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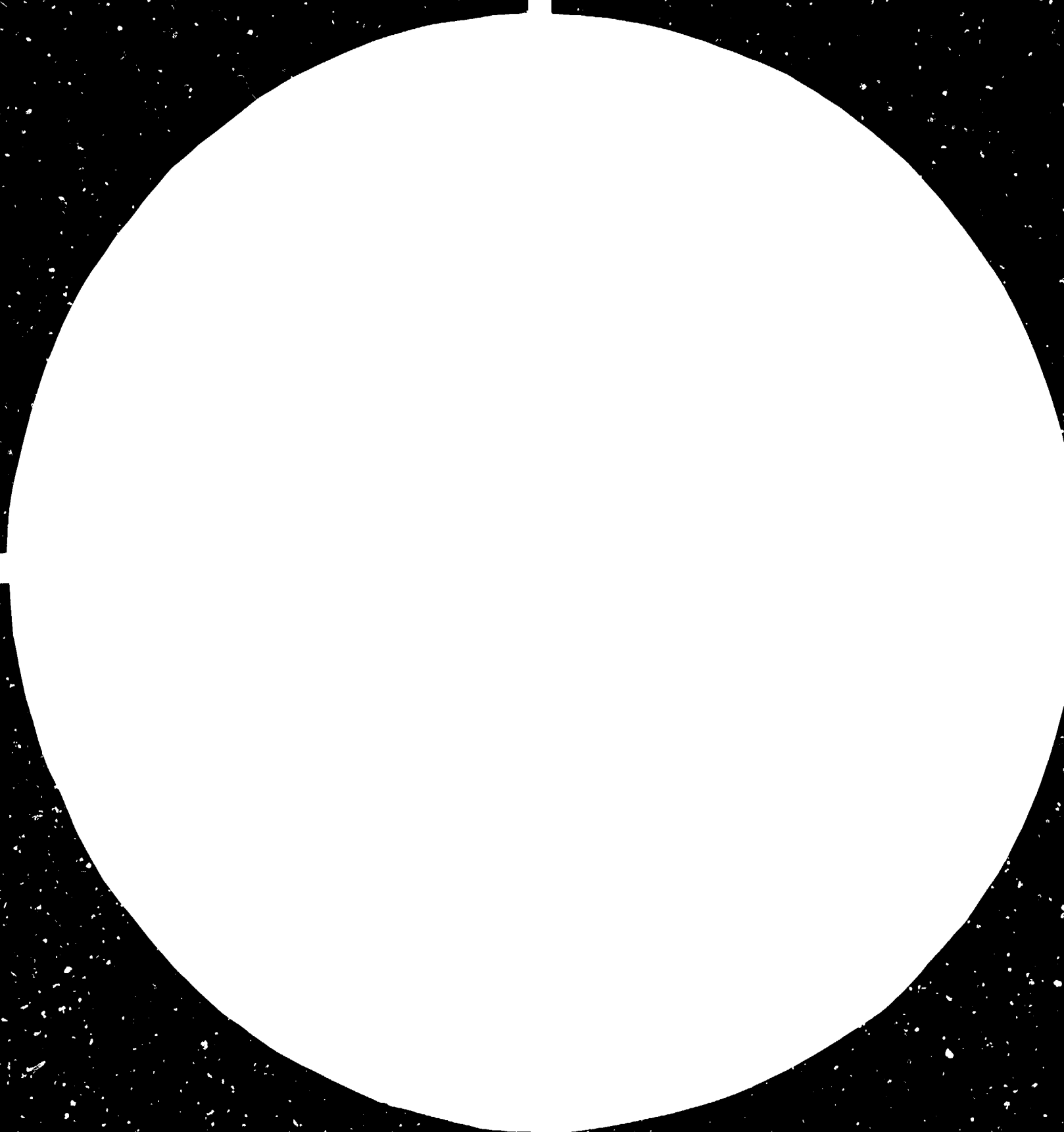
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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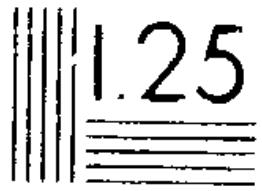
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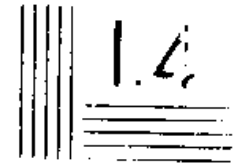
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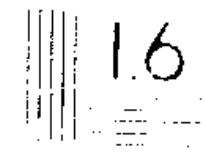
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13 April 1983
English

Iraq

ASSISTANCE TO THE GLASS INDUSTRY

DP/IRQ/79/001

IRAQ

Terminal report

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

Based on the work of H. Persson, expert in gas control systems

United Nations Industrial Development Organization
Vienna

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Explanatory notes

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The monetary unit in Iraq is the Iraqi dinar (ID). During the period covered by the report, the value of the Iraqi dinar in relation to the United States dollar was $US 1 = 0.31.

ABSTRACT

During his second assignment at Ramadi, Iraq, from 15 March to 27 May 1983 within the framework of the project "Assistance to the glass industry" [illegible], the team leader reviewed the work that had been carried out since the beginning of the project in August 1979. The results were given in a progress report, which was discussed at a Tripartite Review Meeting at Ramadi on May 16.

There were two experts at Ramadi, a glass-forming machine expert and an electronic engineer. Their work was found satisfactory by the technical management.

Advice was given to the management regarding decoloriding of glass for tableware. The team leader recommended the addition of arsenic as a decolorizer. It was thus possible to get a reasonably well decoloriced glass using arsenic, selenium and cobalt. Most important, however, was to stop using dirty cullet and brown sand containing a high percentage of iron.

The quality of the sheet glass was not found satisfactory. One of the main problems was that dolomite varied too much in its chemical composition. There were also problems with the sand and with the homogeneity of the batch. It was recommended to keep a thorough check on the composition of the raw materials and the batch. When making sheet glass it is very important to keep all conditions constant. The viscosity points of the glass must be within specified limits.

There were still many problems in the new batch plant. The team leader recommended that a qualified engineer should be selected as a batch plant manager.

The furnace efficiency was very low at Ramadi. Two furnaces instead of four should be used for the tableware glass. One furnace should serve four to five machines and not two to three. This would reduce the quantity of oil used per ton of glass, the number of personnel, improve the working conditions in general and considerably reduce the cost of glass products

per unit. It was also recommended to evaluate the use of recuperative furnaces instead of regenerative furnaces for the tableware glass. Recuperative furnaces are cheaper to build, have a better fuel efficiency and are easier to operate than regenerative furnaces. In particular this applies to furnaces with capacities of less than 100 tons per day.

It was suggested to use a new composition for the container glass. A glass with lower alkali content would be cheaper and the machine speed could be increased.

Recommendations were given regarding safe distribution of fuel oil and gas. Various steps to prevent a fire were also discussed. Literature on this and on gas leakage detectors was given to the department concerned.

The new laboratory has all the necessary equipment to control raw materials, glass and glass products. There is, however, a shortage of skilled personnel.

The team leader recommended strongly that the glass company should consider entering into a technical assistance agreement with a well qualified glass manufacturing company. UNIDO could give advice regarding such an agreement, which could be part of a new UNIDO project.

CONTENTS

INTRODUCTION

The team leader was at the duty station from 15 March to 27 May 1983. Two UNIDO experts were working at the glass factory during this time, F. Allison, expert in mechanical maintenance of IS machines and F. Dicara, expert in electronic control devices.

The UNDP budget for experts for the project is 60.6 man-months. By the time the two experts and the team leader complete their present assignments, the input of experts will have been 50 man-months. An expert for preventive maintenance (6 man-months) and an expert for gas distribution (3 man-months) are under consideration.

Two fellowships (4 man-months) have been completed and the parties have agreed that there should be no more fellowships.

The production in the glass factory during the visit of the team leader was as follows:

Furnace number	Capacity (tons/day)	Output (tons/day)	Machine	Products
1	45	31	2 MDP, H-24	Tableware
2	45	19	1 MDP	Tableware
3	35	16	1 MDP, H-28	Tableware
4	35	16	1 MDP, H-28	Tableware
5	50	40	2 IS6SC	Containers
Sheet	85	67	3 Fourcault	Sheet glass

In addition sodium-silicate ($Na_2O \cdot 2SiO_2$) glass was produced. This recuperative furnace had an output of 13 tons of glass per day.

A new line for gold decoration of tea tumblers was installed during the assignment.

The new glass container factory with three furnaces and nine IS single gob machines had not yet been started. Preparations were being made and it was planned to start one furnace and two machines during the third quarter of this year.

The new batch plant at the old factory had been in operation since October 1982.

The quantity of glass produced had doubled since the first visit of the team leader. The quality of the products had also improved.

One of the main problems for the management of the glass factory was to find qualified Iraqi personnel. A considerable proportion of the employees came from China, Egypt, Poland and some other countries.

I. RECOMMENDATIONS

1. Although the quantity of glass products has increased and the quality has improved since the project started in August 1979, the efficiency of operation is still quite low. In order to achieve higher efficiency, i.e. increase the output of glass products and reduce the cost per unit, and in order to obtain a good result using modern technology at lowest possible price the Ramadi Glass Factory with the assistance of UNIDO should enter into a technical assistance agreement with an advanced glass manufacturing company.

2. The performance of foreign workers and engineers in the glass factory is very good. More training and teaching should, however, be given to Iraqi personnel.

3. The number of tableware furnaces should be reduced from four to two and the furnace efficiency should be increased. There should be four or five machines at each furnace.

4. At least one of the IS machines should be changed to double gob operation.

5. One or two furnaces for tableware glass should be evaluated and changed from regenerative to recuperative operation. Furnaces with recuperations are cheaper to build and install and more simple and efficient to operate.

6. The team leader should return to the glass factory when the project reaches its final stage. It would also be an advantage if he could visit the factory once or twice a year, if a technical assistance agreement is signed with a foreign glass company as a new UNIDO project.

II. FINDINGS

A. General

When the project started in 1979, the output of hollow glassware was about 24,000 tons per year. In 1983 the output will be approximately 42,000 tons. The production equipment has been modernized and there are now many automatic processing lines controlled by electronic devices.

Four furnaces are used for tableware glass, one for container glass and one for sheet glass. The production programme and the types of machines installed at different furnaces are described in the introduction.

The product quality has improved in general since the project started. The operation and the maintenance of glass machines are better than before and the machine speeds have been increased. The functioning of the electronic devices on the processing lines is quite satisfactory and the electronic department has been instructed how to test and adjust the equipment.

At present there are many foreigners working in the factory. In general they give a good service, but it would of course be an advantage to have more Iraqi employees taking over the various duties. Training of local workers must therefore continue.

In addition to the activities given in the job description for the team leader (see annex I), the management of the glass company wanted him to study and give advice on the following:

(a) Trouble shooting in the sheet glass plant in order to improve the production;

(b) Improved decolorizing of the tableware glass.

The progress of the work discussed at daily meetings with the counterpart Hikmet Razzoki, technical director of the company and M.A. Abbood, chief engineer. Once a week there was also a meeting with the director-general, Fouad Al-Kahil. Discussions were also held with Robin, laboratory manager.

This close contact and good co-operation with the top management of the company helped the team leader considerably in carrying out his work.

B. Glass manufacturing

Sheet glass

The quality of the sheet glass produced was poor. One of the main reasons for this was the variation of the composition of the dolomite. In order to compensate for a low MgO content, the limestone was increased. It took a considerable amount of time to achieve the right composition of the produced glass.

The density measurements showed that the glass in the furnace was not homogeneous. Also, the percentage of the cullet was not kept constant.

Other reasons for the low efficiency of the production of sheet glass were a layer of sodium sulphate covering the glass in the furnace, insufficient compressed air and poor quality of the asbestos rollers.

Glass decoloricing

In general all glass produced had a distinct green colour. Unfortunately it was not possible to make an analysis of the iron content of the glass.

An experiment was carried out in furnace number 1 to obtain a well decolorized glass. As a first step no dirty cullet was added to the furnace. Since some of the cullet is covered by oil and contains a lot of rubbish, it should never be added to a glass furnace. Without the dirty cullet the colour of glass improved considerably.

As a next step 150 g of arsenic trioxide was introduced into the batch. This had not been done before, at least not during the past 10 years. The arsenic is a good oxidising agent of the ferrous iron. The colour of the glass decreased in intensity and the glass became brighter.

Finally a small proportion of cobalt oxide was added to the batch.

By using arsenic selenium and cobalt it was possible to obtain quite a well decolorized glass. Some improvement can still be achieved by somewhat adjusting the proportions of the decolorizing agents.

A completely colourless glass cannot be obtained with the available raw materials. And such a high quality of glass is not normally required for the types of glass products manufactured at present.

The new batch plant

The new batch plant in the old glass plant has been in use for about half a year. This is an automatic batch plant controlled by electronic devices. There have been many problems in the new plant, but these have in general been solved by the representatives of the Belgian supplier.

The local workers are not yet fully trained, which may cause problems when the foreign workers leave.

Training should be intensified and a well qualified local person should be appointed as the batch plant manager. This is strongly recommended.

Efficiency of the furnaces

The efficiency of the furnaces in the Ramadi Glass Factory is very low. A special report was presented to the company management (see annex II).

Improved glass composition

Four different glass compositions should be used in the Ramadi factory:

Glass 1: for container glass
Glass 2: for pressed tableware
Glass 3: for H-28 and H-24 machines
Glass 4: for sheet glass.

At present the same composition is used for glass 2 and glass 3. It could be changed at a later stage when the machines have been moved to new furnaces.

More important at present is the change of the composition of the container glass (see annex III). The following suggestion was made:

	Present glass (Percentage)	New glass (Percentage)
SiO_2	72.40	72.75
Al_2O_3	1.60	1.75
CaO	10.50	11.10
Na_2O	15.00	14.00
SO_3	0.50	0.40
	100.00	100.00

The new glass is cheaper, it has a more suitable viscosity - it is a "shorter" glass - and the speed of the glass forming machines can be increased.

The composition of the glass in furnace number 5 has been changed as suggested. It is proposed that the same glass composition should be used in the new glass plant.

C. Distribution system of fuel oil and gas and fire prevention

The distribution system of fuel oil and gas has been discussed with Ali Hasan, Head of the Industrial Service Department.

The tanks and storage equipment for fuel oil and gas were inspected by the local authorities and were found acceptable.

Literature covering the following items was given to Ali Hasan:

(a) Gas, gas leakage and gas alarm: Level of explosion limits (LEL values), gas detection, alarm systems, suitable detectors, gas warning systems;

(b) Gas detection: nstruments for detection of gas leakage;

(c) Prevention and control of fire in the glass industry: Control equipment, routine and periodic checks, storage and distribution of LPG, precautions manual, check-lists, action to be taken in case of fire.

It was agreed that some companies should be contacted regarding offers for suitable equipment and instruments. The contacts have been made.

D. Preventive maintenance

It was originally intended that the glass machine and electronic experts remain at the duty station for 12 months. Since it was difficult to find experts willing to stay for a year, the duration of the assignments was changed to six months.

The experts should concentrate on the operation of the machines and the electronic devices rather than maintenance. An additional expert should be recruited to deal with maintenance only.

Other foreign experts working in the glass factory have assignments for one year or more. It has been possible for these experts to include preventive maintenance as part of their work. It may therefore not be necessary to have an expert for preventive maintenance. This will be further discussed at the Tripartite Meeting.

E. Quality control

The laboratory is now well equipped to carry out all necessary chemical and physical tests on raw materials and glass products. The new laboratory has been in use since March this year.

The main problem for the laboratory at present is to find qualified personnel.

Two occurrences during the short assignment of the team leader illustrate how important it is to have a well equipped laboratory with skilled personnel.

A bad quality dolomite arrived when the laboratory equipment was moved to the new building. The dolomite was not analysed and serious production problems occurred in the sheet glass plant.

A sand with high iron content arrived and could not be analysed. This gave rise to a marked green colour of all the glass products.

When all the equipment has been installed and skilled personnel is available, the new laboratory will be of great value to the glass factory. The laboratory is of good international standards.

In general the inspection of the finished products has been satisfactory. The inspection of the H-24 tea timblers should, however, be improved. The tumblers very often contain small sharp pieces of glass adhering to the inside bottom. Such tumblers should be rejected.

F. Tripartite Review Meeting

A tripartite review meeting was held at Ramadi on 16 May.

Annex I

JOB DESCRIPTION
IRQ/78/001/11-07

POST TITLE: Expert in gas control systems.

DURATION: Ten weeks.

DATE REQUIRED: March to May 1983.

DUTY STATION: Ramadi, Iraq.

PURPOSE OF PROJECT: Assistance to the Ramadi Glass Factory to increase the efficiency of operations.

DUTIES: The expert will be expected to:

1. Review project activities with the management of the glass company.
2. Make recommendations regarding methods of glass manufacturing.
3. Study the distribution system of fuel gas in the factory.
4. Study the methods of preventive maintenance in the plant.
5. Study the methods of quality control of the glass products.
6. Evaluate the procedures and methods mentioned in 2 to 5 above and recommend improvements.
7. Arrange a Tripartite Review Meeting.
8. Make recommendations for future activities in order to improve the technology and working conditions of the plant and to increase its capacity.

Annex II

EFFICIENCY OF THE FURNACES

The following six furnaces are in operation at the Ramadi Glass Factory.

Furnace number	Melting area (m^2)	Working area (m^2)	Capacity (tons/day)	Output (tons/day)	Supplier	Furnace started
1	32	8.8	45	30.6	Toyo	24 June 1981
2	32	8.8	45	19.1	Toyo	8 June 1981
3	22	5.8	35	15.9	Sorg	15 Feb. 1979
4	22	5.8	35	15.9	Sorg	25 Feb. 1980
5	25	2.7	50	40	Sorg	7 May 1981
Sheet	84	32.3	85	67.4	USSR	21 June 1982

Types of machine, oil consumption and melting efficiency are shown in the following table:

Furnace number	Machines	Oil consumption (l/ton of glass)	Output (tons/m^2 of melting area)
1	2MDP, H-24	306	0.96
2	2MDP	430	0.60
3	MDP, H-28	453	0.72
4	MDP, H-28	453	0.72
5	2 IS6SG	265	0.80

The average output in tons per m^2 melting area for furnaces number 1 to 5 is 0.92, which is low. Usual figures for similar furnaces are 1.5 to 2 tons per m^2. For larger furnaces the melting efficiency is 2 to 2.5 tons per m^2 of melting area.

The consumption of oil in the Ramadi furnaces is high. Normally it should be 150 to 200 l per ton of glass and for larger furnaces 125 to 150 l. The average figure for Ramadi furnaces is 380 l per ton, sheet glass not included.

If the annual output of container and tableware glass in the Ramadi factory is 42,500 tons (350 days a year), the annual quantity of oil used will be 16,150 m^3. With a consumption of 200 l of oil per ton of glass 7,650 m^3 of oil could be saved. If the price of oil is ID5,000 per m^3, then ID38,000 per year could be saved.

The main reason for the high oil consumption per ton of glass produced is the low output of glass from the furnaces. Each furnace could serve four to five machines.

Since additional machines may not be included in the present planning for the Ramadi factory, it may be worth while to consider having two instead of four furnaces for tableware glass.

There would then be the following furnaces and machines for hollow glass:

H-28, H-28, H-24, MDP
5 MDP presses
2 IS machines.

The capacity of furnace number 1 should be 45 tons, of furnace number 2 it should be 50 tons. The melting areas can be 30 m^2 and 33 m^2 respectively.

It can be assumed that the speeds of the machines can be increased by at least 10 per cent by altering the composition of the glass to some extent. The total output of tableware glass would then be 35 and 40 tons per day or 26,250 tons per year (350 working days).

The furnace number 5 could have two double gob machines. The output would then be increased from 10,710 to 20,500 tons per year. If in addition the speed is increased by 10 per cent, the output will be 22,500 tons per year. The melting area must be increased to 42 m^2.

The total output of glass tableware and containers would thus be 48,750 tons per year. The oil consumption can be assumed to be 200 l per ton of glass. This means a consumption of 9,750 m^3 of oil per year.

The following table summarizes the above:

	At present	As suggested
Container furnace	1	1
Tableware furnaces	4	2
Tons of glass/year	82 500	48 750
Oil used (m^3/year)	16 150	9 750
Cost of oil/year (ID)	80 750	48 750
Cost of oil/ton of glass (ID)	1 900	1 000

In addition, the cost of labour, utilities, furnace depreciation, furnace equipment and maintenance would be reduced. The cost of rebuilding tableware furnaces would be reduced by almost 50 per cent.

A thorough study should be carried out regarding the above-mentioned suggestions and decisions should be made before rebuilding the furnaces.

Annex III

IMPROVED CONTAINER GLASS

The most expensive component of the glass batch is soda ash. The price paid for soda ash at present by the Ramadi Glass Factory is ID55,500 per ton. The cost of the soda ash is more than 50 per cent of the total cost of the batch.

In the glass industry there is a tendency to reduce the use of soda ash in the batch. Many glass companies use only 12.6 per cent or less of Na_2O. The present value at the Ramadi Glass Factory is 15. This is an expensive glass and the machine speeds must be kept low.

Now that the speed of the machines has been somewhat increased, the Na_2O content should be decreased. The following glass composition is proposed:

	Present glass	New glass
	(Percentage)	(Percentage)
SiO_2	72.40	72.75
Al_2O_3	1.60	1.75
CaO	10.50	11.10
Na_2O	15.00	14.00
SO_3	0.50	0.40
	100.00	100.00

To be melted this new glass will not require additional energy than is used for the present glass.

The price of the batch will be reduced by approximately ID 11,200 per year.

This more modern glass will also have several technical advantages such as increased machine speed. If furnace number 5 is converted for the proposed glass now, there will be sufficient time for testing before the new plant is started. This new glass should be used in the new container furnaces as well.