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ASSISTANCE IN THE ESTABLISHMENT  
OF A PILOT FURNITURE PLANT

DP/DRK/86/011

THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

Technical report: Training manual on panel sizing\*

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

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\* This document has not been edited

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PREFACE

This training manual is one of a series prepared by a UNIDO Furniture Production Expert, Radmilo Malis, while serving as Chief Technical Adviser of a UNDP financed and UNIDO executed project in the People's Democratic Republic of Korea, to assist in the establishment of a Pilot Furniture Plant in Pyongyang (Project DP/DRK/86/011).

This manual deals with panel sizing.

The manuals were written to achieve two major goals, first: to give trainees a broader view of an industrial system and second: to serve as a practical guide to machine operators and assemblers, thus enabling them to better perform their duties.

A particular attention has been devoted to materials and their proper utilization, to the design and quality of products, to the organization of the work areas and to safety measures.

The description of the machines is based on those bought for the Pilot Furniture Plant.

These manuals have been written in such a way that they can also apply to other similar factories.

The entire scope of the training envisaged to be given, with the intended audience for each topic is given in Annex I.

The syllabus, namely the topics, the duration of lectures (theory) and practical work and the level of competence attained after completion of the course on this topic is given in Annex II.

1. Introduction

Panel sizing is the first processing operation in manufacturing case furniture. Though simple, this operation is very important for the optimal utilization of raw materials, and, therefore for an economical production. The following is intended to train machine operators to properly perform panel sizing operations.

2. Cutting list and utilization of boards.

The cutting list for panel sizing is a production documents containing specified rough cut parts. It shows the quantity and sizes (net and gross dimensions), as well as the grade, thickness and dimensions of panels to be cut (see fig. 1).

The cutting list contains the date of issue, the number of the job order, the name of the parts, the code of the parts, the code of the drawing, the quantity (number of pieces) of parts, the dimensions, thicknesses and grades of the boards to be cut into parts, the net sizes and volumes of parts, the gross sizes and volumes of parts, the quantity of all parts (in cubic meters), the name and the department (person) who prepared it, the name and the department (person) who approved it, the name of the operator who completed the job order.

On the right side of this form, there are columns for evidence of the number of parts actually produced and the date. Totals are given for the columns where appropriate. The form gives information for cutting and evidence of the work done. The panels are the largest expense in the production of case furniture and knowledge and care is needed to get a maximum yield and an adequate quality.

A board sawing scheme must be attached to the panel cutting list. It is a production document indicating the way in which the panel should be sawn, the number of boards to be cut and the number of pieces for each size to be produced. See fig. 2.

PYONGYANG WOOD PROCESSING COMPLEX  
Pilot Furniture Plant

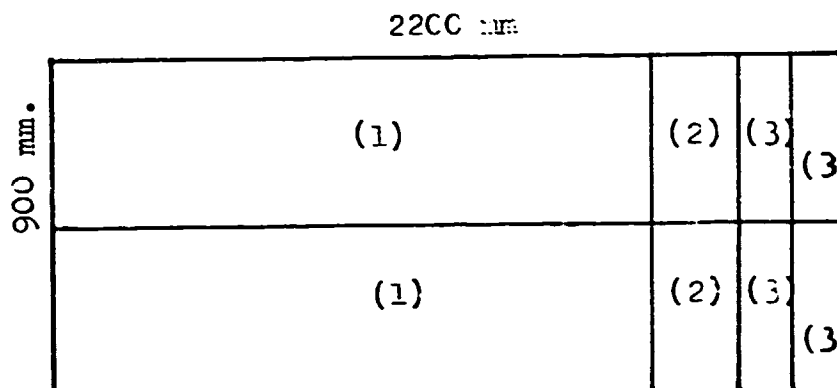
Date of issue \_\_\_\_\_  
Job order No. \_\_\_\_\_

**CUTTING LIST**

No.	Name of parts				Quality	Material	Net size mm			Gross size mm			Net m <sup>3</sup> --- Pcs.	Cut out <u>date</u> pcs			Tot. pcs
							L	W	Th	L	W	Th					
1.																	
2.																	
3.																	
4.																	
5.																	
6.																	
7.																	
8.																	
9.																	
<b>Total:</b>																	
Prepared by: Date:		Approved by: Date:				Operators: 1. 2. 3.						m <sup>3</sup> of panels cut					

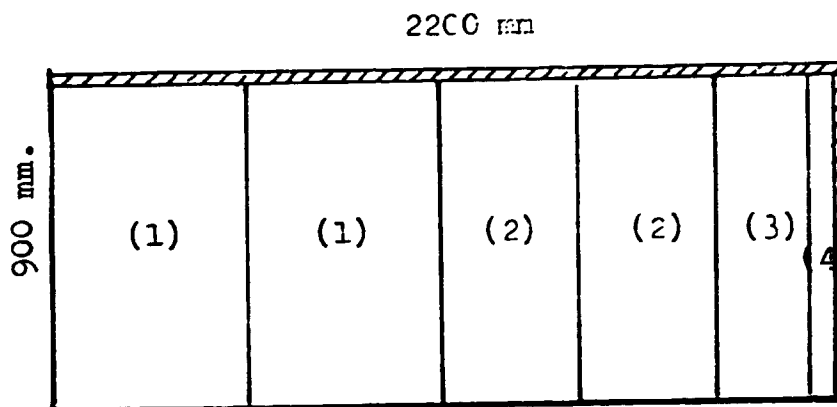
Fig. 1: Cutting list for panel sizes.

Example 1



Material: Particle board 2200/900/19mm - 100 pieces  
 Cut parts: (1) Door 1643/449/19mm - 100 pieces  
 (2) Drawer front 161/449/19mm - 100 pieces  
 (3) Drawer front 235/448/19mm - 200 pieces

Example 2:



Material: Particle board 2200/900/19 mm - 200 pieces  
 Cut parts: (1) Shelf 855/558/19 mm - 400 pieces  
 (2) Shelf 855/388/19 mm - 200 pieces  
 (3) Shelf 855/288/19 mm - 400 pieces  
 (4) Footing front 855/ 70/19 mm - 200 pieces

Fig. 2: Panel sawing schemes.

Since the scheme represents the pattern of sawing giving maximum yield, it must be adhered to by the operators on the panel sizing machine. The work preparation unit is in charge of the preparation and issuance of the cutting list and the panel sawing scheme. The net sizes of parts are taken from the detailed drawings. To get gross sizes, the net sizes are increased by 15 mm in each direction for post-veneering squaring up operations. The kerfs must also be taken into consideration when preparing the panel sawing scheme.

The sizes of wood based panels can vary depending on the type of panels and on technological conditions. The most common sizes of particle board on the world market vary from 120 to 130 cm and 180 to 190 in width and 240 to 600 cm in length. The size of particle boards produced in the Pyongyang Wood Processing Complex is 90 x 220 cm. Larger sizes of panels have a higher yield, and a variety in sizes of parts result in a higher utilization of panels as well. For this reason, it is advisable to have only one place for panel sizing for the company's needs. In this way, waste is minimized. The preparation of the panel sawing scheme is creative work which requires good experience and a creative way of thinking. Today, software programmes exist to optimize cutting and, many companies use computers for preparing optimal panel sawing patterns, and panel sizing machines are programmed to cut panels in accordance with these programmes.

### 3. Panel sizing machines

The selection of a panel sizing machine mainly depends on the capacity required. For a production rate of 5 to 10 cubic metres of panels per day, it is sufficient to have a circular saw with a sizing carriage supporting the panels while sawing. The machine should be operated by three workers, one operator and two assistants. This machine can also be used for other operations if necessary.

For a production rate of 8 to 15 cubic meters per day, the vertical single blade panel sizing machine is frequently used. The machine has a structure to support the pack of panels positioned edgewise. An overhead vacuum grip can be used to pick up the single panels and position them on the machine. The single blade is guided by an arm for lengthwise and crosswise sawing. Two workers can operate this machine, an operator and an assistant.

Higher production rates require high capacity machines with one or more sawing units. The sawing packs are positioned either on a fixed table and sawn with moving blades or on a travelling table moving in two directions. There are three well known systems of such machines:

1. A machine equipped with multiple blades for lengthwise sawing of a panel pack and with a top sawing unit for crosswise sawing.
2. A machine with a single blade sawing unit swivelling by 90° for lengthwise and crosswise sawing.
3. A sizing line of two units of which the first is usually used for lengthwise and the second for crosswise sawing. The entire pack or the single strips are moved by a conveyor after lengthwise sawing. Automatic loaders and unloaders can be used for the packs of panels. This panel sizing line can be controlled mechanically or by a numerical programme. The number of workers can be one to three, while productive capacity, which varies according to the type of sizing and the batch size, can be 20 to 100 cubic meters per day.



The basic technical data for the selection of a panel sizing machine are:

- maximum width of work piece,
- maximum distance between two circular blades,
- minimum distance between two circular blades,
- number of circular blades,
- diameter of circular blades,
- diameter of bore of circular blades,
- maximum depth of sawing,
- cutting speed (rpm),
- feed rate (m/min),
- power requirements,
- overall dimensions,
- weight.

Make, brand, type, year of production and the name of the machine are important data for the identification of the equipment (eg. when ordering spare parts). Since the panel sizing machine for the Pilot Furniture Plant has not yet been identified, the detailed description of its construction and particular features cannot be given before the machine is chosen.

#### 4. Characteristics of circular sawblades.

Circular sawblades are the only working tools for the panel sizing machines. Circular blades are chosen according to the material to be sawn and the way of feeding. Wood based panels are produced with synthetic glues that cause rapid wear of tools. Therefore, it is recommended to use circular saw blades with carbide tips. If carbide tipped sawblades are not available, high speed steel circular sawblades must be used.

The diameter and bore of the circular sawblade is predetermined by machine. The form, pitch and parameters of the teeth should be chosen according to the material being sawn. The thickness and set of teeth should be selected in accordance with the diameter of the blade, the thickness of sawing and the feed rate. The diameter of a circular sawblade must be related to the maximum depth of sawing.

In the case of carbide tipped teeth, the KV form of teeth should be chosen for panel sizing, but the NV form is also acceptable when high speed steel blades are used as well as for manual feeding.

In order to select proper tools, catalogues of tool producers should be used as a guide. The following parameters for circular saw blades for panel sizing operations can be recommended as a guidance:

Form of teeth	KV	NV
Diameter of sawblade "D" (mm)	300-700	200-500
Tooth pitch "t" (mm)	0.06D	0.07D
Tooth height "h" (mm)	0.5t+2	0.5t+1
Thickness of blade "s" (mm)	0.1D	0.1D
Set of teeth "Δs" (mm)	0.3s	0.2s

	$\sqrt{d \cdot 5D}$	$5\sqrt{D}$
Diameter of tightening plates	20	35
Clearance angle $\alpha^\circ$	50	40
Wedge angle $\beta^\circ$	20	15
Rake angle $\delta^\circ$	3	2
Gullett radius "R" (mm)		

Levelling, tensioning and sharpening of circular saw blades are of utmost importance for their correct operation.

Sawblades with blunt teeth must first be cleaned from the resins stuck on the surface. After cleaning, they should be levelled and all lumps should be removed for the blade to be as flat as possible. The third operation is tensioning. When tensioning is done correctly, the blade will run without wobbling and fluttering and saw in a straight line.

If the teeth have to be set, this must be done before sharpening since this is the last operation for preparing sawblades.

Proper tool maintenance is important for many reasons. Dull tools cause harmful vibrations of the axle. The danger of accident is diminished when the tools are well maintained. Energy consumption increases with dull tools. Workers must push the workpiece harder against the vibrating and dull tools. A dull tool tends to tear the fibres of the wood resulting in poor quality of the surface.

It is very important to sharpen tools before they become too dull. In particular, expensive tungsten carbide-tipped tools should be sharpened when they are still in a good working condition. Using dull tools too long shortens their life and increases the wear of the grinding wheels. Regular and frequent sharpening saves tool material and lengthens the life of tool grinding machines. It is usually better to sharpen tools too often than too seldom.

All sharpened tools, especially carbide tipped tools, must be stored in separate wooden boxes. Proper boxes must always be used for moving tools from a place to another.

The saw operator should know how to check the circular sawblade before setting it on the machine. He should return sawblades which are not correctly prepared to the sharpening shop and use only correct ones.

In ordering circular sawblades, the following important details must be specified:

- the type of the sawblade
- the diameter "D" (mm)
- the kerf "B" (mm)
- the size of bore "d" (mm)
- number of teeth "Z"
- material to be cut
- the revolutions per minute (rpm)
- the rate of feed (m/min)
- mechanical or manual feeding.

Circular sawblades with carbide tipped teeth have a limited peripheral speed, and the maximal speed of cutting must not exceed 60-80 m/sec. The cutting speed ( $v$ ) depends on the diameter of the sawblade ( $D$ ) and the number of rotations ( $n$ ).

$$v = \frac{D\pi n}{60000} \text{ (m/sec)}$$

$v$  - cutting speed (m/sec)  
 $D$  - diameter of sawblade (mm)  
 $n$  - number of rotations (rpm)  
 $\pi$  - 3.14

The circular sawblade with its elements is shown in fig. 3 and the elements of a circular sawblade's teeth are shown in fig. 4. The method for checking the tension of a circular sawblade is shown in fig. 5.

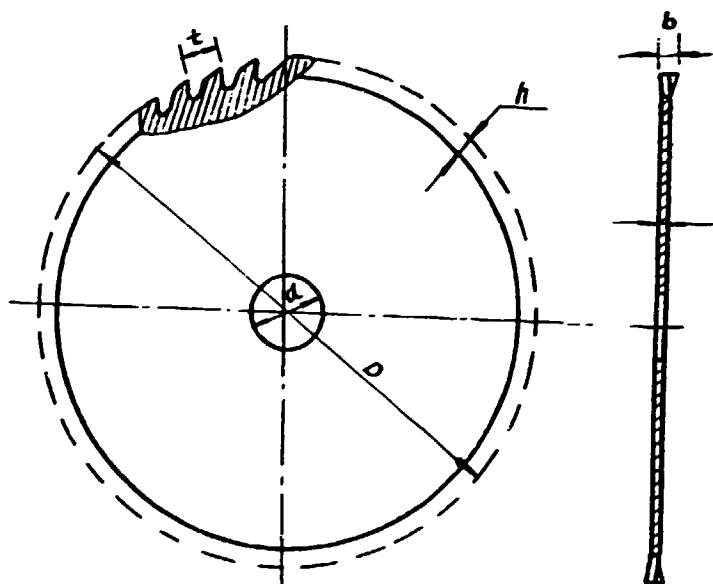


Fig. 3: Circular saw blade and its elements

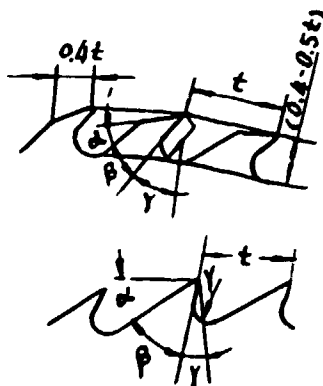


Fig. 4: Teeth elements of a circular saw blade.

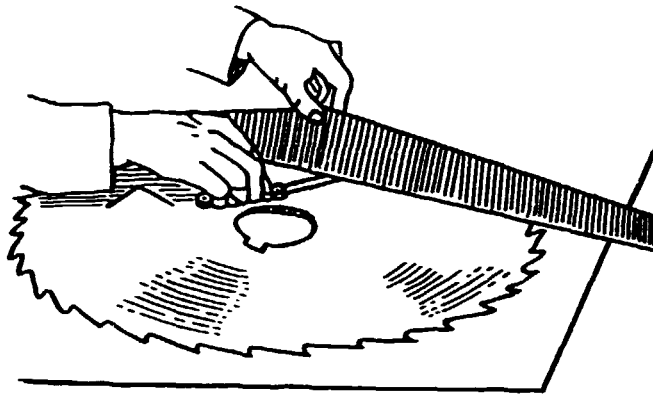


Fig. 5: Controlling tension of a circular saw blade

#### 5. Organization of work area

The purpose of organizing the work area is to allow a higher productivity and maximum safety in production.

The organization of the work area for the panel sizing operation determines the position of the raw material (panels to be cut), cut parts and waste with respect to the position of the machine. The basic principle is avoiding unnecessary movements of the operator or his assistants.

The organization of the work area depends on the type of panel sizing machine available and on the type and size of the panels to be cut. In the case of the Pilot Furniture Plant, a simple panel sizing machine with a sliding table and two sawbaldes will be used. In such a case, the wood is cut lengthwise first, then crosswise since the cut strips have to be turned.

The panels to be cut are placed on the right hand side of the operator, so that when the sliding table is pulled back the panels can be easily loaded on it. The dead roller conveyor is placed next to the fixed side of the machine. The container for wastes can be located at the outgoing side of the machine, to the left of the assistant, and the pallets for the sized parts can also be placed on the left hand side of the assistant. Assuming that internal transport with pallets and hand-lifting jacks is available, the organization of the work area could be as per fig. 6. A small dead roller conveyor will be very suitable for returning lengthwise cut strips for crosswise cutting.

When the required quantity of a certain size of parts is achieved, the pallet should be taken to the next work station, thus freeing the place for more parts to be produced.

The proper illumination, heating, air circulation as well as an efficient dust extraction system are all part of a good organization of the work area. A small cabinet for tools, production documents and measuring instruments should also be placed next to the machine. Safety measures and protective devices, which are a very important factor in the organization of the work area will be explained further in the text.

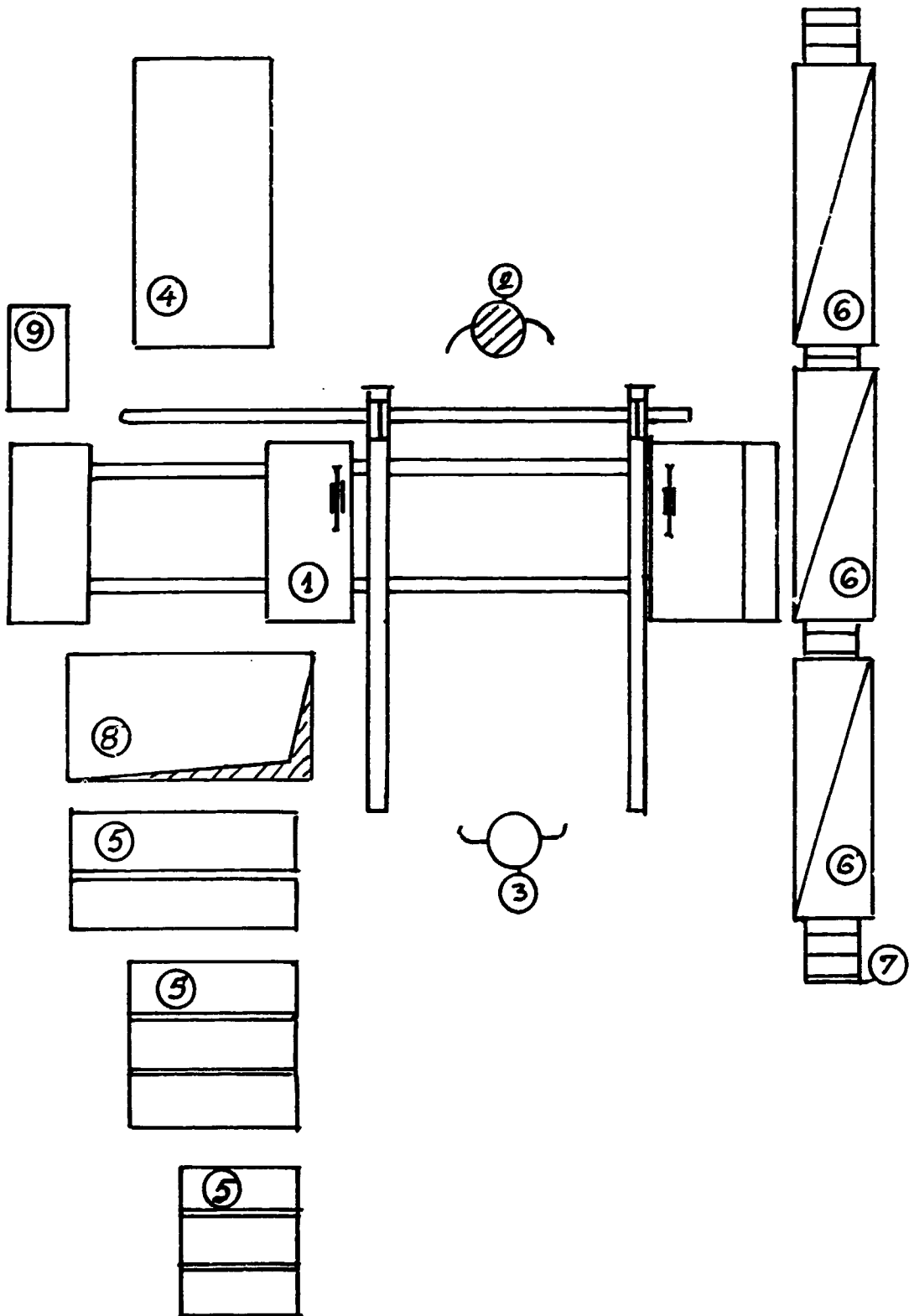


Fig. 6: Organization of work area for panel sizing operations, where:  
(1) Panel sizing machine; (2) Operator; (3) Assistant;  
(4) Panels to be cut; (5) Parts cut to sizes;  
(6) Lengthwise cut strips returned for crosswise cutting;  
(7) Dead roller conveyer; (8) Container for waste;  
and (9) Cabinet for tools, measuring instruments and documents.

6. Performing panel sizing operations

Before starting production work, the operator must do the following:

1. Check the documents (cutting list and sawing pattern), to see if everything is clear and precisely defined. If not he must request their completion.
2. Check the material brought for cutting: size, thickness, quality and quantity. If it is not adequate it is better to report to the foreman than to start cutting the wrong material.
3. Check the sawblades for their proper maintenance. He must not start work with tools which are not properly maintained since it is dangerous to himself as well as harmful for the machine and the material.
4. Check the machine in general by watching electrical instruments and listening to sound out any possible irregular vibrations and overheating. Should any abnormality be noticed, the operator must report to his supervisor and request a maintenance service.
5. Check the lubrication of the machine, and whether the V-belts are properly tightened with the proper number and size (avb: of what?).
6. Check all the protective devices (riving knives, protective top guards, etc.) for their proper fixing.
7. Have all unnecessary material or waste in the work area cleared away before starting work on the machine.

The most important duty of the operator is to set both the machine and the working tools according to the requirements of a particular operation. In the case of panel sizing, the distances between the sawblades must be set precisely and checked by sawing a piece of panel and measuring it.

When setting the sawblades, it is important to check that the blades and lateral parts are free of resins and tightened properly. The teeth of the sawblade must stick out of the cut by about 15 mm. The sawguard must be removed, the nut on the saw shaft loosened and turned in the rotation direction in order to change the sawblade.

The operator must check and adjust the perpendicular position of the sawblade to the sliding table. All adjustments must be done with steering wheels which must be tightened afterwards. After ensuring that the machine and the material are prepared, the operator can start production. By turning on the motor, and positioning the panels on the sliding table, lengthwise sawing can start.

If the edges of the panels are damaged, they must be positioned in such a way that they fall in unavoidable waste. If the sliding table is pushed manually, two or three panels can be cut in a pack. These must be fixed or pressed by hand to avoid shaking. The feeding rate must be so adjusted that the blade does not get stuck in the middle of the operation. In case of mechanical feeding, the number of panels in a pack and the rate of feeding are determined by the type of machine used.

The operator must check the precision of cutting (sizes and perpendicularity) and, if necessary, adjust the machine. He and his assistant must control the number of pieces for each size to ensure that the job order is fulfilled.

At the end of the shift the operator must clean the machine and his assistant the work area around the machine. The parts produced are placed on pallets and the waste in a container. The maintenance unit must be informed if there is anything wrong with the machine. The main switch is to be turned off when the operator leaves the machine.

Squaring of saws is done as follows: the guard is removed and the saw brought to cutting position, the square is placed against the sawblade (care should be taken that it rests on the flat part of the sawblade and not on the teeth), the screws should be loosened and the blade adjusted with the square. The adjustment must be carefully verified. Then the screws are tightened.

Furthermore, instructions, adjustments and operation procedures prescribed by the machine producer must also be adhered to.

#### 7. Safety measures

Panel sizing machines are basically circular saws. Unfortunately, injuries occur frequently. Most often, these are injuries of the hands, sometimes internal organs and eyes are also injured.

Apart from general safety measures, special means of protection must be taken on panel sizing circular saws. Certain safety and protection rules must be followed:

- The machine should be checked for its good working condition. The saw opening slot in the work table must not exceed 10 mm. A protective top guard must be provided to ensure that the saw remains fully enclosed.
- The saw blade should be checked for its proper preparation and sharpness. The diameter of the blade must correspond to the thickness of the pack of panels.
- The dust exhaust pipe must be checked for its proper connection to the machine.
- The saw should not wobble when it rotates. If it does, the blade should be replaced.
- In case of manual feeding, a proper riving knife behind the sawblade is obligatory. It should be adjusted both horizontally and vertically (see fig. 7)

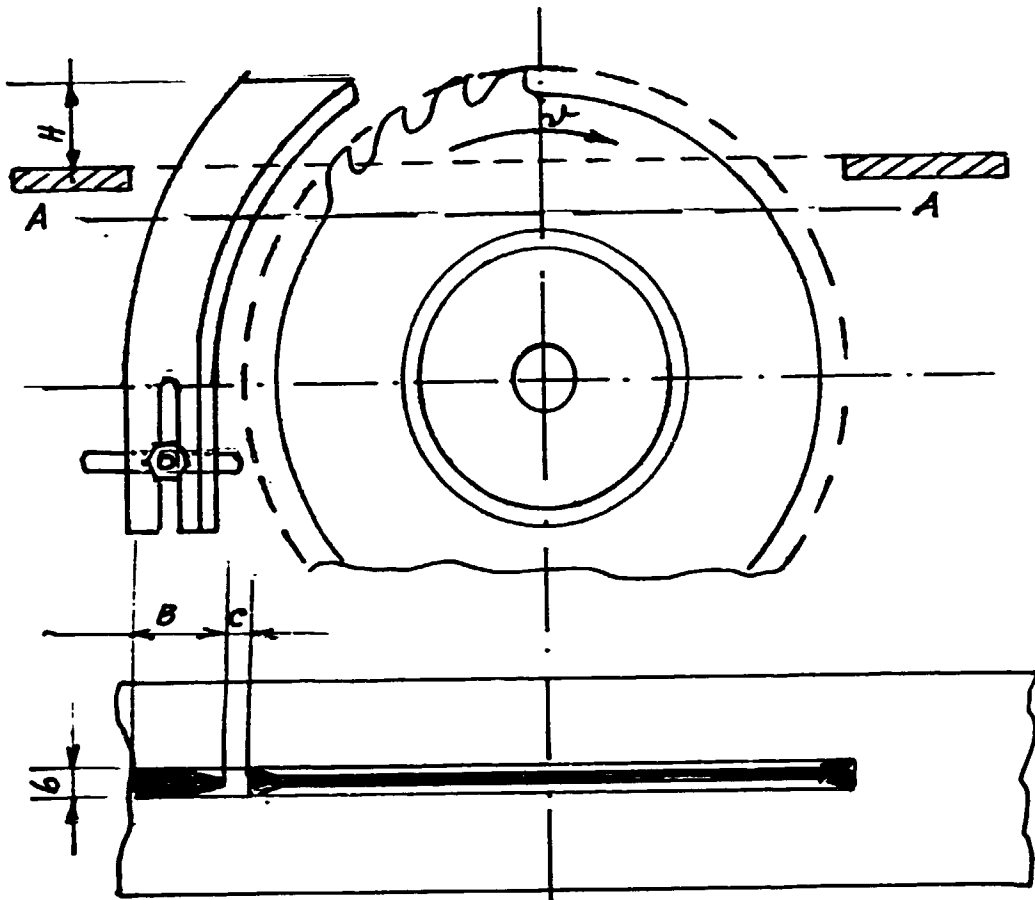


Fig. 7: Riving knife behind the sawblade

- Any object which could cause injuries or reduce productivity should be removed from the working area.

- The operator must hold the panels firmly against the fence of the sliding table with his left and push the table with his right hand.

- The electric installations on the machine must be done properly and these must be fully isolated. The machine must also be properly grounded.

- No attempt should be made to stop the rotation of the saw by pressing against the sawblade with a piece of wood or anything else. The operator must wait until the saw stops rotating before changing the blade.

- No part of the machine should be removed except during adjustment and change of tools.

Haste is very often the cause of many injuries. Work must be performed at a normal pace and with a total adherence to safety measures.



ANNEX I

TRAINING PROGRAMME FOR FURNITURE MANUFACTURING

1. Introduction

This training programme is designed to accomplish the objective and outputs foreseen in the project "Assistance in the Establishment of a Pilot Furniture Plant" (DP/DRK/86/011).

Referring to the project document, the immediate objective is to "train wood technicians and machine operators in the efficient operation of all the machinery and maintenance of tools, so as to manufacture furniture of medium quality", and also to "train managerial staff in overall management techniques including introduction to the marketing of furniture products".

This objective will be achieved through the accomplishment of outputs Nos. 6, 8 and 10.

Output No. 6 states: "20 wood machinists, 10 assemblers and four team leaders trained in the efficient use of the available manufacturing equipment, able to manufacture furniture of medium quality acceptable for export."

Output No. 8 states: "Two wood technicians trained to design and make the required production fixtures aimed at attaining accurate machining of components parts."

And output No. 10 states: "Design of overall factory organization, with established work preparation, cost accounting and management procedures, with managerial staff trained in (a) factory management based on modern industrial production methods and in (b) the basic elements of marketing."

The planned activities of the quoted outputs are:

For output No. 6:

- 6.1 Prepare a training programme for furniture manufacturing.
- 6.2 Prepare a training manual for each of the major production operations.
- 6.3 Train 20 machine operators, 10 assemblers and four team leaders to manufacture furniture of acceptable quality.

For output No. 8:

- 8.1 Train two wood technicians to design, produce and maintain jigs and other furniture production fixtures.

For output No. 10:

- 10.3 Train factory management in modern industrial production methods.
- 10.4 Acquaint the managerial staff with the basic elements of export marketing.

Training labourers is an integral part of production in modern industrial enterprises. Technical and technological developments are offering, practically on a daily basis new products and methods which make human work easier, safer and more productive. To follow such advances, people working in industry have to learn and to train in order to acquire new knowledge and skills necessary for the handling of modern equipment and processes.

In developing countries, such training has a decisive importance for the fuller utilization of new production techniques and for mastering new technological processes. To avoid unnecessary mistakes and to gain indispensable skills, training courses are the most rational mode, because people can learn, in a short time, the best ways of performing their production duties.

## 2. Training programme for the Pilot Furniture Plant

This training programme is designed to meet the specific requirements of the Pilot Furniture Plant. The main topics covered in the programme are:

1. Wood, affiliated products and other materials used in the production of case furniture;
2. Furniture products: design, construction and quality standards;
3. Production organization and work preparation;
4. Panel sizing;
5. Veneer trimming and joining;
6. Veneering;
7. Processing of veneered furniture parts: trimming, tenoning edge banding and drilling;
8. Moulding and routing;
9. Sanding;
10. Finishing;
11. Preassembling, assembling and packaging;
12. Tools, jigs and measuring instruments;
13. Quality control;
14. Safety measures in the furniture production;
15. Management based on modern industrial production methods;
16. Basic elements of marketing.

The main goals of this training are to enable workers, not only to learn how to perform their jobs, but also to understand the industrial production system as a whole.

Courses numbers 1, 2, 3, 12, 13 and 14 are foreseen to be attended by all workers to be trained, while the other courses are intended only for the workers who will perform the respective production operations.

All these courses are independent from one another, but in their totality they represent an integral training programme for the production of casegoods furniture in a medium size factory.

3. Methodology of training

There is an old Chinese wisdom which says "What I hear I will forget, what I see I will remember, and what I have done I will know." The output of this training should be knowledge learned by workers who will increase their ability for effective production. To achieve this, the training method will rest on three steps as follows:

1. Explain (to hear),
2. Demonstrate (to see), and
3. Try (to do).

Short manuals, written in a simple language, understandable to the workers, will be prepared for each course, translated into Korean and distributed to the trainees. All graphs, tables and formulae will be adjusted to the level of understanding of the people to be trained.

Theoretical teaching will take place in a classroom and its duration will be adapted to the minimum of theory which has to be known for a certain job. This part of the teaching will be performed by the expert (CTA) and the Chief of the Technical Department in the Pyongyang Wood Processing Complex (PWPC).

The practical part of the training will be organized at work areas for the respective work operations. For that purpose, the work areas must be organized correctly, including production documents, materials, tools, jigs, gauges, pallets, protective devices and everything that is necessary for productive, safe and good quality work. The expert will explain and show how to check a machine, tools, jigs and, in the case of wrong adjustments, how to correct them and prepare the equipment for correct use. The expert will show the correct way of performing operations and continue to supervise these operations until he concludes that proper work is fully accepted and that the quality of production is satisfactory.

The Chief of the Technical Department and other engineers who have undertaken training abroad will also collaborate in performing this practical training. Some practical experience of the trainees will help in the practical part of training.

Course No. 12 (tools, jigs and measuring instruments) should be conducted by the Tool Maintenance Expert.

Course No. 13 (Quality control). The manual prepared during the CTA's first mission can be used.

Courses Nos. 15 and 16 ("Management based on the modern industrial production methods" and "Basic elements of marketing") are foreseen for the managerial staff and will be conducted in a way to initiate discussion and an active participation of the trainees.

4. Selection of trainees

The persons to be trained will be selected by the counterpart, according to their duties and to the topics of the training programme. Besides workers who will directly perform particular production operations, all other people concerned with certain aspects of the production, such as foremen, members of the management, maintenance personnel etc. could be included in the training.

It is recommended that in selecting the trainees attention should be paid that their physical and psychological abilities be in accordance with the requirements of the pertinent jobs.

The list of trainees is an integral part of the training programme, and it determines the number of copies of the training manuals to be prepared and distributed for every course.

5. Training programme

TITLE	TRAINING HOURS	
	Theoretical	Practical
1. Wood, affiliated products and other materials used in the production of case furniture	4.5	1.25
2. Furniture products: design, construction and quality standards.	2.75	0.5
3. Production organization and work preparation	4.75	2
4. Panel sizing operation	2.75	3.5
5. Veneer trimming and joining	2.75	4.5
6. Veneering	5	4.5
7. Processing of veneered furniture parts: trimming, tenoning, edge banding and drilling	4.5	9.25
8. Moulding and routing	2.75	4.75
9. Sanding	0.25	4.75
10. Finishing	4.25	6.75
11. Preassembling, assembling and packaging	4.5	8.5
12. Tools, jigs and measuring instruments	5.75	4
13. Quality control	5	2.5
14. Safety measures and work protection in the furniture industry	5.5	1.25
15. Management of production in a modern industrial factory	10.25	4
16. Basic elements of marketing	5.25	-
<b>GRAND TOTAL</b>	<b>70.50</b>	<b>62.00</b>

Detailed syllabi for each topic are given in Annex II.

ANNEX II

DETAILED SYLLABI OF THE PROPOSED TRAINING COURSE

Topic 4: Panel Sizing Operations.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
4.1	Introduction	0.25	-	Understanding the purpose of the course.
4.2	Cutting listS. panel sawing schemes and utilization of boards	0.5	--	Ability to understand cutting lists and sizing scheme and to produce furniture parts in accordance with these documents.
4.3	Panel sizing saws	0.5	1	Knowledge bout construction of panel sizing saws, their functions and work principles.
4.4	Characteristics of sawblades for panel sizing saws	0.5	0.5	Knowledge of all elements and parameters of sawblades used for panel sizing operations.
4.5	Organization of the work area	0.5	0.5	Ability to organize the work area to comply with safety measures and the rational utilization of equipment and energy
4.6	Performing panel sizing operations	--	1	Ability to set up a machine and to perform panel sizing operations in a safe and efficient way and to produce parts with a required dimensional precision.
4.7	Safety measures	0.5	0.5	Understanding dangers which may occur because of improper use of the machine or because of neglecting the safety measures.
TOTAL		2.75	3.50	