

For Restricted Circulation only

 SHAKAMBHARI GROUP #SteelWithin		SHAKAMBHARI ISPAT & POWER LTD. (Formerly known as Ess Dee Aluminium Ltd.)	
STANDARD OPERATING PROCEDURE			
Title: Operation for Printing Machine			Page No. 1 of 7
SOP No.	Version No.	Effective Date	Next review date
SIPL/PDI/010	00	06.07.2026	05.07.2028

1.0 PURPOSE

- 1.1 To establish a standard procedure for the safe and effective operation of the Gravure Printing Machine used for printing pharmaceutical & food packaging foil, ensuring consistent print quality, product identification, and compliance with Good Manufacturing Practices (GMP).

2.0 SCOPE

- 2.1 This SOP applies to the Printing section of the Production Department.

3.0 REFERENCE(S) & ATTACHMENTS

3.1 References

- 3.1.1 In-house

3.2 Attachments

- 3.2.1 Attachment I : Printing Log Book :SIPL/PDI/010/F01/00
 3.2.2 Attachment II : Printing Label : SIPL/PDI/010/F02/00
 3.2.3 Attachment III : Mix Ink Label SIPL/PDI/010/F03/00

4.0 RESPONSIBILITY

4.1 Production Department Person:

- 4.1.1 To prepare the SOP.

4.2 Production Head

- 4.2.1 To ensure the training of the SOP to all concerned personnel involved in implementation of the SOP.
 4.2.2 To ensure the implementation of the SOP after training.

4.3 Quality Assurance Person

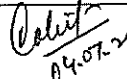
- 4.3.1 To check the SOP and to maintain the original copy of the SOP.
 4.3.2 To issue the controlled copy of the SOP and maintain its issuance record.
 To retrieve the controlled copy of the SOP when it is superseded/obsolete and maintain its record.

4.4 QA Head / Plant Head

- 4.4.1 To approve new or revised SOP.
 4.4.2 To ensure the implementation of the defined system.

5.0 DISTRIBUTION

- 5.1 Quality Control
 5.2 Production

Prepared By:	Checked By:	Approved By:
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STANDARD OPERATING PROCEDURE

Title: Operation for Printing Machine			Page No. 2 of 7
SOP No.	Version No.	Effective Date	Next review date
SIPL/PDI/010	00	06.07.2026	05.07.2028

6.0 DEFINITION(S) & ABBREVIATION(S)

6.1 Definitions

6.1.1 **Printing Unit:** Each station of the printing machine in which the cylinder image is transferred onto the substrate is referred to as a printing unit.

6.1.2 **Printing Cylinders:** The image to be printed is engraved on cylinders. While printing, the inks transfer onto the substrate. These are also called Rotogravure Printing Rollers: 'Roto' means rotate and gravure is a process of printing. The rotogravure printing rollers rotate into the ink pan and the doctor blade wipes the maximum ink from the cylinders, transferring the ink of the engraved image area onto the substrate.

6.2 Abbreviations

6.2.1 QC: Quality Control

6.2.2 M/C: Machine

6.2.3 CYL.: Cylinder

6.2.4 RM: Raw Material

6.2.5 MPM: Meters Per Minute

6.2.6 HMI: Human Machine Interface

6.2.7 PSI: Pound per square inch (1 lb/in²; one pound-force applied to an area of one square inch).

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STANDARD OPERATING PROCEDURE			
Title: Operation for Printing Machine			Page No. 3 of 7
SOP No.	Version No.	Effective Date	Next review date
SIPL/PDI/010	00	06.07.2026	05.07.2028

7.0 PROCEDURE

7.1 Check list before running of machine:

7.1.1 Printing Operators / Printing Supervisors shall check the following checklist before running the printing machines:

7.1.1.1 Ensure that all printing units are operational with respect to electrical supply and that air pressure from the compressor is 6 bars. Ensure all electrical panels including the Siemens HMI panel are working. If any problem is found, coordinate with the maintenance department.

7.1.1.2 Ensure that all doctor blade assemblies are moving.

7.1.1.3 Ensure all blowers with heaters are working on the printing units.

7.1.1.4 Operators check the daily production planning and work orders (Job code, Artwork code, Job Name, Batch no., Printing Quantity and other details mentioned on the job cards), and that approved LSD shade cards are available on the machine.

7.1.1.5 Check printing roller availability in the cylinder store room.

7.1.1.6 Check rubber roller availability in the rubber roller store room.

7.1.1.7 Check raw material availability (size and quantity) on the shop floor as per work order.

7.1.1.8 Check inks and solvent on the shop floor. If not available, arrange them immediately from the RM store.

7.2 Pre-Make Ready of Job

7.2.1 As per priority of the production plan, the Assistant Operator brings the related printing rollers from store and checks the code as per job plan. Check all cylinders visually for any damage, de-chroming, etc.

7.2.2 Load the cylinders on the machine as per the Cylinder Loading and Unloading procedure.

7.2.3 Load the rubber rollers as per the Rubber Roller Loading and Unloading procedure.

7.2.4 Change the doctor blade as per the Doctor Blade Change procedure.

7.2.5 Change the cover of the ink tray as per the Ink Tray Change procedure.

7.3 Make Ready

7.3.1 Rubber Roll Loading

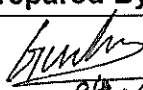
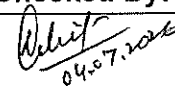
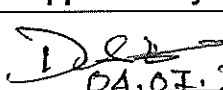
7.3.1.1 Remove the previously loaded rubber roll.

7.3.1.2 Take the rubber roll to be loaded as per the material size and put it on the machine.

7.3.1.3 Check the bearing for any damage. Apply oil to the bearing for lubrication.

7.3.1.4 Take the plate to the printing unit where the rubber roll is to be fixed.

7.3.1.5 In case the rubber roll is a hollow type, insert the rubber roll shaft into the roll. Clamp it, tighten the align bolt and fix the bearing properly.

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STANDARD OPERATING PROCEDURE			
Title: Operation for Printing Machine			Page No. 4 of 7
SOP No.	Version No.	Effective Date	Next review date
SIPL/PDI/010	00	06.07.2026	05.07.2028

7.3.1.6 Follow the same process for all required printing units' rubber roll fixing.

7.3.2 Cylinder Loading

7.3.2.1 Before loading the cylinder on the machine, clean the cylinder and mechanical shafts properly. If stretch film is wrapped on the shaft, remove it.

7.3.2.2 Put the cylinder on the shaft carefully. Ensure that the cylinder surface does not touch any metal or hard object, as it may damage the cylinder.

7.3.2.3 Match the cones and cylinder bore and fix them manually. Ensure that no body part, especially fingers, gets stuck between the bore and cone.

7.3.2.4 Engage/tighten the cylinder with the line shaft properly using the lever.

7.3.2.5 Wrap the cylinder cone and pneumatic/mechanical shaft with stretch film.

7.3.2.6 Follow the same process for all required printing units' cylinder fitting.

7.3.3 Ink Filling in Tray

7.3.3.1 Put a clean or same-colour tray on the ink station.

7.3.3.2 Load the ink tray in the printing unit as per the colour sequence of the job.

7.3.3.3 Filter the ink using filter cloth if required.

7.3.4 Doctor Blade Changing

7.3.4.1 Remove the worn-out blade from the blade holder. Use cut-resistant hand gloves while handling the doctor blade. Store the worn-out blade in the "Un-usable Doctor Blade Box".

7.3.4.2 Clean the blade holder properly with solvent.

7.3.4.3 From the blade box, cut the length 20 mm extra than the cylinder width.

7.3.4.4 Insert this blade into the supporting blade properly. Clamp it properly from both sides. Ensure that no gap remains in between.

7.3.4.5 Follow the same process for changing the doctor blade in all required units.

7.3.5 Cylinder Cleaning

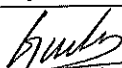
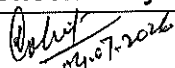
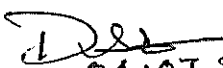
7.3.5.1 Run the cylinder in idle mode at a speed of 60 mpm. Take a cotton cloth wet with solvent and put some cylinder cleaning powder on it. Use rubber hand gloves during this activity.

7.3.5.2 Clean the cylinder properly until the petroleum jelly is fully removed. If required, use another cloth to clean properly.

7.3.5.3 Follow the same process to clean all the required cylinders.

7.3.6 Ink Start and Doctor Blade Setting

7.3.6.1 Take the ink tray upward using the rotating screw until the ink level touches the printing cylinder.

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STANDARD OPERATING PROCEDURE	
Title: Operation for Printing Machine	
Page No. 5 of 7	
SOP No.	Version No.
SIPL/PDI/010	00
Effective Date	Next review date
06.07.2026	05.07.2028

- 7.3.6.2 Take the blade assembly down gradually using the rotating screw.
- 7.3.6.3 Set the blade on the cylinder as per the ink flow and image to be printed.
- 7.3.6.4 Give pneumatic pressure as per the standard machine parameters. Ensure the blade is wiping the ink completely from the non-image area.

7.3.7 Roll Loading at Unwinder

- 7.3.7.1 Check the information written on the label of the rolls issued from stores as per the Job Card. Preserve this label in the box provided at the rewinder side.
- 7.3.7.2 Remove the packing material from the roll.
- 7.3.7.3 Check the direction of the roll (inside/outside) to be printed.
- 7.3.7.4 Shift the roll from the pallet to the manual stacker (trolley) carefully.
- 7.3.7.5 Insert the air shaft into the core of the roll put on the trolley.
- 7.3.7.6 Move the trolley in/out and left/right to match the locking chuck position. After putting the shaft inside the chucks, lock it properly.
- 7.3.7.7 Slowly take the trolley downwards and remove it from the unwinder side of the M/C.
- 7.3.7.8 Now shift the roll to the centre of the shaft and lock it by injecting air.

7.3.8 Core Loading at Rewinder

- 7.3.8.1 Take a 3-inch core according to the size of the substrate mentioned in the Job Card.
- 7.3.8.2 Insert the air shaft into the core.
- 7.3.8.3 Put the shaft on the rewinder matching the chuck slots. Lock it properly.
- 7.3.8.4 Shift the core to the centre of the shaft and lock it by injecting air.
- 7.3.8.5 Wrap the self-adhesive tape spirally on the core in such a way that the adhesive of the tape faces outside.

7.3.9 Taking Web Path

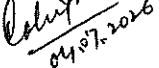
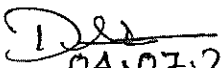
- 7.3.9.1 Take the web path according to the diagram validated by QA.

7.3.10 Data Setting in HMI

- 7.3.10.1 On the M/C rewinder side HMI, set the cylinder circumference in mm. Also set the In-feed, Out-feed, Unwinder and Rewinder tension as per the standard machine parameters.
- 7.3.10.2 On the M/C unwinder side HMI, set the Roll OD in mm. This is to be entered at every roll change.

7.3.11 Parameters Setting in All Units / Panel

- 7.3.11.1 On the M/C unit, set the printing nip pressure and doctor blade pressure, and switch on the blade oscillation.
- 7.3.11.2 On the blower panel, set the temperature of the required units as per the standard machine parameters.

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STANDARD OPERATING PROCEDURE			
Title: Operation for Printing Machine			Page No. 6 of 7
SOP No.	Version No.	Effective Date	Next review date
SIPL/PDI/010	00	06.07.2026	05.07.2028

7.4 Machine Operation

7.4.1 Job Setting

- 7.4.1.1 Switch on the blower and heaters of the required units.
- 7.4.1.2 Reset all alarms on the machine HMI.
- 7.4.1.3 Stop the idle mode. Switch on all the tensions.
- 7.4.1.4 Set the speed to 15 MPM and switch to run mode.
- 7.4.1.5 Switch on the printing nip of the first unit. Check that the material is aligned according to the rubber roll size and printing area. If not, adjust the web guider.
- 7.4.1.6 Switch on the printing nip of the second unit. Match the registration of the image with the help of the compensator roller push button and engage/disengage of the printing cylinder. Follow the same process for all further units.
- 7.4.1.7 Increase the M/C speed to 40 mpm. Fine-tune all the units' registration. Once it stabilizes, stop the machine for proof reading.

7.4.2 Proof Reading

- 7.4.2.1 Draw a printed sample with proper registration. Ensure that at least one complete repeat is present in the sample.
- 7.4.2.2 Check the sample for any printing problems like print missing, cell filling, spots, lines, etc. If required, check the repeat length.

7.4.3 Shade Matching

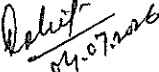
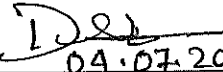
- 7.4.3.1 Check the shade against the approved shade card. Do the correction required for all colours. Mix the ink properly after the correction, then run the machine again at a speed of 40 mpm. Draw the sample again until the shade is closest to the approved shade card. Submit the sample to QC for checking.

7.4.4 QC Approval

- 7.4.4.1 Take the feedback of QC. If any corrections are required by QC, do the corrections and draw a fresh sample again until both parties reach consensus.
- 7.4.4.2 Sign off the First-off format of QC by both the printing technician and the QC person, then start the machine.

7.4.5 Machine Running

- 7.4.5.1 Follow the previous steps to run the machine at a speed of 40 mpm. Once the registration is OK, increase the speed to 70-100 mpm.
- 7.4.5.2 Take a side cut if Possible and verify that the printability and shade are OK.
- 7.4.5.3 Run the job at the speed as per the standard machine parameters.
- 7.4.5.4 For any printing defect, put a yellow tag and mention the tag detail on the printing sticker. On completion of each roll, check the sample for quality, fill the details on the printing sticker and paste it on the roll.

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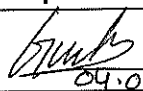
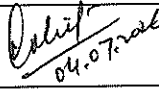
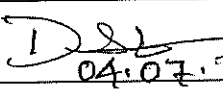
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STANDARD OPERATING PROCEDURE			
Title: Operation for Printing Machine			Page No. 7 of 7
SOP No.	Version No.	Effective Date	Next review date
SIPL/PDI/010	00	06.07.2026	05.07.2028

7.4.6 Area Line Clearance

- 7.4.6.1 Once the job is finished, stop the machine from run mode and switch to idling mode at a speed of 40-45 mpm.
- 7.4.6.2 Take the ink tray down by rotating the screw.
- 7.4.6.3 Pour solvent on the cylinder from the doctor blade side.
- 7.4.6.4 Take the doctor blade up. Clean all the cylinders properly by cotton cloth until no ink traces remain in the cells. Apply petroleum jelly on the cylinder surface evenly.
- 7.4.6.5 Stop the machine from idling mode. Disengage all the cylinders.
- 7.4.6.6 Cover the cylinder with PET or poly film, then cover the cylinder with corrugated sheet.
- 7.4.6.7 Remove ink from the ink tray to the ink can of all units.
- 7.4.6.8 Remove the ink tray from the units.
- 7.4.6.9 Remove the cylinder from the unit and return it to the cylinder store.
- 7.4.6.10 Remove all the rubber rollers.
- 7.4.6.11 Remove all the ink/solvent-soaked cotton cloths from the machine.
- 7.4.6.12 Remove all the materials as mentioned in the line clearance checklist. Fill the line clearance record.
- 7.4.6.13 Fill the details of quantity, time, etc. in the printing log book.

8.0 REVISION HISTORY

Revision No.	00	Effective Date	06.07.2026	CC No.	NA
Details of revision: New SOP					

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