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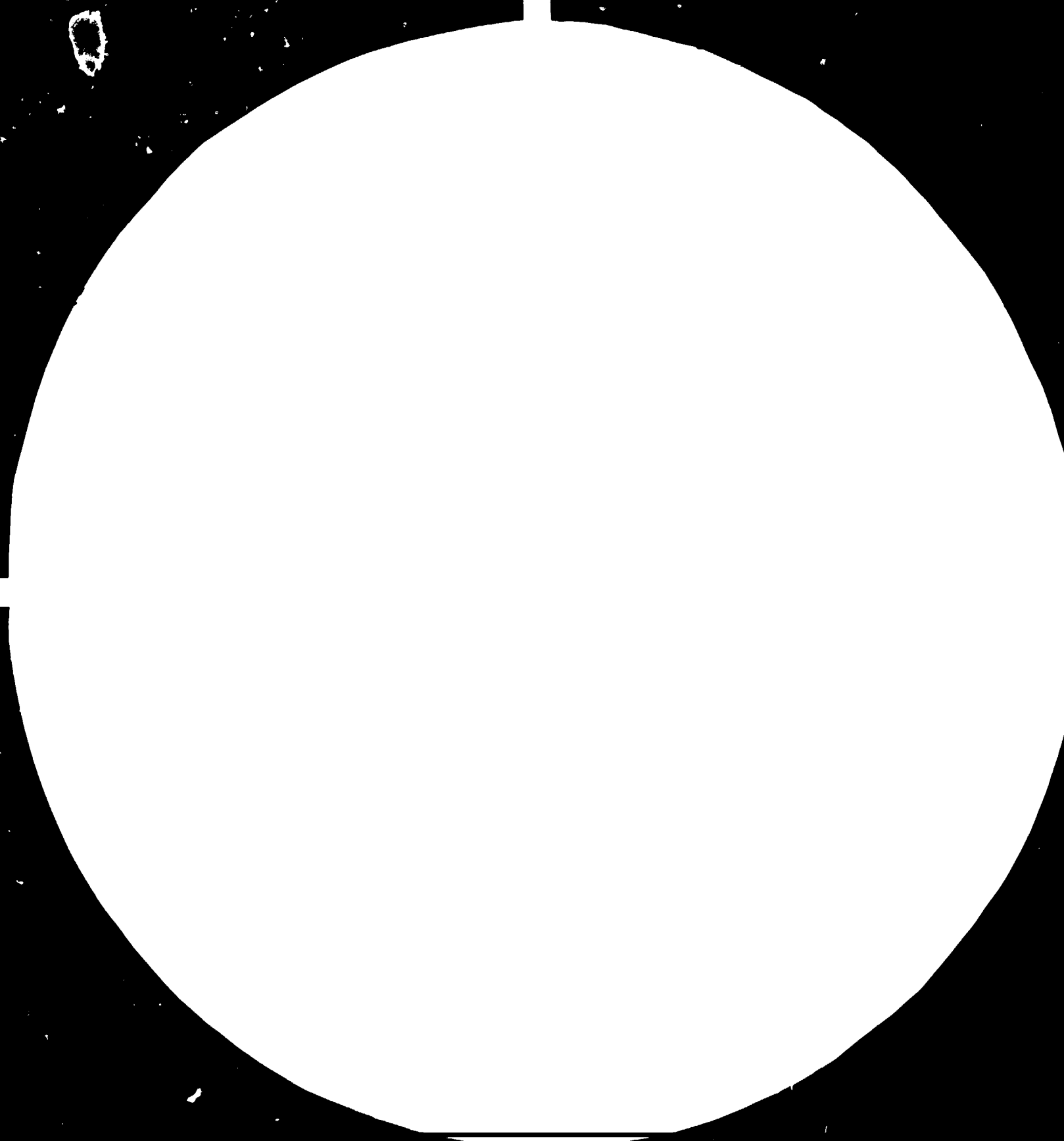
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23 May 1985
ENGLISH

PILOT FURNITURE PLANT

DP/LAO/81/017

LAO PEOPLE'S DEMOCRATIC REPUBLIC

[Laos]

Technical report: Training of technicians in operating and
maintaining woodworking machinery, and assistance in
overall management techniques*

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

Based on the work of Karl Fuchs,
Furniture Production Technician

United Nations Industrial Development Organization
Vienna

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Introduction

This report covers a span of 12 months, i.e. from April 1984 to April 1985, during which UNDP/UNIDO assistance has been provided to Laos in the woodworking industry under project LAO/81/017 by Karl Fuchs, Chief Technical Adviser of the project and Furniture Production Technician.

During a number of years assistance has been given to the furniture industry of Laos, starting in 1970 and ending in 1980, under a number of small projects, which were then incorporated into a large one. After the changes of 1975/76, the Government decided to establish its own facilities.

With the assistance of UNDP/UNIDO, a furniture plant was erected which, because of its size and equipment, is unique in Laos, with the intention of manufacturing wood products of a higher value.

The production area of this plant covers 2500 m². The factory employs 160 workers and has 45 woodworking machines and 10 saw-doctoring machines installed.

Background of the project

According to the project document signed in February 1983, the present project is expected to continue the work already started under DP/LAO/74/010 (Integrated Woodworking Project). Since the machinery provided under this project was considered not to be sufficient for the efficient operation of a production line, it was intended to purchase, through the present project, additional machinery, in order to complete this production line. Furthermore it was intended to train manpower at all levels. The factory should be able to attain export standards in about five years.

The project is designed to reach this level in two phases. After two years, a thorough assessment will be made to review the progress in upgrading of the workmanship.

This is needed to enable the country to replace its exports of raw timber with wood products of a higher value.

Together with the already existing plywood factory, the wood and rattan industry is becoming the single major centre for the development of the woodworking industry in Laos.

Objectives of the project

The present project had in principle been defined at the time of the termination of project LAO/74/010, but has been reformulated during a preparatory assistance phase of one month.

According to the project document, it is foreseen:

- (a) to complete the establishment of the first modern Pilot Furniture Plant in Laos;
- (b) to train technicians in effectively and efficiently operating and maintaining all the machinery, so as to manufacture furniture at an intermediate level of quality;
- (c) to train the management staff in overall management techniques of a furniture plant and to introduce them to the export marketing of furniture products.

At the end of the project, a base will have been laid for the further improvement of the products of this plant to the level of export standards.

It is anticipated that export quality will be achieved during a short follow-up project.

For the implementation of these objectives, one Chief Technical Advisor, three woodworking experts and three UN-Volunteers as well as several short term consultants were foreseen to assist the project. So far, only the Chief Technical Advisor, Mr. Karl Fuchs, was fielded, from April 1984 to March 1985. His duties are outlined in Annex 1.

Assessment of the work done by the project

A. Requisition of woodworking and saw-doctoring equipment

As a base for selection and requisition of woodworking machinery the following aspects have been taken into consideration:

- (a) raw materials to be utilized (timber, plywood, particle board, glue, lacquer);
- (b) size and design of the production plant;
- (c) nature and design of products to be manufactured (eg. series production);
- (d) number of productive workers;
- (e) development status of the country and state of trained manpower;
- (f) climate of country (eg. tropical insulation, etc.).

In consideration of these aspects, machinery has been selected and purchased during former projects and has been installed in the production lines. In order to complete one production line for efficient operation additional woodworking machinery was ordered during 1984. For details see Annex II.

In placing such an order, one has to determine that the respective machines be equipped with the corresponding tools. These tools should always be available in duplicate so as to ensure that one set is always in a sharpened and adjusted condition.

As for cutters, saw blades and drill bits, it is essential to know all given technical data of the machine, such as:

- (a) spindle and bore diameter;
- (b) minimum and maximum rotation per minute;
- (c) configuration of tools (HSS, carbide-tipped);
- (d) direction of rotation of the machine's spindles;
- (e) direction of work such as with or across the wood grain;
- (f) manual or automatic feeding.

It is strongly recommended that all machine descriptions, operation instructions, spare part lists and technical drawings - sent along with the new equipment - be kept very carefully to facilitate requesting and replacing spare parts, wearing parts and accessories.

B. Placing and installation of machinery

In order to place and install the machinery advantageously, a plant layout (see Anne. III) had to be prepared to state the positions so as to ensure that space for transportation of work pieces (pallets) be kept free and a proper production flow be developed.

A smooth production flow may be given, provided that the machines are lined up in consideration of the wooden products to be manufactured.

For instance, in front of the four side spindle moulder, a surface planer has to be placed in order to plane at least one surface. It is a matter of fact that timber is very often inaccurately sawn and shows differences in thickness. The automatic feeding system of the four side spindle moulder allows for correction of maximum 6 mm difference in raw thickness. In case of a higher thickness discrepancy, an automatic safety switch turns off the feeding system. Subsequently, the automatic feeding unit has to be opened manually in order to be able to remove the work piece. And finally, the machine has to be reset to the final thickness. This interruption slows down the capacity of the machine and is rather time consuming. It could happen, in case that this machine is operated by an unreliable machinist, that differences in the final thickness may occur, caused by the procedure mentioned above.

Furthermore, it is essential to leave enough space on the feeding side of the machine in order to place these pallets with work parts, as well as on the front and on the rear side, in order to pile up and to store the processed work pieces.

Additionally, the maximum length of the work pieces to be manufactured has to be determined. All these aspects have to be carefully considered, especially when placing key position machines such as a four side spindle moulder, a panel saw, a multiple boring machine and a wide belt sander.

Woodworking machines designed for high-speed operation have to be placed and mounted on an appropriate plane and levelled concrete foundation, in order to avoid vibrations causing defects

during the operation. Woodworking machines designed for normal or low-speed operation have to be equipped with shock absorbers, usually available in the trade. If not available, pieces of old truck tyres have to be cut (app. 10 x 10 cm) and placed beneath each stand of the machine for use as shock absorbers.

The electrical installation of the machinery has to be carried out exclusively by skilled electrical technicians. The diameter of the power cables has to be selected bearing in mind the recommendations of the supplier. The lead of the power cable has to be put under floor or descended vertically from the ceiling. Power cables should never lie loose on the floor for reasons of blocking transport ways and creating a source of danger.

The entire machinery ought to be connected to the existing dust-exhaust system. For machinery not designed to be linked to the dust-extraction system, such as high speed routers, boring machines, surface planers, etc., a special funnel-shaped exhaust hood has to be fabricated out of plywood or sheet metal in order to remove the sawdust. Full capacity of the technical equipment, a smooth production flow and security in the machine shop may only be attained if all measures stated above are being observed.

C. Introduction and basic training on machinery in view of machining methods suitable for series production

New machinery ought to be put in operation and introduced to the machine operator as fast as possible, in order to answer its purpose: namely to increase the productivity of the factory.

Mounting and installation of machinery and specially the training of machine operators on these new machines should not hamper the production flow, let alone block it. Putting this aim into practice means: The machinist has to be instructed in the use of the machine as outlined in the machine descriptions and operating instructions delivered with it. All possible applications of the machine have to be emphasized. The operator has to be informed about the correct set-up and insertion of tools and their availability. The importance

of observing safety regulations has to be strongly recommended. In case of doubt, maximum speed has to be avoided.

It is very useful to explain and show in practice the facts of the capacity of the machine to the operator, in order to motivate him to contributing in making the most out of it.

Basic training on new machinery should be performed in using these machines from the very beginning to manufacture pieces from the actual production series. Thus, the normal production flow will not be hampered.

During the expert's assignment, a wide range of machines were already in use (see Annexes IV and V), and machine operators had already received basic training in the use of this equipment by a former international expert ^{1/}. However, operators already trained show the tendency to forget in course of time the various applications of the machines. Consequently a repetition of training had to be performed from time to time, in order to highlight the efficient use of the equipment.

For instance, it is essential to emphasize the importance of manufacturing and utilization of auxiliary devices such as jigs for application on machines. A special workshop for jig and sample-making had to be established. The preparation of these precision devices should only be carried out by highly skilled wood technicians. We strongly recommend that jigs be used as often as possible to improve efficiency and security. Already when applied to small batch series, jigs pay for themselves since

- all work pieces have the same size and shape after processing;
- efficiency in production may be increased;
- safety in handling the machines is improved.

Woodworking machines, like spindle moulders, have to be provided with an automatic feeding system in order to assure a proper feeding speed which improves the smoothness of cutting and profiled surfaces. Thus, manpower will be preserved and safety on this machine

^{1/} See Technical Report prepared by Mr. A. Sumarokov, dated May 1981.

will be improved. The machine should be fed in the direction of the wood grain to ensure an improved cutting surface.

It has to be repeated from time to time that faulty work pieces (with worm holes etc.) should be removed and not be processed and passed on to subsequent work stations.

In a factory equipped with modern machinery the transportation of work pieces has to be performed without impairing the capacity of the machines. Wooden pallets, adapted to the products to be manufactured and to the size of the hand forklift truck available, have to be used. (For a drawing of the type of pallet recommended, see Annex VI.) The pallets laden with work pieces have to be placed next to the feeding side of the machine, ensuring that a continuous feeding of the machine is feasible. The worker, placed at the outlet of the machine has the additional task to control the quality of the work pieces and remove faulty components. Faults occurring such as knife marks, differences in size, etc., have to be reported to the machine operator without delay, so that he may immediately solve the problem. Furthermore, control should be performed by the supervisor, who has the task to check the size repeatedly in order to avoid faulty production.

Off-cut material may hamper the space for transportation, create a source of peril and mess up the factory. This problem may be solved by using boxes, placed on wooden pallets, to collect it.

One essential fact, in order to produce in series, is the utilization of work drawings and work descriptions.

D. Work drawings and work descriptions

The significance of using work drawings and work descriptions accompanying the work pieces through the processing has been strongly emphasized.

Work drawings contain all required figures such as dimensions, profiles, position and dimensions of bores and the like. Thus, faulty production may be avoided. Detailed work drawings should

always show the entire furniture piece to be produced to a small scale. Machine operators reading the work drawings may comprehend the intention of work pieces easier, and the manufacturing process will be simplified. (A sample of work drawings developed during the assignment are given in Annex VII.)

In addition to the work drawings, work descriptions have to be prepared so as to accompany the work piece through the entire manufacturing process.

Putting this into practice means that descriptions of work to be carried out on each machine through which the work has to pass has to be mentioned, each manufacturing process has to be described in detail and furthermore dimensions and quality of raw materials used have to be indicated. (A sample of work description is given in Annex VII.)

As stated above, work description cards and drawings have to accompany the work piece from the very beginning (timber yard) until it reaches the intermediate store. Once it arrives there, the quantity is checked and a quality control has to be carried out, and the work description cards and drawings have to be replaced by new records established to accompany the goods through the next department (lacquer shop, assembly shop, etc.) until the finished product reaches the last quality control and finally the warehouse.

A working drawing of the working tables manufactured for the assembly shop is given in Annex VIII.

Generally one can find a column on work description sheets foreseen for filling in the actual time used for processing. These figures should be used as supporting records for the final cost calculations. Eventually, these work descriptions may be used to determine the processing time and thus, are very useful for establishing a production bonus system.

E. Assembly of carcasses and frame-built furniture

One essential fact to ensure a smooth production flow within the assembly shop is that exclusively impeccable quality

furniture and faultlessly manufactured work pieces reach this department.

Machinery and work places have to be mounted and installed in accordance to the plant layout (see Annex III).

There exist two assembly lines in this factory:

1. a line for frame-built furniture such as chairs, tables, etc., as well as windows, panel doors, etc.
2. a line for carcasse-built furniture such as cupboards, wardrobes, office desks, etc.

Each work piece has to pass through the scheduled work places and has to be prepared for assembly, i.e. wooden dowels have to be put in, fittings have to be mounted using jigs, etc. Eventually, work pieces ready for assembly have to be stored in front of either the carcasse or the universal clamp.

Using a carcasse clamp assures exact angles and faultless glueing of carcasses. Since the pressure of the clamp is adjustable, deformation of carcasse ends, tops or bottoms may be avoided. While the carcasse stays in the clamp, the rear panel has to be placed and fixed. Once the rear panel has been set, the carcasse will be rigid enough to be taken out of the clamp. Before passing on to the next work place the carcasse ought to be stored for a while, in order for the glue to set.

The subsequent work places are intended for assembly work such as hanging of doors, adjusting drawer-boxes, fixing of stands, etc.

After passing through all these necessary stations, a quality control should be carried out. Any occurring faults have to be corrected at this station. After passing a last quality control test, the completed work piece has to be carefully transported to the warehouse.

Pallets have to be used for the transportation of goods and carried by hand fork lift trucks.

F. Saw-doctoring and maintenance of technical equipment

The durability of machine tools depends on proper reconditioning, exclusively performed by well trained saw-doctors.

It is a matter of fact that merely under utilization of well conditioned tools, quality products may be manufactured economically.

A drawing of the roll-fronted tool box for maintenance, manufactured locally for the project, is given in Annex IX.

An additional task for the saw-doctor staff is the maintenance of machinery. Generally, lubrication lists and service/maintenance suggestions are delivered with new machines. It is absolutely necessary to follow the supplier's instructions and carry out services in time in order to avoid breakdowns which will necessarily interrupt the production flow and consequently curtail the productivity of the production line.

A maintenance plan has to exist for each machine indicating

- (1) a schedule and description of each operation (greasing, re-setting, etc.)
- (2) a timetable indicating the maximum operating hours between maintenance operations.

Maintenance has to be carried out based on these records, utilizing lubricants suggested by the supplier.

If it becomes obvious that parts of a machine repeatedly wear out fast, this part has not only to be replaced, but also an investigation has to be carried out in order to find out the primary source causing the problem.

As a base for training of saw-doctors and maintenance technicians, the various manuals in Lao prepared by G. A. Woods, P. Borretti, P. Mahdac, J. Kadlec and A. Sumarokov (under previous projects) ought to be used.

G. Inventory taking and preparation of inventory stock lists

For a project of this size, a well equipped storage room for spare parts, tools, auxiliary material and accessories is specially

important. An adequately large room ought to be equipped with shelves in order to store the materials properly. At least one shelf has to be prepared for each machine, properly marked, in order to indicate all the items kept in stock for this particular machine.

A most essential step to keeping a well organized store-room is to collect all packing lists, spare part lists, machine descriptions, technical drawings, etc. very carefully in order to have everything - spare parts and records - immediately at hand when required.

It is important to keep stock lists. All incoming new equipment ought to be listed in these forms in accordance to the packing lists delivered. In order to avoid breakages in stock of materials and goods, a minimum quantity ought to be calculated taking into consideration the terms of delivery and rate of utilization. This minimum amount has to be noted in the stock lists.

The store keeper in charge has to have at least a basic technical knowledge, in order to be able to run the issue and return of goods smoothly.

Saw blades, cutter heads, knives, boring tools, etc. have to be placed in an orderly way and clearly arranged on shelves, prepared for this very purpose, in order to serve the machine operators promptly.

Special issue and return lists have to be kept for these tools.

The condition of the tools returned has to be checked by the store keeper with the aid of a saw-doctor, and, if necessary, they should be reconditioned in order to keep only well prepared tools in stock.

As for sanding belts, a particular storage is important - specially in a tropical climate, where high humidity exists. A special small room for storing sanding belts, equipped with electric bulbs, lit to reduce humidity, ought to be prepared. Sanding belts have always to be kept in a hanging position.

Auxiliary material such as lacquers, varnishes, stains, thinner, glue, etc. has to be stored in an air-conditioned room. Considering the fact that inflammable fumes may occur, there should be no uncovered electric wires and switches in this room. It is advisable that there be no electrical installation at all, or that explosion proof fittings be used.

An annual inventory is absolutely necessary in order to balance the stock according to the books with the actual stock.

H. Timber seasoning

It is a well known fact that the manufacture of high quality furniture is only feasible with the utilization of seasoned timber. (Moisture content should be approximately 12 percent.) Taking into account that the natural seasoning process - specially in a tropical climate - may take long. it is necessary to kiln dry timber for reasons of profitability.

Kiln drying has to be performed in the following sequence:

1. A load for a drying-chamber (approximately 30 m³) must consist of timber of one species only, or of species requiring the same kiln drying schedules. When mixing species is unavoidable, the slowest of the schedules recommended should be used.
2. The loading of a wide range of thicknesses must be avoided.
3. The moisture content of the timber entering a chamber should not show big differences.

In order to shorten the kiln drying process, it is advisable to pile wood coming from the sawmill in a covered timber store, so as to reduce the moisture content naturally. The capacity of the drying kiln may thus be increased and, moreover, energy and operating costs may be reduced.

For instance, it takes 28 days to kiln-dry fresh wood with a moisture content of 26 percent. Naturally air-dried wood at a moisture content of 20 percent requires only 14 days in a kiln to reach 12 percent.

In order to fire the factory's kiln boiler, 3m³ of firewood are needed per 24 hours.

A permanent stock of approximately 250 m³ timber would guarantee that only air-dried wood is used for kiln-drying, and a non-stop operation of the chamber be assured. The timber has to be piled taking into consideration the species, thickness and original moisture content.

There exists a roofed timber yard on the factory's premises, intended for the storage of about 250 m³ seasoned wood. This yard has to be filled with 250 m³ of sawn timber, in order to ensure a proper material flow for the production. The present requirement of timber is approximately 100 m³ per month. These 250 m³, as stated above, would enable the factory to eventually execute large orders.

A manual in Lao, on wood seasoning, prepared during the previous project by E. Mattson should be used in order to train kiln operators^{2/}.

I. Assistance to the technical and administrative management staff

A permanent assistance to the technical and administrative management staff is recommended, since a basic requirement for the economic running of a factory is a good management:

Management personnel currently show a tendency for routine blindness and ignorance. For these reasons weak points ought to be focused on and recommendations for improvement ought to be made. Advice and expertise has to be given to show the management personnel how to run the factory efficiently and economically.

The significance of an assured raw material supply for the factory has to be pointed out again and again. Negotiations with technical government departments and ministries must be pursued until the expected results have been attained.

The priority of this Pilot Furniture Factory has to be emphasized, in order to avoid symptoms of indifference causing failures.

^{2/} During the expert's assignment (April 1984-March 1985) only 100m³ of timber have been kiln-dried. The timber in storage never exceeded 40 m³.

The importance of having trained manpower available must be pointed out continuously. Suggestions concerning training programmes for wood technology ought to be made, not only to provide expertise to the project, but also to the various other factories in Laos.

Study tours for Lao wood technicians are recommended. When drawing up a programme for a study tour, preference should be given to countries with medium-sized industries using an intermediate technology. The visit of such well-organized factory will be most informative for the participants.

During the expert's assignment, a study tour to Czechoslovakia was planned for six Lao participants (see Annex IX).

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UNITED NATIONS

ANNEX I



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

PROJECT OF THE GOVERNMENT OF THE PEOPLE'S
DEMOCRATIC REPUBLIC OF LAOS

JOB DESCRIPTION

DP/LAO/81/017/11-01/31.7.A

Post title Furniture Production Technician (Team Leader)

Duration Two years

Date required As soon as possible

Duty station Vientiane

Purpose of project To complete the establishment of the pilot furniture plant started under project LAO/74/010, to train technicians in operating and maintaining the machinery and to train management in overall management techniques of the furniture plant.

Duties

The technician will be assigned to the furniture factory of the wood and rattan industry, a state enterprise under the Ministry of Industry, Handicrafts and Forests.

He will be responsible to lead the team of internationally recruited experts (comprising also a tool and machine maintenance technician, a surface finishing technician, a management adviser and consultants, as well as 3 UN volunteers).

In addition he will be responsible for the following duties:

1. The installation and commissioning of the equipment purchased by the project;
2. The training of supervisors and wood technicians in the full and efficient use of the production equipment available under actual production conditions, and the training of assemblers;
3. The introduction of machining methods suitable for series production with interchangeable components;
4. The development of required production fixtures aimed at attaining accurate machining of component parts;
5. The training of supervisors in the selection of appropriate cutting tools

...../..

Applications and communications regarding this Job Description should be sent to:
Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

Qualifications Engineer or economist or wood technician with experience in overall management of a middle sized furniture plant. Experience in developing countries desirable.

Language English or French (basic knowledge of the other desirable)

Background information Assistance to the furniture industry of Laos has been provided by UNIDO for a number of years, starting in 1970 and ending in 1980 under a number of small projects which were then incorporated into a large one.

Originally this assistance concentrated on the training of manpower and the provision of trouble-shooting services to the existing factories. With the changes that occurred in the country in 1975-76, the Government decided to establish its own facilities. To this end the UNDP/UNIDO assistance in the period 1977/80, concentrated on strengthening the EML (Bois manufacturés Lao), a state owned plant, to convert it into a wood pilot furniture plant. To this end, UNDP/UNIDO provided expertise, equipment and contributed to the cost of erection of the building. Assistance had to be suspended in December 1980 due to lack of funds.

The present project, which is a direct follow up of the previous ones, will provide additional production equipment to complement the production resulting in better management, an improvement in the quality of products, and in increased productivity.

The assistance will be provided over a period of two years through a team of internationally recruited experts comprising a furniture production technician (team leader), and short term consultancies by technicians in tool and machine maintenance and surface finishing and an advisor in management. These technicians will be assisted by three UN volunteers who will be trained in wood machining.

ANNEX II

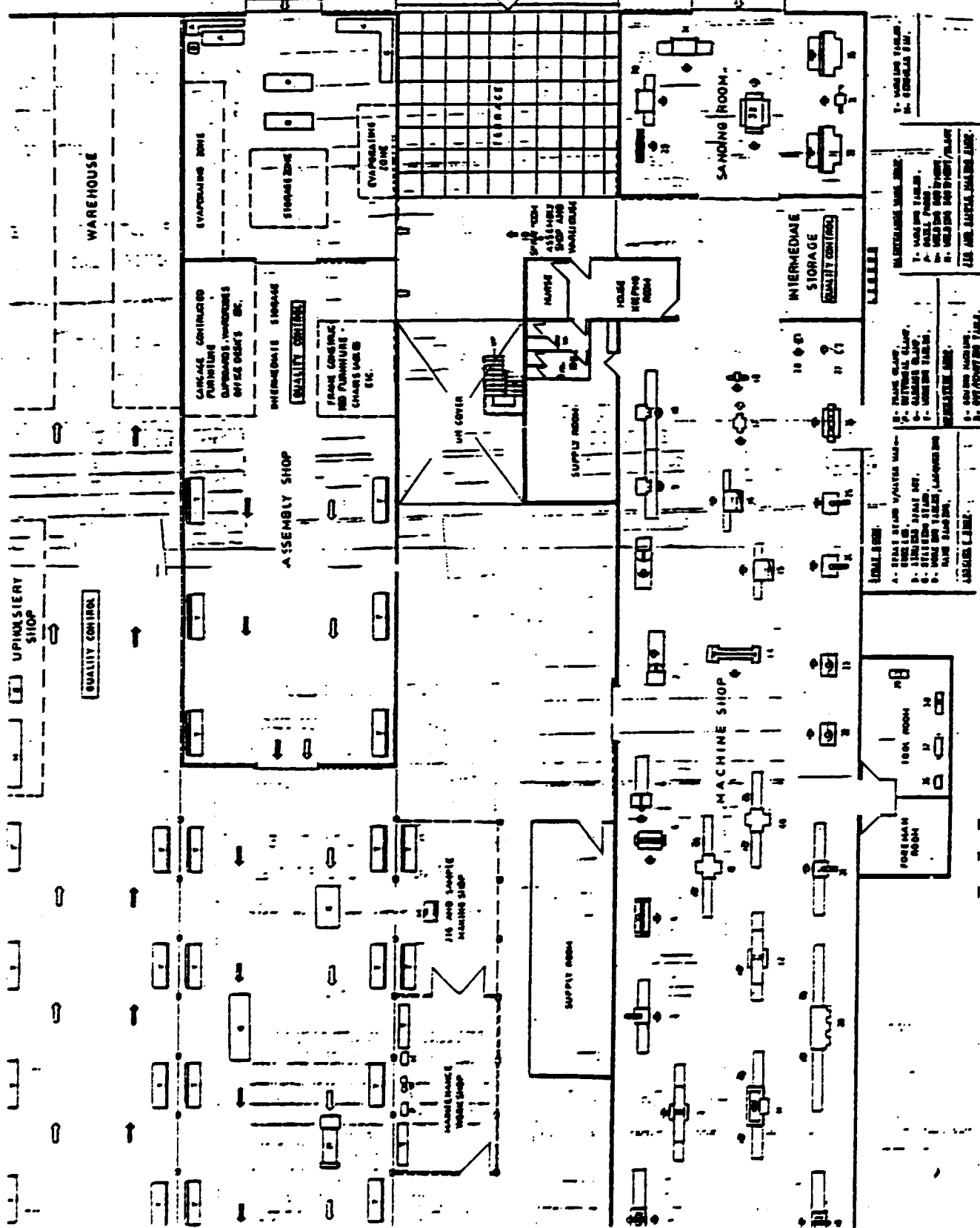
EQUIPMENT REQUESTED DURING THE EXPERT'S ASSIGNMENT
APRIL 1984 - MARCH 1985

No.	Type	Position on layout plan Annex III
1	Toyota pick-up (extended cabin)	
1	Toyota pick-up	
1	Paper copier	
	Flexible pipe/pipe clamps/power cables	
2	Airless spray sets	
1	Carcasse clamp	G
1	Universal clamp	F
1	Wide belt top sanding machine	32
1	Dowel hole boring machine	26
1	Spray stand and spray wall unit	A/B
1	Double sided edge lip trimming machine	
1	Industrial sewing machine/ Rubber foam hand cutting machine	S
1	Moisture content meter	
2	Adjustable grooving cutter	
1	Rebating cutter with spurs	
1	Bevel cutter	
1	Panel raising cutter	
2	Standard profile cutter combinations	
1	Coffering cutter block	
1	Reversible mitre joint cutterblock	
2	Wedge type planer heads	
20	Carbide tipped knives	
1	Ball bearing	
1	Ball bearing/Guide ring set	
6	Planer knives HSS	
5	Circular saw blades	
6	Planer knives HSS	
10	Cross cut saw blades	
8	Quick changing chucks	
4	Countersunk/Carbide tipped	

No.	Type	Position on layout plan Annex III
10	Twist drills diameter 5 mm	
10	Twist drills diameter 6 mm	
10	Twist drills diameter 8 mm	
10	Twist drills diameter 10 mm	
10	Twist drills diameter 12 mm	
3	Machine bits diameter 15 mm	
3	Machine bits diameter 16 mm	
3	Machine bits diameter 18 mm	
3	Machine bits diameter 20 mm	
3	Machine bits diameter 25 mm	
3	Machine bits diameter 30 mm	
3	Machine bits diameter 35 mm	
3	Wedge type planer heads	
24	Straight knives for wedge type planer heads	
3	Wedge type planer heads	
24	Straight knives for wedge type planer heads	
50	Endless bandsaw blades	
50	Endless bandsaw blades	
6	Grinding wheel/diamond	
10	Grinding wheel/korund	
200	Sanding belts 7200 x 150 mm, grit 80	
200	Sanding belts 7200 x 150 mm, grit 100	
200	Sanding belts 7200 x 150 mm, grit 150	
50	Sanding belts 6880 x 150 mm, grit 80	
50	Sanding belts 6880 x 150 mm, grit 120	
100	Sanding belts 3100 x 150 mm, grit 80	
100	Sanding belts 3100 x 150 mm, grit 120	
50	Sanding belts 2000 x 150 mm, grit 80	
50	Sanding belts 2000 x 150 mm, grit 120	

LEGEND

- 1 - CONCRETE WALL
- 2 - CONCRETE COLUMN
- 3 - CONCRETE FLOOR
- 4 - CONCRETE SLAB
- 5 - CONCRETE LINTEL
- 6 - CONCRETE LATERAL
- 7 - CONCRETE TERRACE
- 8 - CONCRETE STAIRS
- 9 - CONCRETE ROOF
- 10 - CONCRETE ROOF SLAB
- 11 - CONCRETE ROOF TRUSS
- 12 - CONCRETE ROOF BEAM
- 13 - CONCRETE ROOF COLUMN
- 14 - CONCRETE ROOF BRACKET
- 15 - CONCRETE ROOF JOINT
- 16 - CONCRETE ROOF EDGE
- 17 - CONCRETE ROOF FINISH
- 18 - CONCRETE ROOF DRAIN
- 19 - CONCRETE ROOF VENT
- 20 - CONCRETE ROOF LIGHT
- 21 - CONCRETE ROOF WINDOW
- 22 - CONCRETE ROOF DOOR
- 23 - CONCRETE ROOF RAMP
- 24 - CONCRETE ROOF STAIR
- 25 - CONCRETE ROOF LIFT
- 26 - CONCRETE ROOF ESCAPE
- 27 - CONCRETE ROOF BALCONY
- 28 - CONCRETE ROOF TERRACE
- 29 - CONCRETE ROOF PATIO
- 30 - CONCRETE ROOF PORCH
- 31 - CONCRETE ROOF DRIVE
- 32 - CONCRETE ROOF GARAGE
- 33 - CONCRETE ROOF CARPORT
- 34 - CONCRETE ROOF WALKWAY
- 35 - CONCRETE ROOF BRIDGE
- 36 - CONCRETE ROOF TOWER
- 37 - CONCRETE ROOF WATCHTOWER
- 38 - CONCRETE ROOF TOWER
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- 98 - CONCRETE ROOF TOWER
- 99 - CONCRETE ROOF TOWER
- 100 - CONCRETE ROOF TOWER



UNIDO

PILOT FURNITURE FACTORY LAO P.D.R.

MACHIAE LAYOUT PLAN

Scale: 1:100

Drawn by: S. S. S. S.

Approved by: S. S. S. S.

MINISTRY OF INDUSTRY
HANDICRAFTS FORESTRY
STATE FOREST ENT (M.F.)
DESIGN SECTION

ANNEX IV

WOODWORKING MACHINES DELIVERED IN 1984

No.	Type	Position on layout plan Annex III
1	Rounding and tenoning machine	8
1	Universal sanding machine	29
1	Stroke belt sander	33
1	Edge banding machine	
2	Spindle moulders	22/23
1	Radial press	27
1	Work bench	
1	Slot mortiser	9
1	Dowel cross-cut and chamfering machine	18
1	Automatic saw sharpening machine	38
1	Welding equipment	
1	Surface planing machine	12
1	Thickness planer	13
2	Band saws	3/21
1	Circular saw	16
2	Speed routers	24/25
2	Radial circular saws	0/1
1	Slot mortising and drilling machine	10
1	Multiple boring machine	28
1	Cutterhead balancing and setting device	

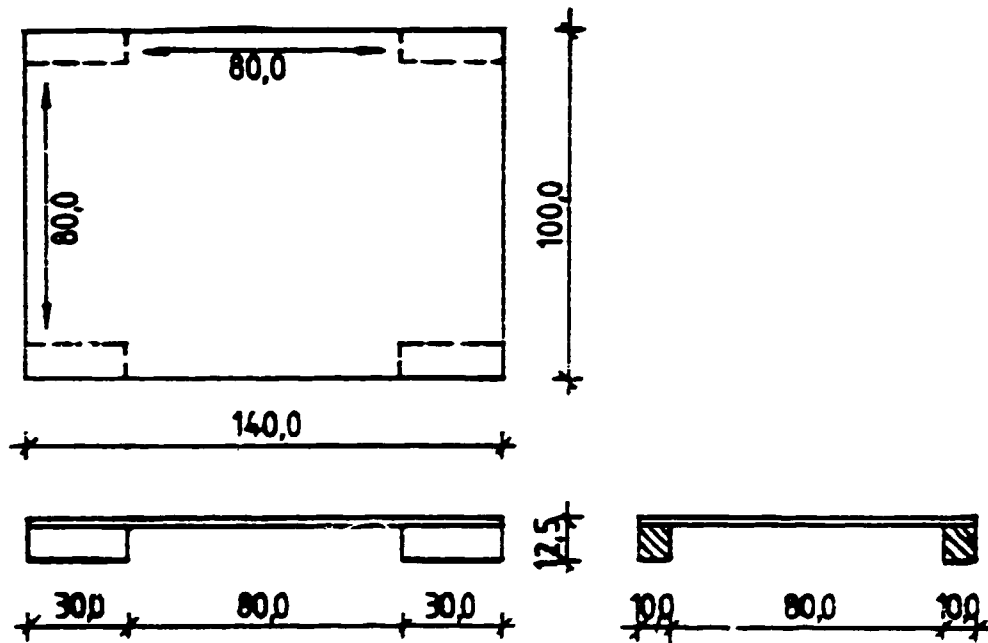
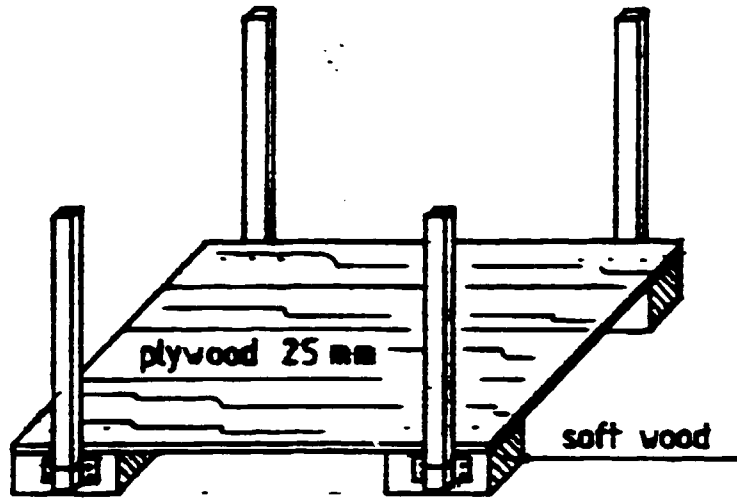
N.B.: The above machines have been installed temporarily.

ANNEX V

WOODWORKING MACHINES PURCHASED AND INSTALLED BY PREVIOUS PROJECTS

No.	Type	Position on layout plan, Annex III
1	Jointer	2
1	Copying lathe	4
1	Automatic lathe	5
1	Dovetailer	6
1	Round tenoner	7
1	Slot mortiser	9
1	Multiple rip saw	11
1	Thicknesser	40
1	Double circular saw	14
1	Taping and screwing machine	17
1	Four side moulder	20
1	Radial saw	15
1	Edge belt sander	30
1	Stroke belt sander	35
1	Drum sander	34
1	Cup grinder	36
1	Bench grinder	37
1	Knife grinder	39

ANNEX VI

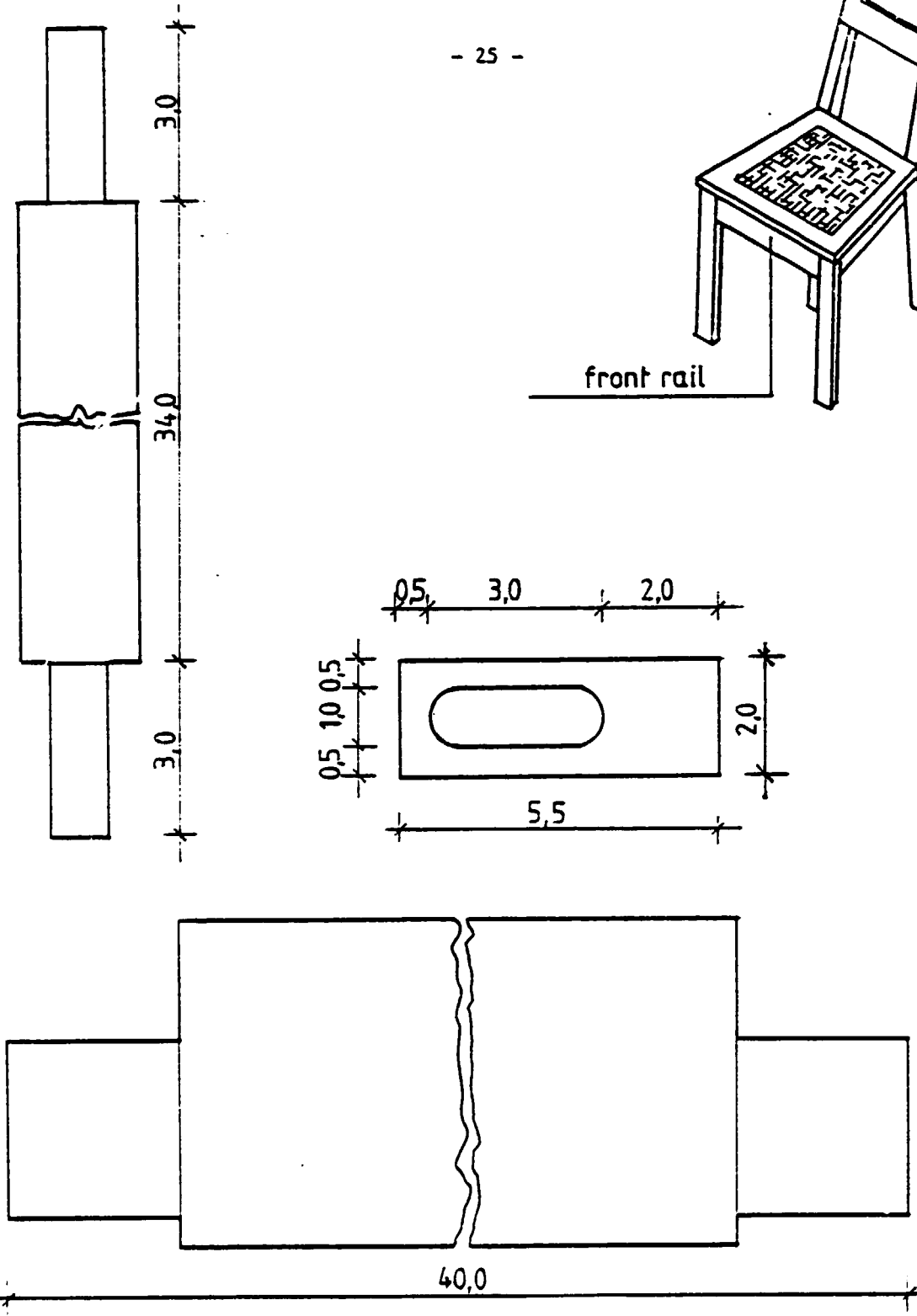
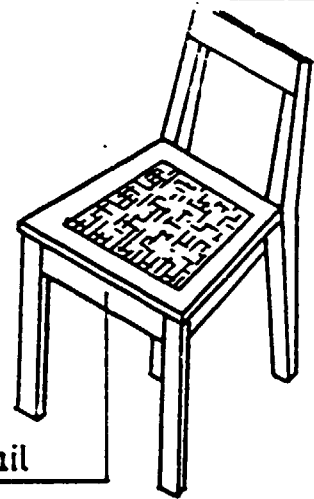


PRODUCT — palett	PART —	SCALE — 1:20
DESCRIPTION —		DRAWING NO,1
<p>pay attention to inside dimension!</p>		DRAWN — fuchs 3.85
		CHECK —
		CHANGE —
DP LAO 81/017 UNIDO 3,85 K. FUCHS		

ANNEX VII

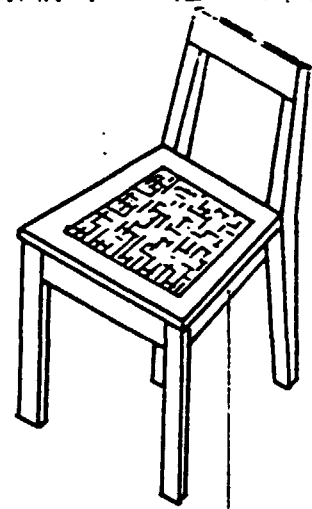
WORK DRAWINGS AND WORK DESCRIPTION CARDS

		<u>Page</u>
Chair Al teak		
1	Drawing of Chair Al teak, part: front rail	25
2	Drawing of Chair Al teak, part: side rail	
	left/right	27
3	Drawing of chair Al teak, part: back rail	29
4.	Drawing of Chair Al teak, part: left front leg	31
5	Drawing of Chair Al teak, part: right front leg	33
6	Drawing of Chair Al teak, part: right back leg	35
7	Drawing of Chair Al teak, part: left back leg	37
8.	Drawing of Chair Al teak, part: front part	
	seat frame	39
9	Drawing of chair Al teak, part: back part,	
	seat frame	41
10	Drawing of Chair Al teak, part: side part (left/ right) seat frame	43
'1	Drawing of chair Al teak, part: back rest	45

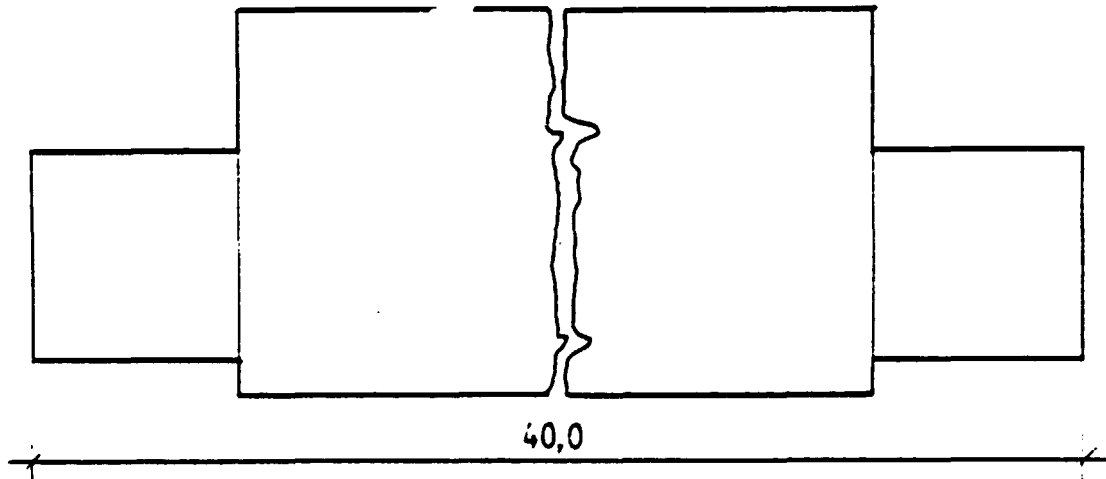
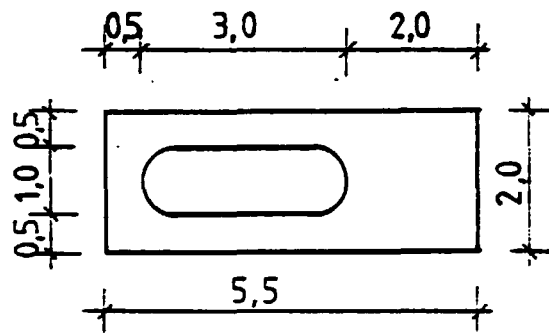
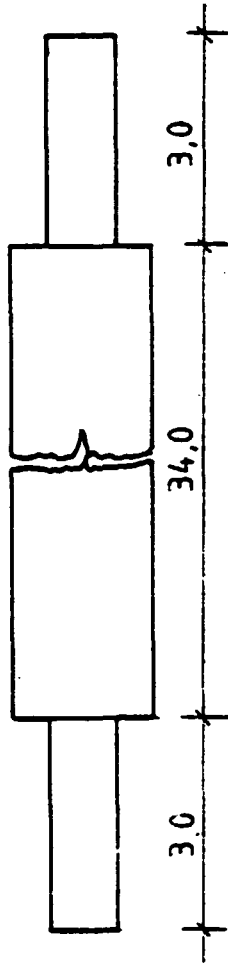


PRODUCT - chair a1 teak	PART - front rail A1	SCALE - 1:1
DESCRIPTION -		DRAWING NO,1
		DRAWN - fuchs 3.85
		CHECK -
		CHANGE -
Surfacing of at least one side must be performed properly.		
DP LAO 81/017 UNIDO 3,85 K. FUCHS		

production end date:			break down:			production start:					
production order no:			issued by:		batch no:	part family: CHAIR A-1/ FRONT RAIL					
no. off.	part no.	finished size			part good	part waste	rough size			jig no.	long
		long	wide	thickn.			long	wide	thickn.		
	CHART 1	40,0	5,5	2,0			42,0	6,1	2,6		
mach. no. material: TEAK WOOD											time used
operation and instruction											
1	CROSS CUT SAW, CUT LENGHT 42,0										
11	MULTIPLE RIP SAW, SPLIT CUT WIDTH 6,1										
20	MOULDER, MOULD TO FINAL SIZE 2,0 x 5,5										
14	DOUBLE CIRC. SAW, FINAL CUT 40,0										
7	ROUND TENONER, SEE WORK DRAWING!										
30	EDGE BELT SANDER, SAND BOTTOM EDGE, BELT GRIT SIZE 100										
32	WIDE BELT SANDER, SAND BOTH SIDES, BELT GRIT SIZE 100										
	TRANSPORT TO INTERMEDIATE STORE I										

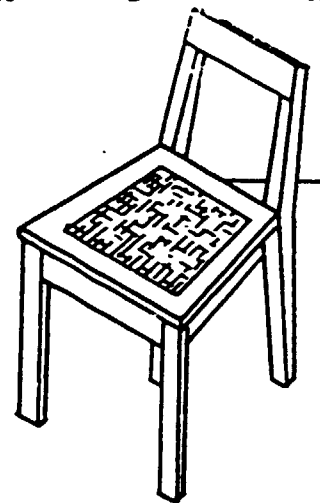
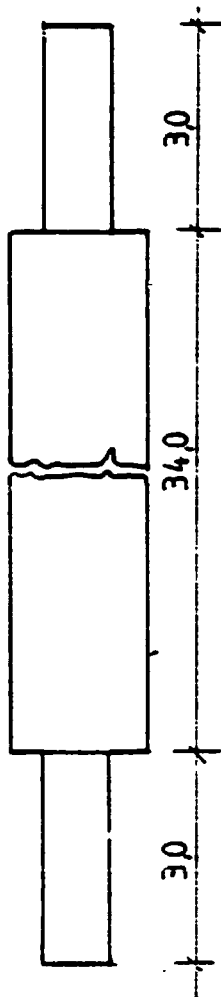


side rail

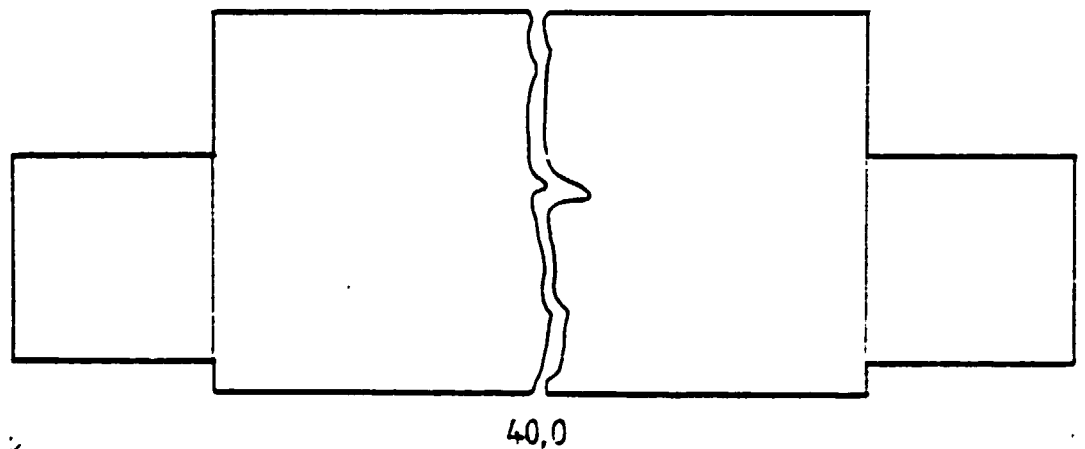
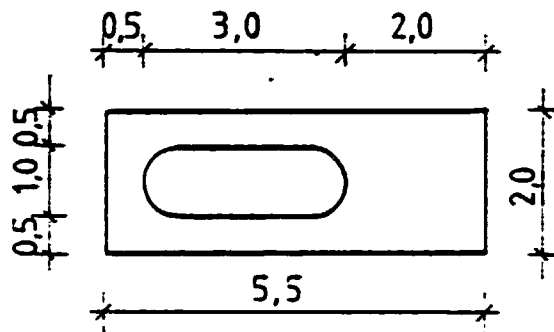


PRODUCT = chair a1 teak		PART = side rail left/right	SCALE = 1:1
DESCRIPTION =			DRAWING NO,2
Surfacing of at least one side must be performed properly			DRAWN = fuchs 3.85
			CHECK =
			CHANGE =
DP LAO 81/017 UNIDO 3,85 K. FUCHS			

production end date:			break down:			production start:			
production order no:			issued by:	batch no:	part family: CHAIR A1/ SIDE RAIL				
no.off	part no	finished size			part good	part waste	rough size		jig
		long	wide	thickn			long	wide	thickn
	CHAIR 2	40,0	5,5	2,0			47,0	6,1	2,6
mach. material: TEAK WOOD									
no.	operation and instruction								time used
1	CROSS CUT SAW, CUT LENGTH 47,0								
11	MULTIPLE RID SAW, SPLIT CUT WIDTH 6,1								
20	MOULDER, MOULD TO FINAL SIZE 20x5,5								
14	DOUBLE CIRC. SAW, FINAL CUT 40,0								
7	ROUND TENONER, SEE WORK DRAWING!								
30	EDGE BOLT SANDER, SAND BOTTOM EDGE, BELT GRIT SIZE 100								
32	WIDE BELT SANDER, SAND BOTH SIDES, BELT GRIT SIZE 100								
	TRANSPORT TO INTERMEDIATE STORE I								

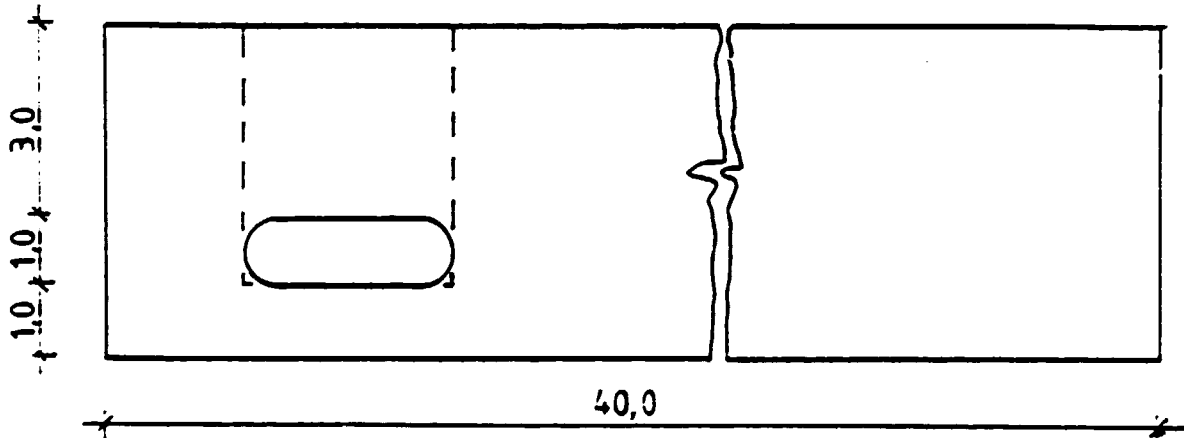
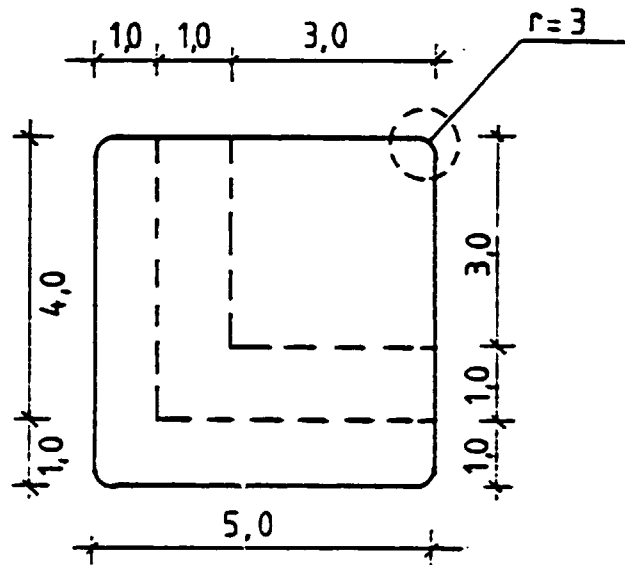
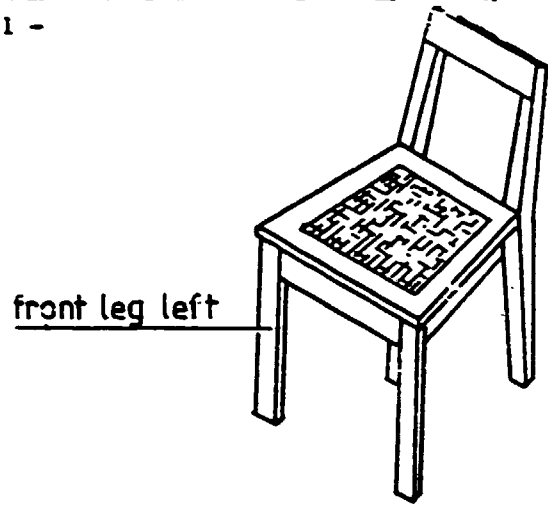
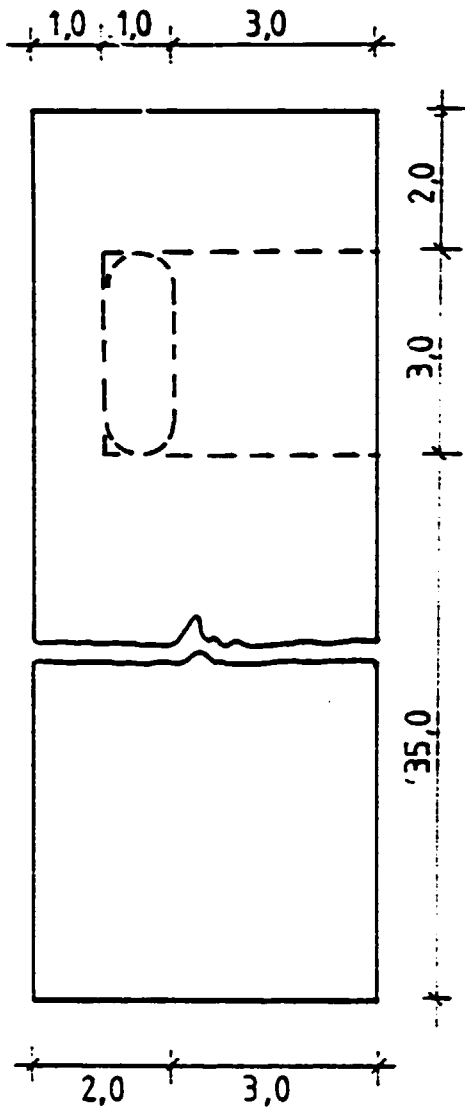


back rail



PRODUCT - chair a1 teak	PART - back rail	SCALE - 1:1
DESCRIPTION -		DRAWING NO, 3
		DRAWN - fuchs 3.85
Surfacing of at least one side must be performed properly		CHECK -
		CHANGE -
DP LAO 81/017 UNIDO 3.85 K. FUCHS		

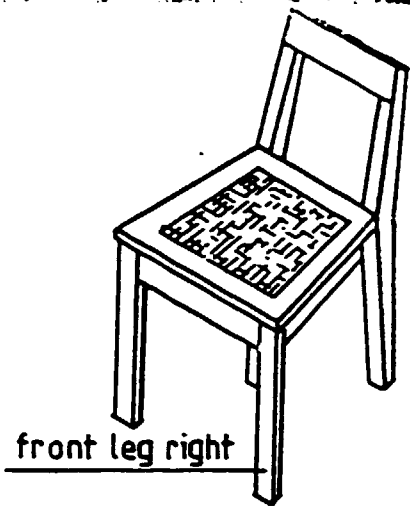
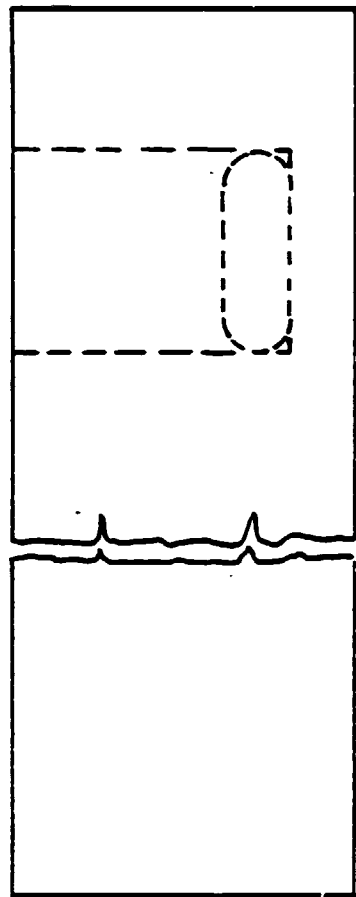
production end date:			break down:			production start:			
production order no:			issued by:	batch no:	part family: CHAIR A1 / BACK RAIL				
no. off.	part no.	finished size long wide thickn.			part good	part waste	rough size long wide thickn.		jig no. long
	CH. ART 3	40,0	5,5	2,0			42,0	6,1	2,6
mach. no. material: TEAK WOOD									time used
operation and instruction									
1	CROSS CUT SAW, CUT LENGTH 42,0								
11	MULTIPLE RIP SAW, SPLIT CUT WIDTH 6,1								
20	MOULDER, MOULD TO FINAL SIZE 2,0 x 5,5								
14	DOUBLE CIRC. SAW, FINAL CUT 40,0								
7	ROUND TENONER, SEE WORK DRAWING!								
20	EDGE BELT SANDER, SAND BOTTOM EDGES, BELT GRIT SIZE 100								
32	WIDE BELT SANDER, SAND BOTH SIDES, BELT GRIT SIZE 100								
	TRANSPORT TO INTERMEDIATE STAGE I								



PRODUCT - chair a1 teak	PART - front leg left	SCALE - 1:1
DESCRIPTION -		DRAWING NO,4
		DRAWN - fuchs 3.85
		CHECK -
		CHANGE -
DP LAO 81/017 UNIDO 3.85 K. FUCHS		

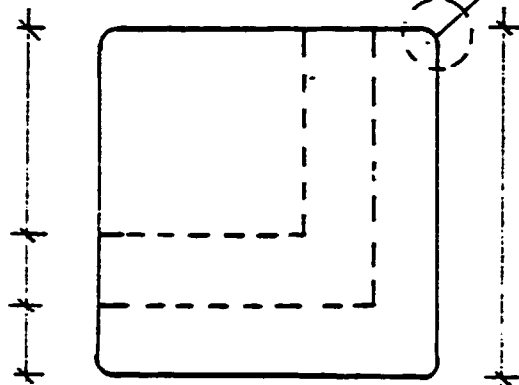
production end date:			break down:			production start:					
production order no:			issued by:		batch no:	part family: CHAIR A1/ FRONT LEG LEP					
no. off.	part no.	finished size			part good	part waste	rough size			jig no.	long
		long	wide	thickn.			long	wide	thickn.		
	CH. A1. T 6	40,0	5,0	5,0			42,0	5,6	5,6		
mach. no.	material: TEAK WOOD										time used
	operation and instruction										
	1	CROSS CUT SAW, CUT LENGTH 42,0									
	11	MULTIPLE RID SAW, SPLIT CUT WIDTH 5,6									
	20	MOULDER, MOULD FINAL SIZE 5,0 X 5,0									
	23	SPINDLE MOULDER, MOULD 4 SIDES WITH PROFILED CUTTER, SEE WORK DRAWING!									
	14	DOUBLE CIRC. SAW, FINAL CUT 40,0									
	9	SLOT MORTISER, SEE WORK DRAWING!									
	30	EDGE BELT SANDER, SAND BEVEL 4 SIDES, LEG BOTTOM SIDE									
	31	WIDE BELT SANDER, SAND 4 SIDES, GAIT SIDE 100									
		HAND SANDING, SAND ROUNDNESS, 4 SIDES, GAIT SIDE 120									
		TRANSPORT TO INTERMEDIATE STORE I									

3,0 1,0 1,0



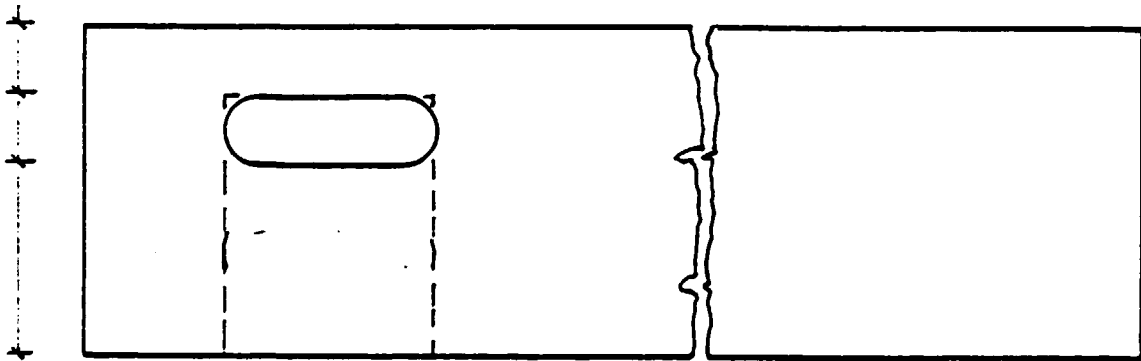
front leg right

3,0 1,0 1,0 r=3



2,0 3,0

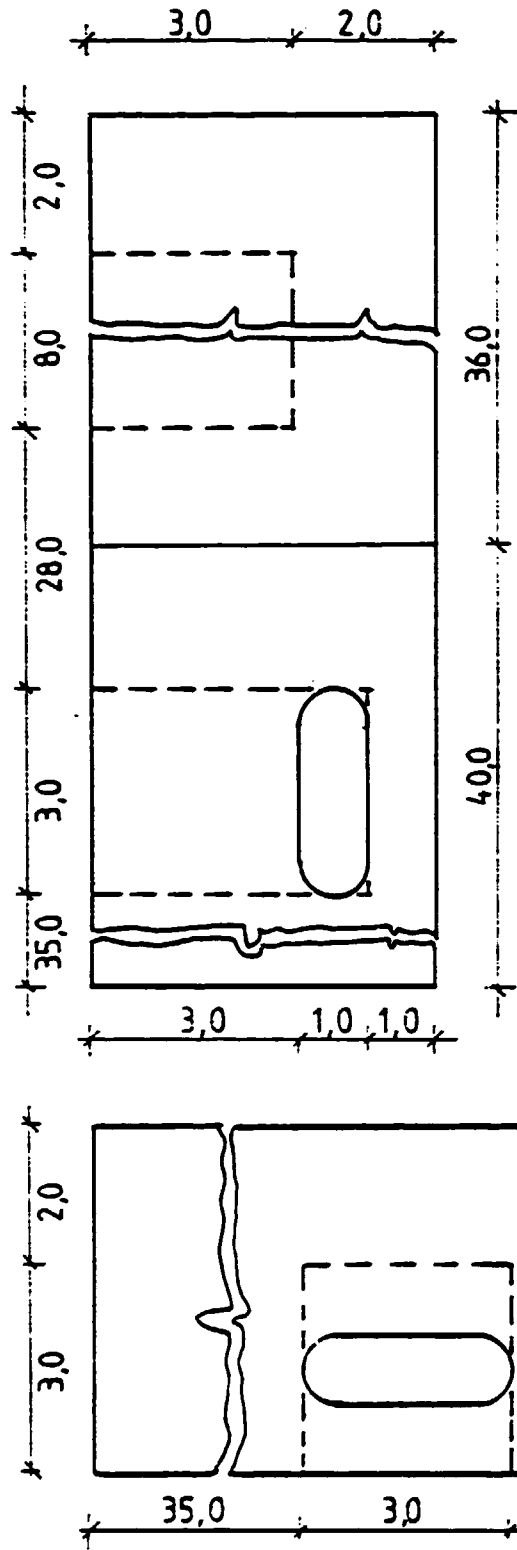
5,0



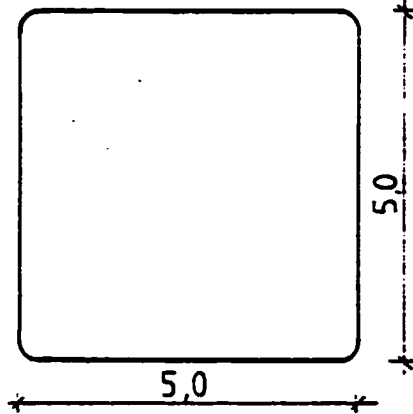
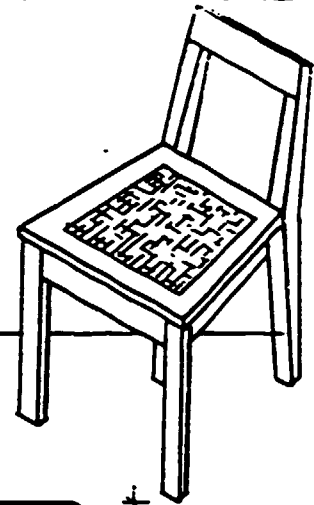
40,0

PRODUCT - chair a1 teak	PART - front leg right	SCALE - 1:1
DESCRIPTION -		DRAWING NO,5
		DRAWN - fuchs 3,85
		CHECK -
		CHANGE -
DP LAO 81/017 UNIDO 3,85 K, FUCHS		

production end date:			break down:			production start:				
production order no:			issued by:	batch no:	part family: CHAIR A1/ FRONT LEG RIGHT					
no. off.	part no.	finished size			part good	part waste	rough size			jig no.
		long	wide	thickn.			long	wide	thickn.	
	CHAIR 5	440	510	510			420	516	516	
mach. no.	material: TEAK WOOD									time used
	operation and instruction									
1	CROSS CUT SAW, CUT LENGTH 420									
11	MULTIPLE 210 SAW, SPLIT CUT WIDTH 516									
20	MOULDER, MOULD FINAL SIZE 510 x 510									
13	SPINDLE MOULDER, MOULD 4 SIDES WITH PROFILE-CUTTER, SEE WORK DRAWING! USE AUTOM. FEED ROLLER									
14	DOUBLE CIRC. SAW, FINAL CUT 400									
9	SLOT MORTISE, SEE WORK DRAWING!									
30	EDGE BELT SANDER, SAND BEVEL, 4 SIDES, LEG BOTTOM SIDE,									
32	WIDE BELT SANDER, SAND 4 SIDES, BELT-GAIT SIZE 100									
	HAND SAMING, SAND EDGE ROUNDNESS, 4 SIDES, GAIT SIZE 120									
	TRANSPORT TO INTERMEDIATE STOCK I									

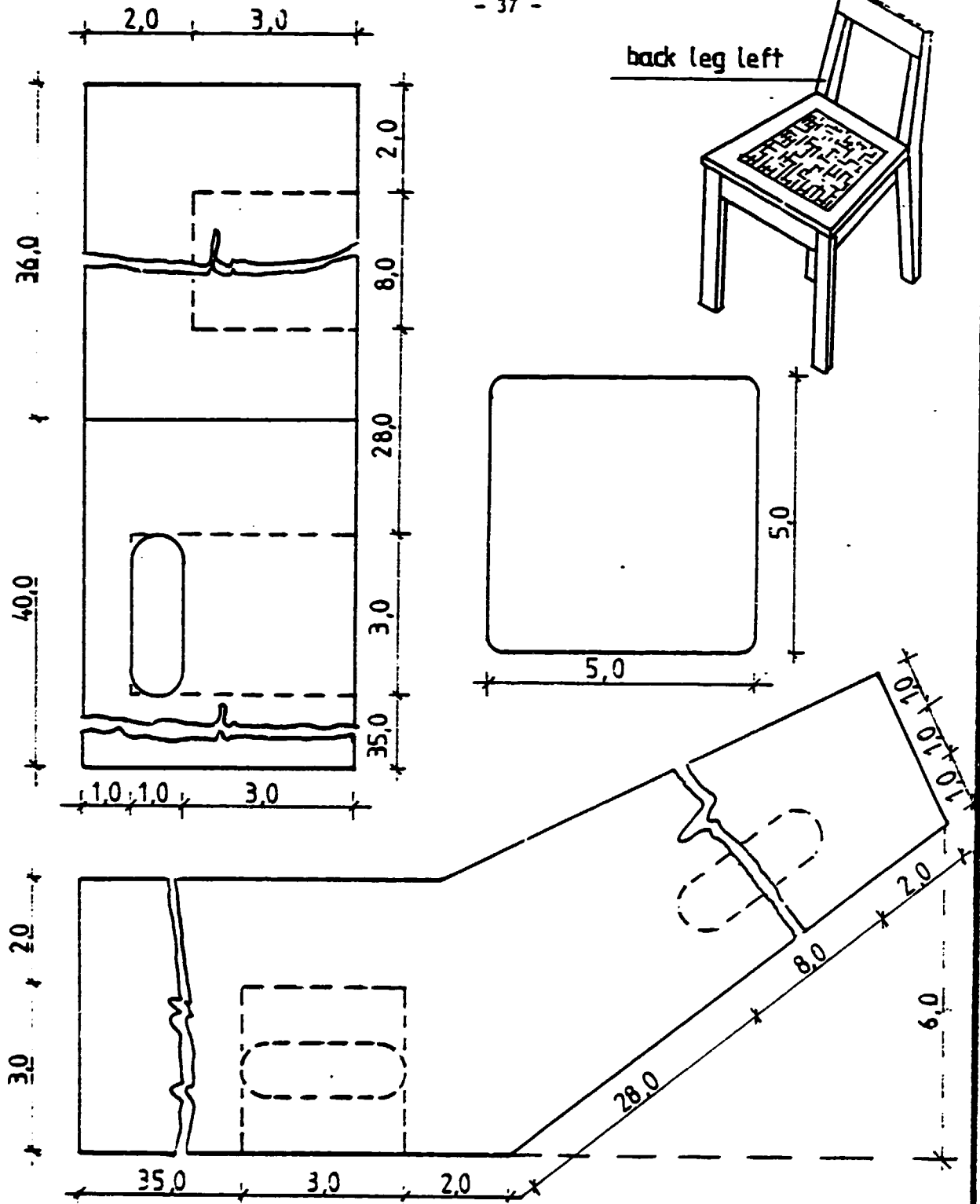


back leg right



PRODUCT - chair a1 teak	PART - back leg right	SCALE - 1:1
DESCRIPTION -		DRAWING NO. 6
		DRAWN - fuchs 3.85
		CHECK -
		CHANGE -
DP LAO 81/017 UNIDO 3.85 K. FUCHS		

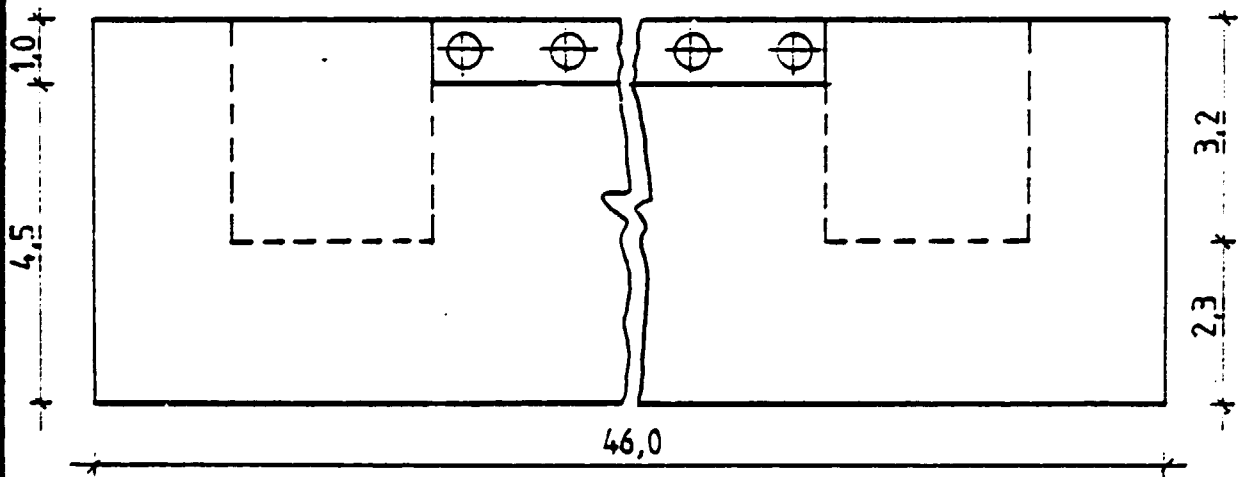
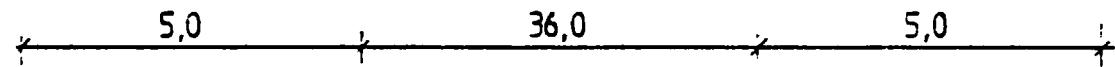
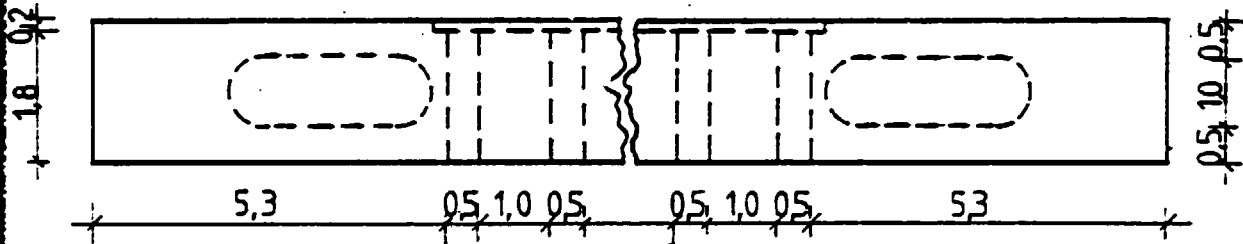
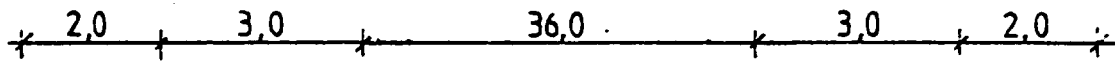
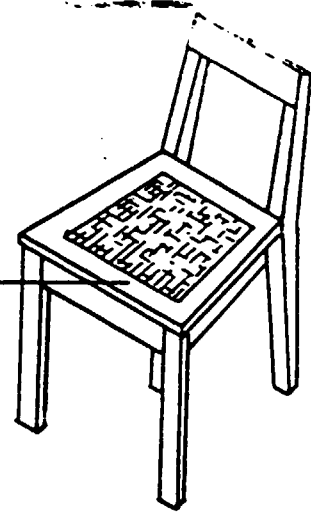
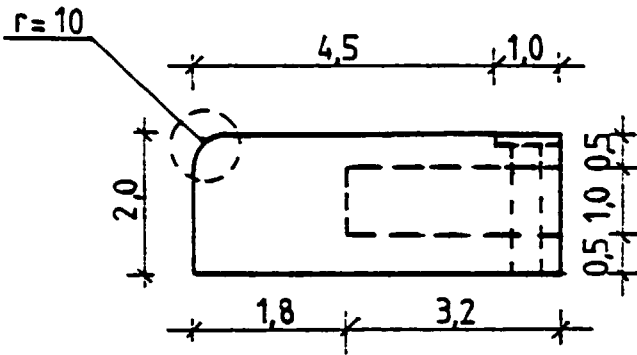
production end date:			break down:			production start:		
production order no:			issued by:	batch no:	part family: CHAIR A1/ BACK LEG RIGHT			
no. off.	part no.	finished size long wide thickn.		part good	part waste	rough size long wide thickn.		jig no. long
	CHAIR 6	76,0	5/3,0	5,0		72,0	10,0	5,6
mach. no.	material: TEAK WOOD							time used
	operation and instruction							
1	CROSS CUT SAW, CUT LENGTH 72,0							
2	JOINTER, PLANE ONE SURFACE							
13	THICKNESSER, PLANE TO FINAL THICKNESS 5,0							
	MAKE STENCIL DRAWINGS, USE BACK LEG MODEL NO. A1							
3	BAND SAW, CUT ACCORDING TO DRAWN LINES							
22	SPINDLE MOULDER, SET THE MOULDER WITH BALL - BEARING AND PLANE HEAD, USE SIG NO. A1 FOR OPERATION.							
14	DOUBLE END SAW, FINAL CUT 76,0, SEE WORK DRAWING!							
9	SLOT MORTISER, MORTISE SLOTS FOR RAILS, SEE WORK DRAWING!							
10	SLOT MORTISER, MORTISE SLOTS FOR BACK REST SEE WORK DRAWING!							
30	EDGE BELT SANDER, SAND 2 SIDES AND BEVEL BOTTOM EDGE, BELT GAT SIZE 100							
31	WIDE BELT SANDER, SAND 2 SIDES BELT GAT SIZE 100							
	HAND SANDING, SAND EDGE TOPSIDE AND 4 SIDES EDGE ROUNDNESS							
	TRANSPORT TO INTERMEDIARY STORE I							



PRODUCT - chair a1 teak	PART - back leg left	SCALE - 1:1
DESCRIPTION -		DRAWING NO, 7
		DRAWN - fuchs 3.85
		CHECK -
		CHANGE -
DP LAO 81/017 UNIDO 3,85 K. FUCHS		

production end date:				break down:			production start:				
production order no:				issued by:		batch no:		part family: CHAIR A1/ BACK LEG LEFT			
no. off.	part no.	finished size			part good	part waste	rough size			jig	
		long	wide	thickn.			long	wide	thickn.	no.	long
	CH. A1.F 7	26,0	3/5,0	5,0			26,0	10,0	5,6		
mach. no.											time used
material: TEAK WOOD											
operation and instruction											
1	CROSS CUT SAW, CUT LENGTH 26,0										
2	JOINTER, PLANE ONE SURFACE										
13	THICKNESSER, PLANE TO FINAL THICKNESS 5,0										
	MAKE STENCIL DRAWINGS, USE MODEL BACK LEG No. A1										
3	BAND SAW, CUT ACCORDING TO DRAWN LINES										
12	SPINDLE MOULDER, SET THIS MOULDER WITH BALL BEARING AND PLANE HEAD, USE JIG No. A1 FOR OPERATION										
14	DOUBLE CIRC. SAW, FINAL CUT 26,0, SEE WORKDRAWING!										
9	SLOT MORTISER, MAKE SLOTS FOR RAILS, SEE WORK DRAWING!										
10	SLOT MORTISER, MAKE SLOTS FOR BACK REST, SEE WORK DRAWING!										
20	EDGE BELT SANDER, SAND 2 SIDES AND REVEL ON TOP AND BOTTOM, BELT GRIT SIZE 100										
12	WIDE BELT SANDER, SAND 2 SIDES BELT GRIT SIZE 100										
	HAND SANDING, SAND TOPSIDE EDGE AND EDGE ROUNDNESS 4 SIDES										
	TRANSPORT TO INTERMEDIATE STORE I										

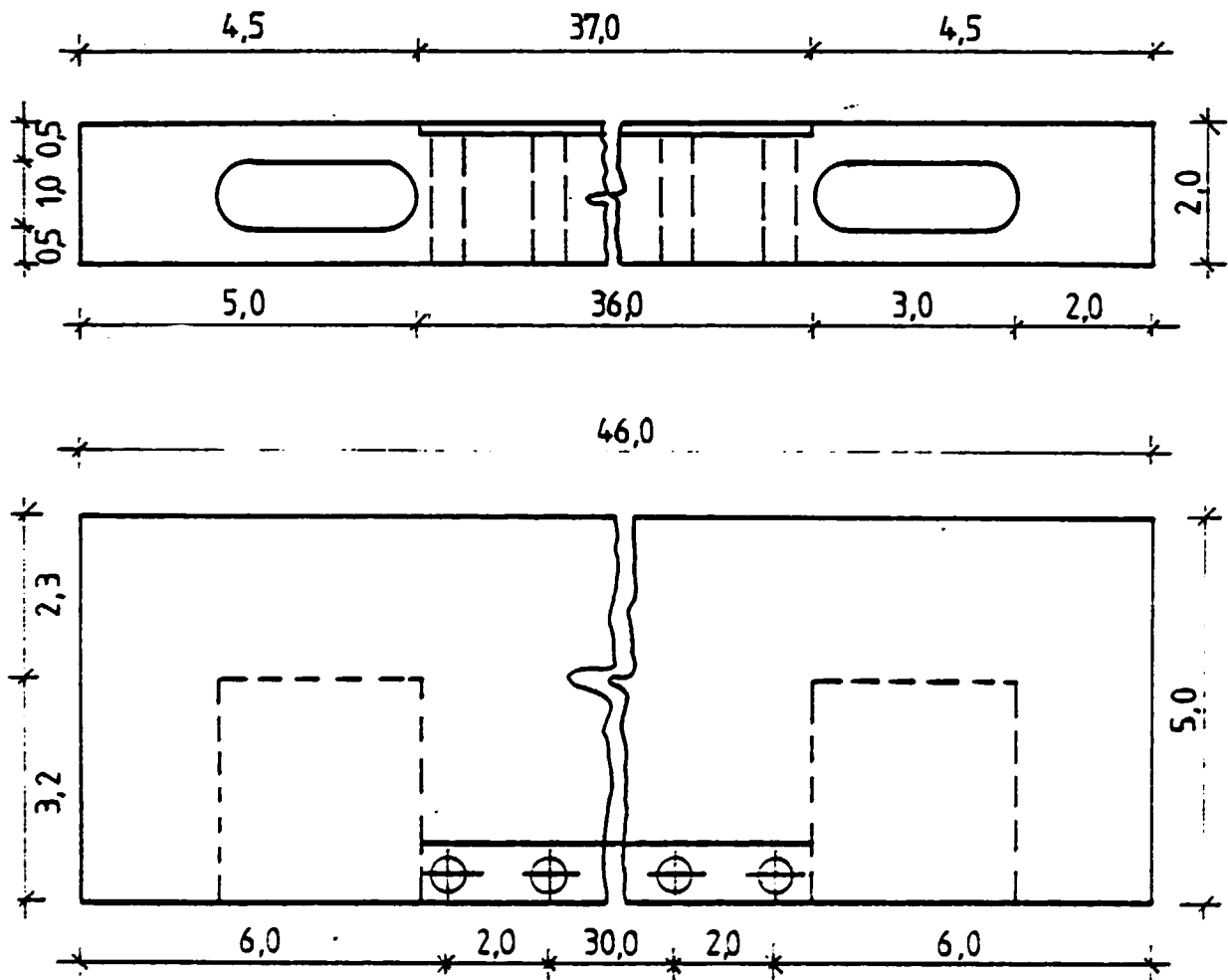
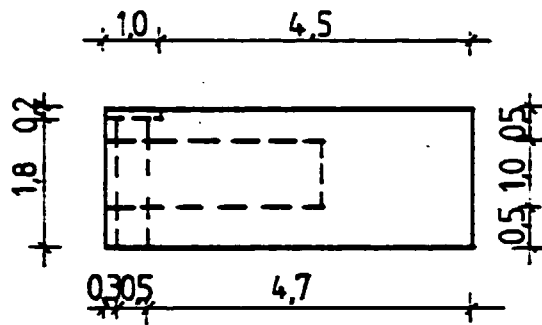
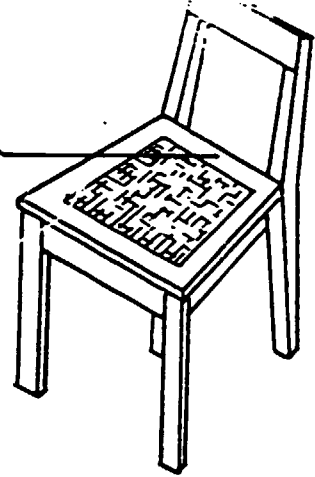
seatframe frontpart



PRODUCT = chair a1 teak	PART = seatframe frontpart	SCALE = 1:1
DESCRIPTION =	⊘ diameter = 5 mm	DRAWING NO. 8
		DRAWN = fuchs 3.85
		CHECK =
		CHANGE =
DP LAO 81/017 UNIDO 3,85 K. FUCHS		

production end date:			break down:			production start:					
production order no:			issued by:		batch no:	part family: CHAIR A1 SEAT FRAME FRONT PART					
no. off.	part no.	finished size			part good	part waste	rough size			jig no.	long
		long	wide	thickn.			long	wide	thickn.		
	CHAIR R	46,0	5,5	2,0			48,0	6,1	2,6		
mach. no. material: TEAK WOOD										time used	
operation and instruction											
1	CROSS CUT SAW, CUT LENGTH 48										
11	MULTIPLE RID SAW, SPLIT TO 6,1										
20	MOULDER, MOULD FINAL SIZE 5,5 = 2,0										
14	DOUBLE CIRC. SAW, FINAL CUT TO 46,0										
23	SPINDLE MOULDER, ROUND ONE EDGE r=10 USE AUTOM. FEED ROLLER										
26	MULTIPLE BORE, DRILL HOLES DIAMETER 5mm SEE WORK DRAWING!										
24	SPINDLE MOULDER, CUT THE REBATE ON TOP SIDE SEE WORK DRAWING! USE BACK STOP!										
9	SLOT MORTISER, MAKE TWO SLOTS SEE WORK DRAWING!										
	TRANSPORT TO INTERMEDIATE STORE										

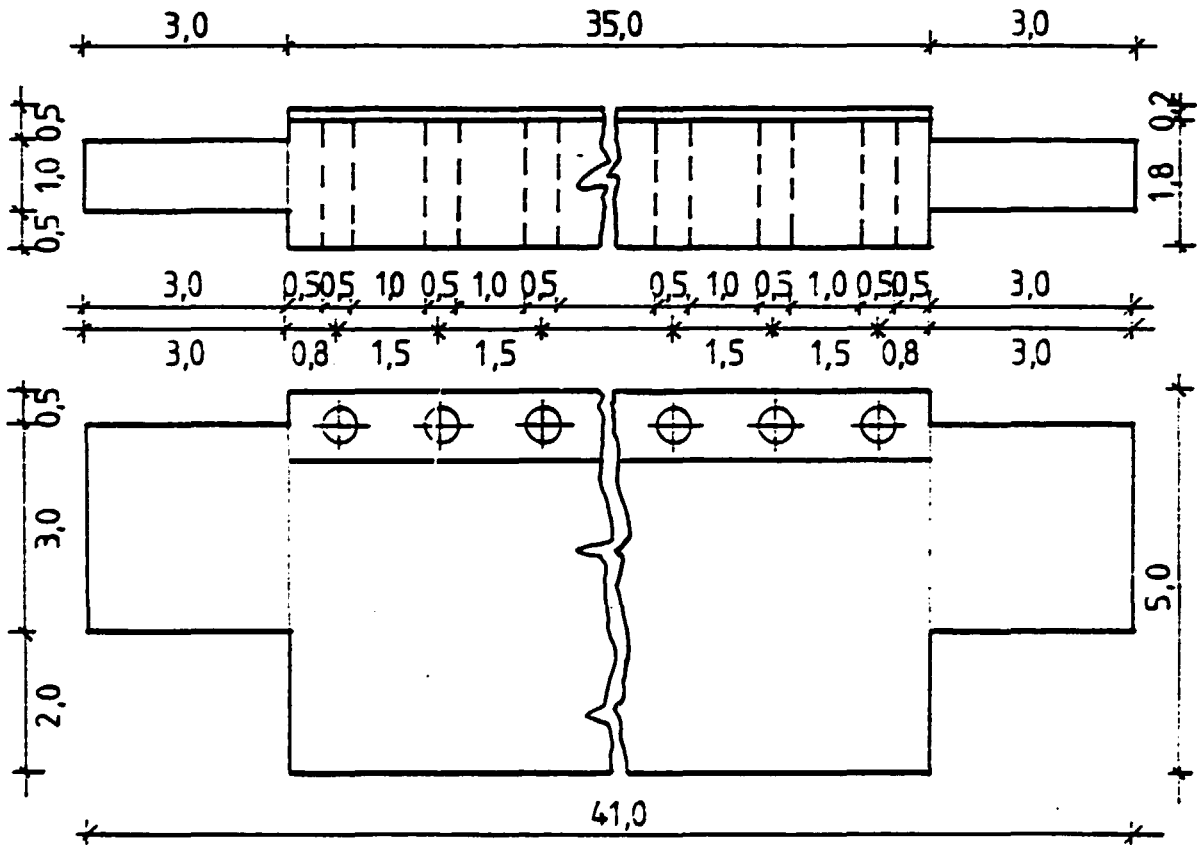
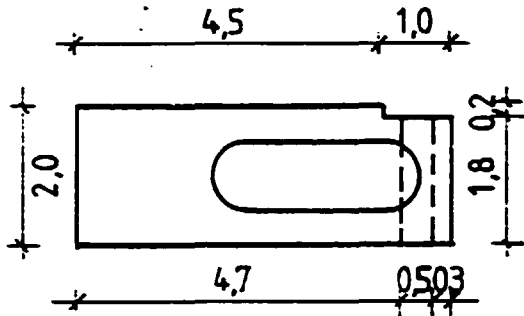
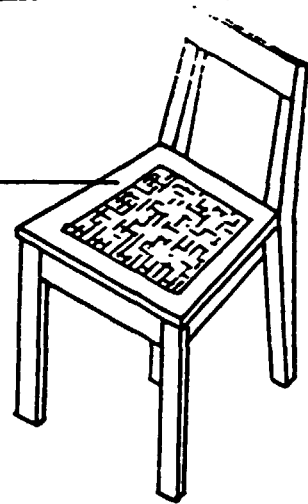
seatframe part-back



PRODUCT - chair a1 teak	PART - seatframe part/back	SCALE - 1:1
DESCRIPTION -	⊕ diameter = 5 mm	DRAWING NO,9
		DRAWN - fuchs 3.85
		CHECK -
		CHANGE -
DP LAO 81/017 UNIDO 3.85 K. FUCHS		

production end date:			break down:			production start:				
production order no:			issued by:		batch no:	part family: CHAIR A1 SEATFRAME PART BACK				
no. off.	part no.	finished size long wide thickn.			part good	part waste	rough size long wide thickn.			jig no. long
	CHAIR 9	46,0	5,5	2,0			42,0	6,1	2,6	
mach. material: TEAK WOOD										time
no.	operation and instruction									used
1	CROSS CUT SAW, CUT LENGTH 42,0									
11	MULTIPLE RIP SAW, SPLIT TO 6,1									
20	MOULDER, MOULD FINAL SIZE 5,5 X 2									
14	DOUBLE CIRC. SAW, FINAL CUT TO 46,0									
23	SPINDLE MOULDER, CUT REBATE ON THE OTHER SIDE, USE BACKSTOP, SEE WORK DRAWING!									
26	MULTIPLE CORE, DRILL HOLES, DIAMETER 5MM SEE WORK DRAWING!									
9	SLOT MORTISER, MAKE TWO SLOTS SEE WORK DRAWING!									
	TRANSPORT TO INTERMEDIATE STORAGE									

seatframe sidepart
left / right



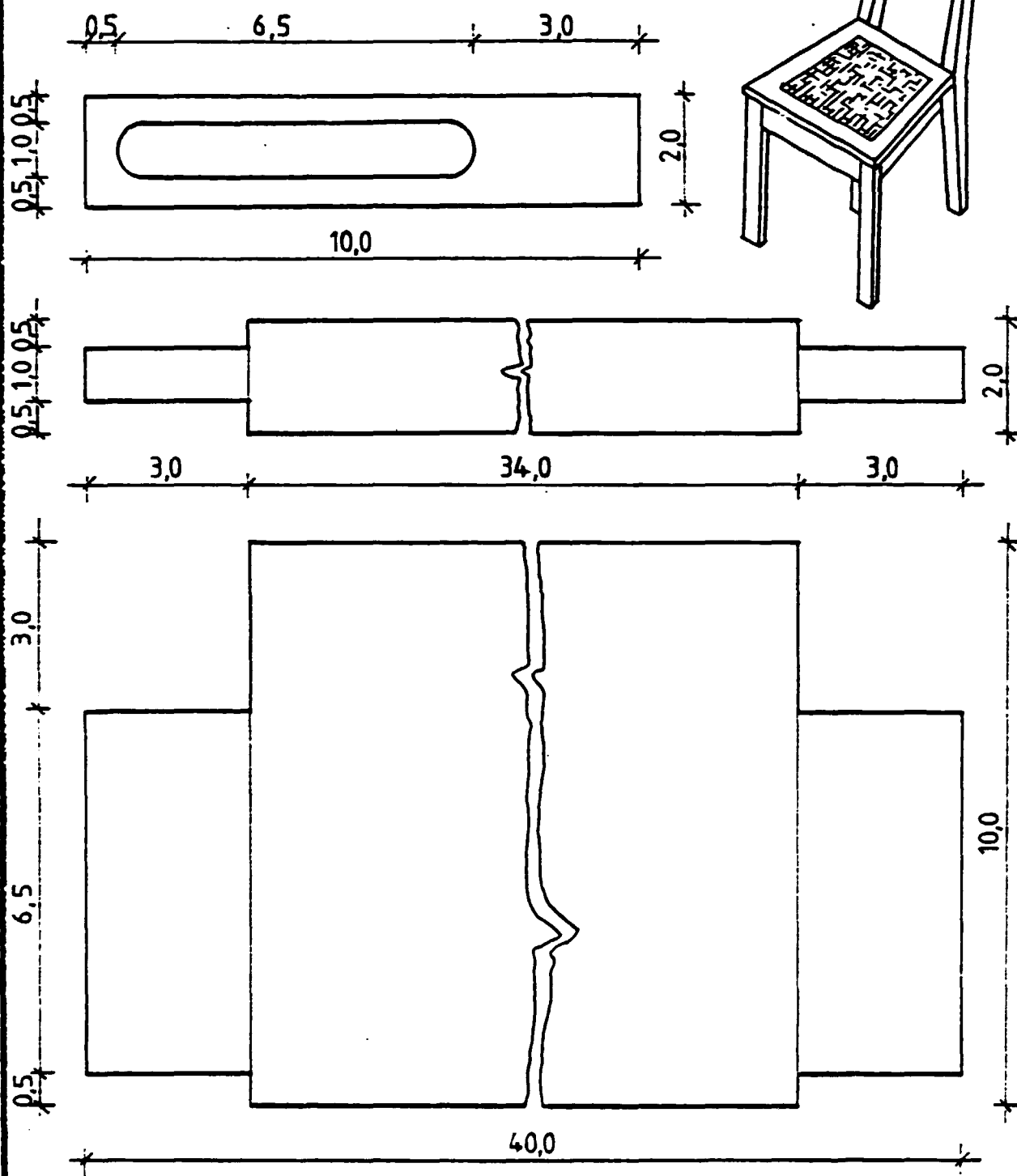
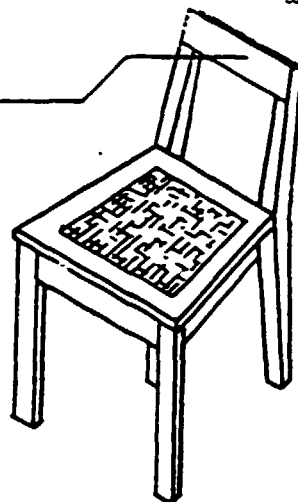
PRODUCT = chair a1 teak	PART = seatframe sidepart	SCALE = 1:1
DESCRIPTION =	⊘ diameter = 5 mm	DRAWING NO. 10
		DRAWN = fuchs 3.85
		CHECK =
		CHANGE =
DP LAO 81/017 UNIDO 3.85 K. FUCHS		

production end date:			break down:			production start:			
production order no:			issued by:		batch no:	part family: CHAIR A1 SEAT FRAME SIDE PART LEFT			
no. off.	part no.	finished size long wide thickn.			part good	part waste	rough size long wide thickn.		jig no. long
	CH. A1.1 10	41,0	5,5	2,0			43,0	6,1	2,6

DOUBLE QUANTITY

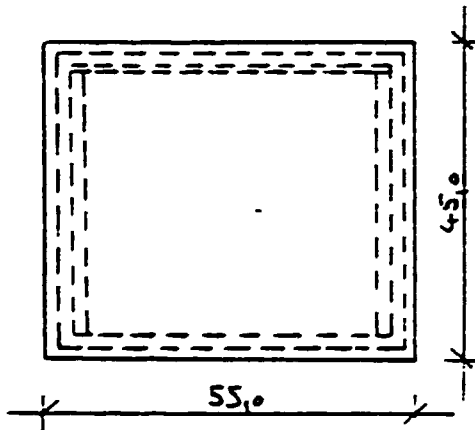
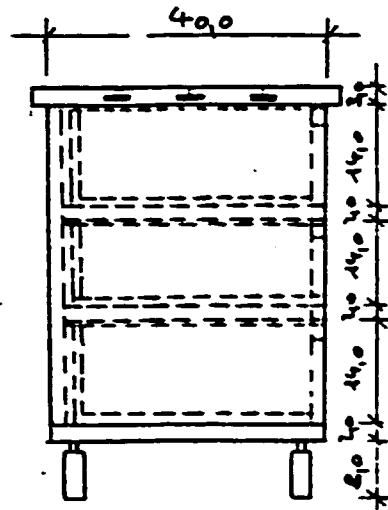
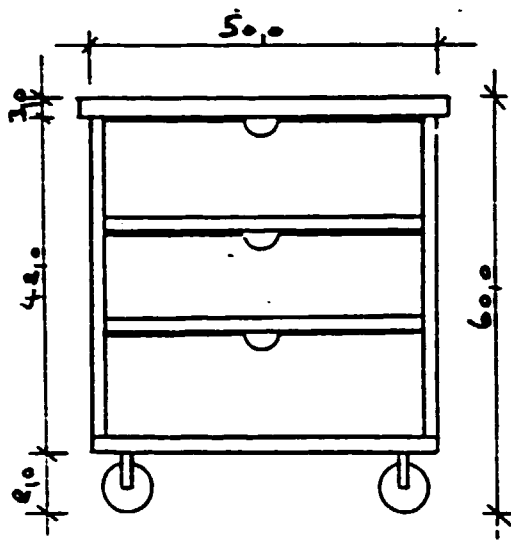
mach. no.	material: TEAK WOOD								time used
	operation and instruction								
1	CROSS CUT SAW, CUT LENGTH 42,0								
11	MULTIPLE RID SAW, SPLIT TO 6,1								
20	MOULDER, MOULD FINAL SIZE 5,5 X 2,0								
14	DOUBLE CIRC. SAW, FINAL CUT TO 41,0								
26	MULTIPLE BORE, DRILL HOLES, DIAMETER 5MM SEE WORK DRAWING!								
13	SPINDLE MOULDER, CUT REBATE ON THE OTHER SIDE, USE AUTOM. FEEDROLLER, SEE WORK DRAWING!								
8	ROUND TENONER, MAKE TWO TENONS, SEE WORK DRAWING!								
	TRANSPORT TO INTERMEDIATE STORAGE								

back rest



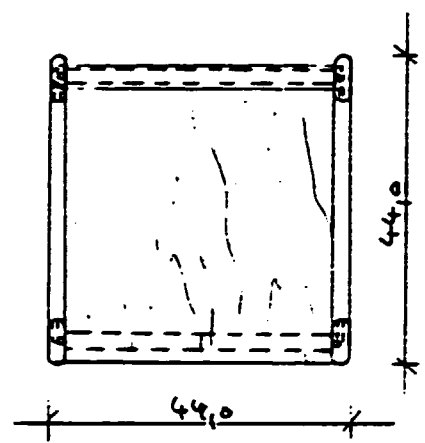
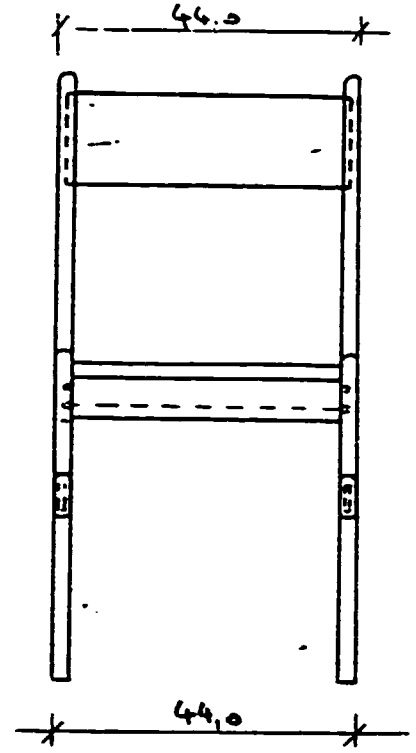
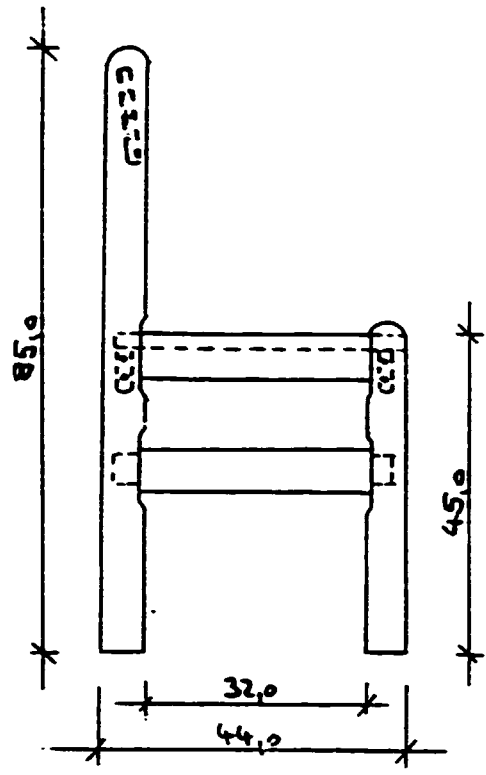
PRGDUCT - chair a1 teak	PART - back rest	SCALE - 1:1
DESCRIPTION -		DRAWING NO,11
		DRAWN - fuchs 3,85
		CHECK -
		CHANGE -
DP LAO 81/017 UNIDO 3,85 K. FUCHS		

production end date:				break down:			production start:			
production order no:				issued by:		batch no:		part family: CHAIR A1 BACK REST		
no. off.	part no.	finished size long wide thickn.			part good	part waste	rough size long wide thickn.			jig no. long
	CHAIR A1	490	190	20			420	196	26	
mach. no. material: TEAK WOOD										time used
operation and instruction										
1	CROSS CUT SAW, CUT LENGTH 420									
11	MULTIPLE RID SAW, SPLIT TO 20,6									
20	MOULDER, MOULD FINAL SIZE 20,0 x 20									
14	DOUBLE CIRC. SAW, FINAL CUT TO 490									
8	ROUND TENONER, MAKE TWO TENONES, SEE WORK DRAWING!									
30	EDGE SANDER, SAND TWO EDGES BELT GRIT SIZE 100									
32	WIDE BELT SANDER, SAND BOTH SIDES BELT GRIT SIZE 100									
	HAND SANDING, BEVEL THE EDGES GRIT SIZE 120									
	TRANSPORT TO INTERMEDIATE STORE									



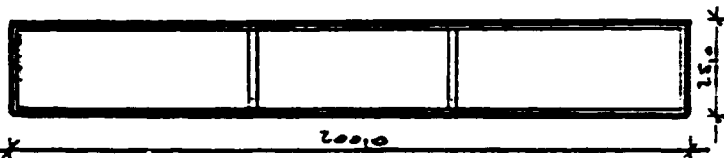
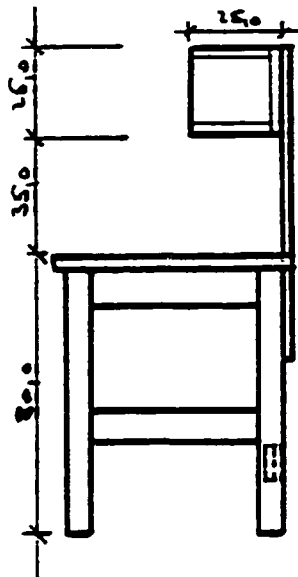
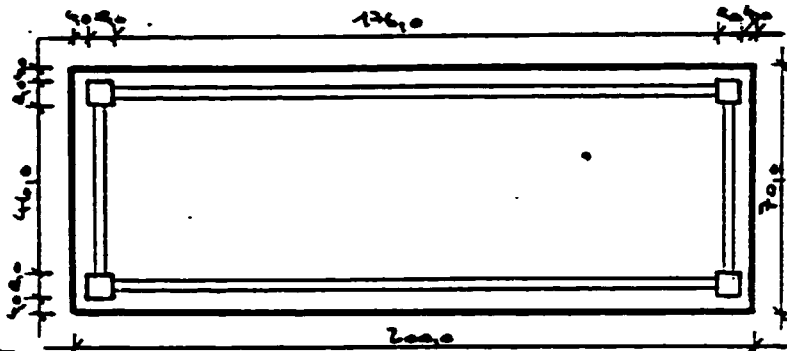
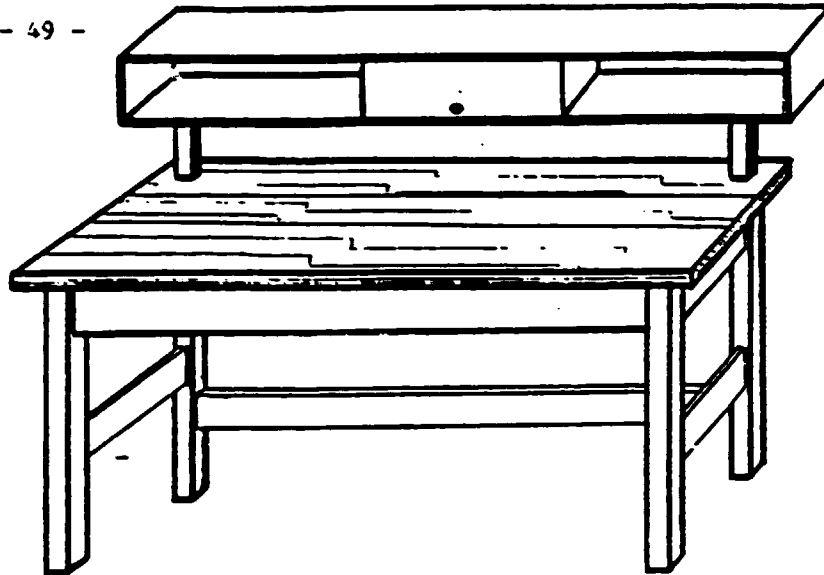
TOP: SOLID WOOD
 CORNERS AND DRAWERBOXES
 MADE OF PLYWOOD 2.0 CM

PROJECT: ROLL-FRONTED TOOL BOX/MAINTENANCE	PART:	SCALE: 1:10
DESCRIPTION:		DRAWING NO.:
		DRAWN: FUCHS 1.02.69
		CHECK:
		CHANGE:
CP. SAC 81/217 11.1.6 5.01 K. WIGGS		



PROJECT: CHAIR / TYPE EXPORT PART:		SCALE 1:10
DESCRIPTION:	NEW DESIGN A=12	DRAWING NO.:
		DRAWN: FUCHS 2.10.84
		CHECK:
		CHANGE:
SP. IAC 21/217 17.1.84 F. F. K. FUCHS		

ANNEX VIII



TOOL CHEST: MADE FROM PLYWOOD 20mm
 TABLE TOP: MADE FROM PLYWOOD 2x20mm=40mm
 TABLE CONSTRUCTION: MADE FROM HARD WOOD

PROJECT: WORK TABLE/TOOL CHEST PART:		SCALE 1:20
DESCRIPTION:		DRAWING NO:
WORKING TABLES FOR ASSEMBLY SHOP		DRAWN: FUCHS 4.02.69
		CHECK:
		CHANGE:

ANNEX IX

PROGRAMME FOR A STUDY TOUR TO CZECHOSLOVAKIA

Six Lao wood technicians should participate on a three week tour to visit a:

- Furniture factory manufacturing with solid wood,
- Plywood factory,
- Panel factory,
- Factory producing upholstered furniture,
- Factory producing doors and windows,
- Factory manufacturing with bentwood,
- Wood research institute,
- Specialized consulting and engineering firm.

