

Make-Ready Downtime Reduction in Printing and Packaging Production Sector



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The purpose of this project is to reduce the Downtime in Production and majorly concentrating in the makeready department. Downtime is the time from the first equipment breakdown to full running production. Clearly if at any time production is not producing quality prints, profits are lost. Reducing machine down time has an instant beneficial effect on manufacturing production efficiency and output. On the basis of platemaking time reduction, ink consumption reduction, and pre-makeready time reduction segments issues concerning were analyzed and daily reports were collected so that each and every issue is monitored and respective modified actions be generated.

1. Introduction

1.1 Platemaking Downtime Reduction

Platemaking time reduction is necessary to increase and improve the production and manufacturing techniques. The problems in the platemaking process should be tackled in such a way that the downtime due to these errors is minimal or reduced to zero. The problems can be stated as follows:

- Screen cut
- Dent marks on plate
- Screen light and screen dark
- Letter cut
- Letter smudge
- Dot missing

These problems are caused mainly due to machinery defects and human errors.

1.2 Ink Related Downtime Reduction

The inks used are mostly UV based inks. Mixed inks are generally prepared by colour separation and referring to the pantone book with the obtained pantone number.

Most of the problems faced in this department can be stated as follows:

- Shade variation
- Original master card not available for verification

These problems are mostly caused due to lack of organised approach. Internal control methods should be updated technological vice.

1.3 Pre-Makeready Downtime Reduction

Pre-Makeready department generally consists of Negative preparation, colour separation, Platemaking, Ink mixing, and Plate mounting. Plate mounting is very important and critical step in the pre-makeready section. Some of the problems due to mounting can be stated as follows:

- Air Bubble
- Cross Mounting
- Joint Open
- Plate Damage

These problems generally arise due human errors. These problems can be minimized to a larger extent by strictly following the standard operating procedure.

1.4 Objective of the Project

Our project deals in the field of 'Printing on Plastic and Laminated tubes'. Our major motive is to emphasise on 7 Point plan which can be stated as follows:

1. Goal- Current and Target
2. Scope
3. Time Lines - Current details/data, Analyse, Improve &Control
4. Process flow

5. Categories
6. Value added (VA) & Non Value added (NVA)
7. Inputs

2. Processes

2.1 Plate Making

The platemaking procedure starts from receiving the negative from Graphic department till plate mounting. The plates so used are of two types

- WF95DY3
- KF95GC

And one varnish plate

- WF95M

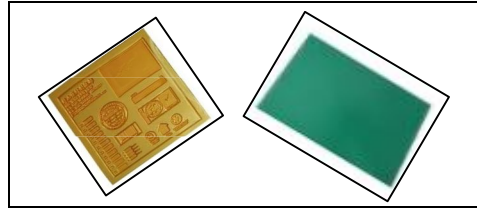


Figure 2.1 Printing Plate Sample

KF95GC is assigned as the Normal plate. The colour so observed is yellow weighing 626gm.

Here conventional 1% dot requirement is not achieved.

WF95DY3 is blue in colour weighing 693gm and conventional 1% dot requirement is achieved here.

WF95M is used as the Varnish plate. This plate weighs about 357gm. This plate is mostly referred as a solid plate.

The plates are cut depending on the number of tracks such as single double track forms. And on the basis of machine configurations they are assigned as HSL and LSL.

They are basically termed as follows:

HSL: High speed line

LSL: Low speed line

The maximum print width is 250mm but preferred width in Essel ProPack is 230mm.

Platemaking machine comprises of the following units:

- Exposure unit
- Developing/washout unit
- Drying unit
- Post exposure unit

2.1.1 Procedure

- Cutting the plate according to the required size of the negative.
- Removal of the cover from the emulsion side quickly.
- Contact the emulsion side of negative with the nylo plate without any accumulation of dust or air bubble in between and then apply vacuum sheet on to it.
- The transparency of the vacuum film should be maintained such that it should allow only 70% of the light to pass through it.
- Vacuum sheet should be cleaned with CTC solution and the UV lamp intensity should be maintained at 360 lux to 420 lux
- It is important to determine the correct exposure time using the grey scale depending on the image of the negative film.
- Water temperature should be maintained at about 30 to 33 deg Celsius for development.
- The water should be changed after developing 7 plates.
- The actual time may vary depending on the type of the washout unit.
- It is strongly recommended to dehydrate a washed out plate immediately after washout using sponge roller.
- Dry the plate at 60 to 70 deg Celsius with air circulation.
- Post exposure is done mainly to cure the polymer completely.

2.2 Ink Mixing

The process of ink mixing starts from gathering information from the job card such the colour pantone number, pantone formula, etc. till supplying the ink for production.

UV based inks are used. 22 types of direct inks' are used.

For matching the shades for a particular ink draw down is done.

0.25gms of ink is precisely weighed and is applied on the roller of the draw down machine. Then the sample of the ink shade is taken on a laminate and sent for approval.

After the draw down sample is dried, the sample is analysed through two steps:

- First, the sample is visually checked for shade matching.
- Second, the sample is checked with a spectrophotometer for delta E values.



Figure 2.1: Ink Mixing Unit

If the delta E value is less than 2, the sample is approved and the ink is accordingly prepared.

Ink mixing is done with the help of an ink mixing machine. Special colours such as gold, silver etc. is not prepared but are directly available.

Drying of the ink is done by using UV lamp where the sample so prepared is passed under the UV lamp for about 5-6 times so that the draw down samples is completely dried.

This drying is considered to be one of the important procedures as on storing, they can be effectively used for further references without undergoing any corrections.

Visual inspection is mostly done under safe light. This safe light is obtained by D-65 machine where it significantly helps in checking the colour match.

The amount of ink prepared depends upon the patch size of the image.

The inks are mostly bought from Siegwark and DIC. Per Kg of ink costs Rs.1200.

2.3 Plate Mounting



Figure 2.2 Plate Mounting Unit

The process of plate mounting starts from selecting an appropriate cylinder till sending the prepared plate to the makeready trolley.

After selecting the appropriate cylinder the cylinder is mounted on a stand equipped with a pedal.

Double sided tape is applied on the cylinder. The place on the cylinder where the joint is to be made is applied with a special kind of double sided tape.

The non-readable side of the plate is applied with talcum powder.

The plate is then placed on the cylinder and the registration is done using a micro resolution camera. This camera basically helps in matching a plus mark seen magnificently from the plate with assigned position on screen. This thereby helps the worker to perfectly apply the printing plate onto the cylinder. The plate is so mounted, that no air bubbles are trapped in between the cylinder and plate.

The joint on the plate is made with the help of soldering. This soldering device basically helps in adjoining the edges of the plate uniformly. Perfect joint depends upon the skill of the worker and the precise pressure so applied while soldering. The assembly is then bubble wrapped and sent to the makeready trolley.

The bubble wrap is necessary to protect the plate from any damage before it reaches the production area.

A common impression cylinder is used on a central impression press for multicolor printing. On such a press, the substrate is carried around a large-diameter cylinder where it contacts four to eight different plate cylinders, each of which lays down a separate colour plus varnish is possible with various online converting procedures.

The width of the central impression cylinder is observed to be 3mm with diameter as 1058mm and with circumference 3144mm.

2.3.1 Vertical Accumulator

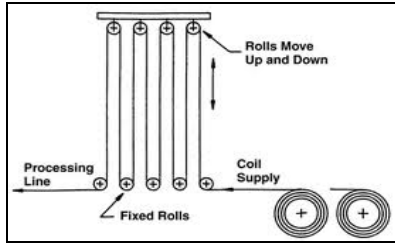


Figure 2.3 Vertical Accumulator Process

The machines are equipped with a Vertical Accumulator. The vertical accumulator expands collecting a considerable amount of web and decreases the federate to the machine. They are used to keep the finishing web for some time so that a new web is easily introduced in the meantime. This basically pulls up certain length of web so as accumulate it and once a new web roll is attached the accumulated web is released and further down time is effectively eliminated.

3. Issue Management

Project Issue Management Status

Issue and Description	Issue Resolution
Platemaking issues <ul style="list-style-type: none"> • Unwanted image on the substrate • Dent marks on plate • Screen light and screen dark • Letter cut • Letter smudge • Dot missing 	These issues are mostly discovered due to machinery defects and human errors. The down time occurring due to these issues is mostly more than 90 mins. Each issue individually lands up having down time about 20-40 mins minimum. Machinery defects mostly include repeated usage of bad brush for developing purpose, and further defects observed due to assignment of wrong exposure time.
Ink mixing issues <ul style="list-style-type: none"> • Shade variation • Original master card not available for verification 	Here problems so occurred are more or less due to the absence of master card. A master card is the reference card from which the color and tone is verified. Down time here is seen to be 30-40 mins. Further shade variation issues land up having down time about 60-120 mins.
Plate mounting issues <ul style="list-style-type: none"> • Air Bubble • Cross Mounting • Joint Open • Plate Damage 	These issues are generally due to human errors and we can also term it as mere negligence. Further as this process totally depends upon the worker’s skill and experience it should be taken care that the process so followed should be effectively checked simultaneously. The down time so seen here is mostly more than 90 mins as a complete corrected plate is necessary for further steps.

4. Prepress Daily Report

The prepress daily report effectively signifies the total number of jobs undertaken on a particular day and further keeps all the details regarding its workflow.

This report significantly includes the major areas covered by a job for its production right from its layout construction assigned by the Graphics Department till its proof is verified.

On the basis of following aspects the job profile and work flow is registered:

- Job card availability and its accuracy
- Negative availability and its accuracy
- Plate making and its accuracy
- Production time lost (mins), if any time extra plate making
- Plate mounting and its accuracy
- Production time lost (mins), if any time extra plate mounting

- Ink mixing and its accuracy
- Production time lost (mins)
- Plan adherence
- Makeready trolley and its accuracy
- Production time lost (mins)
- Total time lost (mins)

Here we see that each procedure is accompanied with term 'accuracy'. This accuracy is nothing but the judgement so carried out after the process. And if the accuracy includes any wrong statement, correction is done and further extra time is added to the time lost in production.

4.1 Proposed Project Work

- We are in the process of improving the production structure keeping in mind the assigned guidelines.
- On the basis of daily reports, action plans will be generated. This action plan would comprise the effective techniques for elimination of the defects further it will include a systematic workflow right from pre-makeready till the production procedures.
- Each department will be focusing on implanting a revised format so as to easily eliminate unnecessary issues caused by negligence.
- Further machinery issues will be corrected by try and error method subjected to modified values and their results. Adding up more functional tools to enhance the storing property of print profiles would also be done.
- By having proper guidance from our college faculty and the Essel ProPack management, we hope to conclude the project successfully under given conditions and time.

5. Methodology

5.1 Plate Making Process

Precautions and Specifications:

- Unexposed plate- For longer shelf life it should be stored at 298K in dark room at 65% humidity.
- Processed plate- Should be sealed in a polythene bag kept in a dark room at humidity 50-70%
- Unexposed plates are recommended to be handled under yellow safe light.
- Fine lines or line dots need a longer exposure time, shorter exposure time gives deeper reverses and sharper halftones.
- Water temperature should be maintained at 303-306K, in the developing unit and the water should be changed after developing 7 plates.
- The drier temperature should be maintained at 333-343K
- The UV lamp should have intensity between 380-420 lux.
- The vacuum sheets should be cleaned with CTC solution before placing the job for exposing. The vacuum sheet should be changed after exposing 200 plates.
- The brush of the developing unit must be checked at regular intervals i.e. after washing 250 plates, its surface should be good and the brush sets should be placed in rotation. The whole set of the brush must be changed after developing 3000 plates.

5.1.1 Procedure

- Receive the plan and the checked negative from the graphics department.
- If pinholes are present in excess on the negative then the negative must be returned back to the graphics department else they can be covered with the opaque solution.
- The order number and the bromide number should be verified with respect to the plan.
- Verification of LSL and HSL should be done along with the verification of the single track and double track job.
- Design code must be matched from negative pouch and file
- Choose nylo plate grade as per the details on the pouch i.e. whether to use KF95GC or WF95DY3
- Cut the plate according to the required size i.e. negative size plus 5mm. Always a varnish plate should be used for the reference.
- Wastage of plate should be avoided.
- Set machine parameters as per details on the negative pouch.
- Remove the protection layer on top of the nylo plate and put in under the negative.
- Place them in exposing chamber under vacuum.
- Placement of the plate in the exposure table should be according to the UV lamp intensity, marked area and according to the job type.
- Expose the UV rays for defined time period.

- After taking away the negative, wash the exposed side of nylo plate for defined period with raw water in washing chamber.
- Wipe out the excess water from the nylo plate surface using spongy roller.
- Dry the washed nylo plate in drying chamber of plate making machine for specified time. Usually it is 300secs or 5min
- If post or back exposure is requested on the negative pouch, provide for specified time. Usually it is 7mins.
- Do visual checking on the dried nylo plate.
- Ok nylo plate is sent for offline printing.
- If any defect noticed after visual inspection and offline proofing the plate is discarded and the above mentioned procedure is repeated again with necessary corrective actions.
- Make entries in register and send plates for mounting with the color written on them.

5.2 Plate Mounting Process

- The process starts with obtaining the finished plate till the plate is sent to the makeready trolley.
- Appropriate cylinder and gears are chosen for the specific jobs.
- The chosen gears should be tested with a gear tester for their structural integrity at regular intervals.
- The plate is then adjusted onto the cylinder with the help of the plus marks present.
- The plate is fixed onto the cylinder with the help of double sided adhesive tape. A special type of double sided adhesive tape is used for the joint area.
- The readable side of the plate is mounted on the face of the cylinder.
- The joint is then made with the help of soldering.
- The assembly is then checked for any defects and then it is bubble wrapped and is sent to the makeready trolley.

5.3 Ink Mixing Process

- Receive plan, job card, bromide, shade card and inks.
- Check whether the job is processed for first time or an existing one.
- If existing job, mix ink as per ratio provided in shade card.
- If it's a new job, ink mixing ratio is taken from pantone number provided in bromide.
- Make drawdown using IGT proofer as per SOP and check the values against master/pantone.
- If delta E value is less than or equal to two, accept the ink, else re- mixing to be done by adding suitable color.
- Attach the draw down sample which has the value and date of checking mentioned on it-in the product file.
- Update details in ink mixing production log.
- For new jobs, update the ink mixing ratio in shade card and new master draw down after obtaining delta E less than 2.
- Clear the ink for production by arranging on MR trolley and by completing the pre-make ready trolley checklist.

6. Observations

PLATE MAKING						
Month	OCT		NOV		DEC	
Issues	Downtime (min)	Frequency	Downtime (min)	Frequency	Downtime (min)	Frequency
Dent	420	7	105	2	410	4
Letter smudge	45	1	0	0	0	0
Letter cut	0	0	285	4	345	5
Line curve	135	3	0	0	0	0
Unwanted screen	90	1	0	0	45	1
Text bold	160	3	0	0	105	2
Screen damage	60	1	0	0	0	0
Up to up variation	0	0	30	1	0	0
Wrong text	0	0	0	0	45	1
Dot miss	0	0	0	0	90	2
Screen miss	0	0	390	4	0	0
Pinholes	30	1	0	0	0	0
Total	940		810		1040	

PLATE MOUNTING						
Month	OCT		NOV		DEC	

Issues	Downtime (min)	Frequency	Downtime (min)	Frequency	Downtime (min)	Frequency
Air bubble	90	2	0	0	105	2
No grub screw	100	2	50	1	45	1
Cross mounting	30	1	60	1	95	2
Counter NA	30	1	0	0	0	0
Plus mark stuck on plate	30	1	0	0	0	0
Wrong roller given	20	1	0	0	0	0
Plate damage during loading	50	1	0	0	0	0
Trolley late	30	1	30	1	30	1
Wrong plate	60	1	0	0	120	1
Tape on plate	0	0	45	1	0	0
Counter not right	0	0	60	1	0	0
Wrong reference	0	0	45	1	0	0
Shaft tight	0	0	0	0	0	0
Improper inputs	0	0	0	0	0	0
Wrong gear	0	0	30	1	30	1
Total	440		320		425	

INK MIXING						
Month	OCT		NOV		DEC	
Issues	Downtime (min)	Frequency	Downtime (min)	Frequency	Downtime (min)	Frequency
Shade variation	150	4	450	7	345	5
Wrong ink	60	1	60	1	0	0
Wrong label	0	0	120	1	60	1
Ink late	0	0	0	0	45	1

Figure 6.1: Prepress Observation Report

7. References

1. Helmut Kipphan, "Handbook Of Printing Media": Procedural formats for various processes
2. www.wikipedia.com : Diagrams, figures, pictures.
3. NIIR Board, "Screen Printing Technology Hand Book": Ink mixing machineries
4. Adams Faux Rieber, "Printing Technology": Accumulator workflow and Machineries
5. RH Leach "The Printing Ink Manual": Inking Machineries