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# METHODOLOGY FOR THE PURCHASE OF WOODWORKING MACHINES *

by

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## Introduction

The furniture industry of developing countries is often characterized by belonging to small entrepreneurs who started as craftsmen, made money, and expanded their operations by buying machines to increase productivity. Unfortunately in doing so they still reason as craftsmen and not as industrialists. This is clearly shown in the way in which they take decisions with respect to range of products manufactured, production methods, marketing, costing, and last but by no means least, selection of equipment.

This study deals solely with this last topic, which, to the eyes of UNIDO, is a field in which the furniture and joinery industry of the developing countries lag a long way behind the developed countries. 1/ Unfortunately there are too many cases in the developing countries of instances when the industrialists have purchased the wrong pieces or the wrong assortment of machines. Once this is done, not only is scarce foreign currency misspent - from the point of view of the national economy - but, looking at the level of profitability of the plant, the investment is unsound because poor use was made of available funds, thus affecting the plant's overall profitability. In the developing countries capital is the scarcest resource, and mis-spent capital affects the company's profitability for the life expectancy of the machine. Because the industry of these countries is not developed, producers know more about one another than in the larger, more sedative conditions of the developed countries. Consequently, once a

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1/ To help developing countries in this field UNIDO has convened in 1973 a technical meeting on the selection of machinery for woodworking industries, and a workshop for wood processing in 1975. Some 50 documents were prepared for these two meetings. Basically the first dealt with individual machines while the second dealt with production lines. The reports bear the documents No. ID/133 and ID/180 respectively, and the individual studies were published in the ID/WG 151... and ID/WG 200/... series.

wrong decision has been made it is more difficult to get rid of an inapproriate machine in a developing country than in a developed country.

In spite of the lack of capital more mistakes are made in the developing countries because of

(a) ignorance about what is needed,

(b) ignorance about what is available,

(c) ignorance about the specific requirements of the wood being machined,

(d) lack of consideration of economics of scale and full utilization of the machine.

This is further compounded by the fact that very often in developing countries personal - human - considerations come into play when selecting machine. In many instances there are no local agents, or when they do exist, the machine in question only represents a very small part of the firm's turnover and the agent's staff are not competent to give any technical advice.

In the rare instances when technical advice is available the salesman is far better equipped than the purchaser since he tends to know what is on the market and what the shortcomings of the product he represents are when compared to those of his competitors, and he could easily avoid mentioning these points.

This study will attempt to give a methodology which could help the smaller industrialists in the developing countries in the selection of woodworking machines most suitable to their needs.

Basically adequate answers must be found to the following questions:

(a) Why is the machine needed? In fact, is it really needed? I.e. identifying the actual needs for the machine and draw up its technical specifications.

(b) How would the installation of the machine affect the other machines already installed?

(c) How does one proceed in purchasing a machine?

These topics are discussed in greater depth hereunder.

## 1. Identifying the actual needs for the machine

There are many reasons for purchasing a woodworking machine for a furniture or joinery plant in a developing country. The following are some of the most common general reasons:

(a) To mechanize hitherto manual operations thus saving labour requirements - i.e. increase the production capacity with the same labour force.

(b) To mechanize manual operations hitherto done by skilled craftsmen, thus reducing the need for skilled labour, which is either not available or more expensive.

(c) To lower production costs through mechanization (use of lower cost labour, higher productivity, etc).

(d) To assure precision during machining which later on would reduce assembly costs.

(e) For work safety reasons, i.e. to carry out mechanically (and to some extent automatically) operations which are dangerous.

In the developed countries there is one further reason, seldom applicable in developing countries. It is to mechanize handling so as to reduce the need for unskilled labour.

The above general considerations apply in the case of the purchase of any machine, but it must be remembered that in purchasing a machine one is in reality always interested in obtaining the performance of a

specific operation by a machine.

It would be useful before a decision on purchasing a machine is made to use value analysis on the components to be machined so as to see whether it could be simplified thus allowing the use of a simpler - and consequently less expensive - machine. Unfortunately this can only be done in those factories which specialize in selected ranges of products and manufacture their own line for the market, as against accepting to produce anything provided the price is right. (The latter is more often the case in developing countries.) This analysis would determine:

(a) The function of the component - it could well be that it is redundant in its present form or could be replaced by a simpler one which would cost less or be purchased already manufactured - a good example being metal corner pieces for chairs.

(b) The alternative materials from which the component under consideration could be manufactured. (This might lead to lower material costs, simpler machining and/or less waste.) A good example is the use by some Finnish plants of two glued particle board strips (instead of sawn wood) to produce the frame for a door panel. This resulted not only in the use of cheaper raw material - particle board being less expensive than solid wood in Finland - but also in less waste, with no corresponding increase in machining sophistication or machining time.

(c) Product simplification and standardization should be seriously studied as this will affect the choice of machine since in the first case a simpler and probably cheaper unit could be purchased, while in the second case standardization will lead to the possibility

of producing in larger series, hence justify more sophisticated machines which have a higher productivity yet need longer machine set-up times.

(d) The last item in the value analysis of the components relates to determining the machining requirements: type of operations, precision, etc. The process presently used should be studied in depth so as to determine whether the machining operation can be carried out on an existing machine which is less fully utilized. For example it might prove more economic in the immediate future to spray surfaces than to purchase a new curtain coating machine in spite of the former's greater waste of surface coating material. Similarly a spindle moulder could be used to make tenons, etc. It might well be that the machine envisaged would be too sophisticated for the product it is to produce, or even too precise. In developing countries this latter assumption is unfortunately seldom the case since the tendency is to allow poor machining precision which is then hand finished before assembly. This state of affairs allows on one hand the creation of more jobs, but on the other hand it prevents the production of knock-down mass produced furniture for export since these would have to be hand fitted at the time of assembly.

It is only when this has been done that one can determine the type and capacity of the machine one has to purchase, and the result might be that through rationalization, purchase of components from outside, or re-design of the product there is no need for the machine since the needed extra capacity is small enough to warrant the use of overtime at peak order periods.

## 2. Assessment of existing resources

An individual machine in a factory is part of a whole process or flow line and should never be considered as an individual entity. One of the more common reasons for purchasing a machine is the need for extra processing capacity. It must be remembered that once this machine has been purchased the bottleneck in the production line has been moved to the next most utilized machine. Doubling the production capacity for the operation in question might result in an increase in overall capacity of the line of only 10 per cent if the next most fully utilized piece of equipment is being used at 90 per cent of its capacity. It is therefore imperative, before deciding on the purchase of any one machine to study the overall capacity situation in the plant, so as to establish an order of priorities and a long range plan, and to allocate financial resources according to this plan.

While in no way wishing to minimize the need to introduce changes and modern processing techniques in the developing countries, there is no point in purchasing a machine that is far more advanced technologically and in its operating precision than the rest of the existing plant since the costly new machine will not be used to its full advantage, and its maintenance and adjustment might be too sophisticated for the existing labour force, thus necessitating the hiring of either a highly qualified technician, who would not be fully employed, or, worse still, an expatriate. Consideration has to be given to this point, but this should not be an impediment to the introduction of modern woodworking machinery in developing countries. Whenever possible the plant's technicians and operators should be formally trained in the operation of the new machine, either abroad or locally.

The introduction of a new machine in a plant pre-supposes the existence of space at the appropriate point in the production line. Consideration

should be given to coupling the new machine -- if at all possible -- to an existing one using conveyors thus reducing materials handling and labour requirements. It is unfortunate that in developing countries very little thought is given to this problem. Management has often not yet realized that no value is added yet unnecessary costs are incurred in moving by hand semi-manufactured components from the ground near one machine and placing them again on the ground near another one further down the line, and repeating this operation throughout the process. Unfortunately also, the introduction of a new machine in a process line is too often done at the expense of the area allocated to intermediate storage of components. Whereas the new machine would justify an increase of this area, more often than not, is the cause for the reduction of this area, thus the advantages of the increased capacity are often lost due to physical bottlenecks in material handling. The result is that whereas in theory the new machine should have smoothed the production flow, in actual fact it creates additional confusion at the shop floor level. The higher the capacity of the machine, the larger the need for intermediate storage.

The implantation of a new machine often justifies the movement of the existing ones; yet this is unfortunately seldom the case, in spite of the fact that woodworking machines are relatively light and seldom need special foundations. It is strongly recommended to use the disturbance to production caused by the installationof a new machine to make the modifications to the location of the other machines in the neighbourhood of the new one to minimize the adverse affect on flow caused by the new machine.

In selecting machines - or types of machines - the plant's "micro infrastructure" should be taken into account. For example, before a decision to purchase a machine is made, one must consider the availability

of the necessary electric power - both quantitatively (in kilowatts) and qualitatively (with respect to voltage and the number of phases); the capacity to supply the required volume of compressed air, or the required pressure, without unduly starving machines further down the line; the availability of steam (for kiln and presses), again at the required pressure and quantity; and dust and waste capacity must be ascertained. The need to install a larger power transformer cum distribution cabin, or a larger boiler or compressor could make the purchase of a new machine of a specific type much more expensive than the price of the machine itself.

By and large physical facilities of woodworking plants need not be greatly modified in introducing new machines. Two exceptions are presses for veneering and/or laminating, which require specially heavy foundations, and paint spraying stations which require special ventilation and fire walls to separate this high fire-risk area.

In considering the purchase of a machine, the effects of the introduction of a new machine on the existing tools room facilities should not be overlooked. As far as possible tools should be standardized - e.g. bores of cutter-heads used on spindle moulders should have the same diameter, so as to reduce the need of investing in a complete set of tools for each machine. Also, the type of tools used on the envisaged machine should be studied carefully to ascertain whether it would necessitate the introduction of new machines in the tool room. Carbide tipped tools, for example, need special machines, which are far more precise (and costly) than those used for normal or high speed steel cutters. Even the introduction of the first solid cutter-head or band saw in a plant using plane knives and circular saws would need modifications to the grinders previously used for maintaining knives and circular saws. These again could imply considerable additional costs. In all cases the introduction of new types of tools would imply the training of

the saw doctors presently employed and/or the employment of additional higher skilled saw doctors and maintenance staff.

3. Labour/Capital considerations

Developing countries have a chronic surplus of labour and shortage of capital whereas the opposite is the case in developed countries. Because of this there is a tendency - and often a direct urge from the Government - to use (or mis-use) labour intensive methods of production. Another common argument used is that in these countries labour costs are low when compared to developed countries and therefore should be encouraged it being often overlooked that whereas this is the case, productivity is even lower.

While not attempting to play down the role industry could play in the creation of employment, the selection of equipment with an appropriate degree of mechanization should be determined scientifically. One way of industrializing is to minimize investment capital (i.e. using simple equipment, machines, installations and buildings) while bearing in mind the low level of education and wages in developing countries.

However, if the industry is to be competitive on world markets, the criteria should not be solely to create employment, but rather to guarantee that the funds invested are used as efficiently as possible to increase the competitiveness and profitability of the company. Fixed investments are larger and the labour cost lower.

In comparing the two, the difference between the two investments (capital and labour intensive alternatives) is noted, and an amortization rate of the equipment has to be assumed. This is not the tax deductible depreciation allowed by law, but a faster rate related not to the life expectancy of machine for tax purposes, but to the duration during which the machine is still considered technologically advanced. (This is related

more to the machine's resale value than to its bookkeeping value). In the case of special machines, purchased to produce competitively a specific product, the expected life of the product (i.e. the time span during which it will be produced) is taken for calculating the amortization rate of these special machines. To this, the yearly interest on the extra sum to be amortized in the more expensive alternative is added. This additional cost per year should be less than the wages of the additional persons needed in the labour intensive alternative for the investment to be justified.

It is recommended that such comparisons be made before deciding on the purchase of major pieces of equipment.

## 4. Suitability of second hand equipment

Industrialists in developing countries are sometimes offered second hand equipment, and are tempted to purchase it. There is nothing wrong with the concept of second hand equipment per se provided that the following points are borne in mind:

(a) Offers which propose second hand machinery that has not been re-conditioned to meet precision standards for woodworking machines in the major developed countries should not be considered.1/ There are, in many developed countries, firms that specialize in the re-conditioning of machines, and, provided that the re-conditioned machine is still suitable from a productivity point of view and is guaranteed by them, and that the firm is a serious one, the concept of buying a re-conditioned second hand machine should not be rejected.

(b) In buying a re-conditioned second hand machine it must be realized that one is buying obsolescence from a technological point of view.

(c) Obtaining spare parts for second hand machinery tends to be more difficult than for new machines. (This is sometimes not the case

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1/ Some of these are given in UNIDO publication ID/WG/151/25

for simple, old-fashioned equipment if the spare parts are to be manufactured in the developing country.)

If the above points are taken into account then re-conditioned second hand equipment can be purchased advantageously for use in furniture and joinery plants in developing countries.

5. Use of power tools, multipurpose machines, special purpose machines or complete lines

The type of machine and its degree of sophistication would depend on the type of products manufactured, the degree of standardization, size of batches, etc. The first stage in mechanization after the use of hand tools is to use power tools. However, even heavy-duty power tools are insufficient for continuous industrial production because of lack of precision and worker fatigue except for use in assembly operations (such as sanding, nailing, spraying and perhaps some boring operations).

Multipurpose machines are not really suitable for industrial production because as the machines have only one or maximum two motors the machine can only be used to perform one (or maximum two) operations at a time. In most developing countries the furniture and joinery industries use individual special purpose machines, since such machines are the most versatile. Complete lines are unappropriate because these countries generally do not have the large enough markets to assure such mechanized production. Such lines are also generally too capital intensive and sophisticated for developing countries.

6. Identification of the actual machine required

Once all the above factors have been analysed, the point when the

actual technical specifications of the machine to be purchased can be finalized has been reached.

An internationally accepted decimal classification of woodworking machines has been adopted by the European Association of Woodworking Machinery Manufacturers (EUMABOIS). It has been adopted by France and Germany as their national standards, and reproduced by UNIDO as one of its documents 1/ Although somewhat outdated technologically, it could help the layman in the definition in technical terms of the machine to be purchased.

The various parameters of the machine have to be clearly defined: e.g. in the case of thicknessers and sanders the maximum width and thickness of the pieces to be machined; in the case of four-side moulders the number of heads, and the maximum and minimum cross sections, etc.

Of particular importance to the developing countries is the need to specify the species to be machined - specially if these are to be dense tropical hardwoods, since some machines are sometimes underpowered for such heavy-duty work.

Information must also be given on the power available; and it might prove useful to mention the other characteristics which might limit the selection of a given type of machine (e.g. the non-availability of steam in selecting a small kiln, or of compressed air for machines having pneumatic controls, limitations in the availability of equipment in the tool room, etc.).

## 7. Methodology for identifying suppliers of equipment

Because industrialists in the developing countries are cut off from the main equipment producers in the developed countries, and also because the woodworking and upholstering equipment used in the developing countries is

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1/ Standardized classification and terminology in the woodworking machinery industry by H. Eldeg. (Document No. ID/WG 151/14)

relatively simple and not purchased as complete turnkey plants, or complete lines, but over the years as the need arises; industrialists wishing to purchase them do so on an ad hoc basis and seldom go to fairs or analyse what is available on the world market before making a decision. Whereas the former is inevitable, the latter can and should be avoided.

The first step would be to identify the local suppliers - if any - and the local agents of foreign companies, and determine, based on local knowledge (e.g. engineers from the local university) whether the local metal working industry could produce any of the ancillary equipment needed by the machine, such as dust extraction systems, conveyors, etc. This list is drawn up, and to it must be added foreign producers. One good source of addresses are the various national associations of woodworking machinery manufacturers of the various developed countries. These exist in the United States, Japan, and most European countries. In the case of the latter they are grouped under the European Committee of Woodworking Machinery Manufacturers (EUMABOIS). Their addresses are given in the UNIDO guide to sources of information on the Furniture and Joinery Industry. 1/Other sources are the commercial attachés (or Trade Representatives) of these various developed countries in the developing country's capital city. They might even have the catalogues of specialized International Fairs for woodworking machines. These, if available, are of course the best possible sources. A list of these specialized fairs and their frequency is given in annex 1.

The more advanced developing countries should not be ruled out as potential suppliers of equipment, since some are already producing basic machines of acceptable quality and of the simple yet sturdy designs suited

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1/ UNIDO publication ID/188 (UNIDO/LIB/SER.D/4/Rev.1).

for the conditions in other developing countries.

Needless to say that the ideal solution would be to visit one of the specialized fairs.

## 8. Methodology for the comparison of the bids received

The comparison of the bids received, in reply to the enquiries placed using the procedure outlined in section 7 above, is the final - and most complex - operation in this sequence. Bearing in mind the actual requirements - as identified in section 6 above - the various offers received are analysed and compared in a tabular format. The various parameters - both technical and economic - are first identified and all offers received compared for each and every item.

If a double end tenoner were to be taken as an example, the following are some of the technical parameters which should be compared (these are not listed in order of importance):

- maximum and minimum dimensions of the components that can be machined
- feed speed and whether they are infinitely variable or not
- rated power of the motors driving machining heads and the feed chain; and their suitability for machining dense tropical hardwoods
- number of cutterheads provided and their position
- possibility to incorporate at a later date additional machining heads (saws, cutterheads, routing and grooving attachments, etc)
- rotation speed of the cutterheads
- existence of scribing saws
- possibility to rotate cutterheads for making mitred joints
- maximum and minimum size of saws (diameter) and cutterheads (diameter and height)

- interchangeability of saws and cutterheads with other tools used in the factory
- precision of machining for various operations
- ease of setting up machine and changing the tools
- ease of maintenance (e.g. centralized lubrication)
- type of electric controls
- safety features
- consumption of compressed air ($m^3$ per minute and pressure required)
- need for special ancillary equipment in the tool room or maintenance workshop to operate the machine
- net weight of the machine (the heavier the weight, the sturdier the construction and the smaller the risk of vibrations; and this might necessitate special foundations)
- floor area required
- etc.

From the economic point of view the following parameters should be compared (also not listed in order of importance):

- production capacity (pieces of a given size per hour)
- labour requirements - number and qualifications
- cost price of the basic machine
- cost price of basic spare parts
- cost price of the machine with attachments which could be purchased at a later date
- cost of ancillary equipment needed in the tool room and for dust extraction to operate the machine
- cost of tools for the various machining heads
- cost of installing the machine (including foundations, electric and pneumatic connections, dust extraction connections)

- cost of training the labour to operate the machine
- etc.

Furthermore the following other commercial considerations should be taken into account:

- availability of a local agent and services offered by him
- possession in the plant of machines by the same manufacturer and their performance
- delivery date
- payment and credit conditions
- ease of obtaining an import licence for the machine and its tools
- guarantee - both with respect to its duration and the items covered
- availability of instruction book(s) for erecting and operating the machine in a language understood locally
- currency of payment and currency guarantee clauses in offer
- force majeure clause
- conditions for price increases at seller's discretion
- etc.

It is only when all these points have been considered for all the offers received that a decision can finally be made. Needless to say simpler, more basic machines are compared on fewer points.

Points to look out for in comparing offers are the following:

- items for which the supplier quotes approximate prices - sometimes unrealistic under local conditions - for items needed to operate the machine which the purchaser has to provide
- items which the supplier states should be obtained locally (starters, motors, etc.) and which in fact are unavailable on the local market

- comparison of actual cost of the machine taking into account different financing arrangements and interest rates proposed by various suppliers

In comparing complete lines the basic characteristics of each machine are compared and individual machines are assessed on a point basis. The characteristics of each machine are not compared in as much detail as for individual machines because the line is purchased as a "package deal" and is selected on the merits of the whole package and not on the merits of individual machines, since they cannot normally be replaced at the discretion of the purchaser. (By analogy one cannot obtain a car with a different electric equipment or carburettor than those normally offered by the manufacturer.) Such a point system, as used a few years ago by UNIDO consultants in evaluating bids for a turnkey purchase of a complete particle board line is given in Annex 2. It shows the system used, but a similar one would have to be devised for each and every special processing line.

## 9. Conclusions

The above procedure might seem complicated but it has to be followed if costly mistakes are to be averted.

It is often a good investment to seek the advise of specialized, impartial, free-lance woodworking industries consultants who exist in the developed countries. Some of the developing countries that have large forest resources already have such specialists. In other cases, foreign specialist consultants from the developed countries often operate on a regular basis in some developing countries, and some even have established branch offices.

The added cost is often paid back in a matter of months, since costly mistakes in equipment selection can be avoided.

## ANNEX 1

LIST OF SPECIALIZED WOODWORKING MACHINERY FAIRS

| Name of Fair | City and country | Frequency | Time held |
|---|---|---|---|
| INTERBIMALL | Milan, Italy | every 2 years | spring, even years |
| LIGNA | Hannover, Federal Republic of Germany | " " " | spring, odd years |
| International Woodworking Machinery and Furniture Supply Fair | Louisville, Kentucky USA | " " " | autumn, odd years |
| Woodworking Machinery and Equipment Fair | Nagoya, Japan | " " " | autumn, even years |
| EXPOBOIS | Paris, France | " " " | spring, even years |
| IWIE | Birmingham, U.K. | " " " | autumn, odd years |
| HOLZ | Basel, Switzerland | " " " | autumn, odd years |
| HOUT | Rotterdam, The Netherlands | " " " | autumn, odd years |
| Holzmesse | Klagenfurt, Austria | " " " | summer, odd years |
| National Woodworking Machinery Exhibition | Valencia, Spain | " " " | autumn, odd years |

ANNEX II 1/

## Classification system

## used for technical and technological comparison of individual machines and equipment for particle board production

It has to be pointed out that the classification system outlined below is an attempt to express the technical level and the technological reliability of machinery and equipment offered. For each of the equipment groups three to four quality degrees are specified, taking into account the most up-to-date technological knowledge. The individual quality degrees are characterised by a certain number of points allotted. It is, of course, obvious that this system can be applied for comparison in the horizontal lines of the table only. In view of the fact that the system does not consider the proportionate weight of different equipment groups /e. g. pressing group contra silo/, a vertical addition of points would be misleading.

| | Number of points |
|---|---|
| **Raw material yard:** | |
| fully mechanized | 2 |
| partially mechanised | 1 |
| not offered | 0 |
| **Debarking station:** | |
| Material losses: | |
| - low - drum debarker | 3 |
| - medium - ring debarker | 2 |
| - high - cutter debarker | 1 |
| - debarker not offered | 0 |
| Feeding to debarker: | |
| - mechanized, metal detector | 2 |
| - mechanized, no metal detector | 1 |
| - by hand | 0 |
| Capacity: | |
| - 1 shift for 3 shift production | 3 |
| - 2 shifts for 3 shift production | 2 |
| - 3 shifts for 3 shift production | 1 |
| - not offered | 0 |

1/ Originally issued as annex 2 to a study entitled General selection guidelines for woodworking machinery, by Arnost Trávnik (UNIDO document ID/WG. 151/6).

| | Number of points |
|---|---|
| **Bark removal:** | |
| - mechanized incl. milling of bark | 2 |
| - mechanized | 1 |
| - not offered | 0 |

**Manufacture of particles:**

**System proposed:**

| | |
|---|---|
| - seperate manufacturing lines for surface and for core particles and seperate storing of sawdust, shavings and particles produced from hogged chips | 3 |
| - seperate manufacturing lines for surface and for core layer particles but without separate storing of sawdust, shavings and of particles produced from hogged chips | 2 |
| - one manufacturing line for both surface and core particles without differentiated storing of sawdust, shavings and of particles produced from hogged chips | 1 |

**Capacities:**

| | |
|---|---|
| - 1 shift for 3 shift production of boards | 3 |
| - 2 shifts for 3 shift production of boards | 2 |
| - 3 shifts for 3 shift production of boards | 1 |

**Removal of splinters**

| | |
|---|---|
| - combination of air and mechanical sifting | 3 |
| - air sifting | 2 |
| - mechanical sifting | 1 |
| - not proposed | 0 |

**Silo for particles:**

| | |
|---|---|
| - over 100 $m^3$ | 3 |
| - medium, over 50 $m^3$ | 2 |
| - small, below 50 $m^3$ | 1 |

**Drying:**

**Dryer:**

| | |
|---|---|
| - fire protection device with automatic fire extinguishing equipment and automatic control of M. C. of particles | 3 |
| - the same but with manual control of M. C. | 2 |
| - hand operated fire extinguishing device only | 0 |

**Possibility of reusing dust from board production**

| | |
|---|---|
| - combined reuse of dust in the production line as well as by burning in the dryer | 2 |
| - burning dust in the dryer or in the boiler | 1 |
| - no provision made | 0 |

Number of points

Screening units behind the dryer

- combination of air and mechanical sifter 3
- air sifter 2
- mechanical sifter 1
- not proposed 0

Glue blending

Bin for dry particles

- capacity over 25 $m^3$ with level indicator on several points of the bin 3
- capacity below 25 $m^3$ with indicator for "full" or "empty" 2
- low capacity without level indicator 1

Dosing of particles

- continuous quantity control 3
- discontinuous quantity control 2
- volume dosing 1

Construction of glue blender

- stainless steel, cooling of drum, no compressed air 3
- steel, cooling of drum no compressed air 2
- steel, cooling of drum, spraying with compressed air 1
- steel, no drum cooling, spraying of glue with compressed air 0

Dosing of glue and paraffin emulsion

- interlinked with particle dosing, quantity control 3
- interlinked with particle dosing, no quantity control 2
- no interlinking with particle dosing 1

Mat forming station

Type of forming station

- stationary 2
- moving 1

Type of mat

- sifting fine particles into outer layers, continuous quantity control 3
- sifting fine particles into outer layer, discontinuous quantity control 2
- sifting fine particles into outer layer, no quantity control 1

| | Number of points |
|---|---|
| **Prepressing of mat** | |
| - included | 1 |
| - not offered | 0 |
| **Returning of unduly formed mat** | |
| - included | 1 |
| - not offered | 0 |

**Pressing:**

| | |
|---|---|
| **Type of press** | |
| - single opening | 3 |
| - multi day-light with simultaneous closing | 2 |
| - multi day-light without simultaneous closing | 1 |

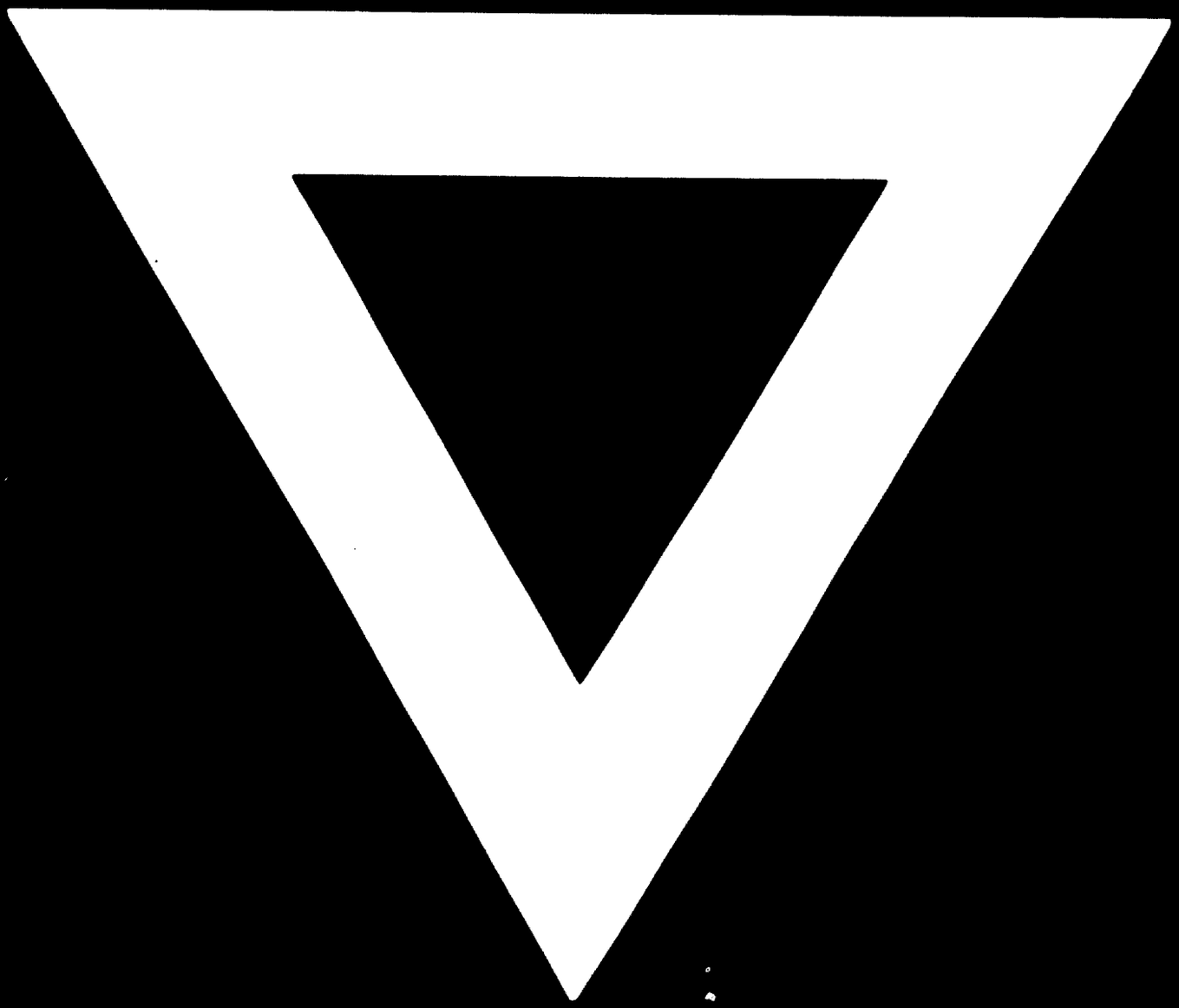
**Note:** Preference is given to single opening press because of the heavier construction enabling to achieve lower thickness tolerances and equalised properties of the board. It has to be, of course, admitted that multi-opening press has a certain advantage in the potential possibility of increasing the capacity

| | |
|---|---|
| **Working pressure** | |
| - min. 35 Kp/cm$^2$ | 3 |
| - min. 30 Kp/cm$^2$ | 1 |
| **Accumulator station** | |
| - pumps for each piston | 3 |
| - accumulator | 2 |
| - pumps | 1 |
| **Feeding system** | |
| - without supporting cauls | 3 |
| - with transport cauls or divided band | 2 |
| - transport band/for maintenance and cost reasons | 1 |
| **Position of press pistons** | |
| - two rows situated above distance bars | 2 |
| - two rows closer to the center line of plates | 1 |
| - one row in the center line of press plates | 0 |
| **Temperature regulation** | |
| - included | 1 |
| - not offered | 0 |

| | Number of points |
|---|---|
| **Temperature adjustment of pressing table** | |
| - included | 1 |
| - not offered | 0 |
| **Distance device** | |
| - in press pistons | 2 |
| - on pressing plates | 1 |
| **Sizing of pressed boards** | |
| - with tools for simultaneous processing twice two sides | 3 |
| - with tools processing once two sides | 2 |
| - with tool processing one side only | 1 |
| **Cooling of pressed boards** | |
| - forced air stream | 2 |
| - natural air stream | 1 |
| - not offered | 0 |
| **Volume/weight control behind the press** | |
| - not necessary due to provisions in other equipment | 3 |
| - is necessary, measuring on several points | 2 |
| - is necessary, weighing of whole boards | 1 |
| - is necessary but not proposed | 0 |
| **Thickness control of pressed boards** | |
| - measuring the whole width of board | 3 |
| - measuring at several points | 2 |
| - measuring in one point | 1 |
| - not proposed | 0 |
| **Metal detector** | |
| - before the press | 2 |
| - behind the press | 1 |
| - not proposed | 0 |
| **Sanding line** | |
| **Type of machine** | |
| - processing on both sides with several tools | 3 |
| - processing on both sides with one tool | 2 |
| - processing on one side | 1 |

| | Number of points |
|---|---|
| **Installation of equipment into a line** | |
| - with automatic flow | 3 |
| - with mechanized flow | 2 |
| - with manual feeding and sorting | 1 |
| **Sorting of sanded boards** | |
| - into three places | 3 |
| - into two places | 2 |
| - into one place | 1 |
| **Storing of ready-made products** | |
| - handling by means of telescopic hoist | 2 |
| - handling by means of a lift truck | 1 |
| - not proposed | 0 |
| **Storing and preparation of glue** | |
| **Raw material store** | |
| - handling proposed including storing racks | 2 |
| - handling proposed without storing racks | 1 |
| - not proposed | 0 |
| **Preparation of glue blend** | |
| - mechanised, allowing for 1 worker to prepare the blend for 3 shifts | 3 |
| - not mechanised, 1 worker is provided for each shift | 2 |
| - simple, with more than 1 worker for a shift | 1 |
| **Laboratory** | |
| - offered | 1 |
| - not offered | 0 |
| **Grinding shop** | |
| - complete for grinding of all tools | 2 |
| - without the possibility of grinding special tools | 1 |
| - not proposed | 0 |

C-674



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