Chapter 6

Graphic Arts

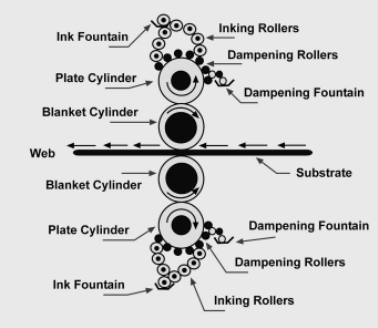
Printing Operations

- Offset lithography
- Flexography
- Rotogravure
- Screen

Offset Lithography

- Uses a planographic printing surface
- Printing unit components:
  - Inking system
  - Dampening system
  - Plate cylinder
  - Blanket cylinder
  - Impression cylinder

Offset Lithography Printing Unit



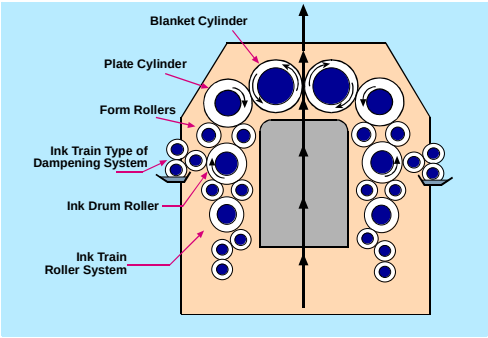
Offset Lithography Processes

- Nonheatset web printing
- Heatset web printing
- Sheetfed printing

Nonheatset Web Printing

- Prints on continuous web of paper
- Line speed 600-2100 fpm
- Uses semifluid inks
- Does not require heat for curing
- Fountain solution is >99.5% water and uses low volatility solvents

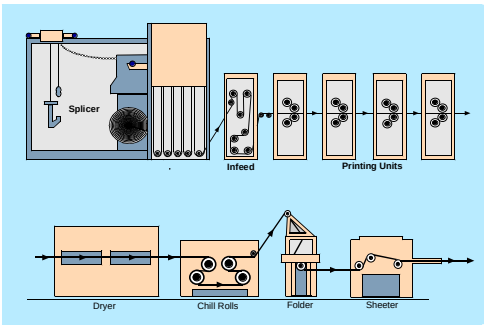
Nonheatset Web Printing Unit



Heatset Web Printing

- Uses fluid inks that dry by evaporation
- Some inks cure by chemical reaction
- Typical dryer temperatures are 225-325°F
- 40-90% of ink solvent evaporates in dryer
- Fountain solution is 5-20% IPA or 2-5% low volatility solvents
- 0-5% of fountain solution solvent remains in web
- Automatic blanket washers evaporate solvent in dryer during wash cycle

Heatset Web Printing Press



Sheetfed Printing

- Applies images to individual sheets
- Typically uses semifluid inks
- May use radiation curing inks
- Fountain solution is 5-20% IPA or 2-5% low volatility solvents
- Finishes are frequently applied

Emission Control Techniques

- Inks
- Fountain solution
- Press cleaning

Nonheatset Web Inks

- Formulated with low volatility solvents
- Guidelines suggest 5% of solvent emitted as fugitive emissions and 95% retained in paper
- Best control technique is ink reformulation

Heatset Web Inks

- Inks cure by evaporation in a dryer controlled with add-on equipment
- Guidelines suggest 80% of solvent is emitted in dryer and 20% retained in paper
- Control methods include incineration and condenser-droplet removal systems

Sheetfed Inks

- Formulated with low volatility solvents
- Guidelines suggest 5% of solvent emitted as fugitive emissions and 95% retained in paper
- Best control technique is ink reformulation

Fountain Solution

- Most volatile additive is IPA
- Use low volatility dampening agents
- Refrigerate fountain solution to 55-60°F
- For nonheatset and sheetfed printing, guidelines suggest 100% of solvent emitted as fugitive emissions
- For heatset printing, guidelines suggest 30% of solvent emitted as fugitive emissions and 70% emitted in dryer

Press Cleaning

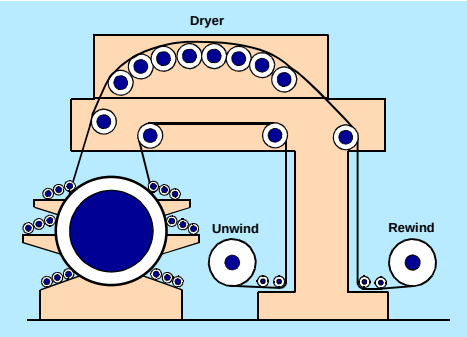
- Reduce VOC content of cleaning solution
- Use less volatile solvents
- Add water and detergent to cleaning solution or use aqueous cleaner
- Put rags and wipes in sealed containers
- For heatset printers with automatic blanket washers, guidelines suggest 60% of solvent emitted as fugitive emissions and 40% emitted in dryer

Emission Regulation

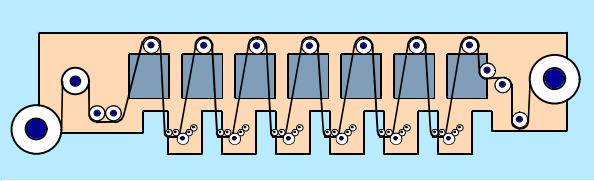
Flexography

- Uses raised image rubber printing plates
- Inks contain up to 75% solvent by weight
- Press designs:
  - Central impression
  - In-line
  - Stacked
  - Newspaper unit
  - Publication unit

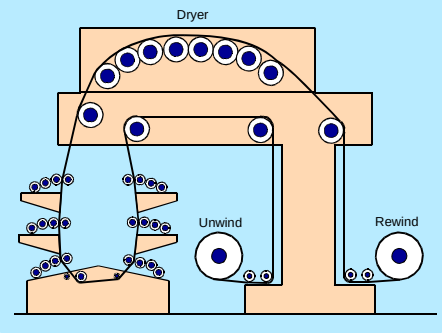
Central Impression Press



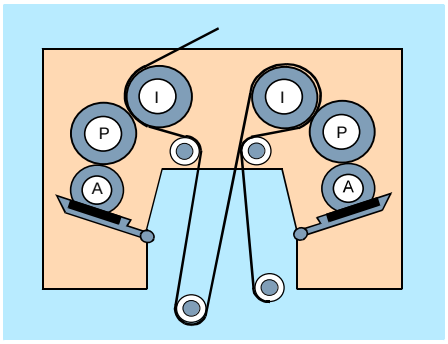
In-Line Press



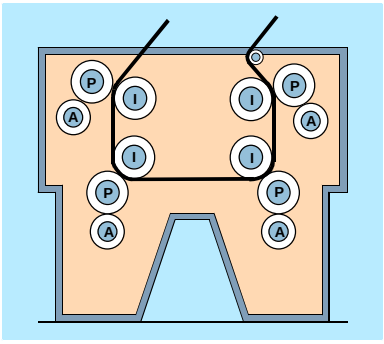
Stack Press



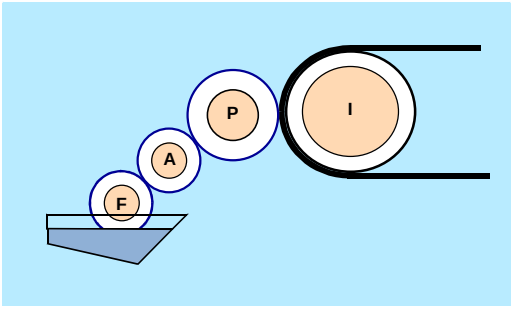
Newspaper Printing Unit



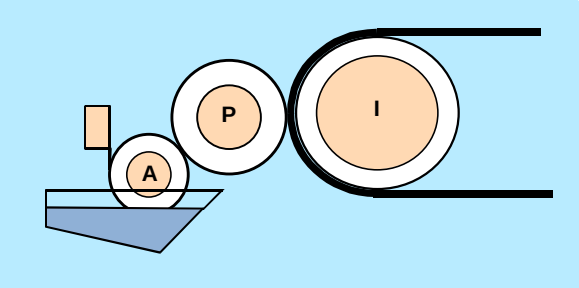
Publication Printing Unit



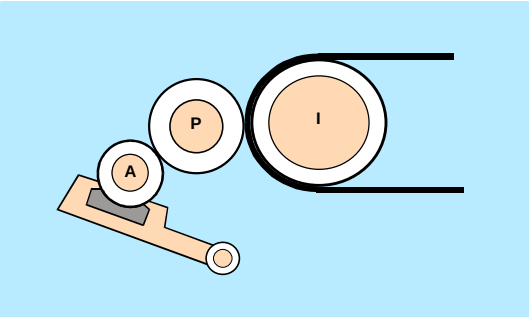
Fountain Roller Style Printing Station



Single Doctor Blade Style Printing Station



Double Doctor Blade Style Printing Station



Types of Inks

- Organic solvent based
- Water based
- Radiation curable

Emission Control Techniques

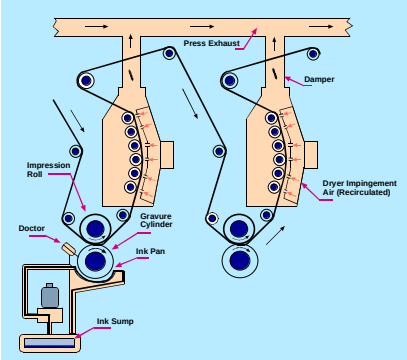
- Reduced-VOC ink
- Reduced-VOC cleaning
- Add-on control equipment
  - Incineration
  - Adsorption
  - Condensation

Emission Regulation

Rotogravure

- Uses engraved chromium plated printing plates
- Inks contain up to 75% solvent by weight
- Industry branches:
  - Publication rotogravure
  - Packaging rotogravure
  - Product rotogravure

Rotogravure Press



Emission Control Techniques

- Reduced-VOC ink
- Reduced-VOC cleaning
- Add-on control equipment
  - Incineration
  - Adsorption
  - Condensation

Emission Regulation

Screen Printing

- Ink flows through screen with stencil bonded to it
- Types of inks:
  - Solvent based
  - Water based
  - UV curable
  - Plastisols

Drying Units

- Hot-air ovens
- Infrared radiation
- UV radiation

Screen Reclamation

- Ink residue removed
- Screen degreased
- Stencil remover applied
- Stencil removed with high-pressure wash
- Haze removers may be used

Emission Control Techniques

- Reduced-VOC ink
- Reduced-VOC cleaning
- Add-on control equipment
  - Incineration
  - Adsorption
  - Condensation

Emission Regulation

Process Inspection

- Review ink composition and consumption records
- Observe ink preparation
- Observe printing area
- Observe curing area

Review Ink Composition and Consumption Records

- Composition data evaluated to determine compliance with permit and regulations
  - Solvent content
  - Solids content
  - Water content
  - Solvent density
  - Ink density
- Consumption data evaluated to determine compliance with permit

Observe Ink Preparation

- Determine if area is ventilated
- Note if drums are kept closed
- Determine if solvents have changed
- Observe spill cleanup
- Get sample of “as applied” ink

Observe Printing Area

- Determine if area is ventilated
- Note changes in printing method
- Determine changes in application rate
- Determine if control system is adjusted
- Observe spill cleanup

Observe Curing Area

- Check physical integrity of oven
- Check oven temperatures
- Determine changes in line speed
- Determine if control system is adjusted