A Peep into the quality of papers and boards for printing

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During the last decade, though the paper industry in India has made tremendous efforts to increase the quantum of producion of papers and boards, the diversity of products has not received its due attention. Leaving aside the other varieties of paper, even the printing papers are being produced to serve the printing industry in general. It is true, that a good reproduction of a print is produced on the right paper onto which has been placed the right amount of right ink by a right printing machine and handled by a well trained efficient crew. Leaving the other factors, which are beyond the scope of this article and competence of the author, the question of a 'right paper' arises. There is a formidable list of variables like ink characteristics, machine and process used, press room atmospheric conditions, the end use of the printed material and the skill and experience of the press man, which are interdependent and related to the requisites of a 'right paper'. Multiply these factors by the number of different processes, presses and types of ink in use, a right paper appears to be a compromise only. The requisites of a right paper is a vast subject which cannot be covered by considering paper on its own and disregarding the above mentioned factors of the printing process. Evidently, it would appear varieties of 'right papers' are necessary to cope up with the demands of the printing industry, which is our largest consumer. In our country, so far, no approach has been made to solve out this problem by formulating standards for main varieties of printing papers. Even the ISI has formulated a general standard for all varieties of printing papers. Naturally, each mill has been making a general purpose paper to suit all the consumers. I am reminded of an incident in 1957, when at a newspaper and Rotary letter press Conference in foreign country, the paper makers asked the printers to specify the properties required of the paper and were told in reply "you should know, you have been making it for long enough". It is true, we have been

making the paper for a long time, but still we do not know what are the requisities of a standard printing paper. What suits one printer is rejected by another. What is worse is that after being satisfied with the quality of supplies received for a long time the printer suddenly finds that it gives him trouble. At times, the troubles appear and disappear and the reason is far from clear, though final result is apparent. Needless to say, unless there is a close co-operation and understanding between the paper maker, printer and the ink maker, it would be difficult for the concerned industries to fulfil the demands of each other. In my humble opinion, it is high time, for each main grade of paper depending upon the particular process, a consensus is arrived at and standards established with close co-ordination and the joint efforts of the All India Federation of Master Printers, All India Printing Ink Manufacturers' Association and the Paper Industry. It would facilitate the paper industry to know the requisites of a right paper required by a particular process of printing trade.

Another problem faced by the industry is, that most of the times the indents from a consumer in a particular variety is so meagre that it makes it practically impossible and certainly most uneconomical especially for Mills having continuous system, to produce a paper fulfilling the customer's You will agree with me, each and every needs Mill cannot produce all the varieties of printing papers suiting all permutations and combinations obtained by the printing trade. It would be, in my opinion, worth considering that a particular type of paper is being specialised by a mill, which makes its best efforts to produce it economically or the printing industry decides to place bulk orders of a paper on a particular mill.

Another difficulty in this respect is varieties of shades and sizes required by the printers. More important is, unless the idents for sizes is so

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chosen that it fits in with the deckle of the machine, the mill cannot only comprise to make a paper, where the side reels could satisfy other customers.

A review of the modern literature will show that varieties of chemicals, specially developed to impart to the paper printing characteristics are being commonly used as beater adtidives, surface sizing or coating formulations. For example, synthetic polymer additives, polyvinyl Acetate, Acrylics, modified starches, styrene butadiene latexes, polyvinyl alchohol and dimensional stability modifiers etc., which despite high cost improve the printing qualities excellently. Many of the chemicals are not available in India and the few available are very costly. The joint efforts of the two industries are needed to induce the Government and the chemical manufacturers to think in terms of producing these chemicals, suitable for the purpose based on extensive research. The introduction, manufacture and application of such chemicals require extensive research to be carried out. Some of the major industries can think of establishing a research unit in their organisations to concentrate on this aspect. The paper technicians, the industry and the Government, especially our association IPPTA should seriously consider the feasibility of establishing an institution in our country, on the lines of TAPPI or recently formed PIRA where in June, 1967, the two associations of England-namely, printing, packaging and Allied Trade Research Assiciation and the British Paper and Board Research Association-joined to form PIRA, the Research Association for the Paper and Board, printing and packaging industry.

The Indian paper industry being not equipped with the most modern equipments, and the import restrictions, abnormally high cost and their nonavailability in India stand in the way of producing good quality printing papers. We have to find some way of equipping ourselves with certain modern equipments to make a better printing paper or board. For example, the trailor blades, air knives or counter rolls for the coating process which provide an uniform and predetermined coating thickness, expanded rolls for increasing the dimensional stability of paper, automatic control devices for maintaining with'n tolerances specifications like substance, moisture and caliper etc.

The above considerations and their applications would certainly need some time and patience,

though the efforts could be strengthened to bring fruitful results at the earliest opportunity. But till then are we to sit idle ? I may, with your permission, be allowed to admit that we can do certain things immediately to satisfy the printing trade. Our approach to the complaints from the printers, howsoever genuine they may be, is not proper and requires a clear thinking on both sides. Both insist that they are right and no effort is being made to determine the proper cause or to study is reasonableness. I would emphasize again the need of close co-operation and understanding amongst the concerned industries to solve the problem. Personal contacts and discussions by competent technical representatives, and exchange of visits can enable the industries to learn something of the other particular craft. Criticisms from the printers must be taken in good spirit by the paper manufacturers. Goodwill is an important ingredient and the value of the understanding of the other man's problems cannot be over-estimated. I assure you, and you are aware of, the approach has been same in number of advanced countries. It would positively solve some of the present day problems so acutely faced by the printing industry due to the paper being deficient in certain respects.*

While discussing the requisites of a good paper and board for printing jobs, I am not unaware of considerable limitations under the prevailing Indian conditions like non-availability of long fibred rawmaterials, the use of different raw materials by different mills, the same mill using variety of rawmaterials due to its shortage, lack of upto date process and product control devices in addition to the above observations mentioned. To add, it has been unfortunate, that even the Tariff commission, while fixing the paper prices, has not taken due recognition of the fact that printing papers are specialized papers and cost more, if done properly. However, it cannot be denied that there is an extensive area which would be explored by us for effective improvements immediately. The first thing we could do, is lay down certain minimum standards of our own, and ensure that all efforts are taken to produce papers of accepted standards, consistent and unifrom within reasonable degree of variations. It is admittedly true, a printer has some latitude in adopting his process to the paper and overcoming certain deficiencies present in the paper. But once we promise to supply a particular paper, and the pressman adjusts his process accordingly as per the

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first available sheet of paper from ream or reel. becomes helpless when finds that the paper is not uniform in certain aspects like substance, caliper, smoothness, absorbency, moisture and pH etc., and varies from sheet to sheet of the ream or in same sheet.

To achieve this objective, it is but essential that a good quality control organisation staffed by experienced and enthusiastic personnel and equipped by a good laboratory conducts the extensive quality control, especially the statistical quality control which has gained considerable importance in modern times. More important is, this must have co-operation from all concerned in the industry and active support from the management. I am glad, few mills do have started thinking on these lines, but much has to be done in the near future. In this connection, I may draw your attention to the lack of proper testing equipments in our laboratories like PATRA or IGT testing equipments to assess few important printing qualities and characteristics described in the foregoing paragraphs.

The constantly increasing production cost due to various reasons beyond our control is a factor which has a close bearing to the production of good printing papers and boards to a certain extent. Similarly the heavy import restrictions stand in our way. Both the subjects are beyond the control of paper technicians and require only active and sympathetic consideration and co-operation from the Government.

Coming back to the subject of requisites of a good printing paper and board, I would not discuss the important part played by the printer and the ink maker to get efficient and good printings as I do not find myself competent enough. I would, in the foregoing paras, discuss few important requisites of a good paper for the printing purposes, correlating the troubles the printer encounters due to the stock being deficient in these respects, and confine myself to the role of a paper maker in giving a good quality paper and board. How best these qualities could be achieved under the prevailing conditions is beyond the scope of this paper and not proper to speak to this august body of well experienced paper technicians.

Requisites of a good paper and board for printing :

Heavier the substance less the trouble experienced by a printer, but considering the economies

to the printer the substance has to be kept down to a figure which gives good printing characteristics. More important is the uniformity of the substance throughout the web. Same holds good for the caliper. Excessive variation, especially in boards, can reduce the printing speed and cause uneven printing resulting in rejects and damage to press due to extra pressure required. Naturally the paper requires a good formation free from fibre flocculations, inter fibre voids due to loss of fines and improper distribution of loading material etc. The irregular, localized or adjacent differences in the bulk of the sheet would result in varying degree of absorption of ink producing a mottled effect. However, substance, caliper, density, smoothness, bulk, compressibility and formation are all interdependent and closely related to each other.

Maximum efforts should be made to even out the irregularities of the sheet surface due to fibre and felt wire markings, otherwise extra ink will have to be used to ensure that the valleys and depressions are 'bottomed', leading to non-uniform films and a mottled appearance. Given good smoothness, image of the type or the block will be more faithfully reproduced. However, the degree of smoothness will depend upon the printing process. The extent, to which the printer can compensate for insufficient smoothness by increase in pressure, is limited by the occurrence of punching. Here the proper compressibility helps to compensate the insufficient smoothness and ink receptivity.

Additional smoothness and/or compressibility is generally required on paper and boards for gravure printing, as it is essential that each gravure cell makes close contact with the surface, otherwise inks from the cells will not be transferred. Poor smoothness would result in dot misses. For flexographic inks, smoothness could be slightly low since printing process use rubber or synthetic composition plates in conjunction with slightly higher ink film thickness. Some surface roughness is permissible in solid printing since missed cells can be obscured by flowing ink from adjoining cells. Under some conditions of ink and inking, too high a finish may result in excess of ink being left on the surface with consequent troubles of set-off and filtering in half tones etc. Hence, it follows that a very high gloss surface is not as necessary as uniformity in its micro contours.

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Furthermore, prints especially colour prints will appear better when printed on smooth paper and when coated with a gloss varnish or other finishing processes because the light reflected from a smooth or glossy surface as from a mirror is unchanged in colour. When a beam of light falls on a coloured glossy surface, a part is reflected back as White light at an equal angle, the remaining penetrates the surface, is partially absorbed, scatter and re-emerge as coloured light at variety of angles. When the surface is viewed at the mirror reflection angle, it will appear white but from all other directions of viewing appear coloured. An unfinished or mat surface can be considered to be made up of a very large number of small reflecting surfaces arranged at random. When light falls on such a surface, sime will be reflected in every direction mixed with the colour light which has penetrated and scattered. Thus, from any direction, the surface will appear to reflect colour film white i.e. the colour will be less saturated and less pure than of a good finished and glossy paper.

Good opacity is demanded of all printing papers as the poor opacity results in print and show through. In letterpress, it is of great importance though it is not as cruical for web offset and rotogravure printing. The paper or board must be extremely clean specially for high class printing jobs. Specks, shives and dirt etc. in the final stock would result in bad appearance of the printed paper and produce wear on the printing surface. It could effect the shade of the print and create troubles during its running on the press as discussed later.

The importance of paper absorbency and receptivity to the ink in the printing process is usually associated with its influence on ink transfer, gloss, set off, strike through and other optical properties. These factors depend on a complex inter-relationship among several paper properties, ink characteristics, printing process and conditions, and it is difficult to expect any absorbency test to correlate with all end results under all circumstances.

Absorbency plays an important role in letter press where the ink dries almost by absorption and well over half the ink stays on the paper. A normal MF finish possesses a satisfacotry absorption capacity but when papers with a higher S/c finish are used, the ink may smear on cylinders and folders. Solid printing requires a well closed nonabsorbent surface to avoid the washed out colours which are caused by excessive ink penetration. In offset printing ink receptivity is more critical than letter press. Unless the ink is promptly taken up by the paper and board, especially board capillaries, it will be squashed between plate and board resulting in unsatisfactory impression, appearance and blurring of image. In letter press, however, the excess ink can escape from the surface with the raised portion of the plate.

It has to be emphasized that the absorbency, whatever its degree may be, must be uniform as otherwise the ink will dry at different speeds at different places even though the drying is mainly by oxidation and evaporation. Evaporation drying, though could be affected in both absorbent and non-absorbent stocks, would be slower in nonabsorbent papers. Oxidation drying is possible on all surfaces absorbent or non-absorbent either by letter press or litho.

The paper should possess a good brightness as it can influence the appearance or process colour in colour printing to a considerable extent. Even for letter press printing the colour should appeal to the market. It is very important factor since the basis of the whole procedure is the absorption of colour from white light by the ink layers before and after its reflection from the paper sur-Shade is a complicated property different face. from brightness. The customers rarely desire to have original white and each printer desires a different shade. It is certain that good shade and brightness is important for printing stocks. A particular effect occurs when the whiteness is reinforced by optical whiteners, which though superficially extractive, fluorescence, absorbing ultraviolet and remitting the energy as a bluish white light. This can complicate the reproduction of process. colours very considerably since the layer of colour inks will absorb ultraviolet and the light penetrating the absorbed films reflected back from paper surface may not always give a true expression of the colour of actual ink. There is further a greying effect in light tones where the ink dots are surrounded by a white paper which owes its whiteness to fluorescence rather than scattering. The bluish white paper in between the dots reflects excessive blue, counteracts the blue absorption or the yellow and produces greyed effect. Photogravure is capable of giving brighter results on

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these papers than either letter press or litho, since the paper is more completely covered by even sized dots peculiar to the process. Fortunately or unfortunately the use of artificial whiteners has become a must in recent years, but probably the whitest sheet may not be more suitable for reproduction of process colour work. But whatever the shade or brightness is aimed, it is essential to keep it uniform throughout the stock.

The degree of acidity or alkalinity in the paper is an important property and large variations in pH can cause slow drying of inks and fading of colours. It must not be either too high or low. There is no common rule but it is certain that pH must be kept fairly constant in the stock, as stock having a pH lower than 5 retards the drying of inks as acidic fibres tend to null fy driers like cobalt used in the ink.

Coating process has contributed cons derably to the high class printing jobs. Besides being of decorative nature it provides a paper or board of high smoothness, better gloss and ink receptivity which otherwise is not possible, even in best calendered papers. It does help in reproducing small dots very faithfully in half tone illustrations. Major importance is the uniformity of the coating thickness and its high pick strength. In offset printing, coating applied, must be moisture resistant to enable the paper to have high pick resistance even in slightly wetted stage.

Picking of coated surfaces affects printing operation and efficiency similar to that of fluffing and dusting, and occurs when the forces involved in splitting an ink film exceeds the surface strength of the paper. The three factors involved are—paper strength, picking strength of the ink and the printing speed. It usually refers to the removal of areas of paper larger than a single fibre by the ink during splitting of the ink film between printing blanket or surface and paper web. Several chemicals to prevent the effect have been developed and used in modern times. A paper maker has to do his utmost to eliminate this defect, though, at times it is only for the printer to reduce the ink tack to avoid the trouble especially on a soft paper.

Paper must have suffic ent surface strength, a general requirement for all types of printing papers and boards, to provide optimum press runnability

and withstand the strains placed upon its surface during the passage of the web through the press, and also the tension strains present in the general webbing of the paper. For example, in off-set printing the intimate contact between two fast moving surfaces imposes high stress on the stock and naturally the surface strength is more important than in the letter press. I may however point out the low strength perhaps causes few troubles on the press. It is often the fact that paper breaks on the fast running presses, but in all the cases, the strength of the sheet may not necessarily be at fault. Quite possibly, the paper breaks could be traced out to press conditions like snatching, too much break on the reel or worn-roll bearings etc. But if the breaks are legitimately attributed to the paper and customer complains about poor surface strength, it is seemingly a question of loose particles and fibres tied to the surface so loosely that they come off and soil the rubber blanket or the type. The elimination of felt hairs, shives, pinholes, lumps, sisal etc. can avoid the breaks due to rupture a these points.

Fluffing has been well defined as the release of fluff and dust consisting of mainly individual fibres and particles of loading etc. or small aggregates from paper surface during printing operations. Similarly dusting occurs with coated as well as uncoated papers due to the release of very small loose particles of coating or dust. It is unfortunate that many paper and boards produced in India have this trouble which constitutes a great problem to the printers and the reason for bulk of complarats. It is particularly troublesome in off-set and rotatory printing where the fluff accumulates on the blanket, roll or plate. Fluff deposited on the blanket picks up moisture from the water used for damping the blanket and tends to refuse ink. It leaves its important image in the printing area and causes the press to be stopped for cleanings affecting the efficiency and productivity of the process. The dust collects on static surfaces and bars also, drops off and causes filling in of plates, types and blocks in case of letter printing. It could even be taken up by the wet impressions and be subsequently wiped off and collected as a paste on a bar or folder. Evidently, the excess of fluff or dust causes unnecessary shuts and wash down during the run. On the other hand, if the material 1s not cleaned in time, the accumulation weakens and wears the printing plate due to its abrasive action and leads to a poor print definition, and may even blind the

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printing area. Thus it is obvious, for a stock suitable for printing especially off-set and rotatory, efforts should be made to minimize fluff or dust, which would have the same effect. This could be controlled as you know, to a great extent by controlling the furnish, good formation of the sheet on the wire, condition of presses and felts, and graduated drying. Certain chemical additives also help to reduce the defect. Proper surface sizing minimizes the trouble to a great extent. Minimising of slitter dust by meticulous attention to slitter knives by proper grinding and re-setting, and removal of dust at the dry end and doctor blades at every opportunity would solve the problem to some degree. In case of reels, brushing at the ends could be done before wrapping.

It is essential to maintain h'gh tension throughout the printing process especially on web-offset and modern fast machines. To ensure this requirement to avoid creases and breaks in the paper web, the reels must be exactly wound, firm and even with perfect centre and clean cut edges. Baggy sidedness and variation of winding tension seem to be most common fault and much machine time and effort is wasted to ensure a proper run and register of print. Proper reeling ensures the brake hand in the press to keep tension and lateral adjustments to a minimum. If the paper could be made free from edge tear, cracked edges, creases, tear outs, and calender cuts, to a great extent breaks due to rupture at these point could be avoided. To achieve better productivity in the printing press, joints in the reel, kept to minimum in number, should be carefully made and splicing material selected to give a joint of minimum thickness and maximum strength, and momentary resistant to high temperature where ink is to be artificially dried. Admittedly the lack of care and attention by the reeler crew can make the best print paper create sufficient troubles for the press.

If the stock is in the sheet form, it should be flat free from curl and waviness which results in frequent tripping of the feeder, and certain minor defects like bells in the paper which are fairly large circled thin places surrounded by raised rings due to frothing on wire, and dandy picks etc. The torn and folded sheets within the ream must be avoided especially for automatic presses. While packing care must be taken to ensure that perfect papers free from all the defects are packed failing which

successive sheets will be through out of register, as the length of the sheet will no longer be aligned with that of plate image. The result is worse in colour work where a double or ghost image may be obtained. Though, this could be due to other causes also, but if the stock itself is defective the conditions get worse.

It may not be improper to lay emphasis on the handling of reels or ream packages since mechanical damage at this stage can cause troubles to the press. Changing direction of roll without the use of turning board or skid invariably damages several layers of paper. Bumping causes flats and knocks on the edges, causing cracks for some distance down the reel.

The moisture in the paper plays an important role during printing process. As optimum moisture has to be maintained as with increasing moisture content the opacity and brightness reduces though glaze improves. Bulk finish and strength properties are also effected. Too dry a paper will be easily susceptible to the absorption of moisture due to changes in atmospheric conditions creating printing problems as well as waviness and curl in the paper. Paper, being a very hygroscopic substance, is very susceptible to the atmospheric condition, causing process of expansion and contraction resulting in deformation of the paper, poor register, folding and binding difficulties. The uniformity of the moisture throughout the stock is of greater importance, especially for papers which require an exact standard of colour register. Besides other troubles, ununiform moisture at various places gives different absorption of inks and anamotonous drying of the same print. I am not unaware of the prevailing Indian conditions of climate and weather, but admittedly this could not be an excuse. We would control the uniformity to certain extent. The paper should have the maximum possible dimentional stability. However, so far it has not been possible to make a paper which is not affected by atmospheric conditions but to some extent, control of suitable and stable moisture, can help in producing a right stock for the printing industry. It would further avoid the static electricity which at times is a source of trouble to the press like ink flying and missing of ink etc.

Though it may be impertinent on my part to talk about the atmospheric conditions in the press

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it cannot be disputed that it plays an important role in producing a good print register and increasing the output. Even the best control at the hands of paper makers with respect to the moisture to produce an ideal paper could be the undesirable one for the printing industry, unless care for the press room conditions is taken to ensure that the paper has a moisture slightly higher than the one equilibrium with the press room conditions. To elucidate my view, the following clarifications may be necessary.

The perfect sheets and reels from the Mills can give rise to coggling, curls and waviness in the press due to difference in the atmospheric conditions of the mill and the press, as the papers would tend to pick up or loose moisture until it is in equilibrium with the atmosphere of the press. Same holds good for the atmospheric conditions of the place where the stock is stored-whether in the mills or in the press. The expansion can take place during a multi-coloured printing job resulting in overlapping and misregister of colours. Absorption of moisture leads to the change in the rate of absorption and consequently drying, resulting in sheer of bronzing of the ink which contrast with the natural colour of the print. The press room conditions vary from press to press and the percentage of the paper moisture in the paper corresponding with the humidity of the press will not be alike.

Some inks dry slowly under moist conditions probably because moisture retards oxidation drying and reduces the paper absorbency for oils and inks hindering the penetration of the ink, in which case the ink is likely to lie over the paper surface consuming more ink causing set off and smudging before drying by oxidation. The ink on a high mo sture paper may pick and appear to be dull or lack full colour. Poor register, set off, paper stretching or smudging may occur.

In fast drying solvent based inks like flexographic, fast evaporating solvent causes adjacent air to be cooled below dew point, deposits moisture which effect drying time of the ink causing difficulties like bloom, blush and orange peel especially in monsoons.

Inks printed on dry papers may crystallize, or fail to print clearly resulting in fuzzy impressions requiring excessive ink, poor register, set off, smudging cracking and breaking of sheets at rolls. In some inks evaporation helps speed drying either aiding oxidation or reducing absorption that might result in show through. The half tone illustration will be blurred, indistinct and ink will show a The metallic inks tendency to strike through. should dry by oxidation in such a way that the powder is held on the surface of the sheet. It printed on a dry sheet they will rub off because the fibre absorbs the vehicle rapidly leaving the power on the top without any binder. Further it enhances the dusting and pick up and coating due to poor binding.

Thus it could be concluded that a good paper and board for printing purposes should possess certain common qualities irrespective of the process, ink or press used. Certain characteristics are desired by different processes in different ways, which only a printer can choose and tell the paper maker. In view of the above discussions, it is for the paper technicians, of course with the co-operation of printers, to decide and implement what best could be done to achieve a right paper for the right printing in the printing industry.

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