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**HAND-TOOLS BLANKS AND DIES PRODUCTION
PREPARATORY ASSISTANCE**

DP/VIE/86/042/11-51/11-52

VIET NAM

Technical report : Present production technology and needs for improvement.*

Prepared for the Government of Viet Nam
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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1. INTRODUCTION

The mechanical handtool manufacturing in Vietnam is allocated at four factories:

- The Mechanical Handtool Factory, Hanoi
- Factory No.2 for Mechanical Tools Bac Thai
- Hai Phong Handtool Factory
- Chu River Mechanical Factory

The first one covers about 60% of the total production. The production programme comprises pliers of various sizes and types, grip wrenches, sheet cutters, table vices and bicycle cranks. The product mix, quality and quantity do not satisfy the internal and export market requirements. The yield of products is low and life-time of dies very limited. The products, dies and cutting tools for manufacturing are based on imported rolled long products of various not always properly selected steel grades. Existing facilities and especially needed for the blanks preparation and die making are obsolete what hinders the upgrading of technologies, quality and quantity of production.

UNIDO as executive agency on the request of the SR Vietnam Government will assist upgrading of technologies mainly the blanks preparation and dies making and concentrating its efforts for the Mechanical Handtool Factory Hanoi in order to radiate them for other factories of hand tools.

2. RECOMMENDATIONS

2.1. The Mechanical Handtool Factory Hanoi with its well prepared engineering staff seem to be the best to allocate funds and efforts for upgrading the handtool manufacturing methods.

2.1.2. In order to avoid frequent mistakes in supply of imported raw materials for production and semi-products for die making it will be highly recommended to pronounce the Mechanical Handtool Factory Hanoi as a leader for the purchases.

2.1.3 As proposed by PFF and PD new equipment, study tour, fellowships when concentrated in Mechanical Handtool Factory Hanoi may bring the best expected results for end target. Supported by CTA and experts the National Project Director (NPD) and its implementing group will create a nucleus for further efficient development in the country.

2.1.4 It will be highly recommended to provide the merits for the MHFH and the others to replace the coal fired reheating furnaces by modern ones. It is considered as very reasonable to invest at least one modern hammer able to pace with the cross-rolling mill.

2.1.5 As the next step to upgrade the blanks preparation the investment of at least one forge-roll will be highly recommended.

2.1.6 Implementation proposed by PFF and PD new equipment capacities will be limited by bottle-neck in products machining. It will be therefore highly recommended to introduce (invest) at least one broaching machine.

2.1.7 No good reference hand books and technical magazines are available in the country on hand tools manufacturing so MHFH should have a library and other factories can also benefit from this.

2.1.8 New equipment and temperature controllers are required, especially for dies/toolings heat-treatment so that dies are uniformly hardened.

3. FINDINGS

3.1. GENERALITIES (TECHNOLOGY FOLLOW-UP SEQUENCE)

Imported rolled long products supplied as round and flat bars (sometimes of improper sizes and steel grades) or cut with shear mechanical presses into pieces by volume required for expected products. Except pre-cut blanks for pliers for the rest of programme round bars or preforged blanks are applied. Blanks are preforged by hand by open forging with pneumatic hammers. Reheating of cut pieces, precut or preforged blanks is executed by coal fired furnaces (Hai Phong applies bunker-oil fired furnaces). Very obsolete system of blanks preparation and preheating markedly decreases the yield of products and their quality.

It badly influences the dies working conditions causing excessive wear and premature need for their rebuildings and frequent damages.

The preheating of dies, flat or bending passes, precoating of dies surface, dies lubrication and scale removal (Hai Phong applies here compressed air) are not adopted. Lack of these depreciates the life-time of dies and the surface quality of products.

Trimming of flash after forging is executed by mechanical presses with dies of improper steel grade (except the Mechanical Handtool Factory, Hanoi) frequently with improper finishing (shape and surface). The life-time of trimming dies is very short.

Lack of control equipment to supervise the reheating condition of blanks, intermediate annealing of semi products and finish heat treatment of products (except timing when induction heating applied) increases problem for proper dies use and in addition lowers the products quality.

It is a broad variety of steel grades (about six grades) imported for forging dies making (sometimes too expensive for shallow cavities) frequently supplied as heavy section round of square rolled bars. For blanking and trimming tools some companies apply steel grades as for forging dies (except Hanoi). Others apply three steel grades (carbon; high chromium; high chromium-molybdenum) frequently too expensive for certain applications.

Improper shape and sizes for dies making compulses factories for preforging of die blocks which deteriorates their quality (lack of temperature control for reheating; improper cooling conditions).

Companies are compelled to prepare by themselves majority of milling cutters for which three steel grades are used (obsolete 18% W and 9% W and modern W - Mo). Improper use of as supplied high speed steel bars compulses companies to preforge them. Lack of control facilities damage the raw materials for milling cutters). Improper preheating conditions, lack of control for salt bath furnaces causes damages and at the end a short life-time of cutters.

Simple equipment for product machining (broaching is not applied) increases difficulties for finishing of products.

Among all as listed difficulties three common may be selected which via complex action will markedly benefit in upgrading the technology and hitherto products quality and their output (yield and quantity) :

- Control equipment
- Dies making, finishing, reshaping and redressing
- Blanks preparation system

The monitoring of temperatures during whole sequences of products manufacturing, dies and cutting tools making will directly influence dies/tools performance, quality and output of products.

Machines, auciliary equipment, technology for dies making finishing and their maintenance, will benefit in upgrading the technology, decrease unit consumption, and increase output of products.

Improved dies making conditions will allow for modifications in trimming and widen the application of precut blanks.

Prerolling of blanks for as broad as possible production programme will benefit in increased yield, extension of dies life-time and output.

3.2. STATE OF DIES MAKING AND THEIR WORK

3.2.1. Dies Designing

Basically 3 types of dies are being used for handtools manufacturing by conventional methods by using hammers and friction presses in Vietnam hand tools factories.

- (a) Blank cutting dies
- (b) Forging dies
- (c) Trimming dies.

For all these dies to perform in a satisfactory manner following stages are of much importance.

- (1) Design stage
- (2) Manufacturing stage
- (3) Heat treatment stage
- (4) Working of dies stage
- (5) Dies and its maintenance stage.

Design stage

Before designing a die choice of die steel is very important. In Vietnam they are using alloy steel forging dies and high carbon high chromium for blank cutting dies. Hardness retained after tempering for forging dies which is quite satisfactory for shallow forgings like pliers, spanners and other allied handtools. Also while selecting a die steel care has to be taken that proper die steel heat treatment equipment is available in the company.

Blank cutting die design

Hand tools in general have a very typical material flow along the heads and the handle portions while forging is done from round bars then it is very difficult to have a uniform flash flow all along the contour of the item being forged. Keeping this criterion in mind hand tools are generally forged from blanks. Hand tools factories at Vietnam are also doing the same for pliers. A cutting blank should have the following criterion.

- (i) Material flow should be uniform
- (ii) It should give more or less uniform flash all along the contour of forging
- (iii) As far possible grains should be along the forging

and not across it.

These parameters are more or less taken care off in blanking die design at Vietnam factories.

Forging die design

Before commencing of forging die design it is very important to know whether forging die is to be used for forging hammer or friction press.

Basic parameters for forging die design are :

- (a) Bending die-giving approx. Shape to cut pieces and removing of scale.
- (b) First drop-giving the approx. Shape with in tolerances.
- (c) Finish drop-giving the needed shape with close tolerances and stamping is also done here.

In the present study it has been noticed that forging dies for hammers take care of all the above points where as dies for presses have only the finish drop. So blank piece is directly put in the final drop. Even though production is not so fast, die life is tremendously reduced. As no arrangement for removing scale is there, it further worsen the problem and total production form a die is 3500 pieces average as compared to 7000 pieces in case of forging die for hammer.

Flash flow :

Flash is necessary evil so far as close die forging is concerned. In case of drop/pneumatic hammer forging, it is not possible to have flashless forgings. But flash thickness has to be varied depending upon the forging die material and extra amount of raw material in blank. If the cutting blank is properly designed than the flash thickness should be low. In present situation in case of pliers forging die flash thickness in design is given as 1,2 mm +1,0 which is quite high. It has been advised to the hand tool factory to control the flash thickness at die making stage 0.8mm and this has to be exercised closely.

While designing bending die care has to be taken that no sharp corners are there. First drop is more in thickness and less in width in such a way that material in first drop is sufficient to fill the 2nd drop properly. Thus load on 2nd/finish drop will be minimal and increasing the life of dies.

Draft angles should be just sufficient that die does not stick on the hammer/press. Also we can not be very liberal with the draft angles as otherwise load on machining and grinding will

increase excessively.

Trimming die design

Hand tools in general after forging are normally cold trimmed. As trimming is done in cold stage, die edges should be retained for quite longer application. High carbon high chromium material is recommended for dies making. For easy redressing die is made in two or more parts and joined with pins.

For items where alloyed raw materials are forged hot trimming is done and trimming die design is altered accordingly.

3.2.2. Raw materials for dies and cutting tools

Most of the die steel used in the country are imported presently. Even though the designs are taking care of proper die steels but while coming to the practice not many are available for the die making. So they have always to make compromises.

At times they have to use medium high carbon steels in place of high carbon high chromium materials. Edge retention in HCHC die steel is much higher as compared to plain carbon steels and that is also one of the main reason for such low productivity from blanking dies/trimming dies.

Forging of die blocks :

Once again because of non availability of right size of die blocks forging of die blocks in square or rectangular shapes is done from rounds. Heating of die blanks is being done in coal fired furnaces without any temperature controls.

Also no controls are being exercised to check these forged die steel blocks to see that these are free from internal cracks, overlappings and other microstructural defects.

It has been stressed to the authorities not to undertake such forging of die blocks under present controls. In case of this has to be taken, it should be done with temperature and other metallurgical controls.

Also High Speed Steel for making cutting tools is imported. The factory gets one or two sizes and then reforge again to the required size without any temperature and atmosphere controls. High Speed Steel thus forged can not give good results in spite of the fact that we will have modern equipment for Heat-treatment.

Manufactures test certificates should be asked for each and every bar of die block being imported. Also the same should be cross-checked at own laboratory of HTFH and only then released for die making.

Stocks: It is concluded that variety of die steels has to be stocked. Different for forging, blank cutting, trimming dies. Sufficient stocks of the dies steel should be build up at HTFH so that these can be supplied to other factories on demand from time to time as well.

3.2.3. DIES MANUFACTURING

Once a die has been properly designed next most important stage is die making. In Viet Nam die making is using most primitive techniques. After rough machining dies and forging dies in particular are finished by cartesian approach. Even tool likes scrappers, needle files and rifflers are not made available. One only gets a very rough shape in the die making and exact shape of hand tool cavity is achieved by hand finishing. So work load on machining and finishing is very high.

Even though here desings are satisfactory, die making requires much more improvements because of equipment of die making requires upgradation. Designs have to be followed more stringently to get better results.

Development of masters for copying

New masters for copy milling machine for copying have to be developed and hand tool factory at Hanoi has been advised accordingly.

Electrodes for Electric Deischarge Machines

Electrodes for EDM wil be made out of graphite for rough machining and copper (99,99% purity, OFHC grade) for finish erosions. Graphite is very easy to machine and can be finished easily. Graphite suitable for EDM again will have to be imported as no local sources are available.

Dies finishing

Again virtually no equipment is available for dies finishing. Whatever rough shapes are achieved by outdated machinery the same have to be accepted by minor filing and scrapping Annex 1 includes the equipment for dies making. Dies finishing is the most important parameter and the material flow is with minimum friction in a die. Procedures for die making have been explained to the works as is given in Annex 3. Further Annex 1B explains fully the application of machinery/equipment for modernization of die making.

Dies reconditioning

Under the present conditions there exist no provision for the reconditioning of the dies. Once a die is put on the hammer/press, blanking press or trimming it is removed only when it is finished. In case of a die is reconditioned a little after using 10 - 20% of its life then its total life can be increased to manifolds than the existing standards.

Dies checking

Presently dies made are not checked and sent for performance directly as there is no method for checking the dies. Simple process of taking plasters in two blocks and then matching has been suggested. This method of checking forging dies is foolproof and does not require any special equipment. Dies thus checked will have much less load on trimming dies and thereby increasing the life of a trimming tool as well.

Also the workload on subsequent machining operations will reduce considerably thus increasing the output per man per machine per cutting tool used.

Blank cutting dies and trimming tools should also be checked more thoroughly before these are sent to forming section.

3.2.4. DIES HEAT TREATMENT

Pre-heating of dies

Presently pre-heating of dies for heat treatment is being done in coal fired open type furnaces, with no temperature controllers. As the furnaces are open type, dies surfaces are getting oxidized and thus some parts get too much scaling. When this pre heated dies are finally heated in salt bath and quenched, gives soft spots. That is one of the major reason of die failure.

For this new furnace for pre-heating dies with air circulation and temperature controllers have been suggested. These can be fabricated by HTFH as complete know-how is available with them.

Dies heat treatment equipment in Vietnam is not so obsolete but has lived its life and thus needs replacement.

Salt bath furnaces

Salt baths in Hand tool Factory need replacement as these have lived their life. Transformers are in good shape. Process layout for dies heat treatment is given in Annex 4.

Temperature controllers

Presently virtually no temperature controls exists so far as salt baths are concerned. It is sheerly judgement of operator's eyes and quenching. Keeping this in view various temperature controllers in Annex 2 have been suggested which will give the required controls.

Digital temperature Indicators

Seing the present trends it has been suggested to purchase a set of digital temperature indicators, so that in case a temperature controller becomes out of order then at least temperatures are seen with this and controlled manually till replacements are arranged.

Digital temperature controllers

A set of digital temperature controllers has been suggested to be procured so that temperature is controlled and easily read.

It is to be noted that the salt baths as applied needs rectification. The three chemical reaction possible in a salt bath at high temperature are oxidation, carbonization and decarburization. One method of rectifying austenitizing baths such as salt mixtures.

1. Add 50gm of boric acid for each of 45kg of salt after every 4 hour period of operation
2. Insert a 75mm graphite rod into the bath for one hour for every 4 hours of operation.

Quenching : To produce maximum depths of hardness in water hardening tool steels, it is essential that they be quenched as rapidly as possible. In most instance, water or brine solution consisting of 10% NaCl (by weight) in water is used. Occasionally for an even faster quench, an iced brine solution is employed.

3.2.5. WORKING OF DIES

Forging dies prior to building into the press or hammer ought to be preheated. Preheating of dies at strictly controlled temperatures (accordingly to applied machine; dies steel grade and intricateness of the pattern) improves their working conditions. At Vietnam factories due to lack of equipment dies are improperly made and no control at preheating.

Scale removal, precoating of the dies surfaces, lubrication at work decrease to great extent the dies wear. No one of visited factories applies with bending or flatening passes due to the scale removal of the blanks surface in insufficient. The situation is in addition deteriorated by the application of coal fired furnaces (except the Hai Phong Factory) unable to temperature and atmosphere. Control the precoating of dies surfaces is not applied. Scale removal during forging (by pressurized air blow) applies only Hai Phong Factory while lubrication is in use only at the Chu River Factory.

Lack of equipment prevents any reconditioning of dies at work. Due to even minor defects decrease the quality of products or causes premature failures of dies.

Blanking and trimming dies (frequently with improper design see 3.2.1) operate without lubrications and due to lack of equipment are prematurely rebuilt.

3.2.6. BRIEFING ON DIES MAKING AND USE

A short briefing on steel grades selection for blanking, forging and trimming dies has been executed (appropriate literature left for study)

Willingness and eagerness of local personnel allowed to arrange improvised conditions by which it was possible to demonstrate some of basic elements for forging dies finishing and their pattern control. The control by the use of plaster of paris and masters revealed some inadequacies. The method of their rectifying was also demonstrated.

Approach to the selection to heat treatment of forging dies was arranged. Lack of control equipment prevented to leave exact guidelines. The control of heat treatment quality evaluation has been demonstrated.

In order to convince the forgers on the benefit of dies lubrication an improvised "oil-graphite" suspension has been prepared and applied. About 15% improvement of die life was achieved in two weeks application.

In order to present future dies making and use conditions (to be expected after commissioning of the equipment to be purchased by the project's funds a short description of the mode of operation has been prepared (Annex 3)

3.3. BLANKS PREPARATION

3.3.1 Applied technology

Pre-cutting blanks are applied only for forging of pliers (remark see 3.2). The bending operation of pre-cut blanks is arranged as separate operation by open dies on pneumatic hammer or mechanical presses. Such a method increases efforts and due to elimination of scale removal abilities of flattening or bending passes does not positively influence the forging dies conditions. Three factories (Bac Thai, Hanoi, Chu River) are equipped with improvised forge-rolls. Not always proper design, inadequate rolls adjustment possibilities, limited wedge positioning for rings do not allow their expected application for blanks preparation. With great respect (even admiration), it is to be stressed that even with such primitive units the Bac Thai Factory rolls semi-products for pincettes and Chu River blanks for hoes production.

The rest of production programme is produced from round bars. Bars are cut by shears and it is to be noticed that in majority of cases cut is not vertical with apparent burr. The cause of improper cut rely on obsolete equipment, inadequate equipment and condition of knives.

Cut to volume bars after reheating are free forged into appropriate blanks. Despite of great skill of the workers such blanks will always cause uneven flow and excessive trimming (not to mention accelerated dies wear). Preforged blanks after reheating are forged into semiproducts ready for trimming. To lower load during trimming and improve machinability forged parts are both apparent in annealing furnaces at 800°C (Chu River is equipped with furnaces with forced circulation).

3.3.2 Briefing on modern technology and equipment. With existing equipment it is possible to apply present blanks for medium size spanners. This application needs flat bars of appropriate size (not available). Needed drawings and literature were left for further use.

The Hanoi forge-roll in existing lay out may be utilised for the first reduction of bars of improper uses supplied for manufacturing (such as procedure should not be considered in the future as a recommended one). Appropriate calculations and pass-design has been prepared and left for

rolls tunning. Roll-pass design system for forge-rolls and additioned literature left for further reading.

The most advanced continuous lines for handtool manufacturing were presented and appropriate literature left for further reading inclusive characteristics of all steel grades applied to various products.

Principles of cross rolling (sometimes called wedge or transverse rolling) were explained. Reports from research work on the rings design and results of operation of the unit left for further reading.

3.3.3 Blanks preparation for Screw Drivers

Rotary swaging machine for blanks preparation for screw drivers bits has been taken in the project document. Finished diameters in closed tolerances can be achieved very fast. Also the surface finish is very good. Tips are cold machined in such a way that material loss is not there and also toughness will be of very high order because of cold working. Yields will be the order of 85% or more and relatively high rates of production.

3.4. CONCLUSIONS

3.4.1 Obsolete equipment of the visited factories does not permit implementation of modern technologies for blanks production, die making and redressing.

3.4.2 As prepared by reporting consultants PFF and PD (presented as separate documents) when implemented will make essential changes in upgrading the technologies hitherto products quality/quantity. Along with it is to be expected that production economy will be improved (yield of products, dies life-time, unit consumption of dies/tools)

3.4.3 The capacity utilisation of proposed cross-rolling will be limited by obsolete forging equipment. It will be therefore highly recommended to invest in modern hammers.

3.4.4 Coal fired furnaces (Hai Phong bunker oil fired but obsolete) will hinder the upgrading of technologies and quality of products. Action ought to be taken to replace them by mechanical oil fired/electric type furnaces.

3.4.5 The mechanical Handtool Factory Hanoi leading among others is well prepared for the acceptance of modern technologies and act in the future to benefit the others. Its engineering staff and management is well prepared among others shown its eagerness to accumulate and control transferred "Know-how"

A. FINANCIAL APPRAISALS

Even though the cost of die making will increase because of overheads of new and costly equipment the same will be more than covered by following facts :

- a) Blanks prepared on cross rolling mill will have 0,45 yield as compared to 0.3 presently. For example in present case we have to import 10.000 tons of raw materials to give a finish production of 3.000 tons. But with the improved technology we can double the output to 6.000 tons from just 13.000 tons of raw materials. (a 100% output increase from only 30% increase in raw material)
- b) Die finishing will be much better and thus increasing the life of dies from 3.500 at present to 5.000 pcs in case of press forging. So in case if presently 100 pairs of forging dies are being used than we shall be requiring just 70 pairs of dies.
- c) Similarly with redressing of blank cutting dies, sheet metal dies and trimming dies the life will be doubled. thus bringing down the unit dies consumption to 50% of the present.
- d) As the dies will be much more accurately made, thus work load on subsequent machining and finishing operation will be reduced as less of excessive material will have to be removed from the forged components. There will be at least saving of 15% on this account.
- e) Total production per shift of equipment will also increase because minor repairs can be done on the forging equipment itself and thus reducing the down time and resetting time of dies, we hope to increase the productivity at least by 15%.
- f) Finally, the quality of handtools will markedly improve and thus increasing the realization per ton by at least 15%-20% and thus earning the much required foreign exchange from abroad.

B. SPECIAL NOTE

Besides reviewing and evaluating the technology and equipment used in Viet Nam for dies manufacturing and heat treatment for mechanical hand tools, work has also been done in Project Formulation Framework (PFF) and Project Document on UNDP guidelines for this project VIE/86/042, Hand tool Blanks and Dies Production.

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Annex 1**MACHINERY REQUIREMENT FOR MODERNIZATION OF DIE MAKING**

No.	Machine	Specifications	Quantity	Power kW
1	- Electric Discharge Machine (Spark Erosion Machine)	Work table 600 x 400 mm with spares	1	24,0
2	- Copy Milling Machine (Servo controlled)	Copying ratio 1:1 Max Finish, Size 510x450mm with pattern forming attachment; Rotary table (300 dia) Angular swival table (300x300mm). Fixed milling attachments		
3	- Pentograph	Copying ratio 1:20 Max finish; size 300x300mm with set of master letters numerals	1	0,5
4	- Shaper Machine with Copying Attachment	Max. Ram stroke 600 mm Max. shaping width 600mm	1	11,0
5	- Flexible Shaft Grinding machines with 4 mm dia. Shaft, Hand pieces and Collets of 3mm and 6 mm dia.	Speed 12000 RPM max	3	2,0
6	- Flexible Shaft Grinder machines with 10mm dia Shaft, Hand pieces and Collets of 3 and 6 mm dia	Speed 8,000 and 12,000RPM	2	1,5
7	- Single Lip tool Grinder	With collets which can grind tools of 1, 2, 3, 6, 8, 10, and 12 dia	1	0,1
8	- Pneumatic Die Grinders of various sizes 2 each	With 3 and 6 mm dia	4	
9	- Band Saw Machine	Max. Height 200mm. Angular Adjustment 15o	1	

**CONSUMABLES REQUIREMENT FOR OPERATION
OF DIE MAKING EQUIPMENT**

1	- Copper Bars 100x100x300mm OFHC Grade 99.99% purity min.	6 Nos	For making electrodes for EDM
2	- Graphite Blocks 300x300x300mm	4 Nos	For making of Electrodes for EDM
3	- Single Lip Tools 6, 8, 10 and 12 dia (with 5% Moly) 150mm length	24 Nos	For making tools for copy milling
4	- Straight Cup Wheels 100x50x20, AA60K5V8 grade	24 Nos	For grinding the single lip tools, for copy milling and to be used on single lip tool grinder.
5	- Mounted points (medium grade) A-15, A-53, B-96, B-182, W-146 W-153, W-154, W-220, 3"x1/2"x 1/2" wheels with 3mm shank/6mm shank dia	500 each	For matching of cavities of forging dies, for finishing of dies, re- conditioning of trimming dies.
6	- Polishing Emery Cloth for Polishing of dies 120, 320, 400, 600 grades	50	For polishing of forging dies, moulding dies.
7	- Band Saw Blades 6mm, 12mm width	200meters each	To be used on band saw machine for cutting of profiles
8	- Single lip tools of 1, 2, and 3 mm dia	12 each	To be used as tools for pentograph
9	- Scrappers, Rifflers, Files of various shapes for die finishing	6 sets each	To be used manually for finishing of dies along with the shaft grinders and mounted points.
10	- Compound Plaster	12 packets	To check the dies on copy milling, die matching stages
11	- Grinding Sticks Rough 1"x1"x6"	24	For dressing of mounted points

**APPLICATION OF MACHINERY REQUIREMENT FOR
MODERNIZATION OF DIE MAKING**

1	- Electric Discharge Machine; (Spark Erosion Machine	Forging dies sinking, plastic moulding dies for sleeves, pressure casting dies, rolls for cross-rolls sinking, sheet metal dies, bending dies for sheet metal working.
2	- Copy Milling Machine	Forging dies cavity machining from masters, plastic moulding dies, rolls for cross rolls machining.
3	- Pentagraph	For making stamps, engraving in forging dies, engraving in moulds
4	- Shaping Machine with Copying Attachment	Copy the forging dies blocks for ring spanner and combination spanner dies, copy shaping of profiles of blanking dies and punches, trimming dies and punches.
5	- Flexible Shaft grinding Machine with 4mm Ø Shaft Hand pieces and collets of 3mm, 6mm dia. Pneumatic Die grinders of small size with 3 mm dia collet.	For matching of cavities after copy milling/Spark erosion. Also polishing of dies after heat treatment.
6	- Flexible Shaft Grinder Machine with 10 mm dia. Shaft with hand pieces and Collets of 3mm and 6mm dia.	Forging dies polishing after heat treatment, redressing of trimming tools.
7	- Band Saw machine	Contour sawing for blank cutting dies, punches, sheet metal dies angular sawing for trimming dies, template sawing.
8	- Single Lip Tool Grinder	For grinding tools reqd. for copy milling and pentagraph.
9	- Ultrasonic Portable Unit	To check the internal defects in die blocks; high speed steel after rough machining only.

.../..

Annex 1B (cont.)

10	- Spare Set of Thermo-couples	To be installed inside a salt bath to controll the exact temperatures.
11.	- Digital Temperature Controllers.	To be used in salt baths tempering and preheating furnaces, electric furnaces as stand byes.
12.	- Optical Pyrometer	To cross-check the digital temperature controllers from time to time. Also whenever any temperature controller/ser.ser goes out of order this can be used till repairing/ replacement is done.
13.	- Hardness Testing Equipment	To check the hardness in Brinell, Rockwell and VPN so that exact hardness on cutting edges/dies is determined.

Annex 2**EQUIPMENT REQUIREMENT FOR DIES HEAT TREATMENT SECTION
UPGRATION**

No.	Equipment	Specifications	Quantity
1	- Ultrasonic portable unit	With battery/main supply operation. With probes which can be used manually	1
2	- Digital portable optical pyrometers	Temperature range 700oC - 1300oC	2
3	- Temperature tester	Range 100 - 400oC	1
4	- Temperature controllers for salt bath furnaces with set of thermocouples and spares	Range 800o - 1300oC L' types thermocouples	3
5	- Universal hardness tester with 2 sets of spare pointers	To check HRC, HRB, BHN and preferably VFN hardnesses	1

PROCESS FLOW CHARTS FOR DIES MAKING

Sheet Metal Dies

Shaping/Milling

Grinding

Marking

Drilling

Cutting on Band Saw

Filing

Heat treatment

Grinding/Finishing

FORGING DIES

Shaping/Milling

Grinding

Marking

Copy milling/EDM

Finishing

Using grinding machines,
scrappers, files and
Rifflers and stamping
and controlling the
dimensions

Flash flow

Bending Dies cutting (for hammer dies)

Heat treatment

Surface grinding

To take care of
H.T. deformations

Final Polishing

Final inspection

Ready to use

TRIMMING DIES

Shaping / Milling

Band saw cutting

Drilling

Profile shaping

Cutting angle shaping

Filing

Heat treatment

Cutting angle finishing (by flexible
shaft grinding machine)

Ready to use

PROCESS FOR HEAT TREATMENT OF DIES

Pre Heating of dies in
Electrical air circulated furnaces

Heating in Salt Bath
(with temp. controls)

Quenching in oil/water
Checking Hardness Uniformity

Tempering

Polishing

Supplementary information

PROJECT'S PHILISOPHY

(Additional explanations to PFF and Prodoc annexes).

EXISTING STATUS :

- Inadequate knowledge in materials engineering sciences
- Plastic forming of metals knowledge obtaining from up-to-date level
- Limited information about the scope of manufacturing methods of hand tools generally and their application and use in national economy
- Obsolete equipment for mechanical hand tool manufacturing, low yield of products, high consumption of tool steel grades (short life-time of tools and dies used for manufacturing), very low labor productivity.
- Poor products quality

PROJECT'S TARGETS :

- Adequate knowledge of materials engineering sciences will upgrade the selection of steel grades for tools preparation. Their heat and mechanical treatment and appropriate stock handling during products manufacturing.
- Metal flow calculations, dies designing systems, loads and efforts required during hot and cold forming transferred to local personal will improve the yield/quality of products and improve the tools performance.
- Localisation of existing factories and their production level does not allow the partitioning of the project's expenditures and efforts. Therefore, the project must be concentrated in one factory to radiate the knowledge and to cooperate with possible help to other companies.
- The Mechanical Hand Tools Factory-Hanoi has been selected as the best suitable place for the allocation of the project. The Government agreed to allocate their additional funds for production equipment compatible with units to be supplied by projects's funds.

CHARACTERISTICS OF THE EQUIPMENT
(additional data to Annex V in Prodoc)

Item numbers as in Annex V Prodoc

Item 1 :

- Supplied bar length \sim 5,0m
- Capacity 60 - 80 pcs/min
(depending on size and shape)

Remark : Total costs may be cut by changing solid state frequency changer into rotating unit (for induction heating of bar stock)

Item 7 :

- Extended time version on monitor not required

Item 12 :

- Essential are Brinell (B) and Rockwell (C)

Item 33 :

- Automated work not required, hand supply of bars,
- Bar sizes ϕ 4,0 - 12,0 mm

HAND TOOLS (MECHANICAL) IN NATIONAL ECONOMIES

There are about 8000 various handtools applied in national economies.

A. Agriculture

- Parts for soil preparation machines
- Hand tools for soil preparation and plants curing
- Hand tools for harvesting and crops handling
- Parts for harvesting machines
- Hand tools for assembling, repair and maintenance for the equipment

B. Transport vehicles

- Parts for vehicles (bicycles, motor-bikes, lorries, carts, cars)
- Assembling, repair and maintenance tools

C. Mechanical, electrical, plumber workshops

- All essential tools to perform the job

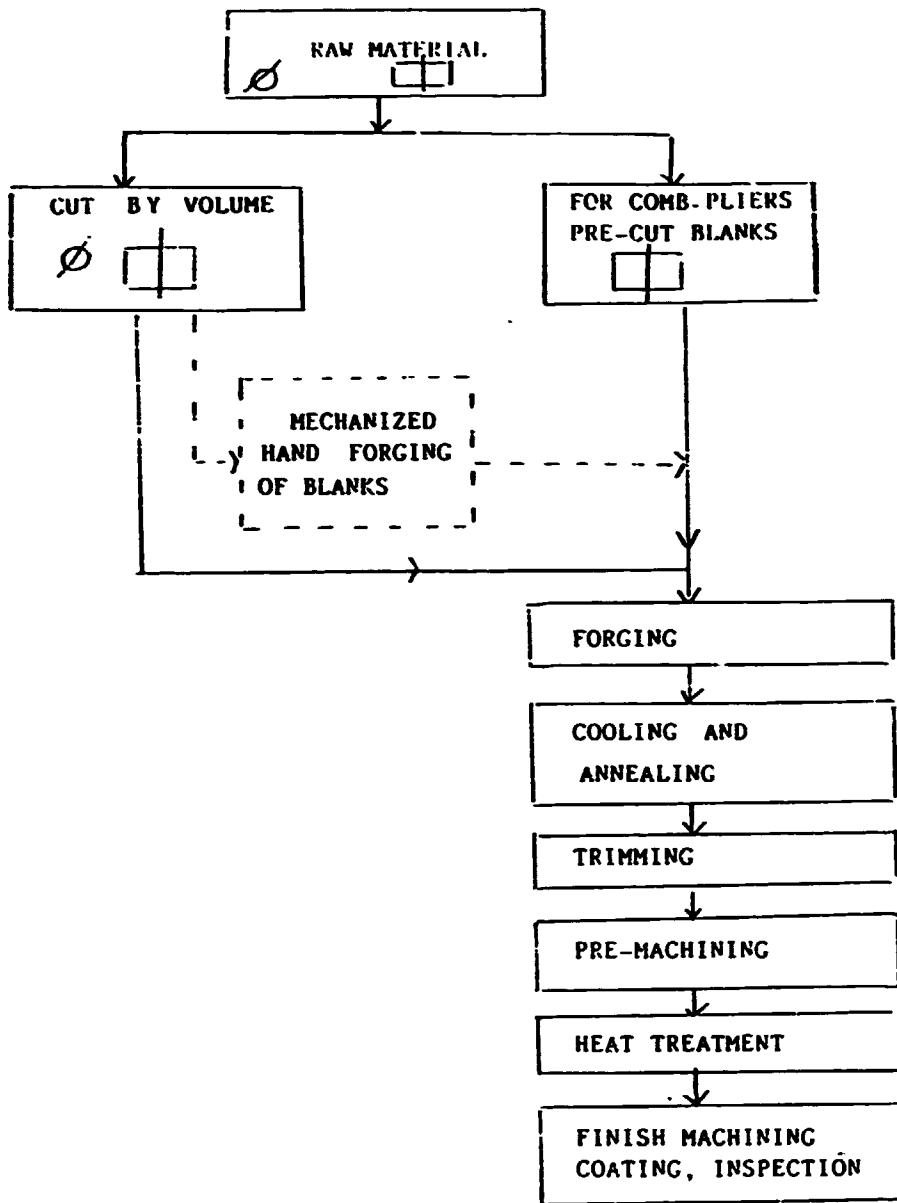
D. Buildings, wood products industries

- Assembling of units
- Repair work

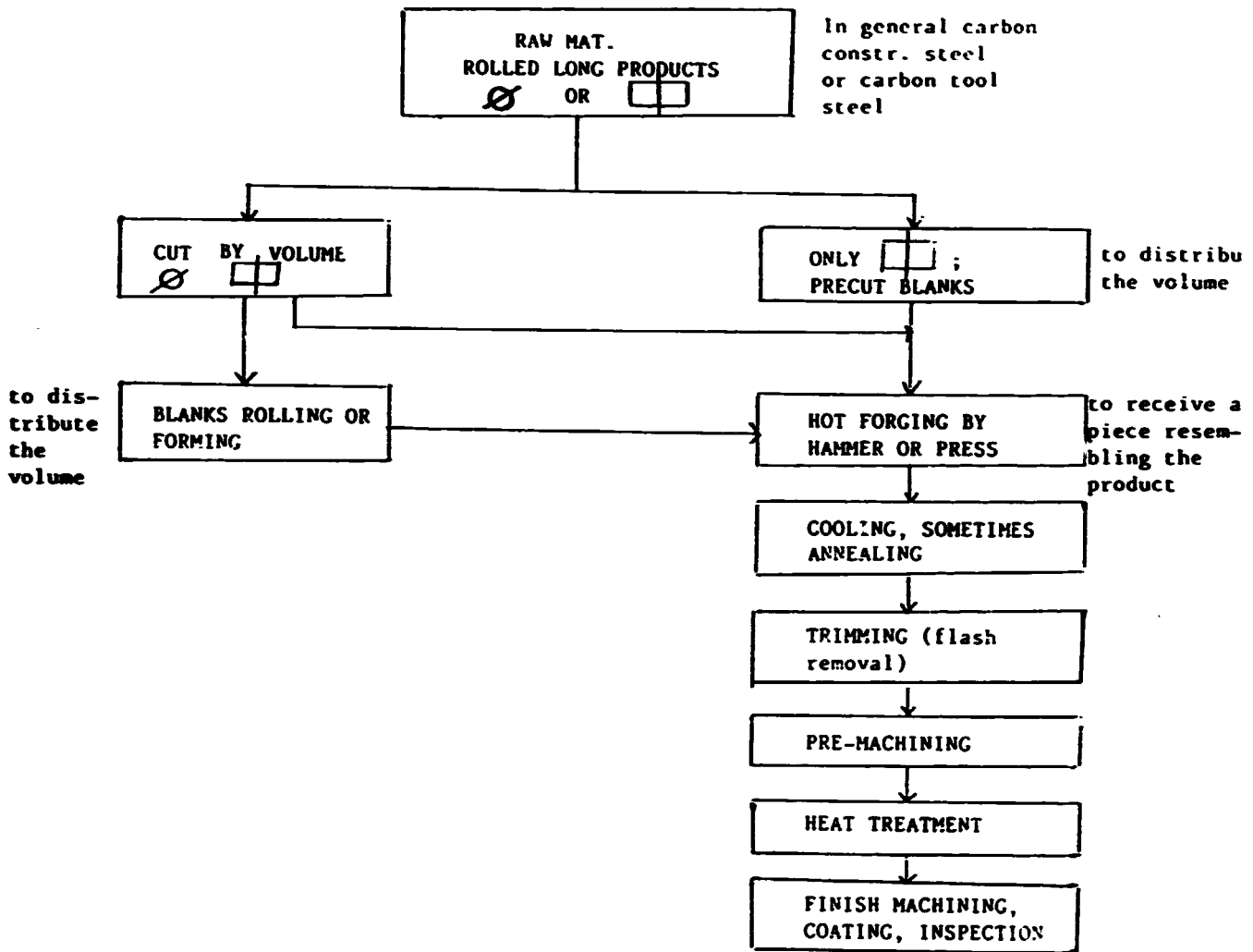
E. "Do it yourself"

- Kits of various tools are essential . In general : for ages the human being operates hand tools which are more developed and becoming more sophisticated

HAND TOOLS MANUFACTURING (EXISTING) AS APPLIED NOW IN VIETNAM



HAND TOOLS MANUFACTURING-UPGRADED
 (Flow-chart-material) - simplified chart



COMPARISON ① → ②

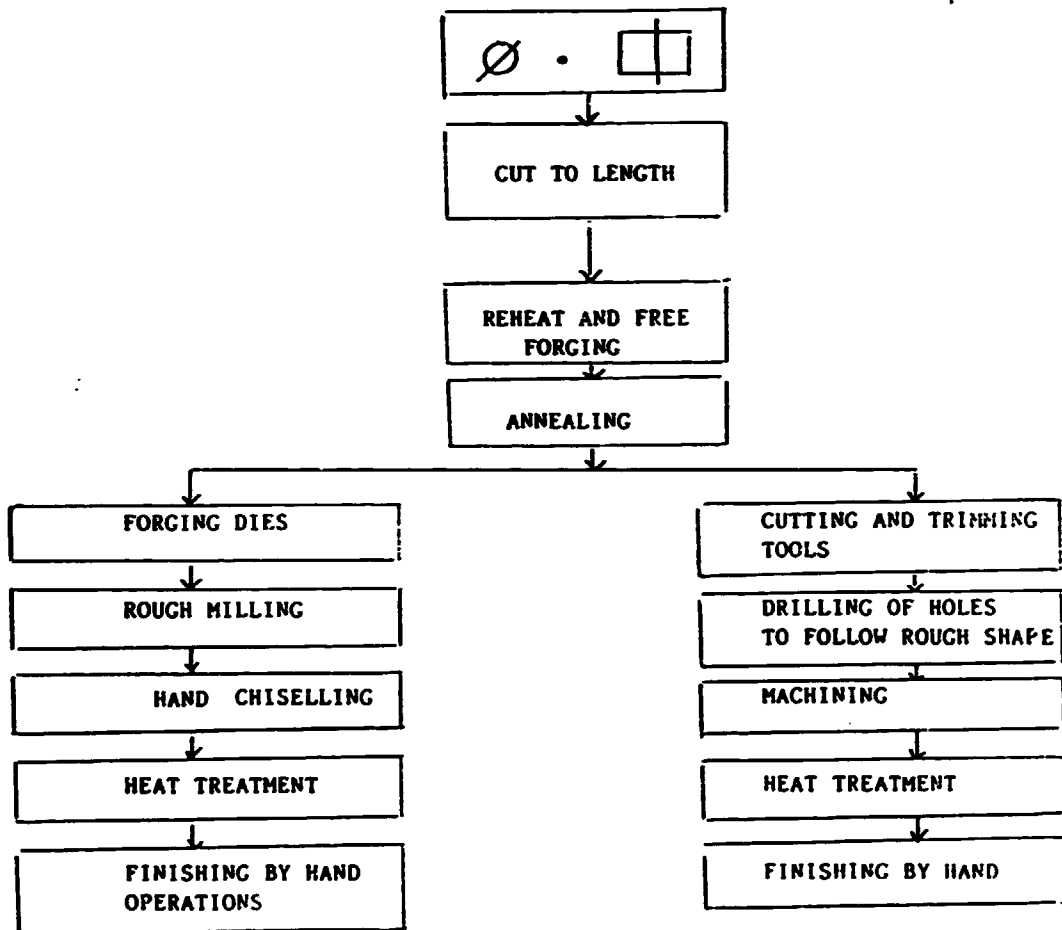
	①	②
AV. YIELD OF PRODUCTS	0,3	0,6
DIES LIFETIME 1000 pcs	3,5	10,0
PRODUCTS APPEARANCE	BAD	GOOD
PRODUCTS TOLERANCES	BAD	GOOD

- ① Existing installation
- ② Upgraded installation

DIES MANUFACTURING AS APPLIED NOW IN VIETNAM

(Maintenance operations do not exist)

Raw material - only alloy steel ; rolled or forged \varnothing and \square long products.

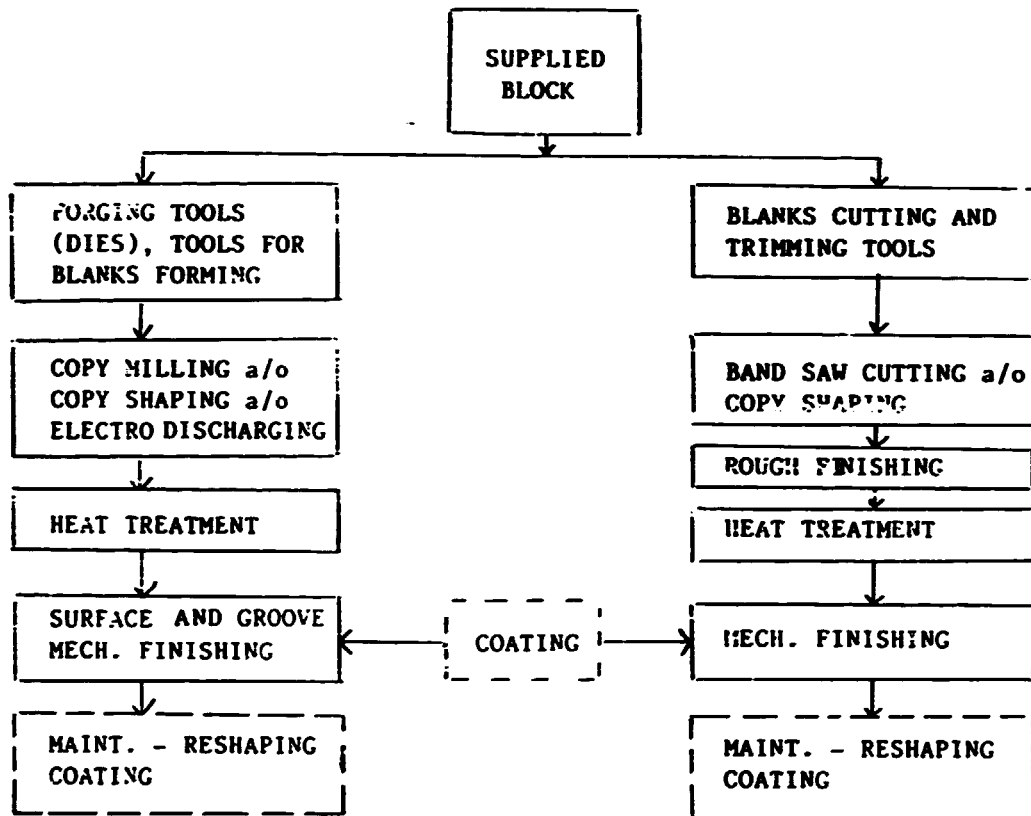


UPGRADED DIES MANUFACTURING AND MAINTENANCE

(simplified chart)

- Raw materials
- High grade carbon tool steel
 - Special high alloy tool steel
 - Medium alloyed tool steel

Raw materials supplied as forged pieces with appropriate size, shape and hardness.



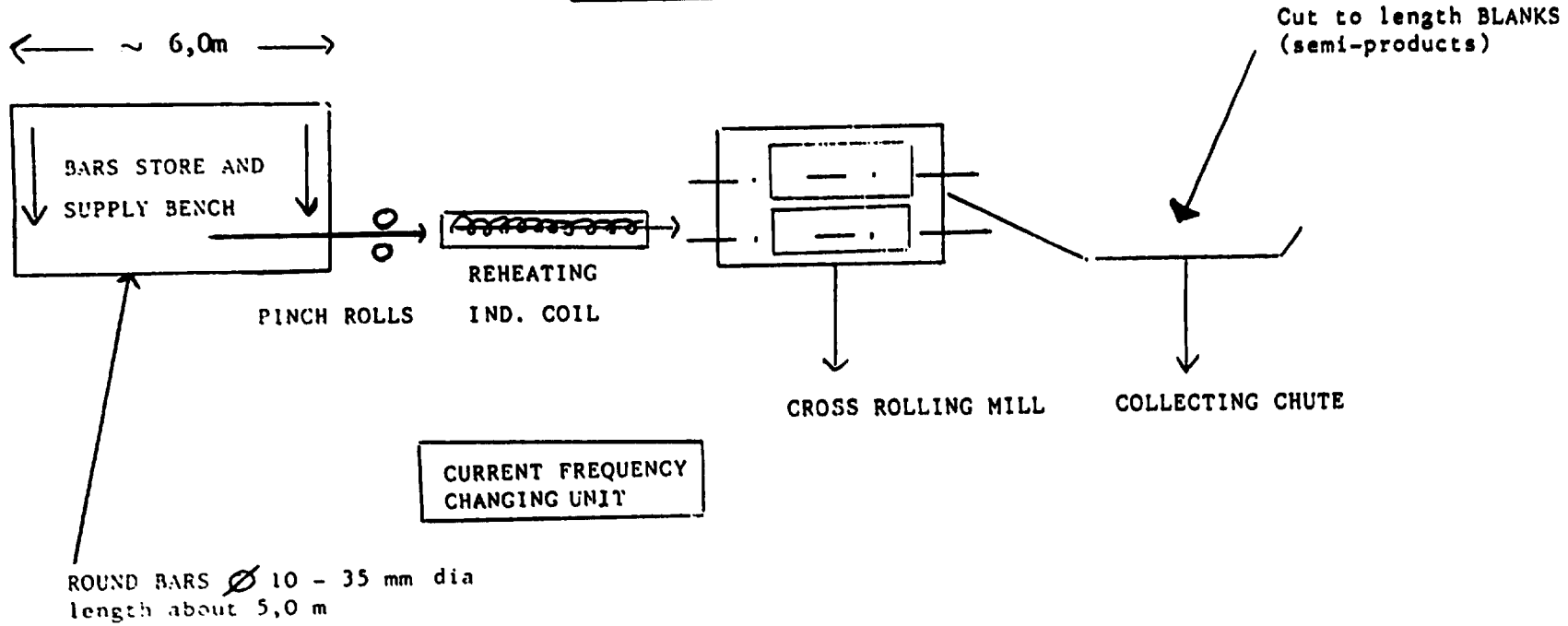
COMPARISON OF DIES MAKING AND THEIR EFFECTS

	①	②
DIES LIFE-TIME UNTIL FIRST RESHAPING 1000 Pcs	3,5	10
DIES LIFE-TIME AFTER RESHAPING 1000 pcs	not appl.	5
CUTTING AND TRIMMING TOOLS LIFE-TIME 1000 pcs	10	50
RESHAPING OF CUTTING TOOLS 1000 pcs (life-time)	not appl.	20
TIME CONSUMPTION FOR DIES AND TOOLS PREPARATION (TAKING (2) AS A UNIT)	10	1
MAINTENANCE OPERATION	not appl.	easy

① Existing installation

② Upgraded installation

BLOCK DIAGRAMME OF CROSS-ROLLING
MILL UL-35 OPERATION



TECHNOLOGY CONTROL AND QUALITY CONTROL UNITS IN PRODOC

A. Shape, size, design

Planimeter, pantograph, miscellenous plasters

B. Temperature control

Pyrometers, thermocouples, temperature controls

Applied for : - Reheating of stock

- Heat treatment of dies and tools

- Preheating of dies prior to forging

C. Quality control units

- Hardness tester to supervise heat treatment of dies and quality control of products

- Ultrasonic tester to supervise the quality of stock for dies and tools manufacturing