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HIGH LEVEL ADVISORY ASSISTANCE IN ENVIRONMENTAL MONITORING
FOR ALUMINIUM CAST PLANT IN PLEVEN

SI/BUL/90/801

PEOPLE'S REPUBLIC OF BULGARIA

Technical report: First evaluation mission*

Prepared for the Government of the People's Republic of Bulgaria
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

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* This document has not been edited.

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A B S T R A C T

**HIGH LEVEL ADVISORY ASSISTANCE IN ENVIRONMENTAL MONITORING
FOR ALUMINIUM CAST PLANT IN PLEVEN, BULGARIA
SI/BUL/90/801**

Objective of Mission:

In the first part of the mission from 31/07 to 05/08/1990 the plant was visited and inspected in order to get informations and impressions of the environmental situation.

By the results of this visit a measuring plan was developed to give the guidelines for the work of the contractor for environmental monitoring.

The technological installations of the plant are relatively new, but most of the aspiration systems and ventilators are out of order.

This causes a high level of pollutants contaminating the working climate. These pollutants are dust, hydrocarbons, aerosoles with metal content, halogenes, phenole and formaldehyde.

The substances, either by aspiration and ventilation or through windows and doors are emitted into the environment without precipitation.

Bad working place conditions with exeeding concentrations up to 300 % of TLV already effected a critical level of health diseases.

Conclusion and Recommendations:

By the results of the visit the basic information for the contractor about measuring points and substances was prepared. It includes inside and outside plant measuring of airpollutants as well as the analyses of future water support facilities.

Technical recommendations at that moment of the first part of mission are made only generally, as existing aspirators and ventilators must be modernized and some new, including filters have to be constructed, sections of production should be separated by brick walls, noise protection devices both personally as well as technically must be performed.

I. INTRODUCTION

By the purpose of the project, to help the plant for aluminium casts in Pleven, Bulgaria, with the elaboration of the environmental sound and economically efficient guidelines the experts 11-51 and 11-53, as described in the job descriptions (ann. 1 and 2), for the first part of mission visited the plant to get detailed informations about the present situation.

The visit at the plant in Pleven took place from 01/08 to 04/08/1990 with arrival insite on 31/07/1990 and departure on 05/08/1990.

The mission was done and the report of the first part of mission was written by:

Expert 11-51: Consultant in Environmental Engineering
Dipl.-Ing. Dr. W. Gaubinger
Vienna, Austria

Expert 11-53: Consultant in Aluminium casting Technologies
and related economic matters
Ivan Stankovich P.E.
Piedmont, USA

The experts had to find out the technological standard of the plant equipment, the general environmental status of the project area, both inside and outside of the plant and had to discuss it with local authorities.

In respect to the technological situation and equipment as well as the identification of the most hazardous units of the plant they had to elaborate guidelines for the activity of the contractor's team and advise in identification of the contractor.

As a further result of the first part of mission they had to recommend general possibilities to solve the existing technical problems.

These recommendation can only be given in a general form because for detailed technological and environmental specifications the contractor's results of measurement have to be obtained.

Corresponding to the project description dicussions with local authorities as the

- Meteorological Institut of Pleven
- Hygiene & Epidermology Inspection of Pleven
- Environmental Protection Agency

were held to receive special informations about the results of envircnmental plant and outside plant monitoring, physical inspection of the employees but also environmental and sanitary regulations.

Other parts of the job description of both experts, like detailed materials on environmental equipment and alternative technologies leading to the similar production characteristic with economic assessments applicable to the plant will be done after finishing contractor's work in the second part of the mission.

All original objectives for the first part of mission and severai objectives of the second part were attained as requiered and had not to be revaised.

II. CONCLUSION AND RECOMMENDATIONS

As a result of the analyses of the aluminium cast plant at Pleven it may be stated, that from the view of environmental status this plant is not a main producer of dangerous pollutants.

Pollutants are emitted into the environment either "defined" by aspirators or "diffuse through windows and doors."

Nevertheless the investigations of concentrations and analyses of the health status of employees show exceeding levels of concentrations related to general rules.

Health diseases occur in a very high range and must be lowered by improving the working conditions in several departments of the production.

As the plant is operating at a performance of about 30 % at the moment intensive technical considerations are necessary to obtain acceptable working and emission conditions at full capacity.

The following general technical recommendations can be made:

Priority I:

- * To get a general impression of all facilities of the plant a detailed layout, including all aspirators, ventilators and stacks has to be worked out
- * Modification and improvement of present aspirators and ventilators with central control host
- * Personal noise protection in areas with high noise level
- * Replace of fork - truck by electro driven vehicles
- * Immediate measurement of environmental situation by the contractor of UNIDO

- * Permanent control of working place conditions and emissions by use of analysing tubes (DRÄGER or equivalent) and mobile dust measurement device.
- * Personal protection by wearing working clothes and safety protection tools (Glasses, respiratory filter) of high standard, quality and function

Priority II:

- * Separation of plant sections with different operations to decrease dust and noise transmission
- * Installation of aspiration and ventilation systems with central control host to collect the pollutants at the place of generation and exhaust them into the atmosphere
- * Noise reduction device at machines and tools with high noise generation
- * Transportation and storage of mould and core sand in closed systems and tanks - "no open handling"

Priority III.

- * Installation of emission reducing systems (e.g. filters, after burners) to provide or reduce emissions into the atmosphere in accordance to emission substances and regulations
- * Automation of product transportation between the several stages of production

More and detailed recommendations can be given after the detailed determination of environmental situation by the works of the contractor for environmental monitoring.

III. DESCRIPTION OF FACILITIES

The plant which produces aluminium casts for heavy-truck and car wheels as well as special products like fittings, housings, electrical parts, engine parts and radiators (together 500 different products) working 24 hrs a day, has a normal capacity of about 6.000 t of good cast per year.

At the moment the plant runs at a production of 200 t/month (40 %) due to raw material shortage.

Until the end of 1990 this crisis should be solved and the plant should work on his full capacity.

Technologically three casting technologies are used:

- * Counter pressure casting (4.400 t/y)
- * High pressure casting (1.500 t/y)
- * Classic mould casting (100 t/y)

About 350 t/y of mould sand coming from Bulgaria and Western Europe is used in facilities of Italian origin.

Used sand is given to a special company which uses it in road and civil construction.

Aluminium with high purity is imported mainly from western Europe, some raw material is degasified or modified by use of $MnCl_2$ and argon gas in facilities in section 4 (annex 4).

The main alloys used in this plant can be seen in annex 5, 6, 7 and 8.

A. Buildings in General

The whole company consists of several buidings but there is one main building containing all important facilities of production.

South of the plant the main office building including management dept., economic dept., parts of the technical dept., the capital construction dept. and separate sub departments of the company is located.

How the whole company is organized can be seen in the figure of annex 3.

Arround the main production building three smaller buildings are of interest for technological and environmental considerations.

North of the main plant building one building, housing future electroplating and painting facilities is situated. Between these two building a roof covered open working place is located for removing the mould sand from the products.

In the west of this a new building for housing the waste water treatment facilities which is in construction now is located.

Across the road, west of the main building, a building for assembling mechanical products is located, in which painting at present is performed.

B. Main Plant Building

In the center of the company area the main production building is located. It includes all facilities except painting, electroplating and waste water treatment.

The assembling of the several production units may be seen in the layout and description of annex 4.

The ground area of the building is about 10.000 m² and with an average height of 14 m (annex 9) a cubic content of 140.000 m³ is calculated.

From the view of environment and technology the following facilities (concerning to annex 4) of the production are of special interest.

Section 1: Heat treatment furnaces

Section 2: Laboratory in Administration (3 rd floor)
Machine tool
Console crane

Section 3: Aspirator

Section 4: Casting machines VP 1300
Casting machines VP 1000

Section 5: Casting machines VP 1000
Casting machines VP 400
Hydraulic pressing
Console crane

Section 6: Sand blasting machine
Several machine tools
5 t crane

Section 7: Laboratory (hardness test)
Tool machines
Welding
Core machines
Core dryer
Manual forming section
Material storage
Core assembly
Induction melt furnace

Section 8: High pressure cast machine Polak 1000
High pressure cast machine Polak 400
High pressure cast machine MV 1000
Repair shop

Section 9: Gas welding
Service section

The sections are not separated from each other by brick or concrete walls but only some unefficient very low constructions of steel or paperbord.

The whole building during winter season is heated by warm air supply in section 1 and section 7 with the following performance.

Section 1: 4 Vent. 30.000 m³/h each
2 Vent. 20.000 m³/h each
p = 120 mm WS

Section 7: 3 Vent. 30.000 m³/h each
p = 120 mm WS

That means that there is a warm air supply volume of together 250.000 m³/h.

For cooling the air in summer at section 6, four air supply ventilators with 30.000 m³/h each are installed. Several smaller units of air supply lead to an average air supply volume for cold air of 270.000 m³/h.

The building is equipped with several aspiration and ventilation facilities with a number of 97 ventilators with 6.000 m³/h each. This causes a total volume of exhaust air of 582.000 m³/h.

As not all ventilators are in operation this volume will not occur in the present situation.

B.1. Melting furnaces (pic.1)

In section 7 (annex 4) 6 middle frequency melting furnaces are installed with a performance of 500 kg each. Melting takes about 45 minutes.

For special products two middle frequency furnaces of "ALUTHERM - Company" (GDR) with a capacity of 250 kg/45 min are in use at section 7 .

No one of the furnaces has an aspiration system with ventilator, but the generated gases and air pollutants are either deposited in the hall, aspirated by the hall aspiration system or emitted through open windows and doors.

B.2. Founding Workshop:

Founding mainly takes place in sections 4 and 5 (annex 4).

Three High Pressure Cast Machines are working in section 8 area beside the mould section.

In general two modern technologies are used.

* Counter Pressure Cast System (pic. 2)

The principle funktion of this technology, which is also used in other countries and was even sold to european companies is shown in annex 10.

From environmental aspects, attention has to be paid to the exhaust gas (small quantity) during the casting process from the counter pressure volume which is now exhausted into the atmosphere without cleaning. Exhaust gases of 5 machines for the modification of alloy with $MnCl_2$ are filtered in a bag-filter-system.

The following cast facilities with counter pressure technology are installed:

- Section 4: 5 machines VP 1300 (fig. 1 annex 4, with aspiration, ventilation and filter)
28 machines VP 1000 (fig. 3 annex 4)
- Section 5: 6 machines VP 1000 (fig. 1 annex 4)
12 machines VP 400 (fig. 2 annex 4, with aspiration and ventilation)
8 machines VP 100 (fig. 10 annex 4)

* High Pressure Cast Machines (pic. 3)

In section 8 three machines of this type are installed.

- 1 POLAK 1000
- 1 POLAK 400
- 1 MV 1000

All machines are missing aspiration of the generated gases.

Generated gases and pollutants are exhausted into the hall and emitted through hall aspiration and open windows.

As for this process coatings on the basis of graphite and water - glass with sulfur content are used, attention should be paid to the substances generated.

B.3. Thermic Treatment

Thermic treatment facilities are installed at section 1 (fig. 1, 2, and 3 annex 4) for material hardening. For the defined cooling of heated products water is used.

Beside this thermo treatment facilities in section 1, heat treatment furnaces (fig. 6 and 7 annex 4) for special product conditioning are in use.

B.4. Mould Section

In section 7 eight core machines (fig. 14 annex 4) with aspiration and ventilation are in use (pic. 4).

Sand of bulgarian or western europe origin is either dried, mixed with binding material (fig. 2i), stored in containers and manually shoveled into the machine storage facility or preprepared material is delivered in containers and given into the storage tank (pic. 5).

Normally the binding material for mixed sand is water glass and glueoil.

Preprepared sand uses phenolic resins containing formaldehyde as binding material. 80 % of the used material is preprepared sand.

This section also includes manual forming (fig. 17 and 18), storage of cores and transportation (pic. 6,7).

B.5. Mechanical Workshop

Mechanical workshop, specially in section 6 of annex 4, includes all mechanical facilities needed for the finalization of the products and production of steel forms.

Main attention has to be paid to the sections for welding (fig.9 in section 7 and fig. 4 in section 9 of annex 4) and the section of repair shop (fig. 5 at section 8 of annex 4) because of dust and noise emissions.

B.6. Laboratory

This is mainly located on the third floor of the administration building.

Here several analyses of alloy contents are made by the use of HCl (Hydroxychloride) and HF (Hydroxyfluoride), two very strong acids.

Aspiration does not work sufficiently and the aspiration system may cause short circuits to other rooms, e.g. the copy room, which is contaminated with ammonia.

C. Other Buildings

From the other buildings only one is of environmental importance.

This is the building in which at present time some painting is performed, as several products, specially car wheels have to be painted.

C.1. Painting

Painting is performed in a building in the west of the main building. The room is normally used for machanical works and has no special equipment for painting works.

The different colors are applicated by pneumatik pistole application system or manually.

The used coating - systems are mainly based on nitrocellulose laqueurs with a content of solutants in the range of 70 % .

The following quantities of coatings are used:

finish coating	500 kg/y
ground coating	500 kg/y
others	500 kg/y

With this quantity of coatings 1.200 car wheels are painted per year at the moment. The designed capacity should be 1.000 wheels per month.

D. Future Facilities

The company is considering to adapt the production in respect of the needs of market.

These needs in general are painted or/and plated products.

D.1. Electroplating

In a building beside the main building, facilities for electroplating, mainly for steel parts are in construction.

It is including pickling with HCl and NaOH and plating with Zn, Cr, P and Cu.

Copper was also tried to be applied on aluminium wheels as a basis for chromating.

The constructed equipment is of Bulgarian origin, the basins of plating process, except washing steps, are closed, aspirated and equipped with exhaust system to the atmosphere without filter.

D.2. Painting

In the building of electroplating, a new painting facility is in construction. In this part of the plant no wheels, but several other products will be painted.

For car wheels a separate painting facility is considered due to quality requirement.

The painting installation consists of 4 cabins for pneumatic application, two pre-dryers and two anneal ovens.

Application cabins are equipped with aspiration, water curtain to minimize over-spray emissions and ventilation.

The anneal ovens are equipped with aspiration and ventilation but no system to reduce organic emissions, e.g. use of an "after burning system" for the exhausted air.

D.3. Waste Water Treatment

In respect of the constructed electroplating and painting facilities a waste water treatment plant is in construction too.

It is located in a separate building beside the main building.

It is of italian origin and shows the following main steps of waste water treatment.

- * neutralization
- * koagulation
- * Zn - separation
- * Cr - separation
- * P - separation
- * Cu - separation
- * HCN- neutralization
- * flacking
- * precipitation
- * clean water control

The purified water is drained into the public canal system.

Main attention has to be paid on the purification efficiency to prevent problems in the public canal system and public water treatment facilities.

E. Energy and Water Supply

- * Electric energy is covered by the local public supplier. The installed electric power is 20 kW, the consumption at present is about 5 kW.
- * Heated water is covered from the local district heat supplier.
- * For direct heating of several facilities gas is used, covered by the local gas supplier.
- * Compressed air is generated in 3 compressors (2 stand - by) and distributed by an internal network.
- * Water is covered by the local water supply company with an amount of 400 m³/day.

100 m³/d are required for the losses of water coolers,
300 m³/d are used for social demand of the 702 employees.

Those figures mean a specific water consumption of 427 liters per employee and day, which is a rather high value.

Normal consumption of water for social purpose in european area is in the range of 250 liters per employee and day.

The company has now drilled her own fountain in a depth of 130 meters to guarantee independent water supply. The results of analyses of the water by the local authorities show several contaminations which could embarrass the use of this source.

IV. SOURCES OF EMISSIONS

Main sources of emissions related to the several parts of the production are precised in the following statements.

The main pollutants either on working places or in exhaust gas streams are

- * dust with metall contents
(including aerosols)
- * hydrocarbons
- * phenole
- * formaldehyde
- * sulfurdioxide
- * nitrogenoxides
- * hydroxy - chloride - acid
- * hydroxy - flouride - acid
- * noise

A. Melting furnaces

In this part of the plant (section 7, annex 4) the following air pollutants are expected.

- * dust
- * hydrocarbons
- * metallic components
- * noise
- * heat radiation

As there is no aspiration system to collect these substances directly at the place of generation, working places are influenced by this pollutants mainly.

B. Founding workshop

In this part of the production, which takes place mainly in section 4, 5 and 8 (annex 4) we have to make a distinction between the 5 counter pressure machines (fig. 1, section 4), where alloy is modified with $MnCl_2$, the facilities in section 4 and 5 where ready alloy is used and the high pressure cast machines at section 8 (fig. 2, 3 and 4).

Counter pressure casting - Section 5, fig. 1:

- * dust
- * aerosoles with metall content
(Al, Si, Fe, Cu, Cr, Mn, Mg, Ni)
- * hydrocarbons
- * HCl
- * noise
- * heat radiation

The 5 furnaces are equiped with aspiration (pic. 8) and a bag filter to remove dust particles from the exhaust gas and particulary it is also efficient on the reduction of hydrochloric - acid.

Other counter pressure cast facilities

In those cast machines where no modification and/or purification is performed the main pollutants are given with

- * aerosoles with metal content
- * hydrocarbons
- * noise
- * heat radiation

Most of them, except fig.2 in section 5 are not equipped with aspiration systems and therefore the pollutants contaminate the hall climate.

High pressure cast machines, section 8, fig. 2, 3 and 4:

A special problem is given with the high pressure cast machines in section 8 (annex 4)

Main pollutants are

- * dust
- * aerosoles with metal content
- * hydrocarbons
- * phenole
- * formaldehyde
- * sulfurdioxide
- * nitric oxides

None of the three machines is equipped with aspiration system but the pollutants contaminate the hall air.

C. Thermic treatment

Thermic facilities are found in section 1 and 2 for hardening and metallurgical conditioning of products.

There are no special pollutants beside steam and heat radiation.

D. Mould Section

D.1. Moulding

Specially in the area of cole machines there is a large potential of generated pollutants including to the following substances.

- * dust
- * hydrocarbons
- * phenole
- * formaldehyde
- * sulfurdioxide
- * nitric oxides
- * noise

The 8 cole machines (section 7, fig. 14) are equiped with two aspiration systems but no filter. Contaminations of the working area with phenole and formaldehyde must be expected with a high ammount.

In the area of hand forming the main pollutant is given with dust.

D.2. Transportation and Handling.

Transportation is performed by use of open containers and fock lift - trucks.

They put the containers in front of the cole machines where the cole - sand ist put on the floor and shoveled into the storage tank of the machines (pic. 5).

By this handling a high ammount of the very small particles of the sand is distributed all around in this area and causes a high degree of working place contamination.

E. Mechanical Workshop

The main problems in this area are noise generation and heat radiation. Some problems may occure by the use of oil - water - emulsions for drilling and lathing.

These emulsions may not be given to the waste water system but should be recovered or treated as waste.

Different emissions may occure at the welding facilities including dust with organic and anorganic components as well as hydrocarbons.

F. Transport cars (Fock-Lift-Trucks)

Several of these trucks with gasoline or diesel engines are used for transportation.

They cause a high degree of generated pollutants as

- * hydrocarbons
- * nitric oxides
- * sulfur dioxide
- * lead aerosoles
- * soot

G. Laboratory

In the laboratories different pollutants, depending on the methode of analyses may occure.

In general the following substances are of interest

- * HCl
- * HF
- * H₂SO₄
- * hydrocarbons
- * nitric oxides
- * ozone

Ozone is generated in the process of metall analyses by use of "spectrai - analyses".

H. Painting

As the coating systems contain a high ammount of solutants the main problem are hydrocarbons. These hydrocarbons in general include

- * acetone
- * methyl-ethyl-ketone
- * toluene
- * benzine
- * hexane
- * amines

Beside these volatile substances dust (over - spray) occures during painting with pneumatic application which contains metall components like chromium and even lead.

V. EXISTING ENVIRONMENTAL PROTECTION EQUIPMENT

A. Aspirators and Ventilators

All over the main building 97 Ventilators are installed with a performance of about 6.000 m³/h each (pic. 9,10).

This means, that the whole ammount of exhausted air should be

582.000 m³/h

that would cause an air - change - rate of

$L = 4,15 \text{ h}^{-1}$

Because of technical problems most of the ventilators are out of work, so that aspiration does not work efficiently.

Some machines of the plant are equiped with aspiration systems directly at the machines. None of these aspirators has a filtering system included.

Main facilities with aspirators are

8 cole forming machines (fig.14, section 7)

12 counter pressure cast machines (fig.2, section 5)

There is no central control panel for the function of the ventilators to be supervised without looking at each facility.

B. Dust Filter (BMD)

The only facilities of production equipped with a filter system are the counter pressure cast machines in section 1 of annex 4 (fig. 1).

The five counter pressure cast machines show aspiration devices (pic. 8) which can be turned over the furnaces to collect the gases generated during $MnCl_2$ modification.

The collected gases are ducted to a bag filter system (pic. 11, 12) of BMD company (GDR)

The main datas of the filter are:

Type:	GTFSL 0,75/2,7/90
System:	Garant
max. Volume:	10.600 m ³ /h
Ventilators:	2 (1 stand-by)
Sections:	2
Area of filters:	152 m ²
Length of filter:	1.800 mm
Diam. of filter:	150 mm
Bag cleaning:	pneumatic
Bag material:	polyester
Erection:	1986

By this filter system 3 of the furnaces may be aspirated at the same time.

The separated dust also binds and neutralizes some of the generated hydrochloric - acid. Effects of HCl may be seen inside of the filter, as steel parts show rust formation of high level.

VI. LOCAL CONDITIONS

A. Surrounding facilities

Around the cast plant several other companies are located, generating even high level emissions, both in quantity and risk.

A.1. Cement Works

Near to the aluminium casting plant a cement workshop is located which causes a high degree of dust emissions and deposits in the area around.

There is an electric filter system installed which shows good efficiency (148 mg/m³ in the exhaust gas) but it is supposed, that it is not always in operation due to high costs.

Beside dust the mainly generated substances of the rotary kiln are carbonoxides, sulfurdioxide, hydrocarbons and nitric oxides.

A.2. Ceramic Works

A ceramic company is also located near to the cast plant, generating all specific emissions (organic and anorganic) of this process.

As this ceramic plant uses "Masud" (heavy oil) as combustibles a high level of SO₂, NO_x, dust and soot emissions will occur.

A.3. Metal Works

The aluminium cast plant is surrounded by 2 metall works with specific emissions according to the used processes.

A.4. Power Plants:

Near to the cast plant two power plants are in operation, using gas and masud as combustibles.

B. Meteorological Conditions

The meteorological conditions of Pleven area are shown in annex 15.

The main wind direction is west (34,7 %) followed by east wind (19,8 %).

Pleven area is characterized by inversion situations with a duration of 10 - 15 day in winter and a few hours in sommer, specially in the morning.

Inversion reaches up to 1300 - 1500 meters with a maximum altitude of 3000 meters.

C. Plant Monitoring

Plant monitoring is performed by the hygienic inspection of Pleven either on request or within every 3 years.

Monitoring is concerned to the different facilities of the plant.

The analyses shows values exceeding the norms and threshold limit values up to three times. (see report of expert 11-54)/

As a result of the investigations the hygienic inspection of Pleven has given order to perform hygienic activities.

Main technical orders are:

- * Aspiration of pollutants at casting and founding facilities
- * Modernization of transport of the casts for immediate removing from the machines
- * Separation of cole sand preparation facilities from cole machines
- * Aspiration has to be in permanent operation
- * Lift trucks should be replaced by electric driven vehicles
- * Coatings should be replaced by water soluble systems

D. Outside Plant Monitoring

For the monitoring of the surrounding area 5 measuring points served by the hygienic inspection and the environmental agency of Pleven with several measuring devices are in operation.

Measures are made 4 times a day.

Number	Location
1	Near to cement works
1	Railway station
2	Down town
1	Near Danube (40 km away)

The determined substances are

- * Dust
- * Lead Aerosoles
- * Sulfur dioxid
- * Nitric oxides

A result of the measures of the hygienic inspection is shown in annex 25.

E. General Environmental Regulations

Rules and specifications for "emissions" and "immissions" of several substances are existing in Bulgaria.

The emission - concentration - limits are depending on the exhausted volume and the height of stack. By the use of factors for different substances the limits may be determined.

Maximum "Immission" concentrations are given with different threshold limit values for different substances e.g.

Ammonia	0,2	mg/m ³
Nitric oxides	0,085	mg/m ³
Sulfurdioxide	0,5	mg/m ³
CS ₂	0,03	mg/m ³
H ₂ S	0,008	mg/m ³
soot	0,15	mg/m ³

VII. RECOMMENDATIONS ON THE CONTRACTOR FOR
ENVIRONMENTAL MONITORING

Measures for the determination of the different pollutants should be performed at the following places of the plant.

Measure points are indicated with "M" and are concerning to the lay out in annex 4.

Inside plant:

M1. Stack of "BMD - Filter"

Dust, dust analyses (Al, Mn, Mg, Si, Cu, Cr, Ni, Fe), granulometric analyses of dust, pH of dust, determination of dry substance of dust, chlorine, TOC (total organic compounds), volume, temperature

M2. Working place condition at casting section 4, fig.1

dust, TOC, chlorine, flouride, noise, temperature

M3. Working place conditions between cast machines section 4, fig. 3 and 4

dust, TOC, phenole, formaldehyde, noise, temperature

M4. In front of melting furnaces section 7 (pic. 1)

dust, dust analyses (Al, Cr, Cu, Ni, Si, Fe, Mg, Mn), TOC, granulometric analyses of dust, chlorine, noise, temperature

M5. Opposite of the melting furnaces (section 7) in 4 of the installed aspiration systems (tubes, pic. 9, 10)

dust, 1 dust analyses (metal content and granulometric analyses), TOC, volume, temperature

- M6. Product finishing beside welding in section 9, fig.4
dust, noise, temperature
- M7. Welding facilities section 9, fig. 3
dust, dust analyses (metals and granulometric analyses), TOC,
noise, temperature
- M8. Working place beside high pressure casting machine section 8,
fig.2 (pic. 3)
dust, TOC, phenole, formaldehyde, SO_2 , NO_x , noise, temperature
- M9. Aspirator of cole machines section 7, fig. 14, in the tube
dust, dust analyses (metals and granulometric analyses, dry
substance), TOC, phenole, formaldehyde, volume, temperature
- M10. Working place at the cole machines section 7, fig. 14
(pic. 4) and handforming section fig. 17
dust, dust analyses (metals and granulometric analyses, dry
substance), TOC, phenole, formaldehyde, temperature
- M11. Aspirator of VP 400/VP 1300 cast machines section 5, fig. 2
dust, TOC, phenole, formaldehyde, SO_2 , volume, temperature
- M12. Laboratory on 3 rd floor of the administration building
in section 2 and 3
TOC, flouride, chloride, NO_x , temperature
- M13. Working place conditions at painting workshop in the west,
opposite of main building
dust, TOC, acetone, toluene, dust analyses for lead and
chromium content

M14. Mechanical workshops at working places

section 2, fig. 1-6	noise
section 3, fig. 5-12	noise
section 5, fig. 3-4	noise
section 6, fig. 4, fig.6-32	noise, TOC
section 7, fig. 26-29	noise
section 9, fig. 5-6	noise, TOC

M15. Aspirator section 2, fig.8

dust, TOC, volume, temperature

M16. Working place at core dryer section 7, fig. 15

TOC, phenole, formaldehyde, temperature

M17. Working place at thermic treatment facility in section 1, fig. 6-7

TOC, temperature, noise

M18. Working place at cast machines in section 5, fig. 10

dust, TOC, phenole, formaldehyde, noise, temperature

M19. Working place in front of mixer furnace section 5, fig. 8

dust, TOC, noise, temperature

M20. Working place in front of the sand blasting machine in section 6, fig. 2

dust, temperature

Outside plant:

M21. Sporting area between central administration and plant building

dust, noise

M22. Area between main building and electroplating plant building
dust, TOC, phenole, formäldehyde, noise

M23. In front of building where painting is performed now
dust, TOC, noise

Water analyses:

M/4. One complete water analyses of the planned water supply
fountain including "koli - bacteria status"

All measurement of air - pollutants and noise has to be done
using the German VDI - Standards (VDI = Association of German
Engineers), water analyses is to be performed according to the
DEV (German Standard Methode).

Job Description

SI/BUL/89/ /11-51

Title: Consultant in environmental engineering.

Duration: 6 weeks (split mission)

Date required: January 1990 (first part)

Duty station: Pleven, with travels to Sofia.

Purpose of Project: To help the Plant for Aluminium Cast with elaboration of the environmental sound and economically efficient guidelines.

- Duties:
1. To review the environmental data at the project site compiled prior to the project initiation.
 2. To investigate the environmental status of the project area and the soundness of the on-going technologies at the Pleven plant (jointly with consultant 11-53).
 3. To discuss, with the national project authorities the candidatures for the local supporting team.
 4. To elaborate guidelines for the activity of the contractor's team and advise in identification of the contractor.
 5. To organize the joint mission of experts 11-52, 11-54 and contractor's team for the elaboration of the final guidelines.
 6. To preside at the group meeting to be held in UNIDO with participation of qualified staffmembers of UNIDO, IAEA and IIASA and summarize findings of this meeting.
 7. To prepare drafts for the report documents.
 8. To consult on the further management of the plant.

Qualifications: A technical university or equal degree in environmental monitoring, pollution control and waste treatment. At least 10 years of practical experience in this area is a must. Experience in organizing working groups and in leadership in similar projects is an asset.

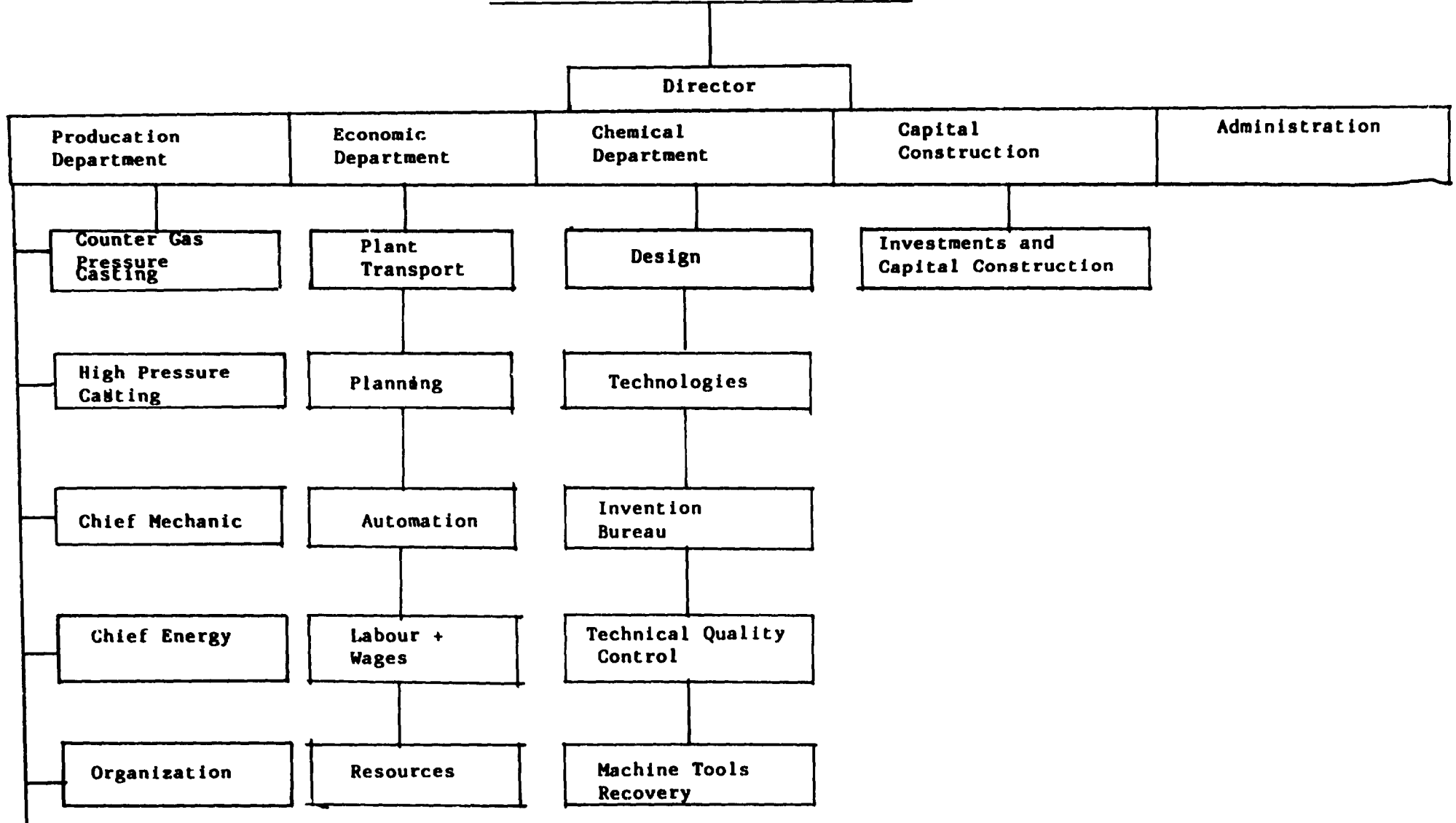
Language: English

Job Description

SI/BUL/89/ /11-53

- Title:** Consultant in aluminium casting technologies and related economic matters.
- Duration:** 1 man month (split mission)
- Duty station:** Pleven (3 weeks)
Vienna (1 week)
- Purpose of Project:** To help the Plant for Aluminium Cast with elaboration of the environmental sound and economically efficient guidelines.
- Duties:**
1. To participate in the detailed survey of the Plant for aluminium casts.
 2. To identify the most hazardous units of the surveyed Plant and advice on the immediate mitigation of the acute factors. (jointly with consultant 11-51).
 3. To elaborate the detailed materials on the alternative technologies leading to the similar production characteristic with the economic assessments applicable to the Plant.
 4. To provide necessary data on the technological measures for the environmental optimization of the Plant activities on the short-and long-term basis.
 5. To participate in the consultant team visit to the Plant for the finalization of the initial findings and advise to the Plant authorities on the efficient application of the elaborated recommendations.
 6. To prepare the technical report and discuss it as one of core documents during the expert's meeting in UNIDO.
- Qualifications:** Technologist in Aluminium casting with strong background in economic evaluations and with experience in environmental issues.
- Language:** English

ORGANIZATIONAL CHART OF PLEVEN PLANT



INDEX OF FACILITIES

Section 1

- | | |
|-------------------------------|--------------------------------|
| 1. Thermo (heat) treatment | 2. Console Crane 1000 kg |
| 3. Tub with water | 4. Control of the furnace |
| 5. Electrical panel | 6. Heat treatment furnace |
| 7. Heat treatment furnace | 8. Machine Tool |
| 9. Revolver type machine tool | 10. Revolver type machine tool |
| 11. Cutting tool (Saw) | |

Section 2

- | | |
|---------------------------------------|-------------------|
| 1. Machine tool | 2. Congole crane |
| 3. Sewing machine | 4. Machine tool |
| 5. Machine tool | 6. Machine tool |
| 7. Area of Ultrasonic control | 8. Polishing tool |
| 9. Painting shop | 10. Saw |
| 11. Hermetic test stand | 12. Machine tool |
| 13. Machine tool | 14. Machine tool |
| 15. Equipment for radiation assembly. | 16. Storage dies |

Section 3

- | | |
|---------------------------|-----------------------------|
| 1. Administration | 2. Administration |
| 3. Administration | 4. Administration |
| 5. Hydraulic machine tool | 6. Hydraulic machine tool |
| 7. Drill | 8. Aspirator |
| 9. Electric box | 10. Machine Tool (wood) |
| 11. Storage | 12. Area for heat treatment |

Section 4

1. Casting Machine VP-1300 - 5 machines
2. Microprocessor transporting line
3. Casting machine VP-1000 - 28 machine

Section 5

- | | |
|----------------------------------|-----------------------------------|
| 1. VP-1000 - 75 | 2. VP-400 - 12 |
| 3. 40T Press | 4. 60T Hydraulic Press |
| 5. 25T, 4 column hydraulic press | 6. 100T, 4-column hydraulic press |
| 7. Tool S13 | 8. Mixer furnaces |
| 9. De-gassing | 10. VP100 |
| 11. X-ray equipment | 12. X-ray equipment |
| 13. Administration | 14. Spare part storage |
| 15. Storage of press dies | 16. Cleaning section |
| 17. Material storage | 18. Congole crane |

Section 6

- | | |
|--------------------------|----------------------------|
| 1. Tool storage | 2. Sand blasting machine |
| 3. Congole crane - 3 | 4. Locksmith section |
| 5. 5t crane | 6. Drilling tool |
| 7. Drilling tool | 8. Electrical erogion |
| 9. Precise machine tool | 10. Precise machine tool |
| 11. Drill | 12. Tool Machine |
| 13. Tool machine | 14. Caroussel tool machine |
| 15. Polishing tool | 16. Polishing tool |
| 17. Polishing tool - 2 | 18. Polishing tool - 2 |
| 19. Precise tool machine | 20. Administration |
| 21 to 32 Tool machine | 33. Electrical tool |

Section 7

- | | |
|---------------------------------|----------------------------|
| 1. Transformer | 2. Lab (hardness fest) |
| 3. Tool machine | 4. Tool machine |
| 5. Tool machine | 6. Tool machine |
| 7. Energy storage | 8. Tool machine |
| 9. Welding | 10. Storage (mechanic) |
| 11. Storage (electrotechnical) | 12. Transformer |
| 13. Storage | 14. Core machines - 8 |
| 15. Core dryer | 16. Loading carrier |
| 17. Manual forming section | 18. Manual forming section |
| 19. Material storage | 20. Core assembly |
| 21. Core mixer | 22. Manual forming section |
| 23. Induction furnace control | 24. 500 kg. induction |
| 25. Mechanical cleaner furnaces | 26.- 29 Machine tool |

Section 8

- | | |
|--|---|
| 1. Forming machine | 2. High pressure cast machine
(Polak 1000) |
| 3. High pressure cast machine
(Polak 400) | 4. High pressure cast machine
(INV 1000) |
| 5. Repaire shop | 6. Material yard |

Section 9

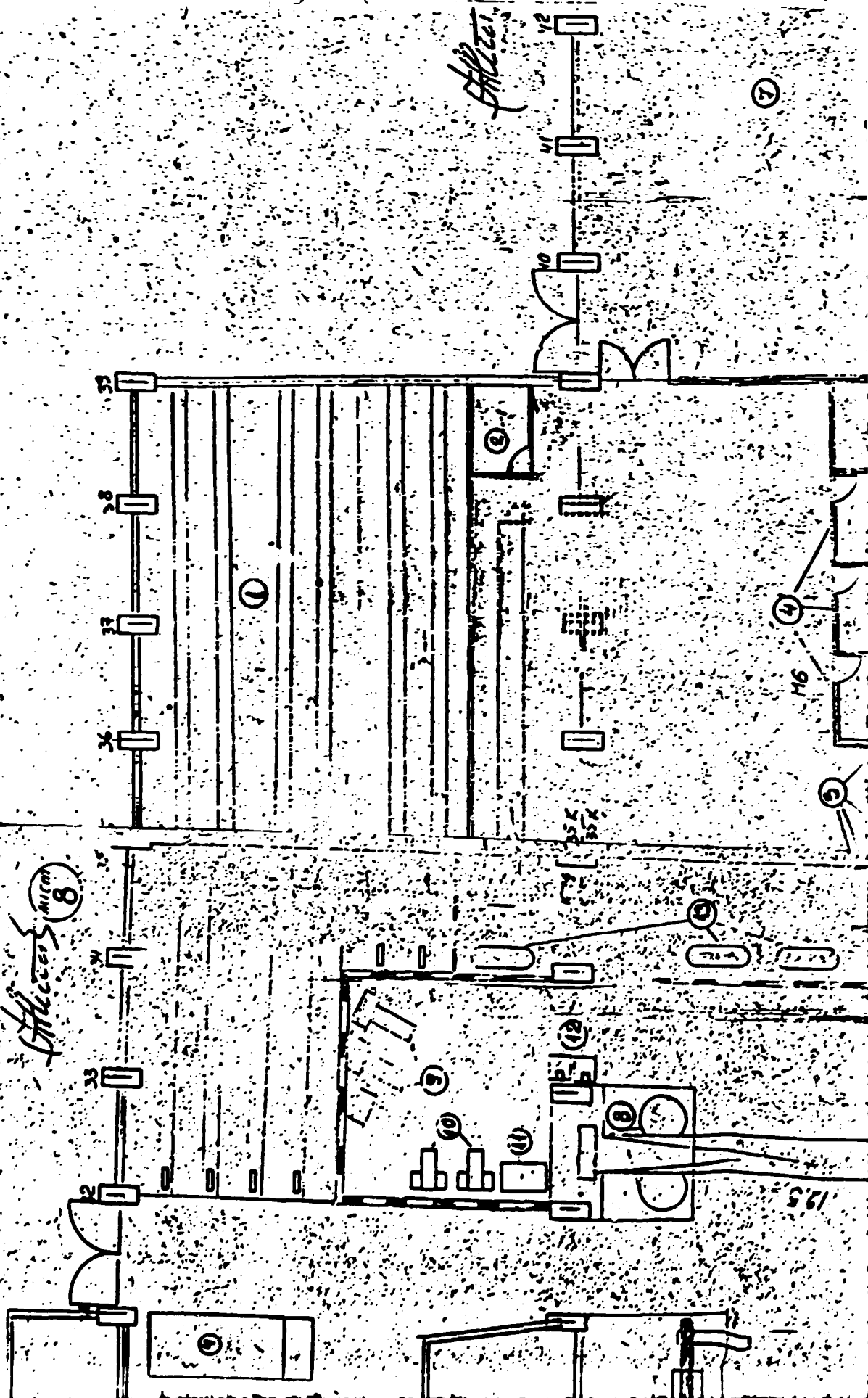
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|-----------------------------|------------------------------|
| 1. Storage | 2. Technical Control Section |
| 3. Gas Welding | 4. Service section |
| 5. Tool | 6. Press (manual) |
| 7. Fuel production storage. | |

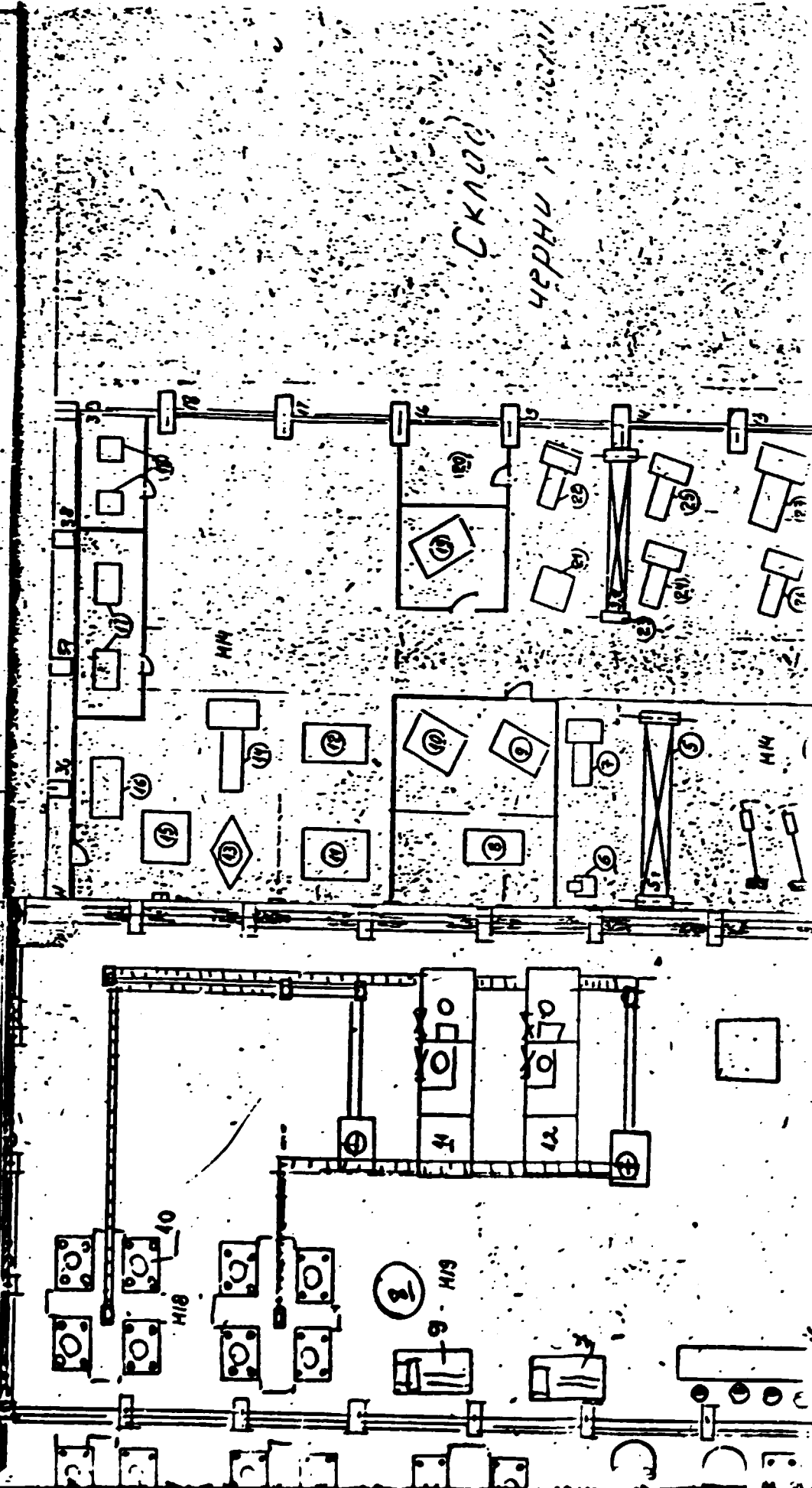
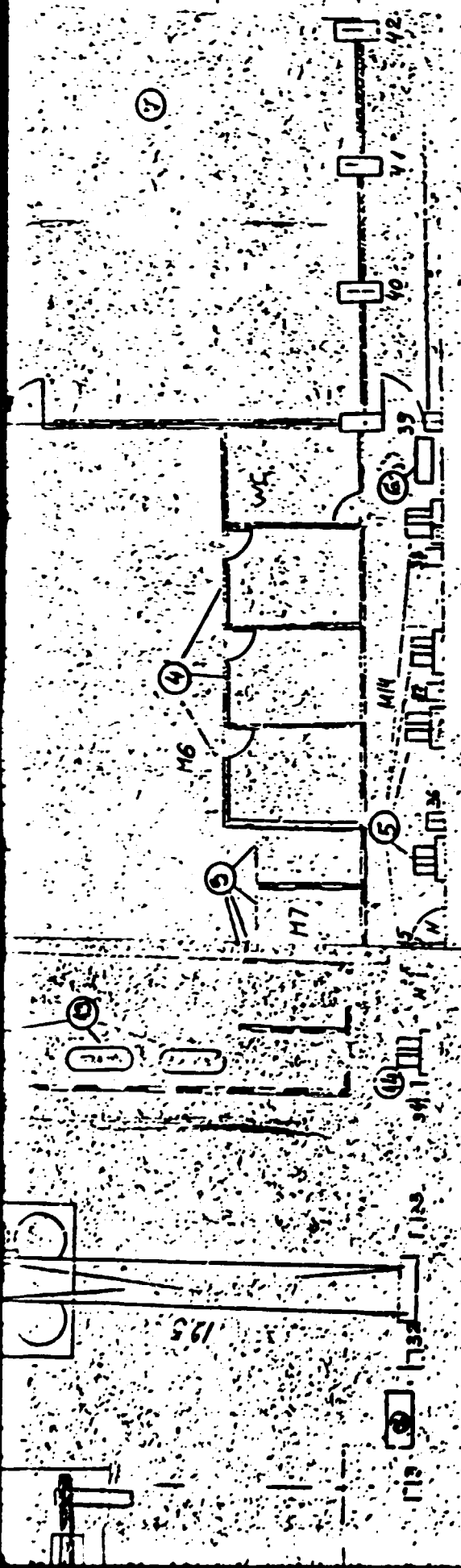
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ЭМД
2
о оборудоване в корпусе
а ЗАО

Шлевер 8

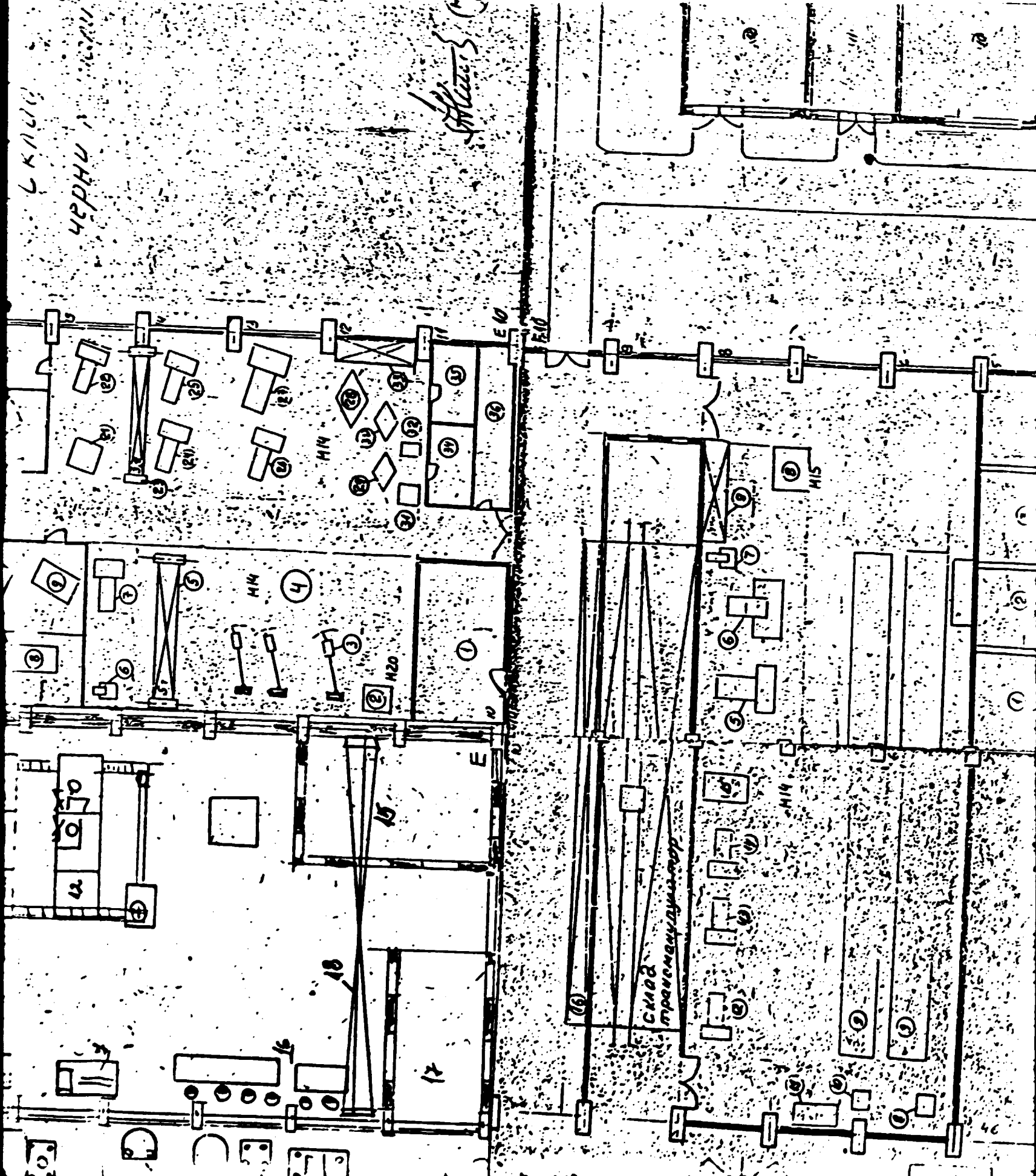




SECTION 3

4 КИЛО
ЧЕРНИ

План № 6



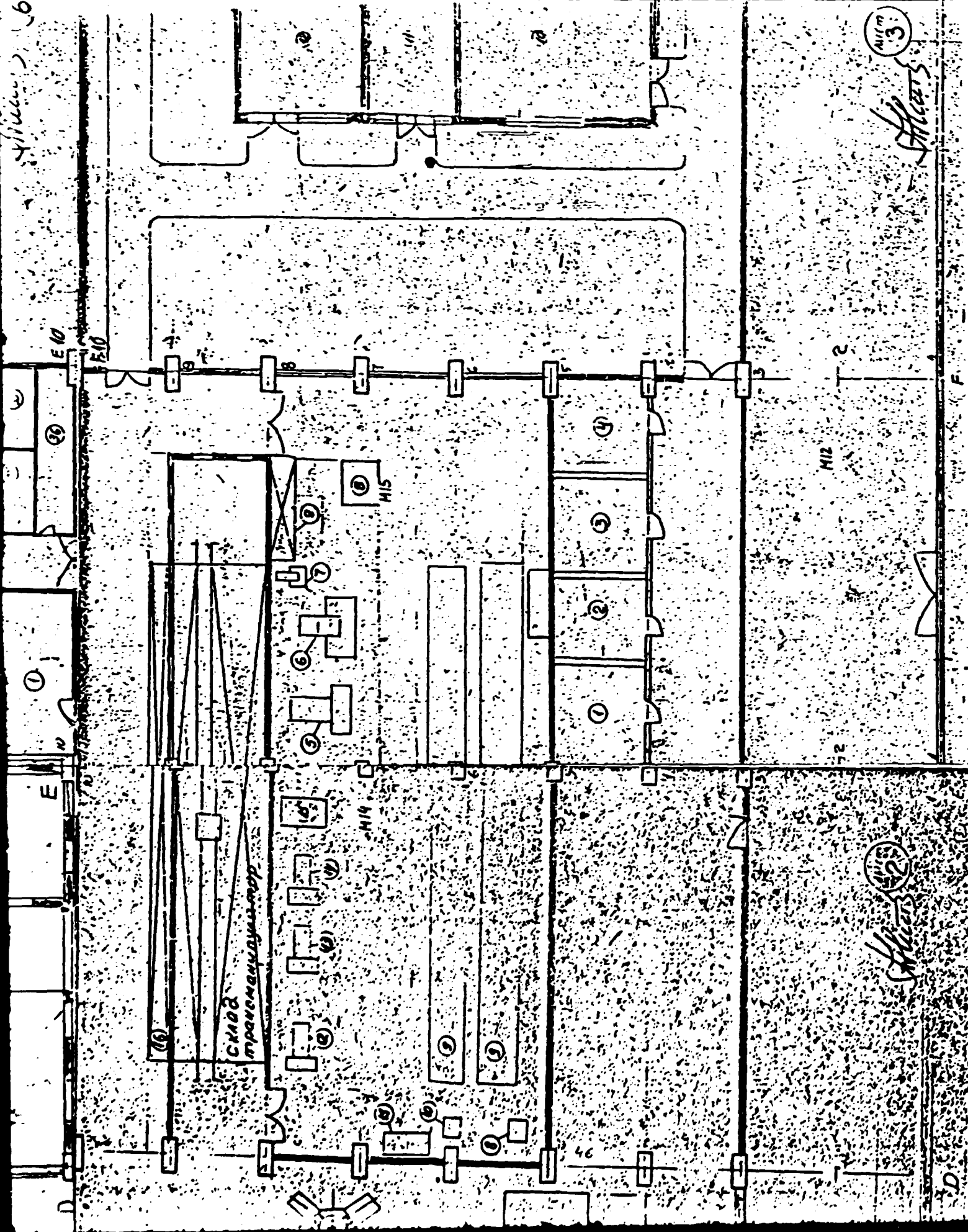
SECTION 4

ANNEX 4

Шифры 1-6

Лист 3

Листы



Лист 2

Листы

Склад
инструментов

M19

MIS

M12

E10

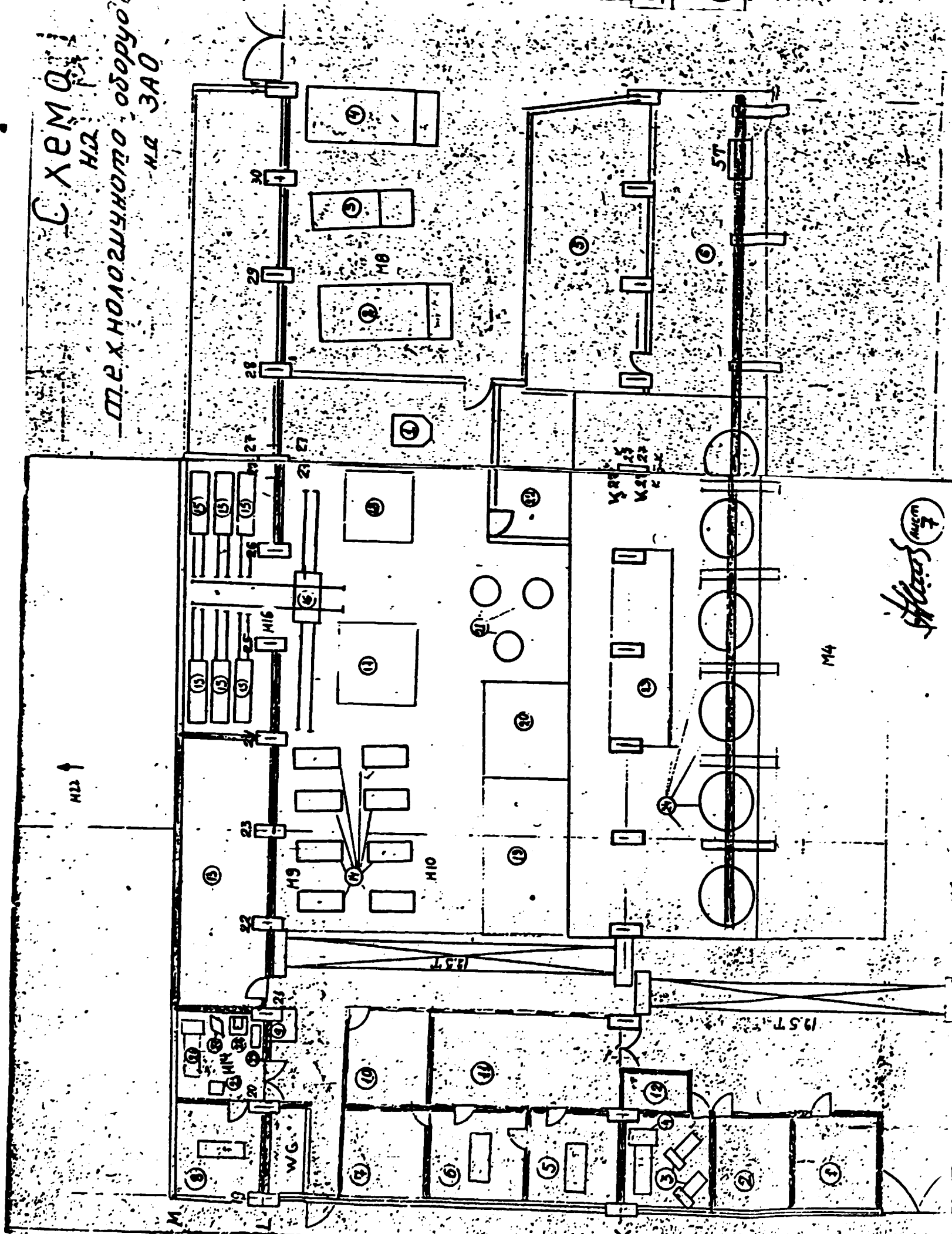
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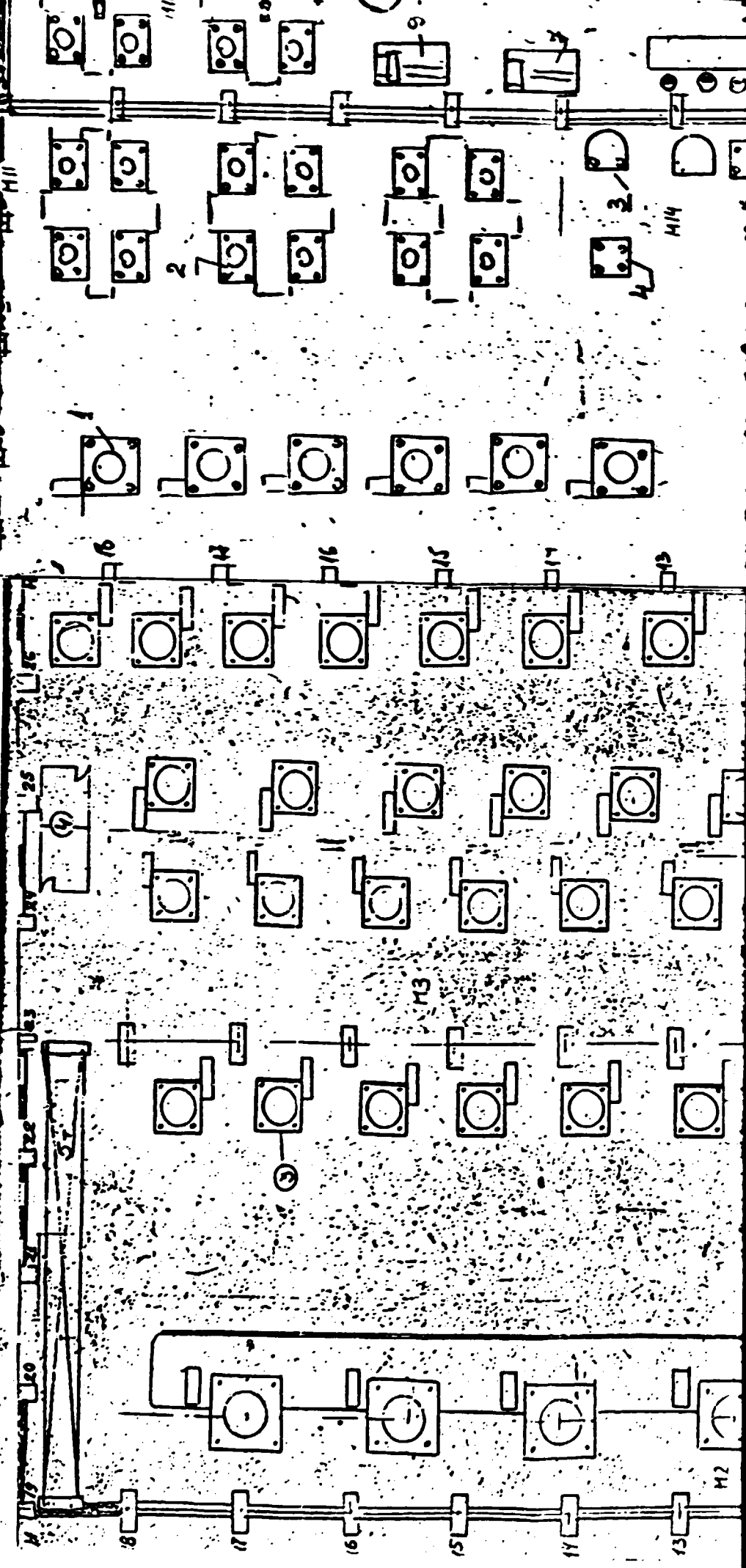
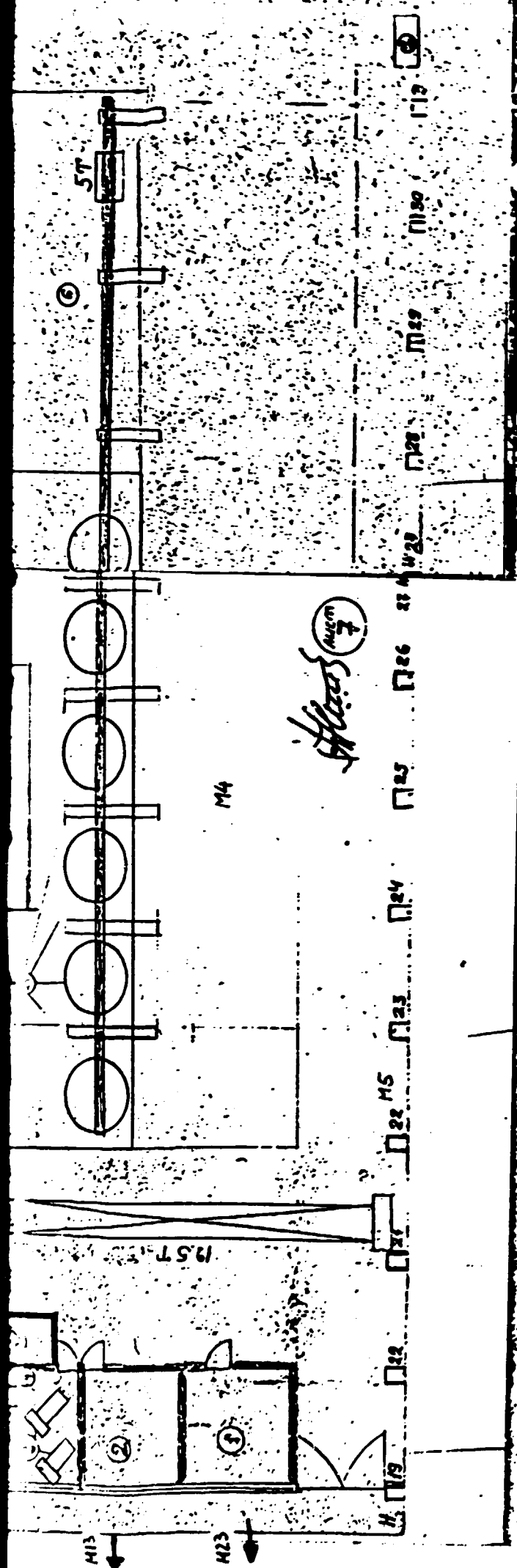
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 НА
 ПОЛОЖЕНИЯ ОБОРУДОВАНИЯ
 НА ЗАО

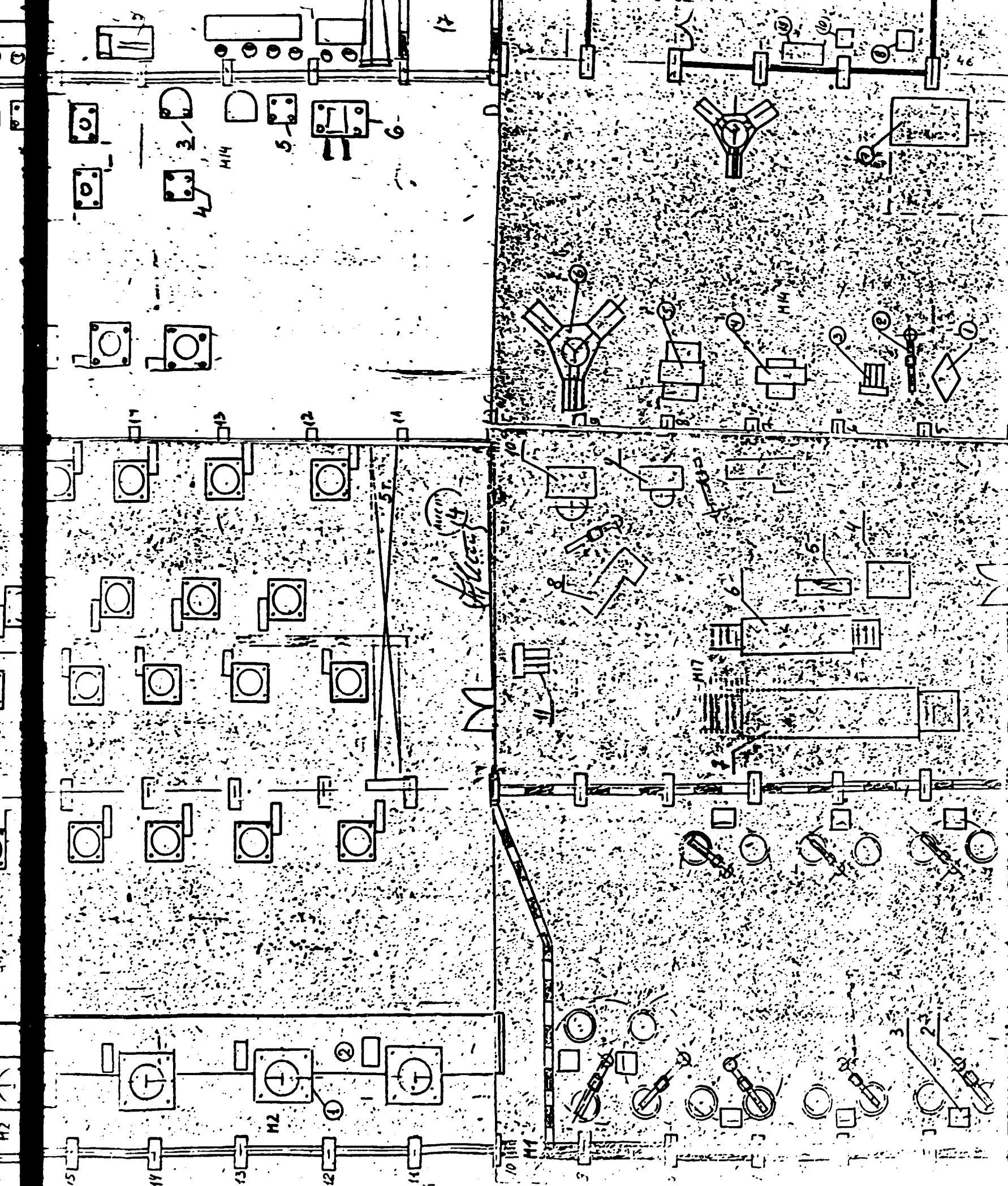


SECTION 5

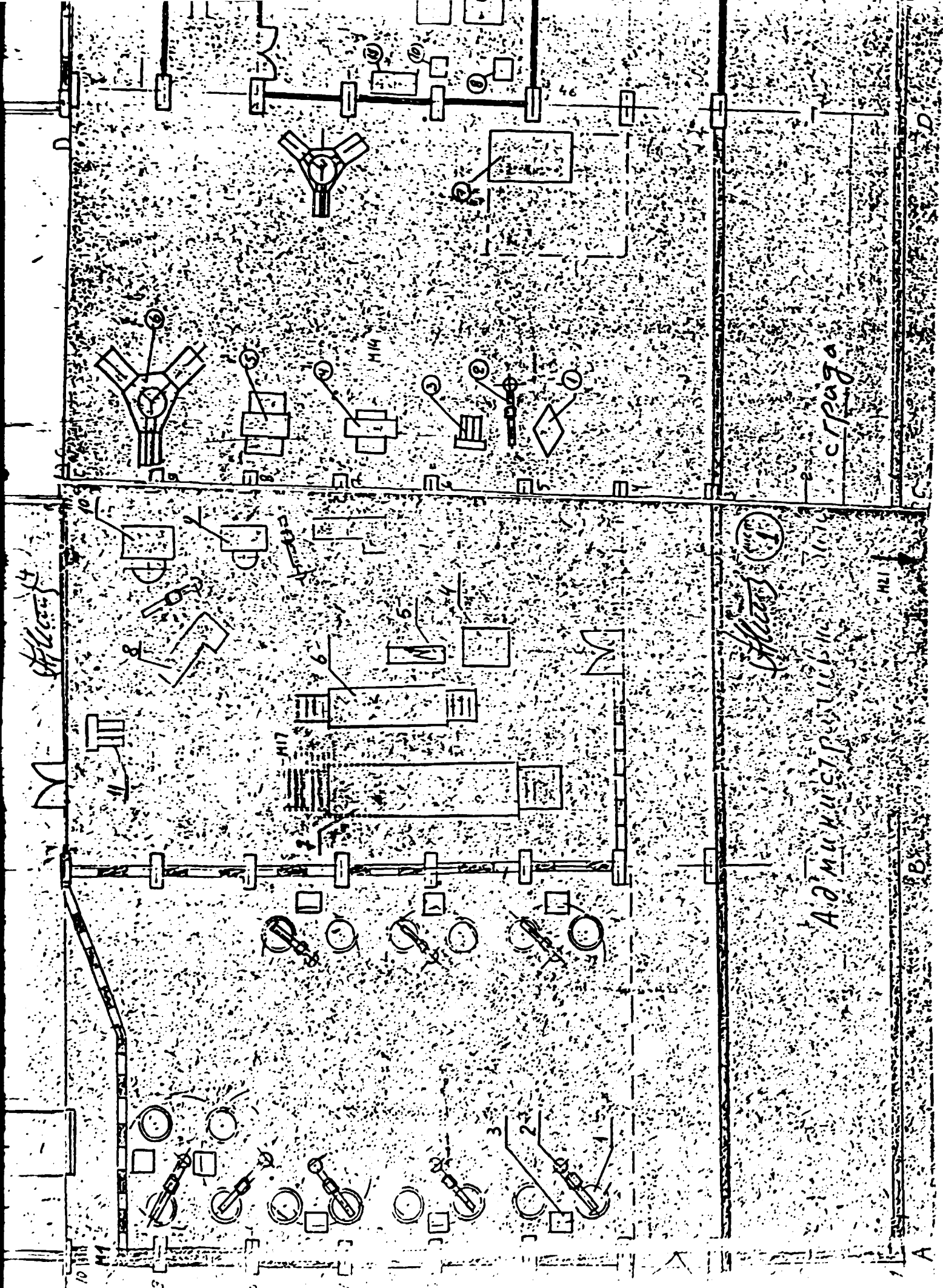
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SECTION 6



SECTION 7



SECTION 8

GENERAL MOTORS ENGINEERING STANDARDS ~~SAE Material Handbook~~

METALLURGICAL REQUIREMENTS FOR CAST ALUMINUM WHEELS
GM 4337-M

1 SCOPE. This specification covers basic metallurgical requirements for heat treated cast aluminum wheels.

2 CHEMICAL PROPERTIES.

2.1 The chemical composition (percentage by weight) shall conform to modified* cast aluminum alloy AA-A356.0 as indicated below.

Silicon	6.5-7.5
Iron	0.20 max
Copper	0.20 max
Manganese	0.10 max
Magnesium	0.25-0.45
*Titanium	0.07-0.20
Zinc	0.10 max
Other Elements:	0.05 max each
	Total 0.15 max

2.2 Wheels shall be cast from melt containing at least 70 percent by weight of virgin aluminum. Whole wheels may constitute 30 percent maximum of the melt. Sprues, runners, gates etc. must not be recycled for this casting.

3 MECHANICAL PROPERTIES. (As determined according to ASTM . . .) Mechanical properties shown indicate the minimum performance level required in the casting. The test specimen shall be taken from the designated rim area.

Tensile Strength	205 MPa
Yield Strength (0.2% Offset)	130 MPa
Elongation	7 percent

4 HARDNESS. The hardness of the casting shall be HB60-90 as determined at the designated area.

5 HEAT TREATMENT.

5.1 The castings shall be solution treated and precipitation hardened according to the following specification.

Heat at 540° ± 5°C for eight (8) hours minimum at temperature. Within one (1) minute, quench in hot water (Approx. 70°C) _{212°F}

Age at 155° ± 5°C for two (2) hours minimum at temperature.

5.2 Heat treatment which differs from this specification shall be approved by the purchaser.

6 WORKMANSHIP AND FINISH.

6.1 Castings shall be smooth, well cleaned, free of cracks, inclusions; and other characteristics detrimental to machinability, appearance or performance.

6.2 Minimal but sufficient stock allowance must be provided on castings to insure complete surface clean-up on all designated finished areas. The designated finished areas shall be free from tool marks and scratches which would be detrimental to appearance or performance.

7 INSPECTION AND REJECTION.

7.1 Shipments of material under contract or purchase order quoting this specification shall be equivalent in every respect to samples approved by purchaser, and new samples shall be submitted when changes in formulation and/or processing practices are necessary.

7.2 While samples may be taken from incoming shipments and checked according to this specification, the supplier shall accept the responsibility for shipments meeting the requirements stated without dependence upon the purchaser's inspection.

7.3 Internal porosity to be compared to established standard as agreed to by purchaser and supplier.

7.4 All wheels shall meet the requirements of PQS-10-200.

7.5 Wheels must be purchased from approved sources.

8 MARKING. Identifying marks (manufacturer, mold number, cast date, etc.) shall be agreed to by purchaser.

CADILLAC				
	11-79	-	Issued	AEMS/EMSP
CONTROL DIVISION	DATE	SYM	REVISION RECORD	AUTHORITY

These requirements were developed without considering whether patents may or may not be involved. Therefore, the supplier shall be required to observe patent filings.

ALLOYS USED FOR CASTING TREATMENT

Al-Mg 6

Mg 6 - 6.8%
Mn 0.15 - 0.25%
Si - 0.05 - 0.25%
Zz - 0.05 - 0.15%
Ti - 0.08 - 0.15%
Se - 0.05 - 0.15%

HSTM (COi)

Si - 6.5 - 7.5%
Ug - 0.3 - 0.4%
Cu - 0.10%
Un - 0.05%
Zn - 0.05%
Ti - 0.20%
Sz - 0.025 - 0,035%
Fe - 0.12%

AMX 605

Cn - 5.6 - 6.4%
Cz - 0.20 - 0.55%
Mn - 0.20 - 0.55%
Ti - 0.20 - 0.45%
Zz - 0,08 - 0,25%
Fe - 0.25%

General Motors

Si - 6.5 - 7.5%
Mg - 0.25 - 045%
Cu - 0.20%
Mn - 0.10%
Zn - 0.10%
Ti - 0.07 - 0.20%
Sz - 0,025 - 0,035%
Fe - 0.20%

TYPE	Si %	Mn %	Mg %	Ti %	Sr %	B %						New Re- cycled.	
							Fe %	Cr %	Ni %	Zn %	Cu %		
AlSi12Mg	10,5	90	0,1	90	0,01	-	90	90	90	90	90	75 / 25	
	13,0	0,4	0,3	0,15	0,08		0,30	0,2	0,05	0,10	0,05		
AlSi12Mg	10,5	90	0,1	90	0,01	-	90	90	90	90	90	75 / 25	
	13,0	0,4	0,3	0,15	0,08		0,30	0,2	0,05	0,10	0,05		
AlSi12Mg	10,5	90	0,1	90	0,01	-	90	90	90	90	90	75 / 25	
	13,0	0,4	0,3	0,15	0,08		0,30	0,2	0,05	0,10	0,05		
AlSi12Mg	10,5	90	0,1	90	0,01	≥	90	90		90	90	75 / 25	
	13,0	0,4	0,3	0,15	0,08	0,0001	0,25	0,2		0,1	0,05		
AlSi7Mg	6,5		0,25	0,15	0,02	-	90						75 / 25
	7,5		0,45	0,25	0,07		0,20						
AlSi7Mg	6,5		0,25	0,15	0,02	-	90						75 / 25
	7,5		0,45	0,25	0,07		0,20						
AlSi12Mg	10,5	90	0,1	90	0,01	≥	90	90		90	90	75 / 25	
	13,0	0,4	0,3	0,15	0,08	0,0001	0,25	0,2		0,1	0,05		
AlSi12Mg	10,5	90	0,1	90	0,01	-	90	90	90	90	90	75 / 25	
	13,0	0,4	0,3	0,15	0,08		0,30	0,2	0,05	0,1	0,05		
AlSi7Mg	7,0	90	0,25		0,01	-	90	90	90	90	90	75 / 25	
	8,0	0,1	0,4	0,15	0,08		0,25	0,05	0,05	0,05	0,05		

HK TO: *ALL*

- 50 -

CHEMICAL COMPOSITION

Annex 6

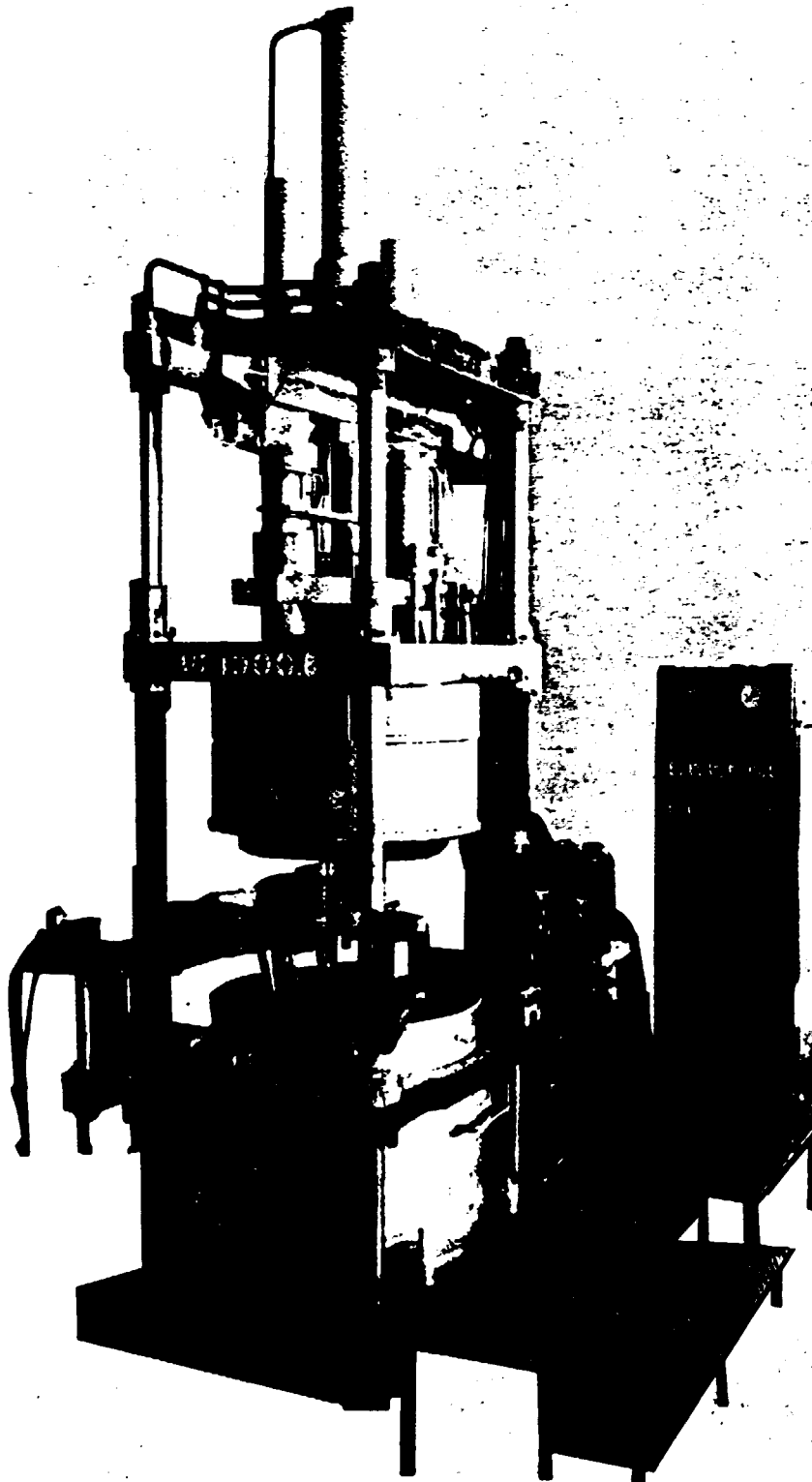
Table 1.

	Si	Fe	Cu	Mn	Mg	Ni	Zn	Pb	Sn	Be	Ti	Al
AlSi4Cu1Ti	-	-	4,2	-	0,15	-	-	-	-	-	0,05	-
	0,3	0,35	5,0	0,1	0,35	0,05	0,1	0,05	0,05	-	0,35	-
AlSi5Cu1Mg	4,5	-	1,0	-	0,4	-	-	-	-	-	-	-
	5,5	0,6	1,5	0,5	0,6	0,3	0,5	0,1	0,1	-	0,2	-
AlSi5Cu3	4,0	-	2,0	0,2	-	-	-	-	-	-	-	-
	6,0	0,8	4,0	0,6	0,15	0,3	0,5	0,1	0,05	-	0,2	-
AlSi7MgFe	6,5	-	-	-	0,2	-	-	-	-	-	-	-
	7,5	0,5	0,2	0,6	0,4	0,05	0,3	0,05	0,05	-	0,2	-
AlSi10Mg	9,0	-	-	-	0,15	-	-	-	-	-	-	-
	11,0	0,6	0,1	0,6	0,4	0,05	0,1	0,05	0,05	-	0,2	-
AlSi12	11,0	-	-	-	-	-	-	-	-	-	-	-
	13,5	0,7	0,1	0,5	0,1	0,1	0,1	0,1	0,05	-	0,2	-
AlSi12Cu	11,0	-	-	-	-	-	-	-	-	-	-	-
	13,5	0,9	1,2	0,5	0,3	0,3	0,5	0,2	0,1	-	0,2	-
AlMg5Si	0,5	-	-	-	4,0	-	-	-	-	-	-	-
	1,5	0,5	0,1	0,5	6,0	0,05	0,2	0,05	0,05	-	0,2	-
AlMg10	-	-	-	-	9,5	-	-	-	-	-	-	-
	0,3	0,3	0,1	0,15	11,0	0,1	0,1	0,05	0,05	0,05	0,15	-

Table 2.

	Si	Fe	Cu	Mn	Mg	Ni	Zn	Pb	Sn	Ti	Al	
AlSi8Cu3Fe	7,5	-	2,5	-	-	-	-	-	-	-	-	-
	9,5	1,3	4,0	0,6	0,3	0,5	1,2	0,3	0,2	0,2	-	-
AlSi12Fe	11,0	-	-	-	-	-	-	-	-	-	-	-
	13,5	1,3	0,1	0,5	0,1	0,1	0,1	0,1	0,05	0,2	-	-
AlSi12CuPa	11,0	-	-	-	-	-	-	-	-	-	-	-
	13,5	1,3	1,2	0,5	0,3	0,3	0,5	0,2	0,1	0,2	-	-
AlSi10MgH	9,0	1,3	-	-	0,15	-	-	-	-	-	-	-
	11,0	1,5	0,1	0,6	0,4	0,05	0,1	0,05	0,05	0,2	-	-
AlSi7MgH	6,5	-	-	-	0,2	-	-	-	-	-	-	-
	7,5	1,3	0,2	0,6	0,4	0,05	0,3	0,05	0,05	0,1	-	-

VP COUNTER-PRESSURE CASTING MACHINES



The VP line counter-pressure casting machines have been developed to meet casting manufacturers' requirements for efficient production of aluminium castings with high mechanical properties.

Since more than ten years they have been finding an expanding application in manufacturing cast components for the automotive industry and other engineering fields in a number of industrial countries – the USSR, the Federal Republic of Germany, France, Hungary, Poland, Roumania, etc..

Principles of casting technology

The main feature of the counter-pressure casting technology is the pressure of a technological gas that acts upon the melt during the die-filling and the solidification of the casting. The pressure is produced both in the airtight die housing and the holding furnace of the machine. As a result of an adjustable pressure differential created between the two vessels the melt from the furnace flows upward through the tube and fills up the die cavity smoothly at a preset rate. The gas pressure acting against the front of the melt which fills the die – the „counter-pressure” – suppresses the release of the gases present in the melt keeping them in a dissolved state thus eliminating the gas porosity in the casting. The solidification of the casting proceeds, the metal in the die cavity being under the action of the gas pressure in the housing and that of the melt pressure at the die inlet. That significantly improves the conditions for melt infiltration and efficient feeding of the casting. An integral structure can be obtained even in thick sections in the upper part of castings without the use of risers. If, however, small risers are used in some cases, they work under the same gas pressure, their efficiency being increased many times. That makes the yield of usable castings from the metal poured very high. Since the whole casting process takes place in closed vessels, the CPC technology provides much better working conditions and minimizes air pollution as well.

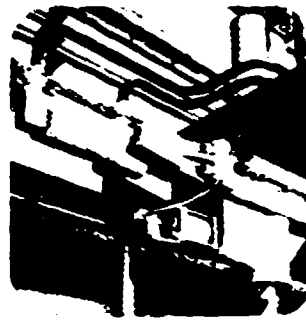
VP counter-pressure casting machines

The VP line machines today embody the experience of more than 15 years of development and operation of counter-pressure casting machines. They are designed to provide simplicity and convenience in operation and maintenance and to meet best the ergonomic requirements and safety regulations. The simple and reliable concept - rugged four tie bar vertical construction with an integrated holding furnace - is developed in a system of carefully considered and well proven technical solutions which provide dimensional stability, accuracy in guiding and positioning the moving parts, high rigidity and dependability of the machine for long time heavy service in foundry conditions.

A VP machine can be operated in four modes - setting, separate operations, semi-automatic and automatic. The control system provides for a single full cycle in a semi-automatic mode and a number of consecutive cycles in a automatic mode to be performed. To assure good reproducibility of the technological cycle the control system allows monitoring and automatic control of the technological parameters as well.

According to the specific production needs the machine can be equipped with a casting unloader, core pull assemblies, a furnace replacing shuttle, a sand mould retraction device, etc. of the wide range of optional equipment available. The control of each device is integrated into the machine control system.

VP 1000 is the medium type most popular and widely used machine of the line. It's latest version VP 1000.8.2 is being supplied since 1983. It incorporates all general design features of VP concept.



Two-piston hydraulic transport cylinder

▲ Clamping device - self-detaining wedges, hydraulically operated

Safety scotch for preventing premature free-fall of the moving plate

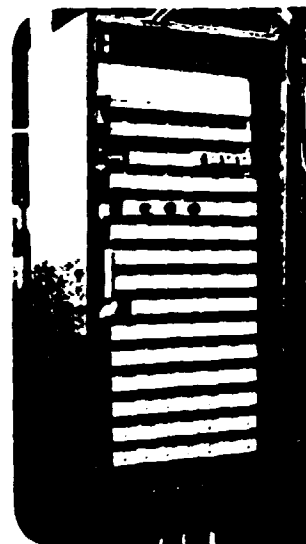
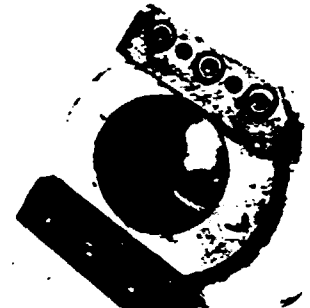


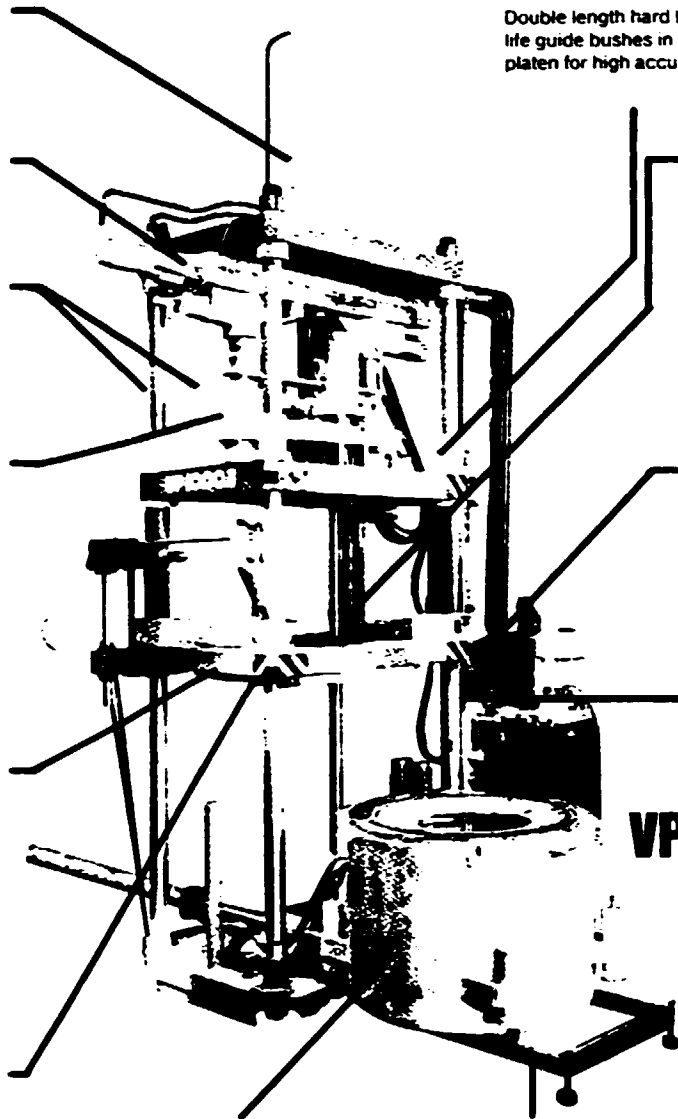
Hydraulic ejection system with adjustable speed, force and stroke



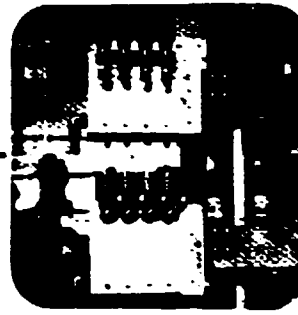
▲ Freely set up lid, easily accessible furnace for any kind of work. Simple user tube (ceramic or cast iron) attachment, minimum change-over time

Special guide bushes fitting to the intermediate plate for compensating thermal expansion of the construction



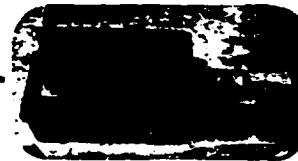
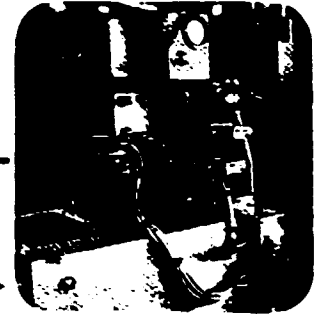


Double length hard bronze long life guide bushes in the moving platen for high accuracy guiding.



Air/water cooling system, normally up to six independent die cooling circuits with control and visual indication of the cooling fluid flow rate. Each circuit automatically controlled (on/off) either by time, temperature or both

Separate hydraulic power pack with controls assembled in a block. Standard hydraulic components intended for water-glycol fluids.



Intermediate platen double-position hydraulic locks for fixing in down position or lifting together with the moving platen

VP 1000.8.2

Holding furnace with crucible, electric resistance heating, heavy duty welded steel housing manufactured to Pressure Vessel Standard. Immersed thermocouple assembly, heating elements safeguarding control circuit thermocouple, crucible leakage detector

Folding rail pair and hydraulic retraction unit. Automatic positioning of the furnace in and out of the machine by a simple button press

The electric system controls all the machine movements in every mode of operation, the movements of the casting unloader, the core pull cylinders, the furnace retraction unit and the replacement shuttle. It controls the gas cycle performance, the melt temperature in the furnace and the temperature of the main die areas as well.

The free standing control cabinet which accommodates all the components as relays, adjustable timers, thermoregulators etc., is sealed against contamination. All terminals are numbered for quick and easy maintenance. Solid state and microprocessor based versions are available at request

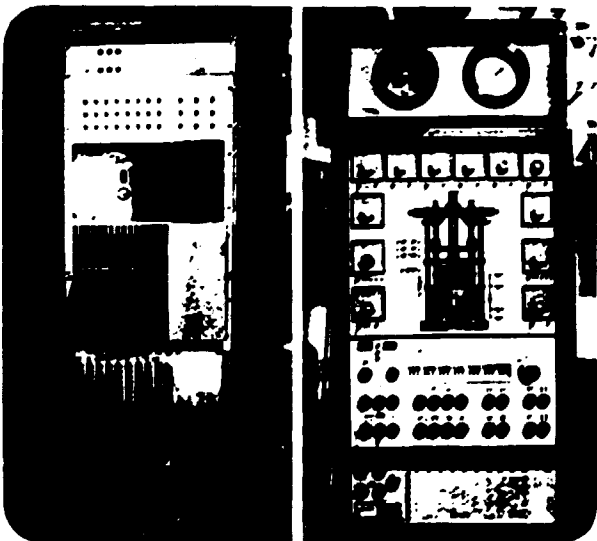
Display panel visualizing all the steps of the cycle in their sequence with control lights and an operator control station for single cycle operation and emergency stop are available as optional

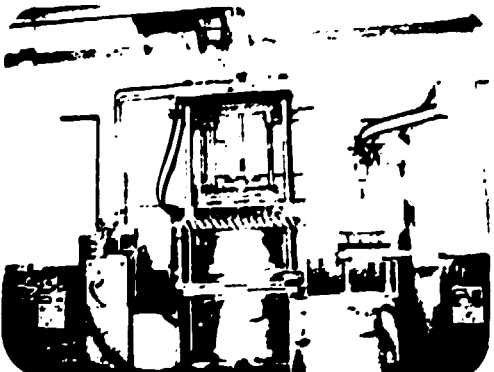
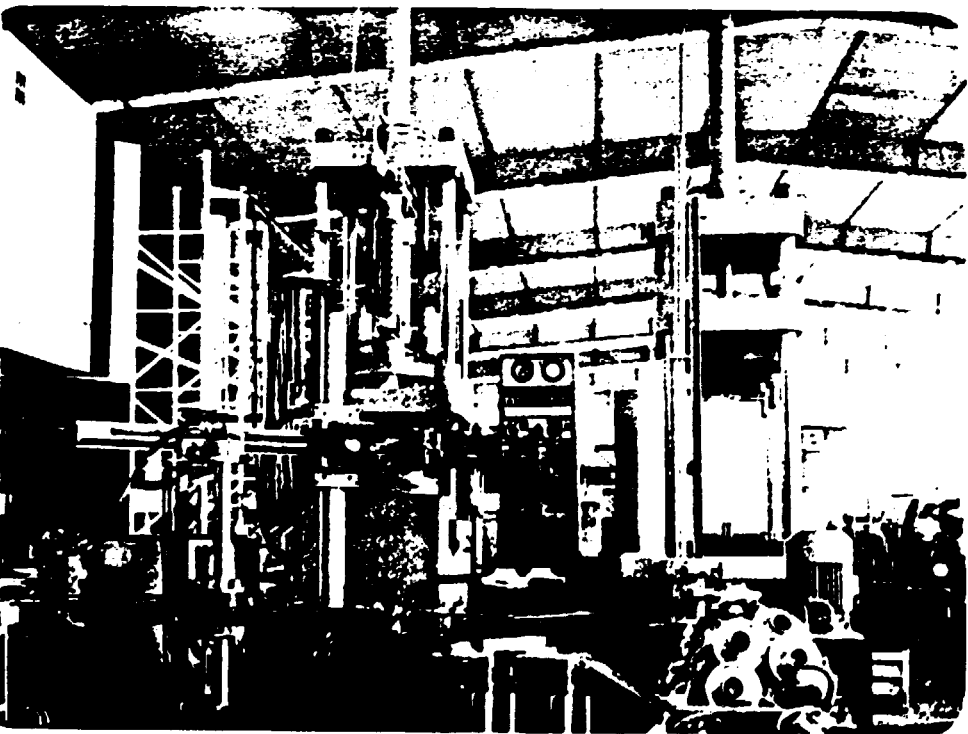
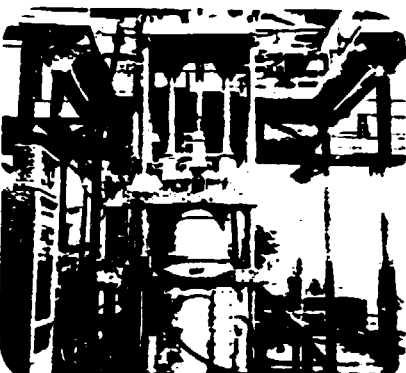
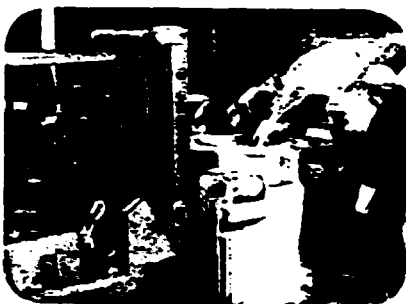
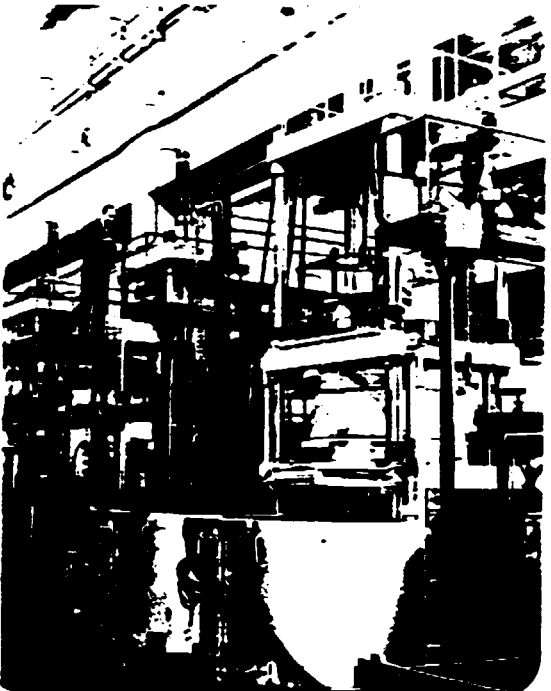
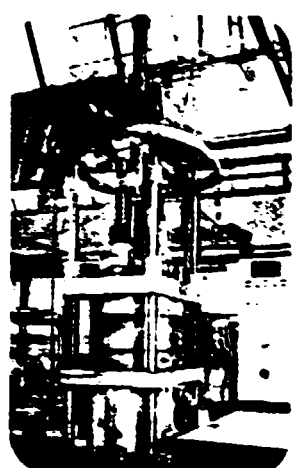
Standard supply - as to European standards, alternative local variations can be considered, if specified

Safety interlocks

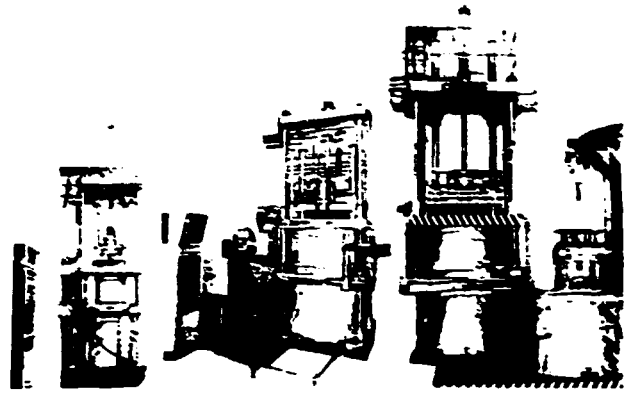
Hydraulic, pneumatic and electric interlocks prevent unprogrammed closing and opening of the machine or metal injection in all modes of operation and every programme

Fully interlocking electromechanical or infrared optronic machine guarding is available at special request





TECHNICAL SPECIFICATION



	VP-400.3A	VP-1000.8.2	VP-1250.2
1. Overall machine height	4910 mm	5530 mm	6040 mm
2. Total overall width (floor area)	2850 mm	3710 mm	3750 mm
3. Total overall length (floor area)	2200 mm	5000 mm	5825 mm
4. Weight without tooling and hydraulic fluid	10000 kg	17000 kg	19000 kg
5. Metal capacity of the furnace	250 kg	500 kg	500 kg
6. Die carrying platens size	820 x 1250 mm	1300 x 1600 mm	1800 x 1400 mm
7. Space between tie bars	470 x 1020 mm	900 x 1300 mm	1055 x 1455 mm
8. Die height (max.)	600 mm	800 mm	800 mm
9. Die housing diameter (max.)	600 mm	1000 mm	1250 mm
10. Moving platen stroke	800 mm	800 mm	1000 mm
11. Opening force	190 kN	420 kN	500 kN
12. Clamping force	700 kN	820 kN	1040 kN
13. Ejector platen stroke (max.)	110 mm	150 mm	150 mm
14. Ejection force (max.)	300 kN	600 kN	800 kN
15. Air pressure required (supply)	0,6 - 1,0 MPa	0,6 - 1,0 MPa	0,6 - 1,0 MPa
16. Operating pressure of the machine	0,63 MPa	0,63 MPa	0,63 MPa
17. Operating pressure of the pneumatic system	0,45 - 0,60 MPa	0,45 - 0,60 MPa	0,45 - 0,60 MPa
18. Air consumption per cycle	3 - 4 Nm ³	4 - 8 Nm ³	9 - 12 Nm ³
19. Cooling water consumption (without die cooling)	20 - 25 dm ³ /min	25 - 35 dm ³ /min	30 - 40 dm ³ /min
20. Cooling water pressure	0,20 - 0,40 MPa	0,20 - 0,40 MPa	0,20 - 0,40 MPa



List of people met:

- Mr. Michael Boutoussov, Substantive Officer, UNIDO VIENNA
- Mr. Theodor Tivonov, President, Metal Technology, Pleven, Bulgaria
- Mr. George Popovski, Deputy Plant Manager, Alu Cast Plant, Pleven, Bulgaria
- Mr. Michael Slavkov, Chief Energy Engineer
- Mr. Panaiot Ivanov, Deputy Director
- Mrs. Evangelitza Wankowa, Chief Laboratory
- Mrs. Tanja Shoumkova, Staff member, Metal Technology, Sofia Bulgaria
- Mrs. Naida Nickolova, Meteorologist, Meteorological Station, Pleven, Bulgaria
- Dr. Nadra Wasilawa, M.D., Hygiene Inspection, Pleven
- Mrs. Itzetzta Shopova, Chemist, Hygiene Inspection, Pleven
- Mrs. Swetla Petkova, Phisicist, Hygien Inspection, Pleven
- Mrs. Ionka Angelova, Director, Bulgarian Environmental Protection Agency (BEPA), Pleven Bulgaria
- Mrs. Mariane Zakova, Chief Expert Radiation, BEPA
- Mrs. Elka Dodeva, Chief Expert Information, BEPA
- Mr. Veniamin Ptzov, Chief Expert Chemical Industry, BEPA
- Mrs. Rumiana Peeva, Chief Expert Chemical Laboratory, BEPA
-

List of References:

Boutoussov, M. " The Integrated Quality Concept, An Approach to
Balanced Industrial Activity", Resources Policy,
Butterworth Ltd., England 1982

General Motor Engineering Standards, Metallurgical Requirements
for cast aluminium wheels, Cadillac, 1979

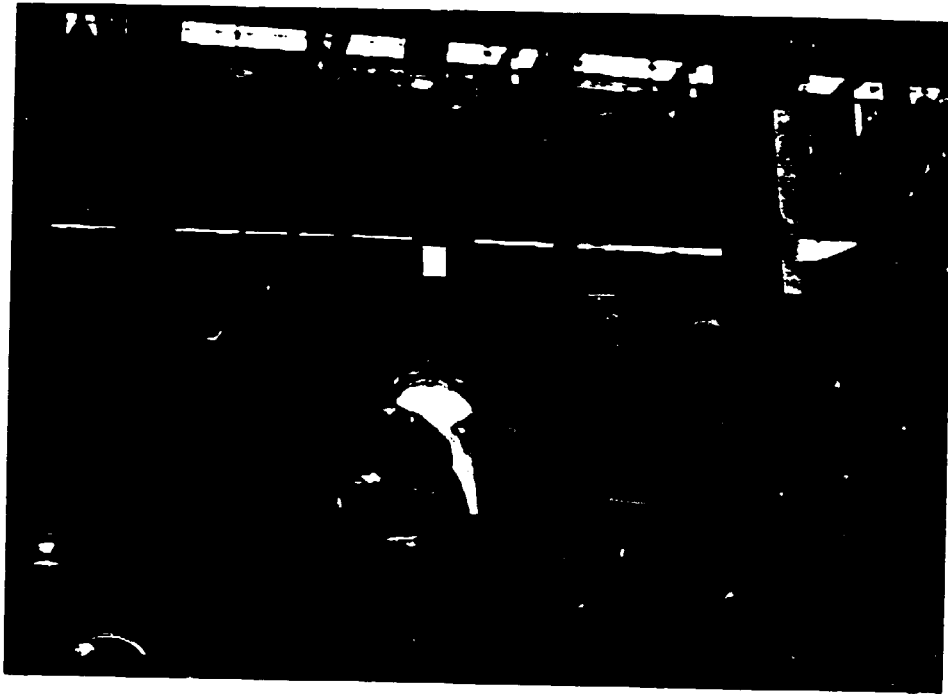
Industrial Ventilation, a Manual of recommended Practice,
American Conference of Governmental Industrial Hygienists,
Lansing, Michigan, USA

Stankovich, I, "Computer Program for Air Pollution Control",
Manual for IBM PC, Piedmont, California, USA

Stankovich, I, "Pitch Fume and Dust Scrubber", Bulk Solids
Handling Vol.5, Nr. 3, Germany 1985

Stankovich, I, "Materials Handling Handbook", Section 28, John
Wiley & Sons Inc., New York 1984

Stankowich, I, "Problems in Control of Particulates in Bulk
Material Handling", ASME, Atlanta 1977, USA



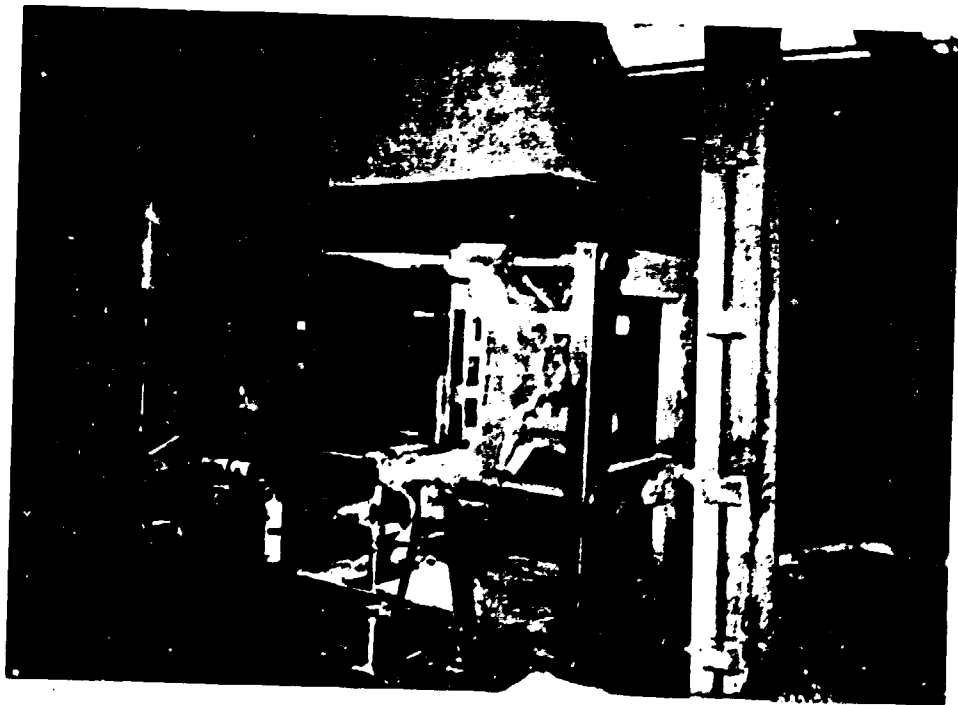
PICTURE NO. 1 Melting furnace



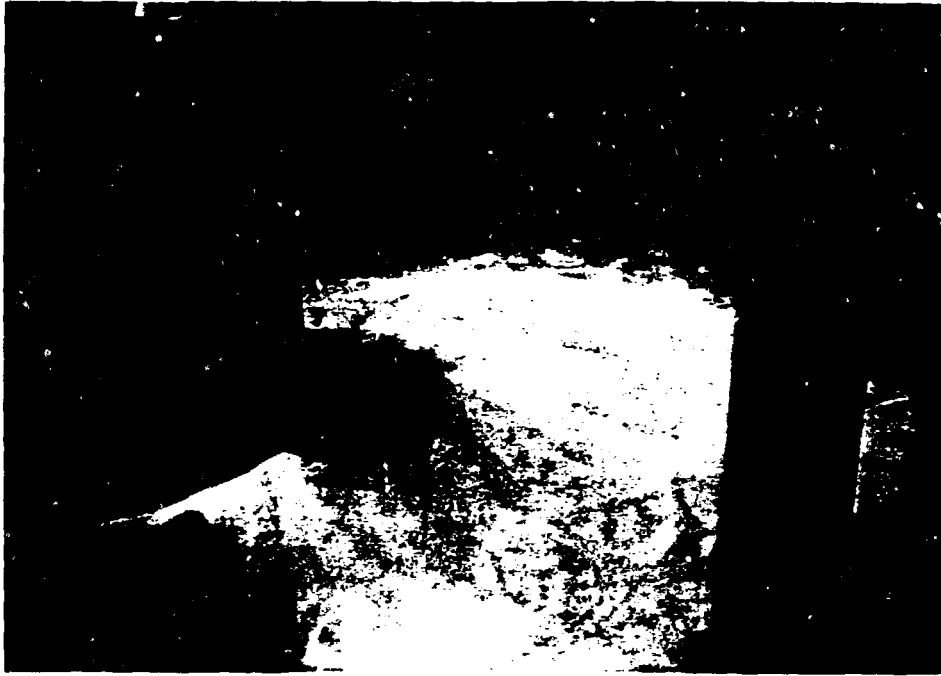
PICTURE NO. II Counter pressure casting



PICTURE NO. III High pressure casting



PICTURE NO IV Core machine



PICTURE NO. V Core sand storage



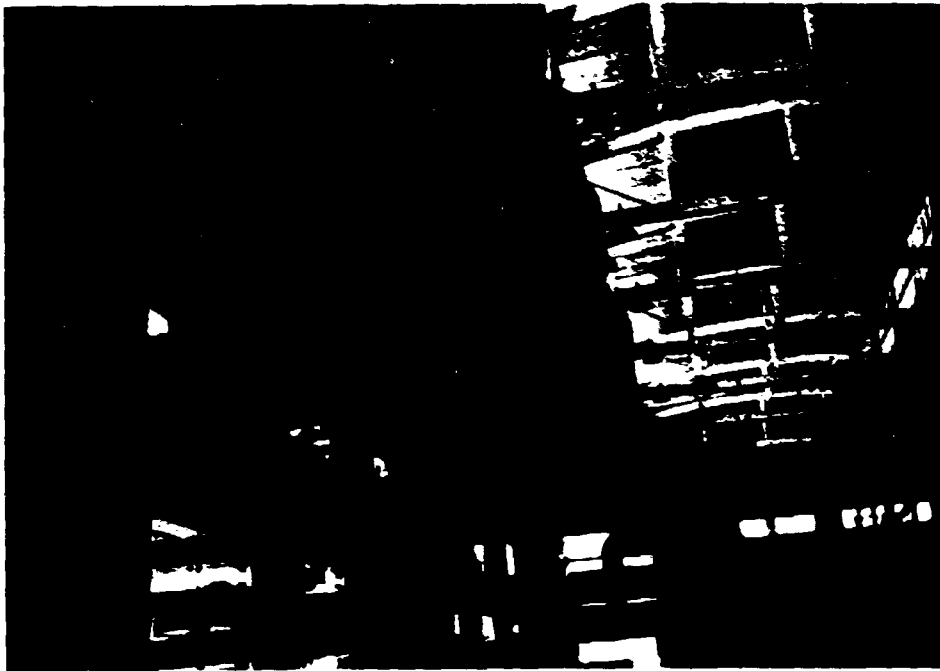
PICTURE NO. VI Hand forming



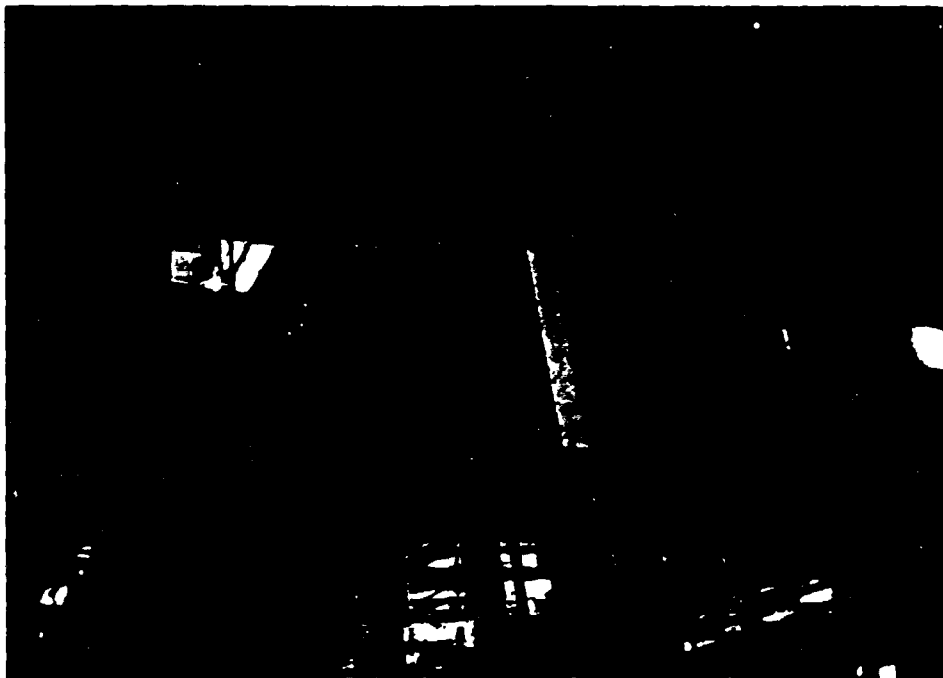
PICTURE NO. VII core storage



PICTURE NO. VIII Counter pressure casting with modification furnace



PICTURE IX Aspiration system in melting area



PICTURE X Aspiration system detail



PICTURE NO. XI "BMD" bag-filter



PICTURE NO XII filter bag