HANDS-ON PRINTING

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THE NORDIC ASSOCIATION OF HEATSET PRINTERS

NAHP HANDS-ON PRINTING

NAHP Hands-on printing starts from problems that you as a printer may encounter during production, and gives hints to possible causes for these problems. It is limited to those causes that the printer can do something about directly.

Hands-on printing is no schoolbook describing the behaviour of ink, water, paper, printing etc. Neither does it tell very much about how error causes are fixed. We suppose most printers would know that, once they get the hints what to look for.

Hands-on printing is divided into two sections, Print Quality Problems and Runability Problems. In each section, first find the headline that appears to describe your problem best, then proceed to the various possible causes.

Hands-on printing is based on general state of the art knowledge in heatset printing and has been field tested on the shop floor. Experts from the following NAHP member companies have taken part actively in the project:

Keskuslaboratorio – Centrallaboratorium (KCL), Finland
Sun Chemical, Germany
Sörmlands Grafiska, Sweden
Trelleborg, United Kingdom
UPM-Kymmene, Finland

THE NORDIC ASSOCIATION OF HEATSET PRINTERS – NAHP

Already in the 70's the heatset printers in Sweden had regular meetings, discussing production related questions, such as new materials and new technology.

In the beginning of the 90's the group was extended to admit heatset printers in all Nordic countries as member companies, i.e. Sweden, Norway, Denmark and Finland. The group established a formal association, and in 1999 the organization changed its name and is now called The Nordic Association of Heatset Printers, NAHP.

A few years later the circle of countries was extended to include also the three Baltic states Estonia, Latvia and Lithuania.

The organization's goal is to promote productivity and quality by initiating research projects and arranging interesting and educating activities such as seminars and study tours.

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PRINT QUALITY PROBLEMS

Q1	Misregister	• Misregister in web direction • Misregister in cross cylinder direction
Q2	Poor image colours	• Incorrect colour match • Image lacks gloss
Q3	Ink in non-printing areas	• Marking • Toning and scumming
Q4	Uneven print	• General • Mottling • Streaks parallel to the cylinder • Streaks in web direction • Ghosting • Low contrast • Piling
Q5	Defects in the printed image	• General • Hickeys • Blistering
Q6	Quality changes during print run	• General
Q7	Drying problems	• Smearing (rub-off and set-off) • Chalking (sweat-back)

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Q1 – MISREGISTER

- Misregister in web direction
- Misregister in cross cylinder direction

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Q1 - MISREGISTER

Paper and reel properties certainly may affect printing register, e.g. winding profile (hardness profile) of the reel, or hydroexpansivity of the paper. However, there is little the printer can do to cure this during production. Good practice for avoiding problems is to run successive reels from the same jumbo reel position, or an adjacent position.

If misregister appears to be connected to web behaviour, start by increasing web tension as much as possible without going to the risk of a web break. Have in mind that maximum permissible web tension depends on paper quality and web width.

Misregister in web direction

Paper:

- Check quality of reel, and in case of defects set splice accordingly earlier.
- Out of round reel.
- Poor quality of reel winding near the core, increase web tension or decrease printing speed.
- Hydroexpansion in SC and uncoated paper, try to run with less water.

Web tension:

- Web tension too low or too high, this would be the first thing to adjust.

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Printing unit:

- One or more plates not properly registered on the cylinder.
- One or more plates printing longer or shorter image than the others (underpacking).
- Piling on the blanket (see Q4 Piling).
- Loose blanket, not properly tightened.
- Blanket feeding types (positive, neutral, negative) improper or not matching, especially important for sleeve blankets.

Misregister in cross cylinder direction

Paper:

- Slack edges in web.
- Hydroexpansion in SC and uncoated paper, try to run with less water.

Web tension:

- Web tension too low or too high, this would be the first thing to adjust.

Printing unit:

- Blanket feeding types (positive, neutral, negative) improper or not matching, less influence on cross register than on length register.
- Too much water being run (fan out).
- Check temperature of printing unit: rollers 28–32 °C, fountain solution 10–15 °C, blanket 28–35 °C.
- Web tension between units varies, check blanket height if dot gain is different across the cylinder.

Q2 – POOR IMAGE COLOURS

- Incorrect colour match
- Image lacks gloss

Q2 – POOR IMAGE COLOURS

Incorrect colour match

Provided prepress is matched to press characteristics, the main causes for incorrect colour rendering are dot gain problems, poor ink trapping or different ink demand for different papers.

Printing plate:

- Inappropriate plate (rip) curve.
- Plate blinding (wear).

Printing unit:

- Wrong target densities used for the specific paper.
- Dot gain incorrect, e.g. excessive pressures anywhere (roller – plate, plate – blanket).
- Blanket not tensioned properly (slur or doubling), mostly visible on the trailing edge of the copy.
- Check temperature of printing unit: rollers 28–32 °C, fountain solution 10–15 °C, blanket 28–35 °C.
- Ink trapping incorrect, check trapping.
- Ink-water balance incorrect.
- Ink dirty, particularly yellow ink.
- Dampening system contaminated: adjust fountain solution to recommended pH and conductivity values, and if this does not cure the error, flush fountain system and renew solution.

Image lacks gloss

Printing unit:

- Too much water being run.
- Too much alcohol in the fountain solution.
- Too low ink densities.

Dryer and chill rollers:

- Drying temperature too high.
- Web temperature after the chill rollers should not exceed 30 °C.

Q3 – INK IN NON-PRINTING AREAS

- Marking
- Toning and scumming

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Q3 – INK IN NON-PRINTING AREAS

The paper is discoloured because the non-printing areas of the plate accept ink. The non-image areas can also get foul as the web touches dirty machine parts.

In the first case ink is transferred to non-image areas of the paper via the plate and the blanket. The core problems are plate, ink and fountain solution. Toning and scumming are two of the most common disturbances in offset printing. It normally starts as toning, and if you don't master the toning, it may continue as scumming.

Toning can be corrected with less ink or more water. If this does not help, stop the press and clean the plate with plate cleaner and gum. Scumming cannot be removed from the plate, once it is there.

Marking

Dryer and chill rollers:

- Insufficient drying or press speed too high for the drying capacity.
- Insufficient chilling.
- Chill roller condensation, solvents build up on chill rollers.

Superstructure:

- Web trolleys running in the image area.
- Web flutter in dryer, increased web tension may help.
- Marking in folder due to insufficient drying.
- Ink build-up in the superstructure, e.g. too high air temperature in turner bars or former.
- Check silicone mixture and function of unit.

Toning

Low emulsification ink does not carry water enough to clean the plate, even at ink-water balance. Toning is not always visible on the plate, and in case it is, it can be washed off but often comes back again.

Scumming

Scumming occurs when the fountain solution is unable to keep the non-image area on the plate clean. Scum can be seen on the plate but cannot be removed easily.

Printing plate:

- Plate improperly processed which mainly affects water transfer.
- In case of scumming, change plates.

Printing unit:

- Rollers desensitised or glazed.
- Ink or dampener roller setting incorrect.
- Ink-water balance improper.
- Fountain solution not balanced.
- Too much alcohol in the fountain solution.
- Detergent in fountain solution.
- Temperature too high in fountain solution pan or on inking rollers: rollers 28–32 °C, fountain solution 10–15 °C, blanket 28–35 °C.

Q4 – UNEVEN PRINT

- General
- Mottling
- Streaks parallel to the cylinder
- Streaks in web direction
- Ghosting
- Low contrast
- Piling

Q4 – UNEVEN PRINT

The print appears uneven. Some phenomena are streaks, ghosting and mottling. The causes for uneven print are manifold, ranging from paper, ink and fount properties to roller settings, printing pressure, cleaning and temperatures.

General

Printing plate:

- Plate improperly processed.

Printing unit:

- Pressure blanket-to-plate too low.
- Blanket covered with dust and lint from paper.
- Blanket thickness uneven, or damage in blanket.
- Roller setting incorrect.
- Rollers glazed or dirty.
- Too much water being run.
- Poor ink-water balance.

Mottling

Unevenly transferred or absorbed fount solution, back-trap piling (see Q4 Piling), moiré from prepress and paper dust may give solids that are spotted. Poor paper formation and too hydrophobic paper promote mottling.

Printing unit:

- Excessive printing pressure.
- Too much water being run.
- Too much ink being run.
- Too quick ink setting in paper causing back-trap piling.

Streaks parallel to the cylinder

Streaks parallel to the cylinder axis indicate mechanical bounces or vibrations due to incorrect cylinder or roller pressures.

Printing unit:

- Blanket too high.
- Blanket slack, not tensioned correctly.
- Form roller setting too hard or unequal across the width.
- Form roller surface too hard.

Streaks in web direction

Streaks in web direction often depend on dampener problems. They also may occur in the drying-chilling section.

Printing plate:
- CtP laser deficiencies causes regular streaks on plate.

Printing unit:
- Ink roller surface glazed or coated, does not accept ink.
- Fountain rollers dirty, greasy or worn.
- Fountain roller setting to plate unequal across the width.
- Fountain solution too acidic (coated paper).
- Ink starvation, increasing or decreasing water feed may help.

Dryer and chill rollers:
- Dryer temperature too high.
- First chill roller temperature too low, solvents build up on chill rollers.

Ghosting

Ghost images can be seen in solids or heavy image parts. Separate three types of ghosting, depending on the origin of the ghost image:

1. Ghosting from the reverse side of the paper. This phenomenon is known as mechanical ghosting or vanishing dots.
2. Ghosting from an image (or other heavy print) in web direction. This is known as mirroring.
3. Ghosting from an earlier job.

Mechanical ghosting

1. Mechanical ghosting

The true nature and remedy for mechanical ghosting are not fully known. Minor register movements, available as an automatic function on modern presses, can get rid of mechanical ghosting.

Printing unit:

- Washing the blanket will help temporarily.
- Increase web tension.
- Change ink sequence, e.g. between cyan and yellow.
- Blankets with other release properties might cure the problem.

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2. Mirroring
Mirroring, related to ink starvation, is often a layout issue which the printer cannot influence during printing.

Printing unit:
- Oscillating movement of ink rollers too restricted.
- Too much water being run.
- Too little ink being run.
- Increase ink ductor speed in order to get a thinner ink film.

3. Ghosting from earlier job
A ghost image appears from a previously printed job.

Printing unit:
- Blanket embossed from earlier pressrun.

Low contrast

Printing unit:
- Blanket overpacked or underpacked.
- Blanket not tightened correctly.
- Too much ink being run.
- Dot gain incorrect, too high.

Piling

Ink or paper coatings build up to a dry accumulation on areas of blanket, plate or rollers. It is connected with high ink tack and low surface strength of the paper.

Snake piling is a build up of ink, starting on the blanket edges in the shape of a snake, which will damage the blanket.

Back-trap piling is a special phenomenon related to quick ink setting in the printing nip. Ink from the first units, typically black, will accumulate on later units, typically yellow, and eventually come back to the paper.

Paper:

- Paper coating piling in the image areas of the blanket.
- Cold paper reels.

Printing unit:

- Blanket overpacked (most likely).
- Low blanket requires too much ink for the density targets to be reached.
- Rollers improperly set.
- Too much or too little water being run.
- Too much alcohol in fountain solution.
- Check temperature of printing unit: rollers 28–32 °C, fountain solution 10–15 °C, blanket 28–35 °C.

Q5 – DEFECTS IN THE PRINTED IMAGE

- General
- Hickeys
- Blistering

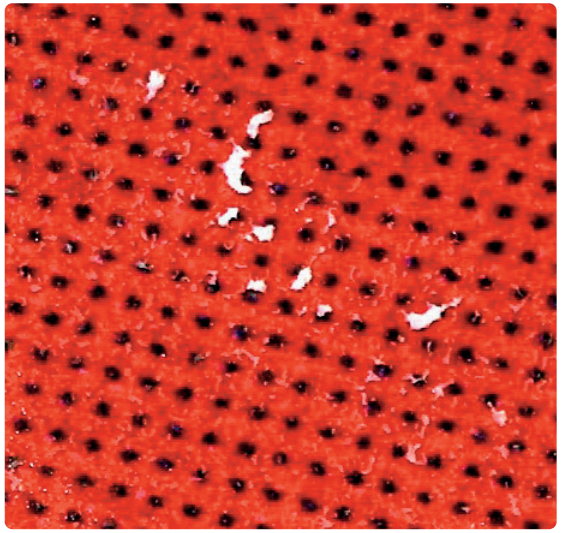
Q5 – DEFECTS IN THE PRINTED IMAGE

General

Solids show light, whitish spots or speckles. This can be caused by foreign particles or picking.

Printing unit:

- Blankets and roller train dirty, first thing would be to clean them.
- Identify if it is picking or particles.
- Blanket too low.
- Too little water being run, tacky ink picks paper fibres.
- Too much or too little alcohol or substitutes in fountain solution.
- Ink train too hot, affecting viscosity and ink tack.
- Ink oscillator cooling water too cold.



Picking

Hickeys

Hickeys are white spots surrounding a small centre spot of ink. They are caused by solid particles sticking to the plate. The particles may origin from paper, press, air condition system or other sources.

Paper:

- If hickeys appear on one side of the print only, they most likely come from the paper.

Printing unit:

- Wash plate.
- Roller worn, disintegrating.
- Ink and fountain roller trains dirty.
- Ink contaminated and dirty.
- Blanket dirty.

Ambient conditions:

- Press room dirty.

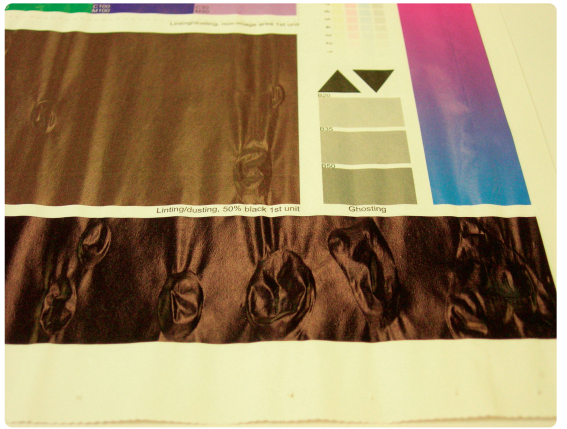
Blistering

Too high drying temperature, excessive moisture in paper or heavy ink coverage promote blistering. Blistering is most likely to happen on coated paper. SC paper can suffer micro blistering, which appears as a roughened surface.

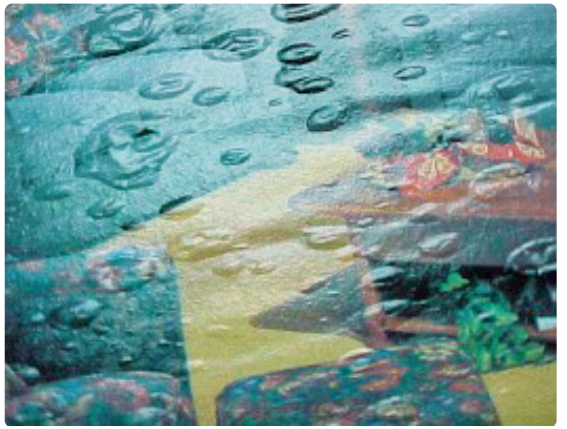
Paper:
- Coating problem, try other paper if possible.

Printing unit:
- Ink density too high.

Dryer and chill rollers:
- Reduce drying temperature and accordingly press speed.



Blistering


Blistering

Q6 – QUALITY CHANGES DURING PRINT RUN

- General

Q6 – QUALITY CHANGES DURING PRINT RUN

General

These are quality changes that develop over time as the press is running. They do not appear suddenly. The printed image gradually loses density, changes colour or becomes grainy.

Printing plate:

- Check for plate wear.

Printing unit:

- New blanket sinks.
- Blanket-to-plate pressure too high.
- Ink-water balance improper.
- Ink ductor roller stripping.
- Ink or dampener form rollers incorrectly set.
- Ink piling on rollers, blanket or plate.
- Fountain solution properties changing during the run, e.g. becomes too acidic or contains too much gum.
- Fountain solution contaminated by detergent.

Q7 – DRYING PROBLEMS

- Smearing (rub-off and set-off)
- Chalking (sweat-back)

Q7 – DRYING PROBLEMS

Rub-off and set-off are two different phenomena, primarily related to ink properties. A printed surface can have good rub-off but poor set-off and vice versa. Note that smearing often can occur in finishing, but the cause is to be found in printing.

Smearing (rub-off and set-off)

Printing unit:
- Excessive ink thickness being run.

Dryer and chill rollers:
- Dryer temperature too low.
- Chill roller cooling temperatures too high.
- Silicon application improper.

Superstructure:
- Air temperature in angle bars and former too high, web runs hot.

Chalking (sweat-back)

The surface of the ink is dry, but it is not bound properly to the paper surface. The problem is very difficult to detect and cure, and usually does not show up until in the bindery.

Printing unit:
- Make sure ink-water balance is correct.

Dryer and chill rollers:
- Try to modify drying temperatures.

RUNABILITY PROBLEMS

R1	Web breaks	• General • Start-up breaks
R2	Reel splice failure	• General • Failed splice • Splice initiated web break
R3	Web wander, creases or wrinkles	• General
R4	Folder problems	• Jams • Tear • Creases
R5	Ink misting	• General

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R1 – WEB BREAKS

- General
- Start-up breaks

R1 – WEB BREAKS

Breaks usually occur when press tension variations become excessive and coincide with local area weaknesses in the web. Web wander, web touching in the dryer (Q3 Ink in non-printing areas) and blanket properties affecting web release are other web break causes.

Paper manufacturing defects certainly can cause break. Since the printer cannot influence them, they are mainly left out here. What the printer can do, however, is to examine the reels before use. If the reason for problem is paper related, always collect order number and reel number for subsequent discussion with the mill.

It is good practice to change reel if you suffer two web breaks in the same reel.

General

Paper:
- Poor handling of reels during transportation or in the printing plant.
- Defects in paper, particularly the edges.
- Out of round reel (flying paster mainly).
- Bad conditioning of reels.

Web tension:
- Web tension too high or too low.

Reelstand:
- Badly set infeed nip roller.
- Excessive movement of web guide.

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Printing unit:

- Printing impression too high, too low or uneven.
- Uneven blanket height between units.
- Blanket that is slack and incorrectly tensioned.
- Ink and paper debris build-up on blanket.
- Too much water being run.
- Printing unit dirty, ink dripping.
- Buzzle wheels or air set too hard.
- Web detectors dirty.

Dryer and chill rollers:

- Touching and tearing of web in dryer.
- Drying temperature too high.
- Tar condensate drops on web.
- Deposits on chill roller surface.
- Chill roller tension (gain) incorrect.
- Chill roller nip setting incorrect.
- Incorrect temperature settings.

Superstructure:

- Incorrect air pressure on air turner bars.
- Dirty or damaged air slots in air turner bars.
- Turner bars not aligned.
- Build up on ends of pipe rollers.
- Slitters worn.

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Ambient conditions:
- Ink too cold.
- Paper too cold.
- Humidity to low or too high.

Start-up breaks

Different papers, e.g. SC and coated papers, may require different start-up procedures. Too quick and heavy inking can cause web break.

Printing plate:
- Excessive plate gum left on plates.

Printing unit:
- Water in cylinder gaps.
- Excessive dampening at start up.
- Too much or too little ink put too quickly on the web.

R2 – REEL SPLICE FAILURES

- General
- Failed splice
- Splice initiated web break

R2 – REEL SPLICE FAILURES

Splice failure is any failure from the initiation of the splice cycle until the splice has left the folder.

Two particular splice failures are:
Failed splice: the new roll does not paste to the expiring web.
Splice initiated web break: the web breaks during the splicing cycle.

General

Paper:
- Reel fault not inspected prior to loading.
- Conditioning of paper, especially too cold paper.

Preparation:
- Tape protective strip not removed.
- Tape extending beyond edge of web, sticks to rollers or blankets.
- Rupture tabs incorrect or covering splice detection tab.
- Splice detection tab in wrong position or sensor dirty.
- Tabs come loose and stick to expiring web or blanket.

Reelstand:
- Excessive reel vibrations.
- Worn reel drive belts.
- New roll not aligned with expiring roll.
- Pasting brush dirty or worn.
- Pasting roller edges worn because different web widths are being run.
- Compensating roller oscillation.

Failed splice

Preparation:

- Inadequate splice tape pressure.
- Uneven tape profile from overlaps.
- Dust, solvent, moisture on open splice tape.

Reelstand:

- Incorrect alignment to nipping roller (zero speed splicer).

Splice initiated web break

Preparation:

- Wrong type of splicing, e.g. too thick splice for the printing nip.

Reelstand:

- Debris build up on roller edges.
- Reel sidelay incorrect.
- Brush arm tension too low (break before 1st printing unit).
- Preparation made too far in advance (break before 1st printing unit).
- Infeed tension too high for lightweight paper.

R3 – WEB WANDER, CREASES OR WRINKLES

- General

R3 – WEB WANDER, CREASES OR WRINKLES

The paper itself has nonuniform characteristics across the web, specifically moisture content that affects edge tension. Misalignments in the web path may be another cause.

General

Paper:
- Tapered reel of paper, or excessive variation of web tension across the width, less important for zero speed splicer.
- Excessive tension on one or both edges due to loss of moisture.

Reelstand:
- Paster generated creases (no image under overlap).

Web tension:
- Incorrect web tension anywhere in the line.
- Too low tension may give web wander.
- Too high tension can give wrinkles or creases for a paper with poor profile.

Printing unit:
- Blanket height too high or too low.
- Inconsistent blanket height between units.
- Blanket washing procedures or fluid mixture incorrect.

Dryer and chill rollers:

- Dryer airflow variations.
- Chill roller creases, e.g. due to dirt (generally during start-up and in web direction).

Folder:

- Former angle incorrect.

Superstructure:

- Nip roller adjustment incorrect.
- Debris build up on edges of web lead.
- Turner bar air pressure setting incorrect.

R4 – FOLDER PROBLEMS

- Jams
- Tear
- Creases

R4 – FOLDER PROBLEMS

Jams

Superstructure:

- Incorrect nip roller settings.
- Too much silicone causes slip in the folder.

Folder:

- Cutting incorrect, knife or cutting block worn.
- Delivery fan incorrectly set.
- Guide settings incorrect.
- Dirt on sensor of folder jam detector.
- Transport belt incorrectly set or damaged.

Tear

Superstructure:

- Incorrect nip roller settings.
- Slitter blade dull or incorrectly set, important.
- Former angle incorrect.

Creases

Web tension:
- Web tension incorrect.

Superstructure:
- Badly set nip rollers.
- Turner bar air slot blocked.
- Air pressure incorrect or air temperature too high.
- Former angle incorrect.
- Ink build-up on former and turner bars.

Folder:
- Transport belt incorrectly set or damaged.

R5 – INK MISTING

- General

R5 – INK MISTING

Printing speed and ink characteristics are important for misting. An ink that works well at a lower speed may give severe misting problems at higher speeds.

General

Printing unit:

- Excessive ink on rollers.
- Incorrect roller setting.
- Too low ink ductor roller speed.
- Air curtain blocked or not functioning properly, check this.
- Ink train and ink rollers too warm, affecting viscosity of the ink.
- Improper ink-water balance.
- Improper or dirty fountain mix, e.g. too much IPA.