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ELECTRONIC AND OPTICAL REPAIR AND MAINTENANCE CENTRE

DP/VIE/80/039

VIET NAM

Technical report: Setting-up of a precision glassblowing workshop*

Prepared for the Government of Viet Nam
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Albert Zwart,
consultant in precision glassblowing

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Vienna

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Summary

Under my supervision the two petrol gas-plants were installed. Because of poor construction many problems had to be overcome to get them in working condition. After completion of the installation of the machinery, copper pipelines for gas, air and oxygen were installed in the workshop. Thereafter I started the training program. I gave instructions on a cutting-, a drilling- and a grinding-machine. Instructions on the electrical cracking unit, the optical glass-strain detector and the dividing machine have also been given.

Having done this I started to make small item of glass e.g. parts for destillation apparatus, pipettes, burettes, connections for glass etc.
I installed also a mercury cleaning apparatus. A mercury destillation apparatus was designed.

The cooperation with the University of Hanoi during my stay there was very good. We were able to obtain many necessary materials from them.

Acknowledgement

The consultant wishes to express his gratitude to the Project Staff, both national and international, as well for their valuable efforts as for their assistance. Their contributions to the fulfilment of his mission are greatly appreciated. He wishes to express his special thanks to:

Mr. Son (NPD)
Mr. Suri (CTA)
Mr Tinh (director)
Mr. Duc (deputy director)
Mr. Hung (secretary)
Mr. Quang (translator)
Mr. Chinh (in charge of glassworkshop)
Mrs.Ha)
Mr. Tuan An)
Ms. Lieu) glassblowers.

Job Description

Being a consultant in precision glass-blowing I discussed with UNIDO the aims of this mission. They are as follows:

1. Assistance in the setting-up of a Precision Glass-blowing Workshop;
2. Training of the technical staff of glass-blowers in the repair and construction of blown glass apparatus. Emphasis should be laid on the construction of simple items from glass e.g. burettes, hydrometers, pipettes, parts for destillation apparatus, etc.;
3. drawing up recommendations concerning the purchase of equipment for the workshop. The consultant is expected to inform the Government of the Socialist Republic of Vietnam of his findings and recommendations.

Workscheme of A. Zwart

Project DP/VIE/80/039 Hanoi

14 Oct.	Arrival
15 Oct.	Meeting NPD/CTA. Familiarization with glass workshop
16 Oct.	Unpacking of Petrol Gasplants
17/18	Sat/Sun, weekend
19 Oct.	Design of workshop. Design of electrical installation for machinery 220V/380V
20 Oct.	Installation of the glassblow tables
21 Oct.	Installation of the machinery
22 Oct.	Installation of the machinery. Visit to the University of Hanoi in order to get needed materials
23 Oct.	Visit to store of UN for materials. Installation of the cutting-, drilling-, and grilling-machinery
24/25	Sat/Sun, weekend
26 Oct.	Installation continued
27 Oct.	Installation continued
28 Oct.	Installation of the small petrol gasplant
29 Oct.	Demonstration of the small gasplant to visitors
30 Oct.	Installation of the automatic on-off switch for the gas-plant. Workshop made ready for visitors-day
31 Oct.	"Open day"
1 Nov.	Sunday/weekend
2 Nov.	Installation of copper tubing for the supply of gas, oxygen and air to the glassblow tables
3 Nov.	Installation of the electrical circuits. Training on machinery
4 Nov.	Installation finished, training on cutting of glass
5 Nov.	Training on machinery
6 Nov.	Visit to the store of the University. Installation of the compressor. Burners connected to tubes and the system tested on leaks
7/8	Sat/Sun, weekend
9 Nov.	Delivery of an empty oxygen bottle and materials from the University
10 Nov.	Training on graduating machine. Oxygen tubes tested with air pressure on 6 at.
11 Nov.	Glassblow tables made ready. Visits of guests
12 Nov.	Demonstration of the use of burners. Visit with CTA of the shop of the University to see the annealing furnace and the acetylene generator
13 Nov.	Instruction on the cutting and drilling machines
14/15	Sat/Sun, weekend
16 Nov.	Installation of the big petrol gasplant, many parts of this machine found missing
17 Nov.	Demonstration of the making of transfers on glass
18 Nov.	Visit to the University store to get small materials for glasswork. Much time spent to locate leaks in the big gasplant

19 Nov.	Oxygen cylinder got filled.
	Installation of the sand blasting machine
20 Nov.	Oxygen flame operation done for the first time.
	Training on burners with oxygen for hard and soft glass.
21/22	Sat/Sun, weekend
23 Nov.	Training.
	Installation of the big gasplant
24 Nov.	Visit to the glassblowers of the University of Hanoi.
	Installation of the valve on the big gasplant.
	Discussion about the gashouse with CTA
25 Nov.	Training
26 Nov.	Elimination of a leak in the big gasplant.
	Training on the small gasplant
27 Nov.	Training continued
28/29	Sat/Sun, weekend
30 Nov.	Training
1,2,3,4	Dec., Training continued
5/6	Sat/Sun, weekend
7,8,9,10	Dec., Training continued
11 Dec.	Debriefing at UNDP Hanoi
16 Dec.	Departure.

Activities and experiences

After a meeting with the NPD and the CTA the consultant has made a program for the work to be done in two months as well as a demonstration program for a "visitors day" on October 31, 1987. A layout for a glass-blowing workshop has been drawn and discussed thoroughly (ANNEX I and II). Also an electrical layout has been drawn and lists of material required drawn up. Deliveries of ordered items were checked and controlled if they were in store, including the Herbert Arnold stock. Lists of required items were prepared.

The project store has provided materials and tools for the glassblowing workshop. We made a selection of different types of burners which have been installed in the workshop. I visited the store of the University of Hanoi for borrowing small materials e.g. copper, pipes, valves, electrical installation parts and an empty cylinder with reduction valve for oxygen.

Under his supervision the four glassblow tables were installed in such a way that an easy distribution of gas, air and oxygen was possible. The copper tubes for gas had a diameter of 28 mm and those for oxygen of 15 mm and were laid under the tables. The weldings were made with tin. The whole system was tested with air under a pressure of 6 atomospheres. The small "petrol gasplant" was installed as fast as possible in the glassblowing workshop with a rubber tube to the burner in view of the "visitors day". One day before that day there was a good production of gas for use by the burners.

There were some problems because the machinery was incomplete. The compressor with reduction valve was installed in the workshop and connected to the burner with a tube. At a later date the compressor was removed to the gashouse. The city gasburner of Herbert Arnold did not operate properly on the petrol gasplant. The city gasburner could only burn properly on air and gas. The allgas-burner of Herbert Arnold on the contrary gave good quality of the flame, as well on propane as on butane and also on petrolgas as was shown. Under his supervision the cutting-, grinding- and drilling-machines and the dividing machine, the electrical cracking on-off and the optical glass-strain detector were installed.

The cutting-machine was assembled and its waterpump was installed. It was shown how to use and install the diamond tipped wheel in the right position. The cutting of glass tubes and plate glass under angles of 25-45° and 90° was demonstrated. We tried to use the waterpump of the cutting-machine also for the drilling-machine, but the water pressure provided by this pump was insufficient for both the drilling- and the cutting-machine. Two types of drills were available; the diamond drill proved to be the best and gave a better result.

The ginding-machine can be used to make ground glass connections and ground glass valves. The speed of the machine can be changed by means of a control knob. A wash basin was installed. The connection to the water mains was not immediately possible.

Instruction was given on the operation of electrical cracking-off. Instruction was given on the operation of the optical glass strain detector. The interpretation of the various colour patterns was shown. Instructions were given on relief of excessive strain in the glass components by means of an annealing furance.
The empty oxygen gasbottle obtained from the University of Hanoi was filled at an oxygen factory.
After "visitors day" we have also installed a large petrol gasplant, although many problems were encountered at the installation. Some problems were caused by the fact that the petrol gasplant was incompletely shipped to Hanoi. We have put a valve in the line between the machine and the tank and a valve in that between the tank and the gas-nebulizer. The system was found to leak and the safety valve was working in the wrong direction! Now the gasplant is operational.

Together with Mr. Suri and Mr. Chinh we visited the glassblowery of the University of Hanoi to have a look at their furnace and acetylene generator.

The consultant has given instructions, lectures and demonstrations on the use of all the machinery and has shown the important features of every machine to the staff of the glassblowing workshop.

Findings

The situation at the beginning of this mission was such that the glassblower operated a kerosene gasplant (not to be mixed up with the later installed petrolgas (gasoline) plant). The necessary air was provided by a a footpump which had to be moved 38000 times a day. The public electrical powerplant is breaking down frequently. A switch over to another public powerplant would give a considerable improvement.
Voltage fluctuations and power cut are a common occurrence. The voltage is not stable and running the motors on a low voltage will easily damage their windings. The installed machine requires daily attention. For these reasons it will be impossible to make complex glass items. Provision of a furnace is necessary.
A lot of soft glass is in storage at the center facility. The quality of this glass is poor, however a new glass factory will be operational in about two years (heard from UNIDO-Vienna). For the manufacturing of pyrex objects the use of oxygen instead of air is a necessity. At the moment only soft glass can be handled. It is most desirable to install facilities and machines to enable repair of larger glass objects.
No gascylinders for oxygen are available. The quality of the flame will be much better when oxygen is used instead of air. The glassblowers are able to make graduations on glasstubes and plates but are not able to design letters and indications. It is necessary to have a pantograph.
In the workshop bigger glasswork was also lying, waiting for repair. For such work a small glassblow lathe is useful. With such a machine one can repair and make many more items. It is required that the drilling machine has a separate waterpump providing sufficiently high water-pressure.

Recommendations

Safety at the worksite

At the beginning of my mission the situation was as follows:
The greatest danger in the workshop was that the big and small petrol gasplant were placed within the glass-blowing workshop. In case of leaks we were confronted with a very dangerous situation. Therefore it was necessary to build a gashouse outside the building with ventilation on all sides. It was also necessary to make a door directly from the workshop to the gashouse. The electrical wiring in the gashouse should be explosion proof.
During my mission all demands have been fulfilled.
On the workplace foam and in the gashouse fire protection and foam (CO_2 type) was needed. Instruction on the use of fire extinghuishers was needed. 18" exhaustfans on the roof are still necessary in order to draw the gases into the open air. Roomfans are necessary for temperature regulation during the summer. The ceiling has to be painted in a white colour. 380 V must have an indication whether or not the 3 phases are operational.

Teaching in glassblowing

There is a school for glassblowing in Leiden (Leidse Instrumentmakers School) The Netherlands, but a good training requires 1 or 2 years. The schoolfees are approximately 1000 $/year. The other possibility is 5 till 6 months training in the Physical Laboratory of the University of Amsterdam. Some knowledge of the English language is required for the visiting students. It is also possible to train the Vietnamese glassblowers in Hanoi.

Note: The consultant will forward to the CTA a list of books about scientific glassworks when he is back in The Netherlands.

Maintenance schedule for the machinery

Petrol gasplant
Must be cleaned once a month. The petrol of the gasplant must be filtered. Sometimes the quality of the oil is insufficient and the oil is very dirty. Filtration of the oil is necessary.
Compressor
The oil-level must be checked weekly. The oil must be changed for the first time after 10 hours of operation.

Drilling-, and cutting-machine

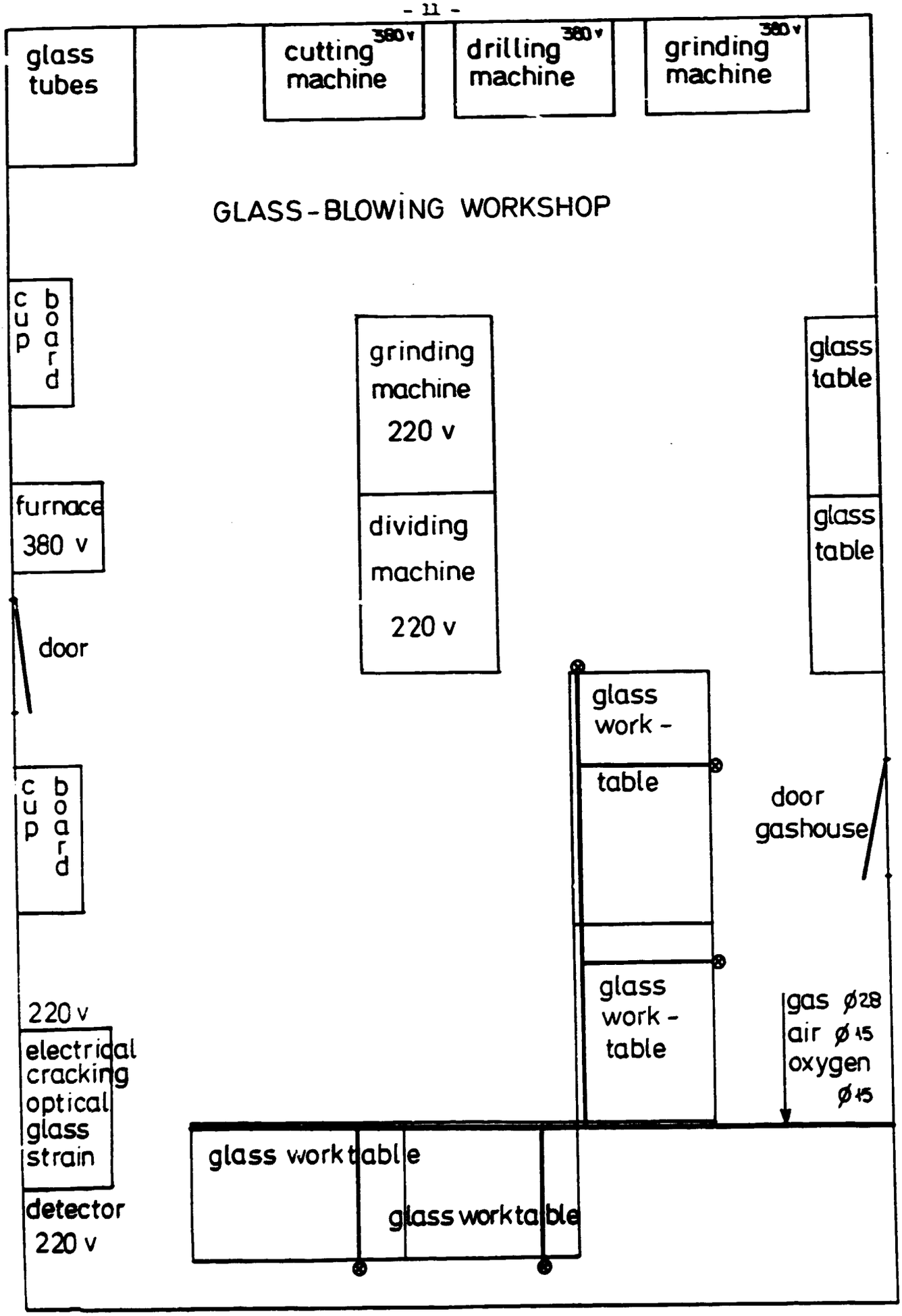
The diamond tools must be cleaned by sandstone before use. When the watertanks are empty they have to be filled with water and special oil on a basis (10:1).

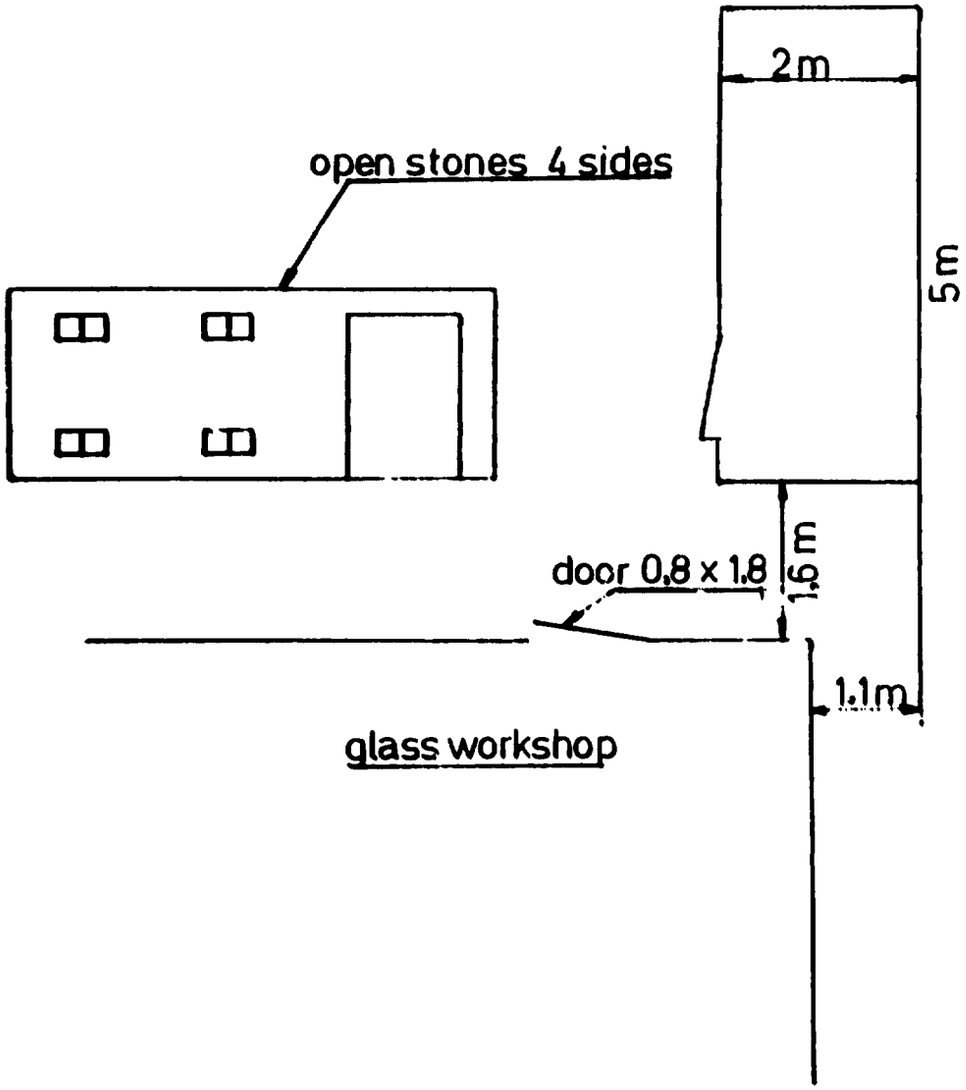
Drilling-machine
Must be used with the right speed according to the different drill diameters (see instruction manual).

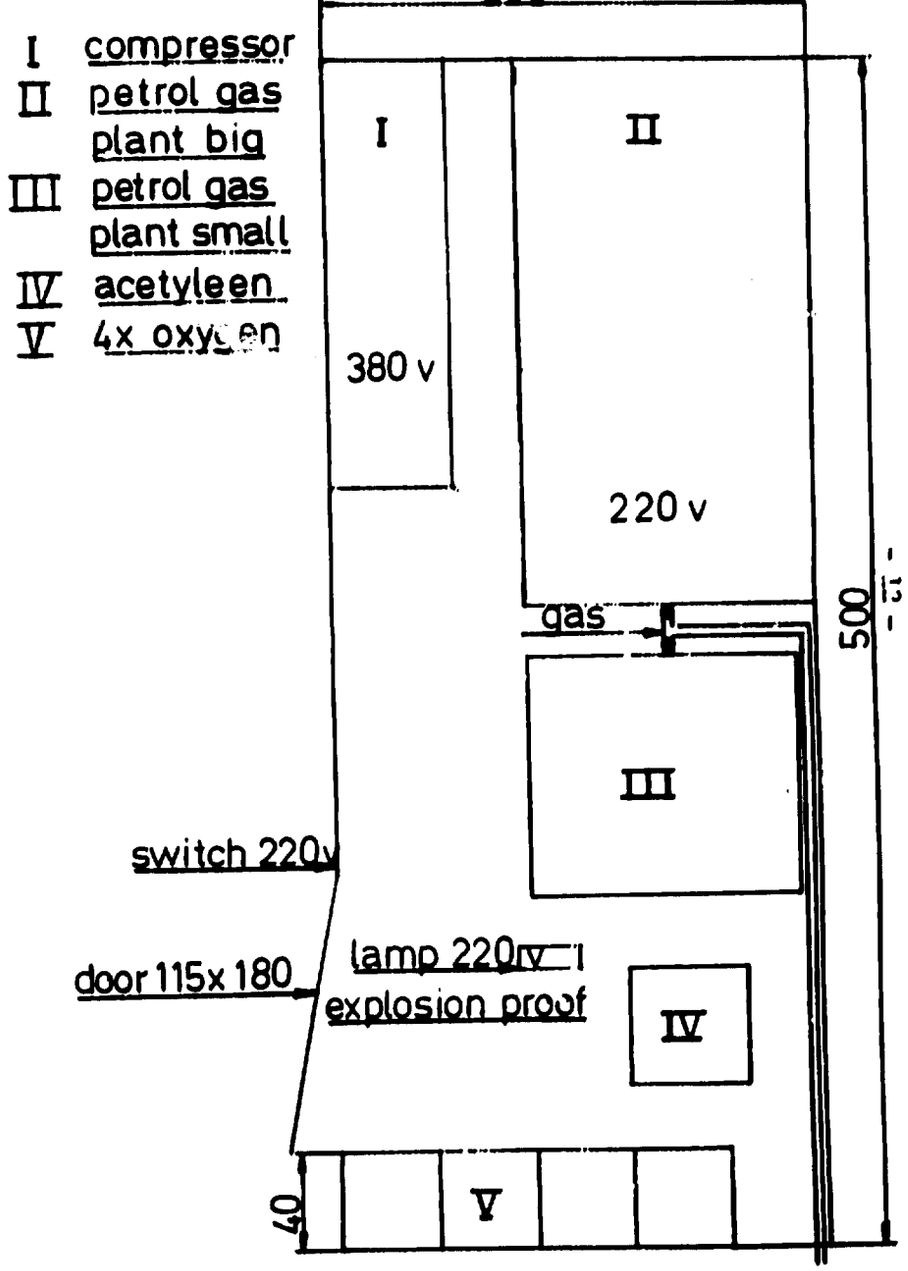
Grinding-machine
Glasstables
Dividing-machine
Electrical cracking
Optical glass straindetector
} have to be cleaned once a week

List of required items

Furnace max. temp. 800 degrees		± 2500 $
Pressure Reduction valve for oxygen		± 150 $
4 Cylinders oxygen		± 800 $
Books scientific glassworks		± 150 $
Pantograph Art Nr. 401		± 4000 $
Waterpump with water collecting tank for drilling-machine art. nr. 561/01		± 1300 $
Glasstubes hard glass of 1.5 m from Schott-Ruhrglass		
Glassblowlathe Universal		±40000 $
Standard alcoholmeter	(0-50) class 1 (X2)	?
" "	0-10, 10-20, 20-30)	
" "	30-40, 40-50, 50-60)class 0.1	
" "	60-70, 70-80, 80-90) (X2)	?
" "	90-100)	
" "	(50-100) class 1 (X2)	?
Densimeter	(-10-0-70) (X2)	?
Glassvalves	20x	± 150 $
Acetylene generator		± 750 $


glass tubes
cutting machine 380 v
drilling machine 380 v
grinding machine 380 v
GLASS-BLOWING WORKSHOP
cup board
grinding machine 220 v
glass table
furnace 380 v
dividing machine 220 v
glass table
door
glass work - table
door gashouse
cup board
glass work - table
220 v
electrical cracking optical glass strain
gas ø28
air ø15
oxygen ø15
glass worktable
glass worktable
detector 220 v


2m
5m
open stones 4 sides
door 0,8 x 1,8
1,6m
1,1m
glass workshop


gas building
200
I compressor
II petrol gas plant big
III petrol gas plant small
IV acetyleen
V 4x oxygen
I
II
380 v
220 v
gas
500
III
switch 220v
door 115x180
lamp 220v
explosion proof
IV
40
V