Outer cover

भारतीय सर्वेक्षण विभाग

SURVEY OF INDIA

स्थलाकृति – पुस्तिका

HANDBOOK OF TOPOGRAPHY

अध्याय X

CHAPTER X

नवम् संस्करण

NINTH EDITION

अक्टूबर, 2009 तक संशोधित

(Revised and corrected up to October, 2009)

मनचित्र पुनरूत्पादन

MAP REPRODUCTION

भारत के महासर्वेक्षक, के आदेश से प्रकाशित।

Publishsd by order of Surveyor General of India

भारतीय सर्वेक्षण विभाग मुद्रण वर्ग, में 2009 में मुद्रित।

Printed at the Printing Group of Survey of India, 2009

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Price Rupees _____

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MAP REPRODUCTION

FIRST EDITION 1912

SECOND EDITION	..	..	1919
THIRD EDITION	..	..	1928
FOURTH EDITION (Provisional)	..	..	1939
FIFTH EDITION	..	..	1954
SIXTH EDITION	..	..	1966
SEVENTH (Revised) EDITION	..	..	1986
EIGHT (Bilingual) EDITION	..	..	2000
NINTH EDITION	..	..	2009

When any correction to the Handbook is considered necessary the **ADDITIONAL SURVEYOR GENERAL, PRINTING ZONE, HYDERABAD** should be addressed.

Subsequent procedure will be as laid down in Chapter-I

Record of Correction Slips to Chapter X, Map Reproduction

C O N T E N T S

HALF-TONE PROCESS AND COLOUR PRINTING

ORGANIZATION

GENERAL INSTRUCTIONS

DIGITAL PRINTING

NOTES OF TECHNICAL INTEREST

APPENDICES

PREFACE TO NINTH EDITION

The Ninth Edition of the Topo Handbook Chapter X is being brought out in Bilingual form with a view to implement the Official Language

Policy of the Government. Hindi version of this Handbook has been vetted by the Central Translation Bureau, Department of Official Language, New Delhi.

This edition has been brought up to-date by incorporating information on the latest technological developments in the area of Map Printing and new techniques introduced in the department.

This bilingual edition contains a good deal of new informations about Scribing, Use of polyester base films, Colour-trol technique, rub-on-proving, dot etching digital printing etc. and characteristics of paper. All efforts have been made to make this chapter to provide a better understanding of the subject of Map Production in simple language.

This chapter containing various sections and Appendices will prove itself more useful for our Officer and Staff in establishing a closer link of activities involved in faster production of quality maps.

Dehradun

…… 2009

Surveyor General of India

LIST OF CHAPTERS OF THE HANDBOOK OF TOPOGRAPHY

Plane Tabling *

Topographical Mapping

Reconnaissance and Special Surveys

(Not allotted) *

Forest Surveys and Maps

Map Reproduction

Geographical Maps

Photogrammetric Survey

*****Names likely to change

MAP REPRODUCTION

SECTION I – PRINTING IN GENERAL

1. Definition :- Printing is an art of recording and multiplying a written message sketch or a drawing on paper in a legible and attractive style suited. It is through this medium that mankind is able to get books, magazines, newspapers and abundance of information to carry out its cycle of all kinds of activities. In the same way engineers and defence forces look towards a printed map to plan their course of operations.

2. Discovery of Paper :- The discovery of paper is said to have been reported in the year A.D. 105 by Tsai Lun of China. From China, the use of paper moved gradually westward reaching Egypt about A.D. 990, Spain in 1150, Italy about 1270 and Germany in 1390. The first paper mill was erected in Germany in the 14th Century.

3. Invention of Movable Types :- Paper had now become the medium for producing hand written materials and for reproducing pictures by wooden block printing by hand. But the methods were too slow and costly. This realization led to a search for ways and means of overcoming such handicaps.

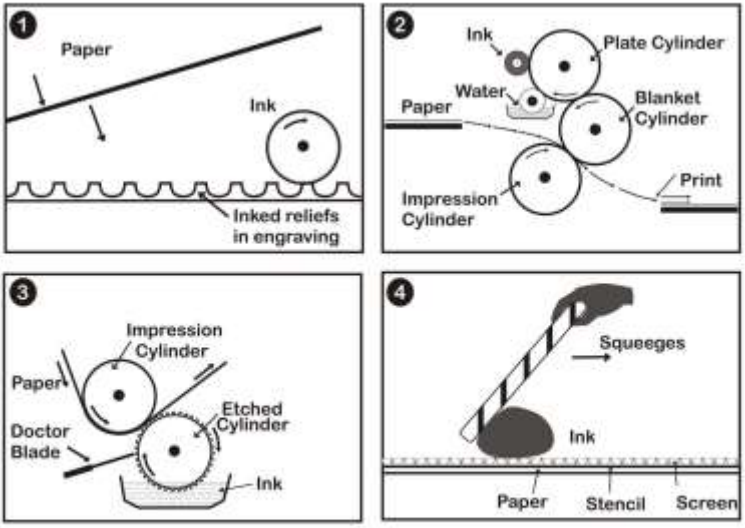
Experimentation began and resulted in the invention of movable types of metal cast in matrices which constituted the important foundation of printing as we know it today. The credit for this invention goes to Johannes Gutenberg of Germany. His famous contributions is the 42-line Bible which was printed on a simple hand operated press which resembled the old wine press of that time. Printing with the handpress was a slow and laborious process. This created interest in many inventors of that time in many countries of Europe to develop steady and speedy methods and machines of printing. Without going much in detail it will suffice to say here that the art of printing started by

SECTION I – PRINTING IN GENERAL

Gutenberg soon turned in to a type of technology and ultimately took the shape of an industry which gradually placed a number of methods of printing in the hands of interested user all over the World.

4. Printing Processes :- The major printing processes shown in the accompanying diagrams on next page are :

Letterpress.
Offset Lithography.
Gravure.
Silk Screen.



Letterpress Printing process is about 500 years old. It was first used in a practical manner by Johannes Gutenberg in Germany about the year 1450. Letterpress printing is done from a raised or a surface in relief like a plateau-cast, cut or etched from metal and other substances. The surface of the type or illustration extends

SECTION I – PRINTING IN GENERAL

above the body of the type or plate and is the printing surface. The non-printing surface is used only to hold the printing surface together and its level is below the printing surface. When the printing surface is coated with ink and pressed against paper, printing results.

Letterpress machines are comparatively simple and less sophisticated. The process is used for printing newspapers, books, magazines, periodicals, balance sheets, cartons, boxes, letterheads and envelopes, etc.

Offset lithographic printing process was discovered in 1798 by Alois Senefelder, a Munich (West Germany) playwright. The term lithography is from two Greek words : Lithos- a stone and graphein- to write; hence it means “stone writing” or “writing on stone.”

The basis of the **principle is that oil and water do not mix**. The printing surface is an oily image in level with the non-printing surface. Unlike the other printing processes, the printing surface is first dampened and then inked. The non-image areas retain uniform layer of moisture whereas the image areas attract a thin layer of the oily ink. The ink from the image areas is transferred (offset) on to a rubber blanket as inverse image from where the paper picks it up as the printed impression.

A slab of lime stone four to six inches thick was at first used as a printing surface by Senefelder. Later on the stone was replaced with metal plates.

Various kinds of metal plates are used now to print single and multicolour prints on high speed sheet fed and web fed offset presses. Offset printing process is suitable for printing calendars, maps and atlases, greeting cards, posters, magazines, charts and reprint editions of books.

SECTION I – PRINTING IN GENERAL

Gravure printing process is also known as Intaglio. The printing surface is the recess part of an engraved copper plate or cylinder. A thin, watery ink is used in this process. It fills the recesses. Excess ink from the relief surface is wiped clean by a straight edge called the doctor blade. Paper, in contact with the cylinder surface, sucks the ink from the recesses to give a printed impression.

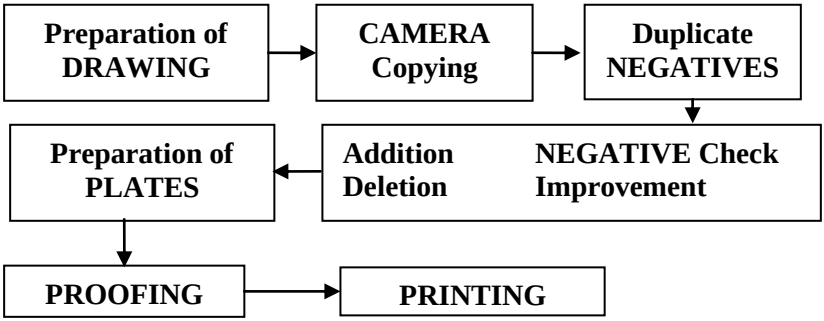
In **Silk Screen** printing the image area is made into a stencil by opaquing the non-image area of a piece of silk cloth stretched on a frame. The stencil is prepared photographically on a pigmented gelatine coated presensitised film. A good presensitised film available in the market is Five Star Autotype film having a red pigmented gelatine coated on a clear 0.05 mm polyester base of high dimensional stability. The stencil film while wet is adhered to the silk cloth with emulsion side to mesh and the film backing is peeled off gently when dry. When ink is pressed against the stencil (Screen) it passes only through the non-opaque area and registers a print of the stencil on the paper held underneath the printing frame.

The process is mainly suited for short-run line jobs and that too of not very fine lines. Half tone illustrations in screens of 16 lines per cm and coarser give satisfactory results. Solid areas print rich and beautiful. Fluorescent inks and

metallic inks bring about the best possible results. The process is also used for printing of glass, plastic sheets, cloth scrolls, etc. It can duplicate coloured posters, lettering, chalk drawings, brush drawings, and even natural structures. The process offers a whole range of design possibilities which can hardly be bettered for speed and clarity by any painting, drawing or even montage method.

SECTION II – MAP PRODUCTION(CONVENTIONAL)

5. General :- It is the Offset Lithographic Printing Process which is used to print maps and can be illustrated in the form of a flow chart as follows :-



6. Preparation of Originals :- The originals for map reproduction may be prepared in a variety of ways. Of these the commonest are:-

(a) Drawing and typing by hand on plain and metal mounted drawing paper. Plain drawing paper does not hold accurate dimensional stability when subjected to humidity variations and is a poor material to obtain good register in multicolour maps. Metal mounted drawing sheets are preferred to prepare separate colour drawings for multicolour mapping work. Regrained zinc or aluminium metal plates can be used as a mounting base.

(b) Ink drawings can be prepared to agree with photographic detail by drafting directly on the photographic print. The silver image is then dissolved leaving the inked drawing on the cleared photographic paper. This process is used for making line drawings from photographs, or for redrafting line sketches, symbols, or insignias that are poorly drawn or printed.

(c) Scribing or etching through a pigment coating on a plastic base to form a negative. The plastic based scribed sheeting is dimensionally stable and is of such a colour that it will not transmit blue, green or violet light to which orthochromatic photographic materials and lithographic coatings are sensitive. The scribe originals can be used

directly for the preparation of press plates or for the preparation of photographic positives.

Originals can also be drawn :-

(i) On any drawing paper as well as on any paper
(ii) On Kodatrace
(iii) On tracing cloth
(iv) On enamelled metal plate
(v) On polyester drafting films with one or both sides matt
(vi) On tin foil.

Name originals are prepared from typewritten, hand-press composed or Photo-type-set words. In using a hand-press the words are composed letter by letter and are typed by hand on the fair originals on drawing paper, Kodatrace, polyester drafting film or any other material. Photo-type-set words are composed photographically in a machine called 'the Phototype Setting Machine, as positive or negative on a strippable or non-strippable film. The photocomposed words are fixed to the original base with the help of a wax adhesive, double-side cello tape or some other suitable adhesive.

Phototype setting is the latest form of composition method. Photolettering machines are designed to produce type on either film or paper in sizes from 4 to 48 point or larger as required.

7. Quality of Originals :- The Reproduction Office should endeavour to maintain a uniformly high standard of reproduction to preserve the reputation it has built up for first class work. It must, therefore, insist that the originals submitted should be of the best possible quality. The following points must be borne in mind in making an original for reproduction :

(a) The paper must be perfectly smooth, clean and free from creases or blemishes. (Chapter VI, para 9).*

(b) Black lead pencils must never be used on fair sheet. (Chapter VI, para 14).*

(c) All line work should be black, unbroken and sharp. This is best attained by using a ruling or swivel pen in reference to a mapping or crow-quill pen.

(Chapter VI, para 15).*

(d) The Indian ink used should be free from grit and dust and should be sufficiently thick to give true black lines, unless the lines are truly black they cannot be reproduced properly by photography.

(Chapter VI, para 19).*

(e) Erasures should be avoided as far as possible. A name typed over an erased portion of the paper will, unless the erased surface of the paper is very carefully treated, invariably appear blurred on reproduction. (Chapter VI, para 21).*

(f) Pasting on the face of a fair sheet is undesirable.

(Chapter VI, para 22).*

(g) *When despatching fair sheets, the instructions contained in Chapter II, Appendix VI and Chapter VI, Appendix "C" should be carefully followed.

8. Types of Originals :- All originals can be classified into :-

1. Line Originals and
2. Continuous tone Originals.

Originals such as Name, Outline, Contour, Green tree and Grid are known as *Line Originals* and Hill Shade original is known as *Continuous tone Original*.

In general, photographs are the most common form of continuous tone originals. For purpose of reproduction they should possess normal contrast and a long scale of gradation, besides displaying well defined detail and tone values in the middle tones and shadows.

The most suitable prints are those made on glossy bromide paper of normal contrast, and from negatives in which the highlights and shadows of the subject are properly recorded.

The prints should not be unduly 'flat' for lacking in vigour, nor should they show excessive contrast.

9. Care of Originals :- There is no excuse for soiling originals by the dirty hands of workmen nor is there any excuse for spattering expensive photographs and art work with chemicals, inks and other foreign matter during the course of plate making. A simple precaution is to place all originals in paper envelopes or folders the moment they are despatched from one office to another. In fact, originals should always be kept in covers and removed only at the time of photography.

10. Photography of original:- This section makes the photographic negatives required in the Photo Litho processes. Direct, reverse or halftone negatives are made according to Register Slip instructions. It should be noted that for flat-bed printing a reverse plate is required and a direct plate for offset printing. The normal photographic negative is reverse and, to obtain a direct negative, a prism or mirror is fitted in front of the camera lens.

Wet plates are normally employed for photographing the line originals but with the installation of Klimsch Camera polyester base stable films are also being used for both line and continuous tone originals. The original to be photographed is placed on the copy board and focussed to the required dimensions on to the ground glass screen of the camera. Dimensions to required scale of reproduction are obtained by reading on scales fitted in the camera or with the help of metal mounted paper strips on which the dimension have been marked. The registar slip gives dimensions, and small distortions in the shape of the originals can generally be rectified by tilting the copy board. It is unusual to find departmental originals which cannot be photographed very nearly to the exact dimensions required.

Where the exact dimensions cannot be attained for all sides of a negative it is usual when photographing standard sheets to bring the top and bottom parallels exactly to scale. With other work the
practice is to bring the longer dimensions as near the correct scale as possible.

When, as with Departmental Maps, separate originals are submitted for different colours, it is usual to photograph the outline original first and make the others to conform to the dimensions of this. Accessory matter such as headings, footnotes, symbol tables, etc. is pinned up in position on the original by the operator if not already pasted on the originals by the Drawing Offices. This accessory work may be engraved of typed. No. exposure will be made until the Section Officer has satisfied himself that the negative will conform to the given measurements and that the additional matter is complete and in its correct position. For his guidance the Section Officers will keep charts of all additional matter which has to appear on departmental and extra-departmental publications. He is responsible for keeping these charts up-to-date. This Officer has great responsibility as mistakes or omissions at this stage may be difficult and costly to rectify later.

After exposure, the Section Officer will inspect the negative and check dimensions, and originals will not be removed from the copying board till this inspection is completed.

Where re-photography is ordered the operator makes a note to this effect in his diary.

After being passed, negatives are varnished (in case of wet plates) to protect the film, and are then passed to the Powder Section (wherever available) or direct to the Retouching Section for improvement. They are then sent to the Plate-making Section for printing down on a metal plate.

11. Contact Printing :- Negatives prepared on gelatine bromide or lith type photographic film or plate are duplicated by contact in a contact printer. It is called Contact Printing method because the

negative is exposed in perfect contact on the photographic plate or film. Preparation of contact bromide prints and diapositives from aerial photo negatives for use in photogrammetric work is also done by contact printing in KG-30 or Log Etronic contact printers.

12. The Negative Store Section has two sub-sections, the *Negative Store Section* and the *Glass Cleaning Section*. In the Negative Store Section film negatives and glass negatives are stored for record in an orderly manner and to obtain cleaning or storing orders for all negatives stored there.

The Glass Cleaning Section feeds all sections with their requirement of clean glasses. Glasses are obtained either from store or by cleaning off negatives. This facility exists in Printing offices where wet plate photography is also used.

13.Retouching :- This is one of the major sections of a Reproduction Office. In fact, all jobs take proper form after they come out of this section. The Officer-in-Charge of the section should have a general knowledge of fair-mapping and must have a good knowledge of map reproduction processes, and be well conversant with all publication orders.

The functions of the section are :-

(1) Retouching of negatives.
(2) Colour separation of negatives.
(3) Correction of negatives.
(4) Correction of tint combined negatives.
(5) Preparation of tint stencils.
(6) Colour retouching and chemical etching.
(7) Examination of negatives against guides, proofs, orders, etc.

The section consists of :-

(i) Retouchers Photo.
(ii) Examiners.

The Retoucher Photo strengthens and touches up weak parts, cuts in any details that may have been obscured or omitted on the original. He paints out all defects or details which are not required, makes colour separation negatives, cuts in direct or reverse letters and figures on the negatives. He also corrects by stripping in new matter when necessary. He prepares negative/positive stencils and layer stencils on glass prints, and also improves screens, tints, etc.

An Examiner examines negatives against colour patterns, originals, proofs, etc. He should be a man with superior educational qualifications. He should have a fair knowledge of Photo Litho processes in general, and must be up-to-date in his knowledge of all publication orders.

From the Photo Section, negatives are passed on to the Retouching Section. Originals, colour guides, etc. are also passed on from the Photo to the Retouching Section. Colour patterns, P.O.P.s, etc. are sent to it direct as soon as received.

The glass prints for tint stencils required for combining line and tint, are called by the Retouching Section as and when required.

The Retouching Section is not responsible for errors or omissions arising out of defective originals or colour patterns, but any error or omissions discovered are reported to the Manager. No alteration or correction to any original or colour pattern is made except by the express orders of the Director

Negatives after examination, are passed to the Plate-making Section. The originals are stored with the Litho-drawing Section.

14.Graining :- This is an essential preliminary preparation for any plate to be used for lithographic printing. The object of graining is to hold the water while printing and to prevent the greasy printing ink from adhering to the surface of the plate. The grain required is a fine matt surface and is produced by placing the

plate in a shallow trough and covering it with a layer of glass or metal balls, fine sharp river sand or some other suitable abrasive and water, and giving the tray an eccentric rotating motion. The sharpness and not the depth of the grain is what matters.

To a large extent it is the grain of the plate which determines the quality of a print. It has often been seen that use of nicely grained plate can enable a skilled machine operator to produce a fine job with inferior inks or worn dampers and rollers.

Both zinc and aluminium plates can be grained by the process described above. However, a chemical and electro-chemical technique has been developed in recent years for the surface preparation of aluminium litho plates. Although the process is not used in the department, it is based on the principle that the surface of an aluminium plate gets etched when treated chemically or electro-chemically in solution containing alkali salts, chromates, phosphates, fluorides or chloride ions at suitable concentrations, producing a uniformly grained surface. This is subsequently oxidized anodically in an electrolyte containing chromic acid, sulphuric acid and/or phosphoric acid. Such a surface is commoly known as 'ANODISED.'

Plates used in the case of presensitized aluminium plates or wipe-on or rub-on plates have anodised surface or even a better surface called the micrograin surface. These plates have good grease and water receptive qualities and are suitable for long runs. The anodization of the plate's surface protects it from oxidation.

Graining of Plates :- There are three types of grain :-

(a) Fine grain- this is used for fine line and half-tone work. After long runs the plate may become polished when even damping of the plate becomes very difficult.

(b) Medium grain- used for normal map work.

(c) Coarse grain- used for poster printing and large colour solids. When this type of printing is done much water is used together with large amounts of ink.

Qualities Required in a Grain :- The most important quality required of a grain is that it is consistent. If it is not consistent the result is poor and uneven printing.

15.The Litho Plate-making consists of Printer-down operators and Technical Labourers. Each Printer-Down operator should be capable of carrying out each operation of the Albumen, Deep Etch and Vandyke processes and should not be classed as an operator until he can do this. In actual practice it is usual to employ different operators for each stage.

Sharp litho plates are essential for good printing and to obtain these correct exposure and a skilled touch in developing are necessary. This touch can only be acquired with experience.

The characteristics of a good lithographic plate are sharp lettering and absence of thickening or breaks in the lines. In map reproduction the most important plates are those for the black outline and the hills. Great care must be taken with contour plates to ensure that where contours are close they are not coarse. It is preferable that some should be dropped as coarse contours obscure other detail on the map.

Sunlight gives the best results, but in dull weather arc lights may be used.

When making Albumen plates from a set of colour negatives, the operator should endeavour to print down the work in the same relative position on each plate, as this assists the printer to obtain registration quickly. Use of register pins is also helpful in obtaining plates of a set of colour negatives.

The Assistant Manager responsible for this section will examine and initial plates before they pass on to the Litho Branch for proving.

Litho Printing Plates :- Two types of metal printing plates are used :-

(a) Zinc Plates.
(b) Aluminium Plates.

Zinc is darker than aluminium and two and a half times the weight. Zinc dissolves readily in nitric, sulphuric and hydrochloric acids. It is not affected by cold solutions of caustic soda and caustic potash. Zinc does not oxidize as easily as aluminium and holds the image well. The surface is harder than that of aluminium. Zinc has good grease receptive but relatively poor water receptive qualities. For this reason there is a tendency for the image to scum and thicken up if care is not taken.

Aluminium is lighter in colour and the work can be seen more easily than on zinc. It takes a finer, deeper grain than zinc and gives a clean, sharp image. However, the image does not hold as well as on zinc. Aluminium is not affected by nitric acid but is attacked vigorously by hydrochloric and dilute sulphuric acid but not by concentrated sulphuric acid. It is also affected by caustic soda and caustic potash. Aluminium has poor grease receptive but good water receptive qualities.

16. Methods of Preparing Litho Plates :- There are three main methods of putting down the work on a litho plate. These are

(i) The Albumen Process
(ii) The Vandyke Process.
(iii) The Deep Etch (or Gum Reversal) Process.

The Albumen Process :- It is a surface plate making process and is applied to print work from a photographic negative on to the

SECTION II – MAP PRODUCTION

surface of a sensitised metal plate. It is used for the preparation of plates in all cases when the printing of a map involves photography

of an original or the use of a standing negative or the use of scribed plates.

Photography of an original is always necessary when a map has to be printed in several colours and the separation of colours has to be carried out on duplicated photographic negatives; and when a map has to be printed on a scale larger or smaller than the scale of the original. This is always the case with standard departmental maps. The Albumen process is, therefore, the one used for the preparation of most of the litho plates from which standard departmental maps are printed.

The first essential to preparing a good litho plate by the Albumen process is the production of a good photographic negative.

A brief description of the Albumen process is given below :-

A grained metal plate is coated with a solution containing ammonium bichromate and egg albumen, and when dry, is placed in a pneumatic printing frame in contact with the photographic negative to be printed down and is then exposed to sunlight or artificial light from arc lamps. Where the light penetrates the transparent line work of the negative, the bichromated albumen coating on the plate is rendered insoluble. The rest of the coating on the plate, which is protected from the light by the opaque body of the negative, remains soluble. After exposure, the plate is removed from the printing frame and its coated surface is rolled up with a mixture of black ink, turpentine and benzole, which dries rapidly. The plate is then developed by washing it in clear water while rubbing lightly over the surface with cotton wool. The soluble portions of the coating are thus removed to expose the grain of the plate, while the insoluble portions adhere to the plate as sharp black work. The plate, when dry, is then ready for the printing machine.

SECTION II – MAP PRODUCTION

When a map has to be printed in several colours, the photographic negative is duplicated and with the aid of opaquing, a separate negative is prepared for each component colour. These colour separated negatives are use to prepare a set of litho plates by the Albumen process, from which prints in each colour are made in correct registration. In scribing, each colour plate is separately scribed and litho plates made from these.

The Albumen process is also adaptable to printing down on glass. Glass prints are used to prepare the stencils with which to combine line and tint work when it is necessary to print lines and tints in one colour from a single metal plate. The glass prints used for this purpose are not rolled up with black ink but are colour dyed. Such work in scribing is done on peel-coat sheets in the form of preparing open-window negatives.

The Vandyke Process :- This process which was worked out by late Mr. F.R. Vandyke in the Photo-Litho Office in 1906, does not lie in the direct chain of production of the ordinary departmental map. It is, however, extremely useful for the rapid reproduction to scale, of maps and engineering drawings drawn on tracing cloth or some thin and translucent material.

It differs from the albumen process in that it produces positive plates direct from positive originals : it is similar to it in that it also depends on the hardening action of light on bichromated glue. The sensitised metal plate is dyed, after exposure, with methyl violet and developed under running water. This leaves the metal of the plate bare where it was protected from light by the lines of the work. Greasy ink is then spread over the plate and a second development in hot water removes the hardened portions of the coating, leaving only the greasy ink adhering to the surface of the bare metal where it was exposed during the first development.

The Deep Etch Process :- This process which is rapidly increasing in popularity in Europe and the U.S.A. was first

successfully worked in the Photo-Litho Office in Calcutta in 1935. It consists of producing a lithographic plate from a positive with the essential difference, from the plates produced by the Vandyke or Albumen process, that the work is etched into the plate with acid.

The advantages of this process are :-

1. The grain of the plate under the work is reduced so that the work is sharper.
2. The recessed work will carry more ink.
3. The work being recessed and carrying more ink is less liable to be attacked with lithographic etches.

4. The work is less liable to be robbed of its ink at each impression of the machine.
5. Being recessed and based on a thin coating of shellac instead of a layer of bichromated colloid the work is more durable.

The process is particularly useful in conjunction with Dot Etching for illustration colour-work, as the plates can be made direct from the positive on which the Dot Etching is carried out.

17.Proving Presses :- These are of two kinds; direct and offset. In the first the paper receives the impression direct from the plate whereas in the latter the impression is transferred from the plate to a rubber blanket and from the blanket to the paper. It follows then that in the first case the image on the metal plate is reversed while in the second case the image on the blanket is reversed but that on the plate is direct.

Presses are further divided into automatic presses and handpresses. In the latter the plate is dampened and inked up by hand and in an automatic press these operations are done mechanically.

Printing Machines are also divided into rotary and flatbed machines.

SECTION II – MAP PRODUCTION

Handpress and flatbed machines have become obsolete. Automatic offset rotary machines, which are capable of higher speeds, are being used now. The Department has a few handfed rotary machines which, however, are rarely used.

The maximum size of work which can be printed is given in Appendix III.

Prior to printing, a proof of a map is necessary to ensure correct registration and reproduction of all colours and mapping detail. Corrections are made on negatives, positives and scribed plates. Ideally there should be no corrections necessary but this is never the case. Mistakes in drawing or scribing, name placement, colour registration, etc., are always discovered. Also it may be possible that new information for the map is received after the drawings have been completed and positives or negatives made for printing down to plate.

A proof can be prepared by two methods :

(i) On a Proving Press,

(ii) By Rub-on Proving Process.

Proof presses with or without automatic inking and dampening arrangement are used. In addition to proving, various jobs such as the preparation for drawing blue-prints, are also carried out on a proving press. Work which cannot be done on the printing presses such as the surprinting of information on trimmed and published maps, is also carried out here. Extra-departmental project maps and other miscellaneous jobs of small runs are usually printed on proving presses.

The preliminary proofs of standard sheets in black, brown and green, and impressions in grey for the preparation of colour guides, are all made on a proving press; also the preliminary proofs in colour for examination in the Reproduction Offices before the plates are corrected and sent to the machine press.

SECTION II – MAP PRODUCTION

Other classes of work occasionally carried out by this section are the duplication of plates, the making of dyed set-offs for preparation of boundary riband plates, transfers and, should occasion demand, the combination of work from two or more plates using the MacLeod or Penney bar, the mounting of plane-table sections and the surprinting of the standard marginal items.

A setoff is a non-greasy impression made from one litho plate on to a clean plate to serve as a guide for the litho-draftsman. See para 82.

Work can be drawn or printed on special ‘transfer’ paper and transferred from this paper to a metal plate. See para. 85.

By the rub-on method a proof in colour is prepared on a white plastic sheet. The method consists of applying light sensitive dye coating of the required colour to the plastic sheet by wiping or rubbing with the help of some cotton wool or cheese cloth.

Each of the colour negatives is exposed in sequence in contact with the dye coated sheet and developed with a weak ammonia solution. The negative detail remains in colour of the dye used on the plastic sheet and the remaining area is washed clean. The process is repeated for each remaining colour and the result is a proof in full colours.

18.Litho-Drawing :- This is another important section in the office. The section officer virtually controls publication. He is responsible for the examination of proofs, preliminary prints and material and for the marshalling and passing of plates for final printing. He must have a good general knowledge of map reproduction and fair mapping, and should know his way about the departmental handbooks on these subjects. Copies of all Map Publication Office orders affecting map reproduction are kept in this section for reference.

SECTION II – MAP PRODUCTION

The main work of the section consists of :

(a) The examination of proofs, preliminary prints and material submitted by the Proving Section.
(b) The correction of litho plates.
(c) The drawing on litho plates of boundary ribands and solids (not usual).
(d) The gumming out of litho plates and laying down of tints and stipples by the Ben Day's method for commercial work such as posters (only when required).

The Section comprises of :

Proof-Examiners.
Litho Draftsmen.

A Proof Examiner examines proofs against originals and colour patterns. He is usually a man with superior educational qualifications who has had practical experience of one or more other trades in the office.

A Litho Draftsman should be able to carry out corrections, draw and lay down tints on a litho plate in flat position or mounted on the printing machine.

The Litho Drawing Section is not responsible for any errors or omissions arising out of defective originals or colour patterns. The Proof

Examiner, however, with experience acquires a knowledge of what is right and wrong and should point out any errors or omissions detected. He should not, however, waste time in looking for such errors and omissions. The points to be attended to in examination are :

(i) Quality of reproduction.
(ii) 'Doubling' of detail in 2 or more colours.
(iii) Completeness and correctness of all footnotes, headings, etc., for which the Reproduction Office is responsible.
(iv) Registration.
(v) Fouling of contour values by details in another colour.
(vi) General agreement of marginal features of departmental sheets with adjoining published sheets on the same scale.

SECTION II – MAP PRODUCTION

Generally speaking the first pull from every plate is examined for quality of reproduction only. The detailed examination is made later when colour plates are ready and proofs for examination are pulled in colours. All corrections are noted on the colour proof. If corrections are too heavy to be carried out on the plate, they must be made on the negative and a fresh plate supplied. In this case, the corrections are marked by the Drawing Section on a black pull which is sent to the Retouching Section for guidance. The Litho Drawing Section may also call for fresh plates if any plate is considered unsatisfactory. Black pulls from these fresh plates are carefully examined. After plates have been supplied, negatives are made over to the Negative Store Section for disposal. Colour proofs, together with the R.S. are finally submitted to the Manager for approval. If the work is extra-departmental and proofs have been called for, colour proofs only are submitted. After approval of proofs and correction of plates, the latter are passed to the Plate Storing Section where they are kept till required for printing. The examined colour proof accompanies the Register Slip to the Machine Printing Section to guide the printer. All proofs from plates of negatives which are to be kept are sent to the Assistant Manager, concerned to get the negatives corrected before storing.

Originals, colour pattern, etc., forwarded by the Retouching Section remain with the Litho Drawing Section until printed copies are despatched and plates are cleaned or racked : they are then passed through the Despatching Section to the Map Record and Issue Office for disposal.

The following miscellaneous instructions should be carefully observed :

(1) Preliminary prints should be stamped conspicuously with the legend 'Uncorrected Proofs.'

(2) Proofs of extra-departmental work issued to indentors should have a red label attached to them, drawing attention to the fact that corrections are difficult to carry out and have not been estimated for.

SECTION II – MAP PRODUCTION

(3) Drawing blue-prints will be stamped with the Office stamp and date. The dimensions of the negative plate and the blue-print are also marked on the blue-prints.

Each Printing Offices has single and multicolour machines Northern Printing Group

19. Printing :- This is carried out on electrically driven offset machines which are fed either by hand or by automatic feeders. In the case of hand-fed offset machines the rate of feed is the limiting factor to the rate of speed at which the machines can be run. It is about 1,500 impressions per hour. In the case of automatically fed offset machines the speed at which the machines are run is varied to suit the class of work being printed and the texture of the paper being used. On an average it is about 3,500 impressions per hour. For new machines, it will be more. The normal rate of speed of flatbed machines is about 600 impressions per hour.

Paper, before use in the printing presses, is hung in the press room for at least 24 hours to 'condition' it to the temperature and humidity of the machine room in order to minimise distortion due to expansion and contraction. For better control of atmospheric conditions press-rooms nowadays are made Airconditioned. Some machines are also used to condition paper.

As distortion of paper is always likely to be greater across the grain of the paper than along the grain, it is advisable to feed the paper to the machines with the grain of the paper parallel to the grippers. Any

appreciable distortion across the grain of the paper can then be taken up by altering the packing of the cylinder.

As per stretches slightly in the press it is advisable to polish it by running it through the press once before printing actually begins. After a sheet has passed through the machine for one print-ing it takes some time before it regains its normal shape. This limits the speed at which a job in several colours passes through the machines, and one printing per day, single or double colour, is the normal rate of progress.

SECTION II – MAP PRODUCTION

Each printing office has single and multiple colour machines in Northern, Eastern, Western, Southern Printing groups. A four and Five colour printing machines are installed in these groups. Northern printing group, Dehradun has a four colour Roland- West Germany made. Western Printing Group, Delhi has Five colour west Germany made Offset printing machine. Southern Printing group has one four colour East Germany KBA- 105- Universal Offset Printing machine

Together with the type of machine available the efficiency of machine utilisation is important. The completion of a printed job in the offset machine is the responsibility of a skilled machinist. His work involves often heavy physical exertion, but a proper understanding of machine's technical, electrical and electronic concepts by him is essential for economical operation with low make ready and stoppage times.

A machine printer must have a thorough knowledge of the art of litho printing, and a good eye for colour. He must have a practical mechanical knowledge of the machine which is allotted to him to enable him to get the best of it. He is personally responsible for its oiling, cleaning and general maintenance. A good machine printer should be printing impressions of the first two colours within 90 minutes of putting the plates into his machine. The time taken to register subsequent colours will depend to a great extent on the condition of the paper and whether the work has been printed down on the plate by the Plate-making Section to its correct lay. The time taken to register the second two colours is generally a fairly reliable indication of the machine printer's skill.

The printing unit in the machine is the most dangerous and demands understanding of controls covering safety in operation. The printer should always lock the safety button when working on
a dangerous part. The cylinders can take the whole arm. The printer should not wear loose clothing such as flopping sleeves when working on a press. He should also keep his working area around the machine clean and free of oil and obstructions.

SECTION II – MAP PRODUCTION

Work is distributed among machines by the Section Officer or the Assistant Manager; the printer draws the plates he requires from the Plate Storing Section, paper from the Paper Expense Store of the Despatching Section and inks, etc. from his own Section Officer.

All plates are washed and inked up in a proving press before being put into a machine. The machine printer is responsible for applying bitumen to his own plates, and for handing them over to the Plate Keeper after printing is finished.

Before stopping work each day the printer should clean off his plate, and gum it up. He should also clean the inking rollers, wash the blanket, cover the printed sheets and switch off all electric controls of his machine.

The black plate is mostly printed first because other colours must match, especially with the black line drawing. This gives the printer the best frame in which to fit the other colours. After the black printing the darker colours like red and blue are printed next because they must have the best fit.

If there are difficulties in registration of remaining colours for the printer then small mismatchings in the lighter colours are not so serious as these are not easily visible to the naked eye.

In printing thematic maps or maps for an Atlas by colortrol process or colour mixing the sequence of colours to be followed is black, yellow, red and blue.

The following is the normal order in which the different colours of standard sheets are printed.

Topographical Maps : 1-inch, ½ inch
: 1 :50,000 and 1 :250,000
: Black Outline.
Red .. Grid, Roads and sites.

SECTION II – MAP PRODUCTION

Blue .. Perennial water features.
Brown .. Contours.
Topographical Maps : Green .. Trees.
Boundary ribands.
Yellow .. Cultivation.
Shade .. Hill relief (only if required).
Geographical Maps : 1/M, 1/2M .. Political.
Black .. Outline.
Red .. Roads.
Blue .. Rivers.
Brown .. Contours.
Boundary ribands.
Shade (only if required).
Geographical Maps : Layered Maps.
Black .. Outline.
Red .. Roads.
Blue .. Rivers.
Brown .. Contours.
Ist Brown .. Layer.
Ist Red .. Layer
2nd Brown .. Layer.
Yellow .. Layer.
2nd Red .. Layer.
Green .. Layer
Shade (only if required).
Blue tint or solid for rivers between any of the layers.

Each printer in charge of a machine maintains a diary showing paper received, impressions pulled, copies printed, and balance of paper in hand. These diaries are the basis of monthly returns which are kept for the record of out-turn and spoilage.

When work is completed, the printed copies are passed to the Despatching Section for examination, trimming when required and despatch. Examined colour proofs received with Register Slips are also passed to the Despatching Section for disposal.

SECTION II – MAP PRODUCTION

The Litho Machine Printing Section is usually under the charge of an Assistant Manager. He must be a good practical printer and a good organizer. He should know the capabilities of his printers and the characteristics of his machines. He must distribute work with forethought and should exercise close supervision to ensure good work and to prevent waste in power and material.

20.Matching of colours in Printing :- A map is often made or marred by the way it is reproduced; and even with perfect registration and plates of good quality a great deal still depends on the strengths and tones of the colours used in printing. Standard colours should be used as far as possible, but hard and fast rules cannot be laid down as to colours and strengths of printing, as what suits one sheet may ruin another. For example where the country is mountainous and vegetation scarce the tree plate may have to be printed very strongly to avoid losing the symbols. The same strength of green for dense jungle in hill country in Assam might obliterate the contours; and were the latter specially strengthened to show up, names might become illegible. The shade is another plate which must be printed with judgement to give the best effect of relief and at the same time not obscure detail.

For a good matching of colours and registration the moisture content of the paper is very important because it is related to the stretching of the paper during the operation of the press. Thus for good register work the paper, which has already been for a long time under the same temperature and humidity conditions as those in the press room, is run once through the press without printing an image on it. This operation is called polishing paper. It is in fact feeding of paper through the machine at high speed with the dampening rollers on and the inking rollers *off*. The printing plate is a blank one and receives no ink. This process is done to condition the paper before the printing of the first colour begins. The paper in this process has tendency to stretch slightly under the

influence of the water and the press tension. It takes about a day for the paper to regain its shape after this process.

Another important factor in colour matching and registration is the relative *humidity* of the air in the press room. It is the percentage of water vapour actually present in the air to the maximum amount which the air can hold at that temperature. The relative humidity can., however, create several problems in the lithographic press-rooms. When it is low the pressman can have problems with static electricity. High relative humidity slows down the drying time of inks on the sheets of paper because the paper is so full of moisture that it cannot absorb the printing ink.

The next important thing in map printing is to have the colours the same on adjoining sheets or on other sheets of the same series. One way to check this is to use the same batch of ink as far as possible. Another way in which colour can be controlled is to use a sheet in the required standard colour with a hole in the sheet. The colour is checked by comparing the standard strip with the printed colour.

Colour in topographical maps consisting of mainly line details can be controlled by visual comparisons but colour in printing thematic maps has to be measured differently. The ink film thickness has an important significance for the offset process. If it is relatively shallow, it is known as ‘under inking’. This can give rise to a number of technical problems such as loss of contrast, loss of gloss, alteration of the colour percentage, a greater risk of hickie formation and colour variations. For such reasons measurement of colour in printing solids and tints in thematic maps should be done with a reflection densitometer. Density measurements are taken of solid and 75 per cent half-tone or tint areas.

Knowledge of paper for a printer is also important. In its simplest terms, paper can be defined as a matted web of cellulose fibres. Cellulose is a basic fibrous substance found in all plant
growth, but for paper making purposes the number of resources is limited by reason of availability, quality and cost. Today, the soft woods and hard woods provide the bulk of the cellulose fibre

content from which the paper is made. In short the paper making operations involve digesting, bleaching, refining and mixing.

The actual formation of paper starts at 'wet' end of the paper machine where the prepared mix is pumped. The mix flows through a moving wire screen. As the mix normally is made up of 1 per cent fibre and 99 per cent water, it moves only when shaken and by the time it has travelled to the end of the wire section enough water is removed to make it self supporting and transferable to a moving felt blanket which now transports it on its way through the press section, the drier sections, and finally to the calendar rolls which impart its hardness of finish. From the calendar stacks the finished sheet is wound onto a huge reel. Lastly the paper is sheeted and packed on skids or in cartons.

Offset paper must be resistant to curl. It must have a high pick resistance and well bound surface fibres, and good ink receptive and driving qualities also. The fibres of paper when moistened swell about 30% in diameter but increase only 2% in length. Papers are coated to cover up the fibrous structure to improve surface and printing quality. Grain of the paper is a characteristic of all machine made papers.

Offset paper is distinguished from two sides. The bottom side or wire side on the paper machine is more porous than the top or the felt side. The wire side contains less filler and it has a more pronounced grain. The felt side has a closer formation, less grain and is smoother. It is usually the better printing side and printing papers are preferably packed with the felt side up.

Lithographic paper troubles are well-known in offset printing. Close register essential for multicolour work can be obtained by close control of the moisture of the paper. Airconditioning of machine hall is very important. During printing the sheets must be
quite flat and with the grain direction across the press so that stretch due to the swell of the fibres by moistening will occur around the cylinder. Misregister then can be compensated by shifting packing from under the plate to under the blanket. If paper has more moisture around its edges than in the main body of the

sheet the two edges across the grain elongate and become wavy. If the paper is drier around the edges than it is in the main body we have what is called a light-edged sheet. It is also important that for high speed feeding the gripper edges and side edges of the sheet must be trimmed straight and square.

Good treatment of paper to press-room conditions can avoid a lot of matching troubles during printing. Plastic coverage over the piles during the waiting period in the press-room is recommended.

Good weights for paper to print maps are usually between 80 grammes/m^2 to 110 grammes/m^2.

The responsibility for getting the best out of a set of originals must ultimately rest with the Manager, but by the time he can see a finished copy of the map it is too late to make any alteration; so the real responsibility lies with the Assistant Manager. This officer must keep in close touch with every stage of work in each machine and see that the right strengths of colours are used to give the best effect on the finished map. If a sheet is likely to be a difficult one they should personally approve the strength of colour used before allowing the run to commence.

21. Despatching :- All completed reproduction work, with the exception of photographic work for private individuals, passes to the Despatching Section for disposal. Here it is examined with the Register Slip to ensure that all requirements have been met. The examination should be directed in particular to.

(a) Press order and any amending instructions on additional page register Slips.

(b) Condition of printed copies. No copies should be allowed to issue which are dirty, smudged, rollermaked or torn, and which have indifferently registering colours or incorrect shades of colour.

(c) Imprints.

When work has been examined and passed by the Officer-in-charge of the Despatching Section, the serviceable copies are

trimmed, counted and bundled as directed on the Register Slip. A daily printing report with three copies of each map is submitted to the Director after Manager's approval and the bulk copies are sent for disposal according to the instructions.

The Register Slip, duly completed as regard cost together with a printed copy, is submitted to the Manager for despatch orders. On receipt of the despatch instructions the Register Slip is passed on to M.R.I.O. or concerned Despatch Section for compliance of the despatch instructions. The originals, colour patterns, guides, etc., are obtained from the Litho Drawing Section, where they have been stored and sent with the Register Slip to M.R.I.O. or concerned Despatch Section.

Examined colour proofs are filed in the Despatching Section.

The Despatching Section controls the issue of paper for printing purposes. This is dawn in bulk from the main Reproduction Office Stores and issued as required. The Despatching Section Store is known as the Paper Expense Store and accounts for all receipts and issues of paper. Before issue, paper is taken out ot its wrapping, conditioned in the seasoning machine and stored on a convex board to ensure that it lies flat when fed into the machines.

22. Plate Storing Section :- The responsibilities of the Section Officer of the Plate Storing Section include :

(a) Safe custody of all plates handed over to him.
(b) Obtaining orders whether plates are to be cleaned off or stored.
(c) Storing of plates.
(d) Proper preservation of plates before storage.
(e) The numbering and listing of all stored plates.
(f) The periodical review of stocks and storing orders with a view to keeping stocks down to a reasonable level.
(g) The record of the history of a plate by noting :-
  (i) All orders passed regarding storage or cleaning.
  (ii) Reports of any other occurrence affecting a plate.
(h) The supervision of the Graining Section.

SECTION III – REPRODUCTION METHODS (CONVENTIONAL)

The foregoing paragraphs have dealt briefly, with various processes at the command of the map producer. This section deals with their application to the problem of map production.

23. Reproduction in Colours :- In producing a map in colours, all the processes employed are aimed at the production of a set of complementary litho plates, which, when printed in different colours in exact registration, will give the required colour effects. In general there are two methods of obtaining these sets of complementary plates. The first is to draw/scribe a separate original for each colour. A separate plate is scribed for each line colour on a dimensionally stable scribe coated plastic sheet. Open window negatives on peel-coat mylar sheets are made for each colour to be printed as solid, tint or pattern.

Separately drawn originals for each colour on drawing paper are not satisfactory because of the varying climatic conditions. Originals on drawing paper are nearly always somewhat distorted at the time they are photographed. It is hard to produce a set of negatives from different originals which will fit exactly. Separate originals on drawing paper are used only in the case of brown and green for standard sheets. The second method is to draw detail, for printing in different colours, on the same original. This is photographed and as many duplicates are made of the original negatives as there are colours. Each one of these is opaqued for a different colour, or in other words all detail not to appear in the particular colour on the finished map is blocked out with photo-opaque. This method has the advantage of giving a set of negatives which fit perfectly, but is very slow and laborious. It is employed for the separation of blue, red and black detail in standard sheets.

24.Ribands of Colour :- Ribands and solid patches of colour can be printed from metal plates on which they have been drawn in a greasy ink by hand. A "set off" from the master plate is used as a guide and the work is copied from a colour pattern.

SECTION III – REPRODUCTION METHODS

The method which is generally used now is by making a dyed glass print of the outline. On this glass print the boundary riband, or patches of colour are painted in and from this a deep etch plate is made. The

advantages of this method are that if the plate is spoiled a fresh plate can be prepared much quicker than in the former method and the glass positive can be kept standing along with other negatives.

See para 29 also for printing solid colours by open-window negatives on peel-coat mylar sheets.

25. Tints :- The basis of all tint work is a screen ruled at close intervals either with parallel and diagonal lines or in squares on a glass or film base.

Two methods of producing tints are employed and the results are known respectively as photo tints and litho tints. In general, litho tints are only used when the area to be tinted is small.

To produce a litho tint an etched impression of a photograph of a line and square screen is prepared on copper. From this a pull is made on a special transfer paper and transferred to the metal plate by pressure in a hand press. The area to be tinted, if not otherwise indicated is marked on a powder set off. This is gummed up, leaving the area for tint exposed.

When a etched half-tone copper plate is not available a litho tint may be obtained as follows. An albumen plate is first prepared by printing down from the negative made by photographing a line and square screen. This plate is placed in an offset proving press, rolled up with transfer ink and an impression is taken on the rubber cylinder. The plate to which the tint is to be applied is then gummed out in the usual way, locked into the press and receives the tint from the rubber blanket. This method though satisfactory does not yield results as sharp as those obtained from an etched copper plate.

SECTION III – REPRODUCTION METHODS

Another method to produce a litho tint is known as "Ben-Day's Medium". The parts on the plate which are to be left plain are painted out with gum, the plate is dried, the tint laying celluloid
is inked up with lithographic ink, and this tint is transferred to the plate by means of a roller. The gum is then washed off, and, if another tint has to be laid on a different part of the plate, the process of painting out, etc., is repeated. Varying combinations can be made by laying one tint on top of another.

A photo tints is printed directly on to the metal plate from a negative, which may also contain line work of the same colour. To produce the tint on the negative, a photo of the line and square screen is printed on to it through a stencil, by the Powder process. This stencil may be either a photographic negative or a glass print. The former is made by photographing a tint original on drawing paper, on which the areas to be tinted have been painted up soild. The latter is made by masking out, on a glass print, all the areas which are not to be tinted. A glass print stencil is always used when line and tint work of the same colour have to be combined in one negative.

The method of combination of line and tint work consists of printing first the tint through a stencil, and then the line work, on to a glass plate sensitised for the Powder process. After the first exposure, the corners only are developed, to give registration marks for placing the second negative in position. After the second exposure the whole negative is developed. It then contains the line and tint work combined in registration.

This method is used for making the red, blue and green combined line and tint negatives of standard sheets, as follows. A powder negative is made from the complete outline negative, and this in turn is duplicated to give powder negative No. 1. This is then duffed, for all names, lettering, boundaries, etc., which fall on the area to be tinted. From this a powder duplicate No. 2 is made and also a glass print. The latter is duffed up to and including the edges of all areas for tint. It is now printed through a dot screen on

to a glass sensitised for the powder process. After exposure, the screen and stencil are removed and the corners developed in the dark room. Using these corners to obtain registration, powder duplicate No. 2 is put in position and another exposure made. The glass is then fully developed. The resultant negative has the complete outline, less items duffed out in powder negative No. 1, and has the dot tint where required. Two powder duplicates of this are made, and duffed, one for blue and the other for red. The various lateral reversals should be noted; and also the necessity for duffing out on powder negative No. 1, all items falling on a tint area.

Glass print stencils are made from a master negative and obviously give sets of plates in exact register. A photographic stencil is not always satisfactory, as the original may distort and not be amenable to correction in the studio. A method has been evolve, however, for correcting such stencils. Briefly it is effected by imposing a red powder image of the complete outline on the photographic stencil. Working against light, the stencil is added to or scrapped away where it does not coincide with the tint limits of the powder image. The register marks of the powder image are accepted as the register marks of the corrected stencil nad the powder image is then removed.

The necessity for this correction may, to some extent, be obvisted for standard topographical maps by always printing the blue-print for the tint original in the same relative direction to the grain of the paper as the original drawing. Metal mounting the blue-print also helps and this is usually done with the larger guide maps. The glass helio stencil, however, has such obvious advantage over the photographic stencil that time is generally saved in the long run by making one.

Parallel light is essential for printing down tints as there is the thickness of the glass between the stencil and screen. Sunlight reflected from a mirror is normally used. Line and tint work when

prepared under the scribing procedure can be directly combined on the plate with the help of stud and punch-hole technique.

Combinations of tints give an increased range of colour effects for any given number of printings, but as the tints ordinarily used on departmental maps are plain blue, red, yellow and green, the principle is generally applied to layered maps and to maps having special theme with many colour combinations. The application is discussed later in para 35.

26. Colour Separation :- Masking or opaquing of unwanted work with the help of photo-opaque by hand on duplicate powder negatives has been referred to in para 29 as a method for colour separation of line work. A mechanical mothod can sometimes be employed for the separation of one colour from a complete outline. The principle is as follows. A complete outline powder negative is opaqued say for black. From this a glass print

is made. This glass print and the original outline negative are then printed down simultaneously in register by the powder process. The resultant negative will be complementary to the black. The photo-retoucher's task in further separation is obviously simplified. The method is mainly confined to sheets which are congested as it effects little saving in time for the normal sheet.

27. Hill Shading :- An impression of relief is given to hill features in some maps by printing a "shade" to represent the shadow that would be cast by light coming from a particular direction. A stump shaded original is prepared on a blue-print of the complete outline and contour combined. A combined print on tracing paper in black and brown of the outline and contour is also supplied as a guide for the shader. The shaded original is photographed by the half-tone process, and from the half-tone negative a contact positive is made. The positive is then dot etched, removing all dots from the area where no shade is required, and correcting any errors in the tone value of the shaded areas. From the corrected positive a deep etch plate is made. Continuous tone negatives may also be prepared, either on the same scale or on a reduced scale.

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After the artist has worked on this negative a positive transparency is made through the screen by contact or in the
camera. Chemical etching may be carried out on the positive as required before the printing plate is made.

28. Combination of Work :- Work from several negatives can be superimposed and combined into one negative by the powder process of can be directly combined on the plate with the help of stud and punch-hole technique. In applying the powder process a sensitised glass is exposed in contact with one negative. After exposure, corners and points of contact with the adjoining negatives are developed, the second negative registered with these points, and a second exposure made. This procedure is repeated till the combination is completed. The negative is then fully developed.

29. Thematic Maps :- Maps carrying special theme such as Geological, Geographical, Agricultural, etc., are termed as Thematic Maps. Such

maps generally contain a large number of colour shades and each shade represents a particular information in the map.

In the conventional approach of map printing there should be a press plate for every colour shown in the map. A new technique known as "COLOR TROL" is now used in Survey of India to reproduce such maps in four colours only. The technique is basically based on tri-colour process printing as used for the reproduction of coloured illustrations.

As per the tri-colour printing theory the three process inks-cyan, magenta and yellow-when used in various combinations of solids and half-tones can produce number of colour shades (hues). Normally when solids of three colours in equal proportion are mixed they result in seven hues, i.e., yellow, red, blue, orange,

violet, green and brownish black. The number of these hues is extended when coverages of four half-tone screens ruled at different angles are used as solid (100%), 10%, 30%, 50% and 70%.

In all about 215 hues can be produced and are represented in a chart form known as *Color Trol Chart*. This chart, as a rule, is printed with a standardized set to three colour process inks and on paper intended for use in printing the maps.

The hue chart is now regarded as a standard aid in planning and preparation of open-window negatives on peel-coat material for the various colour combinations of the thematic map to be printed. One plate for each colour with necessary half-tone screen percentages is prepared. The map is printed in the sequence of yellow, red, blue and the ink deposit density of each colour is controlled with an electronic densitometer.

30. Preparation of Drawing Blue-prints from Plane-table Section :- At the close of each field season, a large number of plane-table sections are sent by survey parties to the Reproduction Office for the preparation of drawing blue-prints for fair mapping. The parties want their blue-prints with the minimum of delay, so speed is essential in the reproduction work. There are various methods of producing the litho plates from which the drawing blue-prints are made, but they all begin with the photography

of the plane-table section. This is enlarged photographically from the scale of survey to that of fair drawing which is generally 50% greater.

When the plane-table sections composing a full sheet have been photographed, the subsequent work may be carried out by three or four different methods, which will be described briefly.

The most common of these methods are :

(1) The Ozalid paper method,
(2) The Correctostat Bromide paper method,
Combination by Albumen Process,

SECTION III – REPRODUCTION METHODS

(3) By Mosaicing with black-prints or film Negatives.

Of the above methods, (1) is used if the size is incorrect and the adjustment required is fairly large, (2) is sometimes employed where the edges of work are not straight lines but the tops of mountain ranges, etc., and so that it is hard to get a good joint between fitted on to the graticule lines in its appropriate position and everything else except the actual work is masked off with red paper. An exposure is made, the negative replaced by another which in turn, is fitted in position, masked and exposed. When all negatives have been exposed the plate is inked up and developed in the usual way.

31. Mosaicing with Black Prints of Film Negatives and Positives :- Mosaicing with black prints is the method that has been in use in the Department for many years and is still in use.

The black prints of P.T. Sections are pasted on a projection made on drawing paper. Some variations in dimensions are however experienced in using the drawing paper which is subject to climatic distortion. The mosaic is now made on a dimensionally stable surface like a glass or a transparent mylar sheet. The projection is prepared on a tracing paper/cloth or on a hard mosonite board. These are place underneath the glass or mylar film to which the film negatives or positives of P.T. Section are pasted with the help of transparent cello tape. Care should be taken not to use cello tape more than absolutely necessary and to avoid overlapping of film edges and forming of raised and uneven areas.

No photography of these mosaics done and litho plates are prepared directly to supply the blue-prints.

SECTION IV HALFTONE PROCESS AND COLOUR PRINTING

32. THEORIES OF HALF-TONE PROCESS

The nature of light has been used as the basis of several theories explaining the effects of the half-tone screen. Three important theories have been put forth to explain the action of the half-tone screen in translating an image into a series of dots. They are pinhole, diffraction and penumbral shadow theories. Each theory has some merit toward an understanding of the theory of dot formation.

Pin-hole Theory: The pinhole theory, also referred as Ives theory was proposed in 1888 by FREDERIC E. IVES. According to this theory each opening in the screen acts as a tiny pin-hole lens and each projects the image on the film based on the film based on the amount (quantity) of light striking it. Only a pin point of light is projected from the shadow areas and the highlight areas of the original reflect enough light to produce a large solid dot.

Diffraction Theory: The diffraction theory of half-tone images was investigated by FRUWRITH, METTLE, YULE and suggested by Max Levy in 1894. This theory states that the size of the dot is influenced by diffracted light from glass screen. When light passes through a half tone screen it produces a central bright spot on the sensitive material. This spot is surrounded by a series of concentric light rings of less intensity and if the light from one ring overlaps the bright spot of another it adds to its intensity. According to this theory, the half-tone screen is considered to be double diffraction grating.

Penumbral Theory: The Penumbral theory of dot formation is presented in 1908 by clerc and calmes, following the investigation of TALLENT, DOLLAND AND DEVILLE (1895). The word ‘Penumbra’ means partial shadow and ‘Umbra’ sharp edge shadow behind the opaque

screen lines. According to this theory the screen creates a shadow on the film which is large or small depending on the intensity of light. The detail of the

penumbral theory is quite complicated, geometrical optics are used for explaining the depth of darkness or shadow at any point causing the dot formation.

HALFTONE PHOTOGRAPHY

Half-tone photography converts on image with continuous tones, such as a black and white glossy photograph, into a form by which the image can be printed and still resemble the continuous-tones. A continuous-tone image may have a wide range of tones. These tones tend to merge into each other without clearly defined boundaries. The printing machine cannot vary the amount of ink printed to show tone difference in the print. But the image can be divided into dots of various sizes. The print will appear to have light and dark areas according to the size of the dots. The mixture of light reflecting from images and paper gives the illusion of tone. An area of larger dots close together with less white paper showing would appear dark very small dots widely separated with a large area of paper showing in between would appear light.

Half-tone Process: The half-tone process converts the continuous-tone images into a pattern of very small dots. The size and shape of the dots vary, depending upon the results wanted and the density of the tones to be printed. These dots are reproduced upon the printing plates and, when printed, appear as solid areas. The surface around the dots is the colour of the paper. To the naked eye the individual dots are not seen, and the printed image resembles the original continuous-tone image. The dots can be seen by examining a printed sheet half-tone image with a magnifying glass.

The size of the dots used depends upon the distance from which the printed material will be seen under normal conditions. Half-tones to be used in reading material use very small dots, they are intended for viewing from the normal reading distance. If a

poster or larger display material is printed using half-tones, the dots will be considerably larger.

Half-tone Negatives: A half-one negative is made by placing a half-tone screen in the camera between the image (copy) and the sensitive material. When an exposure is made by the camera, the light from the copy is broken by the screen into a pattern of dots on the sensitive material. The developed film will have a dot for each hole in the screen. The size of the dots depends upon the size of holes in the screen and the amount of right projected through these holes. The shadow (darker) areas on the copy reflect little light. These dots on the exposed film are very small. Lighter copy areas (highlight) reflect more light. These areas produce a larger dot on the exposure film. The following steps give the procedure used to produce half-tone photography:

1. Examine the continuous-tone copy. The copy should have shadow, middle-tone (Intermediate tone) and highlight tones. Select highlight and shadow areas.
2. Calculate the copy Density range (C.D.R.).
3. Verify the base Density of the graphic arts film.
4. Find the Screens basic Density Range(BDR).
5. Fix the copy and gray scale at the center of the copy board. Lock the copy board in position.
6. Calculate and adjust the screen distance (for glass screen).
7. Illuminate the copy evenly.
8. Adjust the camera and focus the image to the reproduction percentage.
9. Select-f-stops for multiple exposures.
10. Set up the sensitive material (Half-tone Lith film) emulsion facing you.
11. Cover film with larger sized screen, emulsion side toward film (for contact screen). Turn on vacuum and check the screen is held by suction all round firm.

12. Close the back body, and position the screen (glass screen).
13. Make the flash exposure (this exposure must be made before or after making one main image exposure through the lens.)
14. Set the timer and proper-f-stop for the image exposure through the lens.
15. Open vacuum back and remove the screen and replace it in its position.
16. Close the camera back and give film a bum (no-screen) exposure to the original.
17. Turn-off vacuum and remove screen and film.
18. Check developer variable, when correct, process the exposed film. Developer temperature and time of development determine negative density and quality.
19. Inspect the dot percentage (highlight and shadow areas).
20. Wash and dry the half-tone negative.

The dot formation on the photographic sensitive material is dependent upon:

a) The size and the shape of the lens aperture (f-stop)
b) The screen distance(glass screen to the surface of the sensitive material).
c) The speed and contrast of the sensitive material.
d) The intensity of light reflected from the original.
e) The exposing time.
f) Developing time and temperature of developer.

33. Film Screens.—These are on film material and can be a line screen image, cross line screen, dot screen, or a symbol

screen. For most screened parts cross line or dot screens are preferred because of the fact that dot screened areas are smoother and nicer for our eyes.

The value of screens is indicated in percentage. *Colortrol* charts used for printing thematic maps in three colours are prepared with the help of dot screens in percentages of 10, 30, 70 and having angles of 30º, 60º and 0º or 180º to the horizontal, counter, clockwise, respectively for red, yellow and blue.

Use of such screens has also been discussed in para 31 (Tints), 34 (Combination of work), 35 (Layered Maps), and 36 (Thematic Maps).

34. Glass Half-tone Screen.—Most commonly used for making half-tone negatives is the glass cross-lined screen. In map production it is used for reproducing hill shading models or continuous tone drawing and photographs.

Glass screens consist of two pieces of ruled glass cemented together so that the opaque rules (lines) on one piece of glass cross the lines of the other piece at 90-degree angle. The rulings are put with a high precision machine. These rulings are then etched into the glass, following which the depression is filled with a pigment. On the grating formed by the lines when the pieces of glass are placed face to face, the width of the aperture (opening) equals the width of the opaque line in glass screen for photolithography. The two pieces of glass are cemented together with Canada balsam and the edges bound with aluminium.

The 120- and 133-line screens are commonly used for black and white half-tone reproductions. Finer screens upto 300- and 400 line are used for the higher grades of work. Screens are available in both rectangular and circular shape.

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To obtain the half-tone negative, the screen is placed in the camera between the lens and the photographic emulsion at a predetermined distance. This distance is called the screen distance and depends on the extension of camera and the ruling of the screen. The longer the camera extension and the coarser the screen the greater the distance between screen and the sensitive plate. Setting of correct screen distance forms the basis of working with the glass half-tone screen.

35. SCREEN DISTANCE

The screen distance is the distance from the ruling of the screen to the sensitized material. The distance between the sensitive plate and the screen is adjustable.

Screen distance has a fixed ratio:-

$$\frac{\text{Diameter of the lens opening}}{\text{Camera extension}} \qquad \frac{\text{Screen aperture}}{\text{Screen Distance}}$$

$$\text{Or screen distance} = \frac{64}{2\text{x ruling}}$$

Continuous tone black and white original is put on the copy-board. Screen is interposed between the lens and the sensitive plate and the original is photographed. The halftone screen breaks up the image into squire or dots as the light only passes through the transparent position of the screen.

The dark parts on the original reflect less light so they photograph as very fine dots on the negative. So the continuous tone original tone is broken into varying size of dots and sejuiry. Albumen plate is made from this negative and these dots and squares are printed onto paper giving full picture of the subject.

In halftone photograph, there exposure are given to the same copy. For each exposure opening of the lens aperture varies.

Flash is given with the smallest opening of say 4 mm in diameter. The function of this exposure is to give intensity to the dots, specially the deep shadow. Then exposure is given to photograph the brightest parts on high light. In this case opening of the lens for normal subject is about 12 mm. During this exposure the middle tones and shadow tones are to a certain extent affected but not appreciably.

CHOICE OF SCREEN RULING : The choice of screen ruling is also influenced by the paper surface texture and the grain. The finer the screen, the better the paper must be. The most widely used screen rulings for various grades of paper are:

	SCREEN RULINGS	SUITABLE FOR
*	45, 55	Lowest grades of news print
*	65, 85	Best newsprint and machine finished paper
*	100	Super calendered paper, imitation art paper and cheap grades of art paper
*	120	Normal art paper, good imitation art paper, and fine grade super calendered paper

36. Exposing and Processing the Halftone Negatives.-After having set the screen distance and the lens aperture an exposure is made to obtain the half-tone negative. Film used is of lith type high contrast emulsion. Two exposures are made, the main and the flash. The flash exposure is an auxiliary exposure and is given by means of the light reflected from a clean white paper or with a flashing lamp attachment fitted with the camera at a lens aperture of f/64 or f/90. the flash exposure is necessary to get a fine pinpoint dot in the shadow portions of the subject and also to increase opacity of each dot at its core without increasing the dot size or shape.

Developing the Negative.-A special chemical, called developer, is used to reduce the exposed silver bromide crystals to pure silver. Developer is available as a concentrate in both dry
and liquid forms. The concentrate must be mixed with water according to the manufacturer's recommendations. Process film developer is generally prepared in two parts, part A and part B. these two parts are mixed just before you develop the film. Once mixed, the developer will remain usable for about one hour. The temperature of the developer should be kept between 68º and 75º F (20 º - 24 º C).

Stopping the action of the Developer.- A mild acetic acid solution, called a step bath, is used to stop the action of the developer. The temperature of the stop should be about the same as the developer.

After the film is developed, transfer it to the stop bath, with a pair of tongs. The stop neutralizes the action of the developer. Let the film remain in the stop bath for a minimum of 30 seconds while you continuously agitate the tray.

Removing the Unexposed Silver Crystals.- Use a fixing solution to remove all unexposed and undeveloped silver crystals from the developed film. The fixer will also harden the film emulsion. Its temperature should be about the same as the developer.

Washing the Film.-Wash the film under clear running water for about ten minutes. Improperly washed film will begin to fog and discolour in a relatively short time.

Drying the film.-Dry the film by hanging it in a dust free area. Attach clips to opposite sides of the film. Use the top clip to hang the film. Use the top clip to hand the film. The weight of the bottom clip helps prevent the film from curling.

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37. CONTACT SCREENS: The development of contact screens has greatly simplified the techniques of making black and white halftones and has made it possible for literally thousand of new platens to do their own halftone work. The price of these much lower then glass

screen and easy to handle also. Basically, two types of contact screens are used.

1. **Magenta Contact Screens:** Magenta screens are designed to work with monochromatic(black and white) originals. Filters may be used to changes the basic density range of screen. Magenta negative screen are used on a process camera to produce halftone negatives from opaque (paper)positive prints. Magenta positives screens are designed to make halftone positives in a contact printing frame from continuous tone negative transparencies. It can be used in contact with sensitized material. This provides vignette dots. It is made of film.

2. **Gray Contact Screens:** Gray contact screens are popular for reproducing black and which photographs and are designed also to work with coloured continuous-tone originals. Gray screen do not respond to filter control of the basic density range of the screen. Gray negatives screens are intended to be used to make negatives from either opaque or transparent copy. This also provide vignetted dots. Gray contact can be used for indirect colour separation method. It is also made of film.

In making the negative, the screen and the film are placed emulsion to emulsion. For satisfactory contact, it is necessary to have the screen larger in size than the sensitive material.

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Since variable screen distances and focus adjustments are not required in the case of contact screens, the operator when making a negative in the camera, can select any or the optimum aperture of the camera lens. In other words a half-tone negative from a contact screen can be made at a lens aperture of f/11 or f/16.

For good results lith type photographic material of any manufacturer is strongly recommended. It is essential to use the prescribed developer recommended by the respective film makers. Half-

tone negatives in a camera using glass screen can also be made by wet plate photography. For processing a wet plate the following are used :

Developer

Iron Protosulphate	250 grams
Glacial acetic acid	150 c.c.
Alcohol	150 c.c.
Gelatin	5 grains
Water	3000 c.c.

Fixing Bath

Potassium cyanide	30 grams
Water	300 c.c.

To intensify the negative, it is first bleached in a copper sulphate bath made up as follows:

Copper sulphate	240 gram
Potassium bromide	120 c.c
Water	3000 c.c

It is then rinsed for a minute and placed in the following bath :

Nitrate of silver	50 grams
Water	1000 c.c.

Should additional clearing and blackening is necessary, the following baths are used :

Clearing

Iodine	10 grams
Potassium	20 grams
Water	600 c.c.
and	
potassium cyanide	30 grams
water	600grams

38. COLOUR PRINTING—Colour is a physiological sensation experienced by the eye when light of a given quality is received by retina. Sunlight contains all of the wavelength that the eye can detect. We call sunlight as white light. If a glass prism is placed in a beam of white light, the shorter wavelengths are bent more then the longer wavelength. Visible spectrum is formed between 4000 angstrom (measure of wavelength) and 7000 angstrom. Light wave are electromagnetic waves. They make-up only a small part of the total electro magnetic spectrum, but they have particular importance for us. Our eyes, and those of other animal are especially good at detecting waves from this part of the total spectrum. The part of total spectrum that contains wave of light, light is known as the visible spectrum. This differs slightly in range of wave lengths for different eyes.

The colour we see are the reflection of visible area of the electro magnetic spectrum. That is, the colour of object is the

light that is reflected by the object. Colour can be reproduced by adding together coloured light. Colour can also be reproduced by using materials that substract colours from areas of spectrum. The colour of a printed reproduction is the reminder of light not substrancted (obsorbed) by the ink, pigment on paper. Printing is done with colour subtracting primaries (yellow, magenta and cyan) to reproduce the colours desired.

ADDITIVE AND SUBTRACTIVE THEORIES—Additive theory of colour: Colour travels in waves and that white light is a combination of several colours. The length of the wave determines the colour. Red waves are the longest and blue waves are the shortest. A visible spectrum is formed between 4000 angstroms and 7000 angstroms. The three primary light colours are: Blue, Green and Red. Added in equal quantities, these three produce white light. Red and Blue light blend to make magenta, which the compliment of green light. Blue and green lights blend to make cyan, which is the compliment of red light, green and red lights blend to make yellow, which is the complement of blue light. When the primary of any complementary light is added, white light is produced. For complementary light is added white light is produced.

For example when the primary light blue is added to the complementary yellow, white light produced.

Red + Blue = Magenta (The complementary of Green light)
Blue + Green = Cyen (The complementary of Red light)
Red + Green = Yellow (The complementary of Blue light)

Subtractive theory of colour: This theory is man made, pigment and inks. They are super imposed or printed on each other on the production of colours, prints and printed impression on paper. The images subtract certain colours and transmit others. They become visible by reflection from the paper. The primary colours of subtractive process of colours are blue, violet, red and yellow. They are more properly called, Cyan, magenta and yellow. If a cyan filter is placed between the eye and the

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light, it will subtract red. A magenta filter will subtract green and yellow filter will subtract blue. If all three filters cyan, magenta and yellow are super imposed and placed between the eye and white light, all light is absorbed and result is black.

Yellow + Magenta	= Red
Cyan + Yellow	= Green
Magenta + Cyan	= Blue
Primary colour	= Yellow, Magenta and Cyan
Secondary colour	= Orange (Red-orange), Violet (blue violet), Green
Tertiary colour	= Orange + Green = Citrine,
Orange + Violet	= Russet
Green + Violet	= Olive

Process colour basis : Process colour is a system of producing a full variety of colours by printing a set of three standard colour inks in various combinations and proportion, usually analog with a forth ink, black. The ideal process inks are selectively transparent inks one of which absorbs all of blue third of the spectrum, another absorbs the green

third, and another, the red third; while transmitting all other. Consider a band of each of these inks printed on white paper. The yellow ink will transmit light of green and red wavelengths and absorbs blue. The magenta ink transmits blue and red wave length and absorbs green. The cyan transmits blue and green and absorbs red. Magenta and yellow superimposed, result in red (red-orange), cyan and yellow super imposed appear green. All three super imposed result in the absorption of all wavelengths and the sensation is black.

PRINCIPLE OF COLOUR SEPARATION—The production by contacting, camera or electronic scanner means, of one photographic image for each process colour to be printed is called colour separation. Colour Separation' normally forces the use of colour filters in connection with process-colour printing. Three different filters are used: blue, green, and red. Filters are

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dyed gelatin films that pass different proportion of light of different wavelengths.

The use of colour in printed materials is increasing rapidly colour pictures contain hundreds of small areas of separately different colours. It would be impossible to print each of these separately. Most colours can be reproduced by printing in their place some mixture of three selected colours, some times with the addition of black. The four colour commonly used in printed colour reproductions are: (1) Yellow, (2) Magenta, also known as process red, (3) Cyan, also known as process blue, and (4) Black. The terms magenta and cyan are used in place of red and blue not only because they describe the colours of the actual inks more accurately, but because this avoids confusion with he blue and red of the colour separation filters.

Each colour will be transferred to the paper by a separate printing plate. To make these printing plates, we first need four negatives, each recording densities for the varying amounts of colour required. Making these negatives is called 'colour separation'.

COLOUR SEPARATION ESSENTIALS

1. The two main kinds of copy for colour separation are:

a) Reflection copy: Reflection copy is original material for reproduction, which is normally viewed and must be photographed by reflected light. Examples include oil pigments, dye transfer and other photographic colour prints, fabric swatches, water colour and pastels.

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b) Transmission copy: Transmission copy is a copy normally viewed and photographed by transmitted light. Transmission copy includes transparencies and colour negatives.

2. **Camera:** The basic requirement of colour separation that places special demands on the camera is the need to produce three or more separate images that can be combined in exact register at all places on the image. This requirement demands a camera that is very firm and solidly based, with the copy board, lens, and film holder elements perfectly aligned. A good vacuum back is important. The sizing of the reproduced images must be exact. A scale focusing system permits returning precisely to a previous setting for reproduction. There should be provision to fix the register pins on the film holder.

3. **Colour Corrected Lens:** Another necessity for precise register of camera separations is a properly coloured corrected (apochromatic) Lens, an apochromatic Lens is a complex assemblage of optical components design.

a) To bring all colours (Green, Blue and Red) to a sharp focus at the same focal plane, and
b) To produce an image of exactly the same size and position in each colour.

Another possible problem in colour work is flare – non-image light reaching the photosensitive material through the lens. Coated lenses reduce internal reflections from the lens surfaces, thus reducing flare. One possible cause of flare is a temporary condition dirty or dusty lens

surfaces. Front and back surfaces should be cleaned with a piece of lens tissue carefully avoiding scratch. If the lens barrel has a slot for filters, the slot should be covered with tape when not in use.

4. **Half tone Screens:** If a glass cross-line screen is used, it should be set in round frame (circular screen) that can be rotated in guides in the camera back. The use of contact screen is more common. The gray contact screen necessary in the direct

method of colour separation. Magenta contact screen is used for screening separations in the indirect method.

5. **Lighting:** An important characteristic of a light source suitable for colour work is a spectral output closely similar that of sunlight. Pulsed-xenon lamps, with a colour temperature of about 5,400 k and a very constant light output is more suitable. Quartz-iodine and Mercury vapour lamps are low, medium and high pressure types available, but less suitable for colour work.

6. The ‘ LITH’ Type Emulsion.- It is a high contrast emulsion and is used in photo mechanical work for making line and half-tone negatives. The emulsion which is made with silver- chloride and is developed with special formaldehyde- type developers has good speed and exposure-development latitude. The line and half-tone work on lith type emulsion with lith type development is recorded much better, than on any other emulsion. The lines come out real sharp with dense black background in the non-image areas. The half-tone dots reproduce well, strong and evenly dense all over. Lith material is available in both orthochromatic and panchromatic types. Orthochromatic lith emulsion is used for making monochrome line and half-tone negatives and positives.

7. Panchromatic (Pan) Film: Sensitive to all visible wave lengths of light, is used for the production of both colour correcting masks and colour separations. There are special films particularly designed for making colour correcting masks, matched with special pan films for the separations and suitable colour filters in colour separations correction systems. There are also special multimask films available that combine several colour correcting masks in a single film.

8. Filter: The main requirement in colour separation are filters. These negative are exposed through colour filters consisting of dyed sheets gelatin on glass. The three colour printers are actually photographic records of red, blue and green

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light transmitted or reflected by the original copy, separation filters for process colour work are particular shade of blue, green, red that divide the spectrum into approximate thirds. An amber filter is sometimes used in making the black printer.

Filters for colour separation

Filter	Transmittance or Reflection	Absorption
Blue	Blue	Red and Green
Green	Green	Red and Blue
Red	Red	Blue and Green

Filter ink Relationship

Filter	Ink
Red	Cyan
Green	Magenta
Blue	Yellow
Yellow	Black

Subtractive Colour

Magenta Ink	+	Yellow Ink	=	Red
Yellow Ink	+	Cyan Ink	=	Green
Cyan Ink	+	Magenta Ink	=	Blue
Magenta + Cyan + Yellow			=	Black

Colour Separation Procedures –In addition to making separations by scanner, there are two other basic methods: direct-screen and indirect screen colour separation. Each has advantages and disadvantages. Both are capable of good quality reproduction. Due to the introduction of electronic exposure computers, film

process, and special films, both methods are equally superior. Which method is to be followed depends on individual conditions and preferences. The basic methods of colour separation include: (1) The direct screen method (2) the indirect screen method, and (3) Electronic colour scanning.

The conditions for colour printing are not perfect: paper does not reflect white light 100%, inks are not as transparent as they should be, and they are not completely reflect or absorb colours. Ink also do not always trap correctly, which seriously affects the overprint colours. The essential methods of correcting and adjusting the natural defects of ink, paper and press conditions is by masking. A mask is a weak image on photographic film, and it is placed in the optical system when colour separations, are made. Masking is essential for all colour separations, whether made by the direct or indirect method. The following masks are generally used. Colour correction masks, highlight masks, and under colour removal masks.

39. Direct Method of color separation —The principles of making direct-screen separating negatives are similar, whether they are made by contact, in the enlarger, or on the camera. In each case, a gray negative contact screen is placed between the copy image and a panchromatic lith film. Red, Green, and Blue filters are used to separate the colours. The black printer negative is usually made by a split-filter (Red, Green and Blue filters) exposure. The exposure is made through the proper filters and a half-tone screen. Two types of copy can be used in direct colour separation, transmissive and reflective copy with transmissive copy the light source penetrate the multi-colour original. The filter separates the colour and the screen forms the image into half-tone dots, which are recorded on the film. This forms the separation negatives. With reflective copy the lights are in front of the multicolor image. This is the same as

with black and white half-tone photography. The reflected light has the colours separated by

a filter. The remaining image is screened and the separated image is recorded one film . This forms the separation negative.

For constant results and to use different transparencies, exposure and processing conditions are fixed. Three exposures are used to obtain correct highlight, middle-tone, and shadow dot values and the exposures are adjusted to the screen characteristics. In offset and letterpress, it is necessary to print more cyan than magenta and yellow to achieve gray balance. Dot percentages that give gray balance under average conditions:

	Highlight	Middle-tone	Shadow
Cyan	5%	65%	95%
Magenta	4%	50%	85%
Yellow	4%	50%	85%

40. Indirect Method of color separation —Indirect colour separation produces a better quality reproduction than the direct system. Generally, masks are made to correct the colour for defects in the ink. Indirect colour separation differs from direct separation because two steps are needed. First the continuous tone separation negatives are made (Pan-tone film). Continuous-tone separation negatives for the indirect process are made to specific aim points of highlight, middle-tone and shadow. The only difference is that continuous-tone densities are being used instead of dot percentages. Then the half-tone photography is made as a second step. A screen positive (ortho lith film) is made to make printing surface.

The separation negatives (continuous-tone) are made by passing the exposure light from the original through the filter on to the separation negative film. A red filter is used when making cyan separation negative. A blue filter is used when making the yellow separation negative.

A blue filter is used when making the yellow separation negative. A green filter is used when making the magenta separation negative. The black separation negative is often made by three (multiple) exposures. One each with the red, green and blue filter.

Once a good set of continuous-tone negatives that fits the screen range is obtained making the screen positives is fairly simple. If the negatives are to layout size, positives are made by contact. Screen range adjustment can be done by using compensating filters. Yellow filter can be used to lengthen the screen range. Shortening the screen range is possible with a magenta filter. The production of positive screening are simple, but it is important to be extremely accurate. Dot percentage must be exact throughout the scale. Whether positives are made by contact, in the camera, or enlarger, the screen is always placed in contact with the lith film emulsion to emulsion, with good vacuum contact.

41. The Moire' Effect.- In all screened colour reproduction work, there is the possibility of a noticeable pattern, or moiré effect in the printed result. The most common causes of this pattern effect in colour work are improper trapping of ink and improper screening. The latter possibility occurs whenever two half-tone screen patterns are superimposed in printing. The moiré effect can be minimized by rotating, or angling" the screen to a different position for each colour separation. The angle between the vertical and one of the parallel lines or rows of dots of a screen is clled the ' screen angle'. Certain combinations of screen angles can be selected to reduce or eliminate the moiré effect. The greater the angle between the rows of dots of the different colour inks, the less chance there is for an undesirable moiré. This condition is usually fulfilled when the careen angles are 30 degrees apart from each other. Screen angles for three colour printing are 45° (oyan), 75° (magenta), 90° (yellow) and 105° (oyan).

42. GRAY SCALE—Gray scale is a strip of film or paper with a series of graded tone blocks, or steps, ranging (on film)

from dense black to clear film, or (on paper) from solid black (shadow) to white (highlight). A strip of standard gray tones, ranging from solid black (shadow) to white (highlight). A strip of standard gray tones, ranging from white to black, placed at the side of original copy during photography to measure tonal range obtained, and in the case of colour separation process for determining colour balance or uniformity of the separation negatives. It is available either on paper or on transparent acetate for use with transparencies.

Quality Control Device: The simplest quality control device for the graphic arts photography to use is the gray scale. It is easy to handle and easy to evaluate. Gray scale should be used with all copy, no matter if the film will be machine or tray processed. With machine processed film, the gray scale will show the amount of exposure required. With tray processing, the gray scale functions more as an indicator of development. The image should be developed, by taking the gray scale desired aim point. It serves as a guide for measuring exposure and the density range of t he emulsion. The tonal range of graphic arts films can be demonstrated by record on a gray scale. Long scale (wide) materials can photograph a wide range of tones and developed to low contrast. Materials which reproduce only a few tones are said to have a short scale (narrow) and developed to high contrast.

Making a Gray Scale—Take a strip of continuous-tone film (normal Negative emulsion) and give a series of progressive time exposure using a light source of constant intensity. Each exposed step should bear a constant ratio to its neighbour . this can be achieved by doubling the exposure time in each cases, example 0, 1, 2, 4, 8, 16, 32 etc. After suitable development this will appear
as a stepwedge. Refer to this at the time of exposure and developing to get a standard density. Intensity of illumination, developing time, temperature and developer should be constant.

43. Colour Control Patches.- A valuable aid to judging colour-separation negatives and colour correction is a cobtrol strip

called colour control patches. The control strip is made up of six key-colour areas plus at least three others- black, white paper, and a three colour overlap. The six key-colour areas show the three process inks printing separately and their three two-colour overlaps. Due to a wide variety of process colours used in lithography it is advisable to have control strips made from the litho inks actually used.

44. Colour Correction.-Commercially used all process inks fail to meet the desired ideal of one-third spectral absorption and two-thirds reflection. This becomes obvious when we look at a reproduction printed from uncorrected separations, as all cold colours become warmer or grayer and warm colours lack full strength. These are failures of the process inks to fully reflect the colours that ideal inks would reflect.

Wihle there has been some improvement in ink-hue purity in recent years, the best available cyan and magenta inks still absorb some blue light and the best cyan still absorbs some green light. This means that more than one ink absorbs light in each one-third part of the spectrum and that, consequently, the brightness of greens, blues and purples in limited to the reduced level that these ink mixtures can reflect. It also means that the purest colours thes inks can reproduce will not be obtained without colour correction of the separation negatives or positives. This brings us to the conclusion that colour correction is an important and critical step in lithographic colour reproduction as long as we continue the use of inefficient process inks.

Much of the colour correction in lithography and other graphic arts processes has traditionally been done by handwork of artists or e4tchers. Photo engravers have long depended on local etching and burnishing of the copper printing plate to change colour tone values with little or no work done on negatives. While colour correction by hand is still in practice to some extent, photographic methods, called masking, are becoming better

understood and are now taking over an increasing amount of this work

45. Dot Etching.—Dot etching for colour correction consists of reducing the dot sires of the half-tone positives to provide the desired printing values.

To permit any etching whatsoever, the entire half-tone dot must have a density greater than 0.80 over its entire area. The more a dot is to be reduced in size, the greater its central density must be. The normal camera half-tone dot increases in density towards its centre. Dot etching dissolves the silver off the top as well as the sides of the dot in reducing its size.

A glass screen dot has a relatively steep density gradient from the core to the dot margin. A half-tone dot made with a contact screen is usually softer. The density gradient between its centre and margin is much less. Consequently half-tone dots prepared with the ruled glass screen are usually capable of greater size reduction by dot etching.

Reduction as great as 40 per cent to 50 per cent of dot size is sometimes necessary to adjust the differed dot values. In cases where masking has been used the dot size reduction the dot size reduction seldom reaches to 40 per cent Half-tone positives having a slight feneral fog in the shadow or highlight region can be improved by an overall etch in Farmer's reducer which is used for dot etching.

Farmer's reducer is made as follows :

STOCK A

Potassium Ferrieyanide	300 grams
Water to make	5,000 c.c.
(Store in brown bottle)	

STOCK B

SODIUM THIOSULPHATE (Hypo)	1,240 grams
Water to make	5.000 c.c.

For tray use in flat-etching or staging:

.

STOCK A	1 Part
STOCK B	4 Parts
Water	32 Parts

Add stock A to water, then add stock B.

For local reduction with brush:

STOCK A	1 Part
STOCK B	4 Part
Water	12 Part

Add stock A to water, then add stock B.

If longer working life is desired, stock A and stock B can be diluted separately each in six parts of water. For local reduction, the stock B (Hypo) solution is first applied by brush. The stock A is then applied with another brush. Action is stopped by swabbing with water. Farmer's reducer should be mixed just before use. It is self exhausting and its activity declines rapidly after mixing.

When etching is to be confined to specific areas, other parts of the positive including register, corner and trim marks are painted out with the asphaltum varnish or staging fluid with the brush. The half-tone positive is placed in water containing a few drops of wetting agent and allowed to soak for a minute. It is then transferred to the etching tray. Etching is usually done in two or three stages by watching carefully the reduction in dot size at each stage. After each reduction the staging lacquer is removed with a solvent and the dot size examined. For further reduction as may be necessary the staging is again applied and the steps repeated. Only

thing to remember is that the positive must be thoroughly dry before applying the staging lacquer.

Dot size can be increased a few per cent by intensifying the fringe area. Once the dots are intensified they are not suitable for later dot etching. For intensification the following solutions can be used.

STOCK A

Silver Nitrate, Crystals	60 grams
Distilled water	1,000 c.c.
(Store in brown bottle)	

STOCK B

Sodium Sulphite, desiccated ..	60 grams
Water to make	1,000 c.c.

STOCK C

Sodium Thiosulphate (Hypo) ..	105 grams
Water to make	1,000 c.c.

STOCK D

Sodium Sulphite, desiocated ..	15 grams
Elon (or Metol)	25 grams
Water to make	3,000 c.c.

For use, slowly add one part of stock B to one part of stock A. stir to mix thoroughly. Continue stirring while adding one part stock C to dissolve the precipitate. Allow the solution to clear. Then add three parts of stock D, stirring continuously. Use the intensifier immediately.

Immerse the half-tone positive in a tray of intensifier or apply the solution locally with an inorganic plastic-fiber etching
brush. Do not use hair brushes or cotton wool. Circulate the solution over the area until sufficient intensification has been obtained. Then flush the positive with water and place it in a tray of 25 per cent hypo solution for two or three minutes. Intensification should not be carried on in direct sunlight.

It will be noticed that, in this method, there is no opportunity for seeing a proof till the work on the positive has been completed. With an experienced operator who can gauge the strength required in each positive, one or at the most two trail sets of plates will be all that are necessary before he obtains a set which will print satisfactorily; but until he has gained experience, several trial sets of plates and proofs will be required before he can obtain proper tone correction.

The finished positives may be printed down on to a metal plate either by the Deep Etch process or negatives may be made from them and printed down on to a metal plate by the Albumen process.

SECTION V—ORGANISATION

46. GENERAL—Survey of India has a printing zone with head quarters at Hyderabad. Under printing zone, there are four printing groups as described below:

Northern Printing Group (NPG), Dehra Dun is under the control of the Director. It is organized into two main branches i.e. Photo Wing, Litho Wing. There are four other sections,- Correspondence, Accounts, Central Technical Office (CTO) and Store Section.

Eastern Printing Group, Kolkota is under the control of the Director. It is organized into two main branches i.e. Photo Wing and Litho Wing there are four other sections viz., Correspondence, Accounts, CTO and Store Section.

Southern Printing Group, Hyderabad is under the control of the Director. It is organized into two main branches viz., Photo Wing and Litho Wing there are four other sections- Correspondence, Accounts, Technical Section, Production Control Section and Store Section.

Western Printing Group, Delhi, is under the control of the Director. It is organized into two main branches i.e. Photo Wing and Litho Wing. There are five other sections Correspondence, Accounts, CTO, Store Section and map sales office.

Each printing group has a Deputy Director,a Manager Map Reproduction (Sr.), who is assisted by Manager Map Reproduction (Jr.), and Assistant Managers .

The printing zone, Hyderabad has also a post of Chief Manager to advise the Additional S.G. on technical problems and on procurement of new printing machines, equipments and systems.

The Chief Manager also coordinates with all the directors in technical control of the materials. Chief Manager also makes a close watch on the various techniques and standards of production

in different printing offices. His advise is also taken in areas of research, training and requirement of printing personnel.

Photo Wing and the Litho Wing holds different sections.

PHOTO WING:-

Retouching Section
Photo Studio Section
Photo Lab / Photo Type Setting Section
Plate Making Section
Graining Section

LITHO WING :-

Litho Drawing Section
Proving Section
Printing Section
Paper Cutting Section
Map Despatch Section
Maintenance Section

MISCELLANEOUS:-

Central Technical Section.

Correspondence Section.

Stores Section.

Ministerial Section

Technical control is in the hands of the Manager Map reproduction (Sr.)/ Manager Map reproduction (Jr.), assisted by Assistant Manager and Senior Reprographer. All technical matters, stores, correspondence will be routed through Manager Senior/ Manager Junior to Director.

The main functions of administration and correspondence are concentrated in the Office of the Director concerned.

SECTION V—ORGANISATION

An Assistant Stores Officer is assisted by some storekeepers and clerks provided in each directorate to help in the procurement of printing machinery and raw materials. Procurement of paper and non-indigenous machinery and stores is handled by Deputy Stores officer, S.G.O. for the requirement of all the printing groups. The store section of Printing Zone is responsible to process the administrative and financial sanctions of all the printing groups.

There is one Works Managers in each printing group to look after the maintenance and repairs of printing machinery and equipments.

47. ESTABLISHMENT :-

Gazetted Officer, Class-I	Director, Dy.Dir.,Managers (Senior / Junior)
Gazetted Officer, Class-II	Work Manager,Assistant Managers, E&AO, ASO
Non-Gazetted Officers, Class-III, Division – I	Senior Reprographers, Office Superintendent
Non-Gazetted Officers Division –II,	Reprographers,UDC, LDC, Store Assistant, Store Keeper, Record Keeper Stenographer Class-III,
Class IV	Technical Labourers Khalasis, Safaiwala.

There are two grades of Managers Map Reproduction (Sr.) and Manager Map Reproduction (Jr.). Manager Senior is directly recruited or promoted from Managers Junior. Managers Junior posts are directly promoted from Assistant Managers.

Assistant Managers are directly recruited through UPSC or promoted from Senior Reprographers.

SECTION V—ORGANISATION

The Class III Division-I (Senior reprographers) supervisory staff works in the section. Senior Reprographers posts are directly promoted from Class-III Division-II (Technical). The Class-III, Division-II (Technical) comprise the bulk of the operators who are designated according to their trades and graded into four classes according qualifications and abilities. Grade promotions are made on passing trade tests. For full particulars see C.O.439 (Adm.)

Appointments are direct or by promotion from the class-IV establishment. See C.O. 435

The Class-IV establishment (technical) provides the less skilled tradesmen "designated as semi-skilled technical labourers".

Some of the IMPORTANT EQUIPMENTS held in the different printing Offices are :

	Photographic	***Printing Machines***	***Proofing presses***
1. **Northern Printing Group, Dehra Dun.**	Klimach commodore Camera, Log E Contact Printer, Devomat Film Processor, Protocol Registration System (Cartographic System B), Densitometer	Crabtree-Countess, Monarch, Sovereign (Two Colours) Roland Rekord- RVK-3 B (Four Colour) and RZK-3 B (Two Colour)	Mailander, Dufa VII
2.Eastern Printing Group, Kolkatta	Klimcsh Commodore Camera, Densitometer	Crabtree-Countess (Two Colour) Roland Rekor 1- RZK 3 B (Two Colours)	Mailander, Dufa VII
3. Southern Printing Group,	Klimach Super Autohorika Camera, Log E	Roland Rekord 322RK-3 BT (Single Colour)	Mailander, Dufa VII

Hyderabad	Contact Printer, Film Processors-Versamat, Kodalith, Hadego Phototype-setter, KG-30 Contact Printer	2, HMT (Double Colour) 2, HMT (Single Colour) and KBA RAPIDA 105-Universal (Four Colours) Printing Machine	
4. Western Printing Group, New Delhi	Klimach Commodore Camera, Densitometer	Roland Rekord RZK 3 B (Two Colours) Speed Master-CD- 102 (Five colours).	FAG 104

Dimensions of the above printing machines, proof presses and cameras are given in Appendix III to this chapter.

SECTION VI—GENERAL INSTRUCTIONS

48. DUTIES OF MANAGER MAP REPRODUCTION SENIOR :-

He is fully responsible for the efficient working of all the technical sections including production control/ CTO and store section. His duties comprise mainly the regulation of work. The issue of orders, as to process and methods to be employed, stepping up of out put, watching expenditure, and arrangements for training of personnel.

He must have a complete practical knowledge of all the process in use and should be able personally to work each process. He should go round the sections regularly and personally know each man and his work. He must keep himself upto date by studying the latest processes and inventions and be thorough on the look out for any means of increasing the efficiency of his unit either by better processes or by improved out-turn. He should also make sure that his Managers Map Reproduction junior, Assistant Managers and senior Reprographers keep themselves informed about the new technology / processes and inventions and carryout experiments where necessary.

49. DUTIES OF MANAGER MAP REPRODUCTION JUNIOR:-

The Junior Managers, whenever provided, assist the Senior Manager in all technical matters. In addition a Junior Manager co-ordinates in the maintenance, repairs and running of all machines. He is also responsible for shift working and security arrangements. Like the Senior Manager he is also to go round the sections and personally know each man and his work. He is also to keep himself up-to-date by studying the latest processes and inventions from the available books and journals.

SECTION VI—GENERAL INSTRUCTIONS

50. DUTIES AND RESPONSIBILITIES OF ASSISTANT MANAGERS MAP REPRODUCTION:-

(a) General - The Assistant Managers provided in each Printing Office, are allotted duties to supervise and control production in Photo & Litho Branches. Each Assistant Manager is expected to have a practical working knowledge of all the modern processes and equipment associated with his respective branch and in use in the Department. He must keep his technical knowledge up-to-date by study of trade journals, books, etc. with a view to improving upon the standards in the Department. From his practical experience and expert knowledge, acquired during his long service in his profession, he will impart training to juniors and new entrants and will bring them up to the proper standards. He must move round his sections frequently and correct immediately any faults appearing in his branch in technical work, equipment and organization. He must personally know each man and his work and be able to assess his technical ability, conduct, reliability, etc. He must be well conversant with all standing orders, Technical Instructions, Specifications and color schemes issued from time to time. He is also to watch proper utilization of Government machinery and stores and is to inform his Senior Manager on anything happening adverse for immediate corrective measure. He is responsible for stores inspection and attestation of stores ledgers. He is also to ensure that all stores are properly indented and accounted by the persons responsible for it.

(b) Important daily duties of Assistant Managers in Photo Branch:

(i) To examine all originals before photography or plate making and issue instructions briefly on the process or method to be adopted for the job.

(ii) To check for quality and correctness the photographic and duplicate powder negatives and

bromide prints before they are dispatched from one section to another.

(iii) To see that all the registers, stock books and diaries maintained for providing material for various reports are properly and accurately maintained in each section and initial them at least once a week after scrutiny and physical verification where necessary.

(c) Important daily duties of Assistant Managers in Litho Branch:

(i) To see that all the machinery in use is oiled and greased before being worked and to check the machine maintenance card kept for this purpose.

(ii) To see that the printing work is evenly distributed and completed within a reasonable time.

(iii) To pass and initial the colours of the jobs in the Printing Section, put up to him by the Section Officers (both the Assistant Managers and the Section Officers are, however, equally responsible for the correctness of the colour tones and the quality of printing).

(iv) He is responsible for at least 1% check of all the maps and the flat printed sheets after these have been examined by the Impression Examiner and in token of having dine this, he will initial the Daily Printing Report and the Departmental copies sent with the report. As for pamphlets, books. etc. he will approve one copy before finally binding and will check a few copies that these are properly bound.

(v) To see that all the registers, stock books and diaries maintained for providing material for various reports, etc. are properly and accurately maintained in each section and initial them at least once a week after scrutiny and physical verification where necessary.

50a. DUTIES AND RESPONSIBILITIES OF WORKS MANAGER:-

He is responsible for repairing of machinery and equipments pertaining tonprinting office.

51. Authority for undertaking work.- No work may be undertaken in the Reproduction Offices without the sanction of the Additional Surveyor General Printing Zone. The Addl.S.G.'s Office conducts all correspondence with indentors, issues instructions to the concerned Printing Directorate under his signature and then the Director's office dispatches preliminary prints, material (blue prints, etc.) and proofs to the indenter.

Completed work is passed to the Addl. S.G.'s Office for disposal. CTO/PC also makes recoveries bill for cost of work from extra-departmental indenters.

Work is classified as **Departmental** and **Extra-departmental** (for fuller definition see Chapter I, para 11). The latter is only undertaken when it does not interfere with departmental work. For detailed instructions regarding the taking up of Extra-departmental printing work, see Appendix IV.

SECTION VI—GENERAL INSTRUCTIONS

52. Register Slips.- All work sent to the Reproduction Office for printing etc. is accompanied by a Register Slip on which full instructions are given by the Director's office in the form of orders for the Manager concerned. If the work is extra-departmental the Register Slip also contains instructions of the Addl.S.G.PZ's Office regarding the disposal of copies and the recovery of costs.

The Manager enters any additional instructions on the Register Slip and passes it on with the originals to the branch concerned. Assistant Managers then add their own instructions before the work is put in hand. Any later instructions are issued on an additional R.S. which is attached to the main R.S. which accompanies the work on its passage through the Reproduction Office, each section entering its costs at office rates on the back. These are summarized when the work has been completed, and the R.S. is passed with the originals to the Map Record and Issue Office, who retain the originals and pass the R.S. on for final Lodgment in the Director's Office. When a reprint of the sheet is required, orders are issued on the same Register Slip, but with the publication of a revised edition a new Register Slip is issued. Each Register Slip has a letter and number followed by the last two figures of the year in which it was issued and these are printed on the left hand bottom corner of the published sheet, just below the border line.

The same principles are followed in the issue of Register Slips for Extra-departmental work, the same R.S. being employed for successive reprints of the same work. Departmental R.S.s are distinguished by the letter 'D' and Extra-departmental R.S.s by the letter 'E'. Instructions on Register Slips must be complete in themselves and must not invite reference to other papers or files unless for record purposes or to draw attention to an authority in support of instructions. *Clear, accurate and complete instructions are absolutely essential.*

SECTION VI—GENERAL INSTRUCTIONS

53. Estimates.-Before taking up Extra-departmental work, cost and time estimates are always required. These are prepared in the branches concerned on special forms, using the current scale of cost rates. For work done for departments of the central and state governments a discount is allowed. It should be noted that these are merely estimates and do not lay any claim to accuracy, as it is impossible to forecast the exact expenditure on operations like negative retouching. The charges actually made are those entered on the back of the Register Slip while going through the Reproduction Office less any discount. Should an indentor require a precise quotation beforehand for the cost of a job, this may be given and will be adhered to, but in quoting, a certain margin of safety should be allowed for unforeseen expenses to avoid the possibility of a loss. This especially applies to work for private individuals and firms where a loss would be open to serious objection.

54. Cost Rates.-Books are maintained in every section of Reproduction Offices showing the value of the work turned out per month at cost rates, and the cost in labour and material plus a share of the overhead charges. They also have a column showing percentage profit and loss. These books are of value in keeping the Manager and Director informed whether the section is working to full capacity or not and assist them in the periodical examination and revision of cost rates.

55. Imprints.-The subject of imprints is dealt with fully in Chapter I, paras 37 to 41; it will only be summarized briefly here. There are five imprints for the correctness of which the Reproduction Office is responsible. These are:

Press Imprint.
Surveyor General's Imprints and date.
Reproduction Imprint.
Copyright Imprint and price note.
Warning box.

SECTION VI—GENERAL INSTRUCTIONS

A Press Imprint contains the Register Slip number and its year of issue, party or D.O. in which the sheet was drawn, scale of fair drawing, press order and the year of printing (see Chapter VI, Para 444). Reprints from standing plates are indicated by adding the new press order and year of printing to the existing imprint.

The Surveyor General's Imprint appears on all Departmental Maps and on any Extra-departmental Maps which are in any way based on Survey of India publications. In Maps based on Departmental Surveys date appears under the imprint.

A Reproduction Imprint will be printed on all departmental and extra-departmental maps and commercial jobs in the following from:

Printed at Northern Printing Group, Eastern Printing Group, Southern Printing Group, Western Printing Group of Survey of India. This indicates that the job has been printed by the different printing groups of Survey of India.

56. Registration of work.-A register is kept by the CD,CTO,PC showing the value of all work which passes through the Reproduction Office. This is compiled from the Register Slips which pass through his hands on completion of the work. The CTO section keeps subsidiary registers and card indexes; and each section also keeps a card for each job on which the value of the work done is recorded.

57. Stages of Publication.-The publication of the standard series of maps falls naturally into two stages, a preliminary stage and a colour stage. The first commences with the photography of the originals, and concludes with the issue of preliminary proofs in black, brown and (if there is a tree original) green and of material for preparation of Press order proof, colour patterns, tint originals, shade original, grid original and in the case of a layered map, material for layer guides. The colour stage commences with the receipt of colour patterns, etc. and concludes with the issue of

colour proof. The final stage commences with the receipt of Press order proof, final correction of plates, and the printing and dispatch of the finished map.

Maps under re-issue, either as revised editions or as reprints from uncorrected originals, are usually submitted complete with their colour patterns, etc. They have, therefore, no
preliminary stage and after photography go straight to the colour stage. For maps for publication in black and brown there is obviously no preliminary stage.

58. Regulation of work.-The Manager watches the progress of all regular departmental work through CD/CTO/PC's records and registers in the sections. This is kept up-to-date by daily returns from Sections. By this method he can at a glance see where there is a tendency to congestion, and relieve it by overtime or any other means.

59. Storage of Plates and Negatives.-When work has been completed and dispatched from the Reproduction Office, negatives and plates are only kept of work for which recurring demands are expected. Normally storage of plates for long periods is avoided.

The following plates are kept:

(a) Only those which the Director has ordered to be kept on the Register Slips.

(b) Plates on which storage charges have been paid or guaranteed.

The following negatives are kept:

(i) All negatives of Departmental work, unless otherwise ordered by the Director, Also see para 106.

(ii) Negatives of Extra-departmental work which the indentor has asked to be kept standing and on which the indentor has asked to be kept standing and on which storage charges have been paid or guaranteed.

The difference between standing or stored negatives plates should be noted. 'Standing' is the term applied to the negatives/plates of Departmental work and 'stored' to those of Extra-departmental work.

60 Cleaning of Plates and Negatives.- Plates of survey blue-prints or material are cleaned off when surveyed plane table section are received by the indenting officer. Plates of drawing
blue-prints are cleaned off on receipt of the fair drawn originals. Negatives of the above are cleaned off after satisfactory prints have been made from plates.

No negatives of standard departmental sheets will be cleaned off without the Director's approval.

Storage of Extra-departmental plates and negatives will be period of reviewed by their respective keepers and cleaning orders asked for when further storage does not appear to be justified or when stocks are excessive. Applications for cleaning orders will be made to the Director on a special form and if for negatives, should pass through Assistant Manager, Photo and Litho.

Plates for which negatives or Black print originals are available should generally be cleaned off unless orders for their retention are specifically issued.

The officer preparing a Register Slip must state clearly: on it whether plates or negatives are to stand or to be cleaned off. The following must be borne in mind when entering the above remarks:

After printing, negatives/positives/metal plates will be taken on the charge by the concerned sections and proper ledgers must be maintained indicating the date of receipts. The use and through type metal plates (One time used) may be cleaned and sold yearly.

No indentor of Extra-departmental has any right to the plates which remain the property of the Reproduction Office. In special cases, the Addl.S.G. PZ may permit the transfer of a plate to the indentor on payment of storage charges and a charge to cover the actual cost of the metal.

61. MODERN TECHNOLOGY

With the modernization of Printing Industry latest technology have been introduced in Survey of India . Now a days the old system of printing maps from fair drawn originals or scribed materials have been replaced by CMYK Plates . After digitization of field verified sheets , those datas were patterned and converted to Post Script formats . These datas were then converted to CMYK film positives/negatives for final printing. However it is to be kept in mind that the procedures adopted are software oriented.

1. HARDWARE USED :

i) SERVER (Windows 2000)
ii) Windows Workstation
iii) HP2500CP Plotter (PROOFER)
iv) IMAGE-SETTER (BG-3800) – LASER BASED
Resolutions : 1000,1270,2000,2540 ppi
Drum and optics system are supported on air bags
Film sizes : 80 X 110 cm and 52.1 X 64.8 cm
(AGFA – Red sensitive Film)
Accuracy : $\pm$ 0.005 mm.
v) AUTOMATIC FILM PROCESSOR :- The Automatic Film Processor has Developer, Fixer and Water in three trays and Automatic Film dryer unit.
vi) COMPRESSOR : To maintain the airbags
vii) VACUM PUMP : To hold the film on the drum and to unload the exposed film.

2. SOFTWARE USED. :- The pre press software installed on the SERVER is MERCATOR 3.0
a. COMPONENTS :
i) MAP CENTRE - Map Symbolisation software and cartographic editing software
ii) MAP EDGE : For minor editing and map composition.

iii) FLEXRIP PROOF - For HP2500CP Proofer (To obtain paper proof before creation of CMYK film positives b)

iv) FLEXIRIP BI - For exposing jobs on the BG – 3800 Image Setter to obtain separate CMYK film positives / Negatives.

3. PROCEDURE :

a) A combined PS file is made from the DCDB file by using plotter drive bg 3800 OSM Plot
b) This PS file is then opened in Map Edge software and different colours used in the file are checked for screen angle , LPI is given for inks Cyan, Magenta, Yellow and Black according to the specified standards.
c) This results in a graphic file in the native .GRS format.
d) The resulting map can be previewed in WYSIWYG mode.
e) Now a paper proof is taken through flexRipProof software in a plotter.
f) This proof is checked for its correctness and if this proof is found correct then this job is ready for creation of CMYK positives/negatives.
g) Then CMYK film positives/Negatives are created through flexRipBI software in BG 3800 Image Setter. This software rips the job and forwards the ripped bit-map data on to the image setter, which exposes the data and after exposing films are developed on online processor.
h) Finally four different film positives/Negatives namely Cyan , Magenta , Yellow and Black are obtained which forms the input material for the Printing Office.

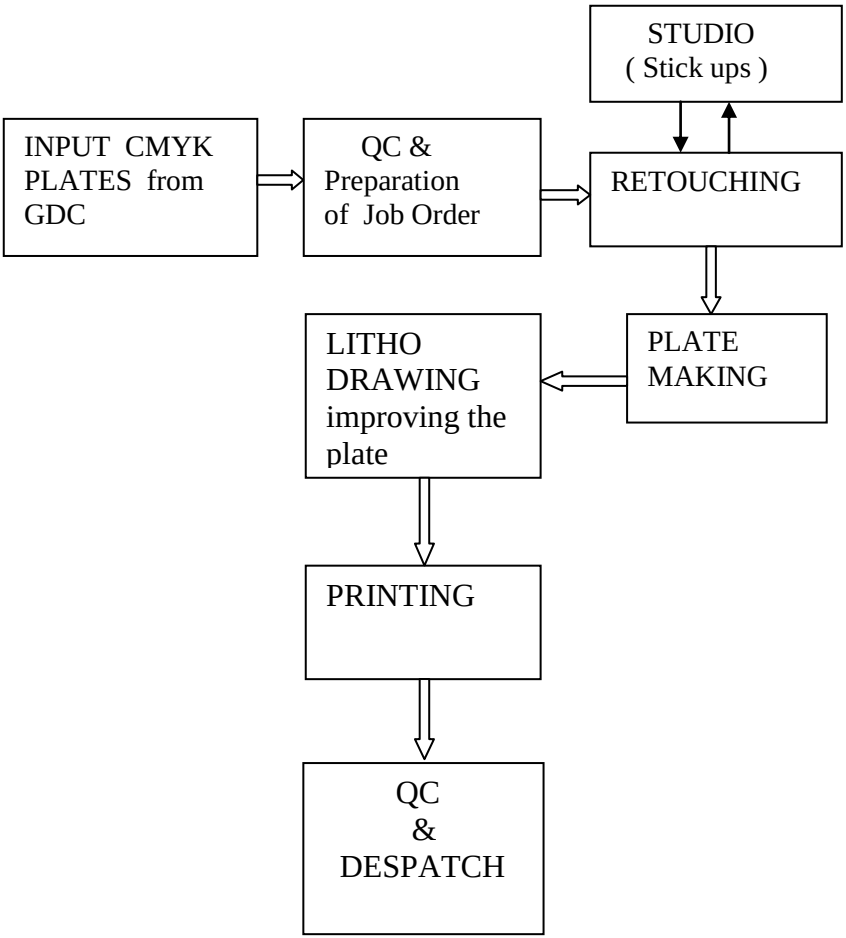
4. NEED OF MAP PUBLISHING SYSTEM :

Map Publishing system offer a solution to cut down the delay and produce CMYK colour composites of high quality for the printing machine.

Earlier the printing process was delayed due to

a) Exchange originals between Cartographic unit and Printing office results in delay.
b) Delay also occurs in combination of negatives and retouching work in the Printing office before plate making.

62. FLOW-CHART OF THE MODERN TECHNOLOGY :



63. COLOUR SCHEME FOR OPEN SERIES MAPS

COLOURS	C	M	Y	K
BLACK	-	-	-	100
CONTOUR	30	50	50	-
RED (Linear details)	-	100	100	-
RED (Filled Symbols)	-	70	70	-
GREEN	100	-	100	-
BLUE (Linear details)	100	-	-	-
BLUE (Filled Symbols)	70	-	-	-
ROAD Ex-way outer	-	-	-	100
ROAD Ex-way inner Fill	20	60	-	-
ROAD 1st. Importance outer	-	-	-	100
ROAD 1st. Imp. Inner Fill	-	70	40	-
ROAD 2nd. Imp. Outer	-	-	-	100
ROAD 2nd. Imp. Inner Fill	-	45	70	-
ROAD 3rd. Imp. Outer	-	100	100	-
ROAD 3rd. Imp. Inner Fill	-	12	80	-
RED TINT (Blocks)	-	35	20	-
BLUE TINT	30	-	-	-
YELLOW TINT	-	-	25	-
GREEN TINT	20	-	30	-
EMBLEM	-	100	-	-
NAVY BLUE Sheet No. ,Scale & Website	100	100	-	-

64. COMPUTER TO PLATE

CTP, Computer to Plate, technology has gain recognition because it would not only shorten the production processes eliminating film output in the prepress process but also contribute
the rationalization of printing factory itself.

Types of Plate

Thermal plate
It is the first generation negative type that preheats after exposure. It requires expensive
high energy laser. Recently, the second generation was introduced into the market. It is
positive type and doesn't require preheat.

Silver-salt DTR plate
Lowest energy laser can be utilized. It is possible to use 300lpi. There are alumni base
and PET base. The latter is easy to use because it can be outputted from film setter.

Photo polymer plate
It can be used for wide range of printing from low resolution (1200 dpi) and high resolution. It
is close to traditional PS plate in terms of adhesion, resistance to soiling and printing
attributes.

Physical Characteristic
The characteristics are as follows:

Halftone dot area ratio against input data on the plate are1:1 reproduction.
Dot gain at printing for film output PS plate and CTP plate are about the same.

Highlight halftone dot re-productivity shows good highlight adhesion because CTP directly creates halftone dot.

Letter re-productivity quality is good. The higher quality is in the order of thermal,
film output PS plate, silver salt DTR and photo polymer.

Subjective features

Thermal plate have high balance in the six points against the conventional PS plate; i) color
ii) reproduction, iii) smoothness, iv) registration, v) moiré, vi) highlight and catch light.

CTP system

CTP workflow can be categorized into two types in terms of data format, the timing of RIP
and page allocation. The two types have direct relationship in terms of efficiency of
correcting process, proof and printing plate, and its output quality.

Direct to plate printing is relatively a new technology, it is becoming very popular due to skipping the use of films in the printmaking process, the technology has had to evolve and expand to maintain the quality of the prints. Some manufacturers have developed techniques to make sure that there is no loss of quality with the elimination of film. In this context, Kodak has developed the Direct Thermal Printing Plate, which uses thermal imaging techniques as opposed to the silver halide or photopolymer technologies used by others.

Direct to plate using thermal imaging involves applying focused heat from a laser diode to the surface coating on the plate until a threshold temperature is achieved. When this happens, an image is formed as written by the platesetter. If more heat is added, nothing happens; the image will not change. It will match the platesetter image exactly, with no dot gain. Many tiny dots make up a picture.

Both film and plate processing involve harmful chemical substances. Although direct to plate printing does not eliminate all the harmful substances, it does produce less than traditional film processing. Another benefit of direct to plate is that, because the film is eliminated and the work is produced via computer, thus save on processing and there is less work involved in the film stripping and proofing.

There is substantial problem in proofing with direct to plate printing. Proofing of prints is vital at most stages of the printing process. Proofing film can bring attention to errors that can be corrected, but with direct to plate, there is no way to accurately judge the image that will be printed. This is a flaw in the technology. While the technology is being developed, it may be up to the user to decide if the quality of the prints is to the standard they desire.

Imaging Silver and Photopolymer Printing Plates

Printing industry strongly depend on excellent focussability of single-mode lasers. In former times internal drum or flatbed plate-setters took advantage of frequency-doubled Nd:YAG lasers (532 nm). However, the pursuit of higher output and better imaging resolution
received a new push when the new violet diodes became available in 1999.

Violet Laser Technology

There are several basic advantages of violet versus green laser which were
previously used in CtP:

• Handling of violet plates under yellow light. Operators can distinguish
contrasts on the plate more precisely. Green plates require red light handling in order to avoid unwanted exposure.

SECTION VII - DIGITAL PRINTING PROCESS

• Green lasers typically emit CW and cannot be modulated intrinsically.

Any pulses have to be generated by external devices. The violet diode laser can be modulated directly and thus saves costs by disposing of external pulsing devices.
• The shorter violet wavelength (405 nm ⇔ 532 nm) enables either better resolution (smaller focus diameter) on the plate or faster scanning at same resolution (smaller beam diameter ⇒ smaller spinning mirror ⇒ higher revolution of spinning mirror possible)

Plate technology
As to the plate side, two plate materials with different illumination sensitivity are currently available on the market:
• silver halide plates
• photopolymer plates
While silver halide plates only require low power of approx. 1 to 5 mW,
photopolymer plates ask for significantly higher laser power (> 20 mW).

power requirement results from a minimum energy level to start the chemical reaction on the plate spot. While the amount of energy per spot is plate dependent and thus fixed, the energy is the product of laser pulse power and imaging time. To achieve a fast exposure, the exposure time is kept low and the pulse power high. Obviously, any fast scanning
along the plate can only be accomplished if the laser on/off cycles (e.g. the laser pulse duration as well as pulse rise and fall times) are short enough. Additionally, rise and fall time effect the

sharpness of the exposed spot on the plate. Any slow pulse rise or fall time will immediately result in blurred plate images or reduced contrast. Due to their design, internal drum setters provide a constant working distance from focusing lens to exposure plane on

the plate. Contrary to this, all flatbed setters need an f-theta lens to correct for the varying working
distance over the scan area. This additional optical element and its varying absorption depending on the scan angle makes it necessary to compensate for this effect by using analog laser power modulation.

Pulsed diode lasers
Industrial 405 nm diode lasers have the following benefit

• output power of more than 60 mW @ 405 nm for high plate throughput.
• optimum beam quality (wavefront error < 0.05 lambda) for best imaging.
• pulse modulation up to 200 MHz (500 MHz optional) for fastest imaging.
• shortest pulse rise and fall times (approx. 1 ns) for sharp imaged dots on
the plate.
Furthermore, the it supports flatbed plate-setters by analog modulation
which can be used up to the MHz range. Any modulation depth and levels in
the range from 1 to 100% can be set by the customer and changed later on
to adapt to future needs.

SECTION VII - DIGITAL PRINTING PROCESS

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65. DIGITAL PRINTING PROCESS

Capturing an Image

To produce a "digital" image, these elements must be converted to digital files that are then manipulated on a computer system with digital imaging software. This step is usually accomplished by scanning the analog image. The scanner measures reflected or transmitted light from the analog image, assigning numerical values to the colors or tones in the image to create a digital copy. With the image "translated" into a series of numbers, the information can be stored on a computer hard disk or other electronic media such as a removable drive, or CD/DVD.

The graphics produced through the use of these applications can be divided into two primary groups or "graphic types," object oriented and bit-mapped. At the completion of the design and layout phase, all elements have been assembled into one file. This file may include both object-oriented and bit-mapped graphics saved in various file formats. The file is then ready to be managed based on the requirements of the selected output device and can now be reproduced.

Producing the Image
Once the image has been captured, it is then transferred to the printing station. The computer directs the speed of the head technology as well as the machine to produce the image. As with all printing processes, digital prints dots, which in turn trick one’s eye into seeing a continuous image. Digital technology prints in four color process -CMYK.

Finishing the Image
Lamination is often used to "finish" digital prints. Using special media, inks and/or laminates, images can be produced which

withstand indoor humidity, sunlight and most outdoor weather conditions. Also, adhesives are available which provide the opportunity to apply digital images to various surfaces.

66 . PLOTTER
Plateless Processes

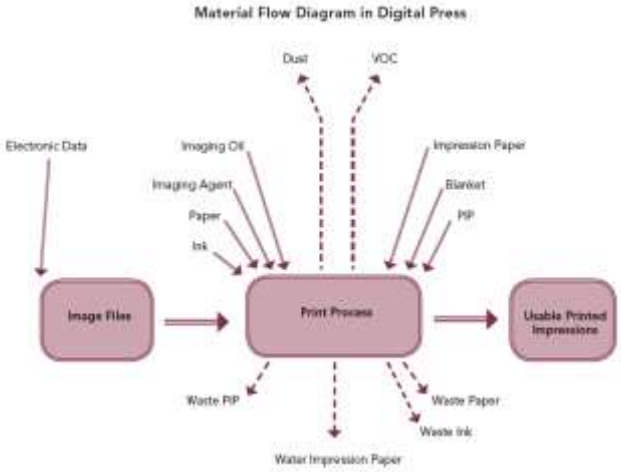
Applications

The various plateless printing processes are quite different from the five major conventional printing process. Unlike traditional processes, the new processes do not use printing plates or any other type of physical image carrier. Instead, they rely on sophisticated computer software and hardware to control the printing elements. Currently, however, the plateless processes are restricted largely to in-plant and quick printing applications.

Process Overview

The plateless processes have a number of advantages over traditional printing processes. The make-ready preparations are done electronically so the different chemicals used with prepress operations are almost avoided. Plateless processes do not require solvent washes and with a few exceptions ,e.g., ink jet printers, dry inks are used. Though the chemicals used in plateless processes depends on the particular process involved, important chemicals include Freon 11, inks, and hydrocarbon based solvents (GATF 1992b).

SECTION VII - DIGITAL PRINTING PROCESS



Basic of Digital Printing

The use of digital printing applications and integration of these applications into traditional print markets is rapidly expanding. Digital, unlike the traditional print processes, is a direct to output device process thus it does not employ a "pre-press" operation as would be associated with traditional commercial printing technologies, i.e., screen or lithographic printing. Instead, the image is created on the computer and transmitted directly to the output device.

The other distinct difference between the use of digital applications and traditional print is the relationship between the equipment and ink delivery system. Output devices such as inkjet printers, are developed with a specific ink and ink delivery system in place which is unique to each digital press. The type of equipment chosen is also driven by the product produced. These factors work to limit product substitution options for most systems.

Equipment options for digital printing are shaped by substrates and the inks that are used. Liquid ink-jet, wet/dry toner systems, solid ink-jet, thermal-transfer and photographic devices are the primary technologies used today. Common digital products include items

such as bus wraps, building wraps, in-store displays, reproduction of photographic images, as well as fine art prints to list just a few.

Determining when to use digital printing instead of a traditional printing process is highly dependent on the number of prints needed as well as the production speed of the output device.

Ink delivery roll-based digital output devices use a substrate delivered on a roll (as in traditional web printing) and printed after it is fed into the machine. Roll-based devices allow you to print on flexible surfaces including paper, vinyl, fabrics and thin plastics. It is also possible to print on various types of papers that are used in thermal image transfer processes such as dye sublimation.

Flatbed devices allow direct printing on rigid substrates, which can range from the common, such as poster board, foam board or rigid plastics; to the uncommon, including metal, glass, wood and other substrates. Printing directly on these rigid substrates may eliminate the mounting processes required of many images printed on roll-based units.

Liquid Inkjet Technology

There are two primary types of Inkjet technology that are used to produce an image.

The first is drop-on-demand. Using this method the heads form ink droplets by applying pressure to the nozzle chamber. This action forces the drop of ink out of the nozzle onto the media or print surface as is needed to create the image. There are two types of drop on demand ink jet heads, piezo and thermal.

The second type of Inkjet technology is continuous. Using this method, the ink is continuously under pressure forming a stream of droplets. The droplets required to form the image are channeled to the media, while the unused droplets are recycled.

Highly important to successful inkjet digital imaging is the print head, which literally “jets” the ink onto the substrate. Piezo heads release ink by applying pressure to the head’s nozzle chamber,

forcing a drop of ink onto the print surface as needed to create the image. With thermal ink heads, a heating element creates a gas bubble in the nozzle chamber; the bubble yields the pressure needed to force a droplet of ink onto the media.

Inkjet printer inks can be aqueous, solvent-based, or UV curable. The print head dictates the ink type that will be used. Aqueous inks are common but production speeds are limited because of the rate of drying for the inks. For high production speed applications, few printers choose to switch to solvent-based inks, which dry through rapid evaporation.

UV inkjet units use ultraviolet light to cure the ink. While many devices applying UV inks are flatbed devices, designed for rigid substrates, it is important to understand that UV inkjet inks can be used only on devices that are capable of curing UV ink. Without the proper UV light, the ink will not cure and will remain in a wet-state for an indefinite period of time.

As in all types of printing, the ink is distinctly important to the creation of a print that has reliable and accurate color, durability and longevity. In today's digital inkjet markets, two ink delivery systems have gained prominence and represent nearly 100 percent of inkjet graphics created worldwide.

Due to issues associated with cost and technology, most entry-level wide-format digital printers use either dye or pigment inks. Dye-based and pigment-based ink systems are both aqueous systems, meaning they are water based. Aqueous ink systems are used on indoor signage and other indoor types of prints that require protected (laminated) usage. For outdoor uses, or to increase the durability of the print, the print must be laminated.

As mentioned earlier, UV inks require specific output devices in order to be cured. Once cured, the finished print offers high durability, even outdoors, without the need for lamination or other steps necessary to protect the print. Currently, UV ink is the ink

system that allows for printing on the widest variety of substrates, including products intended for outdoor use.

Solvent-based ink also offers higher durability and is generally less expensive than UV. However, when purchasing a digital printer using a solvent-based ink system, it is important to consider that the use of

solvents could lead to significant air emissions, triggering the need to comply with air quality regulations. Without proper ventilation, the fumes from these systems may also be a concern for worker safety and health.

67. - SCANNER

Scanner is a device that converts light into 0s and. Practically, scanners convert analog data into digital information. To accomplish the job, scanners use small electronic components (called CCDs, PMTs, or CISs) as their "eyes." These eyes record how much light is reflected off the item being scanned, and report that information to the computer.

To capture the image, the scanner divides the image into a grid, and uses a row of eyes , known as scanning head, to record quantum of light is reflected in each location. Once the computer has all that data, it builds a file that represents the image in digital form. Each of the cells in the grid is called a picture element, or pixel. Scanners differ primarily in how many pixels they can measure (their resolution) and in how the actual scanning process takes place.

When a scanner converts something into digital form, it records the image pixel by pixel what it sees. Different scanners record different amounts of information about each pixel. How much information a given scanner records is measured by its bit depth.

The basic scanner only records monochrome, and is sometimes known as a 1-bit scanner because each bit can only express two values, on and off. In order to see the many tones in between black and white, a scanner needs to be at least 4-bit or 8-bit. The higher

the scanner's bit depth, the more accurately it can describe what it sees when it looks at a given pixel. This, in turn, makes for a higher quality scan.

At present, most color scanners are at least 24-bit, meaning that they collect 8 bits of information about each of the primary scanning colors: red, blue, and green. A 24-bit unit suppose to capture over 16 million different colors, but in practice the number is usually quite smaller. This is near-photographic quality, which termed as "true color" scanning.

Manufacturers are offering 30-bit and 36-bit scanners, which can theoretically capture billions of colors. The only problem is that very few graphics software packages can handle anything larger than a 24-bit scan, because of limitations in the design of personal computers. Still, those extra bits are worth having. When a software program opens a 30-bit or 36-bit image, it can use the extra data to correct for noise in the scanning process and other problems that hurt the quality of the scan. As a result, scanners with higher bit depths tend to produce better color images.

Problem: Not all monitors can display a 24-bit, true-color image. Many monitors display only 8-bit images, with just 256 colors. If an image looks patchy or distorted on screen, it may be the fault of the monitor, not the scanner.

Color Calibration Software

One of the common problem of using a desktop scanner is that a scanned image can look different on screen than it does when printed, and both can vary certain degree from the original. To overcome this problem is color calibration or color matching software. With an appropriate color calibration system installed on computer, an image should appear in the exact same color on screen and on paper.

SECTION VII - DIGITAL PRINTING PROCESS

Components

Light source : Most scanners capture image data by reading light that's been reflected off, or passed through, the item being scanned. To accomplish this process requires a light source, and the quality of that component have a drastic impact on the quality of the resulting scan. When scanners were first introduced, fluorescent bulbs used as light sources. Though it was quite good for many purposes but have two distinct weaknesses- they rarely emit consistent white light for long, and while they're on they emit heat which can distort the other optical components.

Which leads to use of "cold-cathode" bulbs that deliver whiter light and less heat. Fluorescent bulbs are now found primarily on low-cost units

and older models. Contact image sensor (CIS) scanners employ dense banks of red, green and blue LEDs to produce white light.

Optics: To direct light from the bulb to the "eyes" that read light values, CCD scanners use prisms, lenses, and other optical components. A high-quality scanner will use high-quality glass optics that are color-corrected and coated for minimum diffusion. Lower-end models will typically skimp in this area, using plastic components to reduce costs.

Single-pass CCD scanners use one of two methods for reading light values: beam splitter or coated CCDs. When a beam splitter is used, light passes through a prism and separates into the three primary scanning colors, which are each read by a different CCD.

Analog-to-digital converter: A scanner is an electronic component that processes the analog signals from its sensors into digital data for the computer it's connected to. This is a sensitive process, and one that is susceptible to electrical interference and noise in the system.

SECTION VII - DIGITAL PRINTING PROCESS

In order to protect against image degradation, an electrically isolated analog-to-digital converter that processes data away from the main circuit of the scanner.

Types of Scanner

Sheet fed Scanners
Sheet-fed scanners are more like a fax machine than a copier, because they move the page being scanned past the scanning head, rather than the other way around. Some sheet fed scanners only scan a single sheet of paper at a time, while others come with built-in document feeders that can scan multiple-page documents unattended.

Slide Scanners
Some items requires special handling during scanning. Slides, for instance, require a scanner that passes light through the image rather than reflecting off light off it. Because of their small size, slides also need to be scanned on a unit with very high resolution .

To meet these requirements, scanners that handle only 35mm slides were manufactured. These devices are usually much more expensive than flatbed or sheet fed scanners, and are much less versatile.

Drum Scanners
Prior to desktop scanning, most images were loaded into computers through drum scanners. Originals is to be mounted on a glass cylinder, which would then be rotated at high speeds around a sensor located in the center.

Drum scanners advantage lies in the fact that it typically use photomultiplier tubes (PMTs), which are more sophisticated sensors than the charge-coupled devices (CCDs) and contact image sensors (CISs) used in other kinds of scanners. That, and the fact that the original is rotated past the PMTs again and again at high speed, makes drum scanners important professional tools.

SECTION VII - DIGITAL PRINTING PROCESS

Specifications

Dynamic Range :
Dynamic range is measured on scale from 0.0 to 4.0, and the single number given for a particular scanner tells how much of that range the unit can distinguish. A high dynamic range is no guarantee of good scanning results as many other factors effects performance.

Resolution:
Resolution is a measurement of how many pixels a scanner can sample in a given image. Resolution is measured by a grid. With a higher resolution will give more readings; with a lower resolution, fewer readings. Generally, higher resolution scanners produce better results.

Optical & Interpolated Resolution
A scanner's optical resolution is determined by how many pixels it can actually see. The other , interpolated resolution measures how many pixels the scanner can guess at.

Scanning Area
Scanning area is the maximum size image a particular unit can scan.

Scanning Method
Part of what determines the overall quality of a scanned image is the method by which a scanner collects data. Charge-coupled devices are tiny light-sensitive semiconductor chips that consist of an array of light-sensitive photocells. CCD scanners pass a light source over a document on the scanning bed and use a system of mirrors and a lens to focus the image on the chip. CIS scanners, on the other hand, replace the chips, mirror and lens with a single row of sensors placed extremely close to the document.

Speed
Determining the scanning speed is difficult, because there is no single standard for evaluating the time it takes to complete a

scanning operation. Manufacturers frequently specify the raw speed of their scanner motors which is expressed in milliseconds per line, or ms/ln, but that speed rarely correlates with real-world performance.

68. – IMAGE SETTER
An image setter is an ultra-high resolution large-format computer output device. It exposes rolls or sheets of either photographic film or bromide paper to a laser light source. Once the film or paper is developed, a very high quality black and white image is revealed. Development (processing) usually occurs in a unit separate to the image setter, as does raster image processing.

Imagesetter setter output ranges in width; usually between 12 and 44 inches. The resolution of an image setter is typically between 1200 and 4800 dpi.

The image setter has been largely superseded by the platesetter.

Uses of an image setter
Output on film
The basic purpose of an image setter is to produce film, used to expose lithography plates for offset printing. Imagesetter film, however, provides the highest quality exposure for other photo-repro printing processes, such as screen . Imagesetter film is a silver halide-coated plastic film very similar to normal black & white photographic film, except the spectral sensitivity is reduced to a much narrower band around the output of the

laser of the individual image setter. This allows the film to be handled under a safelight, instead of in total darkness like most photographic film.

Output on bromide paper
The use of bromide paper instead of film in an image setter allows it to produce paper output called bromides. Bromides are similar to ordinary laser prints but with four major differences.

SECTION VII - DIGITAL PRINTING PROCESS

The output can be much bigger The output is of much higher resolution. The black is darker, and is of much more consistent color.

69 - COLOUR-TROLL

CMYK

CMYK for 4-color process printing.

Definition: To reproduce full-color photographic images, typical printing presses use 4 colors of ink. The four inks are placed on the paper in layers of dots that combine to create the illusion of many more colors. CMYK refers to the 4 ink colors used by the printing press -- the the subtractive primaries plus black.

C is cyan, M is magenta, Y is yellow, and **K** is a pure black ink, the key plate or keyline color.

The illustration on the above shows a color photograph (center) separated into its CMYK components. A separate plate for the printing press would be made from each one. Those areas on the C plate, for example, that are black and shades of gray would print in varying shades of Cyan. The white areas get no Cyan. Each ink is added in turn to create the final full color image on paper.

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Subtractive Primaries

Definition: Cyan, magenta, and yellow ink colors used in four-color process printing, along with black, are known as the subtractive primaries.

While the three additive primaries of red, green, and blue combine into white light, mixing two of the additive primaries results in one of the subtractive primaries.
For example, red + blue = magenta.
Combining two of the subtractive primaries results in one of the additive primaries.
For example, cyan + yellow = green.
A pure black ink is usually used with CMY for printing purposes.
Mixing all three of the subtractive primaries results in a murky black-like color.

Cyan

Cyan is one of the subtractive primaries used in process color printing.
Definition: One of the 4 colors used in 4-color (CMYK) printing and inkjet printer cartridges, cyan is a blue-green or

turquoise color. Cyan is one of subtractive primaries, magenta and yellow being the other two. Combine

the additive primaries of blue and green and you get cyan. Combined in varying amounts, cyan and magenta produce shades of blue. Cyan with yellow produces shades of green.

Magenta

Magenta is one of the subtractive primaries used in process color printing. Definition: One of the 4 ink colors used in 4-color (CMYK) printing and inkjet printing, magenta is a pinkish shade of red. It is one of the subtractive primaries, the other two being yellow and cyan. Mixing the additive primaries of red and blue produces magenta. Mixing varying amounts of magenta with yellow creates shades of red while magenta with cyan creates shades of blue.

Yellow

Yellow is one of the subtractive primaries used in process color printing. Definition: One of the 4 colors used in 4-color (CMYK) printing and inkjet printers, Yellow is one of the subtractive primaries, the others being cyan and magenta.
Mixing the additive primaries of red and green produces

yellow. Combining varying amounts of yellow with cyan creates shades of green while yellow with magenta creates shades of red.

Additive Primaries

Red, green, and blue are the additive primaries that make up white light.
Definition: Red, green, and blue (commonly called RGB) are the primary color elements that make up white light. Because you ADD the colors together to get white light, we call these RGB colors the **additive primaries**. Colors on screen are displayed by mixing varying amounts of red, green, and blue light.
Adding any two of the additive primaries creates one of the subtractive primaries -- the colors used in 4-color process printing. The additive primaries typically refers to the RGB on-screen color mode. Mixing actual red, green, and blue inks or paints does not produce white.

Process Color
Process color, also known as CMYK or 4-color process printing, uses cyan, magenta, yellow, and black to simulate thousands possible colors.

Each of the process colors is layed down on the page one at a time in varying amounts.

RGB and CMYK Color in Computerised Publishing

Computer monitor emits light which justify that the computer

uses the three color regions of RED, GREEN, and BLUE to reproduce the colors we observe.

Working with images which meant for the **screen or the Web**, we attribute colors by the amount of RED, GREEN, or BLUE in the color. In graphics software these numbers might look like this or similar to it:

RED 255
GREEN 255
BLUE 0

A number between 1-255 designates the amount of each color RED, GREEN, or BLUE.

In order to understand these numbers we translate them into 6 digit **hexidecimal** numbers or **triplets**.

255 RED 255 GREEN 0 BLUE becomes FFFF00. The first pair (FF) is the Red, The second pair (FF) is the Green, and 00 is the Blue. FF is the hexidecimal equivalent of 255 and 00 is the hexidecimal equivalent of 0.

In **print**, we try to reproduce the colors we see. Color (light) is made by *subtracting* differing amounts of other colors from the additive primaries (RGB). While, in printing when we are mixing (adding) inks together the colors don't come out as we might expect.

Therefore, we start with the subtractive primaries (CYM) and mix those in varying amounts plus BLACK abbreviated as K, to get the colors we see printed in magazines and books and MAPS.

Colors are mixed in percentages such as:

CYAN	MAGENTA	YELLOW	BLACK
50	100	25	0

DIGITAL
REPRESENTATIO
COLORTROLL

RGB

Definition: A common color mode, RGB stands for the colors of Red, Green, Blue. Add red, green, and blue light to create white light. Because you ADD the colors together to get White, we call these RGB colors the additive primaries. Colors on screen are displayed by mixing varying amounts of red, green, and blue light.

Working with images meant for the screen or the Web, we write the colors by the amount of red, green, or blue in the color. In graphics software these numbers might look like this: 255 RED 255 GREEN 0 BLUE. A number between 1-255 designates the amount of each RGB color.

RGB is the most common color mode used when creating graphics, even though graphics to be commercially printed

are eventually converted to CMYK mode, the colors used in printing inks.

It means, RGB refers to an on-screen color mode. Mixing red, green, and blue inks or red, green, and blue paints is not going produce white.

Examples: A common problem with files sent for commercial printing is that the creator fails to convert graphics from RGB mode to CMYK mode before sending the file to the printer.

Separations

Definition: On a printing press each color of ink used in a document is printed one at a time. Each printing plate used on the press is made up only of components of the page that have that one color.

SECTION VII - DIGITAL PRINTING PROCESS

Separations are artwork split into component plates of cyan, magenta, yellow, and black in preparation for process printing (CMYK) or into the required number of plates for spot color printing. Each separation prints a single process or spot color. Digital files can be composite separations (all information in one file) or pre-separated (each color on its own page). During prepress one should print separations to own desktop printer to ensure they will separate properly once sent to for final printing.

70. Graining. There are a number of mechanical methods for roughening a metal surface. They are “rotary tub” graining, “sandblasting”, “dry brush” graining, “wet brush” graining, and a combination of rotary tub and wet brush graining called “ball-brush” graining.

Rotary tub graining is sometimes called ball graining, because it is done in a graining machine which consists of a tub with a rotary motion. Small steel marbles, which are usually reject ball bearings, are rotated over the surface of the plates. Water is added and then an abrasive material. The actual roughening is done by the abrasive. The character of the grain is determined by: (1) the hardness of the surface of the metal; (2) the amount of water used; (3) the weight and uniformity of the marble load; (4) the nature, amount, and size of the abrasive, (5) the speed of the grainer. The problems with this type of grain are inconsistency from plate to plate, scratchiness, dirt, and imbedded abrasive.

Sandblasting is used for roughening plates both for wipe-on and other platemaking processes. The plates are mounted on a rotary drum and a dry abrasive is impinged on the surface at an angle to the plate at right angles to the direction of rotation of the plate. Nozzle wear can cause variations in grains with this method, and imbedded abrasive can also be a problem.

SECTION VII - DIGITAL PRINTING PROCESS

Dry Brush Graining is used for treating some plates prior to presensitizing. The can be done with brass or steel wire brushes. The main advantage is that dry-brush graining can be done in line with the treating and coating of presensitized plates.

Wet Brush Graining takes a special machine in which the plates are fed onto a conveyor belt under nylon brushes and the graining is done with a mixture of pumice and water. Even with new aluminum plates, several passes through the machine are needed to get an evenly grained surface without indications of

rolling-mill streaks. This type of grain is usually too fine for good moisture control on large presses.

Ball-Brush Graining is a combination of rotary tub and wet brush graining. In this type of graining good depth is obtained in the tub graining operation and a fine, even texture is produced by the wet-brush technique. These plates have the texture for good-quality printing and the depth for good moisture control on large presses.

Chemical and Electrochemical Graining. Several methods of roughening plates chemically and electrochemically are in commercial use. They are used primarily for treating plates prior to coating in the manufacture of presensitized plates. The most widely used method is the electrochemical treatment of aluminum in a solution of hydrofluoric acid. This produces a fine grain which is used as a base for wipe-on and presensitized plates. It is also used as a preliminary treatment to anodizing.

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Aluminum Anodizing is a process by which a uniformly controlled thickness of oxide is produced electrolytically or chemically on aluminum. When produced, the oxide surface is very sensitive and must be sealed. Usually hot water is the sealant. The sealed surface is very inert to most chemicals, hard, and abrasive-resistant, and highly water-receptive.1

Chemical Treatments. In addition to roughening the surface, chemical treatments are also needed for some processes, especially negative diazo presensitized plates. The diazo compounds used for sensitizing these plates, which are inkreceptive when exposed, will in themselves react with metals. The diazo compounds can only be used if the metals are specially treated to prevent or inhibit this reaction.

When positive presensitized diazo plates are made, special surface treatments are not necessary, although cleaning and usually

some type of fine graining precedes the application of these positive-working diazos.

71- PRESENSITISED PLATES

Processing of Lithographic Printing Plates
There are eight different types of litho plates common to the commercial printing industry: Diazo, Photopolymer, Silver Halide, Electrophotographic (Electrostatic), Bimetal, Waterless, Thermal, and Ablation. The predominant surface plate in use today is termed a "presensitized" plate.

A photopolymer is a polymer that cures, or becomes solid, when exposed to light. The word polymer means “many parts” and is defined as any material, synthetic or organic, consisting of small simple molecules chained together to

form a larger molecule. The photo in photopolymer denotes its sensitivity to light.

72- CHEMICAL USED IN P.S. AND WIPE ON PLATES

AME	CODE	DESCRIPTION	PACKING
ll Kit:- ova Flash nsitizer A&B	3102011 3102012&3102013	• Two part Photosensitive coating solution for wipe on plate making. • Powder A to be mixed with solution B	100 ml 250 ml 500 ml
ova Flash: ack Diamond acquer eveloper	3102021 3102022	Single Step black colored lacquer developer for wipe on plate making	1 Ltr 5 Ltrs
ova Flash: nisher	3102051 3102052	Two in one finish cum densitiser for wipe on plate making	1 Ltrs 5 Ltrs

P.S. POSITIVE PLATE MAKING CHEMICALS

AME	CODE	DESCRIPTION	PACKING
ova Tone P	3103012	Concentrate aqueous developer/ topup for hand on machine processing of positive P.S.Plate.	5 Ltrs
sitive eveloper owder	3111014	Premium developer concentrate in powder form for most aqueous P.S.Plates contents to make 5Liters in tap water	300 gms
sitive veloper	3111022	Ready to use developer for most aqucous P.S.Plates.	5 Ltrs
ova Delete P	3103031	Image remover fluid for long run positive P.S.Plates.	100 ml

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PRESS ROOM CHEMICALS

AME	CODE	DESCRIPTION	PACKING
ltra Font	3201012 3201015 3201016	High performance fountain solution concentrate for sheet fed offset machines. Dilution 1% to 3%	5 Ltrs 25 Ltrs 200 Ltrs

PRESS WASHES

AME	CODE	DESCRIPTION	PACKING
tra wash	3212012 3212015	Premium water miscible blanket and roller wash containing plasticisers for rubber rejuvenation	5 25
ampakleen	3212071 3212072	Premium emulsion cleaner for manual and automate wash up of cloth covered damper rollers.	

PLATE CARE CHEMICALS

AME	CODE	DESCRIPTION	PACKING

ova Clean	3203022	Emulsion scum remover-cum cleaning for non sensitized plates	1 Ltrs 5 Ltrs

GUMS

AME	CODE	DESCRIPTION	PACKING
ltra Gum	3204011 3204012	General purpose desending gum concentrate for universal application. To be diluted to suit specific requirement	1 Ltrs 5 Ltrs
ate cleaning P	3213011 3213012	Premium general purpose emulsion plate cleaner cum-conditioner	1 Ltrs 5 Ltrs
ash-out orage	3213051 3213052	Premium two in one emulsion washout cum storage solution for all type of plates	1 Ltrs 5 Ltrs

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NOTE:- Above solutions are the propritoroy items of M/S Technova and are only uitable for Technova pre sensitized plates. For other brands, their specific hemicals as recommended may be procured and used)

PRE SENSITIZED SYSTEM- NEGATIVE

AME	CODE	DESCRIPTION	PACKING
ega developer 22	3112082	Premium ready to use aqueous developer for hand and processor use will most aqueous negative P.S. plates.	5 Ltrs
tradel	3112031	Fast acting deletion fluid for all types of negatives P.S.Plate.	100 ml

PRESS CARE

AME	CODE	DESCRIPTION	PACKING
vell	3205002	Rapid action repairing gel for blanket low spots and punctures	250 gms
ydromare	3205603	Roller cleaning paste	250 gms
oller Paste	3205601 3205602	Roller cleaning paste	500 gms 1 kg
vish image emover Pen	3205310	Image remover pen	1 No.
vish Image	3205401	Image addition pen	1 No.

ddition Pen			

73- PRINTING PAPER

Choice of paper depends on subject matter and clients choice. There are varities of paper – in it's grade features. Basic properties and features of the paper is given bellow.

Physical Properties
Basis Weight or Grammage
The basis weight, substance or grammage is the fundamental property of paper. The Basis weight of paper is the weight

per unit area. This can be expressed as the weight in grams per square meter (GSM or g/M2), pounds per 1000 sq. ft. or weight in Kgs or pounds per ream (500 sheets) of a specific size. The basis weight is what determines, how much area gets for a given weight. e.g. if basis weight is 50 g/m², for every 1 kg weight, the purchaser gets 20 m². When the basis weight is expressed as ream weight, it tells the buyers how many reams he/she getting for a given weight.

For papermaker basis weight is important from point of view of production rate. For a given machine deckle and machine speed, the production rate per day in MT will be
= Machine Deckle (m) * Machine Speed (m/min) * Basis Weight (g/M2) * 1440/1000000.

All paper machines are designed to manufacture paper in a given basis weight range. Tighter the range and more efficient will be the machine.

Typical Grammage Values:
Grade = g/m2
Newsprint = 40 - 50
Bond = 60 -90

Paperboard = 120 - 300
Accepted trade tolerance +/- 5%

Bulk
Bulk is another very important parameter of paper particularly for printers. Bulk is a term used to indicate volume or thickness in relation to weight. It is the reciprocal of density (weight per unit volume). It is calculated from caliper and basis weight.

Bulk (cubic centimeter/g) = Thickness (mm)* Basis Weight (g/m2) * 1000.

Sheet bulk relates to many other sheet properties. Decrease in bulk or in other words increase in density makes the sheet smoother, glossier, less opaque, darker, lower in strength etc.

High bulk is desirable in absorbent papers while lower bulk is preferred for printing papers particularly bible paper, dictionary paper etc.

Book Bulk: Book bulk is defined as the overall thickness in mm of a given number of paper sheets. The bulking number is defined as number of sheets required to bulk 25 mm or approximately 1".

Typical Thickness Values:
Grade = μm
Newsprint = 60 - 80
Office/Business Paper=105 - 110
Blotting Paper (230g/m2)= 540 - 590
Tracing Paper (90g/m2) = 78
Label Paper (79g/m2) =63
Tissue(28g/m2)= 125
Accepted trade tolerance +/- 10%
Caliper or Thickness

Thickness or Caliper of paper is measured with a micrometer as the perpendicular distance between two circular, plane, parallel surfaces under a pressure of 1 kg./ CM2. Variations in caliper, can affect several basic properties including strength, optical and roll quality.

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Curl

Paper curl can be defined as a systematic deviation of a sheet from a flat form. It results from the release of stresses that are introduced into the sheet during manufacture and subsequent use.

Paper curl has been a persistent quality issue and is increasingly important for paper grades being subjected to high speed printing, xerography and high precision converting processes.
There are three basic types of curl, mechanical curl, structural curl and moisture curl.

Dimensional Stability

Cellulose fibers (main constituent of paper) swell in diameter from 15 to 20% from dry condition to saturation point. Since most of the fiber in paper sheet are aligned in the machine run direction, absorption and de-absorption of moisture by paper causes the change in CD dimension. Such changes in dimension may seriously affect register in printing processes and interfere with the use of such items as tabulating cards. Uneven dimensional changes cause undesirable cockling and curling. Dimensional changes in paper originate in the swelling and contraction of the individual fibers. It is impossible to be precise about the degree of this swelling because paper-making fibers differ considerably in this property, and because the irregular cross-section of fibers creates difficulty in defining diameter.

Dimensional stability of paper can be improved by avoiding fiber to absorb moisture. Well sized papers have better dimensional stability.

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Typical Values:
Grade MD (%) = CD (%)
Bond Paper = 0.100-0.200 0.200-0.400
Coated Art Paper (under 200 g/m2) = 0.090-0.150 0.150-0.350

Formation

Formation is an indicator of how uniformly the fibers and fillers are distributed in the sheet. Formation plays an important role as most of the paper properties depend on it. A paper is as strong as its weakest point. A poorly formed sheet will have more weak and thin or thick spots. These will affect properties like caliper, opacity, strength etc. Paper formation also affects the coating capabilities and printing characteristics of the paper.

There is no standard method or unit to express formation. It is a relative or subjective evaluation.

Friction

Friction is the resisting force that occurs between two paper or paperboard surfaces in contact when the surfaces are brought to slide against each other. This property is measured as a coefficient of friction, which is the ratio of the frictional force, to a force acting perpendicular to the two surfaces.

Two components of friction can be measured, these being static and kinetic friction. Static friction is the force resisting initial motion between the surfaces and kinetic friction is the force resisting

motion of the two surfaces sliding against each other when already sliding at a constant speed.

Measurement of the coefficient of friction is also important in printing papers. There are two methods of measuring Co-efficient of friction of paper. One, which uses Incline Plane & other is Horizontal Plane.

Typical Co-efficient of Friction Values Using Horizontal Plane Method:

Grade	Static Friction	Kinetic Friction
Office/Business Paper=	0.50-0.65	0.35-0.5

Machine and Cross Direction

In paper machine approach flow system, when stock passes through pressure screen, the fibers are oriented lengthwise. If the stock velocity from headbox slice is equal or less than wire speed, fibers which are already oriented lengthwise, will align in the direction of wire run. Fiber alignment can be altered to some extent if stock velocity is less than wire speed. So all papers have a definite grain direction due to greater orientation of fibers in the direction of paper machine run. This grain direction is known as machine direction. The cross direction is the direction of paper at right angles to the machine direction.

While sheeting the paper, machine and cross direction are to be kept in mind and the sheet cutting to be done to suit the end use requirements.

Long grain and Short grain : The sheet is in long grain if the larger dimension is parallel to grain (MD) direction. The sheet is said to be in short grain if the larger dimension is parallel to cross direction (CD).

There is no sure way to determine the MD or CD of a sheet but one crude method which work is; cut a strip of about 1" wide and 2" long paper and moist it. Put this moist sheet on a smooth surface or hand. As sheet will dry it will curl. The direction of curl is CD as paper contract in CD more than MD while drying.

Moisture

Almost all grade of paper has some percentage of moisture. Moisture in paper varies from 2 - 12% depending on relative humidity, type of pulp used, degree of refining and chemical used. Most physical properties of paper undergo change as a result of variations in moisture content. Water has the effect of plasticizing the cellulose fiber and of relaxing and weakening the inter-fiber bonding. The electrical resistance and the dielectric constant of paper both vary with moisture content. The absorption and reflectance of certain bands of infrared and microwave radiation by paper are affected by its moisture content. The amount of water present in a sheet of paper is usually expressed as a percent. The amount of water plays an important role in calendaring, printing and converting process.

The absolute moisture content is expressed as a % of the paper/paperboard weight. The sample is generally not conditioned while doing this test

Typical Moisture Values:
Grade =%
Office/Business Paper=4 -4.5
Accepted trade tolerance =+/- 10%

Smoothness

It is most important parameter for printer. Smoothness is concerned with the surface contour of paper. It is the flatness of the surface under testing conditions which considers roughness, levelness, and compressibility.

Smoothness (Bekk Method): This test is an indirect measure of paper smoothness when it is under moderate pressure(100 kPa).

Roughness (Sheffield Method): This test is an indirect measure of paper smoothness or roughness. It is a measurement of air flow between the specimen (backed by flat glass on the bottom side) and two pressurized, concentric annular lands that are impressed in to the sample from top.

Roughness (Print-surf Method): Very similar to Sheffield methods.
Typical Smoothness Values

Grade	Parker Print Surf (μm)	Bendtsen (mls/min)
Stationery (45-135g/m2)	0.8-2.6	50-300
Business Papers (80g/m2)		100-300

Temperature and Humidity: Conditioning of Paper

It is important to control the moisture content of paper and keep it stable during converting operation. To keep moisture content constant, it is important that paper is conditioned. Conditioning of paper is also of important in many printing and converting operations. In addition to the effect of moisture content on physical properties, it also determines the build up of static of the paper sheet subjected to pressure and to friction. The tendency for paper to develop static

becomes greater with increasing dryness. Cellulose fibers are hygroscopic i.e. they are capable of absorbing water from the

surrounding atmosphere. The amount of absorbed water depends on the humidity and the temperature of the air in contact with the paper. Hence, changes in temperature and humidity, even slight changes, can often affect the test results. So, it is necessary to maintain standard conditions of humidity and temperature for conditioning.

Wire side and Felt side

The side which is in contact with the paper machine wire during manufacturing is called the wire side. The other side is top side. Before a thin layer of fibers deposit on machine wire, fines and fillers drain out hence wire side has less fines and fillers compared to top side.

In case of paper to be printed on one side only, best results are obtained by printing on felt side. Postage stamps are printed on wire side and then gummed on felt side, where the smoothness is helpful for attaining an even application.

Wire side and top side described above are in reference to single ply paper. In case of multi-ply paper/board, every ply will have wire side and top side. The top side of top most layer will be top side and wire side of bottom most layer is wire side of multi-ply board. Different type of fibers, fillers and chemicals are used in different layers for techno-economical reasons.

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Optical Properties

Brightness, Whiteness and Color

Brightness is defined as the percentage reflectance of blue light only at a wavelength of 457 nm. Whiteness refers to the extent that paper diffusely reflects light of all wave lengths throughout the visible spectrum. Whiteness is an appearance term. Colour is an aesthetic value. Colour may appear different when viewed under a different light source. Brightness is arbitrarily defined, but carefully standardized, blue reflectance that is used throughout the pulp and paper industry for the control of mill processes and in certain types of research and development programs. Brightness is not whiteness. The colour of paper, like of other materials, depends in a complicated way on the characteristics of the observer and a number of physical factors such as the spectral energy distribution of the illuminant, the geometry of illuminating and viewing, the nature and extent of the surround and the optical characteristics of the paper itself.

Brightness is measured with two different standards - TAPPI/GE and ISO. Though there is correlation, ISO brightness of a sample is usually lower by 1-1.5 units over GE brightness.

Colour is related to perception and therefore measured or specified in terms of color space. A commonly used system is the CIE L,a,b system. This is based on the idea of color opposites.

L - measure of luminance and varies from 100 for perfect white to 0 for perfect black.

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a - redness to greenness.
b - yellowness to blueness.

Whiteness is the extent to which paper diffusely reflects light of all wavelengths throughout the visible spectrum i.e. the magnitude & uniformity of spectral reflectance measured as the percent light reflectance for the whole wavelength range. The procedural

standards for the measurement of whiteness are explained in ISO 11475.

Typical Brightness Values
Grade % ISO
Office/Business Paper 80-95
Bond 70-92

Color
The quality of light given off by a sheet as described by its hue (tint), saturation (strength), and value (darkness or lightness). A whiter sheet reflects equal amounts of red, green, and blue light - the entire visual spectrum. While most balanced white sheets have a slightly yellowish cast, most people will perceive a sheet with a slightly blue tint to be whiter.

Fluorescence
Fluorescence measures the amount of fluorescent whitening agent present in the paper. Optical brightening agent absorbs UV light and re-emits it as visible blue light. Under lighting with a UV component this makes the paper appear more blue and brighter. All high white grades have high levels of

optical brightener. Less than 5 fluorescence indicates very little optical brightener is present.

Gloss
It is the specularly and diffusely reflected light component measurement against a known standard. Gloss and smoothness are different properties and are not dependent on each other.

Gloss is the specular reflection of light, which is reflected at an equal and opposite angle. Normally measured at 75° or 20°.

Generally, gloss of unprinted sheet/ board is measured at 75° (except for cast coated papers). Printed and varnished surfaces are measured at 60° angle.

Typical Gloss Values

Grade	Gloss at 750
Uncoated Printing Paper	4-6
Matt Coated	10-30
Silk Coated	25-50

Opacity

Opacity is the measure of how much light is kept away from passing through a sheet. A perfectly opaque paper is the one that is absolutely impervious to the passage of all visible light. It is the ratio of diffused reflectance and the reflectance of single sheet backed by a black body

Opacity is measured as the percentage of light absorbed by a sheet of paper.

Typical Diffuse Opacity Values

Grade	Diffuse Opacity %
Newsprint (40-49 g/m2)	90-94
Tracing Paper (60-110 g/m2)	25-40

Strength Properties

Bursting Strength

Bursting strength tells how much pressure paper can tolerate before rupture.
Bursting strength is measured as the maximum hydrostatic pressure required to rupture the sample by constantly increasing the pressure

applied through a rubber diaphragm on 1.20 - inch diameter (30.5 mm) sample.
Bursting strength depends on basis weight of paper. Bursting strength is depends on
Burst Index ,Burst Factor & Burst Ratio .
Typical Bursting Strength Values

Grade	KPa
Coated Paper (250 g/m2)	300-650
Carbonless Paper (50-60 g/m2)	150-200
Bleached Kraft (60 g/m2)	210-260
Test Liner (186 g/m2)	250-475

Compressibility

The reduction in thickness under compressive forces or pressure. It influences the ability of paper to change its surface contour and to conform to and make contact with the printing plate or blanket during printing impression.

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Folding Endurance (Double Folds)

Folding endurance is the paper's capability of withstanding multiple folds before it breaks. It is defined as the number of double folds that a strip of 15 mm wide and 100 mm length can withstand under a specified load before it breaks.

High folding endurance is a requirement in Bond, Ledger, Currency, **Map,** Blue Print and Record Papers. Currency paper has highest folding endurance (>2000). Long and flexible fibers provide high folding endurance.

Hardness

The degree to which paper will resist indentation by some other material such as a stylus, pen or printing plate. Hardness is measured with the help of Bendtsen smoothness tester with load on the measuring head.

Ply Bond/ Scott Bond

The Internal Bond Strength of paper or paperboard (also known as Ply Bond Strength or Z Directional Strength) is the ability of the product to resist splitting when a tensile load is applied through the paper's thickness i.e. in the Z direction of the sheet.

The interlayer strength of the paperboard, measured on Scott Bond Tester, expressed in J/m2.
Typical Scott Bond Values

Grade	J/M2
Cover Paper	125-230
Xerographic Paper	220-400

Coated Cover Paper	200-315
Coated Text	240-365

Resiliency

The ability of paper to recover its original thickness and surface contour after release of the compressive forces of printing nips.

Stiffness

Stiffness is the measure of force required to bend a paper through a specified angle. Stiffness is an important property for box boards, corrugating medium and to certain extent for printing papers also. A limpy and flimsy paper can cause feeding and delivery problems in larger sheet presses. A sheet that is too stiff will cause problems in

copier machines where it must traverse over, under, and around feed rollers. Bond papers also require certain stiffness to be flat in typewriters etc.

Stiffness (Taber):
A measure of flexural rigidity, Stiffness is the bending moment (g-cm or mNm) required to deflect the free and of a 1.5 in wide vertically clamped sample 15° from its center line when load is applied 50 mm away from the clamp; measured in MD & CD.

Droop Rigidity CD:
Droop rigidity measures the stiffness of the paper or board, more often applied to lighter weight grades. CD refers to cross direction, and MD to machine direction, Droop rigidity is higher in the machine direction. The higher the value the stiffer the paper.

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Typical Bending Values

Grade	Bending Moment Stiffness (mNm)		Resonance Length Stiffness (mNm)		
	MD	CD	MD	CD	
Coated Paper (135 g/m2)	65	45	1043	721	
Office/Business Paper (80 g/m2)	39	17	493	160	
Carbonless Paper (46 g/m2)	7.5	3.3	76	34	

Stretch (Elongation)

Stretch is the amount of distortion which paper undergoes under tensile stress. Stretch elongation is usually expressed, as percent stretch to rupture. Stretch can be related to the paper's ability to conform and maintain conformance to a particular contour, e.g. Copier paper, multicolor offset printing papers, liquids packing cartons base papers etc.

The tensile strain developed in a test sample at maximum tensile strength before rupture, measure as the % increase in the length of the sample to the original length.

Surface Strength (Wax Pick No.)

A measure of the surface strength of the sample or surface resistance to picking. Pick occurs due to poor internal bonding strength, making it susceptible to adherence to grade wax sticks (Dennison). This test is valid only for uncoated board or paper.

Acceptable pick level for uncoated papers =>Wax #6
Acceptable pick level for Gloss papers =>Wax #11

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Tearing Resistance

Tearing resistance indicates the behavior of paper in various end use situations
Tearing Resistance: Tearing resistance/ strengths is the ability of the paper to withstand any tearing force when it is subjected to. It is measure in both MD & CD, expressed in mN (mili Newton).

Typical Tear Resistance Values

Grade	Elmendorf Tear mN
Coating Base (80g/m2)	500 - 700
Bond (100g/m2)	700
Office/Business Paper (80g/m2)	500 - 600
Test Liner (186g/m2)	1800

Tensile Strength

The tensile force required to produce a rupture in a strip of paperboard, measured in MD & CD, expressed in kN/m. Tensile strength is indicative of fiber strength, fiber bonding and fiber length.

Tensile Energy Absorption (TEA): TEA is the Tensile Energy Absorption, ie the amount of work required to break the sheet under tension.

Z Direction Tensile Strength: Or internal bond strength provides an indication of strength of board in relation to glue bonding at carton side seams and possible.

Typical Tensile Index Values

Grade	MD (Nm/g)	CD (Nm/g)
Newsprint (40 - 49g/m2)	45 -60	-
Tracing Paper (60-110 g/m2)	70	40

Test Liner (186 g/m2)	175	80
Wet Strength		

Ash Content

The residue left after complete combustion of paper at high temperature. It is generally expressed as percent of original test sample and represents filler content in the paper.

Typical Ash Content Values

Grade	%
Market Wood Pulp	0.3 - 0.5
Newsprint	0 - 12
LWC	30 - 50

Dirt Content

The paper may have number of dirt specks or contraries. These specks can be any unwanted foreign particle that is visible to the eye such as bark, undigested wood (shives), pitch, rust, plastic, slime etc. The number of specks of each area are expressed either as mm2/Kg for pulp or mm2/m2 for paper

Typical Dirt Content Values
Grade %
Bleached Market Wood Pulp < 7 mm2/Kg
Newsprint from deinked pulp 100-300 ppm
Fine Paper from deinked pulp < 10 ppm

pH

The pH value of paper can show residual acidic/alkaline chemicals in pulp, or atmospheric pollutants (e.g. SO2) in valuable paper archives.

The pH value of paper can be determined by:
- Disintegrating the paper in hot distilled water and determining the pH of the extract.
- Disintegrating the paper in cold distilled water and determining the pH of the extract.
- Directly using a wet electrode on the paper surface.

These 3 methods measure different solutions and so give different

Permanence

Permanence is degree to which paper resists deterioration over time. Permanent paper can resist large chemical and physical changes over and extended time (several hundred years). These paper are generally acid-free with alkaline reserve and a reasonably high initial strength. Paper containing pure cellulose fiber are more permanent. Permanency is desirable in Map, currency, bond and record papers.

Pin Holes

Imperfections in paper which appear as minute holes upon looking through the sheet. They originate from foreign particles, which are pressed through the sheet. Absence of pin hole in electrical grade papers is very important.

Porosity

Because paper is composed of a randomly felted layer of fiber, it follows that the structure has a varying degree of porosity. Thus, the ability of fluids, both liquid and gaseous, to penetrate the structure of paper becomes a property that is both highly significant to the use of paper. Paper is a highly

porous material and contains as much as 70% air. Porosity is a highly critical factor in Printing Papers.

Air Resistance (Gurely Method): It is the resistance to the passage of air, offered by the paper structure, when a pressure difference exist between two sides of paper. It is measured as the time for a given volume of air to flow through a specimen under specified conditions. Air resistance is indirect indicator of degree of beating, compaction of fibers and type and amount of fillers.

Air Resistance (Sheffield Method): is explained in TAPPI T 547

Typical Porosity Values

Grade	Gurley Air Resistance (sec)	Bendtsen (mls/min)
Uncoated Paper	500-1500	
Test Liner (186 g/m2)	25	
Gasket	1-5	
Blotting Paper	1 -2	

Print Quality

The degree to which the appearance and other properties of a print approach a desired result. Lot of parameters in paper surface like roughness, gloss, ink absorption, whiteness, brightness affect this.

Printability

The extent to which properties of paper lends them to the true reproduction of the original artwork. This is influenced by the

Sizing / Cobb

Because paper is composed of a randomly felted layer of fiber, it's structure has a varying degree of porosity. Thus, the ability of fluids, both liquid and gaseous, to penetrate the structure of paper becomes a property that is both highly significant to the use of paper. The need to limit the spreading of ink resulted in "sizing" the paper with gelatinous vegetable materials which had the effect of sealing or filling the surface pores. Later, the term "sizing" was applied to the treatment of paper stock prior to the formation of the sheet, with water-repellent materials such as rosin or wax. Resistance towards the penetration of aqueous solution / water is measured by Sizing or Cobb values.
The surface water absorption over 60 seconds, expressed in g/m2, measured by Cobb Test.
Typical Cobb Values

Grade	g/m2
Bond	24-30
Office/Business Paper	22-26
Test Liner (186 g/m2)	100
Unsized	50+
Carbonless Base	18-22

Water Absorption (EDGE WICK)

Water absorption at the edge, expressed in kg/m2, using Wick Test. Board surface is sealed with waterproof tape on both sides, weighed, placed in water @ 80°F for 20 minutes and weighed again to measure the water absorbed by wicking.

74- OFFSET PRINTING INKS

Offset Lithographic Inks:

There are four common types Lithographic inks –they are as follow:

i). Petroleum Based
ii). Vegetable Oil Based
iii). UV & EB Curable
iv). Heatset

Unlike Gravure, Flexo, and Screen are very viscous to the point they are paste-like. Litho inks are generally very strong in color value to compensate for the lesser amount applied. Sheetfed litho inks are similar to oxidizing types of letterpress inks. To accelerate drying and control ink flow characteristics litho inks contain solvents (or drying oils) which result in some VOC emissions from the ink.

Petroleum Based
Linseed and rapeseed (canola) oil have been added to litho inks for years, but other vegetable oils like soybean oil are more frequently being used because because of their lower VOC content, which helps eliminate smudging.

Heatset
Heatset Inks are completely different from non-heatset inks and cannot be interchanged between the two types of presses. Heatset inks are quick drying inks for web printing. The solvents are vaporized as they pass through resins fixed to the paper in such a way that there is no chance for the ink to spread, smear, or soak into the paper. Heatset presses are equipped with a drier, and a chilling system to cool the heated resins and set the image. Heatset inks emit a

significantly greater amount of VOC as compared to non-heatset lithographic inks. Therefore most heatset presses are also equipped with pollution control equipment such as a thermal oxidizer or after burner to destroy the high volumes of VOCs that are being emitted from these inks.

UV & EB Curable
Ultraviolet (UV) and Electron Beam (EB) curable inks are also available for litho printing, but the press must be properly equipped to run these types of inks. The use of UV curable inks is on the rise, particularly for the application of overprint coatings.

Vegetable Oil Based
One advantage of low VOC content is the ability to operate presses at comparable speeds to conventional inks, versus the slow drying and slow press speeds associated with water-based coatings.

Problems:
One disadvantage is VOC equipment can be costly and is still in the development stage, and the inks and coatings may cost as much as three times the price of conventional coatings.

Electron beam curing inks make a good alternative to U.V. inks because they are less costly and less reactive materials can be used. They also require less energy than U.V. curing inks. The down side of E.B. curing inks is the capital costs to outfit a press. Additionally, EB inks, like UV inks, can be a skin irritant. The inks, if exposed to sensitive skin or left on skin, may cause dermatitis and could even cause chemical burns.

SECTION VII - DIGITAL PRINTING PROCESS

Constituents:
Ink is a primary tool used to transfer an image and give specific picture to a substrate. For this to occur an ink must have specific properties if it is to perform properly. It is of no value if it will not

transfer to the substrate or adhere in a proper manor. The contents of any ink are dependent on the conditions under which the products are to be printed and the end use requirements of the printed piece. At its basic definition ink is a combination of components mixed together to form a fluid capable of printing from a printing press. The basic constituents of the inks are:

- **COLORANT/PIGMENT**
- **VEHICLE/VARNISH**
- **ADDITIVES**

COLORANT/PIGMENT

Colorant/pigment is probably the most important item in ink because it conveys the visual identity of an ink. Pigments give color to a substrate by either remaining on the surface or having a tendency to fill in voids on the substrate. Colorant/Pigment is provided to the ink manufacturer in two forms, a dry powder, or in a paste form where the pigment has been wetted with a varnish/vehicle. Most are synthetic materials produced from petroleum chemicals, which are inorganic, while others are organic and formed by nature in mineral or vegetable form.

Pigments are grouped according to their chemical composition. Usually that means color. Each is identified by name and a color index number.
Example-
Lithol Rubine - Pigment Red 57:1.
Where 57 giving its identification number and the 1 indicates that it contains a percentage of Barium compound.

The basic pigment groups are:

1.Yellow
2. Orange
3. Red
4. Green
5. Blue
6. Violet
7. Black

8. White
9. Pearlescent
10. Metallic
11. Fluorescent

Each group contains various shades of hue. Example, yellow will vary from greenish yellow to bright warm yellow. Thus, one can have many different shades of each pigment to achievean optimum color match. Within each group of pigments there are several grades of pigment with a single color index reference. They each may differ in relative density, oil absorption and opacity. They each may have special properties such as light fastness and water resistance. Each can be modified to meet specific needs.

VEHICLE/VARNISH

Vehicle/Varnish is to which a pigment is suspended and allows for transfer of color to a substrate. Varnishes are a combination of different types of resins. Resins, by themselves, are of two basics types, natural and synthetic. Most resins today are synthetic and are made by polymerization involving condensation or addition reactions between relatively small molecules. Usually a vehicle/varnish is a combination of different varnishes, each designed to give ink a specific property or characteristic.

Vehicles/Varnishes are used to give ink body, a gel varnish for stiffness, varnishes used to give ink good flow properties, a lubrication varnish, varnishes for a hard dry ink, varnishes for

quick setting inks and varnishes that achieve a high or dull gloss effect. Vehicle/Varnish in general is used to achieve three specific functions:

1. Allow the pigment to be fully dispersed in an ink formulation and to give an over all stability to the finished product.
2. Allow an ink to transfer through the roller train of the printing press and onto the substrate.
3. Bind the pigment on to the printed surface.

Varnish has so many key properties and characteristics, that a combination of various types can be the difference between a good

performing ink and a bad performing ink. Extensive R&D takes place when formulating varnishes as a vehicle system to wet pigments.

ADDITIVES

The third component of ink is additives. Additives are very specialized components that give ink special properties that pigment and varnish will not do by themselves. The addition of additives is what really specializes an ink all to its own by the printer. Many of them are used in such small percentages, on a per batch bases, example, typically only 2% to 3%, by weight, of drying agents are mixed into a batch of ink.

One group of additives is oils and solvents. This group is used for flow and lubrication properties and can also influence drying characteristics. Various types of oils are linseed oil, which is obtained from the seeds of flax and tung oil, also known as china wood oil, is obtained from the seed of a nut. Mineral oils, or solvents, are petroleum-based products. At present, the substitutes to replace petroleum-based products with those that are obtained from plant matter such as tung and linseed.
Special waxes to impart mar-resistance, improve slip, rub and scuff properties of ink.

Driers

A very important component of ink is its drying mechanism. Driers are used as a catalyst to promote oxidation. In the presence

of driers, oxidation proceeds rapidly and the ink films dry hard in shorter periods of time. Cobalt and manganese are the two most common. Driers come in two forms, as a liquid drier or a paste drier.

CHARACTERISTICS OF INK

Following are the main characteristics of the ink;

- VISUAL
- GIVEN PROCESS
- DRY
- ADHERE
- RESISTANCE

VISUAL CHARACTER

Ink can be formulated in varying degrees with the use of different components. As a basic rule ink is formulated to give 5 characteristics in

order to perform. First, ink is to give visual character to a printed surface. Visual character can be broken down into three properties:

1. Hue - indicates what color the ink is.
2. Strength - is a measure of the color's intensity or saturation.
3. Purity - indicates how bright or dark a color is.

Types of pigments, varnishes, oils and solvents all can alter the inks hue, strength and purity.
Ink vehicle can also affect ink. It must be capable of keeping the pigment dispersed or you may have loss of strength or a vehicle that penetrates the substrate too much will lower strength.

PRINT BY A GIVEN PROCESS
Formulation of ink is greatly determined by the method of printing being used. Various types of printing, such as flexography, gravure, screen, UV, sheet fed or web inks all influence how the ink will be manufactured. Each process is most significant to the formulation of the ink. In SOI printing presses- lithographic inks requires more viscous and paste like than other types of inks.

SECTION VII - DIGITAL PRINTING PROCESS

DRYING CONDITIONS

- ABSORPTION
- OXIDATION
- EVAPORATION
- RADIATION

Inks are designed to dry by various means. The drying mechanism is dictated by the printing process being used and by the substrate being printed.

Absorption is when ink penetrates the fibers of a substrate and is absorbed into the substrate.

Oxidation is when the oxygen in the atmosphere chemically combines with the varnish system converting it from a liquid to a solid. A catalyst is used, a drier, to promote the oxidation of the drying oils. Oxidation rapidly proceeds and ink films dry hard in shorter periods of time.

Evaporation is when a solvent is physically removed from the ink leaving it to bind to the substrate. Radiation cure is with the use of ultraviolet, or UV, drying. Special UV inks must be used for this type of drying.

In most cases the printing press has some form of heat to speed the drying and setting process of the inks. Examples are IR driers, hot air knives and other forms of mechanical heat generated at or near the delivery of the press. This system is installed with the Hidelberg CD102 Printing Machine at Western printing Group, Delhi.

ADHERENCE TO A GIVEN MATERIAL
Ink is to adhere and bind the color to the substrate and keep it there. Pigments have little or no effect concerning adhesion. The adhesive nature of ink comes from the varnish system. Adhesion to various substrates uncoated, coated, matte, vinyl, acetate, foil or

other synthetic substrates must be taken into account when formulating ink.

RESISTANCE PROPERTIES
Inks must be able to resist certain types of chemical or physical attack. It must be able to withstand the rigors of the printing process itself. Conditions of high shear and heat generated on press as well as the addition of fountain solutions and alcohol.

75- NEW OFFSET PRINTING MACHINE

Survey of India is having two nos. of state of art printing machine – one is 5 color Heidelberg's Speedmaster CD 102, installed at WPG, Delhi and other one is 4 color KBA RAPIDA- 105-UNIVERSAL installed at SPG, Hyderabad. Brief details is given bellow about the Heidelberg's Speedmaster CD 102.

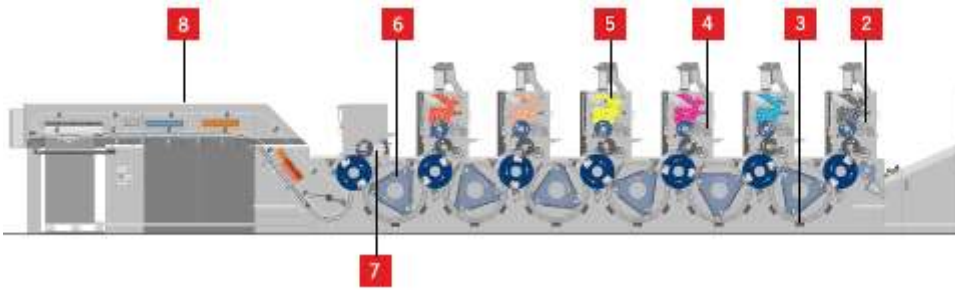
Speedmaster CD 102

SECTION VII - DIGITAL PRINTING PROCESS

The enhanced performance delivered by the new Speedmaster CD 102 from Heidelberg have brought many advantages, such as a high degree of automation and cost-effectiveness and the quality of the printed result.

Enhanced preset functions reduce manual setup work to ensure ease of operation. Moreover, digital integration into the print shop's workflow suggested that jobs can be processed in due time. Advanced automation and further improvements to the feeder and delivery enhanced the Speedmaster CD 102 performance. This machine is designed the press-system and have added a large number of ergonomic refinements - innovations which make the Speedmaster CD 102 not just the most productive press in its format class, but offers a whole new standard in well thought-out functionality.

Speedmaster CD 102 – Flow diagram



Details

The Speedmaster CD 102, the 70x100 (For SOI 72 x 102) universal straight printing press from Heidelberg, offers you a high degree of automation. Tag wise description is given bellow;

SECTION VII - DIGITAL PRINTING PROCESS

1

Preset Plus Feeder - this suction tape feeder opens up new dimensions and has been designed with top performance and reliability, delivering stable, precise sheet travel with sheet thicknesses of up to 0.8 millimeter (0.03 inch).

Preset Plus substantially expands the functionality of the suction head, a feedboard featuring a centered suction tape without sheet

smoother, and multistage sheet monitoring. Saving of job-specific air settings and extended preset capabilities in the CP2000 Center are further highlights.

The automatic non-stop unit considerably facilitates pile change as all functions can be easily activated at the push of a button without the need for manual intervention. In combination the Logistics system, pile change is initiated automatically as soon as the pile height falls below a certain pre-defined level.

2

Modular blanket washup device - program-controlled via CP2000 Center and suitable for both detergent and water applications.

The modular blanket washup device is a self-contained system. It is printing-unit-compatible and can therefore be exchanged between the individual printing units. The entire device can be easily cleaned outside the press independently of the production

run. The washup programs are controlled centrally via the CP2000 Center.**3**

Air Transfer - contact-free sheet guidance of all types of stock , patented Venturi technology.

The patented Air Transfer technology makes the Speedmaster CD 102 the ideal press for serving wide range of printing stock. The blast air is blown outward from the middle of the press by Venturi nozzles. This generates a cushion of air on which the sheet rides while smoothly adapting to the shape of the sheet guide plate. The Air Transfer System is controlled by the CP2000 Center - simply, quickly and with absolute precision - ensuring non-smear print results even at top press speeds.

4

Continuous dampening system Alcolor - constant print quality is ensured by stable feeding of dampening solution.

The speed-compensated and program-controlled Alcolor continuous dampening system ensures consistency over the entire run by

producing a uniform dampening film and a stable ink-water balance. A further advantage of the dampening system is the fact that it can be changed over easily to alcohol-reduced printing. The Vario system prevents hickeys forming on the plate due

to a speed differential between the dampening form roller and the plate cylinder.

5

Inking unit - equipped with optimized, quick-action ink fountains for ink constancy over long job runs.

The quick-response, high-capacity inking units of the Speedmaster

CD 102 ensure stable inking over the entire run, thereby maximizing print quality. Precise inking unit temperature control delivers uniform cond- itions from the first sheet to the last. The process-controlled zero oscillation option automatically shuts down lateral oscillation, thereby preventing any unwanted leveling out of the set inking profile. A remote adjustment facility enables the time at which oscillation starts to be changed precisely from the CP2000 Center without the need for tools.

6

Remotely adjustable diagonal register - the remotely adjustable diagonal register for the coating & print unit cuts make-ready times

and reduces startup waste.

Motor-driven inclination of the transfer cylinder ahead of the coating unit of

the Speedmaster CD 102 also enables defined and reproducible diagonal adjustment of the coating register at all times. The diagonal register is adjusted from the CP2000 Center in the same way as other (Print) register adjustments - namely by a single click. The main economic advantage lies

in the fact that all register settings in the printing and coating units can be made in parallel.

7

Preset Delivery - in combination with the extended delivery offers an optimum drying and travel path for a wide range of coating applications.

The modular design of the Delivery allows you to select the optimum solution from a large range of options to suit individual requirements regarding quality and speed. The installed dryer series

and the powder spray device can be completely controlled from the CP2000 Center . All major air and format settings can also be performed conveniently on the CP2000 Center or the operating panel on the delivery. Its special shape allows air to pass through and virtually eliminates air turbulence in front of and behind the bar. At the same time, the distance between the gripper bar and the sheet guide path has been reduced to maximize the efficiency of the sheet guide plate.

Speedmaster CD 102

Technical Data

Printing Stock

Thickness	0.03 - 1.0 mm (0.0012 - 0.039 in)

SECTION VII - DIGITAL PRINTING PROCESS

Max. sheet size	720 x 1,020 mm (28.35 x 40.16 in)
Min. sheet size	340 x 480 mm (13.39 x 18.90 in)
Max. print format	700 x 1,020 mm (27.56 x 40.16 in)
with AutoPlate	710 x 1,020 mm (27.95 x 40.16 in)
Gripper margin On Plates	10 - 12 mm (0.39 - 0.47 in)
Length x width (max.)	770 x 1,030 mm (30.31 x 40.55 in)
with AutoPlate	790 x 1,030 mm (31.10 x 40.55 in)
Thickness	0.2 - 0.5 mm (0.008 - 0.02 in)
with AutoPlate	0.2 - 0.3 mm (0.008 - 0.012 in)
Plate cylinder	
Undercut	0.5 mm (0.02 in)
with AutoPlate	0.15 mm (0.006 in)
Distance from leading edge of plate to start of printing	43 mm/52 mm (1.69/2.05 in)
Coating plate cylinder	
Undercut	3.2 mm (0.13 in)
Length x width of coating plate	780 x 1,030 mm (30.71 x 40.55 in)
Length x width of metal-edged coating blanket	800 x 1,048 mm (31.50 x 41.26 in)
Distance from leading edge of	

coating plate to start of coating 43 mm (1.69 in)

Max. coating area 710 x 1,020 mm (27.95 x 40.16 in)
Blanket cylinder
Undercut 2.3 mm (0.09 in)
Length x width of metal-edged blanket 840 x 1,052 mm (33.07 x 41.42 in)
Blanket thickness 1.95 mm (0.08 in)
Pile heights (incl. pile support plate and pile board)
Preset feeder 1,230 mm (48.43 in)
Preset Plus feeder 1,320 mm (51.97 in)
Preset delivery 1,205 mm (47.44 in)
Preset Plus delivery 1,295 mm (50.98 in)
Raised press + 500 mm (19.69 in)

POST PRESS SYSTEM – DESPATCHING

Postpress Operations

Postpress operations consist of four major processes:
Cutting, folding, assembling, and binding. Not all printed products, however, are subjected to all of the processes. For example, simple folded pamphlets do not undergo binding.
There are many additional lesser postpress finishing processes such as varnishing, perforating, drilling, etc. Some types of greeting cards are dusted with gold bronze. Printed metal products are formed into containers of various sizes and shapes. Many metal toys are prepared in the same manner. Containers may also be coated on the inside to protect the eventual contents. Other substrates may be subjected to finishing processes that involve pasting, mounting, laminating, and collating. There are also a number of postpress operations unique to screen printing including die cutting, vacuum forming, and embossing.
A limited number and volume of chemicals are used in postpress operations. The major type of chemicals used in

postpress are the adhesives used in binding and other assembly operations. Because chemical usage is limited, only a brief overview of each of the four major postpress operations is provided.

Cutting

The machine typically used for cutting large web-type substrates into individual pages or sheets is called a guillotine cutter or "paper cutter". These machines are built in many sizes, capacities, and configurations. In general, however, the cutter consists of a flat bed or table that holds the stack of paper to be cut. At the rear of the cutter the stack of paper rests against the fence or back guide which is adjustable. The fence allows the operator to accurately position the paper for the specified cut. The side guides or walls of the cutter are at exact right angles to the bed. A clamp is lowered into contact with the top of the paper stack to hold the stack in place while it is cut. The cutting blade itself is normally powered by an electric engine operating a hydraulic pump. However, manual lever cutters are also still in use.

To assist the operator in handling large reams of paper which can weigh as much as 200 pounds, some tables are designed to blow air through small openings in the bed of the table. The air lifts the stack of paper slightly providing a near frictionless surface on which to move the paper stack.

The cutter operator uses a cutting layout to guide the cutting operation. Typically, the layout is one sheet from the printing job that has been ruled to show the location and order of the cuts to be made. Though cutting is generally considered a postpress operation, most lithographic and gravure web presses have integrated cutters as well as equipment to perform related operations such as slicing and perforating.

Folding

Folding largely completes postpress operations for certain products such as simple folded pamphlets. Other products are folded into bunches, known as signatures, of from 16 to 32 pages. Multiple signatures are then assembled and bound into books and magazines. Though folding is generally considered a postpress operation, most lithographic and gravure web presses are equipped with folders. Three different folders are used in modern print shops. They range in complexity from the bone folder to the buckle folder. Bone folders have been used for centuries and are made of either bone or plastic. These folders are simple shaped pieces of bone or plastic that are passed over the fold to form a sharp crease. Today, they continue to be used, but only for small, very high quality jobs. Knife folders use a thin knife to force the paper between two rollers that are counter-rotating. This forces the paper to be folded at the point where the knife contacts it. A fold gauge and a moveable side bar are used to position the paper in the machine before the knife forces the paper between the rollers. The rollers have knurled surfaces that grip the paper and crease it. The paper then passes out of the folder and on to a gathering station. Several paper paths, knives and roller sets can be stacked to create several folds on the same sheet as it passes from one folding station to another. Buckle folders differ from knife folders in that the sheet is made to buckle and pass between the two rotating rollers of its own accord. In a buckle folder, drive rollers cause the sheet to pass between a set of closely spaced folding plates. When the sheet comes in contact with the sheet gauge, the drive rollers continue to drive the paper causing it to buckle over and then pass between the folding rollers.

SECTION VII - DIGITAL PRINTING PROCESS

Assembly

The assembly process brings all of the printed and non-printed elements of the final product together prior to binding. Assembly usually includes three steps: gathering, collating, and inserting.

Gathering is the process of placing signatures next to one another. (A signature is a bunch of printed sheets ranging from 16 to 32 pages.) Typically, gathering is used for assembling books that have page thicknesses of at least 3/8 inch. Collating is the process of gathering together individual sheets of paper instead of signatures. Inserting is the process of combining signatures by placing or "inserting" one inside another. Inserting is normally used for pieces whose final thickness will be less than one-half inch.

Assembly processes can be manual, semiautomatic or fully automatic. In manual assembly operations, workers hand assemble pieces from stacks of sheets or signatures laid out on tables. Sheets or signatures are picked up from the stacks in the correct order and either gathered, collated, or inserted to form bindery units. Some printers use circular revolving tables to assist in this process. However, due to the high cost of labor, manual assembly is used only for small jobs.

Semiautomatic assembly is completely automated except that stacks of sheets or signatures must be manually loaded into the feeder units. During semiautomatic inserting, operators at each feeder station open signatures and place them at the "saddlebar" on a moving conveyer. The number of stations on the machine is determined by the number of signatures in the completed publication. Completed units are removed at the end of the conveyer and passed on to the bindery.

Automatic assemblers are similar to semiautomatic units except that a machine and not a person delivers the sheets or signatures to the feeder station and places them on the

conveyor. In order to improve efficiency, automatic assemblers are typically placed in line with bindery equipment.

Binding

Binding is categorized by the method used to hold units of printed material together. The three most commonly used methods are adhesive binding, side binding, and saddle binding. Three types of covers are available to complete the binding process: self-covers, soft-covers, and casebound covers.

Binding Methods

Adhesive binding, also known as padding, is the simplest form of binding. It is used for note pads and paperback books, among other products. In the adhesive binding process, a pile of paper is clamped securely together in a press. A liquid glue is then applied with a brush to the binding edge. The glue most commonly used in binding is a water-soluble latex that becomes impervious to water when it dries.

For note pads, the glue used is flexible and will easily release an individual sheet of paper when the sheet is pulled away from the binding. Adhesive bindings are also used for paperback books, but these bindings must be strong enough to prevent pages from pulling out during normal use. For paperback book binding, a hot-melt glue with much greater adhesive strength than a water-soluble latex is applied. A piece of gauze-like material is inserted into the glue to provide added strength.

In side binding, a fastening device is passed at a right angle through a pile of paper. Stapling is an example of a simple form of side binding. The three other types of side binding are mechanical, loose-leaf, and side-sewn binding.

A common example of a form of mechanical binding is the metal spiral notebook. In this method of binding, a series of

holes are punched or drilled through the pages and cover and then a wire is then run through the holes. Mechanical binding is generally considered as permanent; however, plastic spiral bindings are available that can be removed without either tearing the pages or destroying the binding material. Mechanical binding generally requires some manual labor.

Looseleaf bindings generally allow for the removal and addition of pages. This type of binding includes the well known three-ring binder.

Side-sewn binding involves drilling an odd number of holes in the binding edge of the unit and then clamping the unit to prevent it from moving. A needle and thread is then passed through each hole proceeding from one end of the book to the other and then back

again to the beginning point. This type of stitch is called a buck-stitch. The thread is tied off to finish the process. Both semiautomatic and automatic machines are widely used to perform side-stitching. The main disadvantage of this type of binding is that the book will not lie flat when opened.

In saddle binding one or more signatures are fastened along their folded edge of the unit. The term saddle binding comes from an open signature's resemblance to an inverted riding saddle. Saddle binding is used extensively for news magazines where wire stitches are placed in the fold of the signatures. Most saddle stitching is performed automatically in-line during the postpress operations. Large manually operated staplers are used for small printing jobs. Another saddle binding process called Smythe sewing is a center sewing process. It is considered to be the highest quality fastening method used today and will produce a book that will lie almost flat.

Covers

Self-covers are made from the same material as the body of the printed product. Newspapers are the most common

example of a printed product that uses self-covers. Soft covers are made from paper or paper fiber material that is somewhat heavier or more substantial than the paper used for the body of the publication. This type of cover provides only slight protection for the contents. Unlike self-cover, soft covers almost never contain part of the message or text of the publication. A typical example of the soft cover is found on paper-back books. These covers are usually cut flush with the inside pages and attached to the signatures by glue, though they can also be sewn in place.

Casebound covers are the rigid covers generally associated with high-quality bound books. This method of covering is considerably more complicated than any of the other methods. Signatures are trimmed by a three-knife trimming machine to produce three different lengths of signature. This forms a rounded front (open) edge to give the finished book an attractive appearance and provides a back edge shape that is compatible with that of the cover. A backing is applied by clamping the book in place and

splaying or mushrooming out the fastened edges of the signatures. This makes the rounding operation permanent and produces a ridge for the casebound cover.
Gauze and strips of paper are then glued to the back edge in a process called lining-up. The gauze is known as "crash" and the paper strips are called "backing paper." These parts are eventually glued to the case for improved strength and stability. Headbands are applied to the head and tail of the book for decorative purposes. The case is made of two pieces of thick board, called binder's board, that is glued to the covering cloth or leather. The covering material can be printed either before or after gluing by hot-stamping or screen methods. The final step in case binding consists of applying end sheets to attach the case to the body of the book.

SECTION VII - DIGITAL PRINTING PROCESS

In-Line Finishing
Historically, the finishing operations described above were labor-intensive operations handled either in-house or by trade shops. Even when performed in-house, finishing operations generally were not integrated with the presses or with each other. Today, web presses are often linked directly to computer controlled in-line finishing equipment. Equipment is available to perform virtually all major post-press operations including cutting, folding, perforating, trimming, and stitching (Adams). In-line finishing equipment can also be used to prepare materials for mailing. The computer can store and provide addresses to ink-jet or label printers, which then address each publication in zip code order (Adams).
One of the most important results of computer in-line finishing is the introduction of demographic binding, the selective assembly of a publication based on any one or more of a number of factorsincluding geographic area, family structure, income, or interests. For example, an advertisement will appear only in those copies of a magazine intended for distribution in the advertisers selling area. Demographic binding has proven to be a successful marketing tool and is already widely used, especially by major magazines (Adams).

One comparison found that the use of in-line finishing equipment can reduce the number of operators and helpers required for an off-line finishing operation by almost half, while at least doubling the rate of production (Adams).

SECTION VIII - NOTES OF TECHNICAL INTEREST

79. Geological Maps – The publication of geological maps is frequently undertaken for the Geological Survey of India, and involves an elaborate and intricate procedure. The basis of these maps is the complete outline of the published Survey of India sheets printed in black or grey on which geological information is printed in colours which may be tints or solids or combinations of the two.

The first step in the procedure is the supply of black prints on Hollingworth paper or any other suitable paper or drafting material of the sheets concerned, to the Geological Survey. These are joined up to make an original complete with borders and returned to the Reproduction Office for the supply of a metal-mounted blue print scribe guides as the case may be. On this, geological details such as limits to colours, colour index, name of the map, and any other geological information which will appear on the finished map in the same colour, is shown. This is known as the colour outline original, and is returned to the Reproduction Office for the supply of grey prints for colour guides and metal-mounted blue-prints or scribe guides.

On these metal-mounted blue-prints or scribe guides geological signs and lines and patches of solid which will be printed in the same colour are drawn or scribed. Signs or symbols of the

same shape but which will be printed in different colours on the finished map may be dawn on the same original, but must be differentiated by different non-actinic colours such as black, red, green or yellow. (They will of course be shown in their correct colours in the colour guide). On the whole, however, it is generally more satisfactory to show them on separate metal-mounted blue-prints.

SECTION VIII - NOTES OF TECHNICAL INTEREST

These originals and colour guide are sent to the Reproduction Offices for the supply of proofs for examination and press order. The task of the Reproduction Office is now a very difficult and complicated one and much thought is required before the work can be commenced. Decisions have to be reached on the tints to be employed and whether they are to be dark, medium or light the number of plates required, and which colour must be sur-printed over others to obtain the exact shade of colour required. A good aid in such matters is the colortrol chart which can be used to decide on shades of colour combinations.

Tint plates of large and duplicated areas are obtained by printing through a glass stencil or window negative of the colour outline original, and a screen. Tints in the smaller areas are also obtained by gumming out a set off from the plate of the outline original and transferring the tint, or by the Ben Day shading medium.

The screens used with the glass stencils and window negatives are generally line screens and the tints transferred are line tints. The reason for this is that if two or three shades of the same colour are required on one plate the darkest is painted in solid, and the medium is made by superimposing another tint at right angles to the first. This of course involves gumming out the area which will only have the single line tint.

In proving in colours the first plate to be put down is that of the colour outline original as the others have to fit onto the limits shown on this. The second plate is that with the deepest colour or most difficult registration, and so on, till

finally all colours are printed. The proof is now sent out for approval and press order.

80. Weights and Measures - The general custom up to now in writing formulae for photographic and similar purposes was to use apothecaries weight but chemicals were sold according to avoirdupois weight. With the introduction of metric system, formulae will be written and chemicals sold on the same uniform system.

Weight

1 microgram	=	0.001 milligram
1 milligram	=	0.001 gram
1000 milligrams (mg)	=	1 gram (g)
1000 grams	=	1 kilogram (kg)
1 metric ton	=	1000 kg

Measure

1000 millitres (ml)	=	1 litre (1000 cubic centimeters)

Length

10 millimetres	=	1 centimetre
100 centimetres	=	1 metre
1 hectometre	=	100 metres
1 kilometre	=	1000 metres

SECTION VIII - NOTES OF TECHNICAL INTEREST

Conversion factors

15.43 grains	=	1 gram,
1 ounce	=	28.350 grams
1 pound	=	454 grams
1 pint	=	0.568 litre
1 gallon	=	4.546 litres
1/16 inch	=	1.59 millimetres
1/8 inch	=	3.17 millimetres
1/4 inch	=	6.35 millimetres
1/2 inch	=	12.70 millimetres
3/4 inch	=	19.05 millimetres
1 inch	=	25.4 millimetres
1 foot	=	30.48 centimetres
1 yard	=	0.9144 metre
1 mile	=	1.609 kilometers
1 square inch	=	645.16 square millimeter
1 cubic inch	=	16.38702cubicentimeters
Fahrenheit to Centigrades	=	(ºF -32) X 5/9
Centigrades to Fahrenheit	=	(ºC X 9/5) + 32

Paper Weight Formulae

The weight in kilograms of paper of a given size in centimeters and a given substance in grams per square metre is calculated as follows:

Ream weight in kgs = Size in cms x GSM x No. of Sheets in ream (or gross) x 10^{-7} (1/100,00,000)

The substance of paper or board in grams per square metre (gsm), when the ream weight in kilograms of paper (or

gross weight in kilograms of board) of a definite size in centimeters is known, may be calculated as follows:

$$\text{Substance in gsm} = \frac{\text{Ream weight in kgs} \times 10^{-7}\ (1/100{,}00{,}000)}{\text{Size in cms} \times \text{No. of sheets in ream}}$$

APPENDIX – I DESIGNATIONS FOR TECHNICAL PERSONNEL

1. Despatcher
2. Electrician
3. Litho Draftsman
4. Litho Printer
5. Negative Keeper
6. Photographer
7. Plate Keeper
8. Printer Down Operator
9. Printer Mechanic
10. Prover
11. Record Keeper
12. Retoucher Photo
13. Store Keeper
14. Senior Reprographer

APPENDIX – II A GLOSSARY OF TERMS AND ABBREVIATIONS USED IN REPRODUCTION OFFICES

Print Original	A printed copy of a map used as an original
Surprint Original	An original of additional matter for Over printing.
Deletion Guide	A guide prepared in colours on a grey print of the complete outline showing all work to be deleted from standing negatives in cases when corrections to a sheet are to be added by means of an insertion original
Tint Original	A supplementary original prepared in solid colour on a metal mounted blue-print showing areas to be tinted or printed in solid colour, such as cultivated areas.
Insertion Original	A fair drawn original prepared on a blue print of the complete outline on undistorting material showing all new work to be added by direct photographic combination.
Shade Original	A supplementary original made on a combined blue-print and stump shaded for half-tone reproduction.
Grid Original	A supplementary original prepared on a metal mounted drawing blue-print on which the grid has been drawn up in black.
Preliminary Prints	Prints issued for preparation of POPs and generally taken to include material for colour patterns and tint original
Boundary Guide	A guide prepared in colour on a black print to indicate colours and widths of boundary ribands to be printed.

APPENDIX – II A GLOSSARY OF TERMS

Layer Guide	A guide prepared in colours on a grey print of the original to assist in preparation of the layer stencils
Colour Proofs	Proofs in colours for final examination, approval and press order
Stripping in negative	A collodion negative of new matter specially prepared for stripping into plate on another collodion negative
Albumen plate	The exposed and developed grained metal plate ready for printing
Gum Reversal Plate	A printed-down metal plate made by the Gum Reversal Deep Etch Process
SOI	Survey of India
C.O.	Complete outline as applied to original, negative or plate.
Beaume	A system of specifying the density of a liquid by a number. Degrees beaume are measured on a Beaume hydrometer. A higher number signifies greater density.
Tints	Colour washes applied to areas on a map. Tints may be dot tints, single line or crossed line tints
Solids	Areas printed in solid colour as opposed to tints
Direct Negative Plate or Print	One in which no lateral reversal has taken place.
Reverse Negative, Plate or Print	One on which the work is laterally reversed.

APPENDIX – II A GLOSSARY OF TERMS

DTP	…..	Desk Top Publication
CTF	…..	Computer to Film
CTP	…..	Computer to Plate
PS	…..	Pre-sensitive/Post Script
TIFF	…..	Tagged Image File Format
RLE	…..	Run Length Encoding
CD	…..	Compatible Dia/ Compact Disc
CPU	…..	Central Processing Unit
UPS	…..	Un-interrupted Power Supply
RUM	…..	Read on Memory
RAM	…..	Read Access Memory
OSM	…..	Open Series Map
DSM	…..	Defence Series Map
NPG	…..	Northern Printing Group
EPG	…..	Eastern Printing Group
WPG	…..	Western Printing Group
SPG	…..	Southern Printing Group
GDC	…..	Geo-spatial Data Centre
PO	…..	Press Order
PI	…..	Publication Instructions
BI	…..	Blue Indent
POP		Press Order Proof
DD		Double Demy
QD		Quad Demy
GSM		Gram/Square/Metre
RS		Register Slip
UV		Ultra Violet
FLIP		Flight Information Publication
RR		Roland Rekord

APPENDIX III – USEFUL DIMENSIONS

Sheet Sizes of Printing Paper (English)

		Size in Inches	Size in mm
Quad Demy (Special)	…..	48 ½ x 35 ½	1232 x 902
Quad Demy	…..	45 x 35	1143 x 889
Double Demy	…..	35 x 22 ½	889 x 572
Demy	…..	22 ½ x 17 ½	572 x 444
Imperial	…..	30 x 22	762 x 559
Double Crown	…..	30 x 20	762 x 508
Crown	…..	20 x 15	508 x 381
Double Foolscap	…..	27 x 17	686 x 432
Foolscap	…..	17 x 13 ½	432 x 343
Royal	…..	25 x 20	635 x 508
Post	…..	19 ½ x 15 ¾	495 x 400

Printing Paper commonly used in Reproduction Offices

Map Printing Paper

Weight	Substance (gsm)	Size in mm
62.9 kg.	100	… 1270 x 990
51.7 kg.	100	… 1150 x 900
55.3 kg.	100	… 1230 x 900
26.2 kg.	100	… 860 x 610
27.5 kg.	100	… 860 x 640

APPENDIX III – USEFUL DIMENSIONS

Drawing Paper

Weight	Size in inches	Size in mm
136 kg. …	46 x 36 ½	1170 x 930
113 kg. …	53 x 31	1340 x 790
109 kg. …	53 x 31	1350 x 790
		840 x 1040

Standard Sheet Sizes of Printing Paper
A-SERIES (TRIMMED)

Designation	Size in mm
A0 …	… 841 x 1189
A1 …	… 594 x 841
A2 …	… 420 x 594
A3 …	… 297 x 420
A4 …	… 210 x 297

APPENDIX III – USEFUL DIMENSIONS

Metal Plates

	Size in Inches	Size in mm
Roland Rekord (Single Colour)	40 $^{9}/_{16}$ x 32 $^{5}/_{16}$	1030 x 820
Quad Demy	48 ½ x 40 ½	1230 x 1030
Double Demy	31 x 37	940 x 790
HMT (Single Colour)	30 ¼ x 38 ½	770 x 980
HMT (Double Colour)	30 ¼ x 36 ½	770 x 925
Monarch Crabtree	48 ½ x 41	1230 x 1040
Plenata	49 $^{5}/_{8}$ x 41	1260 x 1040
Sovereign Crabtree	50 x 43	1270 x 1090
Roland Rekord (Two Colour)	38 ½ x 29 ¾	975 x 755
Roland Rekord (Four Colour)	40 $^{9}/_{16}$ x 31 $^{5}/_{16}$	1030 x 795
Mailander Press	55 x 47	1400 x 1200
Dufa VII Press	57 $^{7}/_{8}$ x 45 $^{7}/_{8}$	1470 x 1165
FAG 104 Proof Press		1080 x 870
CD-102 Heidelburg (Five Colour)		790 x 1020
KBA (Four COlour)		795 x 1050
Heidelburg (Single Colour)		790 x 1020

Process Camera

	Size in Inches	Size in mm
Room Camera (Max. size)	48 x 36	1220 x 910
Klimsch Super Autohorika	40 x 40	1016 x 1016
Klimsch Commodore	50 x 50	1250 x 1250
Monotype Camera (NPG only)	40 x 40	1016 x 1016

APPENDIX III – USEFUL DIMENSIONS

	Size in Inches	Size in mm
Circular Glass Half-tone Screen(133 line)	(i) 49 ½ dia	1255
	(ii) 56	1420
	(iii) 48	1220
Screen (150 line)	56	1420
Rectangular Glass Half-tone Screen (133) line	48 x 40	1215 x 1016

Other Half-tone Screens Used

	Size in Inches	Size in mm
Glass Half-tone Screen(133 line)	36 x 24	910 x 610
Glass Half-tone Screen (133 line)	24 x 20	610 x 510
Glass Half-tone Screen (100 line)	30 x 20	760 x 610
Glass Half-tone Screen (80 line)	30 x 24	760 x 610
Magenta Contact Screen(133 line)	23 x 22	580 x 560

OFFSET Printing Machines

Maximum Size of Printing Area

	Size in Inches	Size in mm
*Monarch Crabtree	48 x 36	1220 x 915
#Pleneta	48 ¾ x 34 5/8	1240 x 880
Sovereign Crabtree	49 ½ x 37 ½	1257 x 953
Roland Rekord (Single Colour)	40 x 28	1020 x 710
HMT (Single Colour)		645 x 965
HMT (Double Colour)		645 x 910
Roland Rekord (Two Colour)	38 x 25 3/18	965 x 640
Roland Rekord (Four Colour)	40 x 28	1020 x 710
Heidelburg (Five COlour)		710 x 1020
Heidelburg (Single Colour)		710 x 1020
K.B.A. Rapida 4 colour		710 x 1030

- *Equivalent to Double Demy size.
- #Equivalent to Quad Demy size.

APPENDIX IV – SPECIFICATION FOR MAP LITHO PAPER

ANALYTICAL REQUIREMENTS:

Sl. No.	Characteristic	Requirements
1.	GSM	100 ±2.5%
2.	Thickness, Microns	120 ± 10
3.	Breaking length (min.).	
	CD	3000
	MD	5500
4.	Tearing Index mN m2g(min)	9
5.	Burst Index KPa M2/g (Min)	1.75
6.	Folding endurance each direction (Min)	150 double folds
7.	One Minute COBB Test Max	20
8.	Wax Pick	No pick kon 7A
9.	Brightness Min	75
10.	Opacity, percent (Min)	90
11.	Moisture Percent by Mass (max)	08
12.	Ash Percent (max)	15
13.	Smoothness, Sec/50 ml (min)	Top 150 Wire 250 (In Bendtsen)ml/min
14.	*p*H	Not less than 6.0

I. OTHER REQUIREMENTS :

1. Furnish :

The paper shall be made from fully bleached pulps and will preferably contain varying percentage of cotton, hemp or soft wood fibres or a mixture of these and should be free from unbleached pulps or mechanical wood. Chemical pulps/woody pulps will be preferred.

APPENDIX IV – SPECIFICATION FOR MAP LITHO PAPER

2. The rag content shall, however be not less than 15 persent.

II. GENERAL REQUIREMENTS:

1. Map Printing Papers shall be of uniform formation evenly finished and generally free from specks, holes and other blemishes.

2. the Paper shall be surface sized and with calendered finish.

3. There shall be no curling defects during storage or during printing.

4. There shall be absolutely no creasing defects during printing.

5. The paper shall be free from stuff.

6. Long Grain Machine Direction

III. PRINTABILITY REQUIREMENTS:

1. Should be suitable for multi-colour printing upto 10 colours on an Offset Printing Machine.

2. Should not curl/crease, tear or split during printing.

3. Should be subjected to change in humidity from 20% to 75% and the change in dimension shall not be more than 0.4% in MD as 0.8% in CD.

4. Should be devoid of fluff.

5. Surface should be able to print 200 lines screen sharp.

6. Should have storage life upto 10 years.

IV. SUBSTANCE:

The substance of Map Printing Paper shall be 100 GSM. Test result shall not vary by more than ± 5% from the nominal substance. Further, the mean of 10 test results shall not vary from the nominal substance by more than ± 2.5%.

V. SIZES AND TOLERANCE ON SIZE:

The sizes are prescribed as below. The permissible deviation in length and width for untrimmed paper shall be ± 0.5 %.

(a) 66 x 86 cms.
(b) 74 x 102 cms.
(c) 110 x 127 cms.

VI. The pH value for Map Printing Paper shall be not less than 6.0, when tested.

VII. ACCELERATED AGEING:

The Paper shall be subjected to accelerated ageing by heating in an oven maintained at $105 + 2^0$ C for 72 hours, at the end of which the paper shall retain.

(a) At least 50% of its original folding endurance,
(b) At least 75% of its original value of brightness.

VII. DIMENSIONAL STABILITY:

The paper shall be subjected to change in humidity from 20% to 75% and the change in dimensions shall not be more than 0.4% in MD and 0.8% CD direction.

IX. COLOUR :

The Paper shall be white.

X. PACKING AND MARKING:

The packing of paper shall be done so as to ensure that the paper is not damaged due to handling and transportation. Each package shall be marked with the following particulars:-

(a) Description and substance, in gm^2 of the paper.
(b) Size of the Paper
(c) Lot Number
(d) Month and year of Manufacture
(e) Indication of source of Manufacture.

APPENDIX IV – SPECIFICATION FOR MAP LITHO PAPER

XI. OPTIONAL REQUIREMENTS FOR ECO MARK:

The manufacturer shall produce the certificate of environmental consent clearance from concerned State Pollution Control Board.

APPENDIX V – INSTRUCTIONS FOR TAKING EXTRA-DEPARTMENTAL PRINTING WORK

The printing work undertaken in the Reproduction Offices can be divided broadly into two categories, viz., Departmental and Extra-Departmental.

Departmental work has overriding priority over Extra-Departmental work. The latter is undertaken only when it does not interfere with the former and with the clear approval of the Director in each case.

Extra-Departmental printing comprises all jobs of the following categories:-

(i) All work for Central and State Government Departments and officials.

(ii) All work carried out on payment for non-Government bodies (such as Municipalities, Corporations and Universities, etc.,), private firms and individuals.

Work under (i) above is given preference over (ii).

2. No work for a non-government body is undertaken unless a formal agreement has been entered into with the indentor as in the agreement form (attached) subject to the following instructions.

(i) If the indentor is a firm or limited company, suitable recitals will have to be inserted. Thus if it is a partnership firm the agreement should be executed as follows:

"A B a firm by …… a partner".

(ii) In case the indentor is a limited company, the agreement shall be executed on behalf of the Company, in accordance with the provision of its articles of Association.

(iii) In case the agreement is executed by a constituted attorney a power of attorney authorizing him to sign the agreement should be produced. In this case the agreement should be executed as follows:

"A B, etc., by his/its constituted attorney……".

The agreement must be signed on behalf of the President by an officer duly authorized by an order made under Article 299 (I) of the Constitution. Addl. Surveyor General, Printing Zone, is so authorized.

Before estimates are submitted to the indentor for acceptance the originals should be scrutinized in the Zonal Office and the estimated expenditure for correcting them must be included. When sending the estimate the indentor must be clearly told that it is an estimate only and that he will have to pay the actual expenditure involved. Full implications of the conditions in the agreement must be explained to the indentor at the time of sending him the extimates.

When the estimated cost of an extra-departmental printing work does not exceed Rs.500/- the job may be treated as ***petty***, for which no formal agreement in the prescribed form is necessary. The indentor is required to

APPENDIX V – INSTRUCTIONS FOR TAKING EXTRA-DEPARTMENTAL PRINTING WORK

make advance payment of the amount shown in the estimates in all cases.

3. Printing work on behalf of the Central and State Governments may be taken in hand if the order for printing is signed by Government indenting authorities in the manner indicated below:

Ministries of the Central Government: The order for printing should be signed by an officer not below the rank of an Under Secretary.

Attached or Sub-ordinate Offices: The order for printing sent by them should be signed by the Head of the Department concerned or the Deputy Head if his rank is equivalent to that of an Under Secretary in the Ministry.

State Governments: The order for printing should be signed by an officer of the local government who is authorized to sign contracts on behalf of the Governor of the State under section 299 of the Constitution Act. In signing the order the officer should sign it for and on behalf of the Governor and the Surveyor General or other officer accepting the order should record on it that it has been accepted for and on behalf of the Central Government.

The order for printing should also contain certificates by signing authority of the central and State Governments to the following effect:

Certified that ,

APPENDIX V – INSTRUCTIONS FOR TAKING EXTRA-DEPARTMENTAL PRINTING WORK

(i) The work has received the administrative and expenditure sanction of the competent authority;

(ii) Requisite funds exist in the sanctioned budget for the year or funds will be arranged to meet the estimated expenditure;

(iii) Debit for the work executed during any year either in whole or part will be acceptable during the same year.

No agreement is required to be entered into with Government bodies.

AN AGREEMENT FOR UNDERTAKING EXTRA-DEPARTMENTAL PRINTING WORK FROM PRIVATE PARTIES.

An agreement made ……day of ……..200……..between the President of India (hereinafter called the Government) of the on part and …….(hereinafter called the "indentor" which expression shall include his legal representatives, heirs and assigns) of the other part whereby the Government……..agrees to execute the under-mentioned printing work required by the indentor:

(Here enter Description of the printing work)

On the terms and conditions hereinafter mentioned, viz.:

APPENDIX V – INSTRUCTIONS FOR TAKING EXTRA-DEPARTMENTAL PRINTING WORK

(a) The indentor accepts the estimates of Rs……. for this work and agrees to pay the actual cost incurred as determined by the Addl. Surveyor General, PZ …. The decision of the said Addl. Surveyor General, PZ being final;

(b) That the indentor shall pay in advance to the Addl. Surveyor General, PZ, ……., Survey of India the sum of Rs……(Rupees……..(in words)) which is the estimated expenditure to be incurred by the Government up to the proof stage;

(c) That the indentor shall pay such additional amount as may be incurred by the Government in case the indentor introduces any modifications to the original specification before the proof stage is reached;

(d) That the indentor shall pay such further sum as may be incurred by the government (as to which the decision of the Addl. Surveyor General, PZ shall be final) in case he requires some modification to the original specification after the proof stage is reached and a second proof is asked for by him.

(e) That the indentor shall pay to the Addl. Surveyor General, PZ …..the balance of the cost involved (including freight, postage, etc., charges) in advance before the printing is undertaken by the Government;

(f) That the government undertake that printed maps/charts/diagrams, etc., shall be delivered to the indentor within ……. Days/months from the date the final proof duly approved by

the indentor is received by the Addl. Surveyor General, PZ …… except that this time limit shall be deemed to have been extended in circumstances over which Government have no control, such as a general strike by workmen, breakdown of machinery, sabotage, civil disturbance, etc., etc.

(g) That the Government shall not e liable to execute any part of the printing work required by the indentor unless any or all of the above clauses are fulfilled. If any of these clauses are not fulfilled or if the indentor cancels the work and the work is stopped before completion he shall be liable to pay the actual cost incurred upto the stage at which the work is stopped.

2. All disputes and differences arising out of or in any wise touching, or concerning this agreement (except those the decision whereof is otherwise hereinbefore provided) shall be referred to sole arbitration of the Surveyor General of India, in case his designation is changed or his office is abolished, to the sole arbitration of the officer who for the time being is entrusted, whether or not in addition to other functions, with the functions of the Surveyor General by whatever designation such officers may be called (hereinafter referred to as the 'said officer') and if the Surveyor General or the said officer is unable or unwilling to act, to the sole arbitration of some other person appointed by the Surveyor General or the said officer willing to act as such arbitration. It will be no objection to any such appointment that the

arbitrator so appointed is a Government Servant, that he had to deal with the matters to which this agreement relates and
that in the course of his duties as such Government Servant he has expressed views on all or any of the matters in the disputes or difference. The award of the Arbitrator so appointed shall be final and binding on the parties.

In witness whereof the parties have hereunto set their hands the day and year first above-mentioned.

Signed by the said Indentor
…….
(Signature of the indentor)

In the presence of:-

1st Witness……..

2nd Witness ……

Signed by the said Addl. Surveyor General, PZ ……..Survey of India for and on behalf of the President of India

……..
(Signature and designation
of the officer)

In the presence of :-

1st Witness……..

2nd Witness ……

****

APPENDIX - VI

TYPOGRAPHICAL SYMBOLS TO BE USED IN CORRECTING PROOFS

Note: (Prints to be taken out after getting +ve/ -ve from NPG (PZO Rs.No.7614-103 D' 98)

I N D E X

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