UNIT- III
SHEET CONTROL AND DELIVERY IN OFFSET PRESS

Sheet Control:
Sheet control means separating the sheet from the pile board and transporting the sheet one by one in the printing unit in correct register. The sheet control devices are blowers, suckers, infeed wheels, brush wheels, metal wheels, rubber wheels, side lay, front lay and infeed wheels.

Automatic Sheet Feeder:
These are the feeders which automatically separate the sheets from the pile board and transfer the sheets into the printing unit.

Friction feeder:
Friction feeder feeds the sheets one by one by means of friction devices. Friction feeding is mainly used in small offset duplicators. This is also used in folding machines.

In the friction feeder there is a set of retaining spring clips. These clips catch the front or leading edge of the pile of paper. This finger avoids the passing of more than one sheet into the machine. The friction draw bar and control rod also present in these feeders. The control rod is also acts as the pile height governor. The friction draw bar and control rod are involved in feeding the paper into the machine.

First the friction draw bar and control rod both moves downwards and presses the top of the pile. The control rod remains in its place but the friction draw bar moves towards the control rod by releasing the topmost sheet of the pile from the retaining clips. At the same time as the control rod is stationary, a buckle will be formed in the sheet. So, only one sheet will be separated due to the buckle forms. Now the control rod moves upwards to its original position. But
the friction draw bar moves towards the retaining clips thus moving the separated sheet over the clips. The friction draw bar will move until the leading edge of the sheet is inserted into the nip of the forwarding rollers. Then the friction draw bar will move to its original position for the next cycle.

The metal strips are used in the feeder head which are used to avoid the passing of double sheet going for printing during sheet separation.

**SHEET STEADYERS:**

The sheet steadiers are present in the feeder head and it is provided in a manner that its flat edge contacts in the two side edges and rear edge of the stacked paper to avoid the displacement of paper during lifting and forwarding operation. These sheet steadiers are having up and down movement.

**Pneumatic or Suction Feeder:**

This type of feeders is operated with the help of air supply. The pneumatic feeders are divided into two types,

1. Single sheet feeder or Successive sheet feeder
2. Stream feeder or Continuous feeder.

**Types of Automatic feeder**

The automatic feeders are divided into types,

1. Single sheet feeder or Successive sheet feeder
2. Stream feeder or Continuous feeder.

**Single sheet feeder or Successive sheet feeder:**

This feeder is present in the machine which is working with front separation principle. The speed of the front separation machine is slow when compared to the speed of the back separation machine, because in front separation machine the sheet has to be waiting for sometime to allow the full sheet to cross the front separation suckers. Example for front separation machine is mini offset machine.

The working sequence of single sheet feeder is as follows:

1. The pile height governor senses the height of the pile and automatically raises it to predetermined position.
2. The air nozzles situated at the front and rear side’s forces the air into the top pile partially separating them.
3. The front suckers descend and take hold of the first sheet.
4. The forwarding suckers lift and the sheet is moved forward suckers until the leading edge of the sheet is between the rollers.
5. The forwarding rollers close on to the sheet and it is conveyed to the feed board.

The single sheet feeder is generally found on smaller presses which run about the speed of about 6000 IPH.
Stream Feeder:

These types of feeders are present in the machine which is operated by back separation principle.

The speed of the stream feeder machine is high when compared to the speed of single sheet feeding machine because the feeder head is present at the back edge of the paper present in the pile board. So the suckers do not able to wait for the full sheet passing. The stream feeders are present in the general offset machines as well as high speed machines.

**The sequence of operation of stream feeder is as follows:**

1. Air is forced into the back edge of the pile separating the top sheets. The rear suckers descend and take hold of the top floating sheet.
2. The sucker’s raises the back edge of the sheet and the hold down foot descends to firmly hold the remaining sheets to the pole. This hold down foot often acts as the pile height governor.
3. A steam of high velocity air is now directed under the top sheet, lifting the front edge to level with the forwarding rollers.
4. The sheet is now moved forward by cushion of air to pass between the forwarding rollers and the drop wheels which close on to the sheet and convey to forward. As the sheet is taken by the forwarding roller, the back separation unit begins its next cycle.

**Feeder head components:**

**Feeder head:**

This is the part of the feeding unit present above the pile board. It consists of the components which are used to separate and to forward the sheets one by one for printing.

**Feeder head components:**

The devices which are present in the feeder head are called feeder components. The feeder head components are air blast nozzles, rear pickup suckers, sheet steadiers, separation brushes and fingers.

1. **Air blast nozzles:**
   
   This component is present at the feeder head and used to blow forced air at the back edge of the pile board where the pile of paper is present. The air lifts the paper at the back edge which helps for the separation of single sheet for printing.

2. **Rear pickup suckers (Lifting Suckers):**

   This is the suckers present in the machine which works by back separation principle. This sucker sucks the air to separate the sheets in the pile board at the back edge. The other name of the rear pick up suckers is called lifting suckers.

3. **Forwarding pick up suckers (Forwarding suckers):**

   These are the suckers present after the rear pick up suckers which receives the paper from the lifting suckers and forward the received sheets one after one over the feed board area.
4. Lifting and forwarding suckers or Rear pick up and forwarding suckers:

These suckers are also present at the back edge of the paper at the pile board. These suckers perform both the lifting and forwarding operations on the paper. So these suckers are called as lifting and forwarding suckers.

5. Brushes:

The brushes are used in the feeder head which are used to avoid the passing of double sheet for printing during sheet separation operation. The bristles of the brushes enter into the lifted papers and help to avoid the suction of double sheets for printing.

6. Metal strips or metal fingers or sheet separation strips:

These are the flexible metal fingers which contacts the back edge of the pile of paper. These strips are used to avoid the passage of double sheets going for printing.

Sheet forwarding devices:

These are the devices which are used to transport the sheets one by one from the pile board area over the feed board to the front lay for registration. The forwarding suckers are given as follows:

1. Forwarding suckers:

These suckers receives the sheet from the lifting suckers and forwards the received sheets into the feed board

2. Conveyor tapes:

These endless belts are made of hard – wear material. These are connected with the shaft at the front and back edge of the feed board. These are present in correct tension for helping the tensioning rollers for free movement.

3. Running -in wheels:

These wheels must be positioned over the conveyor tape and tensioned for giving correct pressure to the sheets for movement over the feed board.

4. Conveyor assemblies:

Two or more feed board rails are situated over the feed board. The Running in wheels, brush wheels and ball assemblies are attached to the rails by movable clamps.

5. Forwarding rollers:

These rollers are present over the rotating shaft. These are used to transport the sheets from the pile board to the feed board.

Sheet registering devices:

These are the devices present in the feed board which is used to register the sheets in the front and side edges to pass the sheet in a square for the correct positioning of image on the sheets.

The sheet registering devices are classified into front lays and side lays.

a. Front lays:

These lays are present at the last edge of the feed board to register the paper front edge. These front lays are used to register the front edge of the unprinted sheets without any cross. The front lays are divided into two types,
1. Pivoted above from the feed board and
2. Pivoted below from the feed board.

1. Pivoted above from the feed board

This type of front lays is present above the feed board and it Contact the feed board edge during the time of paper comes to the feed board edge for front registration. This is connected with the mechanism present above the feed board.

2. Pivoted below from the feed board

This type of front lays is present below the feed board and it Contact the feed board edge during the time of paper comes to the feed board edge for front registration. This is connected with the mechanism present below the feed board.

b. Side lays:

Side lays are used for the side registration of the paper before printing. The side lays are present at the side of the feed board area. There are two types of side lays are present, they are,

a. Push type side lay and
b. Pull type side lay.

a. Push type side lay:

This type of side lays registers the paper side edge by means of paper Pushing principle. This type of side lays are present in slow running and mini offset machine.

In this type a compensator mechanism and a side lay having to and fro movement is present. When the paper comes for side registration the compensator pushes the paper towards the side lay and due to the movement of side lay and compensator mechanism the paper gets registered at the side edges.

b. Pull type side lay:

This type of side lays registers the sheet at the side edge by means of paper pulling principle.

This side lay consists of a sliding bar or sliding under lay which has to and from movement over the feed board. A roller mechanism is also present over the sliding under lay. Due to the movement of the sliding under lay and roller mechanism, paper side edge gets registered at the side piece.
Detectors:

The detectors are used to detect either early or late arrival of paper in the machine. There are three types of detectors and they are:

1. Early and late sheet detectors
2. Cross sheet detectors
3. Double sheet detectors

Early and Late sheet detectors:

Most presses have a device that detects either the early or late arrival of sheets at the front guides. Four basic types of sheet detectors are used:

**Late Sheet Detectors (or) Mechanical type Sheet Detectors:**

The detector which detects the late sheet are called Mechanical sheet detectors. A sheet reaching the front guides at the proper time prevents a pin from entering a slot in the feedboard. However, if the sheet is late reaching the front guide, the pin drops into the slot, and the feeding action of the press stops. A mechanical sheet detector is easily damaged due to the paper-caused wear or poor adjustment.

1. **Early Sheet Detectors (or) Electromechanical type Sheet Detectors:**

The detector which detects the early sheet are called ElectroMechanical sheet detectors. The electromechanical sheet detector consists of normally open electrical contacts. A sheet arriving too early at the front guides causes the contact points to close, and the feeding action stops. An electromechanical sheet detector is also easily damaged due to paper-caused wear on poor adjustment.

**Photoelectric type:**

The detector which detects the early and late sheet are called Photoelectric type. This type of detector consists of two photocells, one to detect early sheets and one to detect late sheets. Each photocell is paired with a lamp that does not shine on the photocell. If the front guides are up, an early sheet reflects light from the lamp of the “early detector” to its photocell, stopping press rotation and feeder operation. If the front guides are down and the sheet is late, no light reflects from the lamp of the “late detector” to its photocell, stopping feeding action. The operation of each photocell is timed to the position of the front guides. To operate properly, the photocells must be kept clean.


**Pneumatic type:**

which detects the sheet located improperly at the front guide. Consisting of a series of vacuum nozzles, the device detects an improperly located sheet whenever air pressure changes. A change in air pressure activates a tripping device that stops feeding action. Porous stock may cause false detection.

**Three point register system:**

The registration of the paper over the feed board in a way that the edges contact one point at the side lay and two points at the front lay. This three point registration allows paper correct registration during printing.

**Sheet insertion devices:**

These are the devices which inserts the sheets one by one into the printing unit.

The in feed grippers are used as the sheet insertion devices in the sheet fed offset machine.

1. Tumbler gripper system:

   In this system the gripper rotates at an angle of 180 for gripping the sheet at the front lay. After gripping the sheet it again rotates 180 angle in reverse for giving the gripped paper leading edge into the impression cylinder gripper. For the 180 angle rotation the gripper is activated by means of a gripper mechanism.

2. Swing arm gripper system:

   These grippers rotates at an angle of 90 to grip the registered sheet the front lay. These grippers movement is 90 at forward and backward for opening and closing the mouth for gripping the and to give sheet to the impression cylinder grippers for printing.

3. Rotary gripper:

   In this system the gripper rotates continuously at an angle of 360 to grip the registered sheet at the front lay. These grippers rotate continuously in one direction for gripping the sheet from the front lay and to give the paper edge to the impression cylinders.
4. Overfeed system:
   In this system two rotating rollers are present before the front lay. After the sheet registered at
   the front and side lays, due to the rotation of the rollers the sheets directly gets inserted into the
   grippers of the impression cylinder.

3.6 DELIVERY SECTION:
   The delivery is present after the last impression cylinder. This section is used for the proper
   delivery of the printed sheet one over the other. The delivery section consists of delivery grippers
   which receives the printed sheets from the impression cylinder and stack the sheets one over the
   other.

   JOGGING THE DELIVERY PILE:
   Jogging means the proper alignment of the sheets evenly one over the other. For jogging the printed
   paper at the delivery pile board front joggers, rear joggers, (movable) and side joggers are used
   (movable) are used. When the delivery grippers drop the sheets over the pile board, these joggers
   align the sheets evenly.

   These are the devices which are used for stacking the printed paper neatly in the delivery pile board.
   The delivery assist devices are as follows,

1. SUCTION SLOW DOWN ROLLERS:
   Suction slow down and steady the sheets as it enters the delivery. They are usually positioned
   just behind the chain delivery. These rollers are connected with vacuum motor. These rollers have
   holes by which the sheets got sucked by air suction principle. Due to this suction the sheet delivery
   is steady and slow over the delivery pile board.

2. BLOW DOWNS:
   Near the top of the delivery a shaft with series of holes is present. These Shaft is connected
   with air motor. The air is blown over the top of the sheet when the printed sheet got entered into the
   pile board area of the delivery section.

SET – OFF:
   This is the problem caused due to the formation of wet ink of the first printed sheet at the back side
   of the second printed sheets.

   To avoid this problem anti set off devices are used.

   ANTI SET OFF DEVICES:
   These are the devices present at the delivery pile area which applies anti set off components
   over the printed sheets. These components form a layer over the printed wet ink and avoid the set
off problem. Anti set off devices is of two types and they are,

1. **POWDER SPRAYER**

These sprayer sprays the powder form of anti set off component over the printed sheet. These types of sprayers are used only in single color offset machines because the powder does not create any problem while printing multi colors by using the single color offset machines.

2. **LIQUID SPRAYER**

These sprayers spray liquid anti set off component over the printed sheet. The liquid sprayers are only used in multi color machines which completely prints all colors over the sheet in one pass. These sprayers are not used in multi color machines because if we spray liquid on the printed sheet and if we use the printed sheet for next color printing, we could not get the correct color results because the liquid layer avoids the correct merging and correct color formation.

**WEDGES:**

Wooden or plastic wedges are used to produce a neat pile. The wedges can be inserted at the trailing or tail edge of the sheets. These wedges helps to counter tail-end hook (a sharp curl) at the back edge of the sheets.

**PREMAKEREADY:**

This is just to shorten the operations performed during makeready.

**TOOLS:**

1. Torque wrench - Tightening the bolt.
2. Assorted wrench - for making press adjustments
3. Dead weight macrometer - for measuring packing, plates, blanket
4. Packing guage - for measuring plate and blanket heights on the press
5. Magnifier - for checking dot structure
6. Densitometer - for measuring the density of the ink

**MATERIALS:**

Paper, Ink, Blankets and Rollers, Packing Sheets.

**INKING AND DAMPENING SYSTEM WASH UP:**

**TEAM WORK:**

**SCHEDULING:**

- What job order says
- What the next job number is
- If the plates are ready

**Makeready Steps:**

2. Check copy, plates, paper, and ink against instructions.
3. Set sheet handling mechanisms.
4. Pack and mount the plates.
5. Check and prepare new blanket (necessary)
6. Prepare the dampening system.
7. Prepare the inking system.
8. Prepare the makeready books for pile (1:5)
9. Make trial impression.
10. Examine trial impression.
11. Make necessary adjustments to image position/register impression quality and color.
12. Obtain a color and position OK.

MAKEREADY PROCEDURE FOR SINGLE FOR PRINTING:

PREPARE THE PRESS FOR NEW PRESS RUN:

The setting of a previous job should be reset for printing a new job. The inking system should be washed. The dampening rollers may be cleaned if needed. The plate should be removed and taken for storage.

CHECKING COPY, PLATE, INK AND PAPER AGAINST INSTRUCTIONS:

The Original given for printing is taken and it is observed. Then the image in the plate have to be checked for perfection. The quantity of the paper and the quality of paper also checked for fine printing to give quality results.

SETTING THE SHEET HANDLING MECHANISM:

Sheet handling mechanisms starts from pileboard to frontlay. In the pileboard the side guides, front stoppers and feederhead are set according to the sheet size. The double sheet detector must be set according to the stock thickness. The feederboard elements and sidelays are set according to the size of the stock. These sheet handling mechanisms must be set properly inorder to transport the sheets into the printing unit without any stops. The delivery joggers also set according to the paper size for neat stacking of printed papers.

PACKING AND MOUNTING THE PLATE:

The plate used for printing the job should be taken and its thickness must be measured. According to the plate thickness the required thickness of packing sheet is taken and is placed between the plate cylinder and the plate during the mounting of the plate. The thickness of the plate and packing is considered according to the undercut of the plate cylinder.

CHECKING AND PREPARING THE NEW BLANKET (IF POSSIBLE):

During makeready of the machine the condition of the blanket must be checked. If the blanket surface is not in good condition or any unrectified low spots are to be found then the blanket is removed from the cylinder and new blanket is mounted with correct packing.

PREPARING THE DAMENING SYSTEM:

The dampening roller cloth covers are washed to remove the ink particle accumulation. If any cloth covers got damaged then they should be replaced by a new. The after these rollers are mounted in the dampening unit. After that the dampening solution is prepared with correct pH level and the prepared solution is poured in the dampening duct.

PREPARING THE INKING SYSTEM:

The inking system rollers must be cleaned to remove the previous job printed ink. Then the ink
to be printed into the ink duct. Then the ink keys are adjusted for supplying the ink from the ink duct to the duct roller according to the image present in the plate.

**PREPARING THE MAKEREADY BOOKS:**

During makeready of job a number of sheets are required to be printed. If we use unprinted sheets then a number of sheets has to be wasted during makeready. To avoid the wastage of white sheets the makeready books are prepared. The makeready books are prepared by placing 5 waste sheets to 1 unprinted sheet (5:1 ratio). This books avoids unprinted sheet wastage.

**MAKING TRIAL IMPRESSION:**

After the makeready book was prepared a trial impression was made in the unprinted paper by passing the makeready book into the printing unit.

**EXAMING THE TRIAL IMPRESSION:**

From the delivery board the printed white sheet is taken and it is examined through for the registration of image, color density etc., if there is any misregistration (or) color value is found then required adjustments are made and the machine is run to get next trial impression.

**GETTING OK FOR PRINTING:**

After all the adjustments are made and perfect result is obtained in the paper during the trial impression then the printed paper is taken to the supervisor or other higher authorities to get approval for printing.

**RUNNING THE MACHINE:**

After getting approval from the authorities the machine is run continuously to print the required number of copies.

**SAFETY PRECAUTIONS:**

1. Observe all the rules and regulations mentional in the machine manual.
2. Never make major repairs or perform maintenance when the machine is running. Any work or minor service and maintance should be done only after the power is locked out.
3. Never wear loose clothes and hand jewels near to the running machine that will need accidents.
4. Before touching the running parts of the machine make sure the press is completely stopped.
5. Never switch off or byepass the safety devices.
6. Wear hearing protection devices when working in areas with high noise level.
7. Never lean or rest hands on running machine.
8. Avoid carrying tools in pockets to prevent the possibility of dropping into the machine which lead for dampening the machine parts.
9. Do not allow oil, grease, dirt and paper scarps to accumulate on the floors around or break equipment.
10. Do not smoke in the press run.
11. Always wear personal protection equipment where necessary or instructed to protect against personal injury.
12. Check the all guards, covers are completely locked in place before operating the press.