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PREPARATORY ASSISTANCE IN THE ESTABLISHMENT OF A REPAIR AND MAINTENANCE CENTRE IN BARBADOS

UNIDO Contract no. 89/78/CYL
UNIDO Project no. DP/BAR/88/008/A/01/37
GEMCO project no. DP 9830

FINAL REPORT

Prepared for:
THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION, VIENNA

Prepared by:
GEMCO INDUSTRIAL DEVELOPMENT B.V., SON, THE NETHERLANDS

Son, 06 November 1989

SUMMARY AND CONCLUSIONS

Background information and project history
The industrial sector in Barbados has recently experienced a considerable expansion.
A major problem faced in the industrial sector is the unability to fully utilize the available production capacity, which is mainly due to the lack of proper facilities for repair and maintenance of industrial equipment and machinery. A balanced development of the industrial sector in Barbados is seriously hampered by this situation.

In 1985 the Government of Barbados submitted a request to UNDP/UNIDO aimed at strengthening and promoting the establishment of an industrial service programme. UNDP/UNIDO supported this request.

In order to ensure a balanced development of the industrial sector on the long run, Gemco Industrial Development was invited by UNIDO to provide preparatory assistance for the establishment of an industrial repair and maintenance centre.

Problem adressed by the project
In general it can be concluded that major problems envisaged by the industry and the educational institutions are:
1. the unavailability of an industry-oriented training and demonstration programme in repair, maintenance and engineering services, and
2. the lack of facilities in Barbados to perform the required maintenance and repair work for industrial equipment, machinery and tools.

Development Objective
The development objective of the project is to contribute to a plan of the Government of Barbados/ BIDC, aiming at maximizing the country's industrial resources by developing a training and demonstration programme in repair and maintenance and engineering services. The plan is part of the Government's programme to support concentrated industrial expansion, especially in the metal working sector, with a maximum dependency on domestic capabilities and a minimum dependency on import of spare parts and repair work.

Project Strategy and objectives
In order to effectively work on both problems, the project will be divided in two phases, pursuing the same development objective, but each having separate immediate objectives and goals.
Each of these phases are described in separate draft project documents, which are both included in this report.

The two phases to be implemented are:

Phase 1: The establishment of a multi precision metal machining training programme, incorporated within an existing training institute.
The programme should be flexible, geared to existing and future demands of the industry. The training programme should be incorporated within the existing organisation of the Samuel Jackman Prescod Polytechnic.
A separate workshop within the SJPP will be equipped with existing and new equipment.

Phase 2: The establishment of an industrial service centre.
This ISC will fulfil requirements of the domestic industry, by means of having centralised service facilities, rendering technical assistance services and giving crash training courses. The ISC should provide these services on a commercial basis.

Manpower requirements
Phase 1:
For the implementation of the training programme one additional national instructor will be required for the first year, and a second instructor for the second year of implementation.
As for expatriate experts, the mission recommends to have one technical expert assisting the mechanical department of SJPP in general, and the implementation of the new programme in particular, for a duration of 27 months.

Phase 2:
The number of national staff required amounts to 25 in the first year, increasing to 34 in the second and later years.
For a selected number of staff fellowships should be organised.

One expatriate technical expert will be required for a duration of two years. Furthermore a need will appear for specific expertise, to be provided by various short-term engineering consultancies.

Implementation scheduling
It is strongly recommended to have phase 1 of the project approved and a sub-contractor selected before the end of 1989, in order to ensure a timely start of the training programme in September 1990.

Financing resources for implementation of phase 2 should be sought as soon as possible, in order to start procurement of equipment and machinery in May 1991, and to start full implementation in April 1992.

Project cost and finance

Phase 1

In order to ensure a timely and professional follow-up of all preparatory activities undertaken, the mission recommends that UNDP/UNIDO continues to provide financial assistance in the implementation of phase 1. The total project costs are expected to amount to US$ 698.950,-.
The Barbados Government is expected to finance the costs for national manpower and rehabilitation of workshop buildings, estimated to an amount of US$ 30.000,-.

Phase 2

In the mission's view the financing of phase 2 should, in addition to the domestic financial resources, be supplemented by external multi-lateral or bilateral donor agencies.
UNDP/UNIDO may maintain the executing agent, and may continue to provide financial assistance for international expertise, training and/or fellowship activities for phase 2.

The mission recommends that the Government would have a cost-sharing contribution to the international budget, by financing 70 % of the total hardware costs out of bi-lateral or multi-lateral sources of finance.

The domestic industry in Barbados should preferably have a financial involvement in the set up of the ISC.
The mission suggests the domestic industry would cover approximately 30 % of the total hardware component.

Total project costs are estimated to amount to US$ 1.977.000,-, whereby it is assumed that the Barbados Government will provide required physical facilities, estimated at US$ 400.000,- in kind.

Financial and economic analysis

Results of preliminary financial analysis indicate that the establishment of an Industrial Service Centre will be a financially feasible operation.
A detailed economic feasibility analysis was however not in the scope of this study. Therefore a further investigation is needed to confirm the economic feasibility of phase 2 of the project.

From the national economic point of view, the project will contribute to the development of the industrial sector in Barbados, and is expected to create employment opportunities. Furthermore it is expected that by enhancing repair and maintenance capabilities, expenses in foreign currency for these services abroad can heavily be reduced.

PREFACE

Gemco Industrial Development was invited by UNIDO to perform the preparatory assistance in the establishment of a repair and maintenance centre in Barbados.

The Gemco-mission carried out the study during the period of August 27 - September 18 1989.

Results of this mission are presented in this final report, prepared after the discussions with and according to instructions from UNIDO-representatives in Vienna.
This resulted a.o. in the inclusion of two separate draft project documents in this report, one for a first-phase project and one for a second-phase project.

For the realisation of this report we wish to express our thanks to all who supported in the performance of our work.

Especially we wish to thank all people of the Barbados Government, the Barbados Industrial Development Corporation, and the representatives of the Barbados Manufacturing Association, the Samuel Jackman Prescod Polytechnic, UNDP and UNIDO.

W. Kuitert (Technical Training Expert)
M.G.J.M. Janssen (Planning and Production Expert)

Son, 06 November 1989

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P H A S E 1

"The Establishment of a Multi Precision Metal Machining Training Programme within the Samuel Jackman Prescod Polytechnic, Barbados"

UNITED NATIONS DEVELOPMENT PROGRAMME

Project of the Government of
BARBADOS

DRAFT PROJECT DOCUMENT

Project Title :

The Establishment of a Multi Precision Metal Machining Training Programme within the Samuel Jackman Prescod Polytechnic, Barbados (Phase 1)

UNIDO project no. DP/BAR/89/xxx/x/xx/37

Project Duration : 27 months

Executing Agency :

The United Nations Industrial Development Organization (UNIDO)

Estimated Starting Date : July 1990

UNDP and cost sharing financing

UNIDO/UNDP Contribution : US$ 698.950,-

Estimated Government Contribution : US$ 30.000,-

Signed:	Date:	Name/title:
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on behalf of the Government		
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on behalf of the Executing Agency		
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on behalf of the United Nations Development Programme		

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A CONTEXT

A.1 Description of the sector

The resident population in Barbados is estimated at 253.800 in 1988.
In 1988 the two main export sectors - manufacturing and tourism - were responsible for over 60 % of the real growth in economy.
The total nominal GDP at factor cost, estimated at BDS$ 2.665,4 million increased with 6,7 %. The GDP per capita for 1988 is thus estimated at BDS$ 10.500,-.

The total number of people employed (1988) was 100.700, resulting in an official unemployment rate of 18.6 %.
The manufacturing sector provided employment for 12.600 persons.

The industrial sector in Barbados has recently experienced a considerable expansion. During 1988 the real output in the manufacturing sector rose by 6.9 percent, after falling by 6.0 percent in 1987. Between 1981 and 1987 the sector had to face many difficult challenges. Particularly the electronics manufacturing sub-sector faced heightened international competition, resulting in the closure of some major firms, and in significant fall-off in jobs and output.

A major problem faced in the industrial sector is the unability to fully utilize the available production capacity, which is mainly due to the lack of proper facilities for repair and maintenance of industrial equipment and machinery. A balanced development of the industrial sector in Barbados is seriously hampered by this situation.

A.2 Government strategy

The Government of Barbados assigns high priority to a further improvement and expansion of the metalworking and engineering industries sector.
The Ministry of Trade, Industry and Commerce therefore mentions in the Sectoral Development Plan 1988-1993 their intention to influence this expansion of output and employment through the rehabilitation of the manufacturing sub-sector and the encouragement of new investments in this sector.
The strategy for sector development includes the development of the services industries.
Among others the following targets and objectives were identified:
- to increase the percentage of manufacturing contribution to real GDP from 11 % to 14 %;
- to revitalise the manufacturing sector;
- to provide an improved package of technical assistance and incentives to the industrial sector;

- to stimulate real growth in manufacturing exports;
- to promote more cost-effective and efficient delivery of services to the manufacturing sector;
- to improve the capability of the industrial sector.

The Government would furthermore ensure that industrial and educational policies are coordinated, in order to permit the industrial sector to derive the maximum support from the educational sector.

In 1985 the Government of Barbados submitted a request to UNDP/UNIDO aimed at strengthening and promoting the establishment of an industrial service programme. UNDP/UNIDO supported this request.
Accordingly, the awareness of the need for improved maintenance and repair facilities was expressed during a 'Maintenance Week' held in Barbados in 1986.
This was followed by a technical meeting held in May 1988, attended by senior level managers of identified firms and representatives from the Barbados Industrial Development Corporation (BIDC), the Barbados Manufacturers Association (BMA) and UNIDO.

As a result of discussions during this meeting, a team of two UNIDO-consultants undertook a 3-months mission to Barbados, starting in January 1989. The mission's duties were to assist in solving the immediate problem of machine utilisation, by introducing preventive maintenance programmes in selected companies and to give recommendations for the improvement of repair and maintenance facilities and the strengthening of industrial interaction with training.

In order to ensure a balanced development of the industrial sector on the long run, Gemco Industrial Development was invited by UNIDO to provide preparatory assistance for the establishment of an industrial repair and maintenance centre.

A.3 Institutional framework

The Government's policy for development efforts is that institutions such as the Central Bank of Barbados, Barbados Development Bank, Barbados National Standards Institution (BNSI), BIDC, Barbados Export Promotion Corporation and the commercial banks provide pertinent information and advice to the sector.

The Government's policy for development of industrial training is that industrial training activities should be linked to existing training institutions, i.e. Barbados Community College (BCC), Samuel Jackman Prescod Polytechnic (SJPP) and the National Training Board (NTB).

B PROJECT JUSTIFICATION

B.1 The present situation

B.1.1 The small and medium-scale industry

The existing situation within the metalworking, woodworking and engineering industries in Barbados can be characterised as follows:

- Up till several years ago, a foundry cum machineshop existed in Barbados, where besides the work for the sugar industry jobbing activities for the local industries were performed. After closing of the foundry, a centralised repair and maintenance facility was no longer available.

- Due to its own limited natural resources, Barbados has an import-oriented society; for the industry this implies that raw materials, machinery, accessories, spare parts and consumables have to be imported. For certain tools and spare parts import duties have to be paid.
  Presently the required repair and maintenance work for industrial equipment, machinery, tools and dies is performed by either sending the work to be done abroad, or by having foreign technicians coming to Barbados. These methods are however both time consuming and expensive, and create a dependancy from foreign assistance, without making effective use of domestic resources. Present institutions in Barbados are not capable to develop the necessary technical skills to deal with repair, maintenance and precision engineering works.

- Many industries are exporting a considerable part of their products within the Caricom countries. Very few industries are also exporting to USA and Europe, and if so: only on a limited scale.

- Most industries are equipped with conventional equipment and machinery. Only in a few larger industries more sophisticated machinery is available. In these industries also the demand appears for basic electrical and electronic service facilities.

- In the majority of the industries most machines are old and not properly maintained or even cleaned. Machine tools are in a poor condition. The shopfloors are in a disordered state. Safety conditions are in general poor.

- Most of the industries use no proper maintenance programmes. Only corrective (break-down) maintenance is done.

- Most workers in the industry did not attain any practical education, and were trained on-the-job. Basic technical skills are often lacking, work discipline is not adequate.

In general it can be concluded that major problems envisaged by the industry are:

- The lack of practical skilled workers to execute precision metal machining and maintenance and repair work;
- The lack of sufficient precision machines and equipment;
- The non-availability of a centralised technical service centre.

B.1.2 Educational institutes

- Barbados has in general a good education system. Existing technical education institutes are the Samuel Jackman Prescod Polytechnic (SJPP) and the Barbados Community College (BCC). The SJPP emphasises on craft level training, whereas the BCC provides education and training on technician level.

- Furthermore the National Training Board (NTB) implements a skills training programme and an apprenticeship programme aimed to develop technical skills for the industry.

- The two technical institutes have no sophisticated machinery available. A considerable part of the machinery is old, not in use and/or out of order.

- The interlinkage and coordination between the training institutes and the industry is not adequate.

The problem envisaged by the educational institutes are therefore the lack of practical skills programmes and appropriate, sophisticated equipment, resulting in the fact that although graduate students have good theoretical knowledge, their required practical skills are not sufficient to meet existing demands in the industry.

Summarising the present situation as described above, it can be concluded that the problem addressed by the project is two-fold:

1. the unavailability of an industry-oriented training and demonstration programme in repair, maintenance and engineering services, and
2. the lack of domestic facilities in Barbados to perform the required maintenance and repair work for industrial equipment, machinery and tools.

B.2 Expected end-of-project situation

In order to effectively work on both problems as described in section B.1, the project will be divided in two phases, pursuing the same development objective, but each having separate immediate objectives and goals. These phases are overlapping in time.
This separation is also based on the need for (a) establishing a proper technical training facility and (b) a separate industrial services facility, as expressed by the national parties involved (Government, Barbados Manufacturing Association, BIDC, domestic industries).
The two phases to be implemented are:

Phase 1: The establishment of a multi precision metal machining training programme, incorporated within an existing training institute;

Phase 2: The establishment of an industrial service centre.

Phase 1 of the project is further worked out in this draft project document, whereas phase 2 is described in the draft project document entitled "The establishment of an Industrial Service Centre in Barbados".

The expected impact of phase 1 may be illustrated in the following, which refers to the evolution of the existing situation towards a new situation at the moment of project completion.

Multi Precision Metal Machining Training Programme

At the end of phase 1 the following is expected to be achieved:

1. A multi precision metal machining training programme, geared towards the present and future demands of the industry, will be in operation at an existing training institute. This institute should preferably be the SJP Polytechnic, taken into account:
   (a) physical facilities;
   (b) already available training curricula;
   (c) internal organisation of SJPP;
   (d) SJPP's overall objectives.

   After the two years of project execution 14 trainees would have attended the programme.

2. A National instructor will have taken over the new training programme (theoretical and practical) from the expatriate technical consultant. A second instructor will after one year of project execution have taken over the first course year from the first instructor.

3. Existing machinery and equipment of the mechanical engineering section will have been reconditioned as far as reasonably possible, additional sophisticated machinery and equipment will have been supplied and in full operation.

4. A separate workshop with store room will have been equipped for the MPMM-training programme, an additional office for the national instructor and the expatriate technical consultant will be in use.

5. The interlinkage and cooperation between the SJPP and the industry will be strengthened.

6. Co-ordination among the various technical training institutes and organisations will be strengthened.

B.3 Target beneficiaries

The direct target beneficiaries are:
- The technical/vocational education and training facilities on craft level, in specific the Mechanical Engineering division of the SJPP.
- The apprentices joining the MPMM-training programme.
- The instructors to be recruited.

The indirect target beneficiaries are the domestic industries, having a shortage of skilled labour, especially geared to skills required for repair and service works.

B.4 Project strategy and institutional arrangements

The project strategy for phase 1 is to set up a technical training programme. The programme should be flexible, geared to existing and future demands of the industry. The training programme would be incorporated within the existing organisation of the SJPP in order to fully use existing physical and organisational facilities and to prevent any duplication of related activities.
A separate workshop will be equipped with existing and additional equipment. The Government should provide the required existing facilities to the project, and should obtain, at very short notice, financing resources for the supply of additional equipment and the technical assistance.
An expatriate technical consultant will assist the mechanical department of SJPP in general, and the implementation of the new programme in particular, for a duration of 27 months.

A description of the outline of the training programme is given in annex 2, whereas the required workshop lay-out is given in annex 5.

B.5 Reasons for assistance from UNDP/UNIDO

UNDP/UNIDO have assisted the Government of Barbados in the identification of problems raised within the industrial sector by means of several preparatory projects. This assistance resulted in several plans of action, among others presented in this draft project document.
In order to ensure a timely and professional follow-up of these preparatory activities, the mission recommends that UNDP/UNIDO continues to provide assistance in the implementation of phase 1.

B.6 Special considerations

By enhancing repair and maintenance capabilities, expenses in foreign currency for abroad services in this field can heavily be reduced. Furthermore the contribution to industrial development is expected to create more opportunities for employment.

The project will contribute to strengthening the interlinkage between industry and education.

B.7 Co-ordination arrangements

The project may establish co-ordination arrangements with the other training institutions in Barbados as well as institutes abroad, in order to optimize course contents, strengthen the total eductional capacity in Barbados and to avoid any duplication of activities and serious duplication of expensive equipment procurement and operation.

B.8 Counterpart support capacity

The training programme may easily be included within the facilities of SJP Polytechnic.
The existing physical facilities are in a good condition, only some minor adaptations to the buildings may be required (a.o. additional electricity supply). Present course instructors have sufficient theoretical and practical capabilities.

C DEVELOPMENT OBJECTIVE

The development objective of the project is to contribute to a plan of the Government of Barbados/BIDC, aiming at maximizing the country's industrial resources by developing a training and demonstration programme in repair and maintenance and engineering services.
Within this plan priority is given to demonstration of modern maintenance and repair techniques, organisation and upgrading of repair facilities and operations and to in-plant training.
The plan is part of the Government's programme to support concentrated industrial expansion, especially in the metal working sector, with a maximum dependency on domestic capabilities and a minimum dependency on import of spare parts and repair work.

D IMMEDIATE OBJECTIVE, OUTPUTS AND ACTIVITIES

Immediate objective

The immediate objective is to establish a well-equipped training facility within the mechanical engineering department of the Samuel Jackman Prescod Polytechnic, in which a practical skills training programme is operated, emphasizing on repair and maintenance aspects and geared towards existing and future demands of the industry.

Output 1

An established and operational workshop, equipped with machinery and tools for providing technical training programmes.

Activities:
1.1 Adaptations of existing workshop-facilities
1.2 Procurement and shipment of additionally required equipment
1.3 Installation and commissioning of supplied equipment
1.4 Revision and installation of required existing equipment and machinery for the project
1.5 Procurement and supply of course materials
1.6 Training of instructors in operation, repair and maintenance of supplied equipment.

Output 2

The availability and operation of a Multi Precision Metal Machining Training Programme.

Activities :
2.1 Procurement and delivery of training materials
2.2 On-the-job training of the instructor in giving the MPMM-training programme
2.3 Operating this two-year training programme with approximately 14 apprentices per year.
2.4 Taking over the training course by the national counterpart.

Output 3

Improvement of the workshop facilities and existing training programmes of the Mechanical Engineering department of SJPP.

Activities:
3.1 Revision of existing equipment and machinery within the workshops
3.2 Preparing preventive maintenance schemes for machinery
3.3 Assisting activities within the existing training programmes.

E INPUTS

E.1 Government inputs

The proposals mentioned in this sub-section have thoroughly been discussed with the responsible staff at SJPP and Government representatives.

National staff
At present the organisation of the Mechanical Engineering Department of the SJP Polytechnic consists of one Division Head (Chief Instructor), 3 instructors and 2 demonstrators.
The present two-year programme for students consists of the basic machine shop engineering course (first year) and the mechanical fitting course (second year).

The proposed two-year MPMM-training course would be an alternative for students entering the second year.

For the implementation of the training programme one additional national instructor will be required for the first year, and a second instructor for the second year of implementation.

After several discussions with the principal and the division head of SJPP, the general opinion was that one of the present instructors should implement the programme with the assistance of the expatriate counterpart. In this way necessary skills of the national counterpart will be ensured.
One new instructor will be required, who would implement the first year course Machine Shop Engineering. No difficulties for recrutement are foreseen.

The organisation of the Mechanical Engineering Department, the training programmes and job-descriptions of Barbadian key personnel are given in annex 6.

Other national inputs
a) Workshop buildings
At present the Mechanical Engineering Department has 4 workshops available, but only 2 in permanent use.
Consequently one workshop is available for the implementation of the MPMM-programme.
This workshop is in good condition and only needs some civil adaptations, including re-wiring, painting, additional lighting, to be performed before the installation of new machinery.
A storeroom is also available.

b) Nationally provided equipment and workshop-supplies
Part of the existing, for a considerable part idle, machinery and equipment at the SJPP-workshops should be made available for the implementation of the MPMM-training programme.

c) Miscellaneous
An additional office (approx. 25 m^2) should be provided for the expatriate technical consultant and the national instructor.

Equipment requirements from the Government/SJPP are listed in detail in annex 3.

E.2 UNDP/UNIDO inputs

a) International staff
One expatriate technical consultant will be required for the execution of the project. This consultant should be a mechanical engineer with extensive knowledge and experience in the set up and operation of technical training programmes.
The consultant will be required for the total duration of phase 1 (27 m/m), starting in Barbados in July 1990.

b) Subcontracts
The mission proposes that all activities to be performed in phase 1 are sub-contracted by UNIDO to a company which is specialised in both supply of the required equipment and training programme as well as the provision of the expatriate technical consultant. The sub-contractor should furthermore have professional backstopping and supervision facilities.

c) Training
No fellowships are foreseen during phase 1 of the proposed project.

d) Equipment and supplies
In addition to the already existing machinery and equipment at SJPP, new sophisticated equipment, tools, spare parts, consumables and raw materials will have to be supplied before the actual start of the training programme (September 1990).
Also the training materials have to be supplied.
A detailed description of all these items is given in annex 4.

F RISKS

As the proposed phase 1 of the project will be implemented within the existing organisation of SJP Polytechnic, the risks that the project would seriously delay or prevent the achievements of the project's outputs and objectives are low.
Major risks are:
- the non-availability of timely financial resources - low risk
- the non-availability of a suitable practical training programme - low risk

G PRIOR OBLIGATIONS AND PREREQUISITES

Prior obligations and prerequisites required before the project can commence implementation are:

Government obligations and prerequisites:
- Institutional arrangements, as outlined in section B.4
- The assurance of counterpart support capacity, as stated in section B.8
- Government inputs, see sub-sections E.1
- Budget, see section J.

UNDP/UNIDO obligations and prerequisites:
- Institutional arrangements, as outlined in section B.4
- The assurance of UNDP/UNIDO inputs, as stated in sub-sections E.2, and section J (Budget).

General prerequisites:
- The Government and UNDP/UNIDO should strive to progress according to the workplan, as given in annex 1.

The Project Document will be signed by UNDP, and UNDP assistance to the project will be provided (1) only if the prior obligations stipulated above have been met to UNDP's satisfaction, and (2) subject to UNDP receiving satisfaction that the prerequisites listed above have been fulfilled, or are likely to be fulfilled. When anticipated fulfillment of one or more prerequisites fails to materialise, UNDP may, at its discretion, either suspend or terminate its assistance.

H PROJECT REVIEWS, REPORTING AND EVALUATION

The project will be subject to tripartite review, i.e. a joint review by representatives of the Government, executing agency and UNDP every 12 months, the first such meeting to be held within the first 12 months of start of full implementation of phase 1. The national project co-ordinator and/or the senior project officer of the United nations executing agency will prepare and submit to the UNDP field office at least 3 months before each tripartite review a Project Performance Evaluation Report (PPER). Additional PPER's may be requested, if necessary, during the project.

A project terminal report will be prepared for consideration at the terminal tripartite review meeting of each phase. It will be prepared in draft sufficiently in advance to allow review and technical clearance by the executing agency at least 4 months prior to the terminal tripartite review.

The project will be subject to evaluation 18 months after start of full implementation of phase 1. The organisation, terms of reference and timing will be decided after consultation between the parties involved in the project.

I LEGAL CONTEXT

This Project Document will be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement between the Government of Barbados and the United Nations Development Programme, signed by the parties on 21 October 1974.
The Host Country Implementing Agency will, for the purpose of the Standard Basic Assistance Agreement, refer to the Government Co-operating Agency described in that Agreement.

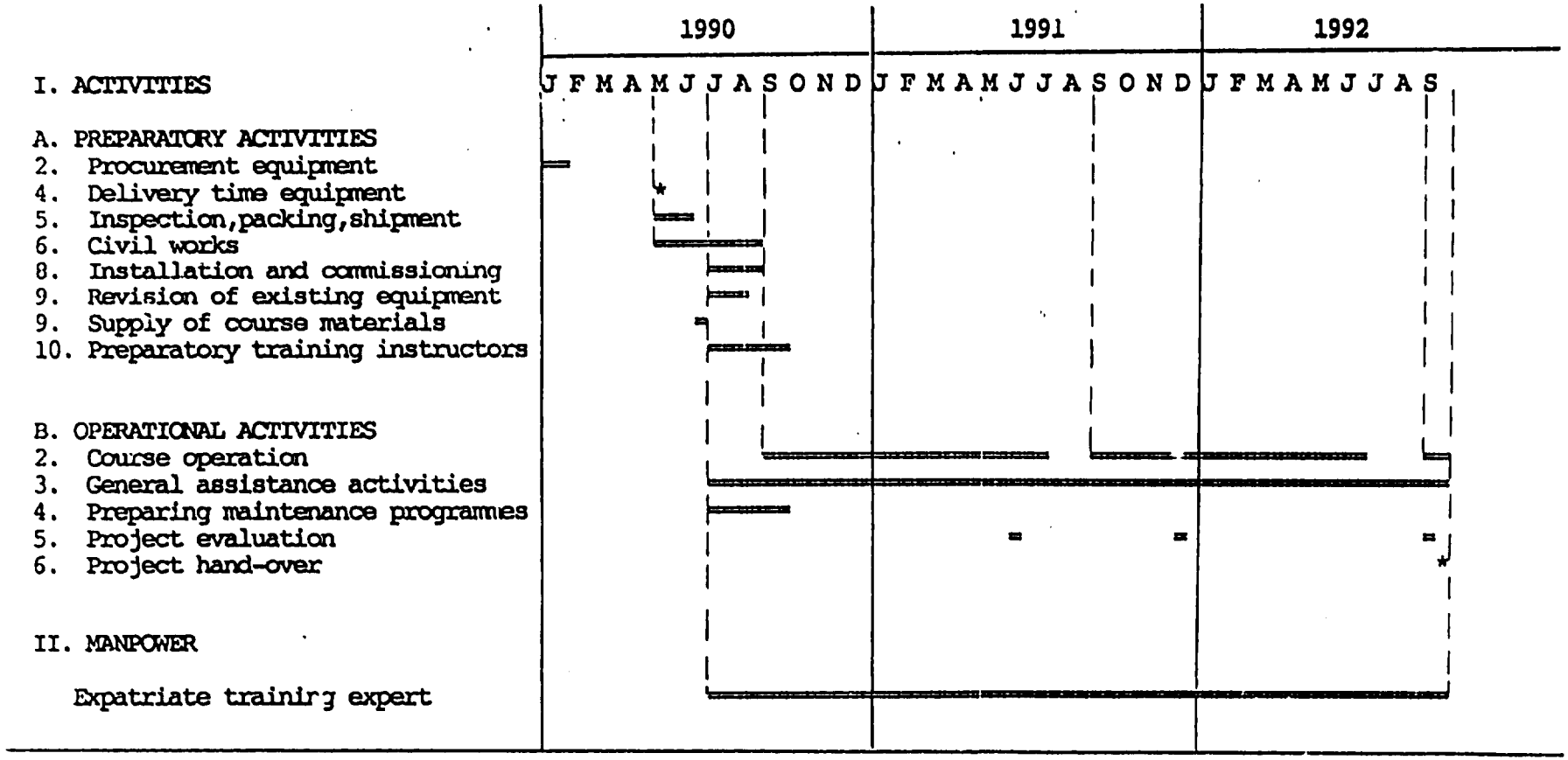
The following types of revisions may be made to this Project Document with the signature of the UNDP resident representative only, provided he or she is assured that the other signatories of the Project Document have no objections to the proposed changes:

(a) Revisions in, or addition of, any of the annexes of the Project Document;
(b) revisions which do not involve significant changes in the immediate objectives, outputs or activities of a project, but are caused by the rearrangement of inputs agreed to or by cost increases due to inflation; and
(c) mandatory annual revisions which rephase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility.

J PROJECT BUDGET COVERING INTERNATIONAL CONTRIBUTION

CODE NR.	DESCRIPTION	TOTAL MM.	TOTAL US$	1990 MM.	1990 US$	1991 MM.	1991 US$	1992 MM.	1992 US$
11.	PROJECT PERSONNEL								
11.1	Technical Consultant (training expert)	27	241950	6	51900	12	108600	9	81450
15	PROJECT TRAVEL								
15.1	Consultant international travel		5000		2000		2000		1000
16	OTHER PERSONNEL EXPENSES		8000		2500		3000		2500
	TOTAL PERSONNEL		254950		56400		113600		84950
30	TRAINING								
30.1	Training curriculum		15000		15000				
40	EQUIPMENT								
41.0	Expendable equipment								
41.1	Machine- and hand tools, measuring tools, raw material, consumables		68000		45000		23000		
42.0	Non-expendable equipment								
42.1	Machinery, equipment, furniture, accessories		337000		337000				
42.2	Teaching materials		8000		8000				
42.3	Packing and shipment		6000		5000		1000		
	TOTAL EQUIPMENT		419000		395000		24000		
50	MISCELLANEOUS								
51	Sundries		10000		3000		4000		3000
99	PROJECT TOTAL		698950		469400		141600		87950

ANNEX 1 BAR CHART OF PROJECT IMPLEMENTATION (PHASE 1)



ANNEX 2 THE MULTI PRECISION METAL MACHINING TRAINING PROGRAMME

The suggested outline for the multi precision metal machining training programme is as follows:

Duration	: 2 (two) years
Location	: Samuel Jackman Prescod Polytechnic
Number of trainees	: 14 per year
Start of implementation	: September 1990

COURSE CONTENTS

Total training hours : 2150 (2 years)

THEORY	**750 hrs**	**35 %**
Workshop Mathematics		90 hrs
Engineering Science		70 hrs
Industrial Orientation		10 hrs
Engineering Materials		60 hrs
Measuring Techniques		150 hrs
Engineering Drawings		175 hrs
Workshop Technology		175 hrs
Safety		20 hrs

PRACTICE	**1400 hrs**	**65 %**
Tool and Die-making		350 hrs
Turning		350 hrs
Milling		350 hrs
Machining (semi-jig boring, spark erosion, cylindrical grinding, surface grinding)		350 hrs

ANNEX 3 REQUIRED EXISTING EQUIPMENT AND MACHINERY AT SJPP

This annex comprises :

3.1 : Overview of existing equipment

3.2 : Specification of existing required equipment

- 3.2.1 : Available lathes
- 3.2.2 : Available milling machines
- 3.2.3 : Available grinding machines
- 3.2.4 : Available heat treatment furnaces

Annex 3.1 Overview of existing equipment

Within the workshops at the Mechanical Engineering Department of SJPP a number of suitable machines are present, which may be used for the multi precision metal machining training programme.

Required existing machinery for the MPMM-programme will consist of:

- 4 lathes, to be selected out of the existing lathes (24);
- 3 milling machines, to be selected out of the existing milling machines (7);
- 1 Surface grinding m/c, available for the MPMM-programme;
- 2 granite tables, available for MPMM-programme;
- 1 hacksaw, available, to be shared with other training programmes;
- 2 drilling m/c, available for MPMM-programme;
- 1 manual bending m/c, to be shared with other programmes;
- 1 shearing m/c, available, to be shared with other programmes;
- 2 heat treatment furnaces, available for the MPMM-programme.

The lathes and milling machines to be used for the MPMM-programme will be selected well before start of implementation, depending on condition and available tools.
Existing lathes and milling machines which are considered for the MPMM-programme are listed in annex 3.2.
Also the existing grinding m/c's, as well as the furnaces to be used, are specified in annex 3.2.

Annex 3.2 Specification of existing required machinery

3.2.1 **AVAILABLE LATHES**

Total number of lathes : 24

- Brand	: HARRISON
No. of lathes	: 6
Specifications	
Swing over bed	: 11"
Length of bed	: 36"
Speed range	: 34 - 750 rpm
Feed range	: 0.004 - 0.174 inch/rev
Voltage	: 220/3-phase
Main motor	: 1.125 kW
Tailstock	: MT 3
Space used	: 60" x 72"
Calibration in inches/mm	: inches
Approx. age	: 18 years

Extra accessories :
3-jaw chuck
4-jaw chuck
Face plate
Coolant pump

- Brand	: HARRISON
No. of lathes	: 10
Specifications	
Swing over bed	: 13"
Length of bed	: 42"
Speed range	: 35 - 3000 rpm
Feed range	: 0.03 - 1 mm/rev
Voltage	: 220/3-phase
Main motor	: 2.2 kW
Tailstock	: MT 3
Space used	: 60" x 72"
Calibration in inches/mm	: mm
Approx. age	: 8 years

Extra accessories :
3-jaw chuck
4-jaw chuck
Face plate
Coolant pump
Mechanical taper turning attachment

- Brand : COLCHESTER TRIUMPH 2000
  No. of lathes : 2
  Specifications
  Swing over bed : 15"
  Distance between centres : 36"
  Length of bed : 48"
  Speed range : 25 - 2000 rpm
  Feed range : 0.04 - 1 mm/rev
  Voltage : 220/3-phase
  Main motor : 5.625 kW
  Tailstock : MT 4
  Space used : 72" x 84"
  Calibration in inches/mm : mm
  Approx. age : 11 years

  Extra accessories :
  3-jaw chuck

- Brand : DEAN SMITH AND GRACE
  No. of lathes : 1
  Specifications
  Swing over bed : 13"
  Distance between centres : 42"
  Length of bed : 66"
  Speed range : 49 - 1400 rpm
  Feed range : 0.0016 - 0.025 inch/rev
  Voltage : 220/3-phase
  Main motor : - kW
  Tailstock : MT 3
  Space used : 72" x 96"
  Calibration in inches/mm : inches
  Approx. age : 25 years

  Extra accessories :
  3-jaw chuck
  4-jaw chuck
  Face plate
  Taper turning attachment

- Brand : HARRISON
  No. of lathes : 2
  Specifications
  Swing over bed : 11"
  Distance between centres : 24"
  Length of bed : 36"
  Speed range : 15 - 1000 rpm / 31 - 720
  Feed range : 0.002 - 0.0174 inch/rev
  Voltage : 220/3-phase
  Main motor : 1.5 kW / 1.125 kW
  Tailstock : MT 3
  Space used : 60" x 72"
  Calibration in inches/mm : inches
  Approx. age : 23 years / 28 years

  Extra accessories :
  3-jaw chuck
  4-jaw chuck
  Face plate

- Brand : COLCHESTER STUDENT
  No. of lathes : 1
  Specifications
  Swing over bed : 11"
  Length of bed : 36"
  Distance between centres : 24"
  Speed range : 54 - 1200 rpm
  Feed range : 0.0025 - 0.068 inch/rev
  Voltage : 220/3-phase
  Main motor : 2.25 kW
  Tailstock : MT 3
  Space used : 60" x 72"
  Calibration in inches/mm : inches
  Approx. age : 20 years

  Extra accessories :
  3-jaw chuck
  4-jaw chuck

- Brand : BOXFORD
  No. of lathes : 1
  Specifications
  Swing over bed : 11"
  Distance between centres : 24"
  Speed range : 50 - 2000 rpm
  Feed range : 0.072 - 1.08 mm/rev
  Voltage : 220/3-phase
  Main motor : - kW
  Tailstock : MT 2
  Space used : 60" x 72"
  Calibration in inches/mm : mm
  Approx. age : 8 years

  Extra accessories :
  3-jaw chuck
  4-jaw chuck

- Brand : HARRISON M400
  No. of lathes : 1
  Specifications
  Swing over bed : 13"
  Distance between centres : 36"
  Length of bed : 60"
  Speed range : 40 - 2000 rpm
  Feed range : 0.016 - 0.71 mm/rev
  Voltage : 220/3-phase
  Main motor : 7.9 kW
  Tailstock : MT 5
  Space used : 72" x 96"
  Calibration in inches/mm : mm
  Approx. age : 8 years

  Extra accessories :
  3-jaw chuck
  4-jaw chuck
  Face plate
  Automatic brake

3.2.2 **AVAILABLE MILLING MACHINES**

Total number cf milling machines : 7

- Brand	: JET
Type	: Horizontal/vertical milling m/c
No. of milling m/c	: 2
Specifications	
Table	: 42" x 9"
Arbor	: 1" dia, twin arbor support
Voltage	: 220 V/3-phase
Main motor	: 1.5 kW
Speed range	: 55 - 1220 rpm
Feed range	: 0.94 - 15 inches/min
Vertical head	: MT 40, automatic feed
Vertical speed	: 220 - 2530 rpm
Calibration	: inches
Approx. age	: 8 years
Space used	: 96" x 72"
Extra accessories	
Dividing head	
Rotary table	

- Brand	: BRIDGEPORT
Type	: Vertical milling m/c
No. of milling m/c	: 1
Specifications	
Table	: 42" x 9"
Voltage	: 220 V/3-phase
Main motor	: 1.5 kW
Speed range	: 67 - 2300 rpm
Spindle	: R8
Approx. age	: 15 years
Space used	: 96" x 96"
Extra accessories	
Slotting attachment	

- Brand	: JET
Type	: Vertical milling m/c
No. of milling m/c	: 1
Specifications	
Table	: 42" x 9"
Voltage	: 220 V/3-phase
Main motor	: 1.5 kW
Speed range	: 67 - 2300 rpm
Spindle	: R8
Approx. age	: 8 years
Space used	: 96" x 96"
Extra accessories	
Slotting attachment	

Brand	: ELLIOT
Type	: vertical milling m/c
No. of milling m/c	: 1
Specifications	
Table	: 44" x 11"
Voltage	: 220 V/3-phase
Main motor	: 3 kW
Speed range	: 32 - 1050 rpm
Feed range	: 0.04 - 12.25 inches/min
Vertical head	: MT 40, automatic feed
Calibration	: inches
Approx. age	: - years
Space used	: 96" - 96"

- Brand	: VICTORIA
Type	: Universal milling m/c
No. of milling m/c	: 1
Specifications	
Table	: 36" x 9"
Arbor	: 1" dia, 1 arbor support
Voltage	: 220 V/3-phase
Main motor	: - kW
Speed range	: 45 - 1215 rpm
Feed range	: 0.15 - 15 inches/min
Vertical head	: MT 3
Calibration	: inches
Approx. age	: 25 years
Space used	: 72" x 72"

- Brand	: HARRISON
Type	: Universal milling m/c
No. of milling m/c	: 1
Specifications	
Table	: 30" x 8"
Arbor	: 1" dia, 1 arbor support
Voltage	: 220 V/3-phase
Main motor	: 1.125 kW
Speed range	: 67 - 1500 rpm
Feed range	: 22 - 315 mm/min
Calibration	: mm

3.2.3 **AVAILABLE GRINDING MACHINES**

Total number of grinding m/c's: 3

- Brand	: ELLIOT 8-18
Type	: Surface grinding m/c
No. of grinding m/c	: 1
Specifications	
Table	: 18" x 8"
Voltage	: 220 V/3-phase
Main motor	: 1.125 kW
Wheel hole	: 3" dia, 0.75 " width
Wheel spindle speed	: 2140 rpm / 2850 rpm
Feed range	: 0 - 90 ft/min
Calibration	: inches
Approx. age	: 25 years
Space used	: 72" - 72"

- Brand	: DOALL
Type	: Surface grinding m/c
No. of grinding m/c	: 1
Specifications	
Table	: 12" x 6"
Voltage	: 220 V/3-phase
Main motor	: 0.75 kW
Wheel hole	: 1.25" dia, 0.50" width
Wheel spindle speed	: 3600 rpm
Calibration	: inches
Space used	: 72" - 72"

- Brand	: MYFORD
Type	: Cylindrical grinding m/c
No. of grinding m/c	: 1
Specifications	
Table	: 40" x 4"
Voltage	: 220 V/3-phase
Main motor	: 0.1875 kW
Wheel hole	: 3" dia, 1" width
Wheel spindle speed	: 2200 - 2500 rpm
Work head speed	: 75 - 780 rpm
Calibration	: inches
Approx. age	: over 20 years
Space used	: 72" - 72"
Automatic table feed in two directions	

3.2.4 **AVAILABLE FURNACES**

- Brand	: WILD BARFIELD
Type	: Electrical heat treatment furnace
No. of furnaces	: 1
Specifications	
Overall size	: 48" x 36" x 72" (dxwxh)
Chamber size	: 20" x 10" x 30" (dxwxh)
Voltage	: 220V/3-phase
Max. temperature	: 1175 ^{o}C
Age	: 8 years, not used

- Brand	: JOHNSON 121
Type	: Gas heat treatment furnace
No. of furnaces	: 1
Specifications	
Overall size	: 24" x 24" x 48" (dxwxh)
Chamber size	: 8" x 5" x 14" (dxwxh)
Voltage	: 220V/3-phase
Age	: 8 years, not used
Only bottled gas	

ANNEX 4 NEW REQUIRED EQUIPMENT AND MACHINERY PHASE 1

This annex comprises :

4.1 : Overview and summary of costs

4.2 : General notes for machinery and equipment

4.3 : Specification of machines and equipment

4.4 : Specification of measuring tools

4.5 : Specification of machine- and handtools

4.6 : Specification of raw materials and consumables

4.7 : Specification of teaching materials

Annex 4.1 Overview and summary of costs

This paragraph summarizes the required investments for machinery and equipment, and for raw materials and consumables needed for the first two years of implementing the Multi Precision Metal Training Programme at the Mechanical Engineering department of SJP Polytechnic.

Specifications of machines (items 1.), measuring tools, machine- and handtools (item 2), are given in the following paragraphs.

Budget prices given below include a set of spare parts for two-years operation, for the items where applicable.

Item	Description	no.	US Dollars
1.	**Machines and equipment :** (incl. spare parts for 2 years)		US$ 337.000
1.1	Centre lathe	2	
1.2	Universal milling machine	1	
1.3	Spark erosion machine	1	
1.4	Surface grinding machine	1	
1.5	Cylindrical grinding machine	1	
1.6	Semi-jig boring machine	1	
1.7	Accessories for existing machinery		
2.	**Measuring tools, machine- and handtools :** (for two-year operation)		US$ 60.000
3.	**Raw material and consumables :** (for two-year operation)		US$ 8.000
4.	**Teaching materials :**		US$ 8.000
5.	**Packing and shipment**		US$ 6.000
		+	----------
Total hardware costs C+F Barbados			**US$ 419.000**

Annex 4.2 General notes for machinery and equipment

The following general notes are applicable for the machinery and equipment to be supplied for phase 1:

1. The electrical and hydraulic equipment fitted with the machine should be so designed that they can function under tropical conditions.

2. Adequate ventilation should be provided for motors.

3. The rubber seals, 'O'-rings, liprings etc. should be of material suitable for tropical conditions.

4. The machines should be suitable for connection to 220 Volts, 3 phase, 50 c/s supply, or 110 Volts, 1-phase.

5. The machines are to be equipped with metric dials and scales. The dial gauges and other gauges must be calibrated in the metric scale. Temperature gauges should be in Centigrade scale. Instruction plates should be in English.

6. All tool holders supplied should be according to metric standards.

7. A set of spare parts should be included for the machines applicable, for a 2 years operation.

8. Two sets of spare parts list/catalogues in English showing assembly drawings of important machine parts and units as well as complete details such as part No., Manufacturer's serial number, Type, Size, quantity etc. should be supplied along with the machine to enable the ordering of spare parts as and when required.

9. Two copies of detailed operation manuals in English including foundation drawings, final electrical wiring diagrammes etc. should be supplied. Operator's manuals should include sectional drawings of important machine units and assembly and installation instructions.

10. The total electricity consumption of equipment and machinery in the workshop is estimated at 65 kW (maximum value).

Annex 4.3 Specification of machines and equipment (phase 1)

Name of Machine : **Centre Lathe**

No. of Units Required : 2

Specifications

Height of Centre	133 mm
Centre Distance	470 mm
Swing over Bed	270 mm
Swing over Cross Slide	145 mm
Tool Slide Graduation	0.02 mm
Cross Slide Graduation	0.04 mm/diam.
Spindle Bore	26 mm
Collet Capacity Maximum	18 mm
Spindle Nose Camlock Type	D1 - 4"
Taper in Main Spindle	MT4
Taper in Tailstock	MT2
Feed Range (longitudinal)	0.033 - 0.5 mm/rev
Thread Range Metric	0.25 - 5 mm Pitch
Spindle Speeds	45 - 400 rpm
Main Motor	1.8/5 kW

Accessories Required	Quantity (in total, for the two a.m. lathes together)
Coolant Equipment	2 units
Mechanical Taper Turning Attachment	1 unit
Hydraulic Copying Attachment	1 unit
Lever Operated Tailstock	2 units
Live Centre	2 units
Drill Chuck, 1 - 13 mm dia with arbor MT2	2 units
3-Jaw Self-centering Chuck	2 sets
3-Jaw Soft Self-centering Chuck	2 sets
4-Jaw Independant Chuck	2 sets
Centre Rest	2 units
Carriege Stop	2 units
Quick Change Toolholder	2 units
Quick Change Collet Holder	2 sets
Chip Guard	2 units

Name of Machine : **Universal Milling Machine**

No. of Units Required : 1

Specifications

Spindle Internal Taper, Vertical and Horizontal	ISO 30
Table Movement - Longitudinal	300 mm
Vertical	355 mm
Tranverse	150 mm
Accuracy of Reading on Micrometer Verniers	0.02 mm
Spindle Speeds (stepless)	58 - 200 rpm
Working Feeds (10 feeds)	12-400 mm/min
Main Motor	1.5kW

Accessories Required	Quantity
Fixed Angular Table 700 mm x 250 mm	1 unit
Vertical Spindle Head	1 unit
Horizontal Cutter Arbors, ISO 30 - 16, 22 diam x 137	1 unit each
Shell Cutter Adaptors, ISO 30 - 16 , 22 and 27 diam.	1 unit each
Collet Adaptor, M12 Internal Thread	1 unit
Vertical Arbor ISO 30 - 16, 22, 32	1 unit each
Drill Chuck Adaptor, ISO 30	1 unit
Drill Chuck, 1 - 13 mm dia	1 unit
Dividing Head including drive dog, lever-operated quick-closing attachment, 3-jaw chuck 100 mm dia, perforated plate dividing attachment, 60 notch index plate and dividing-head tailstock	1 set
Circular Table 250 mm dia with perforated plate dividing Attachment	1 set
Dial Indicator-Holders for measuring transverse, longitudinal and vertical movement	1 set each
Milling Vice with Rotary Plate	1 set

Name of Machine : **Spark Erosion Machine**

No. of Units Required : 1

Specifications

Range of Traverse Table:	
- Longitudinal	250 mm
Table Traverse	150 mm
Vertical Slide	150 mm
Max/Min. Distance /table Electrode	450/150 mm
Electrode Weight	60 kg
Co-ordinate Table:	
- Clamping Surface	400 x 300 mm
Weight of Work	300 kg

Accessories

Control System
Software
Filtration System
Electrode Holder Positioning Device

Name of Machine : **Surface Grinding Machine**

No. of Units Required : 1

Specifications

Grinding Length	300 mm
Grinding Width	150 mm
Clamping Surface	400 x 150 mm
Maximum Distance between table Surface and Grinding Spindle Centre	400 mm
Longitudinal Table Movement,Hydraulic,Limit Switch	1 - 24 m/min
Transverse Table Feed	
- Adjustment Graduation	0.01 mm
Automatic at each table reverse	
Automatic, continuous	0-500 mm/min
Wheelhead Vertical Adjustment - Graduation	0-01 mm
Automatic	0.001-0.01 mm
Grinding Spindle Speed	2800 rpm
Spindle Diameter	38.1 mm dia
Grinding Wheel	200 x 16 mm
Motor	3.5 kW

Accessories Required	Quantity
Electro-magnetic Table	1 unit
Optical Measuring Equipment for Transverse Movement, 0.001 mm	1 unit
Dry Grinding Equipment	1 unit
Paper Filtering Equipment	1 unit
Demagnetizing Device	1 unit
Magnetic Clamping table	1 unit
Side, Angle and Radius Truing Device	1 unit
Dial Gauge Stop for Vertical Adjustment	1 unit
Balancing Device	1 set
Grinding Wheel Flange	2 units
Grinding Vice	1 unit

Name of Machine : **Cylindrical Grinding Machine**

No. of Units Required : 1

Specifications

Height of Centres	100 mm
Distance between Centres	400 mm
Table Speed	0 - 5 m/min
Saddle Swivelling	$\pm$ 9°
Wheel Diameter	300 mm
Wheel Width	50 mm
Wheel Bore	127 mm
Speed of in-feed	0-0.04 mm/sec
Wheel Spindle Speeds	1500/1900 rpm
Wheelhead Adjustable Graduation	0.01 mm
Wheelhead Swivelling	$\pm$ 5°
Workhead Swivelling	$\pm$ 360°
Workhead Spindle Speed	65-500 rpm
Workhead Spindle Taper	MT4
Motor	3 kW

Accessories Required	Quantity
Internal Grinding Attachment, spindle max. 80 mm dia	1 set
Wheel Dressing Devices	1 set
Balancing Device	1 set
3-Jaw Chuck, dia 200 mm	1 set
Steady Rest	1 unit
Axial Stop	1 unit
Work Drivers	1 set
Paper Filter Coolant Cleaning Unit	1 unit

Name of Machine : Semi Jig Boring Machine

No. of Units Required : 1

Specifications

Spindle Taper	ISO 30
Working Range X x Y x Z (w)	278x190x120 (350) mm
Drilling capacity	20 mm
Power of Spindle	0.75/1.1 kW
Centerline Spindle - Column	300 mm
Centerline Spindle - Slide Way W	270 mm
Between Slide Way W and Table	20 - 210 mm
Spindle Nose - Working Surface	0 - 650 mm
Spindle Speeds (infinitely variable)	40 - 3600 rpm
Spindle Feeds	0.12 - 0.6 mm/sec
	0.02 - 0.1 mm/sec

Accessories	Quantity
Machine Vice with Rotary Plate	1 unit
Accessories Standard and Special as offered	

Annex 4.4 Specification of measuring tools (phase 1)

Item	Description	Quantity
1	Pluggauges H7 2-11 mm	1
2	" H6 2-11 mm	2
3	" H7 12-24 mm	1
4	Set snap gauges H7 2-20 mm	1
5	Set slipgauges 1-60 mm (32 pcs) Kwal. I	1
6	Radius gauge 1-7 mm	2
7	Radius gauge 7.5-15 mm	2
8	Zero point finder shaft dia. 10 en 4	6
9	Dial gauge (0.01) 10 mm without lug.	2
10	Dial gauge (0.01) 30 mm	2
11	Dial gauge (0.01) 50 mm	1
12	Dial test indicator 0.8 mm (lever type)	2
13	Micrometer 0-25 mm	16
14	" 25-50 mm	3
15	" 50-75 mm	3
16	Micrometer with dial gauge 100-200 mm	1
17	" " 200-300 mm	1
18	Micrometer for groove dia. 0-25 mm	1
19	Digital micrometer 0-25 mm	1
20	Steel rule 150 mm	16
21	" 300 mm	1
22	" 500 mm	1
23	Measuring tape 2000 mm	1

24	Setting unit for subito instruments (slip gauge holder type) 8-160 mm	1
25	Set hole 3-points micrometers 6-12 mm	1
26	Set hole 3-points micrometers 11-20 mm	1
27	Set hole 3-points micrometers 20-40 mm	1
28	Set hole 3-points micrometers 40-100 mm	1
29	Pocket vernier caliper 0-150 mm	16
30	Vernier caliper 0-250 mm	1
31	Protractor 150 mm 180°	1
32	Protractor with dial indicator 200 mm (4x90°-5')	1
33	Engineer square 100 x 63 mm	1
34	" 184 x 100 mm	1
35	Toolmaker set: - straight edge 100 mm - bevel edge prec.square 75x50 mm - " " 40x28 mm - " " 25x20 mm - " " 40x28 mm	1
36	Heavy magnetic measuring stand 75x60x75 mm	1
37	Light magnetic measuring stand 65x50x65 mm	1
38	Steel scriber	4
39	Stand for micrometer dia. 135 mm	1
40	Vernier height gauge 0-300 mm	1
41	Surface plate, cast iron, approx. 600x400 mm	1

42	Digital height measuring and scribing instrument 0-300 mm	1
43	Measuring magnifying glass (7x) dia. 30 mm	1
44	Magnifying glass dia. 20 mm (3x + 6x = 9x)	1
45	Universal electrical volt/amp/ohm meter 1 mV. - 1.000 V. AC/DC 10 µA. - 20 A. 0,1 Ohm - 2 MOhm	3

Annex 4.5 Specification of machine- and handtools (phase 1)

A. General hand tools

Item	Description	Quantity
1	Hacksaw 12"	4
2	Hacksaw blades, set (100 pcs, various t.p.i.)	4
3	Junior hacksaw	8
4	Junior hacksaw blades, set, (50 pcs, various t.p.i.)	8
5	Screw driver 3"	1
6	" 4"	1
5	" 6"	1
6	" 8"	1
7	Cross head screw driver 4"	2
8	" " 6"	2
9	Combination spanner 6 mm	1
10	" 7 mm	1
11	" 8 mm	1
12	" 9 mm	1
13	" 10 mm	1
14	" 11 mm	1
15	" 12 mm	1
16	" 13 mm	1
17	" 14 mm	1
18	" 15 mm	1
19	" 16 mm	1
20	" 17 mm	1
21	" 18 mm	1
22	" 19 mm	1
23	" 20 mm	1
24	" 22 mm	1
25	" 23 mm	1
26	" 24 mm	1
27	Long nose plier 6"	3
28	Waterpump plier 9"	1
29	Allen keys 2.0 mm	1
30	" 2.5 mm	1
31	" 3.0 mm	1
32	" 4.0 mm	1
33	" 5.0 mm	1
34	" 6.0 mm	1
35	" 8.0 mm	1
36	" 10.0 mm	1
37	Toolmakers clamp 2"	2
38	" " 4"	2

39	G-clamp 4"	2
40	" 6"	2
41	Plastic hammer dia. 22 mm	1
42	" 35 mm	1
43	Machinist hammer 1/2 lb	1
44	Letter punch set 3/16"	1
45	" 1/8"	1
46	Number punch set 3/16"	1
47	" 1/8"	1
48	Centre punch 4"	6
49	Flat chisel	2
50	Triangular scraper 5"	4
51	Flat file 4" (smooth)	6
52	" (bastard)	8
53	" 6" (smooth)	8
54	" (2nd cut)	8
55	" (bastard)	8
56	" 8" (smooth)	8
57	" (bastard)	8
58	Half round file (bastard) 6"	8
59	" " 8"	8
60	Round file (bastard) 4"	8
61	" " 6"	6
62	" (smooth) 6"	6
63	" " 8"	4
64	" (bastard) 8"	4
65	Square file (bastard) 6"	6
66	" " 8"	6
67	" (smooth) 6"	6
68	" " 8"	6
69	" (2nd cut) 6"	6
70	" " 8"	6
71	Triangular file 4" (smooth)	4
72	File handle 3.5"	30
55	" 4.0"	60
56	" 4.5"	60
57	File brush	12
58	Oilstone 10x10x120 mm	4
59	Grinding wheel dresser	2
60	Needle file flat (smooth)	4
61	" square (smooth)	4
62	" half round (smooth)	4
63	" triangular (smooth)	4
64	" knife (smooth)	4
65	" flat (bastard)	4
66	" square (bastard)	4
67	" half round (bastard)	4
68	" round (bastard)	4
69	" knife (bastard)	4
70	" baret (bastard)	4
71	" crossing (bastard)	4

72	Needle file holders	20
73	Metric tap and die set HSS M3-M24	2
74	Whitworth tap and die set HSS 1/8" - 1"	1
75	Tool trolley, with drawers, approx. 600x400x800 mm	1
76	Tool box, with 4 trays, approx. 600x250x250 mm	6

B. Milling tools

Item	Description	Quantity
77	Endmill dia 6 mm	6
78	" 8 mm	6
79	" 14 mm	6
80	" 20 mm	6
81	Shell endmill dia. 40 mm	2
82	" 63 mm	2
83	Chipbreaker endmill dia. 16 mm	8
84	Slot endmill dia. 4 mm	6
85	" 6 mm	6
86	" 8 mm	6
87	" 8 mm (long series)	4
88	Endmill 8 mm (long series)	4
89	Shell endmill dia. 50 mm	2
90	Shell endmill (chipbreaker) dia. 40 mm	4
91	" " 50 mm	4
92	Slot endmill dia. 3 mm	6
93	" 5 mm	6
94	" 7 mm	6
95	" 9 mm	6
96	" 10 mm	6
97	" 12 mm	6
98	" 14 mm	6
99	" 16 mm	6
100	Convex endmill R3	4
101	" R4	4
102	" R5	4
103	" R6	4
104	Radius endmill R3	4
105	" R4	4
106	" R5	4
107	" R6	4
108	" R8	4
109	T-slot endmill dia. 18x8	4
110	" 20x4	4
111	" 25x5	4
112	" 25x11	4
113	" 32x14	4
114	Chipbreaker endmill dia. 6 mm	4
115	" 8 mm	4
116	" 10 mm	4
117	" 12 mm	4
118	" 14 mm	4
119	Angular endmill dia. 20x45°	2
120	" 16x60°	2
121	Concave mill R5 dia. 80 mm	2
122	" R6 dia. 80 mm	2

123	Radius mill	R3	dia. 80		2
124	"	R4	"		2
125	"	R5	"		2
126	"	R6	"		2
127	Slit milling cutter		1.0 mm dia 100		2
128	"		1.2 mm		2
129	"		1.6 mm		2
130	"		2.0 mm		2
131	"		3.0 mm		2
132	"		4.0 mm		2
133	"		5.0 mm		2
134	Set of 8 gear wheel cutters		for gears mod.	1	1
135	"		"	1.5	1
136	"		"	2	1
137	"		"	2.5	1
138	"		"	3	1
139	"		"	4	1

C. Turning tools

Item	Description	Quantity
	Carbide soldered:	
140	Knife tool 12x12 mm	4
141	Facing 12x12 mm	4
142	Roughing 12x12 mm	4
143	Knife tool 20x20 mm	4
144	Facing 20x20 mm	4
145	Roughing 20x20 mm	4
146	Boring tool dia. 10 mm	4
147	" 16 mm	4
	HSS:	
148	Cranked rougher 12x12 mm left	2
149	" 12x12 mm	6
150	" 20x20 mm left	2
151	" 20x20 mm	6
152	End face tool 12x12 mm left	2
153	" 12x12 mm	6
154	" 20x20 mm left	2
155	" 20x20 mm	6
156	Knife tool 12x12 mm left	2
157	" 12x12 mm	6
158	" 20x20 mm	6
159	Recessing tool 12x12 mm	6
160	" 6x20x20 mm	4
161	" 12x20x20 mm	4
162	Blind hole boring tool dia. 6 mm	4
163	" 8 mm	4
164	" 10 mm	4
165	" 12 mm	4
166	" 16 mm	4
167	" 20 mm	4
168	Rougher 12x12 mm	4
169	" 20x20 mm	4
170	Bar tool 12x12 mm	4
171	" 20x20 mm	4
172	Thread cutting (bar) 60°	4
173	" 55°	4
174	" 30°	4
175	Internal thread 60° dia. 8 mm	4
176	" 10 mm	4
177	" 55° dia. 8 mm	4
178	" 10 mm	4
179	" 30° dia. 12 mm	4
180	Internal recessing tool dia. 6 mm	4
181	" 8 mm	4
182	" 12 mm	4
183	" 16 mm	4
184	" 20 mm	4

185	Swan neck (parting) 6x12x20	2
186	" (recessing) 10x12x20	2
187	Double roller knurling tool holder	2
188	Single " "	2
189	Cutting knurling tool holder	2
190	Knurling die pitch 1.0 mm (LH)	2
191	" " (RH)	2
192	" " (straight)	2
193	" 0.6 mm (LH)	2
194	" " (RH)	2
195	" " (straight)	2
196	Parallel bars 80x23x5	2
197	" 125x20x8	2
198	" 126x31x8	2
199	Revolving centres (ROHM)	2
200	Half centres MC2	2
201	" MC3	2
202	Female centres MC2	2

D. Drilling tools

Item	Description	Quantity
203	Spiral drill (straight shank, HSS) dia. 1.0 mm	12
204	" 1.5 mm	12
205	" 2.0 mm	12
206	" 2.5 mm	12
207	" 3.0 mm	12
208	" 3.2 mm	12
209	" 3.5 mm	12
210	" 4.0 mm	12
211	" 4.2 mm	12
212	" 4.5 mm	12
213	" 4.8 mm	12
214	" 5.0 mm	12
215	" 5.5 mm	12
216	" 6.0 mm	6
217	" 6.5 mm	6
218	" 6.8 mm	6
219	" 7.0 mm	6
220	" 7.5 mm	6
221	" 8.0 mm	6
222	" 8.5 mm	6
223	" 8.8 mm	6
224	" 9.0 mm	6
225	" 9.5 mm	6
226	" 10.0 mm	6
227	" 11.0 mm	6
228	" 11.75 mm	6
229	" 12.0 mm	6
230	" 12.5 mm	6
231	" 13.0 mm	6
232	Spiral drill (tapered shank, HSS) dia. 11 mm	4
233	" 12 mm	4
234	" 13 mm	4
235	" 14 mm	4
236	" 16 mm	4
237	" 18 mm	4
238	" 20 mm	4
239	" 22 mm	1
240	" 24 mm	1
241	" 26 mm	1
242	" 28 mm	1
243	" 30 mm	1
244	Centre drill dia. 1.6 mm	10
245	" 2.0 mm	10
246	" 4.0 mm	10

247	Core drill dia. 4.8 mm	6
248	" 5.8 mm	6
249	" 7.8 mm	6
250	" 9.8 mm	6
251	" 10.75 mm	6
252	Counter sink drill 60°x10 mm	4
253	" 60°x22 mm	4
254	" 90°x10 mm	4
255	" 90°x12 mm	4
256	Cone cleaner MC2/MC3	2
257	Drilling vice 65 mm x 53 mm	2
258	Drill sleeve MC2 x MC1	2
259	" MC3 x MC1	2
260	" MC3 x MC2	2
261	Drill extractor MC1 - MC4	2

E. Various tools

Item	Description	Quantity
262	Machine tap blind hole M5	4
263	" " M6	4
264	" " M8	4
265	" " M10	4
266	Machine tap (through hole) M3	4
267	" " M4	4
268	" " M5	4
269	" " M6	4
270	" " M8	4
271	" " M10	4
272	" " M12	4
273	Machine reamer dia. 3 mm F8	4
274	" 4 mm F8	4
275	" 5 mm F8	4
276	" 6 mm F8	4
277	" 8 mm F8	4
278	" 10 mm F8	4
279	" 12 mm F8	4
280	" 3 mm G7	4
281	" 4 mm G7	4
282	" 5 mm G7	4
283	" 6 mm G7	4
284	" 8 mm G7	4
285	" 10 mm G7	4
286	" 12 mm G7	4
287	" 3 mm H6	4
288	" 4 mm H6	4
289	" 5 mm H6	4
290	" 6 mm H6	4
291	" 8 mm H6	4
292	" 10 mm H6	4
293	" 12 mm H6	4
294	" 4 mm P7	4
295	" 5 mm P7	4
296	" 6 mm P7	4
297	" 8 mm P7	4
298	" 10 mm P7	4
299	" 12 mm P7	4
300	Tool locker, for storage of cutting tools, each with approx. 10 drawers, approx. size 800 x 1.000 x 1.000 mm	2

F. Clamping materials

Item	Description	Quantity
301	T-bolt M12 x 50	10
302	" M12 x 63	10
303	" M12 x 80	10
304	" M12 x 100	10
305	Nut for T-bolt (M12 x 18)	25
306	High nut for T-bolt (M12 x 36)	15
307	Double clamp M12 x 100	2
308	Finger clamp M12 x 80	4
309	Serrated block 17 - 20 mm	6
310	" 40 - 55 mm	6

Annex 4.6 Specification of raw materials and consumables (phase 1)

for two years operation of machines and equipment as specified (phase 1).

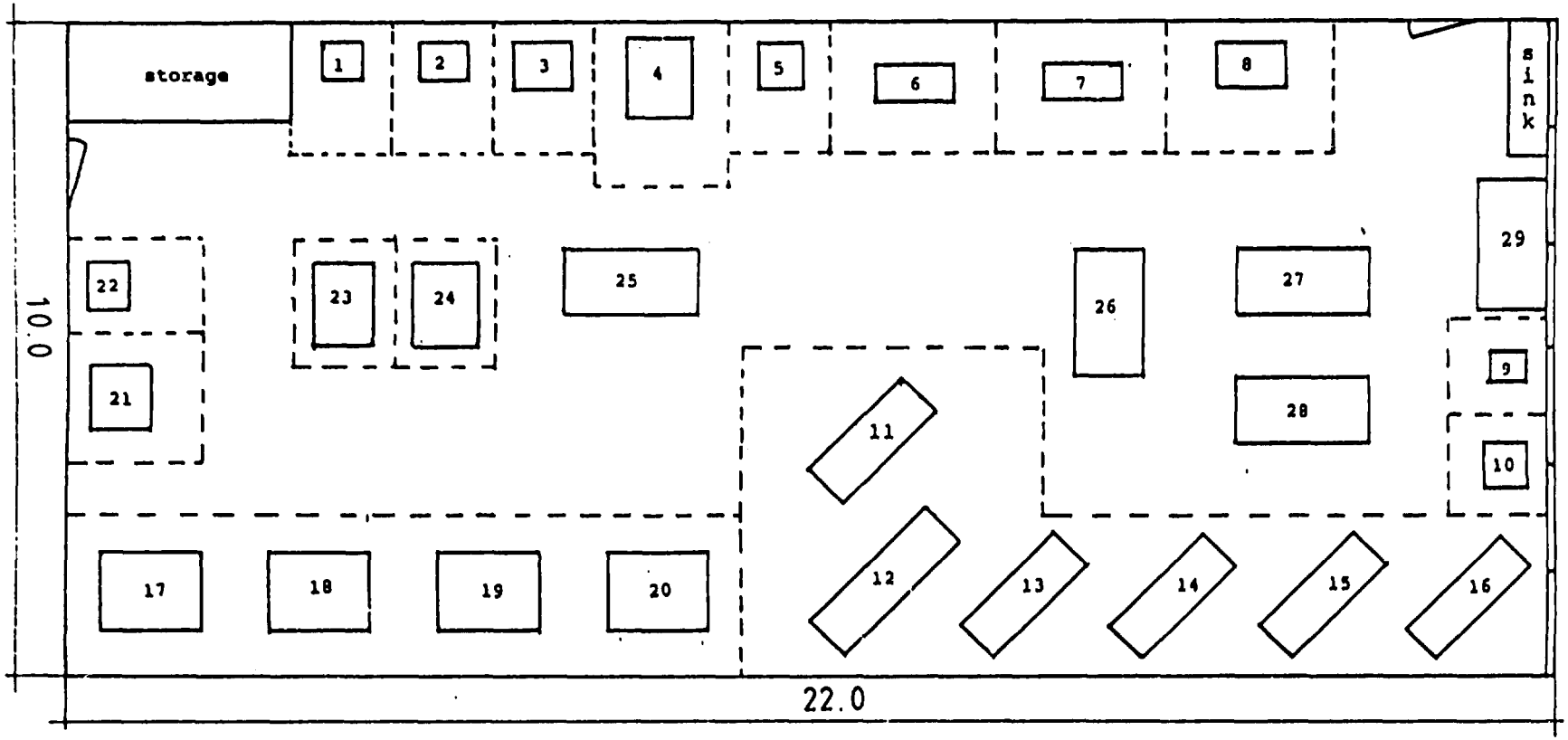
Item	Description
1	Selection of round steel bars, of various diameters, compositions and qualities.
2	Selection of steel bars with rectangular cross-section, of various dimensions, compositions and qualities.
3	Selection of non-ferrous round and rectangular bars, in various sizes.
4	Coolant fluid, matching machines as described.
5	Fluid for spark erosion machine.
6	Lubrication oil and grease
7	Selection of grinding wheels for surface grinding machine, of various characteristics.
8	Selection of grinding wheels for cylindrical grinding machine, of various characteristics, for internal and external grinding.

Annex 4.7 Specification of teaching materials (phase 1)

1 A set of learning elements for the Multi Precision Metal Machining Training Programme, for each apprentice, for the theoretical as well as practical part of the training programme.

2 A relevant selection of teaching equipment and materials for the training programme, such as books, slides, overhead sheets, general office equipment (paper, pens), drawing equipment.

3 A relevant selection of technical journals and literature.



1-2	surface grinding machines
3	cylindrical grinding machine
4-5	heat treatment furnaces
6	shearing machine
7	manual bending machine
8	hacksaw
9-10	drilling machines
11-16	lathes
17-20	milling machines
21	spark erosion machine
22	semi-jig boring machine
23-24	granite tables
25-29	work benches

GEMCO INDUSTRIAL DEVELOPMENT
Esp 5 5691 NJ Son The Netherlands Tel. 04990-74646 Telex 59388 Gemco nl.

Samual Jackman Prescod Polytechnic

GID project DP 9830

Drawing no :9830.02.0

Workshop Lay-out Proposal

Drawn :RB 17-10-89
Scale :1:100, dimensions in meters

ANNEX 6 ORGANISATION CHART AND JOB DESCRIPTIONS PHASE 1

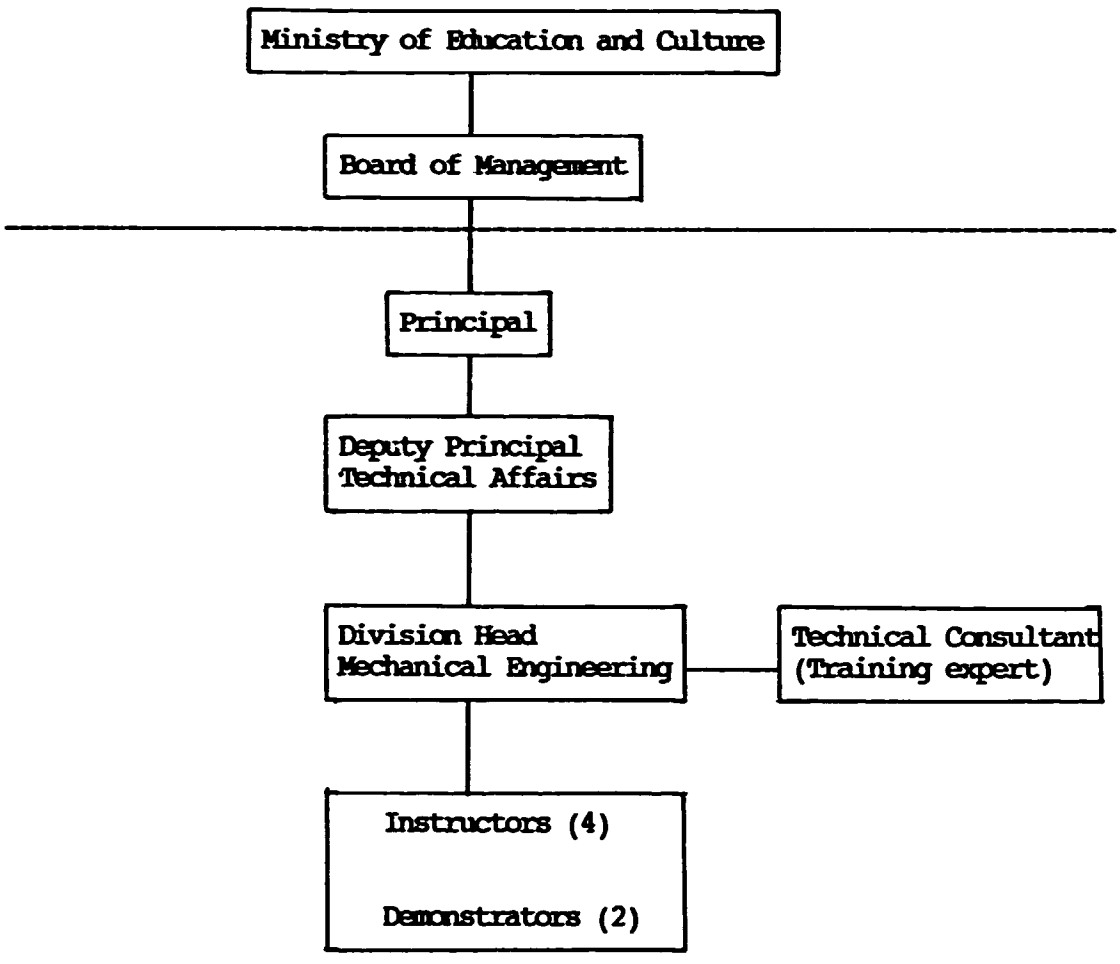
This annex comprises the following proposals concerning the organisation and implementation of full-time training programmes within the Samuel Jackman Prescod Polytechnic :

6.1 : Overall organisation

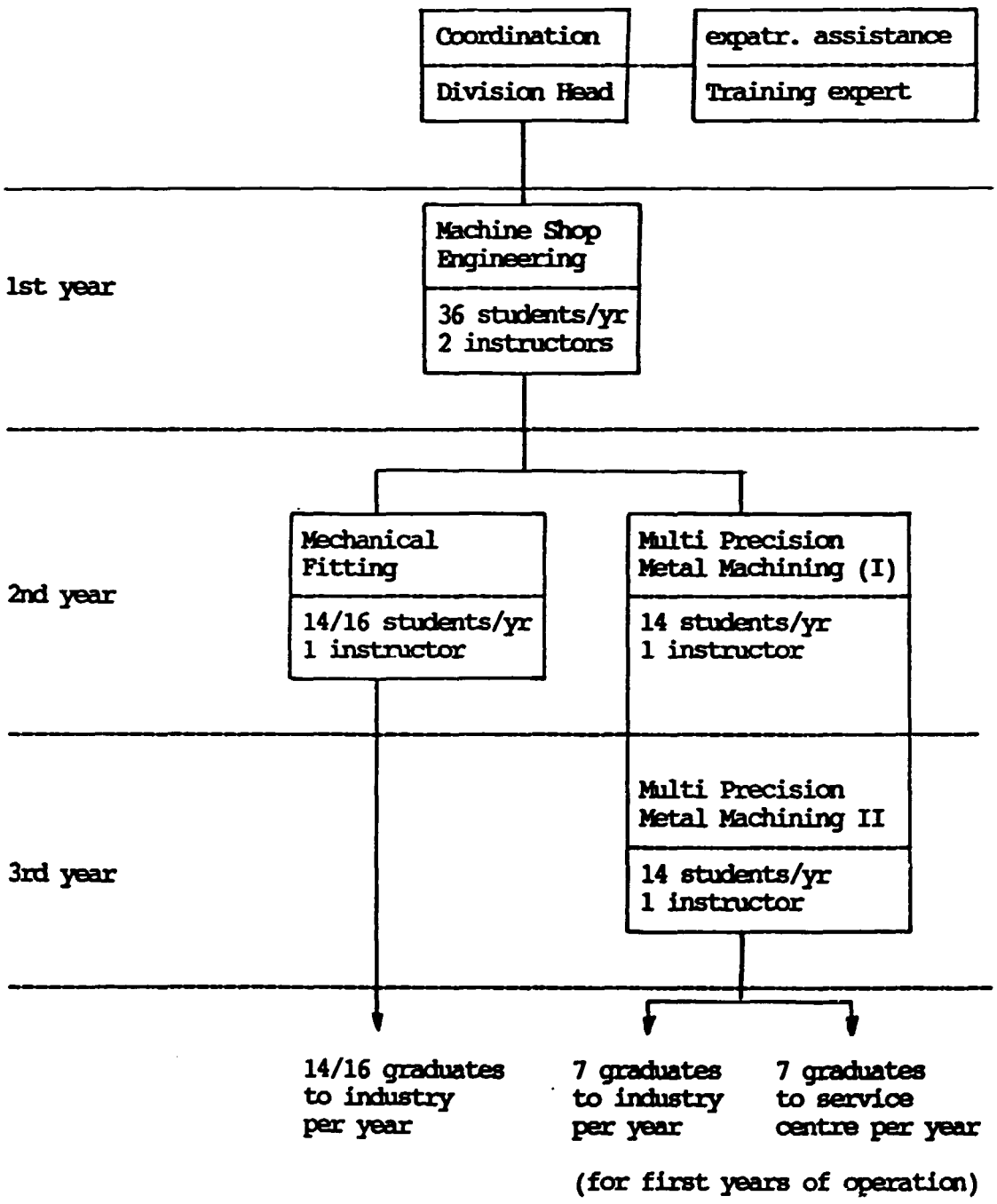
6.2 : Organisation of the training courses

6.3 : Job descriptions of Barbadian key personnel

Annex 6.1 Overall organisation



Annex 6.2 Organisation of the training courses



Annex 6.3 Job descriptions of Barbadian key personnel

The main responsibilities of the Barbadian key personnel within the organisation of the SJP Polytechnic as described in this annex are:

Division Head

- Management of the Mechanical Engineering Department
- Coordination and control of the ongoing training programmes in close cooperation with the expatriate training expert
- Responsible for all machinery, equipment and tools
- Providing practical and theoretical assistance to instructors' activities

Instructor for the Multi Precision Metal Machining Training Programme

- Implementation of the MPMM-training programme, with the assistance of the expatriate training expert
- Taking over the training programme after two years of project execution, in this way becoming responsible for the training programme
- Assisting the instructor who is taking over the first part of the programme after one year of implementation

P H A S E 2

"The Establishment of an Industrial Service Centre in Barbados"

UNITED NATIONS DEVELOPMENT PROGRAMME

Project of the Government of
BARBADOS

DRAFT PROJECT DOCUMENT

Project Title :

The Establishment of an Industrial Service Centre in Barbados (Phase 2)

UNIDO project no. DP/BAR/xx/xxx/x/xx/xx

Project Duration : 24 months

Executing Agency :

The United Nations Industrial Development Organization (UNIDO)

Estimated Starting Date : April 1992

UNDP and cost sharing financing

UNIDO/UNDP/Others : US$ 1.977.000,-

Government Contribution (in kind) : US$ 400.000,-

Signed: Date: Name/title:

---------- -------- ----------
on behalf of the Government

---------- -------- ----------
on behalf of the Executing Agency

---------- -------- ----------
on behalf of the United
Nations Development Programme

TABLE OF CONTENTS

A CONTEXT

A.1 Description of the sector

The resident population in Barbados is estimated at 253.800 in 1988.
In 1988 the two main export sectors - manufacturing and tourism - were responsible for over 60 % of the real growth in economy.
The total nominal GDP at factor cost, estimated at BDS$ 2.665,4 million increased with 6,7 %. The GDP per capita for 1988 is thus estimated at BDS$ 10.500,-.

The total number of people employed (1988) was 100.700, resulting in an official unemployment rate of 18.6 %.
The manufacturing sector provided employment for 12.600 persons.

The industrial sector in Barbados has recently experienced a considerable expansion. During 1988 the real output in the manufacturing sector rose by 6.9 percent, after falling by 6.0 percent in 1987. Between 1981 and 1987 the sector had to face many difficult challenges. Particularly the electronics manufacturing sub-sector faced heightened international competition, resulting in the closure of some major firms, and in significant fall-off in jobs and output.

A major problem faced in the industrial sector is the unability to fully utilize the available production capacity, which is mainly due to the lack of proper facilities for repair and maintenance of industrial equipment and machinery. A balanced development of the industrial sector in Barbados is seriously hampered by this situation.

A.2 Government strategy

The Government of Barbados assigns high priority to a further improvement and expansion of the metalworking and engineering industries sector.
The Ministry of Trade, Industry and Commerce therefore mentions in the Sectoral Development Plan 1988-1993 their intention to influence this expansion of output and employment through the rehabilitation of the manufacturing sub-sector and the encouragement of new investments in this sector.
The strategy for sector development includes the development of the services industries.
Among others the following targets and objectives were identified:
- to increase the percentage of manufacturing contribution to real GDP from 11 % to 14 %;
- to revitalise the manufacturing sector;
- to provide an improved package of technical assistance and incentives to the industrial sector;

- to stimulate real growth in manufacturing exports;
- to promote more cost-effective and efficient delivery of services to the manufacturing sector;
- to improve the capability of the industrial sector.

The Government would furthermore ensure that industrial and educational policies are coordinated, in order to permit the industrial sector to derive the maximum support from the educational sector.

In 1985 the Government of Barbados submitted a request to UNDP/UNIDO aimed at strengthening and promoting the establishment of an industrial service programme. UNDP/UNIDO supported this request.
Accordingly, the awareness of the need for improved maintenance and repair facilities was expressed during a 'Maintenance Week' held in Barbados in 1986.
This was followed by a technical meeting held in May 1988, attended by senior level managers of identified firms and representatives from the Barbados Industrial Development Corporation (BIDC), the Barbados Manufacturers Association (BMA) and UNIDO.

As a result of discussions during this meeting, a team of two UNIDO-consultants undertook a 3-months mission to Barbados, starting in January 1989. The mission's duties were to assist in solving the immediate problem of machine utilisation, by introducing preventive maintenance programmes in selected companies and to give recommendations for the improvement of repair and maintenance facilities and the strengthening of industrial interaction with training.

In order to ensure a balanced development of the industrial sector on the long run, Gemco Industrial Development was invited by UNIDO to provide preparatory assistance for the establishment of an industrial repair and maintenance centre.

A.3 Institutional framework

The Government's policy for development efforts is that institutions such as the Central Bank of Barbados, Barbados Development Bank, Barbados National Standards Institution (BNSI), BIDC, Barbados Export Promotion Corporation and the commercial banks provide pertinent information and advice to the sector.

The Government's policy for development of industrial training is that industrial training activities should be linked to existing training institutions, i.e. Barbados Community College (BCC), Samuel Jackman Prescod Polytechnic (SJPP) and the National Training Board (NTB).

B PROJECT JUSTIFICATION

B.1 The present situation

B.1.1 The small and medium-scale industry

The existing situation within the metalworking, woodworking and engineering industries in Barbados can be characterised as follows:

- Up till several years ago, a foundry cum machineshop existed in Barbados, where besides the work for the sugar industry jobbing activities for the local industries were performed. After closing of the foundry, a centralised repair and maintenance facility was no longer available.

- Due to its own limited natural resources, Barbados has an import-oriented society; for the industry this implies that raw materials, machinery, accessories, spare parts and consumables have to be imported. For certain tools and spare parts import duties have to be paid.
  Presently the required repair and maintenance work for industrial equipment, machinery, tools and dies is performed by either sending the work to be done abroad, or by having foreign technicians coming to Barbados. These methods are however both time consuming and expensive, and create a dependancy from foreign assistance, without making effective use of domestic resources. Present institutions in Barbados are not capable to develop the necessary technical skills to deal with repair, maintenance and precision engineering works.

- Many industries are exporting a considerable part of their products within the Caricom countries. Very few industries are also exporting to USA and Europe, and if so: only on a limited scale.

- Most industries are equipped with conventional equipment and machinery. Only in a few larger industries more sophisticated machinery is available. In these industries also the demand appears for basic electrical and electronic service facilities.

- In the majority of the industries most machines are old and not properly maintained or even cleaned. Machine tools are in a poor condition. The shopflcors are in a disordered state. Safety conditions are in general poor.

- Most of the industries use no proper maintenance programmes. Only corrective (break-down) maintenance is done.

- Most workers in the industry did not attain any practical education, and were trained on-the-job. Basic technical skills are often lacking, work discipline is not adequate.

In general it can be concluded that major problems envisaged by the industry are:

- The lack of practical skilled workers to execute precision metal machining and maintenance and repair work;
- The lack of sufficient precision machines and equipment;
- The non-availability of a centralised technical service centre.

B.1.2 Educational institutes

- Barbados has in general a good education system. Existing technical education institutes are the Samuel Jackman Prescod Polytechnic (SJPP) and the Barbados Community College (BCC). The SJPP emphasises on craft level training, whereas the BCC provides education and training on technician level.

- Furthermore the National Training Board (NTB) implements a skills training programme and an apprenticeship programme aimed to develop technical skills for the industry.

- The two technical institutes have no sophisticated machinery available. A considerable part of the machinery is old, not in use and/or out of order.

- The interlinkage and coordination between the training institutes and the industry is not adequate.

The problem envisaged by the educational institutes are therefore the lack of practical skills programmes and appropriate, sophisticated equipment, resulting in the fact that although graduate students have good theoretical knowledge, their required practical skills are not sufficient to meet existing demands in the industry.

Summarising the present situation as described above, it can be concluded that the problem addressed by the project is two-fold:

1. the unavailability of an industry-oriented training and demonstration programme in repair, maintenance engineering services, and
2. the lack of domestic facilities in Barbados to perform the required maintenance and repair work for industrial equipment, machinery and tools.

B.2 Expected end-of-project situation

In order to effectively work on both problems as described in section B.1, the project will be divided in two phases, pursuing the same development objective, but each having separate immediate objectives and goals. These phases are overlapping in time.
This separation is also based on the need for (a) establishing a proper technical training facility and (b) a separate industrial services facility, as expressed by the national parties involved (Government, Barbados Manufacturing Association, BIDC, domestic industries).
The two phases to be implemented are:

Phase 1: The establishment of a multi precision metal machining training programme, incorporated within an existing training institute;

Phase 2: The establishment of an industrial service centre.

Phase 2 of the project is further worked out in this draft project document, whereas phase 1 is described in the draft project document entitled "The establishment of a Multi Precision Metal Machining Training Programme within the Samuel Jackman Prescod Polytechnic, Barbados".

The expected impact of phase 2 may be illustrated in the following, which refers to the evolution of the existing situation towards a new situation at the moment of project completion.

Industrial Service Centre

At the end of execution of phase 2 the following activities will have been performed:

1. A centralised industrial service centre (ISC), including workshops, quality control room, auxiliary buildings will have been set up within an industrial estate. Equipment will have been supplied, installed and operational for this purpose.

2. Technical staff will have been recruted and trained. Selected staff personnel will have attended fellowship training programmes in various fields of specialisation.

3. A total number of 14 machine operators, having attended the multi precision metal machining programme of phase 1, will be employed at the ISC.

4. The ISC is operated on a commercial basis, with preferably a capital-involvement of the private sector.

5. The following main activities will have been set up and operational:
   - Commercial jobbing activities for domestic small and medium industries within the common facilities;
   - provision of crash training courses for specific demands of the industry, which are not covered by existing training facilities (i.e. SJPP, BCC, NTB);
   - advisory services to domestic industries, a.o. in the field of repair, corrective maintenance, preventive maintenance, productivity, internal organisation.

6. An expatriate workshop expert will have assisted the General Manager in the day-to-day co-ordination and planning of activities.

7. Miscellaneous engineering consultancies will have taken place, geared towards occurring demands during project execution.

B.3 Target beneficiaries

The direct target beneficiaries are:
- the small and medium scale mechanical, metal working and electrical industries in Barbados, who are not in the position to develop the needed repair, maintenance and engineering capabilities independantly, and do not have own facilities for sophisticated/advanced metal working operations and facing technological bottlenecks.

Indirectly the country as a whole would benefit from the economic growth which is expected to develop from further development of the industrial sector, once the problem as described will have been overcome.

B.4 Project strategy and institutional arrangements

The project strategy for phase 2 is to establish an industrial service centre (ISC). This ISC will fulfil requirements of the domestic industry, by means of having centralised service facilities, rendering technical assistance services and giving crash training courses. The ISC should provide these services on a commercial basis, so that on the long run the ISC will become self-supporting.
Financing sources are unknown yet. These should be sought and found at short notice, in order to avoid a gap between phases 1 and 2. The private sector in Barbados should preferably have a financial involvement in set up and operation of the ISC.

B.8 Counterpart support capacity

Concerning the set-up of an industrial service centre, the Government/BIDC will be able to provide suitable project site and buildings.
Professional managerial and technical staff will be ensured by (1) paying salaries, consisting of a basic wage and incentives, comparable to private sector salaries, and (2) employing machine operators who attended the MPMM-training course at the SJP Polytechnic (as proposed in phase 1 of the project).

C DEVELOPMENT OBJECTIVE

The development objective of the project is to contribute to a plan of the Government of Barbados/ BIDC, aiming at maximizing the country's industrial resources by developing a training and demonstration programme in repair and maintenance and engineering services.
Within this plan priority is given to demonstration of modern maintenance and repair techniques, organisation and upgrading of repair facilities and operations and to in-plant training.
The plan is part of the Government's programme to support concentrated industrial expansion, especially in the metal working sector, with a maximum dependency on domestic capabilities and a minimum dependency on import of spare parts and repair work.

D IMMEDIATE OBJECTIVE, OUTPUTS AND ACTIVITIES

Immediate objective

The immediate objective of phase 2 is to establish an industrial service centre (ISC) in Barbados, in order to strengthen the industry in Barbados through decreasing the dependency of the domestic industry on sources abroad.
The ISC will be a focal point of modern technology, and will make available this technology to industries, by means of providing extension services and common facilities on a commercial basis, emphasizing on repair and maintenance of industrial equipment and machinery. Furthermore the ISC will, complementary to existing training programmes, provide specialised crash training courses for technicians from the industry.

E INPUTS

E.1 Government inputs

National staff

The number of required personnel are specified in table E.1. The different departments mentioned are based on the organisation chart, as shown in annex 4. Job descriptions of national key personnel are also described in this annex.

Table E.1: Description of National Personnel

Department/Staff	no. year 1	no. year 2
Management		
- Managing Director	1	1
- Secretary to MD	1	1
Operations Department		
- Manager Operations	1	1
Section Common Facilities		
- Division Head	1	1
- Machine Operators	7	14
- Designer	1	1
- Quality Controller	1	1
Section Extension Service		
- Industrial Adviser	2	2
Section Specialised Training		
- Training Officer	1	1
- Instructor	1	1
Storage		
Store keeper	1	1
Assistant store keeper	1	1
Commercial Department		
- Commercial Manager	1	1
- Assistant	1	1
Administrative Department		
- Controller	1	1
- Clerk	1	1
Section General Affairs		
- Secretary/typist	2	2
- Sweeper	1	2
TOTAL PERSONNEL	26	34

Other national inputs

a) Required land, buildings and facilities
The industrial service centre should be established within an industrial estate. Government/BIDC own a number of factory sites and buildings. If available, the Government/BIDC may decide to establish the ISC within existing factory buildings.
These factory and auxiliary buildings should however meet the minimum conditions for civil works as recommended in annex 3, in which lay-out suggestions for the factory and auxiliary buildings are given.

b) The mission recommends that the Government would have a cost-sharing contribution to the international budget, by financing 70 % of the total hardware costs out of bi-lateral or multi-lateral sources of finance. Funds might for instance be obtained out of the creditline from the Inter American Development Bank, through the Barbados Development Bank.
Furthermore a part of the operational expenses during the project-execution should mainly be covered by international sources.
The required equipment and machinery for the implementation of phase 2 is specified in annex 2.

E.2 Inputs domestic industry

Preferably the domestic industry in Barbados should have a financial involvement in the set up of the ISC.
The mission suggests the domestic industry would cover approximately 30 % of the total hardware component.

E.3 UNDP/UNIDO inputs

The mission recommends that UNDP/UNIDO may maintain to act as executing agent and continues to provide financial assistance for international expertise, training and/or fellowship activities for phase 2, in order to ensure a continued inclusion of this component throughout the project duration.

a) International staff
One expatriate technical consultant will be required for the execution of phase 2 of the project. This consultant should be a mechanical engineer with extensive knowledge and experience in the set up and operation of mechanical/electrical workshops.
The consultant will be required for the total duration of phase 2 (24 m/m), starting in Barbados in April 1992.

Furthermore miscellaneous engineering consultancies are planned over the project period, with a total duration of 4 m/m.
These consultancies will be specified during the project implementation.

b) Sub-contracts
In order to achieve an optimum efficiency of activities to be performed in phase 2 of the project, the mission proposes that hardware supply as well as technical assistance will be provided by the same sub-contractor as used for phase 1, provided that the sub-contractor's involvement in the first phase resulted in a satisfactory performance.

c) Training
The need for extended training courses by means of fellowships is to be defined by the future contractor.
Fields, contents and time schedules of these foreign training courses will be specified during implementation of the project.
It is expected that a total number of 8 m/m will cover the need for fellowships/industrial training abroad for the first two years of operation.

F RISKS

The establishment of the industrial service centre (phase 2) will consequently involve higher risks than the performance of activities in phase 1.
Major risks are:
- The non-availability of financial resources - low risk
- The non-availability of a suitable site - low risk
- The non-availability of skilled national staff - low risk
- Financial break-even point will not be reached after 5 years - low risk

G PRIOR OBLIGATIONS AND PREREQUISITES

Prior obligations and prerequisites required before the project can commence implementation are:

Government obligations and prerequisites:
- Institutional arrangements, as outlined in section B.4
- The assurance of counterpart support capacity, as stated in section B.8
- Government inputs, see sub-sections E.1
- Budget, see section J.

UNDP/UNIDO obligations and prerequisites:
- Institutional arrangements, as outlined in section B.4
- The assurance of UNDP/UNIDO inputs, as stated in sub-sections E.3, and section J (Budget).

General prerequisites:
- The Government and UNDP/UNIDO should strive to progress according to the workplan as given in annex 1.

- The income statements as given in the preliminary financial break-even analysis (see annex 5) should be studied in further detail by the Government/BIDC in order to confirm the economic feasibility of implementation of phase 2.

The Project Document will be signed by UNDP, and UNDP assistance to the project will be provided (1) only if the prior obligations stipulated above have been met to UNDP's satisfaction, and (2) subject to UNDP receiving satisfaction that the prerequisites listed above have been fulfilled, or are likely to be fulfilled. When anticipated fulfillment of one or more prerequisites fails to materialise, UNDP may, at its discretion, either suspend or terminate its assistance.

H PROJECT REVIEWS, REPORTING AND EVALUATION

The project will be subject to tripartite review, i.e. a joint review by representatives of the Government, executing agency and UNDP every 12 months, the first such meeting to be held within the first 12 months of start of full implementation.
The national project co-ordinator and/or the senior project officer of the United nations executing agency will prepare and submit to the UNDP field office at least 3 months before each tripartite review a Project Performance Evaluation Report (PPER). Additional PPER's may be requested, if necessary, during the project.

A project terminal report will be prepared for consideration at the terminal tripartite review meeting of each phase. It will be prepared in draft sufficiently in advance to allow review and technical clearance by the executing agency at least 4 months prior to the terminal tripartite review.

Phase 2 of the project will be subject to evaluation 18 months after start of full implementation. The organisation, terms of reference and timing will be decided after consultation between the parties involved in the project.

I LEGAL CONTEXT

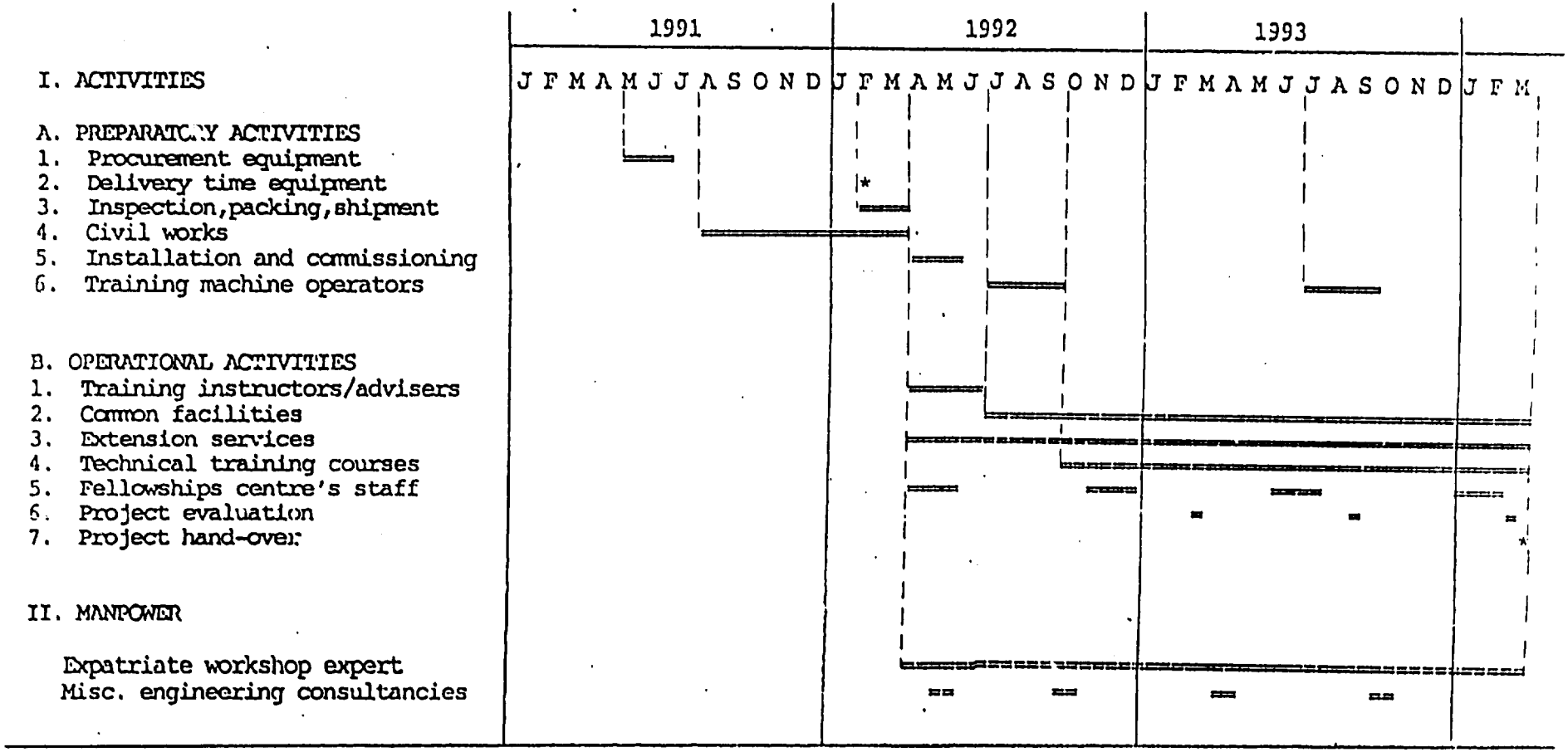
This Project Document will be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement between the Government of Barbados and the United Nations Development Programme, signed by the parties on 21 October 1974.
The Host Country Implementing Agency will, for the purpose of the Standard Basic Assistance Agreement, refer to the Government Co-operating Agency described in that Agreement.

The following types of revisions may be made to this Project Document with the signature of the UNDP resident representative only, provided he or she is assured that the other signatories of the Project Document have no objections to the proposed changes:

(a) Revisions in, or addition of, any of the annexes of the Project Document;
(b) revisions which do not involve significant changes in the immediate objectives, outputs or activities of a project, but are caused by the rearrangement of inputs agreed to or by cost increases due to inflation; and
(c) mandatory annual revisions which rephase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility.

PROJECT BUDGET COVERING INTERNATIONAL CONTRIBUTION

DESCRIPTION	TOTAL MM.	TOTAL US$	1992 MM.	1992 US$	1993 MM.	1993 US$	1994 MM	1994 US$
PROJECT PERSONNEL								
Technical Consultant (workshop expert)	24	217200	9	81450	12	108600	3	27150
Engineering Consultancies	4	36200	2	18100	2	18100		
PROJECT TRAVEL								
Expert international travel		5000		2000		2000		1000
Consultancy international travel		10000		5000		5000		
OTHER PERSONNEL EXPENSES		8000		3000		3000		2000
TOTAL PERSONNEL		276400		109550		136700		30150
TRAINING								
Fellowship - national technical personnel	8	21600	4	10800	2	5400	2	5400
Industrial facility costs fellowships	8	24000	4	12000	2	6000	2	6000
TOTAL TRAINING		45600		22800		11400		11400
EQUIPMENT								
Expendable equipment Tools, consumables, raw material		195000		130000		65000		
Non-expendable equipment Machinery, equipment, furniture, accessories		1400000		1400000				
Packing and shipment		40000		35000		5000		
TOTAL EQUIPMENT		1635000		1565000		70000		
MISCELLANEOUS								
Sundries		20000		7000		9000		4000
PROJECT TOTAL		1977000		1704350		227100		45550


1991
1992
1993
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M
I. ACTIVITIES
A. PREPARATORY ACTIVITIES
1. Procurement equipment
2. Delivery time equipment
3. Inspection,packing,shipment
4. Civil works
5. Installation and commissioning
6. Training machine operators
B. OPERATIONAL ACTIVITIES
1. Training instructors/advisers
2. Common facilities
3. Extension services
4. Technical training courses
5. Fellowships centre's staff
6. Project evaluation
7. Project hand-over
II. MANPOWER
Expatriate workshop expert
Misc. engineering consultancies

ANNEX 2 REQUIRED EQUIPMENT AND MACHINERY PHASE 2

This annex comprises :

2.1 : Overview and summary of costs

2.2 : General notes for machinery and equipment

2.3 : Specification of machines and equipment

2.4 : Specification of measuring tools

2.5 : Specification of machine- and handtools

2.6 : Specification of raw materials and consumables

Annex 2.1 Overview and summary of costs

This paragraph summarizes the required investments for machinery and equipment, and for raw materials and consumables needed for the first two years of operation of the Industrial Service Centre.

Specifications of machines (item 1), measuring tools (item 2) and machine- and handtools (item 3) and raw materials and consumables (item 4), are given in the following paragraphs.

Budget prices given below include a set of spare parts for two-years operation, for the items where applicable.

Item Description	US Dollars
1. **Machines and equipment :** (incl. spare parts for 2 years)	US$ 1.400.000
2. **Measuring tools :**	US$ 55.000
3. **Machine- and handtools :** (for two-year operation)	US$ 110.000
4. **Raw material and consumables :** (for two-year operation)	US$ 30.000
5. **Packing and shipment**	US$ 40.000
	+ ----------
Total hardware costs C+F Barbados	**US$ 1.635.000**

Annex 2.2 General notes for machinery and equipment

The following general notes are applicable for the machinery and equipment to be supplied for phase 2:

1. The electrical and hydraulic equipment fitted with the machine should be so designed that they can function under tropical conditions.

2. Adequate ventilation should be provided for motors.

3. The rubber seals, 'O'-rings, liprings etc. should be of material suitable for tropical conditions.

4. The machines should be suitable for connection to 220 Volts, 3 phase, 50 c/s supply, or 110 Volts, 1-phase.

5. The machines are to be equipped with metric dials and scales. The dial gauges and other gauges must be calibrated in the metric scale. Temperature gauges should be in Centigrade scale. Instruction plates should be in English.

6. All tool holders supplied should be according to metric standards.

7. A set of spare parts should be included for the machines applicable, for a 2 years operation.

8. Two sets of spare parts list/catalogues in English showing assembly drawings of important machine parts and units as well as complete details such as part No., Manufacturer's serial number, Type, Size, quantity etc. should be supplied along with the machine to enable the ordering of spare parts as and when required.

9. Two copies of detailed operation manuals in English including foundation drawings, final electrical wiring diagrammes etc. should be supplied. Operator's manuals should include sectional drawings of important machine units and assembly and installation instructions.

Annex 2.3 Specification of machines and equipment

Item	Description	Qty
1	**Semi jig boring machine** Quick toolchange device, powered down feed, coolant system, centralised lubrication system, motor brake, co-ordinate table with optical reading, graduated rules for the longitudinal, cross and vertical traverses, tapping device, set of servicing spanners.	1
	Approx. specifications: Dimension of table 820x400 mm Drilling capacity in steel 23 mm Distance between spindle nose and table 150-620 mm Longit. traverse 400 mm Cross traverse 300 mm Infinitely variable speed 40-4000 rpm	
	Complete with:	
	- Compound vice jaws 110 mm wide swivels through 360° inclinable up to 90°	1
	- Universal rotary table, dia. 280 mm	1
	- Indexing fixture 2 positions - horizontal and vertical dia. of precision chuck 125 mm	1
	- Reduction sleeves short and long	1
	- Key-tightened chuck	1
	- Tap holder with protection against tap breakage capacity for taps M6-M16	1
	- Boring head boring capacity approx. 5-110 mm boring tool dia. 8 mm graduations 0.01 mm supplied in wooden box with 3 boring tools and key.	1
	- Centering microscope magnification 20x supplied in wooden box.	1
	- Centering device dia. of shaft 10 mm centering accuracy 0.005 mm	1
	- Measuring device permits centering and positioning of workpiece. metric graduation 0.01 mm centering range bore dia. 3-300 mm dial dia. 38 mm supplied in wooden box.	1

Item	Description	Qty
(3)	Each machine complete with: - 3-jaw drill chuck and key, capacity 13 mm - Machine vice, width of jaws 80 mm	
4	**Centre lathe** Straight type, camlock nose mounting, metric spindle, continental type gearbox, bedways hardened and ground, apron control unit for spindle, mounted on coolant tray and sheet metal base with tool cabinet and coolant unit.	2

Approx. specifications:

Height of centres		140 mm
Distance between centres		500 mm
Swing: over bed		280 mm
over cross slide		175 mm
Bore of spindle		25 mm
Spindle nose: mounting D.1 camlock taper		MT3
Travel: of cross slide		160 mm
of compound slide		90 mm
of tailstock spindle		100 mm
Taper in tailstock spindle		MT3
Spindle speed: number		16
range		40-1600 rpm
Pitch of lead screw		6 mm
Metric pitches: number		27
range		0.2-6 mm
Whithworth threads: number		26
range		3.5-80 tpi
Module pitches: number		22
range		0.3-6.0
Number of feeds		16
Range of feeds: sliding	0.02	7 mm/rev.
surfacing	0.01	3 mm/rev.

Each machine complete with:

- Slotted toolblock	1
- Driving plate	1
- Faceplate	1
- Centres MT3	2
- 3-jaw chuck, dia. 125 mm	1
- Chuck guard	1
- Splash guard	1
- Coolant unit, with fittings, complete	1
- Set of spanners and keys	1
- 4-jaw independent chuck dia. 200 mm	

Item	Description	Qty
(5)	- Chuck guard	1
	- Splash guard	1
	- Coolant unit with fittings, complete	1
	- Set of spanners and keys	1
	- 4-jaw independent chuck, dia. 400 mm	
	- Collet chuck, key operated	
	- Multisize collet set, 4-38 mm	
	- Drill chuck, 1-16 mm, with key	
	- Rotating centre MT4	
	- Faceplate dia. 350 mm	
	- Quick change toolpost, complete with 6 toolholders and wrenches	
	- Bedstop, single type	
	- Low voltage lighting unit	
	- 3-point stationary steady	
	- Travelling steady	
6	**Universal milling machine** Metric type, automatic longitudinal table feed, handfeed of table in all three directions.	2

Each machine incliding standard equipment and:
* coolant system
* drawbar M12
* overarm and arbor support
* set of spanners, wrenches and oil gun

Approx. specifications:

Table size	600x200 mm
Longit. traverse X axis	300 mm
Cross traverse Z axis	130 mm
Vertical traverse Y axis	300 mm
Taper on spindle	
Min. spindle speeds	8
Speed range	100-2000 rpm
Number of feeds	8
Range of feed	12/230 mm/min
1 div. on spindle drums	0.02 mm
Electric 2-speed motor (main)	
0.5/1.5 kW	700/1400 rpm

Suitable for electrical supply of ...V, A.C., 3-phase, ...Hz.

Item	Description	Qty
(6)	Each machine complete with:	
	- Vertical milling head that allows swivelling ca. 100°, taper ISO 30 M12	1
	- Simple angular table	1
	- Swivel vice, jaws 110 mm wide, swivels through 360°	1
	- Collet adaptor for double taper collets taper ISO 30 M12	1
	- Collets, set double taper type, capacity 4-20 mm	1
	- Adaptor, set outside ISO 30 M12 inside MT2 and MT1	
	- Drill chuck taper ISO 30 M12 capacity 13 mm	1
	- Milling arbor, long arbor 16 mm dia.	1
	22 mm dia.	1
	27 mm dia.	1
	- Milling arbor, short arbor 16 mm dia.	1
	22 mm dia.	1
	27 mm dia.	1
7	**Universal milling machine** Metric graduation, rapid traverse, quill stroke, spindle nose ISO 30 (ISO 40).	2
	Each machine including standard equipment and: * vertical milling head that allows swivelling of 360° * overarm and arbor support * coolant system * set of spanners	
	Approx. specifications:	
	Table size 700x280 mm	
	Longit. traverse X axis 400 mm	
	Vertical traverse Y axis 450 mm	
	Cross traverse Z axis 180 mm	
	Speed range infinitely variable	
	horizontal 50-2000 rpm	
	vertical 50-3400 rpm	
	Infinitely variable feed range 10-360 mm/min in 2 directions (X+Y)	

Item	Description	Qty
(7)	Each machine complete with:	
	- Milling chuck ISO 30 (ISO 40) with set of collets 2-4-6-8-10-12-14-16	1
	- Universal table, clamping area 600x300 mm, inclination about longitudinal and traverse axis ca. 30° table rotates 360°	1
	- Milling arbor, long, dia. 16-22-27-32 mm	1
	- Milling arbor, short, dia. 16-22-27-32 mm	1
	- Reducing sleeve ISO 30 (ISO 40) for tools with MT, tang inside of ISO taper to take	
	MT 1 tools	1
	MT 2 tools	1
	- Reducing sleeve ISO 30 (ISO 40) for MT tools with internal thread to take	
	MT 1 tools	1
	MT 2 tools	1
	- Drill chuck ISO 30 (ISO 40) shank for direct mounting in milling spidle, chuck self-tightening, capacity: 0-10 mm	1
	- Universal boring and facing head ISO 30 (ISO 40) facing and boring range up to 250 mm, automatic feed 0.05 slide/rev., supplied with 3 boring bars, 2 holders for boring bars and various reducing collets for 8-10-12-14 mm dia. in wooden box.	1
	- Machine vice, width of jaws approx. 110 mm, opening approx. 100 mm, swivel base.	1
	- Dividing head, spindle bore apprxo. 42 mm, spindle taper ISO 50, distance between centres 400 mm, height of centres approx. 100 mm, ratio of worm drive 1:40, direct indexing device 24 notches, indexing plate with 18 hole circles, dividing head supplied complete with overarm and centres, tailstock, draw bolt with handle, combined indexing plate and scale drum equiment.	1
	- 3-jaw chuck, 160 mm dia., suitable for use in conjunction with dividing head.	1
	- Circular table, approx. 350 mm dia. for direct and indirect dividing interchangeable scale drum with indexing plate, indexing plunger for direct indexing.	1
8	**Universal milling machine** Metric type, saddle to be swivelled 45° to either side, table screw designed for climb-milling; hand and automatic feed for all three table movements; safety clutch on feed shaft, automatic lubrication of moving parts, electro-magnetic spindle brake.	1

Item	Description	Qty
(8)	Complete with standard equipment, among which: * coolant system * drawbar M16 * one long arbor 27 mm dia. * overarm, arbor support and brace * set of spanners and wrenches	
	Approx. specifications:	
	Table size 1000x250 mm Longitud. traverse 650 mm Cross traverse 220 mm Vertical traverse 450 mm Swivel of table ca. 45° Taper on spindle ISO 40 Min. number of spindle speeds 12 Range of spindle speeds 40-1000 rpm Min. number of feeds 12 Range of feeds: longit. and cross 12-300 mm/min vertical 5-120 mm/min	
	Complete with:	
	- Machine vice, on swivel base, jaws 125 mm	1
	- Rotary table, for direct indexing, min. dia. of table 250 mm	1
	- Vertical milling attachement head to be swivelling through plane and set at any angle	1
	- Slotting attachment	1
	- Milling arbor, long, dia. 22-27-32 mm	1
	- Milling arbor, short, dia. 22-27-32 mm	
	- Adaptors, set of 4: outside ISO 40 inside MT4, MT3, MT2 and MT1	1
9	**Universal engraving and copy milling machine** Manual controlled, with pantograph.	1
	Approx. specifications:	
	Ratios (3-dimensional) 1:1 to 1:10 Working area (rectangle) 335x150 mm Max. distnace, spindle/worktable 390 mm Worktable traverse longitudinal 160 mm traverse 300 mm Work clamping surface 350x200 mm Master clamping surface 520x320 mm Spindle speeds: 475 .....20000 rpm	

Item	Description	Qty
(9)	Complete with:	
	- Machine lamp	
	- Roll engraving attachment for cylindrical and tapered workpieces. work dia. approx. 20-100 mm max. length of work 240 mm	
	- Rought milling attachment	1
	- Index head, chuck can be tilted 90° and rotated 360° max. work dia. chuck axis horizontal 95 mm chuck axis vertical 110 mm chuck bore dia. 25 mm	1
	- Two-groove copy holder for holding copy strips with 20 mm characters size 120x440 mm	1
	- Single-groove copy holder for holding copy strips with 40 mm characters, size 100x800 mm	1
	- Machine vice with circular base graduated to 360° clamping capacity 80 mm width of jaws 110 mm	1
10	**Shaping machine** Heavy duty type, with manual and automatic horizontal table feed, table with front support and "T" slots on front and on one side, adustable 45° in either direction, automatic tool lifter and re-circulating lubrication system, heavy duty swivelling machine vice, key way cutter holder.	1

Approx. specifications:

Length of stroke	450 mm
Number of strokes	6
Speeds of strokes	20-130/min.
Table size	300-400 mm
Longitudinal traverse	500 mm
Vertical traverse	275 mm
Range of cross feed per cut	0.25-1.0 mm
Down feed toolhead	125 mm
Tool section	16x30 mm
Head adjustable to right and left	60°
Vice jaws width	200 mm
Vice opening	250 mm

Item	Description	Qty
11	**Lap wet grinder** Pedestal type, single ended machine with wheel mounted directly on the motor spindle, pivoted table with angle plate, a protractor guide, motor and wheel adjustable forward for wheel wear, supplied with spare grinding wheel and diamond laps wheel. Approx. specifications: Wheel speed approx. 20 m/sec Motor speed 3000 rpm Table size 420x127 mm	1
12	**Pedestal grinding machine** Double ended type, cast iron or sheet metal pedestal for floor mounting, adjustable toolrests, wheelguards and eyeshields, complete with 2 grinding wheels: one 40 grit and one 80 grit and grinding wheel dresser. Approx. specifications: Wheel size 300x50x25 mm Distance between wheels 600 mm	1
13	**Pedestal grinding machine** Double ended type, cast iron or sheet metal pedestal for floor mounting, adjustable toolrests, wheelguards and safety eyeshields, complete with 2 griding wheels: one 40 and one 80 grit. Approx. specifications: Wheel size 200x25x20 mm Distance between wheels 400 mm	1
14	**Single-lip cutter grinder** Approx. specifications: Grinding wheel spindle speed 4500/min Max. clamping capcacity with collet 17.5 mm Max. lateral traverse of index head slide for off-centre radii, both ways 10 mm Max. relief angle for right hand tools 45° left hand tools 15° <u>Complete with:</u> - Built-in dust exhaust - Measuring projector - Spindle assembly locating fixture	1

Item	Description	Qty
(14)	- Special index head slide (increasing clamping capacity upto 25 mm) - Twist drill grinding attachment - Wheel mounts - Grinding wheels - 6 pcs	
15	**Universal tool and cutter grinder** Universal type, versatile and accurate machine for grinding and sharpening of a wide range of milling cutters, drills, taps, reamers etc., with attachments for cylindrical and internal grinding.	1
	Approx. specifications: Height of centres 125 mm Distance between centres 300 mm Longitudinal movement of table 200 mm Cross-slide movement 115 mm Largest cutter dia. 150 mm One division on scale 0.01 mm Workhead for horizontal and vertical setting 0-360° Grinding wheel dia. 150 mm Spindle speed range 3000-15000 rpm	
	Complete with: - Standard equipment - Set of spanners and wrenches - Light unit - Dust extractor	
	- Spiral grinding attachment	1
	- Flute grinding attachment	1
	- Drill point and tap lead attachment	1
	- Swivel vice	1
	- Radius truing attachment	1
	- Diamond wheel dresser	1
	- Set of various tooth rests	1
	- Magnetic chuck	1
	- Indexing attachment	1
	- Taper mandrils, set 16-22-27 and 32 mm dia.	1
	- Mandrils for side and face cutters, set 16-22-27-32 mm dia.	1
	- Morse taper holders, set for tapers MT4, MT3, MT2 and MT1	1
	- Collet holder	1
	- Collets, set, double taper type, for 6 20 mm dia.	1
	- Grinding wheels, 3 sets of different types.	

Item	Description	Qty
16	**Cylindrical grinding machine** Centre type, for outside and inside grinding, with table swivel device, hydraulic table drive, coolant equipment with filter tank, micrometer table stops, dead-stop infeed handwheel, light unit.	1
	Approx. specifications:	
	Grinding lenght 600 mm	
	Centre height 125 mm	
	Table traverse speed infinitely variable from 0.05 to 6 m/min	
	Swivel of table 10°	
	Headstock speed infinitely variable from 50 to 400 rpm	
	Spindle bore dia. 40 mm	
	Headstock swivel 90°	
	Grinding wheel size 300x40x76 mm	
	Complete with:	
	- Inside grinding spindle	1
	- Wheel flange	1
	- Wheel balancing device	1
	- Diamond dressing device	1
	- Steady rest, three-point type	1
	- Dial indicator for table swivel	1
	- Side and angle truing attachment	1
	- Three jaw chuck, dia. 125 mm	1
	- Three jaw chuck, dia. 200 mm	1
	- Four jaw chuck, dia. 160 mm	1
	- Face plate, dia. 200 mm	1
	- Magnetic chuck, dia. 200 mm	1
	- Radius truing attachment	1
	- Collet chuck attachment	1
	- Set of collets	
	- Set of grinding wheels, size 300x40x76 mm 40 grit: 3 pcs 80 grit: 3 pcs	
	- Set of internal grinding wheels.	
17	**CNC lathe**	1
	Approx. specification:	
	Distance between centres 400 mm	
	Swing over bed dia.280 mm	
	Spindle bore dia. 41 mm	
	Spindle speed range (infitely variable) 40-4000 rpm	
	Spindle nose taper MT5	
	Feed range 1-5000 mm/min	
	Tailstock quill taper MT3	
	Program storage capacity 24K	
	System resolution 0.001 mm	

Item	Description	Qty
(17)	Complete with: Standard accessories and: - Machine enclosure with splash panals and rolling guard - Machine lightning - Coolant equipment - Quick change tool post - Hand tools set - Graphics display - Battery back-up program protection - Playback data input - Tool and spindle orientation - Boring tool holders - Extensive set of tool holders	
18	**Horizontal surface grinding machine** Flat and profile grinding type, hydraulic table drive, infinitely variable, coolant equipment with filter tank.	1
	Approx. specifications: Grinding length 500 mm Grinding width 350 mm Wheel diameter 300 mm Max. distance table top and grinding wheel centre 400 mm Table traverse speed infinintely variable from 2 to 28 m/min. Automatic table cross feed variable from 1 to 60 mm/stroke Graduation on cross feed handwheel 0.02 mm Graduation on fine setting knob 0.01 mm Graduation on vertical setting handwheel 0.002 mm Graduation on fine setting know 0.001 mm	
	Complete with: - Automatic demagnetization equipment - Machine setting blocks - Diamond wheel dressing device, built-in on machine - Magnetic filtration system - Precision machine vice - Electromagnetic chuck, 300x150x60 mm - Set of grinding wheels, size 300x40x76 mm 40 grit: 3 pcs 80 grit: 3 pcs	1 1 1 1 1 1

Item	Description	Qty
19	**Spark erosion machine** Removable walls of the work tank to allow easy access to the clamping surface, electrically released brake to prevent damage caused by bottoming of the electrode in the event of a power failure, table and work head with automatic lubricating system, generator equiped with all the controls required for opeating the machine, built-in warning lamp for readjusting generator.	1
	Approx. specification: Range of traverse table: longit. 250 mm table traverse 150 mm vertical slide 150 mm Max./min. distance/table electr. 450/150 mm Electrode weight 60 kg Co-ordinate table: clamping surface 400x300 mm weight of work 300 kg	
	Complete with: - Filtration system - Electrode-holder positioning device - Controll system and scftware	
20	**Hacksawing machine** Heavy duty type; hydraulic saw frame control, automatic blade lift on return stroke, adjustable cutting pressure, adjustable length of stroke, automatic stop at end of cut, swivelling vice, removable, complete with coolant pump, set of spanners, materials stop.	1
	Approx. specifications: Length of blade 450 mm Cuts round max. 150 mm Cuts square max. 200x200 mm Max. length of stroke 150 mm Number of strokes 90-150 per/min Speeds 2	
	Complete with: - Material stand, adjustable, with solid roller	1
	- Set of 100 saw blades, length 450 mm, 8 teeth per 25 mm	1

Item	Description	Qty
21	**Vertical bandsawing machine** Manually controlled, fixed table, steel insert-type guides, band tension indicator, blade welder and grinder, speed indicator, tiltable work table adjustable band tracking, coolant system, set of wrenches. Approx. specifications: Throat depth 500 mm Max. work height 300 mm Table size 600x600 mm Band speed 15-90 m/min (infinitely variable) 260-1500 m/min Complete with: - Set of 10 spare bi-metal saw bands - Chip conveyor and chip pan - Wheel driven band cleaning brush	1
22	**Hand spindle press** All-steel construction, with cast iron stand. Approx. dimensions: - base to guide 300 mm - throat depth 500 mm - size of screw 80 mm With steel ram and machined base.	1
23	**Profile projector** Bench model, contour and surface illumination. Approx. specifications: Screen dia. 250 mm Magnification 10x; 20x; 50x Projection accuracy: contour I 0.1% surface I 0.15% Delivered with sapre bulbs and fuses. Complete with: - Projection lenses - Projection screen - Surface illuminator - Colour filter set - Glass scale - Swivel centre support - Rotary measuring stage - Holder with lamp - Alignment table - Cover	1

Item	Description	Qty
24	**Surface table** Cast iron, surface and edges planed. Mounted on heavy-duty support. Approx. size: 1x1.5 m	1
25	**Surface table** Granite surface, mounted on heavy-duty support. Approx. size of each table: 1x1 m	2
26	**Lubrication trolly** Simple steel trolley on 4 wheels, suitable for transportatin of 4 drums of 200 l. each.	1
27	**Hardening furnace** Hardening chamber for temperatures upto 1350°C. Complete with: - Controls - Indicators and switch gear - Spare set of heating rods. Approx. inside dimensions of chamber: width 300 mm heigth 200 mm depth 500 mm Mounted on stand to provide working heigth.	1
28	**Tempering furnace** Loading from above, for temperatures upto 650°C, with powerful forced air ciculation. Approx. basket size: dia. 400 mm depth 500 mm Complete with: - Controls - Indicators and switches	1
29	**Oil quenching bath** Steel construction, approx. dimensions: lxwxh = 700x500x500 mm Complete with: - Stable stand to provide working heigth - Drain plug - Mesh wire basket for handling products - 200 l. of quenching oil	1

Item	Description	Qty
30	**Hardness tester** To check hardness by Rockwell, Brinell and Vickers. Equiped with dial gauge, and regulating device for adjustment of loading speed, with standard equipment containing 4 weights of 62.5-100-150 and 187.5 kg load; hardened plane table of approx. dia. 50 mm, prismatic table of approx. dia. 40 mm; holder with ball dia. 2.5 mm; test-plate for Brinell 187.5 kg/2.5 mm set; conversion charts. Distance from centre of spindle to frame approx. 160 mm; max. test height approx. 270 mm.	1
31	**CNC milling machine** Approx. specification: Table size 900x350 mm Table travels X-Y-Z 450-300-350 mm Table feed range 1-5000 mm/min. Spindle cone ISO 30 Spindle speed (infinitely variable) 40-4000 rpm Spindle quill travel (Z) 125 mm Spindle quill feed range 1-5000 mm/min. System resolution 0.001 mm Complete with: - Coolant equipment - Automatic lubrication system - Swivel machine vice - Set of bolts and nuts for clamping - Set of milling, drilling and boring quick change tool holders - Splash tray - Battery back-up program protector - Interactive programmable control unit - Visual display, digital read-out - Programmable subroutines - Automatic tangential approach and corner rounding - Spindle orientation	1
32	**Lockers** For storage of tools, equiment, materials etc. Specification: Steel construction 4 Adjustable shelves 2 Hinged doors Outside dimensions: approx. 1900x20000x400 mm per locker Each locker complete with selectin of approx. 10 small plastic boxes, for small articles such as bolts and nuts etc.	15

Description	Qty
Workbenches Specification: Solid steel construction With wooden top, thickness 40 mm Approx. size; 1800x600 mm per workbench	8
Tool lockers For sotrage of cutting tools. Specification: Steel construction Each provided with approx. 10 drawers of various heights Approx. size wxdxh: 800x1000x1000 mm	12
Raw material racks For storage of steel section, tubes etc. Specification: Steel construction Adjustable brackets Approx. size each: lxwxh: 3000x1500x2000 mm	3
Oxy-acetylene welding set Consisting of: * 1 pc welding and cutting torch set high pressure, injector type for welding mild steel of 0.5 upto 30 mm thickness for cutting upto 100 mm thickness <u>Complete with:</u> - welding nozzles and injectors - cutting nozzles - nozzle cleaners - circular cutting attachments - spark lighter with spare flints - steel carrying case * 2 pcs acetylene gas cylinder (filled) certified, capacity 40 l., colour: reddish * 2 pcs oxygen gas cylinder (filled) certified, capacity 40 l., colour blackish or blue * 1 pc acetylene gas regulator with 2 pressure gauges and flashback arrestor * 1 pc oxygen gas regulator with 2 pressure gauges	1

Item	Description	Qty
(36)	* 10 m. of acetylene hose, colour: red * 10 m. of oxygen hose, colour: black or blue * set of connection pieces (clamps, nipples, couplings etc.) sufficient and suitable for using all above items in combination with each other * welding table, steel costruction, approx. 1000x800 mm, with drawer. * set of auxiliaries, comprising: - welding helmet, fibre glass, with spare lenses - welder's apron, chrome leather - welding goggles, with spare lenses - 3 pairs of welding gloves, 5 finger type.	
37	**Electric arc welding set** Consisting of: * welding transformer/rectifier A.C./D.C. transformer/rectifier welding unit; mobile on solid rubber wheels; air cooled; overload protection; process selector A.C./D.C. and polarity selector; current range selector, current adjuster. Output ratings: A.C. D.C. Open circuit voltage 80 75 Total output (A) 375 350 Max. rated output (V) 28 20 250 A at 100% duty cycle 300 A at 60% duty cycle 375 A at 35% duty cycle * 5 m 4-core primary lead * 5 m electrode lead, insulated and protected, 50 mm^2/400A core, cable eye (clamp type) and fitted with and electrode holder for currents upto 400 A. * 5 m work return lead, 50 mm^2/400 A core, cable eye (clamp type) and fitted with clamp for currents upto 600 A. * welding table, steel construction, approx. 1000x800 mm, with drawer. * Set fo auxiliaries, comprising: - welding helmet, fibre glass, with spare lenses - welder's apron, chrome leather - welding goggles, with spare lenses - 10 pcs steel wire brush - chpping hammer - 3 pairs of welding gloves, 5 finger type. * selection of approx. 1000 welding electrodes of various sizes, for various purposes.	1

Description	Qty
MIG/MAG welding set Comprising: * welding rectifier for arc welding with CO_2 and CO_2/Ar mixtures and with wires dia. 0.8-1.0-1.2 and 1.6 mm. - current: 100% duty cycle: approx. 320 A 60% duty cycle: approx. 400 A - steplessly variable arc voltage between 15-50 V - with cooling, Volt- and Amp. meters, overload protection, pressure regulators, control devices. * 5 m 4-core primary cable * wire feed unit (approx. 2-18 m/min) with wire straightener, for 15 kg wire spools * welding torches, with 3 m connection cable to feed unit * 5 m earth cable with terminal and earth clamp * wire cutter * steel cylinder, cap. 40 l., filled with CO_2 * steel cylinder, cap. 40 l., filled with 80/20 Ar/CO_2 * assortment of 10 rolls (of 15 kgs each) of steel wire in various diameters. * welding helmet with spare lenses.	1
Spot welder Portable, gun type, low weight, with standard equipment, one pair vertical centre tip electrodes, and one paid "S" offset tip electrodes. Air cooled and with timer. Approx. 2 kVA, max. welding cap.: 2+2 mm thickness.	1
Box folder/bender Folding, bending and box forming machine, bench-type. Universal swing beam with sharp and round nose blades. Capacity: 1020 mm width, 2 mm thickness. All-steel construction with stand. Lift of clamping beam from bed 80 mm.	1
Guillotine shear Treadle operated, capacity in mild steel 1015 width x 2 mm thickness. With stand, hold down attachments, and clamping devices.	1
Bending roller Rolling machine. Capacity: 1020 width, 2 mm thickness Approx. dia. of rollers 40 mm. All-steel construction with stand. Slip-out top front roller and adjustable back and top rollers.	1

Item	Description	Qty
43	**Notcher** For cutting edges out of sheet metal. Capacity: 150x150 mm edge size 1.5 mm thickness Hand operated, for bench mounting.	1
44	**Portable nibbling machine** Electrical, portable hand-type; capacity 1.0 mm mild steel, cutting radius 38 mm. With standard equipment, setting gauge, cable and plug.	1
45	**Tool trolley** (without tools) Steel construction. With drawers, for storage of tools. Dimensions approx. lxwx = 60x40x100 cm	6
46	**Hand pallet trucks** For transportation of pallets and pallet boxes. Fork length: 950 mm Carrying width: 500 mm Max. load: 1200 kg With hand-hydraulic lifting/lowering system.	2
47	**Overhead crane beam** Travelling girder, to be moving on crane track. (crane track available in building; therfore not included in this item) Track width (= length of beam): 7.50 m Beam including crane trolley with hoist. Hoisting capacity: 2.5 tonns Max. hoisting heigth: 7 m All movements (loingitudinal, transverse and hoising) to be operating electrically.	1
48	**Set of design office equipment** Consisting of:	1
	* Desk approx. 1.75x0.75 m, with 2 drawers	1
	* Desk chairs	2
	* Drawing board suitable for A0-drawings. Tiltable on stand, with pantographic rule system.	1
	* Set of drawing auxiliaries, such as pens, templates, calculator etc.	1
	* Blueprinting machine suitable for A0-drawings. With set of paper of various sizes.	1
	* Working table approx. 2.5 x 1 m.	1

Description	Qty
Set of office furniture and equipment	1
Consisting of:	
* Desks approx. 1.75 x 0.75 m each with 2 drawers	15
* Desk chairs	15
* Calculators	10
* Locker with hinged doors, 4 shelves each.	15
* Personal computer, with: - hard disc - wordprocessing and spreadsheet software - printer	1
* Typing machines	5
* Photocopying machine for A3 and A4 sizes.	1

Annex 2.4 Specification of measuring tools

Item	Description	Quantity
1	Internal thread plug gauges (M2; M3; M4; M5; M6)	1
2	Pluggauges H7 2-11 mm	2
3	" H6 2-11 mm	2
4	" H7 12-24 mm	2
5	Set measuring pins with holder; 0.3-3.0 mm x steps 0.01 mm	1
6	Set measuring pins with holder; 0.301-6.00 mm x steps 0.01 mm	1
7	Set measuring pins; 1-10 mm x steps 0.1 mm	1
8	Set snap gauges H7 2-20 mm	1
9	Set of isometric screw thread plug gauges 6H according to UN-D12 M2-M2, 5-M3-M4-M5-M6-M8-M10-M12	2
10	Ditto for pipethread, according to UN-D9 1/4" to 1"	1
11	Isometric screwthread snap gauges 6G according to UN-D12 M2-M2,M5-M3-M4-M5-M6-M8-M10-M12	1
12	Ditto for pipethread according to UN-D9: 1/4" to 1"	1
13	Set slipgauges 1-60 mm (32 pcs) Kwal. I	1
14	Ditto, kwal. II	1
15	Set feelergauges 0.03-0.5 mm (14 pcs)	4
16	Radius gauge 1-7 mm	4

Radius gauge 7.5-15 mm	4
Zero point finder shaft dia. 10 en 4	8
Dial gauge (0.01) 10 mm without lug.	4
Dial gauge (0.01) 30 mm	4
Dial gauge (0.01) 50 mm	4
Dial test indicator 0.8 mm (lever type)	6
" 0.24 mm "	2
Dial indicator +/- 0.05 mm (0.001)	2
2 points vernier caliper 500 mm	1
1 and 2 points vernier caliper with offset jaws 10-200 mm	2
Micrometer 0-25 mm	12
" 25-50 mm	6
" 50-75 mm	4
" 75-100 mm	2
Micrometer with dial gauge 100-200 mm	4
" " 200-300 mm	1
Micrometer for groove dia. 0-25 mm	2
Digital micrometer 0-25 mm	2
Dial-snap gauge 0-25 mm	6
" 25-60 mm	2
" 50-100 mm	1
" 100-150 mm	1
Steel rule 150 mm	20
" 300 mm	20
" 500 mm	5
" 1000 mm	2

43	Measuring tape 2000 mm	2
44	Measuring instrument for outside edges 0-7 mm	1
45	Set 2-point dial bore gauges 1.50-3.95 mm	1
46	Set 2-point dial bore gauges 3.70-9.80 mm	1
47	Set 2-point dial bore gauges 10-18 mm	2
48	Set 2-point dial bore gauges 50-160 mm	2
49	Set 2-points dial bore gauges for blind holes 20-140 mm	2
50	Setting unit for subito instruments (slip gauge holder type) 8-160 mm	2
51	Set hole 3-points micrometers 6-12 mm	2
52	Set hole 3-points micrometers 11-20 mm	2
53	Set hole 3-points micrometers 20-40 mm	2
54	Set hole 3-points micrometers 40-100 mm	2
55	Inside micrometer 5-30 mm	1
56	" 25-50 mm	1
57	Pocket vernier caliper 0-150 mm	25
58	Vernier caliper 0-250 mm	4
59	" 0-500 mm	1

Dial caliper 0-150 mm	4
Digital caliper	1
Depth gauge with claw attachement 0-200 mm	2
Dial depth gauge 0-100 mm	2
Screw thread micrometer 0-25 mm	2
" " 25-50 mm	2
" " 50-75 mm	1
Interchangeable anvils for screwthread micrometers for metric screwthread	2
Set screwthread measuring wires for micrometers	2
Table book for 3-wires screwthread measuring	2
Selector for screwthread	2
Set screwpitch gauges	2
Screw cutting gauges	2
"	2
Disc anvil type micrometer 0-20 mm	4
" " 20-45 mm	2
" " 45-70 mm	2
Roughness gauge; planing 25 to 0.8 mu Ra	2
Roughness gauge turning 12.5 to 0.4 mu Ra	2
Roughness gauge surface grinding 3.2 to 0.025 mu Ra	2
Roughness gauge cyl. grinding 3.2 to 0.025 mu Ra	2
Surface roughness measuring system	1

82	Protractor 150 mm 180°-1	4
83	Protractor with dial indicator 200 mm (4x90°-5')	2
84	Clinometer dia. 82 mm (360°)	1
85	Engineer's sprit level 200 mm (0.02)	3
86	Squareness measuring instrument 0-350 mm	2
87	Engineer's square 100 x 63 mm	6
88	" 184 x 100 mm	6
89	" 275 x 140 mm	2
90	Precision square with bevel edge 100x70 mm	2
91	Precision square with bevel edge 150-100 mm	2
92	Cylindrical square dia. 40 mm	1
93	Straightedge 200 mm	1
94	Toolmaker set: - straightedge 100 mm - bevel edge prec.square 75x50 mm - " " 40x28 mm - " " 25x20 mm - " " 40x28 mm	2
95	Measuring stand with granit surface plate (without arm) 200x150x50 mm	1
96	Arm for measuring stand 110 mm	1
97	" " 75 mm	1
98	Measuring stand with a round table and a fixed arm dia. 50 mm	2
99	Heavy magnetic measuring stand 75x60x75 mm	4
100	Light magnetic measuring stand 65x50x65 mm	4
101	Steel scriber	15

Lath-measuring stand with fine adjustment	1
Stand for micrometer dia. 135 mm	1
Universal dial gauge holder (magnetic) 72x36x26 mm	1
V-block with clamp 65x41x41 mm	2
" " 90x56x56 mm	2
Tolerator 110x60x30 mm	2
Compasses 100 mm	4
Vernier height gauge 0-300 mm	2
Surface plate, cast iron, onstand approx. 600x400 mm	2
Digital height measuring and scribing instrument 0-300 mm	2
Measuring magnifying glass (7x) dia. 30 mm	2
Magnifying glass dia. 20 mm (3x + 6x = 9x)	2
Universal electrical Volt/Amp/Ohm-meter 1 mV - 1.000 V AC/DC 10 µA - 20 A. 0,1 Ohm - 2 MOhm	6
Clamp-on current meter (tong type) 500 Amps.	2
Portable tension tester 6 - 400 V. AC/DC with LED-indication	1
Oscilloscope Max. frequency 20 MHz. 2 - 10mV/cm complete with external triggering, adjustable time base and set of measuring auxiliaries	1
Tachometer, max. 10.000 rpm	1
Industrial thermometer, max. 1.200 °C, incl. set of feelers	1
dB-meter, max. 120 dB (A)	1

Annex 2.5 Specification of machine- and handtools

A. General hand tools

Item	Description	Quantity
1	Hacksaw 12"	10
2	Hacksaw blades, set (100 pcs, various t.p.i.)	10
3	Junior hacksaw	10
4	Junior hacksaw blades, set, (50 pcs, various t.p.i.)	10
5	Screw driver 3"	4
6	" 4"	4
5	" 6"	4
6	" 8"	4
7	" 10"	4
8	" 12"	4
9	Cross head screw driver 4"	4
10	" " 6"	4
11	Combination spanner 6 mm	2
12	" 7 mm	2
13	" 8 mm	2
14	" 9 mm	2
15	" 10 mm	2
16	" 11 mm	2
17	" 12 mm	2
18	" 13 mm	2
19	" 14 mm	2
20	" 15 mm	2
21	" 16 mm	2
22	" 17 mm	2
23	" 18 mm	2
24	" 19 mm	2
25	" 20 mm	2
26	" 22 mm	2
27	" 23 mm	2
28	" 24 mm	2
29	Adjustable spanner 8"	2
30	" 10"	2
31	" 12"	2
32	Long nose plier 6"	4
33	Round nose plier 6"	2
34	Combination plier 8"	2
35	Gripfix plier	2
36	Side cutting plier	2
37	Waterpump plier 9"	4

Allen keys 2.0 mm	4
" 2.5 mm	4
" 3.0 mm	4
" 4.0 mm	4
" 5.0 mm	4
" 6.0 mm	4
" 8.0 mm	4
" 10.0 mm	4
Toolmakers clamp 2"	2
" " 3"	2
" " 4"	2
F-clamp 10"	2
F-clamp 16"	2
G-clamp 4"	2
" 6"	2
Wooden hammer, dia. 2"	2
Plastic hammer dia. 22 mm	4
" 35 mm	2
Machinist hammer 1/2 lb	4
" 1 lb	4
Letter punch set 3/16"	2
" 1/8"	2
" 1/4"	2
Number punch set 3/16"	2
" 1/8"	2
" 1/4"	2
Centre punch 4"	6
Flat chisel	2
Triangular scraper 5"	4
Die sinker riffler 5"	4
" " 8"	2
Flat file 4" (smooth)	12
" (bastard)	12
" 6" (smooth)	12
" (2nd cut)	12
" (bastard)	12
" 8" (smooth)	12
" (bastard)	12
Half round file (bastard) 6"	10
" " 8"	10
Round file (bastard) 4"	10
" " 6"	10
" (smooth) 6"	10
" " 8"	10
" (bastard) 8"	10
Square file (bastard) 6"	8
" " 8"	8
" (smooth) 6"	8
" " 8"	8
" (2nd cut) 6"	8
" " 8"	8

89	Triangular file 4" (smooth)	8
90	File handle 3.5"	40
91	" 4.0"	80
92	" 4.5"	80
93	File brush	12
94	Oilstone 10x10x120 mm	10
95	Grinding wheel dresser	2
96	Needle file flat (smooth)	6
97	" square (smooth)	6
98	" half round (smooth)	6
99	" triangular (smooth)	6
100	" knife (smooth)	6
101	" flat (bastard)	6
102	" square (bastard)	6
103	" half round (bastard)	6
104	" round (bastard)	6
105	" knife (bastard)	6
106	" baret (bastard)	6
107	" crossing (bastard)	6
108	Needle file holders	30
109	Metric tap and die set HSS M3-M24	4
110	Whitworth tap and die set HSS 1/8" - 1"	1
110	Tool trolley, with drawers, approx. 600x400x800 mm	2
111	Tool box, with 4 trays, approx. 600x250x250 mm	12

B. Milling tools

Item	Description	Quantity
112	Endmill dia 6 mm	12
113	" 8 mm	12
114	" 10 mm	12
115	" 12 mm	12
116	" 14 mm	12
117	" 16 mm	12
118	" 20 mm	12
119	Shell endmill dia. 40 mm	12
120	" 63 mm	12
121	Chipbreaker endmill dia. 16 mm	12
122	Slot endmill dia. 4 mm	12
123	" 6 mm	12
124	" 8 mm	12
125	" 8 mm (long series)	6
126	Endmill 8 mm (long series)	6
127	Shell endmill dia. 50 mm	2
128	Shell endmill (chipbreaker) dia. 40 mm	4
129	" " 50 mm	4
130	Slot endmill dia. 3 mm	12
131	" 5 mm	12
132	" 6 mm	12
133	" 7 mm	12
134	" 8 mm	12
135	" 9 mm	12
136	" 10 mm	12
137	" 12 mm	12
138	" 14 mm	12
139	" 16 mm	12
140	Convex endmill R2	4
141	" R3	4
142	" R4	4
143	" R5	4
144	" R6	4
145	" R8	4
146	Radius endmill R3	4
147	" R4	4
148	" R5	4
149	" R6	4
150	" R8	4
151	T-slot endmill dia. 18x8	8
152	" 20x4	8
153	" 25x5	8
154	" 25x11	8
155	" 32x14	8

156	Chipbreaker endmill dia.	6 mm			8
157	"	8 mm			8
158	"	10 mm			8
159	"	12 mm			8
160	"	14 mm			8
161	Angular endmill dia.	20x45°			4
162	"	16x60°			4
163	Concave mill R5 dia.	80 mm			2
164	" R6 dia.	80 mm			2
165	Radius mill R3 dia.	80			4
166	" R4	"			4
167	" R5	"			4
168	" R6	"			4
169	Slit milling cutter	1.0 mm dia 100			4
170	"	1.2 mm			4
171	"	1.6 mm			4
172	"	2.0 mm			4
173	"	3.0 mm			4
174	"	4.0 mm			4
175	"	5.0 mm			4
176	Set of 8 gear wheel cutters	for gears mod.	1		2
177	"	"	1.5		2
178	"	"	2		2
179	"	"	2.5		2
180	"	"	3		2
181	"	"	4		2

C. Turning tools

Item	Description	Quantity
	Carbide soldered:	
182	Knife tool 12x12 mm	12
183	Facing 12x12 mm	12
184	Roughing 12x12 mm	12
185	Knife tool 20x20 mm	12
186	Facing 20x20 mm	12
187	Roughing 20x20 mm	12
188	Boring tool dia. 10 mm	12
189	" 16 mm	12
	HSS:	
190	Cranked rougher 12x12 mm left	4
191	" 12x12 mm	12
192	" 20x20 mm left	4
193	" 20x20 mm	12
194	End face tool 12x12 mm left	4
195	" 12x12 mm	12
196	" 20x20 mm left	4
197	" 20x20 mm	12
198	Knife tool 12x12 mm left	4
199	" 12x12 mm	12
200	" 20x20 mm left	4
201	" 20x20 mm	12
202	Recessing tool 12x12 mm	12
203	" 6x20x20 mm	12
204	" 12x20x20 mm	12
205	Blind hole boring tool dia. 6 mm	8
206	" 8 mm	8
207	" 10 mm	8
208	" 12 mm	8
209	" 16 mm	8
210	" 20 mm	8
211	Rougher 12x12 mm	12
212	" 20x20 mm	12
213	Bar tool 12x12 mm	8
214	" 20x20 mm	8
215	Thread cutting (bar) 60°	8
216	" 55°	8
217	" 30°	8
218	Internal thread 60° dia. 8 mm	8
219	" 10 mm	8
220	" 55° dia. 8 mm	8
221	" 10 mm	8
222	" 30° dia. 12 mm	8
223	Internal recessing tool dia. 6 mm	8
224	" 8 mm	8
225	" 12 mm	8
226	" 16 mm	8
227	" 20 mm	8

228	Swan neck (parting) 6x12x20	2
229	" (recessing) 10x12x20	4
230	Double roller knurling tool holder	4
231	Single " "	4
232	Cutting knurling tool holder	4
233	Knurling die pitch 1.0 mm (LH)	6
234	" " (RH)	6
235	" " (straight)	6
236	" 0.6 mm (LH)	6
237	" " (RH)	6
238	" " (straight)	6
239	Parallel bars 80x23x5	4
240	" 125x20x8	4
241	" 126x31x8	4
242	Revolving centres (ROHM)	2
243	Half centres MC2	2
244	" MC3	2
245	Female centres MC2	2
246	Carbide centres MC2	2

D. Drilling tools

Item	Description	Quantity
247	Spiral drill (straight shank, HSS) dia. 1.0 mm	20
248	" 1.5 mm	20
249	" 2.0 mm	20
250	" 2.5 mm	20
251	" 3.0 mm	20
252	" 3.2 mm	20
253	" 3.5 mm	20
254	" 4.0 mm	20
255	" 4.2 mm	20
256	" 4.5 mm	20
257	" 4.8 mm	20
258	" 5.0 mm	20
259	" 5.5 mm	20
260	" 6.0 mm	10
261	" 6.5 mm	10
262	" 6.8 mm	10
263	" 7.0 mm	10
264	" 7.5 mm	10
265	" 8.0 mm	10
266	" 8.5 mm	10
267	" 8.8 mm	10
268	" 9.0 mm	10
269	" 9.5 mm	10
270	" 10.0 mm	10
271	" 11.0 mm	10
272	" 11.75 mm	10
273	" 12.0 mm	10
274	" 12.5 mm	10
275	" 13.0 mm	10
276	Spiral drill (tapered shank, HSS) dia. 11 mm	4
277	" 12 mm	4
278	" 13 mm	4
279	" 14 mm	4
280	" 16 mm	4
281	" 18 mm	4
282	" 20 mm	4
283	" 22 mm	2
284	" 24 mm	2
285	" 26 mm	2
286	" 28 mm	2
287	" 30 mm	2
288	Centre drill dia. 1.6 mm	12
289	" 2.0 mm	12
290	" 4.0 mm	12

291	Core drill dia. 4.8 mm	6
292	" 5.8 mm	6
293	" 7.8 mm	6
294	" 9.8 mm	6
295	" 10.75 mm	6
296	Counter sink drill 60°x10 mm	8
297	" 60°x22 mm	8
298	" 90°x10 mm	8
299	" 90°x12 mm	8
300	Cone cleaner MC2/MC3	8
301	Drilling vice 65 mm x 53 mm	4
302	Drill sleeve MC2 x MC1	4
303	" MC3 x MC1	4
304	" MC3 x MC2	4
305	" MC4 x MC3	2
306	Drill extractor MC1 - MC4	4

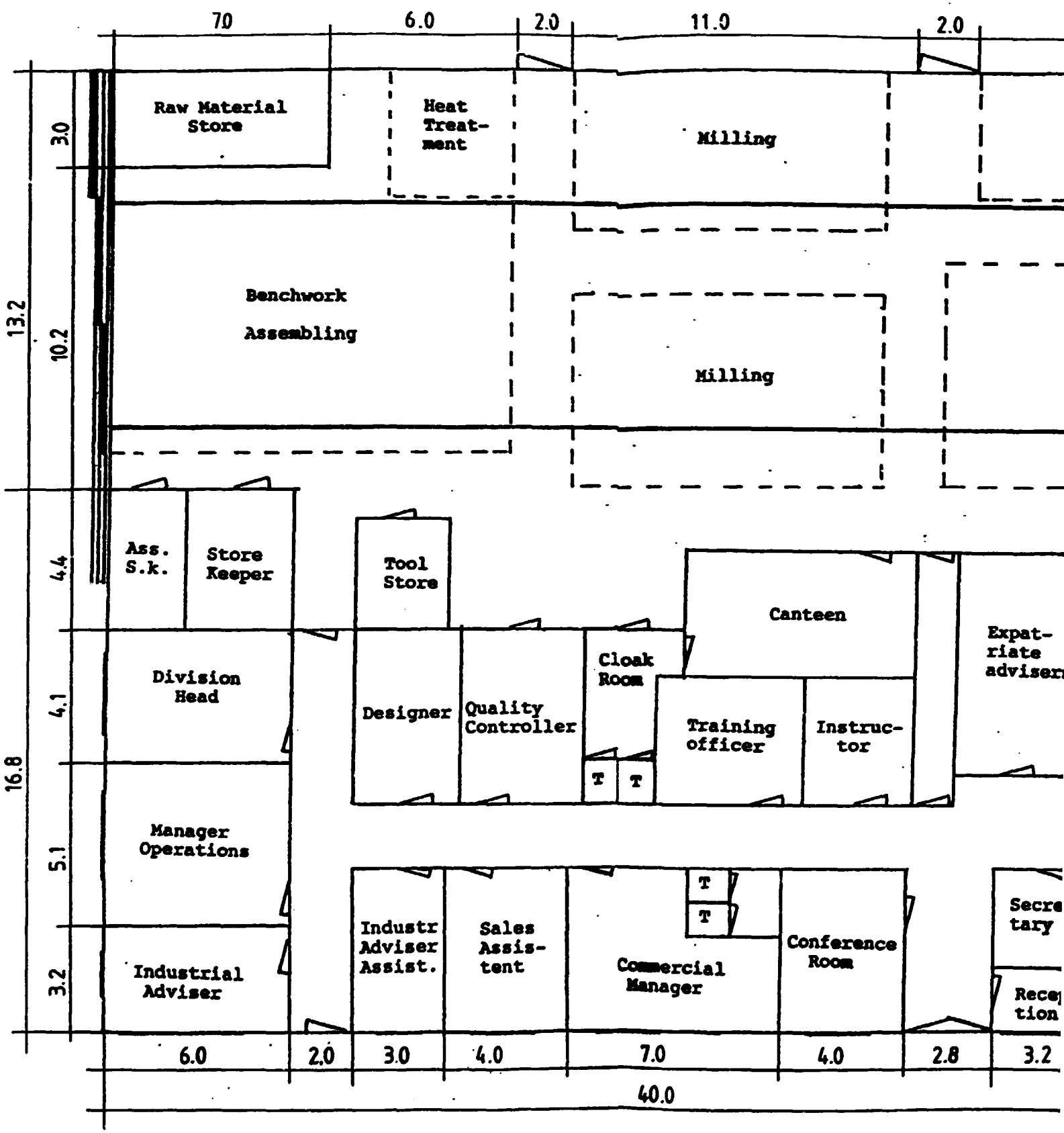
E. Various tools

Item	Description	Quantity
307	Machine tap blind hole M3	10
308	" " M4	10
309	" " M5	10
310	" " M6	10
311	" " M8	10
312	" " M10	10
313	Machine tap (through hole) M3	10
314	" " M4	10
315	" " M5	10
316	" " M6	10
317	" " M8	10
318	" " M10	10
319	" " M12	10
320	Machine reamer dia. 3 mm F8	8
321	" 4 mm F8	8
322	" 5 mm F8	8
323	" 6 mm F8	8
324	" 8 mm F8	8
325	" 10 mm F8	8
326	" 12 mm F8	8
327	" 3 mm G7	8
328	" 4 mm G7	8
329	" 5 mm G7	8
330	" 6 mm G7	8
331	" 8 mm G7	8
332	" 10 mm G7	8
333	" 12 mm G7	8
334	" 3 mm H6	8
335	" 4 mm H6	8
336	" 5 mm H6	8
337	" 6 mm H6	8
338	" 8 mm H6	8
339	" 10 mm H6	8
340	" 12 mm H6	8
341	" 4 mm P7	8
342	" 5 mm P7	8
343	" 6 mm P7	8
344	" 8 mm P7	8
345	" 10 mm P7	8
346	" 12 mm P7	8
347	Set of cutting tools for shaping machine	2
348	Tool locker, for storage of cutting tools, each with approx. 10 drawers, approx. size	
349	800 x 1.000 x 1.000 mm	4
350	Set of T-bolts, nuts and blocks etc. for clamping of workpieces	10

Annex 2.6 Specification of raw materials and consumables

For machines and equipment as specified.

Item	Description
1	Selection of round steel bars, of various diameters, compositions and qualities.
2	Selection of steel bars with rectangular cross-section, of various dimensions, compositions and qualities.
3	Selection of non-ferrous round and rectangular bars, in various sizes.
4	Coolant fluid, matching machines as described.
5	Fluid for spark erosion machine.
6	Lubrication oil and grease.
7	Selection of grinding wheels, of various characteristics, for: all different types of grinding machinery as specified.
8	Set of sawblades for hackswawing machine.
9	Set of sawbands for bandsawing machine.
10	Quenching oil for heat treatment.
11	Selection of electric arc welding electrodes, of various diameters, for various purposes.
12	Assortment of welding wires for MIG/MAG welding, of various diameters and characteristics.
13	Set of design/drawing consumables, comprising: - drawing paper of various sizes - blue printing paper of various sizes - drawing ink
14	Set of office consumables, including writing paper, copier paper etc.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Raw Material Store
Heat Treat-ment
Milling
Benchwork
Assembling
Milling
Ass. S.k.
Store Keeper
Tool Store
Canteen
Expat-riate adviser
Division Head
Designer
Quality Controller
Cloak Room
T
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Training officer
Instruc-tor
Manager Operations
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Sales Assis-tent
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Commercial Manager
Conference Room
Secre tary
Industrial Adviser
Rece tion
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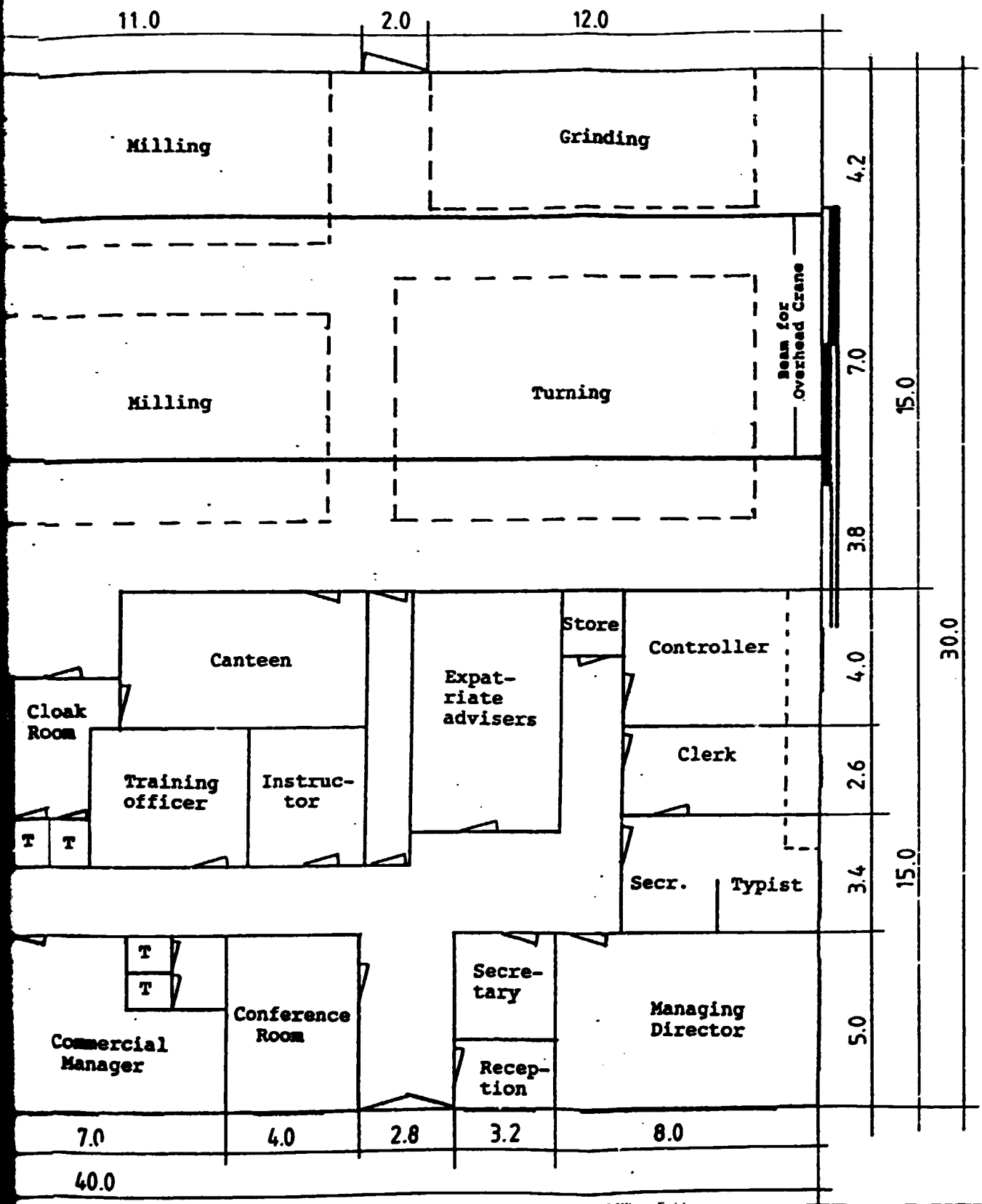
2.0
3.0
4.0
7.0
4.0
2.8
3.2
40.0

SECTION 1

ANNEX 3 PROPOSAL LAY-OUT ISC WORKSHOP



GEMCO INDUSTRIAL DEVELOPMENT
Esp 5 9801 NJ Zuidhorn The Netherlands Tel. 04980-74646 Telex 80388 Gemco nl.

Industrial Service Centre Barbados

GID project DP 9830

Drawing no.:9830.01.0

Workshop Lay-out Proposal

Drawn :RB 2-11-89
Scale :Not to scale, dimensions in meters

SECTION 2

ANNEX 4 ORGANISATION CHART AND JOB DESCRIPTIONS (PHASE 2)

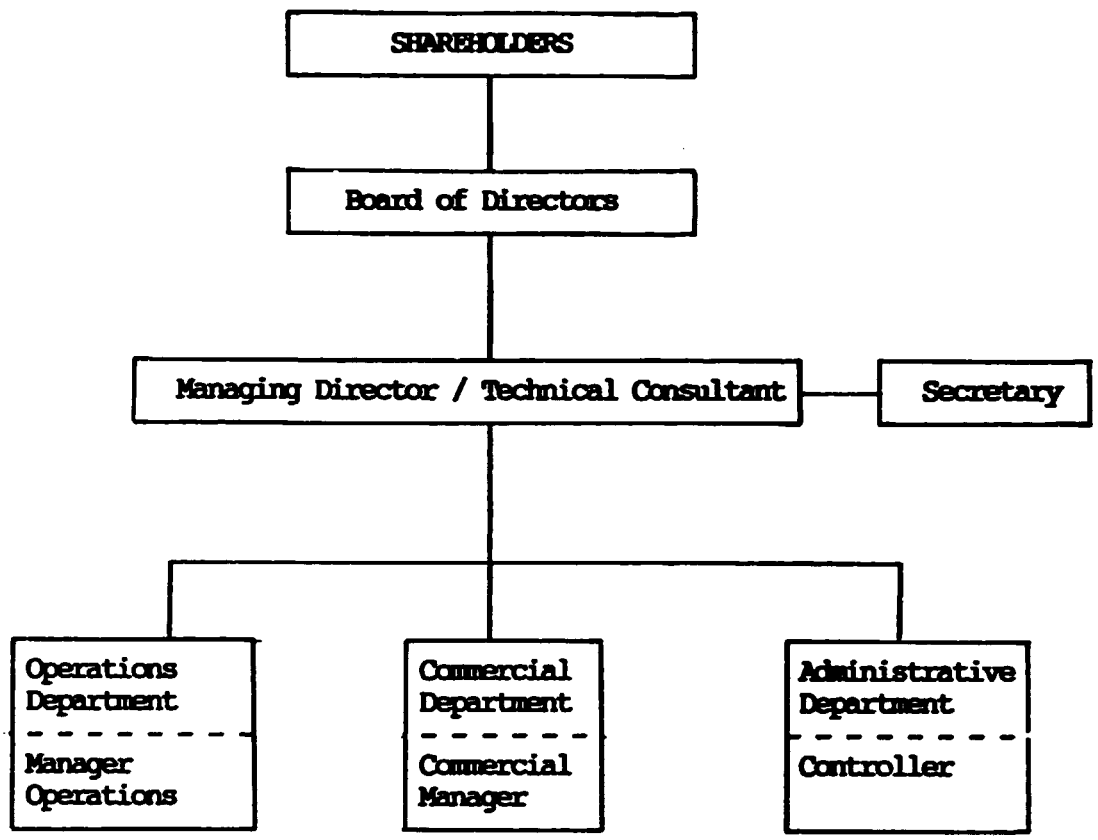
This annex comprises :

4.1 : Overall organisation

4.2 : Organisation per department

4.3 : Job descriptions of Barbadian key personnel

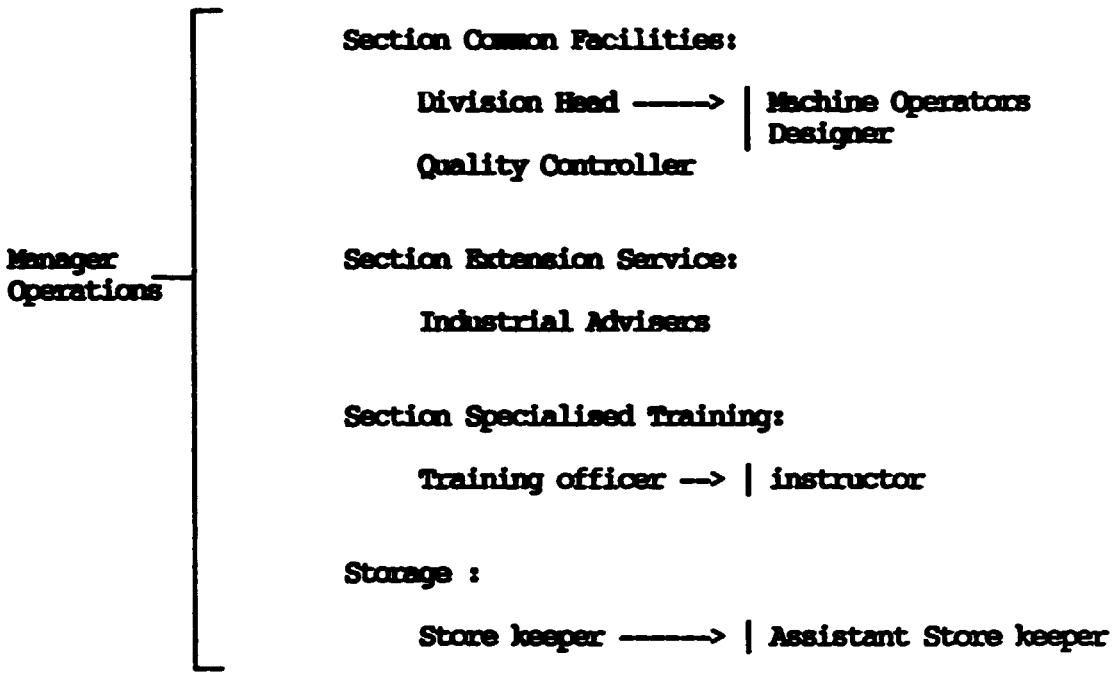
Annex 4.1 Overall organisation



(for further specification per department see next pages)

Annex 4.2 Organisation per department

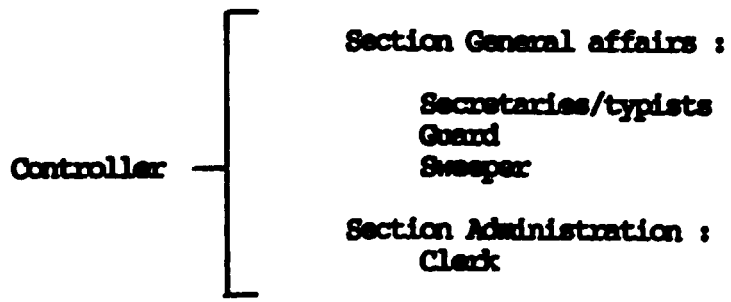
OPERATIONS DEPARTMENT :



COMMERCIAL DEPARTMENT :

Commercial Manager —>—| Sales assistant

ADMINISTRATIVE DEPARTMENT :



Annex 4.3 Job descriptions of Barbadian key personnel

The main responsibilities of the Barbadian key personnel within the organisation as described in this annex are as follows:

GENERAL MANAGEMENT

Managing Director

- Formulation of overall company policy
- Long term strategic planning
- Supervision of activities of all departments
- Evaluation of company achievements and financial results
- Public relations/ general external representation
- Liaison with authorities and official institutions
- Personnel recruitment

OPERATIONS DEPARTMENT

Manager Operations

- Allocation of personnel and equipment capacities between various activities undertaken
- Optimizing efficiency of production methods
- Composition and realisation of production planning
- Responsible for all production machinery, equipment and tools
- Procurement and warehousing supervision
- Organisation and control of industrial extension services
- Management of total operations department

Division Head Common Facilities

- Realisation of production planning
- Repair and maintenance of production machinery, equipment and tools
- Repair and maintenance of technical facilities and buildings
- Managing the Common Facilities section, including the quality control room and design office

Industrial Adviser
(Two industrial advisers are required, one should be an electrical engineer, the other should be a mechanical engineer)

- Rendering advice and assistance to domestic industries in the field of production methods, maintenance and repair and related technical subjects, in the mechanical as well as in the electrical field

- To act as an intermediate to establish and intensify contacts between entrepreneurs and the centre
- If necessary, provide assistance to activities in the other divisions

Training officer

- Preparation of learning elements for the implementation of the crash training courses
- Planning of training activities, responsible for activities of the instructor
- Providing training at the common facilities
- If necessary, provide assistance to activities in the other sections

Instructor

- Providing training at the common facilities
- Providing in-company training to domestic industries
- If necessary, provide assistance to activities in the other sections

COMMERCIAL DEPARTMENT

Commercial manager

- Formulation of marketing plans and strategies
- Realisation of sales targets
- Contacts with existing and potential clients
- Sales prices calculation
- Market research and interpretation

ADMINISTRATIVE DEPARTMENT

Controller

- Budget control/ expenditures supervision
- Annual budget assessment
- Auditing of financial reports
- Composition of balance sheets
- Liquidity planning
- Management of administrative department

ANNEX 5 FINANCIAL ANALYSIS PHASE 2

The mission was, in the final state of this study, requested to include figures on the financial and economic feasibility in this draft project document.
As the duration of the mission was based on the terms of reference as presented in annex 2 of the main report, not all relevant financial data could be gathered in the short remaining period.

Therefore, after return of the mission to the Netherlands, a questionnaire was prepared and sent to Barbados for follow-up at the end of September 1989.
The purpose of these questionnaires was to collect financial data on industrial service activities of domestic industries contracted out abroad or contracted out to a foreign incoming expert. Out of this information sales revenues of the industrial service centre could be estimated.

The filling out of these questionnaires was done by the Barbados Industrial Development Corporation. A total of 18 manufacturers were interviewed. The questionnaires were returned early November to Gemco Industrial Development in Son. Information from these questionnaires was used in formulating the assumptions and conditions as given below, and in preparing the overview of estimated annual costs. These costs consist of operational costs, depreciation and pay-back.
This overview is given in table 5.1.

The assumptions and conditions underlying the estimated annual costs projection are:

- The Barbados Government will give the Industrial Service Centre tax holidays and will exempt the ISC from import duties on raw materials, equipment, machinery, tools, spares, consumables.

- The production capacity used for commercial industrial services does not exceed 80%, reserving 20% for training and demonstration purposes.

- 70 % of the costs of equipment are financed out of international loans, based on a pay-back period of 16 years, grace period of 3 years, interest rate of 5%.

- Equipment is depreciated over 12 years.

- Building costs are estimated at US$ 400.000,-, and buildings are depreciated over 30 years.

- Inflation should be at an acceptable level.

In this stage a conservative conclusion concerning the financial feasibility can be made as follows:

- In order to equal the projected costs (production costs including depreciation and pay-back) and thus to run break-even the sales revenues in project year 5 should amount to US$ 831.585,--

- The capital investment of equipment and machinery within the industries visited by the mission varied between US$ 100.000,- and US$ 3.500.000,- , with an average investment of US$ 800.000,-

- Assuming that the yearly repair and maintenance costs of the industries amount to an average 3 % of the invested capital, i.e. US$ 24.000,- per industry per year, repair and maintenance activities for only 35 industries would cover the estimated annual costs of the ISC.
  Results from the filled-out questionnaires confirm this assumption.

  Furthermore the ISC will obtain revenues from extension services rendered and industrial training given.

- These results indicate that the establishment of an Industrial Service Centre will be a financially feasible operation.

Table 5.1: Overview of estimated annual costs Industrial Service Centre in US Dollars

Item no.	Description	Project year / Production capacity	1 50%	2 75%	3 100%	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	Labour		200000	360000	400000	400000	400000	400000	400000	400000	400000	400000	400000	400000	400000	400000	400000	400000
2.	Raw materials and Consumables		12000	18000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000
3.	Depreciation equipment Straight line (12 years)		116667	116667	116667	116667	116667	116667	116667	116667	116667	116667	116667	116667	116667	116667	116667	116667
4.	Depreciation and maintenance building Straight line (30 years)		13333	13333	13333	13333	13333	13333	13333	13333	13333	13333	13333	13333	13333	13333	13333	13333
5.	Spare parts		0	0	75000	75000	75000	75000	75000	75000	75000	75000	75000	75000	75000	75000	75000	75000
6.	Energy		10000	15000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
7.	Pay back (16 years)		0	0	0	89116	89116	89116	89116	89116	89116	89116	89116	89116	89116	89116	89116	89116
8.	Interest (5% in US$)		57925	57925	57925	57925	53469	49013	44557	40101	35645	31189	26733	22277	17821	13365	8909	4453
9.	Miscellaneous/unforeseen		40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000
	TOTAL COST		529925	620925	746925	836041	831585	827129	822673	818217	813761	809305	804849	800393	795937	791481	787025	782569

REFERENCES AND ANNEXURES TO THE FINAL REPORT

REFERENCES

1. Government of Barbados, Development Plan 1988 - 1993

2. Ministry of Labour and Community Development, Labour market Information Report 1987, St. Michael, 1988.

3. Prime Minister's Office, Economic affairs Division, Economic Report 1988, April 1989.

4. Barbados Statistical Service, labour Force Report 1981 - 1986, Bridgetown, June 1988.

5. Central Bank of Barbados, balance of Payments in Barbados 1989 (data to 1988), Bridgetown, August 1989.

6. Central Bank of Barbados, Economic and Financial Statistics, Bridgetown, July 1987, 1988, 1989.

7. Barbados Industrial Development Corporation, Annual Report 1987/1988, Bridgetown, September 1, 987.

8. Barbados Industrial Development Corporation, Survey of manufacturing Costs in Barbados, Bridgetown, November 1985.

9. Barbados Industrial Development Corporation, The Manufacturers' handbook, 1983.

10. Rachman, R, & Cove, P.C., Immediate Technical Services in Repair and Maintenance and Plant Engineering at Shop Floor Level - Project Document, UNIDO, Barbados, May 1989.

11. Arthur Young, Barbados: a Business and Tax Profile, Bridgetown, July 1, 1988.

12. Royal Commonwealth Society, Barbados (Expatriate Briefings), August 1988.

ANNEX 1 LIST OF COMPANIES AND INSTITUTIONS VISITED

During the mission's stay in the project area the following industries, institutions and persons were visited:

1. **Ministry of Education**
   Mr. Ralph Boyce, Chief Education Officer
   Mr. Stanley Medford, Dy. Chief Education Officer
   Mr. Darlinton Richards, Education Officer Technical Education

2. **Ministry of Trade, Industry and Commerce**
   Mr. K.A. Hutchinson, Permanent Secretary (Ag)
   Mr. Samuel J. Chandler, Dy. Permanent Secretary (Ag)
   Mr. Andrew Cox, Chief Economist
   Mr. Samuel Bayne, Senior Economist

3. **Ministry of Economic Affairs**
   Mr. Ralph Carvallo, Acting Permanent Secretary

4. **Barbados Industrial Development Corporation**
   Mr. Roy Clarke, General Manager
   Mr. Henderson Holmes, Manager Local Operations
   Mr. Trevor O.B. Lovell, Manager Research and Development
   Mr. Nigel Worrel, Business Development Officer

5. **Barbados Manufacturers Association**
   Mr. Bobby Khan, Vice-president
   Mrs. Rita Alkins, Executive Secretary

6. **Samuel Jackman Prescod Polytechnic**
   Mr. Guy Marshall, Principal
   Mr. Merton Forde, Head Mechanical Engineering Department

7. **Barbados Community College**
   Mrs. Norma Holder, Principal
   Mr. Arthur Fingall, Senior Tutor

8. **National Training Board**
   Mr. Raphael Cave, Acting Director of Training

9. **Barbados National Standards Institution**
   Mr. Dudley B. Rhynd, Director

10. **Customs Department**
    Mr. Mark Shorey

11. **Labour Department**
    Mrs. Edna Lowe, Labour Officer

12. **UNIDO**
    Mr. Peter F. Ryan, SIDFA
    Mr. Erling Rask, Programme Officer

13. **UNDP**
    Mr. Rolf Stefanson, Resident Representative
    Mr. Rohinton Sethna, Assistant Resident Representative
    Mr. Gary Lewis, Programme/Information Officer

14. **Barbados Development Bank**
    Mr. Eric Brathwaite, Dy. General Manager

15. **BRC (West-Indies) Ltd.**
    Mr. Peter Gooding, General Manager

16. **Ensopack Ltd.**
    Mr. Matts Rehn, Managing Director
    Mr. Mark Stoute, Production Manager

17. **Barbados Beverages Ltd.**
    Mr. Dennis Hammond, Managing Director
    Mr. Gregory Swift, Production Manager

18. **Supreme Industries Ltd.**
    Mr. Glyne Goodridge, Managing Director

19. **Oran Ltd.**
    Mr. Dennis Cooper, Production Manager

20. **Associated Joinery Systems**
    Mr. Samuel Babb, Administrative Manager

21. **Solar Dynamics Ltd.**
    Mr. Shurland Beckles, Dy. General Manager

22. **Crawford & Massiah Associates Ltd.**
    Mr. David Massiah

23. **Workbench Furniture**
    Mr. James Linton

24. **Century Pipes Ltd.**
    Mr. Gerard Williams, General Manager

25. **Barbados Dairy Industries Ltd.**
    Mr. Carl Sylvester, General Manager
    Mr. James Elliot, Maintenance Manager

26. **Coles Printery Ltd.**
    Mr. Donald Duncan, Financial Controller

27. **Portvale Sugar Factory**
    Mr. Oliver Hinds, Chief Engineer

28. **Ullyet Machine Shop**
    Mr. George Ullyet

29. **Coles Engineering Ltd.**
    Mr. Grannum, Engineering Manager

30. **Structural Systems Ltd.**
    Mr. Ralph Williams, Managing Director

31. **Metal Industries Company Ltd., Trinidad**
    Mr. Dave A. Bhajan, Managing Director
    Mr. Lionel Owen, Senior Electrical Engineer
    Mr. Keith A. Blackman, Training Engineer

ANNEX 2 TERMS OF REFERENCE FOR SUBCONTRACTING SERVICES

Country	: Barbados
Project title	: Preparatory assistance in the establishment of a Repair and Maintenance Centre
Project number	: DP/BAR/88/008/A/01/37

Background information

A number of small- and medium-sized metalworking establishments exists within the country. These establishments and their equipment are in need of sound maintenance and repair programmes if they are to operate in a productive and timely manner. In addition, a good deal of the equipment has been in service for a long period of time without adequate repair and maitenance.

The Government primarily desires to keep all these establishments and their equipment in good condition and secondarily wishes to supplement these facilities and equipment, as required, to support a concerted industrial expansion programme in the metal working sector. It is anticipated that this will be done with maximum dependency on a local capability and minimum dependence on importing spare parts and repair work.

The industrial sector for the local economy has expanded considerably in the last years. Besides the processing of agricultural products and the production of certain consumer goods, new industries in textiles, machinery, footwear, cement, paints and industrial chemicals are now already producing for the local market and for export or have been planned. This rapid growth, combined with tariff protection, has given rise to a certain non-utilization of full production capacity, amongst others, due to the lack of proper upkeep of machinery and equipment. This obliges the local industry to become more efficient to produce on a more competitive basis.

The main difficulty is the fact that much repair and maintenance work has to await incoming technicians, or the work has to be sent abroad to be done. This is expensive and if it continues on a long-term basis, Barbados will not develop the necessary technical skills to deal with repair and maintenance in the precision engineering and electronic fields. It is now necessary to upgrade the level of repair capability in the high technology to serve industries with high technology equipment.

The Barbados Industrial Development Corporation (BIDC) is interested in the establishment of an industry-oriented programme of technical services in co-operation with the Barbados Manufacturers Association (BMA).

Therefore, the Government of Barbados/BIDC wishes to inititate a programme/project aimed at maximizing the country's industrial recources by developing a training and demonstration programme in repair and maintenance and engineering services. The demonstration of modern maintenance and repair techniques, the organization and upgrading of repair facilities and operations and in-plant training, however, will have to receive priority attention. In order to build up appropriate skills and provide engineering services to industry, which are commonly needed, the establishment of an "Industrial Repair and Maintenance Centre" (workshop, tool room, training and services facility) is considered.

Immediate objective

The immediate objective of the project is to bring about elaborated proposals on the establishment of an Industrial Repair and Maitenance Centre with a full-fledged workshop, tool room, training and service facilities. The proposals will include:

1. Detailed inputs of existing industry and its requirements based on the market study;

2. Organizational structure and equipment requirements;

3. Financial inputs required; and

4. The implementation schedule.

Scope of work

The contractor is required to provide two qualified experts (2 m/m) in the field, where they will define, together with the national counterparts, the requirements of the Industrial Equipment Repair and Maintenance Centre and design the project. The field work is to be completed at the home office of the contractor, based on the findings in the field. A draft report (three copies) will be produced by the contractor within four weeks upon completion of the field assignment. The final report will then be submitted to UNIDO upon inclusion of its comments to the draft report.

The contractor's specified duties

1. Review of existing metalworking and engineering industries in the country.

2. Specify the need of the above industrial sector and outline in detailed description the tasks and functions of the "Industrial Repair and Maintenance Unit".

3. On the basis of the above, advise and describe the organization structure of the Unit and make the most appropriate recommendations so that the industry benefits appreciably from its existence.

4. Assist in the selection of the site and advise, if feasible, on the utilization of existing buildings/institutional facilities.

5. Prepare a layout for the buiding in scale 1:100 showing a workshop where each individual equipment item will be placed, heat treatment section, tool room, training and service facilties, and its respective energy and utility requirements.

6. On the basis of (2), propose equipment requirements and prepare for each equipment item-neutral specifications suitable for invitations of international bids.

7. Assess the equipment cost C+F Barbados and provide a delivery schedule.

8. Prepare a list of tools and spares required for a two-year operation.

9. Prepare a list of all raw material and consumable items required for a two-year operation.

10. Specify a manning table preferably supported with a brief job description for local personnel required in relation to the project implementation plan.

11. Specify the rquirements of expatriate expertise and provide a brief job description.

12. Specify training programmes for the fellowships.

13. Prepare an integrated project implementation plan which reflects all inputs, outside and Government in relation to a realistic time schedule.

14. Prepare a consolidated table reflecting all financial inputs to the project and prepare operating expenses.

Time schedule for the execution of contract after award

Briefing of expert team	UNIDO Vienna	1 day
Execution of field work	Barbados	1 month
Debriefing of expert team	UNIDO Vienna	1 day
Preparation of detailed draft report	Contractor's office	4 weeks
Preparation of detailed final report on receipt of comments from the Government and UNIDO	Contractor's office	1 month