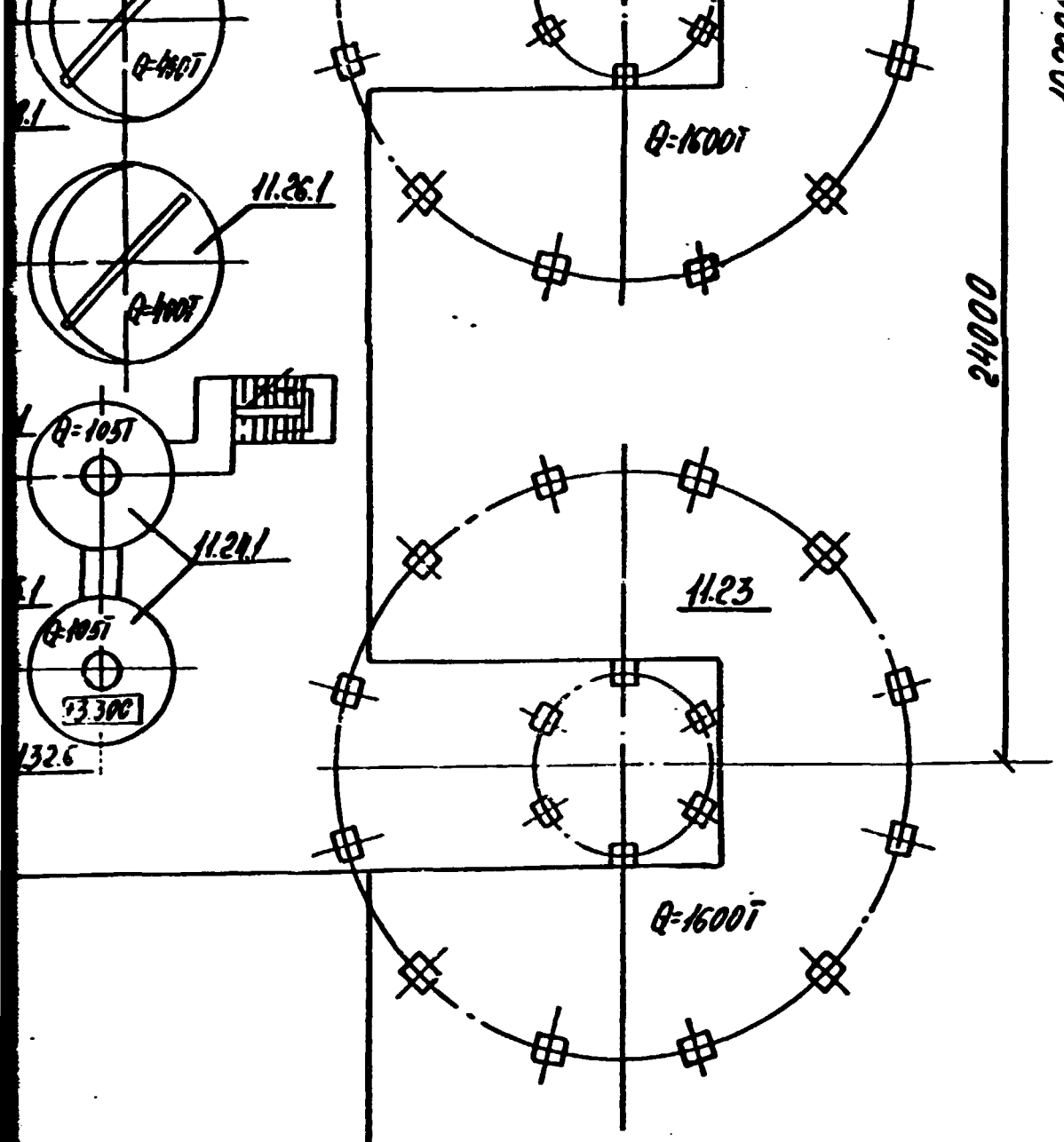
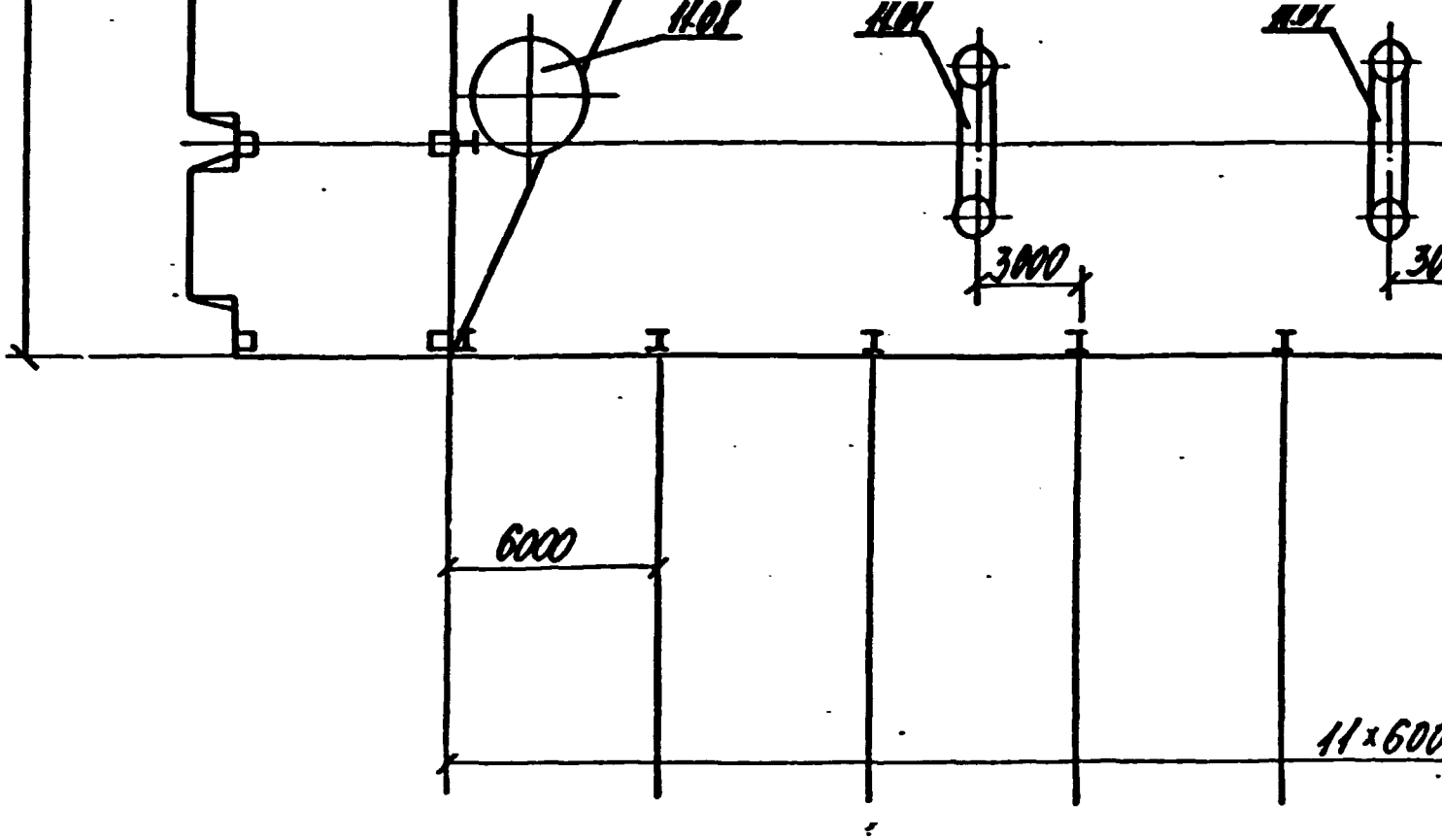
SECTION 10
4
4
SHEET4
SECTION 7



SECTION 11

T3 SHEET4

T4 SHEET4



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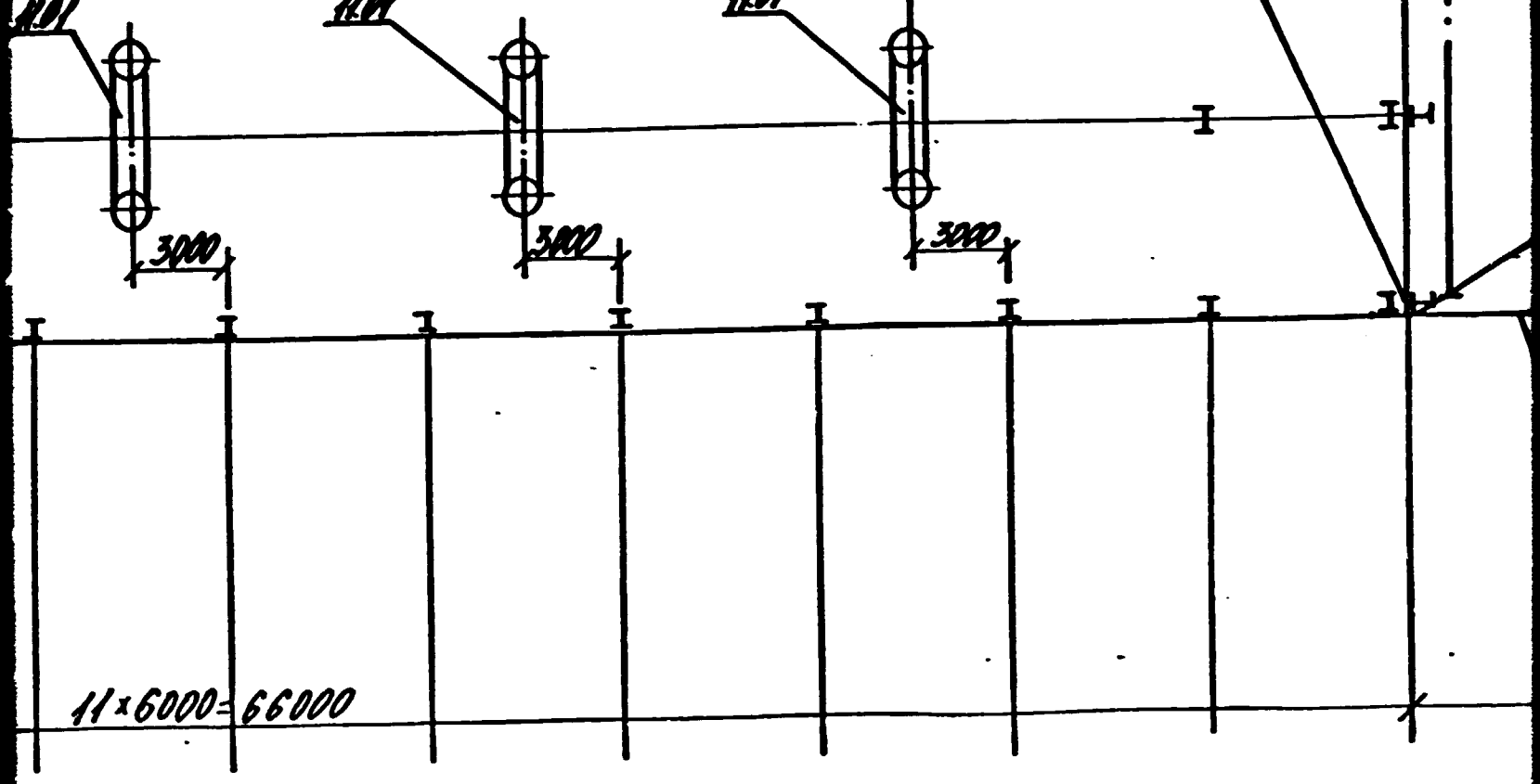
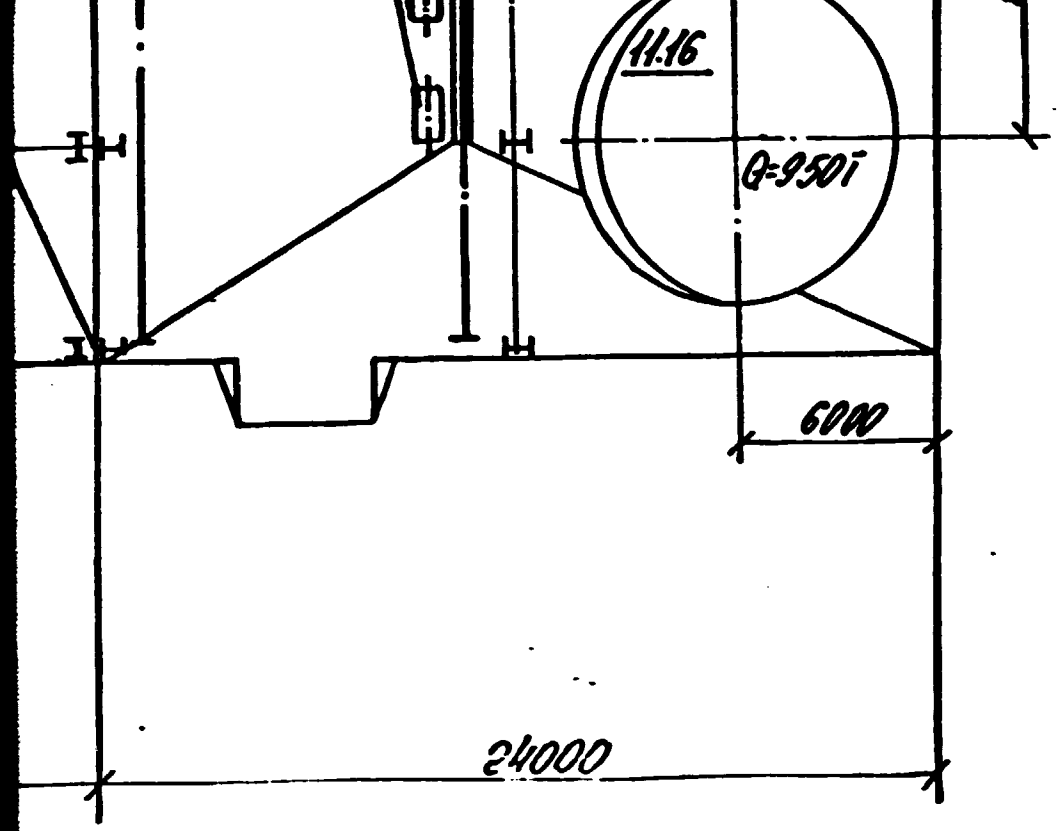


1

SHEET 4

SECTION 13



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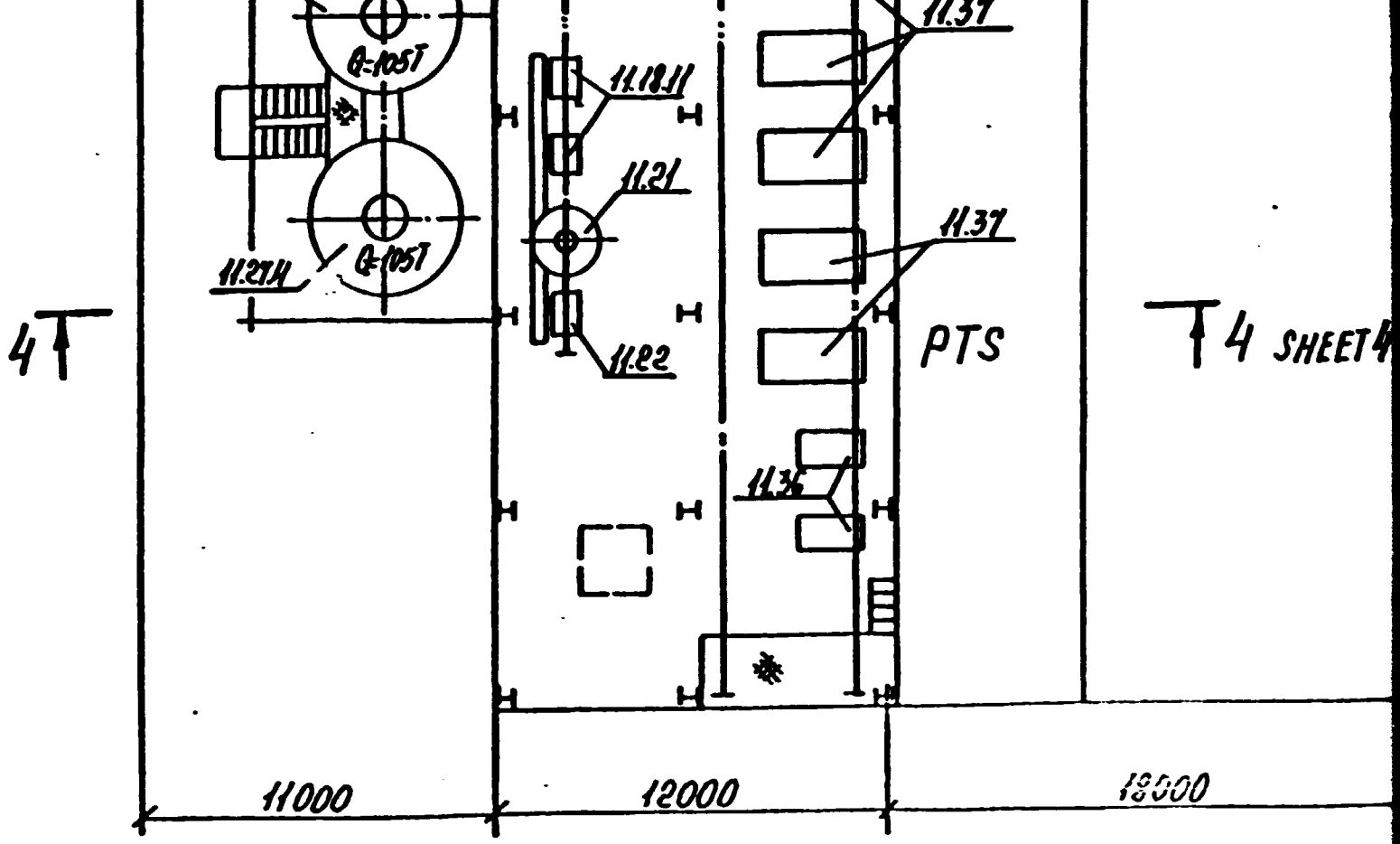
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11.22
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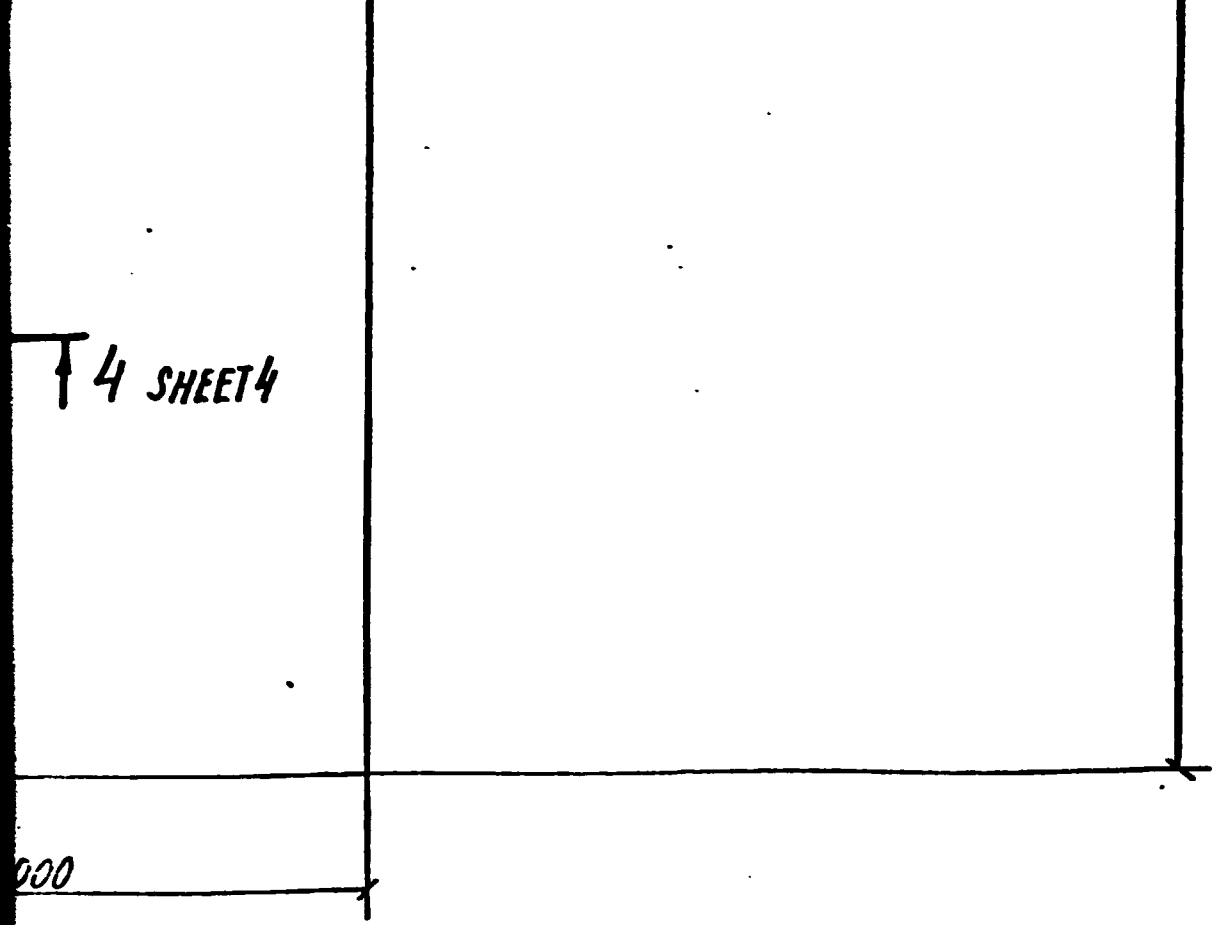
11.37
11.37
11.36
4
PTS
4 SHEET 4
11000
12000
13000

SECTION 15



SECTION 16

SECTION 17

UNIDO CONTRACT NO 85/108

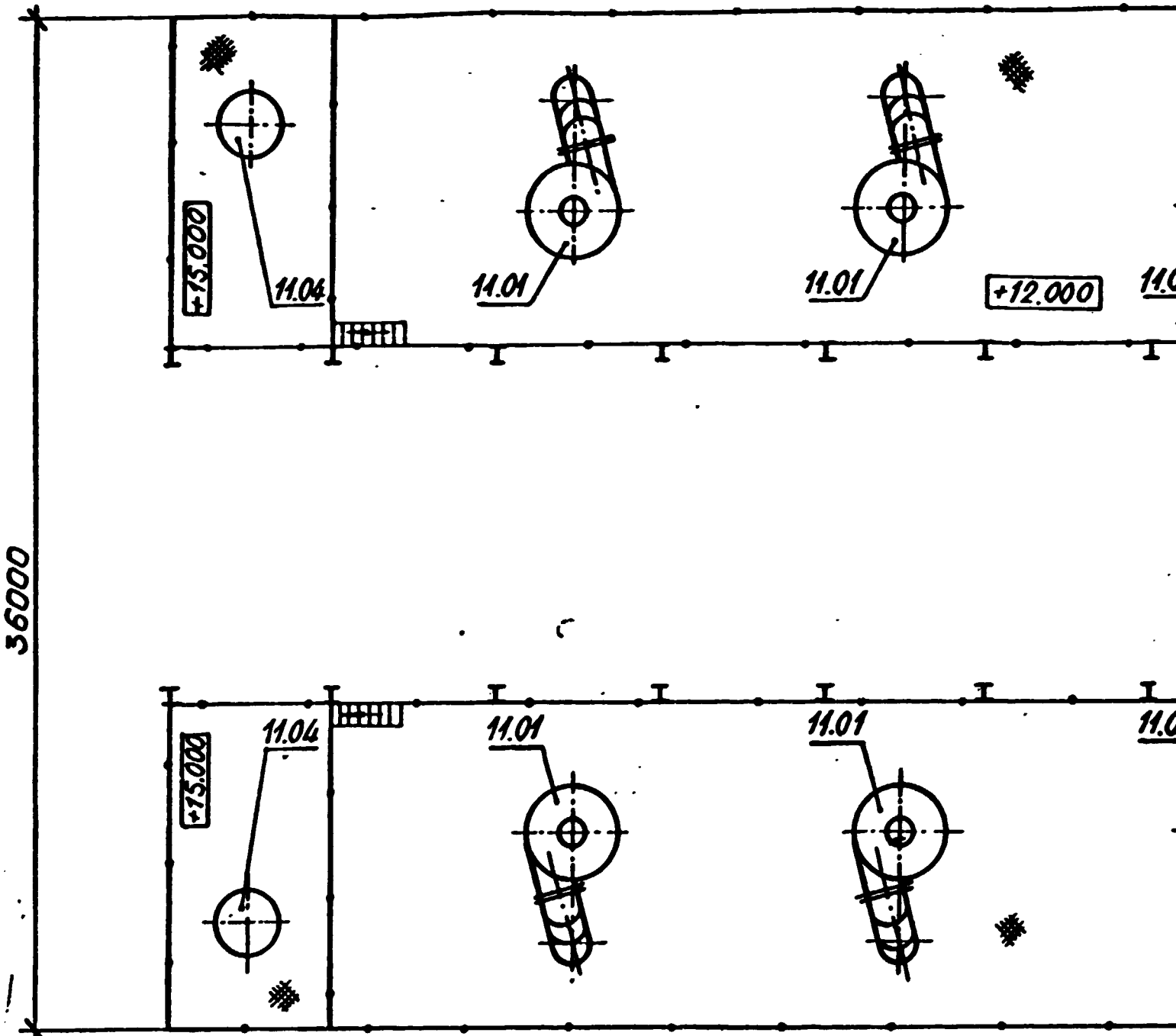
1339553-TM

IRAN. ALUNITE BASED ALUMINA PLANT

	STAGE	SHEET	SHEETS
EVAPORATION AND POTASSIUM SULPHATE PRODUCTION	FEASIBILITY	3	
PLANS AT ELEVATIONS 0.000 AND 7.200	VAMI LENINGRAD		

Size A0

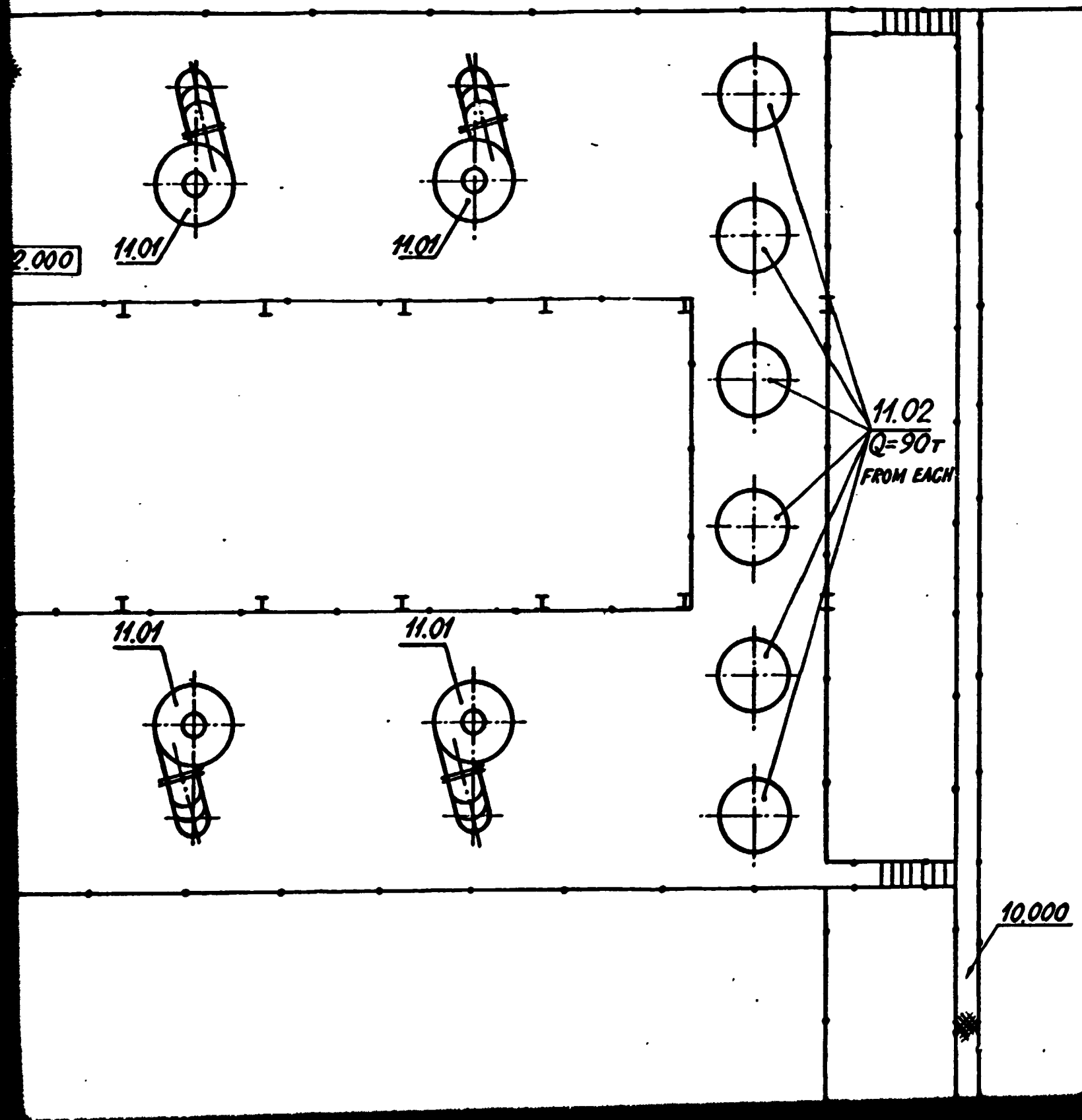
SECTION 1



PLAN AT UPP

SECTION 2

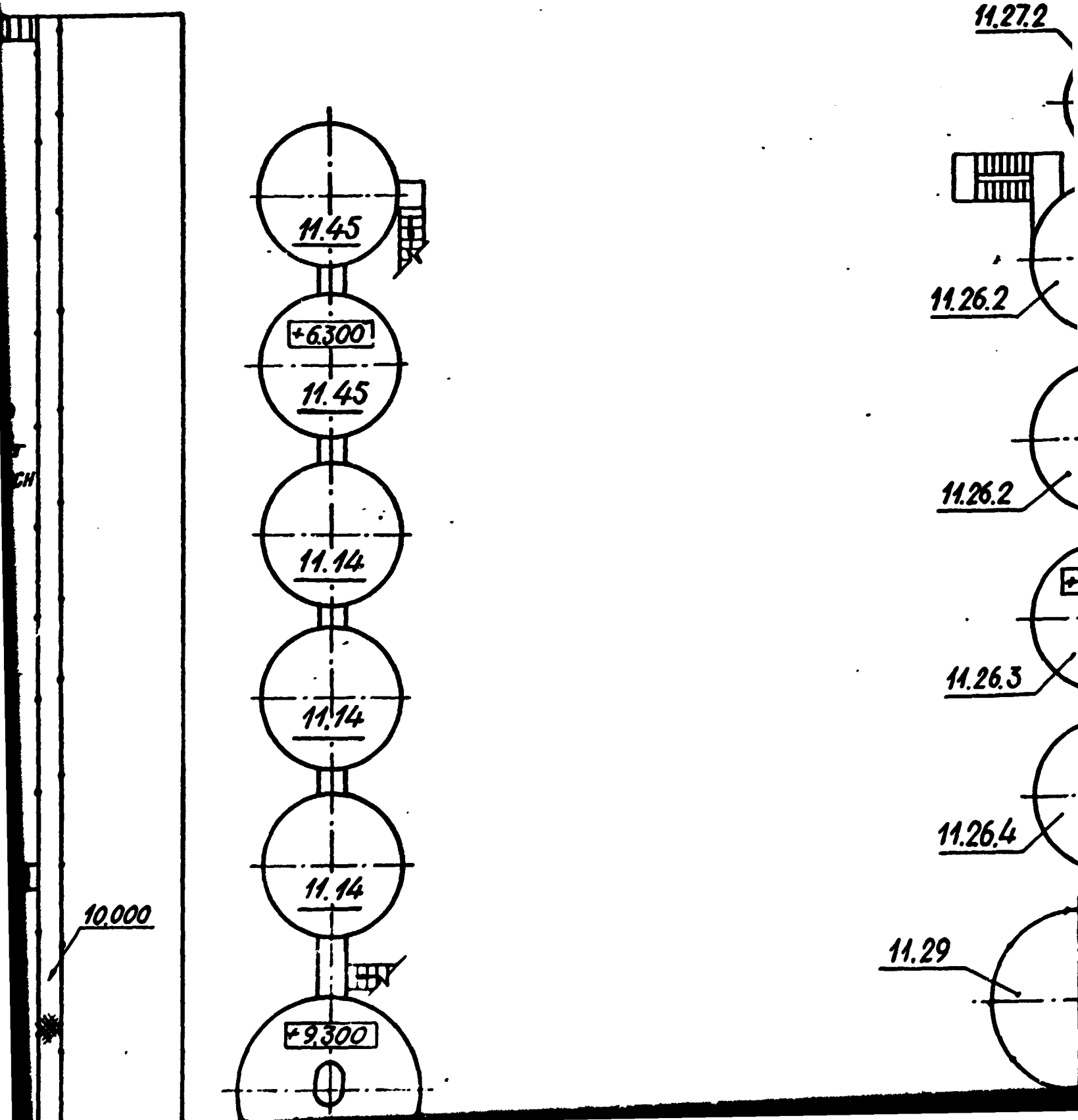
1



I AT UPPER ELEVATIONS

SCALE 1:200

SECTION 3



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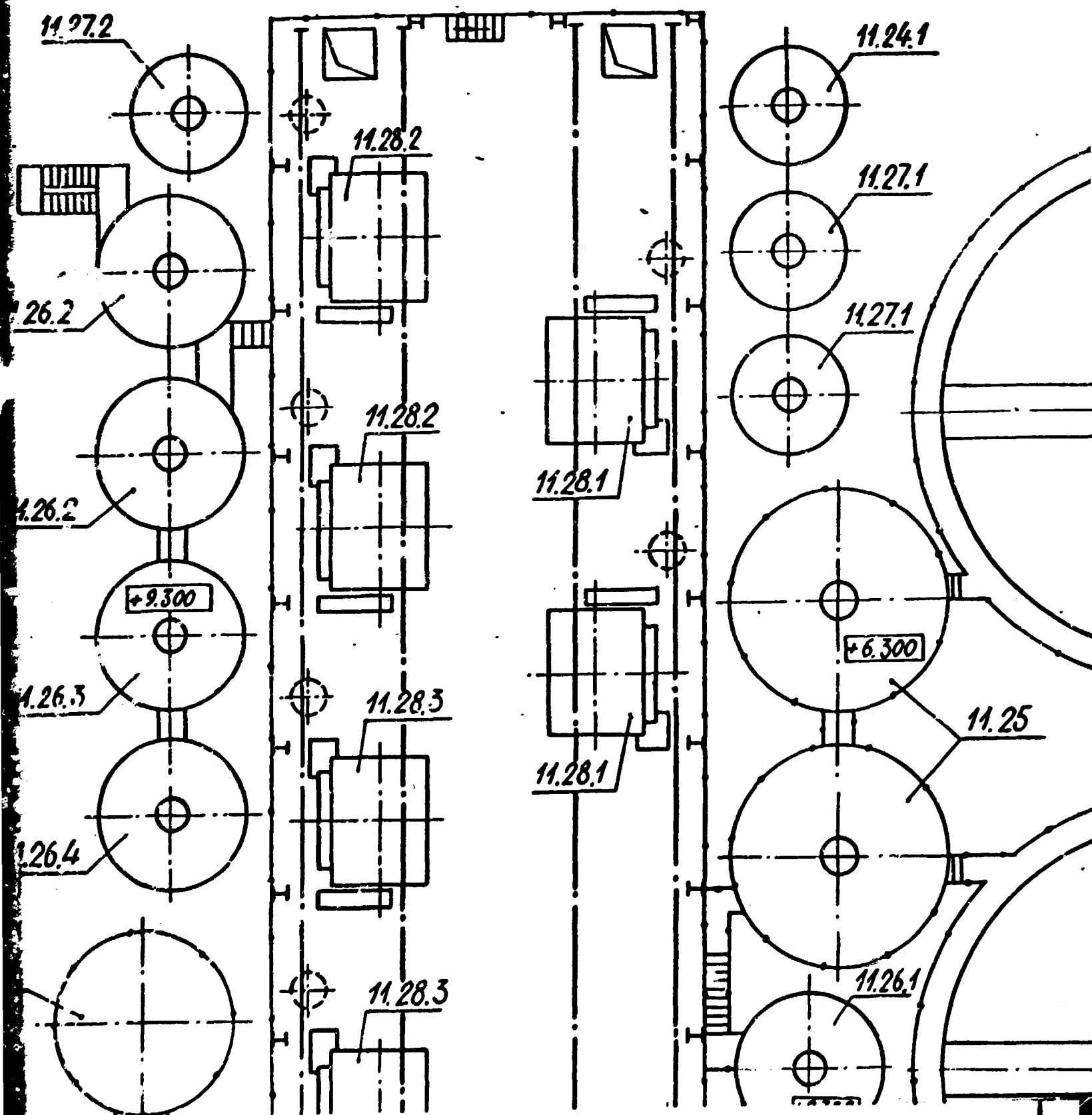
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11.28.2
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26.2
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4.26.2
+9.300
+6.300
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11.25
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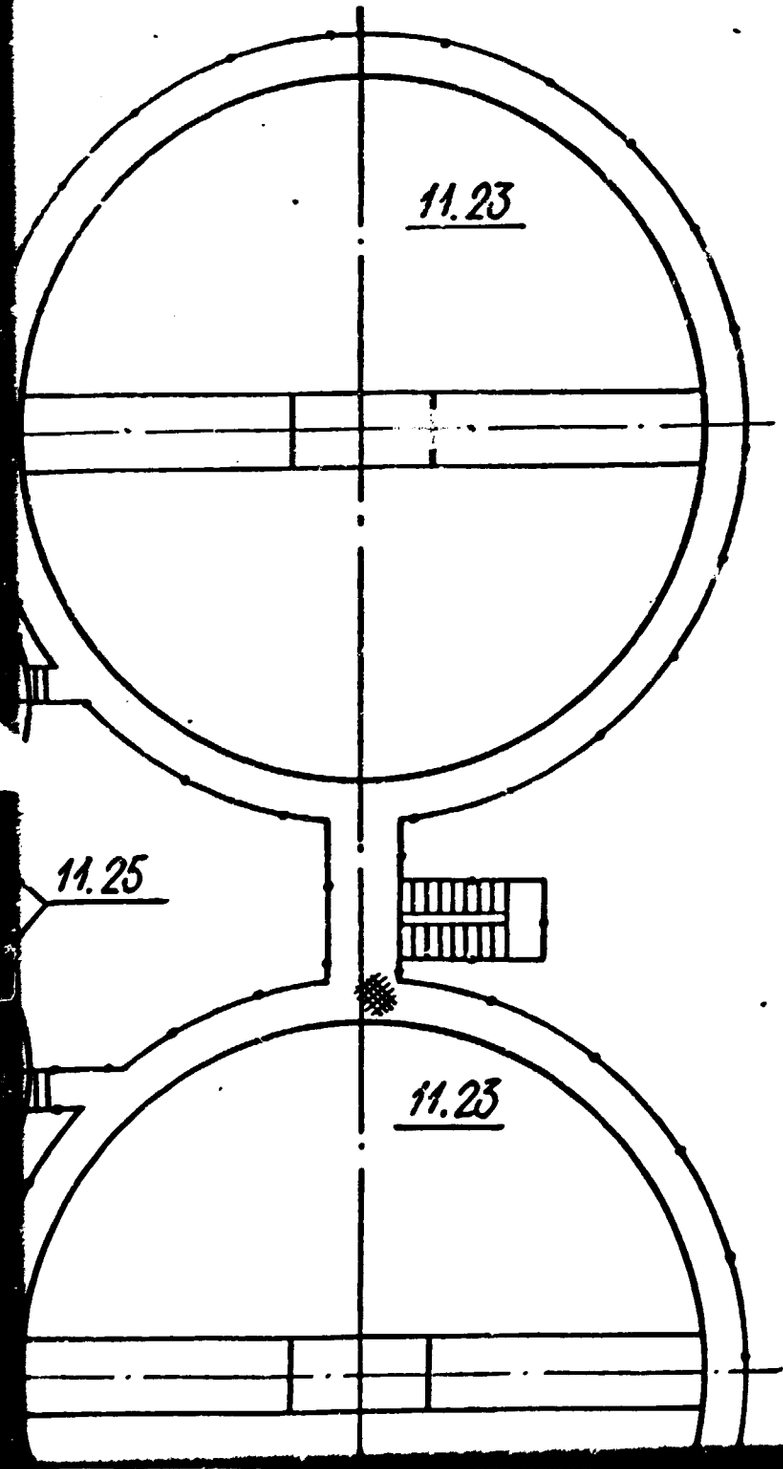
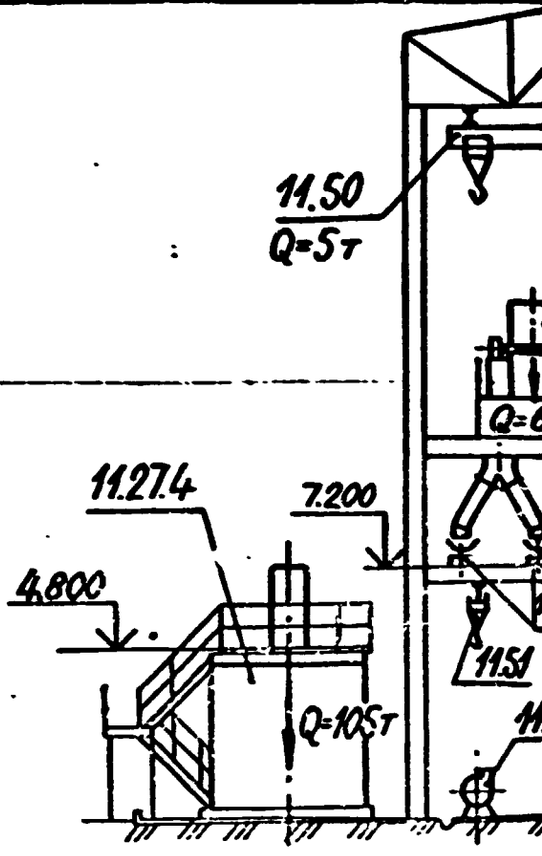
1.26.4
11.28.3
11.26.1

11×6000=66000

SECTION 5





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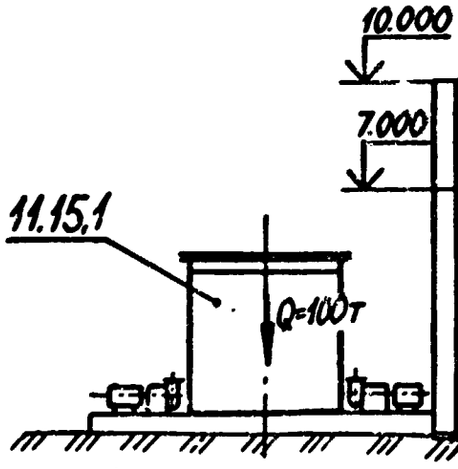

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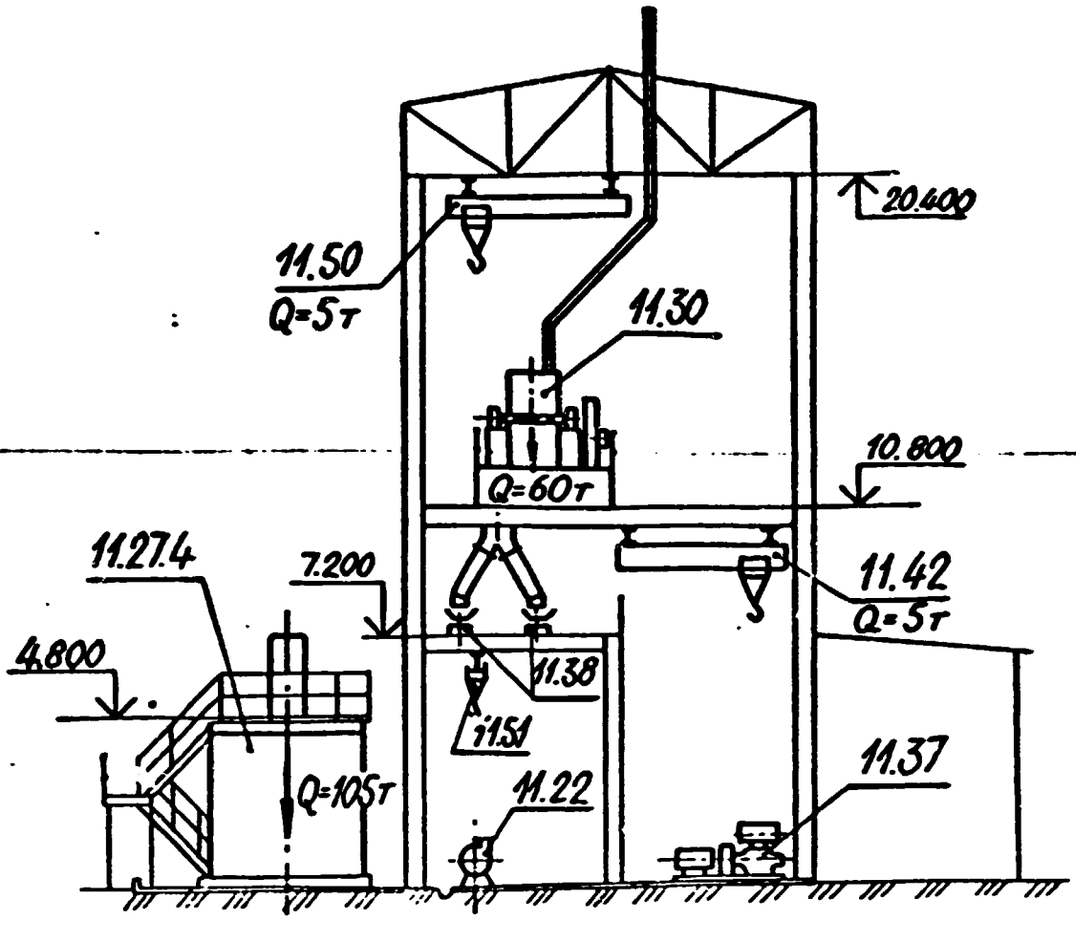
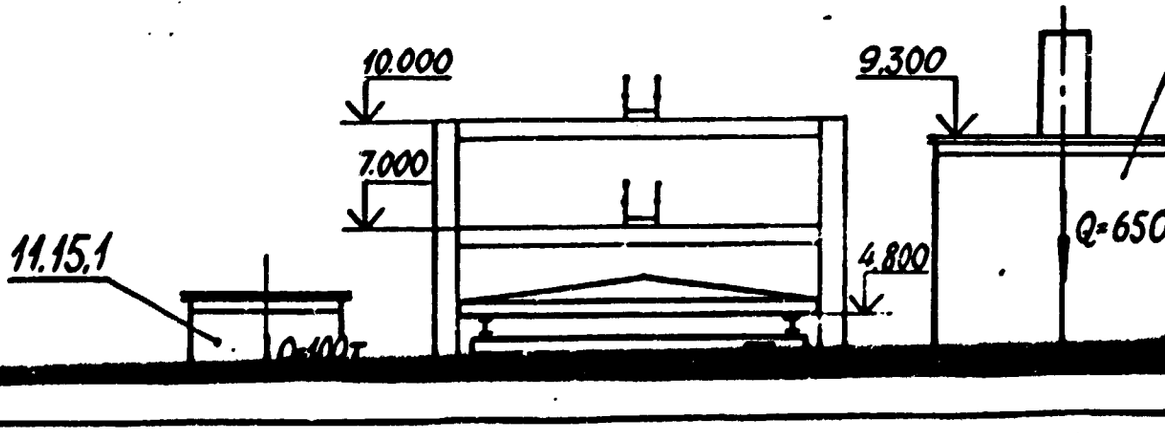
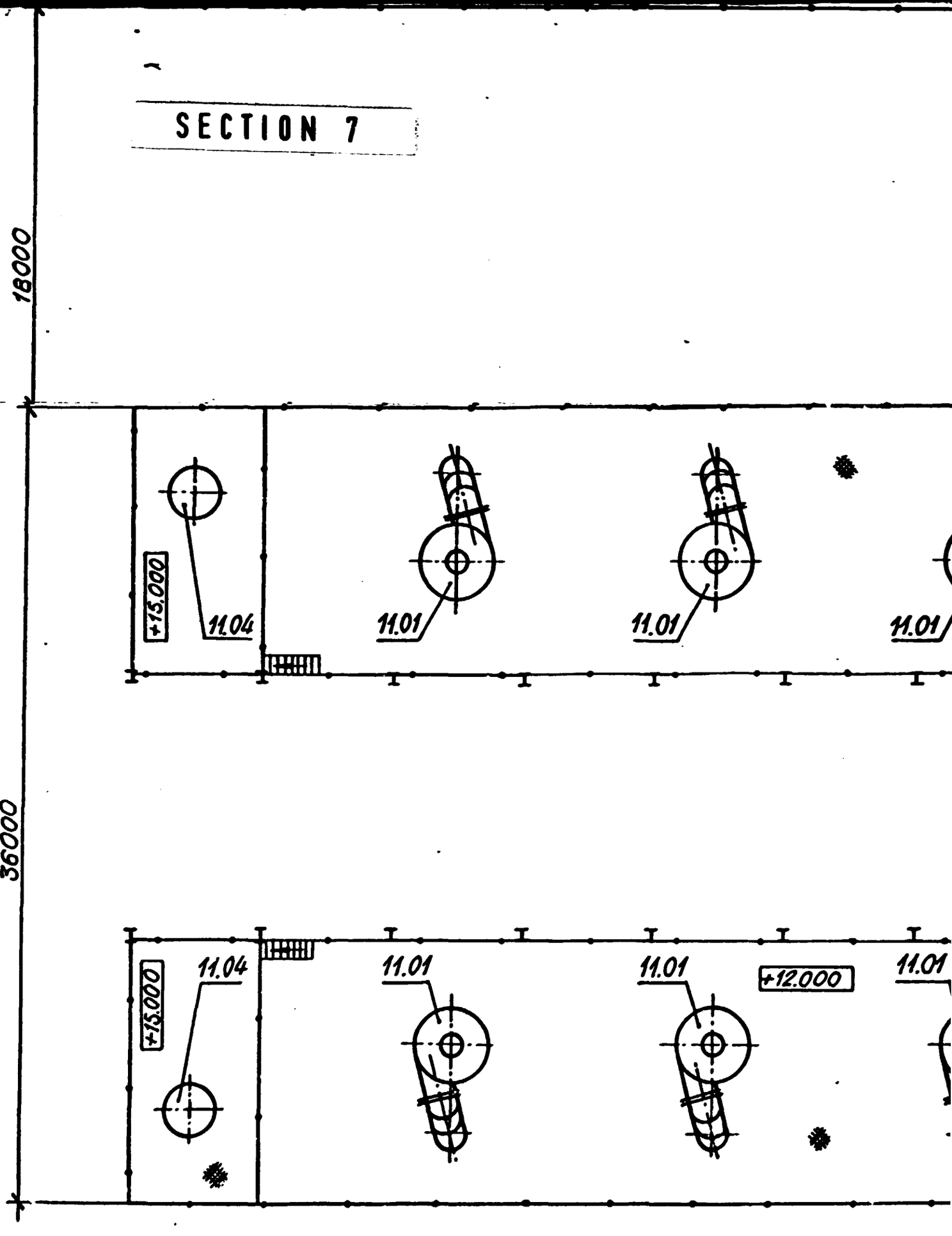


SECTION 6

2-2
SCALE 1:200



SECTION 7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11.01
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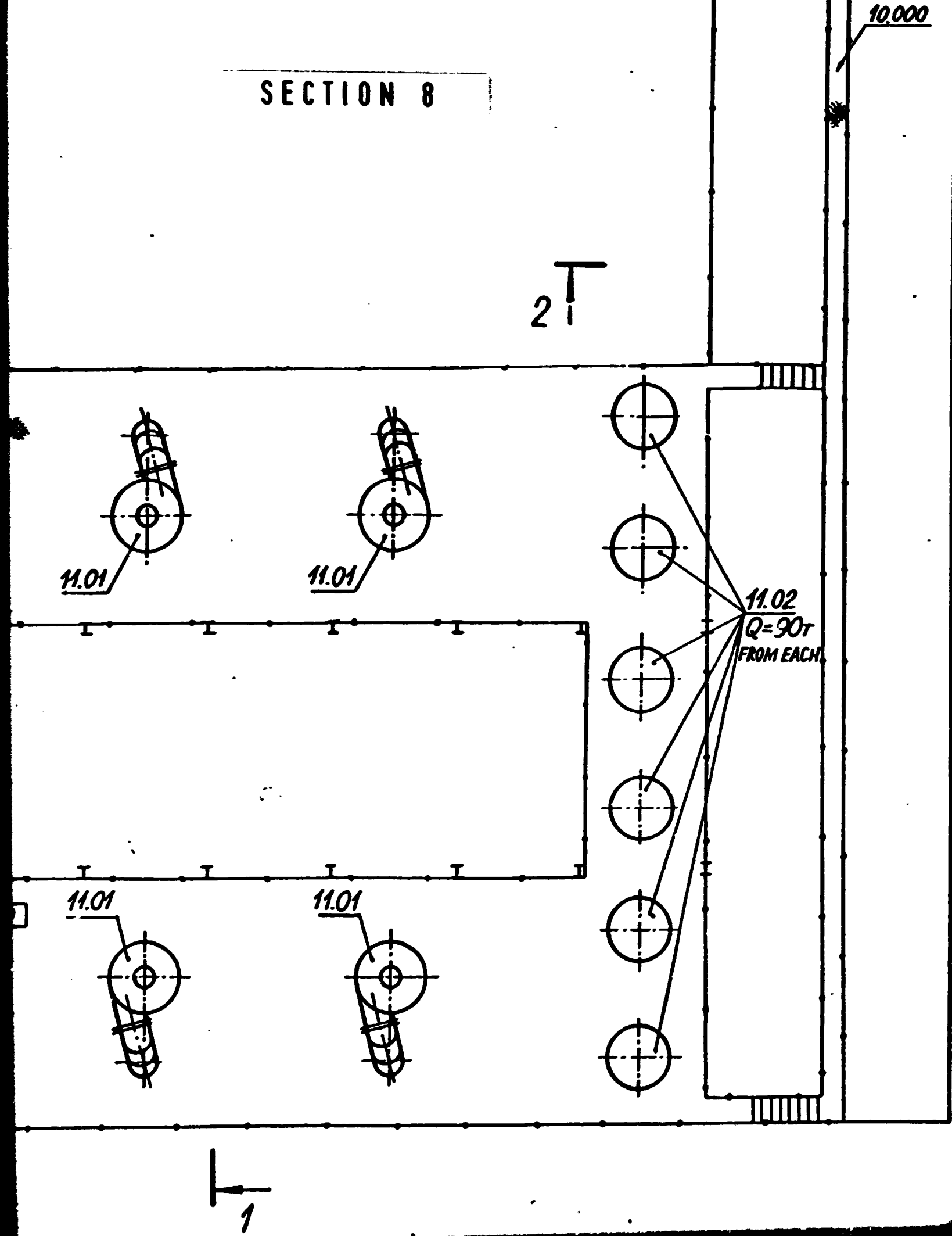
11.04
11.01
11.01
+12.000
11.01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10.000
2
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11.01
11.02
Q=30т
FROM EACH
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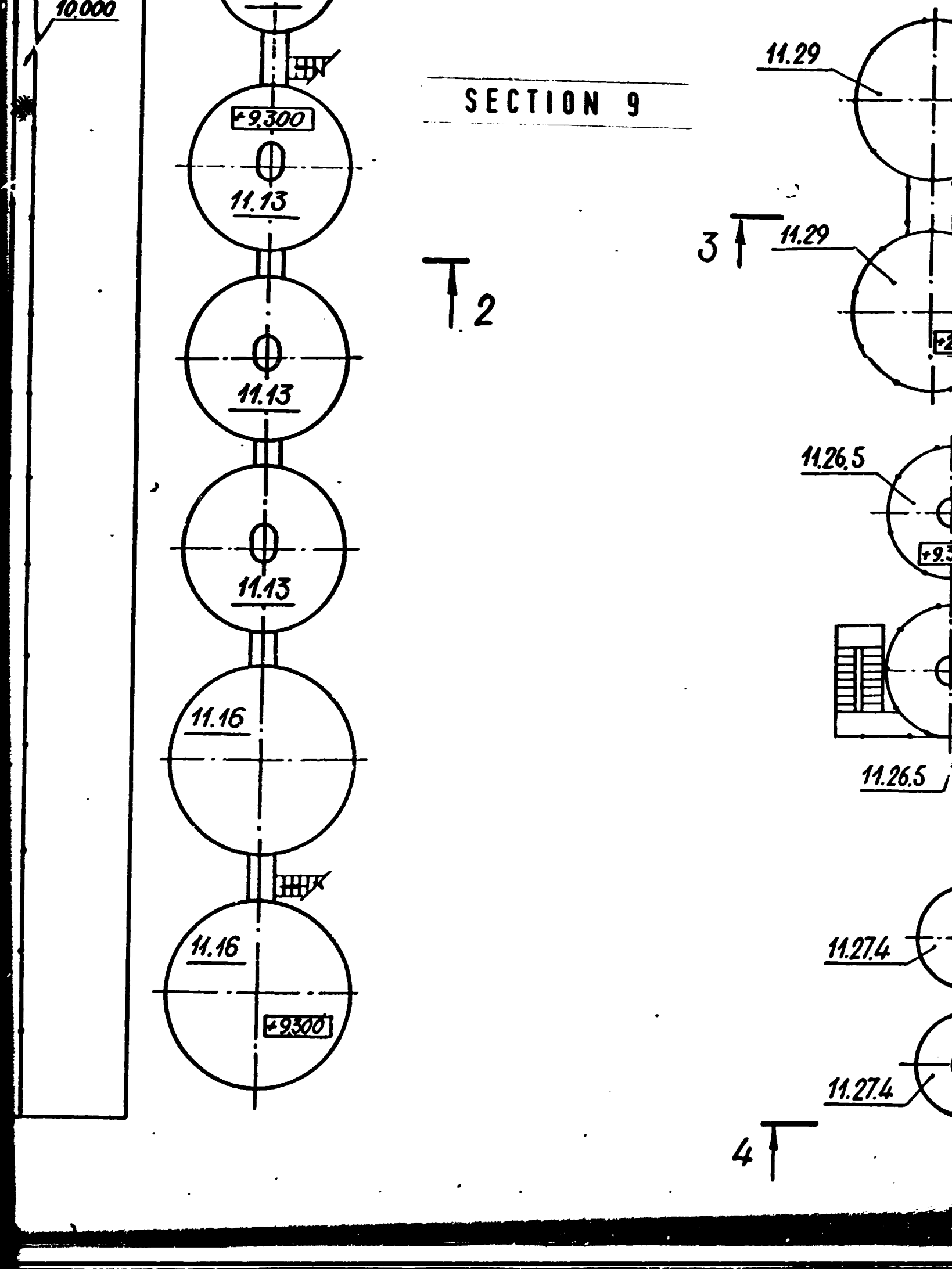
11.01
1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11.13
11.13
11.13
11.16
11.16
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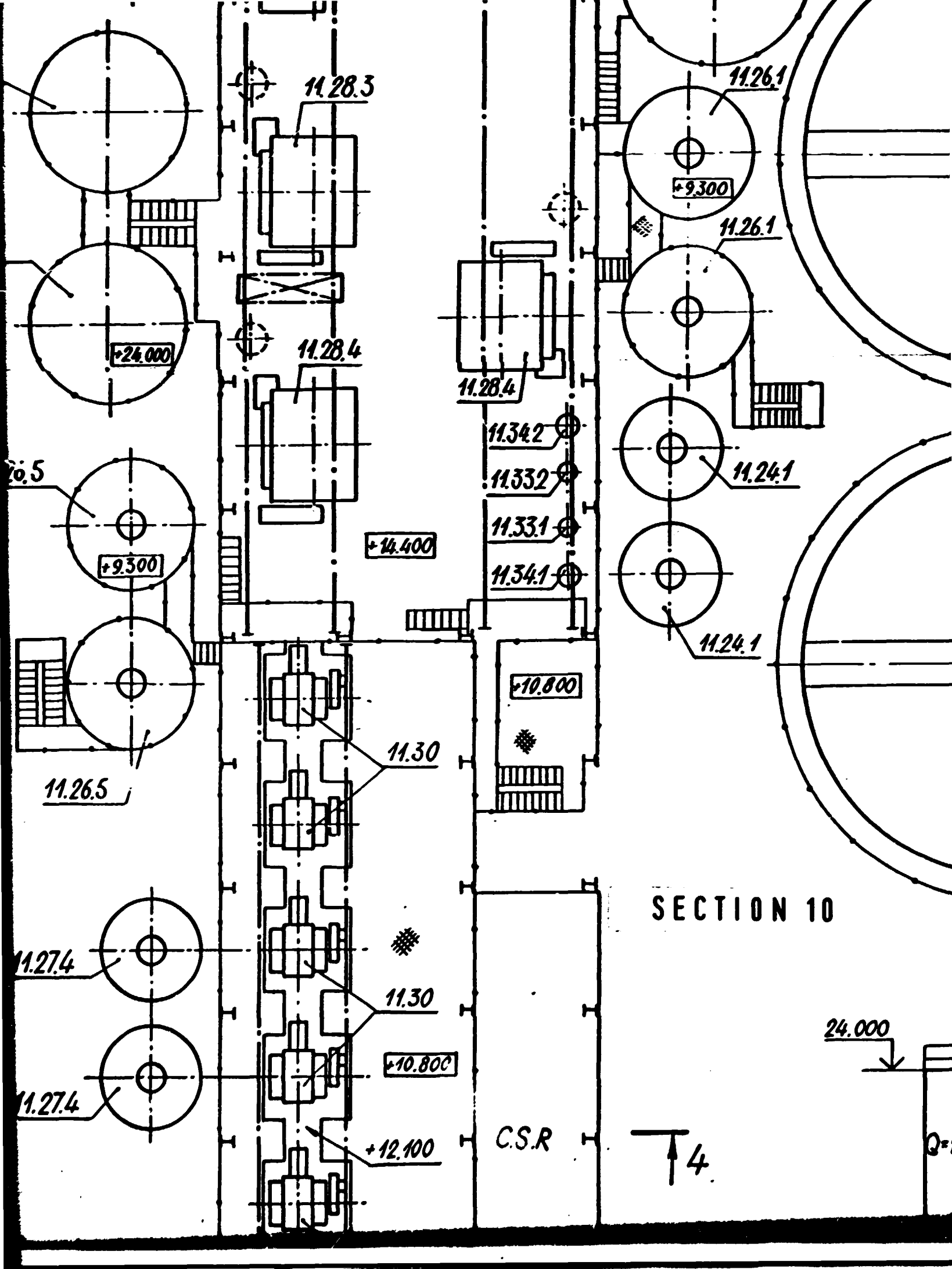
2
3
11.29
11.29
11.26.5
11.26.5
11.27.4
11.27.4
4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11.24.1
+14.400
11.33.1
11.34.1
+9.300
11.24.1
+10.800
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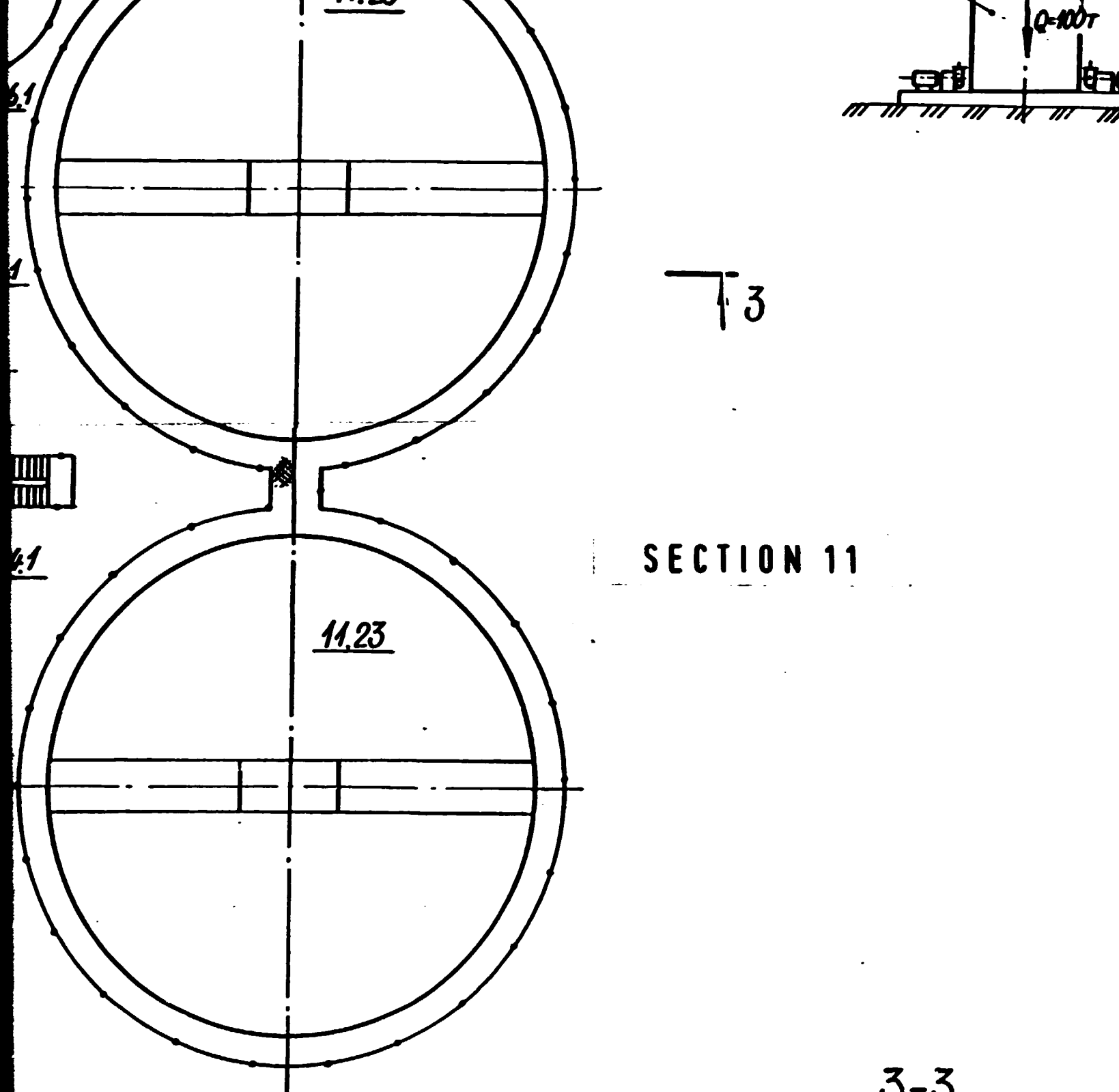
+12.100
C.S.R
SECTION 10
24.000
4



SECTION 11

3-3
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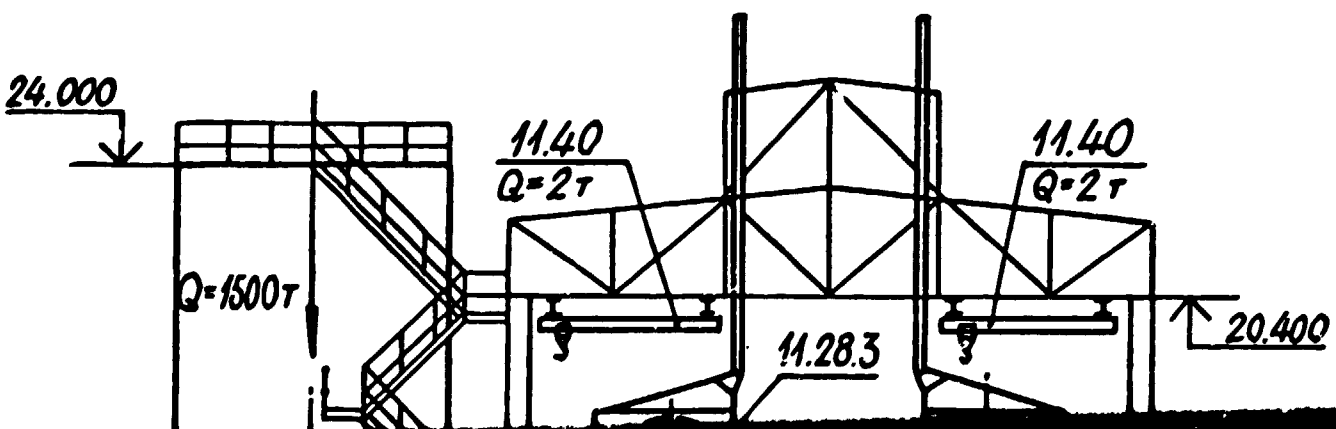

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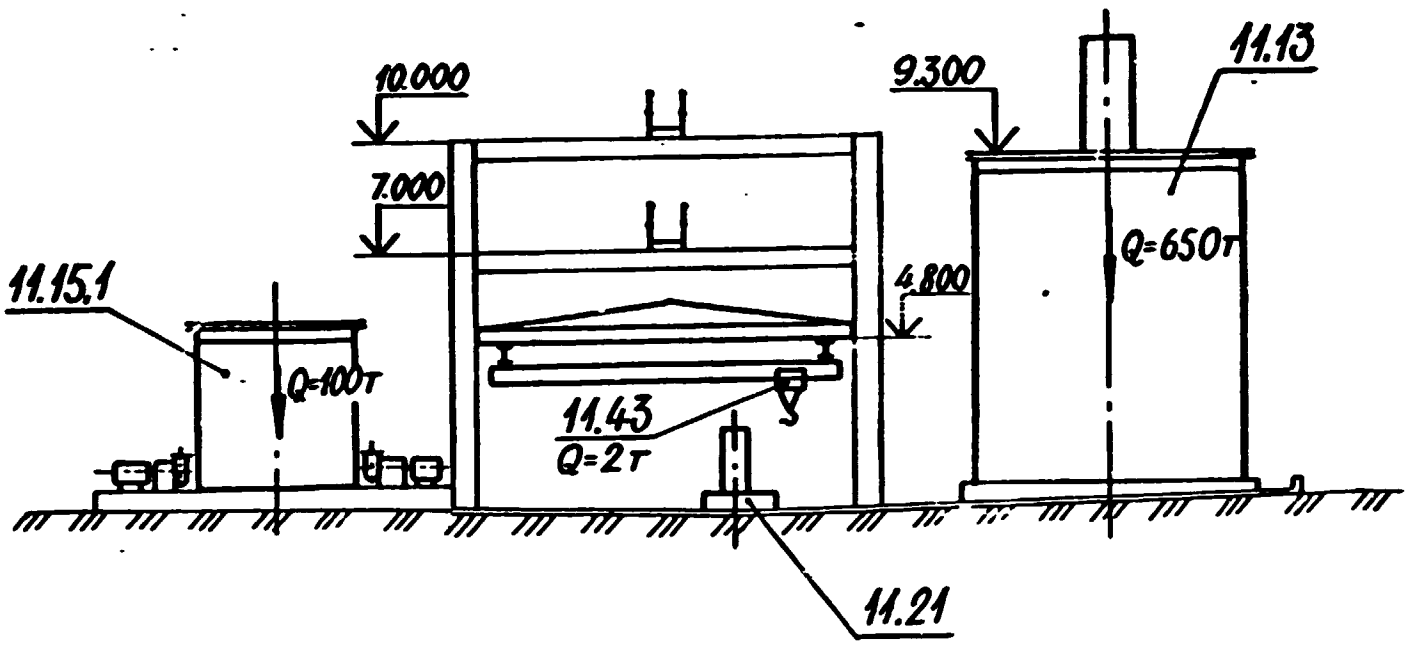
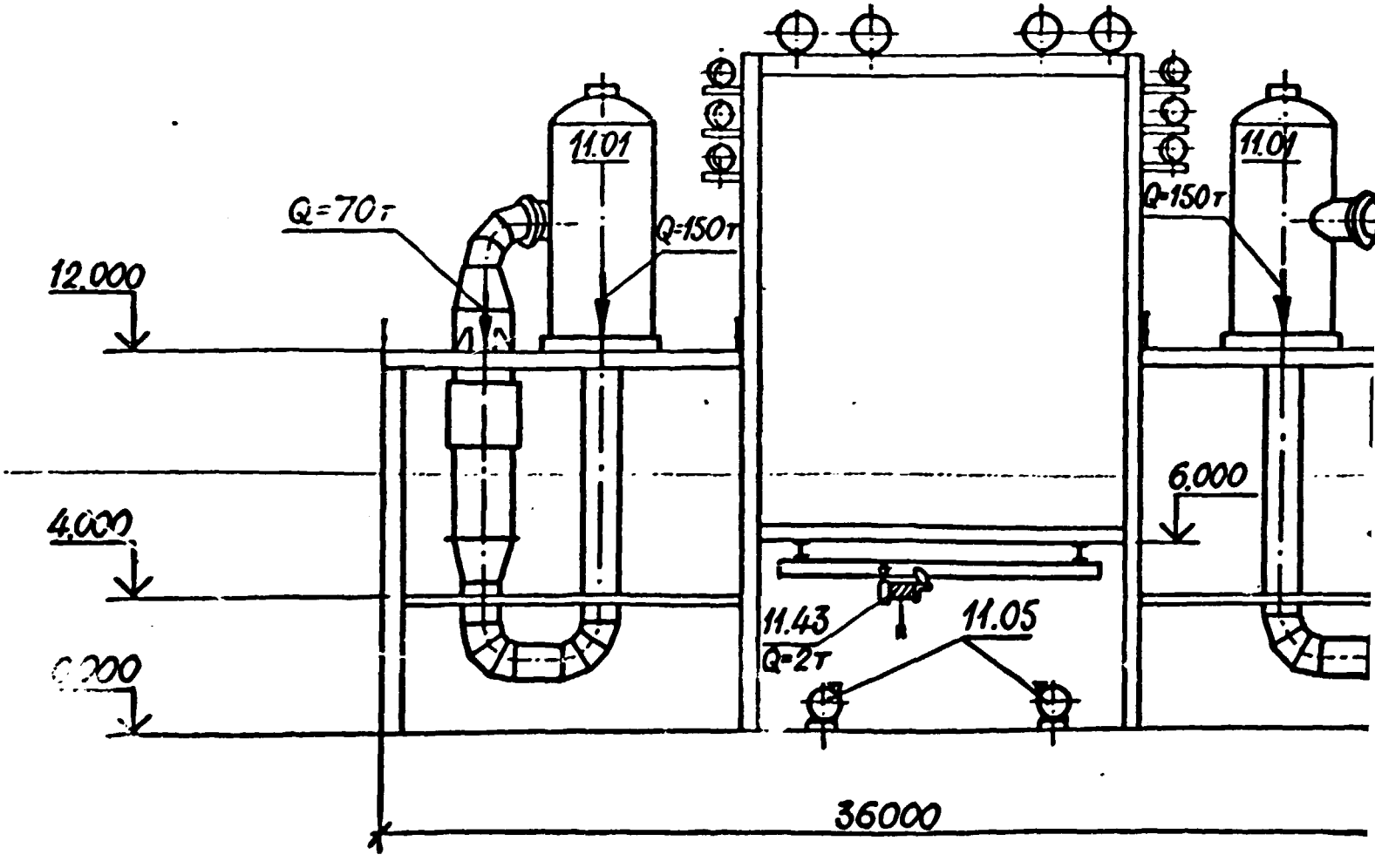


SECTION 12

SECTION 13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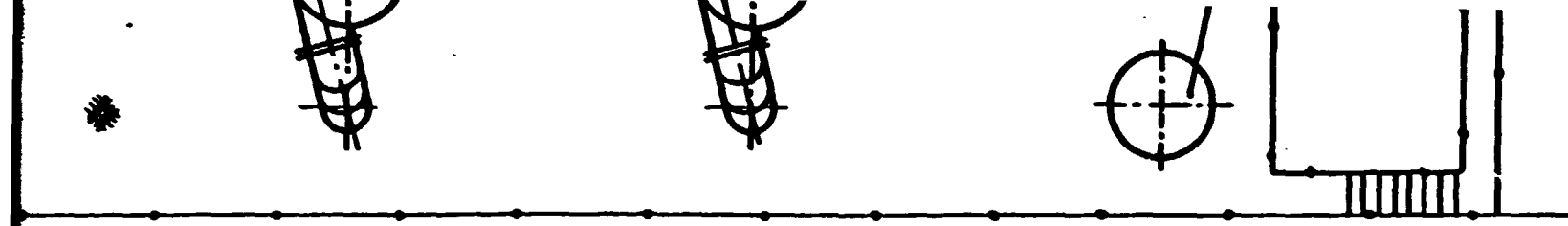
Q=70т
Q=150т
11.01
Q=150т
12.000
6.000
4.000
11.43
Q=2т
11.05
36000



1

SECTION 14

1 - 1

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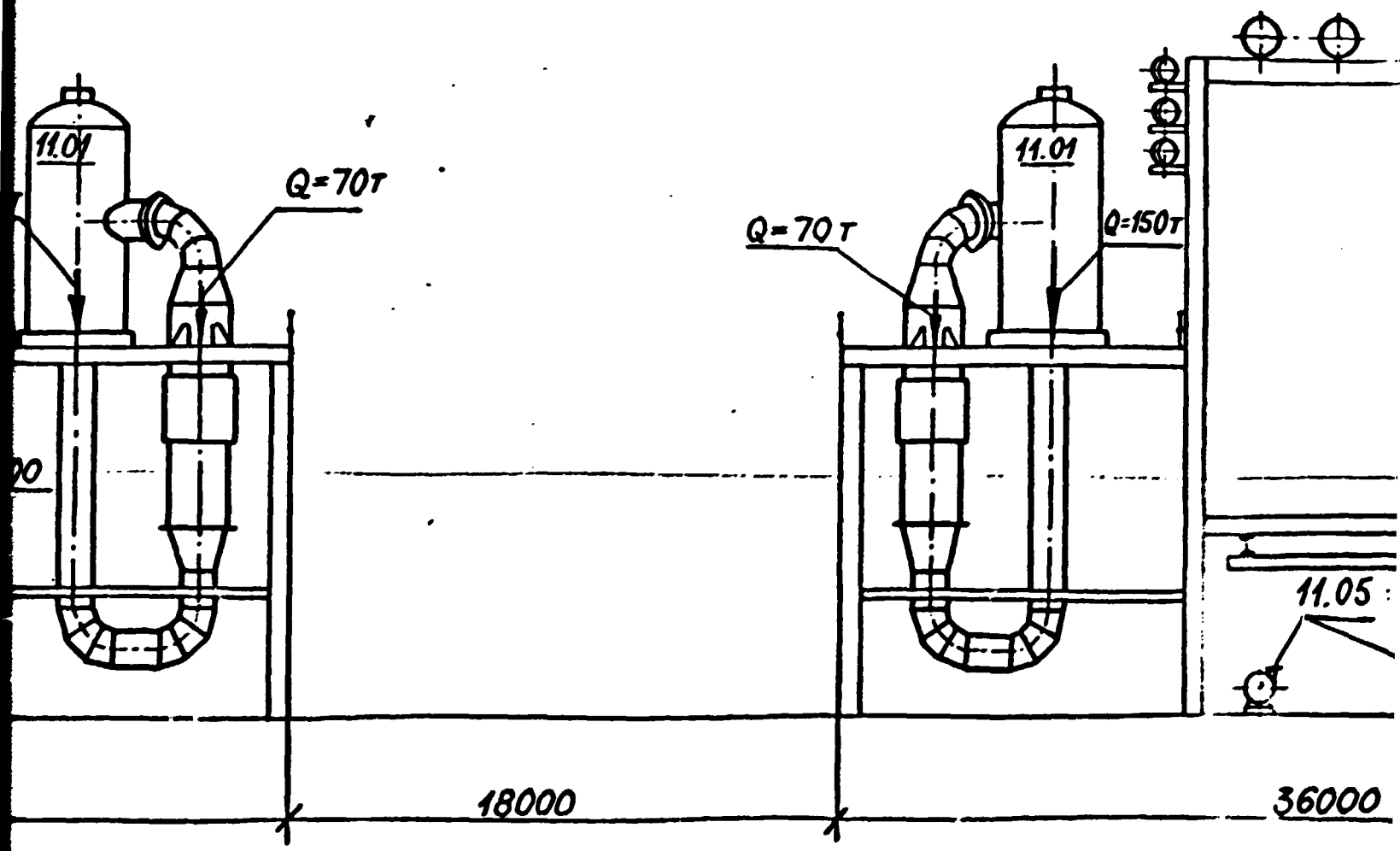
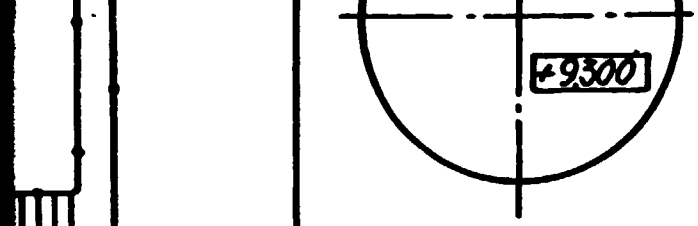
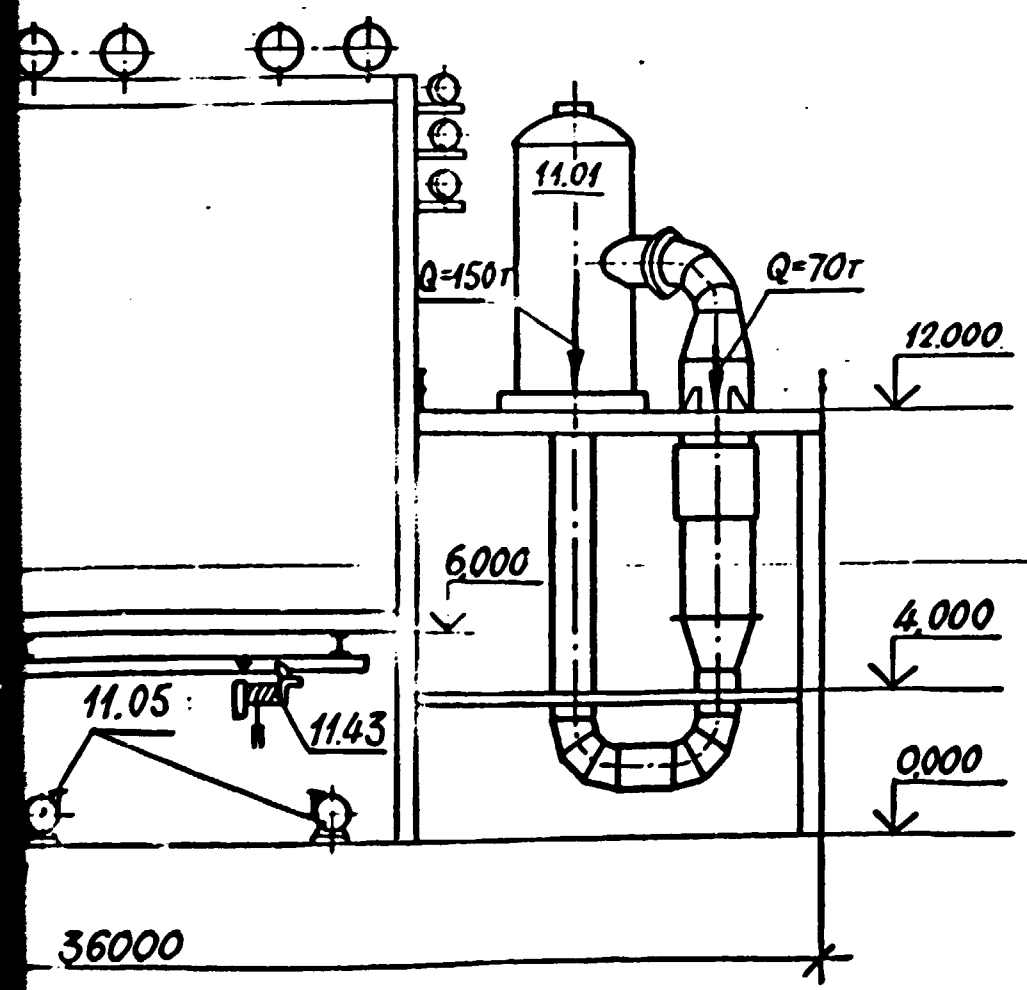


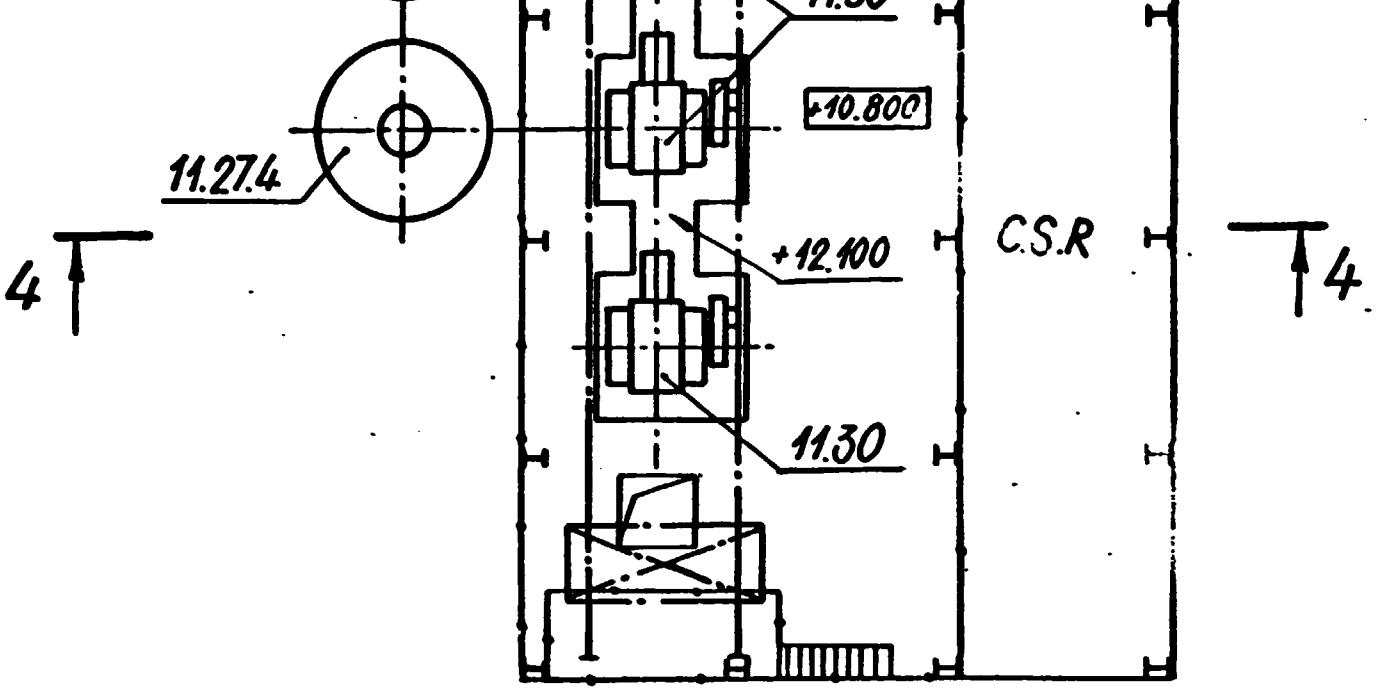


11.27.4

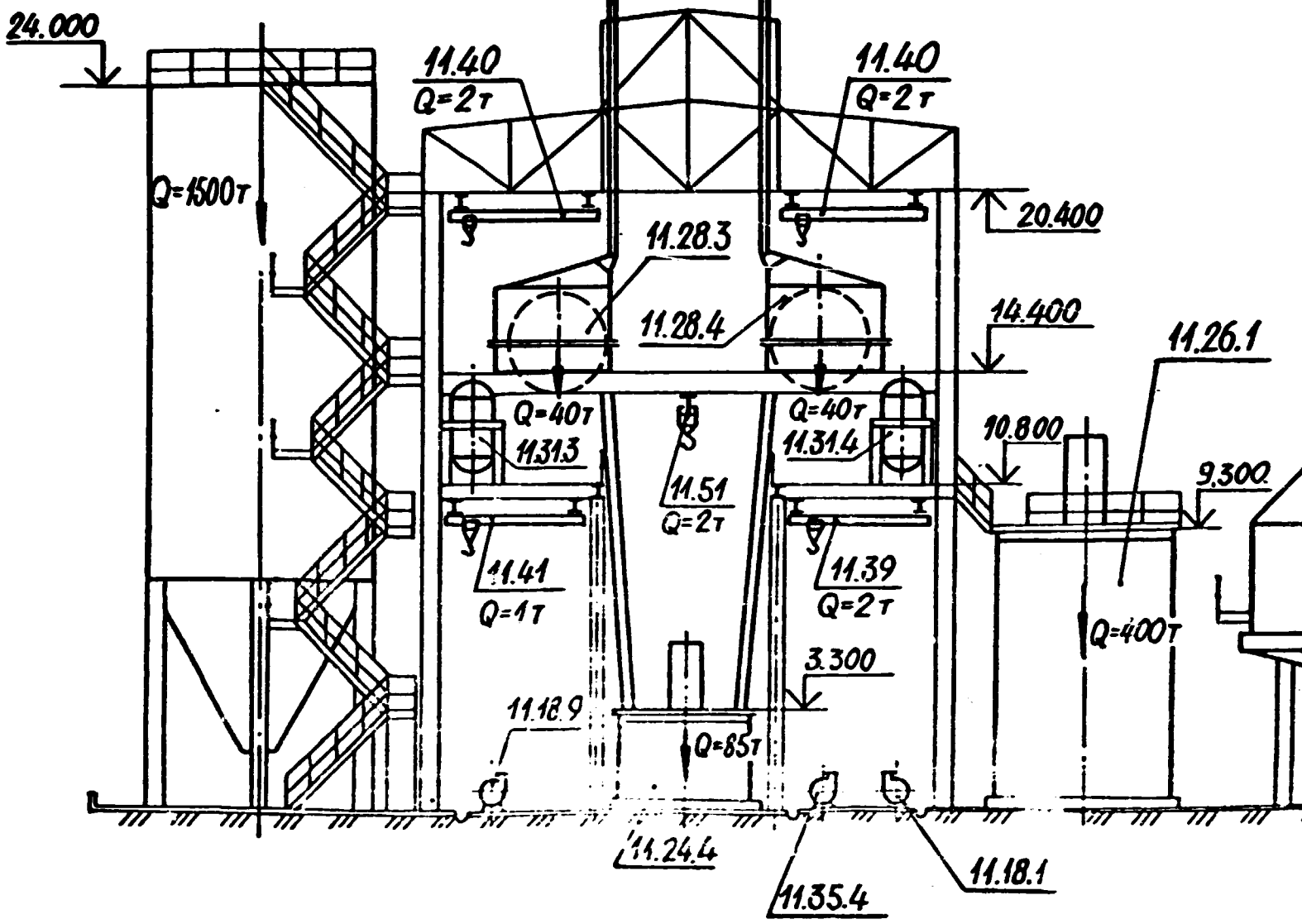
4

SECTION 15



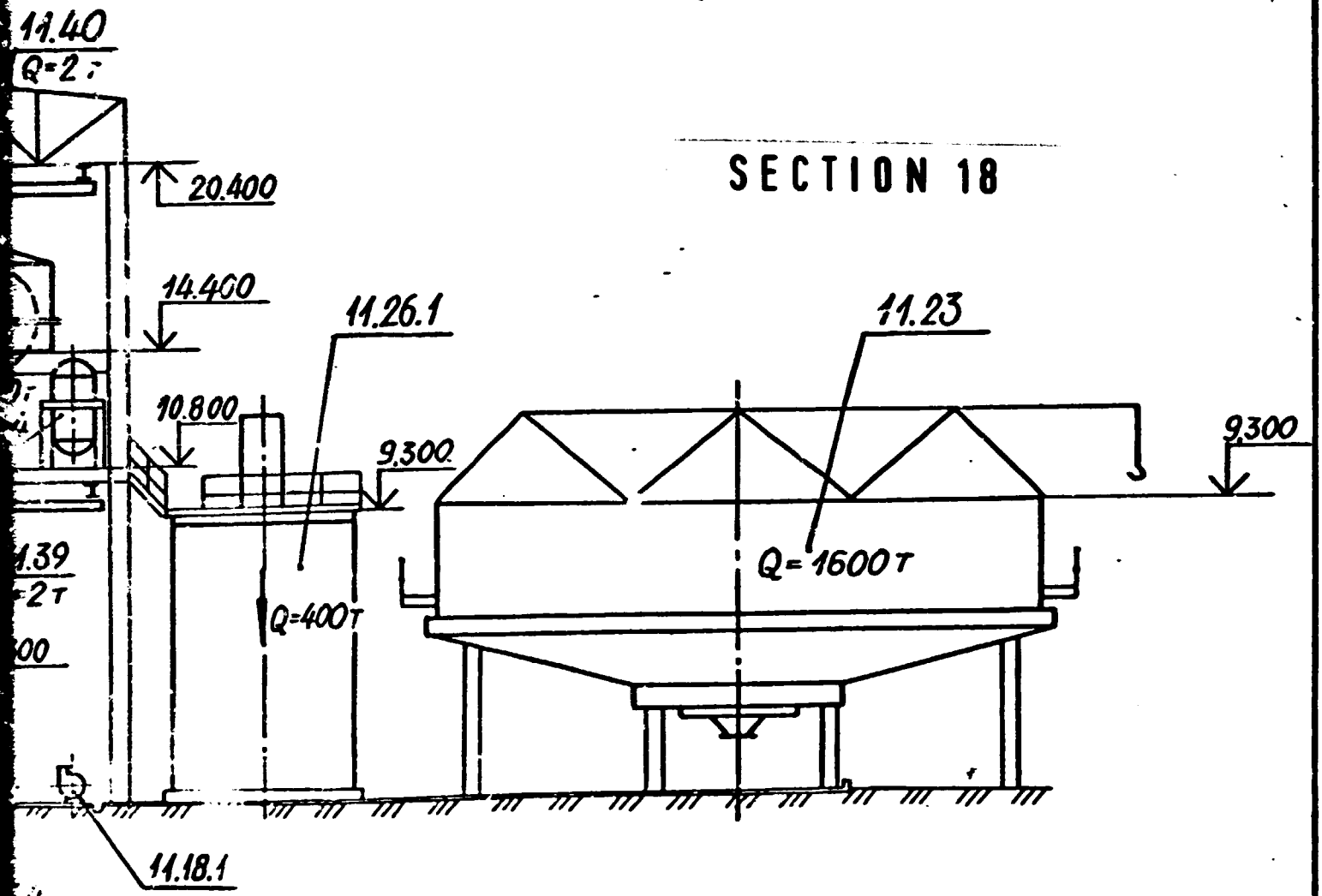


SECTION 16



SECTION 17

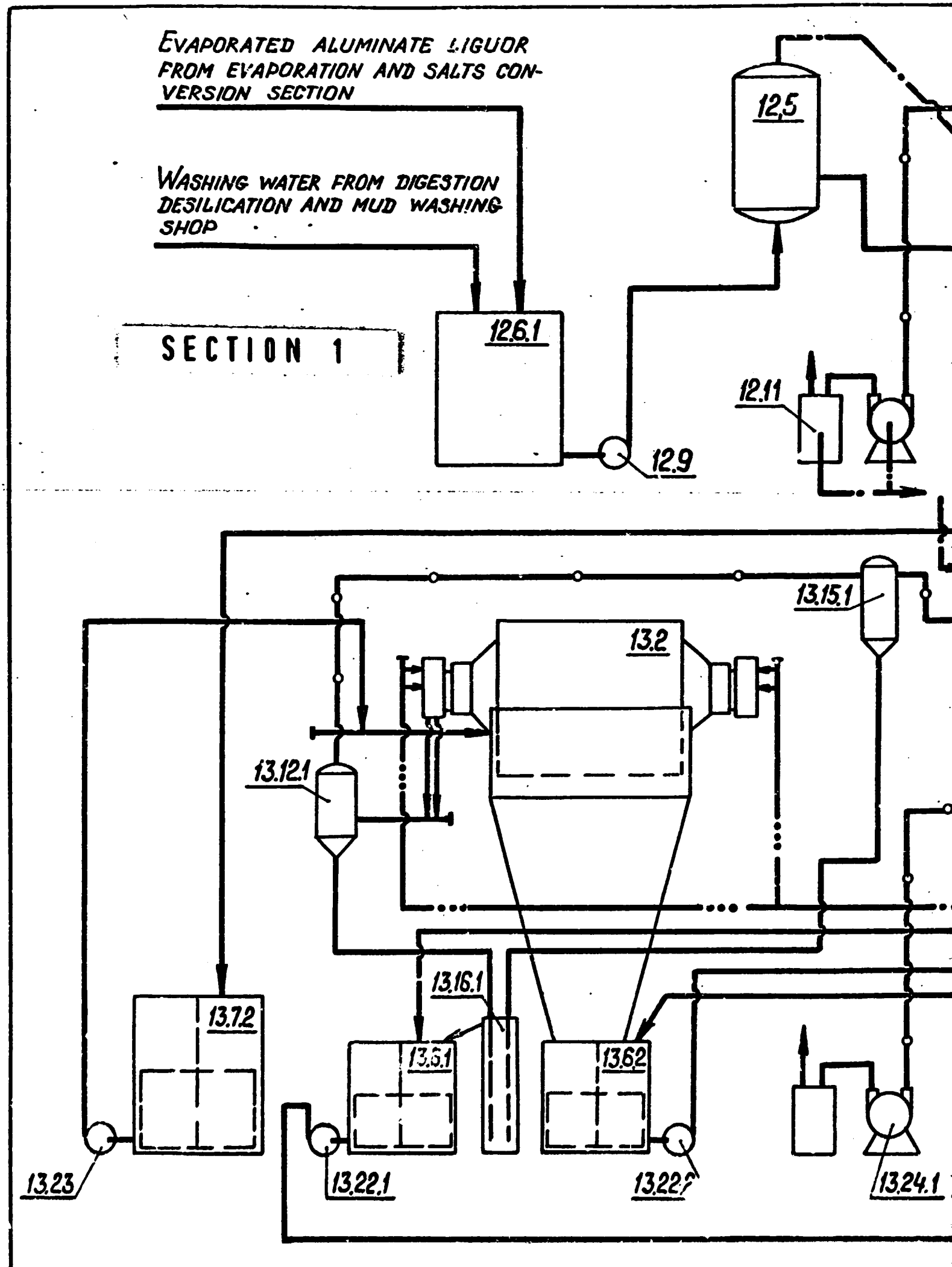
SECTION 18

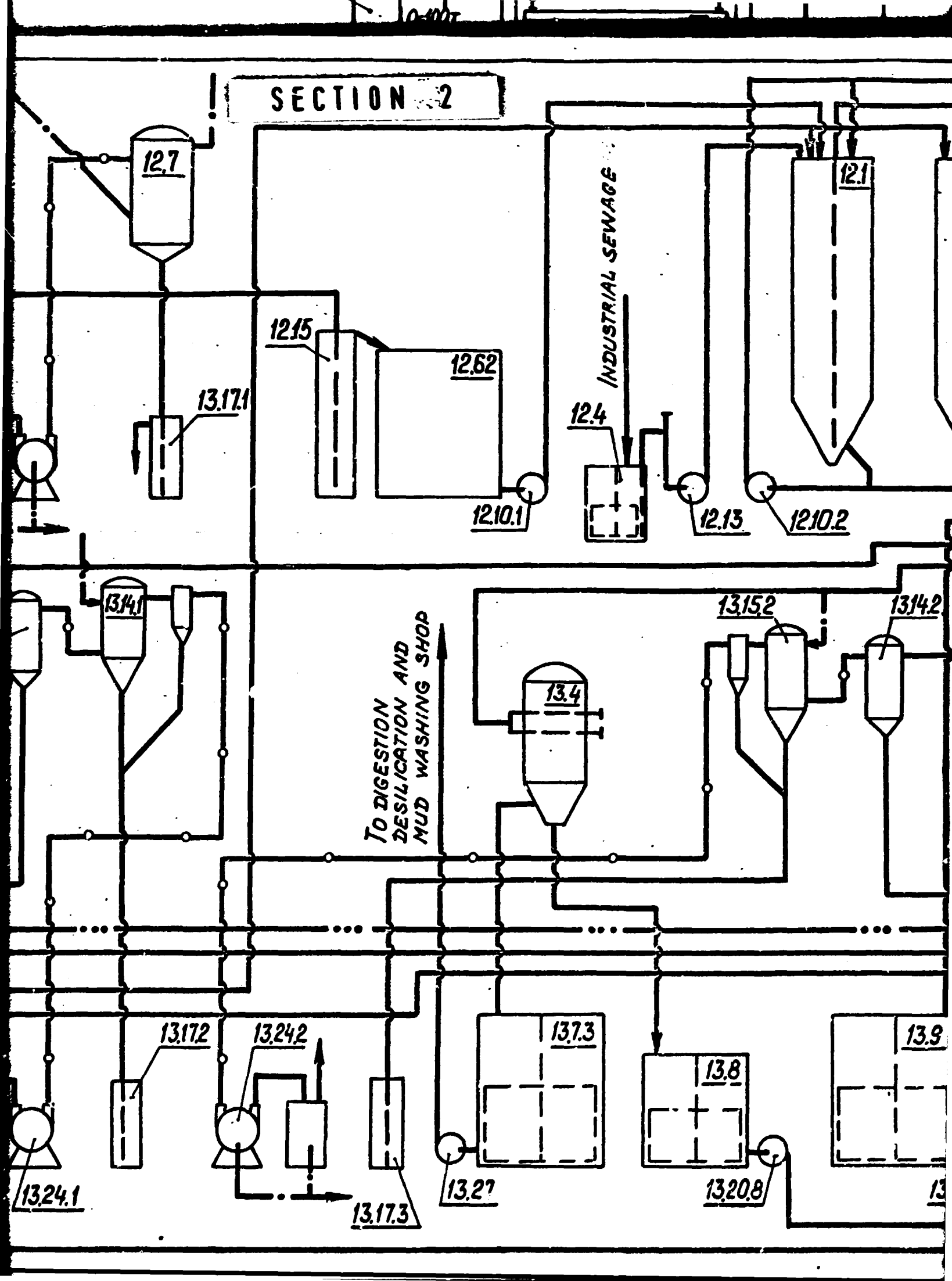


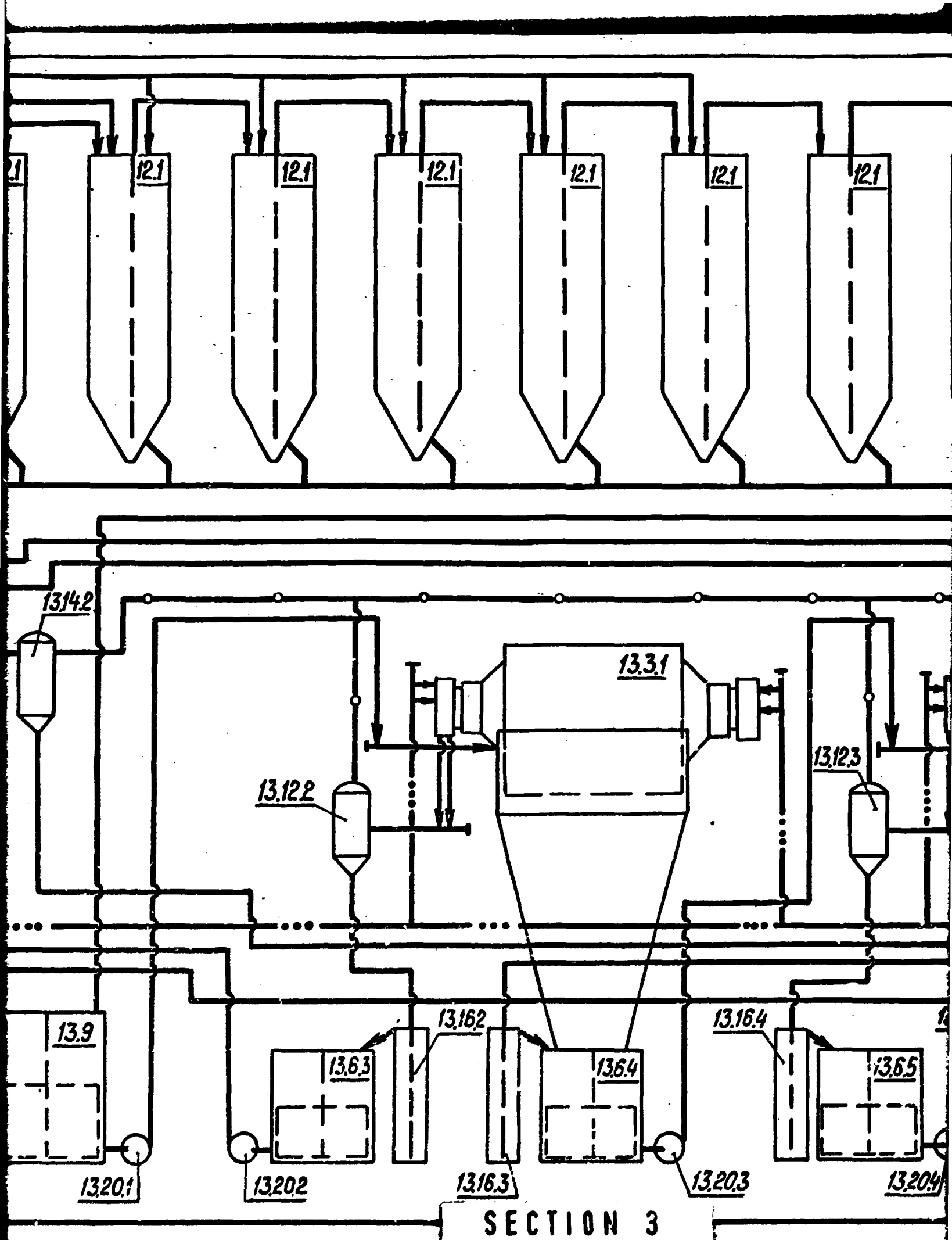
UNIDO CONTRACT No 85/08

1339553-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
EVAPORATION AND POTASSIUM SULPHATE PRODUCTION	STAGE	SHEET	SHEETS
	FEASIBILITY	4	
PLAN AT UPPER ELEVATIONS	VAMI LENINGRAD		

SIZE A0


EVAPORATED ALUMINATE LIQUOR FROM EVAPORATION AND SALTS CONVERSION SECTION
WASHING WATER FROM DIGESTION DESILICATION AND MUD WASHING SHOP
SECTION 1
12.5
12.6.1
12.11
12.9
13.15.1
13.2
13.12.1
13.16.1
13.7.2
13.6.1
13.6.2
13.23
13.22.1
13.22.2
13.24.1


SECTION 2
12.7
12.15
12.62
13.17.1
12.10.1
INDUSTRIAL SEWAGE
12.4
12.13
12.1
12.10.2
13.14.1
13.15.2
13.14.2
13.4
TO DIGESTION DESILICATION AND MUD WASHING SHOP
13.17.2
13.24.2
13.7.3
13.8
13.9
13.24.1
13.17.3
13.27
13.20.8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12.1
12.1
12.1
12.1
12.1
13.14.2
13.3.1
13.12.2
13.12.3
13.9
13.16.2
13.16.4
13.6.3
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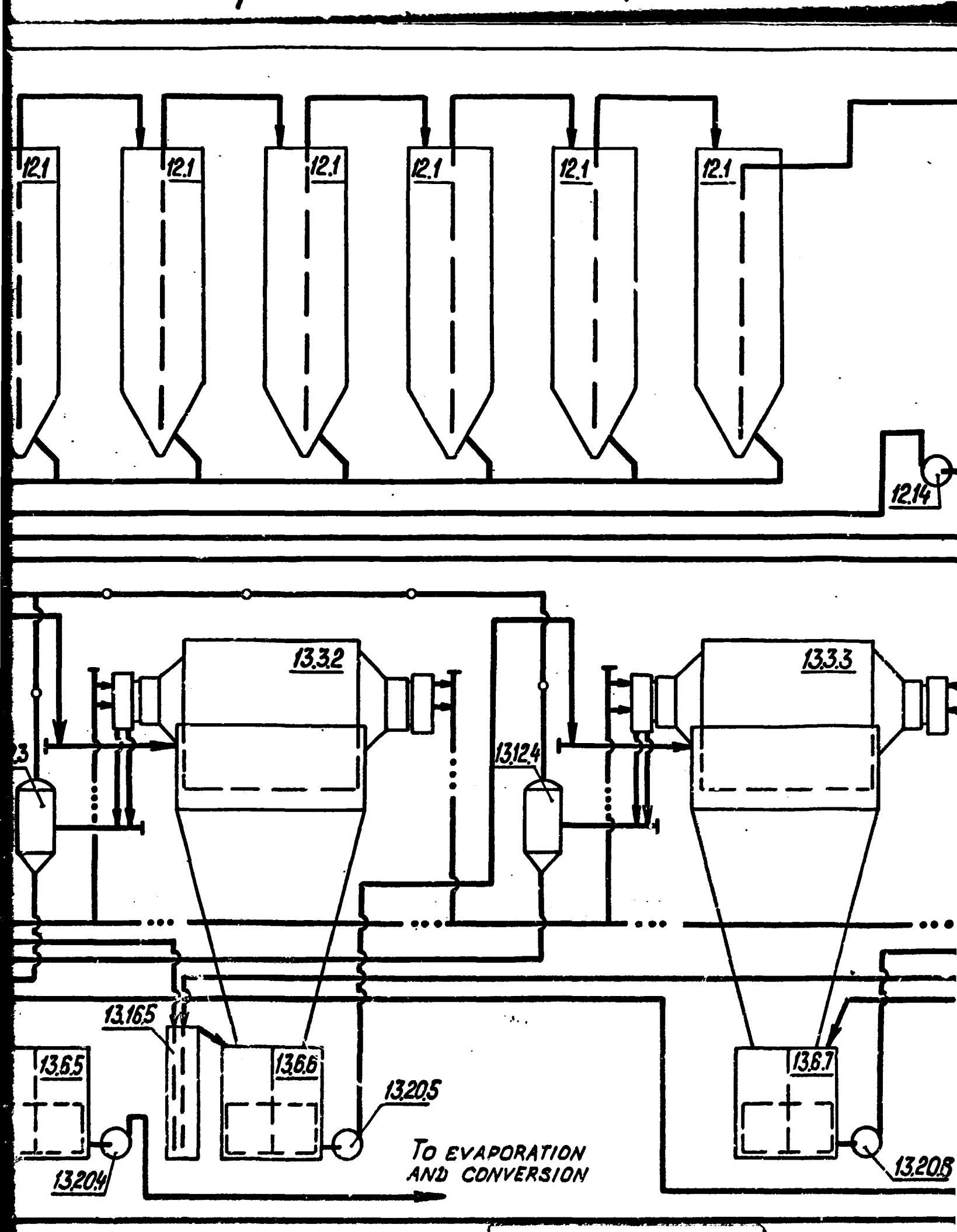
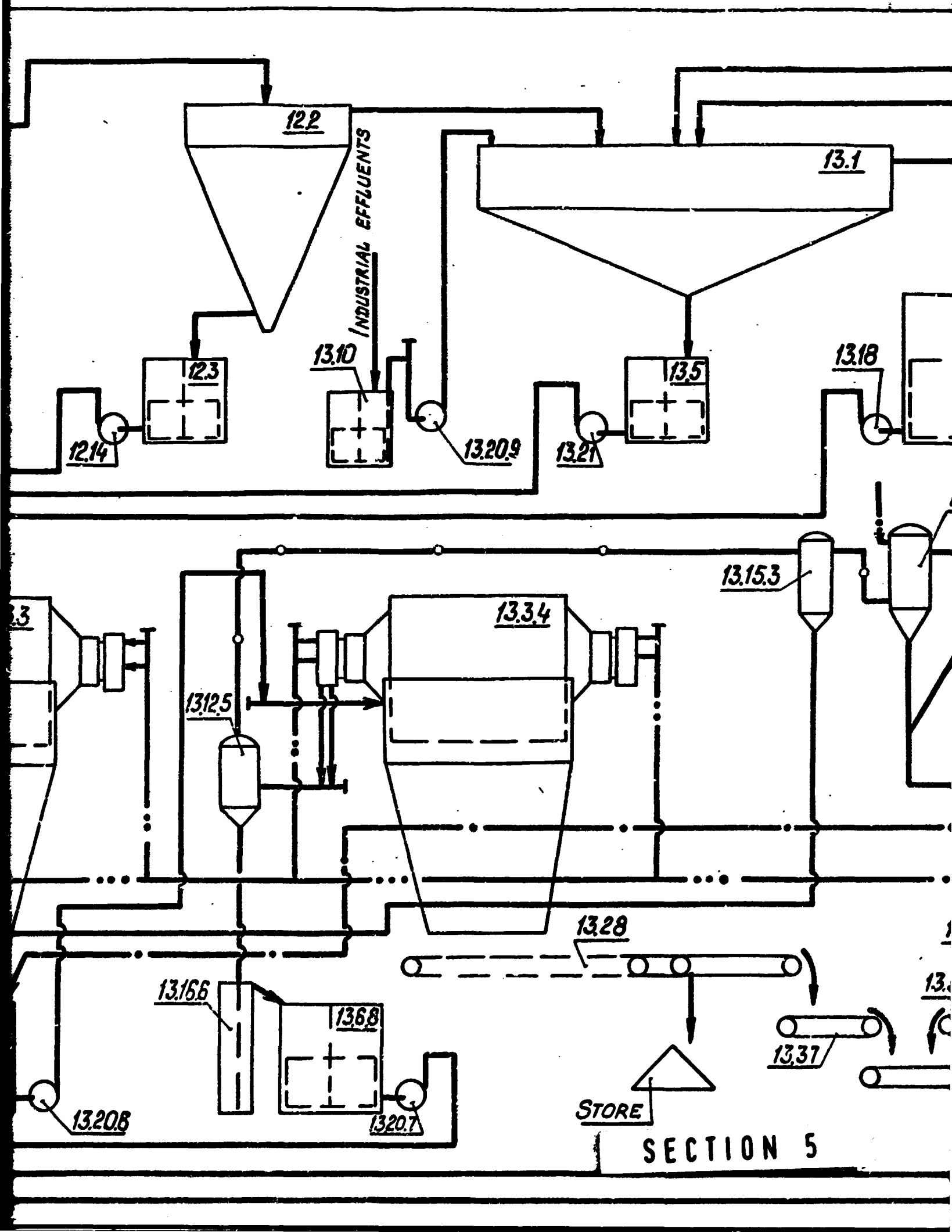
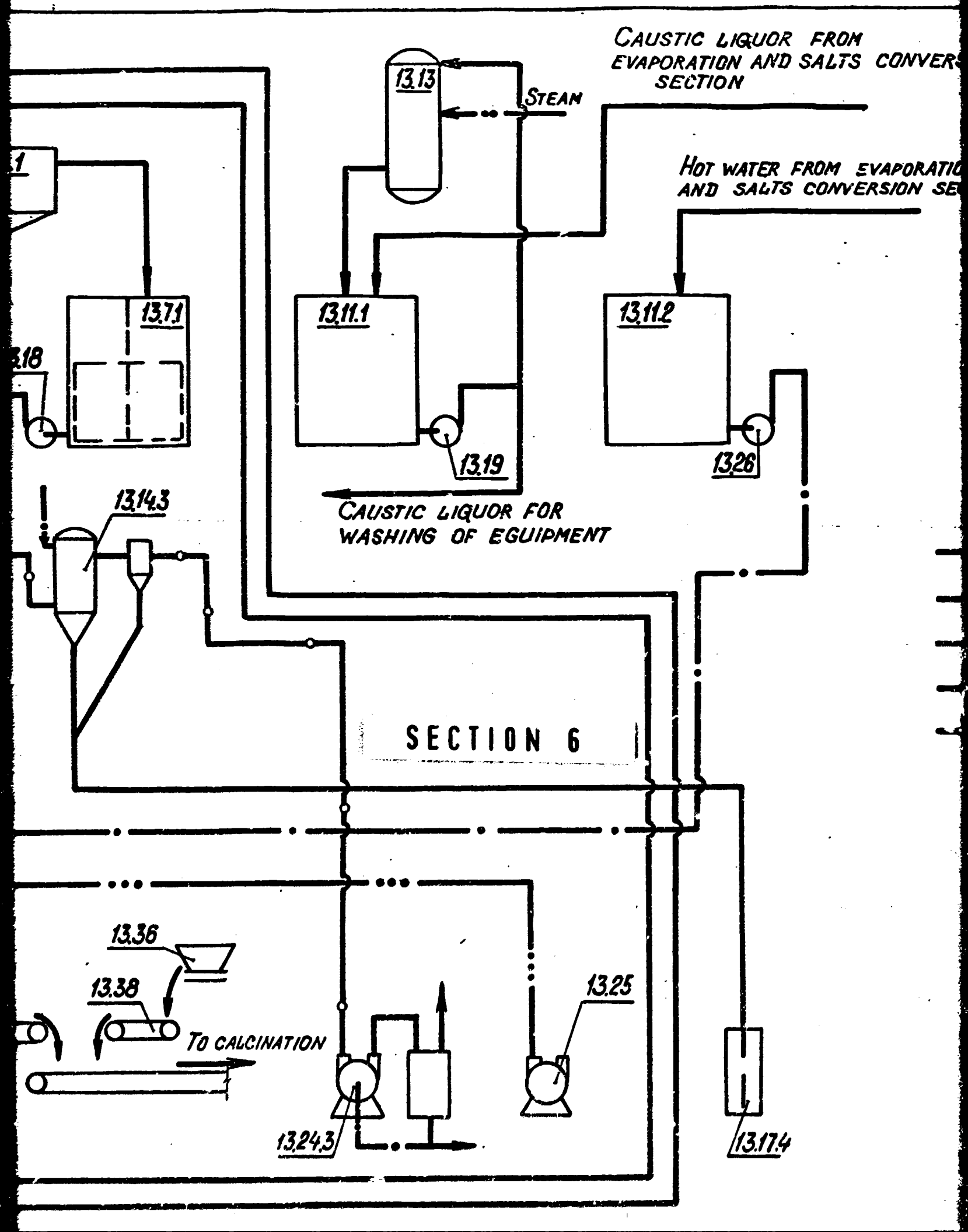
13.6.5
13.20.1
13.20.2
13.16.3
13.20.3
13.20.4

SECTION 3


12.1
12.1
12.1
12.1
12.1
12.1
12.14
13.3.2
13.3.3
13124
13.16.5
13.6.5
13.6.6
13.6.7
13.20.5
13.20.4
13.20.8
TO EVAPORATION
AND CONVERSION


12.2
INDUSTRIAL EFFLUENTS
13.1
12.3
13.10
13.5
13.18
12.14
13.20.9
13.21
13.15.3
13.3.4
13.12.5
13.28
13.16.6
13.6.8
13.37
13.20.8
13.20.7
STORE
SECTION 5


CAUSTIC LIQUOR FROM EVAPORATION AND SALTS CONVERS SECTION
13.13
STEAM
HOT WATER FROM EVAPORATIO AND SALTS CONVERSION SE
13.7.1
13.11.1
13.11.2
13.19
13.26
13.14.3
CAUSTIC LIQUOR FOR WASHING OF EGUIPMENT
SECTION 6
13.36
13.38
TO CALCINATION
13.25
13.24.3
13.17.4

CONVERSION

VAPORATION
RSION SECTION

SECTION 7

LEGEND

- PULP, LIQUOR
- WATER
- COMPRESSED AIR
- VACUUM
- STEAM

	PRECIPITATIO	
ITEM	DESCRIPTION OF EQUIPMENT	
12.1	PRECIPITATOR	V
12.2	HYDROSEPARATOR	Φ
12.3	CHAIN AGITATOR	Φ
12.4	SUMP AGITATOR	Φ
12.5	FLASH TANK	Φ
12.6.1	TANK OF HOT ALUMINATE LIQUOR	Φ
12.6.2	TANK OF COOLED ALUMINATE LIQUOR	Φ
12.7	BAROMETRIC CONDENSER	Φ
12.9	CENTRIFUGAL PUMP	31
12.10.1	CENTRIFUGAL PUMP	31
12.10.2	CENTRIFUGAL PUMP	31
12.11	VACUUM PUMP	50
12.12	ELECTRICAL HOIST. (MOVABLE)	CA
12.13	CENTRIFUGAL PUMP	16
12.14	CENTRIFUGAL PUMP	16
12.15	HYDROLOCK	Φ
	HYDRATE	PRO
13.1	SINGLE-CHAMBER THICKENER	
13.2	VACUUM FILTER	
13.3.1	VACUUM FILTER	
13.3.2	VACUUM FILTER	
13.3.3	VACUUM FILTER	
13.3.4	VACUUM FILTER	
13.4	LEAFFILTER UNDER PRESSURE	
13.5	CHAIN AGITATOR	Φ
13.6.1	CHAIN AGITATOR	Φ
13.6.2	CHAIN AGITATOR	Φ

PRECIPITATION

ITEM	DESCRIPTION OF EQUIPMENT	SPECIFICATIONS	NUMBER	NOTE
12.1	PRECIPITATOR	V=3000 M^3	15	
12.2	HYDROSEPARATOR	Φ10000	3	
12.3	CHAIN AGITATOR	Φ3000×3000	2	
12.4	SUMP ACITATOR	Φ2000×2500	2	
12.5	FLASH TANK	Φ3600	2	
12.6.1	TANK OF HOT ALUMINATE LIQUOR	Φ9000×6000	1	
12.6.2	TANK OF COOLED ALUMINATE LIQUOR	Φ9000×6000	2	
12.7	BAROMETRIC CONDENSER	Φ1200	2	
12.9	CENTRIFUGAL PUMP	315 $\frac{M^3}{HR}$; 40M	3	
12.10.1	CENTRIFUGAL PUMP	315 $\frac{M^3}{HR}$; 56M	4	
12.10.2	CENTRIFUGAL PUMP	315 $\frac{M^3}{HR}$; 56M	2	
12.11	VACUUM PUMP	50 $\frac{M^3}{HR}$ UNDER 70% VACUUM	2	
12.12	ELECTRICAL HOIST. (MOVABLE)	CAPACITY 3,2T	2	NOT SHOWN
12.13	CENTRIFUGAL PUMP	160 $\frac{M^3}{HR}$; 20M	2	
12.14	CENTRIFUGAL PUMP	160 $\frac{M^3}{HR}$; 40M	3	
12.15	HYDROLOCK	Φ1500 H=8000	2	
	SECTION 8			
	HYDRATE	PROCESSING		
13.1	SINGLE-CHAMBER THICKENER	Φ20000	5	
13.2	VACUUM FILTER	F = 40M^2	3	
13.3.1	VACUUM FILTER	F = 20M^2	1	
13.3.2	VACUUM FILTER	F = 20M^2	2	
13.3.3	VACUUM FILTER	F = 20M^2	1	
13.3.4	VACUUM FILTER	F = 20M^2	2	
13.4	LEAFFILTER UNDER PRESSURE	F = 225M^2	4	
13.5	CHAIN AGITATOR	Φ3000×3000	5	
13.6.1	CHAIN AGITATOR	Φ4500×3000	2	
13.6.2	CHAIN AGITATOR	Φ4500×3000	3	

ITEM	DESCRIP
13.6.3	CHAIN
13.6.4	CHAIN
13.6.5	CHAIN
13.6.6	CHAIN
13.6.7	CHAIN
13.6.8	CHAIN
13.7.1	CHAIN
13.7.2	CHAIN
13.7.3	CHAIN
13.8	CHAIN
13.9	CHAIN
13.10	SUMP
13.11	TANK
13.12.1	RECEI
13.12.2	RECEI
13.12.3	RECEI
13.12.4	RECEI
13.12.5	RECEI
13.13	HEAT
13.14.1	BAROM
13.14.2	BAROM
13.14.3	BAROM
13.15.1	TRAP
13.15.2	TRAP
13.15.3	TRAP
13.16.1	HYDR
13.16.2	HYDR
13.16.3	HYDR
13.16.4	HYDR
13.16.5	HYDR
13.16.6	HYDR
13.17.1	HYDR

	ITEM	DESCRIPTION OF EQUIPMENT	SPECIFICATION	NUMBER	NOTE
	13.6.3	CHAIN AGITATOR	Φ4500×3000	2	
	13.6.4	CHAIN AGITATOR	Φ4500×3000	1	
	13.6.5	CHAIN AGITATOR	Φ4500×3000	1	
	13.6.6	CHAIN AGITATOR	Φ4500×3000	2	
	13.6.7	CHAIN AGITATOR	Φ4500×3000	1	
	13.6.8	CHAIN AGITATOR	Φ4500×3000	1	
	13.7.1	CHAIN AGITATOR	Φ9000×6000	2	
	13.7.2	CHAIN AGITATOR	Φ9000×6000	1	
	13.7.3	CHAIN AGITATOR	Φ9000×6000	2	
	13.8	CHAIN AGITATOR	Φ4500×4500	2	
	13.9	CHAIN AGITATOR	Φ6000×9000	2	
	13.10	SUMP AGITATOR	Φ2000×2500	6	
	13.11	TANK	Φ9000×6000	4	
WN	13.12.1	RECEIVER	V = 4M³	3	
	13.12.2	RECEIVER	V = 4M³	1	
	13.12.3	RECEIVER	V = 4M³	2	
	13.12.4	RECEIVER	V = 4M³	1	
	13.12.5	RECEIVER	V = 4M	2	
	13.13	HEAT EXCHANGER	Φ1200; F = 480M²	1	
	13.14.1	BAROMETRIC CONDENSER	Φ800	1	
	13.14.2	BAROMETRIC CONDENSER	Φ800	2	
	13.14.3	BAROMETRIC CONDENSER	Φ800	1	
	13.15.1	TRAP	V = 1M²	1	
	13.15.2	TRAP	V = 1M²	1	
	13.15.3	TRAP	V = 1M²	2	
	13.16.1	HYDROLOCK	Φ1000×4000	2	
	13.16.2	HYDROLOCK	Φ1000×4000	1	
	13.16.3	HYDROLOCK	Φ1000×4000	1	
	13.16.4	HYDROLOCK	Φ1000×4000	1	
	13.16.5	HYDROLOCK	Φ1000×4000	2	
	13.16.6	HYDROLOCK	Φ1000×4000	1	
	13.17.1	HYDROLOCK	Φ1000×1000	1	

SECTION 9

ITEM	DESCRIP
13.17.2	HYDRO
13.17.3	HYDRO
13.17.4	HYDRO
13.18	CENTRI
13.19	CENTRI
13.20.1	CENTRI
13.20.2	CENTRI
13.20.3	CENTRI
13.20.4	CENTRI
13.20.5	CENTRI
13.20.6	CENTRI
13.20.7	CENTRI
13.20.8	CENTRI
13.20.9	CENTRI
13.21.	CENTRI
13.22.1	CENTRI
13.22.2	CENTRI
13.23	CENTRI
13.24.1	VACUU
13.24.2	VACUU
13.24.3	VACUU
13.25	AIR BL
13.26	CENTRI
13.27.	CENTRI
13.28	BELT
13.29.	ELECTRI

E	ITEM	DESCRIPTION OF EQUIPMENT	SPECIFICATIONS	NUMBER	NOTE
	13.17.2	HYDROLOCK	Φ1000x1000	1	
	13.17.3	HYDROLOCK	Φ1000x1000	1	
	13.17.4	HYDROLOCK	Φ1000x1000	1	
	13.18	CENTRIFUGAL PUMP	315 M^3/HR ; 40M	4	
	13.19	CENTRIFUGAL PUMP	315 M^3/HR ; 56M	2	
	13.20.1	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	4	
	13.20.2	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	4	
	13.20.3	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	3	
	13.20.4	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	2	
	13.20.5	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	4	
	13.20.6	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	2	
	13.20.7	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	2	
	13.20.8	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	3	
	13.20.9	CENTRIFUGAL PUMP	160 M^3/HR ; 20M	6	
	13.21.	CENTRIFUGAL PUMP	100 M^3/HR ; 31,5M	10	
	13.22.1	CENTRIFUGAL PUMP	250 M^3/HR ; 56M	2	
	13.22.2	CENTRIFUGAL PUMP	250 M^3/HR ; 56M	6	
	13.23	CENTRIFUGAL PUMP	250 M^3/HR ; 28M	2	
	13.24.1	VACUUM PUMP	50 M^3/MIN UNDER 70% VACUUM	3	
	13.24.2	VACUUM PUMP	50 M^3/MIN UNDER 70% VACUUM	3	
	13.24.3	VACUUM PUMP	50 M^3/MIN UNDER 70% VACUUM	2	
	13.25	AIR BLOWER	5000 M^3/HR	3	
	13.26	CENTRIFUGAL PUMP	90 M^3/HR ; 30M	2	
	13.27.	CENTRIFUGAL PUMP	600 M^3/HR ; 40M	2	
	13.28	BELT CONVEYER	B=500MM ; L=50M	2	
	13.29.	ELECTRICAL CRANE, SUSPENDED,			

ITEM	DESCRI
	SINGLE
13.30	ELECTR
	SUSPE
	SINGLE
13.31	ELECTR
	SUSPE
	SINGL
13.32	ELECTR
	SUSPE
	SINGLE
13.35	ELECTRIC
13.36	APRON
13.37	BELT
13.38	BELT

SECTION 10

NOTE

ITEM	DESCRIPTION OF EGUIPMENT	SPECIFICATION	NUMBER	NOTE
	SINGLE-GIRDER	CAPACITY 2T	1	NOT SHOWN
13.30	ELECTRICAL CRANE,			
	SUSPENDED,			
	SINGLE-GIRDER	CAPACITY 2T	1	NOT SHOWN
13.31	ELECTRICAL CRANE,			
	SUSPENDED,			
	SINGLE-GIRDER	CAPACITY 3,2 T	1	NOT SHOWN
13.32	ELECTRICAL CRANE,			
	SUSPENDED,			
	SINGLE-GIRDER	CAPACITY 3,2T	2	NOT SHOWN
13.35	ELECTRICAL BRIDGE GRAB CRANE	CAPACITY 10T	1	NOT SHOWN
13.36	APRON FEEDER 2-12-120		1	
13.37	BELT CONVEYER	B=500MM; L=20M	2	
13.38	BELT CONVEYER	B=500MM; L=12M	1	

SECTION 11

UNIDO CONTRACT NO 85/108

1339554-TM

IRAN. ALUNITE BASED ALUMINA PLANT

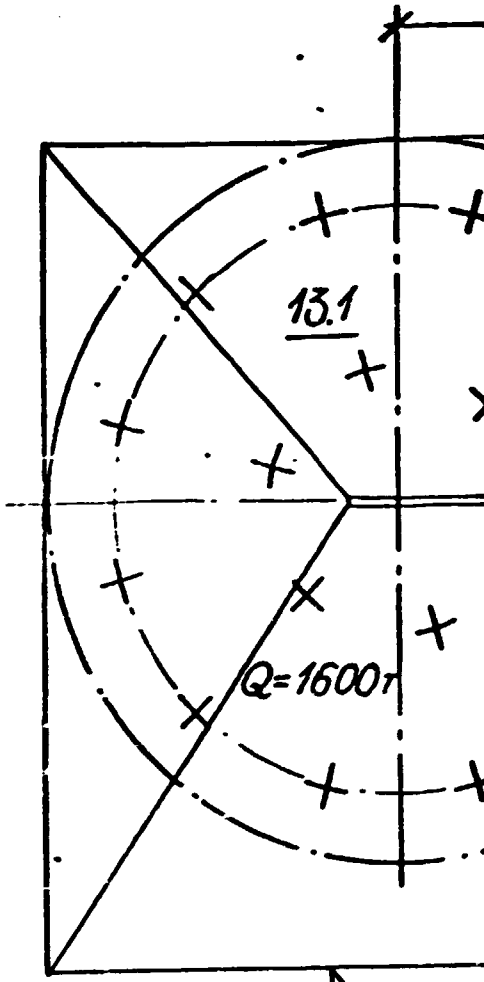
PRECIPITATION. HYDRATE PROCESSING WITH HYDRATE STORE

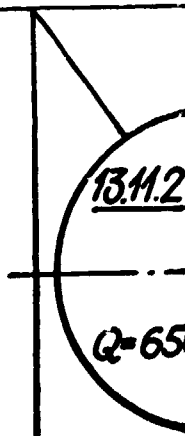
STAGE	SHEET	SHEETS
FEASIBILITY	1	4

APPARATUS - PROCESS FLOWSHEET

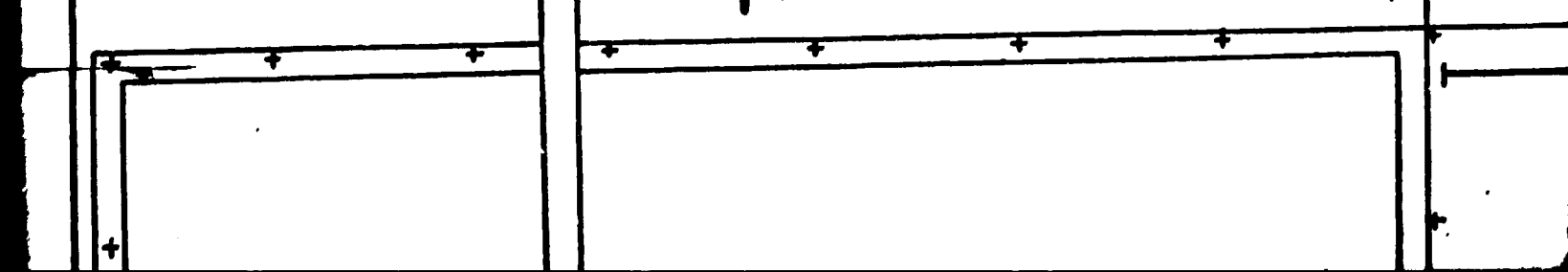
VAMI LENINGRAD

SECTION 1

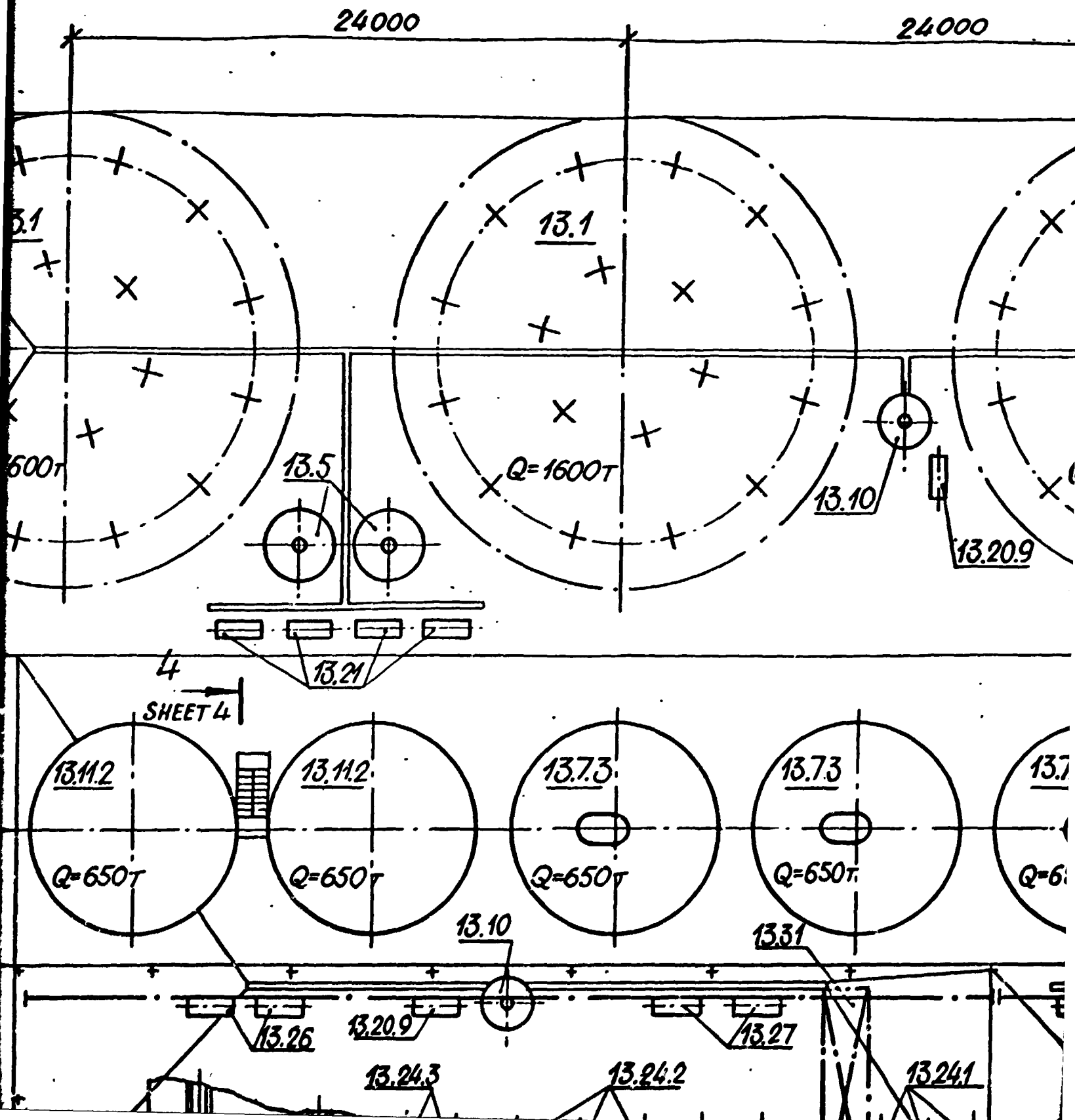




5
SHEET 3

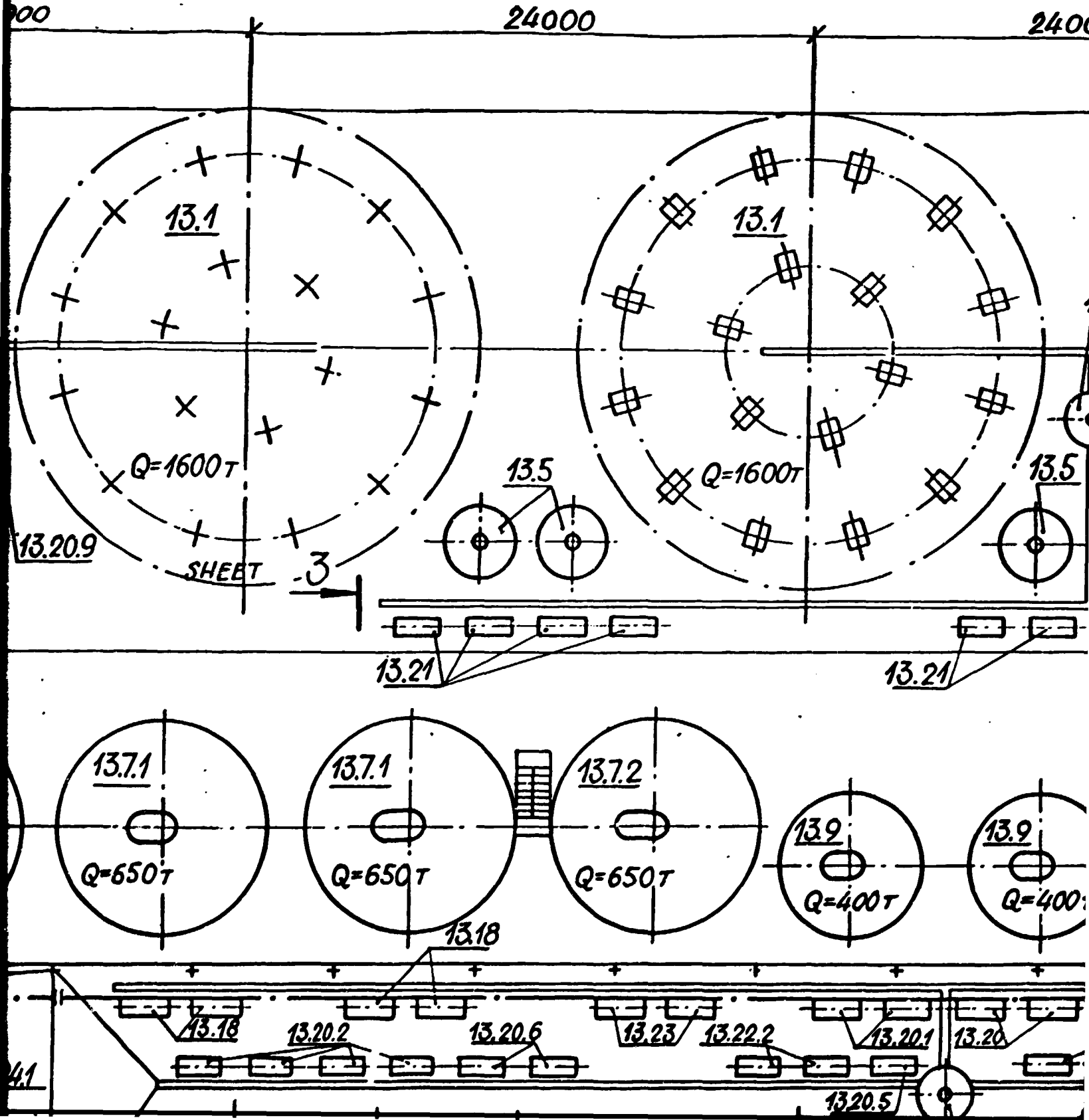


SECTION 2


24000
24000
13.1
Q=1600т
13.5
13.10
13.20.9
13.21
4
SHEET 4
13.11.2
13.11.2
13.7.3
13.7.3
Q=650т
Q=650т
Q=650т
Q=650т
13.10
13.31
13.26
13.20.9
13.27
13.24.3
13.24.2
13.24.1

SHEET 4 2

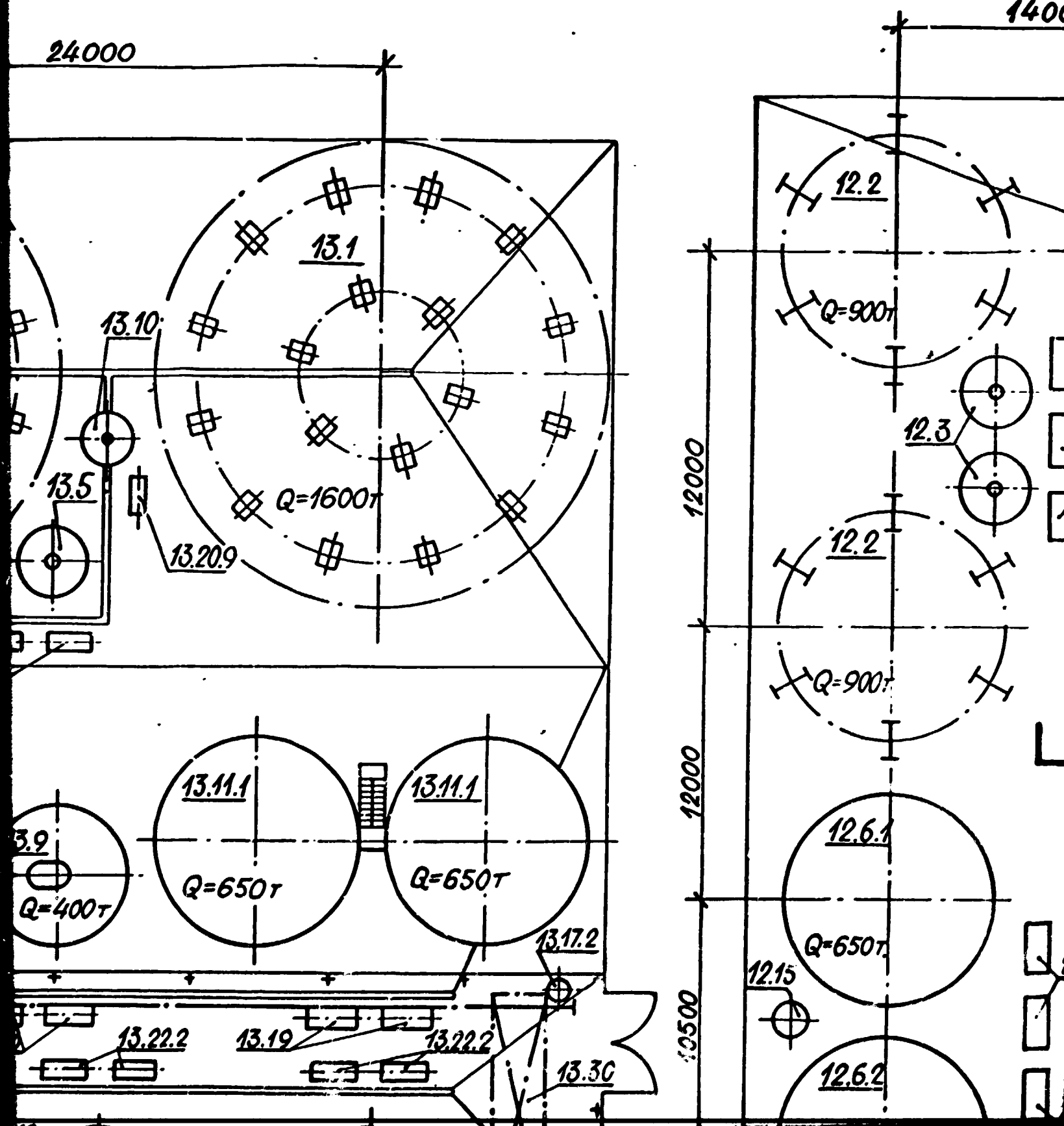
SECTION 3



PLAN AT EL. 0.000

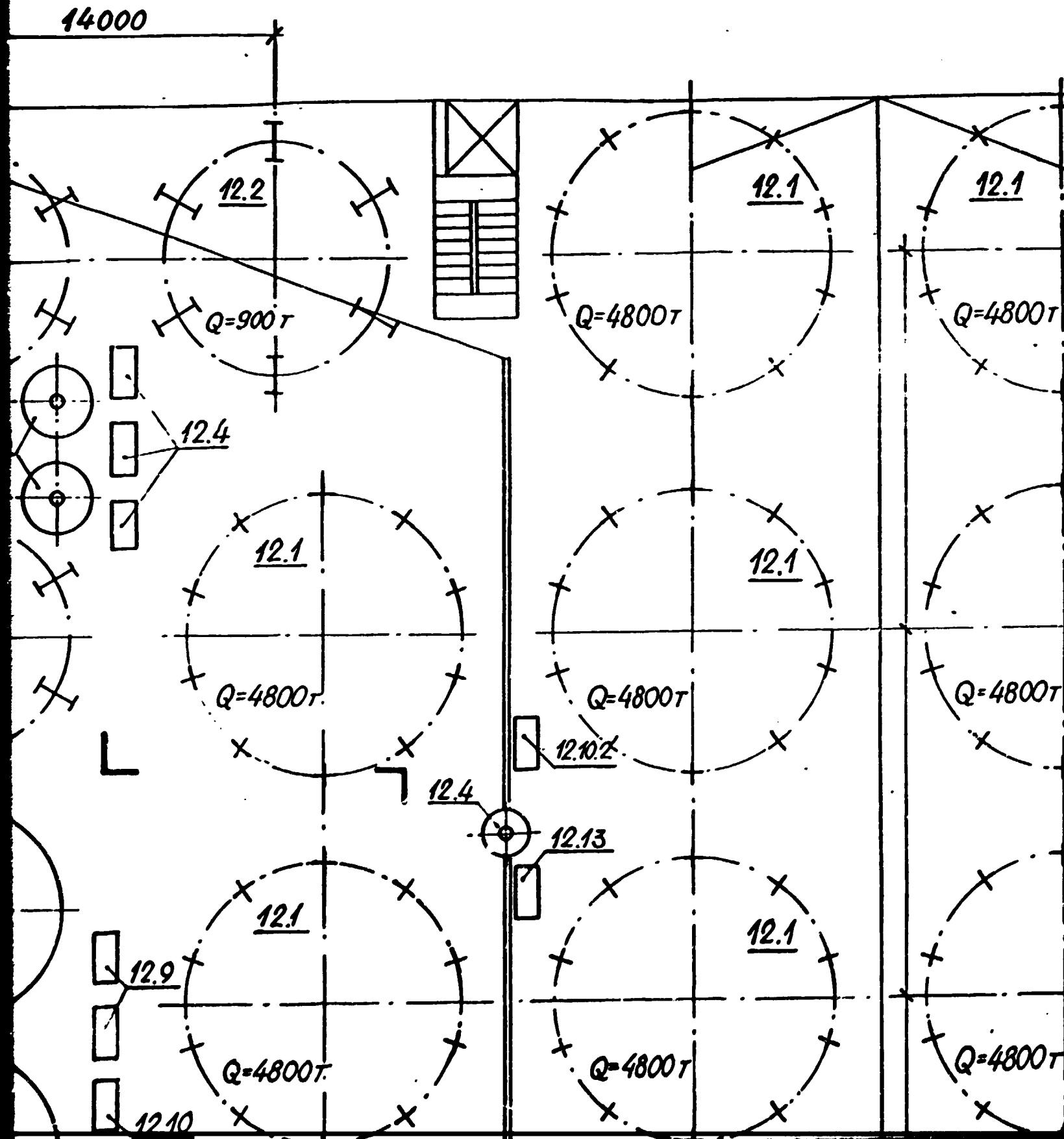
SCALE 1:200

SECTION 4

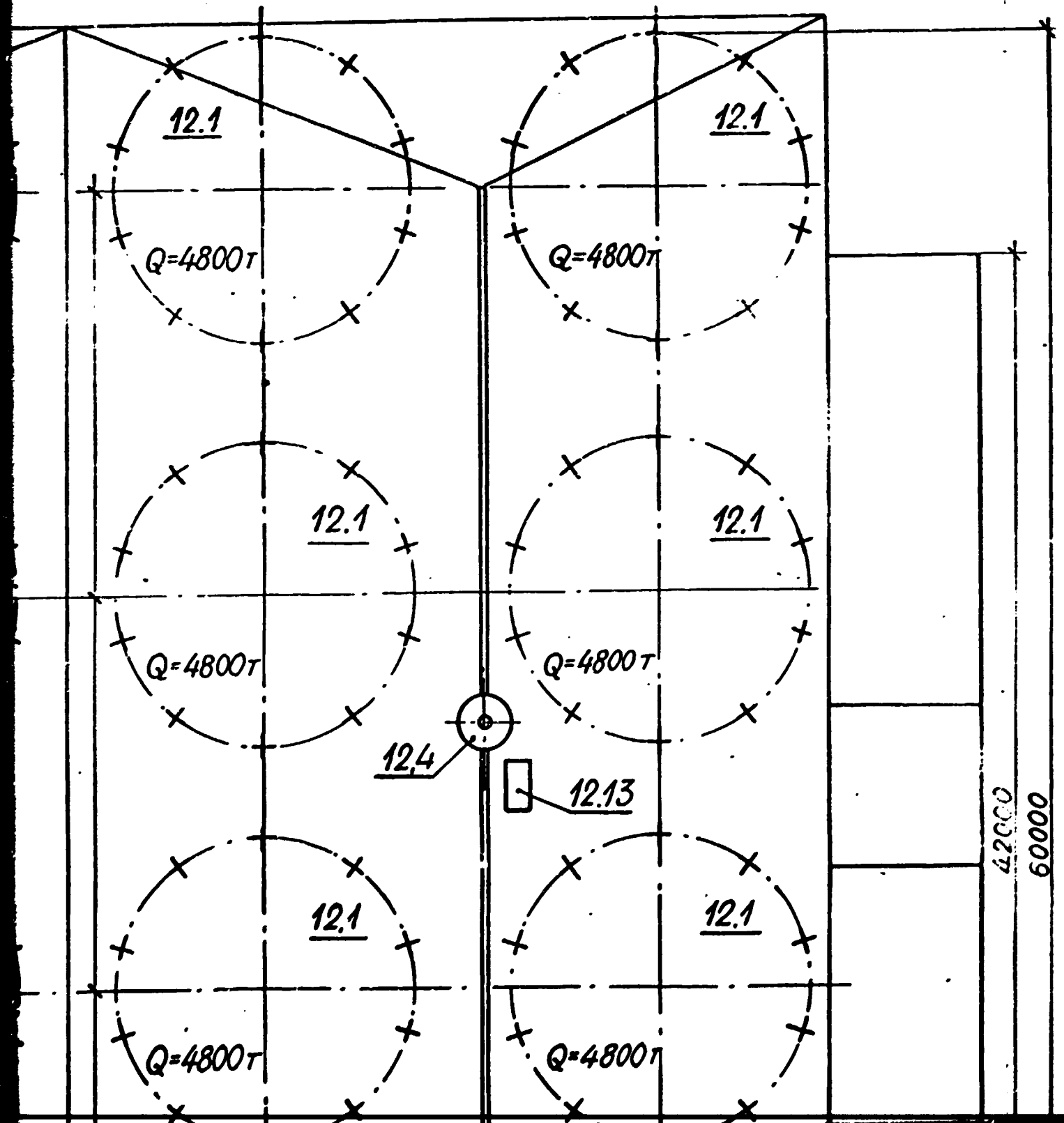


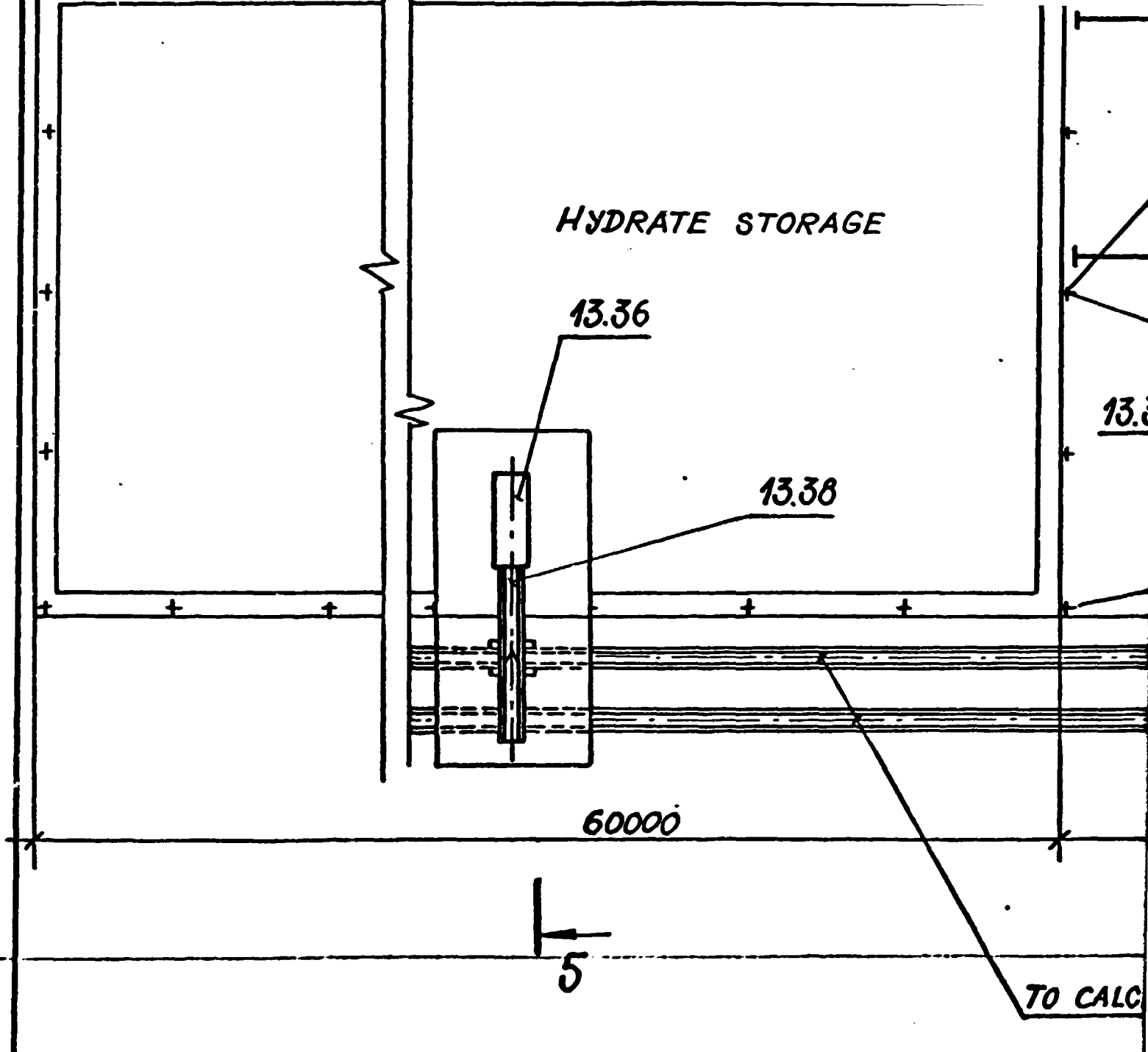
1 SHEET 4

SECTION 5

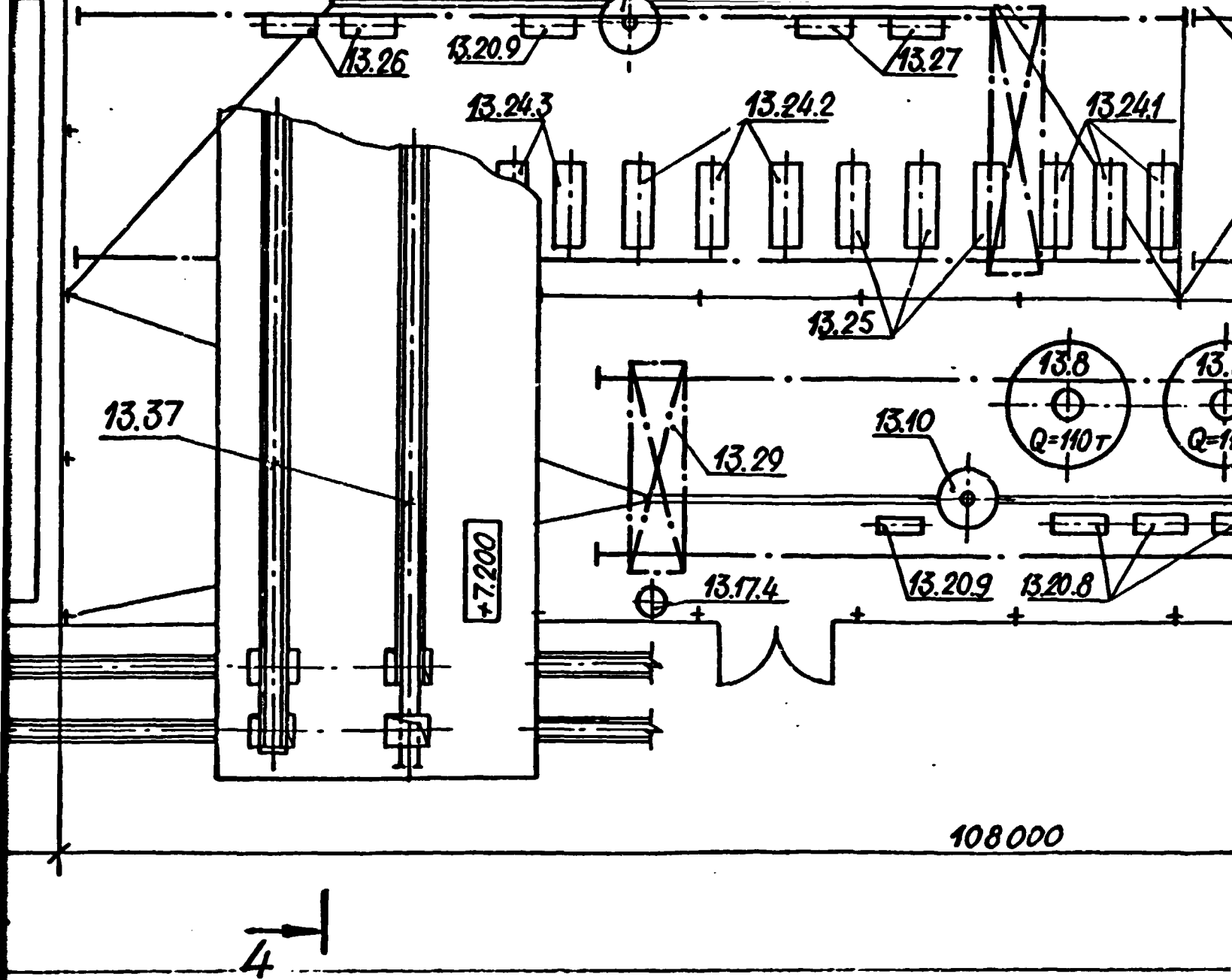


SECTION 6

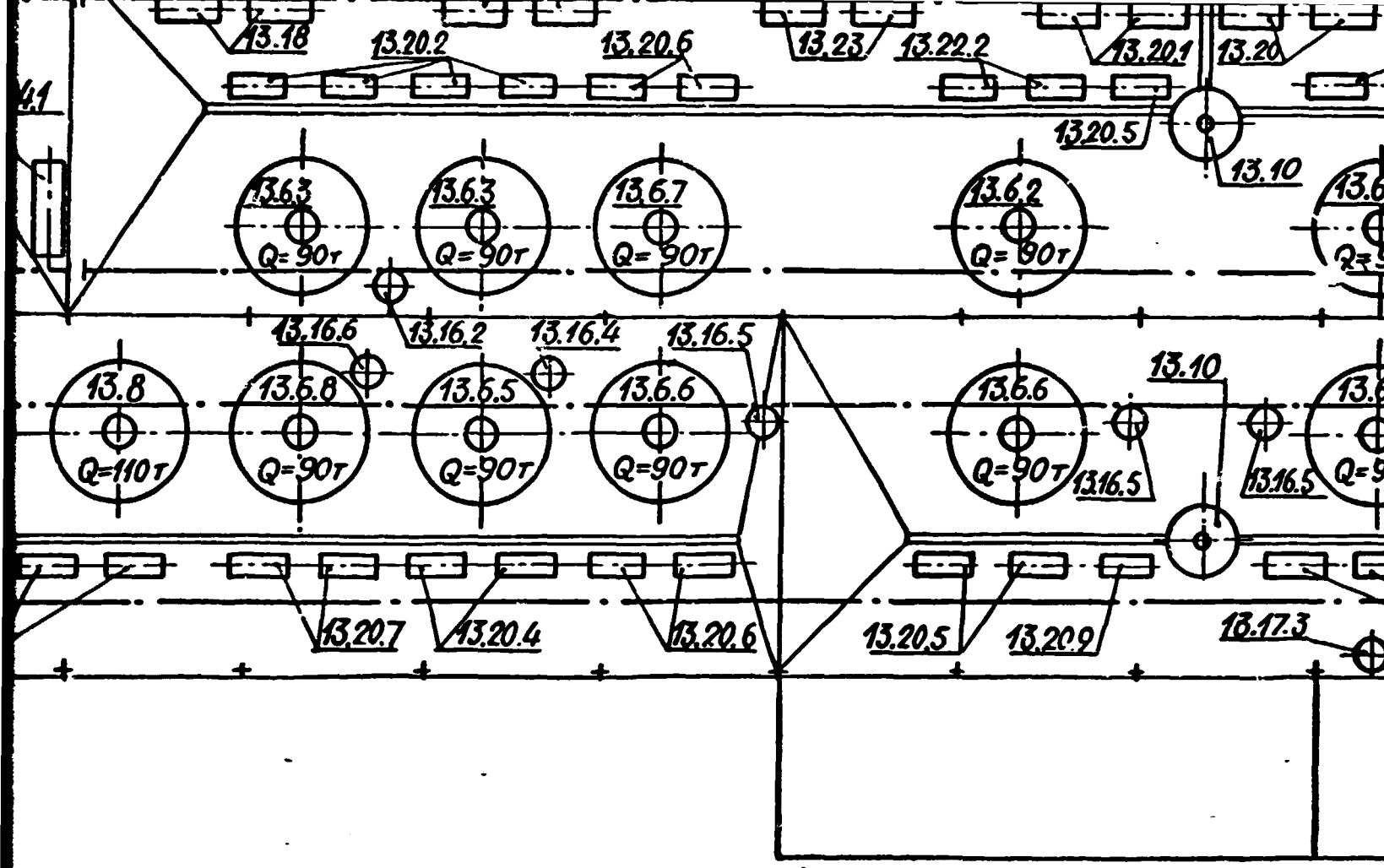

12.1
12.1
Q=4800т
Q=4800т
12.1
12.1
Q=4800т
Q=4800т
12.4
12.13
12.1
12.1
Q=4800т
Q=4800т
42000
60000



SECTION 7


13.26
13.20.9
13.27
13.24.3
13.24.2
13.24.1
13.25
13.8
Q=110т
13.37
13.10
13.29
+7.200
13.17.4
13.20.9
13.20.8
108000
4
TO CALCINATION

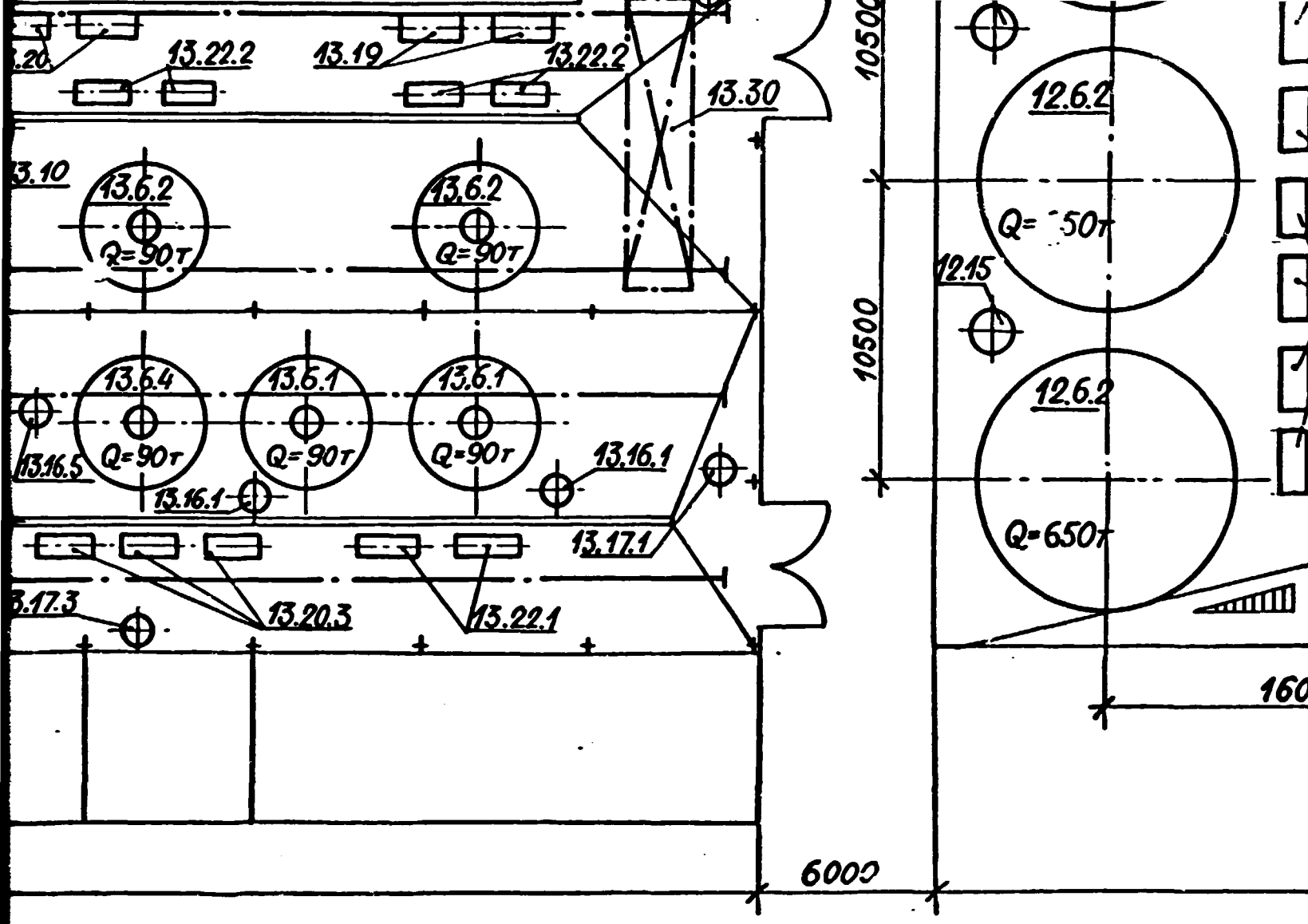
SECTION 8


13.18
13.20.2
13.20.6
13.23
13.22.2
13.20.1
13.20
13.20.5
13.10
13.63
Q=90т
13.63
Q=90т
13.67
Q=90т
13.62
Q=90т
13.16.6
13.16.2
13.16.4
13.16.5
13.8
Q=110т
13.68
Q=90т
13.65
Q=90т
13.66
Q=90т
13.66
Q=90т
13.10
13.16.5
13.16.5
13.20.7
13.20.4
13.20.6
13.20.5
13.20.9
13.17.3

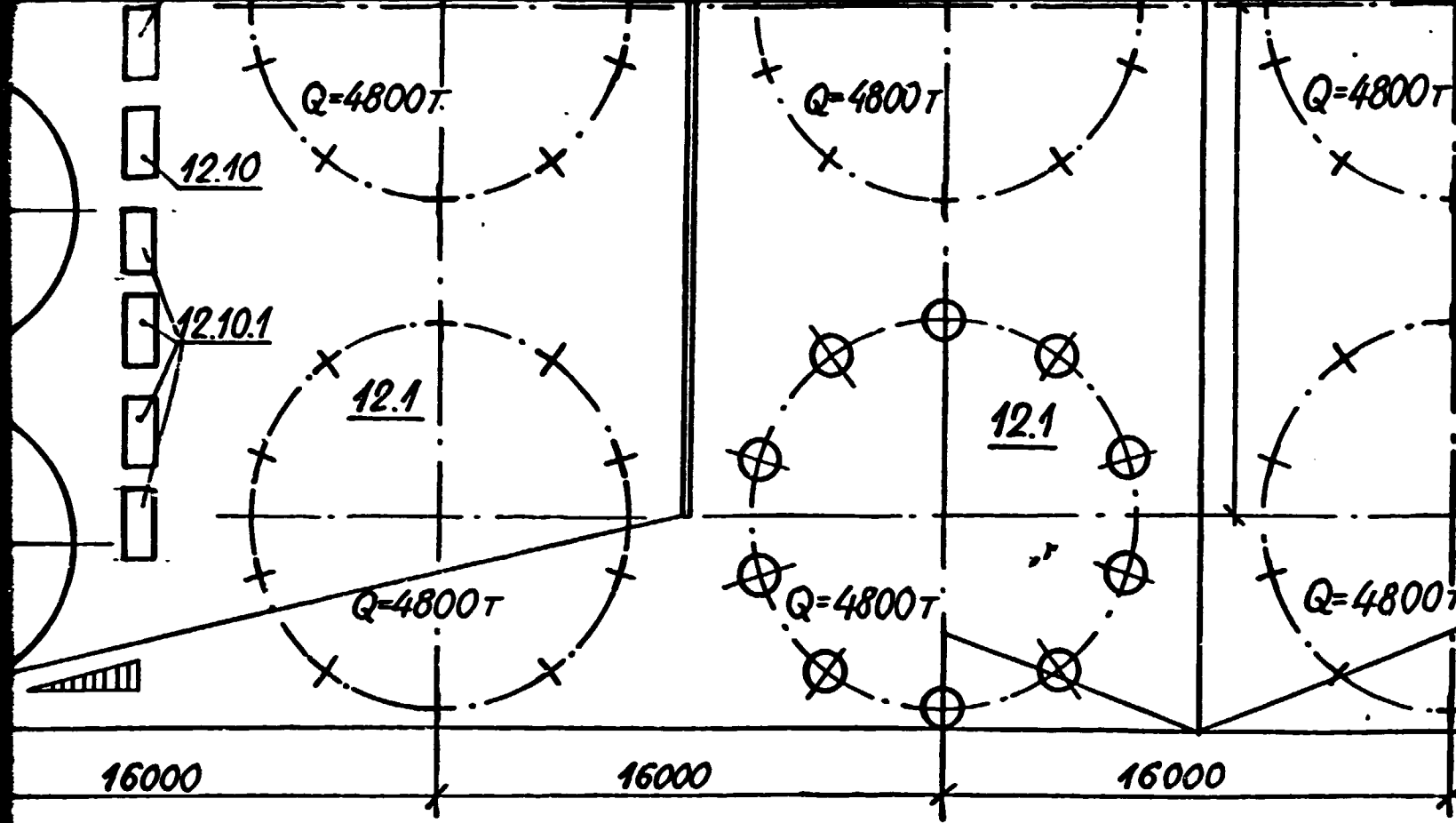
SECTION 9

3

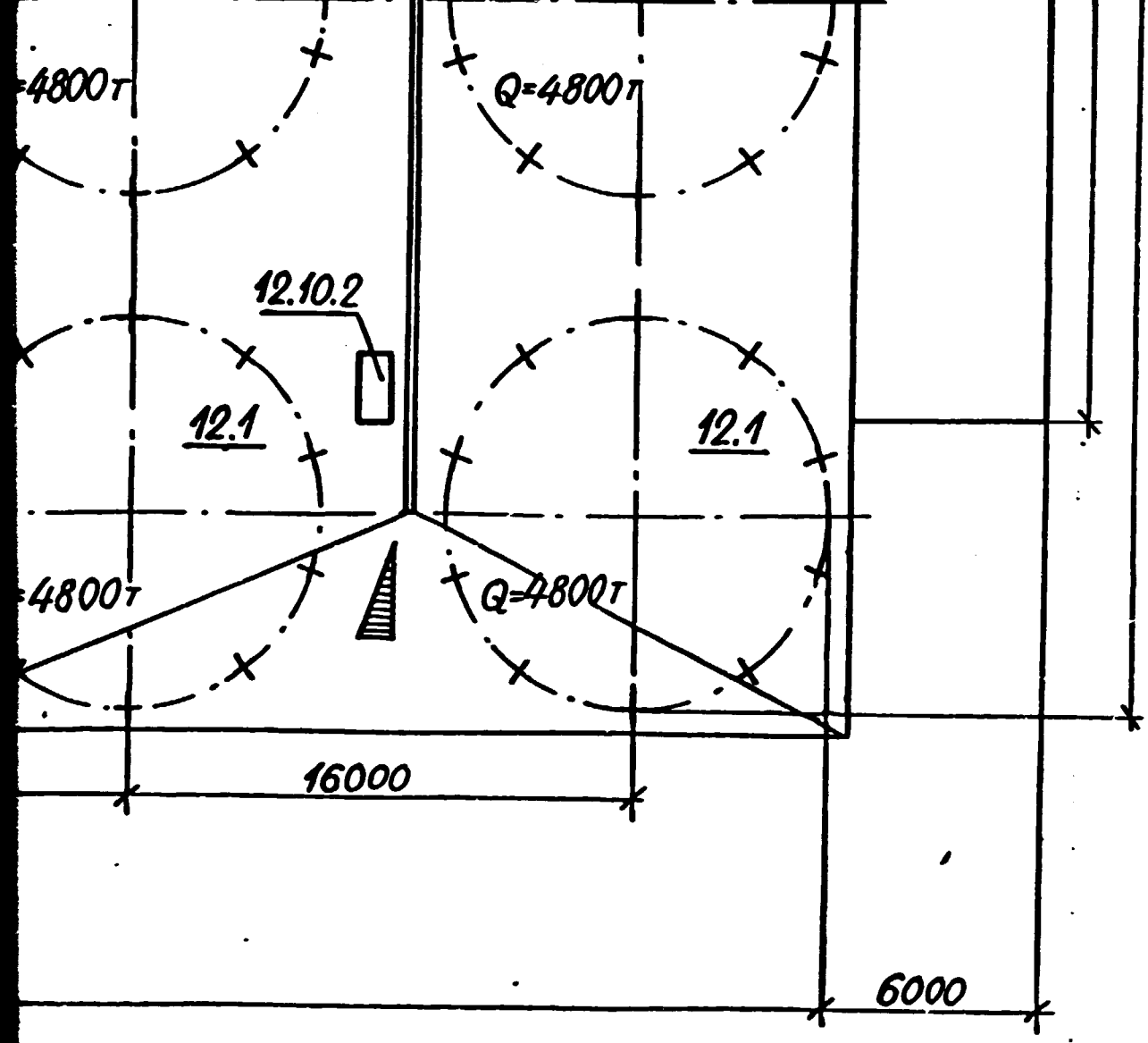
2


13.22.2
13.19
13.22.2
13.30
13.10
13.6.2
Q=90т
13.6.2
Q=90т
13.6.4
Q=90т
13.6.1
Q=90т
13.6.1
Q=90т
13.16.5
13.16.1
13.16.1
13.17.1
13.17.3
13.20.3
13.22.1
10500
12.6.2
Q=650т
12.15
10500
12.6.2
Q=650т
6000

SECTION 10


Q=4800т
Q=4800т
Q=4800т
12.10
12.10.1
12.1
12.1
Q=4800т
Q=4800т
Q=4800т
16000
16000
16000
1
76000

SECTION 11

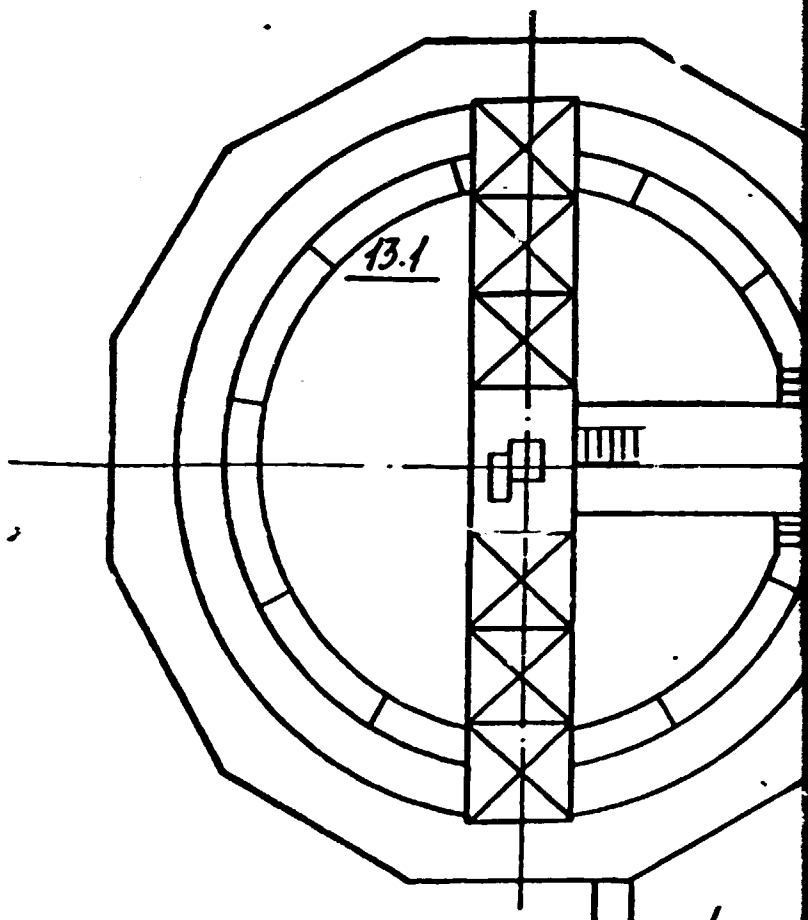


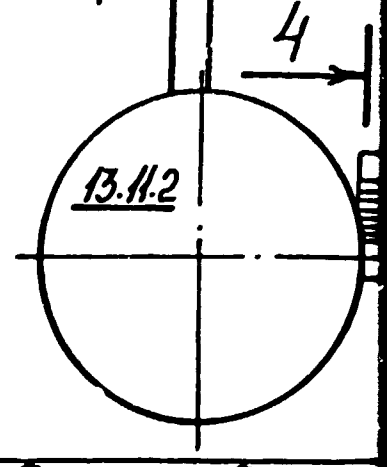
SECTION 12

UNIDO CONTRACT NO 85/108

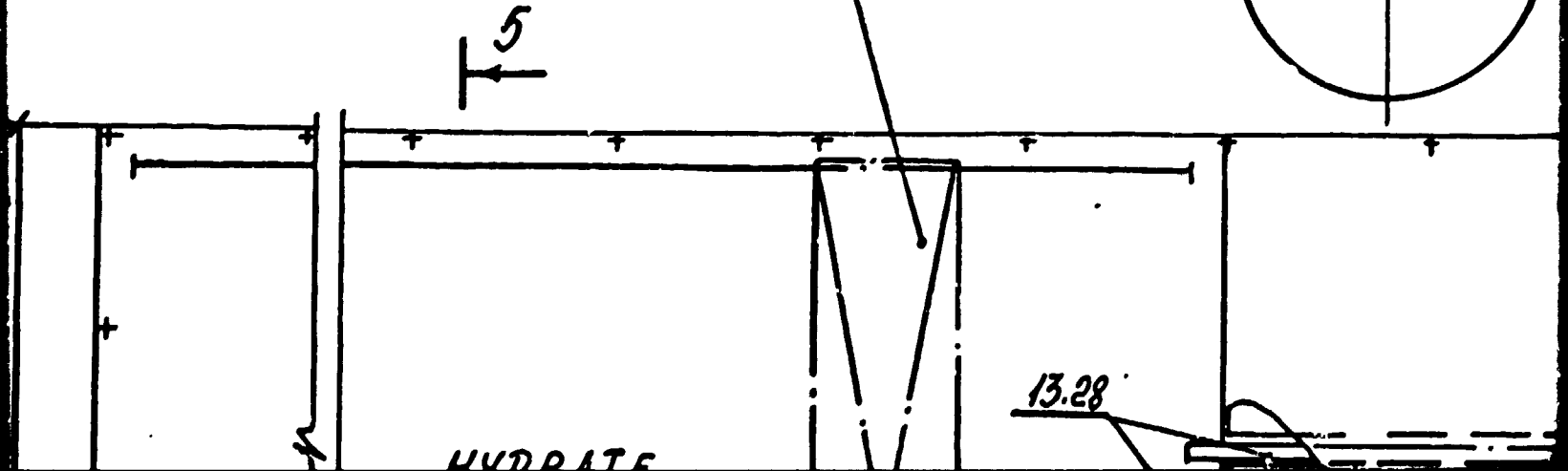
1339554-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
PRECIPITATION HYDRATE TREATMENT WITH HYDRATE STORAGE	STAGE	SHEET	SHEETS
	FEASIBILITY	2	
PLAN AT EL. 0.000	VAMI LENINGRAD		

SECTION 1

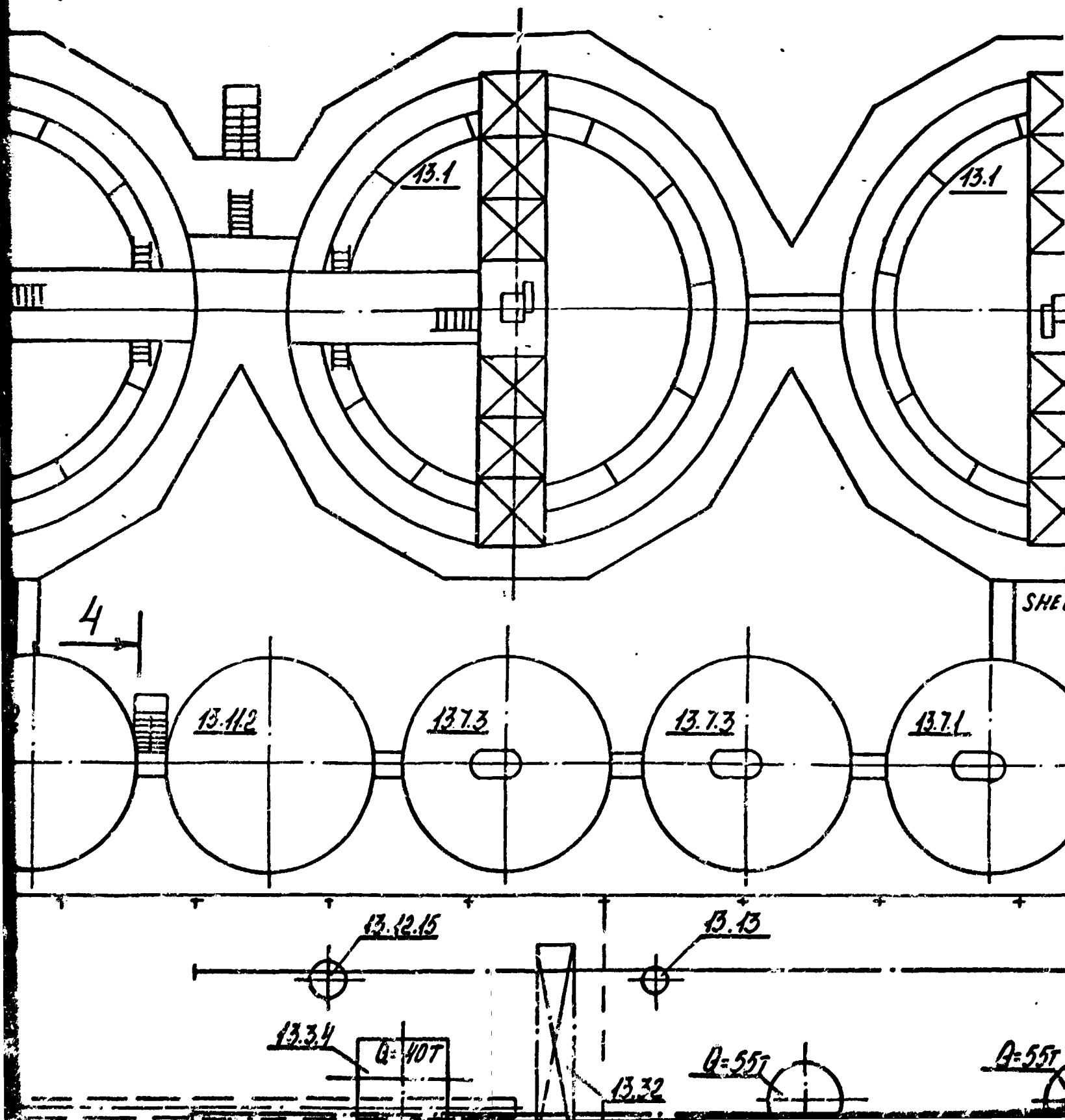




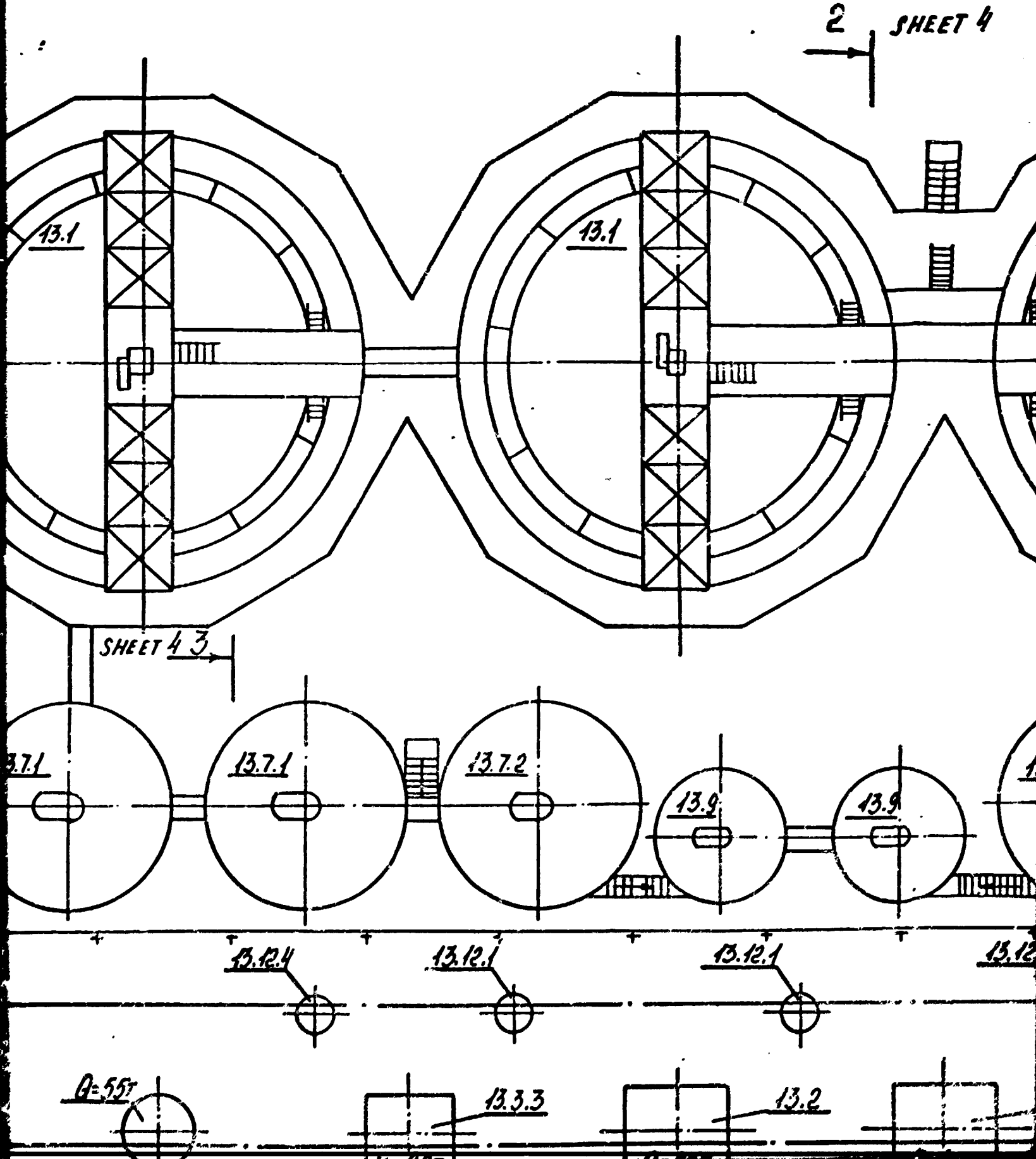
13.35 E.O.T BUCKET CRANE 10T
CAPACITY L SPANE = 22.5M



SECTION 2


13.1
13.1
4
13.11.2
13.7.3
13.7.3
13.7.1
13.12.15
13.13
13.3.4
Q=40T
13.32
Q=55T
Q=55T

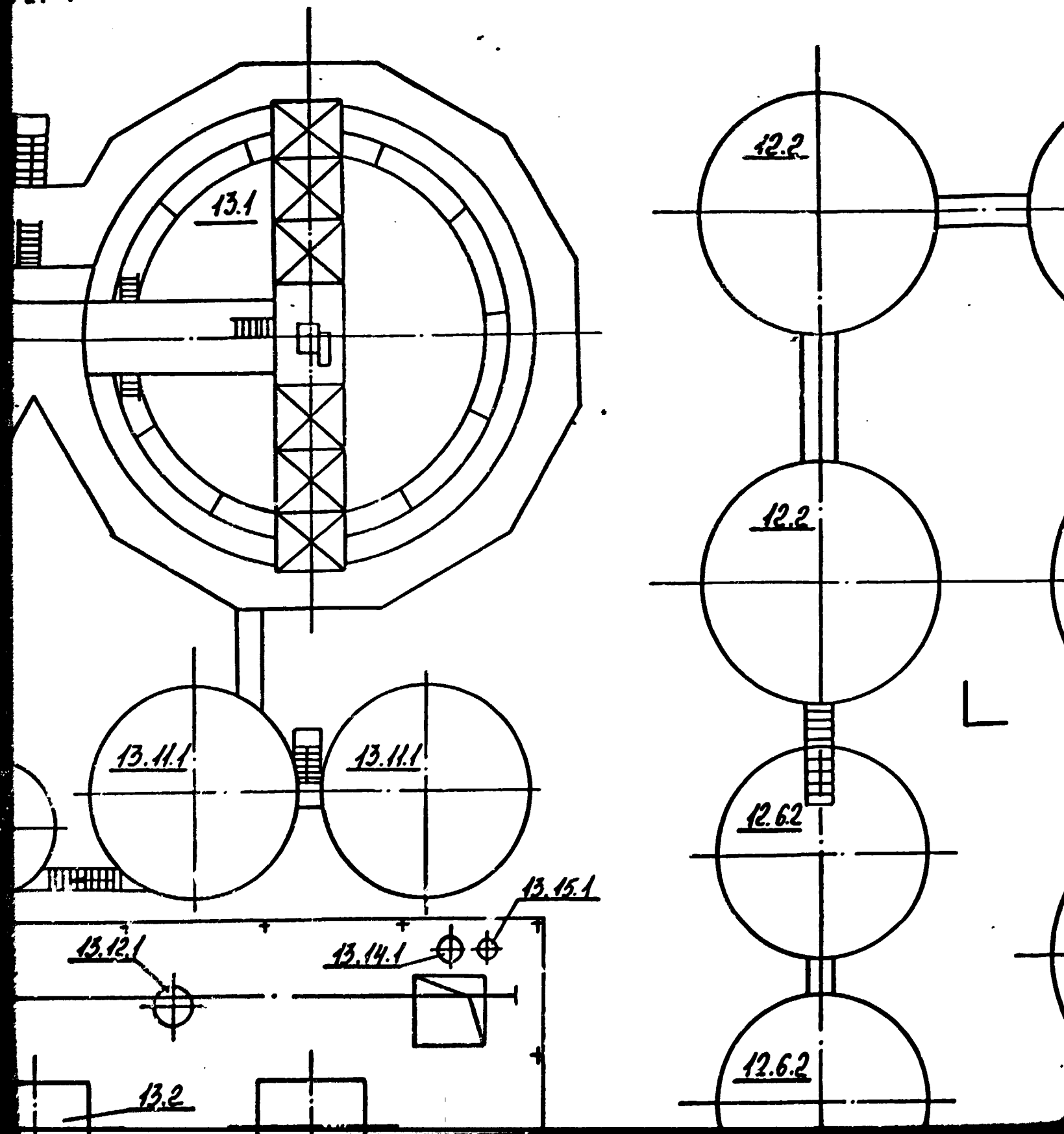
SECTION 3


2
SHEET 4
13.1
13.1
SHEET 4 3
13.7.1
13.7.1
13.7.2
13.9
13.9
13.12.4
13.12.1
13.12.1
Q=55T
13.3.3
13.2

PLAN AT TOP ELEVATIONS

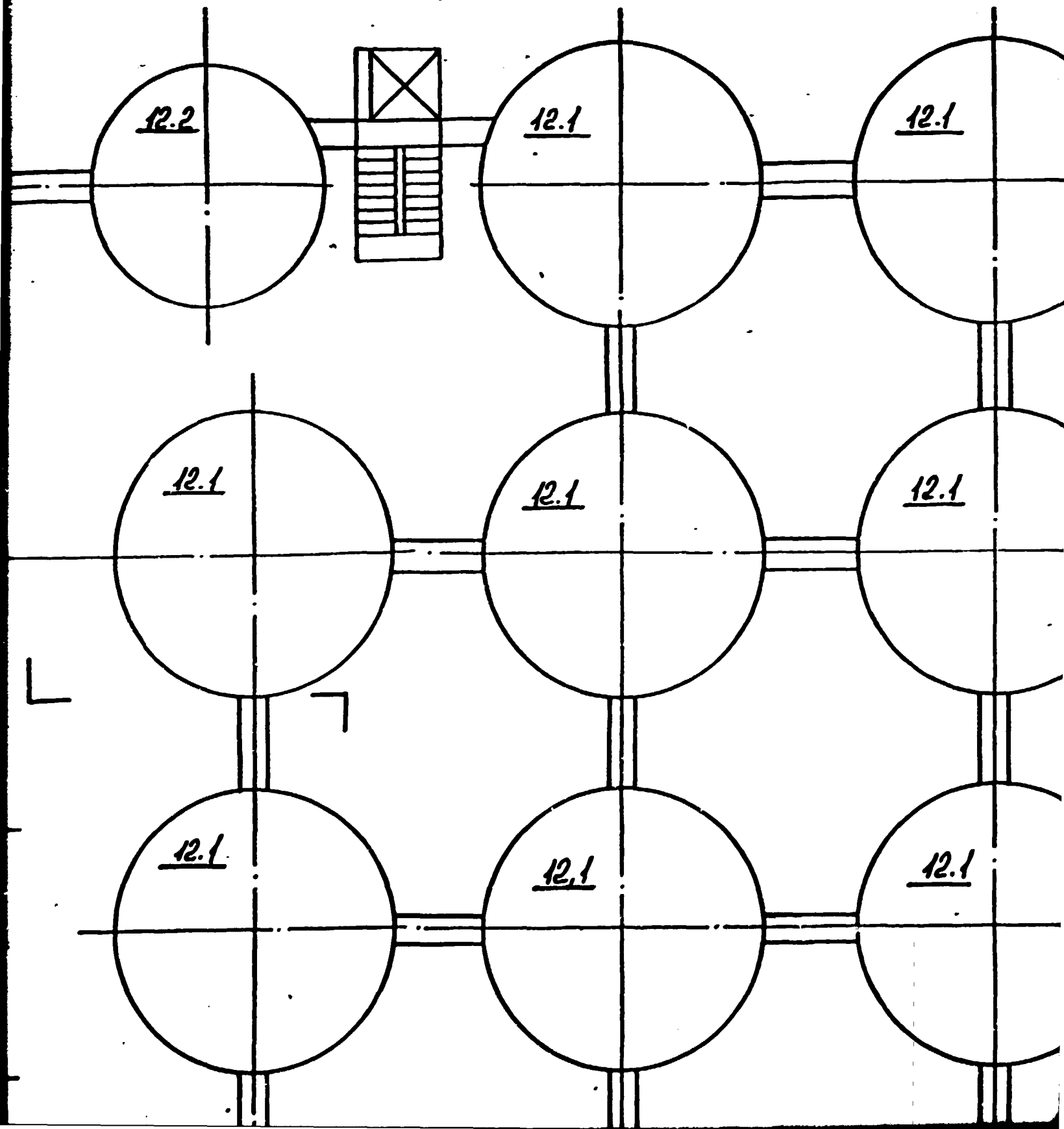
SCALE 1:200

SECTION 4

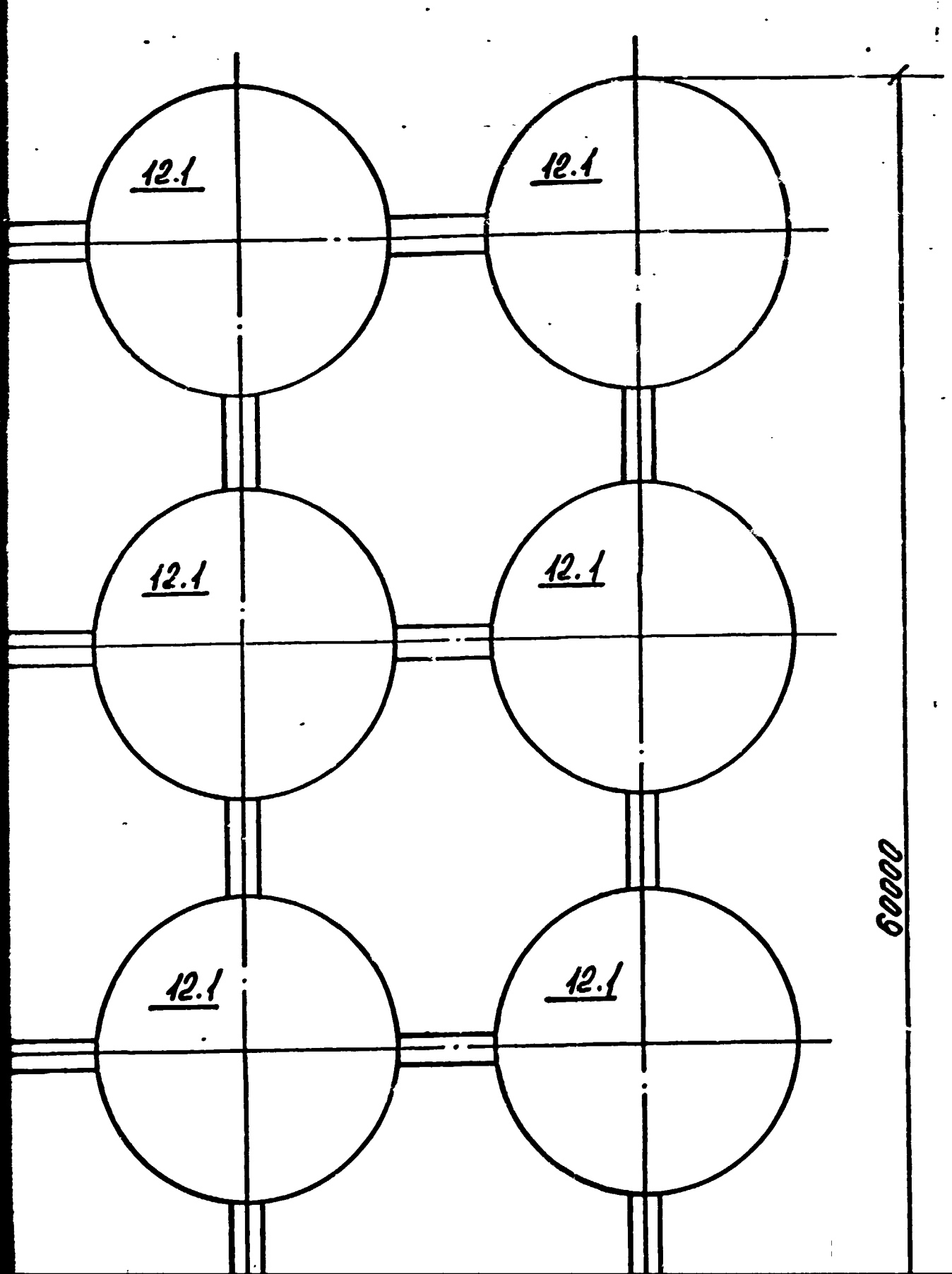


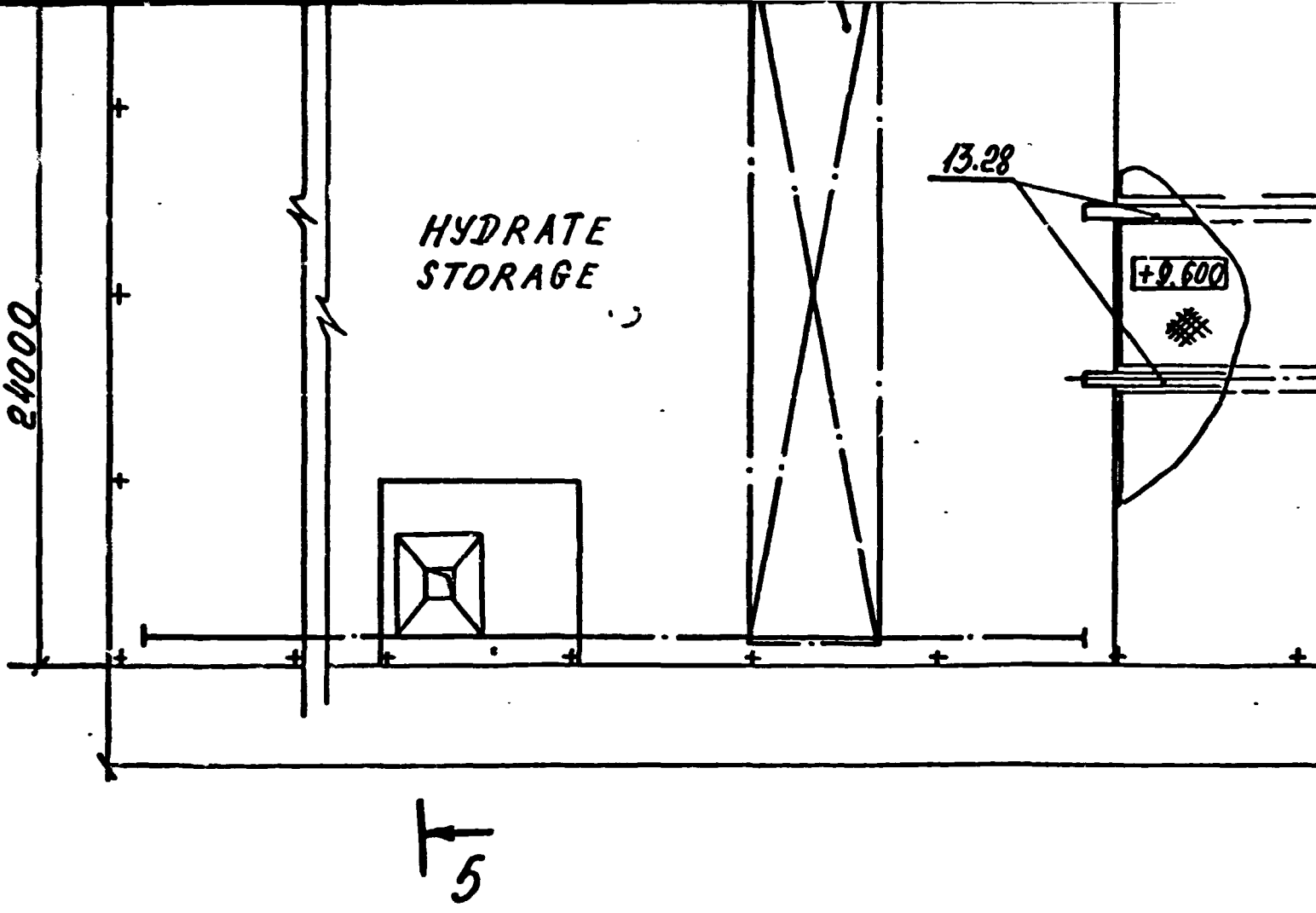
1 SHEET 4.

SECTION 5



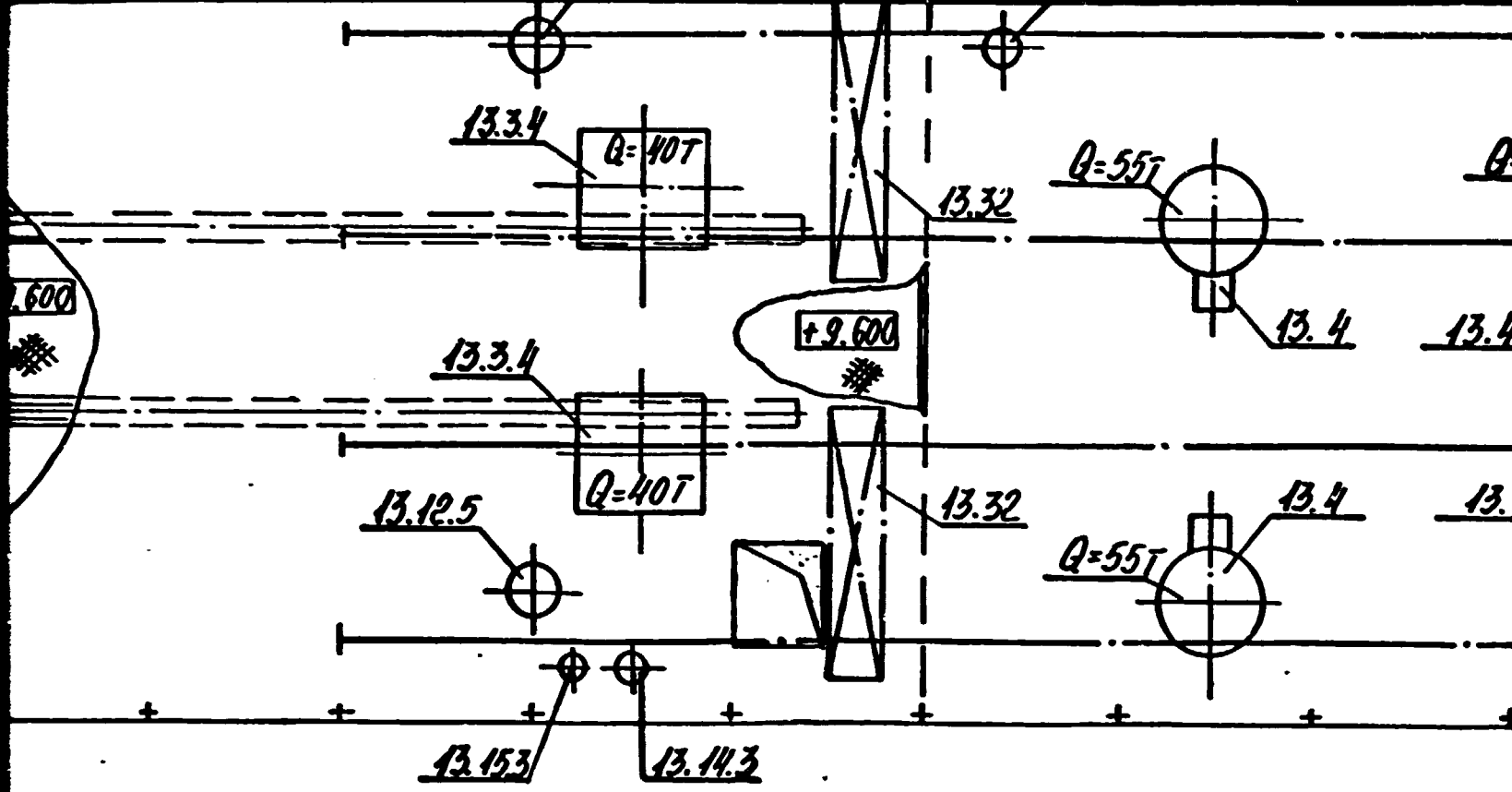
SECTION 6





SHE

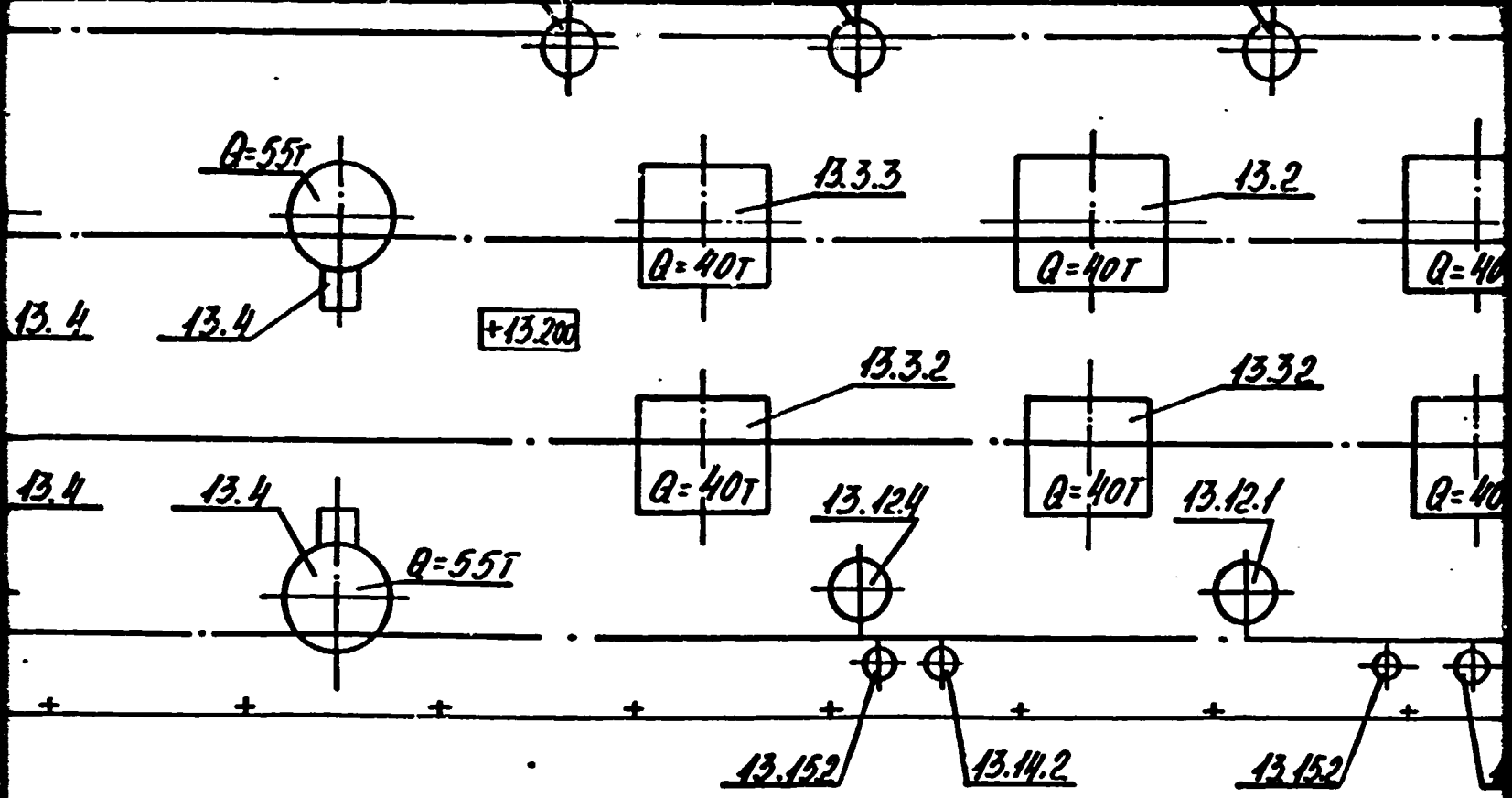
SECTION 7



SHEET 4

4

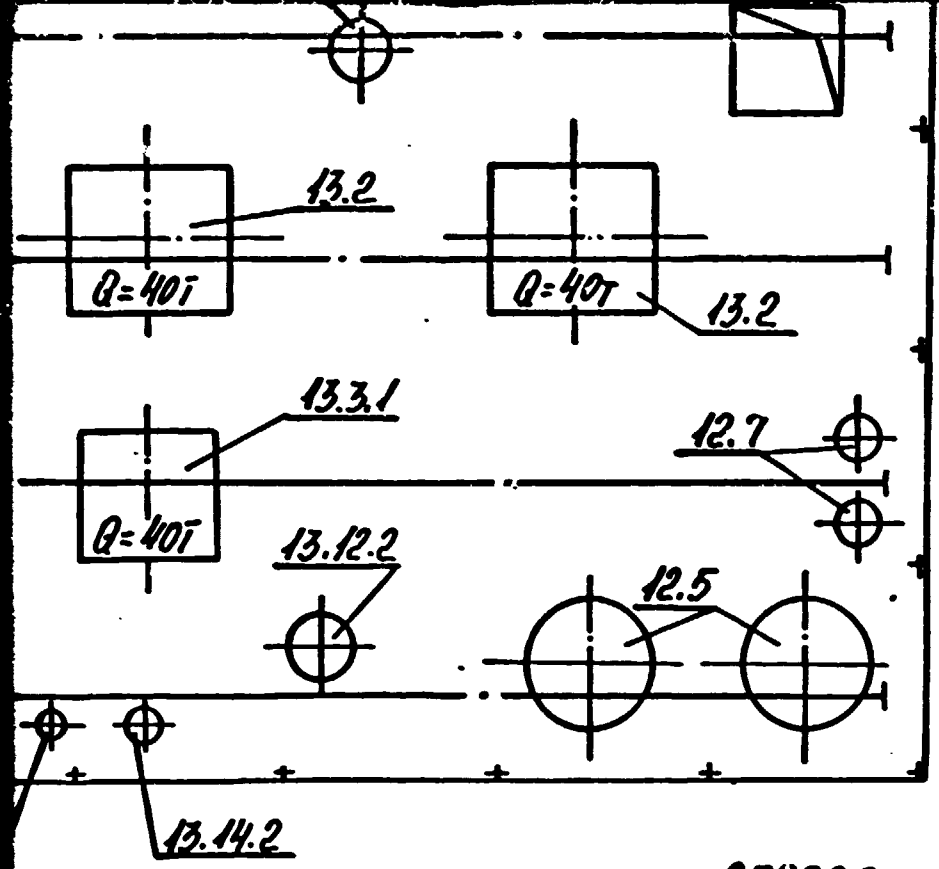
SECTION 8

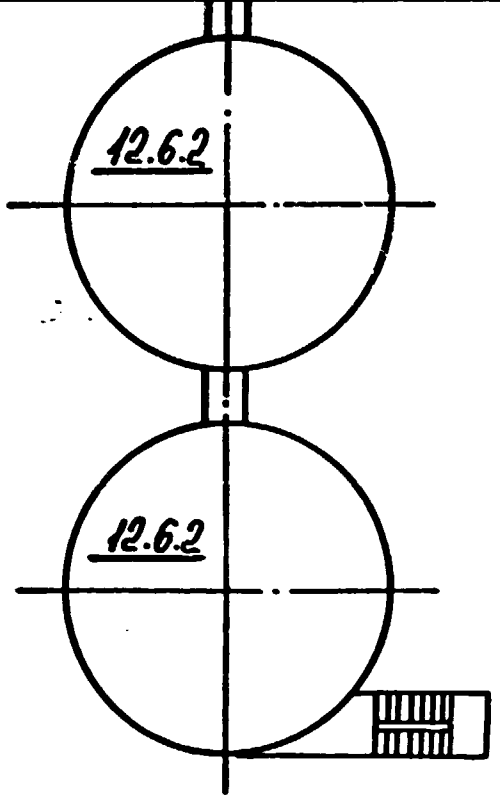

Q=55т
13.4
13.4
13.3.3
Q=40т
13.2
Q=40т
+13.200
13.3.2
Q=40т
13.3.2
Q=40т
13.4
13.4
Q=55т
13.12.4
13.12.1
13.15.2
13.14.2
13.15.2

3

2

SECTION 9

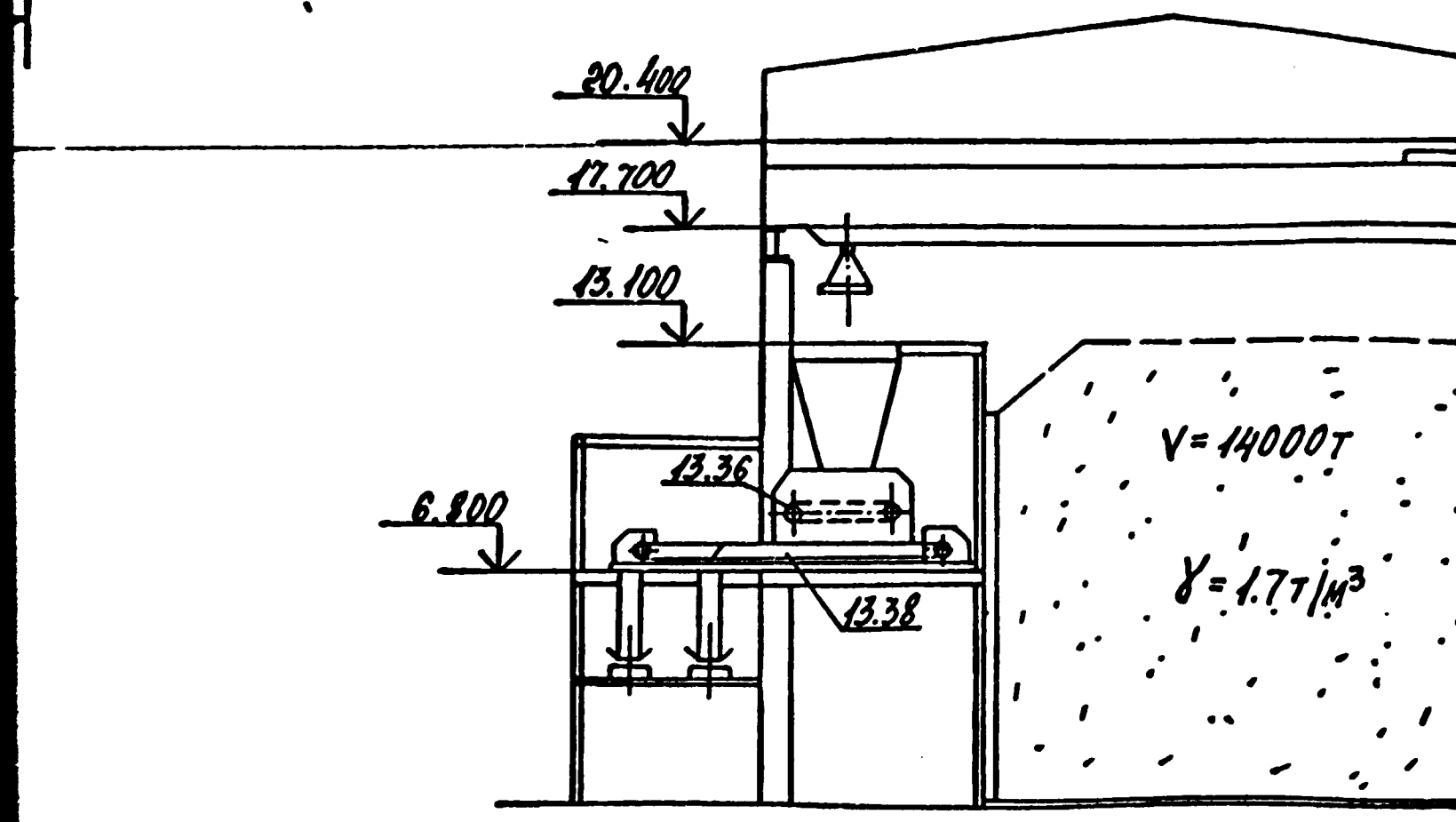


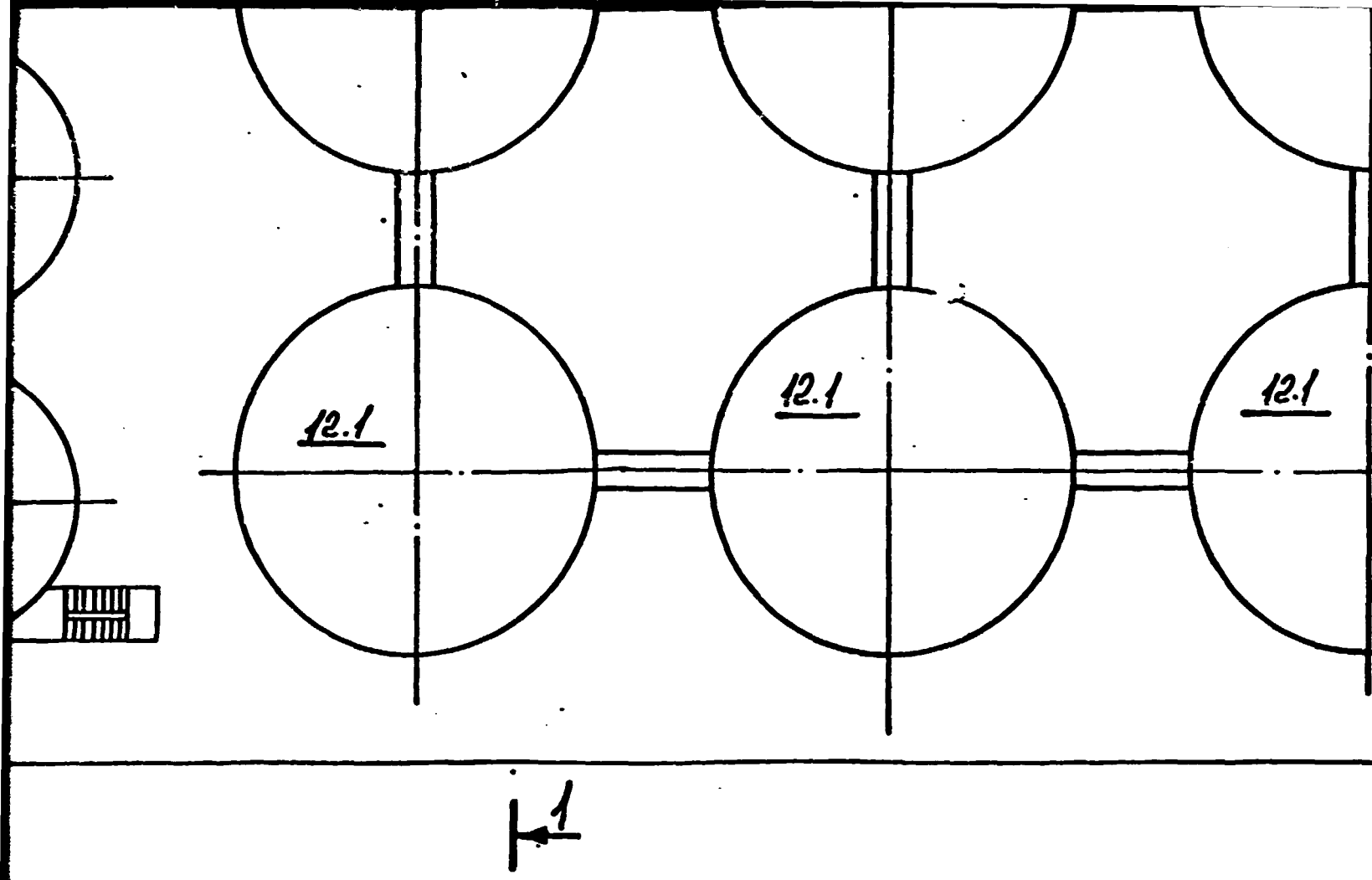


250'000

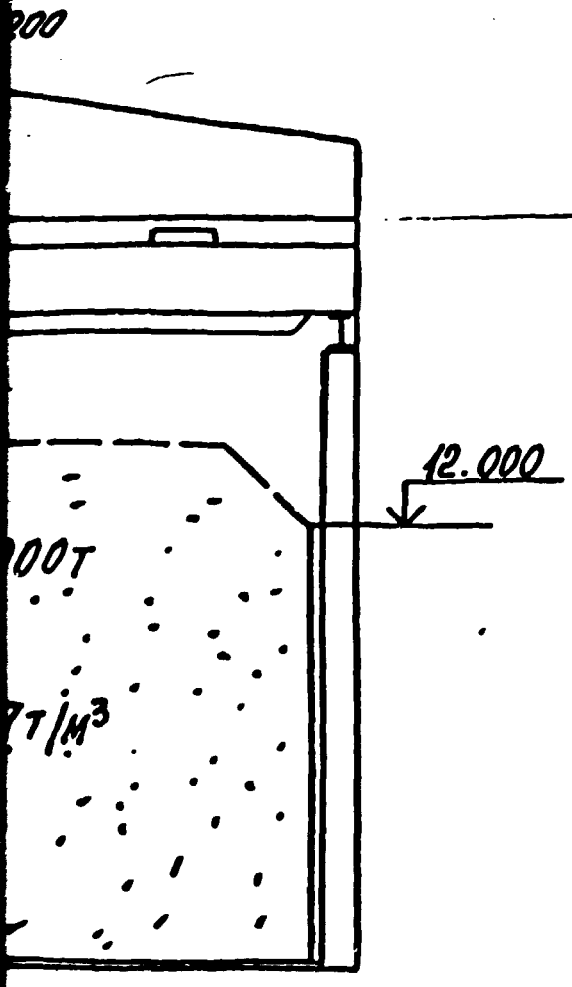
SECTION 10

5-5
SCALE 1:200

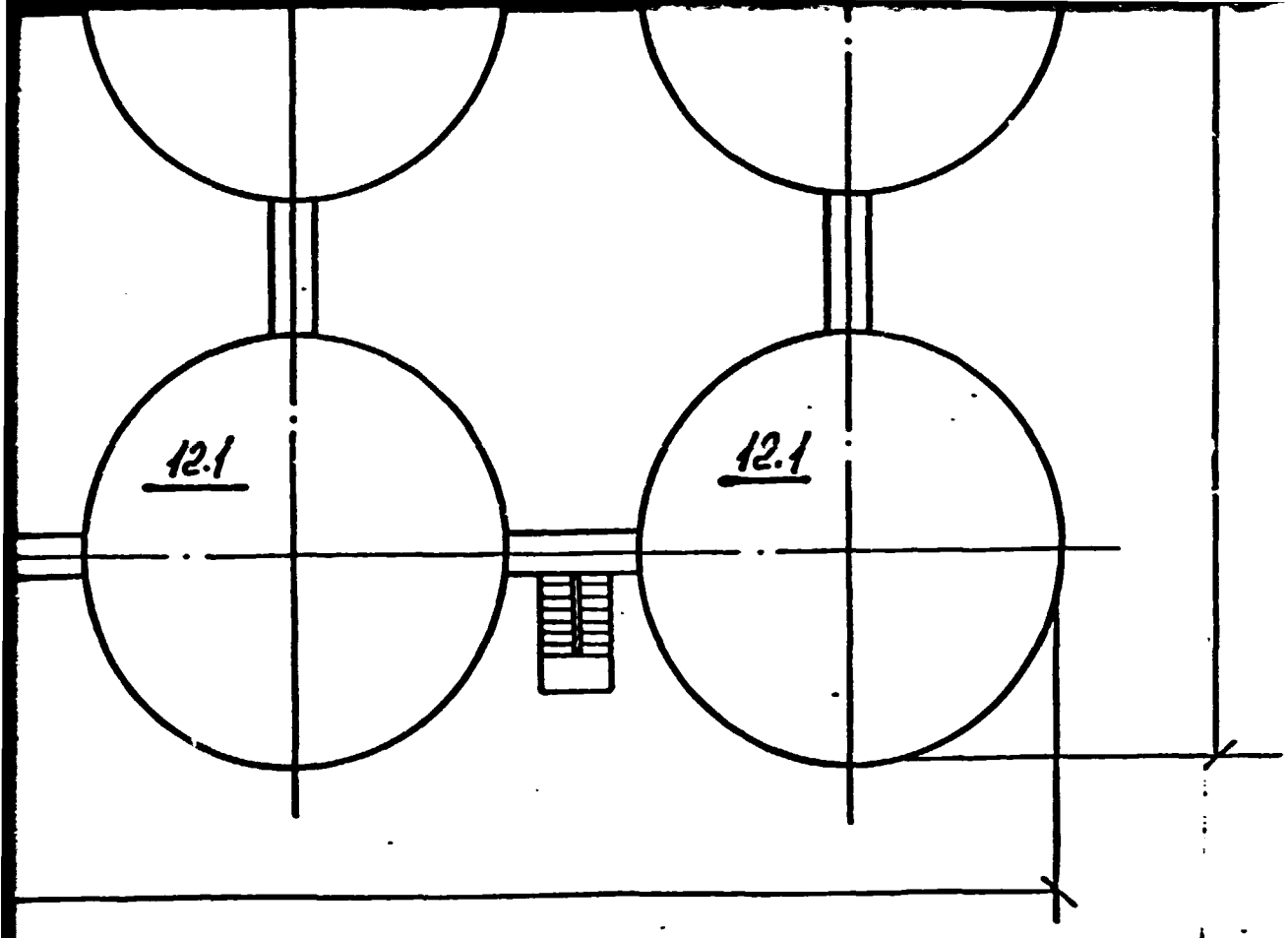




1



SECTION 11



SECTION 12

UNIDO CONTRACT NO 85/108

1339554-TM

IRAN. ALUNITE BASED ALUMINA PLANT

PRECIPITATION HYDRATE TREATMENT WITH HYDRATE STORAGE	STAGE	SHEET	SHEETS
	FEASIBILITY	3	

PLAN AT UPPER ELEVATIONS Section 55

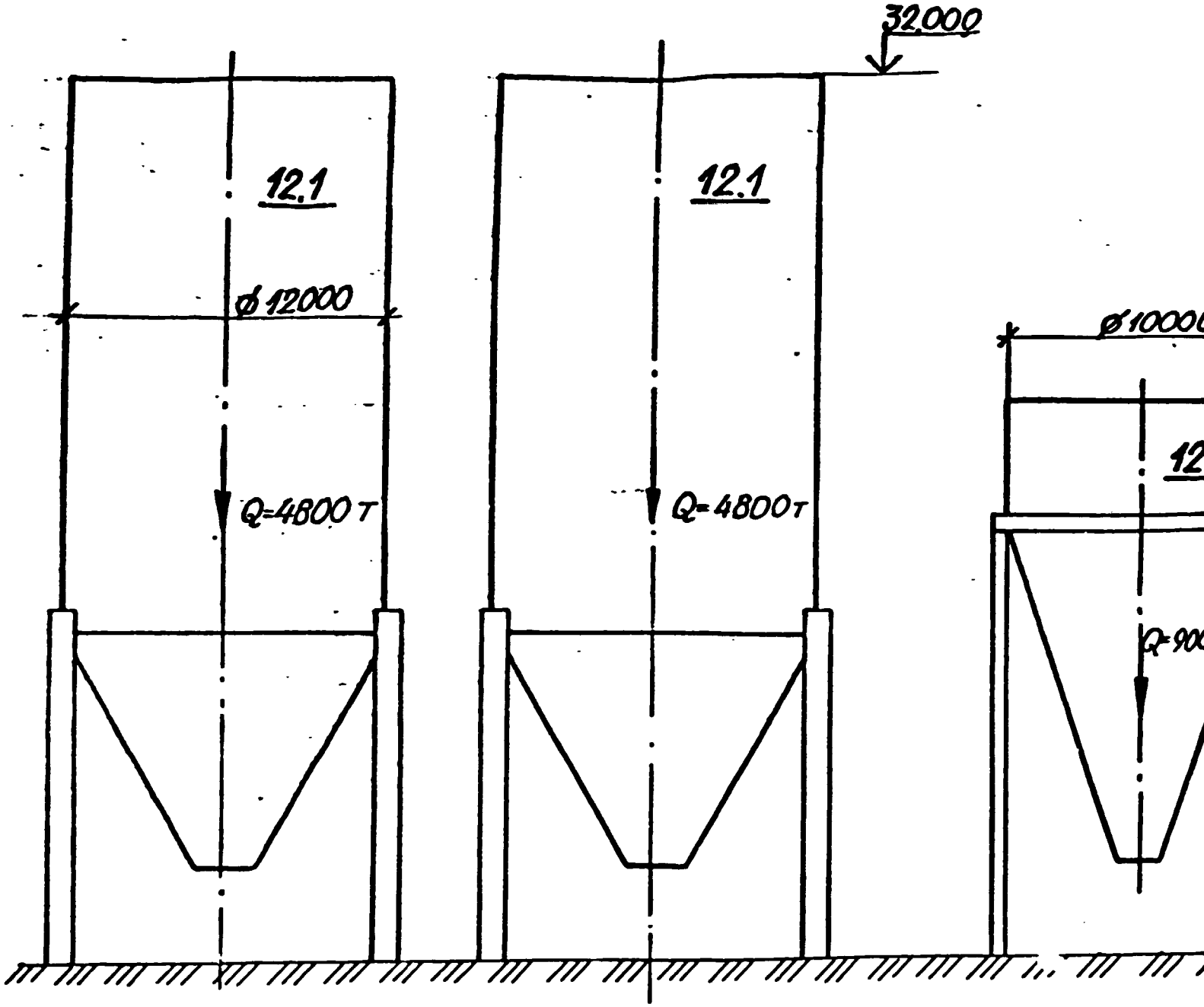
VAMI LENINGRAD

Size A 2x3

1-1

SECTION 1

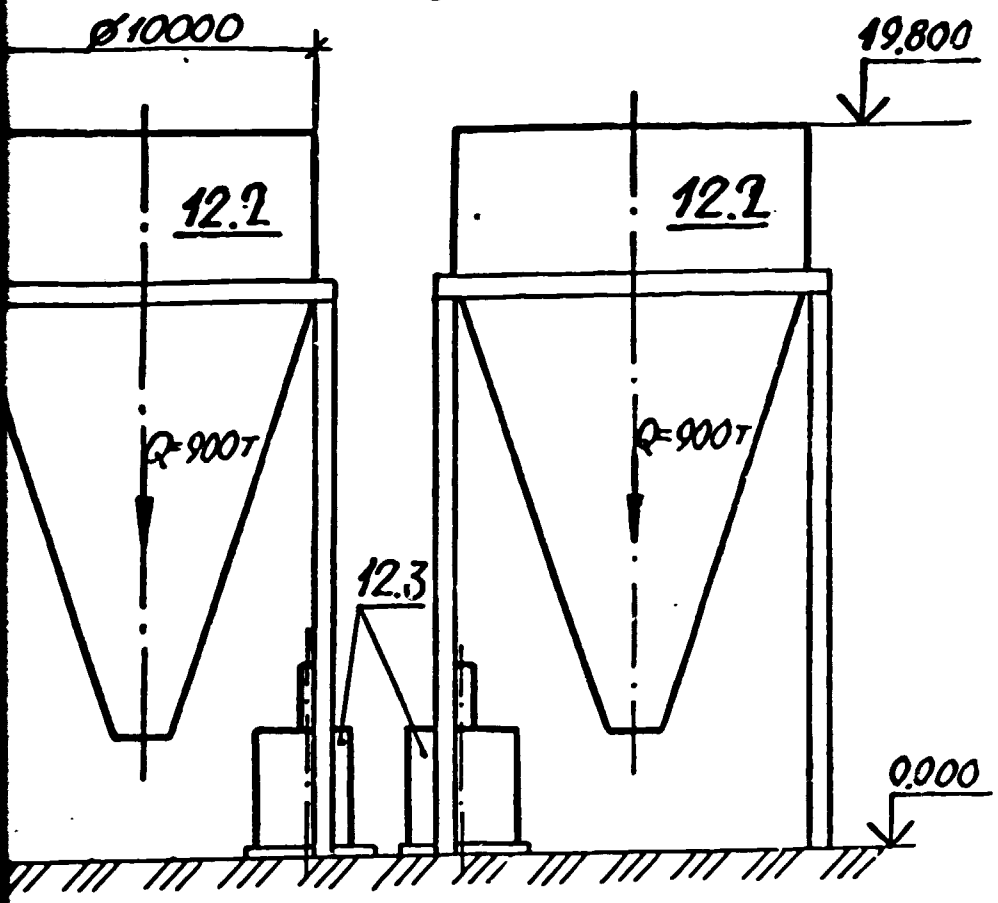
SCALE 1:200



2-2

SCALE 1:200

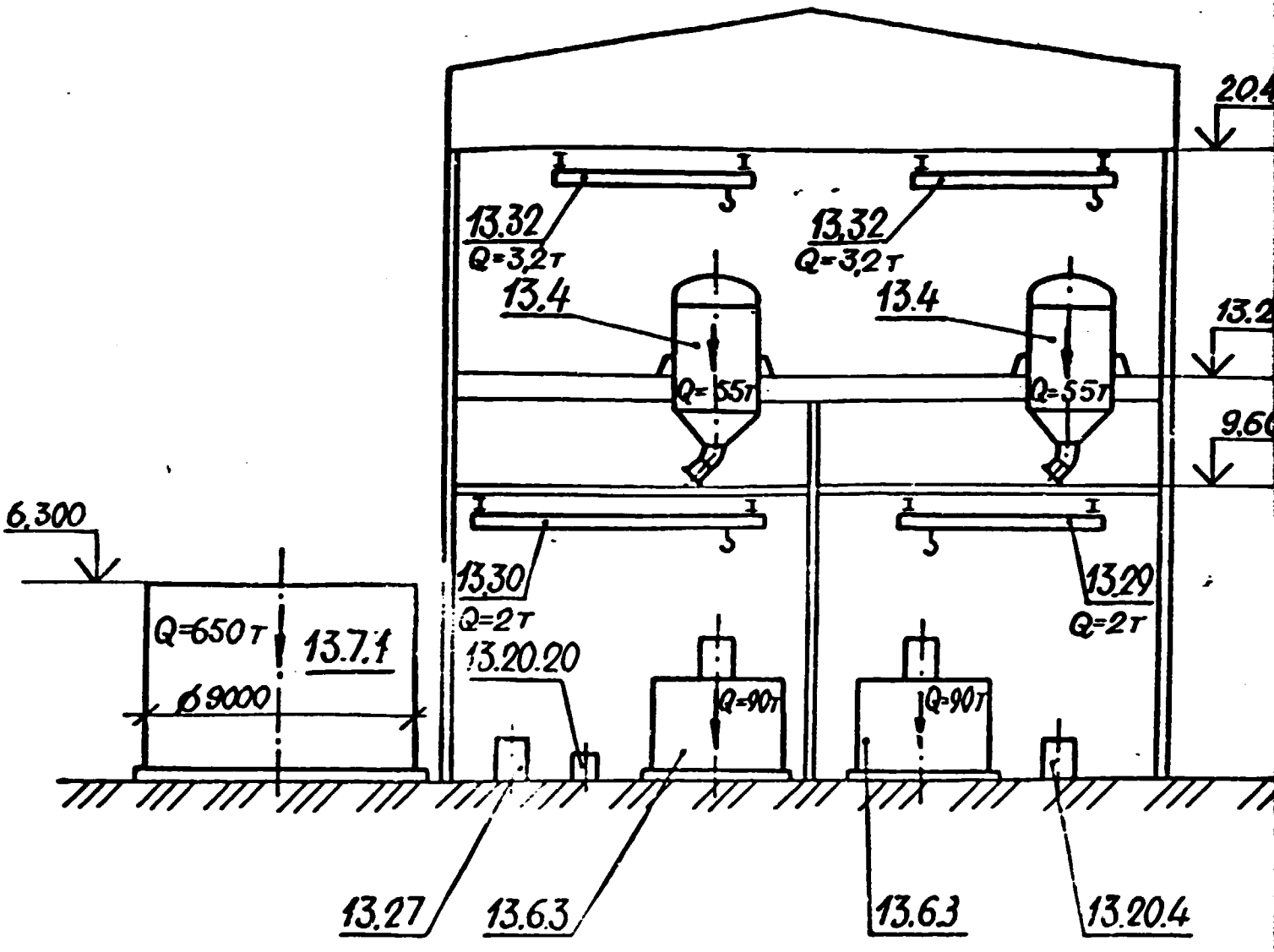
SECTION 2



SECTION 3

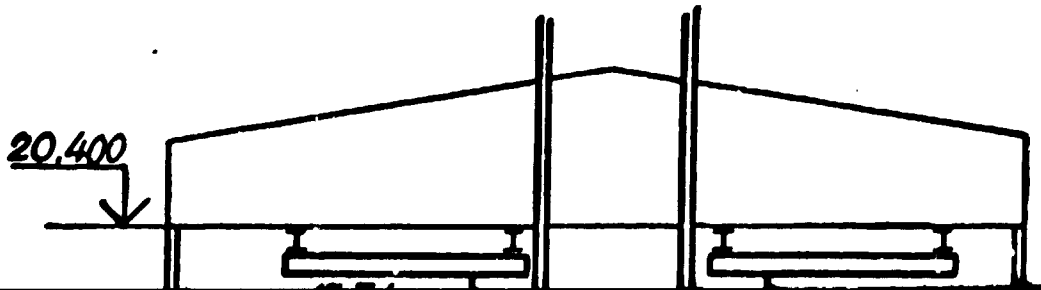
3-3

SCALE 1:200

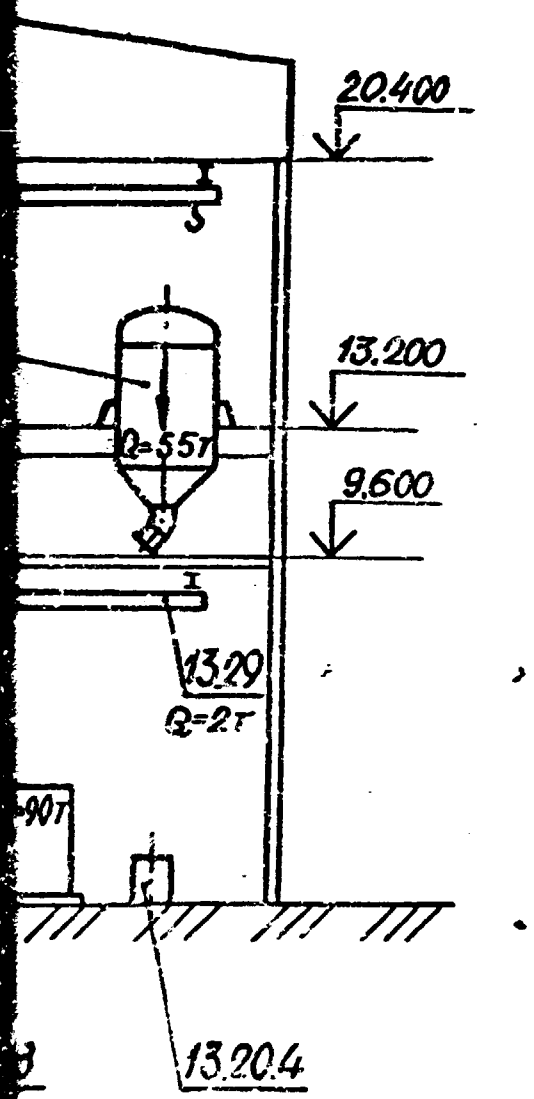


4-4

SCALE 1:200



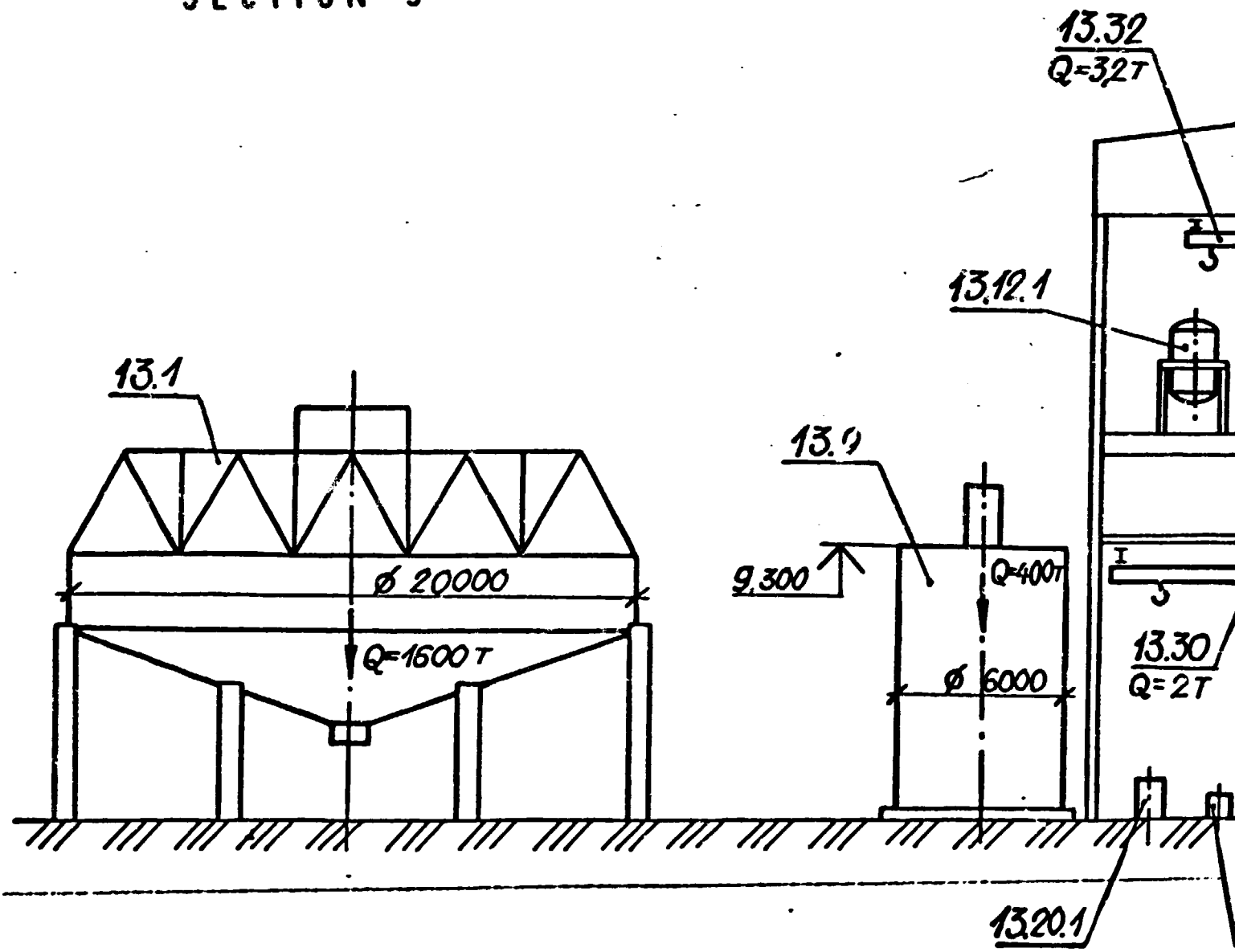
SECTION 4



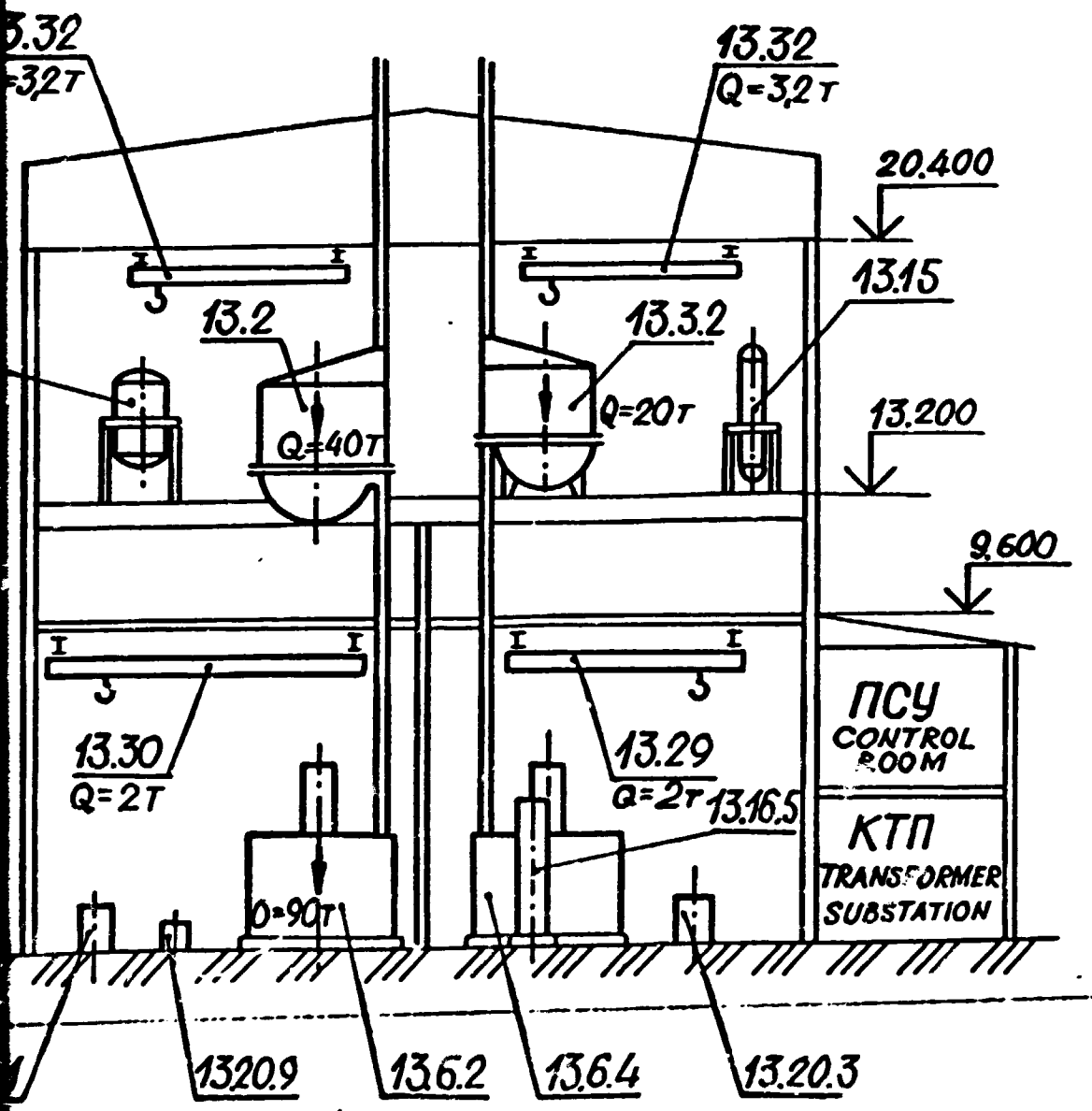
2-2

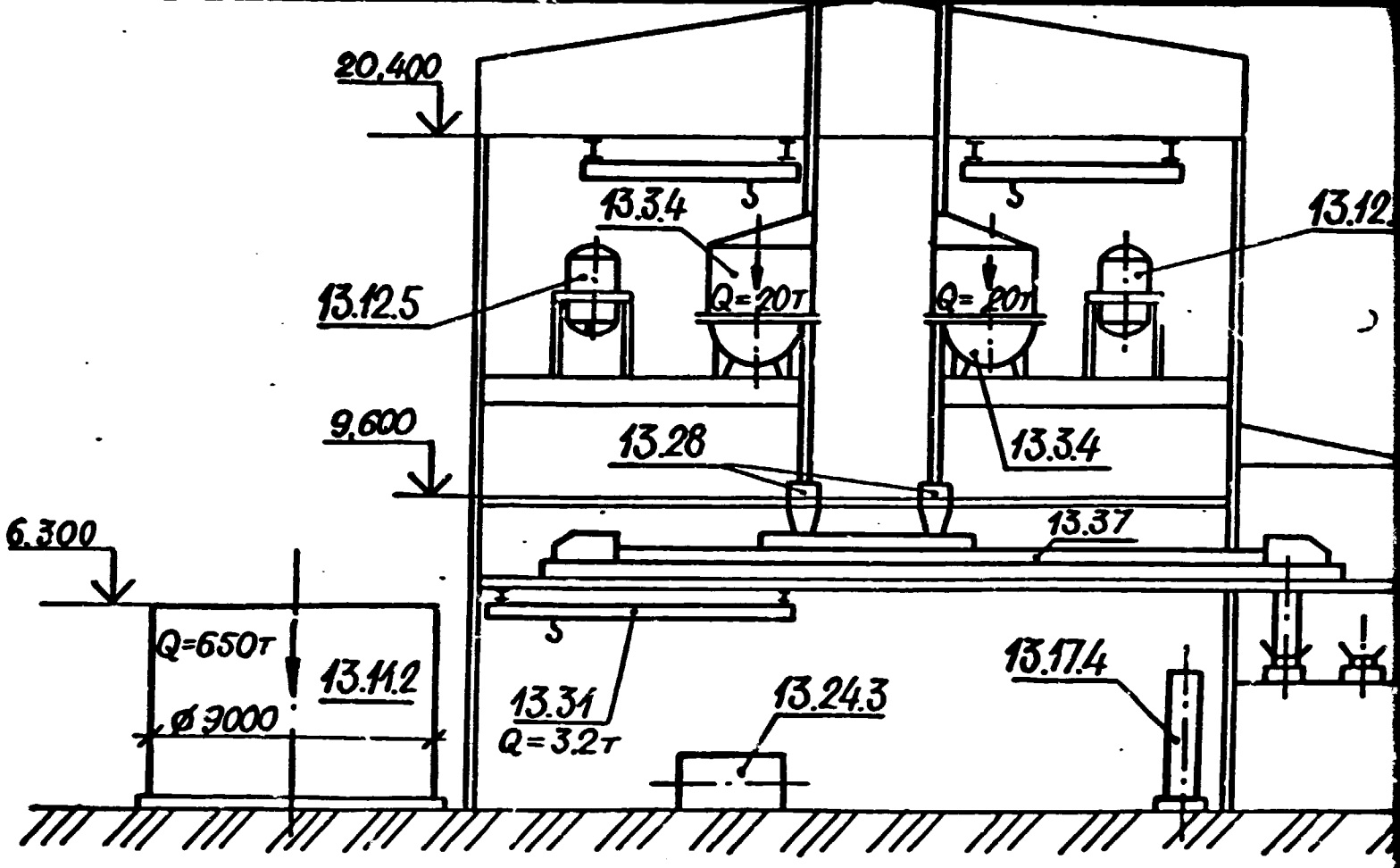
SCALE 1:200

SECTION 5

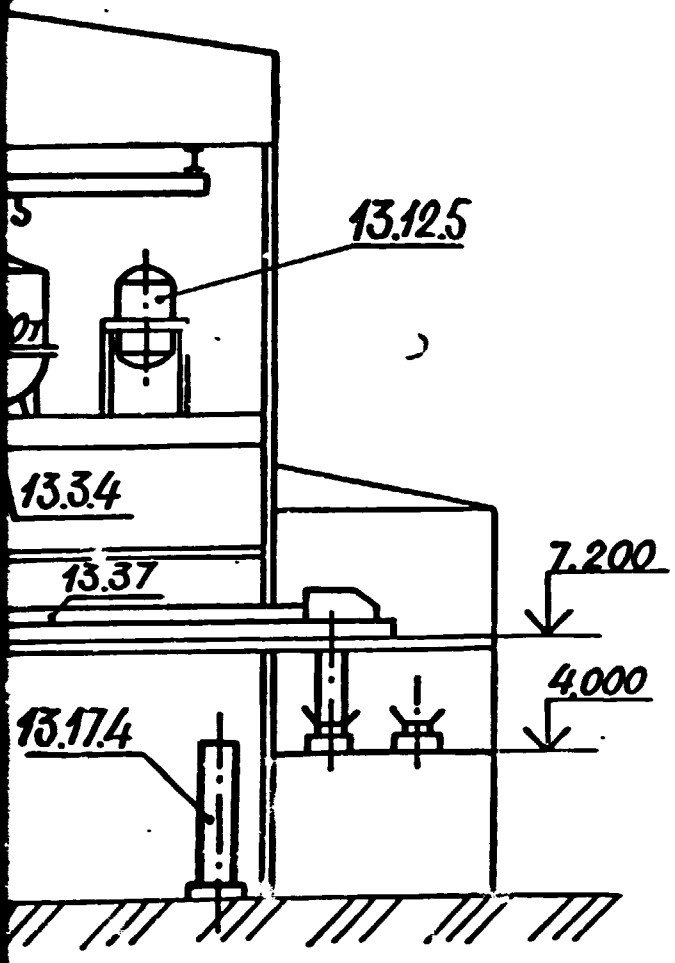


SECTION 6


13.32
Q=3,2т
13.32
Q=3,2т
20.400
13.15
13.2
13.3.2
Q=40т
Q=20т
13.200
9.600
ПСУ
CONTROL ROOM
КТП
TRANSFORMER SUBSTATION
13.30
Q=2т
13.29
Q=2т
13.16.5
Q=90т
13.20.9
13.6.2
13.6.4
13.20.3



SECTION 7

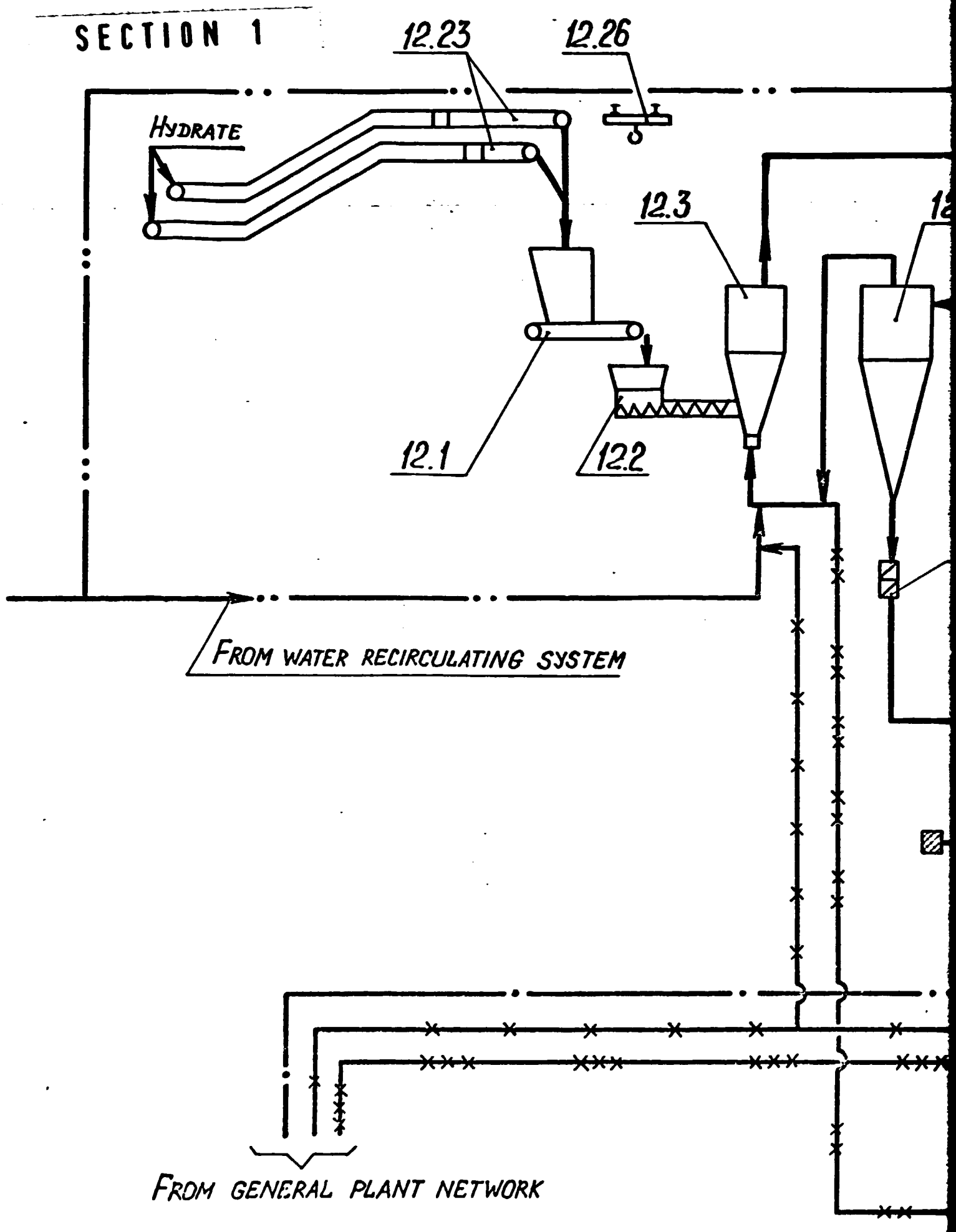


SECTION 8

UNIDO CONTRACT NO 85/108

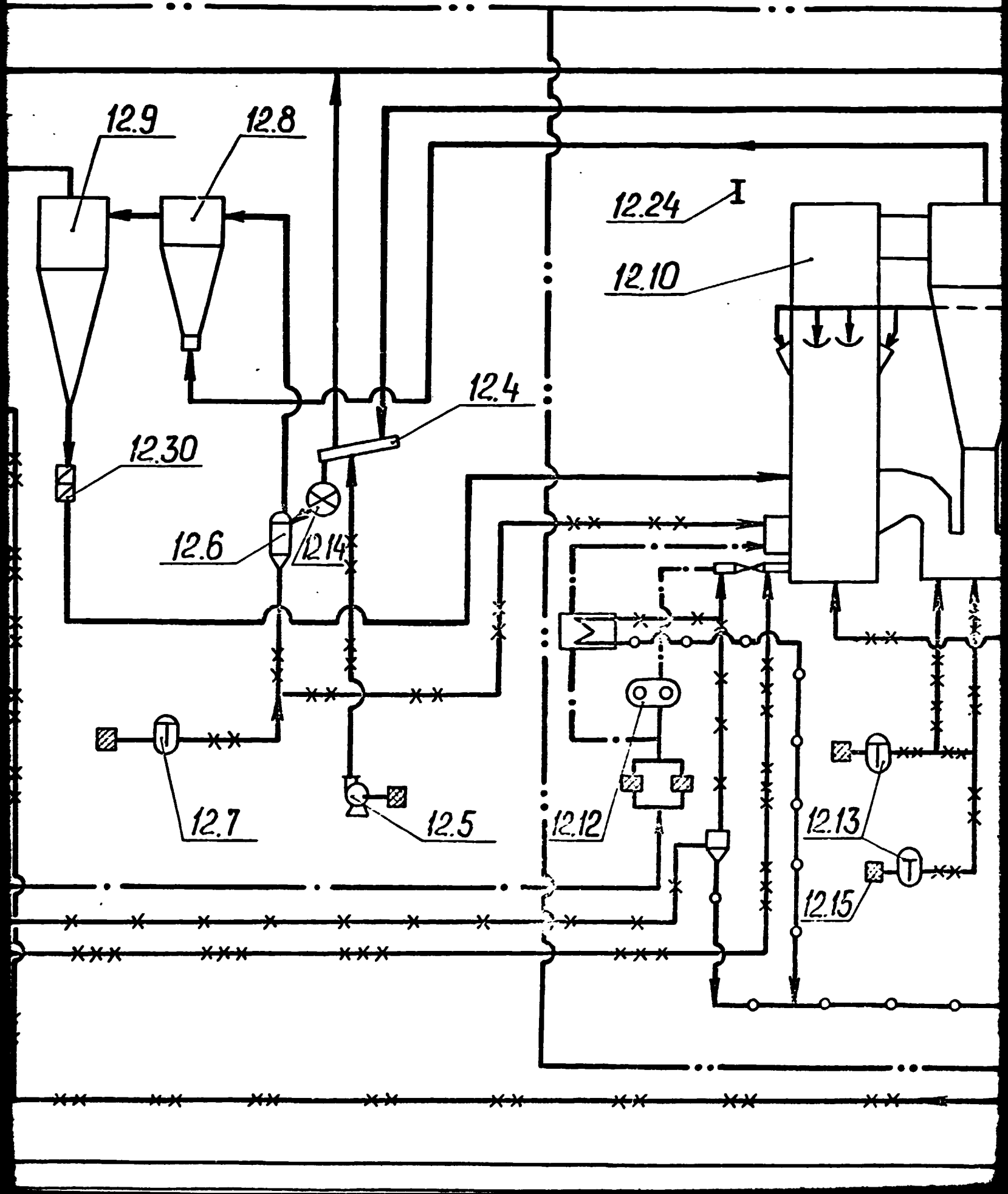
THIS DRAWING IS NOT TO BE COPIED OR TRANSEERRED TO THIRD PARTIES WITHOUT CONSENT OF VAMI INSTITUTE	1339554-TM			
	IRAN. ALUNITE BASED ALUMINA PLANT			
	PRECIPITATION, HYDRATE TREATMENT WITH HYDRATE STORAGE	STAGE	SHEET	SHEETS
		FEASIBILITY	4	
	SECTIONS	VAMI LENINGRAD		

SIZE A1

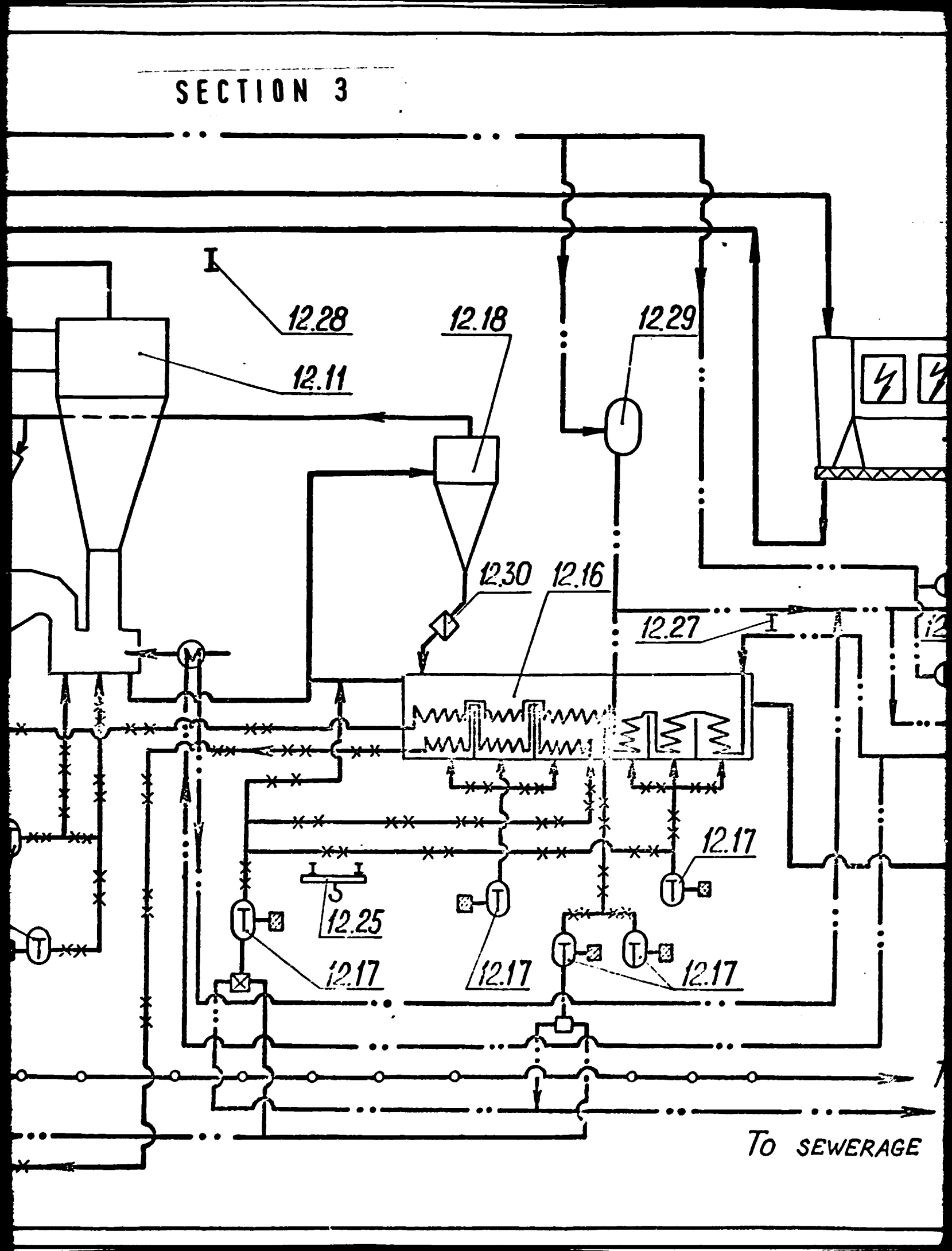

SECTION 1
12.23
12.26
HYDRATE
12.3
12.1
12.2
FROM WATER RECIRCULATING SYSTEM
FROM GENERAL PLANT NETWORK

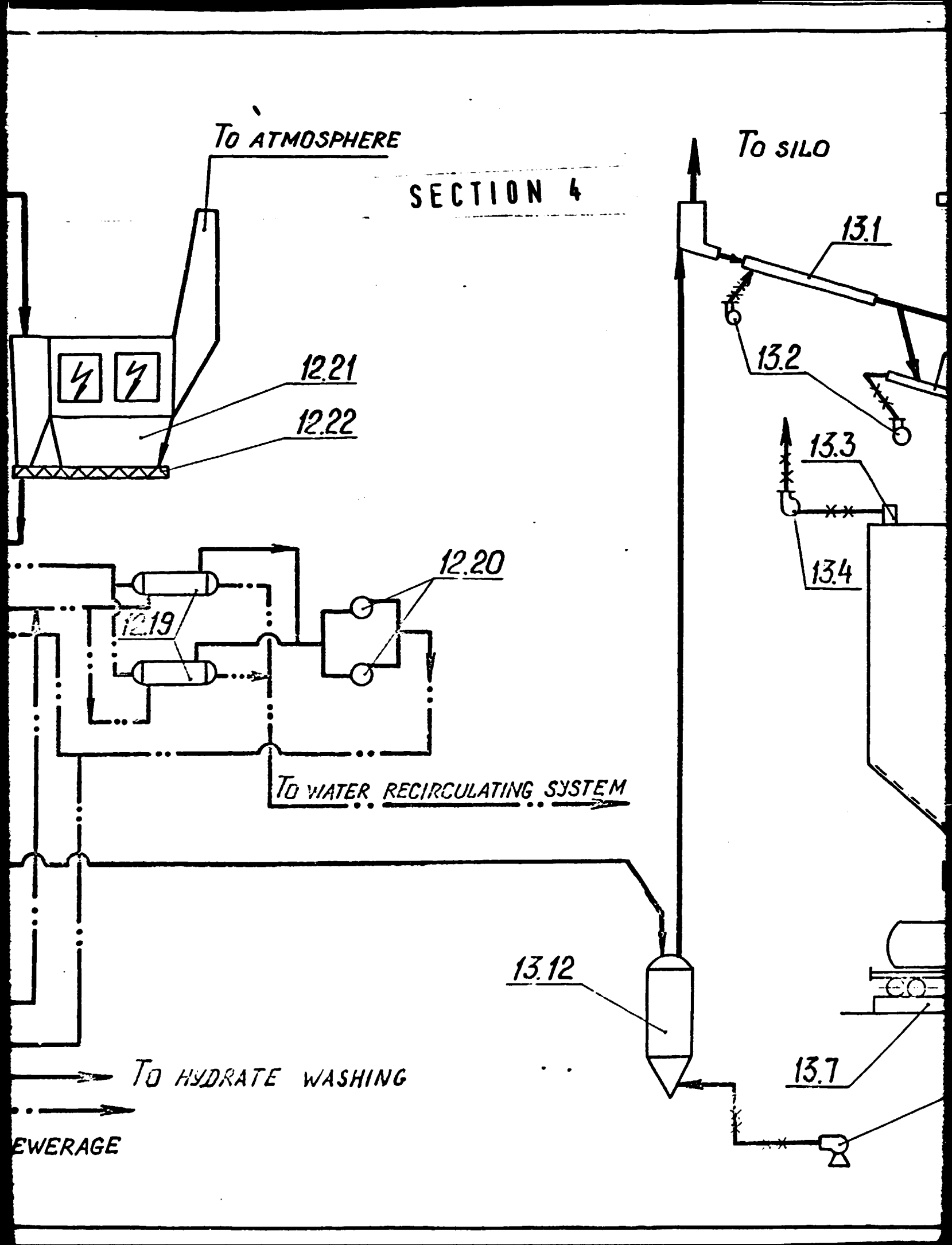
SECTION 2

CALCINATION

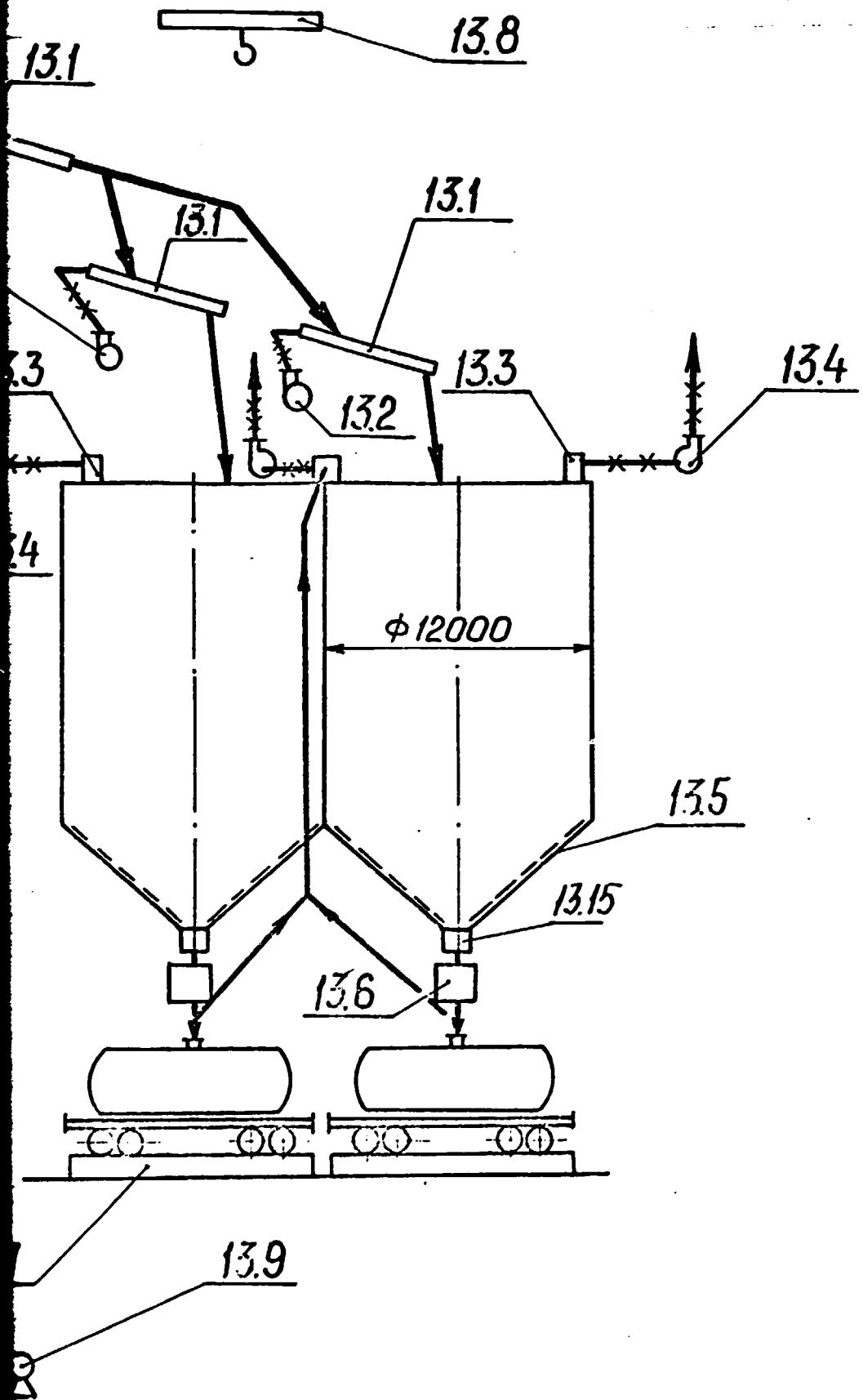


SECTION 3


I
12.28
12.18
12.29
12.11
12.30
12.16
12.27
I
12.17
I
5
12.25
12.17
12.17
12.17
TO SEWERAGE


TO ATMOSPHERE
SECTION 4
TO SILO
13.1
13.2
13.3
13.4
12.21
12.22
12.20
12.19
TO WATER RECIRCULATING SYSTEM
13.12
13.7
TO HYDRATE WASHING
EWERAGE

SECTION 5



LEGEND

MA

DU

FU

W

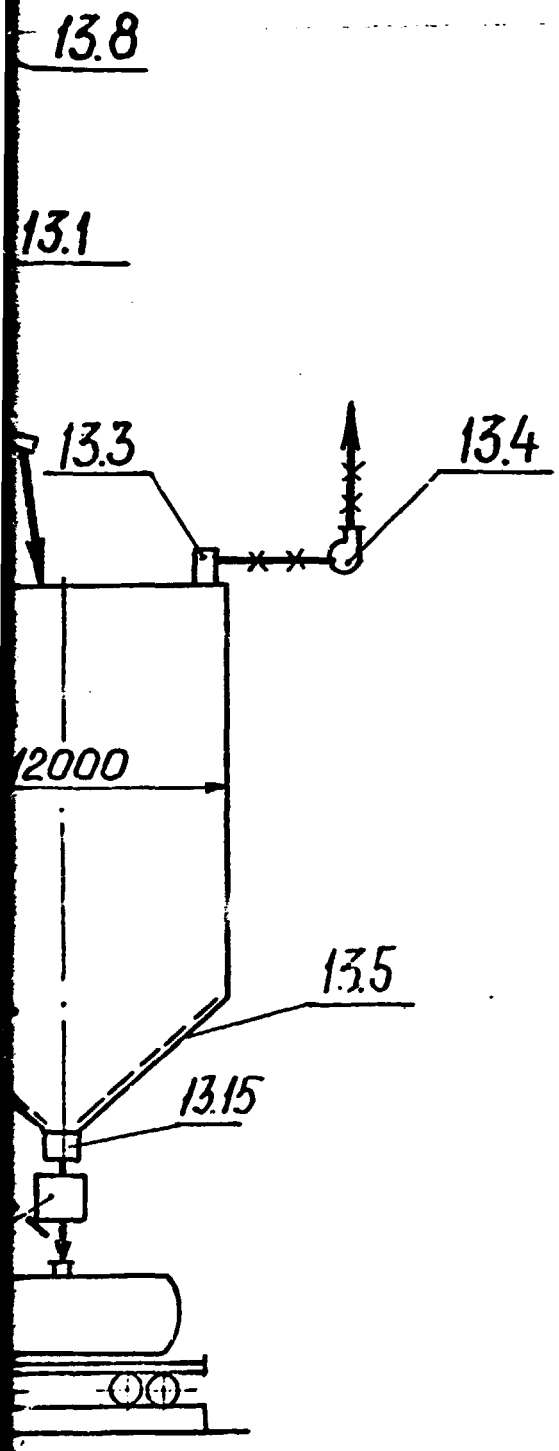
ST

AI

CO

CO

SECTION 6



LEGEND

- MATERIAL
- DUST-LADDEN AIR
- FUEL OIL
- WATER
- STEAM
- AIR
- COMPRESSED AIR
- CONDENSATE

ITEM
12.1
12.2
12.3
12.4
12.5
12.6
12.7
12.8
12.9
12.10
12.11
12.12
12.13
12.14
12.15
12.16
12.17
12.18
12.19
12.20

ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
	CALCINATION			
12.1	WEIGHT PROPORTIONER CБ-111	Q=70 T/HR	1	
122	DOUBLE ROLL SCREW	Φ400,M [illegible] 4A160S43,		
		N=15KW ; N=1400R.P.M	1	
12.3	VENTURI DRYER	Φ2,5M	1	
12.4	AIRSLIDE	B=0,4M	1	
12.5	TURBOGAS BLOWER TГ2430-48	Q=280 M³/HR; N=55KW	1	
12.6	PNEUMATIC ELEVATOR	Φ1,4M	1	
12.7	TURBOGAS BLOWER TB-50-1,6	Q=3600M³/HR; N=100KW	1	
12.8	VENTURI DRYER	Φ3,8M	1	
12.9	CYCLONE	Φ4,8M	1	
12.10	FLUID BED FURNACE	Φ4,5M	1	
12.11	CYCLONE	Φ5,5M	1	
12.12	FUEL OIL GEAR PUMP	N=3KW	1	
12.13	TURBOGAS BLOWER IA24-60-2A	Q=630M³/HR; H=[illegible]	2	
12.14	SCREW FEEDER	Φ400, MOTOR N=2,2KW	1	
12.15	OIL FILTER		9	
12.16	FLUID BED COOLER	F=45M³/HR	1	
12.17	TURBOGAS BLOWER TB-175-1,6	Q=[illegible]	5	
12.18	CYCLONE	Φ3,5M		
12.19	TUBE HEAT EXCHANGER	Φ0,53M, L=6,7M	2	
12.20	WATER PUMP	Q=[illegible]	2	

ITEM	
12.21	ELEC
	ЭГ3
12.22	SCR
12.23	BEL
12.24	ELE
12.25	SUSP
12.26	SUSP
12.27	ELE
12.28	ELE
12.29	COM
12.30	ROT
	COM
13.1	AIR
13.2	FA
13.3	BA
13.4	FA
13.5	FLU
13.6	RAIL
13.7	PLA
	S
13.8	SUS

SECTION 7

ARK	ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
	12.21	ELECTROSTATIC PRECIPITATOR			
		ЭГ3-3,8-42		1	
	12.22	SCREW	Ф0,6М MOTOR N=7,5KW	1	
	12.23	BELT CONVEYOR	B=1000, L=180M	2	
	12.24	ELECTRIC HOIST	Q=2T; H=30M	1	
	12.25	SUSPENDED ELECTRIC CRANE	Q=3,2T; H=6M	1	
	12.26	SUSPENDED ELECTRIC CRANE	Q= 5T; H=30M	2	
	12.27	ELECTRIC HOIST	Q=3T; H=12M	1	
	12.28	ELECTRIC HOIST	Q=2T; H=24M	1	
	12.29	COMPENSATION TANK		1	
	12.30	ROTARY VALVE		2	
		COMMERCIAL ALUMINA STORAGE			
	13.1	AIR SLIDE	B=400	3	
	13.2	FAN	H=17KW	3	
	13.3	BAG FILTER	F=90M²	3	
	13.4	FAN	N=10KW	3	
	13.5	FLUIDISING BOTTOM PIPE			
		409-29-65 / TH-17	1800×525×58	106	
	13.6	RAILWAY TANK CHARGING UNIT	C-926A	2	
	13.7	PLATFORM SCALE			
		SET УВЦ 150-1			
	13.8	SUSPENDED CRANE	Q=2T; H=12M	1	

ITEM.	
13.9	TU
13.10	EL
13.11	WIN
13.12	PNE
13.13	FRE
13.14	WAT
13.15	BOT
	DIS

SECTION 8

ITEM.	DESCRIPTION	SPECIFICATION	QTY	REMARK
13.9	TURBOBLOWER	N = 100 kW	1	
13.10	ELEVATOR WINCH	Q = 150 kG	1	NOT SHOWN ON FLOWSHEET
13.11	WINCH FOR BRIDGES LIFTING	Q = 300 kG	2	NOT SHOWN ON FLOWSHEET
13.12	PNEUMATIC ELEVATOR	Q = 50 T/HR; H = 35 M	1	
13.13	FREIGHT ELEVATOR	Q = 500 kG	1	NOT SHOWN ON FLOWSHEET
13.14	WATER AND OIL SEPARATOR			
	СМЦ-5	Q = 50 M^3/MIN	1	NOT SHOWN ON FLOWSHEET
13.15	BOTTOM PNEUMATIC	Q = 120 T/HR	4	
	DISCHARGER			

SECTION 9

UNIDO CONTRACT NO 85/108

13.80353-TM

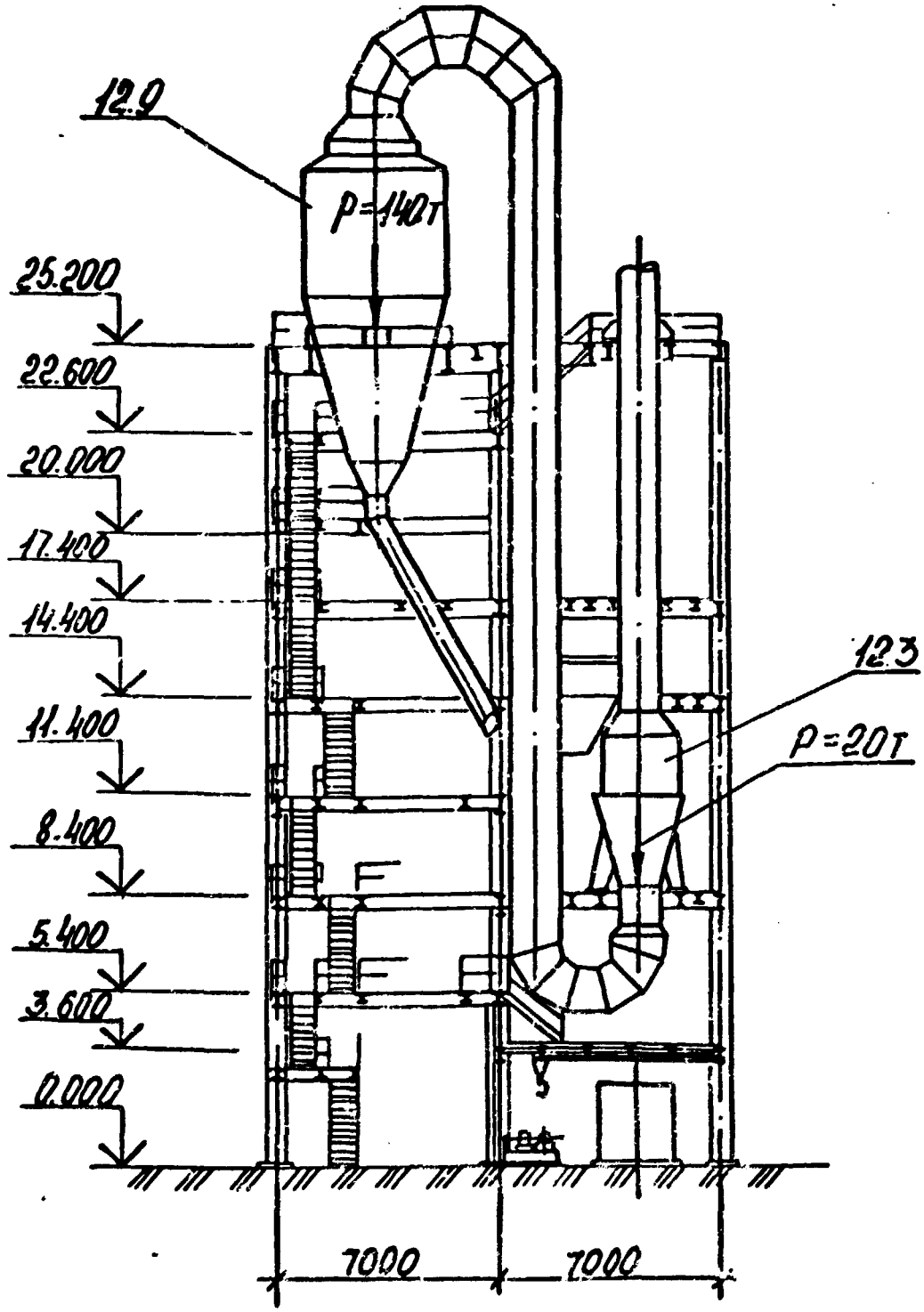
IRAN. NEPHELINE BASED ALUMINA PLANT

ALUMINA CALCINATION WITH METALLURGICAL ALUMINA STORAGE	STAGE	SHEET	SHEETS
	FEASIBILITY		1
EQUIPMENT PROCESS FLOWSHEET	VAMI LENINGRAD		

A–A

SCALE 1:200

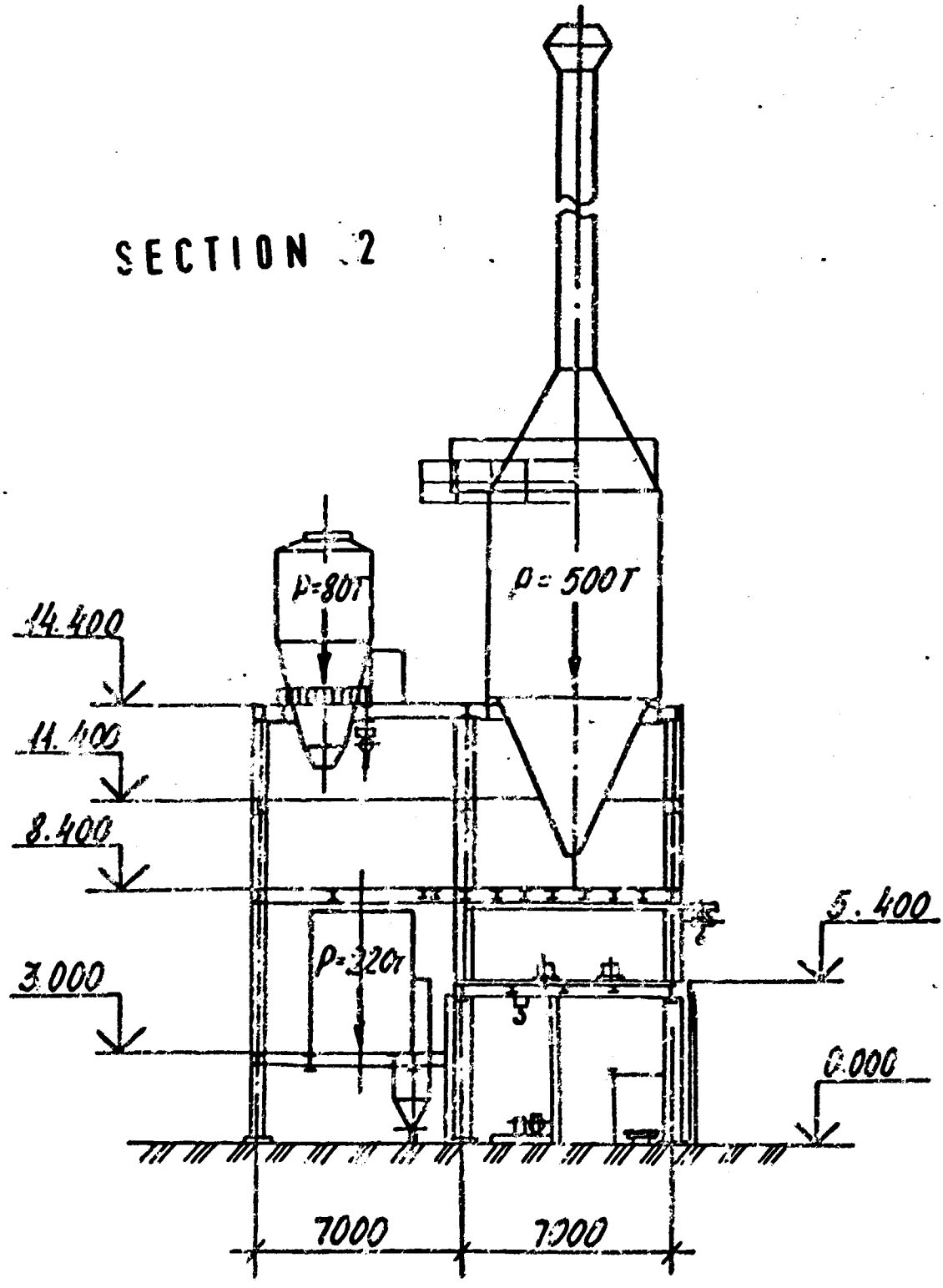
SECTION 1



B–B

SCALE 1:200

SECTION 2



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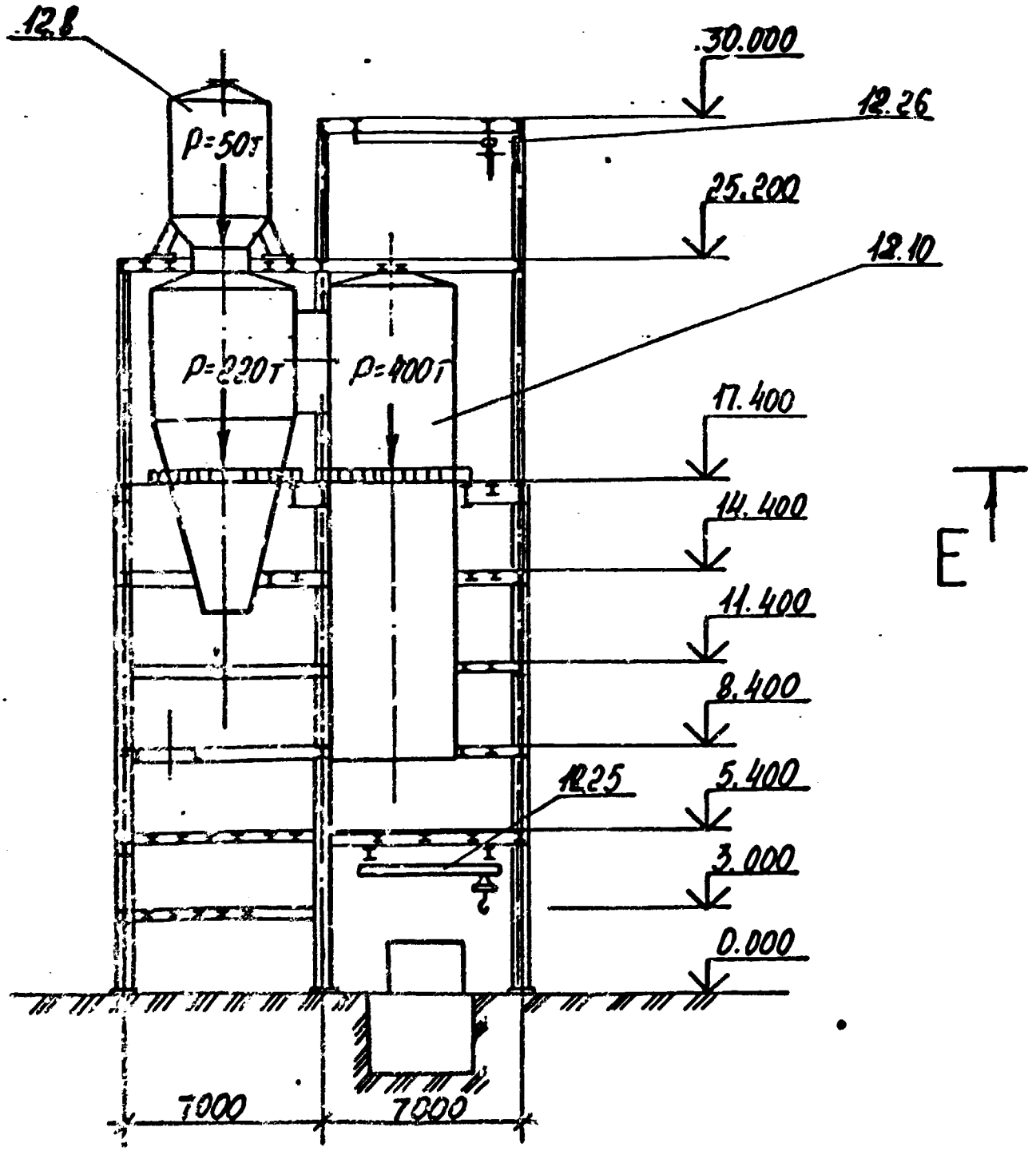
SCALE 1:200

SECTION 3



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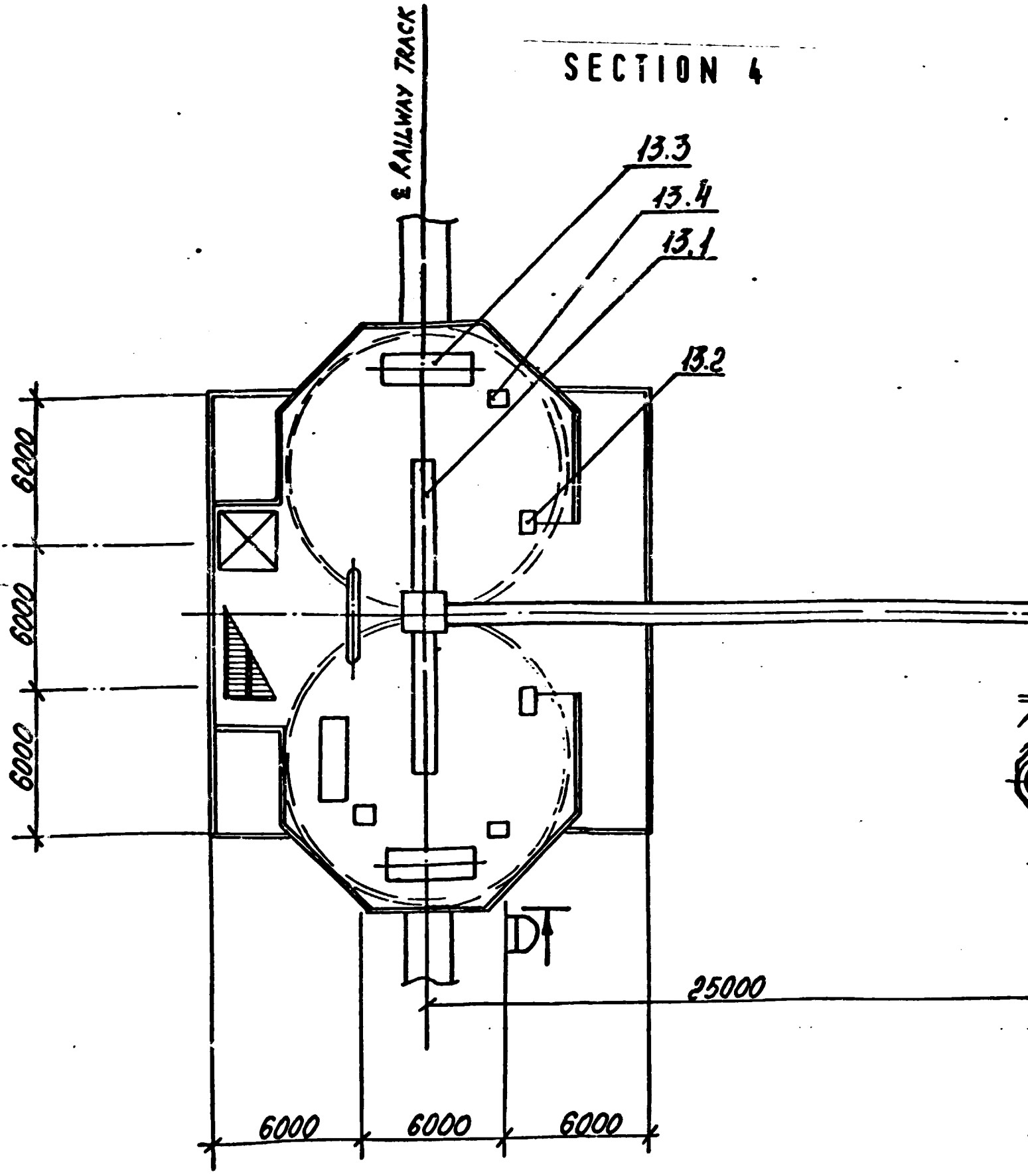
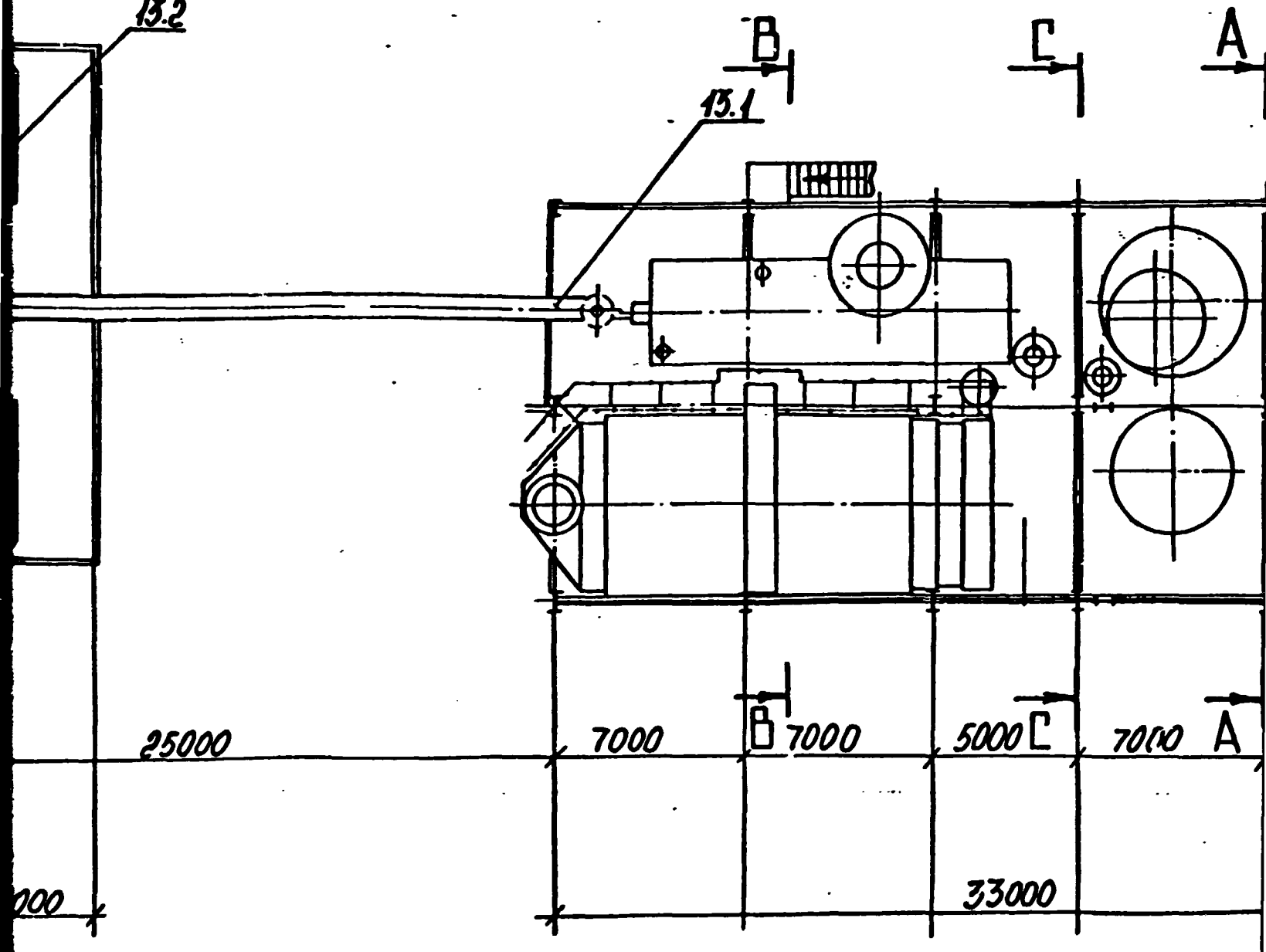

SECTION 4
℄ RAILWAY TRACK
13.3
13.4
13.1
13.2
6000
6000
6000
25000
6000
6000
6000

SECTION 5

13.3
13.4
13.1
13.2

PLAN OF CALCINER AND SILO STORAGE

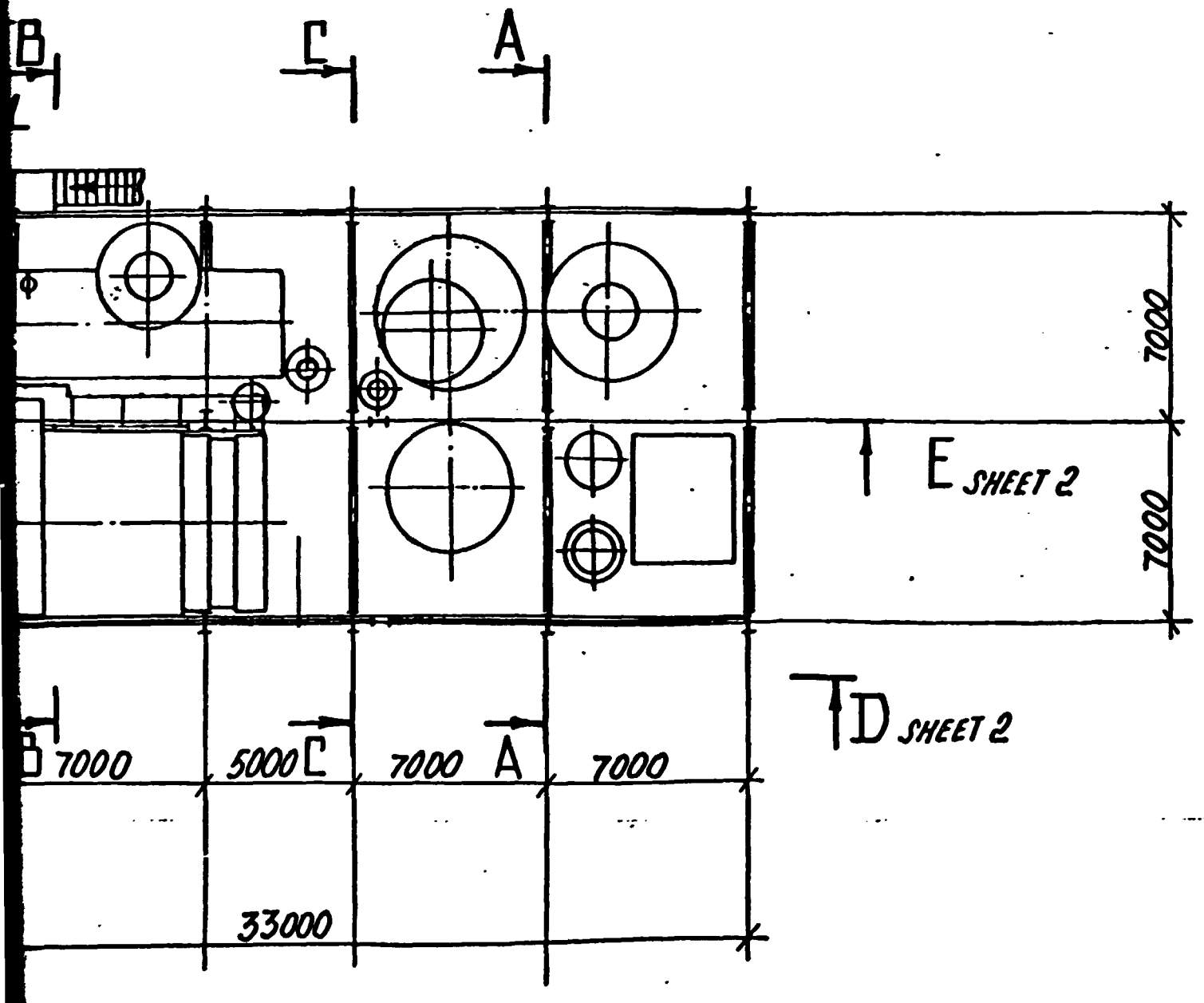
SCALE 1:200



LAN OF CALCINER
ND SILO STORAGE

CALE 1:200

SECTION 6



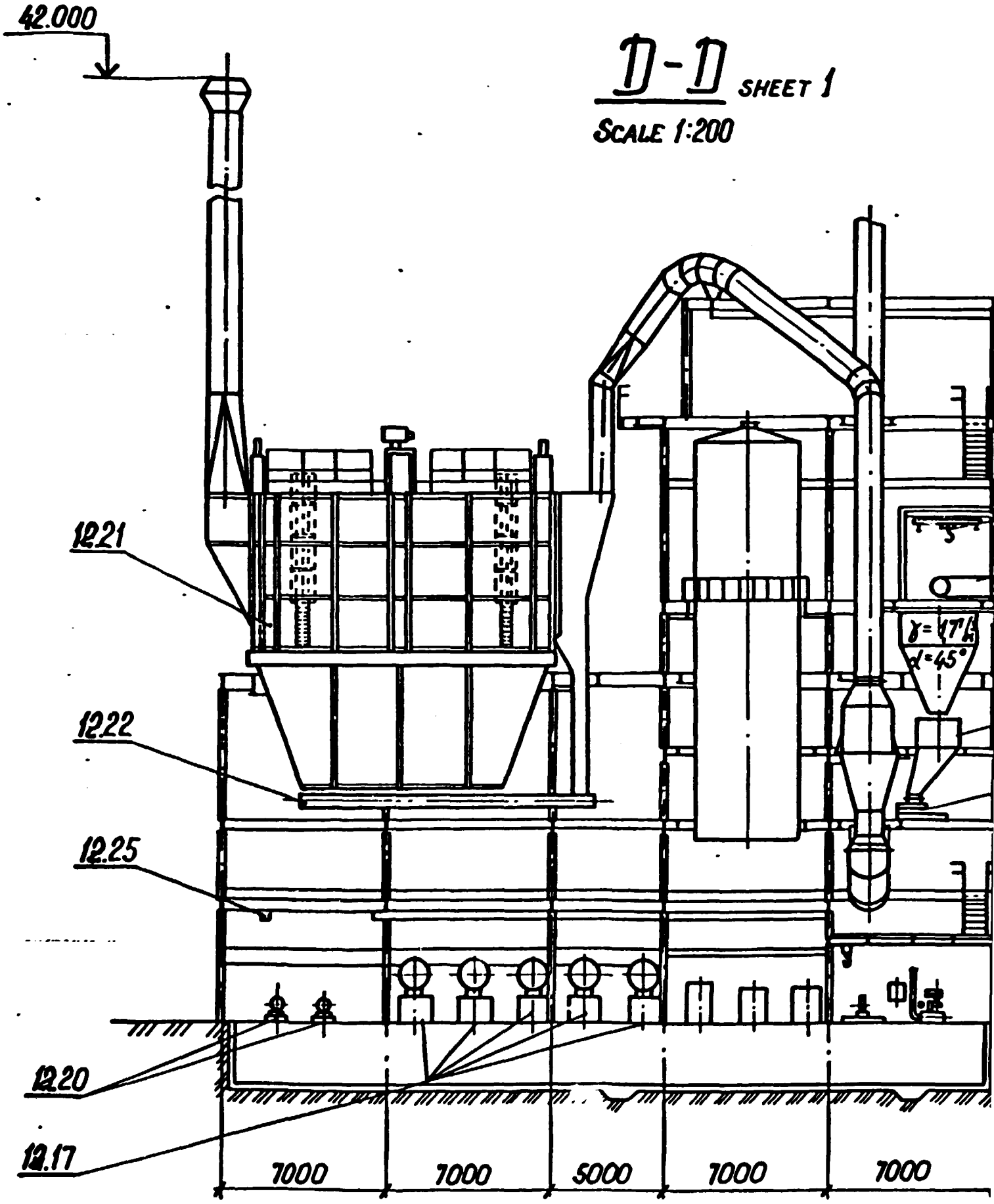
SECTION 7

UNIDO CONTRACT NO 85/108

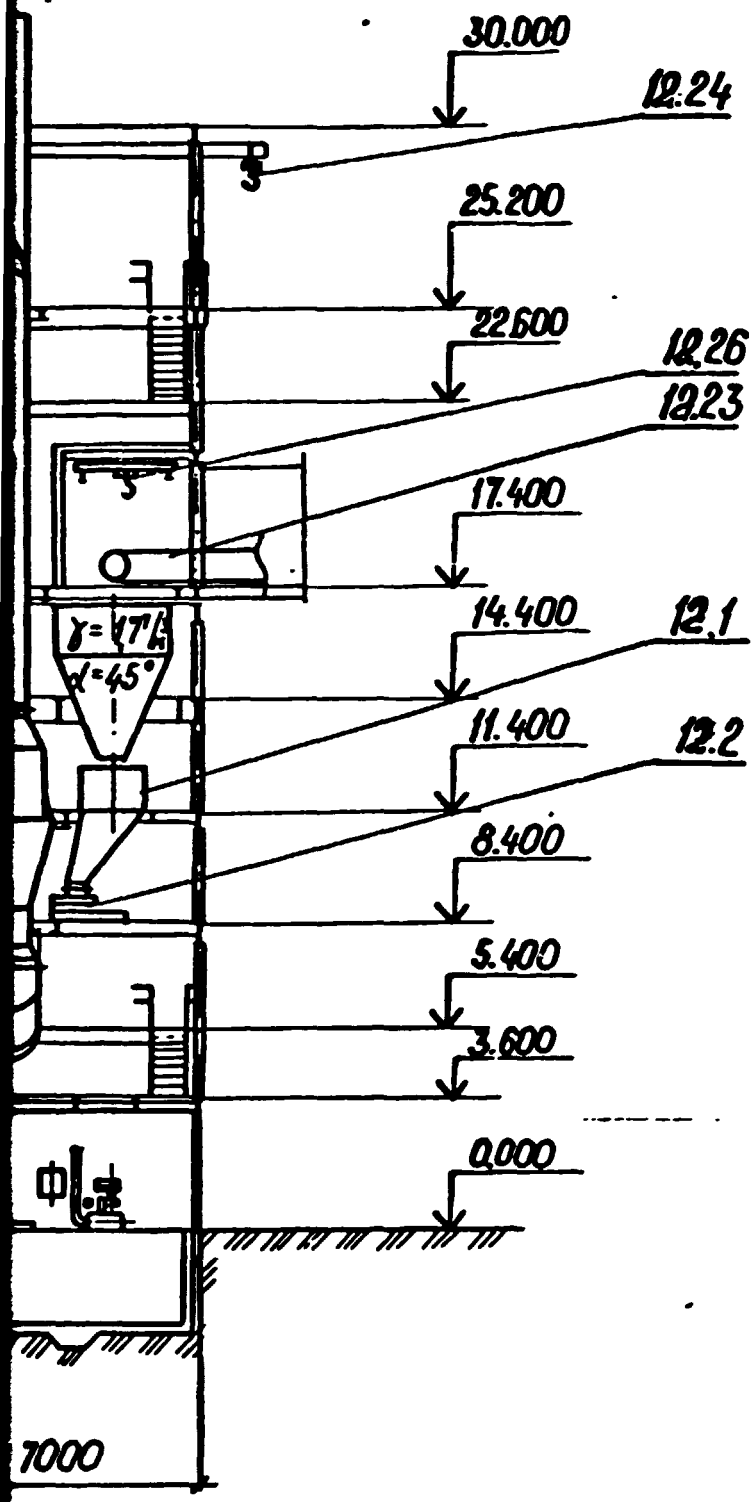
THIS DRAWING IS NOT TO BE COPIED OR TRANSFERRED TO THIRD PARTIES WITHOUT CONSENT OF VAMI INSTITUTE	1390367		
	IRAN. ALUNITE BASED ALUMINA PLANT		
	ALUMINA CALCINATION	STAGE	SHEET / SHEETS
		FEASIBILITY	1 / 2
	PLAN OF CALCINER SECTIONS A-A; B-B; C-C.	VAMI LENINGRAD	

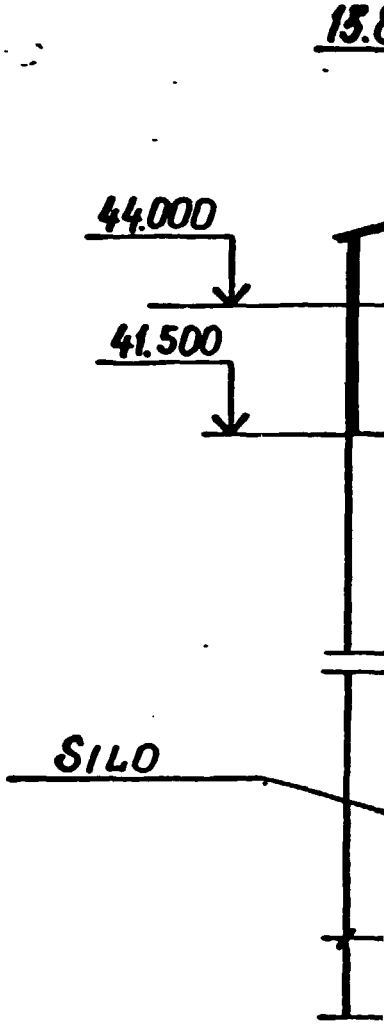
D-D SHEET 1

SCALE 1:200

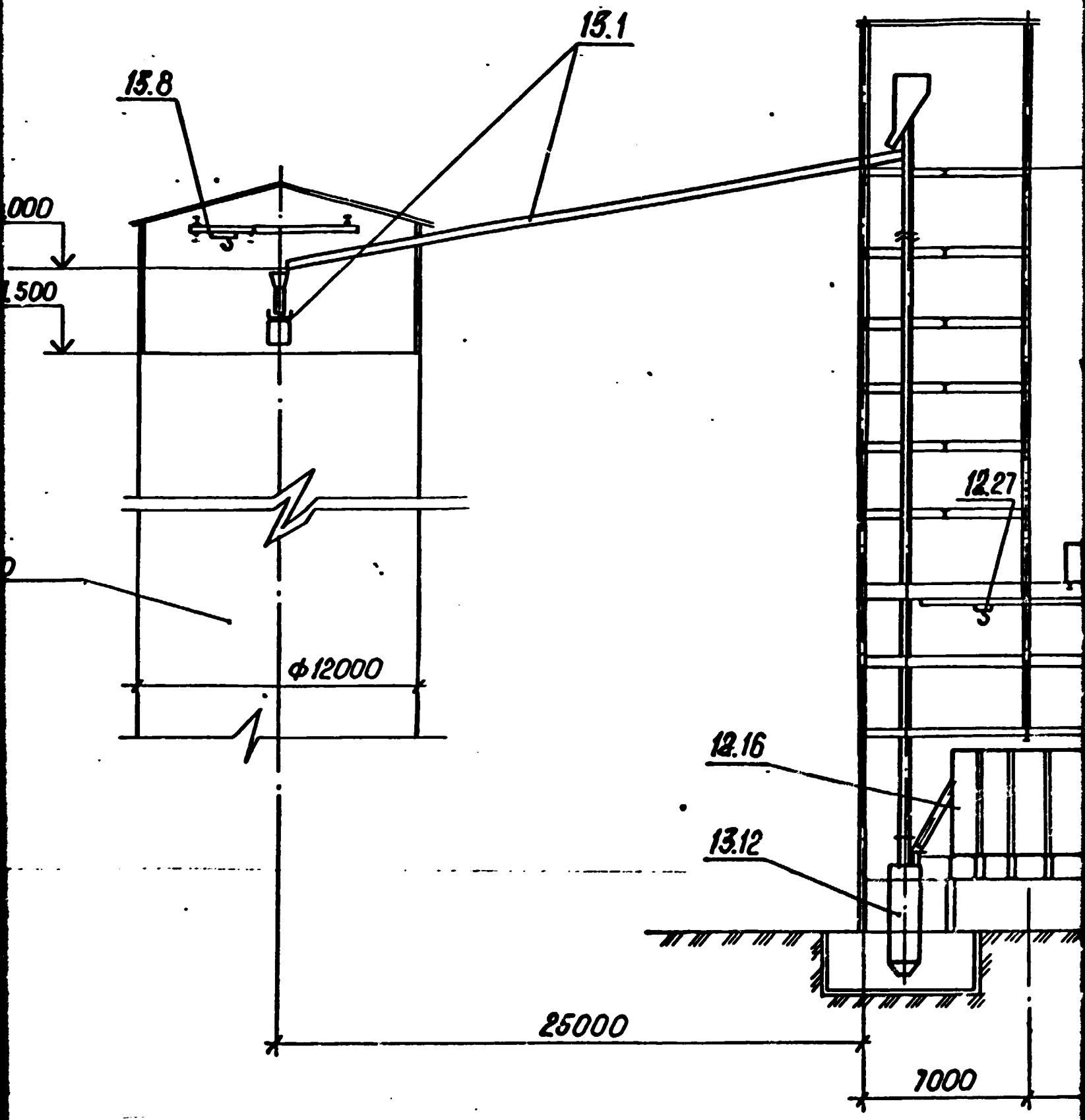


SECTION 1


30.000
12.24
25.200
22.600
12.26
12.23
17.400
14.400
12.1
γ=1.7 t/m³
α=45°
11.400
12.2
8.400
5.400
3.600
0.000
7000


44.000
41.500
SILO

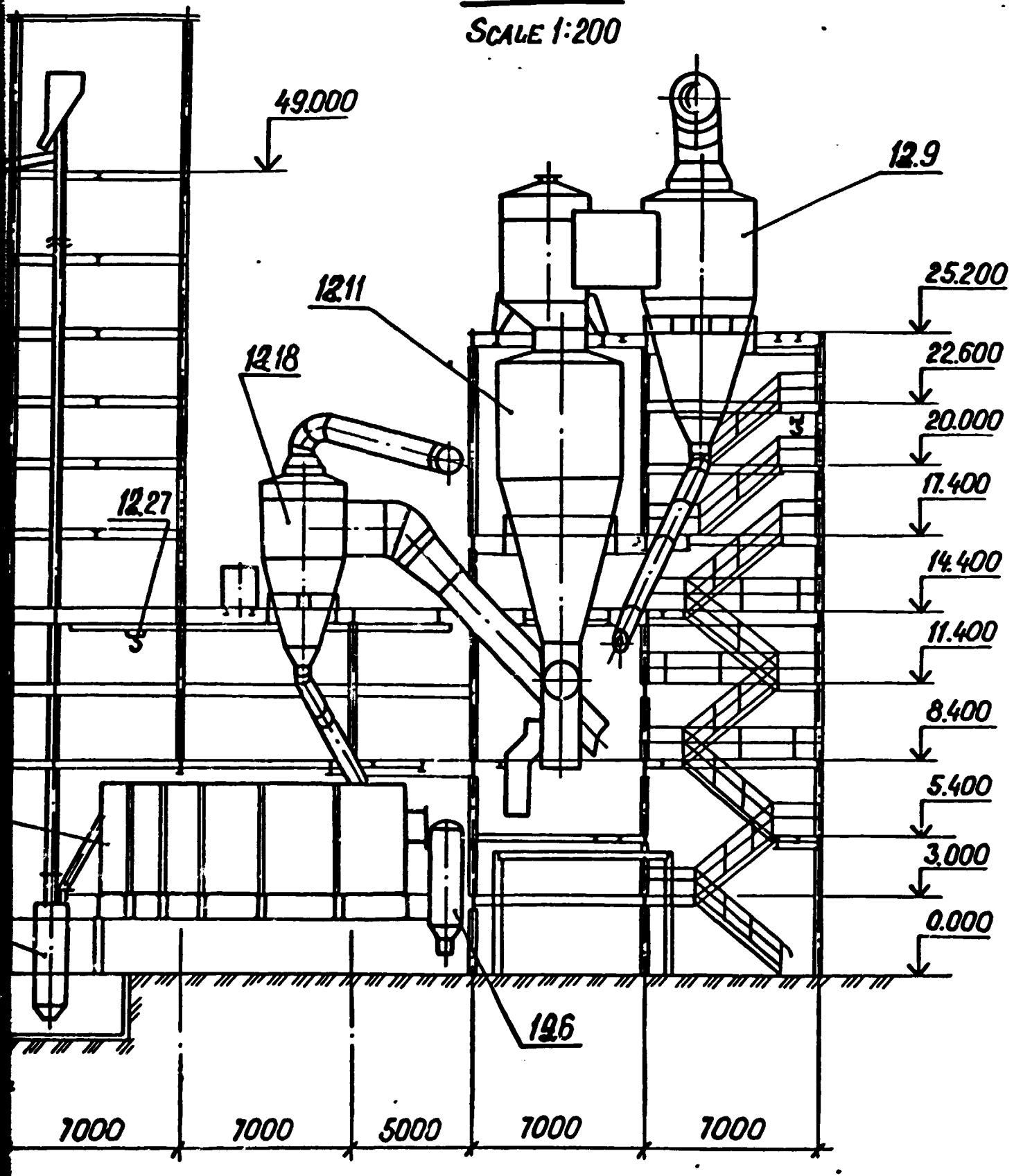
SECTION 2



SECTION 3

E - E SHEET 1

SCALE 1:200



SECTION 4

SECTION 5

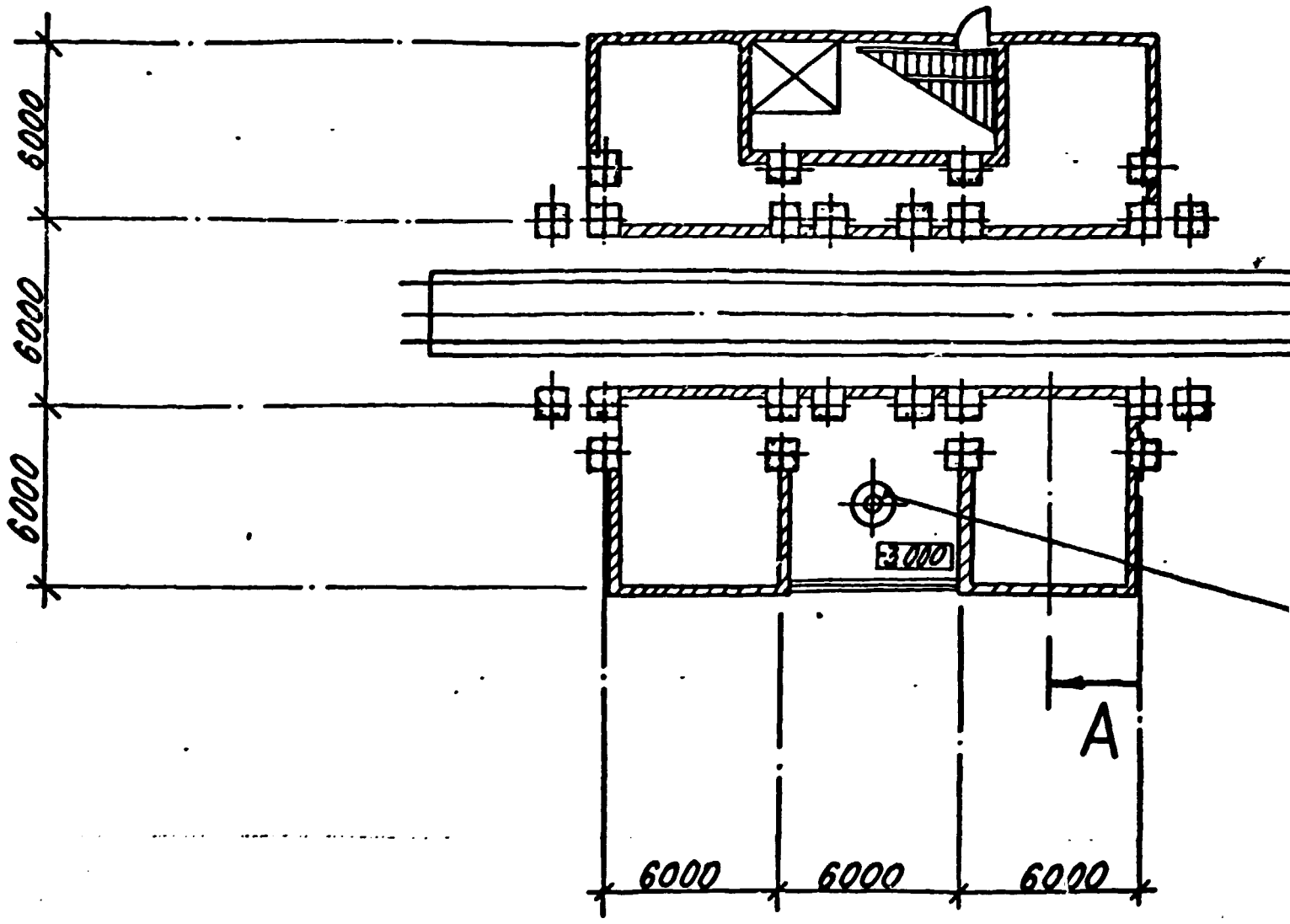
UNIDO CONTRACT No 85/108

1390367-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
ALUMINA CALCINATION	STAGE	SHEET	SHEETS
	FEASIBILITY	2	
SECTIONS D-D; E E.	VAMI LENINGRAD		

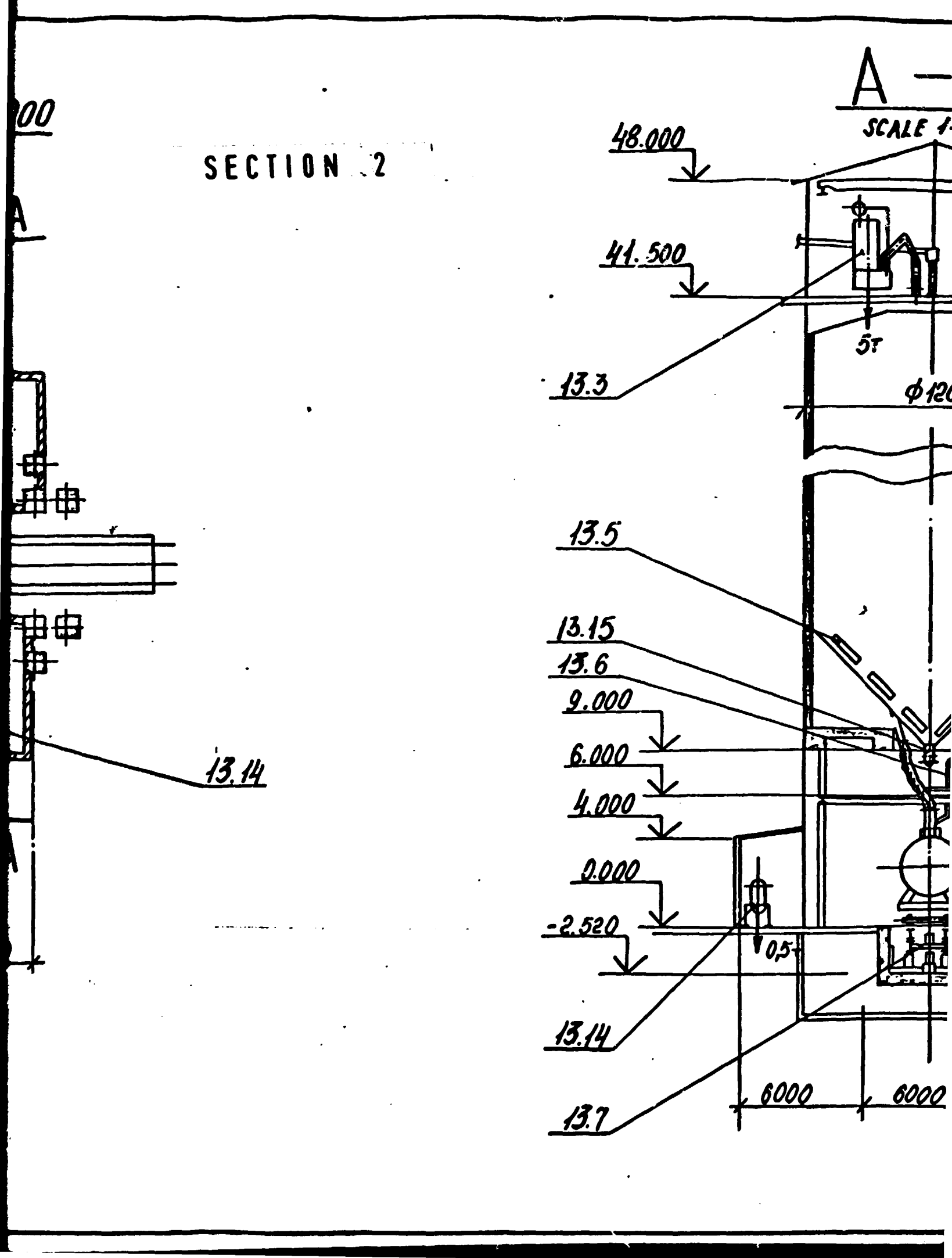
SECTION 1

PLAN AT EL. 0.000

SCALE 1:200

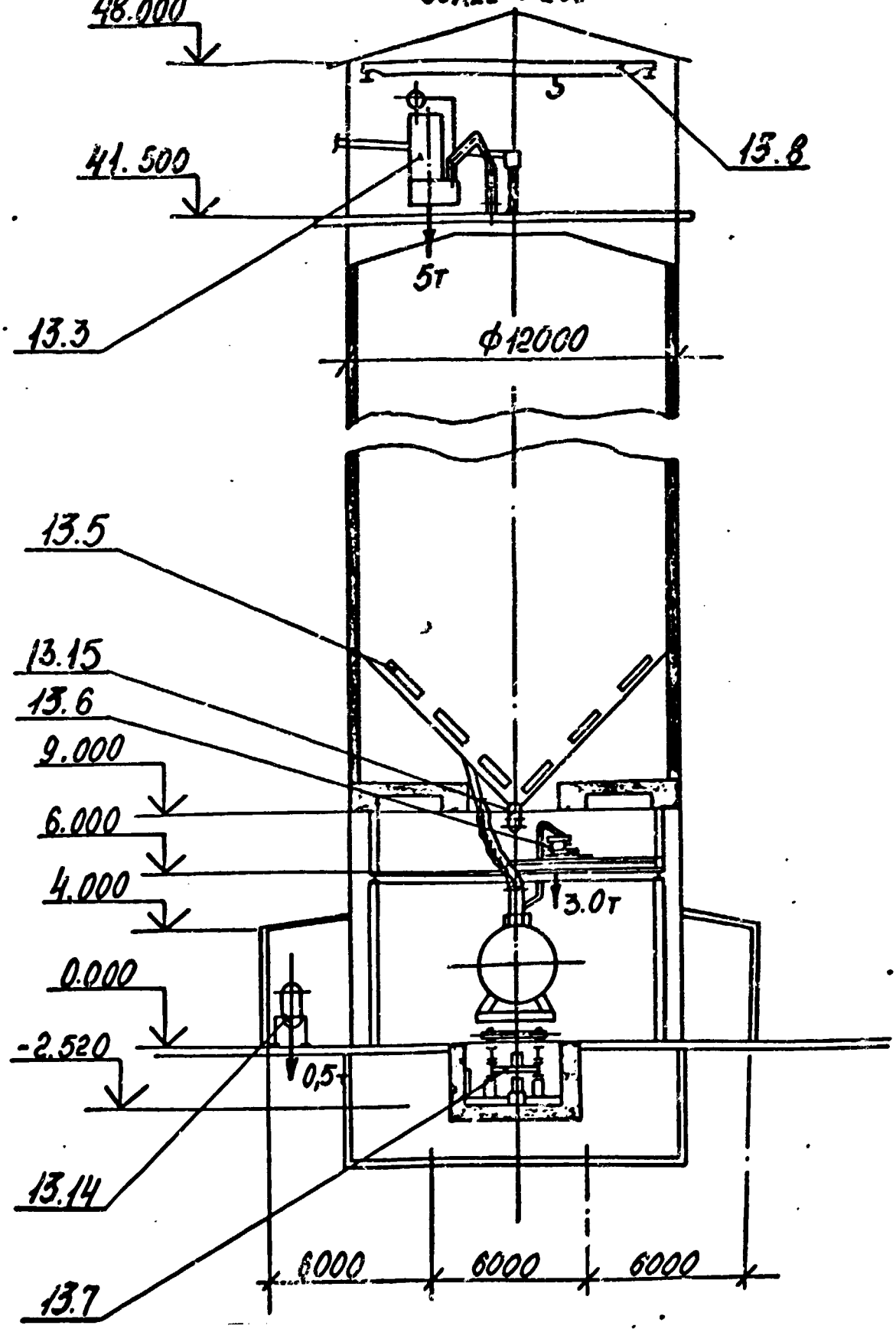


SECTION 2


48.000
41.500
5T
13.3
13.5
13.15
13.6
9.000
6.000
4.000
0.000
-2.520
0,5
13.14
13.7
6000
6000
13.14

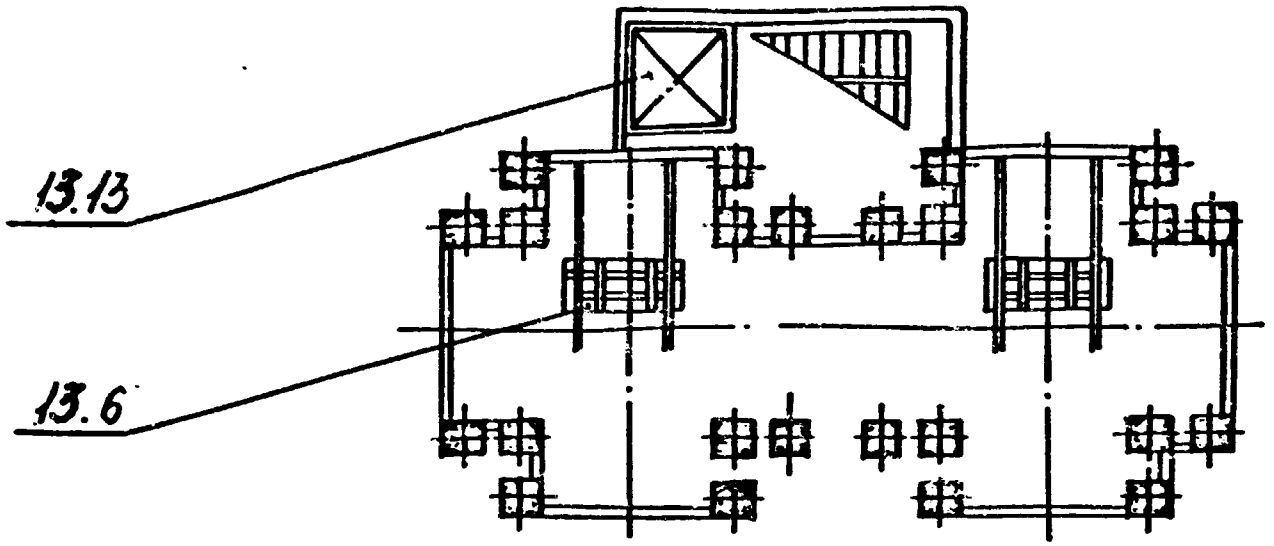
A — A

SCALE 1:200



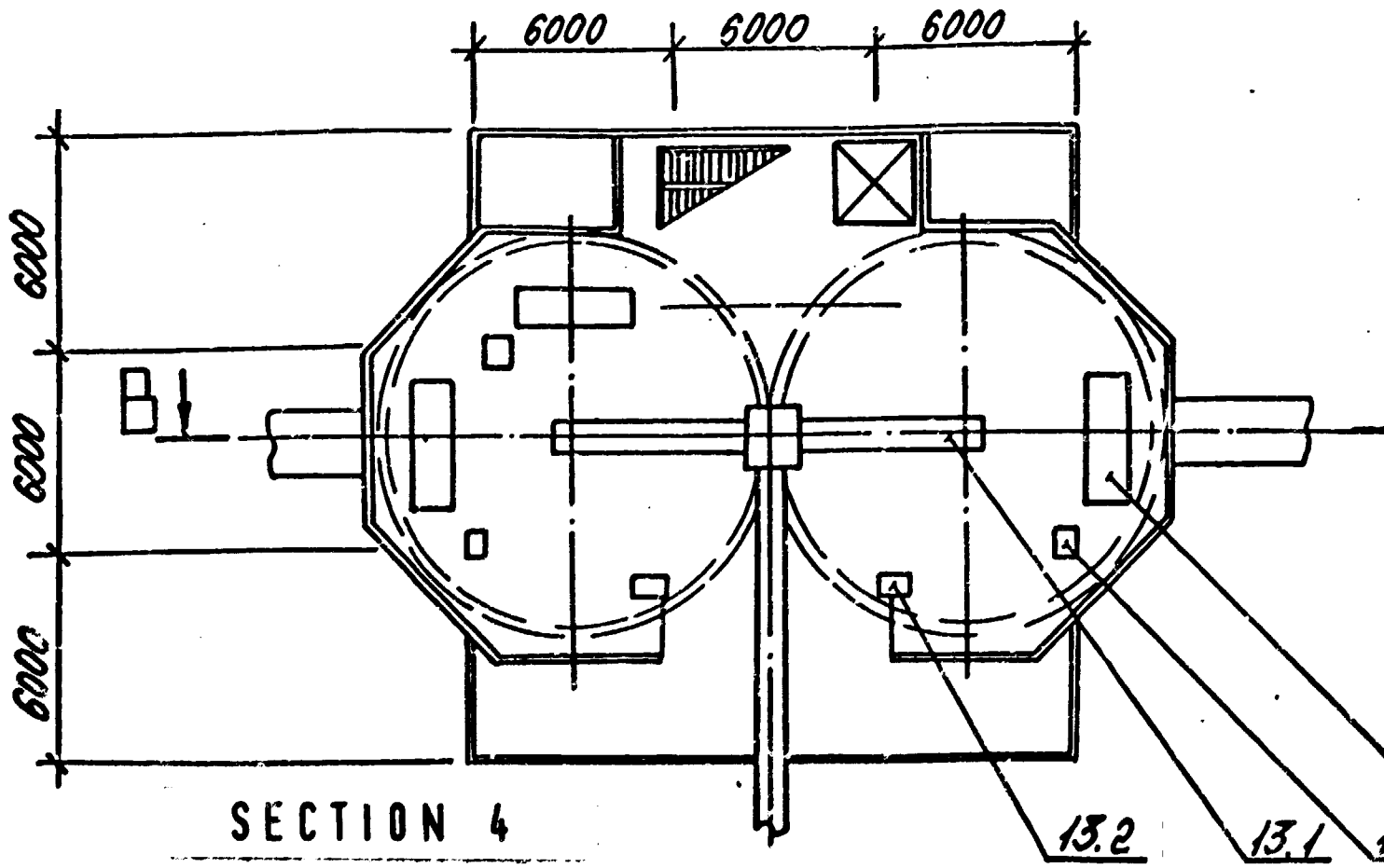
SECTION 3

PLAN AT EL. + 6000



PLAN AT EL. + 41.500

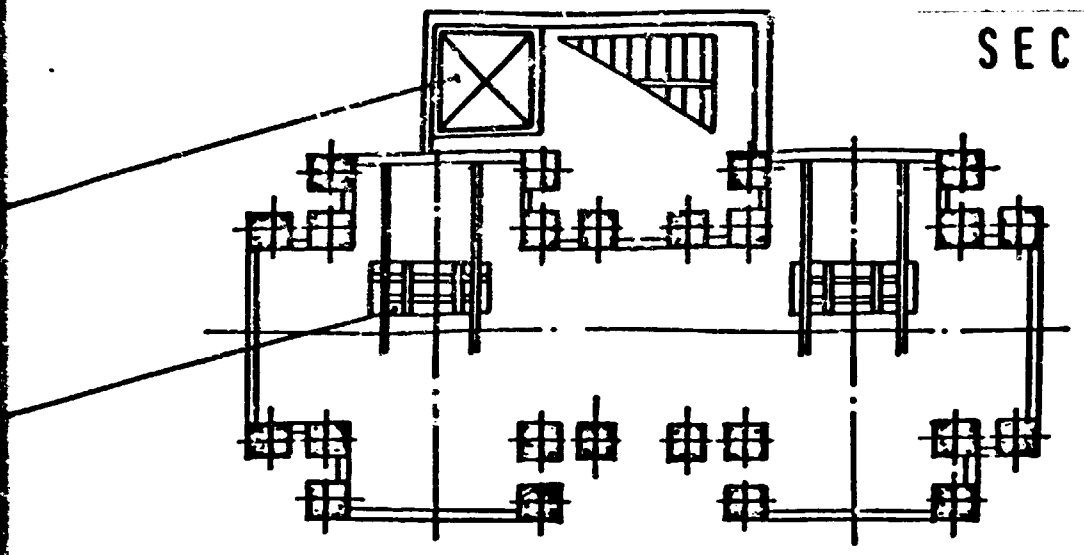
SCALE 1:200



SECTION 4

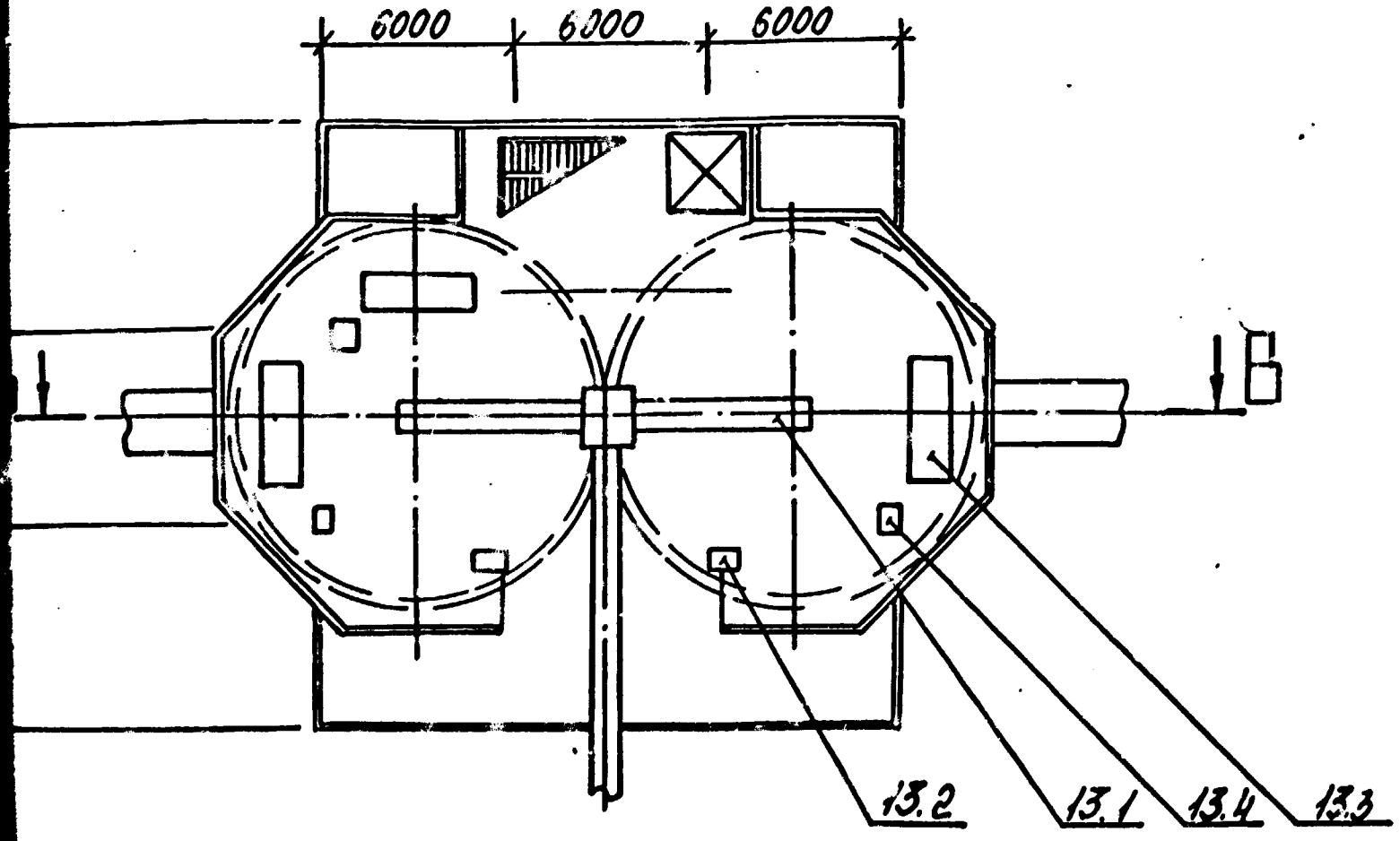
PLAN AT EL. + 6000

SECTION 5



PLAN AT EL. + 41.500

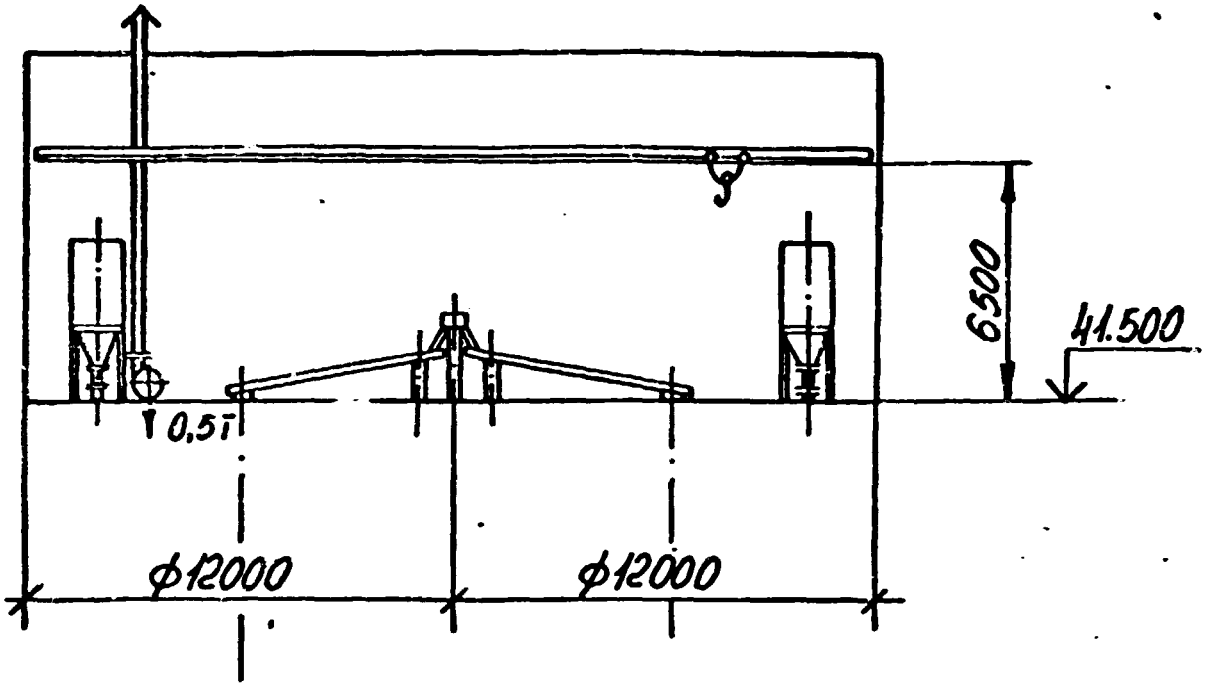
SCALE 1:200



SECTION 6

B - B

SCALE 1:200



41.500

SECTION 7

UNIDO CONTRACT NO 85/108

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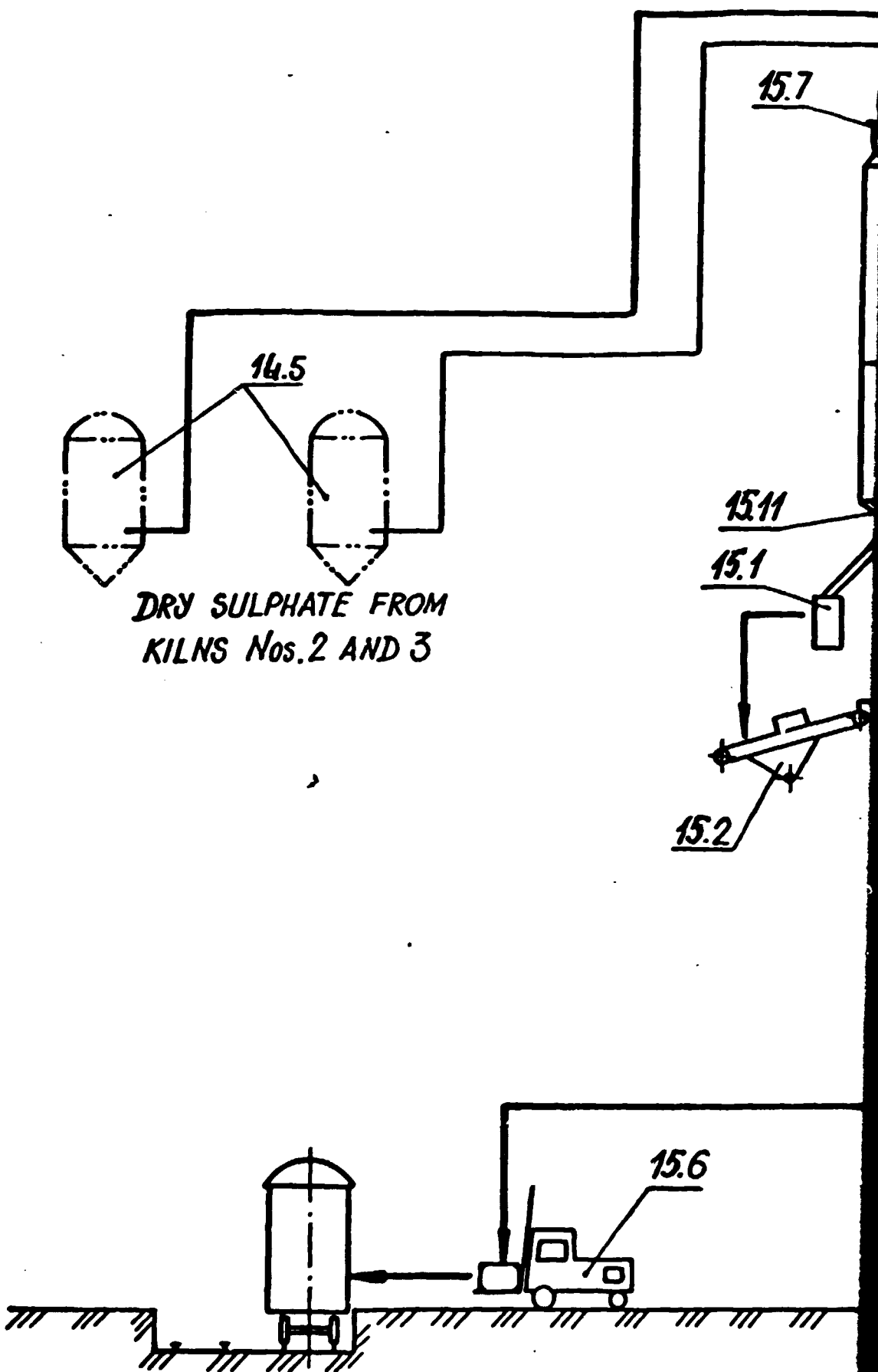
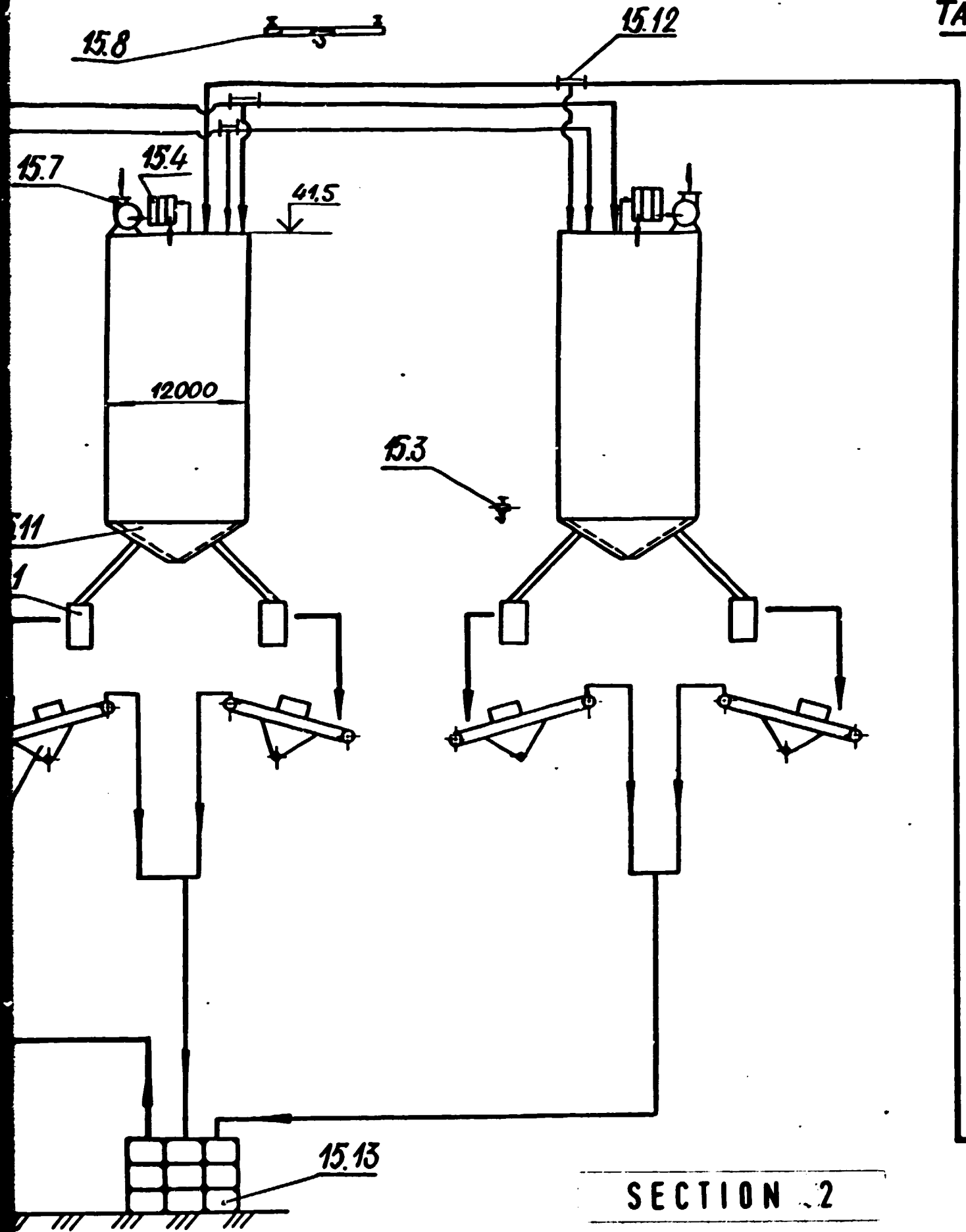
	IRAN. ALUNITE BASED ALUMINA PLANT
COMMERCIAL ALUMINA STORAGE	STAGE: FEASIBILITY; SHEET: ; SHEETS: 1
PLANS AT EL. 0.000; 6.000 41.500. SECTIONS A-A; B-B	VAMI LENINGRAD

SECTION 1

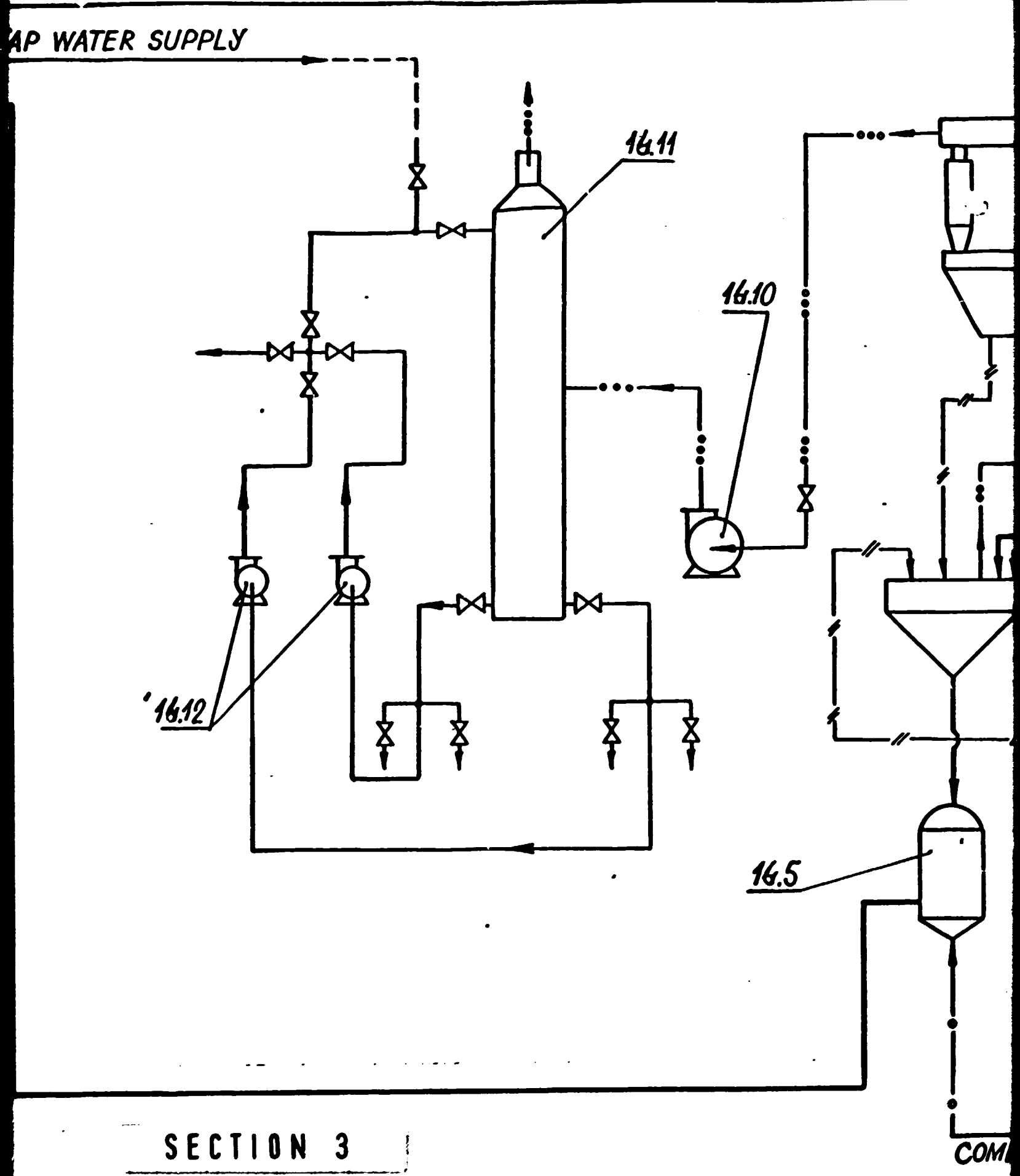


Инв.№ подл. | Подп. и дата | Взам.инв.№

TAP WATE

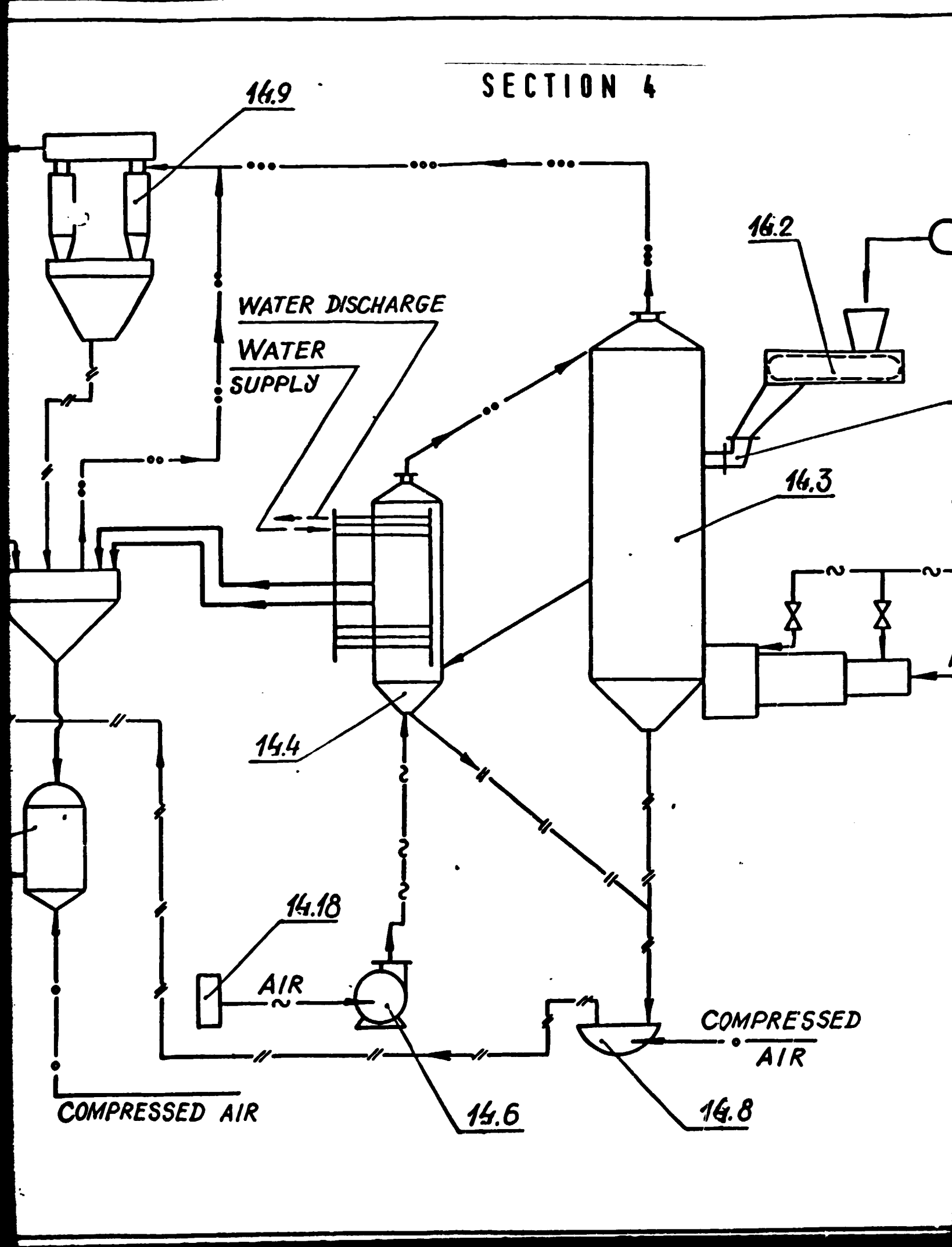


SECTION 2

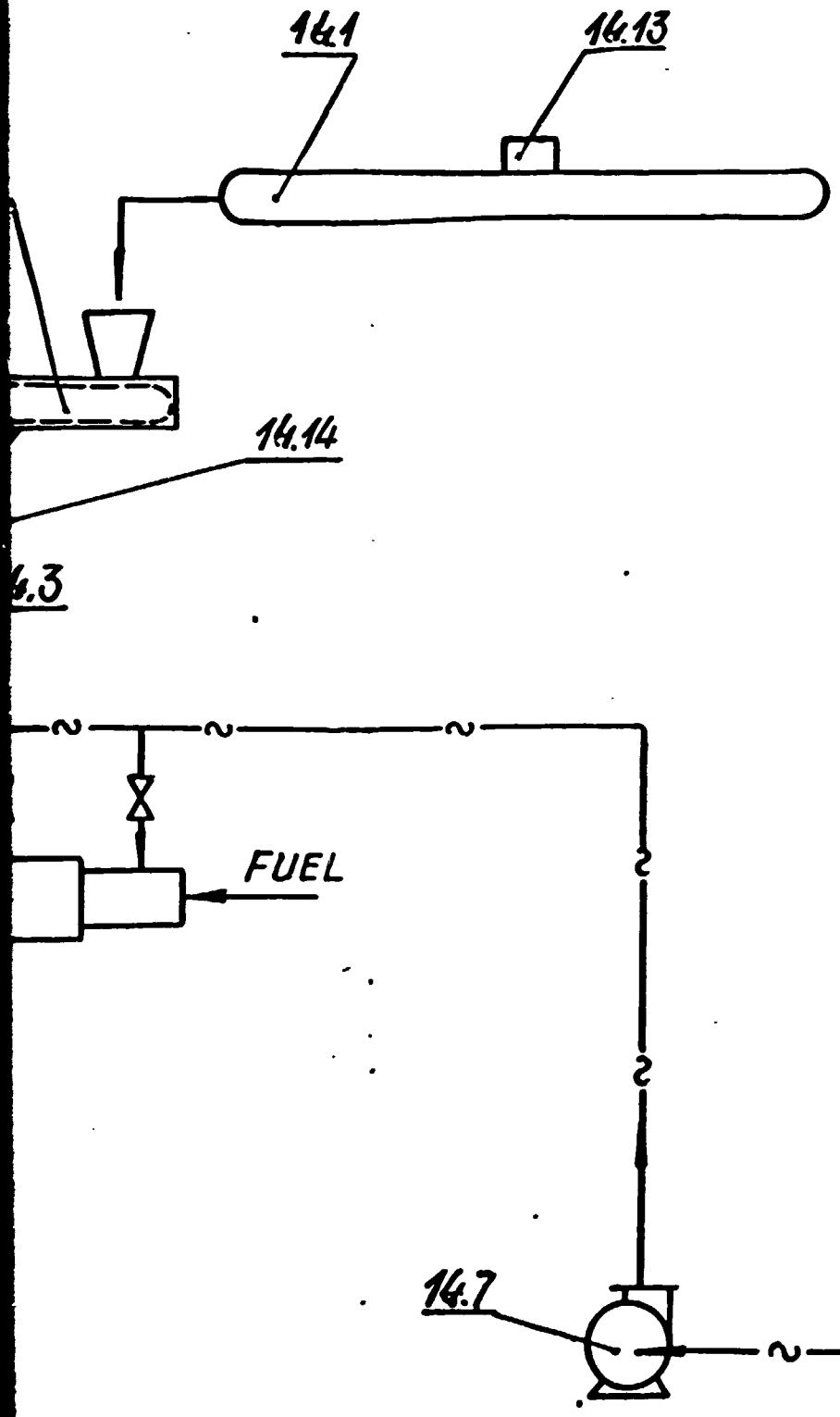


SECTION 3

SECTION 4


14.9
16.2
WATER DISCHARGE
WATER
SUPPLY
14.3
14.4
14.18
AIR
COMPRESSED
AIR
COMPRESSED AIR
14.6
14.8

SECTION 5



LEGEND

- MATERIAL
- SLURRY
- WATER
- DUST RECIC
- AIR
- COMPRESSE
- FLUE GAS
- DUST - LADD

SECTION 6

LEGEND

——— MATERIAL

——— SLURRY

– – – – WATER

——//—— DUST RECICLE

——~—— AIR

——o—— COMPRESSED AIR

——ooo—— FLUE GASES

——oo—— DUST-LADDEN AIR

AIR

ITEM	DESC
	SULPH
14.1	TROUG
	CONV

SECTION 7

ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
	SULPHATE DRYING			
14.1	TROUGH BELT CONVEYOR	B=650; L=75 M MOTOR A02-52-4 N=10 KW n=1500 RPM	2	

ITEM
14.2
14.3
14.4
14.5
14.6
14.7
14.8
14.9
14.10
14.11
14.12
14.13
14.14
14.15
14.16
14.17
14.18
15.1
15.2
15.3

SECTION 8

ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
14.2	PLATE FEEDER	B=500; L=3000	3	
14.3	FLUID BED SALT	ϕ 2300	3	
	DRYER			
14.4	COOLER	ϕ 1800	3	
14.5	CHAMBER PNEUMATIC PUMP	ϕ 1200; ТА-23А	3	
14.6	AIR BLOWER РГН-1200 IE	Q=700 M^3/HR; N=10 kW H=20 kPa	3	
14.7	FAN ВВД-8	Q=10000 M^3/HR N=14 kW H=6,5 kPa	3	
14.8	PNEUMATIC TRANSPORTATION UNIT	ϕ 200	3	
14.9	BANK OF 6 CYCLONES	ЦН-15 ϕ 550	3	
14.10	FAN ЦП-7-40 No 8	Q=10000 M^3/HR N=14 kW H=31 kPa	3	
14.11	SCRUBBER	ϕ 1500; H=9000	3	
14.12	CENTRIFUGAL PUMP	Q=100 M^3/HR H=310 kPa	6	
	ПБ-100/31 м			
14.13	PLOUGH TRIPPER	B=650	4	
14.14	SPREADER	Q=10 R.P.M. MOTOR N=3,2 kW n=1500 R.M.M.	3	
14.15	REMOVABLE ELECTRIC	Q=2т; H=18 м	1	
	HOIST			
14.16	REMOVABLE ELECTRIC	Q=1т; H=6 м	1	
	HOIST			
14.17	REMOVABLE ELECTRIC HOIST	Q=2т; H=6 м	1	
14.18	ROLL FILTER ФР-5	Q=10000 M^3/HR	3	
	COMMERCIAL SULPHATE STORAGE			
15.1	BAGGING MACHINE	Q=200 BAGS/HR	4	
15.2	REMOVABLE BELT	B=400	4	
	CONVEYOR			
15.3	REMOVABLE ELECTRIC	Q=1т; H=12 м	1	
	HOIST			

REMARK

ITEM
15.4
15.5
15.6
15.7
15.8
15.9
15.10
15.11
15.12
15.13

ITEM	DESCRIPTION	SPECIFICATION	QTY	REMARK
15.4	BAG FILTER	$F = 90\ M^2$	2	
15.5	FREIGHT ELEVATOR	$Q = 500$ KG	1	NOT SHOWN ON FLOWSHEET
15.6	AUTOMATIC LOADER	$Q = 1{,}6$ T $H_{LIFT} = 2{,}8$ M	1	
15.7	FAN	$N = 10$ KW; $Q = 7000\ NM^3/HR$	2	
15.8	SUSPENDED ELECTRIC CRANE	$Q = 1$ T ; $H_{LIFT} = 12$ M	1	
15.9	AIR-WATER SEPARATOR	$Q = 50\ NM^3/MIN$	1	NOT SHOWN ON FLOWSHEET
15.10	ELEVATING WINCH	$Q = 150$ KG	1	NOT SHOWN ON FLOWSHEET
15.11	FLUIDISING BOTTOM PIPE	$1800 \times 525 \times 58$	110	
15.12	TWO-WAY SWITCH	D 150	3	
15.13	WOODEN TRAYS	800×1200	600	$K_{exec} = 0.86$

SECTION 9

UNIDO CONTRACT NO 85/108

1390352-TM

IRAN. ALUNITE BASED ALUMINA PLANT

POTASSIUM SULPHATE DRYING WITH POTASSIUM SULPHATE STORAGE.

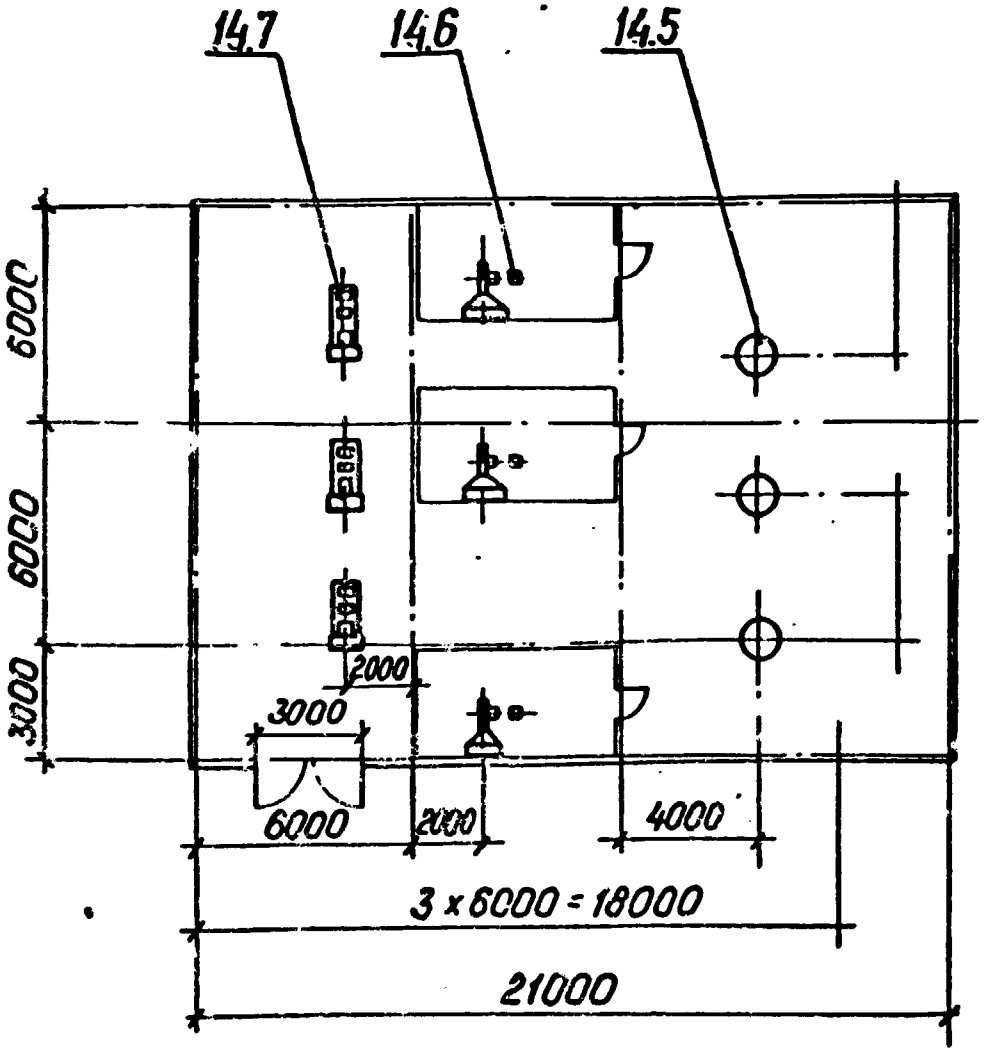
STAGE	SHEET	SHEETS
FEASIBILITY		

EQUIPMENT PROCESS FLOWSHEET

BAMI LENINGRAD

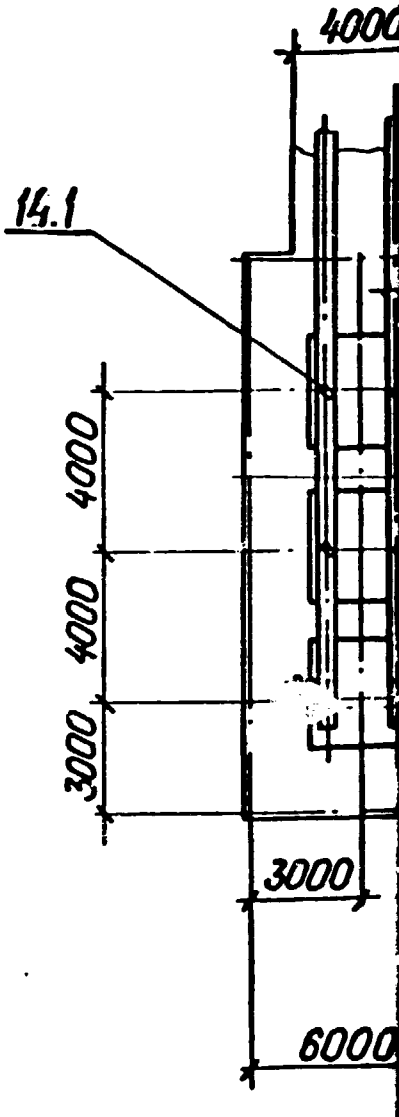
PLAN AT EL. 0.000

SCALE 1:100



PLAN AT EL.

SCALE



SECTION 1

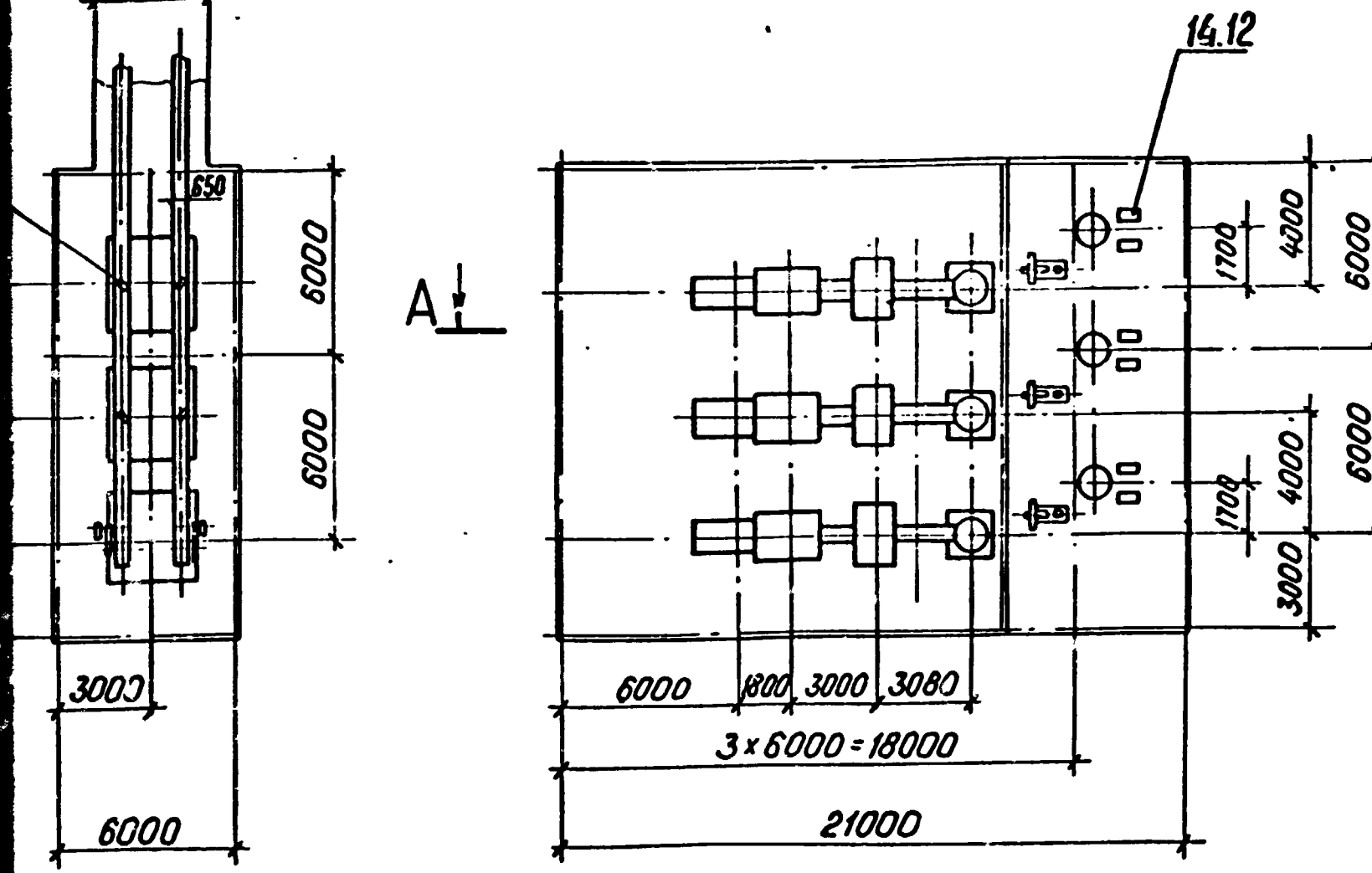
SECTION 2

N AT EL. 13.200

SCALE 1:100

PLAN AT EL. 3.600

SCALE 1:100



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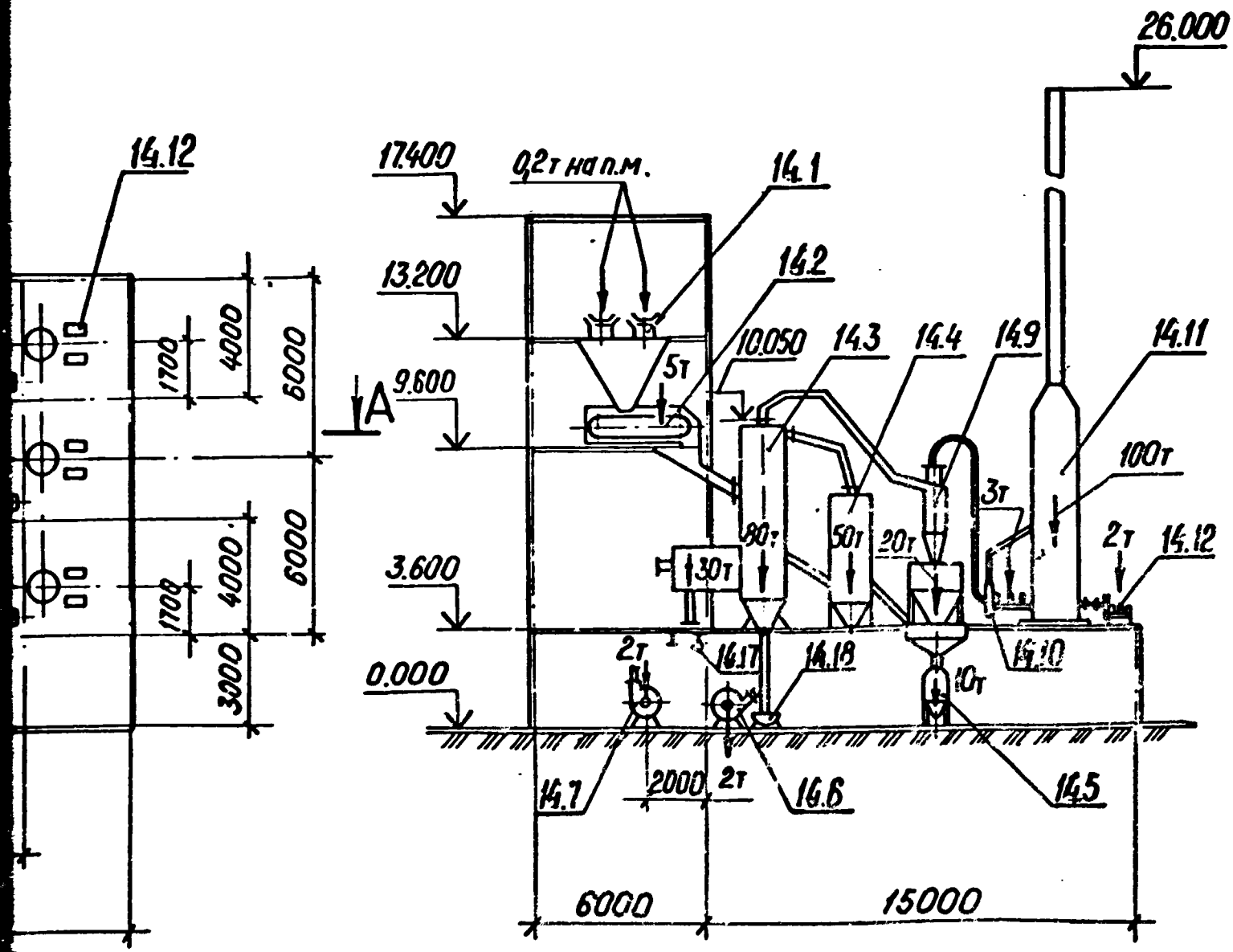
SECTION 3 A-A

SCALE 1:100



SECTION 4

UNIDO CONTRACT No 85/108

1390369-TM

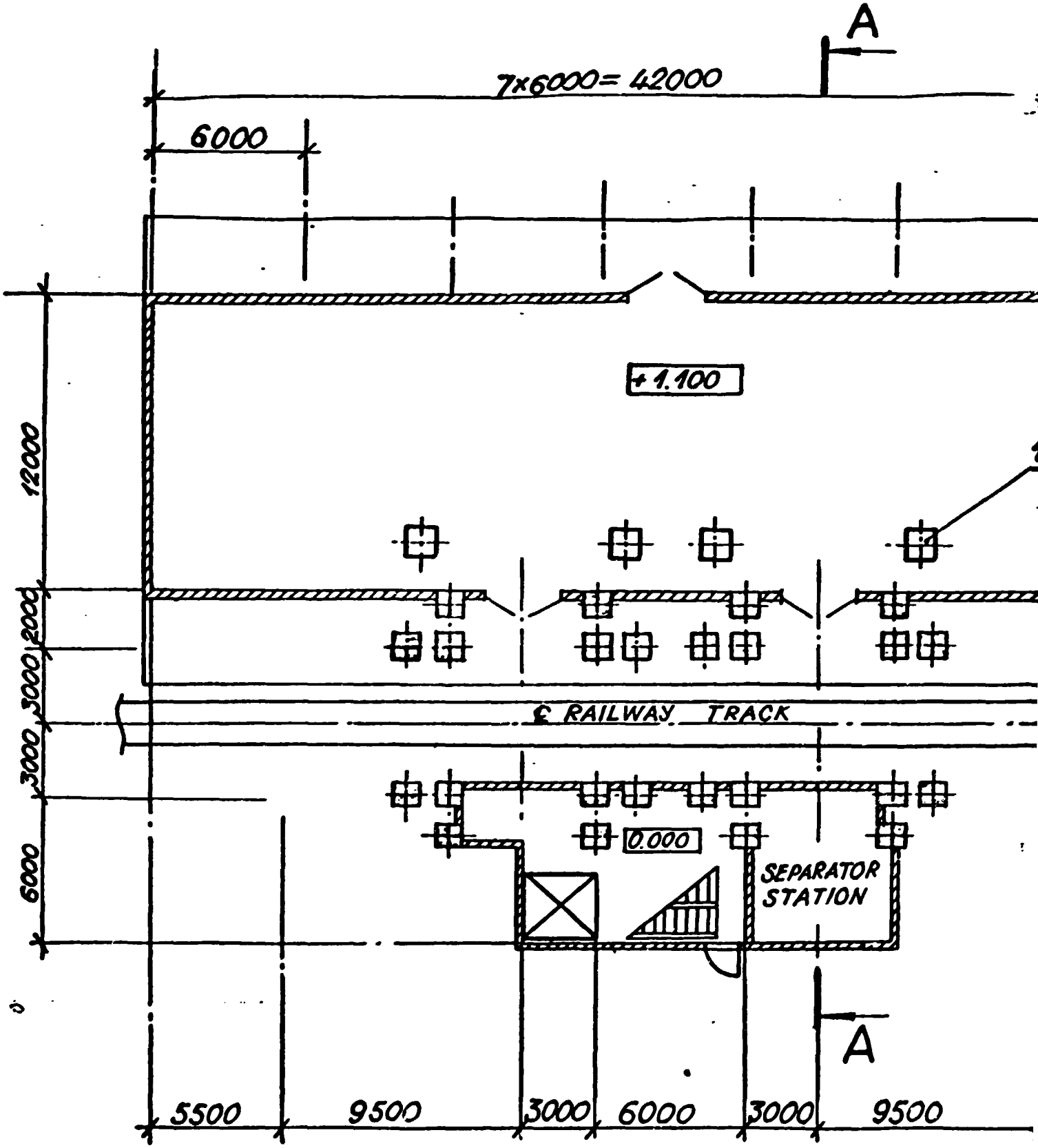
IRAN. ALUNITE BASED ALUMINA PLANT

POLASSIUM SULPHATE DRYING	STAGE	SHEET	SHEETS
	FEASIBILITY		
PLANS AT EL. 0.000, 3.600; 13.200. SECTION A-A.	VAMI LENINGRAD		

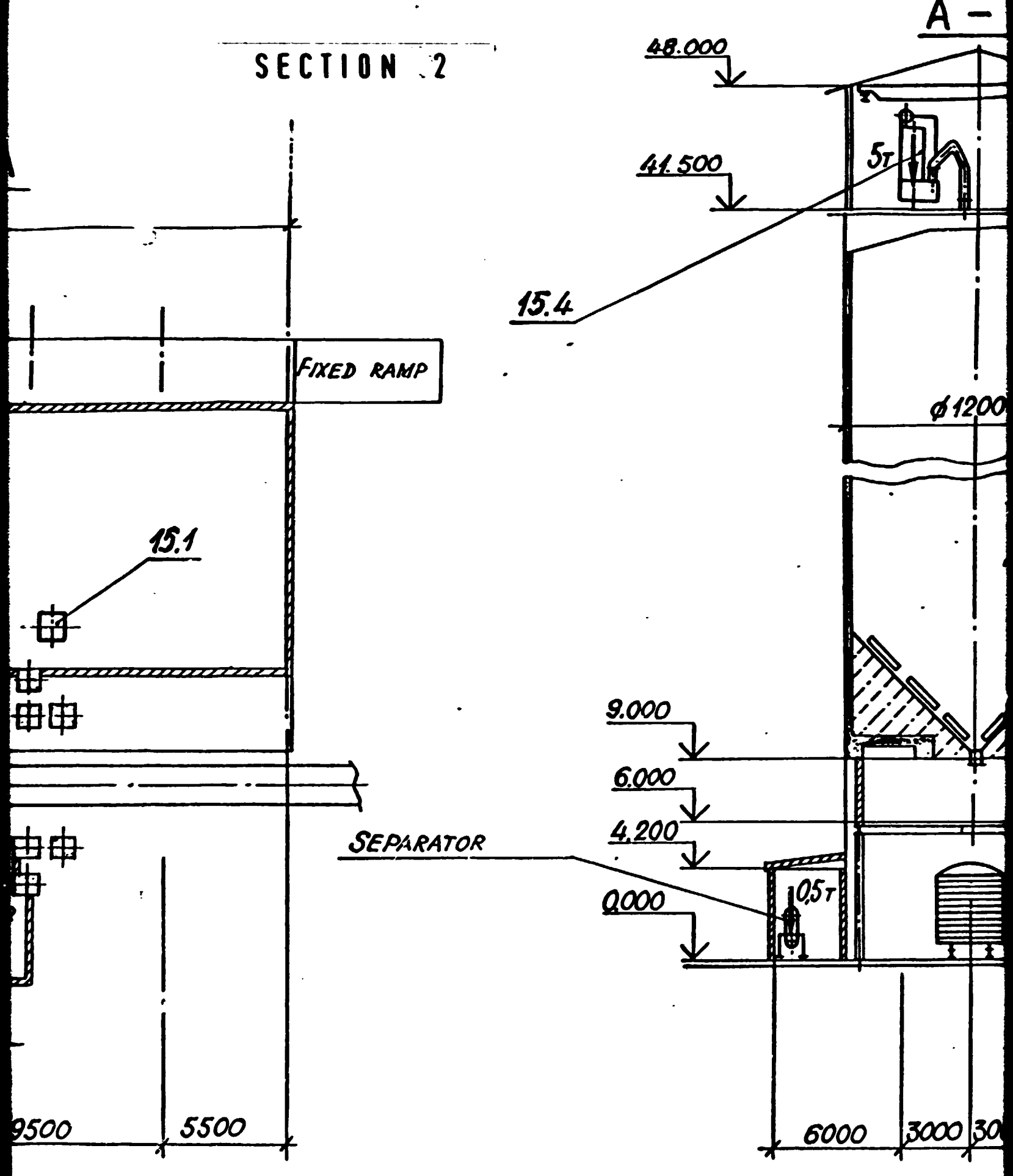
Size A4x4

PLAN AT EL. 0.000
SCALE 1:200

SECTION 1

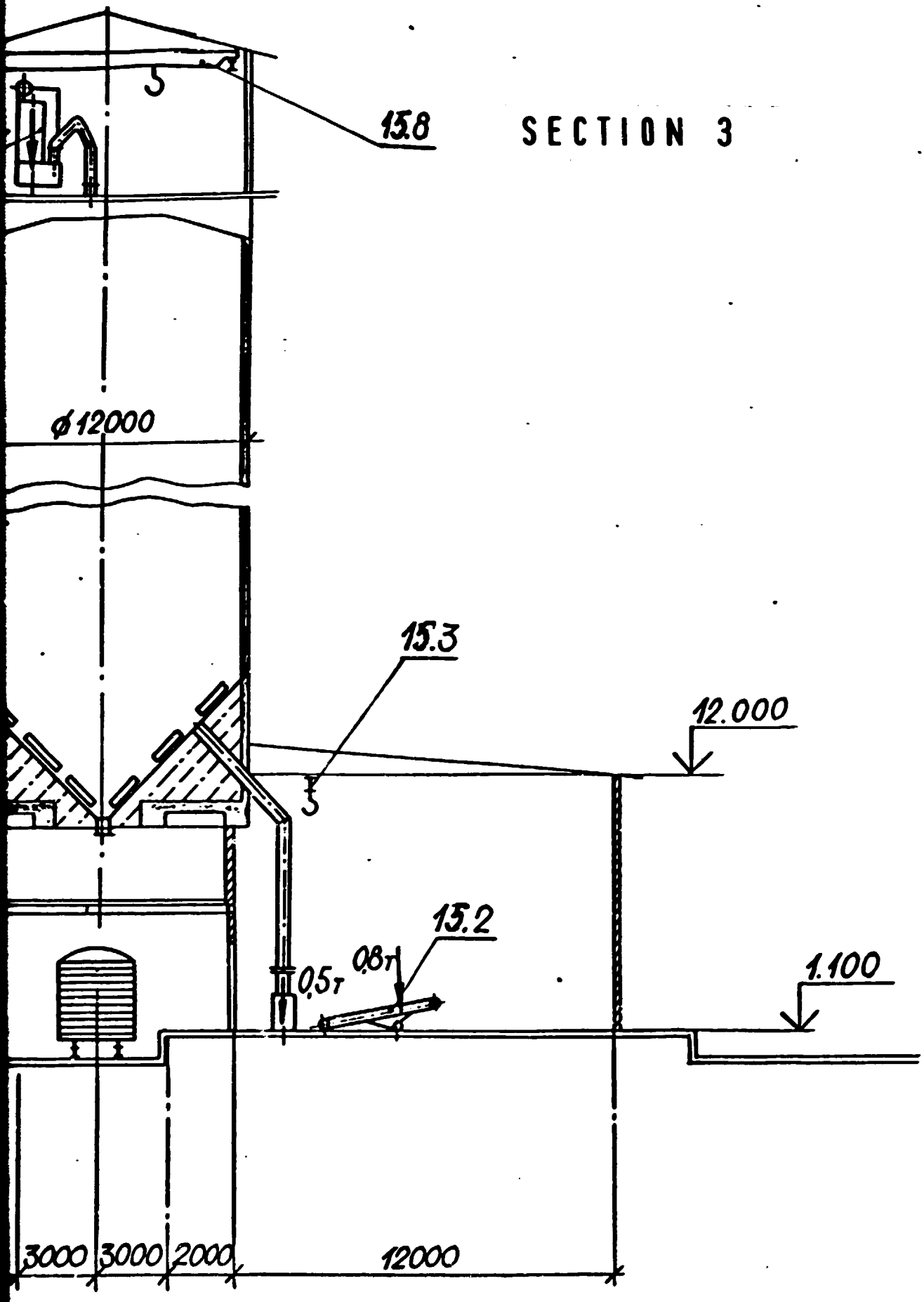


SECTION 2


A –
48.000
41.500
5т
15.4
FIXED RAMP
ϕ1200
15.1
9.000
6.000
4.200
SEPARATOR
0.000
0,5т
9500
5500
6000
3000

A – A SCALE 1:200

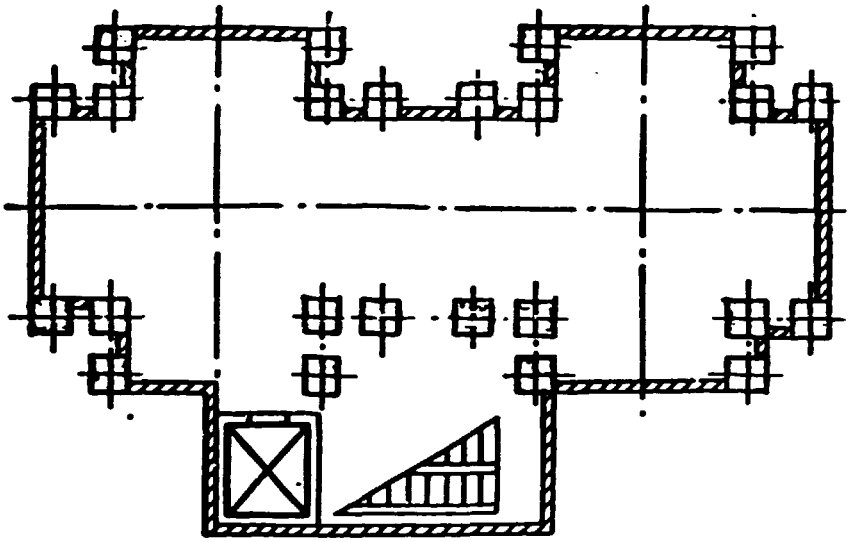
SECTION 3



PLAN AT EL.6.000

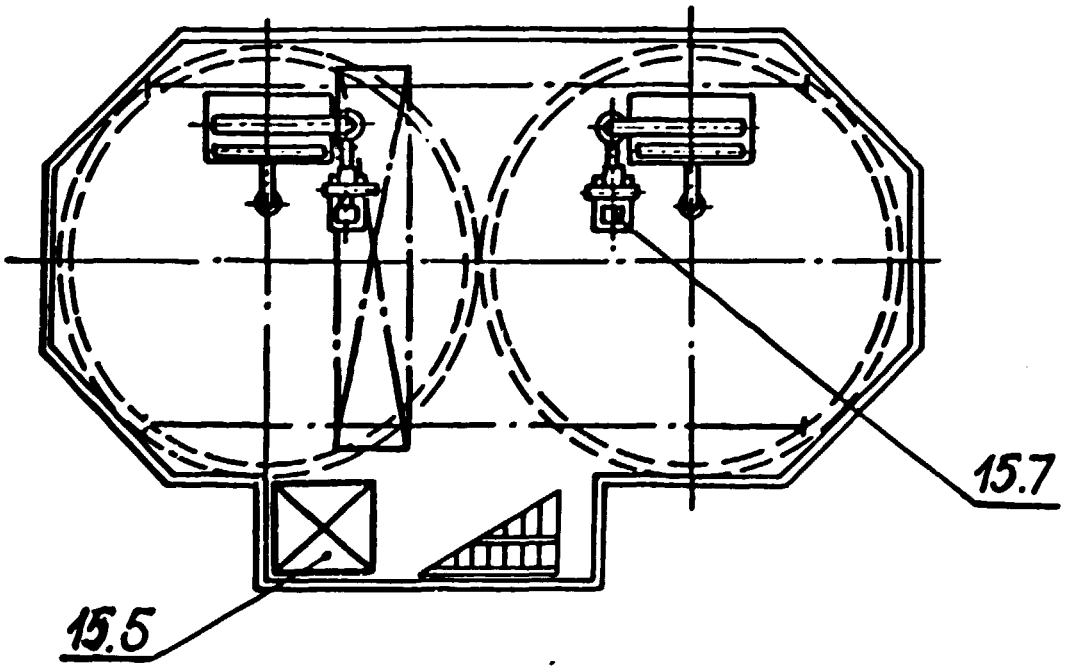
SCALE 1:200

SECTION 4



PLAN AT EL. 41.500

SCALE 1:200



SECTION 5

UNIDO CONTRACT NO 85/108

1390372-TM

IRAN. ALUNITE BASED ALUMINA PLANT

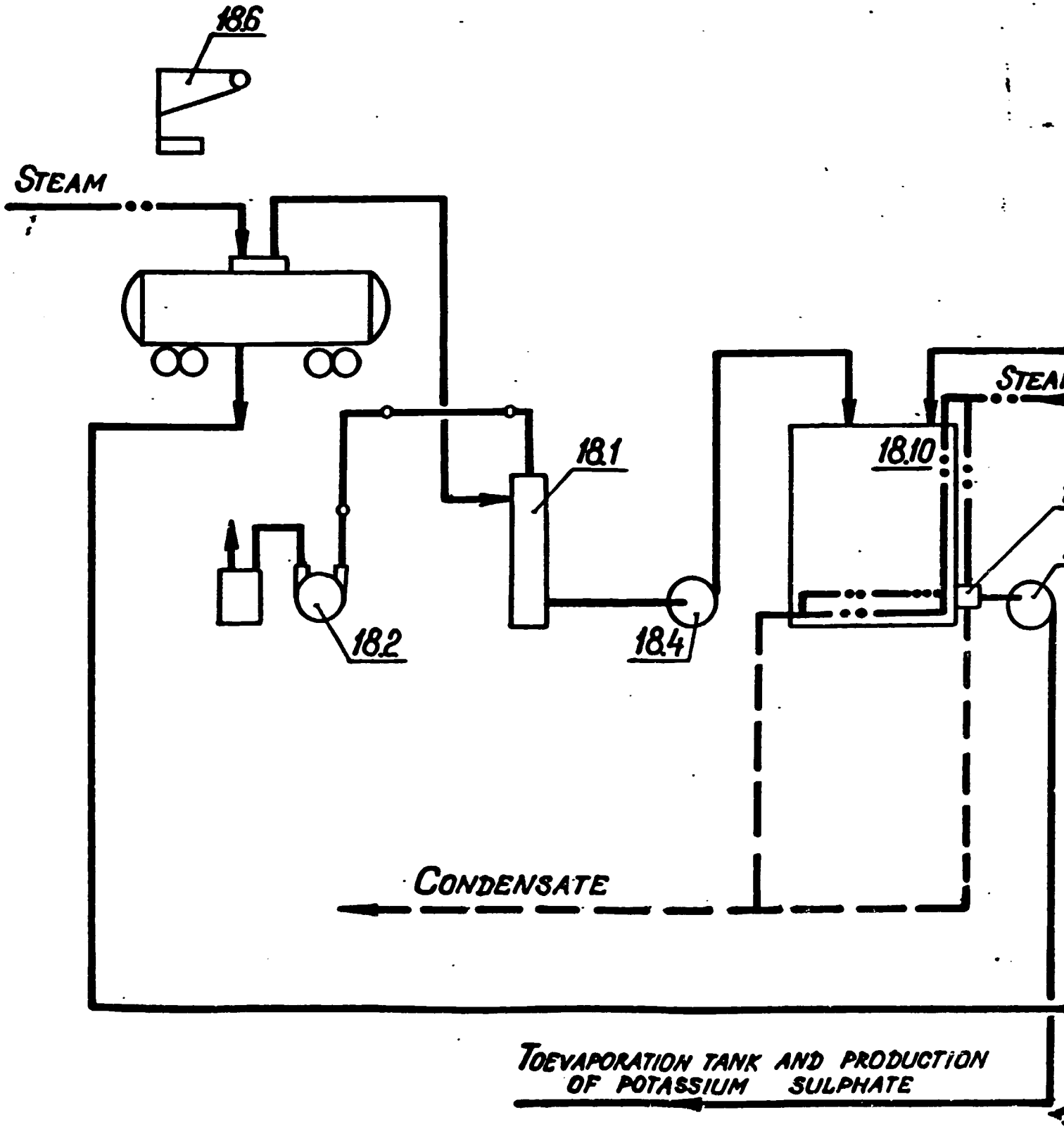
POTASSIUM SULPHATE STORAGE

STAGE	SHEET	SHEETS
FEASIBILITY		1

PLAN AT EL. 0.000; 6.000; 41.500; SECTION A-A

VAMI LENINGRAD

SIZE A4x5

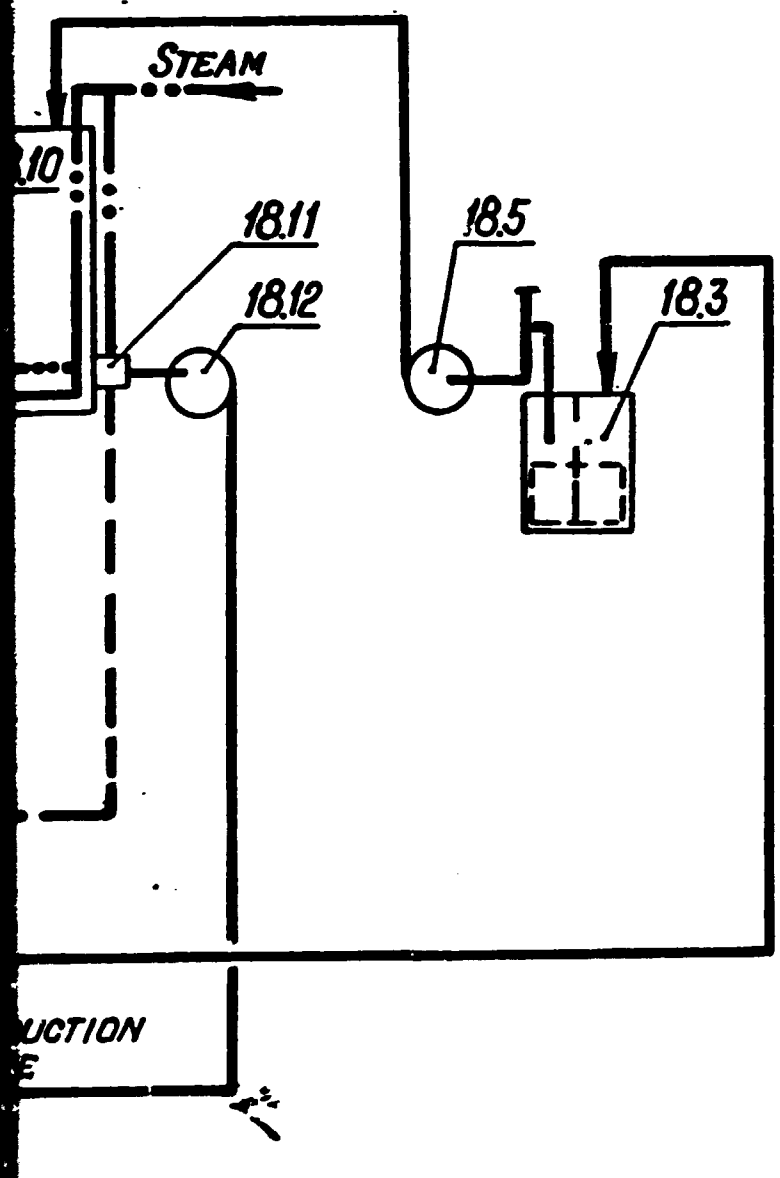

18.6
STEAM
18.1
18.10
18.2
18.4
CONDENSATE
TO EVAPORATION TANK AND PRODUCTION OF POTASSIUM SULPHATE

SECTION 1

SECTION 2

LEGEND

- CAUSTIC
- STEAM
- CONDENSATE
- VACUUM



ITEM
18.1
18.2
18.3
18.4
18.5
18.6
18.7
18.10
18.11
18.12

THIS
COP
TO
CON

ITEM	DESCRIPTION	SPECIFICATION	NUMBER	NOTE
18.1	RECEIVER	Φ500; H=6000	1	
18.2	VACUUM-PUMP	25 M³/MIN	1	
18.3	SUMP MIXER	Φ2000×2500	1	
18.4	CENTRIFUGAL PUMP	315 M³/HR; 16 M	2	
18.5	CENTRIFUGAL PUMP	160 M³/HR; 40M	2	
18.6	ELECTRICAL HOIST	CAPACITY 0,5T	12	
18.7	ELECTRICAL SUSPENDED BRIDGE	CAPACITY 2T	1	
	CRANE			
18.10	TANK	19000; H=12000	2	
18.11	TUBE-JACKET HEAT EXCHANGER	F = 115 M²	2	
18.12	CENTRIFUGAL PUMP	315M³/HR; 40M		

SECTION 3

UNIDO CONTRACT No 85/108

1339555-TM

IRAN. ALUNITE BASED ALUMINA PLANT

CAUSTIC STORE

STAGE	SHEET	SHEETS
FEASIBILITY	1	2

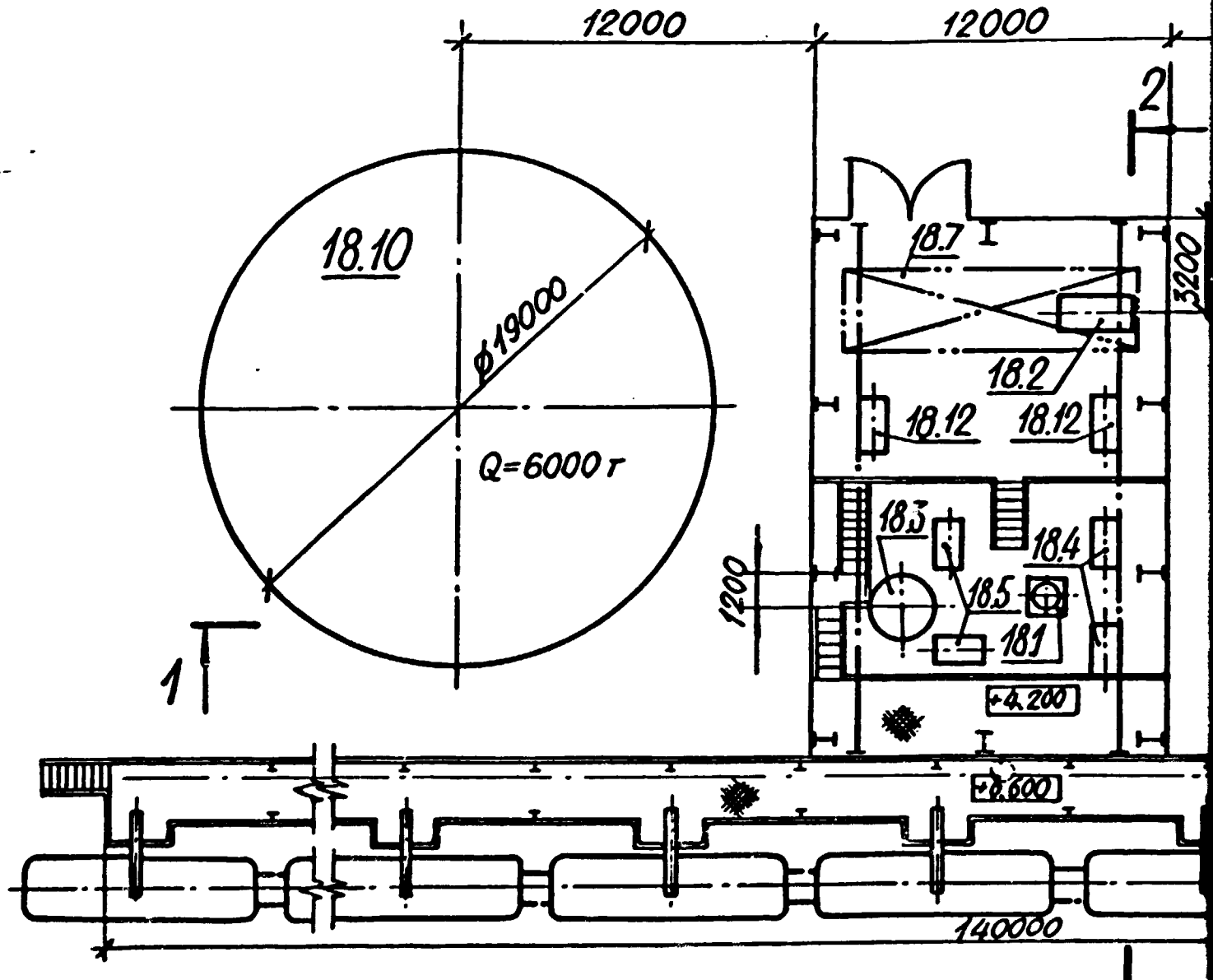
APPARATUS - PROCESS FLOWSHEET

VAMI LENINGRAD

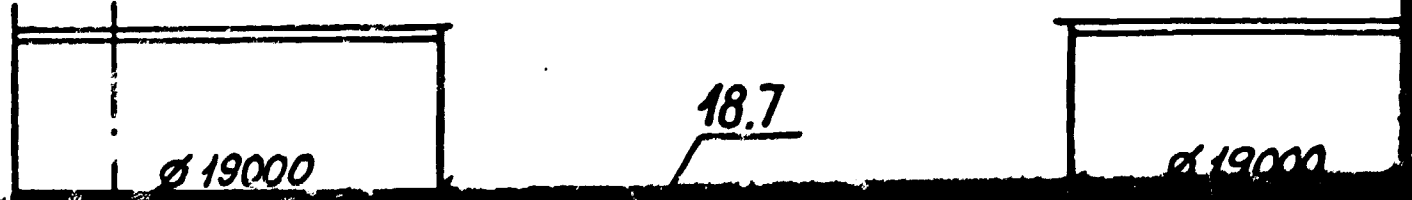
Size A4x3

SECTION 1

PLAN AT EL. 0.000
SCALE 1:200

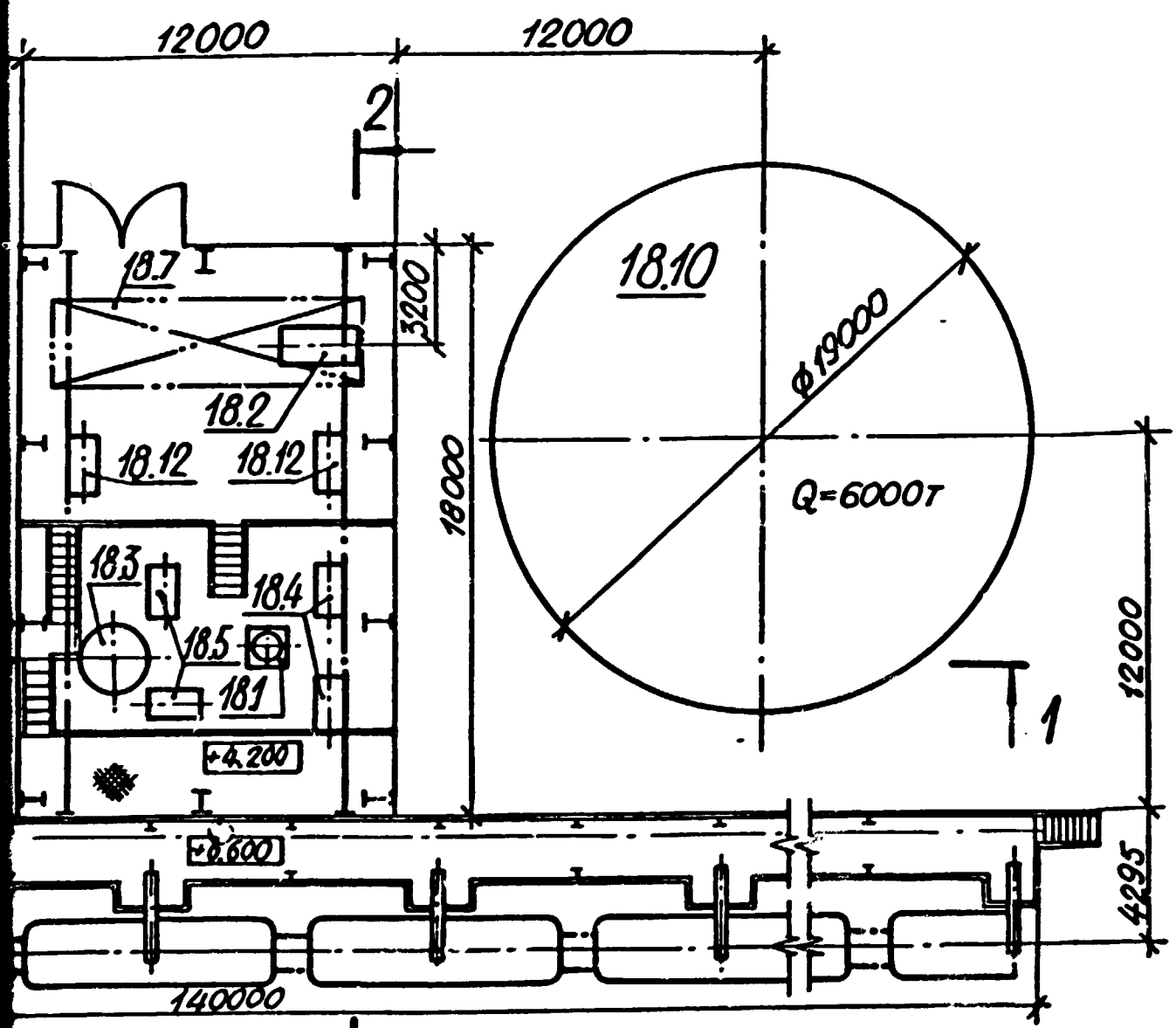


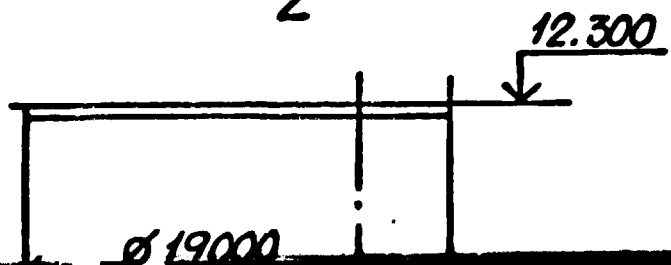
1-1
SCALE 1:200



SECTION 2

PLAN AT EL. 0.000
SCALE 1:200

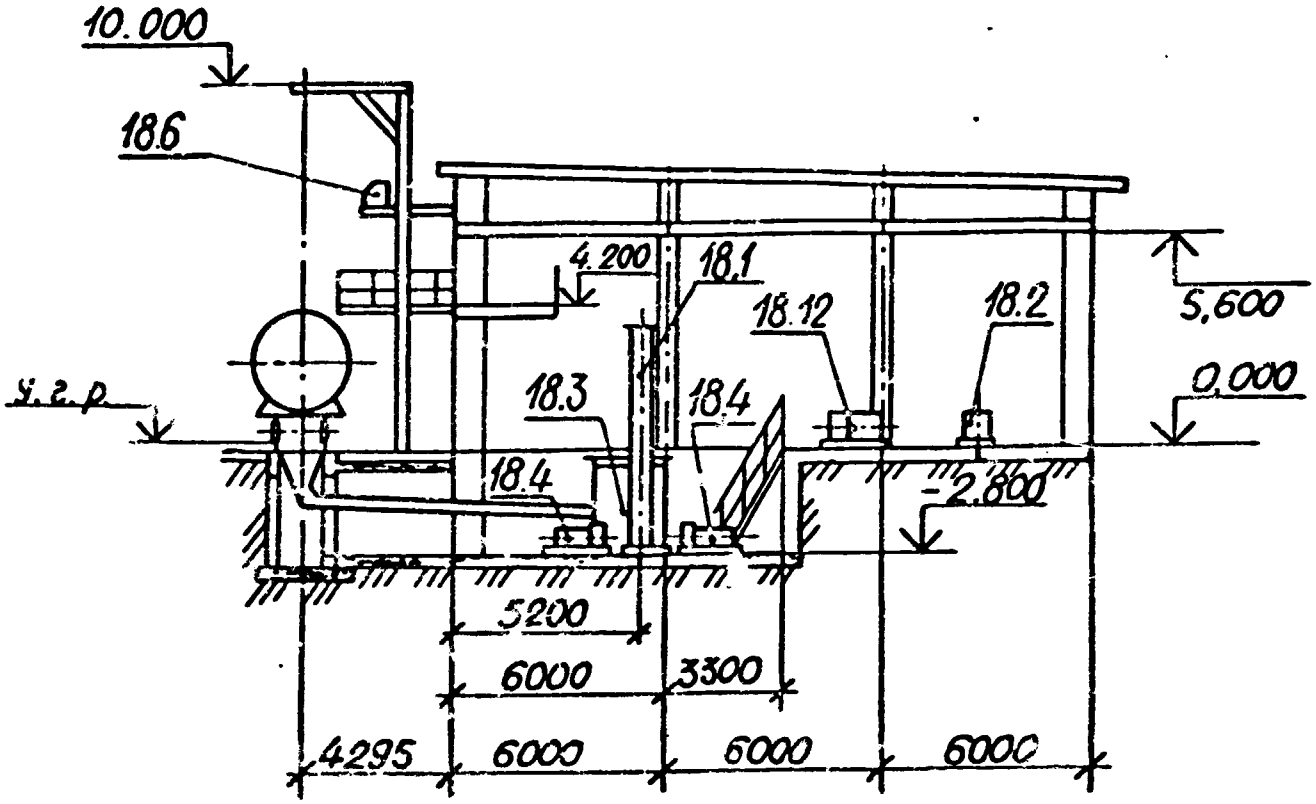


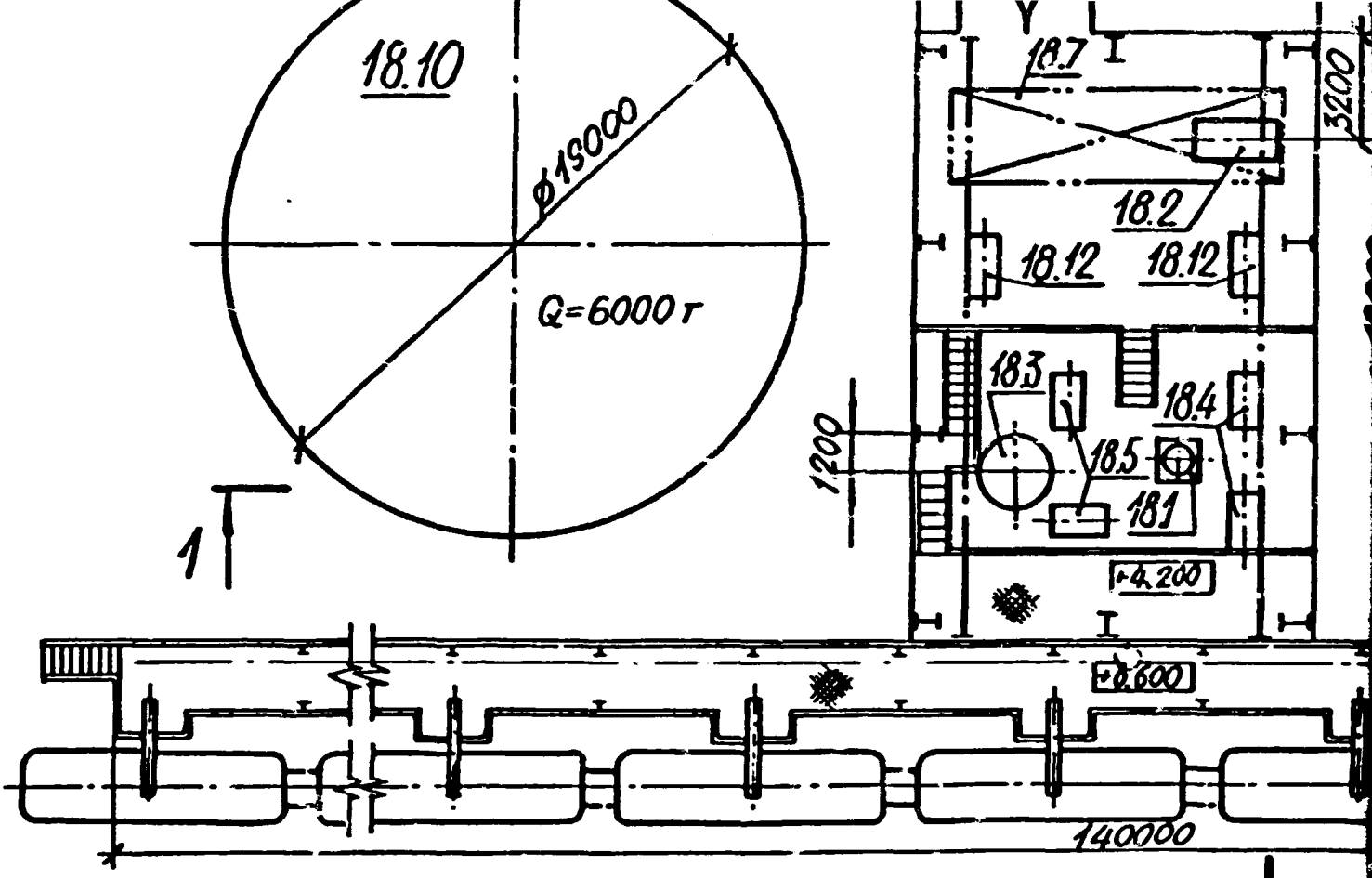


SECTION 3

2-2

SCALE 1:200

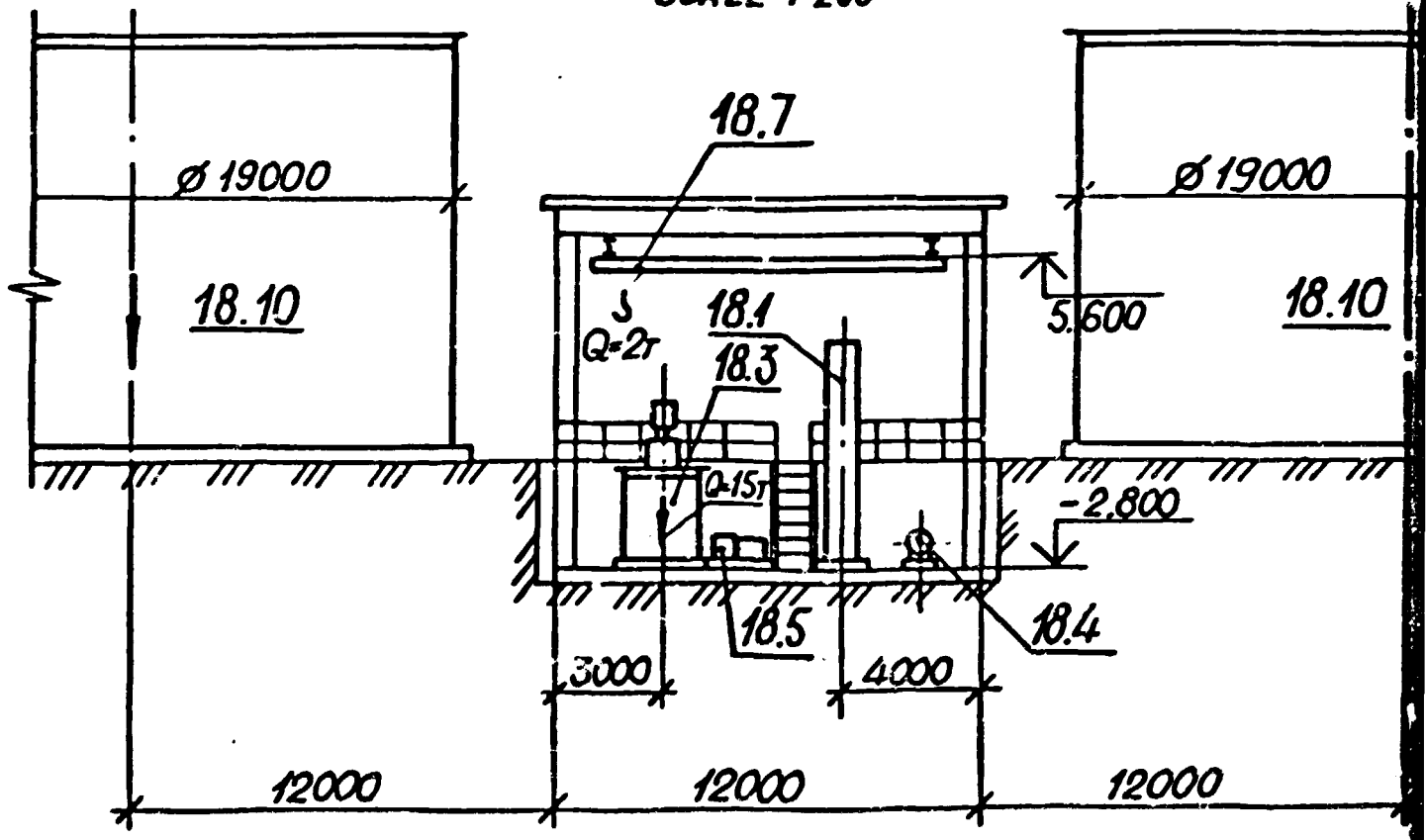


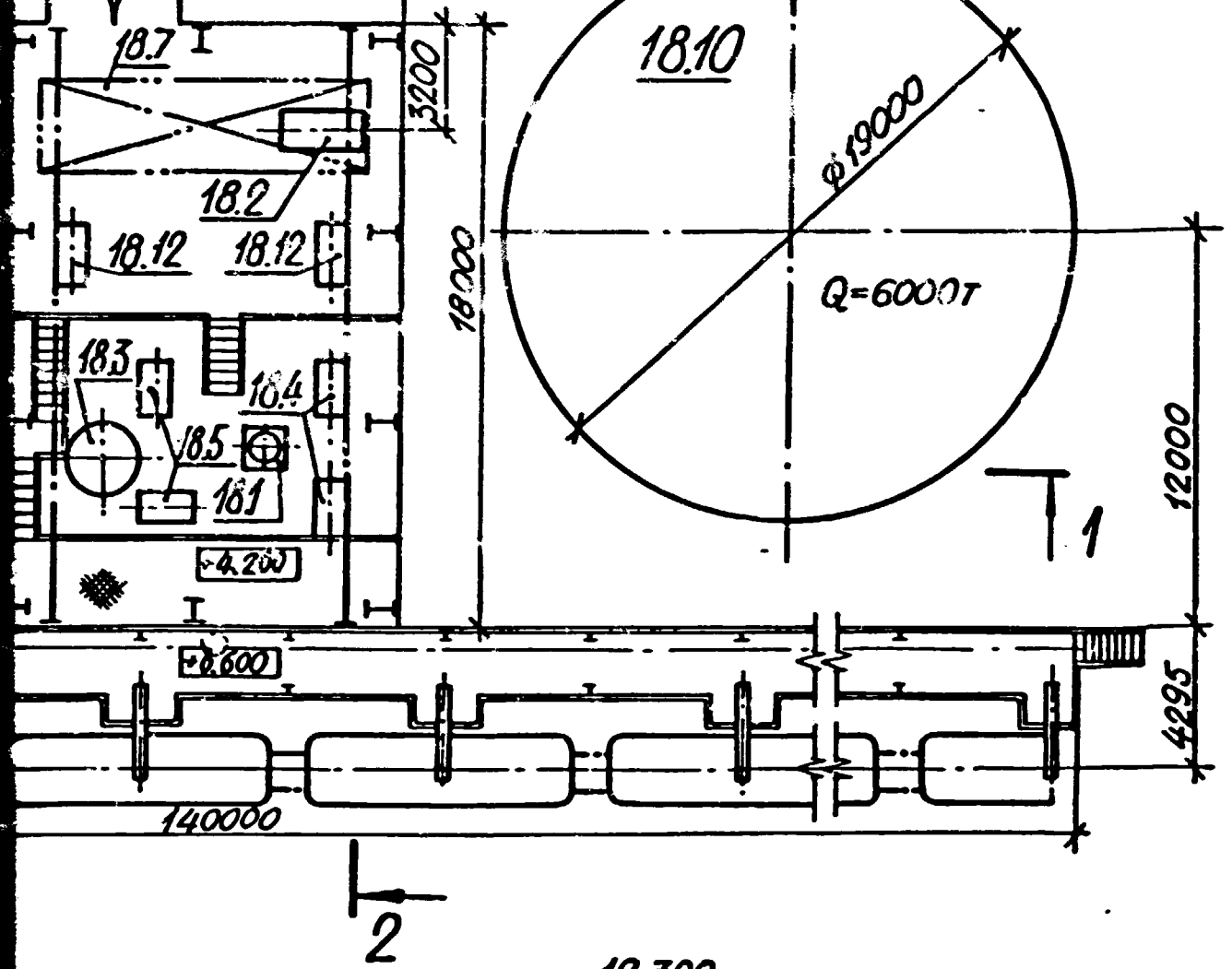


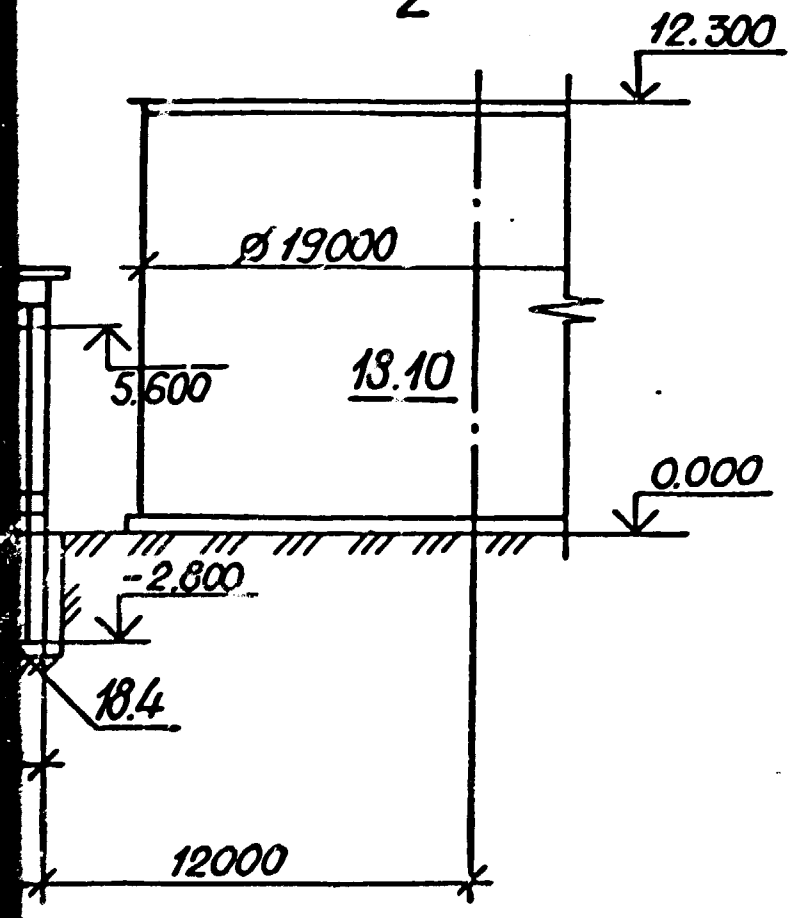
SECTION 4

1-1

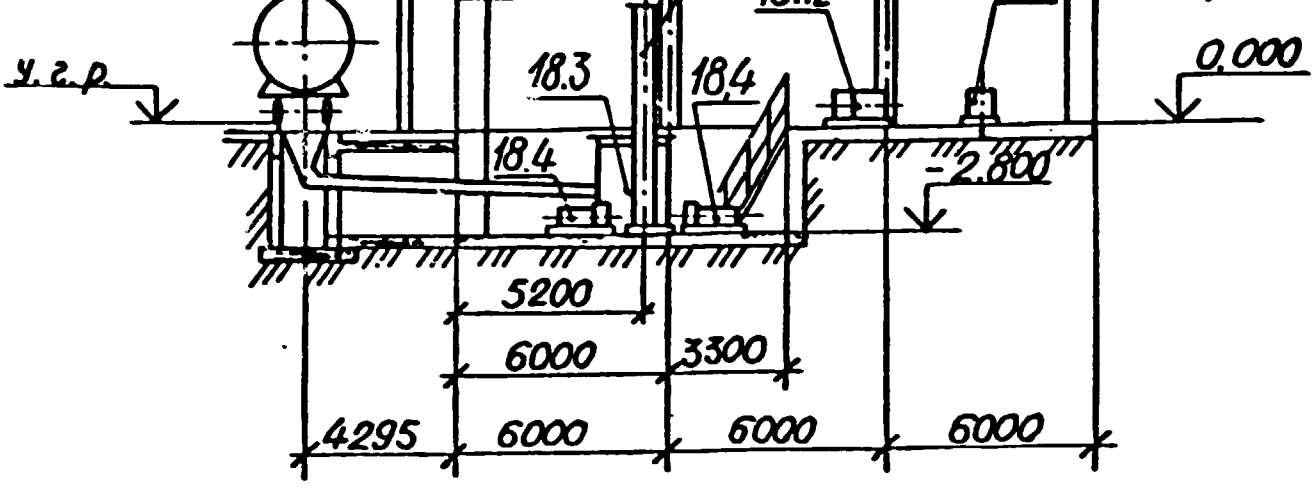
SCALE 1:200




18.7
3200
18.2
18.12
18.12
18.3
18.4
18.5
18.1
-4.200
18.10
ø19000
Q=6000т
18000
12000
1
-8.600
4295
140000
2


12.300
ø19000
5.600
18.10
0.000
-2.800
18.4
12000

SECTION 5

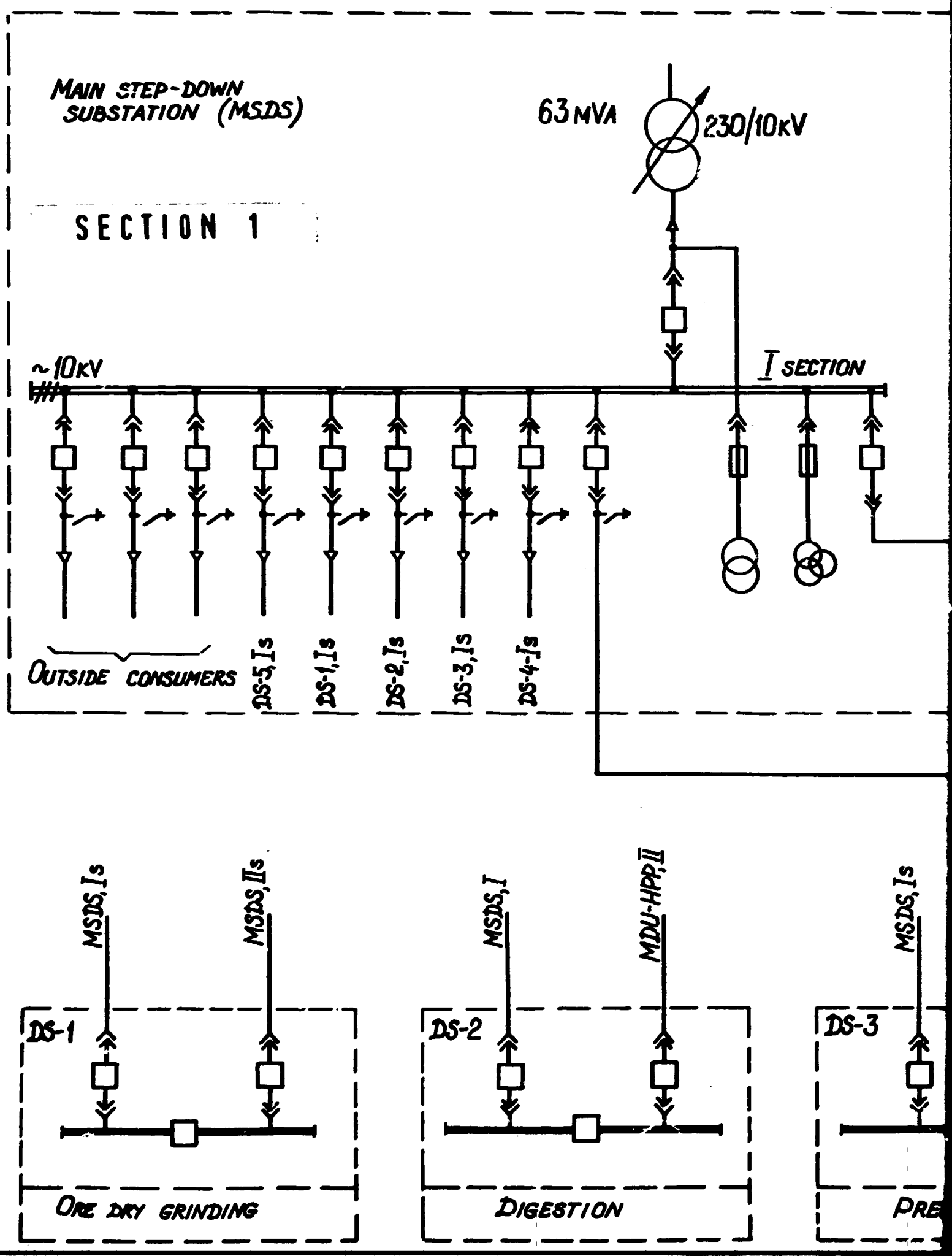


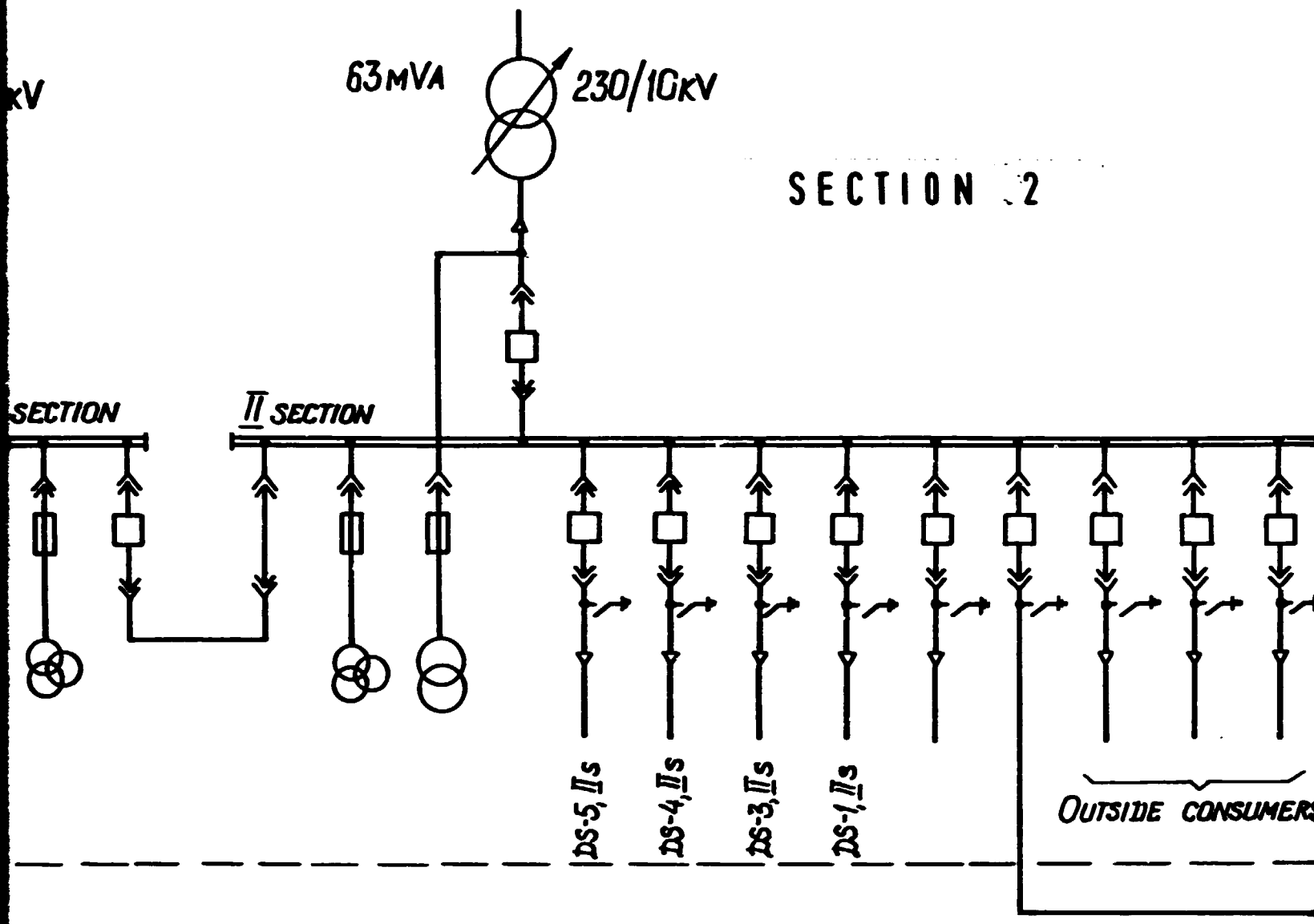
SECTION 6

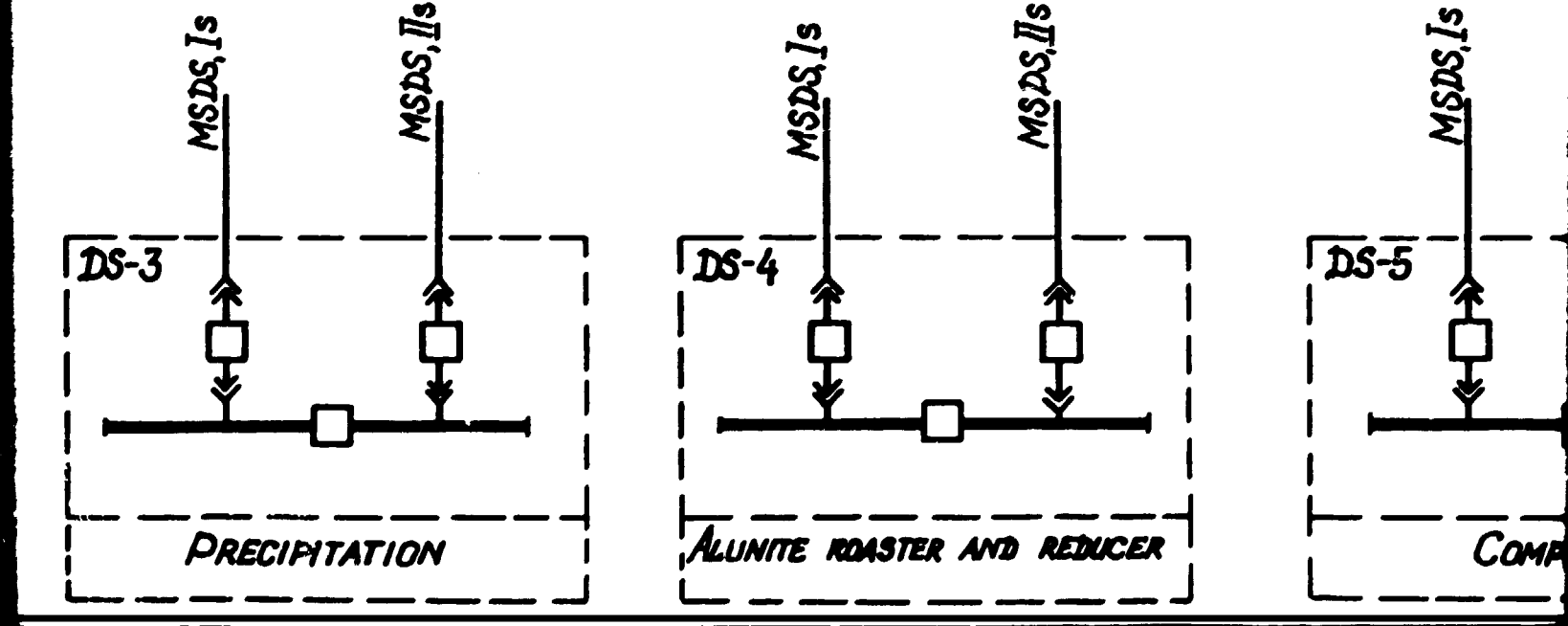
UNIDO CONTRACT NO 85/108

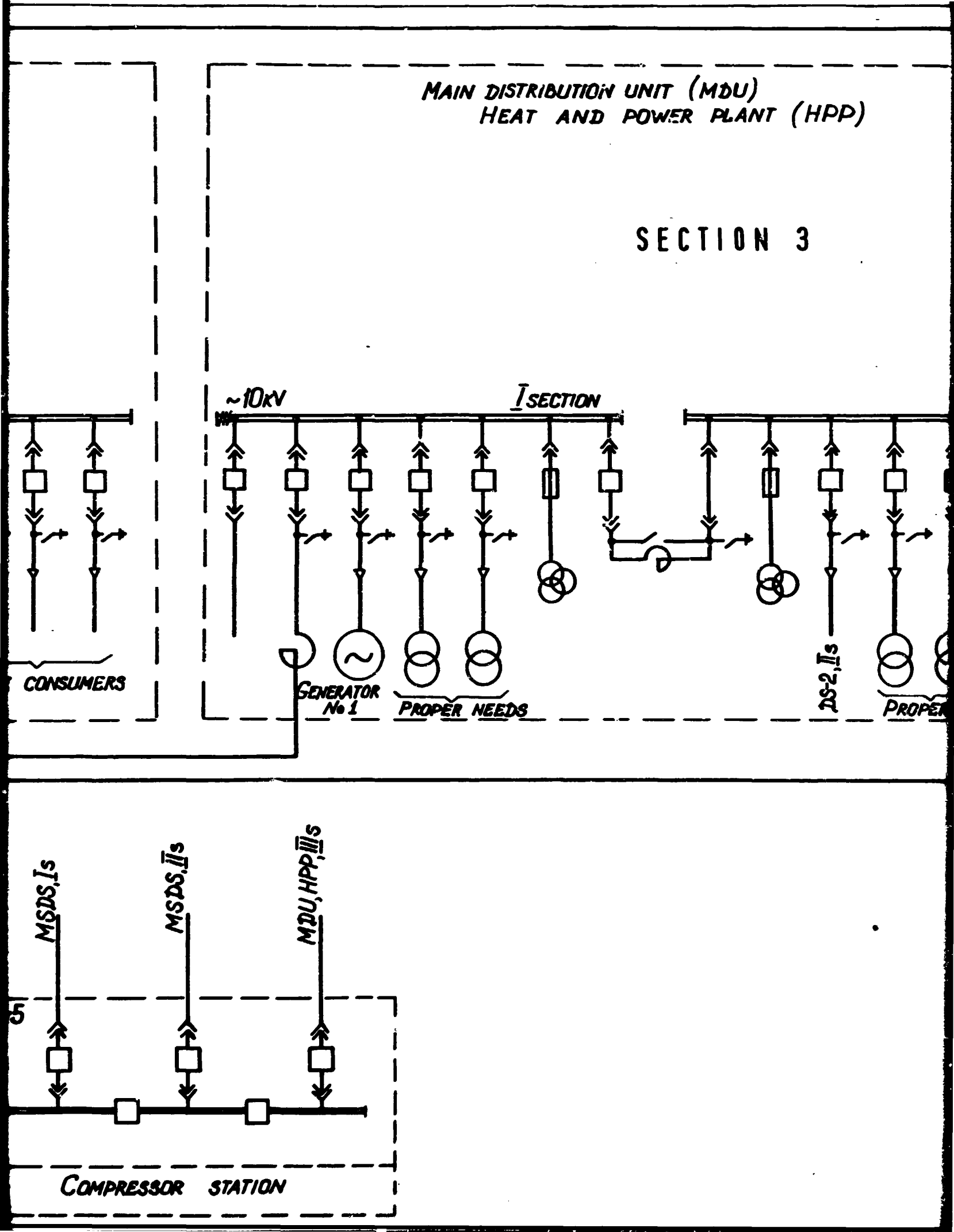
1339555-TM			
IRAN. ALUNITE BASED ALUMINA PLANT			
CAUSTIC STORE	STAGE	SHEET	SHEETS
	FEASIBILITY	2	
PLAN AND SECTION	VAMI LENINGRAD		

SIZE A2

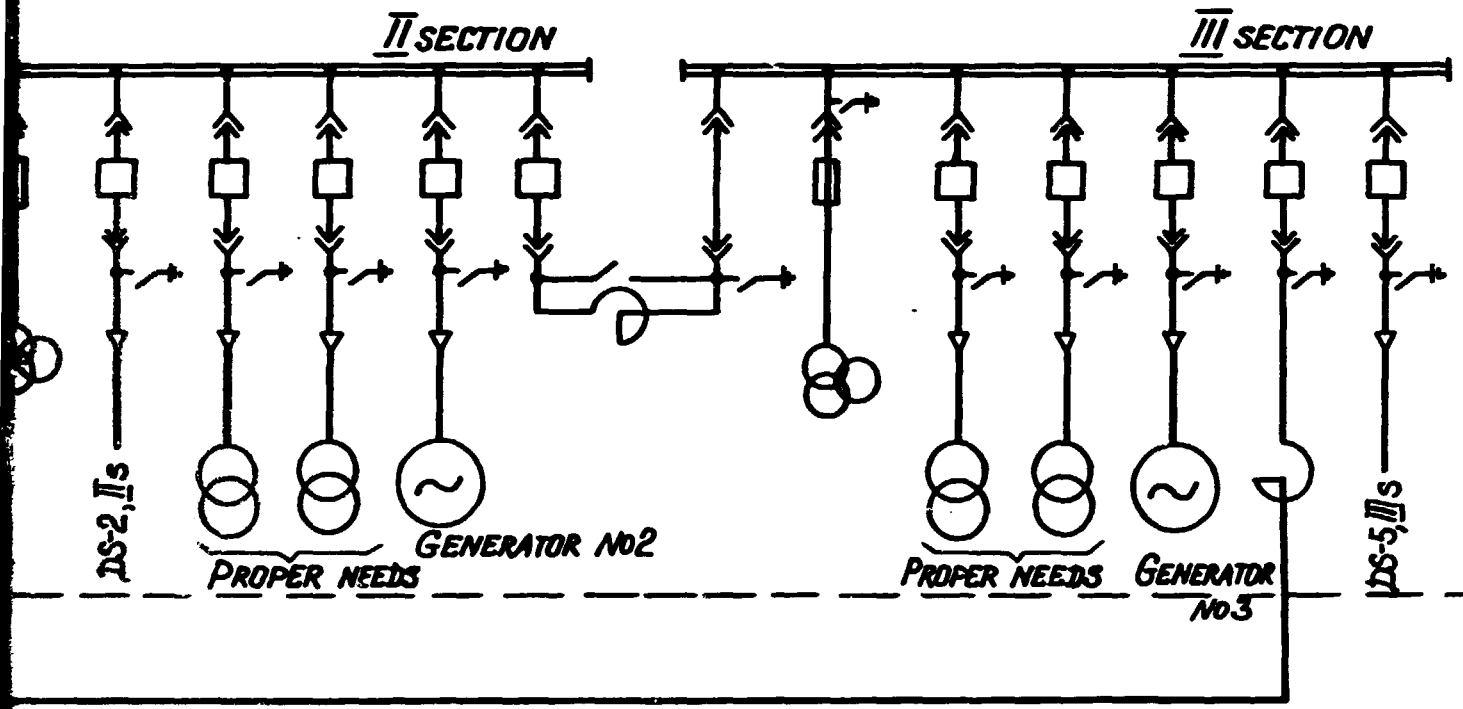

MAIN STEP-DOWN SUBSTATION (MSDS)
63 MVA
230/10 KV
SECTION 1
~10 KV
I SECTION
OUTSIDE CONSUMERS
DS-5, Is
DS-1, Is
DS-2, Is
DS-3, Is
DS-4, Is
MSDS, Is
MSDS, IIs
DS-1
ORE DRY GRINDING
MSDS, I
MDU-HPP, II
DS-2
DIGESTION
MSDS, Is
DS-3
PRE


63 MVA
230/10 KV
SECTION 2
II SECTION
DS-5, IIs
DS-4, IIs
DS-3, IIs
DS-1, IIs
OUTSIDE CONSUMERS


MSDS, Is
MSDS, IIs
DS-3
PRECIPITATION
MSDS, Is
MSDS, IIs
DS-4
ALUNITE ROASTER AND REDUCER
MSDS, Is
DS-5


MAIN DISTRIBUTION UNIT (MDU)
HEAT AND POWER PLANT (HPP)
SECTION 3
~10KV
I SECTION
CONSUMERS
GENERATOR No 1
PROPER NEEDS
DS-2, II s
PROPER
MSDS, I s
MSDS, II s
MDU, HPP, III s
5
COMPRESSOR STATION

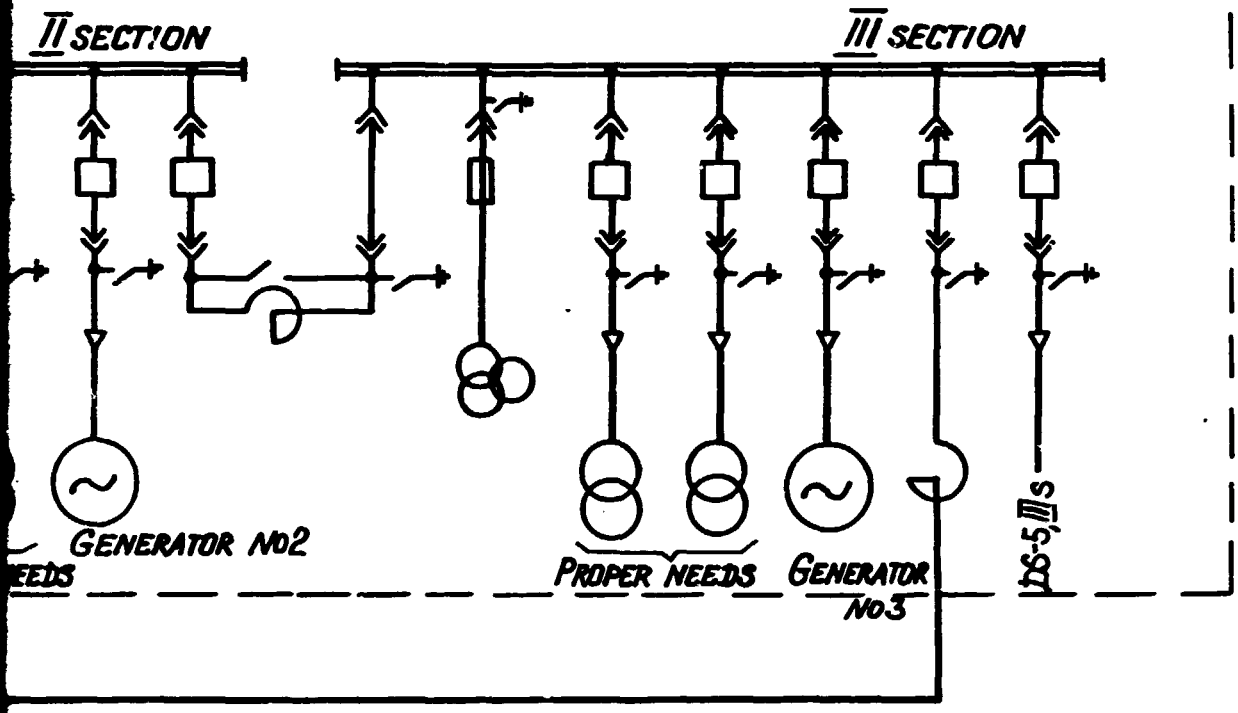
(HPP)



SECTION 4

UNIDO CONTRACT No 85/1

1247955-3	
IRAN. ALUNITE BASED ALUM	
MAIN STEP-DOWN SUBSTATION. HEAT AND POWER PLANT	STAGE FEASIBILITY
POWER SUPPLY DIAGRAM	



SECTION 5

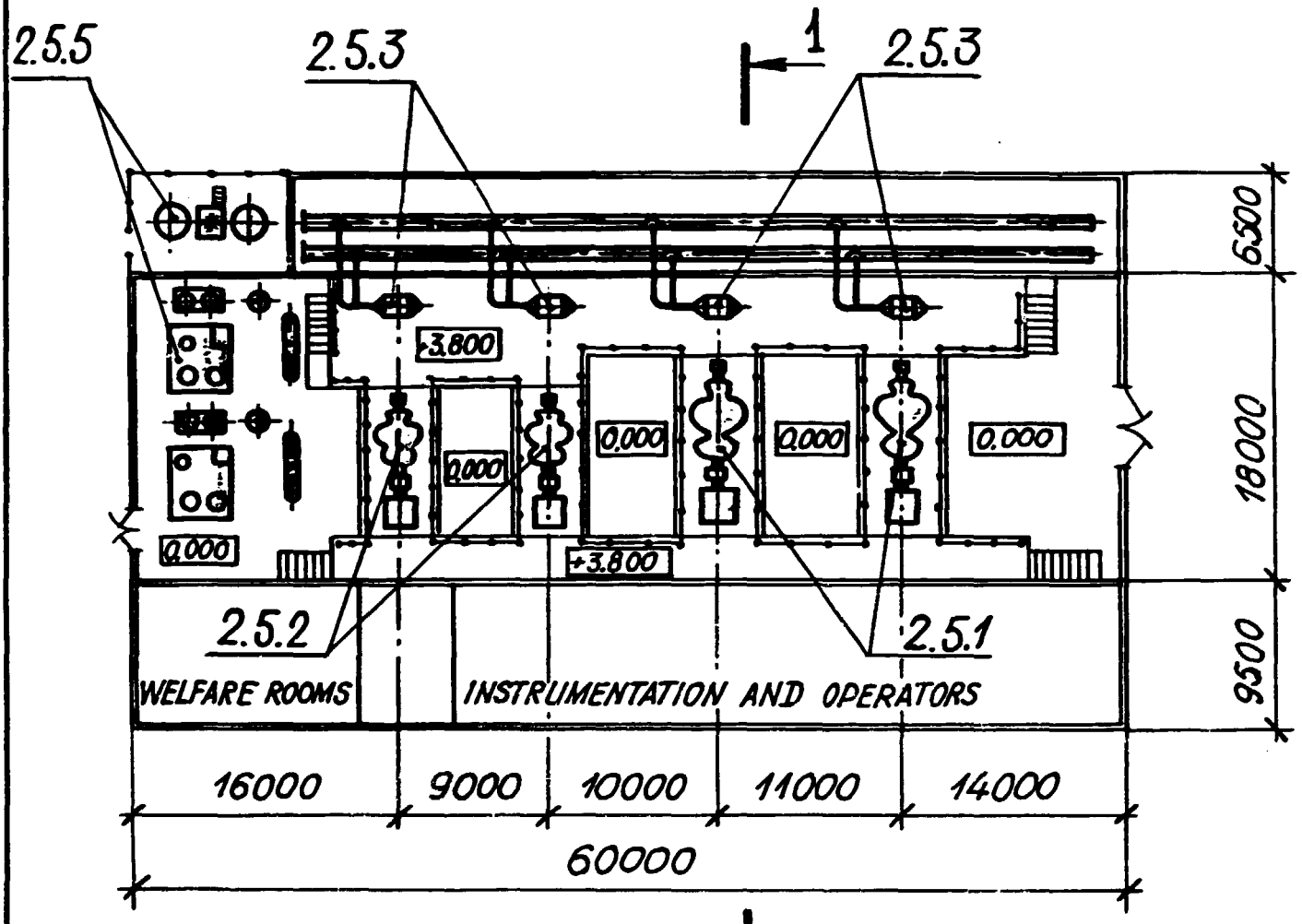
UNIDO CONTRACT No 85/108

1247955-3П

IRAN. ALUNITE BASED ALUMINA PLANT

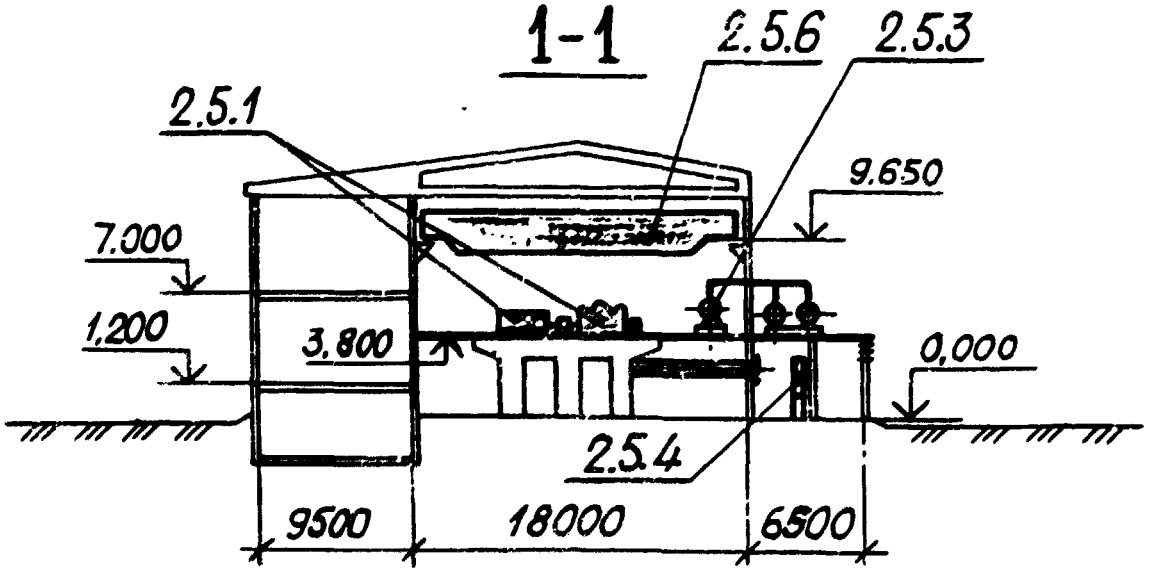
MAIN STEP-DOWN SUBSTATION. HEAT AND POWER PLANT	STAGE	SHEET	SHEETS
	FEASIBILITY		1
POWER SUPPLY DIAGRAM	VAMI LENINGRAD		

SECTION 1



1

1-1



ITEM NO	DESCRIPTION	TECHNICAL CHARACTERISTICS	Q-TY	REMARKS
2.5.1	COMPRESSOR K500-61-5	Q = 508 M^3/MIN P = 0,9 MPA N = 3150 KW	2	
2.5.2	COMPRESSOR K250-61-5	Q = 244 M^3/MIN P = 0,9 MPA N = 1600 KW	2	
2.5.3	AIR COOLER BOK-79,2	F = 79,2 M^2	4	
2.5.4	ROLL FILTER ФР-5	Q = 40000 M^3/H	4	
2.5.5	AIR DRIER A 1000У-02	Q = 50 M^3/MIN	2	
2.5.6	TRAVELLING ELECTRIC CRANE	LOAD CAPACITY 16/3,5 T	1	

6500
18000
9500

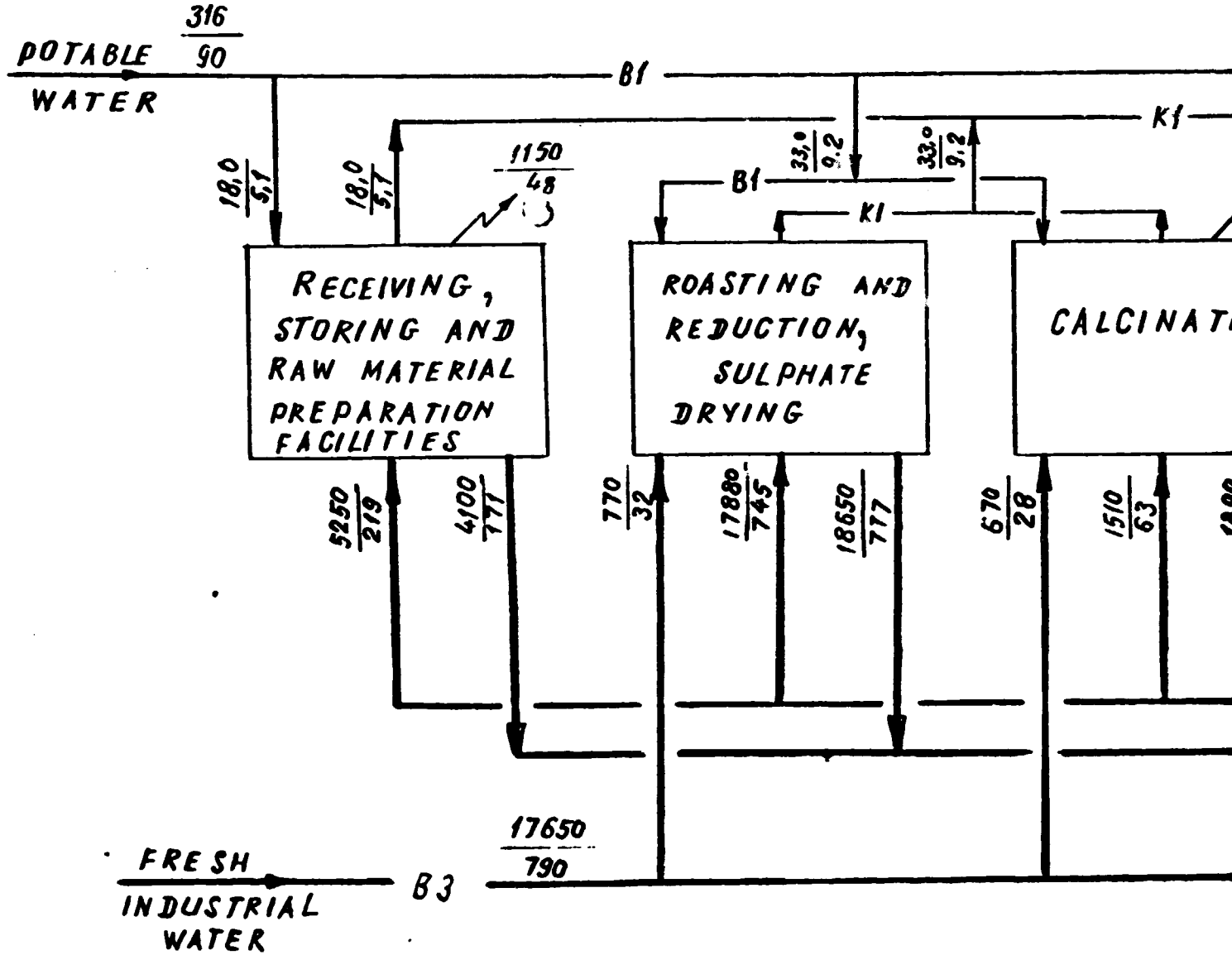
SECTION 2

UNIDO CONTRACT NO 85/108

1236755-TM

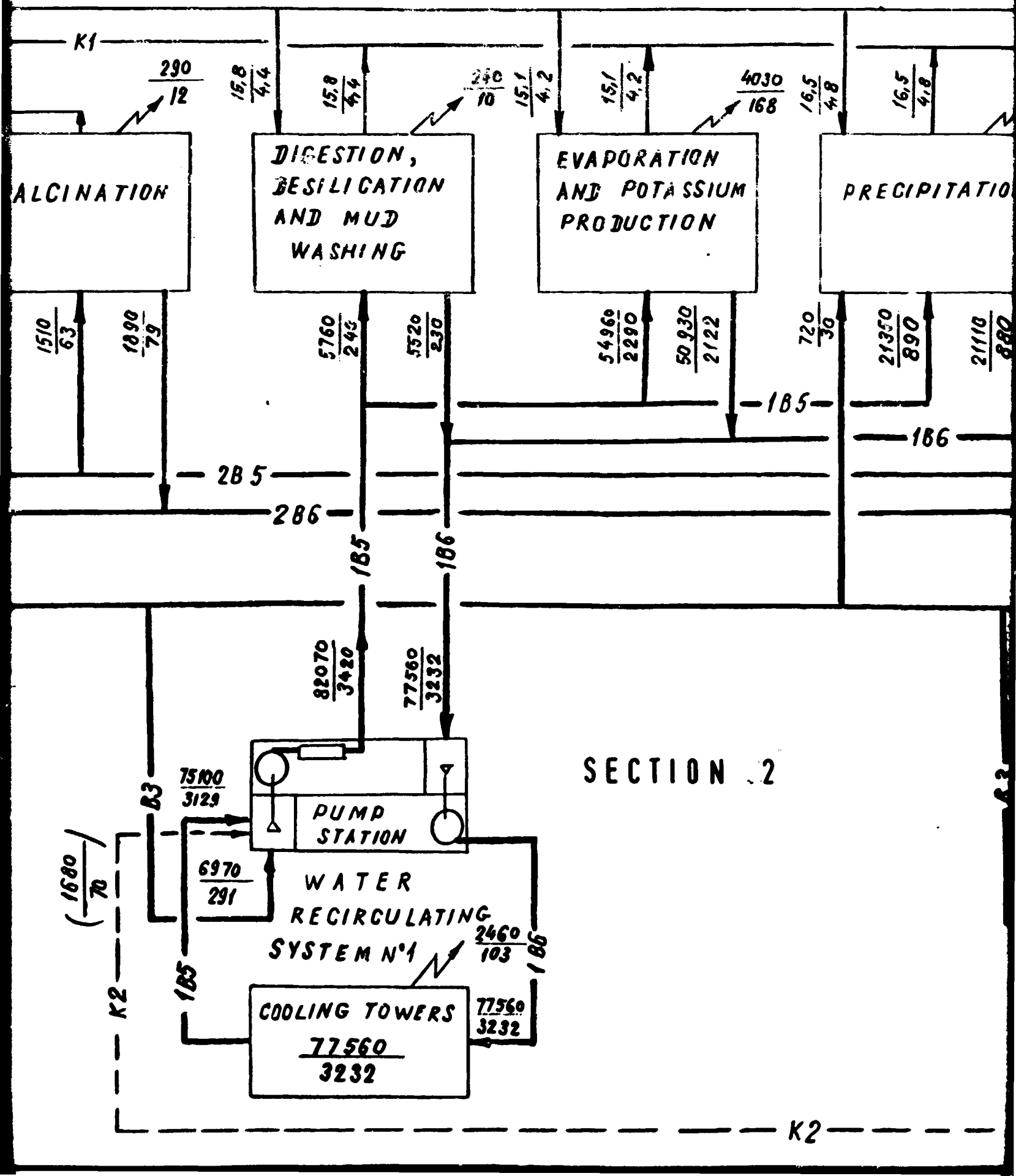
IRAN. ALUNITE BASED ALUMINA PLANT

AIR COMPRESSOR STATION.	STAGE	SHEET	SHEETS
	FEASIBILITY		1
PLAN. SECTION.	VAMI LENINGRAD		


316
90
POTABLE WATER
B1
K1
18,0
5,1
18,0
5,1
1150
48
33,0
9,2
33,0
9,2
B1
K1
RECEIVING, STORING AND RAW MATERIAL PREPARATION FACILITIES
ROASTING AND REDUCTION, SULPHATE DRYING
CALCINAT
5250
219
4100
777
770
32
17880
745
18650
777
670
28
1510
63
17650
790
FRESH INDUSTRIAL WATER
B3
1680
70
K2

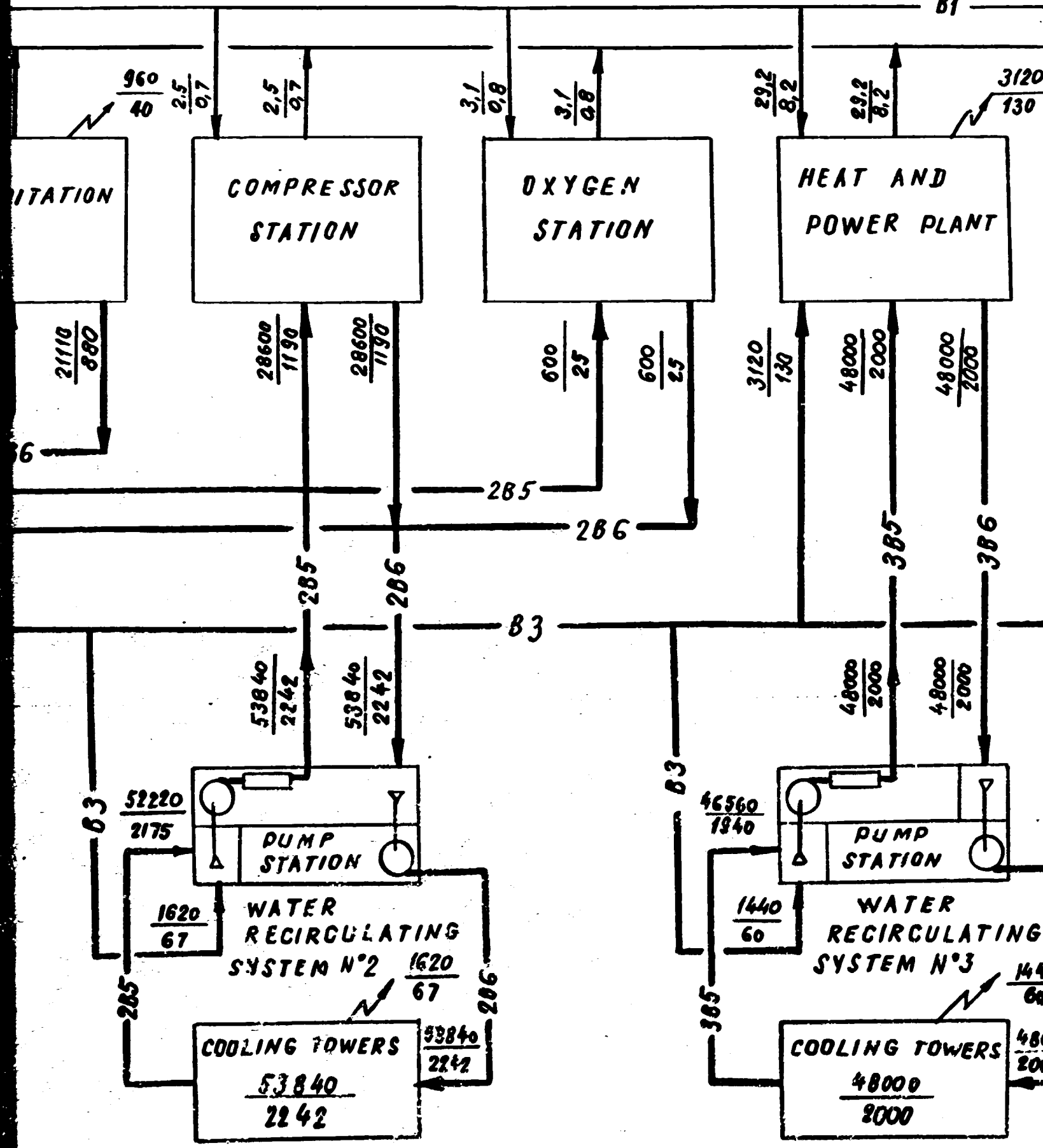
SECTION 1

WATER INPUT AND O

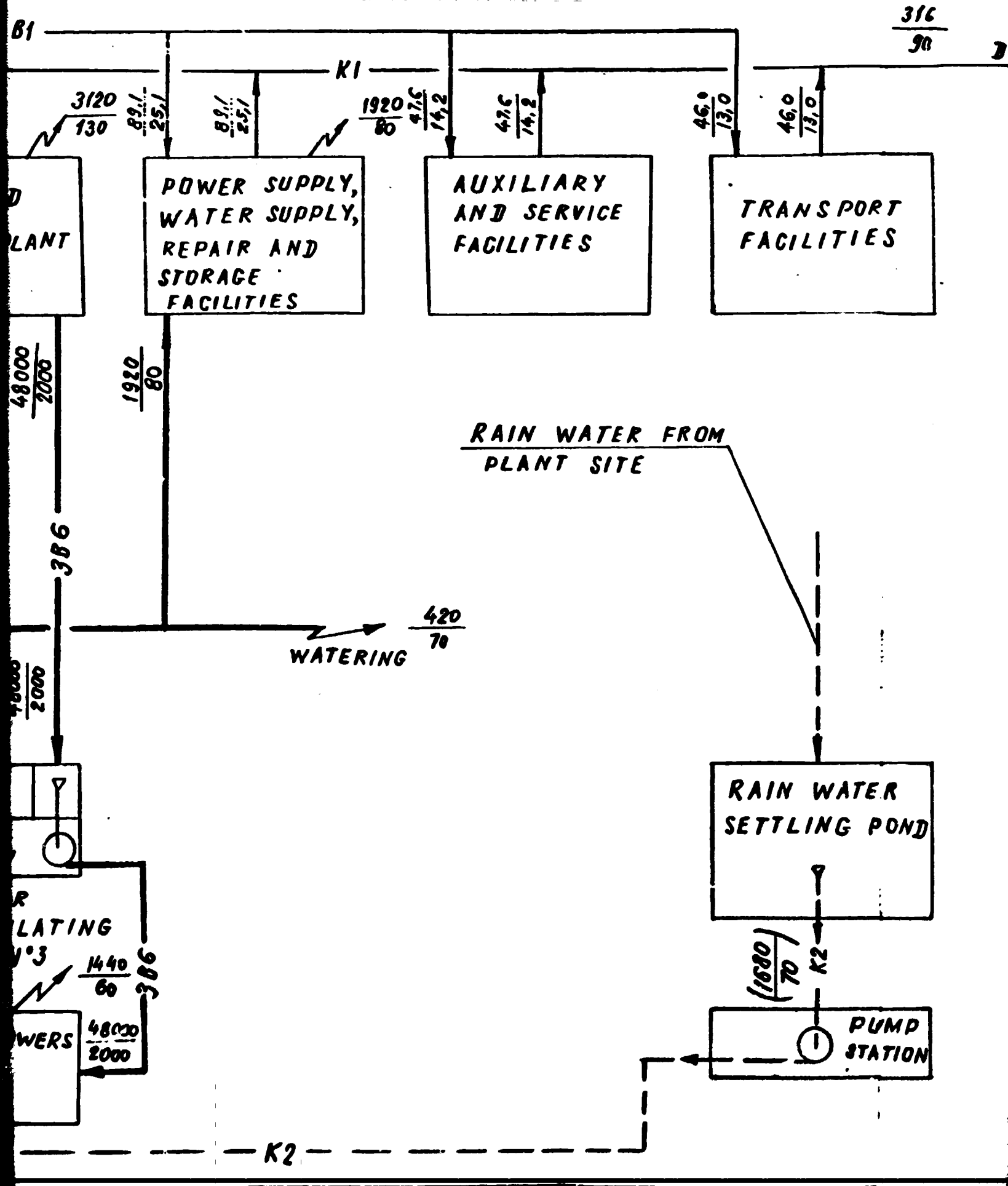


D OUTPUT BALANCE SHEET

SECTION 3



SECTION 4


B1
K1
316/90
3120/130
89,1/25,1
89,1/25,1
1920/80
47,5/14,2
47,5/14,2
46,0/13,0
46,0/13,0
POWER SUPPLY, WATER SUPPLY, REPAIR AND STORAGE FACILITIES
AUXILIARY AND SERVICE FACILITIES
TRANSPORT FACILITIES
48000/2000
1920/80
386
RAIN WATER FROM PLANT SITE
420/70
WATERING
RAIN WATER SETTLING POND
1440/60
386
(1080)/70
K2
PUMP STATION
K2

316
90

DOMESTIC SEWERS

SECTION 5

LEGEND

—B1—	DOMESTIC AND FIRE FIGHTING PIPELINE
—B3—	INDUSTRIAL CLEAN WATER PIPELINE
—1B5—	COOLED (ALCALINE) WATER PIPELINE OF WA RECIRCULATING SYSTEM N°1
—1B6—	HOT (ALCALINE) WATER PIPELINE OF WATER RECIRCULATING SYSTEM N°1
—2B5—	COOLED (CLEAN) WATER PIPELINE OF WATE RECIRCULATING SYSTEM N°2
—2B6—	HOT (CLEAN) WATER PIPELINE OF WATER RECIRCULATING SYSTEM N°2
—3B5—	COOLED (CLEAN) WATER PIPELINE OF WATE RECIRCULATING SYSTEM N°3 (FOR HPP)
—3B6—	HOT (CLEAN) WATER PIPELINE OF WATER RECIRCULATING SYSTEM N°3 (FOR HPP)
—K1—	DOMESTIC SEWERAGE
	WATER LOSSES
	PUMP
	MUD FILTER
--K2--	TREATED RAIN WATER

REMARK

CONSUMPTIONS ARE GIVEN :

IN NOMINATOR - M^3/HD

IN DENOMINATOR - M^3/HR .

PIPELINE

LINE

LINE OF WATER

E OF WATER

NE OF WATER

OF WATER

NE OF WATER

FOR HPP)

OF WATER

FOR HPP)

SECTION 6

UNIDO CONTRACT NO 85/108

1370409-TB

IRAN. ALUNITE BASED ALUMINA P

INSITE WATER SUPPLY AND SEWERAGE

STAGE: PERMANENT

SHEET

WATER INPUT AND OUTPUT BALANCE SHEET

VAM

LENING

REMARK

CONSUMPTIONS ARE GIVEN :

IN NOMINATOR - M^3/HD

IN DENOMINATOR - M^3/HR .

WATER

R

ATER

TER

SECTION 7

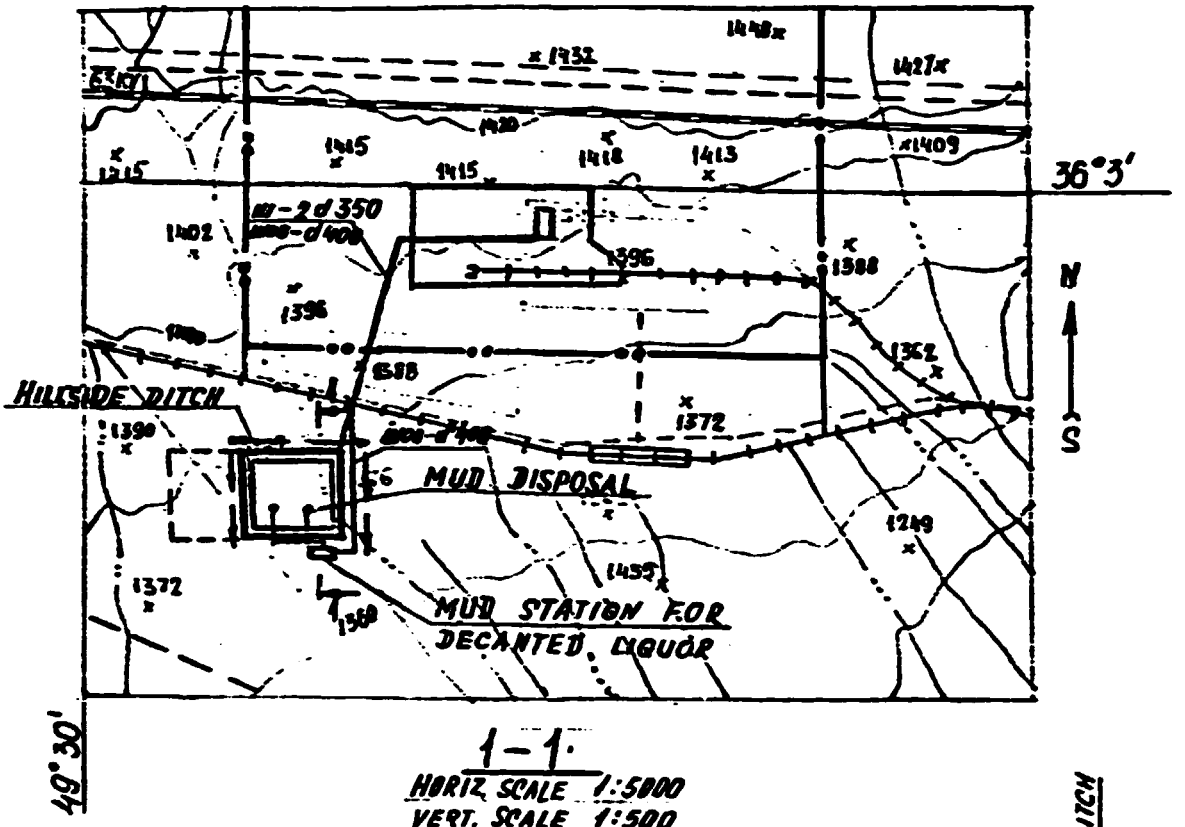
UNIDO CONTRACT NO 85/108

1370409-TBK

IRAN. ALUNITE BASED ALUMINA PLANT

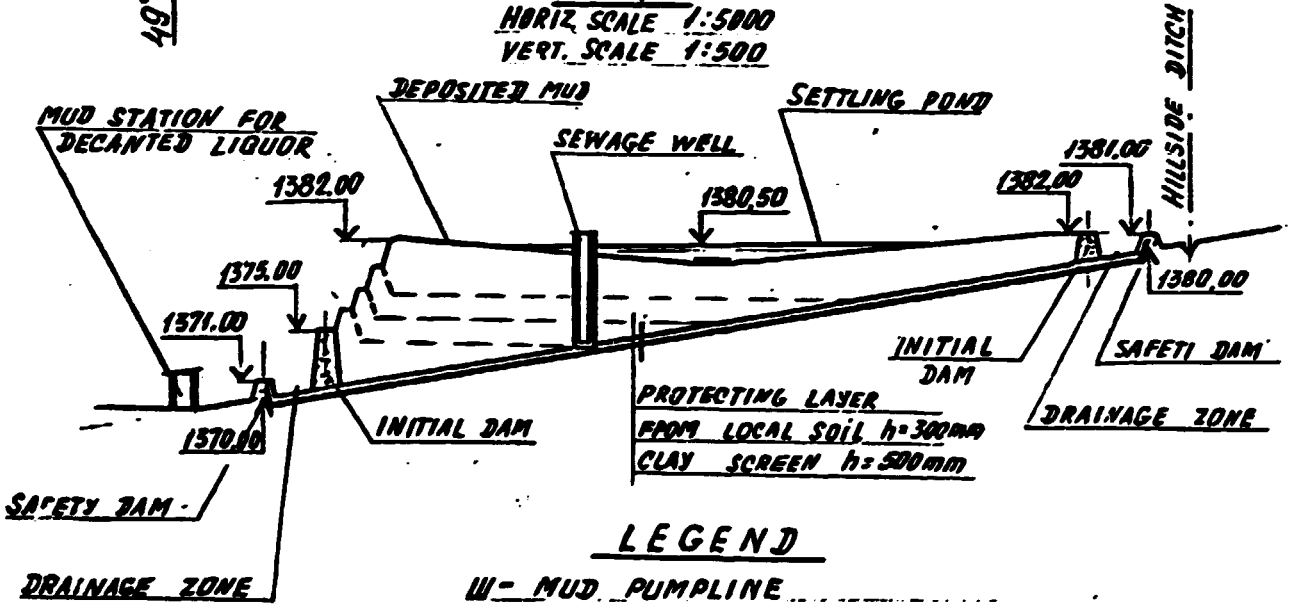
	STAGE	SHEET	SHEETS
INSITE WATER SUPPLY AND SEWERAGE	PRELIMINARY		1
WATER INPUT AND OUTPUT BALANCE SHEET	VAMI LENINGRAD		

SCALE 1:50000



1-1

HORIZ SCALE 1:5000
VERT. SCALE 1:500



LEGEND

W- MUD PUMPLINE .....

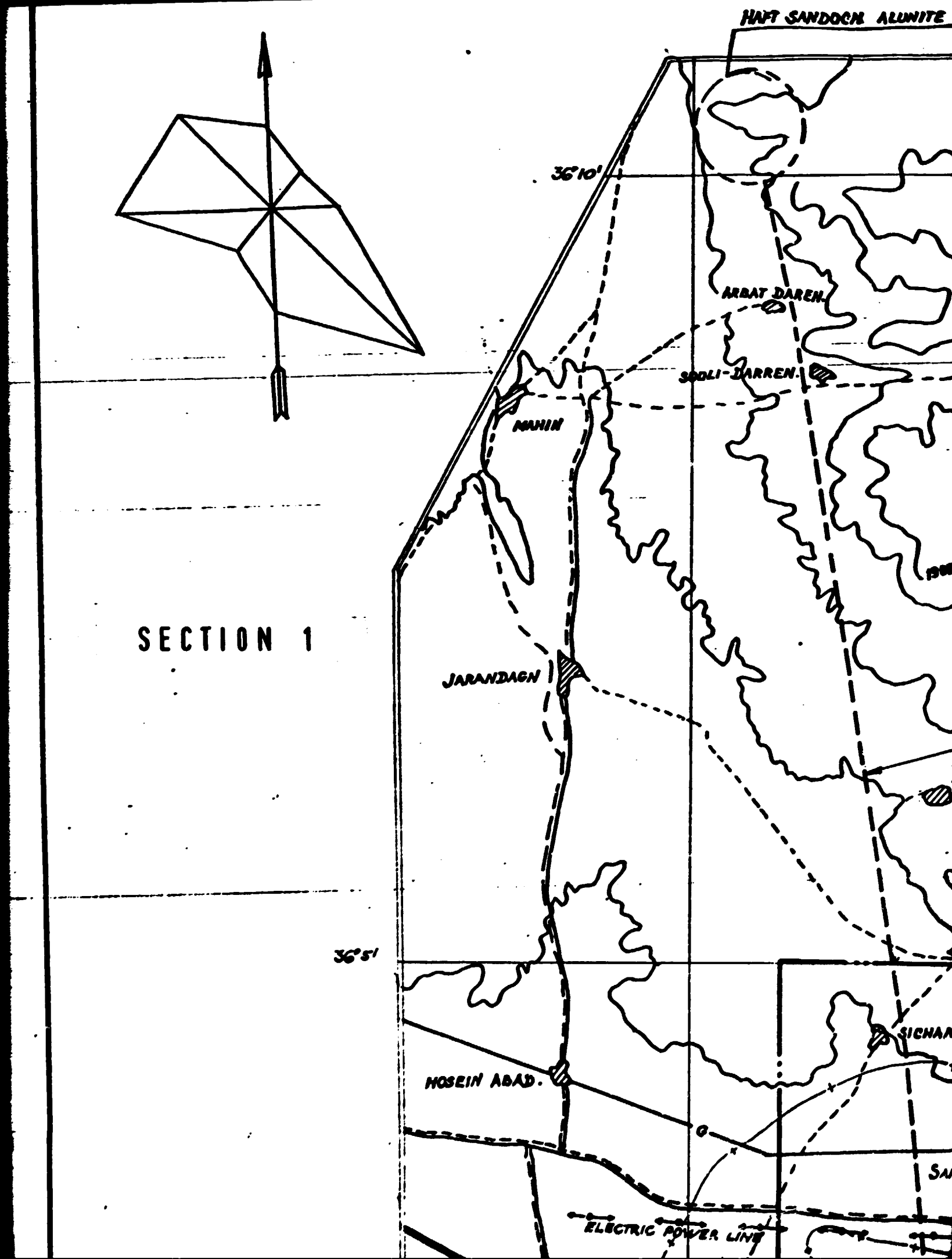
W08- DICANTED LIQUOR DUCT

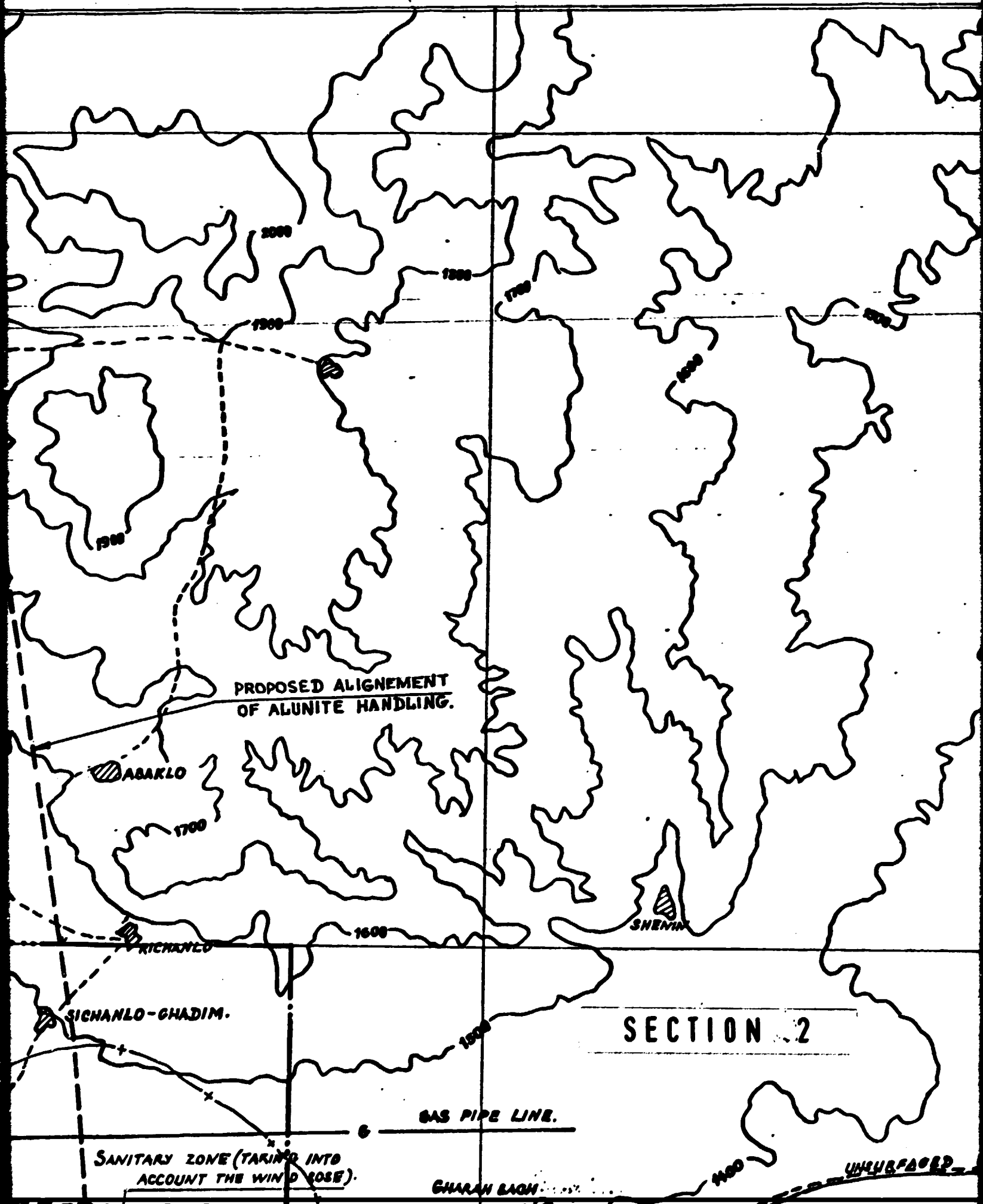
UNIDO CONTRACT NO 85/108

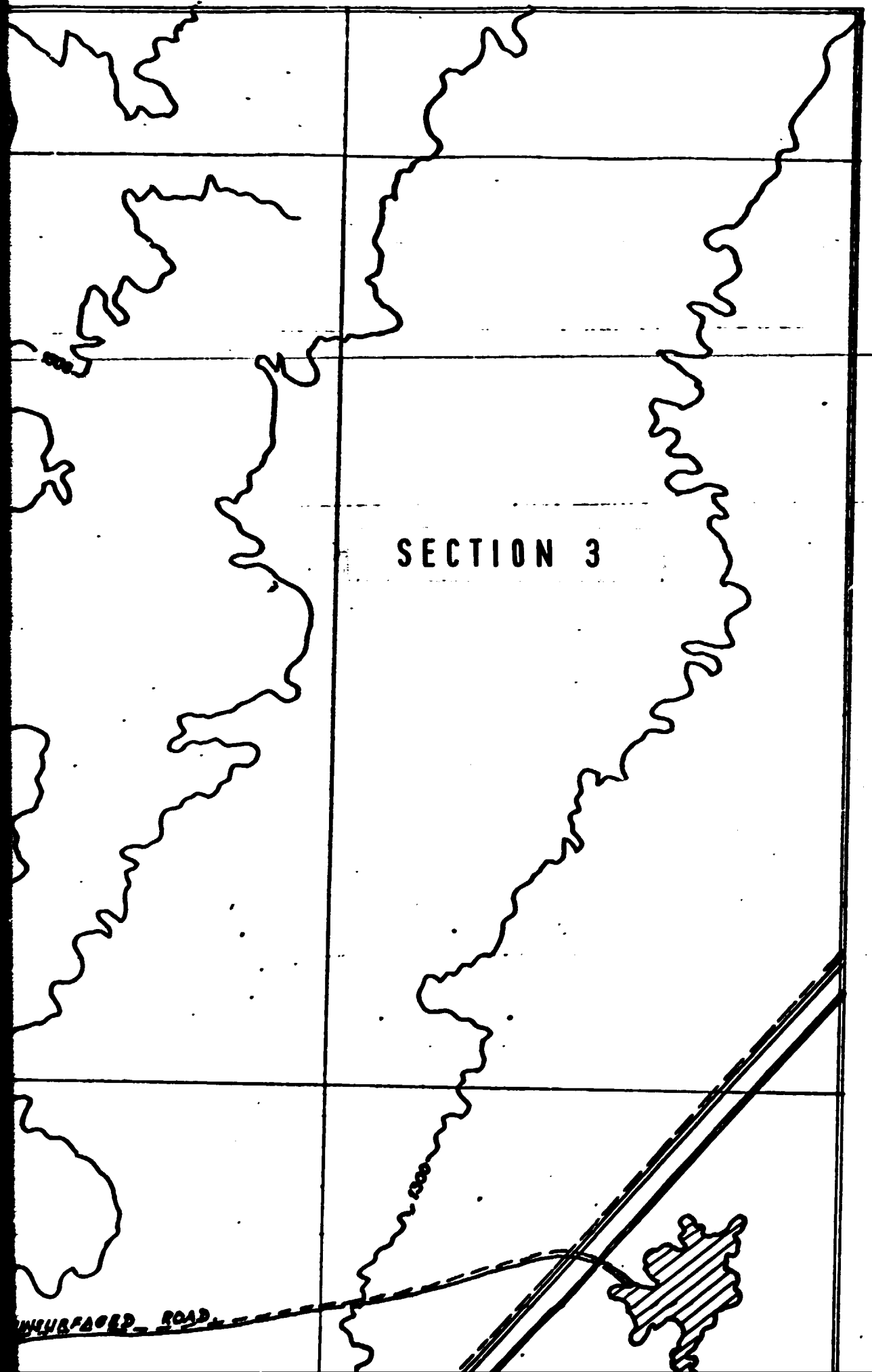
1370388—TW

IRAN. ALUNITE BASED ALUMINIA PLANT

MUD REMOVAL	STAGE	SHEET	SHEETS
	FEASIBILITY		1
PLAN	VAMI LENINGRAD		


HAFT SANDOCHI ALUNITE
36°10'
ARBAT DAREH.
SADLI-DARREH.
MAHIN
SECTION 1
JARANDAGH
36°5'
HOSEIN ABAD.
ELECTRIC POWER LINE


2000
1900
1800
1700
1600
1500
1400
1300
PROPOSED ALIGNEMENT
OF ALUNITE HANDLING.
ABARLO
SHEMIN
RICHANLO
SICHANLO-CHADIM.
SECTION 2
GAS PIPE LINE.
SANITARY ZONE (TAKING INTO
ACCOUNT THE WIND ROSE).
UNSURFACED
GHARAH LAKH


SECTION 3
UNSURFACED ROAD

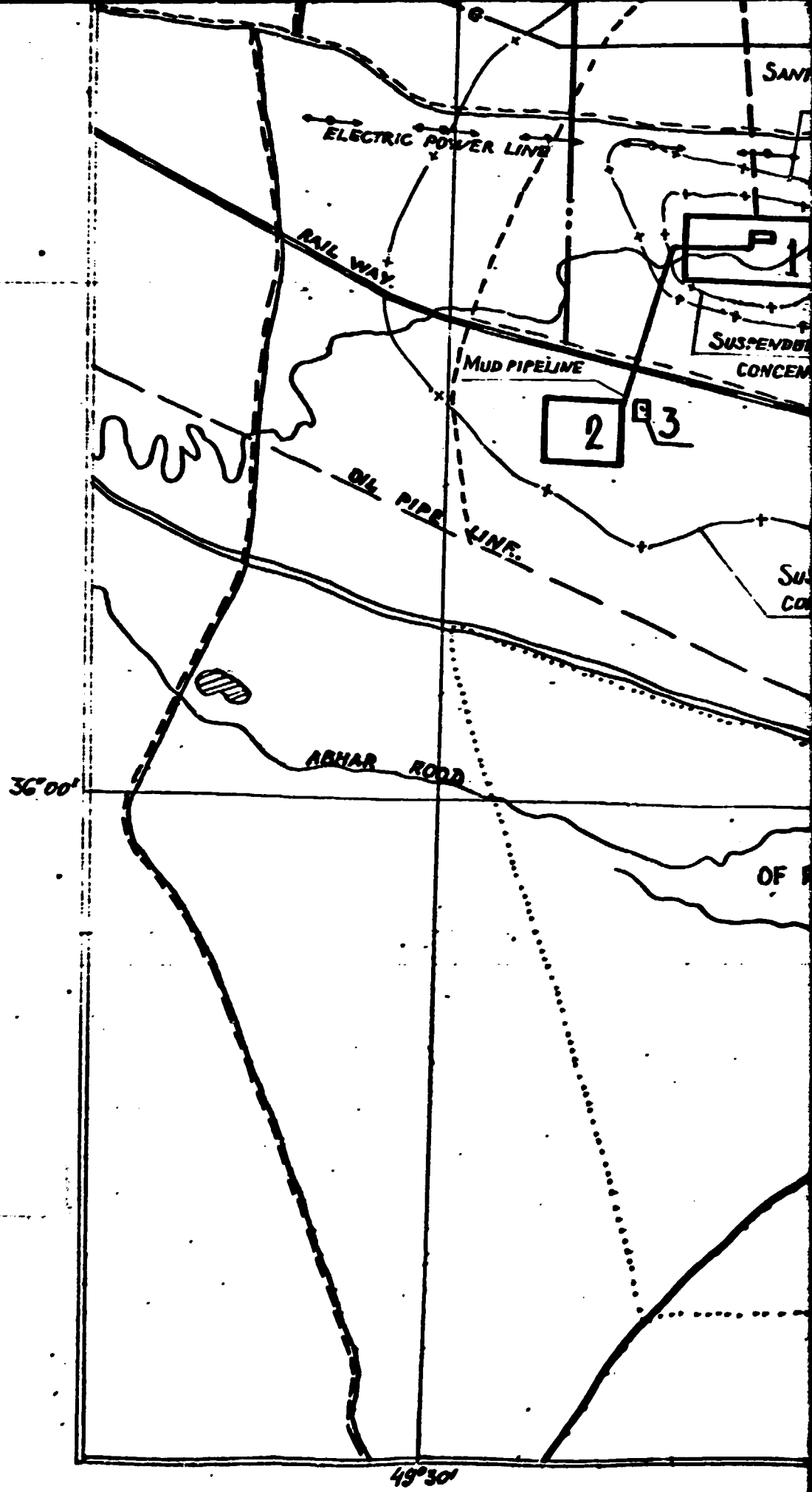
SECTION 4

1. ALUMINA PLANT.

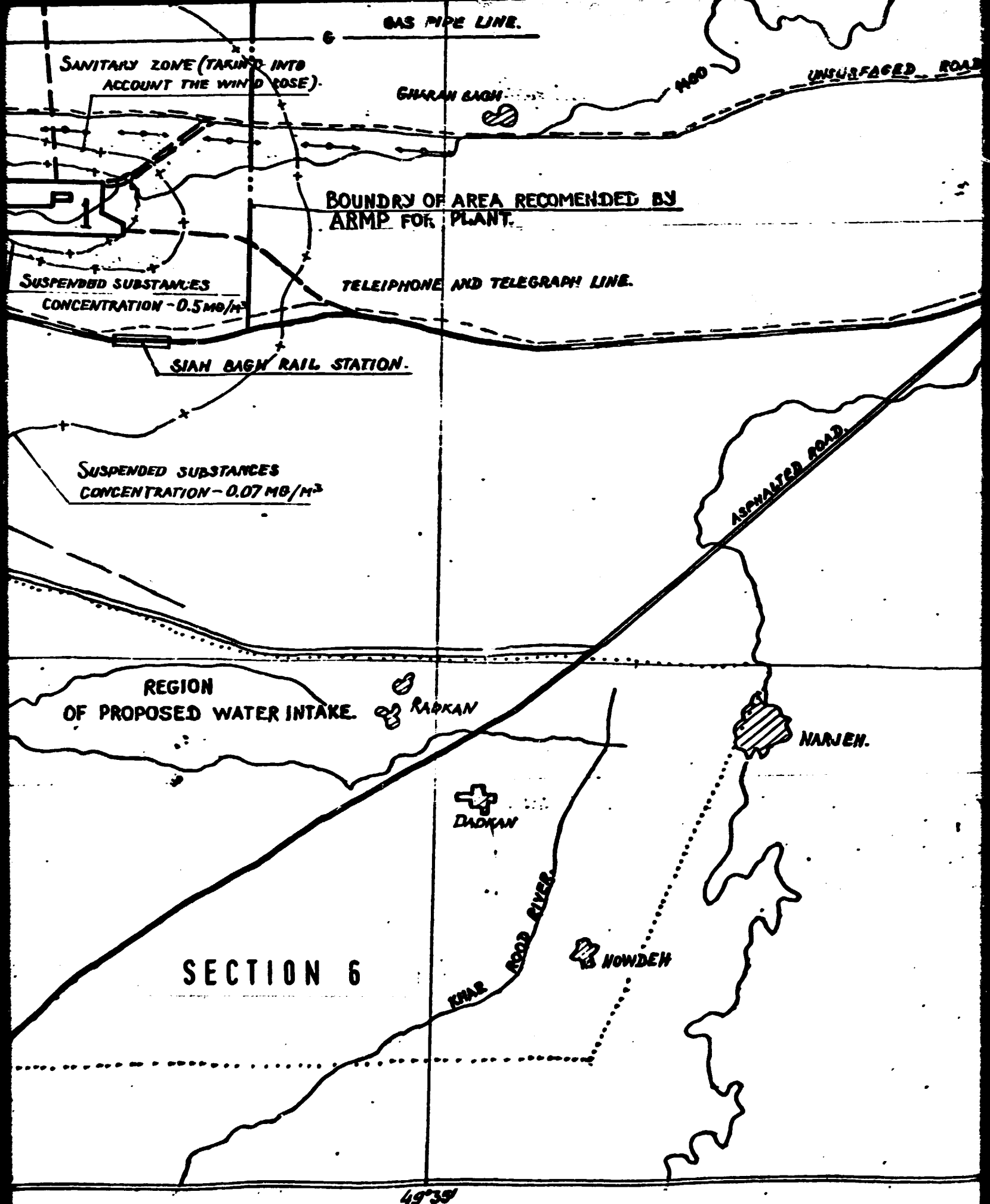
2. MUD DISPOSAL WITH PUMP STATION FOR DECANTED LIQUOR.

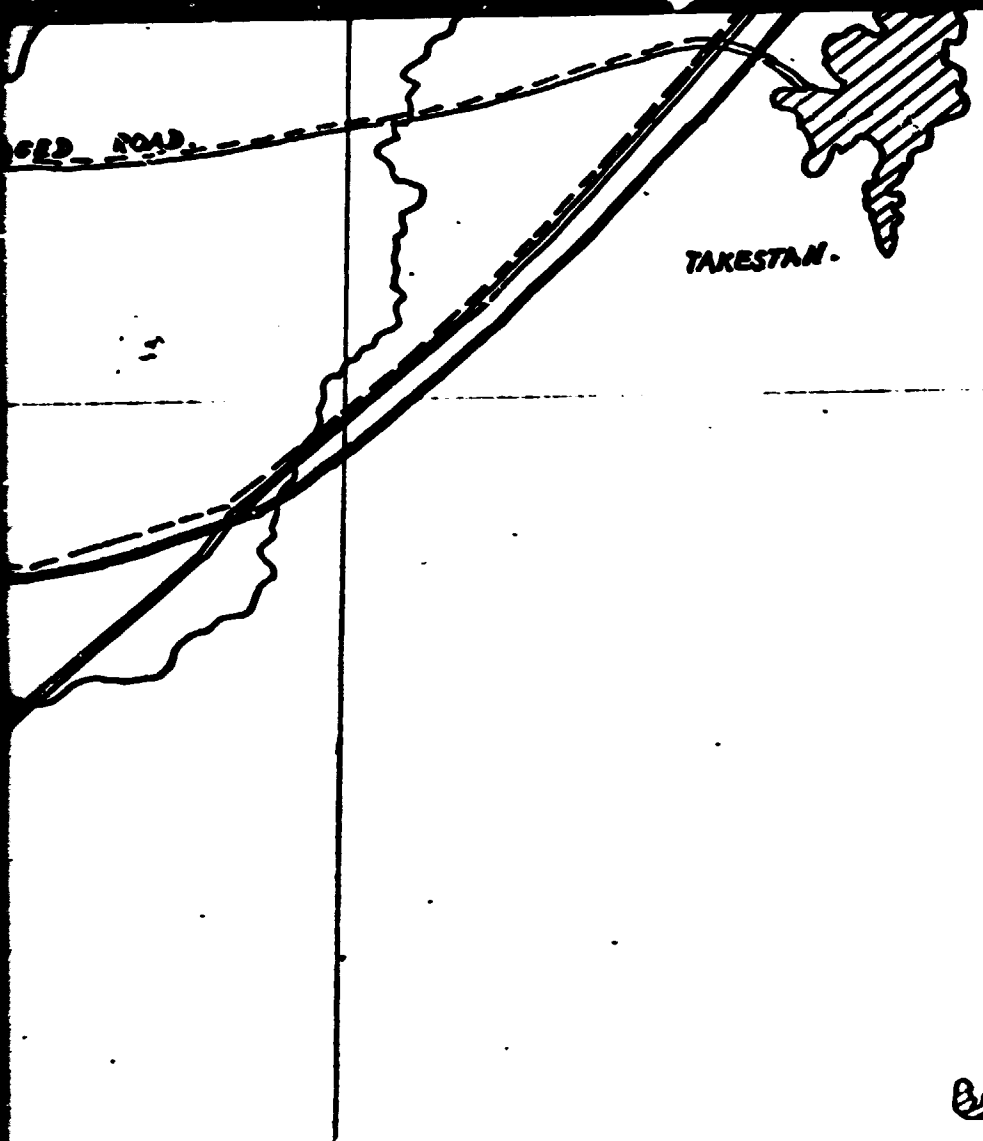
3. SETTLING POND FOR RAIN WATER WITH PUMP STATION FOR PUMPING OF CLARIFIED WATER.

1. LOCATION PLAN WAS PREPARED BASED ON THE TOPOGRAPHIC MAP, SCALE 1:50000, HANDED - OVER BY ARMP IN 1987.
2. INFRASTRUCTURE FACILITIES (WATER SUPPLY, POWER SUPPLY, SEWERAGE, EXTERNAL RAILWAY AND MOTOR ROAD TRANSPORT, ALUNITE HANDLING ETC) SHOULD BE DESIGNED BY ARMP.


ELECTRIC POWER LINE
RAIL WAY
MUD PIPELINE
OIL PIPE LINE
ABHAR ROAD
36°00'
49°30'
2
3

SECTION 5


GAS PIPE LINE.
SANITARY ZONE (TAKING INTO ACCOUNT THE WIND ROSE).
GHARAH BAGH
UNSURFACED ROAD
BOUNDRY OF AREA RECOMENDED BY ARMP FOR PLANT.
SUSPENDED SUBSTANCES CONCENTRATION - 0.5 MG/M³
TELEIPHONE AND TELEGRAPH LINE.
SIAH BAGH RAIL STATION.
SUSPENDED SUBSTANCES CONCENTRATION - 0.07 MG/M³
ASPHALTED ROAD.
REGION OF PROPOSED WATER INTAKE.
RADKAN
NARJEN.
DADKAN
KHAR ROOD RIVER
NOWDEH
SECTION 6
49°39'



SECTION 7

48°40'

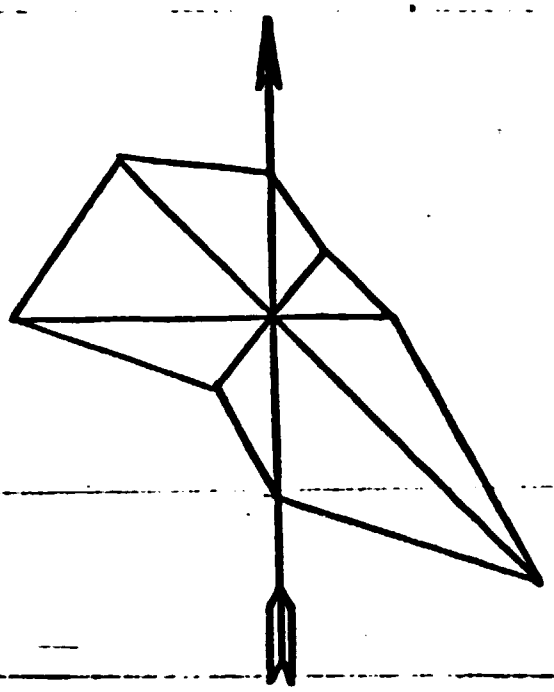
SEWERAGE, EXTERNAL RAILWAY AND MOTOR ROAD TRANSPORT, ALUNITE HANDLING ETC) SHOULD BE DESIGNED BY ARMP.

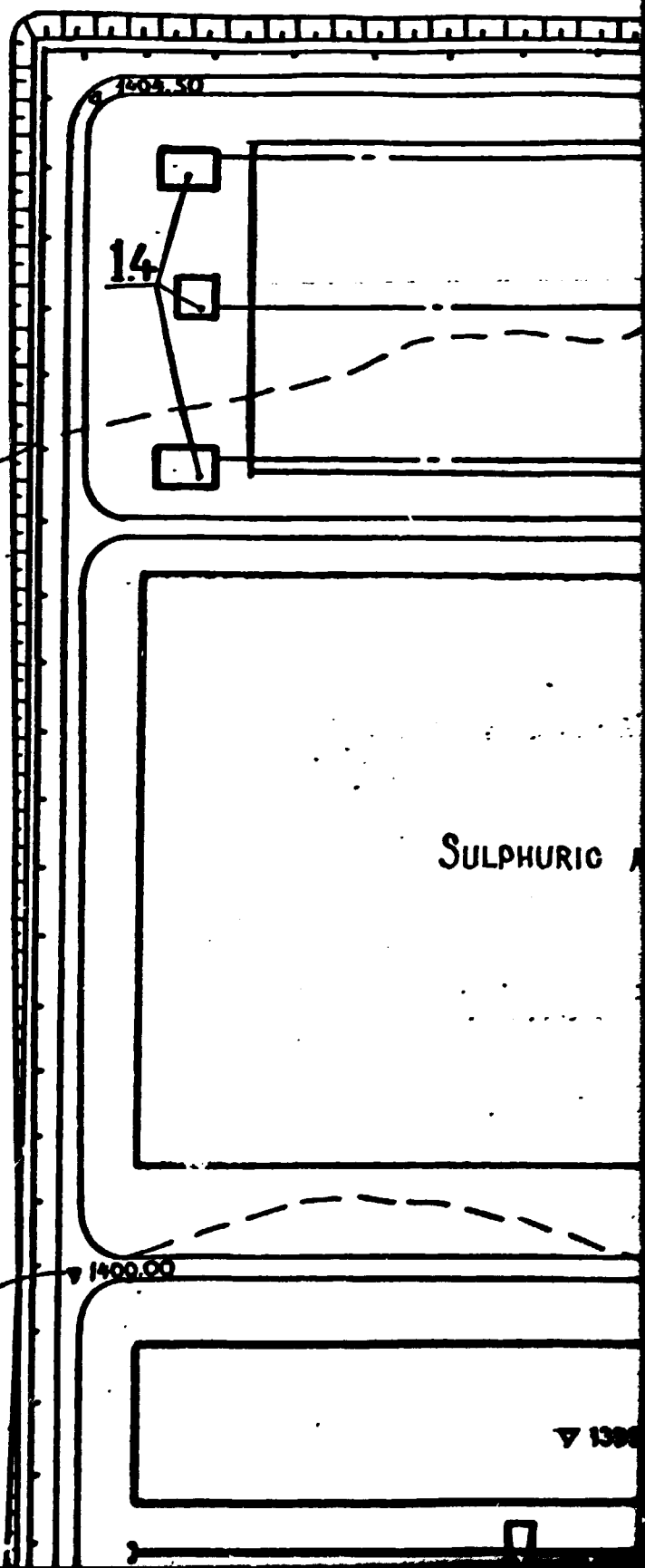
SECTION 8

UNIDO CONTRACT NO 85/108.

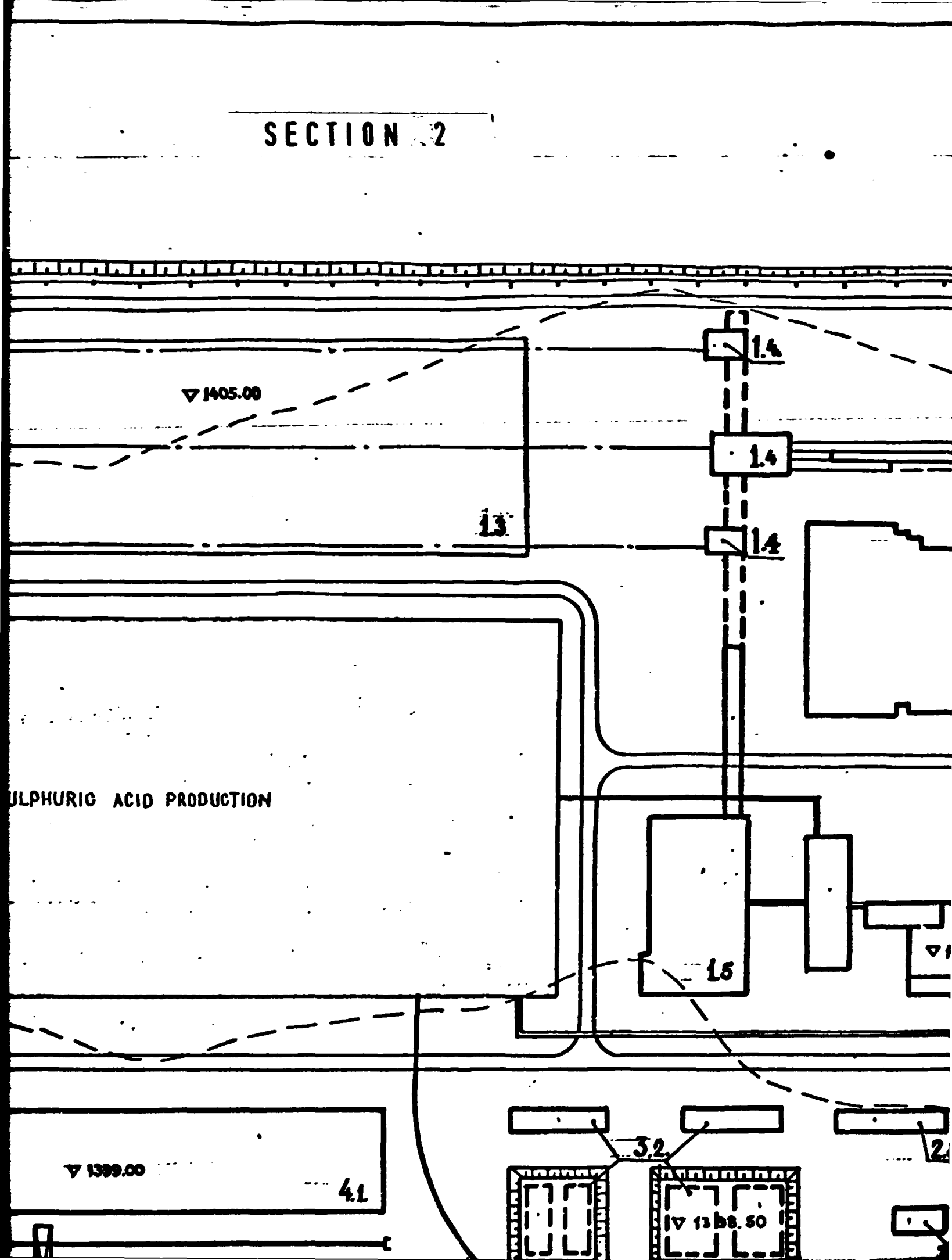
1389972-ГП			
IRAN. ALUNITE BASED ALUMINA PLANT.			
JNDUSTRIAL-SITE	STAGE	SHEET	SHEETS
	FEASIBILITY.		1
LOCATION PLAN.	VAMI LENINGRAD		

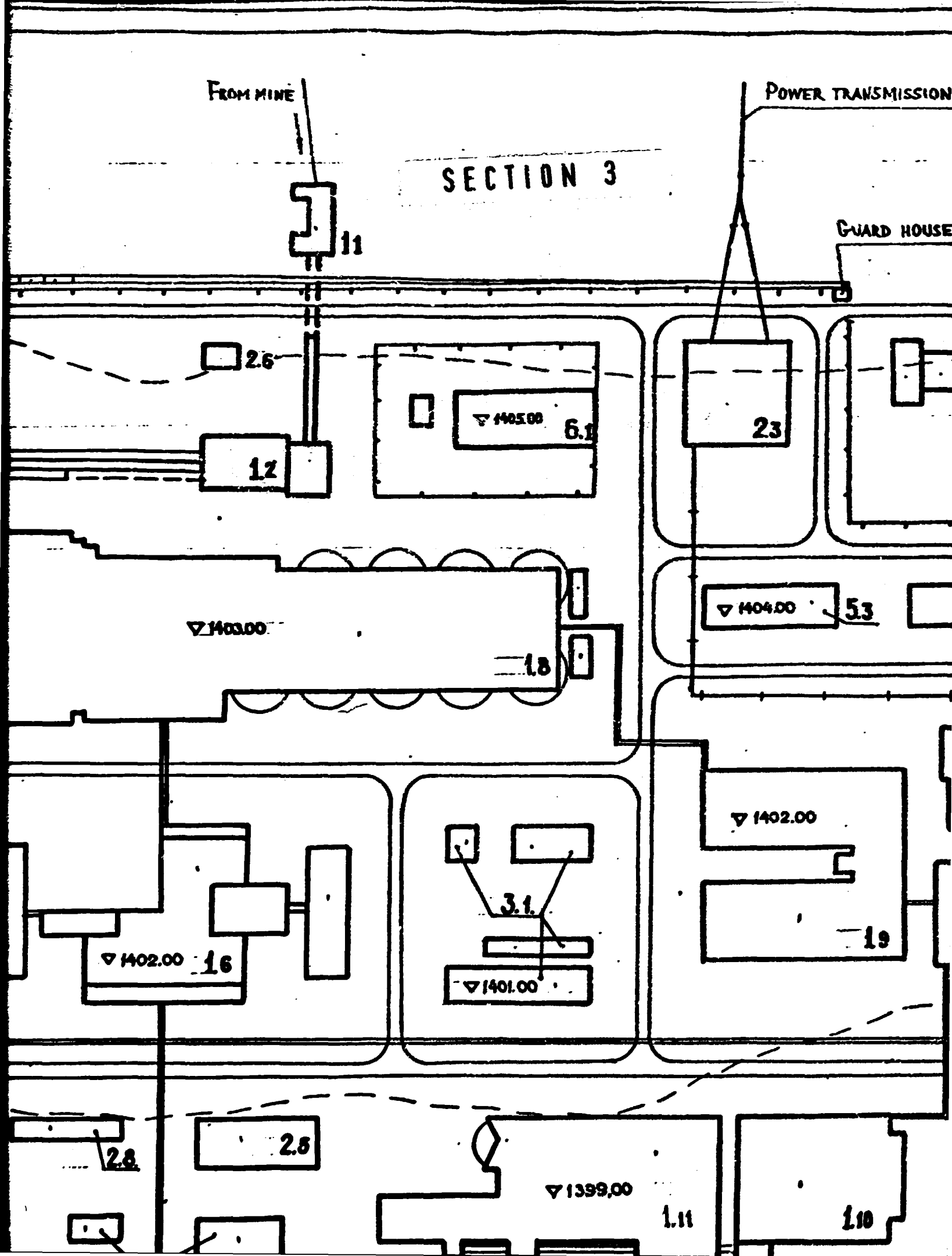
SECTION 1





SECTION 2

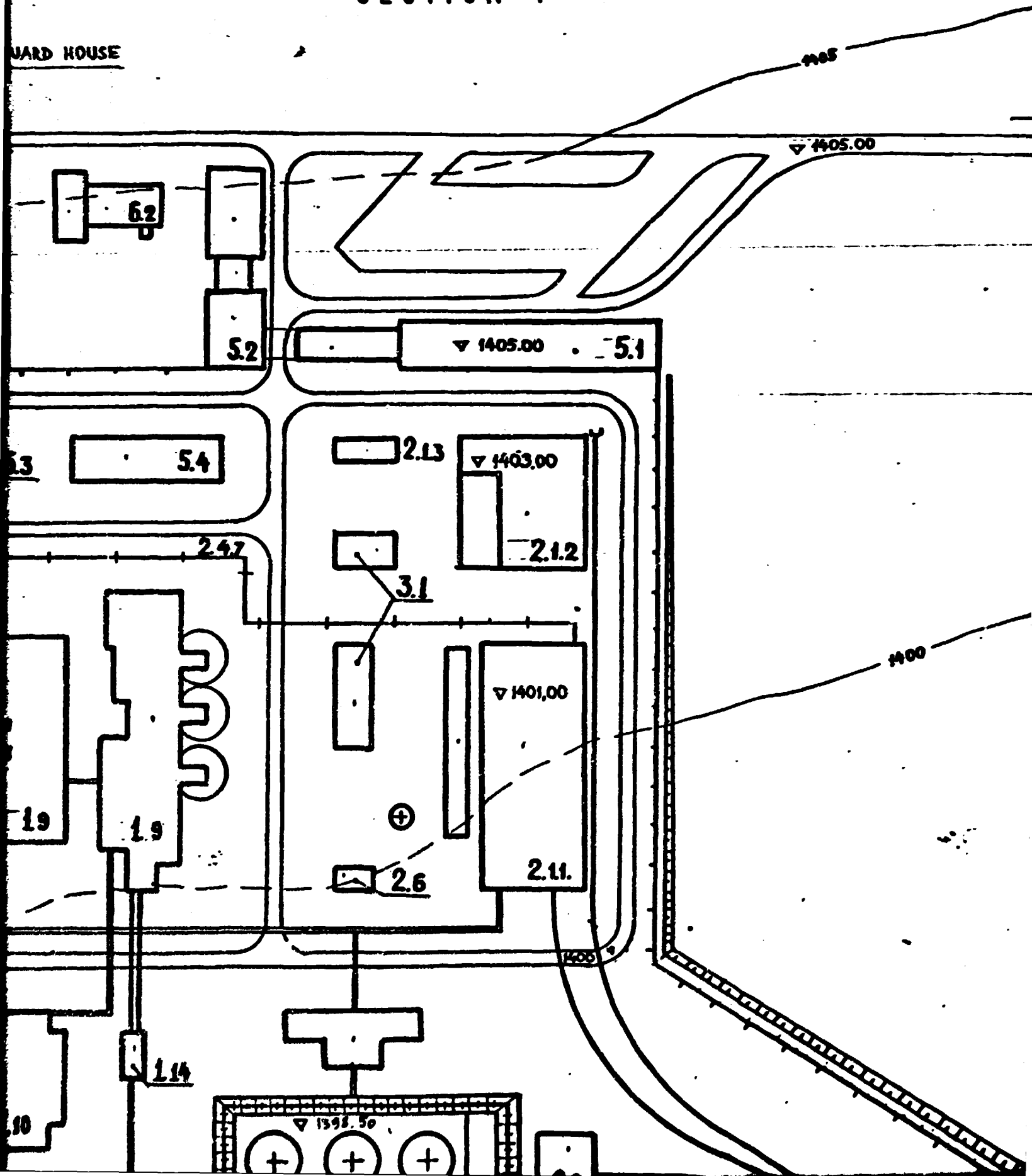

1.4
1.4
1.4
1.3
▽1405.00
ULPHURIC ACID PRODUCTION
1.5
3.2
▽1399.00
4.1
▽1388.50


FROM MINE
POWER TRANSMISSION
SECTION 3
GUARD HOUSE
11
2.6
1.2
▽1405.00
6.1
23
▽1403.00
1.8
▽1404.00
5.3
▽1402.00
3.1
1.9
▽1402.00
1.6
▽1401.00
2.8
2.5
▽1399.00
1.11
1.10

ANSMISSION LINE

SECTION 4

UARD HOUSE



SECTION 5

TAKESTAN.

LIST OF UNITS.

1. MAIN PRODUCTION UNITS.

1.1 ORE RECEIVING UNIT.
1.2 MEDIUM AND FINE CRUSHING.
1.3. ORE BLENDING STORAGE AND CONVEYOR GALLERIES.
1.4. TRANSFER UNITS, DRIVE AND TAKE-UP STATIONS.
1.5. DRY GRINDING.
1.6. ROASTING AND REDUCTION WITH BLOWER STATION.
1.7. SULPHUR STORAGE.
1.8. DIGESTION, DESILICATION AND MUD WASHING.
1.9. EVAPORATION AND POTASSIUM SULPHATE. PRODUCTIO
1.10. PRECIPITATION
1.11. HYDRATE TREATMENT WITH HYDRATE STORAGE.
1.12. ALUMINA CALCINATION.
1.13. COMMERCIAL ALUMINA. STORAGE.
1.14. POTASSIUM SULPHATE DRYING.
1.15. POTASSIUM SULPHATE STORAGE.
1.16. CAUSTIC STORAGE.

2. POWER FACILITIES.

2.1 HEAT AND POWER PLANT.
2.11. MAIN BUILDING.
2.12. CHEMICAL WATER TREATMENT.
2.13. PERSONNEL FACILITIES.
2.2. TRANSFORMER AND OIL FACILITIES.
2.3. MAIN STEP-DOWN SUBSTATION.
2.4. BUS-BARS.
2.5. COMPRESSOR STATION.
2.6. GAS DISTRIBUTING STATION
2.7. FUEL OIL FACILITIES
2.8. OXYGEN STATION.

3 WATER SUPPLY AND SEWERAGE SYSTEMS.

3.1. WATER RECIRCULATING UNITS OF COMPRESSOR STATION.
AND HEAT AND POWER PLANT.

SECTION 6

LEGEND.

PROPOSED BUILDING AND STRUCTURES. WITH ELEVA

UNDERGROUND STRUCTURES.

MOTOR ROADS.

RAILWAY TRACKS.

FENCE.

GALLERIES.

ATIONS.

R STATION.

ASHING.

ATE. PRODUCTION.

DRAGE.

MAIN PARAMETERS OF GENERAL LAYOUT.

SRL. N°	DESCRIPTION.	UNIT OF MEASURE
1.	TOTAL PLANT AREA INSIDE FENCE.	HECTARES.
2.	PREPLANT AREA SURFACE.	HECTARES
3.	AREA BUILT WITH BUILDING AND STRUCTURES.	HECTARES
4.	BUILDING DENSITY.	%
5.	LENGTH OF MOTOR ROADS AND SURFACE OF MOTOR ROADS PAVEMENT	KM / HECTARE

STEM

SSOR STATION. OF EVAPORATION

SECTION 7

ES. WITH ELEVATION.

AYOUT.

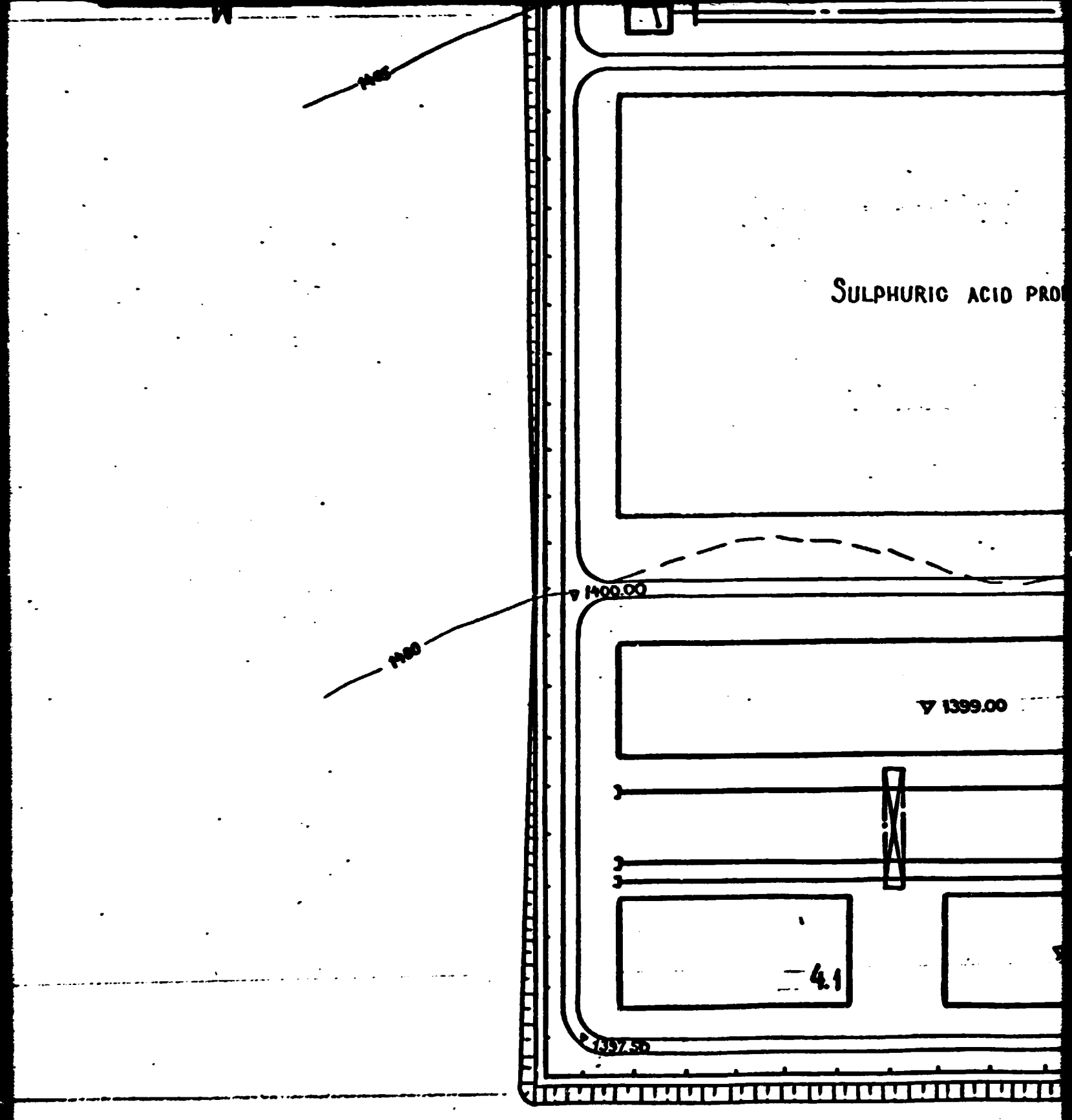
	UNIT OF MEASURE	QUANTITY.
	HECTARES.	72.0
	HECTARES	5.0.
	HECTARES	22.0
	%	34.
	KM / HECTARE	14 / 12.5

GENERAL LAYAUT WAS PREPARED BASED ON TOPOGRAPHIC

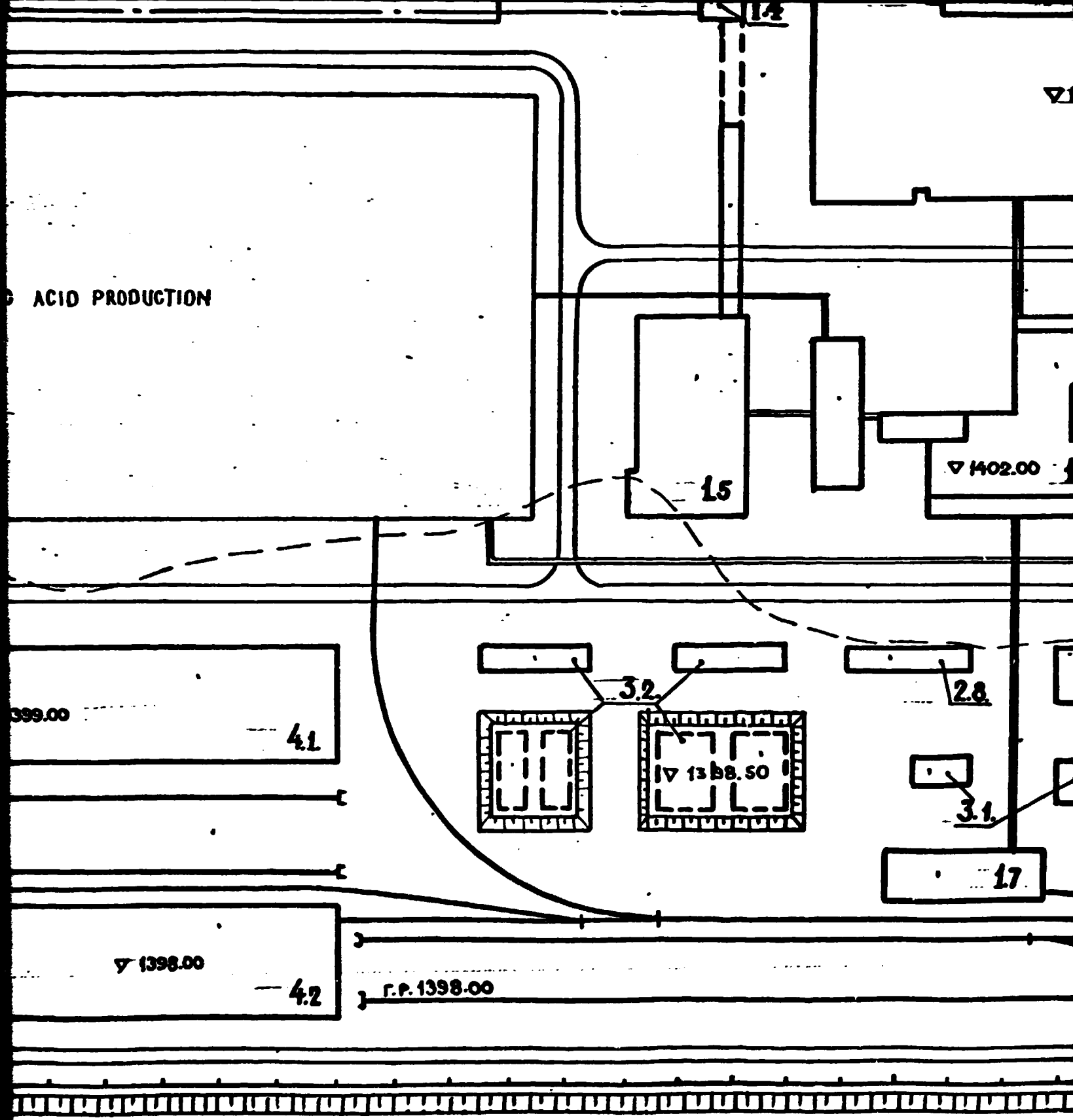
SCALE 1:50000, HANDED OVER BY ARMP IN 1987.

SECTION 8

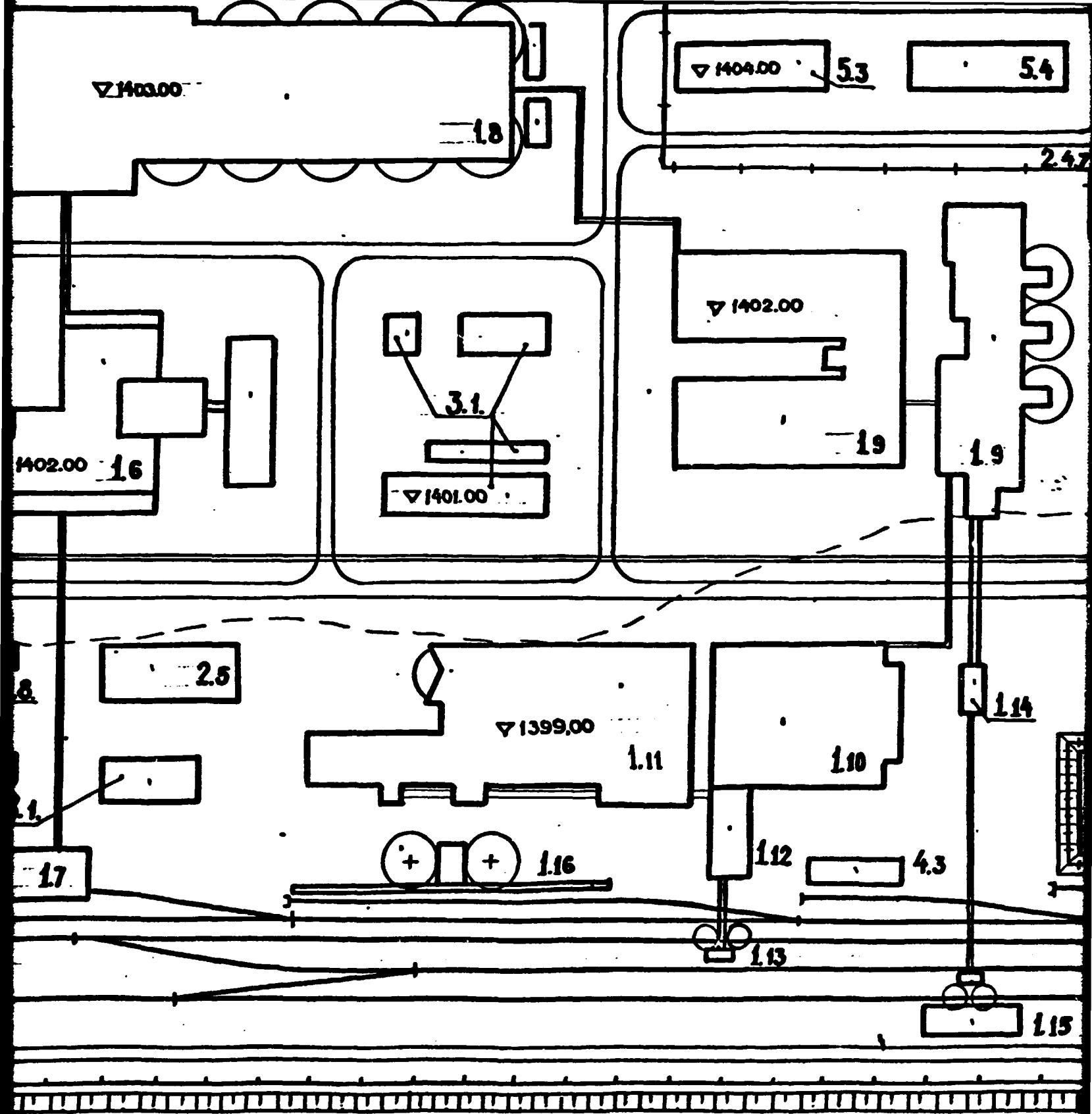
GENERAL LAYAUT WAS PREPARED BASED ON TOPOGRAPHIC MAP, SCALE 1:50000, HANDED OVER BY ARMP IN 1987.



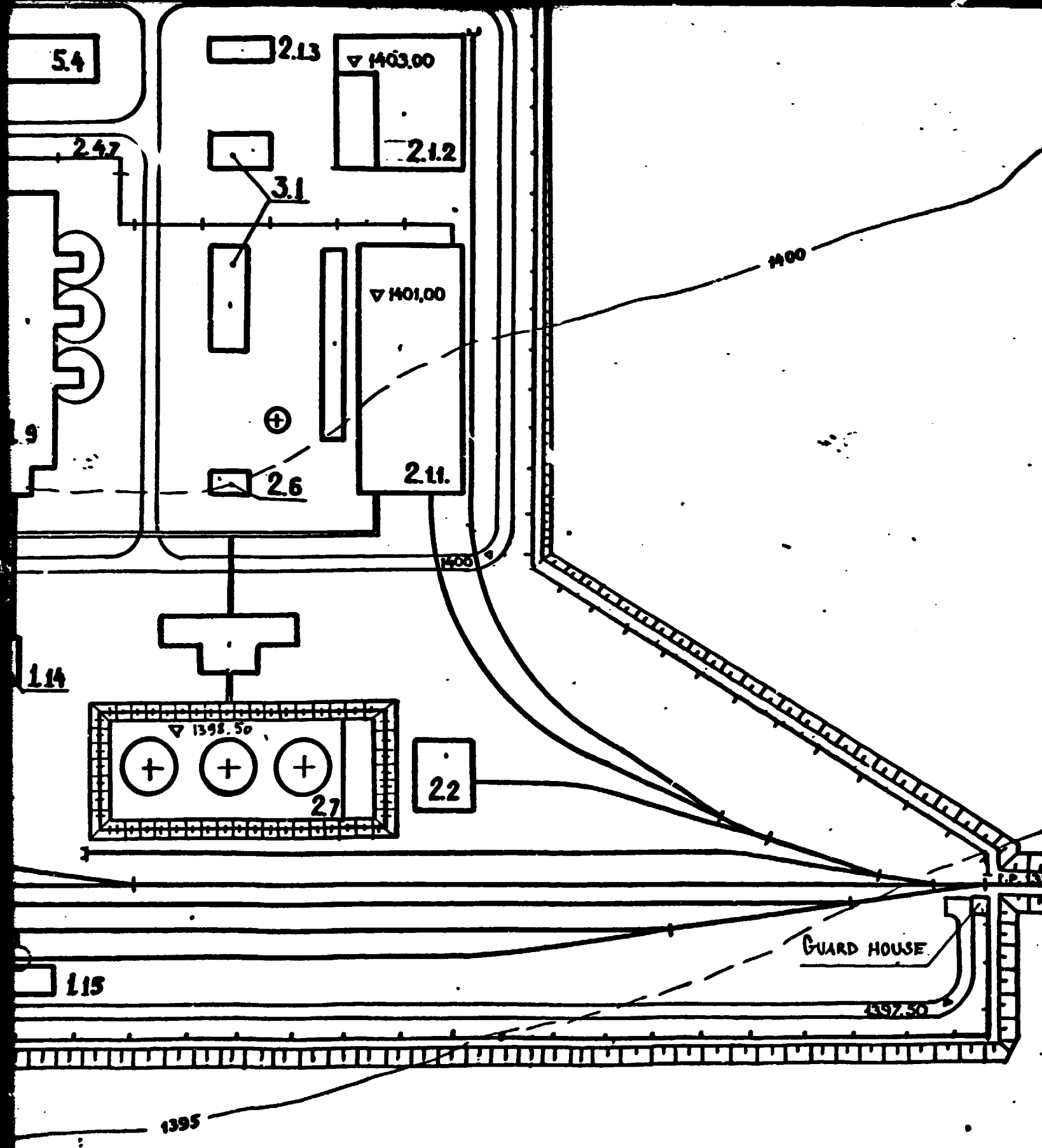
SECTION 9


ACID PRODUCTION
1.4
1.5
▽1402.00
3.2
2.8
▽1398.50
3.1
1.7
4.1
399.00
▽1398.00
4.2
r.p. 1398.00

SECTION 10


▽1403.00
1.8
▽1404.00
5.3
5.4
2.4
▽1402.00
3.1.
1.9
1.9
1402.00
1.6
▽1401.00
2.5
▽1399.00
1.11
1.10
1.14
1.16
1.12
4.3
1.7
1.13
1.15

SECTION 11


5.4
2.13
1403.00
2.1.2
2.4.7
3.1
1400
1401.00
9
2.6
2.11.
1.14
1398.50
2.7
2.2
GUARD HOUSE
1.15
1397.50
1395

SECTION 12

1.10. PRECIPITATION

1.11. HYDRATE TREATMENT WITH HYDRATE STORAGE.

1.12. ALUMINA CALCINATION.

1.13. COMMERCIAL ALUMINA. STORAGE.

1.14. POTASSIUM SULPHATE DRYING.

1.15. POTASSIUM SULPHATE STORAGE.

1.16. CAUSTIC STORAGE.

2. POWER FACILITIES.

2.1 HEAT AND POWER PLANT.

2.11. MAIN BUILDING.

2.12. CHEMICAL WATER TREATMENT.

2.13. PERSONNEL FACILITIES.

2.2. TRANSFORMER AND OIL FACILITIES.

2.3. MAIN STEP-DOWN SUBSTATION.

2.4. BUS-BARS.

2.5. COMPRESSOR STATION.

2.6. GAS DISTRIBUTING STATION

2.7. FUEL OIL FACILITIES

2.8. OXYGEN STATION.

3 WATER SUPPLY AND SEWERAGE SYSTEMS.

3.1. WATER RECIRCULATING UNITS OF COMPRESSOR STATION. OF EVA

AND HEAT AND POWER PLANT.

3.2. TANKS FOR INDUSTRIAL AND POTABLE WATER WITH BOOSTER PUMP

4. REPAIR AND STORAGE FACILITIES.

4.1 REPAIR SHOP COMPLEX.

4.2. MATERIAL STORAGE COMPLEX.

4.3. OILS AND CHEMICAL STORAGE.

5. SERVICE AND AUXILIARY FACILITIES.

5.1. PLANT ADMINISTRATIVE BUILDING.

5.2. TECHNICAL BUILDING WITH TELEPHONE EXCHANGE.

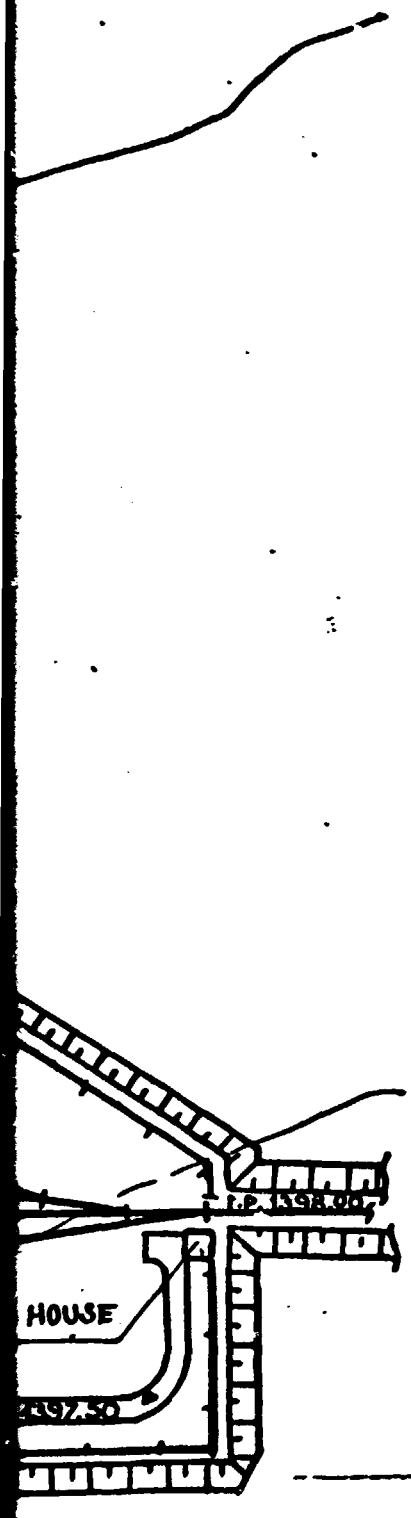
5.3. LABORATORY.

5.4. PERSONNEL SERVICE ROOMS.

6. TRANSPORT FACILITIES.

6.1. SPECIAL VEHICLES GARAGE.

6.2. FIRE-FIGHTING STATION.



MAIN PARAMETERS OF GENERAL LAYOUT.

SRL. N°	DESCRIPTION.	UNIT OF MEASURE	QUANTITY.
1.	TOTAL PLANT AREA INSIDE FENCE.	HECTARES.	72.0
2.	PREPLANT AREA SURFACE.	HECTARES	5.0.
3.	AREA BUILT WITH BUILDING AND STRUCTURES.	HECTARES	22.0
4.	BUILDING DENSITY.	%	34.
5.	LENGTH OF MOTOR ROADS AND SURFACE OF MOTOR ROADS PAVEMENT	KM / HECTARE	14 / 12,5
6.	LENGTH OF RAILWAY TRACK.	KM.	4.0
7.	GREENERY AREA.	HECTARES	14.0.

ON. OF EVAPORATION

STER PUMP STATION

GE.

SECTION 14

UT.

UNIT OF MEASURE	QUANTITY.
HECTARES.	72.0
HECTARES	5.0.
HECTARES	22.0
%	34.
KM / HECTARE	14 / 12.5
KM.	4.0
HECTARES	14.0.

GENERAL LAYAUT WAS PREPARED BASED ON TOPOGRAPHIC M

SCALE 1:50000, HANDED OVER BY ARMP IN 1987.

SECTION 15

UNIDO CONTRACT NO 85/10

138997 3-I

JRAN. ALUNITE BASED ALUMI

INDUSTRIAL SITE.

STAGE FEASIBILITY

GENERAL LAYOUT.

SIZE A 3x5

GENERAL LAYAUT WAS PREPARED BASED ON TOPOGRAPHIC MAP,

SCALE 1:50000, HANDED OVER BY ARMP IN 1987.

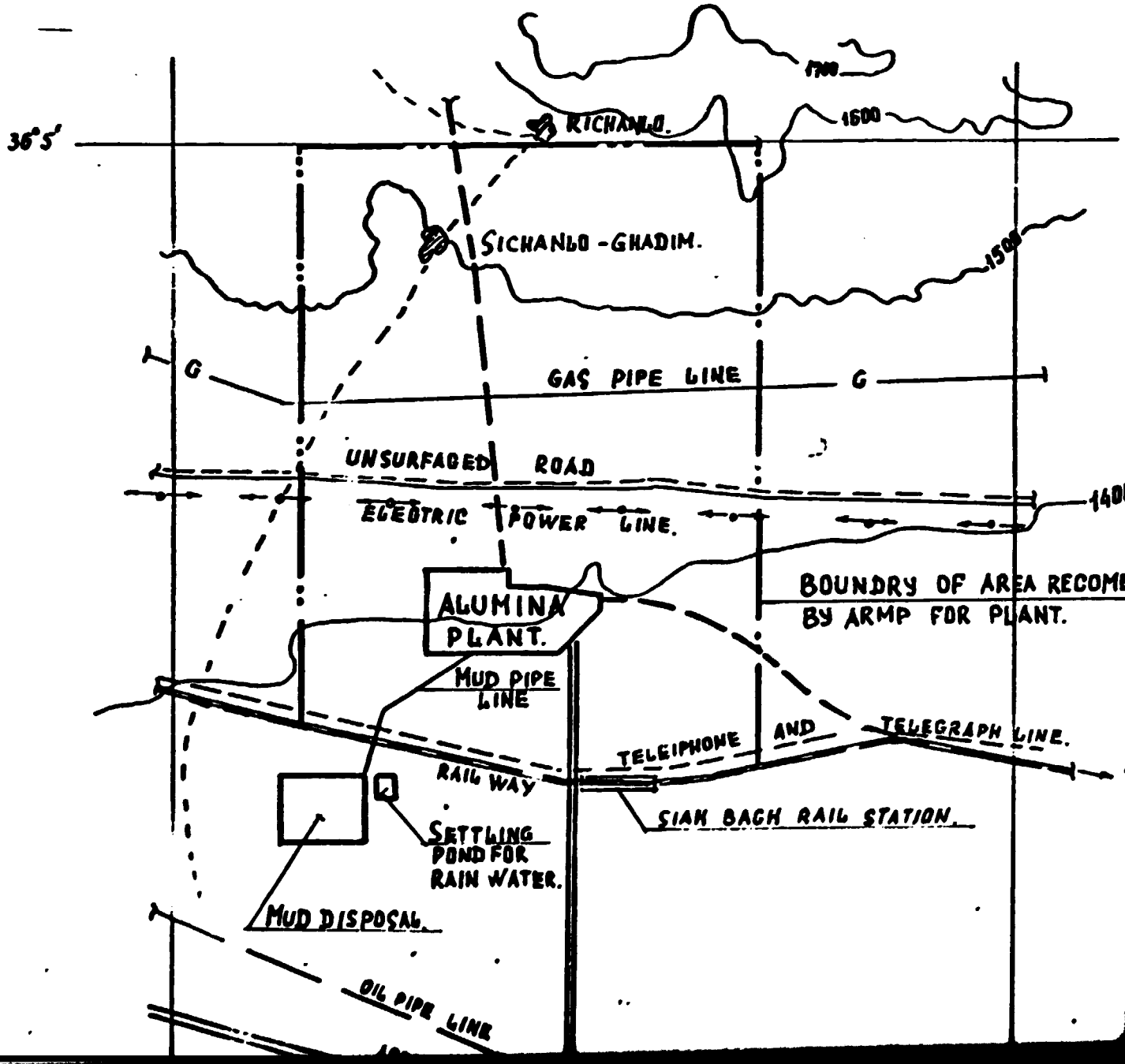
SECTION 16

UNIDO CONTRACT NO 85/108.

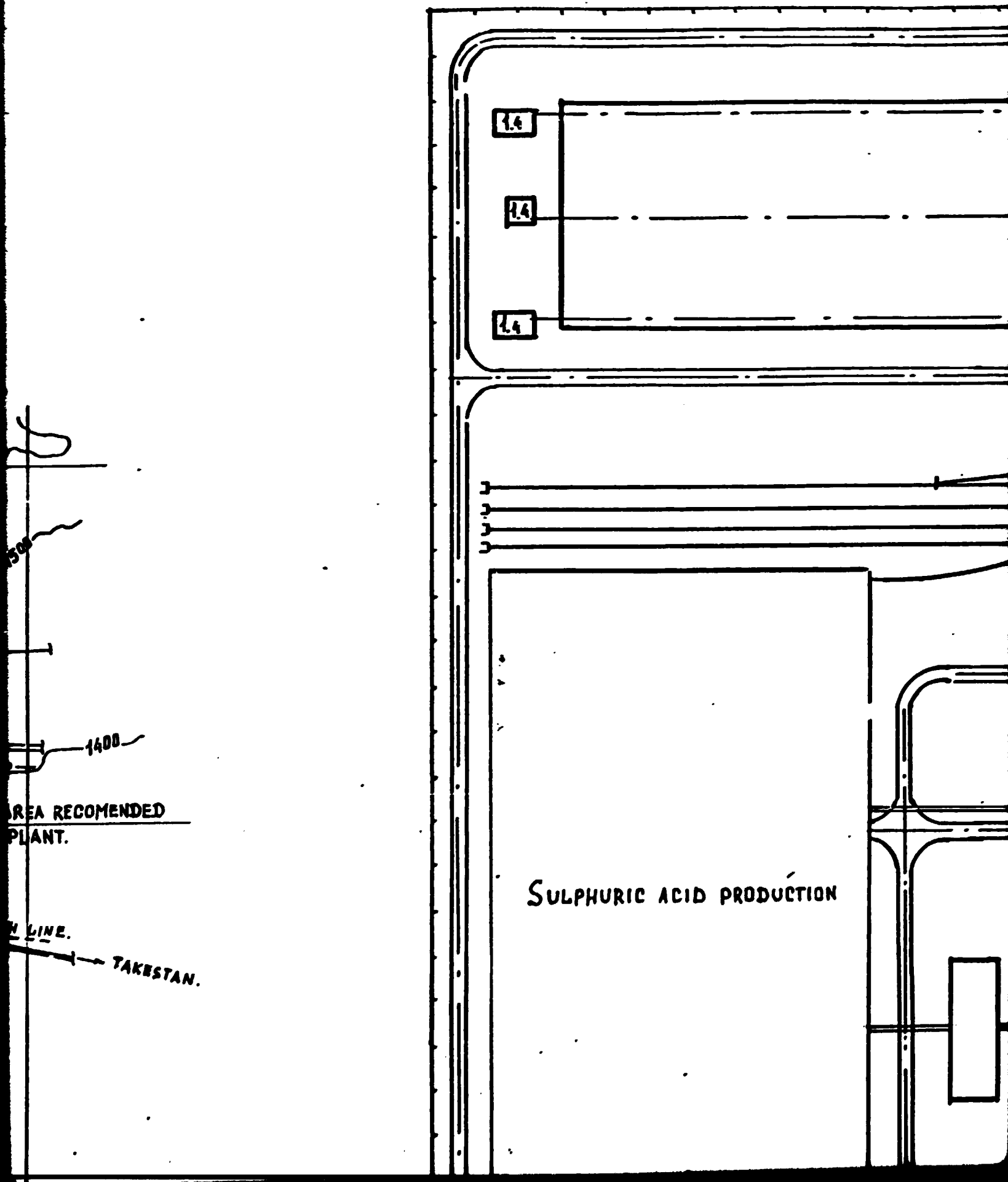
138997 3-ГП			
JRAN. ALUNITE BASED ALUMINA PLANT			
INDUSTRIAL SITE.	STAGE	SHEET	SHEETS
	РЕАЗИЛИЗ		1
GENERAL LAYOUT.	VAMI LENINGRAD.		

SIZE A 3x5.

SECTION 1

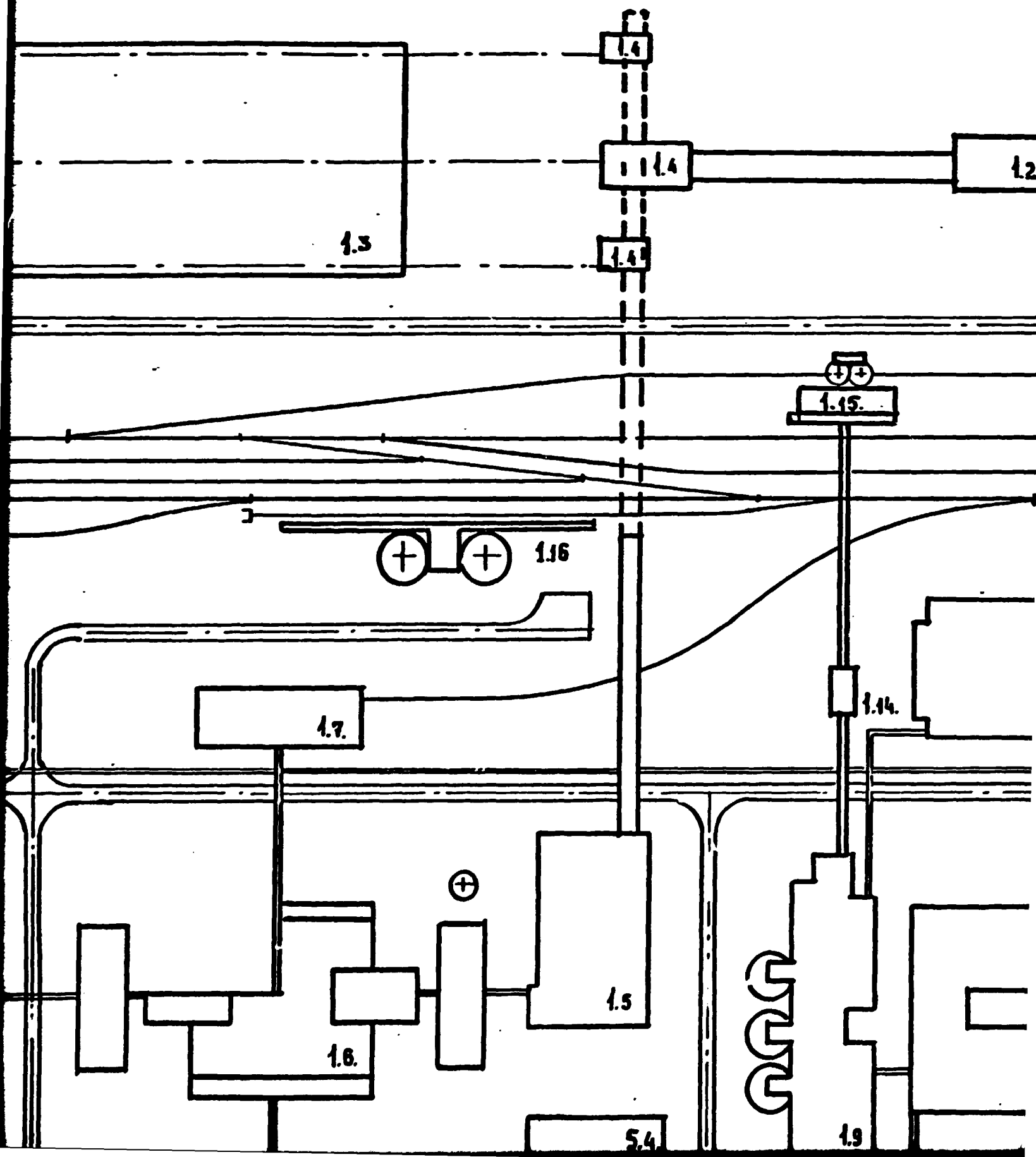

1700
RICHANLO.
1600
36°5'
SICHANLO - GHADIM.
1500
G
GAS PIPE LINE
G
UNSURFACED ROAD
ELECTRIC POWER LINE.
1400
ALUMINA PLANT.
BOUNDRY OF AREA RECOMM
BY ARMP FOR PLANT.
MUD PIPE LINE
TELEPHONE AND TELEGRAPH LINE.
RAIL WAY
SIAH BACH RAIL STATION.
SETTLING POND FOR RAIN WATER.
MUD DISPOSAL.
OIL PIPE LINE

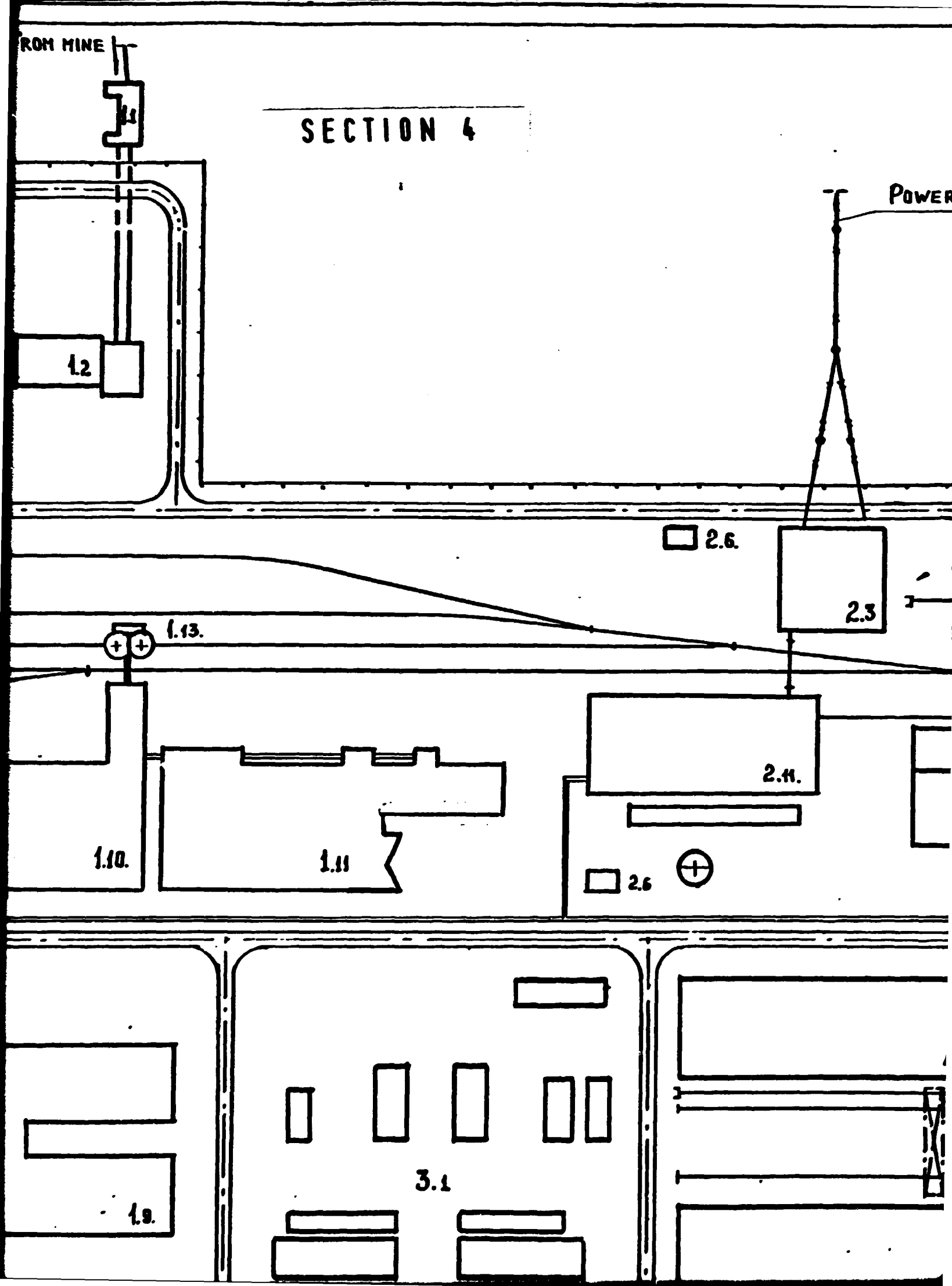
SECTION 2


1.4
1.4
1.4
1400
REA RECOMENDED
PLANT.
N LINE.
TAKESTAN.
SULPHURIC ACID PRODUCTION

FROM MIN

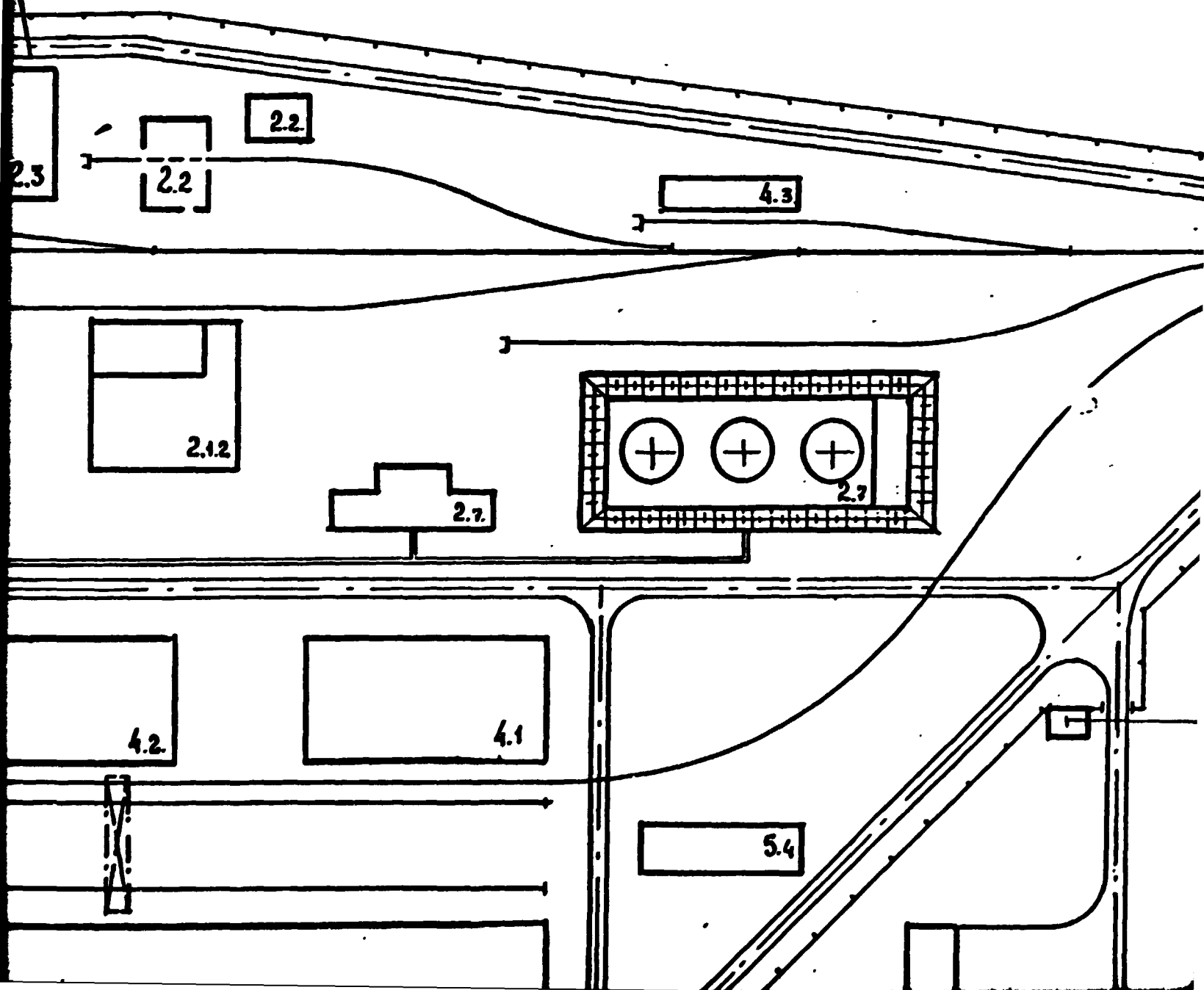
SECTION 3



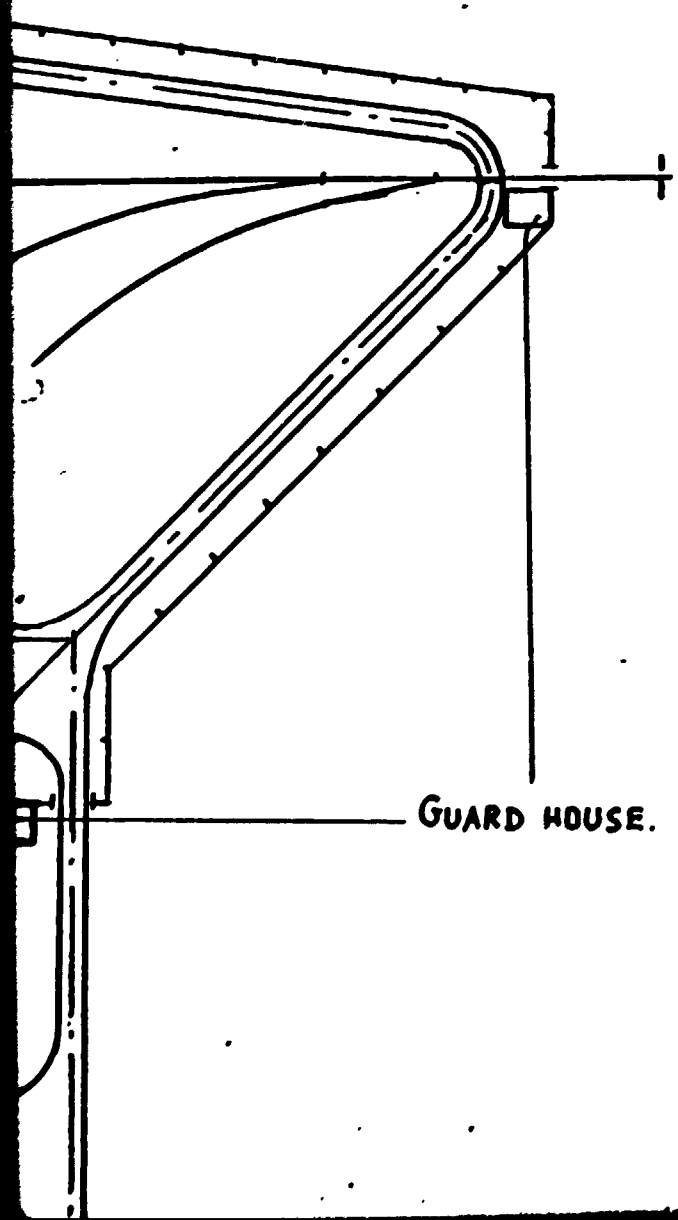

ROM MINE
1.1
SECTION 4
POWER
1.2
2.6.
2.3
1.13.
2.11.
1.10.
1.11
2.5
3.1
1.9.

SECTION 5

POWER TRANSMISSION LINE.



SECTION 6



LIST OF UNITS.

1. MAIN PRODUCTION UNITS.

1.1 ORE RECEIVING UNIT.
1.2. MEDIUM AND FINE CRUSHING.
1.3. ORE BLENDING STORAGE AND CONV
1.4. TRANSFER UNITS, DRIVE AND TAKE-
1.5. DRY GRINDING.
1.6. ROASTING AND REDUCTION WITH BL
1.7. SULPHUR STORAGE.
1.8. DIGESTION, DESILICATION AND MU
1.9. EVAPORATION AND POTASSIUM SU
1.10. PRECIPITATION
1.11. HYDRATE TREATMENT WITH HYDRAT
1.12. ALUMINA CALCINATION.
1.13. COMMERCIAL ALUMINA. STORAGE
1.14. POTASSIUM SULPHATE DRYING.
1.15. POTASSIUM SULPHATE STORAGE.
1.16. CAUSTIC STORAGE.

2. POWER FACILITIES.

2.1 HEAT AND POWER PLANT.
2.11. MAIN BUILDING.
2.12. CHEMICAL WATER TREATMENT.
2.13. PERSONNEL FACILITIES.
2.2. TRANSFORMER AND OIL FACILITIE
2.3. MAIN STEP-DOWN SUBSTATION.
2.4. BUS-BARS.
2.5. COMPRESSOR STATION.
2.6. GAS DISTRIBUTING STATION
2.7. FUEL OIL FACILITIES
2.8. OXYGEN STATION.

3 WATER SUPPLY AND SEWERA

3.1. WATER RECIRCULATING UNITS OF C
AND HEAT AND POWER PLANT.
3.2 TANKS FOR INDUSTRIAL AND DRAIN

SECTION 7

LIST OF UNITS.

1. MAIN PRODUCTION UNITS.

1.1 ORE RECEIVING UNIT.
1.2. MEDIUM AND FINE CRUSHING.
1.3. ORE BLENDING STORAGE AND CONVEYOR GALLERIES.
1.4. TRANSFER UNITS, DRIVE AND TAKE-UP STATIONS.
1.5. DRY GRINDING.
1.6. ROASTING AND REDUCTION WITH BLOWER STATION.
1.7. SULPHUR STORAGE.
1.8. DIGESTION, DESILICATION AND MUD WASHING.
1.9. EVAPORATION AND POTASSIUM SULPHATE. PRODUCTION.
1.10. PRECIPITATION
1.11. HYDRATE TREATMENT WITH HYDRATE STORAGE.
1.12. ALUMINA CALCINATION.
1.13. COMMERCIAL ALUMINA. STORAGE.
1.14. POTASSIUM SULPHATE DRYING.
1.15. POTASSIUM SULPHATE STORAGE.
1.16. CAUSTIC STORAGE.

2. POWER FACILITIES.

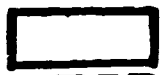
2.1 HEAT AND POWER PLANT.
2.11. MAIN BUILDING.
2.12. CHEMICAL WATER TREATMENT.
2.13. PERSONNEL FACILITIES.
2.2. TRANSFORMER AND OIL FACILITIES.
2.3. MAIN STEP-DOWN SUBSTATION.
2.4. BUS-BARS.
2.5. COMPRESSOR STATION.
2.6. GAS DISTRIBUTING STATION
2.7. FUEL OIL FACILITIES
2.8. OXYGEN STATION.

3 WATER SUPPLY AND SEWERAGE SYSTEMS.

3.1. WATER RECIRCULATING UNITS OF COMPRESSOR STATION. OF EVAPORATION AND HEAT AND POWER PLANT.
3.2. TANKS FOR INDUSTRIAL AND POTABLE WATER WITH BOOSTER PUMP STATION

SECTION 8

LEGEND.



PROPOSED BUILDING AND ST TURES.

UNDERGROUND STRUCTURES.

MOTOR ROADS.

RAILWAY TRACKS.

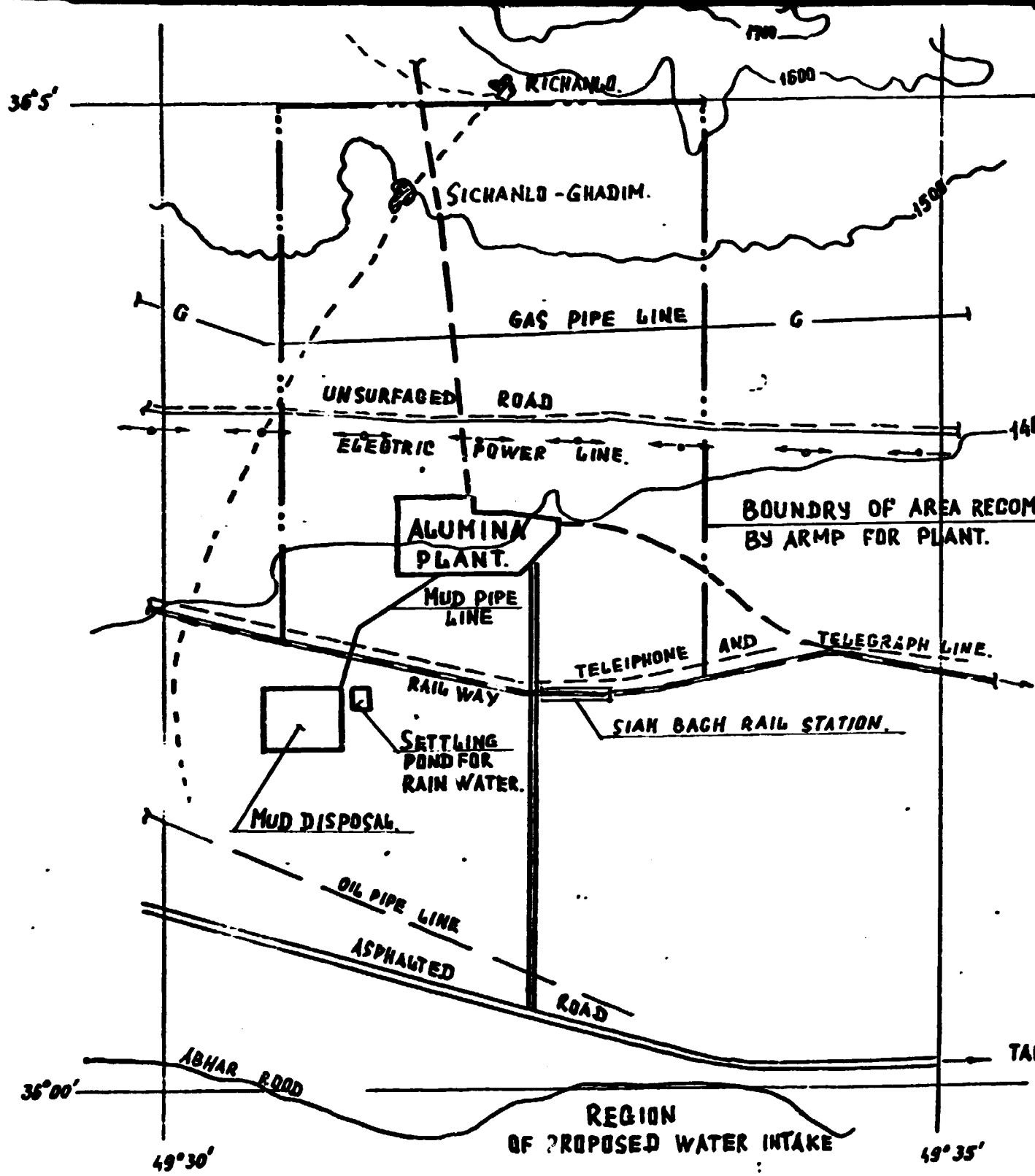
FENCE.

MAIN PARAMETERS OF GENERAL LAYOUT.

SRL N°	DESCRIPTION.	UNIT OF MEASURE	QUANTITY.
1.	TOTAL PLANT AREA INSIDE FENCE.	HECTARES.	82.0.
2.	PREPLANT AREA SURFACE.	HECTARES	9.0.
3.	AREA BUILT WITH BUILDING AND STRUCTURES.	HECTARES	22.0.
4.	BUILDING DENSITY.	%	31.
5.	LENGTH OF MOTOR ROADS AND SURFACE OF MOTOR ROADS PAVEMENT	KM	14

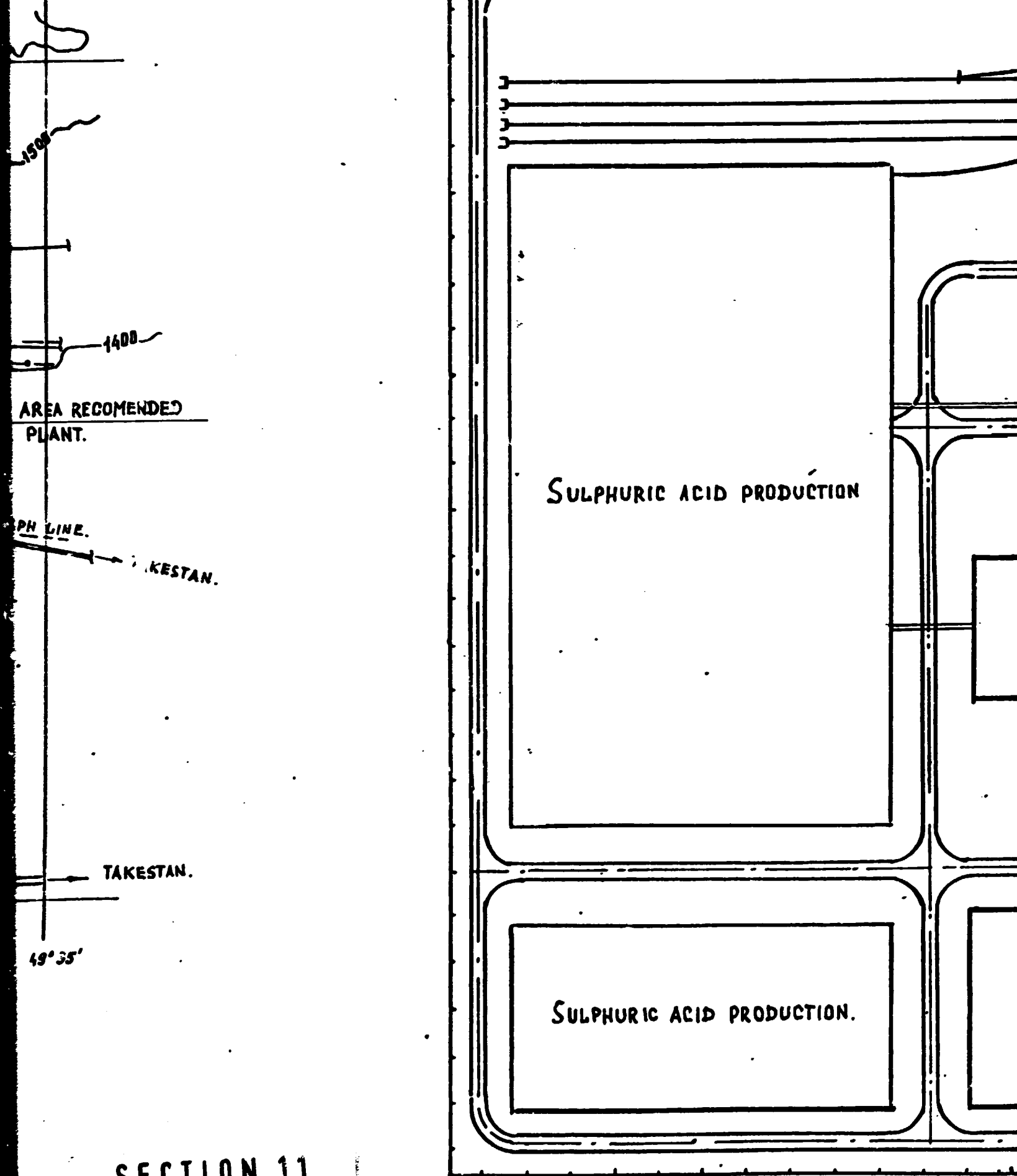
SECTION 9

GENERAL LAYAUT WAS PREPARED BASED ON TOPOGRAPHIC MAP, SCALE 1:50000, HANDED OVER BY ARMP IN 1987.

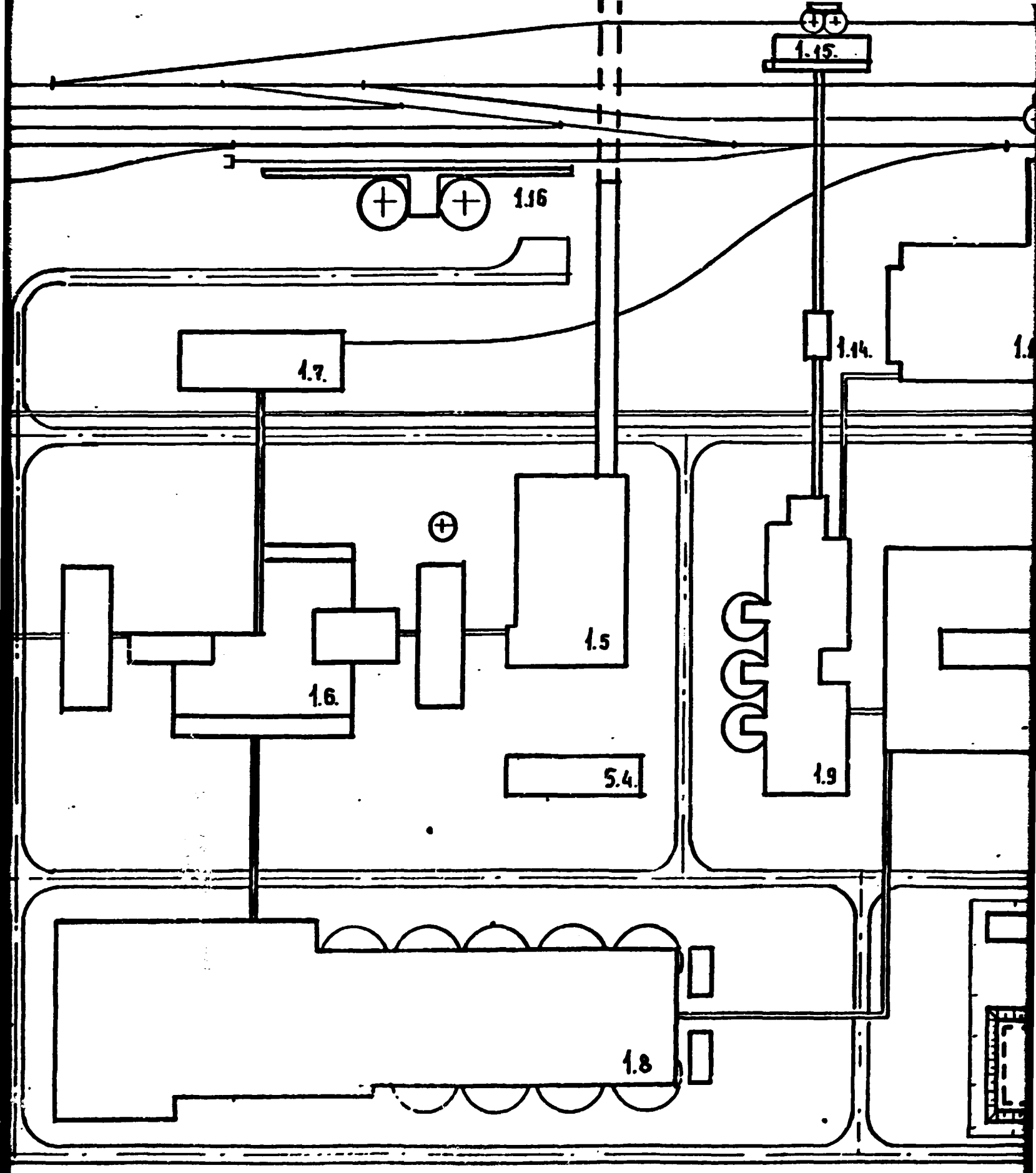


LOCATION PLAN, SCALE 1:50000.

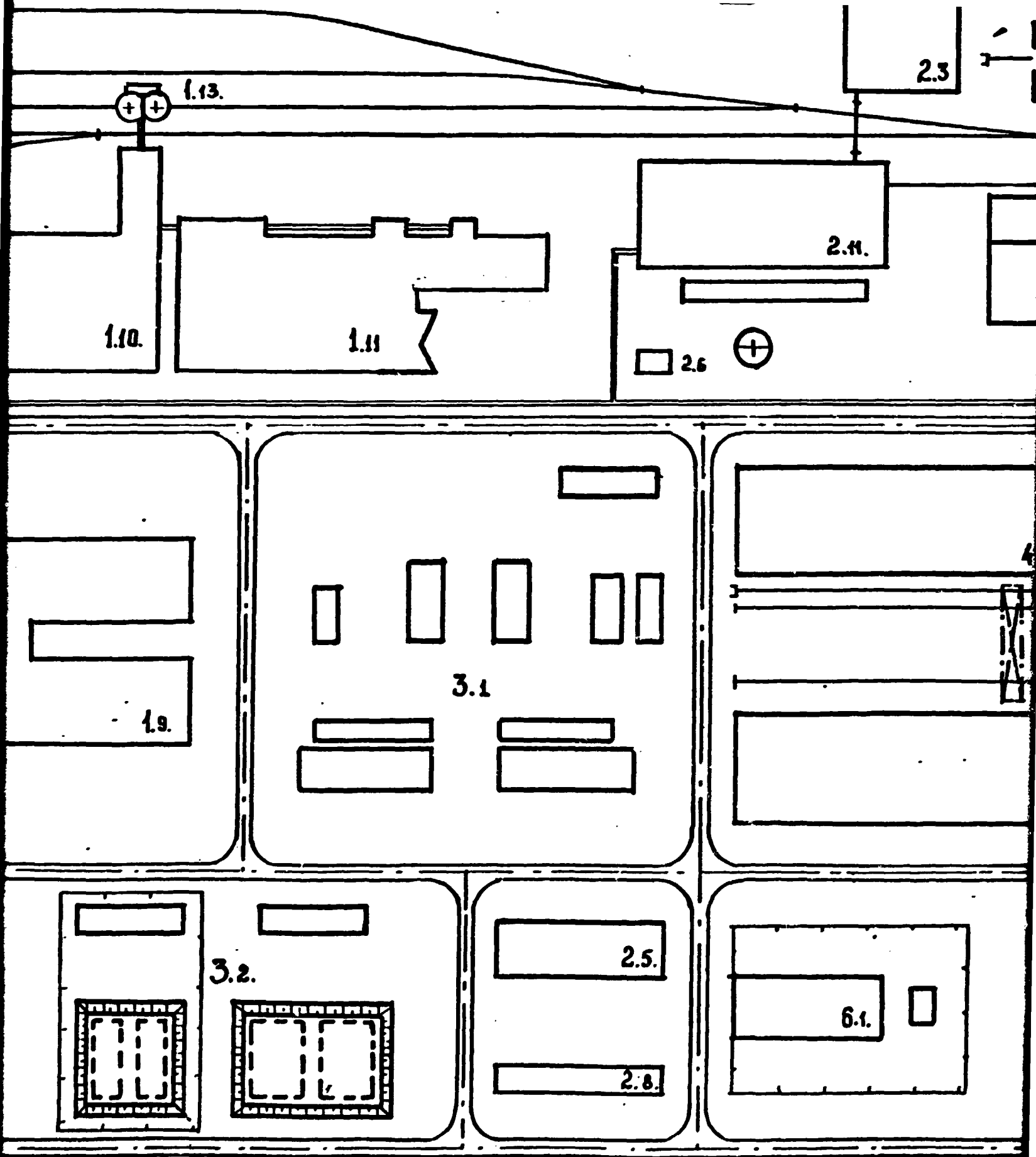
SECTION 10


1500
1400
AREA RECOMENDED
PLANT.
PH LINE.
KESTAN.
TAKESTAN.
49° 35'
SULPHURIC ACID PRODUCTION
SULPHURIC ACID PRODUCTION.

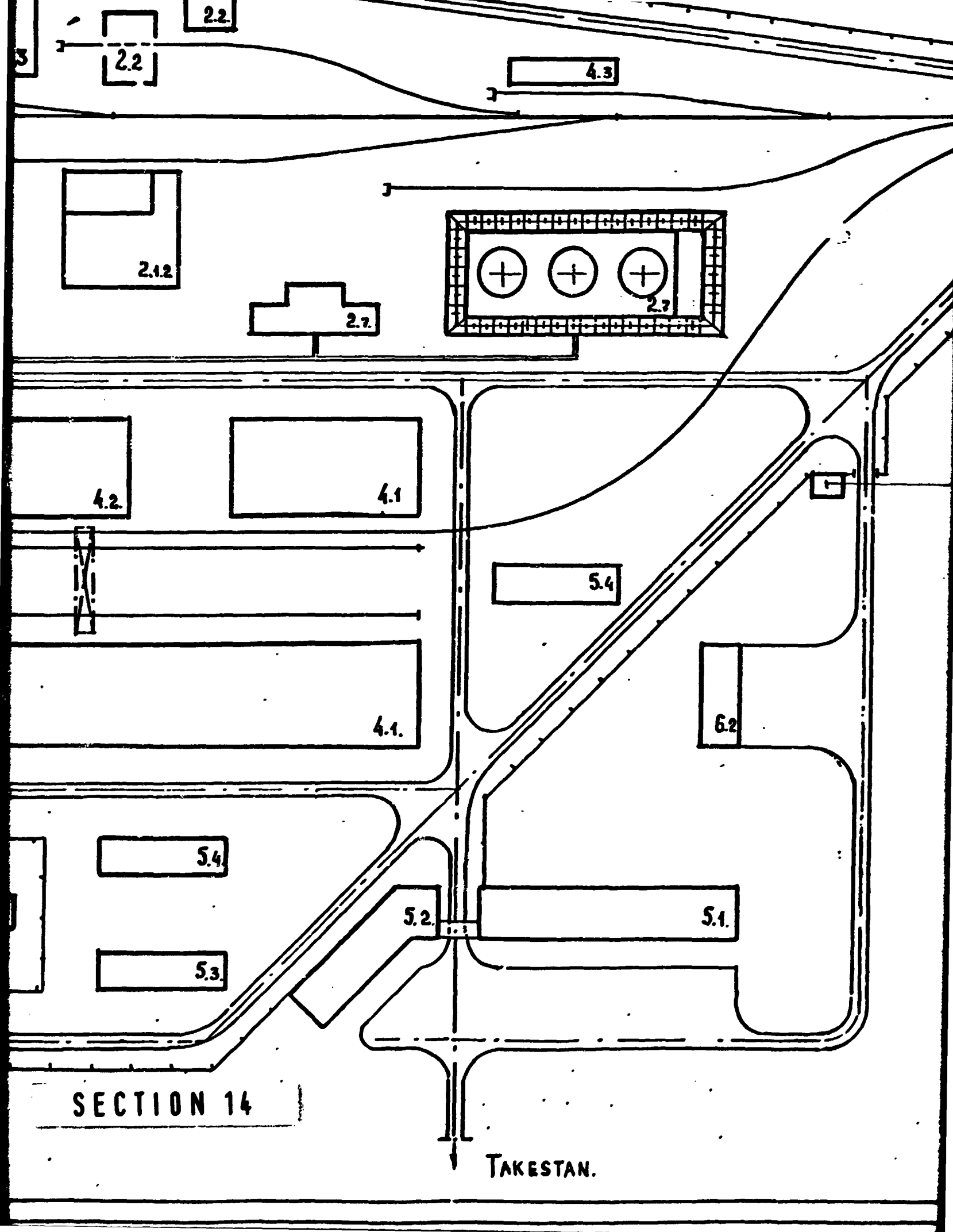
SECTION 11



SECTION 12



SECTION 13


2.2
2.2
4.3
2.1.2
2.7
2.7
4.2.
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4.1.
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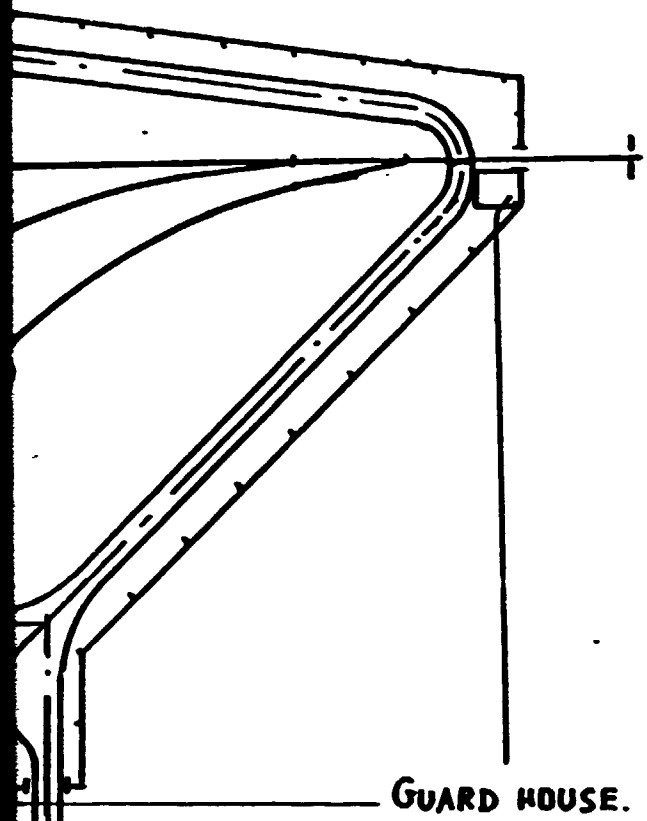
6.2
5.4
5.2.
5.1.
5.3.
SECTION 14
TAKESTAN.



GUARD HOUSE.

SECTION 15

1.10. PRECIPITATION
1.11. HYDRATE TREATMENT WITH HYDRATE
1.12. ALUMINA CALCINATION.
1.13. COMMERCIAL ALUMINA. STORAGE.
1.14. POTASSIUM SULPHATE DRYING.
1.15. POTASSIUM SULPHATE STORAGE.
1.16. CAUSTIC STORAGE.

2. POWER FACILITIES.

2.1 HEAT AND POWER PLANT.
2.11. MAIN BUILDING.
2.12. CHEMICAL WATER TREATMENT.
2.13. PERSONNEL FACILITIES.
2.2. TRANSFORMER AND OIL FACILITIES
2.3. MAIN STEP-DOWN SUBSTATION.
2.4. BUS-BARS.
2.5. COMPRESSOR STATION.
2.6. GAS DISTRIBUTING STATION
2.7. FUEL OIL FACILITIES
2.8. OXYGEN STATION.

3 WATER SUPPLY AND SEWERAGE

3.1. WATER RECIRCULATING UNITS OF COM
AND HEAT AND POWER PLANT.
3.2. TANKS FOR INDUSTRIAL AND POTABLE

4 REPAIR AND STORAGE FACIL

4.1 REPAIR SHOP COMPLEX.
4.2. MATERIAL STORAGE COMPLEX.
4.3. OILS AND CHEMICAL STORAGE.

5. SERVICE AND AUXILIARY FA

5.1. PLANT ADMINISTRATIVE BUILDING.
5.2. TECHNICAL BUILDING WITH TELEP
5.3. LABORATORY.
5.4. PERSONNEL SERVICE ROOMS.

6. TRANSPORT FACILITIES.

6.1. SPECIAL VEHICLES GARAGE.
6.2. FIRE-FIGHTING STATION.

1.11. HYDRATE TREATMENT WITH HYDRATE STORAGE.
1.12. ALUMINA CALCINATION.
1.13. COMMERCIAL ALUMINA. STORAGE.
1.14. POTASSIUM SULPHATE DRYING.
1.15. POTASSIUM SULPHATE STORAGE.
1.16. CAUSTIC STORAGE.

2. POWER FACILITIES.

2.1 HEAT AND POWER PLANT.
2.11. MAIN BUILDING.
2.12. CHEMICAL WATER TREATMENT.
2.13. PERSONNEL FACILITIES.
2.2. TRANSFORMER AND OIL FACILITIES.
2.3. MAIN STEP-DOWN SUBSTATION.
2.4. BUS-BARS.
2.5. COMPRESSOR STATION.
2.6. GAS DISTRIBUTING STATION
2.7. FUEL OIL FACILITIES
2.8. OXYGEN STATION.

3 WATER SUPPLY AND SEWERAGE SYSTEMS.

3.1. WATER RECIRCULATING UNITS OF COMPRESSOR STATION. OF EVAPORATION AND HEAT AND POWER PLANT.
3.2. TANKS FOR INDUSTRIAL AND POTABLE WATER WITH BOOSTER PUMP STATION

4 REPAIR AND STORAGE FACILITIES.

4.1 REPAIR SHOP COMPLEX.
4.2. MATERIAL STORAGE COMPLEX.
4.3. OILS AND CHEMICAL STORAGE.

5. SERVICE AND AUXILIARY FACILITIES.

5.1. PLANT ADMINISTRATIVE BUILDING.
5.2. TECHNICAL BUILDING WITH TELEPHONE EXCHANGE.
5.3. LABORATORY.
5.4. PERSONNEL SERVICE ROOMS.

6. TRANSPORT FACILITIES.

6.1. SPECIAL VEHICLES GARAGE.
6.2. FIRE-FIGHTING STATION.

SECTION 16

MAIN PARAMETERS OF GENERAL LAYOUT.

SRL. N°	DESCRIPTION.	UNIT OF MEASURE	QUANTITY.
1.	TOTAL PLANT AREA INSIDE FENCE.	HECTARES.	82.0.
2.	PREPLANT AREA SURFACE.	HECTARES	9.0.
3.	AREA BUILT WITH BUILDING AND STRUCTURES.	HECTARES	22.0.
4.	BUILDING DENSITY.	%	31.
5.	LENGTH OF MOTOR ROADS AND SURFACE OF MOTOR ROADS PAVEMENT	KM / HECTARE	14 / 12.5.
6.	LENGTH OF RAILWAY TRACK.	KM.	7.5.
7.	GREENERY AREA.	HECTARES	15.0.

SECTION 17

SECTION 18

GENERAL LAYAUT WAS PREPARED BASED ON TOPOGRAPHIC MAP, SCALE 1:50000, HANDED OVER BY ARMP IN 1987.

UNIDO CONTRACT NO 85/108.

1389982-ГП.			
JRAN. ALUNITE BASED ALUMINA PLANT			
	STAGE	SHEET	SHEETS
INDUSTRIAL SITE.	FEASIBILITY		1
GENERAL LAYOUT. (ALTERNATIVE)	VAMI LENINGRAD.		

SIZE A3 x6.

UNIDO Contract № 85/108
Project № DP/IRA/85/003

FEASIBILITY REPORT ON CONSTRUCTION OF ALUNITE BASED ALUMINA PLANT IN ISLAMIC REPUBLIC OF IRAN

Final Report

Volume III

Equipment Specifications

VAMI

V/O TECHNOEXPORT

Leningrad
1988

COMPOSITION OF FEASIBILITY REPORT ON CONSTRUCTION OF ALUNITE BASED ALUMINA PLANT IN ISLAMIC REPUBLIC OF IRAN

Volume I — General Explanatory Note

Volume II — Drawings

Volume III — Equipment Specifications

S U M M A R Y

Summary schedule of equipment and materials

N	Production unit	Unit of measure	Weight	
			equipment	materials
1	Main production units	t	38091.3	6689.5
2	Power facilities units	"	3331.5	3512.0
3	Units of water supply sewerage and mud disposal	"	479.7	1934.2
4	Repair and storage	"	1001.2	125.4
5	Service facilities	"	154.8	116.5
6	Transportation facilities	"	651.2	52.6
	Total:		43709.8	12430.3

1. MAIN PRODUCTION UNITS

1.1. Ore Receiving Unit

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Process Equipment						
		Conveyors, feeders						
1		Plate feeder, width 1800 mm, length 18 m		pc	1	890	890	USA USSR EUROPE
2		Cranes, hoists, lifts						- " -
		Electric underhung crane 3.2 t capacity, lifting height 6 m, span 4.2 m		pc	1	1000	1000	- " -
3		Travelling, manual gear blocks, 2 t capacity		pc	1	65	65	- " -
4		Travelling, manual gear blocks, 1 t capacity		pc	1	40	40	- " -
		TOTAL					1105	
		Pumps, fume exhausters, fans						- " -
5		Centrifugal dust fan with electric motor 4A180M4		pc	1	800	800	- " -
		Sanitary-engineering equipment						- " -
6		Wet dust collector		pc	1	1500	1500	- " -
		TOTAL of Section I. Equipment					4295	

Ore Receiving Unit

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Electrical Equipment						
		Power equipment						
1		Control station boards consisting of frame-design panels		1panel	8	300	2400	
2		Control box of induction motors rated for 380V a.c., consisting of lead-in three-pole circuit breaker w/combination trip rated for 16A to 160A and magnetic starter with thermal relay rated for 16A to 160A		pc	10	40	40	
3		Three-pole power boxes consisting of master switch with fuses rated for 100A to 300A, voltate 380 V a.c.		pc	5	24	120	
4		Power switchboards rated for 380 V a.c. with lead-in three-pole switch with combination trip rated for 250 A and ten output circuit breakers with combination trip rated for 16A to 160A		pc	2	170	340	
5		Three-pole magnetic starters rated for 380V a.c. in dust-proof enclosure		pc	5	24	120	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Electric lighting equipment						
6		Distribution panels with lead-in circuit breaker without trip rated for 100A with six three-phase and twelve single-phase breakers with electromagnetic and thermal trips rated for 63A and 20A		pc	4	50	200	
7		Single-phase stepdown transformer 380/220/34V, power rating 250 VA		pc	8	10	80	
8		Setting breakers 10A, 220V		pc	40	0.6	24	
9		Double-pole plug connectors 10A, 220V		pc	60	0.6	36	
10		Light fixture (miscellaneous)		pc	155		1780	
11		Filament, luminescent, mercury lamps		pc	170		50	
		TOTAL					5550	
		Section II. Materials						
1		Power cable rated up to 1000V, aluminium cores, PVC insulation and sheathing, four-core cable (various cross-sections)		km	5		4800	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
2		Power cable rated for 660 V, rubber or PVC insulation, rubber of PVC sheathing, two-core, aluminium core cable, cross section 4 to 70 mm2		km	5	800	4000	
3		Control cable, aluminium, cores, PVC insulation and sheathing, cross-section 2.5 mm2, 4 to 37 cores		km	3	200	600	
4		Hook-up wire, aluminium cores, cross-section 2.5 mm2, PVC sheathing		km	1	16	16	
		TOTAL					9416	
5		Steel pipe ID 25 to 65		m	1100		3200	
		TOTAL of Section I. Equipment					5500	
		TOTAL of Section II. Materials					12616	

1.2. Medium and fine crushing

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Process Equipment						
		Crushing, grinding, beneficiation						
1		Fine cone crusher, cone diameter 2200 mm		pc	3	108375	325125	USSR USA Europe
2		Medium cone crusher, cone diameter 2200 mm		pc	1	108930	108930	-"-
3		Inertia screen. Sieve size 1750x3860, motor rated for 18.5 kW		pc	1	7150	7150	-"-
4		Inertia screen. Sieve size 2500x6400, motor rated for 55 kW		pc	6	19000	114000	-"-
5		Iron separator for conveyor belt 1000 mm wide		pd	1	5,00	5700	-"-
6		Iron detector		pc	1	190	190	-"-
		TOTAL					561095.	
		Conveyors, feeders						
7		Troughed belt conveyor, belt width 1000 mm, length 170 m		pc	1	64000	64000	
8		Troughed belt conveyor, belt width 1400 mm, length 130 m		pc	1	48000	48000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
9		Trip car for conveyor with belt width 1400 mm		pc	1	13356	13356	USSR EUROPE
10		Automatic belt weightometer for conveyor with belt width 1400 mm		pc	1	450	450	EUROPE
11		Automatic belt weightometer for conveyor with belt width 1000 mm		pc	1	450	450	— " —
12		Scale with electrovibrating feeder with capacity of 320 t/h		pc	6	6745	40470	— " —
		TOTAL					166726	
		Cranes, hoists, lifts						USA USSR EUROPE
13		General purpose E.O.T. crane capacity 20/5 t, span 22.5 m		pc	1	23800	23800	
14		General purpose E.O.T. crane, capacity 20/5 t, span 10.5 m, light duty		pc	1	17000	17000	— " —
15		General-purpose E.O.T. crane, capacity 16/3.2 t, span 10.5 m		pc	1	16500	16500	— " —
		TOTAL					166726	

7

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Pumps, fume exhausters, fans						
16		Fume exhauster with motor 4A-200--54		pc	3	1500	4500	USSR
17		Centrifugal dust fan, motor 4A18054		pc	500	500		— " —
		TOTAL					5000	
		Sanitaryoengineering equipment						
18		Wet dust collector		pc	1	1300	1300	
19		Wet dust collector		pc	3	1500	4500	
20		Household air conditioner		pc	1	53	53	
		TOTAL					5853	
		Pipe fittings						
21		Valves		kg			2500	
		Section II. Materials						
1		Pipelines		kg			28000	
		Total of Section I. Equipment					1123599	
		Total of Section II. Materials					28000	

Medium and Fine Crushing

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Electrical Equipment						
1		Transformer substation complet including - transformer 1000 kA - HV input cabinet - LV input cabinet - sectional cabinet - lines cabinet		set	2	19700	39400	
2		Control station boards consisting of frame-design panels			15	300	4500	
3		Control box of induction motors rated for 380V a.c., consisting of lead-in three-pole circuit breaker w/combination trip rated for 16A to 160A and magnetic starter with thermal relay rated for 16A to 160A		pc	10	40	400	
4		Power switchboxes rated for 380V a.c. with lead-in three-pole switch with combination trip rated for 250A and ten output circiut breakers with combination trip rated for 16A to 160A		pc	5	24	120	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
5		Power switchboards rated for 380V a.c. with lead-in three-pole switch with combination trip rated for 250A and ten output circuit breakers with combination trip rated for 16A to 160A		pc	5	170	850	
6		Three-pole magnetic starters rated for 380V a.c. in dust proof enclosure bobbin 220V thermal reals 63A, 40A, 25A		pc	30		70	
7		Electric lighting equipment						
7		Electric lighting equipment						
7		Distribution panels with lean-in circuit breaker without trip rated for 100A with six three-phase and twelve single-phase breakers with electromagnetic and thermal trips rated for 63A and 20A		pc	5	50	250	
8		Single-phase stepdown transformer 380/220/24 V, power rating 250 VA		pc	10	10	100	
9		Setting breakers 10A, 220V		pc	60	0.6	36	
10		Double-pole plug connectors 10 A, 220V		pc	50	0.6	30	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Light fixture (miscellaneous)		pc	190		1740	
12		Filament, luminescent, mercury lamps		pc	260		85	
		TOTAL					47581	
		Section II. Materials						
1		Power cable rated up to 1000 V, aluminium cores, PVC insulation and sheathing, four-core cable (various cross-sections)		km	6.1		5372	
2		Power cable rated for 660V, rubber or PVC insulation, rubber of PVC sheathing, two-core, aluminium core cable, cross section 4 to 70 mm2		km	6.5	800	5200	
3		Control cable, aluminium cores, PVC insulation and sheathing, cross-section 2.5 mm2, 4 to 37 cores		km	6	200	1200	
4		Hook-up wire, aluminium cores, cross-section 2.5 mm2, PVC sheathing		km	2	16	32	
		TOTAL					11804	

РТП ВАМИ Зак.№ 878 Тир 3030 17/11-23г.

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
5		Steel pipe ID 25 to 65		m	1750		5350	
		TOTAL of Section I. Equipment					47581	
		TOTAL of Section II. Materials					17454	

1.3. Ore blending storage and conveyors galeries

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Process equipment						
		Conveyors, feeders						
1		Troughed belt conveyors belt width 1000 mm length 170 m		pc	1	64000	64000	USSR EUROPE
2		Pile capacity 500 t/h, h of pile 10 m		pc	1	130000	130000	—
		TOTAL					194000	
		Cranes, hoists, lifts						
3		General purpose E.O.T. crane capacity 5 t span99 m h 6 m		pc	1	2290	2290	
4		Travelling, manual gear 3.2 t capacity h 6 m		pc	2	99	198	
		TOTAL					2488	
5		Automobiles, cars vehicals wheel excavator crawler mounted shovel 500 t/h		pc	2	75600	151200	EUROPE

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section II. Materials						
1		Steelstructures		kg			42570	
		TOTAL Section 1. Equipment					347688	
		Section 2. Materials					42570	
		Ore blonding storage and conveyors galeries						
		Section I. Equipment Electric part						
		Electric power equipment						
1		Transformer substation (KT 3) including:		set	1	17500	17500	
		- transformer 630 kW voltage 10/0 H-0 23 kWA		pc	2			
		- HV input cabinet		pc	2			
		- LV input cabiner		pc	2			
		- sectional cabinet		pc	1			
		- line cabinet		pc	4			
2		Control station boards consisting of frame- design panels		1 panel	5	300	1500	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
3		Control box of induction motors rated for 380 V a.c., consisting of lead-in three-pole circuit breaker w/combination trip rated for 16A to 160A and magnetic starter with thermal relay rated for 16A to 160 A		pc	10	40	400	
4		Three-pole power boxes consisting of master switch with fuses rated for 100A to 300A, voltage 380V a.c.		pc	30	24	720	
5		Power switchboards rated for 380V with lead in three lote switch with conbination						
6		Three pole magnetic starters rated for 380V in dust proof enclusure bobbin 220V thermal reals 63A, 40A, 25A						
7		Distribution panels with lead-in circuit breaker without trip rated for 100A with six three-phase and twelve single-phase breakers with electromagnetic and thermal trips rated for 63A and 20A		pc	6	50	300	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
8		Single phase stepdown transformer 380/220/24V p.r. 250 VA		pc	15	10	150	
9		Setting breakers 10A, 220V		pc	40	0.6	24	
10		Double pole plug connectors 10A, 220V		pc	40	0.6	24	
11		Light fixture (miscellaneous)		pc	300		2400	
12		Search light		pc	20	20	400	
13		Filament luminescent lump		pc	620		260	
		TOTAL					24223	
1		Power cable 1000V Al core cable PVH insulation and sheathing 4-core (di' sections)		km	7.1		7625	
2		Pow able rated for 660V, rubber of PVC insulation, rubber of PVC heathing, two-core, aluminium core cable, cross section 4 to 70 mm2		km	3.5	800	2820	
3		Control cable, PVC copper cores, PVC insulation and sheathing, cross-section 2.5 mm2, 4 to 37 cores		km	4	200	800	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
4		Hook-up wire, aluminium cores, cross-section 2.5 mm2, PVC sheathing		km	0.8	16	13	
		TOTAL					11238	
5		Steel pipe ID 25 to 65		m	1600	5150		
		TOTAL of Section I. Equipment					24223	
		TOTAL of Section II. Materials					16388	

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1.4. Unloading units

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment Process						
		Conveyors, feeders belt						
1		Belt conveyor width 1000 mm length 8 m		pc	2	6870	13740	USA USSR EUROPE
2		Troughed belt conveyor belt width 1000 mm length 140 m		pc	1	31000	31000	— " —
3		Troughed belt conveyor width 1000 mm length 450 m		pc	1	64000	128000	— " —
4		Troughed belt conveyor width of belt 1400 mm, length 130 m		pc	1	36000	36000	— " —
5		Troughed belt conveyor, width of belt 1400 mm, length 20 m		pc	1	4000	4000	— " —
6		Automatic simple tare		pc	1	1815	1815	— " —
7		Automatic belt weightometer for conveyor with belt width 1000mm		pc	1	450	450	— " —
		TOTAL					215005	
		Crane, hoists, lifts						
8		General purpose E.O.T. crane capacity 5 t, span 9 m h 6 m		pc	1	2290	2290	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
9		General purpose E.O.T. crane capacity 5 t span 15 m H 12 m		pc	1	3210	3210	USA USSR Europe
10		General purpose E.O.T. crane capacity 5 t, span 9 m h 12 m		pc	2	2350	4700	" —
11		Travelling manual gear capacity 3.2 t		pc	1	99	99	" —
12		Simple preparation apparatus capacity 2.2 t/h		pc	1	1900	1900	" —
		TOTAL					12199	
		Pumps, fume exhausters, fans						
13		Centrifuga dust fan		pc	2	500	1000	" —
		Section II. Materials						
1		Steel structures		kg			119000	
		Total: Section I Equipment					22804	
		Section II Materials					119000	

NOS		Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet	Trans. No					of one piece	total	
		Section I. Equipment. Electric part						
		Electric power equipment						
1		Transformer substation (KT -3) including:		set	1	17500	17500	
		- transformer 630 kW voltage 10/0 4-0 23 kWA		pc	2			
		- HV input cabinet		pc	2			
		- LV input cabinet		pc	2			
		- sectional cabinet		pc	1			
		- line cabinet		pc	4			
2		Control station boards consisting of frame design panels		1 panel	17	300	5100	
3		Control box of induction motors rated for 380V a.c. consisting of lead-in three-pole circuit breake W/ combination trip rated for 16A to 160A and magnetic started with thermal relay 16A to 160A		pc	25	40	1000	
4		Three-pole power boxes consisting of master switch with fuses rated for [illegible]0A to 300A, voltage 380 V a.c.		pc	14	24	336	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
5		Power switchboards rated for 380V with lead-in three-pole switch with combination trip rated for 250A and den autput circuit breakers with combination trip rated for 16A to 160A		pc	4	170	680	
6		Three-pole magnetic starters rated for 380 V in dus-proof encloisure bobbin 220V thermal relais 63A, 40A, 25A		pc	4	170	680	
7		Distribution panels with lead-in circuit breaker without trip rated for 100A with 12 single plases breakers with electromagnetic and thermal trips rated for 20A		pc	15	50	750	
8		Single-phase stepdown transformer 380/220/24 V, power rating 250 VA		pc	15	10	150	
9		Setting breakers 10A, 220V		pc	80	0.6	48	
10		Double-pole plug connectors 10A, 220V		pc	70	0.6	42	
11		Light fixture (miscellaneous)		pc	510		4140	
12		Filament, luminescent, mercury lamps		pc	860		315	
		TOTAL					30201	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Section II. Materials						
1		Power cable rated up to 1000 V, aluminium cores, PVC insulation and sheathing, four-core cable (carious cross-sections)		km	13		14542	
2		Power cable 660 V rubber or plastic insulation, rubber or PVH sheating 2,4- core Al cores section 4-70 vv2		km	8	800	6400	
3		Control cable Al cores PVH isulation and sheathing sections 2.5 mm2 4-37 cores.		km	10	200	2000	
4		Hook-up wire, Al cores cross - section 2.5 mm PVC sheating;		km	1.5	16	24	
		TOTAL					22966	
5		Steel pipe ID 25-65		m	3100		9100	
		TOTAL Section I. Equipment					30201	
		Section II. Materials					32066	

1.5. Dry Grinding

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Process						
		Crushing and grinding equipment						
1		Drum ball mill ⌀ 3700 mm, 3500 mm with motor 1600 kW, 100 rpm, 6000 V,		pc	5	214000	1070000	USSR
		- fan motor, 22 kW, 1500 rpm				2135	10675	
		- local lubricant station, 35 l/min				840	840	
		- central grease station				375	1875	
		- ball charge ⌀ 40 mm				100000	500000	
		Chemical equipment						
2		Air separator, ⌀ 4750 mm lower pipe diameter - 1600 mm		pc	5	17875	89375	- " -
3		Cyclone, ⌀ 3750 mm		pc	5	19450	97250	- " -
		TOTAL					1773375	
		Cranes, hoists, lifts						
4		Electric travelling crane 20/5 t span 10.5		pc	1	26600	26600	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
5		Electric travelling magnetic crane, 15 t, span 13.5 m		pc	1	24900	24900	USSR Leningrad
6		Tower crane, 4 t, lifting height 72 m, boom - 40 m		pc	1	114000	114000	— " —
7		Single-beam electric travelling crane, 5 t, span 6 m, height - 6 m		pc	1	1980	1980	— " —
		TOTAL					167480	
		Conveyors, feeders						
8		Belt conveyor with tripper, length - 280 m, belt width - 1000 mm		pc	2	102480	204960	— " —
9		Discharge car for conveyor 1000mm		pc	2	9106	18212	
10		Continuous weigher, maximum capacity 2 63 t/h		pc	5	2350	11750	— " —
11		Belt weigher for conveyor 1000mm		pc	2	450	900	— " —
		TOTAL					30862	
		Pumps, fans, expanders						
12		Pneumatic chamber pump, 1.29 kg of compressed air per second		pc	5	8050	40250	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
13		Cantilever centrifugal fan, 170000 m3/h, 922 kg/m2 800 kW		pc	5	7000	35000	USSR
		TOTAL					75250	
		Sanitary equipment						
15		Dust trap		pc	2	1300	2600	
16		Domestic air conditioner		pc	1	53	53	
		TOTAL					2653	
		Piping fittings						
17		Valves		kg			1500	
		Section II. Materials						
1		Pipelines		kg			14000	
		Total: for section I - equipment					1282440	
		for section II - materials					14000	
		Section I. Equipment, Electric part						
		Electric power equipment						
1		Transformer substation complet including:		set	1	17500	17500	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		- transformer 630 kVA		pc	2			
		- input HV cabinet		pc	2			
		- input L.V. cabinet		pc	2			
		- sectional cabinet		pc	1			
		- line cabinet		pc	4			
2		Complet switchboards P I-1 P4--10 kV, including		set	1		20700	
		- input cabinet oil breakers		ps	2			
		- sectionnel cabinet circuit breakers 630 A		pc	1			
		- sectionnel switch cabinet 630 A		pc	1			
		- voltage transformer cabinet		pc	2			
		- power transformer cabinet		pc	2			
		- LV equipment cabinet		pc	1			
		- lead-outlline cabinet 630 A		pc	22			
		- complex feeding		pc	2			
3		Packaged distribution unit (DS-2, DU-6 kV), including		set	1		15900	
		- 1000 A input cabinet with oil breaker		pc	2			
		- 630 A sectional switch cabinet		pc	1			

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NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		- 630A sectional breaker cabinet		pc	1			
		- voltage transformer cabinet		pc	2			
		- power transformer cabinet		pc	2			
		- low voltage equipment cabinet		pc	1			
		- 630 A output lines cabinet		pc	14			
		- packaged power supply unit		pc	2			
4		4000 kVA power three phase oil transformer		pc	2	13090	26180	
5		Control station boards consisting of frame-design panels		1 panel	10	300	3000	
6		380V AC asynchronous motor control boxes, consisting of three-pole input circuit breakers with combined release of nominal current from 16A to 160A and magnetic starter. With thermal relay of nominal current from 16A to 160A		pc	10	40	400	
7		Three pole power boxes consisting of master switch with fuses for currents from 100A to 300A 380 VAC		pc	10	24	240	
7[8]		E S P		pc	5	35000	175000	

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NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
8		Power switch boards rated for 380V with lead-in three pole switch with combination drip rated for 250A and den output circuit breakers with combination trip rated for 16A to 160A		pc	3	170	510	
9		Three pole magnetic starters rated for 380 V in dus proof enclausure bobbin 220V thermal relais 63A, 40A, 25A		pc	30		70	
		Electric Lighting Equipment						
10		Distribution points with input sircuit breakers without release for nominal current 100A with six three-phase and 12 single-phase line breakers with electromagnetic and thermal releases for currents of 63A and 20A		pc	10	50	500	
11		Single-phase stepdown transformer 380/220/24V p.r 250V		pc	15	10	150	
12		Setting breakers 10A 220V.		pc	80	0.6	48	
13		Double pole plug connectors 10A 220V		pc	70	0.6	42	
14		Light fixture (miscel)		pc	5		2710	

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
15		Filament luminescent arc meloury lamp		pc	530		200	
		TOTAL					263150	
		Section II. Materials						
1		Power cables up to 1000V with four aluminium cores, PVC insulation and sheath (different section)		km	5.43		4534	
2		Power cable 660V, two or four aluminium cores with rubber or plastic insulation, rubber or PVC sheath, cores, section from 4 to 70 mm2		km	9	800	7200	
3		Control cable of 4 to 37 aluminium cores 2.5 mm2 section with PVC insulation and sheath		km	3.2	200	640	
4		Aluminium installation wire 2.5 mm2 section, PVC sheath		km	2	16	32	
		TOTAL					12406	
5		Steel pipe ID 25-85		m	1450		4355	
		TOTAL Section I - equipment					63150	
		Section II - materials					16761	

1.6. Roasting and reduction with blower station

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Process Tanks, reservoirs, furnace equipment						
1		Roasting furnace, I step, Ø 12,4/10,05 m height 42 m		pcs	3	steel structure 680000	2040000	USSR
						lining 453000	1360000	
2		Roasting furnace, II step, Ø 16,2 x 6 m, height 10,5 m		pcs	3	steel structure 70000	210000	— " —
						lining 370000	1110000	
3		Reduction furnace, Ø 6/4, 6/2, height 30,15 m		pcs	3	steel structure 110000	330000	— " —
						lining 150000	450000	
4		Fluid bed cooler, 3,8 x 12,4 m, height 7,6 m		pcs	3	steel structure 50000	150000	— " —
						lining 120000	36000	
5		Battery of two cyclones Ø 2200		pcs	3	1000	30000	— " —

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
6		Battery of four cyclones, Ø 1600		pcs	3	10000	30000	USSR
7		Battery of four cyclones, Ø 1200		pcs	3	steel structure 11000	33000	- " -
						lining 10000	30000	
8		Battery of six cyclones/Ø 900		pcs	3	10000	30000	- " -
9		Fire box of roasting furnace, I step, Ø 3,2 m, height 10,25 m		pcs	3	steel structure 36000	90000	
						lining 90000	270000	
10		Fire box of roasting furnace, II step		pcs	3	steel structure 30000	90000	- " -
						lining 110000	330000	
11		Reduction furnace fire box		pcs	3	steel structure 30000	90000	- " -
						lining 110000	330000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
12		Fluid bed gate Ø 1020		pcs	3	2300	6900	USSR
13		Fuel oil atomizer of roasting furnace		pcs	24	100	2400	— " —
14		Sulphur atomizer of reduction furnace		pcs	6	31	186	— " —
				Total:			7372480	
				including:				
				steel structure			3033000	
				lining			4240000	
		CChemical equipment						
15		Electrostatic precipitator F = 30 m2		pcs	6	drive 75000	450000	— " —
						steel. structure 75000		
16		Electrostatic precipitator F = 15 m2		pcs	3	drive 75000	225000	— " —
						steel structure 75000	225000	
17		Electrostatic precipitator F = 16 m2		pcs	6	drive 60000	360000	— " —
						steel structure 60000	360000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
18		Shell-and-tube cooler with floating head F = 20 m2		pcs	3	5000	150000	USSR
19		Bag filter F = 90 m^2		pcs	3	3000	9000	— " —
20		Filter Ø 175, h = 0,55 m, P = 40 kg/cm2, t = 40°C		pcs	6	500	3000	— " —
21		Heat exchanger Ø 1400		pcs	3	5000	15000	— " —
22		Reservoir for hydrailic drive oil y = 2 m3, Ø 1 m, P = 10 kg/cm2		pcs	3	1000	3000	— " —
23		Collector for pure sulphur		pcs	3	3000	9000	— " —
				Total:			2259000	
				including steel structures			1035000	
		Pumps, smoke exhausters, fans						
24		Induced fan, 100 000 m^3/h, head 2,5 KPa, electric motor AO -355-M6-43, 200 kW, 1000 rpm		pcs	6	6500	39000	— " —
25		Turbo air blower, 50 000 Nm^3/h, head 14 KPa		pcs	4	5000	20000	— " —
26		Turbo air blower, 30 000 Nm^3/h, head 25 KPa		pcs	4	10000	40000	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
27		Turbo air blower 20000 Nm^3/h head 100 KPa		pcs	4	32000	128000	USSR
28		Induced fan 29000 Nm^3/h, head 3,6 KPa, electric motor 4A200YY , 45 kW, 1500 rpm		pcs	6	6000	36000	— " —
29		Plunger pump, electric motor B180M6, 18,5 kW, 980 rpm, 6,3 m3/h, head 40 kg/cm3		pcs	6	810	4860	— " —
30		Centrifugal pump, immersed, with electric motor 7,5 kW, 3000 rpm		pcs	6	630	3780	" "
31		Fan with electric motor 10 kW, 7000 m3/h		pcs	3	400	1200	— " —
				Total:			272840	
		Conveyor, feeders						
32		Screw feeder ø 320, 12 m long		pcs	3	1200	3600	— " —
33		Dosing device 50÷80 t/h		pcs	3	2200	6600	— " —
34		Air trough ø 273		pcs	15	1000	15000	— " —
				Total:			25200	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Cranes, hoists, lifts						
35		4/8 t tower crane, beam 40 m long hoisting height - 37,5		pc	2	87500	175000	
36		5 t electric suspended crane		do	1	2590	2590	
37		2 t electric hoist, hoisting height - 36 m		do	4	700	2800	
38		Air lift, Ø 1.4 m, lifting height - 4 m		do	3	1400	4200	
		Total :					184590	
		Sanitary equipment						
39		Centrifugal air conditioner		pc	1	2500	2500	
40		Valves and Fittings						
40		Valves		kg			7700	
		SECTION II. MATERIALS						
1		Steel structures		kg			300000	
2		Pipelines		do			422300	
3		Gas ducting		do			120000	
4		Lining materials		kg			270000	
		TOTAL: section I - Equipment					10124310	
		including: steel structures					4068000	
		lining					4240000	

Roasting and reduction with blower station

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	 total	Manufactured indigenously
		SECTION I. EQUIPMENT. ELECTRICALS						
		Power equipment						
1		Packaged transformer substation (PTS 4-1, PTS 4-2)		set	2	19700	39400	
		comprising:						
		- 1000 KVA transformer, 10/0.4-0.23 kV		pc	2			
		- H.V. inlet box		do	2			
		- L.V. inlet box		do	2			
		- sectional box		do	1			
		- line box		do	4			
2		Packaged distribution switchboard (RDS-4) consisting of		set	1		19500	
		- inlet box with oil breaker, 1500 A		pce	2			
		- sectional disconnector box, 1000 A		do	1			
		- sectional switch box 630 A		do	1			
		-bbox with voltage transformer		do	2			
		- box with power transformer		pce	2			
		- L.V. equipment box		do	1			
		- outgoing lines box, 630 A		do	20			
		- power supply set		do	2			

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Control station panels, consisting of frame design panels		1stand panel	32	30	9600	
3		380 V A.C. asynchronous motors control boxes consisting of a three-pole inlet circuit breaker with a combination trip, I_{nom} 16-160 A and a magnetic starter with a thermal relay, I_{nom} 16-160 A		pce	15	40	600	
4		Three-pole power box, consisting of a knife switch with fuses rated at 100 to 300 A, 380 V A.C.		pce	20	24	480	
5		380 V A.C. power distribution stations, consisting of a three-pole inlet circuit breaker with a combination trip, I_{nom} = 250 A, ten outlet circuit breakers with a combination trip, I = 16-160 A		pce	8	170	1360	
6		380 V A.C. three-pole magnetic starters, dustproof, with a 220 V coil, with a thermal relay rated at I_{nom} = 63 A, 40 A, 25 A		pce	45		125	
7		Transformer-converter unit for feeding H.V. rectivied current to electrostatic precipitators of the gas cleaning and dust catching units, consumed power 40 KVA, 380 V A.C., $I_{nom.rect.}$ = 400 mA		pce	24	1685	40440	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
8		Do consumed power 26 KVA, 380 V A.C. $I_{nom.rect.}$ = 2500 mA		pce	48	1595	76560	
9		PTS with two 1000 kVA, 6/0,4 kV oil transformers		set	2	4750	9300	
10		Control boxes, I_{nom}						
		- 1.25 A		set	5	40	200	
		- 2 A		set	154	40	6160	
		- 2.5 A		set	72	40	2880	
		- 3.2 A		set	9	40	360	
		- 4 A		"	4	40	160	
		- 8 A		"	17	40	680	
		- 12.5 A		"	1	40	40	
		- 20 A		"	16	40	640	
		- 50 A		"	8	40	320	
		- 60 A		"	5	40	200	
		- 80 A		"	6	350	240	
11		Box with a knife switch and fuses, Voltage up to 1000 V		pce	19	2200	41800	
12		50 Hz distribution station with switches of outgoing lines, voltage up to 1000 A		pce	28	155	4340	

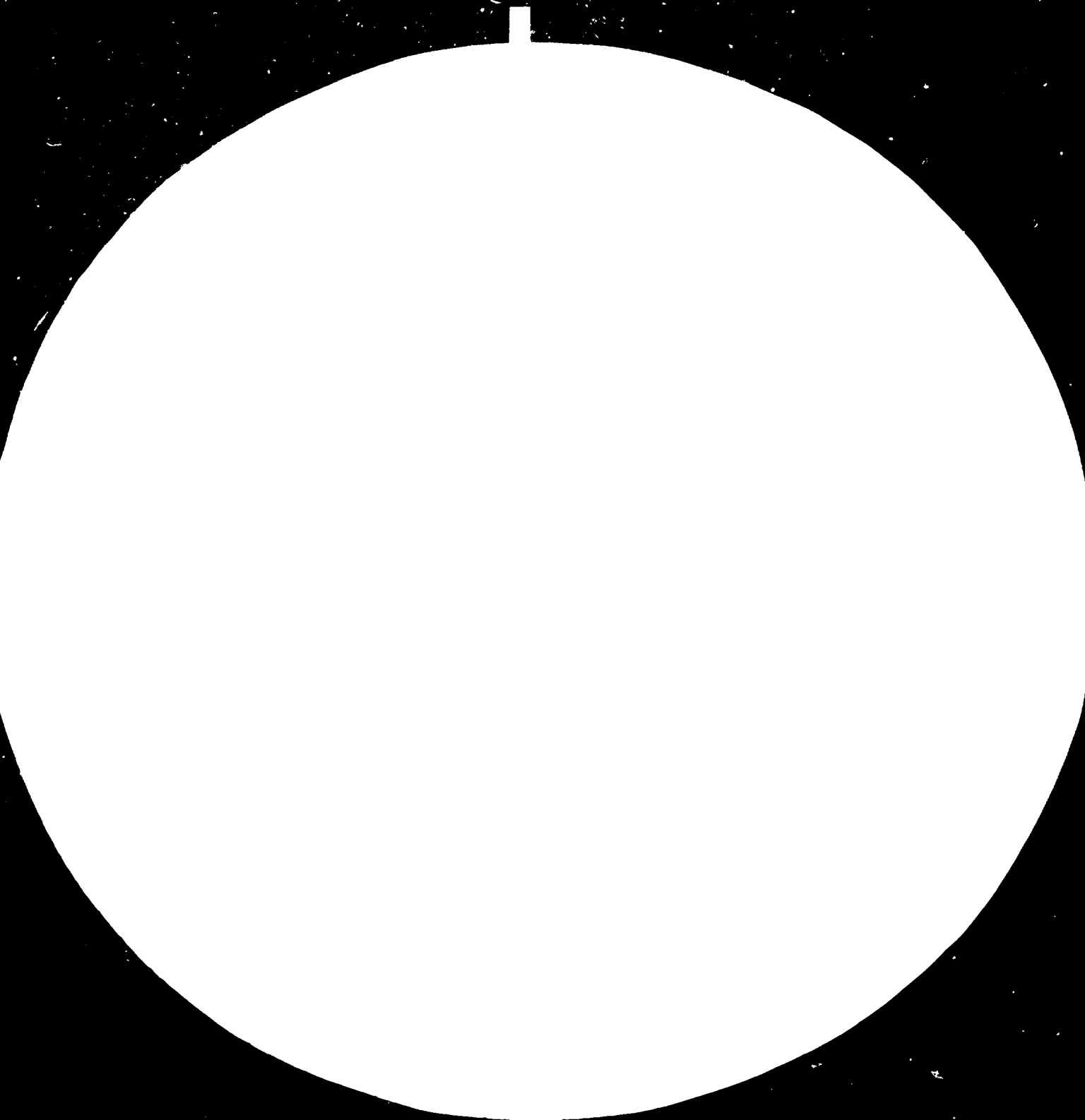
NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
13		Control cubicle of the gas cleaning plant		pce	9	350	3150	
14		Control cubicles		pce	20	300	6000	
15		Control devices of converter units		pce	19	80	1520	
16		Protection resistor		pce	64	0,5	32	
17		Starter, up to 10 A		pce	14	0,7	10	
18		Starter, up to 25 A		pce	2	2	2	
		Electric lighting equipment						
19		Distribution stations with inlet circuit breakers, without trips, $I_{nom.}$ = 100 A, with 6 three-phase line switches, with electromagnetic and thermal trips, $I_{nom.}$ = 63A 20 A		pce	15	50	750	
20		Single-phase stepdown transformer, 380/220/24 V, 250 VA		pce	20	10	200	
21		Switches, 10 A, 220 V		pce	80	0,6	48	
22		Double-pole plug-and-socket connection, 10 A, 220 V		pce	100	0,6	60	
23		Lighting fittings (miscellaneous)		pce	560		3800	
24		Incandescent, fluorescent, mercury-arc lamps		pce	740		215	

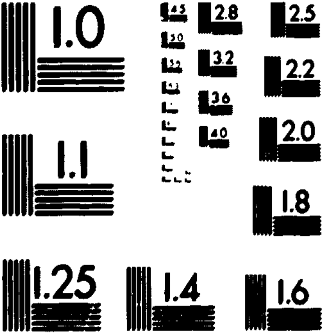
NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Miscellaneous equipment						
25		Communication equipment		pce	32		22176	
		Sub-total:					293347	
		SECTION II. MATERIALS						
1		1000 V power calbe, p.v.c. insulated and sheathed, 4 aluminium cores (various cross-sections areas)		km	14		24120	
2		660 V power cable, rubber or plastic insulated, rubber or p.v.c. sheathed, 2 or 4 aluminium cores, cross-section area from 4 to 70 mm2		km	15	80	12000	
3		75 kV power cable, aluminium cores, cross-section area - 1 x 50		km	3,5		7600	
4		1 kV power cable, aluminium cores, p.v.c. insulated and sheathed (various cross-section areas)		km	30		16375	
5		Flexible control cable, copper cores, rubber insulated and sheathed, cross-section area 3 x 1,5 + 1 x 1 mm2		km	0.45		112	
6		Control cable, aluminium cores, p.v.c. insulated and sheathed, cross-section area 2.5 mm2, No of cores from 4 to 37		km	20	200	4000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
7		Installation wire, aluminium core, p.v.c. sheathed, cross-section area - 2.5 mm2		km	3	16	48	
		Sub-total:					64255	
8		Steel pipe A 25-65		kg			18354	
		Total: section I - equipment					293347	
		section II - materials					82609	

1.7. Sulphur storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		SECTION I. EQUIPMENT. PROCESS DESIGN						
		<u>Chemical equipment</u>						
1		22 m^3 receiving collector for molten sulphur, S = 40 m2		pce	3	5000	15000	USSR
2		Disk-type horizontal filter for molten sulphur S = 6 m2, Q = 70 t/day		do	6	8000	48000	— " —
3		8 m^3 pure sulphur collector		do	3	3000	9000	— " —
4		28 m^3 hopper-melter for sulphur		do	3	5000	15000	— " —
		Sub-total:					83000	
		<u>Cranes, hoists, etc.</u>						
5		5 t overhead electric bucket crane, span - 28.5 m		pce	1	24000	24000	USA USSR EUROPE
6		5 t electric single-girder crane, L = 11.4 m, I = 1.2 m		do	1	2530	2530	— " —
7		5 t overhead electric bucket crane, span - 28.5 m		do	1	24000	24000	— " —
8		3.2 t electric hoist, H = 24 m		pce	3	650	1950	— " —
		Sub-total:					52480	
		<u>Pumps</u>						
9		Submersible pump, Q = 8 m^3/hr, H = 40 mm W.C.		pce	12	630	3800	





MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS

STANDARD REFERENCE MATERIAL 1010a

(ANSI and ISO TEST CHART No. 2)

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		SECTION II. MATERIALS						
1		Steel structures					15000	
		Total, section I equipment					139280	
		section II materials					15000	

Sulphur storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		SECTION I. EQUIPMENT. ELECTRICALS						
		Electric power equipment						
1		Control station panels consisting of frame design panels		1 stand. panel	8	300	2400	
2		380 V A.C. asynchronous motors control boxes consisting of a three-pole in inlet circuit breaker with a combination trip $I_{nom.}$ 16-160 A and a magnetic starter with a thermal relay, $I_{nom.}$ = 16-160 A		pce	10	40	400	
3		Three-pole power box, consisting of a knife switch with fuses rated at 100 to 300 A, 380 V,A.C		pce	5	24	120	
4		380 V A.C. power distribution stations consisting of a three-pole inlet circuit breaker with a combination trip, $I_{nom.}$ = 250 A, ten outlet circuit breakers with a combination trip, I = 16-160 A		pce	2	170	340	
5		380 V A.C. three-pole magnetic starters, dustproof, with a 220 V coil, with a thermal relay rated at $I_{nom.}$ = 63 A, 40 A, 25 A		pce	15		35	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Electric lighting equipment						
6		Distribution station with an inlet circuit breaker, without a trip, $I_{nom.}$ = 100 A, with 12 single-phase line switches, with an electromagnetic and thermal trip, $I_{nom.}$ = 20 A		pce	3	50	150	
7		Single-phase stepdown transformer 380/220324 V, 250 VA		pce	5	10	50	
8		Installation switch, 10 A, 220 V		pce	30	0,6	18	
9		Double-pole plug-and-socket connection 10 A, 220 V		pce	20	0,6	12	
10		Lighting fittings (miscellaneous)		pce	120		1112	
11		Incandescent, fluorescent, mercury-arc lamps		pce	140		40	
		Sub-total:					4677	
		SECTION II. MATERIALS						
1		1000 V power cable, 4 aluminium cores, p.v.c. insulated and sheathed (various cross-section areas)		km	4		4090	
2		660 V power cable, rubber or plastic insulated, rubber or p.v.c.sheathed, 2 or 4 aluminium cores, cross-section area from 4 to 70 mm2		km	3	800	2400	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
3		Control cable, aluminium cores, p.v.c. insulated and sheathed, cross-section area 2.5 mm2, No of cores from 4 to 37		km	2	200	400	
4		Installation wire, aluminium core, p.v.c. sheathed, cross-section area 2.5 mm2		km	0.8	16	10	
		Sub-total:					6900	
5		Steel pipe, D_{nom} 25-65		m	850		2600	
		TOTAL, section I equipment					4677	
		section II materials					9500	

1.8. Digestion, desilication and mud washing. Electrostatic precipitators

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		SECTION I. EQUIPMENT. PROCESS DESIGN						
		Chemical equipment						
1		Reaction autoclave, dia. 2,4 m, height 14.3 m, V = 63 m3		pce	27	18000	486000	USSR USA EUROPE
2		Single compartment thickener, dia 20 m with electric motors:		do	4	18000	72000	- " -
		5.5 kW - for rotating the shaft;				steel struct: 30000	360000	
		4.4 kW - lifting mechanism						
3		Single compartment thickener, dia. 32 m, with electric motors:		do	9	45000	405000	- " -
		7.5 kW - for rotating the shaft;				steel struct. 180000	1620000	
		7.5 kW - lifting mechanism						
4		First-stage separator, dia.2.6 m		do	3	21000	63000	- " -
5		Second-stage separator, dia.3.6 m		do	3	16500	49500	- " -
6		Flash tank, dia. 1 m		do	3	500	1500	- " -
7		Mixing heater, dia. 1 m		do	3	2200	6600	- " -
8		Vacuum- receiver, dia. 1.2 m		do	12	1030	12360	- " -
9		Hydroseal, dia. 1 m, height - 3.6m		do	2	1200	2400	- " -

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
9		Hydroseal, dia. 1.5 m; height 2.5 m		pce	2	1100	2200	
10		Hydroseparator, dia. 10 m		do	4	42000	168000	
11		Chain agitator (sump), dia. 2 m, 2.5 m high; 5,5kW selectric motor		do	10	1140 steel struct. 1200	11400 12000	USA USSR Europe
12		Chain agitator, dia. 3 m, 3 m high; 5,5 kW electric motor						-"-
13		Chain agitator, dia. 4.5 m; 3 m high; 10 kW electric motor		do	21	2640 steel struct. 4550	55440 95550	-"-
14		Chain agitator, dia. 4.5 m; 4.5 m high; 10 kW electric motor		do	6	2870 steel struct. 4920	17220 29520	-"-
15		Chain agitator, dia. 4.5 m; 6.0 m high; 10 kW electric motor		do	10	9940 steel struct.	99400 65400	-"-
16		Chain agitator, dia 7,5 m;4,5 m high; 17 kW electric motor		do	8	17800 steel struct. 13200	142400 160200	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
18		Chain agitator, dia. 7.5 m; 7.5 m high; 17 kW electric motor		pce	6	4900 steel struct. 15970	29400 95820	USA USSR Europe
19		Electrostatic precipitator, surface area - 53 m2, Capacity - 100 000 m^3/hr		do	2	230000	460000	- " -
20		Pressure leaf filter, filtration surface - 225 m2		do	7	6700	46900	USSR
21		Tilting pan horizontal filter, filtration surface - 50 m2		do	6	46500	279000	" —
22		Heat exchanger. Surface area - 180 m2		do	6	5600	33600	USA USSR Europe
23		Trap, V = 1 m^3		do	3	400	1200	
24		Barometric condenser, dia. 0.8 m		do	3	1000	3000	- " —
25		Direct flow cyclone, dia. 1.6 m		do	2	5160	10320	- " —
		Sub-total:					14233820	
		including steel structures					2395800	
		Pumps, I.D. Fans, Fans						
26		80 m^3/hr centrifugal pump, head - 30 m, 30 kW electric motor		do	3	650	1950	- " —
27		100 m^3/hr centrifugal pump, head - 31.5 m, 30 kW electric motor		pce	12	830	9960	- " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
28		Do head - 16 m, 15 kW electric motor		do	19	430	817.0	
29		160 m^3/hr centrifugal pump, head - 20 m, 30 kW electric motor		do	26	830	21580	
30		200 m^3/hr high-pressure centrifugal pump, head - 95 m, 110 kW electric motor		do	2	1100	2200	— " —
31		250 m^3/hr centrifugal pump, head - 28 m, 55 kW electric motor		do	8	1050	8400	— " —
32		315 m^3/hr centrifugal pump, head - 40 m,0100 kW electric motor		do	28	1670	46760	— " —
33		Do 160 kW electric motor		do	4	2180	8720	— " —
34		400 m^3/hr centrifugal sand pump, head - 40 m, 132 kW electric motor		do	2	3000	6000	— " —
35		Do head 20 m, 55 kW electric motor		do	3	1300	3900	— " —
36		1250 m^3/hr,centrifugal sand pump, head - 71 m, 630 kW electric motor		poo	3	10600	31800	"
37		50 m^3/min vacuum pump, vacuum - 70%, 10 kW electric motor		do	7	5190	36300	— " —
38		100 m^3/hr I.D. fan, 200 kW electric motor		do	2	8500	17000	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
39		11.5 m^3/hr fan, pressure - 120kgf/m2, 5.5 kW electric motor		do	6	130	780	
		Sub-total:					203500	
		Conveyers, feeders						
40		11 t/hr suspended-flight conveyer, 20 m long, 5 kW electric motor		do	2	4000	8000	
41		22 t/hr suspended-flight conveyer, 11.5 m long. 3 kW electric motor		do	1	2800	280	
42		6 t/hr screw feeder, dia. 0.25 m, 3 kW electric motor		do	10	580	5800	
		Total:					14080	
		Cranes, hoists, lifts						
43		2 t overhead electric single-girder crane, span - 2 m, hoisting height - 6 m		pce	4	720	2880	
44		2 t overhead electric single-girder underslung crane, span - 6 m, hoisting height -		do	2	800	1600	
45		Do hoisting height - 12 m		do	1	1170	1170	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
46		Do span - 6 m, hoisting height - 6 m		do	1	1200	1200	
47		Do hoisting height - 12 m		do	2	1830	3660	
48		2 t electric travelling hoist		do	4	400	1600	
		Sub-total:					12110	
		Sanitary equipment						
49		Household air conditioner		do	2	53	106	
		Valves and fittings						
50		Valves		kg			1600	
		Tanks, vessels						
51		Tank 7,5 m h = 7,5 m		pce	5	16000	8000	
		SECTION II. MATERIALS						
1		Steel pipe		kg			1000	
2		Steel for steel structures		kg			3000	
3		Pipelines		kg			55000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
4		Heat insulation		kg			1000	
		TOTAL, section I equipment					14545416 including steel 2395800	
		section II materials					60000	

Digestion, desilication, red mud washing, electrostatic precipitators

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I: Equipment, Electrical engineering						
		Power equipment						
1	3	Packaged transformer substation (PTS): PTS 2-1; TPS 2-2; PTS 2-3; PTS 2-4; PTS 2-5		set	5	19700	98500	
		including:						
		- 1000 kVA transformer		pcs	2			
		- high voltage input cabinet		pcs	2			
		- low voltage input cabinet		pcs	2			
		- sectional cabinet		pcs	1			
		- line cabinet		pcs	4			
2		Packaged distribution unit (DS-2, DU-10 kV)		set			21900	
		including:						
		- 1000 A input cabinet with oil breaker		pcs	2			
		- 630 A sectional switch cabinet		pcs	1			

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		- voltage transformer cabinet		pcs	2			
		- power transformer cabinet		pcs	2			
		- low voltage equipment cabinet		pcs	1			
		- 630 A output lines cabinet		pcs	24			
		- packaged power supply unit		set	2			
3		1600 kVA power three phase oil transformer, voltage 10/6 kV		pcs	3	6500	19500	
4		Control station panels consisting of frame-type panels		1 standard panel	130	300	39000	
5		380 V AC asynchronous motor control boxes, consisting of three-pole input circuit breakers with combined release of nominal current from 16 A to 160 A and magnetic starter. With thermal relay of nominal current from 16 A to 160 A		pcs	25	40	1000	
6		Three pole power boxes consisting of master switch with fuses for currents from 100 A to 300 A 380 VAC		pcs	30	24	720	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
7		380 VAC power distribution points with three-poles input breaker and combined release for nominal current 250 A and ten output automatic breakers with combined release of 16-160 A		pcs	15	170	2250	
8		Three-pole AC dust-proof magnetic starters with 220 V coil and thermal relay for nominal currents of 63 A, 40 A, 25 A		pcs	60		80	
		Electric Lighting Equipment						
9		Distribution points with input circuit breakers without release for nominal current 100 A with six three-phase and 12 single-phase line breakers with electromagnetic and thermal releases for currents of 63A and 20A respectivly		pcs	26	50	1300	
10		Single-phase step-down transformer 380/220x/24V; 250 VA		pcs	50	10	500	
11		Installation switch 10A, 220V		pcs	150	0.6	90	
12		Two-pole plug-and-socket connection, 10A, 220V		pcs	250	0.6	150	

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
13		Luminaires (miscel)		pcs	1550		18320	
14		Searchlight with halogen incandescent 1000 W lamp		pcs	20	20	400	
15		Lamps (incandescent, fluorecent, arc mercury, halogen)		pcs	1770		520	
		TOTAL					20430	
		Section II. Materials						
1		Power cables up to 1000 V with four aluminium cores, PVC insulation and sheath (different section)		km	40.5		10560	
2		Power cable 660V, two or four aluminium cores with rubber or plastic insulation, rubber or PVC sheath, cores section from 4 to 70 mm2		km	35	800	28000	
3		Control cable of 4 to 37 aluminium cores 2.5 mm2 section with PVC insulation and sheath		km	25	200	5000	
4		Aluminium installation wire 2.5 mm2 section, PVC sheath		km	4	16	64	
		TOTAL					43624	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
5		Steel pipe, D_{nom} 25-65		m	1000		28240	
		TOTAL of section I equipment					204230	
		under section II materials					71864	

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1.9. Evaporation and Potassium Sulphate Production

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment, Process part						
		Chemical equipment						
1		Single chamber thickener, 20 m dia Electric motor - shaft rotation 5.5 kW - lifting mechanism 4.0 kW		pcs	3	99000 struct steel 9000	297000 27000	USA USSR EUROPE
2		Evaporator, 1000 m^2 area		pcs	16	60000	960000	USSR
3		Liquor flash tank 3000 m dia		pcs	12	10000	120000	— " —
4		Contact heater 1000 m dia		pcs	8	1500	12000	— " —
5		Barometric condensor 2200 m dia		pcs	4	8000	32000	— " —
6		Barometric condensor 0.8 m dia		pcs	2	1000	2000	— " —
7		Condensate flash tank 1000 m dia		pcs	16	10000	160000	— " —
8		Hydroseal 3000 x 3000 dia		pcs	1	2200	8800	— " —
9		Hydroseal 1 m dia		pcs	8	3000	24000	— " —
10		Crystallizer 7.75 m dia, 24 m high		pcs	2	66000,	132000	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
11		Receiver 4 m^3 holding capacity		pcs	6	1000	6000	
12		Batch meter, dia 1000 x 1500		pcs	1	1200	1200	
13		Trap, 2.5 m^3 capacity		pcs	2	1000	2000	
14		Apparatus with chain agitator dia 200 x 2500 with 5 kW electric motor (sump-agitator)		pcs	9	1140 struct steel 1200	10260 10800	USA USSR EUROPE
15		Apparatus with chain agitator dia 7500 x 9000 with 15.5 kW electric motor		pcs	3	7740 str. steel 17130	23220 51390	— " —
16		Chaim agitator 4.5 m dia, 3 m high, 10 kW electric motor		pcs	10	650 str. steel 6540	6500 65400	— " —
17		Chain agitator 4.5 m dia, 4.5 m high, 10 kW electric motor		pcs	8	2870 str. steel 1920	22960 39360	— " —
18		Chain agitator 6 m dia, 9 m high, 13 kW motor		pcs	8	4120 str. steel 24380	35360 115040	— " —
19		Chain agitator 9 m dia, 6 m high, 26 kW motor		pcs	2	4320 str. steel 19050	8640 38100	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
20		Centrifuge 55 kW		pcs	5	8000	40000	USSR USA EUROPE
21		Water circulating machine, 25 m3/min capacity, 90 kW motor		pcs	6	2065	12390	— " —
22		Drum vacuum filter, 40 m^2 filtration area 4.5 kW		pcs	8	13000	104000	— " —
		TOTAL including structural steel					2266900 346900	
		Tanks						
23		Condensata tank dia 6000 x 6000		pcs	3	art. steel 9450	28350	— " —
24		Concentrated acid tank dia 4500 x 4500		pcs	2	str. steel 6230	12460	— " —
25		Diluted liquor tank dia 9000 x 9000		pcs	2	str. steel 21500	43000	— " —
26		Industrial water tank dia 6000 x 6000		pcs	2	str. steel 9450	18900	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
27		Lined tank dia 4500 x 4500		pcs	1	str. steel 6500	6500	
						lining material 2450	2450	
		TOTAL					111660	
		including, structural steel					109210	
		lining materials					2450	
		Pumps, I.D. Fans, Fans						
28		Centrifugal pump 20 m^3/hr rate head 16 m, 2.2 kW motor		pcs	16	1088	17408	Produced in USSR
29		Centrifugal pump, rate 45 m^3/hr, head 30 m, 7.6 kW motor		pcs	5	134	670	— " —
30		Centrifugal pump 90 m^3/hr rate, 85 m head, 45 kW electric motor		pcs	1	520	520	— " —
31		Centrifugal pump 100 m^3/hr rate, head 16 m, 15 kW motor		pcs	20	430	8600	— " —
32		Centrifugal pump 100 m^3/hr, rate, 16 m-head, 16 kW motor		pcs	3	650	1950	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
33		Centrifugal pump 100 m^3/hr rate 32 m-head, 22 kW motor		pcs	28	330	9240	EUROPE USSR
34		Centrifugal pump 100 m^3/hr rate, 31 m-head, 30 kW motor		pcs	9	1000	9000	—"—
35		Centrifugal pump 160 m^3/hr rate, 30 m-head, 30 kW motor		pcs	2	9450	18900	—"—
36		Centrifugal pump 250 m^3/hr rate, 28 m-head, 55 kW motor		pcs	35	1175	41125	—"—
37		Vacuum-pump 50 m^3/hr rate, 110 kW motor		pcs	5	5200	26000	—"—
38		Air blower 5000 m^3/hr rate, 160 kW motor		pcs	2	5600	11200	—"—
		TOTAL					144613	
		Conveyors, feeders						
39		Belt conveyor, 1000 mm belt width, 75 m long		pcs	2	40700 struc. steel 22700	81400 45400	
		Crane, hoists, elevators						
40		Single-girder suspended 5 t E.O.T. crane 4.2 m span, lifting height - 24 m		pcs	1	1900	1900	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	total	Manufactured indigenously
41		Single-girder suspended 5 t E.O.T. crane 4.2 m span, lifting height - 24 m		pcs	1	1900	1900	
42		Single-girder suspended 2 t E.O.T. crane, 4.2 m span, lifting height - 12 m		pcs	1	750	750	
43		Single-girder suspended 2 t E.O.T. crane, 4.2 m span, lifting height - 24 m		pcs	2	960	1920	
44		Single-girder 2 t E.O.T. crane		pcs	3	1390	4170	
45		Single-girder suspended 1 t E.O.T. crane, 4.2 m span, lifting height - 12 m		pcs	1	650	650	
46		2 t electric hoist, lifting height - 12 m		pcs	1	350	350	
		TOTAL					11520	
		Sanitary engineering equipment						
47		Air conditioner		pcs	2	53	106	
		Valves and fittings						
48		Valves		kg			98000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section II. Materials						
1		Pipes		kg			835000	
2		Steel for structural steek		kg			550000	
3		Insulation (thermal)					1000000	
		TOTAL of section I equipment					2759599	
		including: structural steel					501510	
		lining materials					2450	
		of section II: materials					2385000	

Evaporation and Potassium Sulphate Production

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment. Electrical engineering						
		Power equipment						
1		Packaged transformer substation (PTS 2-6; PTS 2-7; PTS 2-3)		set	3	19700	59100	
		including:						
		- 1000 kVA transformer						
		- high voltage input cabinet		pcs	2			
		- low voltage input cabinet		pcs	2			
		- sectional cabinet		pcs	1			
		- line cabinet		pcs	4			
2		Control station panels, consisting of frame-type panel		1 standard panel	80	300	24000	
3		380 V.A.C. Asynchronous motors control boxes consisting of three-pole inlet circuit bkeaker with a combination release, I nom. - 16-160 A, and magnetic starter with thermal relay, I nom - 16-160 A		pcs	25	40	1000	
4		Three-pole power box consisting of master switch with fuses rated at 30 to 300 A, 380 V.A.C.		pcs	20	24	480	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
5		380 V.A.C. power distribution stations consisting of three pole inlet circuit breaker with combination release, Inom = 250A, ten outlet circuit breakers with combination release, Inom = 16-160 A		pcs	5	170	850	
6		380 V.A.C. three-pole magnetic starter, with 220V coil, with thermal relay rated at Inom = = 63A, 40A, 25A		pcs	60		140	
		Electric lighting equipment						
7		Distribution stations with inlet circuit breakers without release, Inom = 100A, with 6 and 12 phase line switches, with electromagnetic and thermal releases, Inom = 20A		pcs	24	50	1200	
8		Single-phase step-down transformer, 380/220/24 V, 250 VA		pcs	40	10	400	
9		Installation switches 10A, 220V		pcs	100	0.6	60	
10		Double-pole plug-and-socket connection, 10A, 220A		pcs	180	0.6	108	
11		Luminaires (miscel)		pcs	1200		15210	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
12		Searchlight with halogen incandescent lamp		pcs	30	20	600	
13		Lamps (incandescent, fluorescent, arc mercury)		pcs	1350		410	
		TOTAL					103558	
		Section II. Materials						
1		Power cable up to 1000 V with 4 aluminium cores, PVC insulation and sheath (different sections)		km	28.8		20050	
2		660 V Power cable, two or four aluminium cores, with rubber or plastic insulation, rubber or PVC sheath. Core sections from 4 to 70 vv2		km	30	800	24000	
3		Control cable, 4-37 aluminium cores 2.5 mm2 section with PVC insulation and sheath		km	15	200	3000	
4		Installation wire, aluminium core 25 mm2, PVC sheath		km	5	16	90	
		TOTAL					47140	
		Steel pipe, D_{nom} 25-65						
		TOTAL of section I, equipment					103558	
		of section II, materials					63230	

1.10. Precipitation

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
1		Section I. Process equipment						
		<u>Chemical equipment</u>						
1		Precipitator, 3000 m^3 capacity		pcs	15	261000	3915000	USSR EUROPE
2		Hydroseparator, 10 m dia		pcs	3	43000	126000	— " —
3		Flash tank 3.6 m dia		pcs	2	14000	28000	— " —
4		Hydroseal 1.5 m dia, 8 m high		pcs	2	8000	16000	— " —
5		Barometric condensor 1.6 dia		pcs	2	3400	6800	— " —
6		Chain agitator 2 m dia, 2.5 m high, 3 kW motor		pcs	2	1140 struct. steel 1200	2280 2400	— " —
7		Chain agitator, 3 m dia, 3 m high, 5.5 kW motor		pcs	2	1780 struct. steel 2000	3560 4000	— " —
		TOTAL					4103900	
		including structural steel					6400	
		<u>Tanks</u>						
8		9 m dia tank 6 m high		pcs	4	15000	60000	— " —

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Pumps, I.D. Fans, Fans						
9		Centrifugal pump, rate 160 m^3/hr, head-20 m, 30 kW electric motor		pcs	2	832	1664	EUROPE USSR
10		Centrifugal pump, rate 160 m^3/hr, head-40 m, 55 kW motor		pcs	3	1050	3150	— " —
11		Centrifugal pump, rate 315 m^3/hr, head-40 m, 110 kW motor		pcs	3	1700	5100	— " —
12		Centrifugal pump, rate 315 m^3/hr, head-56 m, 160 kW motor		pcs	6	2200	13200	— " —
13		Vacuum-pump, rate 50 m^3/hr, at 70% vacuum, 110 kW motor		pcs	2	5200	10400	— " —
		TOTAL					33514	
		Cranes, hoists, elevators						
14		Movable electric hoist, 3.2 t capacity		pcs	2	300	600	— " —
15		Sanitary engineering equipment						
		Air conditioner (household)		pcs	1	5	53	— " —
		Values and fittings						
16		Valves		kg			53000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section II. Materials						
1		Piping					470000	
2		Steel for structural steel					500000	
3		Thermal insulation					200000	
		TOTAL of section I: equipment					4251067	
		including structural steel					6400	
		of section II materials					1170000	

Precipitation

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Electric part						
		Electric power equipment						
1		Transformer substation, complet (KT -3) including		set	1	13000	13000	
		- transformer cap 1600 kW		ps	2			
		- input cabinet h.v.		ps	2			
		- output cabinet l.v.		ps	2			
		- sectional cabinet		ps	1			
		- line cabinet		ps	4			
2		Complet distributor composed of cabinets incl:		set	1	16300	16300	
		- input cabinet oil switch 1000A		ps	2			
		- sectional cabinet disconnect 630 F		ps	1			
		- cabinet of sectional switch 630 A		ps	1			
		- cabinet with voltage transformer		ps	2			
		- cabinet with power transformer		ps	2			
		- cabinet of L.W. equipment		ps	1			
		- cabinet of output lines 630 A		ps	15			
		- feeding complet installation		ps	2			
3		Control station panels consisting of frame-type panels		1 standard panel	7	300	2100	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
4		Control boxes for asynchronous motors V 380 AC composed of 3 poles input automatic switch with combined release 16A to 160A and magnetic staters thermal relais for 16 to 160A		ps	10	40	400	
5		Power boxes 3 poles knife switch with fuses 100A to 300A voltage 380A AC		ps	5	24	120	
6		Power distribution points 380V AC input 3 ples switch with combined release 250A 10 automatic swithes with combined release 16-160A	with		5	170	850	
7		Magnetique starters 3 poles AC voltage 380V dustproof 220 V bobbin thermal relais 63A, 40A, 25A			30		70	
8		Lighting equipment Distribution points with unput automatic swithes without release for 100A						

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		with 6 3 phases and 12 monophase line circuit breakers with electromagnetic and thermal release 63A an. 20A correspondenly		ps	6	50	300	
9		Monophase stepdown transformer 380/220/24V, cap.250 VA		ps	8	10	80	
10		Switches 10A 220V		ps	20	0.6	12	
11		Plug-in connectors, 2 poles 10A, 220V		ps	30	0.6	18	
12		Luminaires (dif)		ps	240		2690	
13		Searchlight with halogene lamp		ps	5	20	100	
14		Filament, luminecent, arc mercury lamps		ps	270		76	
		TOTAL					36116	
		Section II. Materials						
1		Power cable v 1000 V Al conductors PVH insulation and sheath, 4 conductors (fid.sections)		km	4		4487	
2		Power cable 660 A with rubber or plastic insulation, rubber or PVH sheath 4 conductors in Al sections 4-70 mm^2		km	7	800	5600	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
3		Control cable with Al conductors PVII insulation and sheath sections of conductors 2.5 mm2 and number of conductors 4 to 37		km	2	200	400	
4		Instollation wire will Al conductor section 2.5 mm2 PVII sheath		km	1	16	16	
		TOTAL					10503	
5		Steel pipe D 25-65		km	1000		3200	
		TOTAL section I						
		Equipment					36116	
		section II						
		materials					13703	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
3		Control cable with Al conductors PVII insulation and sheath sections of conductors 2.5 mm2 and number of conductors 4 to 37		km	2	200	400	
4		Installation wire will Al conductor section 2.5 mm2 PVII sheath		km	1	16	16	
		TOTAL					10503	
5		Steel pipe D 25-65		km	1000		3200	
		TOTAL section I Equipment					36116	
		section II materials					13703	

1.14. Hydrate treatment with hydrate storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Process part						
		Chemical equipment						
1		Settler 1 chamber ø 20 m		ps	5	18000 steel struc. 90000	90000 450000	USA USSR EUROPE
2		Waterlock ø 1 m, h 4 m		ps	9	1500	13500	— " —
3		Waterlock ø 1 m h 1 m		ps	4	1000	4000	— " —
4		Receiver capacity 4 m3		ps	9	1000	9000	— " —
5		Barometric condenser ø 0.8 m		ps	4	930	3720	— " —
6		Trap capacity 1 m3		ps	4	400	1600	— " —
7		Chaine agitator ø 2 m, h 2.5 m Electromotor cap. 3 kW		ps	6	1140 settl struc. 1200	6840 7200	— " —
8		Chaine agitator ø 3 m, h = 3 m Electromotor cap 5.5 kW		ps	5	1780 steel struc. 2000	8900 10000	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
9		Chaine agitator ø 4.5, h 3 m		ps	13	2640 steel	34320	USA USSR EUROPE
		Electromotor cap.10 kW				4550	59150	
10		Chaine agitator ø 4.5 h=4.5 Electromotor cap 10 kW.		ps	2	2870 steel struc. 4920	5740 9840	— " —
11		Chaine agitator ø 6 m, h = 9 m Electromotor cap 13 kW		ps	2	4420 steel struc. 14380	8840 28760	— " —
12		Chaine agitator ø 9 m. h = 6 m Electromotor cap 22 kW		ps	5	4320 steel struc. 19050	21600 95250	— " —
13		Vacuum-filter, sulface 40 m2		ps	3	18000	54000	— " —
14		Vacuum-filter, surface 20 m2		ps	6	1300	78000	— " —
15		Butters fulter under pressure surface 225 m2		ps	4	10000	40000	USSR
16		Heat exchanger diametre 1.5 m surface 480 m2		ps	1	12000	12000	— " —
		TOTAL					1133260	
						including steel structure	660200	

6

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Tanks, Vessels						
17		Tank diametre 9 m, h 6 m		ps	4	15000	60000	
		Pumps, ehxausters, fens						
18		Centrifugal pump, capacity 90 m3/h pressure 30 m. Electromotor 30 kW		ps	2	650	1300	EUROPE USSR
19		Centrifugal pump capacity 100 m3/h pressure 31.5 Electric motor 30 kW		ps	10	833	8330	— " —
20		Centrifugal pump capacity 160 m3/h pressure 20 m Electric motor 30 kW		ps	30	832	24960	— " —
21		Centrifugal pump, capacity 250 m3/h, pressure 28 m Electric motor 55 kW		ps	2	1054	2108	— " —
22		Centrifugal pump capacity 250 m3/h pressure 56 m Electric motor 110 kW		ps	8	1819	14552	— " —
23		Centrifugal pump capacity 315 m3/h pressure 40 m Electric motor 110 kW		ps	4	1700	6800	— " —
24		Centrifugal pump, capacity 315 m3/h, pressure 56 m Electric motor 160 kW		ps	2	2200	4400	— " —

NOS		Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
	No according to process flowsheet						of one piece	total	
	25		Centrifugal pump, capacity 600 m3/h, pressure 40 m Electric motor 160 kW		ps	2	4200	8400	EUROPE USSR
	26		Vacuum pump capacity 50 m3/min 70% vacuum Electric motor capacity 110 kW		ps	8	5200	41600	— " —
	27		Blower cap. 5000 m3/h Electric motor cap. 160 kW		ps	3	5600	46800	— " —
			TOTAL					129250	
			Conveyers, feeders						
	28		Belt conveyer, width 500 mm length 12 m Electric motor 2.2 kW		ps	1	1500 steel struc. 1000	[illegible]00 1000	— " —
	29		Belt conveyer, width 500 mm length 20 m Motor electric 1.5 kW		ps	2	1700 steel struc. 1500	3400 3000	— " —
	30		Belt conveyer width 500 mm length 50 m Electric power 5.5 kW		ps	2	3000 steel struc. 2800	6000 5600	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
31		Apron feeder width 1.2 length 12 m Electric motor 15/25/30/36 kW		ps	1	30500	30500	EUROPE USSR
		TOTAL					51000	
						including steel structures	9600	
		Cranes, hoists, lifts						
32		Monorail electric capacity 2 t Span 6 m h of elevation 12 m		ps	1	940	940	—"—
33		Monorail electric capacity 2 t Span 9 m h of elevation 12		ps	1	1170	1170	—"—
34		Monorail electric, capacity 3.2 t Span 9 m h of elevation 6 m		ps	1	1270	1270	—"—
35		Monorail electric capacity 3.2 t Span 6 m, h of elevation 24 m		ps	2	1280	2560	—"—
36		Clamshell crane capacity 10 t Span 23 h of elevation 18 m		ps	1	46100	46100	—"—
		TOTAL					52040	
		TOTAL section I equipment					4425550	
						including steel structures	669800	

PTN BAKU Заказ 878 Тир 5000 17/11-80г.

Hydrate treatment with hydrate storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment, Electric part						
		Electric power equipment						
1		Transformer substation complet (KT -1, KT . -2) including		set	2	21500	43000	
		- transformer capacity 1600 kW voltage 10/0.4 - 0.23 kV		ps	2			
		- input cabinet h.v.		ps	2			
		- input cabinet l.v.		ps	2			
		- sectional cabinet		ps	1			
		- line cabinet		ps	4			
2		Panels of command station, frame construction		1 panel		300	22500	
3		Control boxes for asynchronous motors V 380 AC, 3 poles automatic switch with combined release 16-160 A and magnetic starters 16-160 A		ps	25	40	1000	

3

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
4		Power boxes 3 poles, .. 'c switch fuses 100 A - 3.0 A voltage 380 BAC		ps	20	24	480	
5		Power points of distribution 380 V AC input 3 poles switch combined release 250 A and 10 output automatic switches with combined release 16A-160A		ps	10	170	1700	
6		Magnetic starters 3 poles AC voltage 380 V dustproof with bobbin 220V thermal relais 63A, 40 A, 25A						
		Lighting equipment						
7		Distribution points with input automatic switch without release 100A with 6 3 phases and 12 singlephases line switches with electromagnetic and thermal release 63A and 20A		ps	10	50	500	
8		Monophase stepdown transformer 380/220/24V, capacity 250 VA		ps	12	10	120	
9		Switches 10A, 220V		ps	60	0.6	36	

NCS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
10		Plug-in connectors bipoles 10A, 220 V		ps	70	0.6	42	
11		Luminaires (dif)		ps	500		5540	
12		Searchlight halogene lamp 1000W		ps	10	20	200	
13		Filament, luminecent, are mercury lamps		ps	560	17	170	
		TOTAL					75288	
		Section II. Materials						
1		Power cable voltage 1000 V Al conductors PVH insulation and sheath 4 conductors (dif sections)		km	25		26645	
2		Power cable 660V rubber or plastic insulation rubber or PVH sheath, 2-4 conductors Al sections 4-70mm^2		km	13	800	10400	
3		Control cable, Al conductors PVH insulation and sheath sections of conductors 2.5 mm2 number of conductors 4-37		km	10	200	2000	
4		Installation wire Al conductors section 2.5 mm2 PVH sheath		km	2	16	32	
		TOTAL					39077	
5		Steel pipe D 25-65		m	4300		15190	
		TOTAL: section 1 - equipment					75288	
		section 2 - materials					54267	

1.12. Alumina Calcination

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		SECTION I. EQUIPMENT. PROCESS DESIGN						
		Tanks, vessels, furnace equipment						
1		Circulating fluid-bed furnace		pce	1	43600	43600	LURGI ALCOA
2		Fluid-bed cooler, area - 42 m^2		do	1	45500	45500	— " —
3		Cyclone, dia. 3.5 m		do	1	11000	11000	— " —
4		Do, dia. 4.8 m		do	1	2200	2200	— " —
5		Do, dia. 5.5 m		do	1	3000	3000	— " —
6		Compensation tank		do	1	1000	1000	— " —
7		Starting burner with a surface device		do	1	1200	1200	— " —
8		Ejector for liquid fuel		do	1	200	800	— " —
		Sub-total:					108300	
		Chemical equipment						
9		Electrostatic precipitator, for gases		do	1	150000	150000	— " —
10		Venturi dryer, dia. 2.5 m		do	2	4500	9000	— " —
11		Venturi dryer, dia. 3.8 m		do	1	10000	10000	— " —
12		Oil filter		pce	9	200	1800	— " —
13		Tubular heat exchanger, dia 0,53 m, 6.7 m long		do	2	2500	5000	— " —
14		Pneumatic concrete gun with electric-water positive pressure pump		do	1	800	800	— " —
		Sub-total:					176600	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Conveyers, feeders, metering feeders						
15		Belt conveyer, 1000 m wide, 180 m long		do	2	32400	64800	LURGI ALCOA
16		Continuous weigh-feeder		do	1	2200	2200	— " —
17		Stationary twin-screw feeder, dia. 400 mm, 15 kW electric motor, 1400 R.P.M.		do	1	3500	3500	— " —
18		Rotary airlock feeder, dia. 400 mm, 2.2 kW electric motor		do	1	600	600	— " —
19		Screw feeder, dia. 0.6 m, 7.5 kW electric motor		do	1	3500	3500	— " —
20		Air-lock valve		do	2	1000	2000	— " —
21		Airslide, 400 mm wide		do	1	1500	1500	— " —
		Sub-total:					78100	
		Pumps, I.D. fans, fans						
22		Fuel oil gear pump, 0,25 kW electric motor		pce	1	350	350	— " —
23		90 m^3/hr water pump, head 350 kPa 15 kW		do	2	300	600	— " —
24		280 m^3/hr turbo-blower, head 30 kPa 5.5 kW		do	1	300	300	— " —
25		630 m^3/hr turbo-blower, head 50 kPa 13 kW		do	2	400	800	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
26		3500 m^3/hr turbo-blower, head 60 kPa, 100 kW		pce	2	4500	9000	LURGI ALCOA
27		10000 m^3/hr turbo-blower, head 60 kPa, 250 kW		pce	5	6000	3000	— " —
		Sub-total:					41050	
		Cranes, hoists, lifts						
28		3.2 t suspended electric crane, hoisting height - 6 m		do	1	3050	3050	
29		5 t suspended electric crane, hoisting height - 30 m		do	2	3900	7800	
30		2 t electric hoist, hoisting height - 30 m		do	2	630	1260	
31		3.2 t electric hoist, hoisting height - 12 m		do	1	520	520	
32		Air lift, dia. 1.1 m		do	1	1500	1500	
		Sub-total:					14130	
		Sanitary equipment						
33		Central air conditioner		pce	1	2500	2500	
		Valves and fittings						
34		Valves		kg			2650	
		SECTION II. MATERIALS						
1		Pipelines		kg			230000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
2		Steel structures		do			10000	
3		Lining materials		do			581000	
		Total, section I equipment					423330	
		section II materials					821000	

Alumina calcination

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		SECTION I. ELECTRIC PART						
		Electric power equipment						
1		Transformer substation complet (KT 3-4) incl.		set	1	19700	19700	
		- transformer 1000 kW		pc	2			
		- input cabinet 'H.V'		pc	2			
		- input cabinet L.V		pc	2			
		- sectional cabinet		pc	1			
		- lines cabinet		pc	4			
2		Oil power transformer 3 phases 1000 kW, voltage 10/6 kV		pc	1	4700	4700	
3		Control station panels frame construction		1 panel	10	300	3000	
4		Control boxes for asynchronous motors 380 v AC input 3 poles automatic switch with combined release 16-160 A and magnetic starters with thermal starter 16-160 A		pc	10	40	400	
5		Power boxes 3 poles with knife switch fuses 100 A-300 A voltage 380 v AC		pc	10	24	240	
6		Power distribution points 380 v AC 3 poles input switch with combined release 250 A and 10 automatic switches with combined release 16A-160 A		pc	5	170	850	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
7		Magnetic starters 3 poles AC 380 v dustproof bobbin 220 v with thermal relais 63 A, 40 A, 25 A						
		Lighting equipment						
8		Distribution points with input automatic switch without release 100 A with 6-3 phases line circuit breakers with electromagnetic and thermal release 63 A, 20 A		ps	13	50	650	
9		Singlephase stepdown transformer 380/220/24 v 250 vA		do	30	10	300	
10		Switches 10 A, 220 v		do	100	0.6	60	
11		Plug-in 2 poles connectors 10 A, 220 v		do	120	0.6	72	
12		Luminaires (dif)		do	370		4170	
13		Filament, luminisent, are mercury lamps		do	450		140	
		Total:					34317	
		SECTION II. MATERIALS						
1		Power cable voltage 1000 v, aluminium conductors PVII insulation and sheath (different sections)		km	6.5		6351	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
2		Power cable 660 v rubber insulation in rubber or PVH sheath, aluminium conductors 4-70 mm2		km	15	800	12000	
3		Control cable aluminium conductors PVH insulation and sheath conductors sections 2,5 mm2 number of conductors 4-37		km	5	200	1000	
4		Installation wire aluminium conductor section 2,5 mm2 PVH sheath		km	3	16	48	
		Total:					19399	
5		Steel pipe D 25-65		m	2200		7000	
		Total section I equipment					34317	
		section II materials					26399	

1.13. Commercial alumina storage

NOS: No according to process flow sheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		SECTION I. EQUIPMENT. PROCESS DESIGN						
		Conveyers, feeders						
1		Portable belt conveyer, 400 mm wide, 6000 mm long		pce	2	425	850	USSR EUROPE
2		Pneumatic packing machine		do	4	350	1400	— " —
3		45-120 t/hr pneumatic bottom discharger		do	4	502	2008	— " —
4		Automatic loading unit of railway cars		do	2	3000	7800	— " —
5		150 t weigh-bridge		do	2	15300	30600	— " —
6		Airslide, 250 mm wide, capacity - 35 t/hr		do	3	1500	4500	— " —
7		Aeration pad 1800 x 525 x 58		do	110	80	8800	— " —
		Sub-total:					55958	
		Cranes, hoists, lifts						
8		3,2 t single-girder underslung crane, span - 9 m, hoisting height - 6 m		do	1	2045	2045	— " —
9		2 t single-girder underslung crane, span - 9 m, hoisting height - 12 m		pce	1	1030	1030	— " —
10		1.6 fork lift truck, lifting height - 2.8 m		do	1	3000	3000	— " —

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
11		50 t/hr air lift, lifting height - 35 m		pce	1	640	640	USSR EUROPE
12		300 kg winch for lifting bridges		do	4	112	448	— " —
13		150 kg elevator winch, lifting height - 30 m, speed 4.8 m/min		do	1	470	470	— " —
14		500 kg freight lift		do	1	2000	2000	— " —
		Sub-total:					9633	
		Chemical equipment						
15		Air separator, moisture separator capacity - 50 m3/min		pce	1	300	300	— " —
16		Bag filter, surface area 90 m^2		do	3	3000	9000	— " —
		Sub-total:					9300	
		Pumps, I.D. fans, fans						
17		12000 m^3/hr fan, head = 200-700mm W.C.		do	3	400	1200	— " —
18		700 m^3/hr fan, head - 250 mm W.C. 10 kW electric motor		do	3	400	1200	— " —
		Sub-total:					2400	
		Sanitary equipment						
19		Household air conditioner		do	1	53	53	
		Valves and fittings						
20		Valves		kg			300	

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
		SECTION II. MATERIALS						
1		Steel structures		kg			30000	
2		Pipelines		kg			10000	
		TOTAL, section I equipment					77644	
		section II materials					40000	

Alumina product storage

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		SECTION I. EQUIPMENT						
		Electric power						
1		Control station panels frame construction		1 panel	6	300	1800	
2		Control boxes for asynchronous motors 380 v AC including 3 poles automatic switches with combined release 16-160 A and magnetic starter with thermal relais 16-160 A		ps	10	40	400	
3		3 poles boxes including knife swith fuses 100 A-300 A voltage 380 v AC		po	5	24	120	
4		Power distribution points 380 v AC input 3 poles switch with combined release for 250 A and 10 automatic swithes with combined release 16 A-160 A		do	3	170	510	
5		Three-pole AC dust-proof magnetic starters with 220 v coil and thermal relay for nominal currents of 63 A, 40 A, 25 A		po	15		35	

РТП ВАМИ Зак№ 878 Тир 5000 17/11-38г.

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Electric lighting equipment						
6		Distribution stations with inlet circuit breakers without release, I_{nom} = 100 A, with 6 and 12 phase line switches, with electromagnetic and thermal releases, I_{nom} = 20 A		pc	3	50	150	
7		Single-phase step-down transformer, 380/220/24 V, 250 VA		do	4	10	40	
8		Installation switches 10 A, 220 V		do	30	0,6	18	
9		Double-pole plug-and-socket connection, 10 A, 220 A		do	20	0,6	12	
10		Luminaires (miscel)		do	120		1210	
11		Lamps (incandescent, fluorecent, arc mercury)		do	130		33	
		Total:					4328	
		Section II. Materials						
1		Power cable up to 1000 v with 4 aluminium cores, PVC insulation and sheath (different sections)		km	3,3		3201	
2		660 V power cable, two or four aluminium cores, with rubber or plastic insulation, rubber or PVC sheath. Core sections from 4 to 70 mm^2		km	4	8000	3200	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
3		Control cable, 4-37 aluminium cores 2.5 mm2 section with PVC insulation and sheath		km	2	200	400	
		Total:					6801	
4		Steel pipe, D_{nom} 25-65		m	900		2800	
		TOTAL of section I, equipment					4329	
		of section II, materials					11129	

1.14. Potassium sulphate drying

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		SECTION I. EQUIPMENT. PROCESS DESIGN						
		Tanks, vessels, furnace equipment						
1		Cooler, dia. 1800 mm		pce	3	steel struct. 810	2430	USSR
						lining materials 1900	5700	
2		Fluid-bed apparatus for drying salts		do	3	steel struct. 5500	16500	— " —
						lining materials 12900	38700	
3		Six-cyclone battery, dia. 550 mm		do	3	1020	3060	— " —
4		Scrubber, dia. 1500 mm, 9000 mm high		do	3	9700	29100	— " —
5		5-10 t/hr spreader, 3.2 kW electric motor, 1500 R.P.M		do	3	220	660	— " —
							96150	
					including steel structures		18930	
		Conveyers, feeders						
6		Inclined troughed belt conveyer, belt width - 650 mm, 75 m long		pce	2	26000	52000	EUROPE USSR
7		Apron feeder, 500 mm wide, 3000 mm long		do	3	700	2100	— " —

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
8		Pneumatic transport apparatus, dia. 200 mm		pce	3	102	306	USSR
9		One-side plough tripper, 650 mm wide, 2.2 kW electric motor, 1000 R.P.M.		do	4	520	2080	—"—
		Sub-total:					56486	
		Chemical equipment						
10		Roll-type filter		pce	3	300	900	—"—
		Pumps, I.D. fans, fans						
11		100 m^3/hr centrifugal pump, head - 31 mm W.C.		do	6	300	1800	—"—
12		Pneumatic chamber pump, dia. 1200 mm		do	3	1600	4800	—"—
13		700 m^3/hr air blower, head - 2000 mm W.C. 10 kW electric motor		do	3	860	2580	—"—
14		10000 m^3/hr fan, head 315 m W.C. 14 kW electric motor		pce	3	580	1740	—"—
15		50000 m^3/hr fan, head 650 mm W.C.		do	3	400	1200	—"—
		Sub-total:					12120	
		Valves and fittings						
16		Valves		kg			2000	
		Cranes, hoists, lifts						
17		1 t electric travelling hoist, hoisting height - 6 m		pce	1	200	200	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
18		2 t electric travelling hoist, hoisting height - 6 m		pce	1	400	400	
19		Do hoisting height - 18 m		do	1	400	400	
		Sub-total:					1000	
		SECTION II. MATERIALS						
1		Piping		kg			8500	
2		Steel structure		kg			1000	
		Total : section I - equipment					168656	
		including steel structure					18930	
		section II - materials					18500	
		Potassium sulfate drying						
		Section I. Equipment. Electrical engineering						
		Power equipment						
1		Control station panels, consisting of frame-type panel		1 panel	8	300	2400	
2		380v AC. Asynchronous motors control boxes consisting of three-pole inlet circuit breaker with a combination release, I nom - 16-160 A, and magnetic starter with thermal relay, I nom - 16-160 A		pc	10	40	400	

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
18		2 t electric travelling hoist, hoisting height - 6 m		pce	1	400	400	
19		Do hoisting height - 18 m		do	1	400	400	
		Sub-total:					1000	
		SECTION II. MATERIALS						
1		Piping		kg			8500	
2		Steel structure		kg			1000	
		Total : section I - equipment					168656	
		including steel structure					18930	
		section II - materials					18500	
		Potassium sulfate drying						
		Section I. Equipment. Electrical engineering						
		Power equipment						
1		Control station panels, consisting of frame-type panel		1 panel	8	300	2400	
2		380v AC. Asynchronous motors control boxes consisting of three-pole inlet circuit breaker with a combination release, I nom 9- 16-160 A, and magnetic starter with thermal relay, I nom - 16-160 A		pc	10	40	400	

РТП ВАМИ Заказ 878 Тир 5000 17/11-86г.

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
3		Three-pole power box consisting of master switch with fuses rated at 100 to 300 A, 380 v AC		pc	10	25	240	
4		380 v AC power distribution points with three-poles input breaker and combined release for nominal current 250 A and ten output automatic breakers with combined release of 16-160 A		do	3	170	510	
5		380 v, three-pole magnetic starter, with 220 v coil, with thermal relay rated at I_{nom}		do	15		35	
		Electric lighting equipment						
6		Distribution points with input circuit breakers without release for nominal current 100 A with six three-phase and 12 single-phase line breakers with electromagnetic and thermal releases for current of 20 A		do	2	50	100	
7		Single-phase step-down transformer 380/220/24 v? 250 VA		do	4	10	40	
8		Installation switch 10A, 220 V		do	15	0,6	9	
9		Two-pole plug-and-socket connection, 10 A, 220 v		do	20	0,6	12	
10		Luminaires (miscel)		do	90		480	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
11		Lamps (filament, fluorecent)		ps	100		15	
		Total:					4241	
		Section II. Materials						
1		Power cables up to 1000 v with four aluminium cores, PVC insulation and sheath (different section)		km	4,8		4882	
2		Power cable 660 v, two or four aluminium cores with rubber or plastic insulation, rubber or PVC sheath, cores section from 4 to 70 mm2		km	2,5	800	2000	
3		Control cable of 4 to 37 aluminium cores 2.5 mm2 section with PVC insulation and sheath		km	3	200	600	
4		Aluminium installation wire 2.5 mm2 section, PVC sheath		km	0,4	16	7	
		Total:					7489	
5		Steel pipe ID 25-65		kg	1300		3840	
		Total section I - Equipment					4241	
		section II - Materials					11329	

1.15. Potassium sulphate storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		SECTION I. EQUIPMENT. PROCESS DESIGN						
		Chemical equipment						
1		50 m^3/min air separator, moisture separator		pce	1	300	300	USSR Europe
2		Bag filter, surface area - 90m^2		do	2	3000	6000	-"-
		Conveyers, feeders						
3		Portable belt conveyer, 400 mm wide, 6 m long		do	4	425	1700	-"-
4		45-120 t/hr pneumatic bottom discharger		do	4	500	2000	-"-
5		Diverter valve, with electro-pneumatic drive, D_{nom} 150 mm		do	2	250	500	-"-
6		Aeration pad 1800 x 525 x 58		do	110	80	8800	-"-
7		Packing machine, capacity 200 bags/hr		do	4	350	1400	-"-
		Sub-total:					14400	
		Cranes, hoists, lifts						
8		1 t electric single-girder underslung crane, span - 9 m, hoisting height - 12 m		pce	1	1030	1030	-"-

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
9		1 t electric travelling hoist, hoisting height - 12 m		pce	1	220	220	
10		150 kg elevator winch, hoisting height 30 m, speed - 4.8 m/min						
11		1,6 t fork lift truck		pce	1	3000	3000	
12		500 kg freight lift		pce	1	2000	2000	
		Sub-total:					6250	
		Pumps, I.D. fans, fans						
13		7000 m^3/hr fan, head - 250 mm W.C 10 kW electric motor		pce	2	400	800	USSR EUROPE
		Valves and fittings						
14		Valves		kg			300	
		Section II. Materials						
1		Steel structures		kg			3000	
2		Pipelines		kg			1000	
		Sub-total: section I equipment					28050	
		section II materials					40000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Potassium sulphate storage						
		Section I. Electrical equipment						
		Power equipment						
1		Control station board consisting of frame-design panels		1 standard panel	6	3000	1800	
2		Control boxes of asynchronous 380 v AC motors consisting of inpit three pole circuit breakers with combination release rated for 16 A to 160 A and magnetic starter with thermal relay rated for 16 A to 160 A		pcs	5	40	200	
3		Three pole power boxes consisting of master switch with fuses rated for 100 A to 300 A, voltage 380 v AC		do	5	24	120	
4		Power distribution stations, rated for 380 v AC with input three-pole swith with combination release rated for 250 A and ten output circuit breakers with combination release rated for 16 A to 160 A		do	2	170	340	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
5		Three-pole magnetic starters rated for 380 V AC, dustproof, with coil rated for 220 v and thermal relay rated for 63 A, 40 A, 25 A		pc	15		35	
		Electric lighting equipment						
6		Distribution panels with input circuit breaker without release rated for 100 A with twelve single-phase breakers with electromagnetic and thermal release rated for 20 A		pc	2	50	100	
7		Single-phase step-down transformer 380/220/24 v, 250 VA		pc	5	10	50	
8		Installation breakers 10 A, 220 v		pc	25	0,6	15	
9		Double-pole plug connectors 10 A, 220 v		pc	20	0,6	12	
10		Light fixtures (miscellaneous)		pc	105		765	
11		Filament, luminescent, mercury arc lamps		pc	135		40	
		Total:					3792	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section II, Materials						
1		Power cable rated up to 1000 v, aluminium cores, PVC insulation and sheath, four-core cable (various cross-sections)		km	3,6		2720	
2		Power cable rated for 660 V, rubber or plastic insulation, rubber or PVC sheath two aluminium core cable, cross-section 4 to 70 mm2		km	3,5	800	2800	
3		Control cable, aluminium cores, PVC insulation and sheath, core section 2.5 mm2, 4 to 37 cores						
4		Installation wire, aluminium cores, section 2.5 mm2, PVC sheath		km	1,2	16	19	
		Total:					5539	
5		Steel pipe D_{nom} 25 to 65		m	1000		3200	
		Total: of section I: equipment					3792	
		of section II materials					8739	

Caustic storage

NOS No according to technological flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, cipher	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Whom to be supplied by
		Section I. Equipment. Process Design						
		Chemical equipment						
1		Reciver, dia 0.5 m; high 6.0 m	pcs		1	590	590	USSR Europe
2		Chain agitator, dia 2.0 m; high 2,5 m electric motor 5,5 kW	do		1	1140 steel struct. 1200	1140 1200	-"-
3		Heat exchanger. dia 0.6 m	do			3900	7800	
		Pumps, Fans						
4		25 m^3/min vacuum pump, 90 kW electric motor	do		1	2350	2350	-"-
5		315 m^3/hr centrifugal pump, head 16 m, 45 kW electric motor	do		2	2700	5400	-"-
6		160 m^3/hr centrifugal pump, head 20 m, 30 kW electric motor	do		2	1100	2200	-"-
7		315 m^3/hr centrifugal pump, head 40 m, 110 kW electric motor	do		2	2800	5600	-"-
		Cranes hoists						
8		2 t overhead electric single-girder crane. Hoisting height-6 m	pcs		1	1200	1200	-"-
		Tanks						
9		Tank dia 19 m, 12 m high	do		2	185000	370000	-"-

Caustic storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Electrical equipment						
		Power equipment						
1		Contact transformer substations (K T -5) including		set	1	19700	19700	
		- 1000 KVA transformers rated for 10/0,4 to 0.23 kV		pc	2			
		- high voltage input cabinet		pc	2			
		- low voltage input cabinet		pc	2			
		- sectional cabinet		pc	1			
		- line cabinet		pc	4			
2		Control station boards consisting of frame-design panels		1 standard panel	15	300	4500	
3		Control boxes of 380 v AC asynchronous motors, consisting of input three-pole circuit breaker with combination release rated for 16 A to 160 A and magnetic starter with thermal relay rated for 16 A to 160 A		pc	10	40	400	
4		Three-pole power boxes consisting of master switch with fuses rated for 100 A to 300 A, voltage 380 v A.C.		pc	5	24	120	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
5		Power distribution stations rated for 380 v A.C. with input three-pole switch with combination release rated for 250 A and ten output circuit breakers with combination release rated for 16 A to 160 A		pcs	3	170	510	
6		Three-pole magnetic starters rated for 380 v AC, dust-proof, with 220 v coil and thermal relay rated for 63 A, 40 A, 25 A		pcs	30		60	
		Electric, lighting equipment						
7		Distribution panels with input circuit breaker without release rated for 100 A with 6 three-phase and 12 single-phase line breakers with electromagnetic and thermal releases rated for 63 A and 20 A		pcs	5	50	250	
8		Single-phase step-down transformer 380/220/24 v, power rating 250 VA		pcs	5	10	50	
9		Setting breakers, 10 A, 220 V		pcs	20	0,6	12	
10		Double-pole plug connectors 10 A, 220 v		pcs	20	0,6	12	
11		Light fixtures (miscellaneous)		pcs	90		520	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
12		Searchlight with halogen lamp, 100 W		pcs	10	20	200	
13		Filament, luminescent, mercury arc, halogen lamps		pcs	110		35	
		Total:					26364	
		Section II. Materials						
1		Power cable rated up to 1000 v, aluminium cores, PVC insulation and sheath, four-cores (different sections)		km	5,5		4877	
2		Power cable rated for 660 v, rubber or plastic insulation, rubber or PVC sheath, two-four aluminium cores, 4970 mm2		km	3,5	800	2800	
3		Control cable aluminium cores, PVC insulation and sheath, core section 2.5 mm, 4 to 37 cores		km	2	200	400	
4		Installation wire, aluminium cores, 2,5 mm2 section, PVC sheath		km	4,8	16	13	
		Total:					8060	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
5		Steel pipe D_{nom}. 25-to 65		m	1000		3200	
		Total: of section I equipment					26364	
		of section II materials					11260	

Main production units
Instrumentation and controls

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
		Section I. Instrumentation and control equipment						
1		Instruments and automation devices		set	1625	30	48750	
2		Control panels		pcs	290	150	43500	
		Total:					92250	
		Section II. Materials						
1		Control electric cable with copper core KPB type, cross-sections:						
		4 x 1		km	30,05	135	4057	
		7 x 1		km	17,02	196	3336	
		10 x 1		km	5,83	285	1662	
		19 x 1		km	3,55	449	1594	
2		Panel electric cable with aluminium core AKBB - type, cross-sections:						
		4 x 2.5		km	17,15	126	2161	
		7 x 2.5		km	5,6	182	1019	
		10 x 2.5		km	3,75	263	986	
		19 x 2.5		km	0,9	450	405	
		Total:					15220	
3		Steel for structural steel		kg			12450	
4		Steel pipe D_{nom} 50 mm		m	8825	0,3	2648	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
5		PVC tube $D_{nom.}$ 4,5 mm		m'	11970	0,02	240	
		TOTAL: of section I: equipment.					92250	
		of section II: materials					30558	

2. POWER FACILITIES UNITS

2.1. H.P.P.

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Technological part. Power equipment						
1		Boiler unit, capacity 75 t/h, steam 40 abs.bar; 440°C complete with economiser, air preheater, burners, stationary blower, shot cleaning and piping within boiler		set.	5	312000	1560000	
2		Condensing turbine with steam extraction complete with 6000 kW generator, 10 kV, 3000 rpm		set	1	57000	57000	
3		Back-pressure turbine, P = 8 abs. bar complete with 6000 kW generator, 10 kV, 3000 rpm		set	2	39600	79200	
4		Deaerating head, P = 1,2 abs.bar, 150 t/h		set	3	4500	13500	
5		Deaerating installation for heat circuit reprenishment, 50 m3/h, with 15 m3 tank		set	1	4400	4400	
6		Reduction-cooling installation, 30 t/h live steam pressure 40 abs. bar, reduced steam pressure 8 abs.bar		set	2	5000	10000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
7		Reduction installation, 20 t/h, steam pressure: initial - 8 abs.bar final - 1,2 abs.bar		set	2	3000	6000	
8		High pressure preheater with heating surface 60 m2		set	5	3000	15000	
9		Condensate cooler, cooling surface 35 m2		set	5	2300	11500	
10		Network water preheater, heating surface 150 m2		set	2	6000	12000	
11		Condensate cooler, cooling surface 100 m2		set	2	4000	8000	
12		Continious blow down installation comprising separator, heat exchanger		set	3	6000	18000	
13		Sewage flash tank, Ø 820, capacity 1,5 m3		set	1	1500	1500	
14		Intermittent blow-down flash tank Ø 2000, capacity 7,5 m3		set	1	3200	3200	
15		Steam and water preheater, heating surface 15 m2		set	2	1000	2000	
16		Boiler phosphatization unit consisting of dosing pumps, liquor pumps, supports and piping		set	5	1500	7500	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
17		Water alkalization unit consisting of dosing pump, liquor tank, support and piping		set	1	1500	1500	
		Total:					1810300	
		Pumps, smoke exhausters, fans						
1		Feeding pump, 100 m^3/h, 578 m of WC with electric motor 240 kW		piece	5	3000	15000	
2		Network pump, 320 m^3/h, pressure 70 m of W.C. electric motor 90 kW		piece	2	1037	2074	
3		Replenishment pump, 60 m^3/h, pressure 50 m of WC. electric motor 15 kW		piece	2	200	400	
4		Emergency pump, 30-60 m^3/h, pressure 58-45 m of WC, electric motor 17 kW		piece	1	200	200	
5		Smoke enhauster 157000 m^3/h, pressure 171 m of WC, 635 rpm, electric motor 315 kW		piece	5	23000	115000	
6		Blower fan, 83500 m^3/h, pressure 340 mm of WC, 980 rpm with electric motor		piece	5	7500	37500	
7		Axial fan		piece	2	90	180	
		Total:					170354	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Tanks, reservoirs, kiln equipment						
1		Tank - deaerating accumulator, 70 m3, pressure 1,2 abs.bar		piece	3	11000	33000	
2		Tank for sewage collection, 25 m^3		piece	2	4000	8000	
3		Steel tanks accumulating hot water 250 m3		piece	2	9000	18000	
		Total:					59000	
		Cranes, hoists, lifts, loaders						
1		Bridge crane electrically driven 15/3 t capacity, span - 17 m		piece	1	21200	21200	
2		Electric hoist, 2 t capacity, span 3 m		piece	1	900	900	
		Total:					22100	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Plumbing fixtures						
1		Steel plate heater		piece	90	110	9900	
		Piping fixtures						
1		Valves					140000	
		Chemical water treatment						
		Section 1. Equipment						
		Tanks, reservoirs						
1		Chemical water treatment for boilers according to sequence: lime pretreatment and coagulation in charifiers filtration by mechanical filtors, double sodium zeolite softening process 140 t/h. Condensate purification according deironing, 50 t/h		set	1	150000	150000	
2		Chemical water treatment equipment for replenishment of heat supply system with open type water shed t/h		set	1	50000	50000	
		Total:					200000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section II. Materials						
1		**Steel structures**					20000	
2		**Piping**					625000	
3		**Heat insulation (piping)**					390000	
4		**Heat insulation (boiler unit)**					1500000	
5		**Aluminium sheet**					70000	
6		**Steel sheet**					200000	
		Total:					2805000	
		Instrumentation and automation						
		Section I. Equipment						
1		**Automation instruments and facilities**		set	600	30	18000	
2		**Panels**		piece	120	150	18000	
		Total:					36000	
		Section II. Materials						
1		**Electric control cable with copper conductor KPB section** 4 x 1		km	17	135	2295	
		7 x 1		km	15	196	2940	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		10 x 1		km	5	285	1425	
		19 x 1		km	1	449	449	
2		Electric control cable with aluminium conductor AKBB of section 4 x 2,5		km	6	126	756	
		7 x 2,5		km	1	182	182	
		10 x 2,5		km	0,8	263	210	
		19 x 2,5		km	0,8	450	360	
		Total:					8617	
3		Steel tube Dc 50 mm		m	8000		2400	
4		PVC pipes Dc 4,5 m		m	8000		1600	
5		Steel structures metal		kg			8000	
		Total of Section 1:						
		Equipment					36000	
		Of Section II Materials					12000	

2.2. Transformer oil facilities

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment. Process part						
		Chemical equipment						
1		Press filter		piece	2	300	600	
2		Centrifuge for oil, 1500 l/h, complete with electric motor, 19,6 kW		piece	4	600	2400	
3		Adsorber for 100 kg of sorbent		piece	4	220	880	
4		Air drying filter		piece	16	33	530	
		Total:					4410	
		Tanks, reservoirs						
1		Tank for oil, welded steel, 75 m^3		piece	6	5400	32400	
2		Tank for oil, 2 m^3 ø 1400		piece	6	500	3000	
		Total:					35400	
		Pumps, smoke exhausters, fans						
1		Pumps for oil take-in from cistern, 20 m3/h, pressure 4,6 kgs/cm^2 with electric motor BA0-61-4, 13 kW		piece	1	30	30	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
2		Gear pump, 18 m^3/h, pressure 3,6 kgs/cm^2 with electric motor A02-51-6, 5,5 kW		piece	4	148	592	
3		Vacuum pump, 0,4 m^3/h, vacuum 660 mm of Hg, electric motor A02-31-4, 22 kW		piece	1	42	42	
4		Centrifugal fan		piece	2	210	420	
5		Axial fan		piece	2	90	180	
		Total:					1262	
		<u>Cranes, hoists, lifts, loaders</u>						
1		Electric bridge crane, 30/5 t, span 10,6 m		piece	1	35000	35000	
2		Movable geared manual hoist, 2 t, elevation height 3 m		piece	1	150	150	
		Total:					35150	

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
		Vehicles, cars, special vehicles						
1		Oil purification unit (movable) 3000 l/h		piece	1	1310	1310	
		Sanitary equipment						
1		Fan units		piece	10	200	2000	
		Piping fixtures						
1		Steel valves Dc 15÷150		-	-	-	2200	
		Section II. Materials						
1		Pipelines		-	-	-	8470	
2		Steel structures metal		-	-	-	800	
		Total:					9270	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment.Electric part						
		Power equipment						
1		Control boxes for asynchronous motors 380 V alternating current		piece	6	40	240	
2		Three pole power boxes		piece	5	24	120	
3		Power distribution panels, 380 V alternating current		piece	2	170	340	
4		Three pole magnetic starters, 380 V with thermal relays for currents:						
		63 A		piece	10	3	30	
		40 A		piece	10	3	30	
		25 A		piece	20	1	20	
		Lighting equipment						
5		Distribution point with input automatic switch without release for nominal current 100 A with						
		- six three phase line circuit breakers with electromagnetic and thermal releaser for nominal current 63 A		piece	1	50	50	
		- tvelwe one phase line circuit breakers with electromagnetic and thermal releases for nominal current 20 A		piece	4	50	200	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
6		Swithes for 10 A, 220 V		piece	50	0,6	30	
7		Two pole plug-and-socket connections 10 A, 220 V		piece	50	0,6	30	
8		Single phase step-down transformers, 380/220/24 VA		piece	2	10	20	
9		Lighting fixtures		piece	60		320	
10		Incandescent lamp		piece	80		22	
		Total:					1452	
		Section II. Material						
1		Power cable, up to 1000 V, aluminium conductor, PVC insulation and cover (vareous cross-sections)		km	5,5		4055	
2		Control cable with aluminium conductors and PVC insulation		km	2		400	
3		Installation wire with aluminium conductor		km	0,5		8	
		Total:					4463	
4		Steel pipe Dc 32÷65		km	1,8		6045	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Instrumentation and automation						
		Section I. Equipment						
1		Instruments and facilities for control and automation		piece	100	5,0	500	
		Total of Section I Equipment					83686	
		Total of Section II Materials					19778	

2.3. Main step down substation

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment						
		Electrical equipment						
1		Three phase transformer, step-down double winding, 63000 kW, 230/10 kV		piece	2	145000	290000	
2		Power oil transformer, 63 MW, 10/0,4 kV		piece	2	600	1200	
3		External short-circuiting switch 230 kV		piece	2	250	500	
4		Earthing switch 230 kV		piece	2	900	1800	
5		Valve type arrester 230 kV		piece	6	405	2430	
6		Valve type arrester 35 kV		piece	2	73	146	
7		Valve type arrester 15 kV		piece	2	43	86	
8		Entrance bay with oil switch 10 kV, 1000 A		piece	6	1500	9000	
9		Diverging line cabinet with oil switch 10 kV, 1000 A		piece	8	1200	9600	
10		Diverging line cabinet with oil switch 10 kV, 600 A		piece	24	1000	24000	
11		Cabinet with safety devices		piece	2	500	1000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
12		Cabinet with voltage transformers and arresters		piece	4	1000	4000	
13		Distribution panels of alternating current board 0,4/0,23 kV		piece	8	500	4000	
14		Telemecanisation system		set	1		6000	
		Total:					353762	
		Pumps, smoke exhausters, fans						
1		Axial fan		piece	2	90	180	
		Total of Section I Equipment					353942	

2.4. Bussbars and intershop cable circuits

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section II. Material						
1		Three conductors power cable wit aluminium conductors, impregnated paper insulation in lead sheath, cross section mm2, 10 V:						
		3 x 150		km	28,2	6625	186830	
		3 x 70		km	23,6	4404	105700	
		6 V						
		3 x 120		km	2,4	5039	12093	
		3 x 25		km	3,5	2405	8417	
2		Powor cable, 1000 V, aluminium conductors and PVC insulation and sheath cross section mm^2						
		3 x 120+1 x 35		km	2	3200	6400	
		3 x 24+1 x 10		km	15	950	14250	
3		Control cable with copper conductors, PVC insulation and sheath, cross-section 1,5 mm2, number of conductors		km	23	374	8602	
		Total:					342292	
		4+14						
4		10 kV up to 4000 A, symmetrical, three-phase with rigid bars, reinforced pipe insulation 140 x 10		km	0.7		15600	
		Total of Section II. Material					357892	

2.5. Compressor house

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment. Process						
1		Compressor, 500 mm^3/min, P = 0,9 MPa electric motor CTD 3150 2, 3150 kW 3000 rpm		piece	2	34800	69600	
2		Compressor, 250 nm^3/min, P = 0,8 Mpa electric motor CTD 1600 2, 1600 kW 3000 rpm		piece	2	23300	46600	
3		Air cooler		piece	4	1325	5300	
4		Felt air filter, 40000 m^3/h		piece	4	370	1480	
5		Air dryer		piece	2	15140	30280	
		Total:					153260	
		Tanks						
1		10 m^3 tank		pcs	1	1360	1360	
2		2,9 m^3 tank		pcs	2	565	1130	
		Total:					2490	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Fans, smoke exhausters, pumps						
1		Pump 2-25-1,4/16-2c with electric motor AO 2-22- , 1,5 kW, 1450 rpm		pcs	2	63	126	
		Cranes, hoists, filts, loaders						
1		Electric bridge crane with f control, capacity 16/3,2 t, span 16,5 m		pcs	1	26500	26500	
		Pipeline fixtures						
1		Steel valves Dc 500÷800					19000	
2		Pig iron valves Dc 25÷600					20000	
		Total:					39000	
		Section II. Materials						
1		Steel structures					12000	
2		Pipelines					100000	
3		Heat insulation					2000	
4		Steel structures metal					500	
		Total:					114500	

Compressor house

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment Electrical part						
		Power equipment						
1		Complete transformer substation		set	I		6500	
2		Complete distribution unit		set	I		16500	
3		Control station boards			20	300	6000	
4		380 V alternating current asynchronous motors control bax		pcs	10	40	400	
5		3-pole power boxes consisting of knife-switch with safety devices for 100A-300 A; a.c. 380 V		pcs	10	24	240	
6		A.c. 380 V 3-pole magnetic starters		set	1		28	
7		Power distribution points, 380 V of alternating power		pcs	5	170	850	
		Lighting equipment						
8		Distribution points (various)		pcs	7	50	350	
9		Installation switches 10 A, 220 V		pcs	50	0,6	30	

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
10		2-pole plug-and-socket connection 10 A, 220 V		pcs.	50	0,6	30	
11		Single phase step down transformers 380/220/24 VA		pcs.	5	10	50	
12		Lighting fixtures		pcs.	440		3000	
13		220 V incandescent lamps		pcs.	200		30	
14		Luminescent lamps		pcs.	400		160	
		Total:					3190	
		Section II. Materials						
1		Power cable, up to 1000 V, with Al conductors and PVC sheath (various)		km	5,55		6240	
2		Power cable, 660 V		km	7		5600	
3		Control cable with Al conductors PVC insulation (various)		km	6		1034	
4		Installation wire		km	1		16	
		Total:					12890	
5		Steel pipe Dc 25÷50					2700	

Compressor house

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Instrumentation						
		Section I. Equipment						
1		Automation instruments and facilities		set	70	30	2100	
2		Boards		pcs	15	150	2250	
		Total:					4350	
		Section II. Materials						
1		Control cable with Cu conductor of KPB type, of cross-sections:						
		4 x 1		km	1	135	135	
		7 x 1		km	0.7	196	137	
		10 x 1		km	0.5	285	143	
		19 x 1		km	0.2	449	90	
2		Control cable with Al conductor of AKBB type, of cross-sections:						
		4,2,5		km	1	126	126	
		7 x 2,5		km	0,5	182	91	
		10 x 2,5		km	0,3	263	79	
		19 x 2,5		km	0,2	450	90	
		Total:					891	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
3		PVC pipe Dc 4,5 mm		m	500		10,0	
4		Steel pipe Dc 50 mm		m	100		30	
5		Steel structures metal					800	
		Total of Section I Equipment					228916	
		Section II. Materials					131821	

2.6. Gas distribution stations, points N 1 & 2

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Section I. Equipment						
		<u>Cranes, hoists, lifts, loaders</u>						
1		Manual monorail hoist, capacity 1 t		pcs	1	270	270	
2		Manual monorail hoist, capacity 3 t, span 8 m		pcs	1	310	310	
		Total:					580	
		<u>Miscellaneous</u>						
1		Pressure regulator with safety valve and felt filter		set	3	2500	7500	
2		Pressure regulator with safety valve and felt filter		set	1	900	900	
		Total:					8400	
		<u>Pipeline fixtures</u>						
3		Steel valves Dc 25-600		kg	14000			
		Section II. Materials						
1		Steel structures		kg			1600	
2		Steel structures metal		kg			2100	
3		Pipelines		kg			25000	
		Total:					28700	
		TOTAL of Section I - Equipment					22980	
		Section II - Materials					28700	

Gas distributing station. Gas regulating points 1 & II

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Instrumentation						
		Section I. Equipment						
1		Control instruments and facilities		set	25	30	750	
		Section II. Materials						
1		Control cable with Cu conductor of KPB type of cross-sections:						
		4 x 1		km	0,8	135	108	
		7 x 1		km	0,3	196	59	
		19 x 1		km	0,2	449	90	
2		Control cable with Al conductor of AKBB type of cross sections:						
		4 x 2,5		km	0,5	126	83	
		7 x 2,5		km	0,4	182	73	
		Total:					413	
3		Steel structures metal		kg			300	
4		PVC pipe Dc 4,5 mm			300	0,02	6	
5		Steel pipe Dc 50 mm			200	0,3	60	
		Total of Section I - Equipment					750	
		Section II - Materials					779	

2.7. Fuel oil facility

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Process part						
		Chemical equipment						
1		Fuel oil preheater, 30 t/h, pressure 64 kgf/cm2		pcs	2	4090	8180	
2		Fuel oil preheater, 120 t/h, pressure 13 kgf/cm2		pcs	2	8547	17094	
3		Fuel oil filter, 120 t/h, pressure 10 abs bar		pcs	5	485	2425	
4		Fuel oil filter, 30 t/h, pressure 40 abs bar		pcs	2	260	520	
		Total:					28219	
		Tanks						
1		Fuel oil tank equipment, 5000 m^3		pcs	3	2000	6000	
2		Cylindrical tank, 6,3 m^3, Ø 1670mm 3350 mm high		pcs	2	770	1540	
		Total:					7540	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Pipeline fixtures						
1		Pipe valve Dc 10÷250		-	-	-	1200	
		Section II. Materials						
1		Steel structures		-	-	-	1240	
2		Pipelines		-	-	-	45000	
3		Pipelines		-	-	-	44600	
		TOTAL					90840	

Fuel oil facility

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment, electric part						
		<u>Power equipment</u>						
1		Control station boards consisting of frame construction panels			5	300	1500	
2		380 V a.c. asynchronous motor control boxes		pcs	10	40	400	
3		3-pole power boxes, consisting of knife-switch with cut-out for 100 A - 300 A, a.c. 380 V		pcs.	5	24	120	
4		Power distribution points, a.c. 380 V		pcs.	2	170	340	
5		Magnetic starters, 3-pole		pcs.	30		70	
		<u>Lighting equipment</u>						
6		Distribution points with input automatic circuit breakers without release for nominal current 100 A with 6-phase and 12-phase line switches		pcs.	6	50	300	
7		Installation switch 10 A, 220 V		pcs.	50	0,6	30	
8		Single phase step down transformers 380/220/24 V, 250 VA		pcs.	2	10	20	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
9		2-pole plug-and-socket connections 10 A, 220 V		pc	50	0,6	30	
10		Lighting fixtures (various)		pcs	60		350	
11		Incandescence lamps (various)		pcs	80		30	
		Section II. Materials					3190	
1		Power cable, 1000 V, with Al conductors and PVC insulation and sheath (various cross sections)		km	4,5		3280	
2		Power cable, 660 V, with rubber or plastic insulation, Al conductors, 2 or 4 Al conductors (various cross-sections)		km	2		1600	
3		Control cable with Al cnnductors and PVC insulation and sheath, 2,5 mm2 cross-section		m	5		1000	
4		Iratallation wire with Al conductor, 2,5 mm2 cross-section		m	0,5	16	8	
		TOTAL:					5888	
5		Steel pipes Dc 25÷65		km	3,5		9650	

Fuel oil storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Instrumentation						
		Section I. Equipment						
1		Automation instruments and facilities		set	50	30	1500	
2		Boards		pcs	12	150	1800	
		Total:					3300	
		Section II. Materials						
1		Electric control cable with Cu conductor of KPB type of cross-section:						
		4 x 1		km	1,5	135	203	
		7 x 1		km	0,6	196	118	
		10 x 1		km	0,4	288	114	
		19 x 1		km	0,25	449	112	
2		Electric control ccable with Al conductor of AKBB type of cross-section:						
		4 x 2,5		km	1	126	126	
		7 x 2,5		km	0,7	182	127	
		10 x 2,5		km	0,5	263	132	
		19 x 2,5		km	0,3	450	135	
		Total:					1067	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
3		Steel structures metal					500	
4		PVC pipe, Dc 4,5 mm		m	500	0,02	10	
5		Steel pipe Dc 50 mm		m	200	0,3	60	
		TOTAL of Section I Equipment					65047	
		Section II Materials					108015	

2.8. Oxygen station

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Process part						
		Power and compressor equipment						
1		Air compressor 8 m^3/min, pressure 40 MPa electric motor A2K85/24-8/16 4X 4, 160 kW		pcs	2	6200	12400	
2		Air separation installation, 44 m3/h of gaseous oxygen		pcs	2	10400	20800	
		TOTAL:					33200	
		Chemical equipment						
1		Oxygen manifold		pcs	1	36	36	
2		Oxygen bottle 40-200Y with valve, cap and shoe		pcs	300	81	24300	
3		Bath		pcs	2	125	250	
4		Steel barrel, 200 l		pcs	2	50	100	
5		Vessel CPC-250-2-		pcs	1	10	10	
		Total:					24696	
		CCranes, hoists, bloaders						
1		Manual monorail hoist, 1 t, span 7,5 m, length 8,7 m, height of elevation 6 m		pcs	1	490	490	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
2		Manual movable hoists, 1 t, height of elevation 6 m		pcs	5	45	225	
3		Electric hoist, 0,25 t		pcs	1	80	80	
		Total:					795	
		Sanitary equipment						
1		Fans		pcs	10	220	2000	
		Miscellaneous						
1		Cages, buggies, mufflers, pallets, oil separators, jackets		-	-	-	2800	
		Pipeline fixtures						
1		Steel fixtures Dc 6÷32		-	-	-	300	
2		Non ferrous fixtures Dc 10÷20		-	-	-	35	
3		Pig iron Dc 15÷100		-	-	-	600	
		Total:					935	
		Section II. Materials						
1		Steel structures		-	-	-	15000	
2		Pipelines		-	-	-	10200	
3		Aluminium sheets		-	-	-	300	
		TOTAL:					23000	

Oxygen station

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Electrical part						
		Power equipment						
1		380 V a.c. asynchronous motors control boxes		pcs	5	40	200	
2		3-pole power boxes consisting of circuit breaker with safety devices for 380 V a.c. 100-300 A		pcs	4	24	96	
3		Power distribution points, 380 V a.c.		pcs	2	170	340	
4		Magnetic starters, 3-pole, a.c., 380 V, currents 63 A, 40 A, 25 A						
		Lighting equipment						
5		Distribution stations with inlet circut breakers without release Inom - 100A with 6 three phase and 12 single phase switches						
6		Installation switches 10A 220V						
7		Single phase step-down transformer 380/220/24 VA						

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
8		2-pole plug-and-socket connection 10 A, 220 V		pcs	50	0,6	30	
9		Lighting fixtures		pcs	90		770	
10		Incandescence lamps, 220 V, luminescent, arc lamps		pcs	110		40	
		Total:					1761	
		Section II. Materials						
1		Power calbe, to 1000 V, Al conductors PVC insulation and sheath of KBHH type (various sections)		km	1,5		1340	
2		Power cable 660 V with rubber or plastic insulation or PVC sheath and Al conductor, cross-section 4÷70 mm		km	2	800	1600	
3		Control cable, Al conductor, with PVC insulation and sheath, 2,5 mm2 number of conductors 4-37		km	1,5	200	300	
4		Installation wire with Al conductors 2,5 mm2 in PVC sheath		km	1	16	16	
		TOTAL:					3256	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
5		Steel pipe Do 25-65		km	1,8		2750	
		TOTAL of Section I Equipment					66187	
		Section II Materials					34006	

3. UNITS OF WATER SUPPLY, SEWERAGE AND MUD DISPOSAL

3.1. Water recirculating units for process water supplay. Circulating pump stations, cooling towers

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I.Equipment. Process part						
		Pump, exhausters, ventilators						
1		Centrifugal pump, capacity 1000m^3/h pressure 48 m, electromotor power 200 kWt, 1470 r/min		pc.	14	1800	25200	
2		Centrifugal pump, capacity 950m^3/h, pressure 21 m electromotor 160 kWt, 970 r/min		pc.	14	2400	33600	
3		Centrifugal pump, capacity 90 m^3/h, pressure 20 m, electromotor 7,5 kWt, 2900 r/min		pc.	3	138	414	
4		Centrifugal pump selfpriming capacity 3,6 m3/h, pressure 16 m, electromotor 1,5 kwt		pc.	6	70	420	
5		Electric pump capacity 53 m^3/h, pressure 10 m electromotor 4 kwt		pc.	6	60	360	
6		Ventilator capacity 1400000 m^3/h of air static pressure 16 mm, electromotor 75 kw, 170 r/min		pc.	7	8500	59500	
7		Centrifugal ventilator		pc.	5	80	400	
		Total:					119894	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	 total	Manufactured indigenously
		Cranes, hoists, lifts						
8		Monorail electric capacity 3,2 t, span 9 m		pc.	3	1900	5700	
9		Electric hoist, capacity 2 t		pc.	3	360	1080	
		Total:					6780	
		Others						
10		Horisontal mud collector Ø 700		pc.	8	1140	9120	
11		Plain gates 1250 x 1500		kg			57000	
12		Polyethylene sprayers		kg			260	
		Total:					66380	
		Valves						
13		Cast iron stop valve D 50-600 mm		kg			83600	
		Section II. Materials						
1		Puping		kg			241000	
2		Steel for metalwork		"			28940	

Water recirculating units for process water supply

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment, Electric part						
		Electric power equipment						
1		Transformer substation K T -2x1000		set.	3	19700	59100	
2		Panels of control frame construction		1 panel	35	300	10500	
3		Control boxes for asynchronous motors voltage 380 V AC		pc.	10	40	400	
4		Power boxes 3 poles knife switch with fuses 100 A to 300 A voltage 380 V AC		pc.	5	24	120	
5		Power distribution points 380 v AC with 3 poles input switch, combined release 250 A		pc.	4	170	680	
		Lighting equipment						
6		Distribution points with input automatic switch without release for 100 A with 6 3-phases line circuit breakers		pc.	2	50	100	
7		Distribution point with input automatic switch without release for nominal 100 A with 12 single-phase line circuit breakers with magnetic and thermal releases for 20 A		pc.	12	50	600	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
8		Single-phase step-down transformer 380/220/24 v 250 VA		pc.	25	10	250	
9		Switches 10 A, 220 V		pc.	150	0.6	90	
10		Plug-in connections bipolars 10 A, 220 v		pc.	150	0.6	90	
11		Luminaires (dif.)		pc.	490		3750	
12		Filament, arc, luminescent lamps		pc.	790		278	
		Total:					75958	
		Section II. Materials						
1		Power cable voltage 1000 v, aluminium conductors PVH insulation and sheath (different sections)		km	11.5		15100	
2		Power cable 660 v rubber insulation in rubber or PVH sheath, aluminium conductors 4-70 mm2		km	6	800	2400	
3		Control cable aluminium conductors PVH insulation and sheath conductors sections 2.5 mm^2 number of conductors 4-37		km	5	200	1000	

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
4		Installation wire aluminium conductor section 2.5 mm2 PVH sheath		km	4	16	64	
		Total:					18564	
5		Steel pipe D 25-65		m	6500		31840	
		Water recirculating units for process water supply						
		Instrumentation and automatics						
		Section I. Equipment						
1		Instruments and automation facilities		set.	50	30	1500	
2		Boards		pc.	15	150	2250	
		Total:					3750	
		Section II. Materials						
1		Electric control cable copper conductors type KPB sections 4 x 1		km	1.5	135	203	
		7 x 1		km	0.6	196	118	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		10 x 1		km	0.4	285	114	
		19 x 1		km	0.25	449	112	
2		Electric control cable, aluminium conductors type AKBB section						
		4 x 2,5		km	1	126	126	
		7 x 2,5		km	0,7	182	127	
		10 x 2,5		km	0,5	263	131	
		19 x 2,5		km	0,3	450	135	
		Total:					1066	
3		Steel for stellwork		kg			600	
4		Steel pipe D 50 mm		m	200	0.3	60	
5		PVH tube D 4,5 mm		m	500	0.02	10	
		Total section I - Equipment					356362	
		section II - Material					322080	

3.2. Tanks of industrial and potable water with pumping stations

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Process part						
		Pumps, exhausters, ventilators						
1		Centrifugal pump, capacity 400 m3/h, pressure 47 m, electric-motor 110 kwt 1450 r/min		pc.	4	1680	6720	
2		Centrifugal pump, capacity 300 m3/h, pressure 13 m electric-motor 17 kw 1450 r/min		pc.	2	405	810	
3		Centrifugal peripheral pump, capacity 8 m3/h, pressure 20 m electricmotor 2,2 kW		pc.	4	80	320	
4		Centrifugal pump, capacity 1000 m3/h, pressure 52 m electric-motor 250 kW 1470 r/min		pc.	3	1890	5670	
		Total:					13520	
		Cranes, hoists, lifts						
5		Monorail electric, capacity 2 t span 6 m		pc.	1	1025	1025	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
6		Monorail, electric, capacity 3,2 t, span 6 m		pc.	1	1460	1460	
		Total:					2485	
		Valves						
7		Cast iron stop valve D 150-500		kg			27800	
		Section II. Material						
1		Piping		kg			32400	
2		Steel for metalwork					8200	
		Total: section I - Equipment					43805	
		section II - Materials					40600	

3.3. In site water supply and sewerage systems. Pumping stations

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Section I. Equipment. Process part						
		Pumps, exhausters, ventilators						
1		Sanitary pump, capacity 70 m^3/h, pressure 32 m, electricmotor 18,5 kw 1450 r/min		pc.	9	345	3150	
2		Pump electric, capacity 10 m^3/h, pressure 10 m electricmotor 1,1kw, 2880 r/min		pc.	6	25	150	
3		Centrifugal ventilator		pc.	10	80	800	
		Total:					4100	
		Cranes, hoists, lifts						
4		Electric rope hoist, capacity 1 t		pc.	3	220	660	
5		Hand hoist, worm gearing capacity 1 t		pc.	6	40	240	
		Total:					900	
		Others						
6		Grid-crucher, capacity 290-420m^3/h electric motor 220 kw		pc.	6	590	3540	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
7		Slide gates 400 x 800		pc.	6	100	600	
		Total:					4140	
		Valves						
8		Cast iron stop valves D 50-150		kg.			2100	
		Section II. Material						
1		Piping		kg			800	
2		Steel for metal work		kg			500	
		Insite water supplay systems						
		Section I. Equipment, Electric part						
		Electric power equipment						
1		Control panels frame construction		1 panel	4	300	1200	
2		Control boxes for asynchronous motors voltage 380 v AC		pc.	6	40	240	
3		3 poles power boxes knife switch with fuses 100 A to 300 A voltage 380 v AC		pc.	2	24	48	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
4		Power distribution points 380 V AC with 3 poles input switch combined release 250 A and 10 automatic cut-off combined release at 16 to 160 A		pc.	2	170	340	
5		3 poles magnetic starters AC 380 V		pc.	17		31	
		Lighting equipment						
6		Distribution points wit input automatic switch without release for 100 A with 12 singlephase line circuit breakers		pc.	2	50	100	
7		Single phase stepdown transformer 380/220/24, 250 VA		pc.	3	10	30	
8		Switches 10 A, 220 V		pc.	20	0.6	12	
9		Plug-in connections, bipolare 10 A, 220 V		pc.	20	0.6	12	
10		Luminaires (dif)		pc.	70		350	
11		Luminescent lamps		pc.	90		30	
		Total:					1922	

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
		Section II. Material						
1		Power cable voltage 1000 v aluminium conductors PHV insulation an sheath (dif.sections)		km	2		1720	
2		Power cable 660 v rubber or plastic insulation rubber or PVH sheath aluminium conductors 4-70 mm2		km	1	800	800	
3		Control cable aluminium conductors PVH insulation and sheath sections of conductor 2,5 mm2 number of conductors 4-37		km	2	200	400	
4		Installation wire aluminium conductor section 2,5 mm2 PVH sheath		km	1	16	16	
		Total:					2936	
5		Steel pipe D 25-65		km	0,8		3200	

Insite water supply and sewerage systems, Sanitary and fresh water, rain and drainage pump stations

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Instrumentation and automatics						
		Section I. Equipment						
1		Instruments and automation facilities			75	30	2250	
2		Boards		pc.	30	150	4500	
		Total:					6750	
		Section II. Material						
1 1		Electric control cable copper conductor type KPB copper sections						
		4 x 1		km	2.4	135	324	
		7 x 1		km	1.8	196	353	
		10 x 1		km	1.5	285	428	
		19 x 1		km	0.9	449	404	
2		Electric control cable aluminium conductor type AKBB aluminium sections						
		4 x 2,5		km	3	126	378	
		7 x 2,5		km	2,1	182	382	
		19 x 2,2		km	1,2	450	540	
		Total:					2809	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
3		Steel for Metalwork		kg			1800	
4		Steel pipe D 50		m	600	0.3	180	
5		PVH Tube D 4,5		m	900	0.02	18	
		TOTAL section I - equipment					19912	
		section II - material					12243	

3.4. Rein settler with pumping station for clarified water

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Process part						
		Pump, exhausters, ventilators						
1		Centrifugal pump, capacity 70 m^3/h pressure 32 m, 1450 r/m, electric motor 1,1 kw		pc.	3	345	1050	
2		Electric pump, capacite 10 m^3/h, pressure 10 m electric motor 1,2 kw 2880 r/min		pc.	2	25	50	
		Total:					1100	
3		Electric rope hoist, capacity 1,0t		pc.	1	220	220	
4		Hand hoist, worm gearing capacity 1 t		pc.	1	40	40	
		Total:					260	
		Valves						
5		Cast iron stop valves D 50-150		kg			700	
		Others						
6		Slide gates 400 x 800		pc.	2	100	200	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section II. Material						
1		Piping		kg			800	
2		Steel for metalwork		kg			500	
		Total section I - equipment					2260	
		section II - material					1300	

3.5. Mud removable with pumping station

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment						
		Pump, exhausters, ventilators						
1		Centrifugal pump, capacity 500 m3/h, pressure 85 m, electricmotor 160 kw, 1450 r/min		pc.	3	750	2250	
2		Centrifugal pump, capacity 40 m3/h, pressure 45 m, electric motor 8 kw		pc.	2	150	300	
		Cranes, hoists, lifts						
3		Monorail electric, capacity 1 t, length 5 m, span 4,5 m		pc.	1	500	500	
		Valves						
4		Stop valves (gate valve, check valve, rectifiers)		kg.			23150	
		Pumps, exhausters, ventilators						
		Centrifugal pumps		pc.	3	80	240	
		Section II. Materials						
		Steel pipe D 15-500		kg.			875000	
		Total section I - equipment					28546	
		section II - material					882015	

Mud removable with pumping station

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment Electric part						
		Electric power equipment						
1		Control station panels frame construction		com. pan.	5	300	1500	
2		Cortrol boxes for asynchronous motors voltage 380 V		pc.	5	40	200	
3		3 poles power boxes knife-switch with fuses 100 A to 300 A voltage 380 v AC		pc.	2	24	48	
4		Power distribution points 380 v AC with 3 poles input switch, combined release for 250 A and 10 automatic breakers		pc.	1	170	170	
5		Magnetic starters 3 poles AC, voltage 380 V		pc.	15		35	
		Lighting equipment						
6		Distribution points with input automatic switch without release for 100 A with 12 singlphase line circuit breakers		pc.	1	50	50	
7		Singlephase step down transformer 380/220/24 capacity 10 A 220 V		pc.	2	10	20	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
8		Swithches 10 A, 220 v		pc.	20	0.6	12	
9		Plug-in connections, bipolars 10 A, 220 v		pc.	5	0.6	3	
10		Luminaires (dif.)		pc.	15		65	
11		Filament lamps		pc.	15		3	
		Total:					2106	
		Section II. Material						
1		Power cable voltage 1000 v, aluminium conductors PVH insulation and sheath (dif.sections)		km	5.8		3625	
2		Power cable 660 v rubber or plastic insulation, rubber or PVH sheath, aluminium conductors sections 4-70 mm2		km	0.05	800	40	
3		Control cable, aluminium conductors, PVH insulation and sheath, sections 2,5 mm2		km	2	200	400	
4		Installation wire aluminium conductor, section 2,5 mm2 PVH sheath		km	0.01	10	-	
		Total:					4065	
5		Steel pipe D 25-65 mm		km	1.5		2950	

3.6. Mud storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment						
		Automobiles, vehicles						
1		Bulldozer capacity 130 kW		pc.	1		4000	
2		Power shovel, volume of dipper 0.63 m3		pc.	1		11300	
3		Lorry capacity 2 t		pc.	1		2500	
		Total:					17800	
		Mud storage						
		Section I. Equipment. Electric part						
		Lighting equipment						
1		Distribution points with input automatic switch without release for 100 A with 6 3-phases line circuit breakers 63 A, 20 A		pc.	4	50	200	
2		Luminaires (dif.)		pc.	80	15	1200	
3		Luminescent arc lamps		pc.	80		30	
		Total:					1430	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section II. Material						
1		Power cable 660 v rubber or plastic insulation, aluminium conductors sections 4-70 mm2		km	3	800	2400	
2		Installation wire aluminium conductors section 2,5 mm2		km	2	16	32	
		Total:					2432	
3		Steel pipe D 25-50		km	1		2100	
		Mud storage						
		Instrumentation and automatics						
		Section 1. Equipment						
1		Instruments and automation facilities		set.	60	30	1800	
2		Boards		pc.	12	150	1800	
		Total:					3600	
		Section II. Materials						
1		Electric control cable copper conductor type KPB sections						
		4 x 1		km	3	135	405	
		7 x 1		km	0.5	196	93	

Nos No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		10 x 1		km	0,15	285	43	
		19 x 1		km	0,1	449	45	
2		Electric control cable, aluminium conductor type AKRB section						
		4 x 2,5		km	1	126	126	
		7 x 2,5		km	0,5	182	91	
		10 x 2,5		km	0,3	263	79	
		Total					882	
3		Steel for Metalwork		kg			500	
4		Steel pipe D 50 mm		m	150	0,3	45	
5		PVH tube D 4,5 mm		m	600	0,02	12	
		Total section I - equipment					22830	
		section II - material					5971	

3.7. Outsite systems

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment						
		Valves						
1		Stop valves D 50-60		kg			6000	
		Section II. Material						
1		Steel pipe D 50-600		kg			460000	
2		Steel for metalwork					100000	
3		Heat insulation					110000	
		Total:					670000	

4. REPAIR AND STORAGE FACILITIES

4.1. Repair shop block

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Section I. Equipment. Process						
		Furnaces						
1		Electrical resistance chamber furnace, operating t = 1200°C, working space 600 x 1200 x 400			1	6300	6300	
2		Electric resistance chamber furnace, nominal t = 1000°C			1	3450	3450	
3		Electric shaft furnace for gaseous cementation, working t = 950°C			1	5490	5490	
4		Electric furnace for salts, t = 850 °C			1	1325	1325	
5		Heating chamber furnace using gas bottom surface 1044 x 1508		pcs	2	10960	21920	
6		Induction installation		pcs	1	4500	4500	
		Total:					114785	
					including lining materials		71800	
		Pumps, smoke exhaust, fans						
7		Gear pump		pcs	1	-	70	
8		Centrifugal pump		pcs	1	-	80	
9		Centrifugal pump		pcs	1	-	725	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
10		Portable pump, 50 m^3/h		pcs	1	-	150	
11		Rust proof electrical vacuum pump, 75 kW		pcs	1	-	310	
12		Pump unit		pcs	2	87	174	
13		Centrifugal pump		pcs	3	80	240	
		Total:					1749	
		Cranes, hoists, lifts						
14		Electrical single girder, floor controlled, 3,2 t, span - 22,5 m, H = 12 m		pcs	1	-	5650	
15		Electrical gantry crane, 10 t, span - 22,5 m, H = 8 m		pcs	1	-	16300	
16		Electric gantry crane, 5 t, span - 22,5 m, floor controlled H = 12 m		pcs	3	7000	21000	
17		Gantry crane Q = 20/5 t, span 20 m		pcs	1	-	76890	
18		Electric overhead track hoist, 2 t, span 9 m, H = 12		pcs	1	-	1425	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
19		Rotary bracket crane, Q = 0,5 t, height of elevation, 2,8 m, angle of rotation 360°		pcs	2	1245	2490	
20		Electric suspended crane, 2 t, span 9 m, H = 12 m		pcs	2	-	2600	
21		Electric hoist, blast-proof, Q = 2 t, span 9 m, H = 12 m		pcs	2	4000	6000	
22		Electric hoist, 3,2 t, span 15 m, H = 12 m		pcs	1	-	2985	
23		Motor tail truck, Q = 10 t		pcs	1	3582	3582	
24		Motor tail truck, Q = 5 t		pcs	3	2909	8727	
25		Truck with rotary plate		pcs	1	155	155	
26		Tilting truck with hydraulic drive Q = 0,2 t		pcs	1	-	96	
27		Hand bogie, 1 t		pcs	8	136	1088	
28		Hand bogie 250 kg		pcs	3	63	189	
29		Winch, effort - 320 kg		pcs	1	250	250	
30		Winch, effort - 5 t		pcs	1	2050	2050	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
31		Special whinch with device for rewinding of conveyor and 2000 mm wide		pcs	2	5325	10650	
32		Electric loader, 1,5 t		pcs	1	2561	2561	
33		Blast proof electric loader Q = 1 t		pcs	2	2320	4640	
		Totals:					169328	
		Machine-tools						
34		Universal engine lathe, part Ø 400 mm spacing on centres 710 mm		pcs	3	2836	8508	
		1000 mm		-"-	1	3005	3005	
35		2000 mm		-"-	1	3685	3685	
36		Engine lathe, max. part Ø 630 mm spacing on centres 1400 mm		pcs	2	3800	7600	
37		High precision engine lathe, max. part Ø 320 mm, spacing on centres 710 mm		pcs	1	-	2230	
38		Turret lathe, work Ø 25 mm, max. length 140 mm		pcs	1	-	1300	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
39		Universal one column vertical boring and turning machine max. work Ø 1600 mm		pcs	1	-	19900	
40		Horizontal boring machine P C = 1120 x 1250		pcs	1	-	11700	
41		Semi-automatic drill sharpener max. work Ø 80 mm		pcs	1	-	1410	
42		Universal sharpening machine		pcs	1	-	1285	
43		Semi-automatic sharpening-machine for hot swivel head		pcs	1	-	2320	
44		Semi-automatic sharpening machine for disc saws Ø 275 x 1430		pcs	1	-	1640	
45		Horizontal pipe finishing machine		pcs	2	6150	12306	
46		Pipe cutting machine, pipe Ø 10 x 114 mm		pcs	1	-	6650	
47		Universal internal grinding machine, max. Ø of hole 200 mm		pcs	1	-	4975	
48		Universal cylindrical grinding machine max. work Ø 200 mm		pcs	1	-	3000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
49		Surface grinding machine 320 x x 1000 mm		pcs	1	-	6950	
50		Surface grinding machine 200 x 6300 mm		pcs	1	-	1950	
51		Grinding machine Ø of grinding wheel 400 mm with dust aspirating unit		pcs	5	587	2935	
52		Grinding machine, Ø of grinding wheel 200 mm		pcs	1	-	147	
53		Universal milling machine 250 x 1000		pcs	1	-	2280	
54		Horizontal knee-type milling machine 400 x 1600		pcs	1	-	3700	
55		- " - 320 x 1250		pcs	1	-	2900	
56		Vertical knee-type milling machine with swivelling he d 400 x 1600		pcs	1	-	4200	
57		Pipe cutting machine, Ø of pipe 10-114 mm		pcs	1	-	6650	
58		Bench type drilling machine max. Ø of drilling - 12 mm		pcs	2	120	240	
59		Vertical drilling machine, Ø of drilling - 18 mm		pcs	1	-	450	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
60		Vertical drilling machine, max.Ø of drilling - 36 mm		pcs	1	-	1450	
61		Vertical drilling machine, max.Ø of drilling - 25 mm		pcs	1	1020	1020	
62		Radial drilling machine, max. Ø of drilling - 50 mm		pcs	3	4800	14400	
63		Slotting machine with mechanical drive, slotting tool travel 320 mm		pcs	1	-	2300	
64		Shaper 450-700, ram travel 30-700		pcs	1	2900	2900	
65		Balancing machine max. Ø of workpiece 1000 mm		pcs	1	-	2125	
66		Machine for dynamic balancing of rotar		pcs	1	-	775	
67		Winding machine		pcs	1	-	1130	
68.		Winding machine		pcs	1	-	350	
69		Shrouding machine		pcs	1	-	3528	
70		Machine for static balancing of rotars		pcs	1	-	193	
71		Balancing saw with hydraulic handling		pcs	1	-	985	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
72		Universal round saw machine with manual handling		pcs	1	-	660	
73		Jointing machine		pcs	1	-	950	
74		Jointing machine with automatic handling		pcs	1	-	800	
		Total:					157482	
		Press forging equipment						
75		Hydraulic straightening-pressing one column machine, nominal effort	160 t	pcs			7800	
76		Horizontal hydraulic press		pcs	1	-	6800	
77		Hydraulic press, effort 40 t		pcs	21	530	530	
78		One crank press, effort 16 t		pcs	1		1400	
79		3-roller sheet bending machine max.cross-section of sheet 16 x 2000 mm		pcs	1		6900	
80		Pipe bending machine with mechanic drive Ø 63-160 mm		pcs	1		4200	
81		Crank shears with inclined cutting edge max. thickness 16 mm		pcs	1		24000	
82		Combined press-shears, max. thickness of sheet - 16 mm		pcs	2	3200	6400	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
83		Pneumatic forging hammer, Q = 5400 kg		pcs	1		13000	
84		- " - Q = 150 kg		pcs	1		4350	
		Total:					75380	
		Repair machines and mecanisms						
85		Machine for lapping of valves		pcs	1	-	639	
					2	23	46	
					2	60	120	
86		Air operated hammer		pcs	3	6	18	
87		Pneumatic grinding machine wheel diameter 150 mm		pcs	5	6	30	
88		100 mm		"	7	4	28	
89		63 mm		"	4	2	8	
90		Pneumatic manual drill		"	1	-	2	
91		Pneumatic drilling machine, drill diameter 120 mm		"	5	2	10	
92		Pneumatic drilling machine, max. drill diameter 32 mm		"	2	9	18	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
93		inged machine for gas cutting		pcs	1	330	330	
94		Multiple post welding rectifier		pcs	1	420	420	
95		Welding transformer		pcs	2	210	420	
96		Electric butt welding machine		"	1	170	170	
97		Welding panel		"	26	40	1040	
98		Automatic arc welding machine		"	2	805	1610	
99		Vertical welded apparatus with elliptical bottom P = 7 bar, V = 2 m3		"	2	620	1240	
100		Steel bottle for nitrogen, P = 100 kg/cm2, V = 40 l		"	10	60	600	
101		Vertical ganging tank, V = 250 l		"	2	207	415	
102		Impregnation tub		"	2	650	1300	
103		Alkaline liquor neutralization bath 2120 x 1280 x 880		"	1	-	89	
104		Water hardening bath		"	2	256	512	
105		Bath for preparation of alkaline solution for electrolyte, 360 l		"	1	-	89	
106		Bath for distilled water, 360 l		"	1	-	97	

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
107		Washing bath		pcs	9	310	2790	
108		Ganging tank		"	1	-	42	
109		Pressure tank for emulsion, 1 m^3		"	2	300	600	
110		Tank for forgings cooling		"	6	185	1110	
111		Tank for tools cooling		"	3	61	183	
112		Electrical driller, max. drill diameter - 20 mm		"	3	6	18	
113								
114		Device for mechanical edge preparation of conveyor band butt joints		"	3	2	6	
115		Vibration preistant supports of equal frequency		"	150	2	300	
116		Stand for testing of centrifugal pumps		"	1	-	1250	
117		Accumulator		"	2	690	1380	
118		Roller table		"	1	800	800	
119		Support		"	2	70	140	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
120		Two-roller kneader for putty and paste		pcs	2	210	420	
121		Attached pneumatic vibrator		"	1	-	90	
122		Mortar mixer		"	1	-	240	
123		Movable plastering machine		"	1	-	750	
124		Painting device		"	1	-	58	
125		Pressure tank for paint		"	2	17	34	
126		Air cleaner		"	10	4	40	
127		Vibration screen		"	2	10	20	
128		Installation for filler application		"	5	35	175	
129		Mixer for paint compositions		"	5	35	175	
130		Machine for planing of concrete foundation of floors		"	1	-	105	
131		Pneumatic wet cleaning machine		"	2	14	28	
132		Electrical manual bulldozer		"	2	5,3	11	
133		Movable asphalt mixer, 26 t/h		"	1	-	59000	
134		Compressed air blowers		"	2	0,6	1,2	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
135		Bench dial indicating scales, 0,01-10 kg		pcs	1	20	20	
136		Vorte mortar mixer, mixing volume 80/63 A		"	2	160	320	
137		Mortar pumps		"	1	-	490	
138		Trowel finishing machine with floating disc		"	2	3	6	
139		Plaster finishing machine with floating disc		"	2	2,4	4,8	
140		Machine for filler planing			2	2	4	
141		Paint sparayer		"	2	21	42	
142		Paint blower, pneumatic		"	2	0,7	1,4	
143		Pneumatic paint blower		"	2	0,75	1,5	
144		Pneumatic paint blower		"	4	0,75	3,0	
145		Device for building facades painting		"	1	-	288	
146		Movalbe compressors		"	4	-	7060	
		Total:					87101	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Cars, special vehicle						
147		Tractor based excavator		pcs	2	5700	11400	
148		Bending car elevator for fire fighting		"	1		16350	
149		Auto-lift, 500 kg for civil works		"	1	-	10100	
150		Cradle with electric drive, 250 kg		"	2	400	800	
151		Workshop truck for jointers		"	2	5500	11000	
152		Workshop truck for plumbers		"	1	-	6000	
153		Laboratory vehicle for testing of break-down in cables		"	1	-	4675	
154		Repair workshop vehicle		"	1	-	3170	
155		Movable electrical laboratory for testing of electrical equipment and cable		"	1	-	5000	
156		Auto-lift, height of elevation 12 m		"	1	6050	6050	
157		Concrete transporting truck		"	1	5230	5230	
158		Mortar transporting truck		"	1	6400	6400	
159		Three wheel roller		"	1	6500	6500	
160		Machine for cleaning the cracks in asphalt-concrete pavement		"	1	-	5670	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
161		Dust collecting machine		pcs	1	-	2588	
162		Cable jack		"	4	86	344	
163		Movable scales, weighing up to 150 kg		"	1	-	26	
164		Scales Q = 500 kg		"	1	-	200	
		Total:					101503	
		Miscellaneous						
165		Stand for manual gas cutting		pcs	1		3000	
166		Stand for hydraulic testing of pipeline fixtures		"	1	1680	1680	
167		Stand for marking of metal shapes		"	1	-	360	
168		Welder's stand		"	1	165	165	
169		Stand for painting		"	2	132	264	
170		Stand for insulation		"	4	107	428	
171		Stand with suction		"	10	80	800	
172		Stand with suction		"	1	-	108	
173		Stand for varnish collection		"	1	-	100	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
174		Laboratory bench		pcs	1	-	150	
175		Shelf rack, two-sided 2000 x 1000 x 2000		"	22	490	10780	
176		Shelf rack		"	20	254	5080	
177		Rack for large parts and assemblies		"	28	310	8680	
178		Universal rack		"	28	325	9100	
179		Rack		"	1	-	250	
180		Rack		"	9	233	2097	
181		Rack		"	3	286	858	
182		Scaffold for rotors storage		"	6	81	486	
183		Section for charging 4-accumulator batteries		"	8	617	2468	
184		Support for layout plate		"	1	-	58	
185		Support for plate		"	2	83	166	
186		Scaffold for desmantling and		"	6	140	840	
187		Dressing plate		"	1	-	4735	
188		Layout plate 1000 x 630		"	1	-	343	
189		- " - 1600 x 1000		"	2	700	1400	
190		Welding panel		"	5	40	200	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
191		Machine tool operator'		pcs	40	130	5200	
192		Double filter's bench		"	22	600	13200	
193		Roofing operators' bench 2500 x 1200 x 800		"	2	270	540	
194		Carpenter's bench		"	3	172	516	
195		Bench for electric works		"	4	98	392	
196		Installation for workpieces washing		"	2	770	1540	
		Total:					75984	
		;Laboratory equipment						
197		Rockwel hardness testing machine P = 150 kgf/cm2		pcs	1		120	
198		Brinell press, effort 250 kgf/cm^2		"	1		212	
199		Sensor submerged for alkaline solution concentration determination		"	1	-	9	
200		Distiller 25, capacity 25 l/h		"	1	-	40	
201		Muffl furnace for insulation roasting of		"	2	60	120	
202		Steam sterilizer		"	1	-	140	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
203		Blast-proof closed reactor V = 100 l		pcs	1	-	265	
		Total:					906	
		Sanitary equipment						
204		Domestic air conditioner		pcs	5	53	265	
		Pipeline fixtures						
205		Valves		kg			5000	
		Section II. Materials						
1		Steel structures metal		kg			21000	
		Total of Section I Equipment					789483	
		including lining materials					71800	
		of Section II: Materials					21000	

Repair bloc facilities

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I - Equipment. Electrical						
		Power equipment						
1		Packaged transformer substation, including		set	1	19700	19700	
		- transformer 1000 KVA, 10/04-0.23 kV		pc	2			
		- high-voltage input cabinet		pc	2			
		- low-voltage input cabinet		pc	2			
		- sectional cabinet		pc	1			
		- line cabinet		pc	4			
2		Control station panels, composed of frame-type panels		panel	5	300	1500	
3		380 V AC asynchronous motor control boxes composed of three-pole circuit breaker with release of nominal current 16-160 A and magnetic starter with thermal relay 16-160 A		pc	16	40	640	
4		Three-pole power boxes composed of knife-switch with fuses 100-30 A, 380 V AC		pc	70	24	1680	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
5		380 V, AC power distribution points with three-pole release of 250 A and ten circuit breakers with release of 16-160 A		pc	17	170	2890	
6		Static convenrter for AC and DC motor supply and exitation		pc	10	1000	10000	
7		Three-pole 380 V AC dust-proof magnetic starters with thermar relay 63 A, 40 A, 25 A		pc	60		140	
		Lighting equipment						
8		Distribution points with input circuit breakers without releases 100 A, with 6 three-phase and 12 one-phase switches with electro-magnetic and thermal releases of 63 A and 20 A correspondently		pc	23	50	1150	
9		One-phase step-down transformer 380/220/24 V, 250 VA		pc	10	10	100	
10		Installation switches 10 A,220 V		pc	200	0,6	120	
11		Two-pole plug-and-socket connections 10 A, 220 V		pc	100	0,6	60	
12		Luminaires		pc	1000		8200	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
13		Incandencent lamps (arc, mercury discharge)		pc	1400		455	
		Total:					46635	
		SECTION II. MATERIALS						
1		Power cable up to 1000 V with four aluminium cores with PVC insulation and sheath (different core sections)		km	17,2		19200	
2		Power cable 660 V with rubber or plastic resulation, rubber or PVC sheath, 2-4 aluminium cores 4-70 mm2		km	10	800	8000	
3		Control cable with PVC, insulation and sheath, 4-37 aluminium cores 25 mm2		km	10	200	2000	
4		Installation aluminium wire 2,5 mm2 with PVC sheath		km	5	16	80	
		Total:					29280	
5		Steel pipe ID 25÷65		m	6000		21730	
		TOTAL for section I - Equipment					46635	
		for section II - materials					51010	

4.2. Materials storage block

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		SECTION I. EQUIPMENT						
		Cranes, hoists, lifts						
1		End-piler, floor controlled, 1 t, span 11 m, height of elevation 4 m.		pcs	4	2653	10612	
2		Electrical loader, 1,5 t		"	2	2561	5122	
3		Universal electrical loader, 1 t, height of elevation 4,5 m		"	1	2300	2300	
4		Hand truck, 250 kg		"	2	62	124	
5		Dial scales, 1 t		"	1	290	290	
6		Dial scales, 150 kg		"	1	185	185	
7		Bench scales, dial indicating, 10 kg		"	1	20	20	
		Total:					18653	
		Other equipment						
8		Pallet 800 x 1200		pc	2670	32	85440	
9		Frame rack:						
		- frame		pc	585	84	49140	
		- shelf		pc	2131	30	63930	
		Total:					113070	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Sanitary equipment						
10		Domestic air conditioner		pc	2	53	106	
		Total for section I - equipment					131829	
		Material storages block						
		SECTION I. EQUIPMENT						
		Electrical						
		Power equipment						
1		380 V. AC asynchronous motor control boxes composed of three-pole circuit breaker with release of nominal current 16-160 A and magnetic starter with thermal relay 16-160 A		pc	20	40	600	
2		Three-pole power cabinets with knife-switch and fuses 100-300 A, 380 V A.C.		pc	40	24	960	
3		380 V AC power distribution points with three-pole release of 250 A and ten circuit breakers with release of 16-160 A		pc	20	170	3400	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	 total	Manufactured indigenously
4		Three-pole 380 V AC dust-proof magnetic starters with thermal relay 63 A, 40 A, 25 A		pc	50		90	
		<u>Lighting equipment</u>						
5		Distribution points with input circuit breakers without releases 100 A, with 6 three-phase and 12 one-phase switches with electromagnetic and thermal releases of 63 A and 20 A correspondently		pc	17	50	850	
6		One-phase step-down transformer 380/220/24 v, 250 VA		pc	15	10	150	
7		Installation switches 10 A, 220 V		pc	50	0,6	30	
8		Two-pole plug-and-socket connections 10 A, 220 V		pc	50	0,6	30	
9		Luminaires		pc	450	425	4250	
10		Incandencent lamps (arc, mercury discharge)		pc	600		220	
		Total:					10580	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		SECTION II. MATERIALS						
1		Power cable up to 1000 V with four aluminium cores with PVC insulation and sheath (different core sections)		km	2,8		2023	
2		Power cable 660 v with rubber or plastic insulation, rubber or PVC sheath, 2-4 aluminium cores 4-70 mm2		km	5	800	4000	
3		Control cable with PVC insulation and sheath, 4-37 aluminium cores 2,5 mm2		km	2	200	400	
4		Installation aluminium wire 2,5 mm^2 with PVC sheath		km	5	16	80	
		Total:					6503	
5		Steel pipe ID 25÷65		m	1800		4900	
		TOTAL for section I equipment					10580	
		for section II, materials					11403	

4.3. Lubricants and chemicals storage

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		SECTION I. EQUIPMENT						
		Cranes, hoists, lifts						
1		Electrical loader, 1 t, blast-proof height of elevation 3 m		pcs	1	2350	2350	
2		Hand truck with cabin, 0,25		"	2	62	164	
3		Dial scales, 0,5 t		"	4	200	800	
4		Grasp for two barrels		"	1	-	250	
		Total:					3524	
		Pumps						
5		Gear pump with electric motor, 2,2 kW, 1500 rpm, fire proof		pcs	4	95	380	
6		Centrifugal fan		"	5	80	400	
		Total:					780	
		Miscellaneous						
7		Oil regeneration installation		pcs	1	3064	3064	
8		Fire extinguisher, foam, 250 l		"	7	450	3150	
9		Tank 2,0 m^3		"	6	465	2790	
10		Tank 4,0 m^3		"	2	830	1660	
11		Settler, 2,0 m^3		"	2	580	1160	
12		Wooden pallet 800 x 1200		"	112	32	3580	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
13		Rack		pcs			200	
14		Rack		pcs	9	478	4300	
		Total:					19904	
		Pipeline fixtures						
15		Valves					500	
		SECTION II. MATERIALS						
1		Steel structure					5300	
2		Pipelines					1500	
		Total of Section I: equipment					24708	
		of Section II: materials					6800	

Oils and chemicals storage

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		SECTION I. EQUIPMENT						
		Electrical part						
		Power equipment						
1		380 V A.C. asynchronous motors control boxes consisting of input 3-pole automatic circuit breaker with release for current 16-160 A and magnetic starter and heat relay for currents 16-160 A		pcs	5	40	200	
2		3-pole power boxes consisting of knife switch with safety devices from 100 to 30 A, 380 V A.C.		pcs	4	24	96	
3		Power distribution points, 380 V A.C. with input 3-pole circuit breaker, combined release for 250 A and 10 outgoing automatic circuit breakers with combined releases for 16-160 A		pcs	3	170	540	
4		3-pole A.C., 380 V magnetic starters, dust proof, 220 V coil, temple relay for nominal currents 63 A, 40 A, 25 A		pcs	16		28	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Lighting equipment						
5		Distribution points with input automatic circuit breaker without release for nominal current 100 A, 12 one-phase line circuit breaker with magnetic and heat release for nominal current 20 A		pcs	2	50	100	
6		One-phase transformer, 080/220/24V 250 VA		pcs	2	10	20	
7		Circuit breaker 10 A, 220 V		pcs	20	0,6	12	
8		Plug-and-socket connections, 2-pole 10 A, 220 V		pcs	20	0,6	12	
9		Light fixtures (various)		pcs	80		480	
10		Filaments, luminescence lamps mercury are lamp		pcs	10		38	
		Total:					1526	
		SECTION II. MATERIALS						
1		Power cable up to 1000 V, Al conductors, PVC insulation and sheath, four conductors		km	0,54		318	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
2		Power cable 660 V, rubber or plastic insulation or PVC sheath two Al conductors, cross sections 4 - 70 mm		km	1	800	800	
3		Control cable with Al conductors PVC insulation and sheath cross-sections 2,5 mm2, conductors from 4 to 37		km	1	200	200	
4		Installation wire with Al conductor 2,5 mm2 in PVC sheath		km	0,5	16	8	
		Total:					1326	
5		Steel pipe Dc 25-65		m	400		1480	
		Total of Section I: materials					1526	
		of Section II: materials					2806	

5. SERVICE FACILITIES

5.1. Administration building

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment						
		Sanitary equipment						
1		Domestic air conditioner		pc	10	53	530	
		Pipeline fittings						
2		Valves		kg			3000	
		Section II. Materials						
1		Steel pipe					2000	
		TOTAL for section I equipment					3530	
		TOTAL for section II Materials					2000	
		Section I. Equipment. Electrical						
		Power equipment						
1		Control station panels, composed of frame-type panels		1 panel	1	300	300	
2		380 V AC Asynchronous motor control boxes composed of three-pole circuit. Breaker with release of nominal current 16-160A and magnetic starter with thermal		pc	22	40	880	

NOS	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
No according to process flowsheet						of one piece	total	
		relay of nominal current 16-160 A						
3		380 V. AC Power distribution points with three-pole release of 250A and ten curciut breakers with release of 16-160 A		pc	10	170	1700	
4		Three-pole magnetic starter 380 V AC, dust-proof, with coil 220 V and thermal relay 63A, 40A, 25A		pc	25		55	
		Lighting equipment						
5		Distribution point with circiut breaker 100A without release, with 6 three-phase and 12 one-phase circuit breakers with electromagnetic and thermal releases 63A and 20A correspondently		pc	32	50	1600	
6		One-phase step-down transformer 380/220/24V, 250 VA		pc	17	10	170	
7		Suitches 10A, 220V		pc	600	0.6	360	
8		Two-pole plug-and-socket connections 10A, 220V		pc	600	0,6	360	
9		Luminaires		pc	1300		8500	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
10		Incandencent lamps (arc, mercury discharge)		pc	2100		715	
		TOTAL					14640	
		Section II. Materials						
1		Power cable up to 1000 V. Four aluminium cores of different sections with PVC insulation and sheath		km	4.7		19100	
2		Power cable 660 V, two-or four-aluminium cores 4-70 mm2 with rubber or plastic insulation and rubber or PVC sheath		km	6	800	4800	
3		Control cable of 4-37 aluminium cores 2.5 mm2 with PVC insulation and sheath		km	1.5	200	300	
4		Aluminium installation wire 2.5 mm2 with PVC sheath		km	20	16	320	
		TOTAL					24520	
5		Steel pipe ID 25-65		m	4500		32400	
		TOTAL for section I equipment					14640	
		for section II materials					56920	

5.2. Technical building with telephone exchange

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment						
		Sanitary equipment						
1		Central air conditioner		pc	1	2500	2500	
		Pipeline fittings						
2		Valves		kg			3200	
		TOTAL					5700	
		Section II. Materials						
1		Structural steel		kg			1500	
2		Steel pipe		kg			1200	
		TOTAL for section I equipment					5700	
		for section II materials					2700	

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Technical building with telephone exchange

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Electrical						
		Power equipment						
1		Packaged transformer substation, (PTS 2x1600) including:		set	1	21500	21500	
		- transformer 1000 kVA, 10/0, 4-0.23 kV		pc	2			
		- high-voltage input cabinet		pc	2			
		- lon-voltage input cabinet		pc	2			
		- sectional cabinet		pc	1			
		- line cabinet		pc	4			
		- control station panels, composed of frame-type panels		1 panel	1	300	300	
3		380 V AC Asynchronous motor control boxes composed of three-pole circuit breaker with release of nominal current 16-160A and magnetic stavter						
4		380 V. AC power distribution points with three-pole release of 250A and ten circuit breakers woth release of 16-160 A		pc	10	170	1700	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
5		Three-pole 380V AC dust-proof magnetic starters with thermal relay 63A, 40A, 25A		pc	25		55	
		Lighting equipment						
6		Distribution points with input circuit breakers without releases 100A, with 6 three-phase and 12 one-phase switches with electromagnetic and thermal releases of 63A and 20A correspondently		pc	32	50	1600	
7		One-phase step-down transformer 380/220/24V, 250VA		pc	17	10	170	
8		Installation switches 10A, 220V		pc	600	0.6	360	
9		Two-pole plug-and-socket connections 10A, 220V		pc	600	0.6	360	
10		Luminaires		pc	1300		8500	
11		Incandencent lamps (arc, mercury, discharge)		pc	2100		715	
		TOTAL					36140	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section II. Materials						
1		Power cable up to 1000 V with four aluminium cores with PVC isolation and sheath (different core sections)		km	4.7		4427	
2		Power cable 660 V with rubber or plastic isolation, rubber or PVC sheath, 2-4 aluminium cores 4-70mm2		km	6	800	4800	
3		Control cables with PVC isolation and sheeth, 4-37 aluminium cores 2.5 mm2		km	1.5	200	300	
4		Installation aluminium wire 2.5 mm2 with PVC sheath		km	20	16	320	
		TOTAL					9847	
5		Steel pipe ID 25-65		m	5500		13320	
		TOTAL for section I Equipment					36140	
		for section II Materials					23167	

Technical building with telephone exchange

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment						
1		Communication equipment		kg			22400	
		Section II. Materials						
1		Control cable		km	37		26020	
2		Pipes		m	2000		3800	
3		Installation hardnare		kg			12020	
		TOTAL: section I Equipment					22400	
		section II Materials					41840	

5.3. Laboratory

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Section I. Equipment						
		I. Analytical instrumentation						
1		X-ray difractometer for phase analysis		set	1	850	850	
2		Multi-channel x-ray spectrometer (completed with necessary equipment)		set	2	2000	4000	
3		Quartz spectrograph for qualitative and quantitative emission analysis		pc	2	90.0	180	
4		Generator for spectrum analysis with stand		pc	2	120	240	
5		Multi-purpose electronic generator with stand		pc	2	150	300	
6		Microphotometer		pc	2	50	100	
7		Spectrum emission microscope		pc	2	25	50	
8		Rectifier (for spectrum analysis)		pc	1	473	473	
9		Small photoelectric device		pc	1	729	729	
10		Flame photometer for quantitative analysis of liquors		pc	3	50	150	

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
11		AC polarograph for qualitative and quantitative liquor analysis		pc	1	80	80	
12		Photoelectric colorimeter for colorimetric measuring and concentration analysis		pc	7	25.0	175	
13		Polarizing binocular microscope		pc	3	10	30	
14		Gas-liquid laboratory chromatograph		pc	1	60	60	
15		Laboratory PH-meter millivoltmeter with titration block BAT-15		pc	5	10.7	53.5	
16		Laboratory titrimeter for liquor concentration measure by photometric titration method		pc	5	20	100	
17		Scales for dispersion analysis		pc	1	24	24	
18		Thermocouple platinumrhodium-platinum -1. Limit of measure: -20°C - 1300°C. Length of submerged part - 320-500 mm		pc	1	5	5	
19		Thermocouple chromel-aluminium XA. Limit of measure: 0-900°C. Lenght of submerged part 320-500 mm		pc	5	3.5	16.5	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
20		Pyrometric millivoltmeter to be used fogether with thermocouple. Grading -1. Scale 0-1300°C		pc	5	3	15	
21		Same. Grading XA. Scale 0-900°C		pc	5	3	15	
22		Voltage regulator		pc	10	62.0	620	
23		Laboratory autotransformer 0-250 V AC. Maximum amperage 2A and 9A		pc	12	9	108	
24		Aneroid-barometer 600-800 mm mc		pc	3	1.5	4.5	
25		Microcalculator		pc	10	0.3	3	
26		Stopwatch in metal case		pc	5	0.05	0.25	
		TOTAL					8382	
		II. Scales						
27		Laboratory analytical balance. Weighing limit- 100 g		pc	16	14.0	196	
28		Laboratory balance. Weighing limit - 500 g		pc	10	20.0	200	
29		I-class laboratory balance Weighing limit - 1 kg		pc	5	30	100	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
30		Laboratory quadrant balance wighing limit - 5 kg		pc	2	18	36	
		TOTAL					532	
		III. Crushing and grinding equipment. Mac ines and other equipment						
31		Laboratory jaw crusher 80x150mm Size of feed material - 70 mm		pc	3	175.0	525	
32		Disc grinder ⌀ 175 mm Size of feed material - 3 mm Size of discharge material - 0.074 mm		pc	3	91.0	273	
33		Vibration grinder for 4 beakers for laboratory samples grinding maximum beaker feed - 50 g		pc	2	129.0	258	
34		Large-size mechanical mortar		pc	3	20	60	
35		Testing sieve ⌀ 200 mm for granular material. Number of sieves - 6. mesh size - 1.6; 1.25; 0.8; 0.56; 0.4; 0.28; 0.2; 0.14; 0.1; 0.071 mm		pc	2	48	96	
36		Laboratory vacuum pump 50 l/min, 50-3 mm mc with motor AO 2-11-4, 1350 rpm		pc	2	60	120	

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NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
37		Hydraulic press, 10 t force max		pc	2	450	900	
38		Domestic refrigerator		pc	5	80	400	
39		Screw-cutting machine. Max.diameter - 320 mm. Spacing on centres - 500 mm		pc	1	1200	1200	
40		Horizontal milling machine 160x630 mm		pc	1	780	780	
41		Precise bench-type lathe, maximum diameter - 125 mm, length 250 mm max		pc	1	65	65	
42		Bench-type drilling machine. Max. diameter - 12 mm		pc	1	120	120	
43		Grinding machine. Dia 400 mm		pc	2	400	800	
44		Machine for sharpening electrodes for spectrum analysis		pc	2	200	400	
45		Goods-passenger lift, 500 kg		pc	1	7500	7500	
46		Laboratory centrifugal machine		pc	2	86	172	
		TOTAL					13669	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		IV. Platinum articles						
47		Crucible with cap, 18 ml, ø 30 mm		pc	20	0.021	0.42	
48		Crucible with cap, 25 ml, ø 32 mm		pc	24	0.028	0.67	
49		Crucible with cap, 32 ml, ø 35 mm		pc	10	0.031	0.31	
50		High crucible, 15 ml, ø 28 mm		pc	10	0.0163	0.163	
51		Flat-bottom cup, 34 ml, ø 52 mm		pc	3	0.019	0.038	
52		Same, 115 ml, ø 75 mm		pc	20	0.047	0.94	
53		Same, 280 ml, ø 100 mm		pc	6	0.08	0.54	
54		Forceps' tips		pair	3	0.006	0.018	
55		Pallet		pc	2	0.009	0,018	
56		Platinum wire ø 0.5 mm		m	2	0.004	0.008	
		Silver articles						
57		Crucible, 32 ml, ø 36 mm		pc	20	0.026	0.52	
58		Crucible, 54 ml, ø 43 mm		pc	20	0.03	0.6	
59		Silver cup, 15 ml, ø 75 mm		pc	10	0.042	0.42	
		TOTAL					5	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		V. Electric heaters						
60		Laboratory electric furnace. Max. temperature is 900°C		pc	15	80	1200	
61		Same, max temperature - 1000-1200°C		pc	8	80	640	
62		Laboratory electric drier with automatic temperature control (0-350°C)		pc	15	80	1200	
63		Constant-temperature cabinet. 30°-250°C, capacity - 16 l		pc	3	28	84	
64		Instrument for rapid himidity measure		pc	5	6.5	32.5	
65		Shaft electric furnace. Working temperature 1250°C. Working area 100x160 mm		pc	4	60	240	
66		Tube electric furnace. Working temperature 400-1250°C		pc	4	53	212	
67		Electric distiller, 90 l/hour		pc	3	195	585	
68		Electric drier, 135 kW		pc	4	4.2	16.8	
69		Electric hot plates, electric tanks for analytical purposes		pc	40	4.4	176	

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
70		Magnetic agitator for mixing and heating of liquors. Maximum amount of liquor to be mixed - 1.5 l		pc	20	3.5	70	
		TOTAL					4456	
		VI. Analysing instruments						
71		Potable chemical gas analyser for carbon dioxide, oxigen and carbon oxide measuring in percent		pc	5	10	50	
72		Potable laboratory gas chromatograph for complete analysis of waste gases		pc	1	15	15	
73		Chemical gas distributor for express-analysis		pc	6	10	60	
74		Luxometer		pc	2	15	30	
75		Aspitation psychromer for temperature measuring at working place		pc	2	15	30	
76		Noise and vibration meter		pc	2	10	20	
77		Potable rotation air sampler for dust and gas control		pc	2	20	40	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
78		Multipurpose potable gas analyser		pc	2	2.6	5.2	
		TOTAL					220	
		VII. Instruments for oil-product test						
79		Instrument for electric strength test		pc	1	35	35	
80		Instrument for flash point test in the range of 20-75°C in closed crucible with electric heating		pc	2	2	4	
81		Instrument for flash point test in open crucible		pc	2	4	8	
82		Equipment for quantitative analysis of water in oil products		pc	5	5	25	
83		Calorimeter to determine specific heat value		pc	1	150	150	
							222	
		TOTAL					27496	
		Sanitary equipment						
84		Central air conditioner		pc	1	2500	2500	
85		Domestic air conditioner		pc	4	200	800	
		TOTAL for section I. Equipment					30786	

Laboratory

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Electrical						
		Power equipment						
1		Packaged transformer substation (PTS 2x1000) including:		set	1	19700	19700	
		- transformer 1000 kVA, 10/0.4-0.23 kV		pc	2			
		- high-voltage input cabinet		pc	2			
		- low-voltage input cabinet		pc	2			
		- sectional cabinet		pc	1			
		- line cabinet		pc	4			
2		380 V AC asynchronous motor control boxes composed of three-pole circuit breaker with release of nominal current 16-160 A and magnetic starter		pc	10	40	400	
3		380 V. AC power distribution points with three-pole release of 250A and ten circuit breakers with release of 16-16 0 A		pc	30	170	5100	
4		Three-pole 380V, AC dust-proof magnetic starters with 220V coil and thermal relay 63A, 40A, 25A		pc	105		155	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
5		Distribution point with imput circuit breakers without releases 100A with 6 three-phase and 12 one-phase switches with electro-magnetic and thermal releases of 63A and 20A correspondently		pc	43	50	2150	
6		One-phase step-down transformer 380/220/24V, 250 VA		pc	20	10	200	
7		Installation switches 10A, 220V		pc	500	0.6	300	
8		Two-pole plug-and-socket connections 10A, 220V		pc	500	0.6	300	
9		Luminaires		pc	2300		15200	
10		Incandencent lamps (arc, mercury discharge)		pc	3400		1320	
		TOTAL					44825	
		Section II. Materials						
1		Power cable up to 1000V with four aluminium cores with PVC insulation and sheath (different core sections)		km	2.5		2722	
2		Power cable 660 V with rubber or plastic insulation, rubber						

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		or PVC sheath, 2-4 aluminium cores 4-70 mm2		km	100	800	8000	
3		Control cable with PVC insulation and sheath, 4-37 aluminium cores 2.5 mm2		km	3	200	600	
4		Installation aluminium wire 2.5 mm2 with PVC sheath		km	20	16	320	
		TOTAL					11642	
5		Steel pipe ID 25-65		m	7000		17000	
		TOTAL for section I Equipment					44825	
		for section II Materials					28642	

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5.4. Welfare premises

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment						
		Sanitary equipment						
1		Centrifugal fan		pc	4	80	320	
2		Domestic air conditionor		pc	4	53	212	
		TOTAL					532	
		Piping fittings						
3		Valves		kg			1000	
		Section II. Materials						
1		Structural steel		kg			1500	
2		Steel pipe		kg			1500	
		TOTAL for section I Equipment					1532	
		for section II Materials					3000	

Welfare premises

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Electrical						
		Power equipment						
1		380V, AC asynchronous motor control boxes composed of three-pole circuit bkeaker with release of nominal current 16-160 A and magnetic starter with thermal relay 16-160A		pc	10	.40	400	
2		Three-pole power cabinets with knife-switch and fuses 100-300A, 380V, AC		pc	10	24	240	
3		380 V. AC power distribution points with three-pole release of 250A and ten circuit breakers with release of 16-160A		pc	25	170	4250	
4		Three-pole 380V. AC dust-proof magnetic starters with thermal relay 63A, 40A, 25A		pc	60		130	
		Lighting equipment						
5		Distribution points with input circuit breakers without releases 100A, with 6 three-phase and 12 one-phase switches with electromagnetic and thermal releases of 63A and 20A correspondently		pc	23	50	1150	

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NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
6		One-phase step-down transformer 380/220/24V, 250 VA		pc	35	10	350	
7		Installation switches 10A, 220V		pc	300	0.6	180	
8		Two-pole plug-and-socket connections 10A, 220V		pc	300	0.6	180	
9		Luminaires		pc	1500		9900	
10		Incandencent lamps (arc, mercury discharge)		pc	2500	875		
		TOTAL					17655	
		Section II. Materials						
1		Power cable up to 1000V. with four aluminium cores with PVC insulation and sheath (different core sections)		km	15.5		14483	
2		Power cable 660V with rubber or plastic insulation rubber or PVC sheath, 2-4 aluminium cores 4-70 mm2		km	5	800	4000	
3		Control cables with PVC insulation and sheath, 4-37 aluminium cores 2.5 mm2		km	10	200	2000	

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
4		Installation aluminium wire 2.5 mm2 with PVC sheath		km	20	16	320	
		TOTAL					20803	
5		Steel pipe ID 25-65		m	3550		11700	
		TOTAL for section I Equipment					17655	
		for section II Materials					32503	

6. TRANSPORTATION FACILITIES

6.1. Garage for special vehicles

NCS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Section I. Equipment						
		Cars, trucks, special vehicles						
1		Truck 0.8 t		pc	1	1670	1670	
2		Truck 2 t		pc	1	3500	3500	
3		Truck 6 t		pc	6	4700	28200	
4		Dump truck 4.5 t		pc	1	4500	4500	
5		Dump truck 12 t		pc	3	10850	32550	
6		Ambulance		pc	1	1820	1820	
7		Truck crane 25 t, boom - 25 m		pc	1	33000	33000	
8		Canitation truck		pc	1	5000	5000	
9		Truck crane 6.3 t		pc	1	9 000	9000	
10		Truck hydraulic hoist, 4 t		pc	1	8000	8000	
11		Sweeping machine		pc	2	5440	10880	
12		Irrigating-and-washing machine		pc	2	5500	11000	
13		Car with radio station		pc	1	1500	1500	
14		Emergency water supply car		pc	1	5000	5000	
15		Movable centrifugal pump with diesel motor		pc	2	500	1000	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
16		Movable electric welding device		pc	2	500	1000	
17		Tower truck		pc	1	5000	5000	
18		Excavating machine, 0.25 m^3		pc	1	5600	5600	
19		Excavating mac.ine, 0.5 m^3		pc	1	14500	14500	
20		Excavating machine "Belarus" 0.25 m3		pc	1	5500	5500	
21		"Belarus" tractor		pc	1	8000	8000	
22		Buldozer 118 kW		pc	1	17000	17000	
23		Compressor		pc	2	3200	6400	
24		Truck loader 3.26		pc	1	5000	5000	
25		Diesel locomotive		pc	3.	120000	360000	
		TOTAL					584620	
		Garage for special vehicles						
		Sanitary equipment						
26		Centrifugal fan		pc	5	210	1050	
27		Central air donditioner		pc	1	2500	2050	
		TOTAL for section I Equipment					587720	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Electrical						
		Power equipment						
1		380V AC asynchronous motor control boxes composed of three-pole circuit breaker with release of nominal current 16-160 A and magnetic starter with thermal relay 16-160A		pc	2	40	80	
2		Three-pole power cabinets with knife-switch and fuses 100-300A, 380V. AC		pc	10	24	240	
3		380V. AC power distribution points with three-pole release of 250A and ten circuit breakers with release of 16-160A		pc	16	170	2720	
4		Three-pole 380V. AC dust-proof magnetic startes with thermal relay 63A, 40A, 25A		pc	9		210	
		Lighting equipment						
5		Distribution points with input curcuit breakers without releases 100A, with 6 three-phase and 12 one-phase switches with electromagnetic and thermal releases of 63A and 20A correspondently		pc	6	50	300	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
6		One-phase step-down transformer 380/220/24 VA		pc	6	10	60	
7		Installation switches 10A, 220V		pc	100	0.6	60	
8		Two-pole plug-and-socket connections 10A, 220A		pc	100	0.6	60	
9		Luminaires		pc	250		2030	
10		Incondencent lamps (arc, mercury discharge)		pc	370		123	
		TOTAL					5883	
		Section II. Materials						
1		Power cable up to 1000 V with four aluminium cores with PVC inculation and sheath (different core sections)		km	3.14		2363	
2		Power cable 660V with rubber or plastic insulation, rubber or PVC sheath, 2-4 aluminium cores 4-70 mm2		km	2	800	1600	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
3		Control cable with PVC insulation and sheath, 4-37 aluminium cores 2.5 mm2		km	4	200	800	
		Installation aluminium wire 2.5 mm2 with PVC sheath		km	3	16	48	
		TOTAL					4811	
		Steel pipe ID 25-65		m	3000		907	
		TOTAL for section I Eqiupment					5883	
		for section II Materials					5718	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
		Section I. Equipment						
		Special vehicles						
1		Fire-fighting water tank truck		pc	1	9600	9600	
2		Powder-type fire-fighting vehicle		pc	1	9300	9300	
3		Fire-fighting water tank truck		pc	1	14930	14930	
4		Fire pump station		pc	1	11000	11000	
		TOTAL					44830	
		Sahitary equipment						
5		Centrifugal fan		pc	3	210	630	
		TOTAL for section I Equipment					45460	

Fire Station

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
		Section I. Equipment. Electrical						
		Power equipment						
1		380V AC asynchronous motor control boxes composed of three-pole circuit breaker with release of monimal current 16-160A and magnetic starter with thermal relay 16-160A		pc	10	40	400	
2		Three pole power cabinet with knife-switch and fuses 100-300A, 380V AC		pc	1	24	24	
3		380V AC power distribution points with three-pole release of 250A and ten circuit breakers with release of 16-160A		pc	5	170	850	
4		Three-pole 380V AC dust-proof magnetic starters with thermal relay 63A, 40A, 25A		pc	10	1	10	
		Lighting equipment						
5		Distribution points with input circuit breakers without releases 100A, with 12 one-phase switches with electromagnetic and thermal relaases 20A		pc	3	50	150	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
6		One-phase step-down transformer 380/220/24 VA		pc	5	10	50	
7		Installation switches 10A, 220V		pc	100	0.6	60	
8		Two-pole plug-and-socket connection 10 A, 220V		pc	100	0.6	60	
9		Luminaires		pc	300		2000	
10		Inconcencent lamps (arc, mercury discharge)		pc	500		175	
		TOTAL					3779	
		Section II. Materials						
1		Power cable up to 1000V with four aluminium cores with PVC insulation and sheath (different core sections)		km	1.15		540	
2		Power cable 660V, with rubber or plastic insulation rubber or PVC sheath, 2-4 aluminium cores 4-70 mm2		km	1	800	800	
3		Control cable with PVC insulation and sheath, 4-37 aluminium cores 2.5 mm2		km	3	200	600	

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NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg of one piece	Net weight, kg total	Manufactured indigenously
4		Installation aluminium wire 2.5 mm2 with PVC sheath		km	5	16	80	
		TOTAL					2020	
5		Steel pipe IS 25-65		m	3220		9012	
		TOTAL for section I Equipment					3779	
		for section II Materials					11032	

NOS No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg		Manufactured indigenously
						of one piece	total	
		Section I. Equipment. Electrical						
		Lighting equipment						
1		Distribution points with input circuit breakers without releases 100A, with 6 three-phase switches with electromagnetic and thermal releases of 63A		pc	7	50	350	
2		Control cabinet		pc	11	300	3300	
3		Distribution box		pc	25	25	625	
4		Luminaires		pc	340		4100	
5		Incandencent lamps (arc, mercury discharge)		pc	140	0.15	21	
		TOTAL					8396	
		Section II. Materials						
1		Power cable 600V with rubber or plastic insulation, rubber or PVC sheath, 2-4 aluminium cores 4-70 mm2		km	8.5	800	6800	

NOS: No according to process flowsheet	Trans. No	Name and technical characteristics	Type, brand, model, code	Unit of measurement	Quantity	Net weight, kg: of one piece	Net weight, kg: total	Manufactured indigenously
2		Control cable with PVC insulation and sheath, 4-37 aluminium cores 1.5 mm2		km	2.5	500	1500	
3		Installation aluminium wire 2.5mm2 with PVC sheath		km	5.5	16	88	
		TOTAL					8388	
4		Steel pipe ID 25-65		m	10500		27500	
		TOTAL for section I						
		Equipment					8396	
		for section II						
		Materials					35888	

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