

Screen Printing

Historical development

- Stencils
 - China and Japan 960-1280 AD
 - Human hair used to hold stencil pieces together
 - Europe and the colonies
 - Stenciling - popularity for home decoration
 - Hand-cut and slow

Applications

- Almost any substrate, any size or shape
- Posters, plastic bottles, glasses, mirrors, metal, wood, textiles, printed circuits, point of purchase displays, vinyl binders

Advantages

- Versatility of substrates
- Ease of production
- Decorative capacity including glitter, flock, etc
- Thickness of ink deposit - up to 100 x thicker than other processes, strength and durability

Disadvantages

- Slow production
- Poor ink mileage
- Excessive drying times
- Inability to print fine detail compared to other processes

Major Printing Processes - non packaging

| | 1998 | 2002 | 2012 | 2010-15 |
|-------------------------|------|------|------|---------|
| • Offset | 45 | 42 | 37 | 30 |
| • Letterpress | 6 | 6 | 5 | 2 |
| • Flexography | 18 | 17 | 15 | 13 |
| • Gravure | 18 | 17 | 15 | 13 |
| • Screen process | 3 | 3 | 3 | 3 |
| • Electronic/digital | 10 | 13 | 20 | 32 |

The printing process

- Feeding, registration, printing & delivery - same as any other process
- Simple
 - Frame with mesh attached
 - Squeegee to force ink through the mesh
 - Feed the stock to register position
 - Print by pulling the squeegee
 - Remove substrate for drying

Fabric types

- Multifilament
 - Strands of fibers twisted together
 - Sewing thread
 - Natural fibers are always Multifilament
 - Silk



Monofilament

- Single strands
 - Fishing line
 - Polyester, nylon, wire mesh
 - Smooth, difficult to adhere stencils
- Synthetics may be either monofilament or multifilament



Multifilament fabrics

- XX system - 6XX-25XX
 - Multiply by 100 to get *approximate* mesh count per linear inch
 - 12XX x 100 = 120, may run from 115-129 threads per inch
 - Smaller the number, the larger the percentage of open area
 - 12XX for handcut and indirect stencils, 14XX for photo stencils with fine detail

Multifilament fabrics

- Advantages
 - Easy application of indirect stencils
- Disadvantages
 - Fabric thickness limits fine detail
 - Yarn irregularities

Monofilament fabrics

- Specified by actual thread count
 - 160-mesh has 160 threads per inch
 - Available from 60-500 threads per inch

Monofilament

- Advantages
 - Smooth surface yields easy and even ink flow and screen cleaning
 - Very fine meshes available
 - Finer meshes result in less ink laydown, ink savings

Monofilament

- Disadvantage
 - Smooth surface resists adhesion of indirect stencils

Fabrics

- Silk
- Organdy
- Nylon
- Polyester
- Wire cloth

Screen frames

- No standard size or shape
- Construction
 - Wood
 - General applications
 - Inexpensive

Frames

- Aluminum
 - Greater rigidity and stability
 - Expensive
- Roller frames
 - Ease of tensioning fabric
 - Expensive

Attaching fabric to the frame

- Staples and tape
 - Least desirable
 - Puncture fabric, possible tears
 - Difficult to achieve uniform tension
- Cord and groove
 - Groove cut in wood frame with cord inserted

Stretching the Fabric

- Mechanical clamp
 - Fabric clamped in position
 - Screws force clamps outward and increase tension
- Roller frame
 - Fabric attached to rollers with plastic strips
 - Rollers tightened to increase tension

Stretching the fabric

- Mechanical stretching devices
 - Fabric is clamped in mechanical device
 - Tension is applied
 - Fabric is attached to frame with epoxy type adhesive

Tensiometer

- Measures percent of stretch
 - Newtons per centimeter
 - All screen areas should be equal

Stencils

- Hand-cut
 - Paper
 - Simple jobs
 - Adheres to screen by ink alone

Stencils

- Film - soluble film on a polyester base
 - Water soluble
- Indirect emulsion
 - Exposed, developed, adhered to screen
- Direct emulsion
 - Screen coated, exposed, washed out
- Indirect-direct

Squeegee Blade Shapes

1. Square-edge - flat surfaces, general purpose printing
2. Square-edge with round corners - extra heavy ink deposits
3. Round-edge - textiles



Squeegee Blade Shapes

4. Single-side bevel edge - glass
5. Double-side bevel with flat point - clay slip on ceramics
6. Double-side bevel - cylindrical printing



Presses

- Manual - Operator feeds, registers, prints, removes stock
- Semi-automatic
 - Operator feeds, registers, removes stock
 - Press squeegee and floods ink
- Flat-bed cylinder press
 - Automatic feed and register
 - Flat screen prints automatically
 - Fastest press

Presses

- Cylindrical object press - for printing cylinders
- Textile press
 - Multiple head
 - Intermediate drying between prints