THAPAR INSTITUTE OF ENGINEERING & TECHNOLOGY

PATIALA

WORK TERM II REPORT

NORTHERN DIGITAL EXCHANGES LIMITED
SAS NAGAR (Mohali)

Prepared by :

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72 Bachittar Nagar,

Patiala.

15th January 1989.

To Mr. Tikka Jagjit Singh.

Department of Placement & Co-ordination

Thapar Institute of Engineering & Technology,

Patiala.

Dear Sir,

This report titled "WORK TERM - II REPORT" has been prepared for the works for the Production Planning and Control Department of Northern Digital Exchanges Limited. The assingnements during the Work Term were supervised by Mr. S.S.Sodhi, Deputy Manager Manufacturing.

Northern Digital Exchanges Limited is a manufacturer of EPABX's (Electronic Private Automatic Branch Exchange) and as the distinction of being amongst the first companies to start the delivery of totally digital EPABX systems to the market a year ahead of most of its competitors. Presently NODE is manufacturing four models under the NE series and two models under the IOX series.

This "Work Term-II report" contains the reports on the following projects, which were

1.Preparation of Two Handed Process Charts & Development of Time Standards for NE-40 & NE-50 Cards.

2.Preparation of Draft Invoices for Fourth Shipment from OKI.

3.Development of a System for Manufacturing Codification of Cards & Other Equipment in Order to Make the Production Status of the Above Said More Meaningful.

4.Development of a Software to Calculate and Compare the Landed Cost of the Material Which Can be Procured from Different Vendors, with the Objective of reducing the Material Cost.

5.Cost Benefit Analysis with the utilsation of Paper Scrap.

6.Preparation of Production Process Manual.

and the routine activities which were performed.

The time standards have been prepared for the two "higher models" for the various process centres. Also the Two Handed Process Charts have been prepared.

The project titled Production Process Manual has also been put in the software form.

This report has been prepared and written by me and has not received any previous academic credit at this or any other institution. I would like to thank Mr.S.S.Sodhi, Deputy Manager -

Manufacturing, Mr. Raj Ramanand, Senior Enginner - Quality Control, Mr.Dilbagh Singh Broca, Executive Trainee Material Planning & Control, Miss Anita Agarwal, Trainee Engineer -EDP/PPC and Mr.Jaggu Ram, Techanical Assistant - EDP for their guidance and assistance in preparing this document.

Sincerely,

Sukhpreet Singh Giani

(Sukhpreet Singh Giani)

Roll No. 192/84

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I find it a matter of honour to have this opportunity to offer feelings of sincere gratitude and indebtness to Mr. S.S. Sodhi, Deputy Manager (Manufacturing), under whose competent guidance I had the greatest oppurtunity of conducting the present investigation during my Work Term -II at Northern Digital Exchanges Limited.

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Senior Engineer(Customer Engineering) and Mr.Navjeet Singh,Engineer (Production) for their encourging words and deep concern for me.

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ABSTRACT

During the Work Term-II, the assingments were taken up for the Production Planning & Control Department of Northern Digital Exchanges Limited which varied in their nature and content to a great extent. On the one hand where the projects were of typical industrial enginerring and on the other hand the routine activites gave the best exposure to the planning and control aspect of production and material.

The project tiltled "Preparation of Two Handed Process Chart & development of Time Standards for NE-40 & NE-50 cards" has been completed and time standards have been devloped.

The project titled "Manufacturing Codification of Cards & Other Equipments in order to make the Production Status of the Above Said More Meaningful" has found the approval of the top management and has been implemented. This system of codification was put in force on Sept.1 ,88.

The project "Draft Invoices for Fourth Shipment" has been completed and the fourth shipment was received at Works in the month of Oct,88 with the use of the above said draft invoices.

A software has been developed for calculating and comparing the landed cost of a component which can be purchased from different vendors, namely OKI,

alternate and Indian. The alternate source out here means a vendor outside India but not OKI. The software is user oriented and can calculate the minimum landed cost for more than one vendor under particular category.

It was observed that lot of paper goes out as waste which can be used to provide the necessary shielding during the transpotation of the systems from the works to the customer's side. An analysis has been carried out in order to obtain the figures for amount of paper that goes as waste also pay back periods have been calculated.

Also a production process manual has been developed and put in the software.

In addition to it there were certain additional responsibilities that were performed which can be called as routine activities. These include the Preparation of Daily Stock Status Report, Preparation of Packing List depending upon the customer's requirements, Defect analysis for Package Testing, Maintance of W.I.P. Stores and Despatches of the systems.

NORTHERN DIGITAL EXCHANGES LIMITED A CORPORATE PROFILE

NODE: A CORPORATE PROFILE

NODE was set up in the joint sector with PSIDC and technical collobration with OKI ELECTRICAL COMPANY of Japan. The agreement for transfer of technology was signed in september,1986, ground was broken in

late october,1986, the public issue was successfully completed in May 1987,which was over subscriped and the production began on 19th sept. 1987.

The project was completed well ahead of schedule and well within budgeted estimates inspite of 37% deprication of the rupee against the yen between the time the loans were approved and the project was commissioned.

The depreciation of the rupee against the yen was even higher when compared to the exchange rates prevalent at the time the project was conceived, capital goods finalised and submitted for approval to the Financial Institutions.Inspite of this no compromise has been made on quality and NODE today has aplant unmatched in excellence of equipment.The manufacturing facilities available cater to to anticipated future requirements.

OKI has contributed in no small measures to the effort by offering handsome discounts all of which

have resulted in completion at a cost well below Rs.960 lacs envisaged and also approximately Rs.200 lacs less than that of major competitors of NODE. The lower cost and the flexibilty in plant design will stanfd in very good stead in the years to come since the interest costs are lower today and will continue to be so when new products are added to the range.

COMMERCIAL ACHIVEMENTS

Due to some constraints imposed by Ministry of International Trade and Industry of Japan initally some problems were faced which resulted in delays in receiving both capital goods and components from OKI.These constraints were well tacked and constrains were removed and now the production is in full swing.

The order book is quite satisfactory and NODE has garnerd 16% of market share and NODE aims to gain 20% by this end. NODE was amongst the first companies to start delivery of totally digital EPABX systems to the market almost a year ahead of most of our competitors. OKI´s technology commands a high premium in the market and is ideally suited to meet the growing requirements of office autamation of major corporate customers.

Now a days the corporate customer is interested in obtaining their telecom requirements from a single

vendor whom they trust and hold ccountable for the efficient functioning of the entire system. Between Crompton Greaves(an associate company) and NODE, have obtained licences for the manufacture of a host of telecom products e.g., EPABX,telephone sets, modems, data communications terminals etc.

The marketing of some of the new products has already begun which has resulted in giving field experience of maintance and service.

RESEARCH & DEVELOPMENT ACTIVITIES

The R&D team has developed several software package to suit Indian environments.The R&Dteam is also responsible for qualifying components from indigenous and alternate sources as well developing new hardware products to important customers specifications so that new and unique feature packages can be offered, this has resulted in giving a strong competitivr edge .

INDIGENISATION PHASE & ACTIVITIES

It has been the Company's policy not only to meet but also to exceed the Goverment's expectations in the field of indigenisation. Indigenenisation is also essential for the growth and viability particularly in view of the appreciation of Yen. The vendor development and indigensation cell has been succesful in indigenising 20% by value of the IX range which covers upto 250 lines EPABX & forms 60% of the market within the first six months. The

present level of indigenisation is approximately 40% and by the end of the current financial year NODE aims to reach 65% by value therby largely insulating itself from adverse exchange rates. The IOX range of products was introduced in the month of AUG,1988 and its indigenisation was started way before.

HUMAN RESOURCE DEVELOPMENT

NODE practices an open and participative management policy under which the employees are involved in every phase of operations . They are encouraged to contribute to the process of diversification, to the improvement of manufacturing efficiencies and to their of their collegues- both senior and junior. This has paid rich dividends since they have helped in building a strong team spirit and have succeeded in providing an atmosphere that allows every employee to realise his maximum potential. Training and education as a mean of intellectual stimulation has not been restricted to a select few. Several of NODE engineers have been trained by OKI in Japan and more are being sent.This has helped in attracting and to retain the best talent of whom the best results are desired and who reciprocate by giving off their best.

WORK CULTURE OF NORTHERN DIGITAL EXCHANGES LIMITED

Efforts that all employess are treated equally and to uphold the dignity of the individual, the following practices are being carried out in this order

Common uniform for all.

Same food in the same canteen.

Management practices what they preach. The same rules apply to all. Thus even the top management members have to punch cards everyday.

Making the employees feel that the company cares for them.

Oppurtunaties for fast growth for capable persons.

Simplification of procrdures for availing of medical reimbursement, personal loans etc.

Role of departmental manager as a monitor and guide.

Labour -Management Relations, Problem solving approch rather than confortational attitude.

Emphasis on punctuality and attendance, employees reach the factory before shift starting time and the work on the shopfloor begins and ends exactly on time.

NODE PRODUCTS

Northern digital exchanges is presently producing foue models under the IX series and two models under IOX series. The IX systems are advanced EPABXs that use Time Division Multiplex(TDM) speech paths with u-law or A-law pulse Code Modulated Coding(PCM).The full Stored Program Control section is comprised of 8-bit microprocessors and Large Scale Intergrated Circuit(LSI) main memories.

The IX20& 30 use the same circuitry but different size of cabinet that allows up to 64 station lines for IX20 and 128 station lines for IX30.

The IX 40 consists of a single cabinet containing the switching circuitiry and the system power supplies and attendent consoles.The IX 40 is capable of connecting up to approximate 160 lines.The IX 50 uses the same circuitry as the IX 40 but different size of cabinet that allows up to 255 station lines.

Noiseless operation, compact size, and environmental tolerance allows a wide choice of locations for the EPABX cabinet.

The IX 40 & 50 provide a variety of features including MFC-DID(multi frequency code-direct inward dialing) feture, compareable to large scale switching systems with lower cost.The operating program for Office Data Generation is prepared in a

task format. Each task is done in a sequential order and is displayed on the computer screen.

Some of the special features of our product are as following

System Features

1.Area Code Restriction

2.Automatic Drop-out

3.Call forwarding

4.Dictation Access

5.Flexibile station Numbering

6.Last Number Redial

7.Line Lock Out

8.Music on Hold

9.Recorded Announcement Access

10.Special Local Code Restriction

11.Universal Answering System

12.Secretarial Service

13.Call Charging Pattern

MFC-DID Features

1.Talkie Access

2.Dictation Access

3.Station Busy Transfer Mode

Station Features

1.Add-on Conference

2.Call Advance

3.Call Pickup

4.Call Return

5.International Direct Dialing

6.Automatic Call Back

Console Features

1.Attendent Recall Answer

2.Automatic Recall

3.Call Queing

4.Line Lock Out Indication

5.Voice Paging Access

6.Waiting Call Indication

Multikey Telephone (MKT) Service

1.Add on Conference

2.Call Hold

3.Call Hold & Transfer

4.Call Splitting

5.Display Time

6.Dial Monitor

7.Group Calling

8.Hand Free Answer

9.Key Assingement

10.Station Hunting

11.On Hook Dialing

Hotel/Motel Features

1.Morning Call Feature

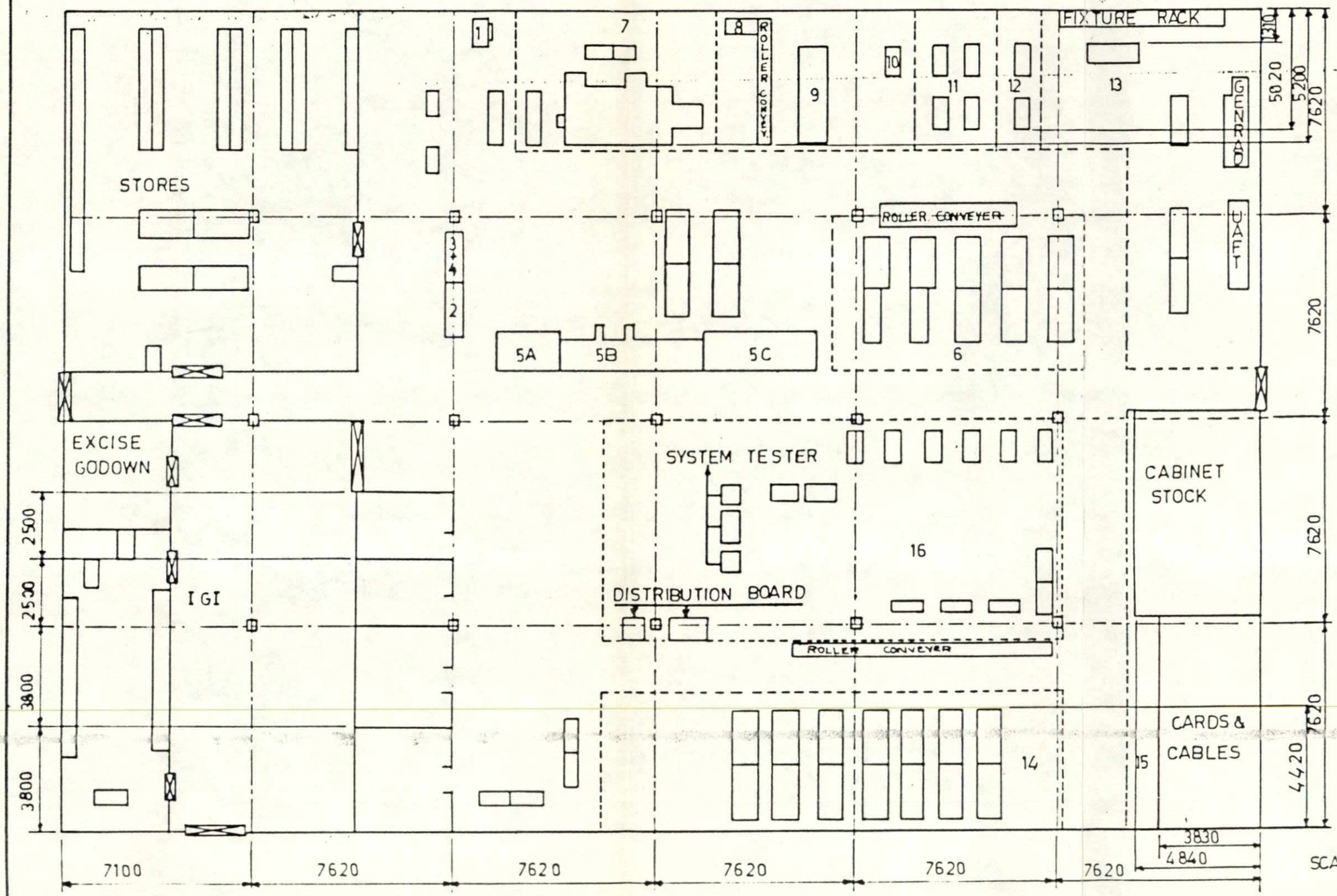
2.Room Status Display

3.Check-in & Check-out Class

4.Station Message Detail Recording

NODE

PRODUCTION HALL LAYOUT



NO	DISCRIPTION & SIZE IN mm
1	BAKING 1000 X 1000
2	MASKING 1980X760
3	ROM WRITING 1980X760
4	PATTERN CUTTING 1980X760
5A	GLUE DISPENSER 2500X2500
5B	CHIP MOUNTER 5500 X 2500
5C	FURNACE 4500 X 2500
6	POPULATION 9400X5900
7	SOLDERING 7300X5500
8	LEAD TRIMING 1240 X 760
9	B-PLATE WASHER 4680 X 1100
10	TERMINAL WASHER 1240 X 760
11	TOUCH UP 5500 X 3400
12	Q.C 5500 X 1800
13	PACKAGE TEST 13600 X 7900
14	MECH. ASSY. 17600 X 5300
15	W.I.P. STORES 15600 X 5300
16	SYSTEM TEST 17600 X 7900

SCALE 1:200

TWO HANDED PROCESS CHARTS & TIME STANDARDS FOR NE-40 & NE-50

WORK MEASUREMENT :-A STUDY

Stopwatch time study is a tool of work measurememt which has been used throughout industry to determine the time required to do work since it was developed by Frederick W.taylor before the turn of the century.

Time Standards are one of the most fundamental units of information which make Scientific Management possible.It is sobering to realize that in all operating system planning and control activities,even those utilising the most sophisticated mathematical and computer techniques, the ensuing decisions are irrevocably dependent upon the bits of performance information(time standards), that are utilised as input.

The work measurerment techniques have travelled a lot distasnce on the path of its development .Numereous techniques have evolved over the period and are finding a lot of uses and applications not only in the industrial field but in other management fields too.This work measurement techniques cover the following under their headings Stop watch Time study,Predetermined Motion Time Standards,Motion Time Measurement etc.

This field of Industrial Engineering which was previously consindered as "Time Cutting Device" has found favours with the various levels of management

and also among the operators.Work measurement has become necesssary for planning, sechduling, loading and wage incentive.

USES OF TIME STANDARDS:

1.For Design of Product:-

The functional perfection desired by the mechanical designer, the styling desired by the sales department for greater customer appeal,the trouble free performance desired by the service department,and the low cost of product desired by everyone can be balanced against a factual standard for evaluation,however such evaluation without a yardstick is extremely difficult.

2.For Design of Productive Equipment:-

The time standards find a use in the above said area in the following manner

a.Ultimate copy of manufacturing of the equipment

b.The effect of alternate methods

c.The effect of alternate designs

d.The economic utility of the equipment

3.For Selecting an Equipment:-When consindertion is being given to the choice of the new equipment either for expansion or for replacement of eisting facilities,performance standards are be used in the following manner

a.Cost of operation

b.Cost of setup

c.Machine capacity

4.For Processing and Operation planning:-The time standards are used in the above said field of I.E. in the following manner

a.To know the total time for each operation

b.The most economic method of scheduling by evaluating the possibilty for

*Multiple cuts

*Concurrent operations

*Multiple machine operations

5.Design of Tools, Jigs and Fixtures:-The time standards find their application in the above said, the design has to be such that the operation can be accomplised within the set time standards also attaining the basic requirement of a good design namely the flexibilty of design and simplicity of design.

6.For Production Scheduling:-The time standards are used for developing the load on man and machine also the man & machine load that a department has to carry can be known through the use of the time or performance standards.Another aspect that can make use of the performance standards is to know the effect of the alternate methods on man and machine and the department involved.Moreover in addition to the above listed the dispatch date or the shipping date can be known by making use of the performance or time standards.

7.For Bubegting and Cost Control:-The time standards find their use in the above said in the following manner

*.Allocating Standard Labour Cost

*.Allocating Indirect Labour Cost

*.For the development of a basis for the distribution of overhead times

8.For Cost Estimating:-Time standards find their use in cost estimating in the following manner

*.Setting Sales Prices

*.Effect of lot size on cost

*.To know the cost of the product now being made or to be made

9.For Job Evaluation and Employee Relations:-The Time standards find their use for knowing Wage/work ratio and to develop a sound scheme in order to know apply and introduce a fruitful wage incentive scheme.

PERFORMANCE RATING : ITS DEFINITION AND NECESSITY

During the recording of the elemental readings in the course of time study, attention is gernally directed towards the kind of the performance the operator is displaying. Thus it may be asked, "Is the work being performed rapidly ?" or "Is the worker deliberately taking more time than he needs to do this work?" Seldom is a time study recorded that is truly representative of the output of a group of several men who may be employed on the same job. It is necessary to insert a step in the time study procedure which evaluates this variation in output and adjust the results to those of a normal performance.

No single solution to the rating problem is universally accepted at present. Clifton A. Anderson Head, Department of Industrial Engineering, North Carolina State University, Releigh in his paper on Rating says that Rating is a comparison of pace or speed of work evidenced by the operator with that defined standard of normal. Another approch is to define the factors which affect rate of production and then to evaluate the operators performance in terms of these definitions. Lowry , Maynard , stegemerten in their paper 'Time and Motion Study and Formulas for Wage Incentive' state "In order that the time

standards established from time study for any degree of skill or effort may be a standard representing average performance, it is necessary to use some method of adjustment of the recorded elemental times if the operator studied gave other than an average performance."

WHY RATING IS NECESSARY:

When several operators are performing the same job, their output will seldom be the same. There is usually one operator who consistently produces more than others in the group. His superiority may be due to in part of a better method of doing the job, but when all men are supposedly following the same method these differences still persist. On the other hand there may be one or two operators who are decidedly slower than the others and acheive less production for this reason. Obviously, it would not be fair to the workers to study the fast man and submit, as a standard for all the group, the result of such a study. On the other hand the study taken on the low-production worker may result in a loose standard which would be reflected in excessively high earnings for some of the group, and consequently high labour cost for the product.

The above discussion implies that one standard is to be set for all persons. This assumes that

equipment, machines, methods, and other variables ordinarily assigned as the responsibilty of the management function are controlled within close limits. The extent of variation of these factors allowable within the standard established should be defind so that further may be compensated for in adjusted time values. Differences in performance as a result of qualifications, aptitudes, and motivation of the operator are reflected in differnt levels of output. Hence different levels of earnings result where a monetary incentive plan is present.

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THE METHOD OF WESTINGHOUSE SYSTEM OF RATING:

The method of assesing performance which is referred to as levelling was deviced by Lowry, Maynard, and Stagemerten . It is in use in many plants and has gained quite wide acceptance,Four elements are given as constituting the important factors which determine the rate of production that an operator achives.These four factors are

1.Skill

2.Effort

3.Conditions

4.consistency

The first two are by far the most important.

Each of the four elements carries a somewhat special or limited meaning.

Skill is defined jas "proficiency at following a given method".The time study man judges the level of skill by observing such things as hesitation,precision of movements, interruptions to the normal cycle by improper performance, and the general coordination and rhythm of working pace manifested by operator.

Effort is defined simply as "the will to work." Effort is consindered to be within the control of the operator at all the times. It is not measured in terms of foot pounds of work done but rather is

judged in terms of the spirit in which the operator attacks the job. It may range all the way from idleness to excess. The introduction of unnecessary work is also indicative of poor effort. This obviously has an effect on method also. Average effort is defined as that manifested by the operator who works steadily and with a fairly good system. Lost motions are reduced and the man takes some interest in his work . Excellent effort is exhibited by the operator who plans ahead, reduces lost motions to a minimum, uses the best method available, and takes a keen interest in his work. He is anxious to demonstrate his superiority.

Conditions are narrowly defined as those conditions which affect the operator rather than the operation. Light, heat, and ventilation, or rather the variation of these conditions from what is normally provided for the given operation, are included in consinderation for leveling purposes. Corrections for this factor cover only minor departures from standards.

Consistency is established primarily as a factor to call attention to the extent of consistency or lack of it. The correction for perfect consistency or poor consistency is a minor factor.

Selected values for performance rating:

		SKILL
+0.08	B2	EXCELLENT
		EFFORT
+0.08	B2	EXCELLENT
		CONDITIONS
+0.06	A	IDEAL
		CONSISTENCY
+0.01	C	GOOD

ALLOWANCES THEIR REQIREMENT AND NECESSISTY

If the operator were able to work continously without interruption, the standard time would be the allowed time for the operation. Constant application to the job is dsomething almost impossible to attain . In the course of the day there are some interruptions for which have to be made to establish the standard time.

The three major classifications of interruptions that the average operator will experience, which must be covered by the allowance, are personal, fatigue, and contingency.

Personal Allowance:- As the name implies, personal allowances covere the time required by the average operator to take care of the personal needs.It includes such items as getting a drink of water, washing hands, and so on. It does not include personal time included in rest periods that are paid for as a separate item. Neither does it include time for eating lunch, if regular lunch periods are designated.

Fatigue Allowances:- One of the most perplexing problems faced by the time study engineer is the measurement of fatigue. In the first place, although the word "fatigue" is used quite freely in industrial circles, and although almost everyone

who has not studied the matter carefully feels that he knows what fatigue is, not even the nature of fatigue is clearly understood. One school of thought belives that there is no such thing as fatigue, but rather that what is called fatigue is manifestation of monotony susceptibilty, boredom, and the like. Another theory accepts the existence of fatigue but recognizes differrent types of fatigue, such as those caused by excessive heat, prolonged exertion, nerve strain, or monotony. All such theories are found interesting but at the same time conflicting but a conclusion has been arrived by all the thinkers on this subject that workers experience exhaustion of strength, either physical or mental or both, as the working day progresses, which for the want of better name has been called fatigue.

A time allowamce has to be incorporated for the puposes of standardising the times, in order to to make the operator work at a optimum rate and at the same time not letting the fatigue to "accumulate"

Contingency allowance: It is an allowance of time added to basic time to account for unavoidable delays such as cleaning of machines, occasionaly lubricating the machines, discussion with foreman, etc.gernally this is a very small percentage of time added to the basic time.

Allowances selected for time standards calculations

Personal Allowance	5%
Fatigue Allowance	4%
Standing Allowance	2%

For an operator in a standing condition during the operation an additional allowance has been provided as "Standing Allowance" since under ergonomic aspects a man is bound to experience more fatigue.

Contigency Allowance	2%

TWO HANDED PROCESS CHARTS FOR OPERATION KITTING

Initial Condition of Man & Material:

1.Operator is in a standing condtion at the working table with an empty plastic bin about 2 feet * 1 foot on the his right hand side .

This bin is finally being used for the storing of the components that have been kitt.

2.Polyethene bags are lying at the left hand side of the operator.

LEFT HAND	RIGHT HAND
*A*Operator is at the working table.	
1.Moves on the list for the component name/qty etc.	1.Holds pencil(unproductive movement)
*B*Moves to the rack and searches for the components	
2.Takes out the bin or antistatic tubes which ever is required for the component being looked for	Idle
*C*Operator comes back to the working table	
3.Holds the bin/antistat	Takes out components
4.Places the bin on the table	Holds the components
5.Takes a polethene bag	Puts the components in the bag

6.Holds the bag	Staples the bag
7.Paste a sticker on the bag	Paste a sticker on the bag
8.Idle	Writes the information about the components on the sticker
9.Puts the bag in the bin	Idle

TIME STANDARDS FOR OPERATION KITTING

OPERATION	AVERAGE TIME IN SECONDS
1.List consultation	6
2.Operator moves from table to rack	3.8
3.Searching for the component at rack	72
4.Operator moves from the rack to the table	2.6
5.Transfer of the component to the bag (includes the time for component counting and pasting of the sticker)	47.4
6.Moves to keep the bin back to the rack	3.5
Total Time	135.4

TIME STANDARDS FOR OPERATION KITTING

CARD NAME	TOTAL TIME	BASIC TIME	STANDARD TIME
CPU	8665.6	10659	11831
HTXA	7040.8	8660.2	9612.8
TSIA	7176.2	8826.7	9797.7
BDRA	3791.2	4663.2	5176.1
BDRB	3926.6	4829.7	5361.0
BDRC	3926.6	4829.7	5361.0
ALMA	5280.6	6495.1	7209.6
TSIB	7988.6	9826.0	10907
LCXA	12592	15488	17192
COTB	10967	13490	14974
POSA	3385.0	4163.6	4621.5
TNTA	5686.8	6994.8	7764.2
FWTA	4332.8	5329.3	5915.6
EBY	6634.6	8160.6	9058.2
EMGA	4739.0	5829.0	6470.2
MEMA	10155	12491	13865

ALL THE TIMES ARE IN SECONDS.

TIME CALCULATIONS FOR OPERATION COUNTING

ALL TIMES ARE IN SECONDS

CARDNAME	TYPES OF COMPONENTS	TOTAL TIME
ALMA	39	1006.2
BDRA	28	722.40
BDRB	30	774.00
BDRC	29	748.20
COTB	81	2089.8
CPU	64	1651.2
EBT	49	1264.2
EMGA	35	903.00
FWTA	32	825.60
HTXA	52	1341.6
LCXA	93	2399.4
MEMAB	75	1935.0
POSA	25	645.00
TNTA	42	1083.6
TSIA	53	1367.4
TSIB	59	1522.2

TIME STANDARDS FOR OPERATION COUNTING OF COMPONENTS

CARD NAME	TOTAL TIME	BASIC TIME	STANDARD TIME
ALMA	1006.2	1237.6	1398.5
BDRA	722.40	888.55	1004.1
BDRB	774.00	952.02	1075.8
BDRC	748.20	920.29	1039.9
COTB	2089.8	2570.5	2904.6
CPU	1651.2	2031.0	2295.0
EBT	1264.2	1555.0	1757.1
EMGA	903.00	1110.7	1255.1
FWTA	825.60	1015.5	1147.5
HTXA	1341.6	1650.2	1864.7
LCXA	2399.4	2951.3	3334.9
MEMAB	1935.0	2380.1	2689.5
POSA	645.00	793.35	896.49
TNTA	1083.6	1332.8	1506.1
TSIA	1367.4	1681.9	1900.5
TSIB	1522.2	1872.3	2115.7

All times are in seconds.

TWO HANDED PROCESS CHARTS FOR OPERATION MASKING

Initial Condition of Man & Material:

1. The operator is in a sitting position.
2. The cards to be masked are lying in a magazine and this magazine is being stored on the working table.
3. All operation assisting equipmemt and material is there at the working table.

LEFT HAND	RIGHT HAND
1. Idle	1. Takes out the card from the magazine and places on the table.
2. Picks up the tape & holds	2. Fixes the tape on the card
3. Picks up the cutter and does the cutting	3. Holds the tape in a manner that it sticks to the card
4. Places the cutter on the table	4. Places the masking tape on the table
5. Places the card in the magazine	5. Idle

TIME STANDARDS FOR OPERATION MASKING

After the operation of baking the cards are taken for the work of masking ,masking is done with the main objective as to avoid the deposition of solder on those particular region .These gernally include the areas on which the connectors have to be inserted in the Touch Up area, also the edge connetors of the PCBs. On certain occasions because of the shortage of the components, the related areas of these shortages are also masked on the PCBs in order to avoid the depostion of solder on these areas. However these maskings are removed at the time of Touch Up of the cards.

Description of Operation	Average Time in seconds
1.Card from the magazine to work table	1.8
2.Masking time per area masked	33.4
3.Card back to the magazine	1.45

So the total time calculations have been done on the following basis

Total Time = No. of areas masked * 33.4 + 3.25

TIME CALCULATIONS FOR OPERATION MASKING

CARDNAME	MASKINGTIME	TOTALTIME
ALMA	133.60	136.85
COTA	100.20	103.45
CPUA	167.00	170.25
DSCA	100.20	103.45
EMGA	133.60	136.85
FLCA	100.20	103.45
GRGA	100.20	103.45
HTXA	133.60	136.85
LCXA	100.20	103.45
LDTA	100.20	103.45
LLCA	100.20	103.45
MRGA	167.00	170.25
ODTB	100.20	103.45
PGTA	133.60	136.85
POSA	100.20	103.45
RVSA	133.60	136.85

All times are in seconds.

TIME STANDARDS FOR OPERATION MASKING

CARD NAME	TOTAL TIME	BASIC TIME	STANDARD TIME
ALMA	136.85	168.33	190.21
COTA	103.45	127.24	143.79
CPUA	170.25	209.41	236.63
DSCA	103.45	127.24	143.79
EMGA	136.85	168.33	190.21
FLCA	103.45	127.24	143.79
GRGA	103.45	127.24	143.79
HTXA	136.85	168.33	190.21
LCXA	103.45	127.24	143.79
LDTA	103.45	127.24	143.79
LLCA	103.45	127.24	143.79
MRGA	170.25	209.41	236.63
ODTB	103.45	127.24	143.79
PGTA	136.85	168.33	190.21
POSA	103.45	127.24	143.79
RVSA	136.85	168.33	190.21

All times are in seconds.

TWO HANDED PROCESS CHART FOR OPERATION IC LEAD FORMING :

The operation of IC lead forming is carried out in order to make the insertion of the ICs during the population operation more easy and accurate in terms of placement.For this purpose a machine is being used but it can be said that man-machine interaction is quite equal.

On the two side of the m/c there are two slots ,the tube containing the ICs which have to be lead formed is inserted on the right hand slot while the ICs that have been leadformed are taken out in an empty Antistatic Tube through the left hand slot. Within the operation the ICs are made to roll over a set of rollers thus making the leads to come in one plane.

Initial Condition of Man and Material:-

1.The operator is in a sitting condition.

2.The AntiStatic tubes containing the ICs are kept at the left hand side of the operator and the tube which contain the lead formed ICs are placed at the right hand side of the operator.

LEFT HAND	RIGHT HAND
1.Holds empty antistatic tube	1.Machine setting
2.Holds the above said	2.Idle

tube	
3.M/C setting	3.Inserts the antista_tic tube which contains ICs to be lead formed.
4.Operates controls	4.Supports the m/c in a tilted condition
5.Takes out the tube from the left slot	5.Takes out the tube from the left slot
6.Transfer of the lead formed ICs to the original tube	6.Transfer of the lead formed ICs to the original tube

The operation of transfering the lead formed ICs back to the original tube is an unproductive one the antistatic tube containing the lead formed ICs i.e. the tube taken out of the left slot should be used as the bin containing the ICs to be transfered to population centre.In this manner a saving of 9.6 secs will be obtained for each set of ICs.

TIME STANDARDS FOR OPERATION IC LEAD FORMING

Description of Operation	Average time in seconds
1.Insertion of empty antistatic tube in the slot	3.1
2.Insertion of antistatic tube containing ICs to be lead formed	5.3
3.Machine operation (per IC)	0.65
4.Transfer of the Formed ICs back to the original tube	9.6

CARD NAME	No. of ICs	TYPE OF ICS	MACHINE TIME	TOTAL TIME
ALMA	5.00	5.00	3.25	93.25
TSIB	77.00	30.00	50.05	590.0
EBYD	99.00	4.00	64.35	136.3
TNTAE	54.00	23.00	35.10	449.1
MEMAB	34.00	16.00	22.10	310.1
BDRC	33.00	13.00	21.45	255.4
LCXA	56.00	18.00	36.40	360.4
BDRA	26.00	14.00	16.90	268.9
BDRB	37.00	13.00	24.05	258.1
COTB	61.00	19.00	39.65	381.6
POSA	70.00	29.00	45.50	567.5
EMGA	15.00	9.00	9.75	171.8
FWTAE	50.00	19.00	32.50	374.5
CPUA	80.00	30.00	52.00	592.0
HTXA	20.00	12.00	13.00	229.0
TSIA	56.00	30.00	36.40	576.4

All times are in seconds.

TIME STANDARDS FOR OPERATION IC LEAD FORMING

CARD NAME	TOTAL TIME	BASIC TIME	STANDARD TIME
ALMA	93.25	114.6975	126.16
TSIB	590	725.7	798.2
EBY	136.3	167.649	184.41
TNTAE	449.1	552.393	607.63
MEMAB	310.1	381.423	419.56
BDRC	255.4	314.142	345.55
LCXA	360.4	443.292	487.62
BDRA	268.9	330.747	363.82
BDRB	258.1	317.463	349.20
COTB	381.6	469.368	516.30
POSA	567.5	698.025	767.82
EMGA	171.8	211.314	232.44
FWTAE	374.5	460.635	506.69
CPUA	592	728.16	800.97
HTXA	229	281.67	309.83
TSIA	576.4	708.972	779.86

TWO HANDED PROCESS CHARTS FOR OPERATION RADIAL LEAD

FORMING:

Initial Condition of Man and material:

1.The operator is in a sitting condition.

2.All the operation assisting equipmemyt and material are lying on the table.

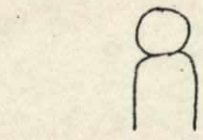
LEFT HAND	RIGHT HAND
1.Takes the strip out.	1.Idle
2.Places the strip on the table.	2.Picks up the cutter.
3.Holds the strip.	3.Forms the lead.

(The operation 3 is perfored for a set of components available on that particular strip)

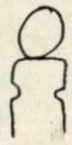
TIME STANDARDS FOR OPERATION RADIAL LEAD FORMING &

CUTTING :-

The operation of radial lead forming is done in order to make the components with such leads that have the leads in the fashion as shown below. This operation is necessary such as to make the component insertion easier. Certain components are already lead formed when procured from the vendor.But kink forming in the leads and the cutting of the lead to proper size is done in the works.



Before Lead Forming



After Lead Forming

Description of operation	Average time in seconds
1.Picks up the component	1.0
2.Forms kink on the lead	3.5
3.Forms kink on the another lead	3.5
4.Places the component back	1.0
TOTAL TIME FOR THE OPERATION	9.0

TIME CALCULATIONS FOR OPERATION RADIAL LEAD FORMING

CARDNAME	TOTAL TIME
BDRC	198.00
BRDA	180.00
CPUA	504.00
EMGA	90.00
FWTAE	243.00
HTXA	945.00
MEMA	477.00
ODTBE	594.00
PBRA	36.00
TNTA	360.00
TSIA	252.00

All times are in seconds.

TIME STANDARDS FOR OPERATION RADIAL LEAD FORMING

CARD NAME	TOTAL TIME	BASIC TIME	STANDARD TIME
BDRA	180.00	221.40	250.18
BDRC	198.00	243.54	275.20
CPUA	504.00	619.92	700.51
EMGA	90.00	110.70	125.09
FWTAE	243.00	298.89	337.75
HTXA	945.00	1162.3	1313.5
MEMA	477.00	586.71	662.98
ODTBE	594.00	730.62	825.60
PBRA	36.00	44.28	50.04
TNTA	360.00	442.80	500.36
TSIA	252.00	309.96	350.25

All times are in seconds.

TWO HANDED PROCESS CHARTS FOR OPERATION AXIAL LEAD

FORMING:

Initial Condition of Man & Material:

1.The operator is in a sitting condition.

2.The components to bre lead formed are attached to a real and are kept on the table. However the components that have been lead formed are obtained in the bin placed under the m/c.

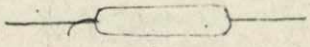
LEFT HAND	RIGHT HAND
1.Takes out the real of components.	1.Idle
2.Placement and adjustment of the real on the m/c.	2.Placement and adjustment of the real on the m/c.
3.Holds the real on the m/c.	3.Operates the controls.
4.Supports the real on the m/c.	4.Supports the real on the m/c.

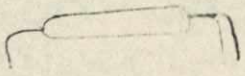
This operation No.4 is carried out while the m/c operation is also being carried out.

5.Takes out the empty real from the m/c.	5.Takes out the empty real from the m/c.
6.Idle	6.Takes out the bin from under the m/c.

TIME STANDARDS FOR OPERATION AXIAL LEAD FORMING AND CUTTING

The operation of axial lead forming is done in order to make the leads of the components in the following shape . The main requirement of the operation is to create the leads in such a fashion so as facilitate the population operation for such components and to give the lead length a proper size.





Description of operation	Average times in Seconds
1. Component movement from bin to the m/c and adjustment	1.3
2. Placement in the slot	1.2
3. Machine Operation	0.7
Total Time	3.2

TIME CALCULATIONS FOR OPERATION AXIAL LEAD FORMING

CARDNAME	TOTAL TIME
BDRC	291.20
BRDA	358.40
CPUA	76.80
EMGA	163.20
FWTAE	35.20
HTXA	32.00
MEMA	54.40
ODTBE	176.00
PBRA	422.40
TNTA	28.80
TSIA	70.40

All times are in seconds

TIME STANDARDS FOR OPERATION AXIAL LEAD FORMING

CARD NAME	TOTAL TIME	BASIC TIME	STANDARD TIME
BDRA	358.40	440.83	498.14
BDRC	291.20	358.18	404.74
CPUA	76.80	94.46	106.74
EMGA	163.20	200.74	226.83
FWTAE	35.20	43.30	48.92
HTXA	32.00	39.36	44.48
MEMA	54.40	66.91	75.61
ODTBE	176.00	216.48	244.62
PBRA	422.40	519.55	587.09
TNTA	28.80	35.42	40.03
TSIA	70.40	86.59	97.85

All times are in seconds.

TWO HANDED PROCESS CHART FOR THE POPULATION PROCESS

Intial Conditions of the Material & the Operator:-

1.All Cards are lying in the magazine(a material handling facility in which the PCB are stored in an horizontal manner).

2.The Bins/Anti static tubes containing the components are lying on the left hand side of the operator.

3.The supporting rails of the "One Man Conveyer" are held loose.

MAJOR MOVEMENT:Transportation of the card to the conveyer

A Operator kneeling down on the floor

LEFT HAND	RIGHT HAND
Takes out the card from the magazine	Takes out the card from the magazine

Holding the card in the left hand moves to the conveyer

B Operator at the machine in the standing position

LEFT HAND	RIGHT HAND
1.Holds the card	1.Movement of the

	suporting rail
2.Fixes the card	2.Fixes the card
3.Tightens the screw on the left side of the fixture	3.Tightens the screw on the right side of the fixture

Goes back to *A*, Repeats *B* till all the cards are there on the conveyer

MAJOR MOVEMENT:-Component Insertion on the Bare PCB
A Operator Sitting on Chair

LEFT HAND	RIGHT HAND
1.Picks up the bin	1.Idle
2.Holds Bin	2.Takes out components from the bin
3.Keeps back the empty bin	3.Holds the components
4.Gets the components from left hand	4.Transfers the components to right hand

B Removal of Empty Bins

1.Picks the bin	1.Idle
2.Transfers bin to the Right Hand	2.Gets bin from Left Hand
3.Moves to pick the filled bin containg the component to be inserted	3.Removes the bin(keeps on the right side cover of the m/c

TIME STANDARD FOR POPULATION OPERATION

The operation of population is the one in which the bare PCBs are given the physical change with the insertion of the components .The operation is performed either at the "One Man Conveyer" or "Populating Stand".At the former the operator is in a sitting condition and the PCBs are made to move in front of the operator on a conveyer with the help of controls at the right hand side of the operator.However at the latter the operator is in a standing condition and here he/she has to move in order to insert the components on the bare PCBs. Generally the number of PCBs that are used at one station is 10 & presently two One Man Coneveyer are being used and five populating stands.Thus in this manner seven operators can work at the above said operation centre.

Operation			Average Time in Seconds
1.Insertion time/card			A
2.Setup time			26
3.Removal time			27
Hence total time for each card			A+53
For Performance Rating			
SKILL	Excellent	B2	+0.08

EFFORT	Excellent	B2	+0.08
CONDITIONS	Excellent	A	+0.06
CONSISTENCY	Good	C	+0.01
Then Basic Time			(A+53)*123/100

Say Basic Time =B

Then using the various previously defined Allowances the Standard time expression becomes

Standard Time B(1+11/100)

And the expression gets modified for the operayor in a standing position

Standard Time B(1+13/100)

By making use of the listed method the following times are obtained for the various cards

CARDNAME	INSERTION TIME	BASIC TIME	STANDARD TIME
ALMA	314.5	452.0	501.7
ATTA	518.5	702.9	780.2
ATTB	794.8	1042.8	1157.5
ATTC	246.5	368.3	408.9
BDRA	348.5	493.8	548.2
BDRC	624.8	833.7	925.4
COTB	2193.0	2762.6	3066.5
CPU	875.5	1142.1	1267.7
EBYA	667.3	885.9	983.4
EBYB	2877.3	3604.3	4000.0
EMGA	429.3	593.2	658.5

FWTA	378.3	530.5	588.85
HTXA	884.0	1152.5	1279.3
LCXA	3221.5	4027.5	4470.6
MEMA	777.8	1021.9	1134.3
POSA	1117.8	1440.1	1598.5
TNTA	544.0	734.3	815.1
TSIA	544.0	734.3	815.1
TSIB	630	840.1	932.5

All the above given times are in seconds.

TIME CALCULATIONS FOR OPERATION INPROCESS Q.C.

(AFTER OPERATION OF POPULATION)

TIME STUDY WAS CARRIED OUT ON VARIOUS CARDS AND THE THE CALCULATION OF TOTAL INSPECTION TIME WAS CARRIED ON THE BASIS OF TIME REQUIRED FOR INSPECTING A SINGLE COMPONENT. AN AVERAGRE INSPECTION TIME PER PIECE WAS CALCULATED AS 1.62 SECONDS.

ALL THE CALCULATIONS HAVE BEEN DONE ON THIS BASIS

CARDNAME	TOTAL TIME
ALMA	119.88
ATTA	197.64
ATTB	302.94
ATTC	93.96
BDRA	132.84
BDRB	314.28
BDRC	238.14
COTB	835.92
CPUA	333.72
EBYA	254.34
EMGA	163.62
FWTA	144.18
HTXA	336.96
LCXA	1228.0
MEMA	296.46
POSA	426.06
TNTA	207.36
TSIA	207.36
TSIB	264.06

TIME STANDARDS FOR OPERATION IN PROCESS Q.C.

CARD NAME	TOTAL TIME	BASIC TIME	STANDARD TIME
ALMA	119.88	147.45	166.62
ATTA	197.64	243.10	274.70
ATTB	302.94	372.62	421.06
ATTC	93.96	115.57	130.60
BDRA	132.84	163.39	184.63
BDRB	314.28	386.56	436.82
BDRC	238.14	292.91	330.99
COTB	835.92	1028.2	1161.8
CPUA	333.72	410.48	463.84
EBYA	254.34	312.84	353.51
EMGA	163.62	201.25	227.42
FWTA	144.18	177.34	200.40
HTXA	336.96	414.46	468.34
LCXA	1228.0	1510.4	1706.7
MEMA	296.46	364.65	412.05
POSA	426.06	524.05	592.18
TNTA	207.36	255.05	288.21
TSIA	207.36	255.05	288.21
TSIB	264.06	324.79	367.02

TWO HANDED PROCESS CHARTS FOR OPERATION WAVE SOLDERING

Initial Condition of Man & Material:

1.The operator is in a sitting position.

2.The materail i.e. the populated cards are lying in the magazine on the right hand side of the operator.

3.The same magazine is being used for the soldered cards.

LEFT HAND	RIGHT HAND
1.Picks up the card from the magazine	1.Holds foresep
2.Holds the card	2.Holds the card
3.Postioning of the card on the conveyor	3.Postioning of the card on the conveyor
4.Idle	4.Checking the postion of the components on the PCB with the help of foresep.

The above said operations are repeated for a set of cards. After this the operator moves to the other end of the m/c to take out this set of cards.

5.Takes out the card from the conveyor	5.Takes out the card from the conveyor
6.Holds the card	6.Holds the card

(During the above said operation the inspection operation by the operator is carried out)

7.Puts the soldered card back in the magazine	7.Puts the soldered card back in the magazine

TIME STANDARDS FOR OPERATION WAVE SOLDERING

The operation of wave soldering is performed on the populated cards in order to adhere the components on to the PCB. The operation of wave soldering uses solder as the bonding material for this purpose i.e. betwwn the PCB and the components. The operation is to a great extent automised but the involvement of the man power can also not be neglected at the same time. In addition to it the wave soldering machine is a high precision machine.

Description of operation	Average time in seconds
1.Card movement from the magazine to the m/c	4.18
2.Positioning of the card on the conveyor	39.1
3.Machine operation	188.81
4.Inspection of the card and placement of the card in the magazine	7.54
Total Time	240.23

Then using the selected rating factors and the allowances the following figures are obtained for the Basic Time and the Standard Time

(The operator has been consindered in a standing position for the purpose of calculation of standard Time)

Basic Time = 295.48 seconds

Standard Time = 333.89 seconds

TWO HANDED PROCESS CHART FOR OPERATION LEAD TRIMING

Intial Conditions of Operator and Material:-

1.Cards that have been wave soldered are lying on the right hand side of the operator.These cards are lying in the material handling facility "Magazine".

2.For the cleaning and inspection of the cards the table adjacent to the m/c is being used .

3.The fixtures for the cards are lying in the rack.

MAJOR MOVEMENT:-Fixation of the Fixture on the m/c

A Operator at the Fixture Rack

LEFT HAND	RIGHT HAND
1.Takes out the fixture from the rack.	1.Takes out the fixture from the rack.
2.Holds fixture	2.Holds fixture

MAJOR MOVEMENT:-Lead Cutting of the cards (this operation is machine oriented)

1.Picks the card	1.Idle
2.Card to m/c (Transportation operation)	2.Card to m/c
3.Holds card	3.Fixture adjustment
4.Set up operation for the card	4.Set up operation for the card
5.Idle	5.Operates vaccum control knob and starts the m/c
6.For the movement of	6.For the movement of

the fixture	the fixture

The operation 6 leads to the cutting of the of the leads on the B side of the PCB.

7.Idle	7.Stops the m/c
MAJOR MOVEMENT:Inspecting the card	
8.Takes out the card	8.Idle
9.Holds card	9.Cutting and cleaning of the card
10.Idle	10.Card back to magazine

TIME STANDARDS FOR OPERATION LEAD TRIMING

The operationof lead triming is performed on the 'B' side of the PCB in order to cut the leads to a uniform length . The operation is performed with the help of a machine called the lead trimmer. In order words the process is machine oriented.

The cards to be lead trimmed are placed on a fixture with their 'B' side towards the cutter. For various types of cards having same dimensional confrigrations there exists a type of fixture.

Description of Operation	Average times in seconds
1.Fixation of Fixture	109.0
2.Card from magazine to m/c	3.21
3.Fixation of card on the fixture	7.72
4.Machine operation	245.2
5.Removes the card and takes to the table	2.9
6.Cutting,cleaning and inspection	89.3
7.Card back in magazine	2.8

The operation of fixation of fixture on the

magazine is done once only for a lot of same type of cards.

Under this condition, for a lot of n cards the time becomes

$X = 109.0 + (351.13) * n$

Then Basic Time = $X * 123 / 100$

and Standard Time (Operator in a standing condition) = Basic Time $(1 + 13/100)$

TWO HANDED PROCESS CHART FOR THE B-PLATE WASHER:-

Initial Conditions of the Material and Operator:-

1.Operator in a standing condition

2.The cards are lying on the left hand side of the operator.

3.The control panel of the machine is on the other side of the insertion window & in this regard the operator has to move a considerable distance to operate the controls.

LEFT HAND	RIGHT HAND
1.Idle	1.Takes out the card from the mag--zine
2.Transporting the card to the machine	2.Transporting the card to the machine
3.Closes the window	3.Idle
MOVES TO THE CONTROL PANEL	
4.Operates control	4.Operates control
BACK TO THE OPERATING WINDOW	
5.Opens window	5.Idle
6.Idle	6.Takes out the card from the washer
7.Holds the card & trans fers to the magazine	7.Holds the card & transfers to the magazine

TIME STANDARDS FOR OPERATION B-PLATE WASHER

The operation of B-plate washing is performed after the operation of Lead Trimming. Here in this operation the 'B' side of the PCB is given a wash with freon in order clean the said side before it moves to the next operation of Terminal Washing. The washer obtains its name from the operation itself or vice versa is also applicable out here. The operation can be performed in the two manners listed out , that is Manual and Automatic. The time observations were made for the both the said operations and are listed below

MANUAL OPERATION

Description of Operation	Average times in seconds
1.Card movement from magazine to m/c	3.52
2.Fixes the card in the m/c and closes the operating window	4.6
3.Moves to the controls	4.1
4.Operates the controls	50.5
5.Moves back to the operating window	3.52
6.Takes out the card from the m/c and places in the magazine	5.31

Total time	71.55

Using the selected performance rating factors and allowances the following figures for basic time and standard time are calculated

Basic time = 88.00 seconds

Stanard Time = 99.4 seconds

(The operator has been consindered as standing)

AUTOMATIC OPERATION

Description of Operation	Average times in seconds
1.Card movement from magazine to m/c	3.52
2.Fixes the card in the m/c and closes the operating window	4.6
3.Auto machine operation	34.0
4.Takes out the card from the m/c and places in the magazine	5.31
Total time	47.43

Basic Time = 47.43 * 1.23 = 58.34

Standard Time = 58.34 * 1.13 = 65.92 secs

TWO HANDED PROCESS CHARTS FOR OPERTION TERMINAL WASHING

Initial Condition of Man & Material

1.The man is in a standing condition.

2.All the cards which have to be given a terminal wash are lying in the tote box and that is being stored on the left hand side.

LEFT HAND	RIGHT HAND
1.Picks up the card from the tote box.	1.Switches on the washer.
2.Inserts the card in the m/c	2.Inserts the card in the m/c.
(During the operation 2 the washing of the terminal is carried out)	
3.Takes the card out	3.Takes the card out
4.Puts the card in the tote box.	4.Idle

TIME STANDARDS FOR OPERATION TERMINAL WASHING

The operation of terminal washing is performed after the operation of B-Plate washing has been carried out. In this operation the washing action is carried on the terminals of the card to make it clean from any impurieties which can effect the contact between the terminal and the connector of the mother board.

Description of Operation	Average Times in Seconds
1. Picks up the card from the bin	1.8
2. Card(Terminal) washing	46.0
3. Side change & inspecton	3.0
4. Card(Terminal) washing	50.0
Total Time	100.8

TWO HANDED PROCESS CHARTS FOR OPERATION TOUCH UP

Initial Condition of Mam & Material:

1.The operator is in a sitting postion.

2.The working space for the operator is a table with all the Operation assisting equipmemt and material on the table . Here the various OAE/M are soldering iron, solder wire, desoldering flux etc.

3.The cards to be touched up are lying in the tote boxes on the floor on the left hand side of the operator.

LEFT HAND	RIGHT HAND
1.Picks the card from the tote box and brings the cards to the table	1.Holds cutter
2.Holds the Cards in a tilted position	2.The cutter is moved on the 'B' side of the card, in order words the cutting operation is performed.
3.Connector insertion	3.Connector insertion
4.Holds soldering wire and supports the connector	4.Holds soldering iron and does the soldering
5.Holds the card	5.Moves the brush on

	the 'B' side of the PCB i.e the cleaning operation
6.Holds the card	6.Holds the card

(during this operation (6) the inspection of the card is carried out.)

7.Card back to the tote box	7.Idle

TIME STANDARDS FOR OPERATION TOUCH UP:

The Touch Up operation is performed in order to carry out the following operations :

1.Certain components are soldered here in the cost centre Touch up and this operation is done manually and gernally these components are connectors.

2.Checking the quality of the soldered card.

3.Insertion of certain jumpers and there soldering

4.A quality check is carried out for the amount of solder, under this a check is made for following namely excess solder and less solder

5.On certain occasion, here in touch up certain shortages are also tackled with i.e. if at all a card doesnot contain ceretain components because of the non availability of them in the stores at the time of population of the card then these short components are inserted and soldered in Touch Up.

Description of operation	Averages time in seconds
1.Card from bin to the work table	4.4
2.Connector insertion and soldering per pin	4.8
3.Touch Up	3360.0
4.Cleaning	66.7
5. Card back to the bin	4.5

CARDNAME	No.of PINS SOLDER	SOLDERING TIME	TOTAL TIME
CPUA	48.00	230.40	3666.0
MRGA	66.00	316.80	3752.4
POSA	16.00	76.80	3512.4
ALMA	16.00	76.80	3512.4
FLCA	34.00	163.20	3598.8
GRGA	34.00	163.20	3598.8
DSCA	34.00	163.20	3598.8
HTXA	50.00	240.00	3675.6
RVSA	68.00	326.40	3762.0
PGTA	68.00	326.40	3762.0
EMGA	68.00	326.40	3762.0
BDRC	100.00	480.00	3915.6
ODTBE	34.00	163.20	3598.8
TSIA	190.00	912.00	4347.6

All times are in seconds.

TIME STANDARDS FOR OPERATION TOUCH UP

CARD NAME	TOTAL TIME	BASIC TIME	STANDARD TIME
CPUA	3666	4509.18	4960.098
MRGA	3752.4	4615.452	5076.9972
POSA	3512.4	4320.252	4752.2772
ALMA	3512.4	4320.252	4752.2772
FLCA	3598.8	4426.524	4869.1764
GRGA	3598.8	4426.524	4869.1764
DSCA	3598.8	4426.524	4869.1764
HTXA	3675.6	4520.988	4973.0868
RVSA	3762	4627.26	5089.986
PGTA	3762	4627.26	5089.986
EMGA	3762	4627.26	5089.986
BDRC	3915.5	4816.065	5297.6715
ODTBE	3598.8	4426.524	4869.1764
TSIA	4347.6	5347.548	5882.3028

All times are in seconds.

MANUFACTURING CODIFICATION FOR CARDS & CABS

MANUFACTURING CODIFICATION

OF

CARDS AND CABINETS

The Emergence of the Problem:- While looking into the production plan for the period AUG.88 to MARCH89 a descrepancy was found in the number of systems that have been manufactured from the date of starting the production.There are basically three files which contain the information about the System Dispatch and hence about the systems which have been sold.These files are "Records of Packages Shipped Out", "Stores Credit Note" & " Monthly Production Returns to the Accounts".The first listed file contains the information regarding the the various PCBs that are dispatched with a system, the listed file contains the information in terms of the various systems/softnodes/cards that are shipped out, the information out here is in consolidated form and the third listed file contains the information about the various systems that have been produced in a particular month and those which have been sold or dispatched.During the looking in of the above listed files it was found out that the figures were not up to the mark because of one reason or the another.

A solution in this regard that emerged was to change the present system of codification of the card and cab. manufacturing numbers.

The Previously existing System :-

In case of the Printed Circuit Board manufacturing number was in numerics. These are denoted in the following manner 00436,00567 or others.The flaw which was noted in this type of codification is that no information what so ever could be generated out of it.The manufacturing number was just a serial number which didnot give any information rrgarding the time and production status/schedule of the card i.e. the day/date or month and year of its manufacturing.

However in the case of the Cabinets/MDF/ATT the manufacturing code did not exist .The only information that could be generated out of the stickers(that were put on the systems at the time of dispatch) were related with the status or time of dispatch.The following information could be generated

1.Specification Number

2.Manufacturing Number

3.Date

Under the Specification Number the "4YU" codes have been included

The term manufacturing number is quite deceptive out here .Under this"NOOxx" was included which was directly related with the number of dispatches that had been made prior to it.It was found out that some times it had a relation with the manufacturing number while at the other hand it did not.Under these circumstances a cabinet or MDF or ATT manufactured prior to another was being dispatched later, in other words neither LIFO nor FIFO was applicable.In simpler words the "Manufacturing Number" had nothing to do with the time/date of productiom or in other words the production schedule.

"Date" was denoted on the sticker in the following fashion X/Y where X represented the week of dispatch and Y represented the year of dispatch.During the time ofanalysis it was found out that these were not in accordance with the production schedule.Also in order to know about the exact date of dispatch the file " The Store Credit Note " had to be referred.

ACTIONS DONE IN THIS REGARD:-A report was prepared under which the suggested changes were listed out and the comparison between the two systems of codifications were listed out.The report was submitted to the higher management. The report received the due consinderation at the hands of the management.Various departments were involved in this and certain changes were suggested out by the production department to make the manufacturing codification more informative and more useful.

THE FINAL VERSION OF MANUFACTURING CODIFICATION:-

To give the manufacturing codification the final shape a meeting was held between the Senior Engineers of the various concerend department namely Quality Control,Production and Production Planning & Control.A draft was prepared for the above said code which than became the final papers in this regard.The final version of the said draft is enclosed here with.

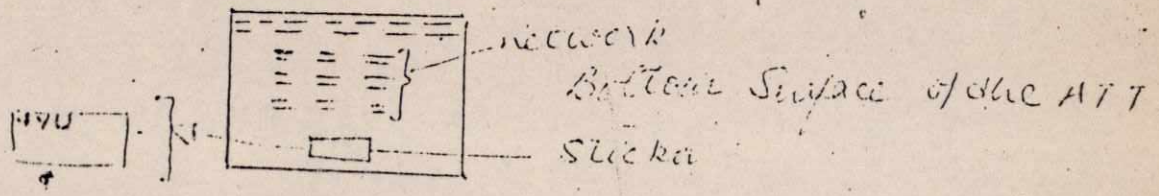
LOCATION:

1. On the cards the manufacturing code will be put on the bottom left hand counter on the 'B' side of the PCB.

2. On the MDF the manufacturing code will be put on the right panel (grey coloured) at the bottom right corner.

3. On the cabinets the manufacturing code will be put at the middle lower panel.

4. The location on the ATT has been explained down under :-



5. Responsibility:

The manufacturing code will be put on the cards, cabinets, ATTs and MDFs by the quality control.

The despatch stickers on the cabinet (which will be one but common for MDF, ATT and cabinet) will be put on the cabinet by the PPC department.

The code on the card will be put by the QC after final inspection and on the cabinet, MDF and ATT it will be put by QC after mechanical assembly.

88 F 01 ____

Year Month Date Serial No.

MANUFACTURING CODIFICATION OF CARDS AND CABINETS

The meeting for the above said was held on Aug,31'88 and it was attended by Mr. P.K. Kalia, Mr. R.Ramanand, Mr. Vivek & Mr. Sukhpreet Singh, and the following points were decided :-

1. The manufacturing code for the cards will be as follows :
   First two letter will depict the year that too in numeric i.e. for the present year the code will be 88.
   This will be followed by an alphabet that will denote the month of production i.e. for the month of september the code will be:I.
   The next two numbers will denote the date of manufacture.
   This will be followed by the serial number.

2. For the cabinets/MDF/ATT the numbers/code will be put with the help of the 'Johnson & Johnson' stickers. These stickers are presently being used for the despatch of the systems. Here on this sticker, under the 'date' column the alphanumeric code will be written that is code denoting the year, month and date.
   And under the 'Manufacturing No.' column the production serial number will be written.
   All other coloumns in the above mentioned sticker will be filled in the same manner as in the previous existing system.
   The use of the above mentioned stickers for the despatch of the systems will be discountinued.
   The serial number will be started a fresh for the cabinets MDF/& ATTs.

3. For the despatch purposes the new metallic stickers will be used and the code numbers & date will be put in the same fashion on as that was being done for the despatches. i.e. date will be put in the x/y fashion, x denoting the week despatch and Y denoting the year of despatch.
   And under the serial number the serial number of despatch i.e. XXXXX will be written/punched.

COST BENEFIT ANALYSIS WITH THE UTILISATION OF PAPER SCRAP

COST BENEFIT ANALYSIS WITH THE UTILISATION OF PAPER SCRAP & INSTALLATION OF PAPER SHREDDER

UTILISATION OF PAPER IN NODE:

Paper is being used at various stages and in different forms out there in NODE. The computer paper is specially finding a great use in the varoius departments. The departments of Electronic Data Processing, Production/Material Planning & Control, Accounts, R&D (Software) and System Testing are the direct users of the Computer Paper. In addition to it there are certain other departments which can be called as indirect users of the above said paper in one form or the other. No doubt when there is utilisation of it there will be scrap too.

In addition to it paper scrap is being generated by the use of other type of papers such as in the form of note pad or typing paper. Also the photostat machine being used is another main generator of paper scrap that too utilising different type of papers that is to say paper of A3 size paper of A4 size and B4 size.

It was observed that all this paper was going as waste. or in other words scrap since no relisation value was being obtained in one form or the another because this paper scrap was gernally burnt.

At the same time the need of the packing material was quite high and it is still so. This packing material is gernally required at the time of dispatch of the system. At present the systems are dispatch without much of cushion between the system and the inner wall of the wooden box, in which the system is dispatched.

Consindering the requirements and the anticipated utilisation of the paper cuttings a need was felt to procure a paper shredder.In business or commercial world the paper shredder is defined as a machine capable of converting tons of material into unreadable material. The old records lying in the office can not be sold as scrap for fear of falling into undesireable hands, so it can be shreddewd and sold for a good price as packing material.

From the above discussion it can be concluded that for the above listed problem of creating packing material in the form of the paper cuttings and maintaing the seceracy of the documents, which was previously being maintained by the burning of the documents, can be solved with the installation of the paper shredder.

STEPS TAKEN FOR THE ANALYSIS IN TERMS OF COST SAVING

Here the main material which can lead to the cost saving is the paper, not only this but also the paper as a scrap is the input and the paper as cuttings is the output. Moreover this paper in the form of paper cuttings is the one element which can improve the present form of packing of the system at the time of the dispatch.

Considering this the first step that was taken in this regard was to know about the type of papers which were being used and the sewgregation of these on the basis that they can be shredded or not.

The second step was to know the amount of the paper that goes as waste i.e. their amount and the money/cost involved with it.

After this an analysis was carried out in order to calculate the benefit that can be obtained with the conversion of the paper scrap into useful paper cuttings and the use of the latter as packing material.

In addition to above said, the excercise of locating the suppliers and getting the prices of the shredders was also carried out.

CALCUALTIONS FOR THE COST SAVING/ PAY BACK PERIOD

Cost of the papers being used in the computers

Type of the paper	Cost/1000	Weight/1000
15*12	121	6.5 kg
10*12	95	5.1 kg

Cost per kg

for type 15*12 =Rs 18.62

for type 10*12 =Rs 18.63

Average weight of sheets that go out as scrap daily

2.1 kg

Average ratio of the papers that go out as scrap

15*12 60

10*12 40

Therefore the total amount of sheets that go out as scrap in a month

2.1 * 22 = 46.2 kg

(22 working days are observed in NODE with saturday and sundays being observed as weekly off days)

Therefore the total amount of sheets that go out as scrap in a year

46.2 kg * 12 = 554.40 kg

i.e in the following ratio the paper goes out as waste

type 15*12 = 332.64 kg

type 10*12 = 221.76 kg

in order words in terms of rupees the paper goes out as waste in the following manner

type 15*12 -------> 332.64 * 18.62 = Rs 6193.75

type 10*12 -------> 221.76 * 18.63 = Rs 4131.38

Total = Rs 10325.13

i.e in a year the total loss because of the paper going as waste is Rupees 10325.13 <----------->

Running cost that is incurred over an year :-

If the paper shredder is equipped with a 0.50 KW motor the following calculations are arrived at

The machine is operated in a month for say 4 hours then over a year the machine is operated for 48 hours

and is made to run at PSEB supply which cost Rs 0.69 per unit

Then cost incurred over the year = 0.50 * 48 * 0.69

= Rupees 16.56

Initial cost of the paper shredder:-

The lowest quated price was Rs 6750 + 10% sales tax

In order words the total amount that has to be paid intially comes to Rs. 7425

If the paper cuttings are purchased for the purchase of packing the systems at the time of dispatch then on yearly basis there will be an expenditure of Rs.3326.4, as the procurement cost of these are Rupees 6/Kg.

The Cash flow chart has been attached.

Also a graph showing the pay back period has been attached.

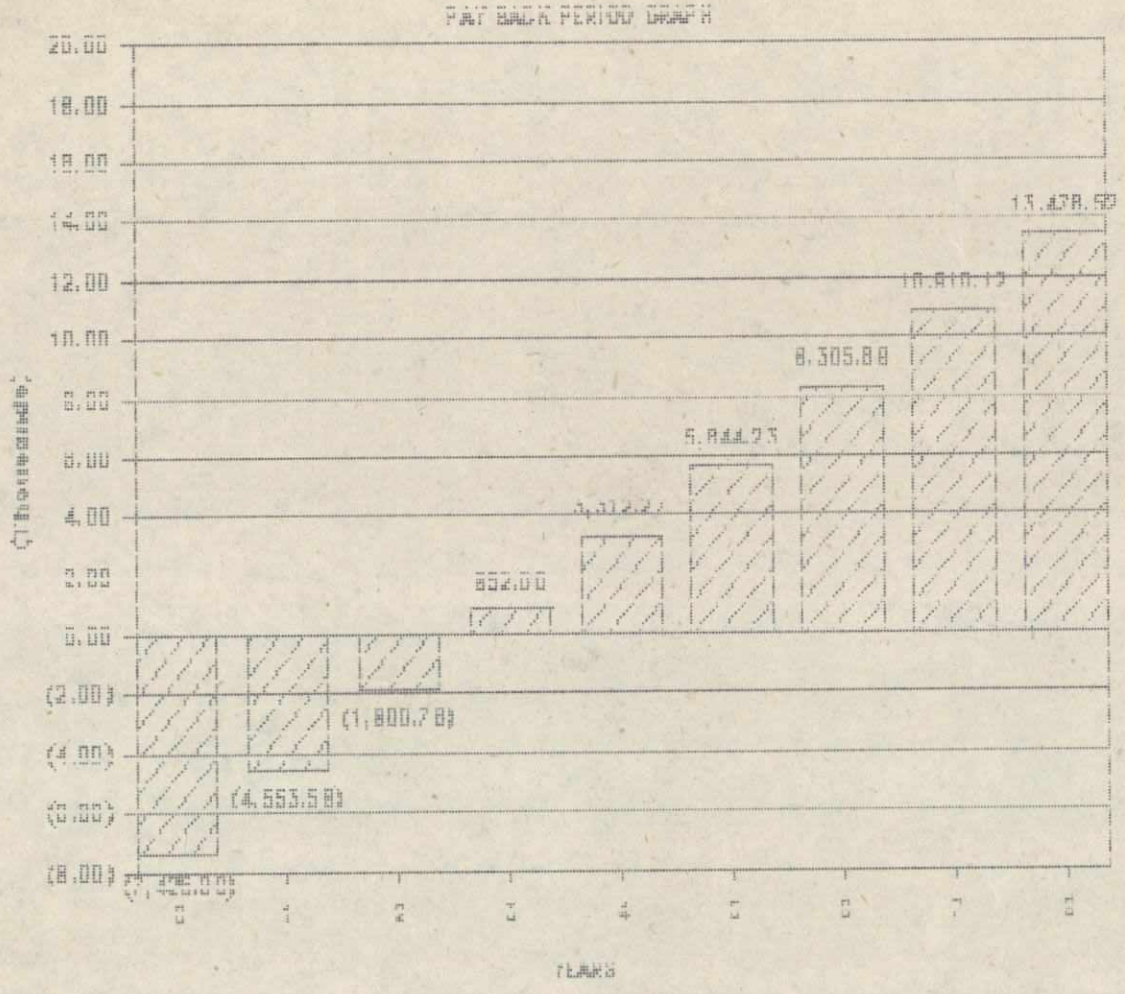
COMPARISION CHART
FOR
ASSUMPTIONS

YEAR	BASE SCENERIO	CASE 1	CASE 2
1	ACTUAL	SAME	SAME
2	+20%	+25%	+15%
3	+10%	10%	10%
4	CONSTANT	CONSTANT	CONSTANT
5	CONSTANT	CONSTANT	CONSTANT
6	+20%	+20%	+20%
7	CONSTANT	SAME	SAME
8	CONSTANT	SAME	SAME
9	CONSTANT	+10%	SAME

CASH FLOW ANALYSIS

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9
OPERATING COST	(00.00)	(16.56)	(19.87)	(21.86)	(21.86)	(21.86)	(26.23)	(26.23)	(26.23)	(26.23)
PAPER SAVING		3326.4	3991.68	4390.84	4390.84	4390.84	5269.02	5269.02	5269.02	5269.02
DEPRECIATION		(2474.75)	(1649.92)	(1099.99)	(733.37)	(488.94)	(325.97)	(217.33)	(144.89)	(96.60)
OPERATING INCOME		835.09	2321.88	3268.99	3635.61	3880.04	4916.82	5025.46	5097.9	5146.19
TAXES ON OPERATING INCOME		438.42	1218.98	1716.22	1908.71	2037.02	2581.33	2638.36	2676.39	2701.75
AFTER TAX INCOME		396.67	1102.9	1552.77	1726.9	1843.02	2335.49	2387.1	2421.51	2444.44
ADDING BACK DEPRECIATION		2474.75	1649.92	1099.99	733.37	488.94	325.97	217.33	144.89	96.60
NET CASH FLOW	(7425)	2871.42	2752.82	2652.76	2460.27	2331.96	2661.46	2604.43	2566.4	2541.04
COMMULATIVE CASH FLOW	(7425)	(4553.58)	(1800.76)	******** 852 ********	3312.27	5644.23	8305.69	10910.12	13476.52	16017.56

CASH FLOW ANALYSIS



CASH FLOW ANALYSIS

CASE-1

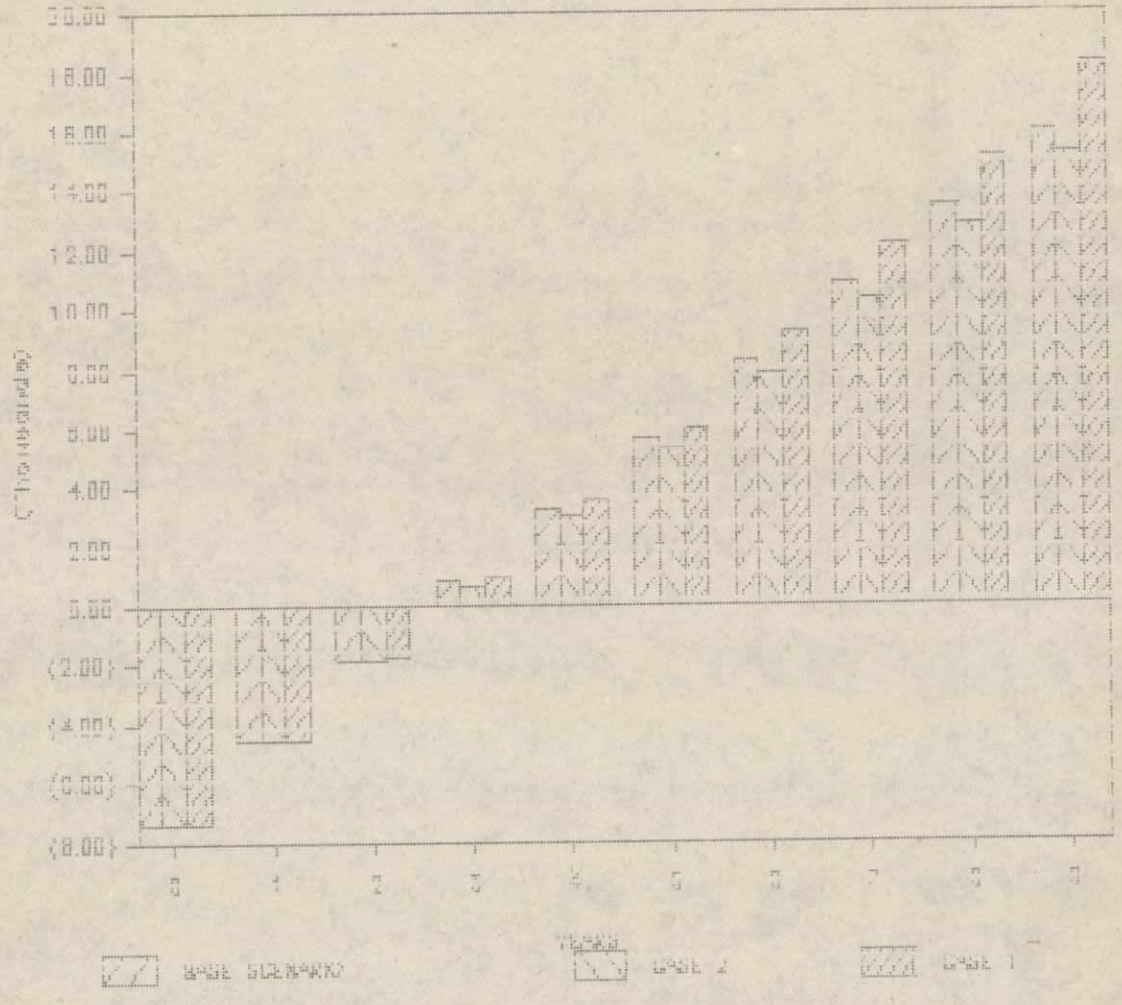
	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9
OPERATING COST	(00.00)	(16.56)	(20.70)	22.77	(22.77)	(29.77)	(29.60)	(29.60)	(29.60)	(32.56)
PAPER SAVING		3326.4	4155.00	4573.8	4573.8	4573.8	5945.94	5945.94	5945.94	6540.53
DEPRECIATION		(2474.75)	(1649.92)	(1099.99)	(733.37)	(488.94)	(325.97)	(217.33)	(144.89)	(96.60)
OPERATING INCOME		835.09	2487.38	3451.04	3817.66	4062.09	5590.37	5699.01	5771.45	6411.37
TAXES ON OPERATING INCOME		438.42	1305.87	1811.79	2004.27	2132.59	2934.94	2991.98	3030.01	3365.96
AFTER TAX INCOME		396.67	1181.5	1639.2	1813.4	1929.5	3009	2707	2791.4	3045.4
ADDING BACK DEPRECIATION		2474.75	1649.92	1099.99	733.37	488.94	325.97	217.33	144.89	96.60
NETCASH FLOW	(7425)	2871.42	2831.42	2739.19	2546.7	2418.4	3334.9	2924.3	2886.2	3142.0
CUMULATIVE CASH										

CASH FLOW ANALYSIS

CASE-2

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9
OPERATING COST	100.00)	(16.56)	(19.04)	(20.94)	(20.94)	(20.94)	(25.13)	(25.13)	(25.13)	(25.13)
PAPER SAVING		3326.4	3825.36	4207.9	4207.9	4207.9	5049.48	5049.48	5049.48	5049.48
DEPRECIATION		(2474.75)	(1649.92)	(1099.99)	(733.37)	(488.94)	(325.97)	(217.33)	(144.89)	(96.60)
OPERATING INCOME		835.09	2156.4	3086.97	3453.59	3698.02	4698.3	4807.02	4879.46	4927.75
TAXES ON OPERATING INCOME		438.42	1132.11	1620.66	1813.13	1941.46	2466.61	2523.69	2561.72	2587.07
AFTER TAX INCOME		396.67	1024.29	1466.31	1640.46	1756.56	2231.69	2283.33	2317.74	2340.68
ADDING BACK DEPRECIATION		2474.75	1649.92	1099.99	733.37	488.94	325.97	217.33	144.89	96.60
NET CASH FLOW	(7425)	2871.42	2674.21	2566.3	2373.83	2245.5	2557.66	2500.66	2462.63	2437.28

SENSITIVITY CURVES



LANDED COST CALCULATION SOFTWARE

MATERIAL COST: Material is the most important element of cost. The cost of material has been defined as "the cost of commodities supplied to an undertaking." Materials may be direct and indirect.

Direct materials include

Material which can be directly related to and identified with cost centres or cost units.

Material which is purchased specifically for a particular job, work order of contract.

Finished product of a particular process which constitutes the raw material of the subsequent process.

Indirect material include

Material which cannot be allocated but can be apportioned to ,or absorbed by cost centres or cost units.

Material which is used in such a small quantity that it is not possible to ascertain its per unit cost exactly.

Let us consider the role of the material and the material control along with the cost associated for the purpose of understanding the effect of these on the net contributional margins.

SALE REVENUES-VARIABLE COST=CONTRIBUTIONAL MARGINS

The above expression is based upon the direct cost accounting system. In the following lines an accounting system and its difference with the

absorption cost accounting system.

Within the framework of the several cost systems, a differentiation is made between the concept that all manufacturing costs must be assigned to each unit of product (absorption costing) and the concept that only the variable manufacturing costs must be assigned (direct costing). Absorption costing is the traditional method, but for the principles of predictive management to work, direct costing techniques are essential.

One of the major problems of a direct cost system is the separation of the fixed overhead from variable overhead. There are lot many techinques for going about this system. These range from consindering all overhead as fixed or consindering each category as either wholly fixed or wholly variable, to separating the portions which behave as either fixed or variable as determined by experience. The problem can be readily solved by consindering the nature of the cost: fixed, planned, or programmed. If the nature of the cost is understood, its classification is generally obvious.

Much of the confusion surrounding direct versus absorption costing system stems from not understanding the purpose of the accounting system. Traditional accounting systems are concerned with inventory valuations, balance sheets, and income

statements. If the nature of the cost of the enterprise is understood it becomes much easier to manage and control them which in turn means decisions can be made at much informed basis.

Under the varible cost we consinder the costs which are dependent upon the level of production and other production related factors. If we specifically consinder the case of present day production techniques, the main thing which comes to the notice is that the practice of allocating cost dependent upon the work hour put in by the operators is now totally out. In other words the only variable cost which has a direct linkage with the net contributional margins is the material cost.

Also the material cost can be bifurcated in two :

The cost for the purchase of the matrial

The cost for holding the material in plant.

Inventroies tie up the a company's most verstaile assest, cash. Businesses have a limited amount of capital available to them from their owners and creditors, and each business tries to use it as efficently as possible to earn bigger profits.

Capital is never so readily available that it can be invested in inventory at no cost.

Storage is the most obvious inventory carrying

space, salaries of personnel related storage expenses, insurance and taxes. Insurance and taxes on inventory are a directly variable cost, because thay are normally paid at a rate directly proportional to inventory value.

Storagre cost can vary widely with the type of material stored and the type of storage facilities used. Usually, the storage costs are equal to at least 4% of the value of the material stored per year.

From the above discussion it can be concluded that in ordr to increase the contributional margins the variable cost has to be decresed, or more precisely the material cost (a variable cost) has to be brought to minimum in order to acheive high bebefits. This can be done in two manners that are with lesser initial cost and lesser holding cost. The present day managemental and manufacturing techniques suggest that with an aim of acheiveing high benefits and investing lesser in material, the indegisation should be based on high and sound bases. In other words by procuring the components that are "Home Made" one can acheive high benefits since first it is easier to procure the component/part because of sound contacts with the vendor, lesser transportation charges. Second the

nullified.

Charcterstics of the Soft ware developed:

The software has been developed with the following aims

The software is meant for doing an analysis in order to generate the figure for landed cost of various vendors. The material has been prevoiusly supplied by our colloborator OKI, with the begining of the indigenisation phase NODE has been always looking out for local as well as alternate sources which can supply the required material. (Out here in NODE the term Alternate is used to describe that vendor which is outside India but is not OKI.)

The software can at the same time tell about that particular vendor for which the landed cost is minimum.

In software is able to covert the cost of the component in any foreign currency into indian Rs. So that the relative comparision factor for all the vendors can be done on this basis.

```
 SET TALK OFF
 SET STAT ON
 SET ECHO OFF
 CLEAR
 CLEAR ALL
 NAM='  '
 MLC=0
 TEMP1=0
 FCOST=0
 PP1=0
 PP2=0
 PP3=0
 VENDOR='  '
 SG =' '
 CD=SPACE(18)
 AC=' '
 YYN=' '
 *************
 @*1,24"SAY""COST BENIFIT ANALYSIS"
  @ 7,10 SAY "ENTER COMPONENT CODE"  GET CD FUNC '!'
  READ
  WAIT
  CLEAR
  STORE 'T' TO FLAG
  K=1
*******************LOOP1*******************
DO WHILE FLAG='T'
YN='  '
AS=SPACE(14)
MS=SPACE(20)
@ 7,10 SAY "ENTER FOLLOWING INFORMATION FOR ALTERNATE SOURCE"
@ 9, 10 SAY "ENTER M/S ...." GET MS FUNC '!'
@ 11,10 SAY "ENTER COUNTRY OF THIS ALTERNATE SOURCE  " GET AS FUNC '
READ
 STORE STR(K,1) TO CTR
 STORE AS TO AS&CTR
 STORE MS TO MS&CTR
USE CURRENCY INDE CURRENCY
FIND &AS
STORE CONVERSION TO CV
USE
FOB =0
@ 13,10 SAY "ENTER THE ALTERNATE SOURCE FOB" GET FOB
READ
FFOB=FOB*CV
STORE FFOB * 1.06 TO CIF
WAIT
CLEAR
D=0
@ 12,10 SAY "ENTER THE DUTY APPLICABLE" GET D
READ
STORE CIF + CIF*D/100 + .02*CIF TO FCIF&CTR
  IF K>1
  STORE STR(K-1,1) TO CTR1
  STORE MIN(FCIF&CTR,FCIF&CTR1) TO MCIF
  IF FCIF&CTR<FCIF&CTR1
   COUNTRY=AS&CTR
   NAME=MS&CTR
   ELSE
   COUNTRY=AS&CTR1
   NAME=MS&CTR1
  ENDIF
ELSE
MCIF=FCIF&CTR
NAME=MS&CTR
ENDIF
?'LANDED COST IS'
```

```
? FCIF&CTR
 WAIT
 CLEAR
READ10 SAY "ANY OTHER ALTERNATE SOURCE EXISTS(ENTER Y/N)" GET YN PICT '!'
       IF YN = 'Y'
       K=K+1
       ELSE
       STORE 'F' TO FLAG
       ENDIF
ENDDO
*******************END OF LOOP1******************
IF k>1
?'MIN IS'
?STR(MCIF,5)
?COUNTRY
?NAME+' '+'IS OFFERING THE MATERIAL AT THE LOWEST COST'
ENDIF
ENDIF
WAIT
CLEAR
*****************
STORE 1 TO I
STORE 'T' TO FLAG1
DO WHILE FLAG1 ='T'
ANS=' '
IMS=SPACE(20)
ISF=0
@ 12,10 SAY "ENTER THE FOLLOWING INFORMATION FOR INDIAN VENDOR"
@ 14,10 SAY 'ENTER M/S ..' GET IMS FUNC '!'
@ 16,10 SAY "ENTER INDIAN SOURCE P.O.P?" GET ISF PICT '9999'
READ
STORE STR(I,1) TO ICT
STORE ISF TO ISF&ICT
STORE IMS TO IMS&ICT

WAIT
CLEAR
XFACO=0
LC=0
PCO=' '
@ 14,10 SAY "SOURCE IS AT PUNJAB/CHANDIGARH/OUTSIDE?(ENTER(P/C/O)" GET PCO
READ
      DO CASE
      CASE PCO = 'P'
      XFACO&ICT = ISF&ICT*1
      STORE .23 TO MF

      CASE PCO = 'C'
      XFACO&ICT = ISF&ICT*0.0075 + ISF
      STORE .35 TO MF

      CASE PCO = 'O'
      XFACO&ICT = ISF&ICT*.04 + ISF
      STORE .4 TO MF

      ENDCASE
LC&ICT = XFACO&ICT*MF+XFACO&ICT
?'LANDED COST IS ...'+STR(LC&ICT)
IF I>1
```

```
READ
IF ANS='Y'
I=I+1
ELSE
STORE 'F' TO FLAG1
ENDIF
ENDDO
IF I>1
?'MIN LANDED COST IS'+STR(MLC)
?'M/S  '+NAM+'IS'
ENDIF
PP3=0
**********************END OF LOOP**********************
? '   PLEASE WAIT CALCULATIONS FOR JAPAN GOING ON'
 USE INV INDE INV
 PP=0
 FIND &CD
STORE POPRICE TO PP
 PP=800
 PP1=PP*.1106
 PP2=PP1*1.06
 PP3=PP2*D/100+PP2
 ? 'LANDED COST(JAPAN) FOR  '+CD+'IS '+STR(PP3)
 FCOST= 0
 TEMP1=MIN(MCIF,PP3)
 FCOST=MIN(TEMP1,MLC)
 DO CASE
     CASE FCOST=MCIF
      VENDOR=NAME
     CASE FCOST=MLC
       VENDOR=NAM
     CASE FCOST=PP3
       VENDOR='OKI'
ENDCASE
 ?'MIN COST IS..'+STR(FCOST)
?'SUPPLIER WITH THE LOWEST COST IS  '+VENDOR
```

```
. DISP STRU
Structure for database: A:CURRENCY.dbf
Number of data records:      29
Date of last update    : 12/01/88
Field  Field Name  Type        Width     Dec
    1  COUNTRY     Character      20
    2  CURRENCY    Character      12
    3  CONVERSION  Numeric         8       4
** Total **                      41

.
Command Line    :<A:>:CURRENCY                  :Rec: 1/29          :       :   Ca

                        Enter a dBASE III PLUS command.
```

```
. disp stru
Structure for database: A:inv.dbf
Number of data records:      92
Date of last update   : 12/20/88
Field  Field Name  Type        Width    Dec
    1  CARDCODE    Character      18
    2  OCOMPCODE   Character      18
    3  DESCRIPT    Character      25
    4  QTY         Numeric         8
    5  POPRICE     Numeric        12      2
    6  CPRICE      Numeric         8
    7  DUTY        Character       8
    8  TPRICE      Numeric         8
    9  IMPOLSTAT   Character       4
** Total **                      110

.
Command Line     :<A:>:INV                      :Rec: 1/92          :

                          Enter a dBASE III PLUS command.
```

DRAFT INVOICES FOR FOURTH SHIPMENT

DRAFT INVOICES FOR FOURTH SHIPMENT

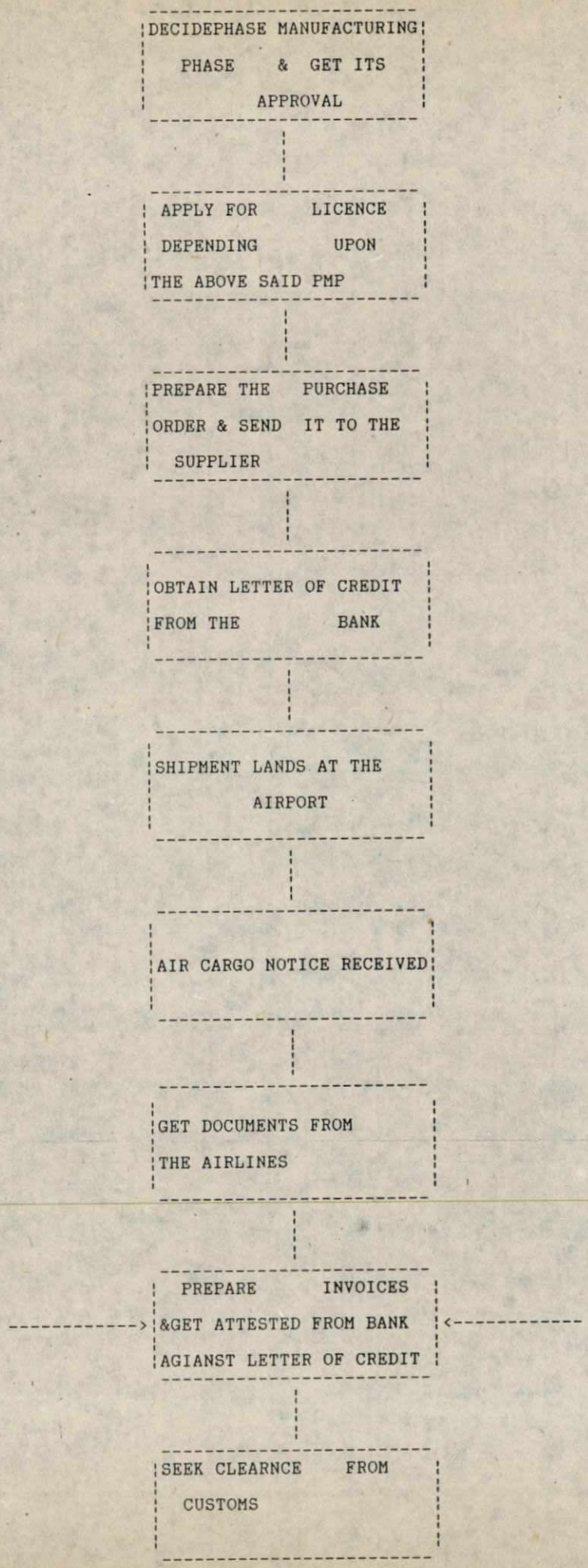
DRAFT INVOICES: In order to procure the material from any foreign category, it is required to get an import licence from the DGTD(Director General Technology Development). This licence definess the quantity which can be obtained from a foreign source, over a defined period of time. In order to obtain the material from the source(in this particular case, OKI) the papers which are submitted to the DGTD and DOE (department of electronics) giving a summary of the material being imported is called as Draft Invoices. This summary is in terms of material classification. In other words from the packing list received from the supplier a summary is obtained for various group of components that are being ordered.

The difference in the packing list and draft invoices is quite significant. The packing list

contains list of the components that are being received where as draft invoice contains a summary of it. Also in the draft invoices a distinction is made between the NOGL and OGL (Non open general licence and Open general licence).

A flow chart has been attached to explain the stage at which the draft invoices are required.

FLOW CHART SHOWING THE STAGE AT WHICH THE INVOICES ARE REQUIRED



PRODUCTION PROCESS MANUAL

PRODUCTION PROCESS MANUAL

A production process manual has been prepared giving the information for the various operations that are performed for each operation centre. The various operations have been listed in a proprer sequence in which they are performed. These are based upon the observations.

In other words operation standards have been put on the paper and they are based upon the working standards of the operators, as observed. In addition to it the other plus point is that now a standards have been set which are particularly dependent upon the operation sechedule of the operators thus acheiving simplification and standardisation.

The manual has been put in the software form for easy assisability.

The operation sequence for operation centre "Wave Soldering" is attached herewith for reference.

WAVE SOLDERING

Carry out the following preoperation checks.

Check the main pressure so that it is at 4Kg/Cm square.

Check for the adjustment of the specific gravity.

Adjust the air pressure of the fluxer to such an extent that the flux running down from the nozzle is blown falling uniformaly all over the nozzle

Check for the cleaniness of the flux removal brush and water level in the refrigator.

Carry out the air knife inspection.

Carry out the preheater inspection, also check for the cleaniness of the reflectors.

Carry out the inspection for the hot air heater, make sure that during the operation the covers should be open.

Check around safety heater, pump shaft and float switch from cleaniness from oxides, strains, dust or dirt.

Check for any impurity at secondry wave fins, if any rub the fin surface with fresh anti oxidising agent.

Check for strains at inside and outside of the solder bath, if any remove with a deposit

ROUTINE ACTIVITIES

DAILY ACTIVITIES PERFORMED DURING WORK TERM-II

The responsibities undertaken out there in NODE varied in their nature and content to a great extent, giving the best exposure to the planning and control aspect of production and material. On the very first day the charge of Work In Process Store and Work In Process inventory was taken over. The W.I.P. Store is that part/phase of production where the cards and other equipment are rreceived after they have been cleared by the system test department. Down hereunder a brief write up has been given to explain the routine activities.

1.Preparation of Daily Stock Status Report:

The Daily Stock Status Report is an Management information report which gives the stock information about the various department regarding the in process inventory. This report is provided in the morning to all the personnels of higher management staff. The production planning is based upon this report. A copy of this report is attached herewith.

2.Prepartion of Packing List:

The information regarding the confrigution of a system and the customer's requirement is prepared by the P.P.C. department in the form of packing list. The packing list is prepared from the Customer's Indent and Works Order. The indent contains information regarding the PCB's that a

customer requires.

Other informations which are fed to the packing list are as following

a. No. of different cables that are required.

b. Requirement of the Attentant Console.

c. Requirement of the Main Distribution Frame

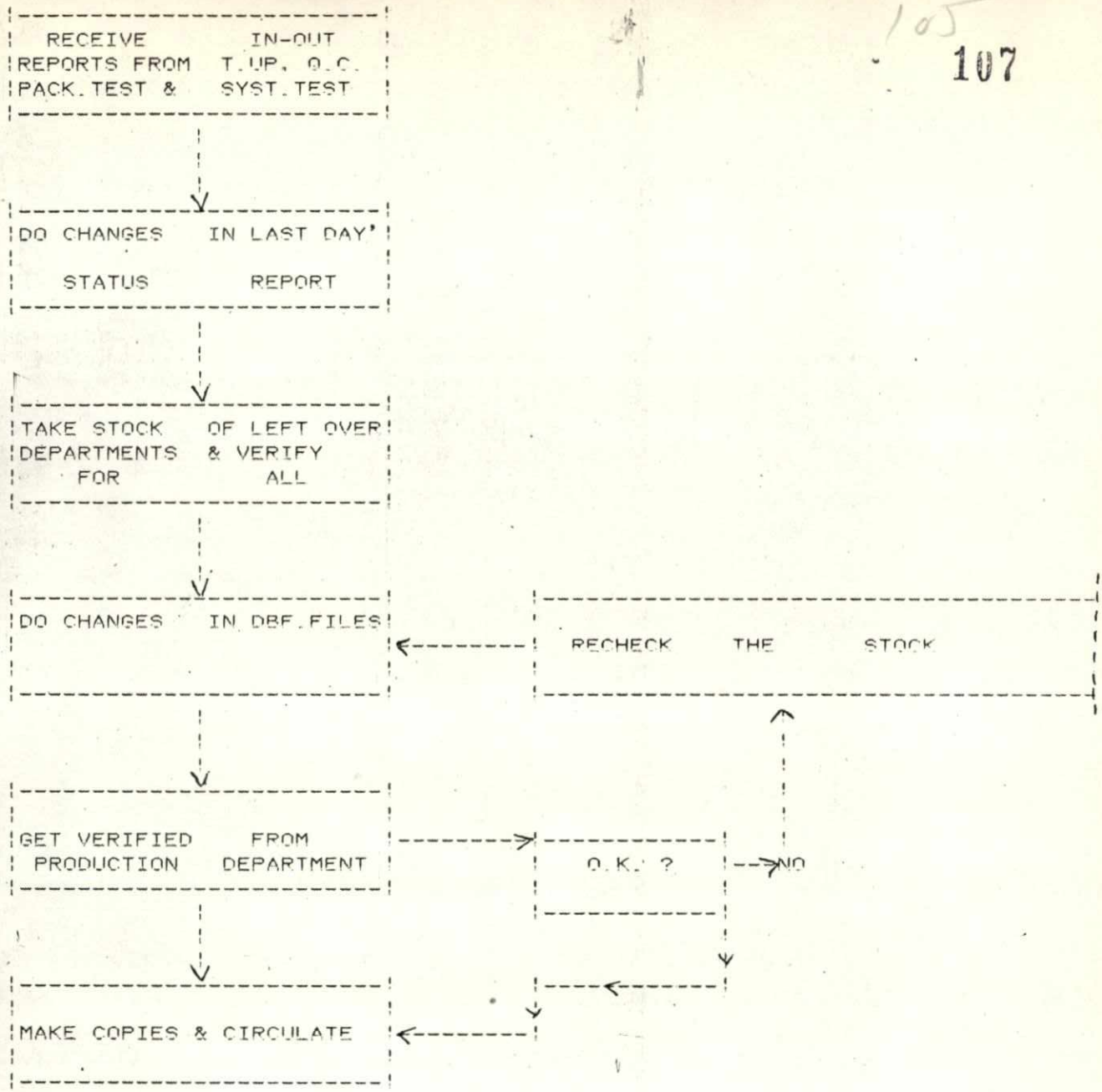
Along with the other informations the likely date of dispatch is also decided , depending upon the material in hand and material inprocess.

This likely date of dispatch is also put on the packing list, and the copies of it are send to the following department

* Production

** System testing

3.Dispatch of systems: The various activities which are performed while dispatching a system are explained with the help of a flow chart.



FLOW CHART FOR GENERATING DAILY STOCK STATUS REPORT

RECEIVE IN-OUT

NORTHERN DIGITAL EXCHANGES LTD

DAILY STOCK STATUS REPORT

CARD	T.QTY	BAKE	CHIP .M.	MASK	KIT	POP	W. SOLD	LD. TRM	BP.WSH	T-WSH	T.UP COMP	T.UP INCO	Q.C.	PKG. TEST	M.A. COMP	M.A. INC.	SYS. TST	WIP	F.G.
DI2014-DTI(40/50)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030 CPUA	13	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	5	4	0
KC030-ADT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030-ALMA	12	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0
KC030-ATTA	26	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0
KC030-ATTB	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0
KC030-ATTC	32	0	0	26	0	0	0	0	0	0	0	0	0	0	0	0	11	3	0
KC030-BDRA	14	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	12	5	0
KC030-BDRB	22	0	0	0	0	4	0	0	0	0	0	1	0	0	0	0	1	3	0
KC030-BDRC	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4	3	0
KC030-CNB(A)	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	0
KC030-CNB(B)	19	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	5	6	0
KC030-CNB(C)	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0
KC030-COTB	58	0	0	10	0	0	0	0	0	0	0	0	0	2	0	0	42	4	0
KC030-DLCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030-DSSA	6	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030-DSSCA	6	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	4	0	0
KC030-EBYA	14	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	4	1	0
KC030-EBYB	32	0	0	0	0	0	0	0	0	0	0	12	14	0	1	0	4	1	0
KC030-EMGA	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0
KC030-FLCA	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
KC030-FWTAE	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	0
KC030-GRGA	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
KC030-HTXA	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	3	0
KC030-LCXA	94	0	0	10	0	0	0	10	0	0	0	6	1	2	0	0	65	0	0
KC030-LDTA	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
KC030-LLCAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030-LLCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030-LLCBE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030-MEMA	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	5	0
KC030-MEMBA	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
KC030-MRGA	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0
KC030-ODTB	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	0
KC030-PBRA	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	23	0
KC030-PBRB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030-PGTAE	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
KC030-POSAE	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	0
KC030-RVSA	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
KC030-TNTA	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	3	0
KC030-TSIA	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	3	0
KC030-TSIB	26	0	0	13	0	0	0	0	0	0	0	3	0	0	0	0	5	5	0
KC030-DSSB	6	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KC030M-CAB	10	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	8	0
KC030S-CAB	17	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	13	0
KC030M-POW	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0
KC030S-POW	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
KC030M-MDF-CAB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0

NORTHERN DIGITAL EXCHANGES LTD

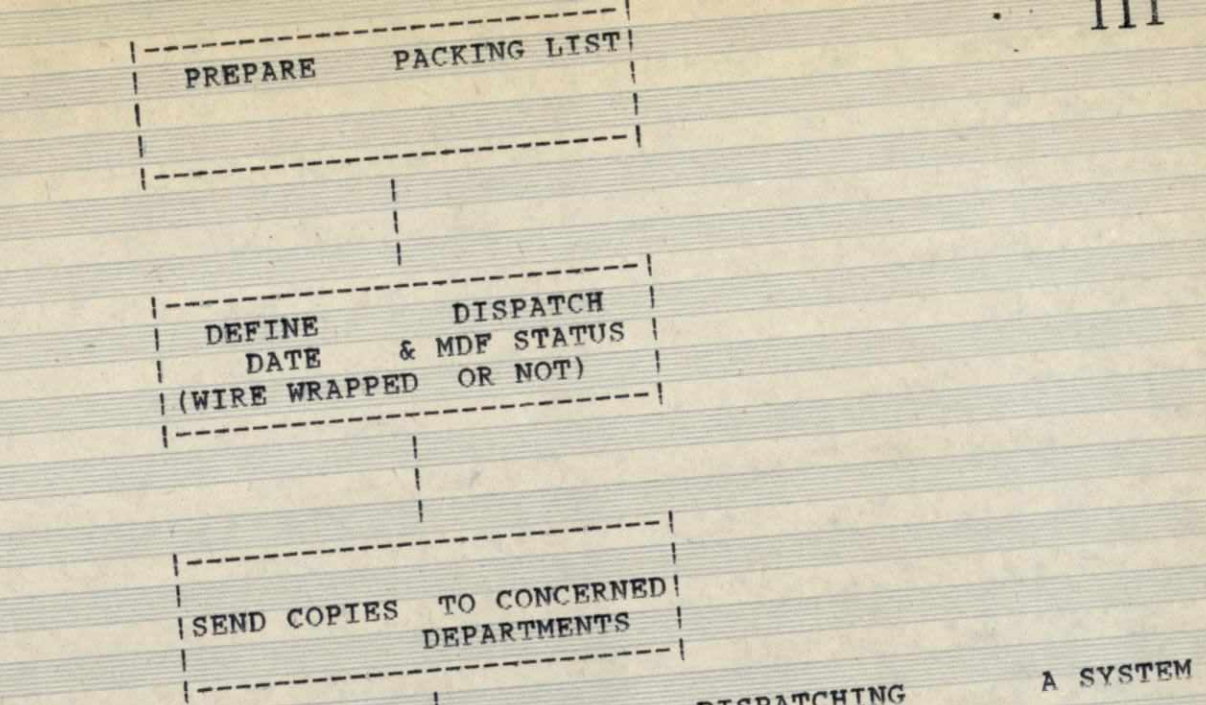
DAILY STOCK STATUS REPORT

CARD	T.QTY	BAKE	CHIP .M.	MASK	KIT	POP	W. SOLD	LD. TRM	BP.WSH	T-WSH	T.UP COMP	T.UP INCO	Q.C.	PKG. TEST	M.A. COMP	M.A. INC.	SYS. TST	WIP	F.G.
KC030S-MDF-CAB	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0
ATT(40/50)	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	5
DI2014-DTIB(20/30)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
KC120-2ADT	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
KC120-3DLC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
KC120-4BWT	46	0	17	0	0	0	0	0	0	0	0	6	1	4	0	0	13	5	0
KC120-6LLC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
KC120-8FLC	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	1	0
KC120-8LCE	161	0	28	0	0	0	0	0	0	0	0	66	3	5	0	0	46	13	0
KC120-CFTAE	23	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
KC120-CPU	22	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
KC120-DSSCA	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	3	0
KC120-EMEM	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0
KC120-JKL	23	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	3	0	0
KC120-LDBWT	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
KC120-MDF-CAB	84	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	82	0
KC120-MRGB	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
KC120-ODBWT	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
KC120-PAGAD	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
KC120-PBRA	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6	0
KC120-PBRB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0
KC120A-CNSA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
KC120A-CNSB	20	0	0	0	0	0	8	0	0	0	0	4	0	0	0	7	1	0	0
KC120A-CNT	22	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
KC120A-DISP	22	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
KC120A-EBY	12	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
KC120A-KEY	22	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
KC120A-MRGA	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5	0
KC120B-CNB	22	0	0	5	0	0	15	0	0	0	0	1	0	0	0	0	1	0	0
KC120B-MISCAE	21	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
KC120C-CNB	24	0	0	13	0	0	8	0	0	0	0	1	0	0	0	0	2	0	0
KC120C-MISCBE	23	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
KC120G-CAB	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	14	0
KC120H-CAB	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	24	0
KC120G-POW	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
KC120H-POW	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
ATT(20/30)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
DI2022	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0
DI2022B	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
HANDSETS	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	52	56
HEADSETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PS4043	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
PS4044	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
PS4048-KCNS	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	1	3
PS4049-MCCNS	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0
NE-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

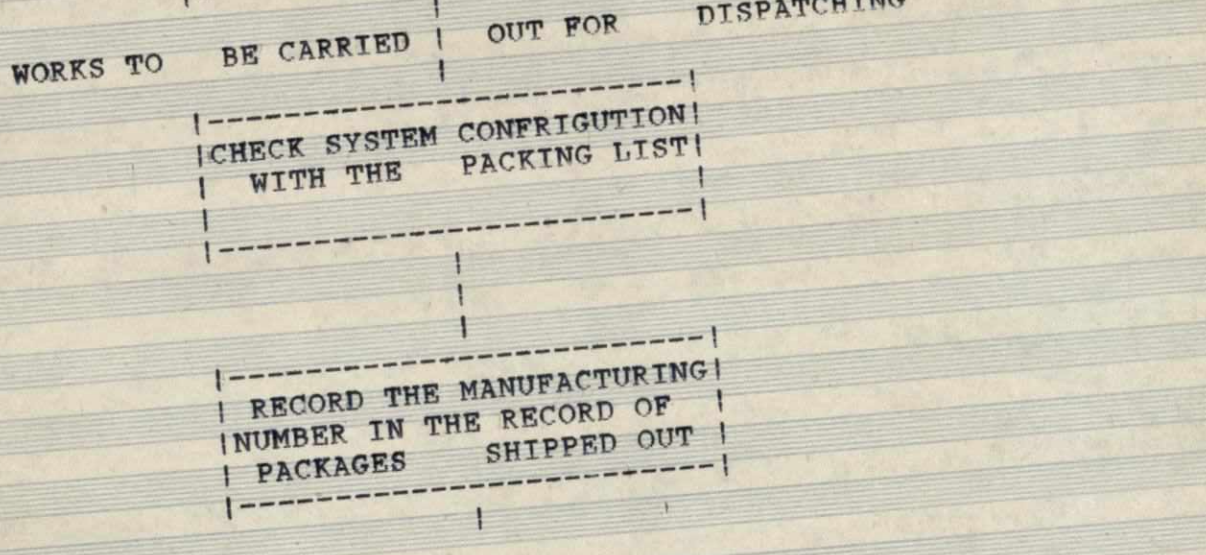
NORTHERN DIGITAL EXCHANGES LTD

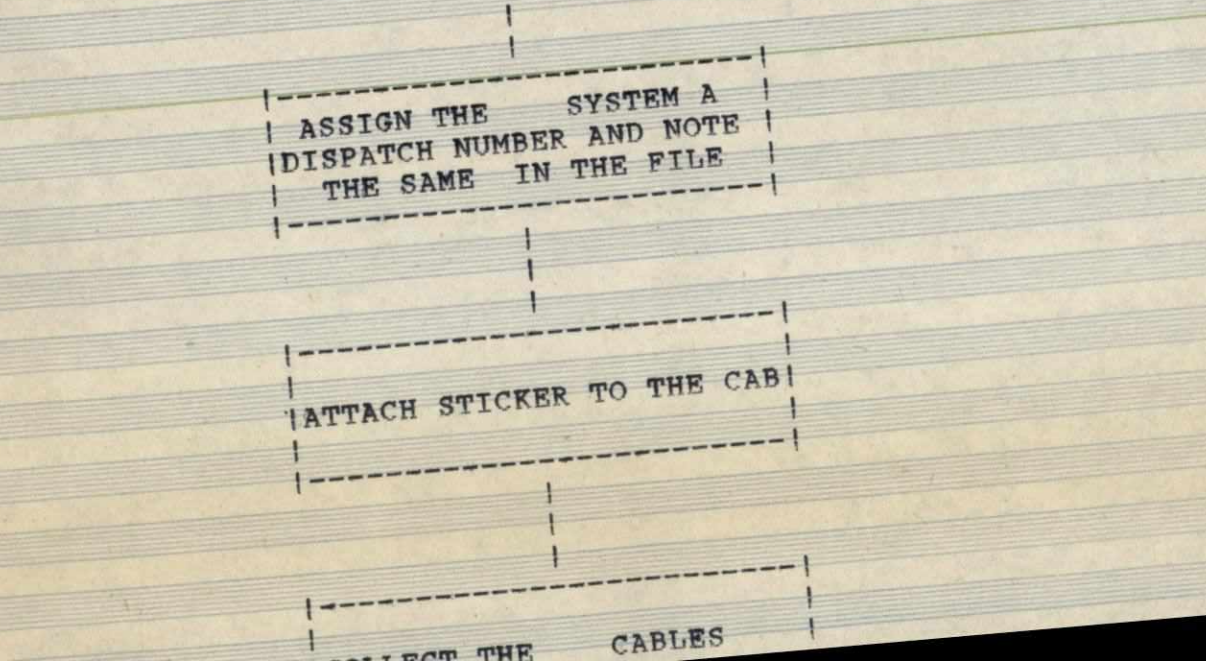
DAILY STOCK STATUS REPORT

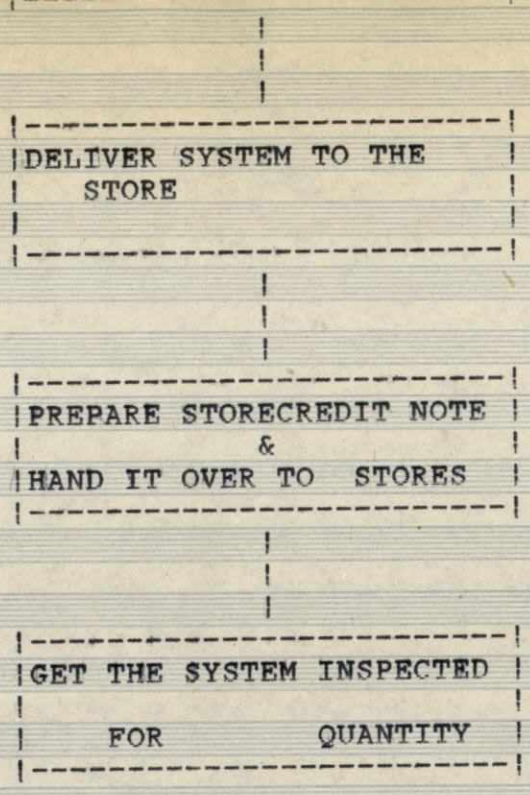
CARD	T.QTY	BAKE	CHIP .M.	MASK	KIT	POP	W. SOLD	LD. TRM	BP.WSH	T-WSH	T.UP COMP	T.UP INCO	Q.C.	PKG. TEST	M.A. COMP	M.A. INC.	SYS. TST	WIP	F.G.
NE-40	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
NE-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** Total ***	1451	0	45	266	0	24	31	10	0		0	107	27	13	19	9	441	459	71



WORKS TO BE CARRIED OUT FOR DISPATCHING A SYSTEM






DELIVER SYSTEM TO THE STORE
PREPARE STORECREDIT NOTE & HAND IT OVER TO STORES
GET THE SYSTEM INSPECTED FOR QUANTITY

CONCLUSIONS AND RECOMENDATIONS

As a result of my stay in the PPC department for a period of six months and where the responsibities assigned ranged from the daily routine work of the department to special assignements, there are lot of points which can be raised out here in the form of suggestions.

However most of the suggestions, the readers will find are linked with the Work-In-Progress Stores (WIP Stores), It has been observed that for certain cards which can be classified as fast moving there exists a multiple stock consisting of both SKDs and CKDs and at the same time there is a tendency to despatch the cards that have been formed late. In other words there is no proper sequence for the movement of the cards from the WIP stores. Certain cards under this category have been lying there in the stores since the day they were produced and these dates can be traced as back as March '88.

This non planning of the flow of the material has not only resultedin the mishandling of the cards but also at the same time has led to certain faults in the cards. A case can be highlighted in this direction, It was seen that PCB KC030- MEMA which has got a battery in its circuit had resulted in the battery failure because of its

overstay in the WIP stores, the battery had to be restored by jacking the card in with the system in POWER ON condition & it took sometime like 3-4 hours to make the card " normal". This not only resulted in the loss of 3-4 hours but also the degradation of the card occured. Another case under the same, that was observed was that of dim printing for the SMDRs for the mishandling and overstay in the WIP Stores.

From the above discussion it can be easily concluded that there is an utmost need for introducing and implementing the concept of First in First Out (FIFO).

Also a method has been devised which is a low investment one and at the same time can give high dividends. This has been highlighted with the help of diagrams. For this there is a need of plastic paper clip/ holder at the maximum.

Another added advantage of it which can be highlighted is in terms of field failure, if FIFO is applied for the out going cards than it means that cards of a particular lot will go to one customer and hence to a particular zone also. If a field failure under this conditions comes back to the works and say a particular defect can be allocated to it, then a conclusion can be drawn

that probably the cards in this zone have got the same defect and the cards can be checked at the customers end for that particular defect. In this manner a defect can be rectified before it occurs resulting in sound customer support and good customer-supplier relations.

Another important issue which canbe raised is that of keeping a track of the cards that come and go out of the plant and specially that in the WIP stores. It has been seen and discussed out there in NODE that the Bin cards are not maintained in the right manner i.e. whenever a card is issued or received in the WIP stores a entry for it is not done on the bin card. In other words the physical stock does not tally with the quantity mentioned on the bin card. This results in the wastage of time of the next user of the WIP store who has to count the cards every time while issusing or receiving the cards. Also this results incertain descripencies in the "Daily Stock Status Report".

Also it is suggested that Multi key telephones(40/50) have been lying there in the WIP Stores since the day they arrived in the plant & there movement has been extrmely slow moving, where as the multikey telephones for system 20/30 have a good demand at the customer's

end but the troubling scene out here in WIP stores is that the stock for these has diminesed in a fast rate. In order to meet the demand and to make the inventory carrying cost for the 40/50 MKT's it is suggested that an excercise be tken up by a group of Engineers coming out with means of converting the 40/50 MKT's into 20/30 ones.

Also the information which is maintained for the dispatch of the system, by the PPC department is not that informative as that it should be. A register is being maintained for the above said under the name "Record of Packages Shipped Out". At the time of dispatch of the systems a record is maintained for the PCBs that are being dispatched. However the following information is lacking from the said records

1.The dispatch status of Peripheral Equipment that includes KCNS, MCNS, MKT, DSS Console, ATT etc.

2.The dispatch status of Main Distribution Frame and its subsidary parts.

3.The dispatch status of Cables and Accesseories.

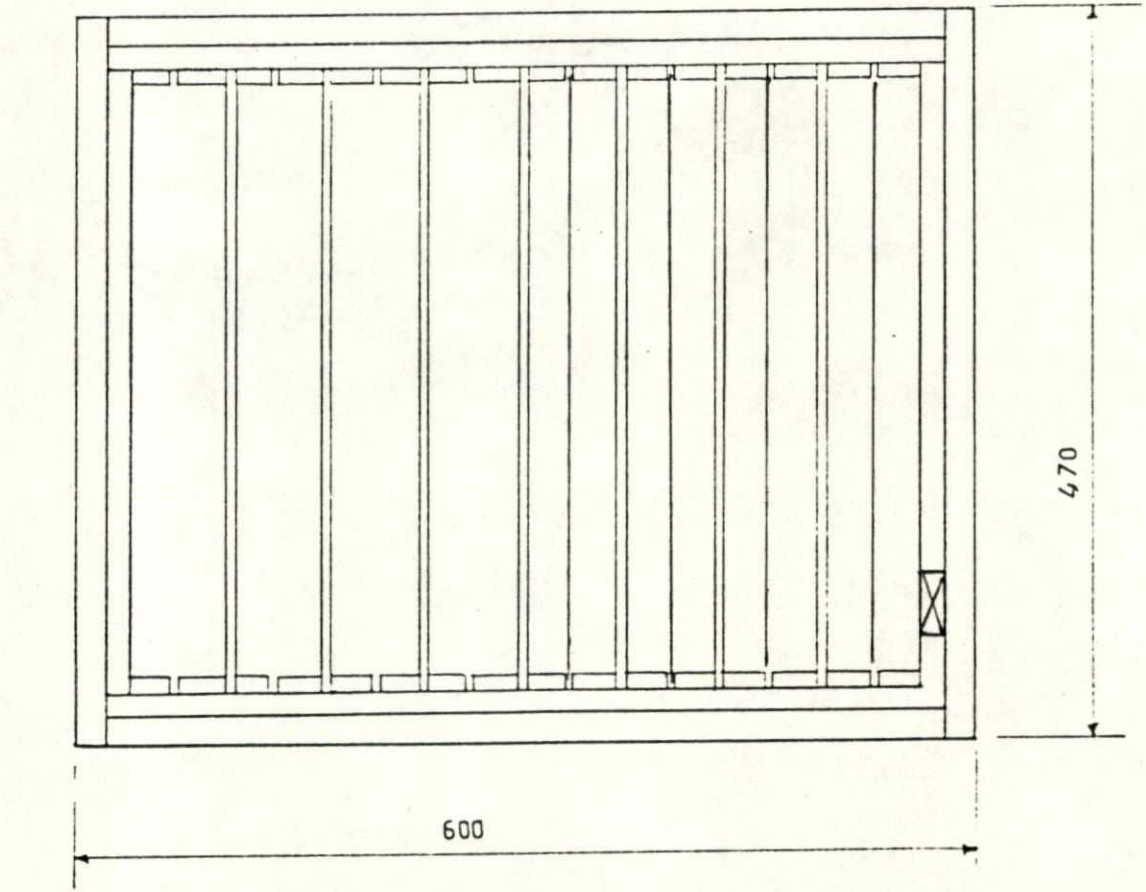
In other words no cross check is carried out for the equipment being dispatched and the customer's requirements. The lack of this excercise results in creating problems of high magnitude since PPC department at that stage is without the actual

figures for the dispatch of equipmemt. If the CGL raises any objection for short supply on the behalf of the customer, PPC is in no position to cross check and/or to counteract the objection because of the lack of the lack of information at its end. In other words the validity of short shipment for the equipmemt listed as 1,2,3, cannot be checked.

It is hereby suggested that the poresent practice of maintaining the information be changed a bit. A proper format should be designed just in a fashion in which the " Packing List" is generated and information regarding the quantity that is being dispatched be maintained. This information should be listed adjacent to the customer's requirement i.e. a record for customers requirement v/s material dispatched be mainatined. In this manner in order to generate any information regarding short shipment for any customer only one peice of paper will be containing the best information. In this way the present practice of obtaining information from two bunch of papers can be discarded , these two being "Packing List" and "Record of Packages Shipped Out'. The above said is self explanatory that in this manner Office Efficieny and Productivity can be increased.

Stage 1
'. Showing card location and the position of the clips
NOTE:- The cards have to be filled in starting from slot 1.

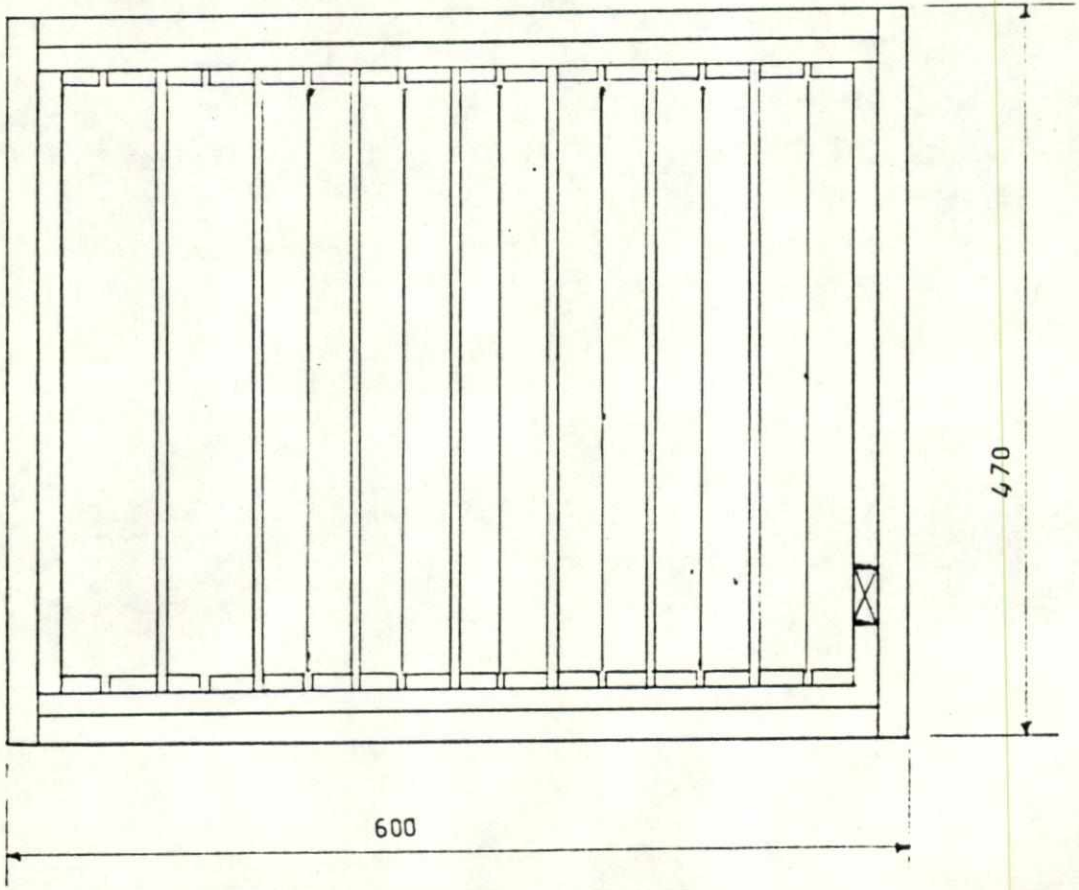
TOTE BOX



TOP VIEW

Stage 2
Assume 2 more cards have come in the box.
The position of the clip will not change thus indicating that card to be taken out first is to be from slot-1.

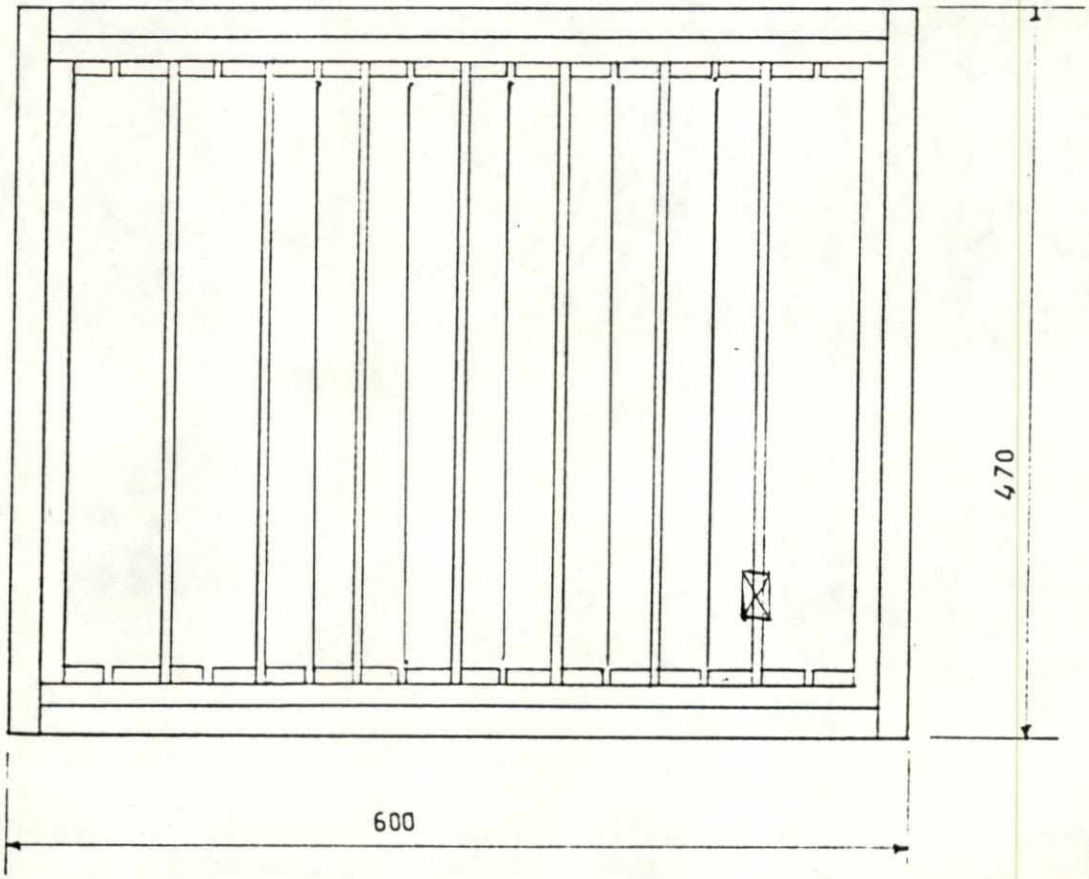
TOTE BOX



TOP VIEW

120

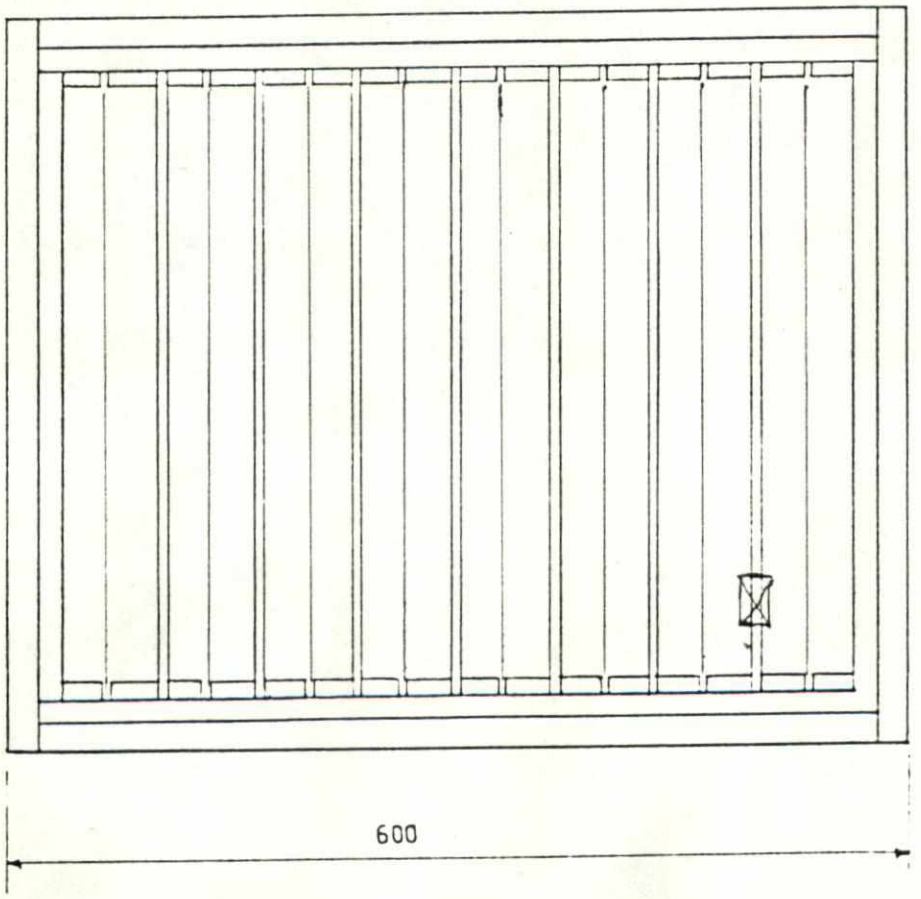
TOTE BOX



TOP VIEW

Stage 3
. A Barrel 1 card is issued out.
The card will be taken out from slot-1, in this case the clip should be put before the slot-2 indicating that card to be removed first is card in location 2.

TOTE BOX



TOP VIEW

Stage 4
'A' Base 3 more cards have come in & the filling of the card should begin from slot-7, with no change in the clip position thus indicating that card to be removed first in that in the slot-2 & thus moving in cyclic order.