



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

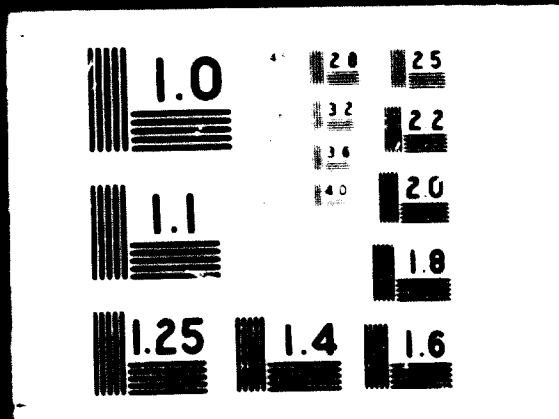
Please contact publications@unido.org for further information concerning UNIDO publications.

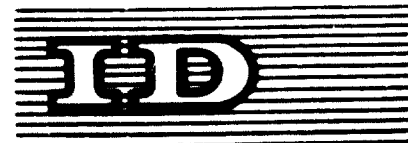
For more information about UNIDO, please visit us at www.unido.org

I OF I

DO

2799





D02799

Distr.
LIMITED

ID/WG.102/25
26 July 1971

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Expert Group Meeting
on Pulp and Paper

Vienna, 13 - 17 September 1971

FORMULATION OF A SET OF RULES
FOR A SYSTEMATIC REPAIR AND MAINTENANCE SERVICE
IN THE PULP AND PAPER INDUSTRIES
OF DEVELOPING COUNTRIES 1/

by
Stanley J. McGilvray
Australian Paper Manufacturers Ltd.
Botany Mill
Sydney, New South Wales
Australia

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

id.71-6128

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

I N D E X

<u>S h e e t</u>	<u>D E S C R I P T I O N</u>	<u>R e f e r e n c e</u>
		Mentioned in Text
1	FLOW DIAGRAM - Plant Identification	5
2	PLANT ITEM MAINTENANCE	10
3	JOB CARD (Face and reverse side)	10a
4	TYPICAL MAINTENANCE PROGRAMME - PREVENTIVE WORK CHECK LIST	12
4a	MASTER INSPECTION SCHEDULE	19
4b	ROUTINE WORK CHECK LIST	20
5	PLANT HISTORY CARDS	21
5a	PLANT RECORD CARDS	22
6	MACHINE SHUT SCHEDULES	26
7	REVIEW OF SHUT SCHEDULE	27
8	ANALYSIS OF REASONS FOR PLANT FAILURE	29
9	BREAK DOWN REPORT SHEET	30

1. INTRODUCTION:

The objective of a repair and maintenance service may be defined as - "To carry out such work at the proper time, to ensure that the production plant is available for the maximum time for safe, maximum output of acceptable quality product. It must achieve this at economic cost".

In order that the engineering group succeed in this objective a systematic approach to their task must be adopted.

The work load must be identified, and evaluated and work planned, prepared and executed at selected times.

The results of the work done, plant failures, machine time lost, losses due to "off-quality" production, labour and material costs should be recorded, critically analysed and decisions made accordingly.

It is emphasised that a system or method as outlined here is a tool or aid to management and exists for the purpose of marshalling engineering skills, management judgment and resources to the best advantage but can in no way replace them.

1. Introduction (Cont'd):

The system must at all times receive critical review to ensure that it is meeting the objectives and redirected or reemphasised as necessary.

2. DESCRIPTION OF A BASIC SYSTEM:

2.1 The Workload:

First of all it is necessary to establish the work that needs to be done to service the plant in terms of the objective. This is maybe known as the Work Load.

The work load is composed broadly of,

2.1.1 Preplanned or Preventive Work.

2.1.2 Minor Jobs.

2.1.3 Breakdown Jobs.

2.1.4 Alteration or Improvement Work.

2.1.1 Preventive Work: The first step in setting up a system is to prepare a list of all plant and equipment involved.

In conjunction with the list, a flow diagram of the manufacturing system showing important items of equipment is vital and should be prepared. This will be of value in understanding the importance of each piece of equipment, in identifying and communicating and assist in many decisions that will have to be made from time to time.

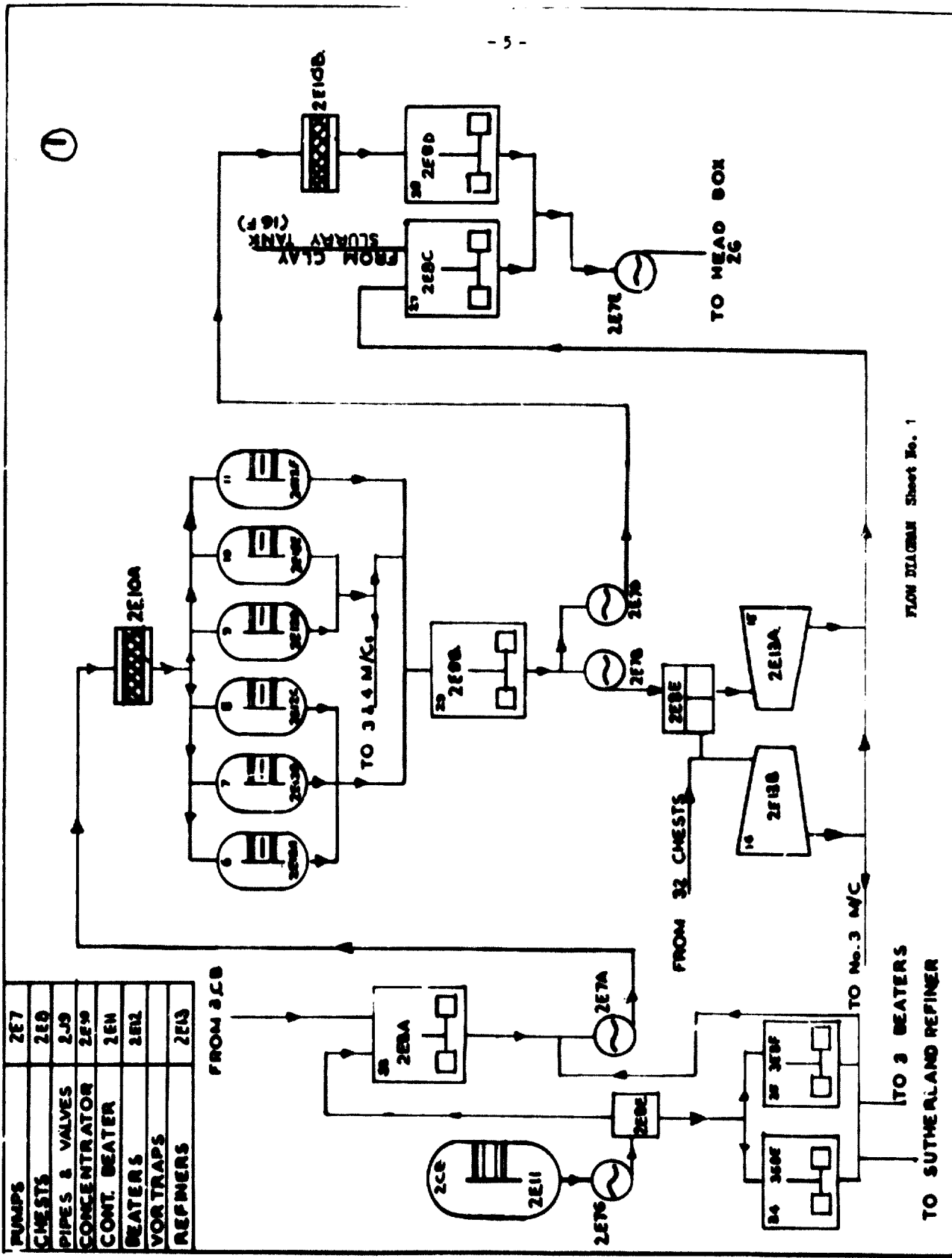
With the aid of the flow diagram the list should be broken down into sections, so too may the diagrams, for example: Machine or Manufacturing Unit Number.

Stock Preparation Section :

Slushing equipment.

Refining equipment.

①



FLOW DIAGRAM Sheet No. 1

PUMPS	2E7
CHESTS	2E8
PIPES & VALVES	2-J9
CONCENTRATOR	2E9
CONT. BEATER	2E10
BEATERS	2E11
VOR TRAPS	2E12
REFINERS	2E13

DATE
DATED

No. 2 M/C STOCK PREPARATION IDENTIFICATION DIAGRAM 100-2E

2. Description of a Basic System:

2.1.1 Preventive Work (Cont'd):

Wet End of Machine

Formation Section - Vat Moulds or Wire Section.
Press Section.

Dry End of Machine

Dryers

Calenders

Reeler

Finishing Equipment (This may be treated as a machine unit if common to a number of machines).

Winders

Cutters

Guillotines

A code number is generated for each equipment assembly location by using a numeral for each machine or manufacturing unit, a letter for each section, a number for each assembly and a letter for each duplicate assembly where they exist.

It is emphasised that these code numbers refer to the assembly location and where interchangeable pairs are provided. These carry additionally, an identifying number from a spares list which is stamped on the frame.

Where there are a number of machines installed, the coding for sections and assemblies remain the same and only the first numeral denoting the machine is changed. This simplicity enables code numbers to be more easily remembered and understood.

Some items of common nature and for which spares in some degree are provided such as pumps, motors and rolls, are also

2. Description of a Basic System:

2.1.1 Preventive Work (Cont'd):

listed separately and given a sequential list number.

Likewise it is common to identify multiple assembly locations with an "on the job" number independant of the code number, for easy everyday use, for example a machine may have as many as eight Sutherland refiners which could be numbered say for No.2 refiner of No.1 Machine, as Number 12 refiner and 22 for No.2 Machine. Each would still carry their code number.

An example of the use of the code number and a typical work request would be:

"Remove refiner supply pump and install spare at
No.12 Sutherland refiner on No.1 Machine".

This could be written briefly and understood on the Job Card as:

1A3B - pump No.271 remove.
pump No.273 install.

The code number would be interpreted as:

- 1 Number 1 Machine.
- A Preparation Section.
- 3 Refiners.
- B Number 12 Sutherland Refiner.
- 271 The number of the particular pump assembly to
 be renewed.
- 273 The number of the pump assembly from spares store

The coded lists are set up in a standard form and issued to all concerned.

Having prepared the list of equipment to be serviced, consideration should now be given to the importance of the individual item to the process in terms of the objective. Such

2. Description of a Basic System:

2.1.1 Preventive Work (Cont'd):

questions as,

1. Can it be allowed to breakdown?
2. Will its failure shut down the main production unit?
If so, how soon after?
3. Will it reduce output of the main unit?
4. Will it affect quality control?
5. How severe would be the failure?
Would it be more costly to repair?
Would it be a safety hazard?
Would it immobilize the main unit for a lengthy time?
6. Should it be repaired on site or replaced?
Is the cost of repair economic?
Should it be replaced and repaired later?
Should it be scrapped?
7. How long would it take to repair it?
How long would it take to replace it?
8. Is it necessary to shut the main unit to work on it?

If the answer is that prevention of breakdown is important from the point of view of,

- (a) Machine production.
- (b) Cost and effect of consequential damage to itself
- (c) Safe working,

it should be listed for preventive attention in order of importance.

These items should be further considered and decisions made as to the frequency and type of attention.

2. Description of a Basic System:

2.1.1 Preventive Work (Cont'd):

This can range from visual inspections, listening, feeling, measuring, use of available instruments namely vibrometers, crack detectors etc., to dismantling all or part, or replacing with a spare unit.

In general, it is more economical to rely on inspections where possible rather than embarking on excessive and needless overhauls. Experience and judgment are necessary in setting up this plan and supervising its operation but both of these qualities are logical developments of use.

From these considerations also it is possible to derive a list of spare units it is economic to hold and some idea of spare parts necessary.

Furthermore, lists of jobs which can be attended to "on the run" and those which require a production unit "shutdown" and length of time of such "shutdown" can be established.

Having determined the frequency, type of work required, and next due dates, the information is entered on to a simple Chartex type card system which serves as a reminder and from this, job cards are prepared and issued for planning and scheduling the work, at least one month before the due date.

The job card should carry information as to the Plant affected, code number, the work required, the due date, the date of the last inspection and any relevant history, together with the signature of the authorising officer.

Provision is made on the reverse side of the card for a brief report on the results of inspection, work done, name of

Form No. 146-1, 200 2/55

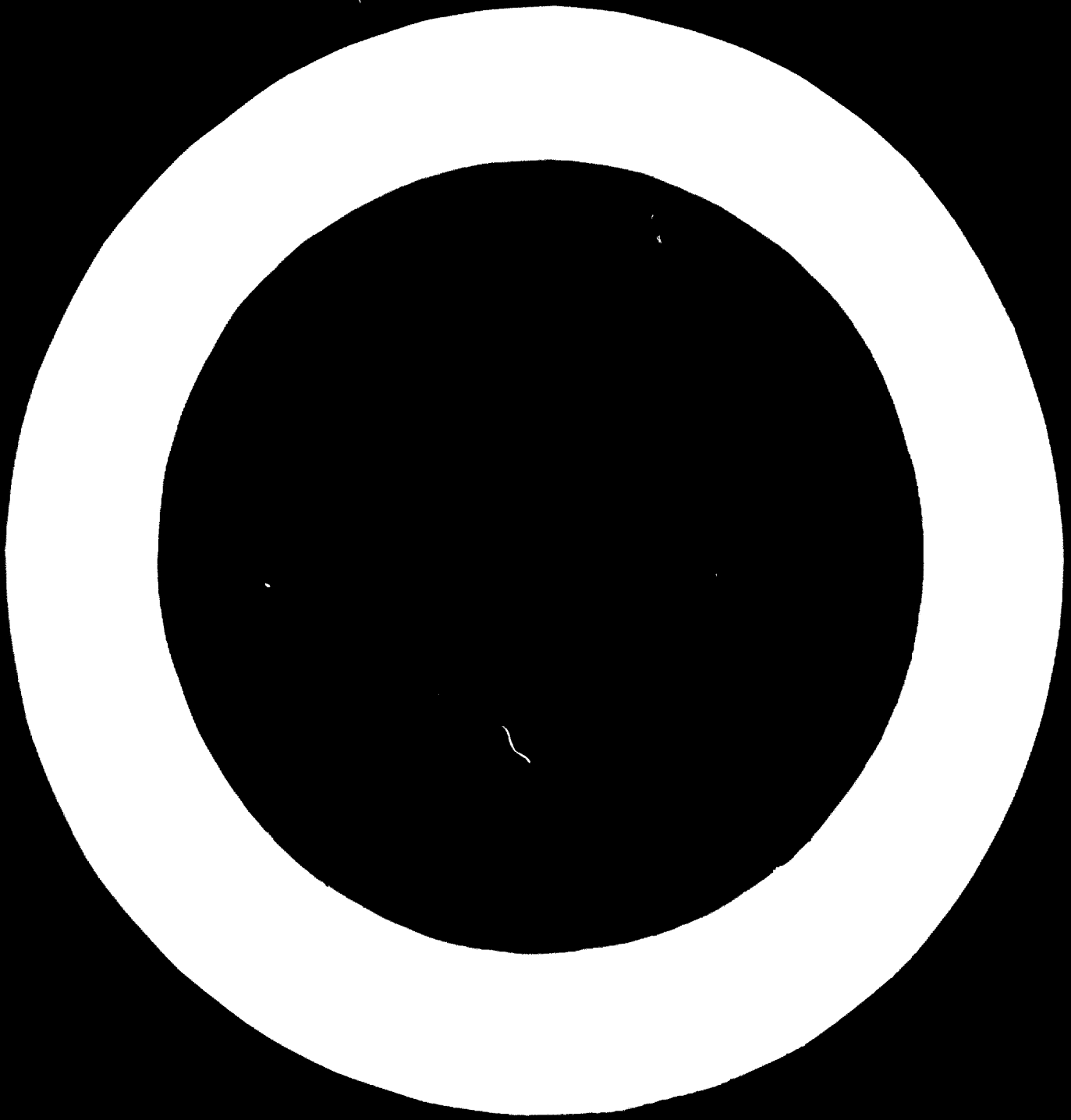
C = COMPLETE OVERHAUL
R = REPLACE

L = CHANGE LUBRICANT
P = PARTIAL OVERHAUL

ITEM	Serial No.	Normal Periods			Mnt. Schedule Number	DUE DATE OF NEXT NORMAL MAINTENANCE														
		L	P	C		JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.			
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
Section																				
Div.																				
Assembly																				

Sheet No.2

JOB No.	DEPT.	TRADE PREFIX	CARD No.
	UNIT		
REQUESTOR'S NAME	DATE	DUE DATE	UNPLANNED PLANNED
DRAWINGS - YES/ ATTACHED /NO	DRG No.		TICK IF COMP.
FULL DESCRIPTION OF WORK REQUIRED (ADJUST, CLEAN, DISASSEMBLE, FABRICATE, INSPECT, INSTALL, OVERHAUL, RE-ASSEMBLE, REMOVE.) PLEASE :-			
REPORT EXTRA WORK ON BACK			
DATE	NAME	T	A MAN HOURS
FOREMAN Fom 115	TICK WHEN COMPLETED		



2. Description of a Basic System:

2.1.1 Preventive Work (Cont'd):

tradesmen, manhours spent and recommendations by the Foreman as to changes in frequency or method of doing the work. This card can also be processed for costing as a time sheet using the code number as a job number.

Relevant and useful information is transferred from the completed job cards to equipment history cards, or the cards themselves may be held as a record for a reasonable period.

All work of a preventive nature may be segregated for records by using a different colour ink or by preceding the Code Number with a "P".

2.1.2 Minor Jobs:

These are, as the name implies, the small items such as "repair a leaky tap". They are authorised and requested by a job card signed by the appropriate officer or alternatively may be, for simplicity, entered on a list kept in the machine room, by the person reporting the defect. Later the list is inspected by the engineering foreman who prepares a job card and takes the action necessary.

Generally these jobs are done on the spot but in some cases the job cards are returned to the backlog for review and scheduling.

2.1.3 Breakdown Jobs:

These jobs which should be reported to the engineering department on the common job card, are failures of plant and equipment generally, ranging from very important failures causing stoppage of production, to comparatively minor effects of a motor or pump somewhere in the system. The work may proceed immediately and a card made out during the progress

5F7K	Suction Pump Return Roll	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									
5F7L	Extraction Pump Return Roll	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									
5J7F	Liners B/Water to Pulpers	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									
5F7X	Suction booster Pump Return Roll	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									
5M7B	Condensate to Hot Wells Pump	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									
5J10C	No.51 Kinney Filter	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									
5F18A	No.1 Vat Extraction Fan	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									
5D7U	No.1-2 Chest to Alice Barton Pump	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									
5J7V	Booster Pump Oscillating Sprays	Action	G	F	P	G	F	P	G	F	P
		Proposed									
		Action									
		Taken									

FOREMAN: I have discussed this list with the Leading Hand, Inspected equipment where necessary, and agree with action proposed.

SIGNED:.....

DATE:.....

ENGINEER: All the above proposed actions have been finalised.

SIGNED:.....

DATE:.....

PLANT: NO. 3 MACHINES

MASTERS INSPECTION SCHEDULES

GEARBOXES & AGITATORS

MTCE CODE NOS. APPLICABLE

2322A, B, C, E & F,

15

PLANT DESCRIPTION:

Chests, agitators, gear wheels, chain drives, belts and pulleys for Nos. 30, 31, 32, 34 and 35 Chests.

Routine "RTE"
Complete "C"
Lubrication "L"
Replacement "R"

4 W
30 W
30 W

1. ROUTINE INSPECTION:

Check for satisfactory operation with equipment in use.

2. COMPLETE INSPECTION (36 Months)

Check for wear -

1. Footstep bearings and top thrust races.
2. Do clutch mechanism, test also for correct operation
3. Chain and sprocket drives and belt and pulley drive, also all bevel gears.

Check for tightness all holding down bolts.

COMPLETE INSPECTION - Coupling rubbers 12 Months.

Check coupling bolts and rubbers for wear and tightness.

Lubrication See 3N11D.

Change oil in totally enclosed gear boxes and inspect gears for wear.

SECTION 11.
NO. 6 MACHINES (CONTINUED)

ROUTE THE FORM NOT COVERED BY PREVENTIVE MAINTENANCE CARD
ISSUE BUT REQUIRING ATTENTION AS DETAILED BELOW.

Mtee. Code No.	Plant or Item	Type of Inspection (Refer to Plant Inspection Schedules for details)	Frequency of Inspection.	Remarks.
SH16	Vickery Felt Conditioner	Routine	Shift	
SM10	Steam Traps Dryers etc.	Routine	Shift	
SK10 SK11	Headers M.G. Drying Cylinders	Routine	Daily	
SM9	Steam Control Wires etc.	Routine	Daily	
SM8A	Agitator Drives	Routine	4-Weekly	
SH16 SK16	All Pelt Roll Druses	Routine	3-Monthly	
SB11A	Beaters	Major	Prodn. Request	
SB13A	Refiners	"	"	
SB13B	Refiner Sutherland	"	"	
SH12	Press Rolls	"	"	
SJ10A	Oliver Filter	"	"	
SK19A	Calenders	"	"	

31254 CA 10/11/67 8

PLANT HISTORY | LOCATION

Form No. 395

MAINTENANCE CODE No.

Material
Cost
Count

Mech. P.M. R. P.M. R. Elec. P.M. R. P.M. R. Minor Count.

WORK DONE (including Defects, Causes, Remedy and Replacements)

REPAIR CONTROL LIMITS

PLANT SERIAL No.

ITEM LOCATION

WORK DONE

PLANT

LOCATION

PLANT SERIAL NO.

PLANT DESCRIPTION

PLANT RECORD
Form No. 13

LENGTH

MANUFACTURER

MODEL/TYPE

WIDTH

SUPPLIER

SERIAL NO.

HEIGHT

S.S. NO.

DATE RECEIVED

NET WEIGHT

ORDER No.

DATE INSTALLED

MISCELLANEOUS DATA

ELECTRICAL EQUIPMENT

DRIVE DATA

MAINTENANCE COPIES NO.

COST DATA

PURCHASE

DUTY

FREIGHT

SALES TAX

INSTALLATION

TOTAL

REPLACEMENT COST

YEAR

VALUE

- 22 -

MAINTENANCE SUMMARY

CODE 1 = Lck. P = Fedral. C = Complete. R = Replace. B = Make Breakdown.
YEAR JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEP. OCT. NOV. DEC. LONG EST

ASSEMBLY	YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	LONG	EST
1.															
2.															
3.															
4.															
5.															
6.															
7.															
8.															
9.															
10.															

DISPOSAL

DATE

REPAIRS

TECHNICAL INFORMATION

ARRANGEMENT DIAG.

FOUNDATION DIAG.

OPERATING INSTR.

MAINTENANCE INSTR.

REFERENCE

2. Description of a Basic System:

2.1.3 Breakdown Jobs (Cont'd):
of the job.

This area of work requires very careful analysis and will be more fully examined later. From the point of view of work load, much of this work would need to be done immediately, but some could and would be deferred for planning to the backlog.

2.1.4 Alteration & Improvement Work:

These jobs are requested by Engineering or Production Personnel and authorised by management on their merits. They cannot be considered as a proper charge against maintenance. However, the job card can eventually be used to authorise the work required utilising the charge number. Labour and services are necessary to carry out the work and this contributes to the work load.

2.1.5 The work load may be summarised and expressed practically as the total number of job cards held in the engineering department. A rough index of the level at which the Plant maintenance is held may be gauged from the total number of backlog job cards divided by the 10 week moving average of numbers of job cards completed each week.

A back log of two to three weeks work for a paper machine is a good level to achieve. It is imperative of course that the records are true and such things as duplication and omissions are carefully avoided. The basic information should be plotted graphically and trends promptly investigated and acted upon.

In practice it is usual for the back log to be divided into

2. Description of a Basic System:

2.1.4 Alteration & Improvement Work (Cont'd):

a number of groups, usually related to a particular engineering supervisor, this may fall also into trade groups.

2.2 Planning:

The purpose of planning is to bring the work force effectively to the task, to ensure the work load backlog is controlled and to ensure that the work force is properly occupied and no waste time of labour, material or machine time occurs.

Most machines are required to shut down periodically for operating reasons. Such things as,

Change of making,
Felt & wire changes,
Roll changes,
Calender changes etc.

These items usually have a life cycle pattern for optimum production and this should be carefully studied in conjunction with production management and a firm pattern of properly scheduled shuts derived, which provide both engineering and production the means of adequate notice for planning their work.

The engineering department should plan to make use of this shut time to the maximum extent and deploy as much of its labour to the machine as possible. It should plan its work as far as practicable not to exceed the production shut time and by mutual planning not to impede each other.

The maintenance backlog having been divided into "on the run work" and "shut down work" a selection of shut down work due is

2. Description of a Basic System:

2.2 Planning (Cont'd):

made and in consultation with production management a shut schedule is prepared. This schedule should be agreed upon at least three working days before the shut down and distributed to the parties responsible, at least two working days before the shut, for detailed familiarisation and preparation by the Foreman.

The schedule usually takes the form of a bar chart on which are listed,

- (a) the job card plant code number.
- (b) a brief job description.
- (c) the tradesman allocated.
- (d) the anticipated time of starting.
- (e) the anticipated time of completion
- (f) the time steam, power and other services are available.

It is the foreman's responsibility to see that the work listed is properly carried out and that the plant is handed over to production at the scheduled times.

A review of the performance should be made by the Engineer promptly and any variations considered and dealt with.

A large amount of preparation work is necessary to ensure smooth functioning during the limited period of the shut down. This work together with other "on the run" work is done whilst the machine is still operating.

To cover this class of work a weekly plan is prepared by the foreman towards the end of the preceding week from his backlog and covers,

SCHEDULE OF MAINTENANCE WORK
NO. 5 MACHINE SHUT - MONDAY 30. 11. 72
POWER REQUIRED 7.00 A.M. UNT DRIERS

Shut
 Lower Rolls
 Fill up vat system & acid
 Stock on
 Let Brd Required
 Start at pressure
 Sat. 7.00 a.m.
 2.00 - 2.30
 2.30 - 3.00
 2.00 p.m.
 3.00 p.m.

ROUTINE & PREVENTIVE MCS.	TR.	DESIGN.	ASSISTS.	P.	C.	P.	W.	R.	B.M.	I.P.	7.30	8.30	9.30	10.30	11.30	MOON	1.00	2.00	3.00	
Check all hoses & connections						1														
O/Haul slice boards on presses						1														
O/Haul wooden Cell water boxes																				
<u>ROUTINES, PREVENTIVE MICE, & OTHER WORK</u>																				
Check and adjust Sheehan rope pulleys																				
Check Calender Doctors																				
2232 Change No. 117 Dry r Header						1														
1833 Change No. 75 Dryer Header						2														
1895 Instal No. 5 Extraction fan						3														
2229 Change Cond. bend No. 94 Dryer						4														
2230 Change slight glass No. 3 Dryer						5														
1610 Replace half cover on No. 116 Dryer						2														
2251 Tighten Ross Grewin fan base						5														
<u>WET END AND PREPARATION</u>																				
2227 Change 2nd Press top & bottom roll						6:7														
2228 Change worn roll at 2nd press						6:7														
2174 Replace adj. bracket on drive shaft & renew belts						6:7														
2168 Repair headbox gates No. 8 Headbox						8														
2196 Repair bottom wash roll bearing housing B/side						9														
2192 Change belts No. 2 V-t Extraction fan						9														
2191 Change belts No. 1 V-t Extraction fan						9														
Routing on short forming seals						10														
2225 Repair broken handrail above 2nd press						11														
2161 Change assembly liners B/water to 10 & 11						12														
Check Ref. pump																				
ack necessary pumps & Refiners																				
Shift Fitter																				
<u>SERVICES</u>																				
Change 3rd Section Sheehan ropes																				
Change 2nd Press top & bottom rolls						1:2														
Remove top platform above 2nd press						3:4:5														
Instal No. 3 Extraction Fan						3:4:5														
Adjust belts 2nd Press						6														
Repair leak in starch line						5														
Repair handrail at return suct. roll						2														
Check valve seats on vat sprays						1														
<u>WET END</u>																				
Routine on Hurlotron																				
No. 6 Vat level loading controls																				
Dryer pressure controller																				
<u>ELECTRICAL MAINTENANCE</u>																				
Insulations																				
Service 15 Ton dry end crane						1:2														
O/Haul remote S/S control No. 51 Suth. Ref. Hyd. pump						1														
Service Hurlotron electric						2														
Service Break Detector						2														
Service "On Machine" lighting						2														
Service Jordan Refiners						3														
Service Jagenberg Rewinder						3														
Service Brushgear-section motors						3&4														
Service Brushgear W.E. field booster						5														
Service Master Set Brushgear						5														
Service Brushgear main & booster M.G. Sets						5														

TO:

PLANT ENGINEER
PLANNING ENGINEER

(9.30 a.m. Day following shut)
c.c. Chief Engineer

ENGINEERING SCHEDULED SHUT REPORT

NO. MACHINE

DATE: ..11..2..71..

	<u>Scheduled Time</u>	<u>Actual Time</u>	<u>Eng. Variation to Scheduled Time</u>
Machine Shut:	7.00	7.45	
Warm up Steam:	7.00 5.00	5.45	
Steam at Pressure:			
Stock on:	8.00	7.45	
Engineering Work Completion Time	8.00	7.45	

ADDITIONAL WORK:

NUMBER OF JOBS: NIL

DESCRIPTION & REASONS FOR ACCEPTING:

.....
.....
.....
.....
.....
.....

SCHEDULED WORK NOT STARTED: NUMBER OF JOBS

REASONS: ~~PIPE~~ .. ~~SWICK~~ .. ~~SHAPES~~ .. ~~2~~ .. ~~CON~~ .. ~~NIP~~ .. ~~GUARDS~~ ..
.. ~~WALK~~ .. ~~CONSIDER~~ .. ~~NOT~~ .. ~~AT~~ .. ~~WIRE~~ .. ~~CHANGE~~ ..
.. 11.2.71 ..

WORK STARTED AND NOT COMPLETED NUMBER OF JOBS

REASONS: .. ~~BLACK~~ .. ~~CONVEYOR~~ .. ~~NOT~~ .. ~~(1403~~ .. ~~3~~ .. ~~POSITION)~~ ..
.. NOT .. FITTED ..

GENERAL COMMENTS: (Refer to Delay if any stating reasons)

.. ~~BLACK~~ .. ~~CONVEYOR~~ .. ~~NOT~~ .. ~~CLEANED~~ .. ~~FIXED~~ .. ~~TO~~ ..
.. ~~ENGINEERING~~ .. ~~UNTIL~~ .. ~~9.25~~ .. ~~AM.~~ ..

COMPARISON TO PREVIOUS SHUTS

.....
.....
.....

SIGNED BY:

PLANNERS:

FOREMAN:

XXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX
XXXX
XXXXXXXXXXXXXXXXXXXX
Service Master Set Brushes
Service Brushgear main & Booster M.G. Sets
Check & service Diff. Regulator-face plates & belts

2. Description of a Basic System:

2.2 Planning (Cont'd):

- (a) Machine Shut Schedules.
- (b) Machine Shut Schedule preparatory work.
- (c) "On the run" work.
- (d) Spares overhaul.
- (e) Provision for on the spot minor jobs.

It is important at this stage to emphasise that every care is taken to see that defects are reported promptly and recorded in the backlog to ensure that the planning done covers all incipient troubles, which may be known to production or engineering personnel. To this end, systematic inspection and check by operators and maintenance personnel may be instituted before the schedule is prepared.

With the construction of a schedule it is possible to reach a degree of commonality on some items for each type of shut resulting in a standard basic schedule for each.

From the shut schedule manning and consideration of the backlog, it is possible to form a good assessment of the range and size of the optimum work force necessary to maintain the plant.

2.3 Records:

2.3.1 Nature of Records:

Records of work done should be kept but will need critical review to ensure that they can be used in a practical way in line with the overall objective.

In particular, they should be able to highlight,

- (a) abnormally repetitive work.
- (b) repeated plant failures.
- (c) high labour or material cost items.

PGE/CE:3

23rd January, 1970.

c.c. Operating Engineer
Plant Engineer
Paper Mill Engineer
Board Mill Engineer
Electrical Engineer
Control Systems Engineer
Power Engineer
Planning Engineer

CHIEF ENGINEER

RECORD OF WORK

CATEGORISING OF UNSCHEDULED ENGINEERING SHUTS
INTO SECTIONS BY SYMBOLS

The following categories shall be marked against each Unscheduled Machine Shut of Engineering origin with the appropriate symbol.

It is intended to analyse the categories and summarise the totals for each section on a quarterly basis.

The categories are as follows:-

	<u>CATEGORY</u>	<u>SYMBOL</u>
1.	Incorrect Planning	P
2.	Incorrect Design	D
3.	Poor Instruction or Supervision	S
4.	Incorrect or poor Materials	M
5.	Workmanship	W
6.	Incorrect Production operation	E
7.	Beyond control of Mill (e.g. S.C.C. power failure - flash flooding)	U

Upon receipt of a Daily Production Report Sheet the Engineer responsible will (if agreeing that the shut is Engineering) mark the sheet with a symbol as listed above.

e.g. (i) Pump Failed "P" (M)
(ii) Motor Failed "E" (D)
(iii) Motor Flooded "E" (U)


PLANNING ENGINEER

Sheet No. 8

ENGINEERING DEPARTMENT
BREAKDOWN REPORT SHEET

To be filled in by Foreman/Assistant Engineer/Section Engineer and re-
turned to Planning Engineer.

1. DESCRIPTION OF BREAKDOWN & DATE

.....
.....
.....
.....
.....

2. CAUSE OF BREAKDOWN

.....
.....
.....
.....
.....

3. ACTION TAKEN TO REPAIR

.....
.....
.....
.....
.....

4. REPORT ON INVESTIGATION TO AVOID A RE-OCCURRENCE

- (a) Is basic design OK?
.....
.....
- (b) Correct materials being used?
.....
.....
- (c) Lubrication requirements
.....
.....
- (d) Is Plant suitable for application?
.....
.....
- (e) Are modifications required to improve performance, if so action
taken and estimated date modifications will be completed.
.....
.....
.....
.....

-2-

- (f) Is there a written procedure for overhaul/adjustments, etc. If not attach recommended procedure to this report.
.....
.....
- (g) When was unit last inspected?
.....
.....
- (h) Are spares holdings adequate if not recommendation & action taken
.....
.....

GENERAL COMMENTS

.....

SIGNED:
FOREMAN:.....
ASST. ENGINEER:.....
SECTION ENGINEER:.....

PLANNING SECTION

Date issued:.....
 Date received:.....
 Progress Report & Date:.....
 Final report and date:.....

SIGNED:
PLANNING ENGINEER

2. Description of a Basic System:

2.3 Records:

2.3.1 Cont'd:

- (d) items that are being "over maintained".
- (e) progressive measurements of large wearing items such as calender rolls, press rolls etc. to give timely warning of renewal, recovering or regrinding.
- (f) the predictions of action thought necessary at the last inspection.
- (g) the movement of spares into production position.
- (h) the progress of spares from production position through various reconditioning phases back to store.
- (i) the backlogs.
- (j) the completion rate of jobs.
- (k) the progressive manhours - expended on maintenance, segregated into P.M. and breakdown.
- (l) the gross tons of product manufactured.
- (m) the value of lost "off quality" production due to equipment failures.
- (n) machine time lost due to plant breakdowns.
- (o) on the spot analyses of the cause of breakdown.
- (p) scheduled shut time for engineering work.

2.3.2 Use of Records:

The records should be used to,

- (1) Review and adjust predictions of the period and nature of plant servicing.
- (2) Classify and identify causes of repetitive work and failure in order to take action to reduce or eliminate. Some headings which can be used are,

2. Description of a Basic System:

2.3 Records:

2.3.2 Cont'd:

- (a) Design of equipment for its purpose and treatment.
- (b) Environment in which it operates.
- (c) Materials in use suitable?
- (d) Workmanship - is it good enough?
- (e) Supervision standards - (good enough?
(adequate instruction to worker?))
- (f) Frequency and type of inspection adequate?
- (g) Training of operators necessary?
- (h) Lubrication attention adequate?

From these considerations action to improve design, materials or environment can be taken or training schemes of specific nature given to supervisors, tradesmen and operators etc.

Items of high cost may be thrown up and consideration given as to reductions where possible.

Information from the records also provide the basis for setting up and reporting on the effectiveness of the repair and maintenance service in achieving it's objective.

2.4 Measurement of Effectiveness:

The facts of life indicate that human beings become bored from the steady applications of systems or methods which appear endless and their intelligent application flags to the great detriment of the system.

A great motivating power is developed by defining the objective and measuring the progress to it's target. It is of great importance to ensure that the objectives are widely known and in a form at each level to ensure identification by each, of the part they have played. The indices developed are

2. Description of a Basic System:

2.4 Measurement of Effectiveness Cont'd:

valuable to management.

Whatever level of performance may be revealed initially, it may be confidently stated that improvements, in some cases vast, are attainable.

The success or failure of developing the motivation may well be a human relations problem for management, and is merely mentioned for a caution in how the system should be introduced. Acceptance by the participants is most essential.

Daily reporting is necessary of,

- (a) Machine time lost due to plant breakdown.
- (b) Machine time lost for planned maintenance work.
- (c) Value of "Off quality" product lost due to properly ascribed equipment defects.

Periodical summaries should be made weekly, monthly, quarterly and annually of these items and compared with preset standards or targets. They should be reviewed with all persons responsible for operating the service according to their specific responsibility.

- (d) Additional indices should be developed to show maintenance manhours per gross ton produced and maintenance cost per gross ton weekly and progressively. Targets for six months periods should be set by the engineer and reviewed and approved by management. Interest and responsibility can be developed right down the line of organisation by encouraging discussion in setting the targets.
- (e) The backlog of jobs reported and not completed should be reviewed and the trend considered.

2. Description of a Basic System:

2.4 Measurement of Effectiveness Cont'd:

- (f) Management inspection of the plant for appearance, housekeeping etc., should also be made to ensure that satisfactory standards are being maintained.

3. Stores & Materials:

The purchase and holding of materials and stores for use by the maintenance and service department may or not, be controlled by that department. It is necessary however that as good a service as is practicable should be provided to assist good planning and in return, good planning of work can very materially assist in efficient inventory control and minimising spares holdings.

The objective of a stores and materials section is to ensure that goods of the right type and specification are available at the right time at the minimum total stock holding.

To this end the maintenance department should advise the Stores Department of the anticipated rate of usage, the required specification of quality, material and dimensions etc., and the time they are required in sufficient time to procure the goods or to decide to stock them and in what quantities they should be held. With the aid of ^{the} maintenance system outlined, much can be done by the maintenance group in this direction.

The stores department in particular, apart from achieving the best supply position to meet the needs of the maintenance department, should critically review all stock lines on a systematic basis to determine that the turnover rate is at a high enough rate. All slow moving stocks should be referred to the maintenance department and management to decide whether they should continue to be held.

3. Stores & Materials Cont'd:

Some items will inevitably become redundant by scrapping of plant items, changed methods of operation, improved materials and even by improved care and maintenance methods, the numbers of certain pieces required may diminish because a maintenance problem has been solved.

Some slow moving items may be held for insurance value to the plant's operation. A critical and ruthless look at this may bring a decision to take a calculated risk - the cost of keeping may well exceed the cost of failure, which of course may never happen. These should be decisions supported by management.

4. Organisation:

This will depend on the size of the plant and the consequent volume of work. The organisational demands increase more than directly as the numbers of machines increase due to the conflict of interest from time to time and planning changes.

The minimum requirement calls for a trained professional engineer supported as the plant and the need grows, by other specialist engineers such as power, electrical or instrument engineers.

Preferentially one foreman should direct the work in the field for best co-ordination and liaison with the production group. It also may be necessary to support him in time with specialist trade foremen such as electrical, instrument, welding machine shop etc.

For the development and operation of a maintenance control system as outlined in this paper, it is essential to have a specialist planner reporting direct to the engineer and liaising strongly with both maintenance and production

4. Organisation (Cont'd):

supervision. The person suitable for this work would ideally be a tradesman-foreman type with good and careful clerical aptitudes, the latter being the more important attribute as training will develop other requirements. He will need to be able to project himself and be accepted to both production and maintenance supervisors, and will need good backing from management and the engineer. Practical men such as foremen have a great aversion to paper work and reporting generally, and unless this support is forthcoming little may be accomplished.

Initially the planning and scheduling would be undertaken by the foreman under the guidance of the planner and the engineer. With the growth of the plant it may be necessary to add to the foremen in the field, in some cases it may be necessary to increase the number of planners under a chief planner. In these circumstances, it is usual to give the planner additional duties to assist the foreman by organising the details of planning and preparation in plant outage times, material on site and other follow up, releasing the foreman for supervision of his men in discipline and work performance.

This represents a beginning and a range of development but the circumstances current at the plant and management judgment must be the final arbiter.

5. CONCLUSION:

The implementation of a system of this type and the close liaison of production and engineering staff will provide a satisfactory means for management to achieve a good level of maintenance at minimum overall cost. The scheme may be introduced in part and developed further as required but

5. Conclusion (Cont'd):

sections 2.1 and 2.2 are imperative for any improvement. The system as described is basic and can be flexibly used and expanded to suit any particular needs. For instance the questing mind considering matters thrown up from the records will soon find themselves involved in method study for better ways of doing a job to save machine time and manhours or to introducing Engineering Performance standards for work measurement. These are logical developments from this basic system and can readily be handled with little extra assistance once the basic system has been established.

To recapitulate briefly the rules to follow are:-

1. Define the objective.
2. Decide and record the work load.
3. Adopt a preventive approach where economic.
4. Prepare for the work to be done.
5. Plan the work to be done at the most advantageous time.
6. Selectively record the work done, performance and failures.
7. Critically review the records in terms of the objective.
8. Follow up and take corrective action.





5.

5.

72