OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

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

DP/ID/SER.A/1302
22 January 1990
ORIGINAL: ENGLISH

RESTRICTED

18640

DEVELOPMENT AND RATIONALIZATION OF CEMENT FACTORIES AND RELATED INDUSTRIES IN THE PTA SUBREGION
DP/RAF/88/077/11-55/J 13419

MOZAMBIQUE

Technical report: Evaluation of the workshop facilities in the Matola cement plant

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

Based on the work of H.-H. Brandt, workshop and cement expert

Backstopping officer: C. Rydeng, Chemical Industries Branch

United Nations Industrial Development Organization

Vienna

V.90-80552 6572T

Explanatory notes

The monetary unit in Mozambique is the metrical (MT). In October 1989, 800 MT = $US 1.

The following abbreviations and acronyms have been used in this document:

CCM	Cimentos de Mozambique E.E.
DANIDA	Danish International Development Agency
FINIDA	Finnish International Development Authority
NORAD	Norwegian Agency for International Development
OPEC	Organization of Petroleum Exporting Countries
PTA	Preferential Trade Area for Eastern and Southern African States
SIDA	Swedish International Development Authority

Mention of the names of firms and commercial products does not imply endorsement by the United Nations Industrial Development Organization (UNIDO).

ABSTRACT

The purpose of the project "Development and Rationalization of Cement Factories and Related Industries in the PTA Subregion" (DP/RAF/88/077/11-55/J 13419) is to enable authorities and factory managers in the PTA region to increase and diversify building materials production through improvements and new installations. To this end, a workshop expert was sent for three weeks to advise on the need for additional equipment and means to improve the existing workshop facilities at the Matola cement plant. The expert was also asked to single out preparatory and technical assistance activities that had not been included in the existing rehabilitation plans and to confer with local personnel on their execution.

It was observed and concluded that the stationary machines of the workshops were generally in usable condition. However, owing to age and low capacity, it was recommended that some of the machines should be replaced by new ones. The instruments and hand-tools available at the workshops, as well as their maintenance, are not satisfactory. Complete new supplies of instruments and tools are thereforerequired. The enclosed lists of recommended new machines, instruments and handtools should be discussed and agreed upon by CCM and the technical assistance team. The total cost of the new machines, instruments and tools is estimated at $US 385,000. The plant installations and concrete structures are in an advanced stage of corrosion and deterioration. A planned visit by an expert in concrete structures is now urgently required.

Equipment for and instruction in personnel safety at a plant are also recommended, together with a completely new plant clinic including medicines and an ambulance.

Plant personnel should initially be trained on-the-job, but theoretical training in classrooms is also recommended, especially for the production personnel. Detailed, long-term training schemes should be prepared and initiated for all plant personnel as soon as possible. The arrival of the technical assistance team from Scancem in mid-October 1989 was well planned by CCM and has raised hopes for a successful rehabilitation of the Matola cement plant.

CONTENTS

Annexes

INTRODUCTION

From 5 to 23 October 1989, the UNIDO expert on cement plants and workshops visited the cement company Cimentos de Mozambique E.E. (CCM). The visit was planned by the Secretariat of the Preferential Trade Area for Eastern and Southern African States (PTA) at Lusaka and the United Nations Industrial Development Organization (UNIDO) as a three-week mission to assist the cement company in its preparations for rehabilitating the Matola cement plant.

The specific purpose of the visit was to assist in the evaluation of workshop facilities at the cement plant and to recommend additional workshop machines and tools. The assistance was to include a review of the preparatory activities planned and initiated by factory management, and the expert was to single out activities that had not been included in the existing rehabilitation plans and to confer with management and personnel of the cement company on their execution.

The rehabilitation of the Matola cement plant is in an advanced stage of preparation, but the cement company needs support to evaluate situations and proposals so it can economize on foreign support and take decisions that would be in the national interest.

A technical services agreement was signed in June 1989 with Scancem International ANS, in Oslo, Norway, and a team of four engineers arrived in Mozambique in mid-October 1989. This technical assistance team is to render long-term services to CCM for the rehabilitation of the Matola cement plant, under the supervision and instructions of CCM management.

There have been four previous reports on the rehabilitation of the Matola cement plant:

(a) "Resumen del informe del Asland de las fabricas de Matola y Nacala de Cimentos Mozambique", prepared by Asland S.A., Spain, at the request of CCM, June 1984;

(b) "Rehabilitation of the Matola cement plant: assessment of need for technical assistance", prepared by Nordic Consulting Group at the request of NORAD, May 1987;

(c) "Rehabilitation of the Matola cement plant: assessment of need for technical assistance: summary and cost up-dating", prepared by Nordic Consulting Group at the request of NORAD, November 1987;

(d) "Report on visit to Mozambique", prepared by Rolf Houd at the request of PTA/UNIDO, April 1989.

The present report describes the workshops at Matola cement plant and lists the machinery and tools required to operate and maintain the plant once it has been rehabilitated.

The personnel met during the mission are listed in annex I.

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

During the last five years the Matola cement plant has been used only for the grinding of cement in small quantities. The main process line for 2,000 tonnes per day of clinker production has been out of use owing to safety problems at the quarry and difficulties with the transport of the limestone.

A programme for the rehabilitation of the cement plant has been approved and financed by European Investment Bank (EIB), OPEC, NORAD, SIDA and FINIDA, and a three-year technical assistance contract has been signed with Scancem, of Oslo, Norway.

During his visit to the plant in April 1989, the CTA in cement for PTA/UNIDO found that some activities, such as the rehabilitation of workshops and repairs to the concrete structures, were not advanced enough to suit the existing rehabilitation programme.

In the course of the present mission, the workshop expert from UNIDO/UNDP observed and described the present condition of the workshops and the requirements for their rehabilitation as follows:

(a) Most of the stationary machines, i.e. the mechanical workshop machines, are in usable condition. A limited number of new machines are recommended for purchase, as specified in annex II. The total value of the recommended new machines is estimated at $US 235,000;

(b) Owing to the general lack of hand-tools and instruments and previous shortcomings in their maintenance, new tools and instruments have been recommended (annex III). The total estimated value of these is $US 150,000;

(c) The damage to the concrete structures at the preheater tower and the raw mix silos should be inspected as soon as possible by an expert to determine the extent of the damage and a method of repair;

(d) The level of personnel safety and health services at the cement plant is unacceptably low. It is recommended that a report should be prepared on requirements in equipment, training, organization and first aid to raise these services to an acceptable level;

(e) Besides on-the-job training and the training of senior personnel at other cement plants, it is important to plan for theoretical training, especially of production personnel, and to start it as soon as possible.

B. Recommendations

1. An extension of the main workshop building should be considered. The purpose of this would be to increase the floor area of the foundry/blacksmith shop and the welding shop.

2. A number of new machines should be procured for the workshops to replace some of the existing machines. The total price of the machines mentioned is estimated at $US 235,000.

3. The floor area of the electrical workshop should be enlarged, and the transport access as well as the crane lift facilities at this workshop should be improved.

4. Possibilities for an enlargement of the vehicle repair shops at the plant should be investigated. If a new vehicle repair shop building were to be built, the old vehicle repair shops could be used for an expansion of the electrical shop, the tool room, the foundry/blacksmith shop, the welding shop or the general stores.

5. The area of the tool room should be increased to 100 or 120 m^2 to allow proper storage and easy access to all the tools that should be available at the tool room.

6. A tool-box with all the tools needed to perform routine services should be allocated to each skilled maintenance worker against signature of receipt. The contents of each tool-box should be checked once a month by the chief of the tool room.

7. Each tool should be marked and identified as the property of the cement company. Numbered coins to identify the users must be required as "payment" for borrowed tools until they are returned to the tool room.

8. A number of new tools should be procured to replace the tools that have disappeared or been lost owing to general use and wear. The total price of the tools and instruments is estimated at $US 150,000.

9. The cause of and impact of the damage to the concrete structures at the plant urgently need to be investigated.

10. The requirements of personnel safety and health should be studied. A paper on the need for and means of introducing a satisfactory level of safety should be prepared by a specialist team. This paper should address training, equipment, personnel and a plant clinic.

11. A training programme for plant personnel should be introduced as soon as possible. The programme should include not only on-the-job training, but also theoretical training in small classes.

12. Detailed, long-term training schemes for the personnel at the Matola cement plant should be prepared as soon as possible.

I. GENERAL FEATURES OF THE PLANT

The Matola cement plant is situated 15 kilometres south of Maputo. The present plant consists of one production line for 2,000 tonnes per day of cement by the dry process. The plant was commissioned in 1974, and the major suppliers of the machinery were Five Lill Cail, Wedag and Fuller. A rehabilitation of the plant in 1978 included design modifications and the repair of damage caused by inexperienced operators.

During the last five years, the only part of the plant that was operated were two mills for the grinding of small quantities of imported clinker. Most of the plant, i.e. the crushing department, the raw mill department and the kiln, has not been in use since 1984 because of security problems with the railway transport of the limestone from the Salamanga quarry, 69 kilometres away.

The plant has suffered severely from not being regularly operated and maintained for such a long time, but because security is now expected to improve, it has been decided to rehabilitate the plant.

The rehabilitation will be financed by the European Investment Bank, the Organization of Petroleum Exporting Countries Fund for International Development (OPEC Fund), Norwegian Agency for International Development (NORAD), Swedish International Development Authority (SIDA) and Finnish International Development Authority (FINIDA). The Government of Mozambique is expected to provide additional funds.

II. MECHANICAL WORKSHOPS

The mechanical workshops are situated in a well-laid-out building that also accommodates the store for spare parts. There is enough space for transport to the main workshop and between the workshop and the store. A 7.5 tonne overhead crane serves the main floor of the workshop and the store. Attached to the main workshop are the foundry/blacksmith shop, the welding shop, the vulcanization shop, the tool room, the foreman's office and toilets.

The floor areas of the various mechanical workshops are as follows:

	m^2
Main floor of the workshop for the machine shop and the fitter's shop	537
Foundry/blacksmith shop	75
Welding shop	61
Vulcanization shop	75
Tool room	61

Since the floor areas of the foundry/blacksmith shop and the welding shop are rather small, it is recommended that the two workshops should be relocated and that the workshop building should be extended.

In all, 67 engineers and workers are employed in the mechanical workshops and mechanical maintenance.

The machines in the mechanical workshops are from 7 to 20 years old, and their quantity and condition is in general satisfactory. In only a few cases will it be necessary to invest in new machines. General specifications and comments on condition are shown in annex IV. The new machines needed for the rehabilitation of the mechanical workshops are listed in annex II.

III. ELECTRICAL WORKSHOPS

The electrical workshops are contained in two buildings. The main electrical workshop, which has the rather small area of 42 m^2, is situated in the same building as the mechanical workshop. Access to this room for machines and heavy equipment, e.g. fork-lifts, is not good. Objects can only be lifted by means of a chain-block fixed on the roof.

It is recommended that the area of the main electrical workshop should be enlarged and that access to it and the crane lift facilities should be improved.

The electronic and instrument workshop is situated in the building block that also contains the kiln control. The area of this workshop is 17 m^2, which is considered adequate if the space is properly utilized.

In all, 31 engineers and workers are employed in the electrical workshops and electrical maintenance.

The specifications and conditions of the machines in the electrical workshops are listed in annex IV. Testing equipment and instruments for the electrical maintenance work are almost non-existent and have, therefore, been disregarded. The new machines required for the rehabilitation of the electrical workshops are listed in annex II. Recommendations for new testing equipment and instruments are listed in annex III.

IV. VEHICLE REPAIR SHOPS

The vehicle repair shops for maintaining the cement plant vehicles (excluding the quarry vehicles) are situated in the same building as the mechanical workshops. The total area of these vehicle repair shops, 378 m^2, is divided into a light vehicle repair shop, a service shop and a heavy vehicle repair shop. The area of the heavy vehicle shop is only 160 m^2, which is considered rather small, especially as the yard and parking area in front of the workshop is also very narrow.

It has been recommended that the vehicle repair shop area should be increased. This could be achieved by constructing a new building for the vehicle repair shops, using the old space to increase the storage area and the electrical workshop area.

Access to the vehicle repair shops is good, but they should each have a trolley hoist, i.e. a chain-block mounted from a wagon on rails, for the lifting of heavy engines and other parts.

In all, 25 engineers and workers are employed in this department.

The existing machines in the vehicle repair shops are listed in annex IV. The new machines required are listed in annex II. Recommendations for new hand-tools are listed in annex III.

V. QUARRY WORKSHOP

The workshops at Salamanga quarry have been sabotaged and are not equal to the task of servicing and maintaining the quarry machinery, including heavy vehicles. New workshops and a spare parts store for the quarry have been designed by CCM and are planned for construction at the same time the cement plant is rehabilitated. The design provides 760 m^2 for workshops and an additional 325 m^2 for garage, offices, toilets etc.

The quarry workshops now employ only four workers, but it is planned to increase this number to approximately 10.

The machines and tools at these workshops are so limited that they have been disregarded in this account. New machines and hand-tools for the quarry workshops were recently purchased with funds received from OPEC Fund (annex V).

VI. CARPENTRY SHOP AND BUILDING MAINTENANCE

The carpentry shop is situated in a building near the mechanical workshops. The same building also contains storage areas for building materials and maintenance equipment and some technical offices.

The floor area of the carpentry shop is 150 m^2, which is sufficient for the required service. Transport space to the workshop and the materials store is good.

In all, 23 engineers and workers are employed in this department.

The carpentry shop contains only a few machines, of which the two main machines, the universal machine and the band-saw, appear to be in reasonably good condition. However, the band-saw now has no endless blades, although a sufficient stock should, of course, be maintained. The existing machines are listed in annex IV.

The supply of proper equipment and hand-tools for the carpentry shop and building maintenance is very poor. New machines, equipment and hand-tools are recommended in annexes II and III.

VII. TOOL ROOM AND HAND-TOOLS

The tool room is presently situated next to the mechanical workshops, and its door and service hatch open on to the main shop. The area of the tool room is 60 m^2.

The tool room is small in relation to the stock of tools required for the maintenance of the plant. Few tools are available from the tool room, as most have been lost or broken. The few tools that remain are not even controlled (by, for instance, registration at the tool room).

It is recommended that the area of the tool room should be increased to 100 or 120 m^2 to allow for proper storage and easy access to all the tools that should be available. New shelves and boards should be fabricated and installed, with proper numbering of each tool position. For identification, the position numbers should be the same as the numbers marked on the tools. Coins with numbers to identify the users should be required as "payment" for the borrowed tools until they are returned.

A tool-box containing the tools needed for routine tasks should be allocated to each skilled maintenance worker against signature of receipt. The contents of each tool-box should be checked against a signed list of tools once every month by the supervisor of the tool room. Only by such a system can the tools be properly controlled. It should at all times be remembered by the users of the tools and the management that the tools are a very important asset for the company, not only because of their procurement costs but also because they are the key to the proper maintenance and operation of the plant.

Recommendations for new tools are listed in annex III.

VIII. CONCERNS THAT HAVE NOT BEEN ADDRESSED IN THE EXISTING REHABILITATION PLANS

The existing rehabilitation plans for the Matola cement plant, which are based on the studies and reports by Asland, Nordic Consulting Group and Scancem, cover the renovation of the cement-making machinery, the technical management of the plant and the economic aspects of the project. They do not cover either the rehabilitation of the workshops or the activities described below.

A. Condition checks and repairs to concrete structures

In the report of his visit to the plant in April 1989, Rolf D. Houd, the Chief Technical Advisor (CTA) of PTA/UNIDO, suggested that the damaged concrete structures at the preheater tower and the raw mix silos urgently required inspection by an expert to determine the extent of damage and the best method of repair. An expert in concrete materials and structural analyses from UNIDO was expected to visit the Matola cement plant in November 1989.

In view of the analyses and recommendations that will be forthcoming, consideration should be given to providing an expert to supervise the repairs to the structures.

B. Personnel safety

General wear and tear, corrosion and deterioration of the concrete have made the plant a dangerous place, even for the minimal activities now taking place. The inexperience of the regular workers and the shortage of safety equipment, e.g. hard-hats and boots, will create a generally hazardous work environment for plant personnel once rehabilitation work has started and groups of workers have been stationed at various locations in the plant.

Some safety equipment was donated by a Danish trade unions organization at the request of Danish volunteers working as safety experts at the Ministry of Construction and Water Supply in Mozambique, and some advisory service has been provided to CCM by the same volunteers. However, to achieve a satisfactory level of safety, a considerable quantity of equipment and services is still needed.

In spite of precautions and safety equipment, some accidents and injuries to personnel are inevitable at large work-sites such as the Matola cement plant. For this reason, a first-aid clinic and a reliable vehicle for ambulance service must be available at the plant during working hours, i.e. 24 hours per day.

Meetings were held with the DANIDA representative at Maputo and with the Danish safety experts at the Ministry of Construction and Water Supply to discuss safety and health problems at the plant. In the course of these meetings, DANIDA said it could consider offering support if sufficient documentation for the safety and health requirements could be provided.

It is recommended that a team of cement experts and safety experts should be asked to prepare a report specifying requirements in the following areas: safety equipment, training programmes, safety organization at the plant, and clinic and ambulance.

The safety experts at the Ministry of Construction and Water Supply should be asked to join the above-mentioned team of experts.

C. Personnel training

It is foreseen that on-the-job training will be offered under terms of the technical assistance contract with Scancem. Also, technical study tours for some of the CCM engineers were suggested by Mr. Houd.

Considering the many years the cement plant has been out of operation, the inexperience of the new engineers and the size of the technical assistance team, it is important that the training of plant personnel at all levels be given a high priority. Only with well-trained engineers and workers will it be possible to operate the plant.

On-the-job training will be good for some of the personnel, e.g. the maintenance personnel, and it can be started as soon as the rehabilitation of the plant has started. However, it will be too late to start training and preparing engineers and production personnel at the time the production process is restarted, so on-the-job training should not be relied on for this category of staff. While some of the process engineers can, of course, be trained during visits to similar process lines in other countries, most of the production personnel must receive basic theoretical training and training in operations at the site and in advance of the restart-up.

It is strongly recommended that the training of plant personnel should be introduced as soon as possible, not only in the form of on-the-job training but also in the form of theory, taught in small classes.

It is also recommended that detailed and long-term training schemes should be set up as soon as possible for the personnel at the Matola cement plant.

Annex I

MANAGEMENT AND SENIOR STAFF MET DURING THE MISSION

Enterprise/title or function	Name
Climentos De Mozambique	
General Director	Helder V. Rodrigues
Technical Director	Teodosio C. G. Dias
Plant Director, Matola	Isufo Isufo
Chief Plant Engineer	Rothembert
Chief Electrical Engineer	Babu Karian
Scancem	
Technical assistance team leader	Kurt Ohlsson
Mechanical engineer	Lars Eriksson
Process engineer	Anders Lyberg
Ministry of Construction and Water Supply	
Safety expert (Danish volunteer)	Benni Bundsgaard
V.E.B. Zementwerke, German Democratic Republic	
Production Director, Nacala	Ulrich Lehmann

Annex II

RECOMMENDED NEW MACHINES FOR THE WORKSHOPS

Mechanical workshops

Quantity	Description/specifications
1	Double-wheel grinder stand Grinding wheel diameter, 400 mm Grinding wheel width, 75 mm
1	Double-wheel grinder stand Grinding wheel diameter, 300 mm Grinding wheel width, 40 mm
1	Single-spindle threading machine for metric die-heads, 10-52 mm British Standard pipe thread and Whitworth thread, 0.5 in.-4 in.
1	Hydraulic single-cylinder press Pressure rate, 100 t
2	Single-housing arc welding machine on travelling carriage Connected load, 15 kW at duty cycle of 100 per cent Control range, 40-600 A Open-circuit voltage, 60-100 V With remote control, connecting cables, welding cables, electrode holders etc.
1	Universal column milling machine Work mounting area, 450 x 2,000 mm
1	Shaping machine Maximum machinable length, 710 mm
4	Parallel-jaw vice Jaw width, 125 mm Opening, 175 mm Depth, 145 mm
1	Pipe vice for lugs up to 3 in. opening, 90 mm
1	Arc air cutting machine Cutting range, 3-100 mm
3	Set of equipment for oxy-acetylene welding and cutting, including welding and cutting torch sets, pressure-reducing valves, gas and oxygen hoses, cylinder trolley
1	Fork-lift (to be used by all workshops) Diesel engine, 90 HP Maximum lift height, 4.0 m Lift capacity, 5 t

1	Central unit for the permanent supply of compressed air for cleaning and driving purposes at the mechanical shop, the welding shop, the blacksmith shop, the electrical shop and the vehicle repair shop. Comprises a compressor delivering approximately 12 m^3/min at an operating pressure of 7.0 bar, including electric drive and switch gear for automatic control, cooler, air receiver, piping valves, snap couplings, hoses and nozzles
1	Plate shears, hand-operated, for cutting plates in unlimited lengths Maximum thickness, 5.0 mm

Electrical workshops

1	Light bench drill machine Drill capacity maximum diameter, 13 mm Drill depth, 60 mm
1	Double-wheel bench grinder for tool grinding
1	Coil rewinder
1	Chain hoist for 5.0 t load Lifting height, 3.0 m Mounted on a rail-wagon with profile swing gibbet

Vehicle repair shop

1	Double-wheel bench grinder for tool grinding
1	Tyre-dismantling machine
1	Upright drilling machine with adjustable speed Maximum drilling diameter, 22 mm Maximum drilling depth, 200 mm
1	Battery charger, 12 V and 24 V
1	Compressed air supply unit for tyres, complete with air receiver, filters, valves, electric motor and flexible hoses
1	High-pressure water pump unit complete with flexible hoses for cleaning of vehicles
1	Complete test bench for engine performance tests, e.g. compression, injection and ignition
1	Tyre-mounting machine for trucks and tractors

Carpentry workshop and building maintenance

1	Double-wheel bench grinder for tool grinding
2	Concrete blender, mobile Capacity, 225 l

1	Vertical blending machine for forced blending of refractory mortar, mobile Capacity, 0.2 m^3
2	Mobile air compressor, complete with air receiver, diesel engine, valves etc.
1	Upright drilling machine with adjustable speed Maximum drilling diameter, 30 mm Drilling depth, 200 mm
1	Wheel bucket tipper with diesel engine for transport of concrete etc. Approximate capacity, 1.5 m^3

Quarry workshop

Complete sets of workshop machines and hand-tools have been purchased and financed by OPEC Fund (see annex V).

Lubrication store

1	Centrifugal oil purifier complete with filters etc., to be utilized for all lubricating oils and transformer oils

Annex III

RECOMMENDED TOOLS

Mechanical work

Quantity	Description/specifications
1	Optical pyrometer, portable, for measuring between 0 and 1 500° C
1	Complete portable instrument kit for vibration testing and balancing, static and dynamic, of rotating machines such as fan wheels
1	Hardness tester for Brinell and Vickers. Simple manual type
2	Magnetic contact thermometer for measuring between 0 and 200° C
1	Digital contact tachometer for measuring between 0 and 5,000 rev/min
1	Digital stroboscobe; flash rate, 200–12,000 flashes/min at 200–12,000 rev/min
10	Shackles, straight model, galvanized; bolt diameter, 0.5 in.
10	Shackles, straight model, galvanized; bolt diameter, 1 in.
6	Lifting hook with safety catch; maximum load, 1,000 t
6	Lifting hook with safety catch; maximum load, 5,000 t
10	Wire rope grip for 6 mm wire
10	Wire rope grip for 12 mm wire
10	Wire rope grip for 17 mm wire
2	50 m length of 6 mm steel wire rope
2	50 m length of 12 mm steel wire rope
2	50 m length of 17 mm steel wire rope
1	Set of trimmers, 10 each for wire rope of diameters 6 and 12 mm
5	Lever winch with wire ropes and hooks; capacity, 2.5 t
5	Lever winch with wire ropes and hooks; capacity, 5.0 t
3	Rapid-action chain-block; maximum load, 3.0 t; lift, 3.0 m
3	Rapid-action chain-block; maximum load, 10.0 t; lift, 5.0 m
6	Ratchet hoist, 4.5 t at 1.5 m lift
6	Ratchet hoist, 6.0 t at 1.5 m lift

2	Hydraulic jack with separate pump and connecting flexible hoses, 200 t
4	Hydraulic jack with separate pump and flexible hoses, 100 t
4	Hydraulic jack with separate pump and flexible hoses, 50 t
4	Trolley hoist (chain-blocks mounted permanently on a rail-wagon with profile), 5.0 t at 3.0 m lift
6	Portable drilling machine, pistol-type; maximum drilling diameter, 10.0 mm; 2,600 rev/min
2	Portable drilling machine, pistol-type; maximum drilling diameter (steel), 13.0 mm; maximum drilling diameter (concrete), 19.0 mm
3	Angle grinder; maximum disc diameter, 125 mm
3	Angle grinder; maximum disc diameter, 180 mm
1	Welding transformer, small, hand-carried, with battery charger, including 1.5 m primary cable, 2.0 m welding cable, with electrode holder; maximum electrode size, 2.5 mm at 220 V and 4.0 mm at 380 V
20	Electrode holder; maximum electrode diameter, 6 mm
20	Welding clamp, maximum 600 A
2	Electrode holder for carbon electrodes
8	Pressure reduction valve for gas welding set, 200-8 kp/cm^2
8	Cutting torch for cutting including handles and connections, 1-50 mm
4	Roller guide for cutting torch
5	Gas welding torch including handles
6	Welding hose for acetylene; length, 50 m; diameter, 6 mm
6	Welding hose for oxygen; length, 50 m; diameter, 6 mm
3	Air gun for cleaning, 0.25 in. hose
2	Set of end mills, straight shank, each set with 16 cutters from 2 to 25 mm diameter
2	Set of slot cutters, each set with 18 cutters from 4.5 mm to 25.5 mm cutter width
2	Set of side milling cutters; each set with 60 cutters from 4.0 mm to 32.0 mm wide
1	Set of seven slotting cutters in widths from 8.0 to 28.0 mm; diameter, 28.0 mm

1	Set of shell end mills comprising seven cutters with diameters from 40.0 mm to 160.0 mm and widths from 32.0 mm to 63.0 mm
1	Set of nine angle milling cutters with angles from 45 to 90°
1	Set of 12 concave milling cutters; width, 8.0–60.0 mm
1	Set of 12 convex milling cutters; width, 3.0–40.0 mm
1	Set of 18 milling chucks in sizes from 2.0 to 32.0 mm
1	Threading tool holder, complete, for external right-hand threads; length, 150 mm
1	Threading tool holder, complete, for internal right-hand threads; length, 180 mm
1	Set of grinding points, complete, comprising a display stand holding 18 types of grinding points, 2 of each
100	Welding brush
2	Lathe centre, revolving, Morse taper No. 2; overall length, 115 cm
2	Set of five lathe centres with ball bearings and detachable tip
4	Tool holder for round or square (12 x 12 mm) tool bits; length, 125 mm
4	Tool holder for parting tools, 40.0 mm
2	Set of square cutting tool bits in packs of 10 or 5 pieces; all sizes from 4 x 4 mm to 25 x 25 mm
1	Set of rectangular cutting tool bits in packs of 10 or 5 pieces; all sizes from 4 x 4 mm to 25 x 16 mm
1	Set of parting tools in 15 sizes, in packs of 10 of each size
2	Set of six ready-shaped cutting tools of different shapes; square shank, 6 x 6 mm
2	Set of six ready-shaped cutting tools of different shapes; square shank, 8 x 8 mm
2	Set of six ready-shaped cutting tools of different shapes; square shank, 12 x 12 mm
2	Set of six ready-shaped cutting tools of different shapes; square shank, 16 x 16 mm
2	Set of six boring tools, lengths from 60 to 95 mm, boring at minimum hole diameters from 3.0 to 14.0 mm; shank diameter, 10 mm
4	Complete set of 46 twist drills 0.5–13 mm
4	Complete set of 20 twist drills 13–25 mm

1	Complete set of 32 twist drills 13-40 mm
1	Complete set of 12 centre drills, 0.8-10 mm
4	Complete set of 57 hand reamers, 1-60 mm
1	Complete set of 27 concrete drills, 3-24 mm
1	Set of 24 open single-ended spanners, 6-50 mm
1	Complete set of 38 open double-ended spanners, 6 x 7 to 75 x 80
2	Complete set of open double-ended spanners, 6 x 7 to 27 x 32
2	Complete set of 5 adjustable spanners; capacity, 14-34 mm
2	Hook spanner for grinders
2	Socket set, sizes 4-12 mm
1	Socket set, sizes 13-32 mm
1	Torque wrench; torque range, 0-35 kgm
1	Complete set of 21 Allen keys, 1.5-19 mm
2	Set of three pullers (straight legs); capacity, 80, 100 and 125 mm
1	Complete set of eight pullers (twin-legged), 80-750 m
1	Complete set of five pullers (curved legs), 80-250 mm
1	Set of two hydraulic pullers (three-legged, with pump); capacity, 300-500 mm
2	Self-grip wrench; capacity, 0-45 mm
10	Combination pliers
5	Water pump pliers; capacity, 40 mm
5	End-cutting nipper, insulated; length, 120 mm
2	Diagonal cutting nipper
5	Set of two flat-nosed pliers; length, 180 mm and 200 mm
1	Chain wrench; capacity, 152 mm
1	Strap wrench; capacity, 200 mm
3	Set of three pipe wrenches; capacity, 24, 50 and 150 mm
1	Letter punch, alphabet A-Z
4	Surface gauge with base

1	Complete set of callipers (outside and inside); maximum span, 150-600 mm
1	Beam trammel; length, 1,000 mm
20	Measuring tape, metric, steel; length, 5 m
5	Measuring tape, metric, steel; length, 20 m
2	Measuring tape, metric; length, 50 m
5	Steel rule; length, 300 mm
1	Steel rule; length, 2,000 mm
1	Engineer's straight edge, rectangular section; length, 1,500 mm
5	Sliding bevel; blade length, 200 mm
5	Square; length, 200 mm
2	Universal square; blade length, 200 mm
10	Universal bevel; blade length, 100 mm
2	Engineers' square; length, 150 mm
2	Protractor, circular disc, Starret type; disc diameter, 85 mm
1	Universal protractor; length of blade, 200 mm
5	Feeler gauge, metric, 13 blades; blade length, 100 mm
2	Feeler gauge, metric, 13 blades; blade length, 300 mm
5	Complete set of screw pitch gauge, thread system type; thread angles, 60 and 66°
1	Depth gauge, metric; measurement depth, 300 mm
1	Micrometer depth gauge; measurement depth, 0-150 mm
10	Pocket vernier callipers, mm and in.; length measurement, 160 mm
1	Vernier calliper for gear tooth measurement, module 1-15
1	Vernier calliper; length measurement, 750 mm
5	Micrometer, 0-25 mm, 1/100
5	Micrometer, 25-50 mm, 1/100
2	Micrometer, 50-150 mm, 1/100
1	Micrometer, 300-450 mm
1	Complete set of internal micrometers, 0-250 mm

1	Complete set of calibrating gauges
2	Vernier height gauge
2	Dial gauge with magnetic base, 1/1000; diameter of dial, 58 mm; range, 0-200 mm
1	One set of two hand tachometers with components; range, 3-500, 300-5,000
1	Engineer's level; accuracy, 0.003 mm/m; length, 310 mm
3	Joiner's level; length, 460 mm
6	Circlip pliers, straight, for internal circlips
6	Circlip pliers, angled, for internal circlips
6	Circlip pliers, straight, for external circlips
6	Circlip pliers, angled, for external circlips
2	Rivet punch
1	Steel cable cutter; length, 250 mm
20	Chisel; length, 150 mm
20	Cross-cut chisel; length, 150 mm
5	Complete set of drifts; diameter of points, 3, 4, 5, 6, 7 and 8 mm
15	Centre punch
2	Set of two cross pein hammers; weight, 220 g and 400 g
15	Ball pein hammer; weight, 250 g
2	Complete set of needle files; length, 160 mm
10	Blunt file; length, 250 mm
10	Pillar file; length, 250 mm
10	Flat file; length, 250 mm
10	Warding file; length, 250 mm
10	Three-square file; length, 150 and 250 mm
10	Square file; length, 150 and 250 mm
10	Half-round file; length, 250 mm
10	Round file; length, 150 and 250 mm
15	Screwdriver; length of blade, 75 mm

15	Screwdriver; length of blade, 150 mm
15	Screwdriver; length of blade, 300 mm
4	Complete set of four Phillips-head screwdrivers
5	Triangular scraper; length, 250 mm
5	Half-round scraper; length, 250 mm
1	Complete set of 32 thread taps, M 1.6-M 44
1	Complete set of three tap wrenches, adjustable; length, 130, 215 and 380 mm
1	Complete set of die stocks
1	Complete set of 32 threading dies, M 1.6-M 44
5	Bench vice; jaw width, 150 mm; jaw opening, 150 mm
10	Bench vice; jaw width, 125 mm; jaw opening, 115 mm
2	Pipe cutter for steel pipes; pipe diameter, 4 in.
5	Hacksaw framer, adjustable for blades; length, 250-300 mm
5	Clamp; jaw opening, 200 mm
1	Bolt cutter; length, 430 mm
1	Wire rope cutter for steel wire; length, 600 mm
1	Tube bender; tube diameter (external), 6, 8, 10 and 12 mm
1	Hydraulic pipe-bending machine; external pipe diameter, 17-60 mm
2	Grease gun, pneumatic, with accessories; pressure, 6 kPa; container capacity, 500 cm^3
3	Manual grease gun; capacity, 500 cm^3
4	Grease pump; capacity, 15 kg; pump tube length, 400 mm
5	Oil can; capacity, 0.3; length of spout, 125 mm
5	Oil can; capacity, 0.5; length of spout, 200 mm
2	Complete set of two measuring cans for oil; capacity, 0.5 and 2 l
3	Set of two funnels; diameter, 120 and 200 mm
2	Drum pump with plastic tube; length, 1,100 mm; capacity, 10 l/min

Welding work

6	Cutting torch; length, 550 mm

6	Set of three cutting nozzles; materials thickness, 1-6, 6-10 and 10-95 mm
20	Cleaning needle
6	Roller guide
6	Circle-cutting device
6	Set of two pressure-reducing valves for oxygen and acetylene
20	Electrode holder
5	Electrode, 7 mm, 600 A
2	Welding hose for oxygen and acetylene; diameter x wall, 6.3 x 3.5 mm; length, 500 mm
1	Welding transformer, 220/380 V, 50 Hz; maximum electrode size, 4 mm
1	Welding machine with accessories; includes: Petrol engine, 10-15 HP Welding generator Maximum power at 60 per cent duty, approximately 250 A Control range, 40-250 A Power generator, 50 Hz, AC, 220/380 V, earth fault protection Power, 10 kVA
4	Welding rectifier, 380/500 V; maximum electrode size, 7 mm; control range, 10-600 A
1	Set of 28 ring spanners, 6 x 7 to 36 x 41
6	Set of 10 ring spanners, 6 x 7 to 19 x 24
1	Set of 10 curved ring spanners, 6 x 7 to 19 x 24
50	Goggles with clear glass
20	Goggles with dark glass
500	Safety helmet
20	Welders mask, including extra glasses dark/clear
200	Pair of leather work gloves
5,000	Dust mask of double-thickness paper, disposable (one-day use)
200	Pair of gum boots; sizes, 38-47
100	Pair of safety boots; sizes, 37-47
25	Leather apron for welders
10	Complete set of asbestos clothing for heat protection

Electrical work

1 Digital manometer for measuring 0-10.00 atm and also in mm of H_2O or Hg

1 Digital multimeter for measuring 200 mV-2,000 V (DC and AC), 0.2 mA-2 A (DC and AC) and 200 Ω-20 MΩ at 2 kHz - 20 MHz

4 Analog multimeter for measuring 0-1,000 V (DC and AC) and 2 Ω-1 MΩ

3 Insulation tester, Megger, 0-500 V (DC)

1 Insulation tester, Megger, battery-operated, 500/1,000/2,500/5,000 V (DC)

1 DC/Hypot. test set, 0.03 kVA; range, 0-6/15 kV (DC); current, 2 mA (operating) and 15 mA (short circuit); power supply, 220 V; 50 Hz

1 Low-resistance double bridge; power supply, 220 V; 50 Hz; range:
0.100 mΩ - 1.1 mΩ
1 mΩ - 11 mΩ
10 mΩ - 110 mΩ
100 mΩ - 1,100 mΩ
1 Ω - 11 Ω
Power supply, 220 V; 50 Hz

1 AC voltage detector, 60 V-120 kV

1 Multifunction chart recorder including 10 rolls of record paper; 0-600 V/0-60 mV (DC); 0-150 mA/0-0.600 mA/0-6 A (DC); 0-600 V/0-300 mA/0-6 A (AC)

3 Clamp-on meters for AC and DC, 0-200 A

2 Clamp-on meters for AC and DC, 0-500 A

1 Transformer oil testing unit, 0-100 kV

2 Digital contact tachometer for measuring 0-5,000 rev/min

1 Automatic transformer; primary, 0-500 V, 200 kVA; secondary, 0-550 V

1 Injector transformer for relay testing; primary, 0-220 V (AC) secondary, 0-10 A

1 Oscilloscope, portable, digital display, multiple parameters, automatic calculations of wave form, voltage and time values; band width, 0-100 MHz power, 200 V, 50 Hz

1 Digital multimeter
0-100 mV - 1,000 V (DC)
0-200 mV - 750 V (DC)
0-0.1 mA - 10 A (DC)
0-0.1 mA - 10 A (DC)
0-10 Ω - 10 MΩ

1 Digital multimeter
- 0-200 mV - 1,000 V (DC)
- 0-200 mV - 750 V (DC)
- 0-0.2 mA - 2,000 mA (DC)
- 0-0.2 mA - 2,000 mA (DC)
- 0-200 Ω - 21 MΩ

2 Analog multimeter
- 0-0.5 - 1,000 V (AC)
- 0-10 - 1,000 V (AC)
- 0-0.5 - 250 mA (DC)
- 0-2 Ω - 1 MΩ

2 Megohmmeter, hand-operated; 100, 250, 500, 1,000 V; 200, 500, 1,000, 2,000 MΩ

1 Loop calibrator, digital, measures and generates 4-20 mA signals; input range, 4-20 mA; output range, 4-20 mA at load 0-600 Ω

1 Process signal calibrator, digital
- Inputs, 0-100 mV, 0-1, 0-10 and 0-100 V
- Input current, 0-100 mA and 4-20 mA
- Output, 0-10 V and 1-5 V
- Output, 4-20 mA, 0-20 mA and 10-50 mA, 0-50 mA
- Input pressure, 0-15 psig
- Power, 220 V

1 Adjustable DC power supply
- Output V, 0-50 V in two ranges
- Output I, 0-50 mA, 0-200 mA, 0-500 mA and 0-2,000 mA
- Load regulation, 0.07 per cent
- Line regulation, 0.02 per cent
- Ripple, 5 mV p-p
- Power supply, 220 V

1 Adjustable AC power supply
- Output V, 0-250 V (AC)
- Output I, 0-5 A
- Power rating, 650 VA
- Leakage range, 0-2.5 mA
- Power supply, 220 V

1 Isolation transformer
- Output rating, 100 kVA
- Input voltage, 20 V
- Output, variable 190-260 V in two steps

1 Resistance R.C.L. decade box
- No. of decades, 7
- Range, 1 Ω-1 MΩ
- Accuracy, 1 per cent

1 Capacitance R.C.L. decade box
- No. of decades, 6
- Range, 100 pF - 100 daF
- Accuracy, 4 per cent

1	Inductance R.C.L. decade box No. of decades, 4 Range, 1 mH-10 H Accuracy, 2 per cent
1	High-speed logic test kit
1	Set of thermocouple indicators and calibrators, input/output model for thermocouple types J, K, T, E, R, S or B
2	Timer/chronometer, 0-1 hour in 1/100 seconds
1	Digital frequency meter for receiving and transmitting signals; frequency range, 5 Hz-1 GHz
1	Semiconductor tester for checking diodes, thyristers, transistors etc.
1	Semiconductor data lock with equivalents of various makes
1	Logic data lock
1	Complete set of open-ended spanners, 6 x 7 to 27 x 32
5	Complete set of open-ended spanners, 6 x 7 to 20 x 22
5	Socket set, 4-12 mm
1	Socket set, 13-32 mm
1	Complete set of 12 Allen keys, 1.5-19 mm
5	Set of Allen keys, 1.5-12 mm
2	Self-grip wrench; capacity, 0-45 mm
8	End-cutting nipper; length, 120 mm
8	Diagonal-cutting nipper; length, 120 mm
6	Measuring tape, 2 m
8	Flat-nose pliers; length, 140 mm
3	Wallet of pliers
3	Circlip pliers for internal circlips; length, 140 mm
3	Circlip pliers for external circlips; length, 140 mm
2	Cable strippers set, 4-13 mm; stripping width, 0.1-4 mm; length, 140 mm
2	Wire stripper for conductor sizes 0.5-6 mm^2; length, 140 mm
5	Cable cutter for cable of maximum diameter 10 mm; length, 190 mm
2	Crimping pliers for cable of maximum section 10 mm^2

6	Set of four drifts; tip diameter, 2, 3, 4 and 5 mm; length, 85 mm
6	Set of three pin punches; tip diameters, 1.6, 2.3 and 3.2 mm
10	Ball pein hammers; weight, 320 g
10	Gloves for electricians, for 500 V
2	Aluminium folding ladder; length, 12 m
3	Complete set of five screwdrivers for Phillips head, 60-200 mm
5	Complete set of electrician's screwdrivers, 75-150 mm
8	Universal pliers (combination); length, 140 mm
4	Bench vice; jaw width, 120 mm
1	Set of two files, 100 and 200 mm
2	Hacksaw frame for hacksaw blade of 700 mm
5	Complete set of 10 ring spanners, 6 x 7 to 20 x 22
1	Complete set of ring spanners, 6 x 7 to 30 x 32
2	Adjustable spanners set; capacity, 13, 20 and 27 mm
2	Soldering iron, 220 V, 50 W
3	Soldering iron, 220 V, 400 W
2	Soldering irons stand
3	Two-pole voltage tester; voltage range, 6-750 V
2	Sets of Phillips keys, angular
10	Tweezers; length, 120 mm

Vehicle repair work

1	Battery charger, 220/12 V
3	Jumper cables, 6-24 V
1	Instrument for testing engine speed, camwheel, battery, alternator, starter motor, engine operation etc.
6	Hydraulic jack, 5.0 t
6	Hydraulic jack, 10.0 t
4	Hydraulic jack, 20.0 t
2	Hydraulic jack, 50.0 t
2	Hydraulic jack, 100.0 t

3	Mechanical jack, 10.0 t
2	Hydraulic garage jack on wheels, 10.0 t
4	Bench vice; jaw width, 100 mm; jaw opening, 100 mm
1	Set of open single-ended spanners, 6 x 7 to 27 x 32
5	Set of open single-ended spanners, 6 x 7 to 20 x 22
1	Set of open double-ended spanners, 6 x 7 to 27 x 32
5	Open double-ended spanners, 6 x 7 to 20 x 22
5	Set of 10 ring spanners, 6 x 7 to 20 x 22
1	Ring spanner, 6 x 7 to 32 x 36
5	Set of two screwdrivers, 180 and 150 mm
5	Set of two Phillips head screwdrivers, 120 and 150 mm
4	Set of two hydraulic jacks, 5 and 10 t
7	Set of Allen keys, 1-12
2	Set of two files, 100 and 200 mm

Carpentry and building work

4	Iron plane, spokeshave; width, 54 mm
4	Iron plane, smooth base; width, 51 mm
4	Iron plane, corrugated sole; width, 51 mm
4	Iron plane, corrugated sole; width, 60 mm
2	Iron plane, circular; width, 45 mm
2	Pack of six plane blades, double; width, 51 mm
2	Pack of six plane blades, double; width, 60 mm
2	Set of eight wood chisels; width, 6-38 mm
2	Set of four firmer gouges, half round; width, 8-25 mm
2	Set of three mortice chisels; width, 3-6 mm
2	Set of turning tools for wood
3	Set of four steel spatulas without handles; width, 50-120 mm
3	Set of four steel spatulas with wooden handles; width, 25-100 mm
3	Set of four steel spatulas with laminated wood handles; width, 100-250 mm

3	Parquet floor scraper with steel handles; width, 63 mm
3	Wrecking bar; length, 320 mm
3	Wrecking bar; length, 600 mm
10	Carpenter's hammer with wooden handles
6	Handsaw, universal teeth; length, 600 mm
4	Tenon saw; length, 350 mm
4	Compass saw; length, 300 mm
2	Universal keyhole saw; length, 270 mm; diameter, 5.0 mm
3	Figure saw; blade length, 200 mm
4	Set of three figure saw blades, fine, medium and coarse; length, 200 mm
1	Embossing machine, Dymo, 6 and 9 mm tape
1	Set of 10 packs tape for embossing machine
1	Stamping set in steel, 4 mm types
1	Set of beam trammels for maximum diameters 1,000-2,000 mm
1	Engineer's level with grooved base; length, 300 mm; accuracy, 0.006 mm
1	Frame levels with groove; length, 200 mm
4	Mason's wood level; length, 1,200 mm
4	Plumb bob, 6.0 kg
2	Glass cutter with large diamond
10	Plasterer's trowel, steel; length, 250 mm
10	Pointing trowel; length, 140 mm
5	Pointing trowel; length, 170 mm; width, 12 mm
8	Finishing trowel, 450 x 270 mm
3	Hand drill for maximum drill diameter 13.0 mm
4	Sweep drill brace
2	Pneumatic breaker for concrete, Atlas Copco Super TEX 25 E
2	Pneumatic breaker for light concrete work, Atlas Copco Super TEX 11
5	Point chisel for sweep drill brace

5	Narrow chisel for sweep drill brace
5	Point chisel for pneumatic breaker
5	Narrow chisel for pneumatic breaker
4	Pneumatic vibrator for concrete
5	Set of flexible hoses for pneumatic tools, 30 m each of 3/4 in. and 1/2 in. hose
25	Snap coupling for 3/4 in. hose
25	Snap coupling for 1/2 in. hose
5	Smoothing plane, standard series; length, 240 mm
5	Jack plane with 50 mm cutter; length, 335 mm
2	Complete set of nine wood chisels, 6-38 mm
1	Set of six spatulas; width, 25-100 mm
1	Set of three wrecking bars; length, 500, 625 and 750 mm
5	Handsaw, universal teeth; length, 550 mm
5	Tenon saw; length, 350 mm; maximum sawing depth, 100 mm
5	Compass saw; blade length, 300 mm
4	Plumb bob; weight, 200 g
4	Glass cutter; length, 130 mm
6	Pointing trowel; length, 140 mm
6	Folding rule; length, 2 m
4	Clamp, Bessey type; jaw opening, 2,000 mm

Vehicle repair work at Salamanga quarry

Hand-tools for maintenance and repair of quarry machines were purchased and financed by OPEC Fund in 1989 (see annex V)

Lubrication work

10	Grease gun with lever arm for grease in bulk; reservoir capacity, 550 cm^3
2	Kit of various grease nipples suitable for grease guns
3	Grease pump with lever arm for grease in bulk, including 2.0 m steel-reinforced flexible hose and coupling; reservoir capacity, 6 kg
5	Oil can; capacity, 0.3 l; length of spout, 125 mm

5	Oil can; capacity, 0.5 l; length of spout, 200 mm
2	Complete set of two measuring cans for oil; capacity, 0.5 and 2 l
3	Set of two funnels; diameter, 120 and 200 mm
2	Drum pump with plastic tube; length, 1,100 mm; capacity, 10 l/min

Annex IV

EXISTING MACHINES AT THE WORKSHOPS

Mechanical workshop

Quantity	Description/specification	Manufacturer	Comment on condition
1	Lathe/sliding lathe Height of centres, 340 mm Distance between centres, 2,500 mm	South Bend	In working condition but old (20 years)
1	Lathe/sliding lathe Height of centres, 450 mm Distance between centres, 3,200 mm	Meuser	Adjustments required (15 years)
1	Lathe/sliding lathe Height of centres, 500 mm Distance between centres, 5,000 mm	Tos Czechoslovakia	In good condition (7 years)
1	Lathe/sliding lathe Height of centres, 135 mm Distance between centres, 680 mm	South Bend	In working condition but old (20 years)
1	Shaping machine Machinable length, 560 mm	Douglas Standard-22	In working condition but old (20 years)
1	Radial drilling machine for manual drilling in steel, maximum 20 mm	Ucimo	In working condition (20 years)
1	Radial drilling machine for semi-automatic drilling in steel, maximum 32 mm	Ucimo	In good condition (15 years)
1	Double wheel bench grinder for tools	Black & Decker	In good condition
1	Double wheel grinder for tools	Baldor erinder	Replacement or repair required
1	Double wheel grinder for tools	Gisag	In good condition
1	Single wheel grinder, heavy-duty	Thcmson	Not working. To be replaced due to age

1	Universal milling machine Work mounting table, 250 x 1,000 mm	Mammutwerk (1963)	In good condition but small
1	Shearing machine, hand-operated, two knives for cutting plates, flat and round bars		Old. Maintenance required
1	Triple rolls, electrical Length of rolls, 1,500 mm Capacity in plate thickness, 6 mm		In good condition
1	Power hack-saw Capacity, 250 mm	Johnson	In good condition
1	Hydraulic one-cyclinder press Maximum pressure, 60 t/10 t Maximum travel range, each 8 in.		In good condition
1	Shearing machine, hand-operated, bench-fitted, for cutting thin plates		Old. Must be replaced
1	Bending and folding machine for thin plates Maximum width, 1,000 mm		Old. Maintenance required
4	Parallel-jaw vices, heavy-duty		3 in working condition. 1 not in order
2	Parallel-jaw vices for tool work		To be replaced

Electrical workshop

1	Lathe/sliding lathe Height of centres, 100 mm Distance between centres, 800 mm	South Bend	In working condition
1	Double-wheel bench grinder for tools		Not in order. To be replaced
2	Parallel-jaw vices		Satisfactory

Vehicle repair shop

1	Valve grinder	Wolf	To be repaired
1	Double-wheel bench grinder for tools		Old. Must be replaced

1	Compressed air supply unit for tyres and cleaning purposes; complete unit with electrical motor. Volume/min at operating pressure of 150 lb/in.^{2}, unknown	Broom-Wade	To be replaced
1	Parallel-jaw vice		Satisfactory

Carpentry workshop

1	Universal machine		Good
1	Endless band-saw		Maintenance required
1	Double-wheel bench grinder for tools		To be replaced
1	Parallel-jaw vice		Satisfactory
1	Concrete mixer, 0.150 m^3		Very old. Not in working condition

Quarry workshop

All machines and hand-tools to be replaced by new ones purchased with money from OPEC Fund (see annex V).

Annex V

MACHINES AND HAND-TOOLS FOR THE QUARRY WORKSHOPS AT SALAMANGA, SUPPLIED OR ORDERED IN 1989 BY OPEC FUND

Hand-tools

Set of metric tools (1)
Standard socket and accessories set, 3/8 in.-5/4 in. (1)
Combination wrenches set, 1/4 in.-5/4 in. (1)
Offset ring wrenches set, 1/4 in.-5/4 in. (1)
Set of hexagonal keys, 1/16 in.-3/8 in. (1)
Set of short combination wrenches, 1/8 in.-7/10 in. (1)
Socket and accessories set (2)
Set of metric tools (2)
Set of inch tools (2)
Set of metric tools in roller unit (1)
Six-point socket set, standard series, 10-21 mm (3)
Combination wrench (3)
Feeler gauge set (4)
Basic workshop tool set (4)
Inspection lamp, 220 V (2)
Spark plug wrench set (1)
Hinged socket set (2)
Hexagonal key set, 2-12 mm (1)
Hexagonal key set, 1/16 in.-1/2 in. (1)
Heavy-duty chain wrench (1)
Spare chains (1)
Slip joint multigrip pliers (4)
Mammoth pliers (2)
Combination pliers (6)
Inside circlip pliers (2)
Inside circlip pliers (1)
Dual-purpose circlip pliers (1)
Screwdriver, 200 mm (5)
Screwdriver, 250 mm (2)
Professional screwdriver, posidrive head, 250 mm (1)
Professional screwdriver, posidrive head, 150 mm (1)
Engineer's hammer, 280 g (2)
Hammer handle (5)
Engineer's hammer, 580 g (2)
Hack-saw frame (3)
Packet of hack-saw blades (10)
Plastic hammer, 270 g (4)
Open-end wrench (3)
Open-end wrench (3)
Files set (2)
File handle (5)
Flat file (3)
Round file (1)
Wall cabinet tool set (1)
Battery service kit (1)
Acid hydrometer (2)
Battery filler (1)
Electrician's set (2)
Electrician's pliers (2)
Wheel nut tool (4)
Piston ring compressor 55-110 mm (1)

Piston ring compressor 100-160 mm (1)
Piston ring pliers 45-100 mm (1)
Piston ring pliers 90-150 mm (1)
Stud extractor set (1)
Stud driver (1)
Tap and die set, metric, coarse, M4-M24, short, chrome steel, with tap wrench and die stock (1)
Tap and die set, metric, fine, M4 x 0.5 to M12 x 1.5, chrome steel, with tap wrench and die stock (1)
Tap and die set UNC, short, chrome steel, 7/32 in.-3/4 in. (1)
Set of drill bits, 1-13 mm in 0.5 mm steps (2)
Drill bits, 5.2 mm, 6.2 mm and 7.2 mm (2)
Set of drill bits, 4 mm-13 mm in 0.5 mm step (2)
Set of drills, 14 mm, 15.5 mm, 17.5 mm, 19.5 mm, 20 mm, 21 mm, 24 mm, 26.5 mm and 30 mm (1)
Bench vice, fixed base, interchangeable jaw with 170 mm (1)
Bench vice, fixed base, interchangeable jaw with 135 mm (2)
Bench vice, swivel base, 360° jaw with 150 mm
Hand vice, jaw with 50 mm (1)
Hand valve lapper, rubber; suction cap diameters, 36 and 30 mm
Valve lapping compound, coarse and fine, 200 g (5)
Torque wrench, 35-175 ft-lb (1)
Set of separators and puller devices for bearing (1)
Nozzle tester, 0-400 kg/cm^2
Tool set for electricians with multimeter 710 (1)
Two-pole voltage tester (4)
Crimping terminal kit (1)
Hexagonal key set (2)
Hexagonal ket set (2)
Adjustable wrench (2)
Monkey wrench (2)
Slip-joint multigrip pliers (2)
Circlip pliers (inside) (4)
Circlip pliers (outside) (4)
Twist drill set (1)
Masonry drill set (1)
Oil can (1)
Side-lever grease gun (1)
Set of connectors and delivery tubes for grease gun (1)
Outside puller (2)

Machine tools

Lathe machine (1)

Type	Workshop lathe
Power	Electric motor, 380 V, 3 phases, AC, 50 Hz
Centre height	150 mm
Centre distance	1,000 mm
Accessories	Rotating centre
	Chucks
	Face plate
	Tool post
	Coolant pump
	Thread-cutting change wheel set for inch and metric
	Motor protection
	Centre drill
	Tool bits

Drilling machine (1)

Type	Pillar type
PowerElectric motor,	220 V, AC, 50 Hz
Accessories	Taper shanks
	Drill chuck
	Motor protection
	Slotted movable table
	Coolant pump

Grinding machine (3)

Type	Bench-type, rough-grinding
Power	Electric motor, 220 V, AC, 50 Hz
Capacity	Up to 31 mm in steel
Accessories	Two sets of grinding wheels
	Adjustable supports and shields
	Motor protection
	Grinding wheel dresser, round

Hand drilling machine (1)

Type	Portable
Power	Electric, 220 V, 50 Hz, AC
Capacity	Up to 13 mm

Hand grinding machine (1)

Type	Portable
Power	Electric motor, 220 V, 50 Hz, AC

Workshop equipment

Compressor (1)

Fully automatic, two stage
Maximum working pressure, 14 kp/cm^2
Free air delivery, 400 l/min
Power rating, 5 HP; three-phase electric motor, 380 V, 50 Hz

Car washer (1)

Electric motor, 220 V, AC, 50 Hz
Pump pressure, 60 bar
Water consumption, 12 l/min
High-pressure hose, 10 m, handle and connections etc.
Stationary type

Welding machine and accessories (1)

Combined welding and power generator
Diesel engine with electric starter, 15-20 HP
Welding generator control range, 40-250 A

Power generator, 50 Hz, three-phase, 380 V, AC
Accessories: Cable set 2 x 10 m, 50 mm^2; cable set 2 x 5 m, 35 mm^2; welder's screen (2); welding holder (2); earth clamp (2); wire brush (4); chipping hammer (2) and cable connectors (2)

Gas welding equipment

Gas lighter (3)
Pressure-reducing valve (3)
Welding torch (4)
Cutting torch (2)
Cutting nozzle (4)
Welding nozzle (8)

Hydraulic jack, workshop crane, grease gun, pumps etc.

Hydraulic jack, portable, 50 t (1)
Hydraulic jack, portable, 10 t (2)
Hydraulic jack, portable, 2 t (1)
Workshop crane, 10 t, overhead-travelling, 12.5 m span, fully electrical on 380 V, 50 Hz, AC (1)
Tip crane, wall-type, 5 t, with electric hoist (1)
Pneumatic grease gun, 350 cc (2)
Spare tube and nipples for the above gun (4)
Grease pump, 5 kg capacity (2)
Set of spare nipples for grease pump (2)
Oil can, 0.5 l (3)
Spare spout for oil can (6)
Set of measuring cans, 5, 2 and 1 litres (2)
Set of funnels (5)
Drum pump for oils, reciprocating type, 0.5 l/stroke capacity (3)
Drum pump for fuel, reciprocating type, 20 l/min capacity (2)
Drum pump for fuel, DC, battery, with flow-meter capacity of 35 l/min (2)

Tyre repair equipment

Tyre lever, 750 mm (2)
Tyre lever, 450 mm (2)
Tubeless tyre valve inserter, 280 mm (1)
Tubeless tyre constrictor, hydraulic (1)
Tubeless tyre changer for size up to 35/65 x 33 (1)
Hydraulic tyre-removing tool (1)
Hydraulic tyre-removing tool for tubeless tyres (1)
Tyre mounting and dismounting machine (1)
Tyre mounting and dismounting machine for heavy vehicles (1)
Tyre pressure gauge, 1-4 kg/cm^2 (2)
Tyre pressure gauge and air pump nozzle, 1-10 kg/cm^2 (2)

Measuring instruments

Spring tape rule, 2 m (3)
Thread pitch gauge (1)
Vernier calliper, 300 mm (2)
Micrometer, 0-25 mm (1)
Micrometer 25-50 mm (1)
Micrometer 50-150 mm (1)
Dial gauge set (1)
Inside calliper, 250 mm (1)
Outside calliper, 250 mm (1)
Depth gauge, 160 mm (1)
Multimeter for electricians (2)
Megger, 600 V, 0-200 MΩ (2)
Clamp-on tester for current (2)