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## Screen Printing Technology Hand Book

bestseller



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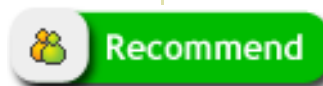
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Screen printing is a printing technique that uses a woven mesh to support an ink blocking stencil. The attached stencil forms open areas of mesh that transfer ink or other printable materials which can be pressed through the mesh as a sharp edged image onto a substrate. A roller or squeegee is moved across the screen stencil, forcing or pumping ink past the threads of the woven mesh in the open areas. Screen printing proves to be a good printing process for multi colour printing. Half tone printing is related to screen printing of photographs. Printings of photographs was at one time considered to be very difficult in screen printing, but now screen printed halftone photographs are also effective and economical in certain types of reproduction. Over the time stickers (transfer) have become an important medium of advertising. Now millions of stickers are printed every year through this method. Transfer stickers are of three types; instant

transfer, heat transfer and water lade transfer. Gumming is an integral part of sticker production. Screen printing technique make use of and is compatible with a variety of materials, including textiles, ceramics, metal, wood, paper, glass, and plastic. It is this quality that allows this printing technique to be used in different industries, from clothing to product labels, fabric labels to circuit board printing etc. Screen printing industry experiences growth in the 10 to 15% per year rate.

Some fundamentals of this book are basic concept and classification of stencils, basic screen printing process, basic registration techniques, screen printing frames, pre treatment of screen printing fabrics, screen printing press, principal of screen process printing, printing on paper and card, printing on vertical surfaces, printing on shaped objects, cylindrical object printing, printing on uneven surfaces, ceramic and glass printing, printing on plastics etc.

This method of Printing has achieved wide spread popularity since the Second World War, although the basic ideas in this process were used by the Chinese centuries ago. The present book contains latest technologies of screen printing along with machinery photographs, addresses of suppliers of machinery and raw materials. This book will be very helpful to new entrepreneurs, existing units and for those who want to diversify in to this field.

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## Related Books

- [Modern Printing Technology](#) [NI4] by NIIR Board, **Rs. 250.00, US\$ 50.00**
- [Handbook on Printing Technology \(Offset, Flexo, Gravure, Screen, Digital, 3D Printing\) 3rd Revised Edition](#) [NI73] by NIIR Board of Consultants & Engineers, **Rs. 1,495.00, US\$ 150.00**
- [The Complete Book on Printing Technology](#) [NI111] by NIIR Board, **Rs. 1,100.00, US\$ 125.00**
- [Directory/ Database/ List of Printing Industries/ Companies in India \(Printing Press, Pre Press, Printing Ink, Printing Materials, Printing Machinery etc.\) 4th Edition \[.xlsx, excel format\]](#) [NID65], **Rs. 3,776.00, US\$ 150.00**

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## Sample Chapters

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(Following is an extract of the content from the book)

---

### [h1]PRINTING ON VARIOUS SURFACES[/h1]

[p]Recently in a screen printing exhibition, screen printing was done on the back of a lamb just to show that with this process you can print any surface of any size, shape and kind. On other versatility screen-printing scores over any printing process. Even without having advanced knowledge of the process, print jobs of many variety can be undertaken with simple knowledge and a few basic items like a printing table, some frames, squeegees and inks.[/p]

[p]As already told in "printing process", chapter printing can be done on any type of surface which can vary from plain paper to glasses, windows, buses, cars, machines or even the aero planes.[/p]

[p]Printing surfaces fall in two classes: porous (absorbent) and non porous (non-absorbent). Designs printed on non-porous surfaces, such as glass and plastic, appear much sharp, as they do not absorb ink. Hard surfaces require a stiffer squeegee and stiffer ink.[/p]

### [h2]PRINTING ON PAPER AND CARD[/h2]

[p]Screen-printing process can be used for any type of paper including decorative wallpapers, visiting cards, letterheads, invitation cards and cover pages etc.[/p]

[p]Stiffer ink should be useful if the paper or card to be printed is more porous. It is also an advantage of screen-printing that light colours appear more clean and brilliant when printed on coloured stock. Printing can be done on bronze silver, gold or some other metallic paper if the ink is mixed with appropriate binding vanishes to reduce its brittleness upon drying.[/p]

[p]Visiting cards should be printed using a very fine bolting cloth for qualitative printing. Cards made of PVC materials should be printed with PVC inks while Matt or Glass finish inks are used as per customer requirement and the demand of the paper to be printed.[/p]

[p]Letter heads are commonly used for official as well as personal purposes. As letterheads are bound together in form of pads, therefore, sufficient margin for cutting and binding has to be kept at the time of printing. This will avoid cutting of the image in the binding process. Invitation cards are generally, for a single occasion and no repeatable, so instead of photographic positives, laser outpur (DTP Tracing) can be used.

[/p]

[p]Cardboard and paper are of greater importance to the processors of posters, displays and point of sales boards and advertising items.[/p]

[p]Cardboards are available in varying thick nesses used primarily by poster and display printers. There are three main categories.[/p]

[olist]

[li]Clay coated[/li]

[li]Patent Coated[/li]

[li]Lined coated[/li]

[/olist]

[p]1. Clay Coated Board: Clay coated board derives its name from a smooth coating of a white clear substance which covers the surface of the stock. Clay coated board comes in varying thickness. The features of this particular stock are the high degree of whiteness of the coating and the smooth surface. There are no discernible hills or valleys which are characterise of the fibrous pulp matter which goes into the making of the board. Clay coated boarder because of its smooth, clean surface, is fine for photographic halftone printing, as well as for routine printing jobs. It is not recommended for displays which are to be diecut with complicated scoring or folding because clay coated board has a tendency to crack somewhat at the point of deeps scores tight folds.[/p]

[p]2. Patent coated Board: This is similar to clay board stock but both sides of the board are covered with "liner". This is a smooth wall finished sheet of paper, superior in quality to the layers of paper within the board itself. This paper liner serves not only as an excellent printing surface but acts as a hinge when the board is cut, scored or creased folded in the die cutting operation.[/p]

[p]3. Lined Coated Board: It is similar to patent coated board and has a lining of paper, usually on both sides. The inside of the cardboard is made of a cheaper material, such as news board, which is somewhat rough. Though the liner covers some of the roughness, it does not completely cover the hills and valleys. Lined board though not of a superior surface quality is however very acceptable for die cutting because the liner acts as a hinge. It is available in colour as well as metallic foils such as silver and gold.[/p]

[p]The other varieties of boards are news board, chip board, corrugated board, jute board, cover stock, chrome coat, show card board, weather proof board, fluorescent sheets, velour paper and flint papers.[/p]

[p]The thickness of board is measure by point or ply. A point is the equivalent of 1/1000th of an inch. A piece of stock 10 points in thickness would measure 1/100th of inch and so on.[/p]

[p]Ply is the unit of measure of thickness of the lighter weight stock. When ordering stock, thought must be given to the direction of the grain. To determine which way the grain is running, tear a piece of stock at both directions. The stock will tear more easily along the grain side, it will tear with greater resistance against the grain. Grain direction is important in die cutting, as well as in poster and display work where the stock is made to stand on end. In a 14" × 22" display the grain should run the 22" way. If the grain runs the other way then there would be a growing tendency on the part of the sign to warp or droop over.[/p]

[p]All paper and boards are subject to expansion or contraction with fluctuating weather conditions. This is especially true of green stock. By that is meant board especially of the lined variety, which is fresh from the mill and has not yet had sufficient time to dry or season. The unseasoned lined stock often shows considerable shrinkage thus affecting the alignment of colours in close register multi-colour printing. To overcome this condition it is advisable to air dry the cards in open racks or sent them through the drying oven before printing. This is referred to as seasoning the stock.[/p]

[p]Paper is not ordered by point size as cardboard. The thickness of paper is measured in terms of "pound" as 60 lbs, 100 lbs, etc. This is determined by the weight in pounds of ream of a paper cut to standard size. The standard size which is the basic size of book papers (the most commonly used in screen process) is 25" × 38". It is upon this basic size of book in a ream (500 sheets) that the basic weight is calculated. Thus a 70 lbs basic weight paper means that 500 sheets of it, cut to sheet size of 25" × 38" would weigh 70 lbs. The 500

sheet weights of sizes other than the basic size can vary in proportion to the area. This means that we can get a 35" × 45" or other size in 70 lbs (or any other weight) but that the weight is still determined on the standard 25" × 38" size. Weights of paper vary from 30 lbs to 120 lbs the greater the weight the thicker the paper. [/p]

[p]As in card board, paper has a definite grain, but this is not crucial as in card board stock. The grain is determined by the direction of paper parallel to its forward movement on the paper machine. Normally, the majority of fibers lie parallel to the machine direction. Generally the strength of the sheet is greater across than the grain. [/p]

[p]Paper is available in coated antique, egg shell, plate, vellum and a variety of decorative finishes. A well-maintained file of paper samples is to be kept by every printer. [/p]

[p]Special effects: To give an impressive look to the various types of cards and papers, special effects can be printed with the spraying of special powder over the wet print and whisking. As the print is wet at the time of spraying of powder, it gets stuck on the print and the print becomes thicker and gets coloured with powder. After the powder is sprayed every paper should be whisked and heated in conveyor. [/p]

[p]These special effects can be divided into four categories: a) Thermography b) Velvet Effect c) Metallic Effect (shades of silver of, gold, bronze and copper) and d) Pearl Effect. [/p]

[p][b>a] Thermography: This process is called raised printing also. This process has an added advantage of drying the inks quickly that is why it is preferred by most of the screen printers. In this process, thermo resin powder is sprayed over the wet prints and after whisking it is heated in the conveyor. This melts the powder stuck on the wet prints. By this the print gets raised and glowing. [/p]

[p]Therm resin powders are available in clear transparent, silver and golden colours. While using silver or golden powder printing should be done in the same colour as of the paper. For any other colour, printing is to be done in that particular colour and a clear transparent powder be used. [/p]

[p][b>b] Velvet effect: Velvet effect is obtained from a "Flock" powder. For getting this effect printing should be done in the same colour as of the powder. This process is widely used in invitation, wedding or greeting cards. [/p]

[p][b>c] Metallic Shade Effect: This process involves printing with silver and golden inks which are available in the market and can be used straight away. Sometimes the design is first printed in the colour of

the paper and again on the same registration printing is done with silver or golden ink to achieve a raised effect which is called "over printing." [/p]

[p][b>d]/[b] Pearl Effect: Pearl powder (one tone and two tones) are readily available in the market or you can even use ready-made pearl inks available in the market. Pearl shades give shining and rich impression and are widely used in wedding cards jobs.[/p]

## [h2]ARTICLES WITH THICK SURFACES[/h2]

[p]Designs on glass, plastic objects, key, chains, tin sheets, aluminium sheets etc. can also be printed with screen printing process. Salient features of such surfaces are discussed below:[/p]

[p]Glass surfaces: Special oil based and ceramic inks are available for printing on glass surface. The ink and the squeegee should be stiff and glass should be absolutely clean. It can be cleaned with methylated spirit before printing. As glass can be an object with sharp edge, screen has to be protected against any damage. A sheet of card board can be helpful in this: Take a card board sheet of the same thickness as of the glass and cut a window in the card board of the size of the glass sheet so that glass can fit into it. While printing that card board sheet can be put under the frame and glass can be placed inside the window. This will save the screen fabric. Squeegee can also be pulled evenly and smoothly.[/p]

[p]Alternatively, Two L shaped arms of cardboard can be cut. Out of which one can be fixed on the printing table with same tape while the other being left movable. During the course of printing, glass can be placed touching the fixed arm and the other movable arm can be placed beside it forming a window.[/p]

[p]Plastic surface: Plastic materials are either rigid or flexible. The flexible plastics generally shrink, bloat or elongate while rigid plastics, are by and large free from such troubles. In plastics banner material polyethylene is a difficult substrate to handle.[/p]

[p]Low-density plastic substrate pose a problem of static electricity, which causes the sheets to stick to printing base and attracts dust. This can be overcome to some extent by the use of anti static spray.[/p]

[p]Low-density polyethylene should be printed using polyethylene inks, while high density polyethylene (HDP) should be printed by using high-density polyethylene inks. HDP materials have to be given corona or flame treatment before printing. Polyester substrates should be printed by using polyester inks.[/p]

## [h2]PRINTING ON METAL & METAL FOILS[/h2]



[p]Metals such as tin and aluminium sheets are still used for various purposes in the printing field especially for advertising. Hoardings and signboards of metal sheets require a base coating of the background colour which can be done namely or with a spray glen. Specially prepared 'tin inks' are available for printing. Paper glass inks are also suitable.[/p]

[p]Metal and metal foils are widely used for utility purposes as well as for point of sale displays. The terms metal and metal foils are two entirely different terms. Metal is rigid, malleable and ductile and should be carefully handled. On the other hand metal foils are easy to handle and is very flexible. They are supplied in rolls. It has a smooth and shiny finish and a variety of colours are available in metal foils.[/p]

[p]Metal are widely used for printing of adverts, nameplates and instrument dials. Both the offset and the screen process can be used for printing on metals. Anodizing which is an etching process can also be used.  
[/p]

[p]Metals have to be cleaned or treated before printing. A mild wash with a dilute acid removes the greasy stains that are on metals while manufacturing. Metals are cut to size before printing and folded if it is of very thin gauge. They have to be given a primer coating first and they are painted enamel white before printing by using spray process or by hand brushing.[/p]

[p]Metals come in different gauge for different applications. The gauges available are 12,14,16, etc., up to 34 gauges. The higher the number the thinner the sheet, the lower the number the thicker the sheet. After printing is completed on the metals a final coat of varnish excluding white areas can be given to prevent it from atmospheric attacks.[/p]

[p]Separate inks are available for printing on metals. These have to be carefully chosen according to the suitability of a particular metal. Inks are available in both matt and glossy finishes. They are generally oil-based inks. The backside of the metal should be given a coating of red oxide to prevent it from rusting. Tin sheets, if meant for display can be mounted on wooden frames.[/p]

[p]Metal foils are mainly used for stickers, wall hangers and for foil embossing. Metal foils are made up of cellulose acetate, polyester and polystyrene bases upon which the metallic coating is given, they have four layers; carrier, release wax, coating and sizing. Carrier is the film base, release wax is meant for the purpose of releasing the metal coating alone on to the stock, coating is the actual metallic colour and finally sizing is meant for fixing the metal to the stock.[/p]

[p]Care should be taken while printing on metal foils, They can either be printed as individual sheets pasted on cards and removed after printing or else they can be fed as a web in modern screen process printing machine. Flexography and photogravure processes can also be used for printing on foils, they are available in different micro gauges.[/p]

[p]Great care must be exercised in screen-printing on foils, to assure adherence of colour to the printing surface. Generally transparent inks are used for printing on metal foils. It is commercially known as hipol inks. Pre-run proofs, allowed to dry and tested for adhesion should always precede actual production. If an ink of a particular manufacturer is used the same variety of reducers (solvents) should be use for thinning the consistence of ink.[/p]

## [h2]TEXTILE PRINTING[/h2]

[p]There are a variety of textiles that are used for screen-printing for various end uses. Some of the textiles that are used are long cloths for printing of banners and sarees. Satin for wall hangers and labels, banian cloth for T-shirt, Gauda material for other cloths. (These cloths are different from one another in texture, strength and finishes).[/p]

[p]Unlike the conventional printing method where one colour is printed at a time and left for drying the printing of cloth involves simultaneous printing of all colours one after another, the exception being single colour work.[/p]

[p]The absorbancy of colour differ from one cloth to another. The desired shade may be obtainable in a coloured cloth as in a white cloth.[/p]

### [h3]Textile Inks[/h3]

[p]Ink will vary with nature of the material. Ink companies formulate colours for a large category of materials, which include wearing apparels, towels, tables cloths textile novelties and banners. The textile colour consists of two parts: one is the binder which acts as a base and the pigment which is the actual colouring dye. These two must be intermixed in the right proportion along with fixing agents to get the desired effects, light fastness and resistance to detergents. Printed-textiles after drying thoroughly to be free from residual solvents must be subjected to heating. The heat brings about chemical reactions or "cure" creating a permanent bond between the colour and the fabric. The curing cycle varies from five minutes at 260 deg. F and 1 minute 375 deg. F. depending upon the fabric users. However, in Indian conditions it is advisable to dry the fabric for about 15 to 20 minutes in bright sun light.[/p]

[p]Another line of textile colours which are recently introduced in the Indian market is formulated on the principle of water base and oil emulsion. These, When heat-treated become durable and fast to light. The colours must be used with a companion extender in varying proportions. The final depth colour brilliance still depends upon the proportion used and thoroughness of the mix. The colour prints with a transparent and dye like effect. Printing one colour over another produces additional tones. These colours, being transparent are limited to white or light coloured fabrics.[/p]

[p]For printing on textiles, we can use gelatine process, knife cut film or chromaline, five star film may be however used for fine drawings with a coating of duco enamel lacquers which are resistant to acidic dyes. Their can be coated for other methods as mentioned above. This will make the screen last longer.[/p]

### [h3]Make Ready[/h3]

[p]In ones piece sheet printing the material to be printed is registered into the printing guides as in conventional way. For printing textiles we have to use meshes from 120 to 200 count or evert coarser ones to permit a full flow through of colour for better penetration.[/p]

## [h2]Picture. 1[/h2]

### [h3]Manual T shirt Printer[/h3]

[p]Tile printing base may be either felt, sponge, rubber, cotton padding or a hard surface depending upon the fabric to be printed. For rigid cloth we may use soft felt paddings and for very flexible material smooth hard base may be used to avoid shifting of materials during the passing of squeegee, to assure good registration in multi-colour work. A pressure sensitive wax table is often used to hold the piece goods in register. A wax adhesive may also be used as an applicator to the cardboard to which each fabric is temporarily mounted. The mounted cardboard with the textile is fed into the guides. Each piece of material will have its won cardboard. After printing is completed in all colours the fabric is easily stripped off and the cardboard may be re-used. Other system involve the use of cloth base, onto which the fabric to be printed is tacked or pinned in position for each print.[/p]

[p]The screen-printing table for printing large yardages of textile is 60 to 80 yards long. It is constructed either of wood or metal A length of 60 yards is generally sufficient for processing of all kinds of textile goods. A width of 64" is necessary for handling bolts of cloth. The wood type tables are covered with a layer of extra heavy felt or rubber, all in one piece without seams. On top of this soft padding is tightly stretched with a

covering of extra heavy oil cloth or similar materials. Textile table constructed of metal have the advantage of more rigid construction and built in heating systems. The top is composed of asbestos plates which retain the heat without expanding or warping the printing base. [/p]

[p]The cloth is laid out on the table as it is pulled tight by a ratchet arrangement. The cloth is then stretched cross-wise by fastening it to the table with pins or special easy to remove staples. All along the top of the table, extending its full length is a metal or wooden rail to which are attached contact stops or register guides. These stops are placed at fixed intervals along the rails and fastened in place with thumbscrews. The distance between the stops are adjustable to the size of the unit. A 1.1/4 screw eyes are placed near each end of one of the narrow sides of the frame to serve as sliding contacts for the rails. [/p]

[p]The print is made in alternate register areas. The stencil is held by the short end and placed in position on the cloth by means of contact stops and a print is pulled by drawing the squeegee towards and away from the operator, up and down. The screen is then lifted and another print is made. Again, a gap is left unprinted. [/p]

[p]When the entire length is complete the alternate flaps are printed. If everything has been done correctly in the matter of registration, the overall design on the cloth will appear continuous without evidence of breaks or unmatched connections. The heat makes the colour dry fast, it is not necessary to wait with the filling in of the alternate gaps until the end of the line has been reached. The gaps are filled by another screen, either applying the same or the next colour in a multi-coloured design. After printing is completed in all colours the cloth is untacked and put through a finishing process. Most colours require an additional steaming process to set the colour permanently on the cloth. The cloth is then put through a continuous washer, travelling through several tubs, the first of which contains a soap solution the other merely containing plain water for rinsing. The material passes through a hot box for drying. It is again framed back to its original width then run through a calendering press for further softening and ironing. If discharge colours are used the material goes through the same process except for that it is given a 4 minute steaming process to develop the colour before it goes to the steam fastening process. Some special colours are developed by an acid fume system and are given the same treatment as application colours. The acid fumes bring out the latent chroma of the colours. All commercially prepared textile colours can be used for all textile-printing jobs. [/p]

### [h3]Very long Banners[/h3]

[p]Normally, perfect registration of colours is not expected in such jobs. Also, owing to their odd size, banners are generally printed in sections. First prepare a printing plan based on the size of your printing

table, your frame size and the dimensions of the matter to be printed. While printing in sections, take care not to print half a letter or a part of the design in one section, leaving the remaining part to be printed in the next section. Prepare sufficient stencils in convenient sizes. and keep as many frames ready with stencils stuck on them.[/p]

[p]For example, you would need four stencils and four frames, and you may have to divide the lettering in three section that you do not print half a letter in one section and leave the other half to be printed in the next section.[/p]

[h2]Picture. 2[/h2]

[h3]Printing of very long banner[/h3]

[p]It is advisable to get every banner starched and well ironed, so that folds and wrinkles may not hamper or obstruct the printing.[/p]

[p]Also, while printing such long banners, it may be convenient to spread the banner on the table and print section by section. Drawing pins may be used to hold the cloth securely in position.[/p]

[h2]Picture. 3[/h2]

[h3]Various section of long banner[/h3]

[p]For speedier work, two colours can be printed at a time. Two persons can work simultaneously on a section with their squeegees dipped in two different colour inks. If both colours are reasonably apart from one another, simultaneous two-colour printing is possible not only in the case of banners as described above, but also in printing other things of smaller dimensions.[/p]

[h2]PRINTING ON VERTICAL SURFACES[/h2]

[p]We have said earlier than one of the advantages of screen-printing is that you can even print on vertical surfaces like walls or the sides of buses or train carriage, or on the sides of huge machines. Such vertical printing would require an attachment known as "retainer box", which can be made locally, and which is attached to the screen frame with small screws. The function of this attachment is to prevent paint from falling and flowing outside the frame when held in an upright position. After attaching the retainer box to the frame, gummed tape should be employed as usual to prevent any leakage. Printing over, this retainer

box can be detached from the frame by removing the gummed tapes and dismantling the screws. [/p]

[h2]Picture. 4[/h2]

[h2]PRINTING ON SHAPED OBJECTS[/h2]

[p]Printing on shaped objects such as bottles glassware, ceramics, jars, tools, instruments, boxes sports and industrial equipments etc. needs on the curved surfaces. [/p]

[p]When thicker objects are to be printed special hinge clamps are used which help in correct registration. The clamps are adjusted according to the thickness of the object and screen is clamped properly. Thick registration guides are also used. [/p]

[p]Irregularly based objects are to be supported at the bottom to keep them stable during the printing. [/p]

[p]Wooden zigs or a mould of Plaster of Paris can be developed for this purpose. [/p]

[h2]Picture. 5[/h2]

[h3]Basic technique for printing on shaped objects[/h3]

[h2]Picture. 6[/h2]

[h3]Manual round printing machine[/h3]

[p]In bottle or container printing, sometimes two or more colours are printed with a single screen simultaneously. To allow this to occur the separate colours must usually be about 10mm. apart. The screen and squeegee blade are separated by the partitions of card, tape rubber or even fabric. [/p]

[h2]Picture. 7[/h2]

[h3]Semi automatic round printing machine[/h3]

[p]The partition are sealed by various means, adhesive, vulcanising etc. to stop see page of ink from one section to another. [/p]

### Cylindrical Object Printing

For printing over such objects a special machine is used which called cylindrical object or round printing machine.

In this process squeegee remains stationary while the object and screen move. Squeegee is attached to a holder in the machine. The holder is attached to the arm which is fixed to an elbow. This facilitates the squeegee's up and down movement. This elbow can be adjusted various thickness of the objects. In such machines screen moves to and from because of which the object kept below also rotates.

### Printing on Uneven Surfaces

Though screen process was a flat surface printing method. It has now branched out into a major process of printing on curved surface and three-dimensional products of all shapes. Indeed, the application of silkscreen to three-dimensional surface is so indispensable that the process is surpassing in total volume, the screening business on flat surface printing in the advertising and display field. In addition to cylindrical, spherical, convex and concave surface screen process is widely used for printing on fabricated materials as tabletops, toys, boxes ceramic tiles, etc. The basic screen process principle remains the same. Put the make ready ink and special equipments are adjusted according to the specification of the particular job.

Printing on round surface is accomplished with: flat stencil. The stencil rests directly on the curvature or crest of the surface to be printed, which in turn rotates on ball bearing rolling pins or fabricated wooden jigs. As the screen is moved side ways, it turns the object with it, thereby rotating on the pins or wooden jigs. Simplest of cylindrical unit is hardly more than a jig. In operation, the cylindrical object is cradled beneath the screen and is revolved beneath it. The squeegee remains stationary, the screen is moved on tracks from side to side, delivering the impressions by momentary contact. The unit may be manually operated or made automatic. Machine size depends upon the size of the protract and the circumference to be printed.

In addition to round or cylindrical objects, there is automatic equipment available for all types of cone shaped objects. This allows for accurate registration and standards of printing which meet the highest level craftsmanship.

## CERAMIC AND GLASS PRINTING

Ceramics are used in wall decorations, for kitchen and toiletry applications. Since, ceramics have a very fine finish, they resist greasy substances and hence, they are used for kitchen and toilets.

[p]Printing on ceramic involves a special ink called Epoxy resin inks which have the property of penetration drying. A dry varnish coat is driven before printing and the ink is absorbed into this varnish coatings. The product after printing has to be stoved or baked. The inks are highly corrosive in nature and proper precautions should be taken for strengthening the screens.[/p]

[p]The ceramic tiles that are printed can be washed off the greasy stains with detergents. Glass is used for many purposes. They are used for windows, car windshields, and kitchenwares and for display shelves. The glassware before printing should be heated with blue flame from a bunsen burner on the area to be printed and should not be touched before or after printing. In some cases this treatment is given after printing to fix the image on to the smooth glass surface.[/p]

## [h2]PRINTING ON PLASTICS[/h2]

[p]The endeavour for perfection in the creation of plastic materials last manufactures, engineers, chemists and research laboratories are bringing about developmental growth in the plastic industry which is having a positive effect on screen-printing. A plastic is a synthetic material consisting of molecule heavy organic substances which are solid in the finished state, but at some stage in the manufacture maybe formed into various shapes through the application of heat and for pressure. While originally, plastics were considered substitute materials. Today plastics are accepted as important industrial and structural materials. The screen printer who is reluctant to accept printing on plastic substrates must realize that it is no longer a question of printing on this material, but how much effort should be put in to this type of printing.[/p]

[p]The constant important developments in plastics make it imperative for the screen printer to make educated choices in their use for printing and for thermoforming. It is suggested that the printer, especially the beginner maintain close contact with his suppliers and approach each project on an individual basis so that practical preferences will emerge.[/p]

Also, because of the constant emergence of new inks and substrates, the screen printer should pretest the ink and substrates for adhesion and other properties before doing a production run. Testing should be done where any doubt exists, since a plastic may vary even from batch to batch. Sometimes ink manufactures recommend that testing be done after the print has been allowed to react with the substrate overnight.

[p]Although, today we generally consider plastics to be synthetic substances, plastics actually may be synthetic natural or caesin, cold molden, lignin and shellac are natural.[/p]



[p]The word "plastics" in the modern sense, is a commercial terms describing a class of industrial materials, whose use overlaps into many industries. Modern plastics are man-made materials produced from high molecular weight synthetic or natural substances which are capable of being formed under heat and pressure, in to the desired shapes at various stages of their manufacture. In modern plastics we are concerned chiefly with materials that may not be found directly in nature but are manufactured from organic matter. Organic matter consists of materials that have hydrocarbons as part of their formulations and plastics are based on organic chemistry.[/p]

[p]Because there are many formulations and flee average screen printer cannot ask for the technical name from a supplier, plastic manufactures have been forced to develop practical scientific nomenclature and trade names for plastics. It is necessary to ideal with plastics generically to obtain the specific chemical formulations. The term "Tyvek" represents the spun bonded polyolefin derivative, "Lexan" is the polycarbonate derivative "Plexiglas" is the methyl methacrylate derivative etc.[/p]

[p]Plastics are classified in to two general types:[/p]

[p]Themo-plastic and thermo-setting plastics. Thermo-plastic are substances capable of being repeatedly softened with application of heat or heat and pressure and are hardened by cooling. Generally, they undergo a physical change and not a chemical change. The thermo-plastic material "Celluloid" (cellulose nitrate) the first American plastic was developed by a young printer, John Wesley Hyatt in 1869 who was looking for a substitute because of ivory shortage.[/p]

[p]A thermo-plastic has an "elastic or plastic memory which implies that it ;may be reheated repeatedly to a forming temperature as in thermo-forming or vacuum-forming, and will revert to its original flat condition when reheated to its forming temperature. Thermo-forming is a process in which a thermo-plastic sheet is heated and pulled down on to a mould surface, forming a three dimensional object. Thousands of thermo-plastics items such as polystyrene, polyethylene, ploypropylene and polyvinyl chloride (PVC) are formed into items such as containers. Screen printed decoration must remain on the container through out the expected life of the product.[/p]

[p]Thermo-setting plastics are materials that undergo a chemical reaction by the action of heat, catalyst, etc. Producing an infusible material and generally making the material impervious for further application of heat. Once they are hardened, they cannot be softened again because thermo-setting substances undergo a chemical change when made into a product. Although the temperature at which the two classes of materials are worked is the same, over heating a thermo-plastic material will soften and melt it, while heating the thermo-setting material above the working temperature may char it.[/p]

[p]Plastic are manufactured by being moulded, cast, calendered, extruded or laminated to almost any specification. Screen printers can obtain these materials in any size, shape, thickness, colour or in stimulated brilliant metallic. Both thermo-setting and thermo-plastics substances can be screen-printed. Most flat surface plastic screen-printing is done in a fashion similar to general screen-printing employing conventional equipment. However, some screen-printing processes on complex or cylindrical surfaces are proprietary or produced on equipments developed in captive or in inplantshops.[/p]

[p]There is no single universal plastic that produces the best properties for all Specific screen-painting applications. Any plastic product which is to be decorated by screen-printing should be designed with attention paid in advance to the process involved in decorating.[/p]

[p]The printer should make decorating of printing on a plastic surface a part of the total standardised process. While screen-printing today represents an obvious answer to decorating plastics, without planning and pretesting the difference in chemical and physicals properties of the substrates and inks may lead to some confusion in the printing process. Inks serve as a decorative propose are designed to enhance a plastic product by providing contrasting colour labelling or impact at point of sales; ink may also serve a more functional and protective need by covering defects or by providing surfaces protection.[/p]

[p]Plastic and screen printing inks are chemical products and consideration must be given to the use of each. The manufacturer of plastic screen-printings inks has become a highly specialised and integral part of screen-printing. Screen printer may print with an ink that may be recommended for printing on more than one type of plastic or may print with an ink that is formulated for a specific plastic. For example a supplier may have an ink formulation for printing on polyester which can also be recommended for other types of plastics. Generally, for printing on vinyl or pyroxylin or a styrene lacquers for printing specifically on styrene which he may also be recommended for printing or rigin vinyl, cellulose acetate butyrate, acrylics and ABS (Acrylonitrile Butadiene Styrene) plastics. Here again, it is suggested that the printer pretest before using an ink not recommended specifically for the plastic. When in doubt, the screen printer should make sure the ink meets such pretest requirements as adhesion, water and humidity resistance, acid resistance, stretch and self and weather resistance. Also, reliable ink manufacturers generally suggest that a sample of the plastic material to be printed be forwarded to the manufacturer for testing before doing a production run-ink and plastics manufacturer are interested in the correct use of their products. It is interesting to note that it took about fifteen years for producers and suppliers of acrylic plastics to educate sign painters in the proper screen-printing of this thermo-plastic material. As is true in general screen-printing, the end use of the product may govern the printing procedure and type of ink which may best be used for printing.[/p]

[p]Where a new plastic is being printed it is suggested that printing conditions be recorded, including such items as type of plastic (trade name or chemical name and manufacturer), type of screen fabric and mesh, type of printing screen, whether off contact printing is used, viscosity of ink, toxicity, odour, drying rule and method of drying, colour retention of ink, squeegee stroke and pressure, atmospheric condition, etc. Such a record is especially useful to the novice for accumulation of objective information and for any possible future reprint of the job.[/p]

[p]Since most plastics are non-absorbant, non-porous smooth and highly polished (so that ink adhesion may be difficult), choosing the correct type of ink is important. The printer should have enough knowledge of the material being printed so that it will be easier to choose the correct ink. Ink must dry uniformly, not causing curling of the sheet, nor sticking to one another when piled.[/p]

[p]Ink adhesion must be compatible with the specific plastic being printed. In many cases, adhesion is obtained by creating a chemical bond with substrate, allowing the ink to remain intact through the life of the product. Some times adhesion of a plastic surface may be impaired if the surface has mold release agents or silicone lubricants on it which have not been removed with correct cleaners or solvents.[/p]

[p]Although, much information on screen-printing may be obtained, from the ink or plastics supplier, it can be tested by simply immersing the printed product in the solvent for about 24 hours. However the advantages of using plastic material such as polyethylene is that it is chemically inert and insoluble in solvents at room temperature.[/p]

[p]It is the chemical inertness that makes ink formulation a difficult task. In the untreated states polyethylene and polypropylene have a waxy surface to which printing ink may not adhere satisfactorily. Pre-treatment of polyethylene has helped to solve problem of permanent adhesion in screen-printing. This may be done by oxidising the surface by means of direct flame treating or by corona discharge (electronic bombardment) or by chemical treatment to produce molecular attraction between plastic & ink.[/p]

[p]While generally there are inks for printing on treated polythelene there are some inks which are recommended for printing on untreated polyethylene and polypropylene. However, a sample of untreated polyethylene material should be tested completely with the recommended ink before eliminating pre treatment.[/p]

[p]Screen printing plastic ink is based on a pigmented or dye coloured solution of the same plastic or resin used in-the manufacture of the plastic to be printed, for example, a practical ink for polyvinyl chloride (PVC) film should be based dispersed in a suitable vehicle. Pigments often are especially tailored for the specific

type of elastic to be printed. The ink on plastics creates a chemical bond and the final print should exhibit properties common to the plastic being printed. Often, inks are specifically formulated for tile particular type of plastic so that the ink Penetrates and becomes an integral part of the final material. For example a rigid non-plasticised PVC may require a different type of ink than a soft or highly plasticised PVC.[/p]

[p]Inks or coatings may be printed on the "first" or "second" surface of the plastic sheet. The first surface or the front surface on which printed design is intended, to be seen. The second surface is the back surface of a transparent sheet or translucent sheet on which the design may be applied. The surfaces may require different ink treatments to obtain given effects. For example, a non-glossy ink may be used on the second surface with gloss being supplied by the surface of the plastic itself. [/p]

[p]Most inks use for printing on the thermosetting substrates are of the backing typed alkyd enamels, epoxy inks and epoxy esters which are printed on thermosets may adhere plastics by mechanical bond and may be dried by oxidation or polymerisation.[/p]

[p]The effect on thermo-plastics may be more critical. For example ink may "craze" styrene while not affecting a phenolic part. Crazing consists of a very fine crack which may extend as a network under a surface or through a layer. Crazing is also caused by incorrectly thermo-forming or vacuum forming a thermo-plastic material. Screen printing on plastics demands a proper choose of plastic, ink correct mesh for printing, perfect preparation, of printing screen and care in drying printed matter.[/p]

[p]Generally, photographic printing screens are water-soluble. Handcut film screens may be employed for printing on plastics. Direct/ indirect and indirect printing stencil may be used, prepared on nylon, polyester or stainless steel fabric. The mesh employed would be governed by the detail to be printed.[/p]

[p]Decoration by screen-printing today is a common method which contributes to the packaging of products. Products may he printed by automatic means. Since manufacturers generally do evaluate their own materials, they should be consulted concerning the use of a questionable ink on a substrate. Because the process employs chemicals and different substrates, a complete job evaluation before printing is a pre-requisite.[/p]

## [h2]SUMMARY[/h2]

[ulist]

[li]By use of screen-printing, you can print on virtually any surface, of any size or of any shape[/li]

[li]Printing surfaces fall in two classes: Porous (absorbent) and non-porous (non absorbent)[/li]

[li]Cylindrical / Round printing can be done by using round printing machines. (Manual as well as semi-automatic machines are available)[/li]

[li]Screen-printed metal & metal foils are used for utility purpose as well as for point of sales displays.[/li]

[li]There are variety of textiles that are used for screen-printing for various end uses.[/li]

[li]Plastics are of two types: (a) thermo-plastics and (b) thermo-settings.[/li]

[li]Printing on ceramic / Glass involves a special ink called Epoxy Resin inks.[/li]

[/ulist]

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