LEAN & GREEN BEST PRAC

ALPHA VERSION

Optimised Paper Handling & Logistics

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7 At the Printer – Paper onto Press

CONTENTS

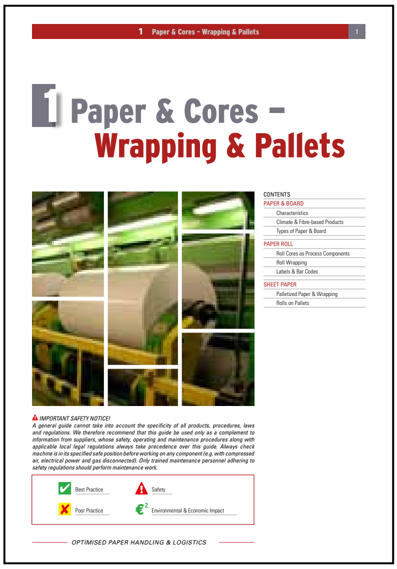
IMPORTANT SAFETY NOTICE!

A general guide cannot take into account the specificity of all products, procedures, laws and regulations. We therefore recommend that this guide be used only as a complement to information from suppliers, whose safety, operating and maintenance procedures along with applicable local legal regulations always take precedence over this guide. Always check machine is in its specified safe position before working on any component (e.g. with compressed air, electrical power and gas disconnected). Only trained maintenance personnel adhering to safety regulations should perform maintenance work.

Best Practice · Safety

Poor Practice · Environmental & Economic Impact

'Optimised Paper Handling & Logistics' is a unique international, cross-industry collaborative project across the supply chain to produce a common, best practice tool and global reference for suppliers, transporters and printers to improve their economic and environmental efficiency. The result will be an e-book of around 180 pages available at no cost to users.



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This Alpha version is for open industry comment to help ensure that the final publication is as comprehensive and complete as possible. To become a reviewer, simply go to the World Printers Online Forum https://shar.es/1vMACo, and then to "Best Practice Guide" under "Printing/Paper" to download the different modules as PDFs and as MS Word documents.

The Guide consists of seven modules that will be independently available for review:

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1: Post short comments on to the Forum, or

2: Make larger changes on the accompanying manuscript document and send directly to the editor Nigel Wells *vimw@wanadoo.fr*

- If you would like to suggest additional material please send as — Graphs/Charts: Excel.; drawings: eps vector format (Illustrator); photos: JPEG format 300 dpi, with minimum compression.
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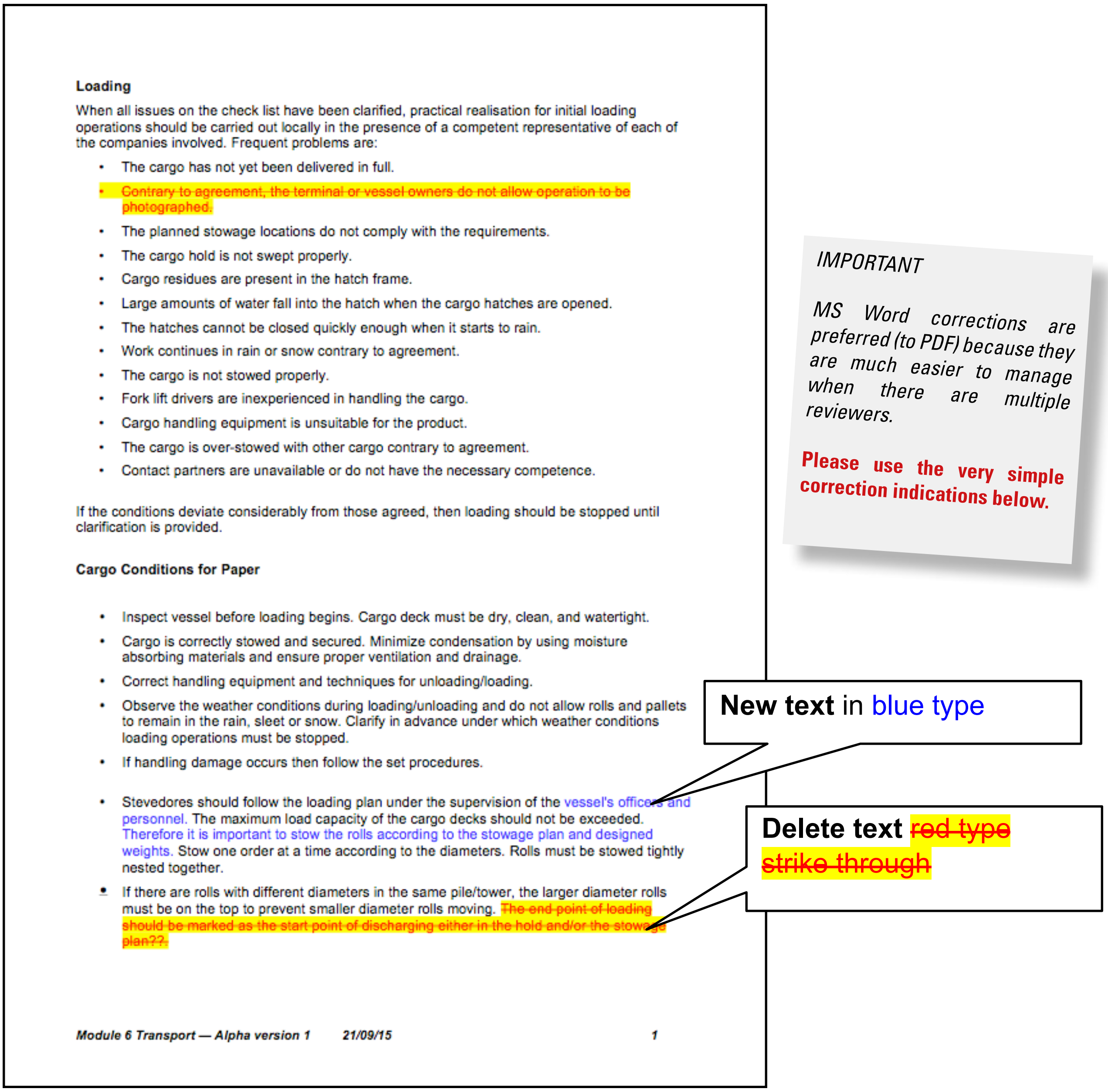


Loading

When all issues on the check list have been clarified, practical realisation for initial loading operations should be carried out locally in the presence of a competent representative of each of the companies involved. Frequent problems are:

- The cargo has not yet been delivered in full.
- ~~Contrary to agreement, the terminal or vessel owners do not allow operation to be photographed.~~
- The planned stowage locations do not comply with the requirements.
- The cargo hold is not swept properly.
- Cargo residues are present in the hatch frame.
- Large amounts of water fall into the hatch when the cargo hatches are opened.
- The hatches cannot be closed quickly enough when it starts to rain.
- Work continues in rain or snow contrary to agreement.
- The cargo is not stowed properly.
- Fork lift drivers are inexperienced in handling the cargo.
- Cargo handling equipment is unsuitable for the product.
- The cargo is over-stowed with other cargo contrary to agreement.
- Contact partners are unavailable or do not have the necessary competence.

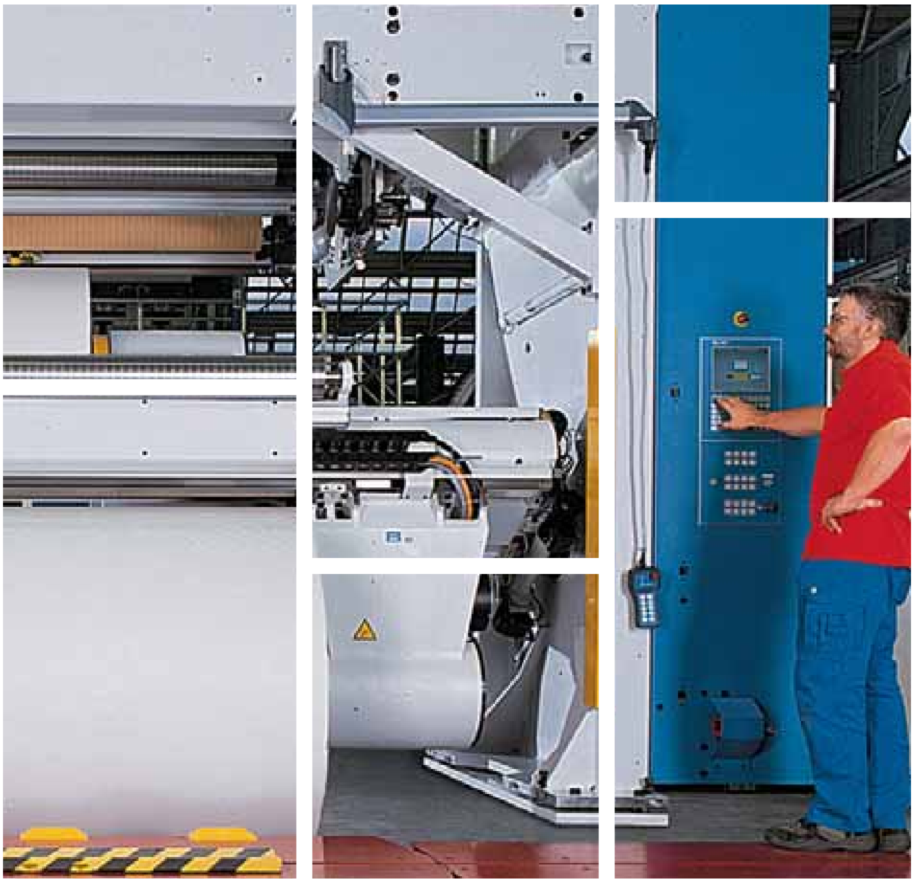
If the conditions deviate considerably from those agreed, then loading should be stopped until clarification is provided.

Cargo Conditions for Paper

- Inspect vessel before loading begins. Cargo deck must be dry, clean, and watertight.
- Cargo is correctly stowed and secured. Minimize condensation by using moisture absorbing materials and ensure proper ventilation and drainage.
- Correct handling equipment and techniques for unloading/loading.
- Observe the weather conditions during loading/unloading and do not allow rolls and pallets to remain in the rain, sleet or snow. Clarify in advance under which weather conditions loading operations must be stopped.
- If handling damage occurs then follow the set procedures.
- Stevedores should follow the loading plan under the supervision of the vessel's officers and personnel. The maximum load capacity of the cargo decks should not be exceeded. Therefore it is important to stow the rolls according to the stowage plan and designed weights. Stow one order at a time according to the diameters. Rolls must be stowed tightly nested together.
- If there are rolls with different diameters in the same pile/tower, the larger diameter rolls must be on the top to prevent smaller diameter rolls moving. ~~The end point of loading should be marked as the start point of discharging either in the hold and/or the stowage plan??.~~

Module 6 Transport — Alpha version 1 *21/09/15* *1*

7 At the Printer – Paper onto Press



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✔ Best Practice	Safety
✘ Poor Practice	€² Environmental & Economic Impact

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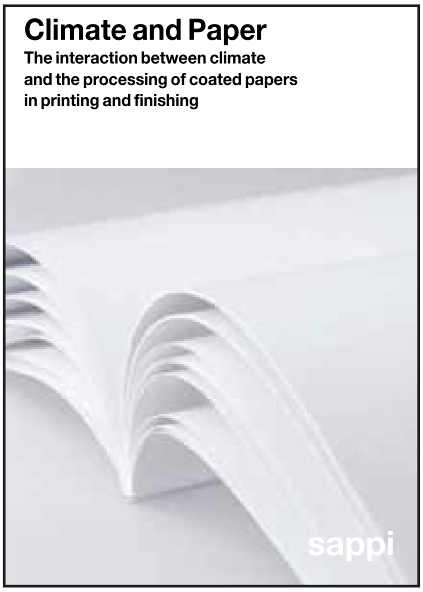
Fundamental paper conditions for printers

For a printer, substrates are the single largest expense (50-70% of total costs), making it essential to minimise waste from all causes. Paper and associated waste comes from several areas: transport, handling, storage and preparation for use. "Two keys for management of productivity are measurement and people. Measure the right things and communicate the measurements to people in a manner that encourages corrective response." War on Waste II (Roger V. Dickeson GCA).

Optimise Temperature & Humidity

	Temperature			Humidity		
	< Lower	20-25°C (68-74°F)	Higher >	< Lower	50-55% RH	Higher >
Poor sheet feeding & jams	●		●	●		●
Static electricity	●			●		
Brittleness			●	●		
Piping paper rolls*						●
Shrinkage on open rolls			●	●		
Burst splice			●	●		●
Splice failure	●		●	●		●
General web break risk				●		●

**Piping occurs in <10 outer layers and increases risk of creasing.*



'Climate and Paper in the Press Room' Sappi technical brochure. Source: www.ideaexchange.sappi.com

Paper that is not in balance with its storage and operating environment can lead to serious printing problems such as static charge and dimension variations, along with set-off, tensile weakness, folding resistance and surface smoothness.

Paper being a porous material, humidity control becomes crucial; temperature has a significant influence on relative air humidity. Air can contain only a specific amount of moisture vapour at a given temperature — the higher the temperature, the more moisture air can absorb. (Relative humidity (RH) is the proportion of absolute moisture content in relation to the highest possible moisture content at a given temperature.) RH is often variable during the course of a day and by season.

Paper will adapt itself to the humidity of the surrounding air by either absorbing or exuding moisture. This tends to occur:

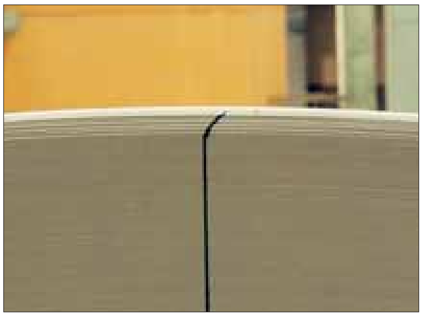
- During summer periods that are hot and humid in non-conditioned warehouses and pressrooms;
- When damp-proof wrapping is not used during transport or storage in humid conditions;
- In winter, when cold paper is unpacked in the warm air of a pressroom the surrounding air temperature will drop sharply, causing a rapid rise in air humidity. The paper edges then absorb moisture, making them swell in relation to the centre of the sheets.

☑ Best practices for optimised paper condition for printing

- Paper stability is achieved at 20°C to 25°C (68-77°F) and 50-55% RH relative humidity.
- Paper should remain wrapped in its packaging until any difference in temperature has been balanced out. The time needed depends on the temperature difference, the size of the stack, and the conductivity of the paper.
- Store the paper in the pressroom for a few days before use if (a) there is a significant difference in temperature and humidity between the pressroom and paper storage area or (b) if paper is delivered directly to the pressroom from the paper supplier.
- Conditioning time depends on the temperature difference between transport or warehouse environment and the pressroom, the conductivity of the paper, and the size of the stack (roll diameter or volume of sheets on a pallet). Conditioning time for rolls also depends upon their diameter because they condition from the edges inwards. *See conditioning chart Module 3.*

Paper Rolls

- ✓ Keep the protective wrapping on as long as possible to minimise risk of damage and the negative effects of atmospheric humidity and dynamic roll expansion. The open time of prepared rolls is determined by the grade of paper and the ambient pressroom RH.
- ✓ In extremely cold winter conditions the outer layers of paper warm up relatively quickly, but the paper near to the core (splice area contact point) can take two weeks to obtain an ideal minimum splicing temperature of 15°C (59°F). Below this temperature there is a high risk of splice failure. Some printers place heaters in the roll core to warm up the adjacent paper to a temperature high enough for splicing adhesives to work; others use liquid glue over a large area on frozen coated paper. A side effect of cold paper is that the inking system cools down and creates flow problems.
- ✗ Preparing splice patterns of several rolls in advance could increase risk of the splice pattern breaking open, as unwrapped rolls take up moisture quickly in the outer spires (layers). This increases the risk of creasing and expansion that can burst the splice pattern. Keep the protective roll wrapping on as long as possible.
- ✗ Taking the end shields off too early can cause roll edges to dry out or absorb moisture, resulting in a visibly skewed profile as the web leaves the roll.
- ✓ Reduce heatset web static by remoistening the paper after the chill rolls with a mixture of water, silicone and liquid fabric softener.



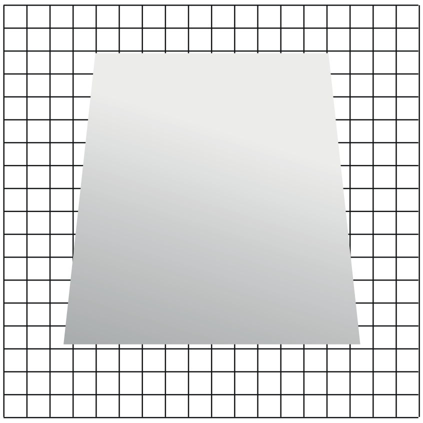
Dynamic roll expansion after wrapper removal. When unwrapped the roll acts like a released spring and will tend to loosen, putting additional tension onto splices prepared in advance. High humidity in the pressroom exacerbates the problem. Cold rolls tend to expand more when warming up. Source: WOCG/icmPrint

Sheetfed Paper Issues

Dimension variations: Paper fibres will either absorb or exude moisture depending on RH, causing them to swell or to shrink, particularly in the cross direction of the paper rather than in the machine direction. A 10% change in RH causes paper to “grow” 0.1% to 0.2% across the width, which will cause printing mis-register.

Humidity and curling: Curling is closely connected to fluctuations in humidity that cause the paper fibres to expand and shrink in the cross direction. If paper is moistened on one side, the fibres expand in one direction, causing the paper to curl toward the dry side. As soon as a balance in humidity within the paper structure has been restored, the effect is cancelled out.

Stack humidity and temperature effects on ink drying: A high humidity balance of the paper stack can significantly extend ink drying times. The effect is pronounced above 60% RH, leading to drying times up to three times longer than normal. Extended drying times can also occur when the stack of printed paper is too cold.

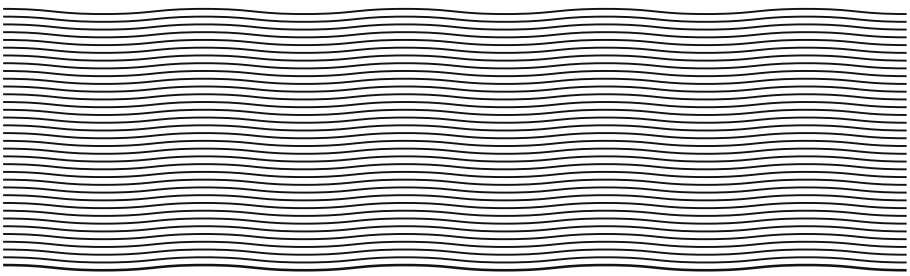


Paper stretch is caused by imbalance of paper RH to that of pressroom. Source: icmPrint.

Static Charges

Static commonly occurs when very dry paper is processed in low air humidity conditions. The critical lower limit is 30-40% RH for both the paper and the pressroom. *See Module 7.*

Relative humidity in a paper pile can be measured with a sword gauge. Source ?



Sheets failing to feed properly because of paper curl, wavy edges or out of square can be minimised by conditioning paper correctly in pressroom. Source: icmPrint.

Internal logistics for printers

Preventing handling and storage defects will result in less physical damage to the paper, minimising paper losses and production difficulties arising from deformed rolls and local paper weaknesses on the edges and surface.

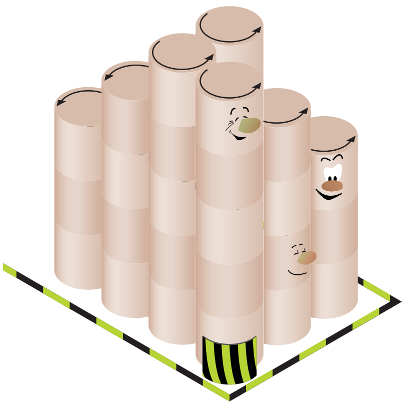
Paper Delivery

Unloading: Use optimised techniques for unloading the specific delivery vehicle? This can be a frequent source of damage. *See Module 5.*

Inspection: For full information *see Module 2*. Any visible damage needs to be reported at every transit point. Failure to note damage on delivery documents and timely reporting to the supplier can result in a claim for damaged paper being rejected; nor does it allow fault analysis to be made to identify and resolve the cause of damage.

☑ Rolls should be inspected on arrival and any visible defects should be noted on the delivery documents (CMR). Additionally, digital cameras can be used to document damage for timely transmission and send by e-mail to those needing this information. For insurance purposes any complaint to the supplier must normally be made within 48 hours.

€² **Failure to note damage on the delivery documents could result in any claim for damaged paper being rejected.**



☑ *Correctly stacked rolls*

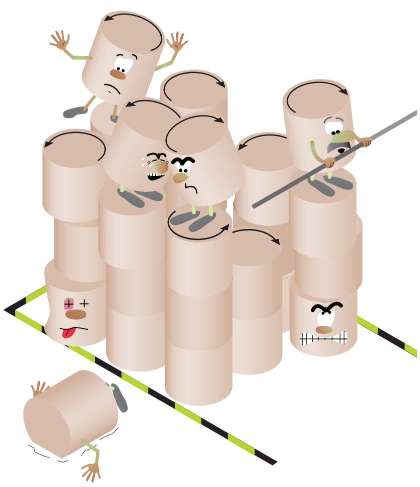
Storage — For full information *see Module 3*

☑ The warehouse should have these attributes:
- Dry
- Clean
- Even/level floor
- Sufficient working space
- Good lighting
- Roll bay markings on the floor
- Storage temperature should be similar to the pressroom.

☑ Rolls should:

- Be stacked on their ends, evenly in straight lines, with same unwind direction
- Not overlap
- Have outer rolls protected with roll guards
- Be used on a "first in, first out" FIFO principle.
- Show a clean, readable label/roll number.

€² Damaged rolls that may require excessive stripping and paper waste before running
€² Rolls which cannot be run at all
€² Deformed rolls, which could reduce press running speed and splicing efficiency.



☒ *Poorly stacked rolls.*
Source: WOCG/icmPrint.

Partly used rolls that are returned to storage should be protected from damage and atmospheric changes with a wrapping capable of withstanding minor bumps and acting as a moisture barrier. The ends should be protected by reuseable end caps. They should have the original roll label reattached or the roll number written on, with gsm, grade/brand. Part rolls should be used at the earliest opportunity to maximise warehouse space and avoid deterioration.

Paper Handling — **For full information** see Modules 4 & 5

- Use correct equipment and handling procedures to maintain rolls in the best possible condition.
- Lift truck capacity must be suitable for the rolls being handled.
- Using the wrong equipment can be a danger to personnel.
- Poor handling and storage will result in more damage to rolls, higher waste levels and increased risk of web breaks during production.

Correct use of lift trucks

- Ensure the mast is vertical.
- Clamp the roll in the middle.
- Lift the roll before moving.
- Ensure sufficient ground clearance before rotating roll.
- Stop before releasing the roll.
- Handle only the number of rolls for which the lift truck is intended.
- Use split arms when handling more than one roll at a time (including multi-packs).

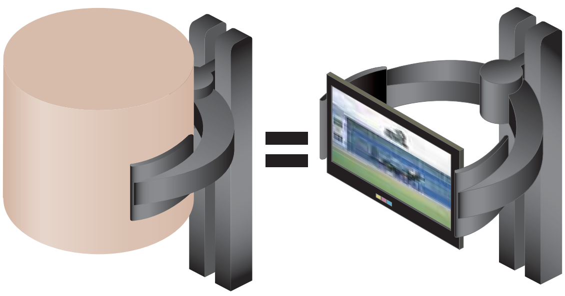
Clamp blades

- Keep the surface clean.
- Inspect clamp blades daily.
- Corners and edges should be well rounded. Grind smooth any damaged edges.
- Some printers attach high density foam pads to the metal clamps to act as a cushion.

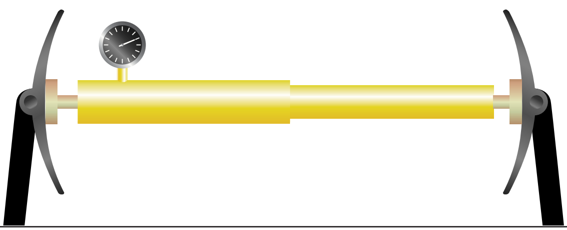
Clamp pressure

Lifting capacity depends on friction between clamp-wrapper-roll.

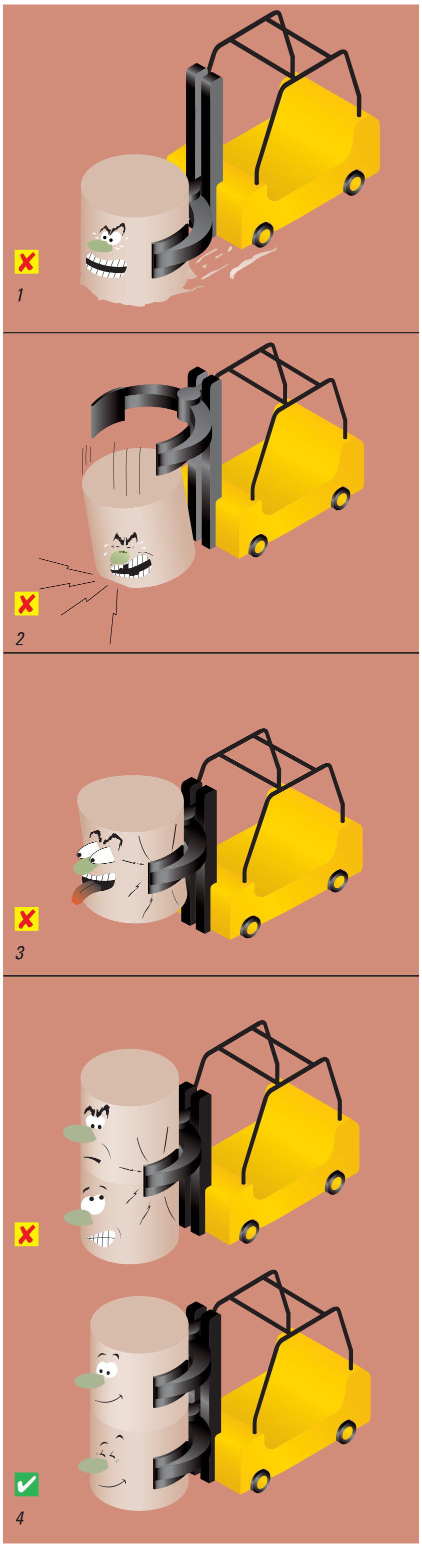
- Always adjust clamp pressure to roll weight and paper quality.
- Check clamp pressure regularly, keep a record.
- Too low a pressure may result in dropped rolls.
- Too high a pressure may result in deforming rolls out-of-round.



Depending upon its grade, a paper roll is worth about the same as a large screen HD TV — it is also just as fragile. Source: WOCG/icmPrint.



Check clamp pressure regularly. Source: WOCG/icmPrint.



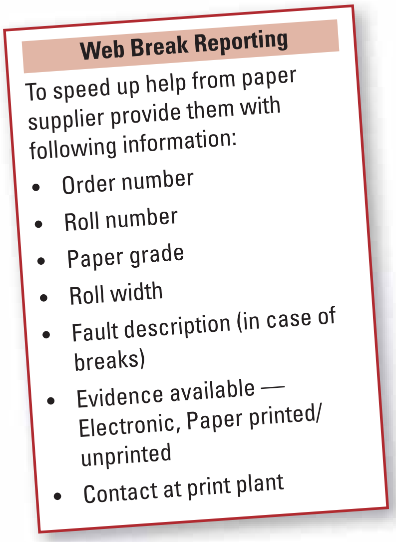
1- Lift the roll before moving.
2- Stop before releasing the roll.
3- Adjust clamp pressure to roll weight and paper quality.
4- Use split arms when handling more than one roll at a time.
Source: WOCG/icmPrint.

Roll processing efficiency

"Often, roll preparation produces such a surprisingly high and unnecessary amount of waste that the productivity of the entire press can be affected. Any mis-splice following careless preparation or any web break due to an inaccurate check of the roll will cause a lengthy production interruption with the corresponding consequences. The successful preparation of the splice greatly depends on the skill and experience of the staff." WAN-IFRA.

To achieve a consistent splice efficiency of over 99% requires (a) correct roll handling and storage, (b) optimum combination of tape and tab qualities, (c) correct splice preparation and (d) an efficiently maintained and operated splicer. Many press and postpress runability problems are also directly related to poor roll storage and handling and/or temperature and humidity variations.

The roll core and the splice pattern on the paper's outer surface are the two key interface points between the paper roll and the press splicer. Both need to provide high functional performance.



Recommendations ERA 'Paper First Aid'.

Web Breaks

Usually occur when press tension variations become excessive and/or coincide with local area weaknesses in the web. Paper damaged from poor handling can be a significant cause of web breaks.

Causes are typically attributed to (source Goss):

30% Paper

20% Poor operating procedures & equipment faults

50% Unknown reasons, includes poor handling & Storage

Paper quality is generally consistent and excessive web breaks due to paper faults are rare (automated roll handling considerably reduces risk). We recommend web break causes should be treated under two classifications:

• Paper defect (manufacturer's responsibility)

• Roll handling and storage damage (transport and/or printer's responsibility)

Web break frequency varies between printing method, print job, run length, type of printing/ finishing, consumables, experience of operators, maintenance, housekeeping, environmental conditions, etc.

A single defect does not necessarily impair runability; however, the combination of two or more will affect press performance. Many faults are rare and unlikely to be repeated throughout the roll (e.g. holes or cuts).

✅ The standard procedure after a web break is to restart with the same roll. Normally if there are two web breaks in the same roll then change it for a new one that preferably has a different position in the tambour (jumbo roll), or a different manufacturing batch. Contact your paper supplier to deal with problem.

What can be done to minimise web breaks?

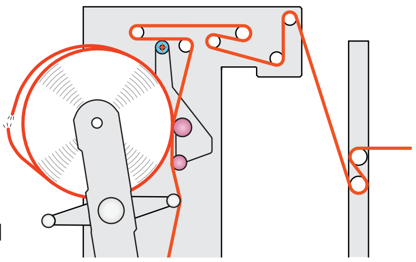
1. Measure and analyse missed splices and web break causes to identify priority areas for improvement.
2. Regularly share with staff data on economic value of paper, waste and web breaks.
3. Introduce best practice to reduce web break probability from both individual and combined causes.
4. Train and motivate staff to apply best practice systematically.

'Web Break Prevention & Diagnosis' provides a systematic best practice approach. Source www. icmprint.com.

Mis-Splices

Any failure of the splice during the cycle — from when the splice arms start to move (or zero speed festoon begins to fill) to the moment the splice leaves the folder without disturbing the web — causing a press stop or excessive waste. During the splice cycle there will be a change in tension profile and any weak spots in the web or splice will be subjected to extra stress and a web break or splice failure can occur. Some causes can be defined as:

1. **Burst splice:** When the new roll bursts open prior to splicing.
2. **Failed splice:** When the new roll does not paste to the expiring web.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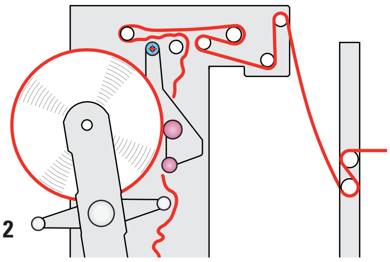
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Some Paper and Splicing Problems at the Printer

		Splicing failure reason				Splicer type	
		Burst	Fail	Mis	Break	Flying	Zero
1	Paper delivery — printer inspection failed to identify roll fault		●	●	●	●	●
2	Poor storage at printer				●	●	●
3	Handling damage at printer				●	●	●
4	Rolls unwrapped too early	●	●	●		●	●
5	Excessive roll vibrations	●	●	●	●	●	●
6	Wrong roll unwind direction (flying paster)		●			●	
7	Incorrect splice pattern type		●	●		●	
8	Splice pattern bursts open before splice						
	— Air pockets	●				●	
	— Dynamic roll expansion (see also 2)	●				●	
*	— Rupture tabs applied too tightly	●				●	
	— Open tape in acceleration belt path	●				●	
	— Too fast acceleration tears paper			●			●
	— Splice shields not fully closed or no vacuum		●				●
9	Failed splice						
	— Inadequate splice tape pressure		●			●	
	— Tape protective strip not removed/No tape applied		●	●		●	●
	— Dust, moisture, solvent on open splice tape		●			●	●
	— Glue unsuitable (tack, temperature, humidity)		●			●	●
	— Cold roll (temperature near core below 10°C)		●			●	●
*	— Rupture tabs incorrect or turned over covering detection tab		●	●		●	
	— No splice detection tab, sensor dirty		●	●		●	
10	Tape or glue overlaps edge of roll			●		●	●
* 11	Tabs come loose and stick to expiring web or blanket			●	●	●	
12	Splice detection tab in wrong position		●	●		●	
* 13	Tab in path of folder slitter			●		●	
14	Too long paster tail causes folder jam			●		●	
15	New roll not aligned to expiring roll or variable roll widths			●		●	●
16	Cocking roller setting incorrect			●	●	●	●
17	Zero speed splicer incorrect alignment to nipping roller		●	●			●
18	Incorrect setting and/or maintenance issues	●	●	●	●	●	●

** Not applicable to multi function splicing tapes*

A high performance automated unwinder can handle web rolls up to 1370 mm (54")Ø weighing 1500 kg at maximum speed up to 300 m/min (1000 fpm) for web widths of 203-762 mm (8"-30"). Source: Hunkeler.

Roll Changing & Splicing Devices

Two techniques are used: either manual unwinders that require the press to be stopped for five minutes or longer to change the roll or automatic roll changing and splicing at full press speed for continuous production. There are many variations of technologies and functions for both.

Unwinders

An expanding shaft supports the roll by its core as it is unwound. The press has to be stopped to manually changeover the roll and to join the expiring web on to the new roll (with glue or tape). Some models allow a second roll to be mounted for more rapid changeover. This technique has largely disappeared from many web applications except for some narrow width web presses and for digital presses for speeds below 150 m/min (500 fpm) because of their low investment cost. The use of larger diameter rolls can reduce the frequency of roll changes by 30-40% — unwinder maximum roll diameters range from 000? to 1370 mm.

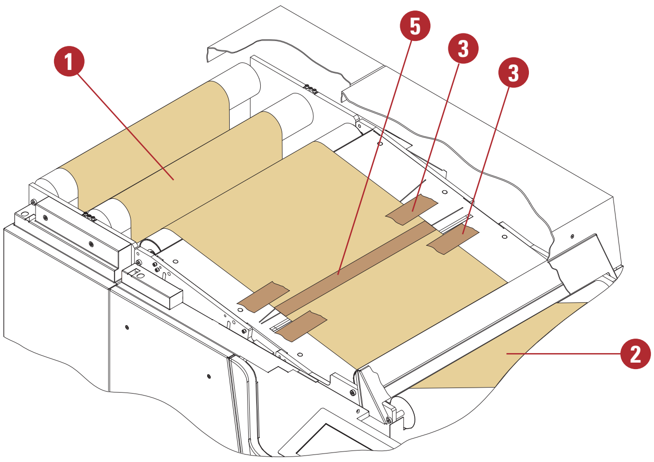
✅ *See page 20 for best practices when using expanding roll shafts.*

Digital Printing & Butt Splicing

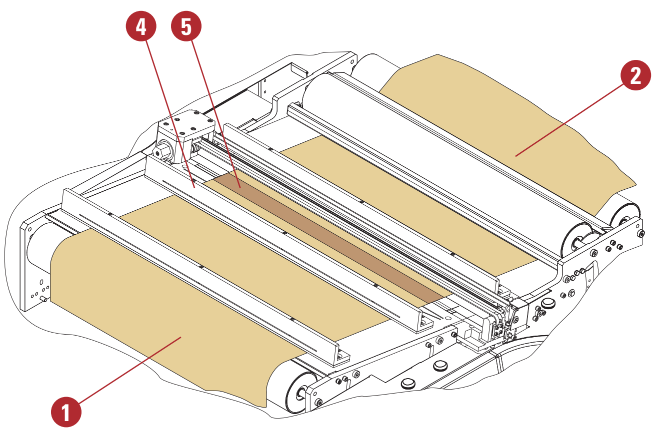
Many digital presses use A4-A3 cut size paper, while high volume presses use rolls ranging in width from 200 to 840 mm. Most inkjet printing systems prefer butt splices to reduce the splice overlap thickness and tail running through the press that could damage an inkjet head.

Manual unwinders take about five minutes to change rolls and prepare a butt splice — this significantly reduces the output of high performance digital presses. Some manufactures offer hybrid unwinder/rewinder systems that by using some automation can reduce roll changeover time by about 50%.

Manual Butt Splicing



Automated Butt Splicing



1 Expiring web
2 New web
3 Manual taped web edges & cutting
4 Automated clamping & cutting carriage
5 Splicing tape
Source: Hunkeler

Manual splicing: When the press is stopped, the outgoing web's edges are lightly taped to the cutting table. The web is then cut, the expired roll removed and a new roll loaded. The new web lead is drawn onto the cutting table and lightly fixed by tape on its edges before being cut. The parallel edges of the two webs are then joined together with a single-sided adhesive tape. The tapes holding down the web edges are then carefully removed and the new roll is ready to be printed.

Semi automatic splicing: Automated clamps hold the web while it is severed by the cutting carriage. A clamp holds the paper in place while the remaining web is rewound on the expired roll. A new roll is loaded and moved into position. Its web lead is drawn under the clamps where it is tensioned and aligned to the outgoing web, and held down while the cutting carriage slices the new paper web. The edges of the expired and new webs are joined with a single-sided adhesive tape. The web is ready to be printed.

Automatic Roll Changing & Splicing

An automatic splicer converts rolls into a continuous web by splicing from roll-to-roll at full press speed, and also assists in loading. Key qualities of the splice and roll change process are:

- Maintain tension and lateral position (in relation to press, infeed, web guide)
- Minimise web breaks, splice failures (press downtime and waste)
- Minimise paper running waste
- Measure running length.

There are two technologies: **Flying splicers** (sometimes called pasters or match speed) and **zero speed splicers**. The main difference between them is that a zero speed splice occurs when the web is stationery (but the press runs at full speed), while a flying splice occurs at the match speed of the running press. There are many variations to these basic designs and this guide must be read in association with the operator's manual(s) for the machines in your plant.

Butt splicing is complicated to automate on zero speed splicers and for this reason the splice tail needs to be short and secured. To minimise risk, some inkjet presses have splice detectors to lift the printing heads from the web.

Zero speed splicer with vertical festoon.
Source: Ecograf.

Technology Options

Shafts or Chucks? Shafts run all of the way through the core and are either mechanically or pneumatically expanded. They provide good adhesion along the length of the core, but cannot be used with damaged cores. They allow the roll to be positioned anywhere along the shaft, which is generally limited to 1450 mm web width or less. Roll shaft systems are simpler than chucks on arms but are more difficult to automate, although can be used with a hoist. Chucks penetrate only the ends of cores, which, therefore, must be of adequate quality and condition to withstand braking torque. Chuck systems are easier to automate and have no width restrictions. Both splicer designs use these technologies.

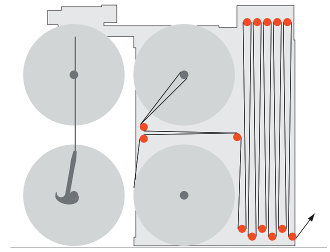
Core or Belt Acceleration? Core braking and acceleration is now common. Some flying splicers use belt acceleration and/or braking on the outside of the roll to provide good torque control — this is no longer common in web offset but is still used in rotogravure.

Flying splicer pastes at full production speed.
Source: Goss.

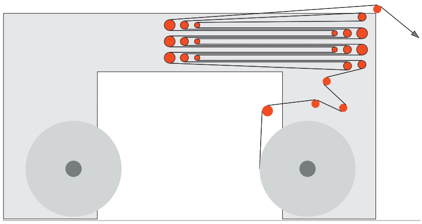
Roll Handling on Pallets

Many printers and converters moving into digital printing do not have roll handling clamp trucks and require their rolls to be supplied on pallets that can be handled manually and with conventional forklift equipment. The preparation and handling of rolls and pallets is often a manual process and leads to limitations in logistics (amounts of pallets on trailers and in containers). Standing rolls need to be handled with care because of the risk of being deformed on the bottom that can lead to unwinding problems at moderate to high speeds.

Standing roll loaded on to a pallet and securely chocked both sides. Source: UPM.



Roll-over-roll with vertical festoon.



Horizontal roll and festoon. Source: WOCG/icmPrint.

Zero Speed Splicer

Splicing occurs when the web is stationery while a festoon of paper provides a temporary stock of paper for the press to run at full speed. Splice preparation is relatively simple and the tape requires only a moderate performance. Advantages of zero speed designs over flying splicers include: their flexibility in unwind direction and choice of the web side to be on top; no restriction on the roll splice diameter, allowing small rest rolls to be used up; and changing the web width is simpler.

The two principal zero speed configurations are:

Vertical festoon with roll-over-roll: This provides simple braking, acceleration, control, easy web-up, with minimum floor space required; it uses core shafts and requires a hoist to load upper rolls. Central loading twin webs are common.

Horizontal festoon: Same functional advantages as vertical but splicer is lower in height and floor loading does not require a hoist; commonly equipped with roll arms and chucks instead of core shafts, integrated infeed, web guide and automated webbing-up.

Splice heads using rubber coated rolling nip splice bars are common. Higher performance models have a one-step operation.

The Splice Cycle

All zero speed designs have a similar splice cycle:

A The new roll is loaded and its web is led to the splice head and the splice prepared. An automatic cycle starts about two minutes before the splice, when a klaxon/flashing light informs the press crew; the splice cycle can also be manually started by the operator.

B Just prior to the splice cycle the festoon rises to its highest position to store the maximum length of paper to allow a continuous paper supply to the press during the splice cycle (during normal running the festoon is maintained by a web brake at a low level to minimise web wander).

C The splice cycle starts by braking the running roll to a stop, which then activates:
• the nip to bring the running web into contact with the adhesive tape on the new roll lead
• the knife cuts the web of the expiring roll.

D The splicer head retracts and the roll is accelerated to the press running speed. The expired roll is removed.

Horizontal zero speed splicer with automated roll loading. Source Goss.

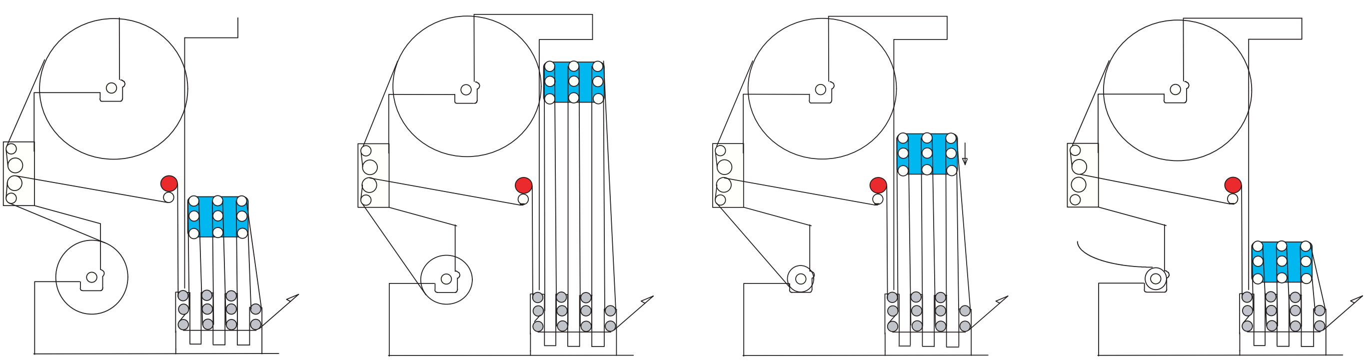
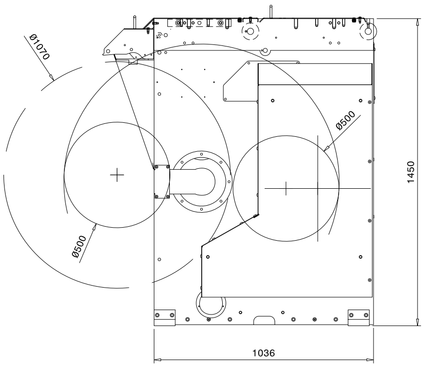


Fig A - Unwinding *Fig B - Festoon fills* *Fig C - Stationery splice* *Fig D - New roll acceleration*

Flying Splicer

The incoming roll and expiring roll both run at full press speed when the “flying” roll change is made. Splice preparation requires precision, correct tapes and tabs.



There are numerous flying paster designs, however, they all have a similar splice cycle. The main differences are in the way rolls are supported, rotated, accelerated and braked — this is a compact model. Source: B&W MEGTEC.

The Splice Cycle

A The new roll is loaded and splice pattern prepared while the running roll is being unwound, An automatic cycle starts about two minutes before the splice, when a klaxon/flashing light informs the press crew; the cycle can also be manually started by the operator.

B The arms (turret) are rotated into the splice position, the splice arm carriage pushes the running web to about 10 mm (0,4") from the new roll surface. The new roll is accelerated (by either a belt on the roll circumference, or by a core drive) to match the speed of the running roll (± 0,5-1%). The new roll is normally automatically aligned to the running web (± 1 mm/0,04").

The PLC synchronises all splice parameters (running web speed, minimum roll Ø at splice, new roll circumference, speed, position of detection tab) and automatically triggers the splice.

The running web is pushed by (roller or brush) against the surface of the new roll about 1,5 m (60”) before the splice pattern, the roll is pasted on to the running web and the splice opens to release the new web

✅ The knife cuts the web of the expiring roll just after the end of the splice pattern (splice tail).

✅ Tension control brake is transferred to the new running roll.

✅ The expiring roll is braked to a halt and the splicer carriage returns to its home position.

C The arms (turret) are rotated into the running position.

Flying splicers for heavy and wide rolls are equipped with automatic loading. This can include a core container (left) into which the expired roll can be placed. Source: KBA.

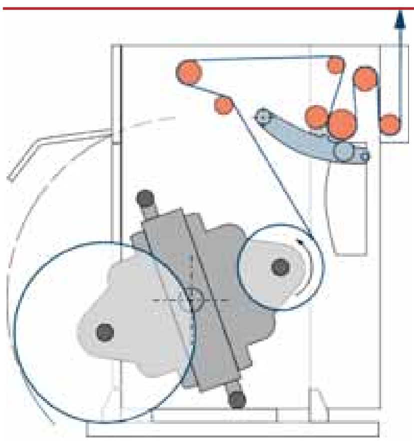


Fig A - Unwinding

Source: Goss Contiweb

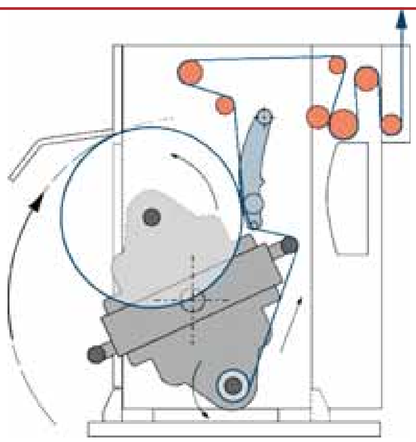


Fig B - Splice cycle

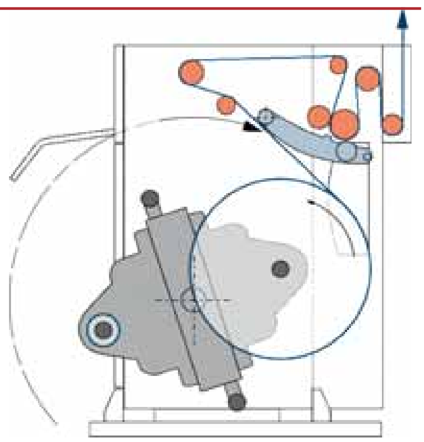
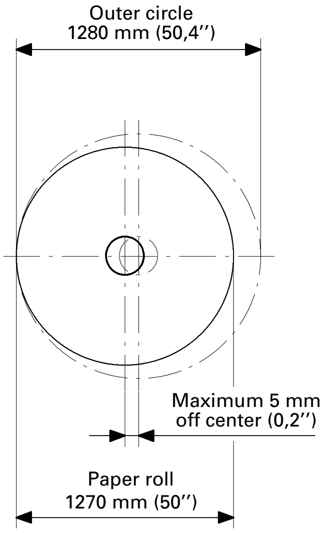
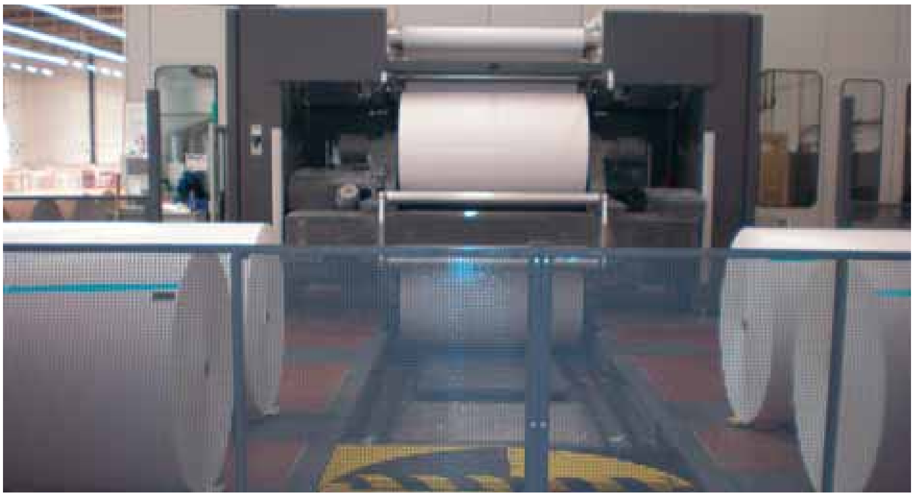


Fig C - Loading.



Out-of-round tolerances for automatic handling. Source: KBA.

Automation Issues



Roll buffer system in heatset web offset. Source: Goss

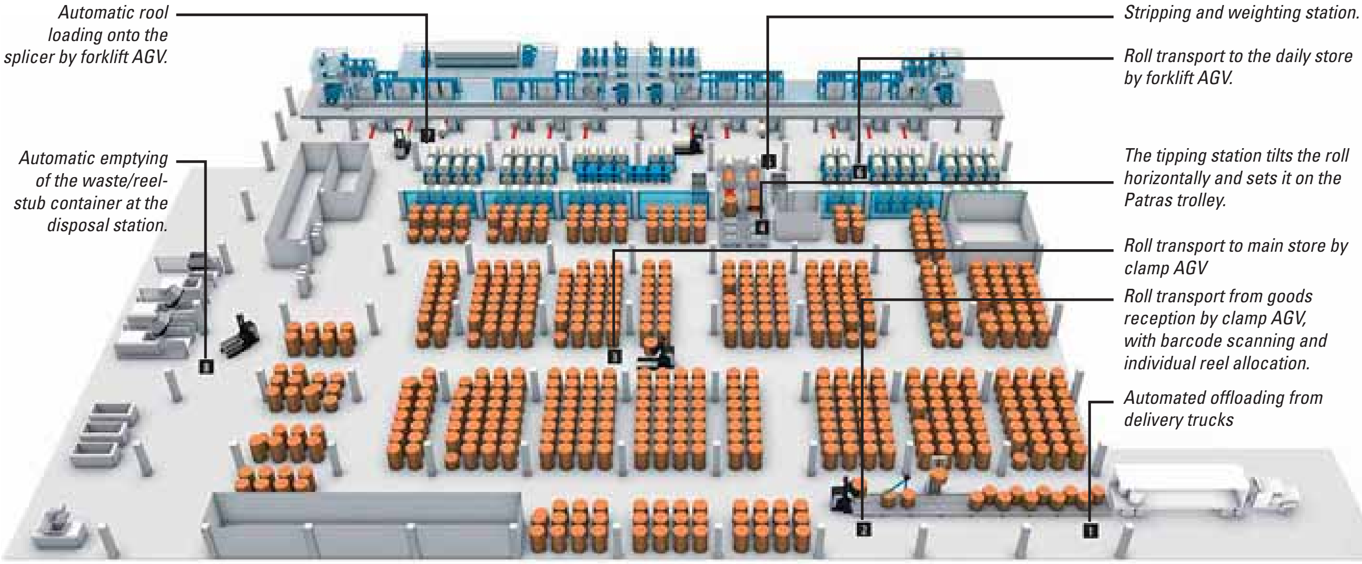
High Press Speeds and Larger Roll Dimensions

Increased offset press speeds up to 20 m/s means reduced intervals between roll changing. Some presses have increased roll diameter from 1250 mm to 1500 mm (50 to 60") to reduce roll changes by 31%; however, this increases roll weight by 44%. Offset web widths have also increased to between 2000 to 2860 mm. This means that rolls of up to 7,5 tonnes need to be handled, requiring automatic roll handling and loading. Publication gravure web widths of 2450 to 3680 mm are common and the widest rolls are 4320 mm. Logistics need to be adapted to handle and store rolls at the paper mill, in transit and at the printer. The threshold for roll handling automation is from 2,2 tonnes (it can be lower) using either rail or AGV systems.

Key automation issues for safety and productivity:

- Auto unwrapping needs standardised roll packaging
- Auto splice preparation needs multi-function splice tape
- Paper needs to be in acceptable temperature RH range.

Most new high speed presses use automated roll handling located in an area secured with safety fencing and access protection around the splicer.



High productivity press installations have increased automation for multiple process steps. Source: KBA

Roll Cores — an Integrated Renewable Component

Cores should be considered as an integrated renewable component, relating to both the paper machine winder and the printing press splicer, in order to achieve high efficiency and reduce waste across the delivery and process chain. The function of the core is to support the paper roll. It must be of sufficient strength and stiffness to prevent crushing in normal handling; while during winding and printing it must transmit torque and avoid vibration and delamination.

Most offset splicers now use core braking and acceleration, making the quality of the core critical to the transfer of torque. Splicers use shafts or chucks to support the roll by the core and firmly lock it without slippage, including during emergency stops. Shafts run through the core and are either mechanically or pneumatically expanded to provide good adhesion along the length of the core, but they cannot be used with damaged cores. Chucks penetrate only the ends of cores and, therefore, these must be of adequate quality and condition to withstand braking torque.

Source Sonoco- Alcore.

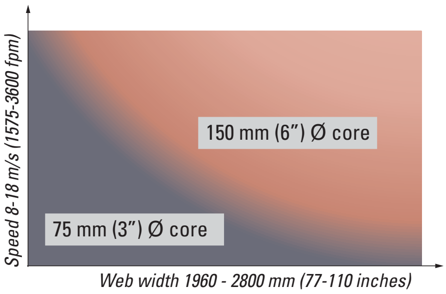
Core Specifications

Normally, it is the paper supplier's responsibility to ensure that the cores on which paper is supplied conform to the printer's requirements. These are determined by the web width, roll diameter and weight, and production speed. Appropriate core properties are important to run the winder and printing press safely. Only the press manufacturer in cooperation with core and paper suppliers can provide information about safe unwinding speed for roll width, weight, speed combinations and core diameter required (76 or 150 mm/3" or 6"). See Module 1 for more information.

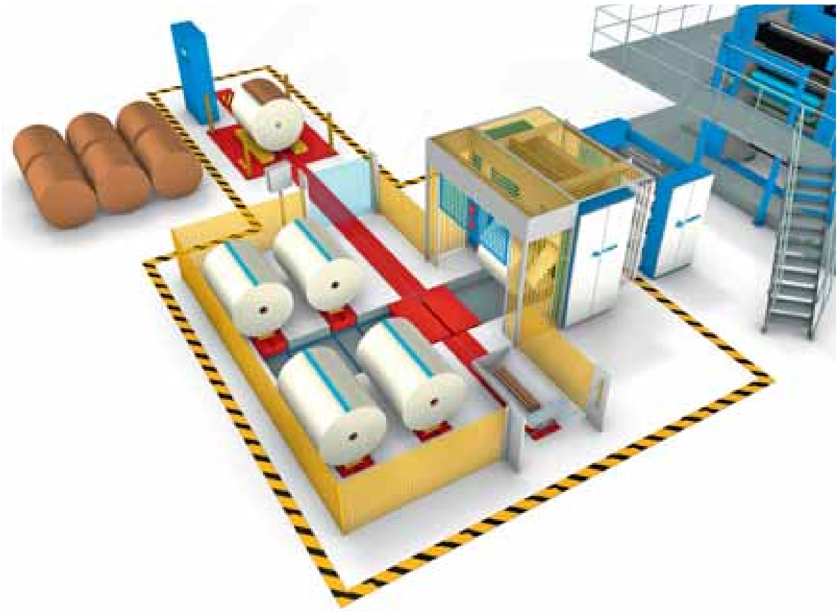
Residual Roll Explosion Risk

High speed presses with web widths over 2000 mm require a higher critical speed (axial E-modulus of core divided by its density). If this value is incorrect the residual roll can explode and may cause serious injuries. Therefore, these offset splicers should be enclosed within safety cages during operation (these are already used in publication gravure). The planned ISO 12643 standard requires a safety barrier against core fragments when web speed exceeds 15 m/s or webs are wider than 2000 mm.

Dynamic strength is measurement to estimate roll weight. It does not correlate web vibration. Critical speed is depending on core E-modulus divided by its' density — a high value is required to avoid residual roll explosion risk at higher web width and production speeds. This may require core roll diameter to be increased from 76 to 150 mm (3" or 6").



This chart indicates core diameter requirements in relation to printing speed and web speed with a splice diameter of 120 mm (4,7"). Always check with the press manufacturer and core supplier particularly when in the transition zone from 75 to 150 mm (3-6") core diameter — see Module 1 for more details. Source Sonoco- Alcore.



A movable barrier in front of the splicer protects operators in case of a residual roll explosion. The door is automatically closed before and after splicing, and at a given web speed and roll revolutions. Source: KBA.

Different characteristics and dimensions are used for different splice conditions. Please check with your supplier to ensure using the correct tape for the conditions in your environment, printing substrates and machinery. Source: tessa®

Splicing Tapes and Tabs

Adhesives (all with high tack)	Coldset	Heatset	Pub. Gravure
Repulpable adhesive	●		●
Repulpable heat-resistant adhesive		●	
Climate resistant adhesive	●	●	●
Tape opening force	**Low**	**Moderate**	**High**
Core driven splicer		●	●
Belt driven splicer	●	●	
Fragile paper quality	●	●	

Modern splicing tapes allow a straight-line splice pattern that has become the market standard for flying splices and has largely replaced complex "V and W" patterns — which are occasionally used in some gravure plants for certain conditions (gloss paper in winter); and for some specific paster types.

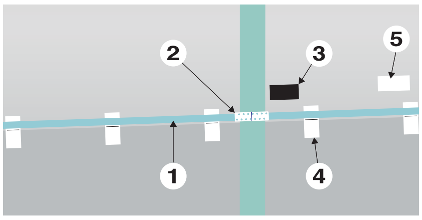
Pressure sensitive adhesive (PSA) tapes must paste the new web to the running web with sufficient adhesion to pass through the press, dryer and exit the folder without failure of the join. High tack adhesive tape functions equally well for zero speed and flying splicer but a low tack zero speed tape cannot be used for a flying splice because it will lead to a mis-splice.

Multi-function splicing tape systems for flying splicers combine several functions (tapes, rupture and detection tabs) into one tape to make splice preparation simpler, faster and more reliable with reduced risks of web breaks. Mono-function splicing tapes and tabs systems are still in (declining) use in some markets and applications.

Tapes are available in a range of widths to suit varying splice characteristics: for flying splice 25 - 50 mm (1-2") and 12 - 25 mm (0,5-1") for zero speed. Undersize tapes increase the risk of splice failure and oversize tapes add avoidable cost.

Liquid glue for splicing is now rarely used due to the difficulties of application and the risk of splice failure. It is sometimes used in very cold conditions. In a number of countries it is also banned due to employee health risks. If liquid glue is used, avoid drops on surface and reel ends. If solvent thinner is necessary, use breathing mask.

Mono-Function Splicing Tapes and Tabs



1 *Splicing tape*
2 *Belt bridge tab*
3 *Splice detection tabs*
4 *Splice rupture tabs*
5 *Folder exit detection tabs*
Source: WOCG/icmPrint.

These systems are still in use, although they have declined in favour of multi-function tape systems.

Splicing tape: Double coated tapes using high-tack pressure sensitive adhesive (PSA) on an acrylic base.

Belt bridge tab: Splicers with belt drive require bridge tabs positioned over the top of the exposed splicing tape in the path of the acceleration belt(s) to prevent premature opening from air pockets forming during acceleration. Bridge tabs are available in different versions depending on the application and paper grade. For papers with lower coating anchorage more exposed adhesive in the belt path is recommended.

✘ Do not use tape liner as a bridge tab as it will separate during acceleration and may cause a mis-splice.

Splice detection tabs: Different types — (a) printed solid black for photocell recognition — correct density and consistency of printing are essential for reliable detection, (b) reflective for light sensor detectors and (c) inductive.

Splice rupture tabs: Hold down the outer spire during rotation to prevent air pockets being formed that can burst the splice during acceleration. The die-cut/perforated tabs break instantly after the splice has been made to release the new roll for unwinding. Number and type of tabs are determined by splice speed and paper grade.

Folder exit detection tabs: Aluminium tab used for sorting out splice waste during postpress processes. (In Europe they are not normally separated from pressroom waste because they are easily removed by filtration during repulping.)

Multi-Function Splicing Tape

These tapes combine different features for a simpler and more reliable splice performance:

- Easy-to-use for operators
- Reliable high quality tape with perfect wetting on most paper grades
- Prevention of air pockets and premature opening during roll acceleration
- Easy opening of the splitting strip and high initial tack at the moment of splice-to-web contact
- Shear-resistant bonding of the top sheet, even for rolls prepared in advance, and throughout the press
- Reliable splice recognition when using splicing tapes with integrated detection.

Contact adhesive: Splicing tapes use PSA (pressure sensitive adhesive) with high tack for three functions:

1. Secure attachment of the top spire of new paper roll during storage, transport and acceleration in the paster.
2. Optimum contact between expiring and new web at the moment of splice. The bond intensity is influenced by the pressure and condition of the contact roller or brush in the splicer.

☑ Follow the manufacturer's settings and maintenance.

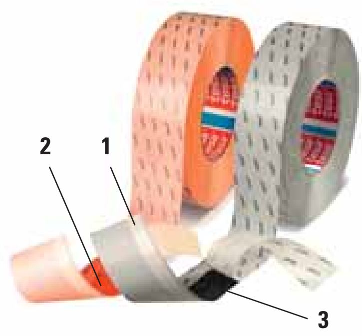
3. Heat-resistant adhesive for high temperatures of heatset press dryer.

Splitting strip: Provides secure closure of the incoming paper roll during storage, transport and acceleration in the splicer. During the splice process the strip precisely opens after pasting contact (from a defined strip width and specified opening force). The splitting strip is like a breaking point independent of the tape's width, positioned 2 mm from the tape's edge for a reliable lifting of the splice. A lower opening force is recommended for belt driven splicers and low quality paper.

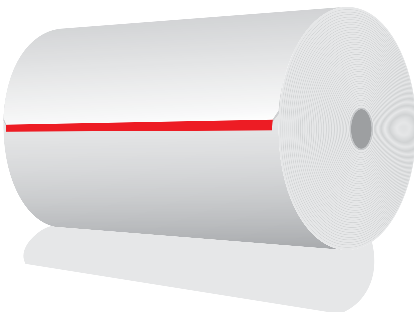
Integrated detection: Reliable splice detection for the correct timing of the contact roller and the knife to cut the expiring web can come from either a mechanical mark on the splicer's axis or automatically, using an optical or inductive sensor. Automatic splice detection reduces the number of mistakes due to wrong tab positioning — the splice will be detected directly on the tape's position. It requires either detection tabs, or splicing tapes with integrated detection:

- A black backing for optical sensors in the splicer.
- Aluminium backing for inductive sensors in the splicer and postpress (to remove printed copies with tape).

☑ Ensure the correct splice tail length when changing from detection tabs to splicing tapes with integrated detection. Request settings from the splicer supplier.



Multi-function splicing tape:
1 *Splitting strip,*
2 *High tack contact adhesive,*
3 *Integrated detection feature.*
Source: tessa®



Roll ready for splicing. Source: tessa®

Temperature and Humidity for Tapes

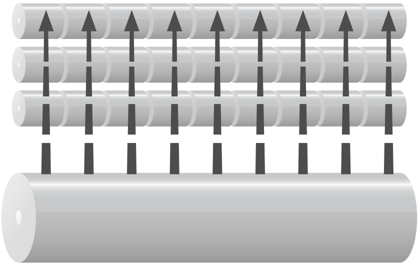
Repulpable adhesives offer very good wetting on paper but also react with the environment and substrate temperature and humidity. Adhesive properties are influenced by temperature and humidity — different adhesive formulations are available to deal with some of these variations. Newer generation tapes have an improved shelf life and a climate resistant adhesive to provide high stable tack under different environment conditions, such as high humidity or low temperature of the paper rolls or pressroom.

☑ Select tape type in relation to ambient temperature and humidity in your plant. Consult tape supplier.

☑ Store tape in its original packaging at a temperature between 10 - 40°C (50 - 104°F) with 40 - 65% RH and away from direct UV exposure. Respect the specified tape shelf life, as adhesive qualities deteriorate over time. Leave protective liner on tape as long as possible.

☑ Cold conditions: Store the tape in the original packaging at ambient pressroom temperature at least one day before use. Special tapes are available.

☑ High humidity conditions: Keep the tape cool (in a refrigerator) except when being used to prepare a splice. Special tapes are available.



Source: WOCG/icmPrint

Web Tension — Key to Efficiency

Optimum web tension is crucial for colour quality and high productivity. Tension variations come from (a) paper (b) press line and (c) poor working practices. Web break risk increases either when tension variations become excessive and/or there are local area weaknesses in the web. Local papermaking weaknesses that may cause web breaks include poor mill splices, creases and hairline cuts that might not resist the tensions applied to the web.

Paper and Roll Characteristics

Paper is primarily composed of natural cellular materials, which by their nature are locally variable and do not react to a given stress in the same way. There will always be some variation in tension profile in all papers from all suppliers. It is normal that there are variations of tension (1) across the width of the papermaking machine, consequently with a variation from roll-to-roll, (2) between the surface and core layers, and (3) at mill splices near cores.

Modern paper mill winders run at speeds up to 50 m/s (8000 fpm) on webs over 9 m (30') wide. To obtain a good and even winding it is important to have even profiles of moisture, hardness and tension. Mill join splices are made after a web break or to make fillings (joining two tambour reels to fit customer diameters). Mill joins should be coloured to allow photocell detection and physical separation and should not be closer than 70 mm (2,75") to the core to avoid any disturbance to the splice cycle and tension.

✅ To minimise roll-to-roll tension variations some printers organise their internal paper storage to print from rolls from the same tambour position. This practice is claimed to provide lower tension variations between rolls during splicing and running, contributing to waste reduction and reduced creasing, particularly on heavier papers. The roll position is contained in the roll number. Many mills print this position on the label when requested. It is best to use position numbers within an order and not mix orders, as the positions do not always match exactly between orders.

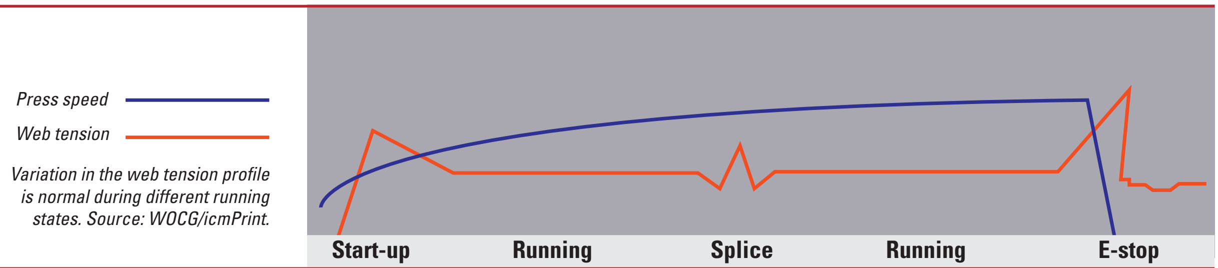
Web Tension Variations from Press Line

Press line tension settings are specified by the press manufacturer and vary from press to press. Generally, they are about five times lower than the breaking tension of the paper. These tensions need to be optimised over time for variables of different papers, blankets, ink and dampening. Web tension control should be smooth and slow.

Equipment influences on tension include: type of splicer and infeed, variation at printing units (cylinder pressure setting, blanket type/packing), automatic blanket washers, dryer, chill rolls and folder. During the splice cycle there will be a change in tension profile. If there are any weak spots in the web or splice they will be subjected to extra stress and a web break or splice failure can occur.

Poor Working Practices

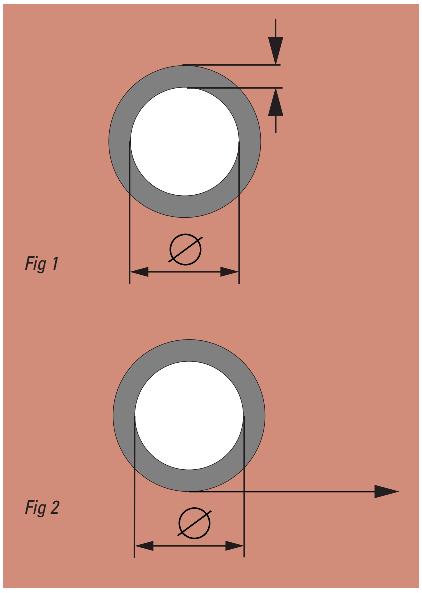
Lack of ongoing training and motivation often results in incorrect setting, operation and maintenance of equipment. Poor roll handling can damage and deform rolls.



Variation in the web tension profile is normal during different running states. Source: WOCG/icmPrint.

Preparing the Roll for Splicing

⚠ PASTER OPERATION SAFETY: Different splicer models have their own specific operation. Therefore, this general guide can under no circumstances replace the supplier's instructions. Before operating the splicer, all staff concerned must know the manufacturer's safety regulations, operating instructions and maintenance procedures.



Core waste is set either as
1 *radial thickness or*
2 *linear length.*
To minimise either having too little core waste or too much, these settings can be changed when the press changes from a very thick to a very thin paper or vice versa. Attention, the external of cores are variable. Source: WOCG/icmPrint.

Paster makeready

- ✅ Set roll width (adjust width between splicer arms to roll width + clearance specified).
- ✅ Core waste: This is the preset length of paper to be left on the core at time of splicing. It is determined on the basis of minimum length to avoid web running off roll and consequent press stop. The last wraps around the core may not be suitable for printing due to wrinkles or embossing.
- ✅ Set low start-up tension setting (to minimise risk of web break at low speed).
- ✅ Web-up splicer after roll is loaded following the splicer manufacturer's instructions.
- ✅ Ensure web guide is centred.
- ✅ Ensure web cocking device is in neutral position. Some zero speed and flying pasters can cock either the festoon or outlet roller. This is used to compensate for deformed rolls. It is essential that this device is in a neutral position when not required as otherwise it will create massive instability in the running web.

Paster and Infeed Tension

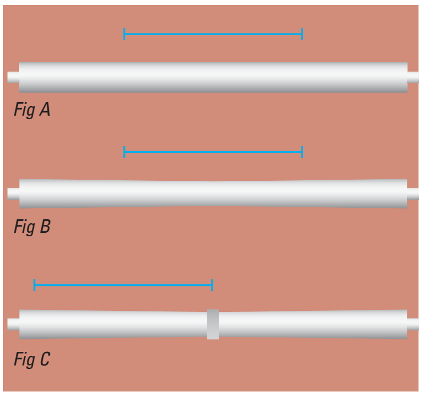
- ✅ Experience identifies these starting points to develop optimum settings on each press (in conjunction with those of the manufacturer). Values depend on: type of paster, winding hardness, printing cylinder assembly (gummi-steel or rubber-rubber), experience of the printer, virgin fibre, mixed, or recycled paper. The following table is a guideline example only.

Commercial start-up tension settings			Newspaper start-up tension settings	
Paster	40-120 gsm	120-150 N/m (0,6,8-8,6 pli)	Paster	70-90 N/m ___ pli
Infeed	30-60 gsm =	(___gsm x 10 x 90%) = __N/m	Infeed	200 N/m ___ pli
	60-90 gsm =	(___gsm x 10 x 80%) = __N/m		
	90-120 gsm =	(___gsm x 10 x 70%) = __N/m	*1 N/m = 0,00571 pli (pounds linear inch)*	

1. Always reset tension when changing paper weight.
2. Set low start-up tension level (to minimise risk of web break at low speed).
3. Fine tune tension during makeready and running.
4. Record settings for each paper and web width for faster future set-up with less waste.

€[2] Too high tension causes wrinkles, increased web break risk and can change print length.

€[2] Too low tensions causes web wander.



A. Parallel festoon rollers
B. Tapered rollers to self-centre the web
C. Off-centre half web requires tapered rollers to be taped. Source: WOCG/icmPrint.

Half and Part Roll Widths

Part roll widths generally run better in the centre (if the folder permits). For twin web in-line configurations the half web should be run in the lower position to print in the second set of units to avoid running a part web over air turns and to minimise tension variations.

Some zero speed splicers use parallel festoon rollers (A). Most splicers use tapered rollers to self-centre the web and provide better tension on web edges (B).

If the roll cannot be run in the centre (for some 2-web productions) the rollers will need to be taped to avoid web wander (C). The dancer rolls can be cocked on some models.

Roll to Web Processing Steps

Preparation with the roll on the splicer is recommended because it is ergonomically efficient and minimises damage and waste. An automated central roll preparation station is used at some installations, but requires careful transport of rolls to the splicers. A few very high volume printers use fully automated systems.

- Roll preparation area needs to be dry, even (free of hard particles), and clean.
- Best practice roll handling avoids damage that frequently leads to excessive paper waste and web breaks.
- Close gates and doors near the splicer to control draughts and dust, temperature and RH variations.
- Premature removal of the wrapping increases the risk of dimensional instability from atmospheric variations, and accidental damage to the white paper.

Manual On-Paster Preparation — roll placed next to splicer

1. Remove end covers and core plugs, inspect, test with Schmidt hammer
2. Record roll number and bar code (if system fitted)
3. Load roll on to splicer
4. Remove brown wrapper, weigh and dispose
5. Slab-off white waste, weigh and dispose
6. Prepare splice
   Rotate roll to avoid dust falling onto tape
   Set cocking roller if needed to compensate uneven rolls
7. Splice cycle
8. Remove core/part roll. Support butt roll as chucks are retracted.

Source: KBA.

Automated Roll Handling System

1. Automated roll delivery and truck unloading
2. Scanning roll data and allocation
3. Automated main roll store
4. Roll preparation with weighing station
5. Record roll number and bar code
6. Automated daily store
7. Load roll on to paster/splicer incl. splice cycle
8. Remove core/part roll – waste disposal

Source: ERA.

Splice Preparation Tool Kit

1. Schmidt hammer to test rolls for soft spots
2. Flat-bladed knife for removing roll end covers
3. Roll slitter for stripping (available from most paper suppliers)
4. Scissors (to cut off splice "ears")
5. Sharp knife with undamaged blade for cutting out damage — store in scabbard when not in use
6. Sandpaper or powered sanding disc to smooth out damaged areas of the roll
7. Tape squeegee/applicator
8. Good lighting where rolls are inspected and prepared for splicing
9. Roll report sheet for monitoring paper data and splice/web break failures
10. Tapes and tabs need to be stored at 10 - 40°C (50 - 104°F) with 40 - 65% RH and protected from sunlight and dust.

Inspect Rolls Before Preparation

Remove end covers with a broad-bladed knife.
Source: WOCG/icmPrint.

- Check wrapped ends for cuts, glue, dirt (dust), dents, water damage.
- Check roundness.
- Note any damage with information about size and depth on delivery list with roll number.
- Take photos of damaged roll parts.
- Check grade, grammage, reel width, core size.

For more information on inspection and reporting *see Module 2*.

1: Remove End Covers (Shields)

✅ If a knife is used, care should be taken not to penetrate the roll end. A broad-bladed knife helps reduce risk.

⚠ The cutting action with the knife should always be away from the person using it to minimise the risk of injury if the knife slips. Always return the knife to a scabbard when not in use.

✅ Inspect white roll ends for damage (cuts, glue, dents, water damage).

✅ Check roll and core for roundness.

- Remove core plugs (if fitted) and inspect core for damage, sweep away any dust (photo ERA 24).
- For splicers with chucks, the outer 10-15 cm (4-6") must be in good condition.
- For splicers with shafts, the core must not be crushed or blocked.

✅ A Schmidt hammer can be used to test rolls for soft spots.

Avoid knife damage to roll. Source: ERA.

2: Record Information/Read Bar Code and Weigh

Record the roll number and other information either manually (most paper mills provide peel-off labels that can be stuck onto a report sheet) or automatically (using barcode) into a data log or Electronic Data Interchange (EDI). This provides essential data on paper use and allows rolls to be traced in the event of paper problems.

Radio frequency (RF) tags are a roll tracking technique used by some mills and printers. The tag is inserted into the roll core and can be automatically read by detectors in the store, on lift trucks, roll transporting devices and at splicers to give the status of all rolls in the plant at all times.

Read bar code or peel-off label.
Source: WOCG/icmPrint.

3: Load Roll onto Splicer

Best Practice and Safety First

⚠ **Before operating the paster, all staff must know the manufacturer's safety regulations and operating instructions.**

⚠ **Arm rotation safety:** Before splicing, and during manual arm rotation, the operator must verify that rotation path is clear of personnel and foreign objects.

⚠ **Emergency stop devices:** All staff must know their location and function.

Unwrapped roll ends: Some paper rolls are marked with inkjet on the ends with roll number, weight, unwind direction, mill splice position. These markings help ensure that the roll is loaded onto the splicer with the correct unwind direction, and marks any mill joins to allow detection and sorting.

⚠ Roll arms are adjusted to the correct width for the roll being loaded plus supplier's tolerance.

For splicers without any form of assisted loading, it is a good idea to paint reference lines on the floor for common web widths to allow better line-up of rolls before they are moved into the arms. Edge damage is common during loading from collisions with splicer arms or chucks and causes avoidable paper damage.

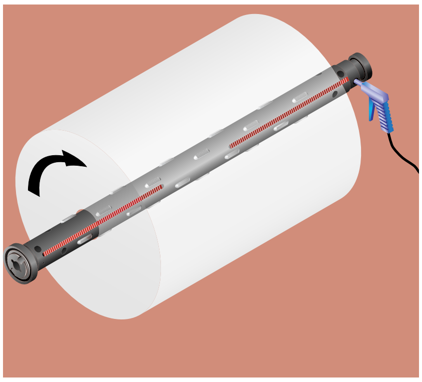
Ink jet printing on roll end shows roll number, weight, unwind direction and mill splice position.
Source: WOCG/icmPrint.

Ensure chucks are fully retracted and free of debris before loading and roll brake is switched on.
Source: WOCG/icmPrint.

Chuck pasters — Roll Loading Safety Check:

- ⚠ Make sure chucks are fully retracted and free of debris before loading and roll brake switched on.
- ⚠ Verify chucks are fully inserted on both sides. Risk is that roll could come free of chucks to create a potentially serious accident, damage to roll and splicer.
- ⚠ Chuck jaws are fully expanded into core. If soft cores are used there is a risk that the chucks will settle into core. If chucks do not provide continuous automatic expansion, then the chucks should be checked for expansion just prior to start of splice cycle.
- ⚠ If manual expansion tools are used (T-wrench, air guns) ensure they are removed and replaced in their storage rack immediately after they have been used. High risk of injury.

- ✅ Make sure that the roll unwind direction (marked on roll end) is correct before loading.
- €^{2} Lost time to unload roll, rotate and reload it creates risk that roll is available too late for splice



Always expand air shaft before roll is loaded.
Source: WOCG/icmPrint.

Expanding Shafts

- ⚠ Expand the shaft before the roll is loaded onto the splicer arms/hoist, otherwise the roll will be off-centre.
- €^{2} Off-centre rolls generate vibrations and tension variations during unwinding, causing increased risk of web break, creasing and mis-register.

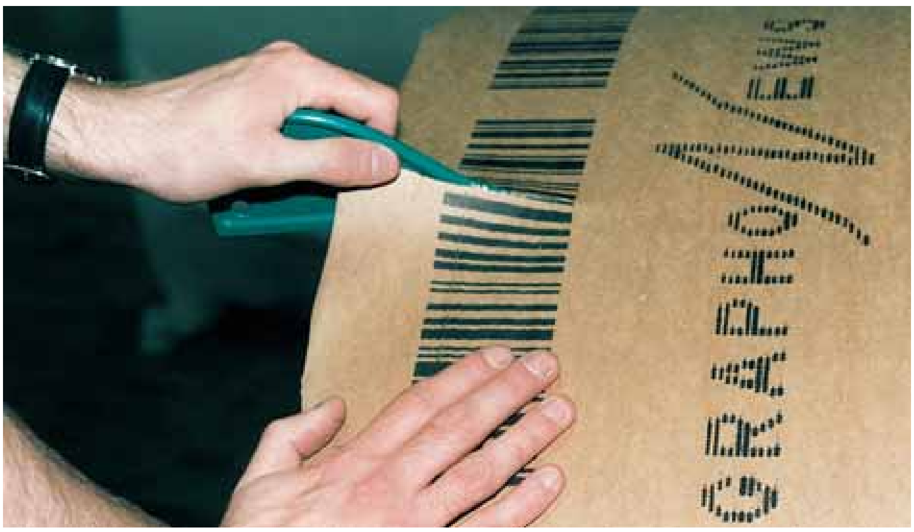
For splicers with roll-over-roll make splice preparation on the shaft when loaded on to hoist.

- ⚠ Follow supplier's procedures to avoid safety and roll damage risks.
- ⚠ Ensure shaft is locked into position in splicer.

4: Remove Wrapper

When unwrapped, roll acts like a released spring and will tend to loosen. This puts additional tension onto splices prepared in advance. Cold rolls tend to expand more when warming up.

- ✅ Use plastic/wooden roll stripper when removing the belly wrapper (do NOT use a knife). Dispose of wrapper with brown waste.
- €^{2} Removing the belly wrapper with a knife is less controllable and can result in excess stripping.



Use a roll stripper to remove the belly wrapper
Source: WOCG/icmPrint.

5: Slab-off White Waste, Record & Dispose

- ✅ Pull individual wraps from the roll, inspecting the edges and belly for damage. Roll surface must be free from impression marks made by stones, nails, wooden parts. If OK, prepare the splice.
- ✅ If further stripping is needed, tear the top layers by hand before introducing the stripping tool. Once the roll is damage free, prepare the splice.

Experience shows that some edge and side damage does not always require stripping to the bottom of the damage. This can often be treated by carefully cutting out with a sharp knife and/or sanding of the area. The press operator should be informed of the problem so that he can slow down the press and nurse the damaged web through the press. Applying a lubricant to damaged area may assist passage through the press.

€[2] Failure to identify end damage may result in a web break during production.

€[2] Risks of accidental damage to the white paper are increased.

€[2] Over-zealous use of the stripper will result in unnecessary waste.

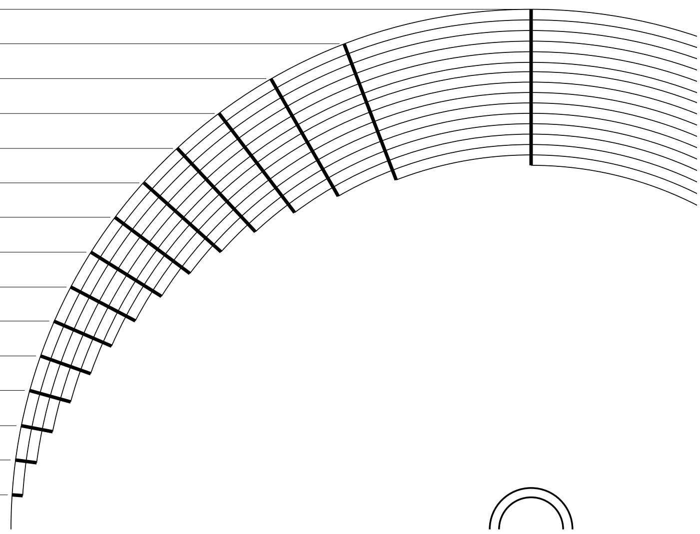
Frequently, more layers are stripped off than are really necessary. It is important to remember that much more paper can be saved at the top of a reel compared with near the core, e.g. 5 mm (0,25") at the top of a reel is equivalent to 5 cm (2") at the core!

Dynamic roll expansion if wrapper removed too early. Source: WOCG/icmPrint.

STRIPPING WASTE CALCULATION CHART

Stripping waste as % of total paper on roll

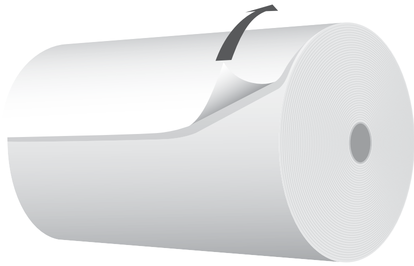
Depth of damage	Roll 1000 mm/40"	Roll 1250 mm/50"	Roll 1500 mm/60"
100 mm 3,94"	36,4%	29,6%	25,0%
90 mm 3,54"	33,1%	26,9%	22,7%
80 mm 3,15"	29,7%	24,1%	20,3%
70 mm 2,76"	26,3%	21,3%	17,9%
60 mm 2,36"	22,8%	18,4%	15,4%
50 mm 1,97"	19,2%	15,5%	13,0%
45 mm 1,77"	17,4%	14,0%	11,7%
40 mm 1,57"	15,5%	12,5%	10,4%
35 mm 1,38"	13,7%	11,0%	9,2%
30 mm 1,18"	11,8%	9,4%	7,9%
25 mm 0,98"	9,9%	7,9%	6,6%
20 mm 0,79"	7,9%	6,3%	5,3%
15 mm 0,59"	6,0%	4,8%	4,0%
10 mm 0,39"	4,0%	3,2%	2,7%
5 mm 0,20"	2,0%	1,6%	1,3%



Separated waste

Environmental best practice and higher value payment for recycling comes from separating waste:

1. Brown waste (end covers, wrapper)
2. Fibre core (strip off white waste)
3. White waste from slab-off, core.
4. Printed waste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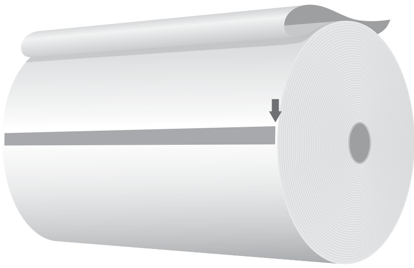
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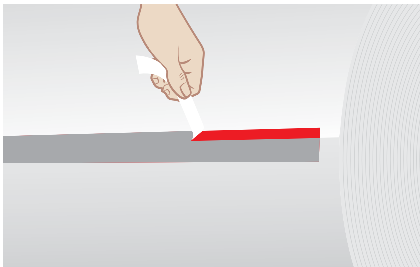
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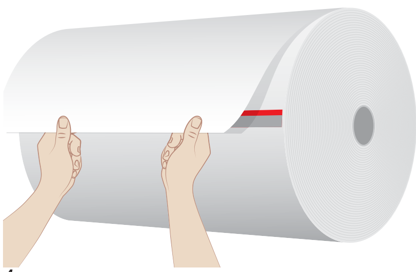
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6.1 Splice Preparation — Single Multi-Function Tape

Apply the brake to stop the roll rotating during preparation.

1. Peel off and fold back the first paper layer (spire) of the new paper roll (figure 1). Do not touch the exposed adhesive area on the reverse of the tape as grease decreases its adhesion.

Apply the tape from left to right with the narrow part of the liner on top*. Leave a space of about 10 mm (1/2”) on each side to prevent exposed adhesive outside of the splice (figure 2).

**Exceptional cases may require preparation to be turned upside down, depending on splice direction and splicer.*

✅ Use a squeegee or plastic card to apply high pressure across the total width and length of the tape after positioning to ensure optimum adhesion.

2. Remove the narrow part of the liner. Pull it upwards at a 90° angle to prevent damage to the splitting strip underneath that could cause premature opening during acceleration (figure 3).

3. Pull the top sheet tightly over the exposed adhesive (figure 4). Expel air between the outer and inner spires so that they lie smoothly to prevent wrinkles or tension difference at the moment of contact between the new and expiring webs.

4. Fold back and tear away the excess material of the top paper layer by hand (figure 5).

❌ Do not use a knife that can damage the tape or paper.

✅ Use a squeegee for higher pressure when pressing the top paper layer on to the tape (Figure 6).

5. Trim both edges of the prepared splice (figure 7). This prevents wrinkles caused by air blowing under the top layer during the acceleration of the new roll.

6. Remove the remaining liner. Pull 90° downwards. The roll is now ready to splice.

7. If belt acceleration, apply belt bridge tab in path of acceleration belt, make sure tape width is fully covered otherwise splice preparation will be torn off by acceleration belt *(see page 24)*.

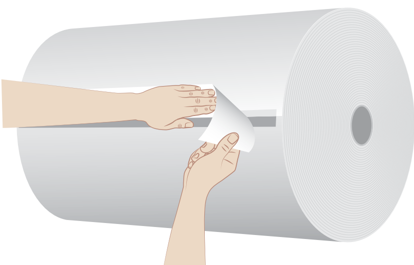
8. If splicing tape does not have integrated detection, apply detection label (black or aluminum), correctly position for optimum tail length, apply an aluminum detection label for postpress exit if required.

✅ Release splicer brake. Rotate roll to avoid dust and moisture condensation falling onto tape.

❌ Dust and condensation on the tape surface reduces its adhesive qualities. If possible, only remove the protection strip/liner from the adhesive just prior to the splice cycle.

✅ Release splicer brake. Rotate roll to avoid dust and moisture condensation falling onto tape.

Set lateral position of new roll to align it with running roll to avoid the high risk of splice failure or web break.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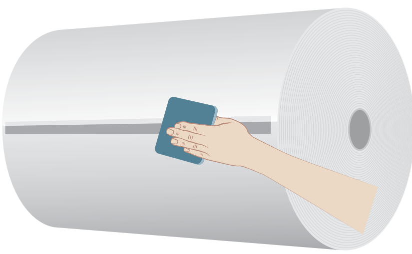
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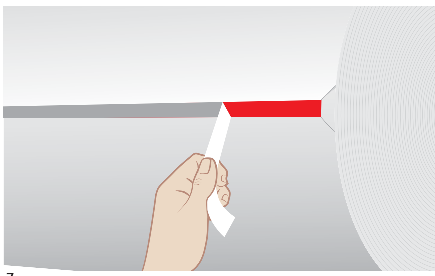
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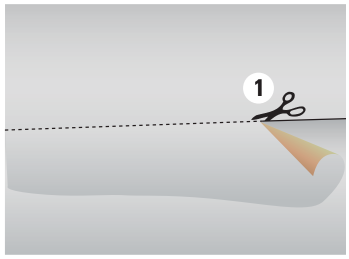
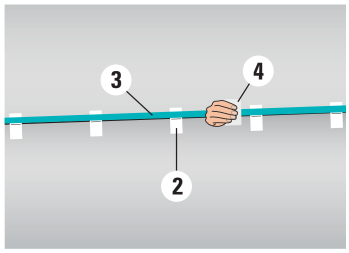
6.2 Splice Preparation — Mono-function Tape and Tabs

Apply the brake to stop the roll rotating during preparation.



1. Fold back the first paper layer (spire) and slit along the folded edge. Expel air between the outer and inner spires so that they lie smoothly.

✘ Wrinkles cause tearing and separation of the top layer from the surface during acceleration.



2. Use rupture tabs to close the roll system. The distance between tabs (100-150 mm/4-6") is related to paper weight and press speed. Outer tabs should be 25 mm (1") from the edges. Use line printed on the tab to position adhesive-free zone under the line pointing to the inner spire of the roll for easy opening at pasting.

✘ Do not apply tabs too tightly or they may break in advance of splice.

✘ Always close the top of the splice pattern to prevent creating air pockets that can cause splice failure.

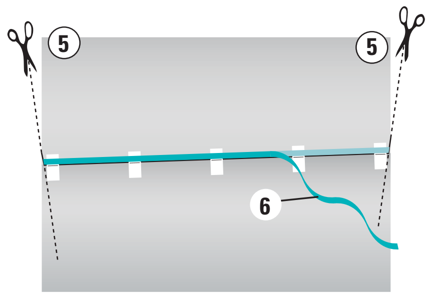
✘ Incorrect rupture tab position increases breaking strength and may result in a failure to open.

3. Apply the tape along the splice profile 2 mm (0,08") from the edges on all three sides. Do not remove protective cover of tape.

✘ Do not allow tape to overhang the roll edges.

✘ Do not stretch the tape and avoid pleats.

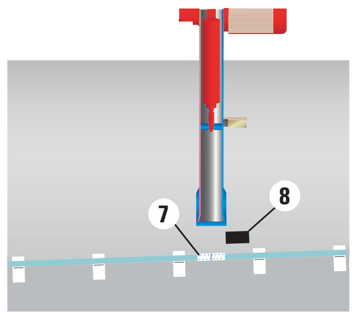
✘ Do not apply tape/tabs in the path of folder slitter wheel path (possible web break of a ribbon).



4. Use a squeegee or plastic card to apply high pressure across the total width and length of the tape after positioning to ensure optimum adhesion

5. Use scissors to cut off "ears" of leading edge next to the external tabs to improve edge profile.

6. Remove PSA tape protective strip.



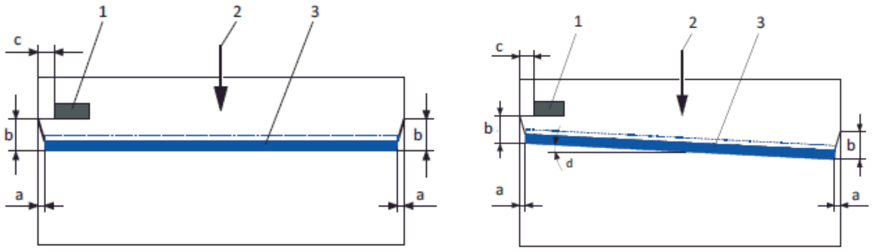
7. If belt acceleration, apply belt bridge tab in path of acceleration belt, make sure tape width is fully covered otherwise splice preparation will be torn off by acceleration belt

8. Apply detection label (black or aluminum). Correctly position for optimum tail length. Apply an aluminum detection label for postpress exit if required.

✔ Release splicer brake. Rotate roll to avoid dust and moisture condensation falling on to tape.

Set lateral position of new roll to align it with running roll to avoid the high risk of splice failure or web break.

Splice Pattern

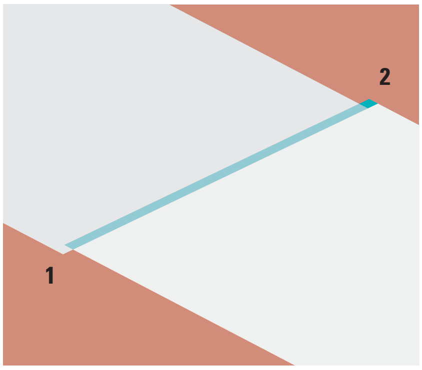


*Straight splice preparation:
1, Reflective tab;
2, Direction of rotation;
3, Splicing tape.
Dimensions:
(a) 20 mm,
(b) 100 mm,
c) 50 mm (
d) 3° maximum angle.
Source: KBA*

The standard pattern is now a straight splice that can be at 90° or at a 1:10 angle to reduce the impact of the splice thickness as it passes through the press.

The pattern depends on the roll drive (external belt or core drive) and the selection of either (a) multi-functional or (b) mono-functional tab and tape systems.

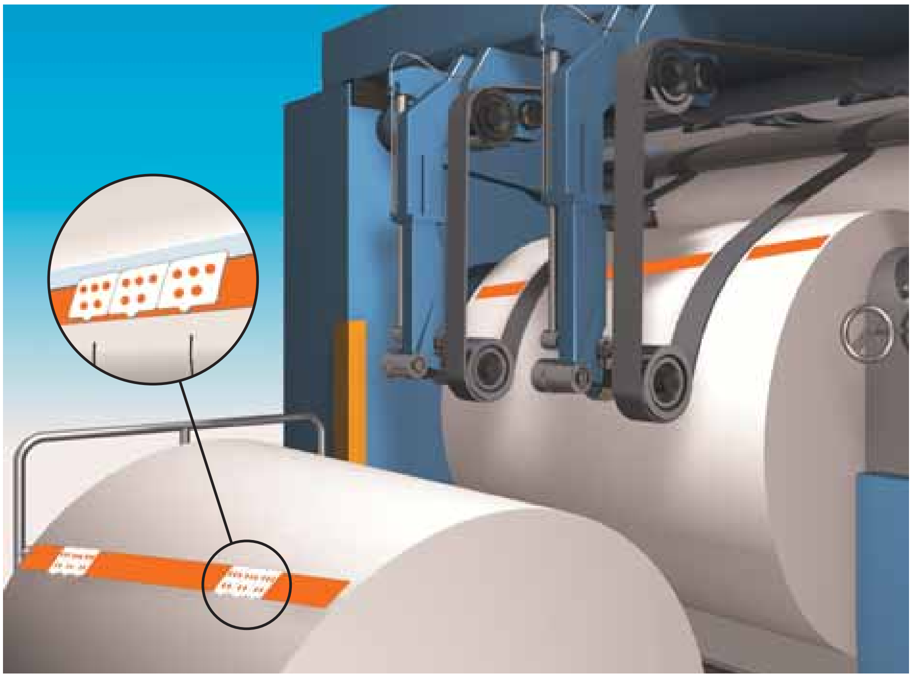
"V and W" patterns — which are occasionally used in some gravure plants for certain conditions (gloss paper in winter); and for some specific paster types. Recommendations for these patterns are not included in this manual but are available from WOCG Guide 1 on www.imcPrint.org.



❌ 1 *Overlapped paper edge sticks to ink build-up on blanket edge tearing the web.*

❌ 2 *Exposed adhesive will stick on to rollers or blanket causing a break.*
Source: WOCG/icmPrint.

Ensure belt bridge covers tape width



Apply belt bridge tab in path of acceleration belt, tab must be 5 mm wider than belt. Holes in belt bridge tab allow correct positioning onto exposed PSA tape, the width of which must be fully covered. A small 'nose' on the leading edge of this bridge tab helps position it correctly. Source: tessa®

Technique to use with discretion

Applying grease to the edges of the web alongside the splice zone should be done with care. The purpose is to avoid roll edges sticking to blanket at splice point. Consequences are accumulation of grease and paper dust on splice arm and splice roller that may reduce its surface life.

Apply belt bridge tab in path of acceleration belt, tab must be 5 mm wider than belt. Holes in belt bridge tab allow correct positioning onto exposed PSA tape, the width of which must be fully covered. Source: tessa®

Splice Tails

All zero and flying splicers normally have tails. For zero speed the position changes with every roll. The flying splicer tail is in a constant position that needs to be set to the splice pattern used.

Tail length should be short to minimise the risk of the tail being cut loose by the folder cutting cylinder (which can trigger a jam detector or cause a folder jam). Flying splicer tail length can be as short as 100 mm (4”). It is influenced by the splice pattern, position of splice detection tab and the accuracy of speed synchronisation between the new and running rolls. Some zero speed splicers can reduce the tail length to the width of the tape (this technique increases preparation time by up to one minute), or make an end-to-end butt splice, but this has more complex preparation.

Secure the Tail

Flying splicers can angle the splice across the web to reduce the impact of the splice running through the press, but this leaves part of the tail longer than the minimum cut length. Many printers reduce this risk by securing the loose tail by:

- ✅ Applying a second narrow strip of PSA (or glue) to hold down the tail, or use an aerosol glue (type 3M Post-i®) to secure the loose area.

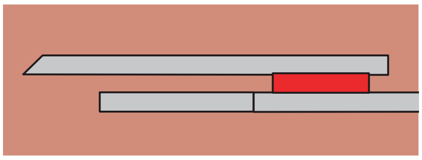
Splice Detection Tab Position = Cutting Point

When preparing rolls there are two simple things to remember for tails:

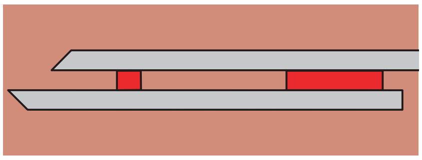
- ✅ The “relative” length of the tail (distance between tab and cut) is determined by the position of the splice detection tab. The same relative tail length is possible for all splice patterns.
- ✅ The “effective” tail length (distance between cut and end of splice pattern) is determined by the type of splice pattern used.

Splice tab position: Irrespective of what splice pattern is used, the distance between the end of the splice pattern and the cut web is always the same providing the splice detection tab is correctly positioned. The tab is always in the same relative position for all splice patterns. The effective tail length is determined by the type of splice pattern.

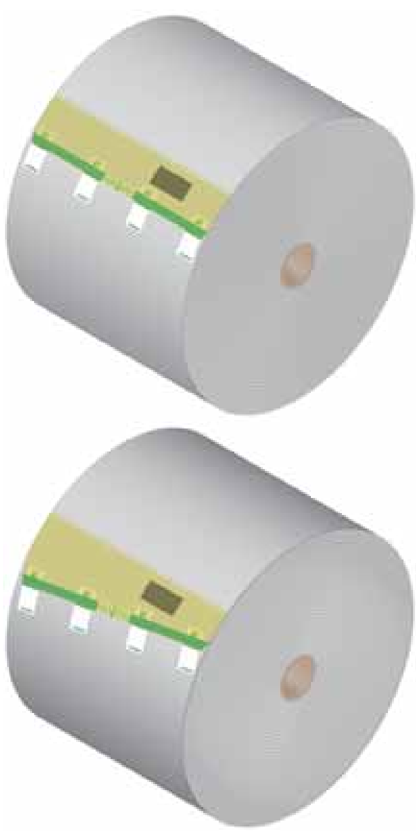
Detector position: A constant tail length error can be caused by a change in the relative position and/or angle of the splice tab detector.



Normal overlap splice with tail. WOCG/icmPrint



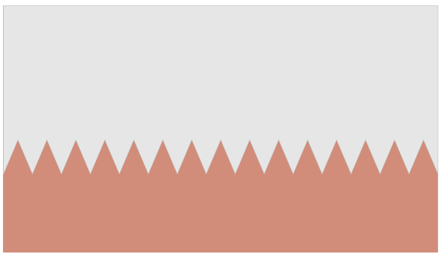
Splice tail secured with a narrow strip of PSA tape. WOCG/icmPrint



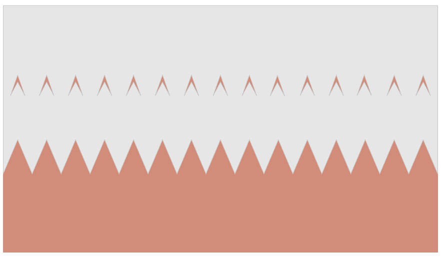
✅ *Apply glue to securely hold down the tail during its journey through the press and folder. The effective tail length is determined by the type of splice pattern. WOCG/icmPrint*

Every Tail Tells a Story

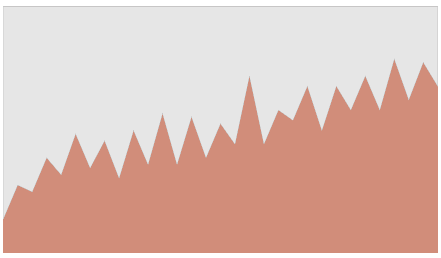
The causes of many splicing problems can be rapidly diagnosed by examining the splice tail. Many are simple and easy to fix by the splicer operator or in-plant technician with the aid of the user manual.



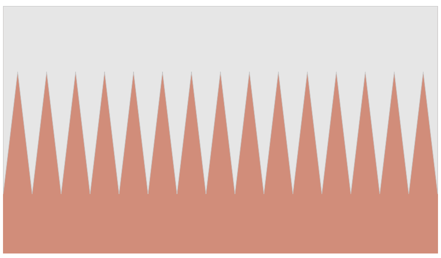
Correct knife cut and short tail length



Knife bounce or too high web tension

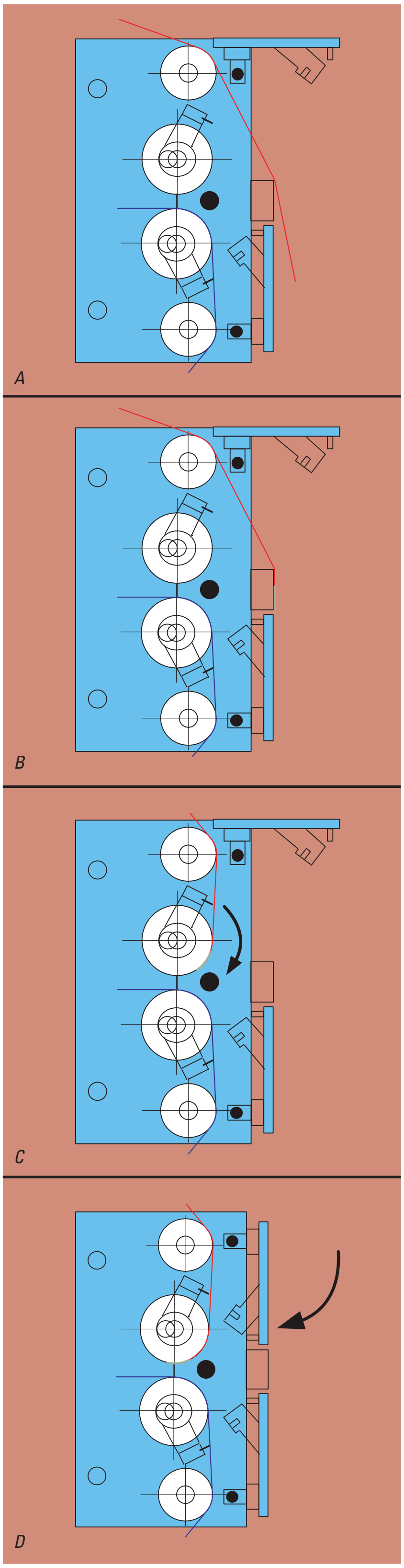


New roll too slow or knife misalignment



Incorrect speed match

Source: WOCG/icmPrint



A. Side view of preparation head
B. Trim off the excess web and apply the splicing tape
C. Transfer to nip roller
D. Close splice head and rotate nip roller in web direction until taut
Source: WOCG/icmPrint

Zero Speed — Rolling Nip Design Type

A) Open appropriate preparation bar

Pull enough paper from new roll to reach past the preparation head and apply holding brake. Place the web against the prep bar where the vacuum will hold it in place.

Align the edge of the web with the running roll. Make sure web is square and uniformly tensioned.

B) Trim off the excess web. Use a sharp knife using the prep bar edge as a guide.

Apply the splicing tape across the full width of the web — 2 mm from the paper edges on all three sides. Do not allow tape to overhang edges. Optimum adhesion requires pressure to be applied across the total width and length of the tape after positioning.

Trim off corners and leading edges to help allow for any small misalignment of webs at splicing.

C) Transfer to nip roller. Re-check alignment of web and ensure it is square and of uniform tension.

- ✘ If the paper is stiff or has a curl away from the nip roll it may be necessary to roll the material so that it conforms to the curvature of the nip roller.
- ✘ It is essential that any uncovered holes in the vacuum bar are sealed off with tape, otherwise a failed splice may occur.
- ✘ Any build-up of tape or paper on nip rolls may prevent a good seal at time of splice.

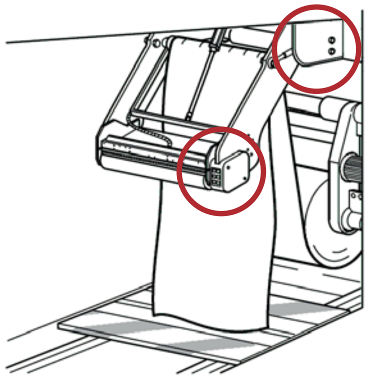
Remove the complete protection strip/liner from the adhesive. Clean off any excess adhesive from the prep bar.

D) Close the splice head. Rotate the nip roller in the direction that the web will be running until it is taut.

- €² Splice failure, web break, paper waste, press downtime, folder jam.
- €² Splice failure (poor adhesion)

Trouble shooting zero speed dancer operation	Fail	Break
Web break during Deceleration		✔
Dancer cylinder ports closed		✔
Chain sprockets worn		✔
Dancer brake malfunction		✔
Web break during Splice: Insufficient air pressure		✔
Web break during Acceleration:		✔
Dancer rollers out of alignment		✔
Dancer bottoms out:		✔
Inadequate air pressure on dancer		✔
Inadequate acceleration signal (air flow volume or electric)		✔
Leaking dancer cylinders		✔
Dancer not at maximum position before splice, runs-out of paper	✔	✔
Dirty or glazed acceleration roller		✔
Loose, dirty or worn acceleration belt		✔
Dancer does not fill prior to splice		✔
Dancer tension too low		✔
Brakes set too tight		✔
Air leaking from brake interferes with running roll solenoid		✔
If dancer fills out before or after splice		✔
Speed signal incorrect		✔
Incorrect brake transducer adjustment		✔
Incorrect or faulty dancer POT/encoder setting		✔

Zero Speed — Vacuum Bar Design With Split Splicer Head



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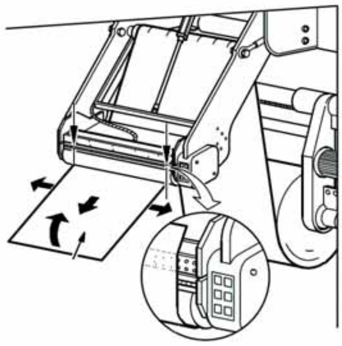

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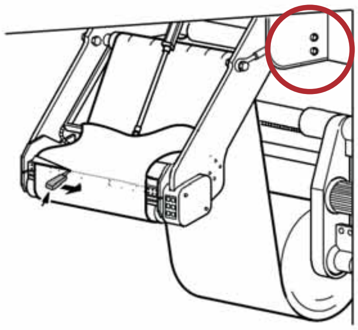
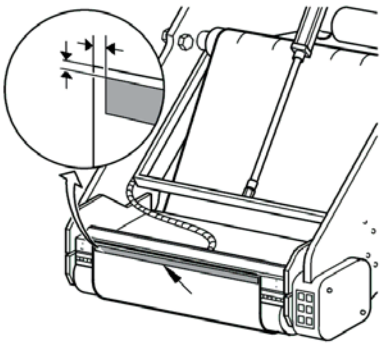


C



D

A. Guide the web around the upper guide roller and unwind the paper until it touches the floor.

Push and hold the "Open splice head half" button until the splice head half near the roll (for which the splice has been prepared) is fully open.

Push the "Handbrake" button to brake the roll and extend the chucks to clamp the roll.

B. Push the "Vacuum" button to activate the vacuum pump.

Pull the web taut without creases.

Read out the web position from the ruler and compare it to the web position of the running roll.

Correct the lateral position of the running roll.

Push the web against the vacuum bar. The vacuum holds the web in the correct web position.

C. Place the tip of the knife in the slot over the vacuum strip and cut off the web in a straight line.

Apply tape to the web along the full web width.

D. Pull the backing film off the tape.

Push and hold the "Close splice head half" button until the splice head half has fully closed.

Troubleshooting & Maintenance

It is essential that the manufacturer's preventative maintenance procedures are completely followed to ensure optimum performance, safety and reliability, and to enhance equipment life. Substitution of recommended consumable parts (drive belts, brake pads, foam rollers) should be done with caution to ensure these alternatives have the same specifications and performance.

Core Troubleshooting

When in doubt contact core supplier to access correct parameters. Usually, the printer does not know the core supplier and therefore should contact their paper supplier.

Poor torque transmission:

Core chew-out at winder or printing press

1. Clean chucks.
2. Check if chucks are worn (including internal parts).
3. Check tolerance between core inside diameter and cylindrical part of chucks.

Compressed oval core and roll:

Check roll truck clamp pressure and handling. *See Modules 4 and 5.*

Roll bounces heavily in unwinding:

Possibly some smoke and burnt smell.

1. Check if roll is out-of-round before looking for a core issue.
2. Check the chuck length and chuck expansion is working correctly.
3. Compare specified roll weight — is dynamic strength too low?

Residual roll vibrates during unwinding near the splice:

Core and paper has too low critical speed in printing press.

1. Check the press supplier requirement for E-modulus of the core and core density relation.
2. Decrease printing speed.
3. Splice at a larger running roll diameter.
4. Change core diameter from 76mm to 150mm.
5. Contact core supplier to identify right core type and asses paper roll residual runability characteristics.

Paper web flutters at the edges near the splicing diameter:

Core has probably deformed due to radial pressure.

1. Use stronger core grade.
2. Use higher wall thickness.
3. Contact core supplier for other options and solutions.

Loose cores:

The whole core slides out from the roll at the printing press and it seems there is no paper pressure left between the core and paper.

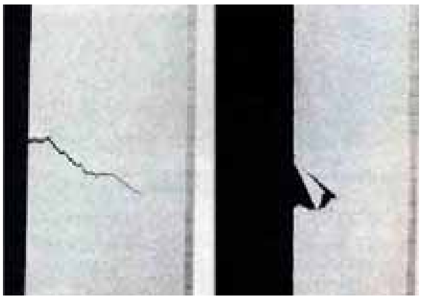
1. Check the length of core and compare to roll width — has it shrunk?
2. Check the delivered paper moisture.
3. Check the delivered core moisture.
4. Check the core package (wrapped or not).
5. Check the humidity at core warehouse and the way from warehouse to winder.
6. If necessary change the core moisture specification, core packaging and handling during operation.

Paster/Splicer Diagnostics						
Splice preparation	**Burst**	**Fail**	**Mis**	**Break**	**Flying**	**Zero**
1. Failed roll fault inspection prior to loading		✔	✔	✔	●	●
2. Rolls unwrapped too early	✔	✔	✔		●	●
3. Excessive vibrations		✔	✔	✔	●	●
4. Wrong roll unwind direction (flying paster)		✔			●	
5. Incorrect splice pattern type		✔	✔		●	
6. Splice pattern bursts open before splice					●	
Air pockets	✔				●	
Dynamic roll expansion (see also 2)	✔				●	
Rupture tabs applied too tightly	✔				●	
Open tape in acceleration belt path	✔				●	
Too fast acceleration tears paper			✔			●
Splice shields not fully closed or no vacuum		✔				●
7. Failed splice					●	
Inadequate splice tape pressure (see also 21)		✔			●	
Uneven tape profile from overlaps		✔			●	
Tape protective strip not removed/No tape applied		✔			●	●
Dust, moisture, solvent on open splice tape		✔			●	●
Glue unsuitable (tack, temperature, humidity)		✔			●	●
Cold roll (temperature near core below 10°C)		✔			●	●
Rupture tabs incorrect or turned over covering detection tab		✔	✔		●	
No splice detection tab, sensor dirty		✔	✔		●	
8. Tape or glue overlaps edge of roll			✔		●	●
9. Tabs come loose & stick to expiring web or blanket			✔	✔	●	
10. Splice detection tab in wrong position		✔	✔		●	
11. Tab in path of folder slitter			✔		●	
12. Too long paster tail causes folder jam (see also 10, 22, 23)			✔		●	
13. New roll not aligned to expiring roll or variable roll widths			✔		●	●
14. Cocking roller setting incorrect			✔	✔	●	●
15. Zero speed splicer incorrect alignment to nipping roller		✔	✔			●
Setting and maintenance						
16. Debris build up on roller edges				✔	●	●
17. Sensor defective or dirty		✔	✔		●	●
18. Roll not up to speed		✔	✔		●	
19. Roll will not go to splice position (paster status problem)		✔			●	
20. Tension/drive belts: Incorrect tension, burred, worn	✔	✔	✔	✔	●	●
21. Pasting brush/roller dirty, worn, incorrect pressure (see also 7)		✔	✔		●	
22. Knife cut too early (see also 10)		✔	✔		●	
23. Knife cut too late (see also 10)		✔	✔		●	
24. Knife failed (see also 10, 17)		✔			●	
25. Improper adjustment or malfunction of paster carriage		✔	✔		●	
26. Roll runs off core		✔			●	●
27. Incorrect brake load/tension setting			✔	✔	●	●
28. No low tension make ready setting (start-up break)				✔	●	●
29. Press stops in splice cycle (no web break but no splice)		✔			●	●
30. Press speed change during paste cycle		✔	✔	✔	●	
31. Oscilation of compensating roller (pumping)			✔	✔	●	●
32. Erratic tension near end of roll			✔	✔	●	●
33. Excessive tension during splice			✔	✔	●	●
34. Brakes fail to transfer correctly		✔	✔	✔	●	●
35. Air supply failure cause loss of tension				✔	●	●
36. Drops of oil, water, ink falling on to web				✔	●	●
37. Overpacked blanket explodes splice in printing unit			✔		●	●
38. Zero speed splicer head rollers out of alignment						●
39. Faulty zero speed dancer operation (see page 26)				✔		●

Paper Roll Repairs

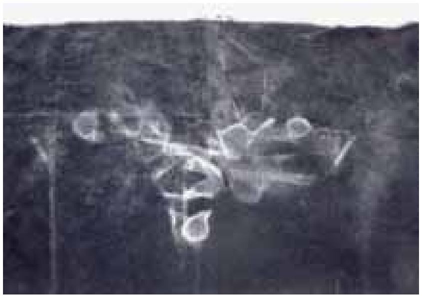
The recommendations on these pages are from 'Paper First Aid' published by the ERA

Loose and bad winding: *Adjust web tension (tight, less tight). Stick tape around a roller in the paper path at the web edges to increase diameter to centre the web. Separate rolls from the same winding position. Change to another roll winding position or different roll batch.*



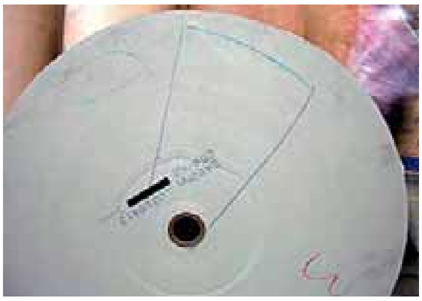
Edge damage: *Slab down the part, maximum 3 cm (1,3") of roll diameter. Control roll end surface to edge cuts.*

Layers glued together: *Glue spray inbetween layers and roll end causes breaks. Remove hard hotmelt spots with knife or grind them with sand paper. Slab off large areas.*



Bad cutting: *Wipe dust down with smooth tissue or velvet. Clean roll end with slightly oiled cotton cleaning cloth. Do not use water or water spray because paper becomes wavy and changes dimension, and its layers may become glued together after drying.*

✘ *The Splice Thorn device — a pin inserted into the damaged core and spread hydraulically to restore the circular shape of the core to restore crushed cores to their original shape — is now rarely used as it does not conform to high quality production.*



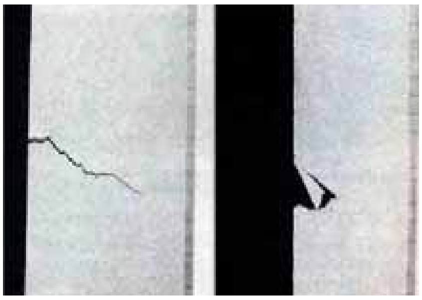
Out-of-round: *Some of these rolls may be unwound but production speed may be affected. However, the high vibrations from running out-of-round rolls may make splicing very difficult or even impossible. Change to a roll from a different batch.*

Glued roll ends: *Sand down the affected area using fine grain emery paper. Slab-off if the area is large. Cut off a piece for the defect documentation and note roll number.*

Burst, flagging: *Nail the area between the first paper layer and core, twice each end. Nails should be placed opposite each other. Rolls with burst that have broken twice should be rejected from press. Increase roll change diameter. Save a remaining core with flagging for paper mill.*

Wrinkles, pleats, calender cuts: *Slab down a part of the diameter. After second break, reject the roll from press and change to a roll from a different batch or winding position.*

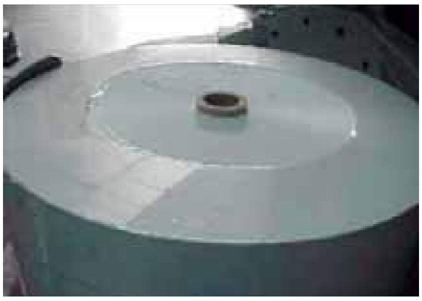
Stickies: *Slab down a part of the diameter. After second break, reject the roll from press and change to a different production batch or winding position. Collect an unprinted piece of paper with defect.*



Edge cuts: *Use emery paper with a fine grain and sand the visible area smooth. Slab down a part of the diameter.*

Core faults: *Remove dust from inside cores before putting roll in press. Cut off paper from wall inside core if the chuck does not penetrate. Reject roll from press if core is out-of-round or damaged!*
Don't use damaged cores!

Side damage: *If side damage is deep use a milling head, if flat use emery paper. Slab-off if damage is less than 7 cm (3") inside roll diameter; if higher, change roll. If rejected to stock then replace the correct roll end shield.*



Slipping core/protruded layers: *Nail the core twice each end (see recommendations for burst/flagging). If roll end gets burned reject it from the press. Use a different winding or winder position.*

Wet roll end: *If roll end shows layer gaps and feels dry, then wet the side slightly with a water sprayer. If wet area is maximum 3 cm (1,3") thick, cut off the part. After a second break, reject the roll from press.*

Poor mill splice: *Use abrasive paper to remove overlapping. If layer is too thick, slab down the layers to position of mill splice, maximum 3 cm (1,3") of diameter — reject roll if protruding layers are deeper.*

Belly damage: *Slab down affected layers. Before use, check core roundness and inner core wall due to broken areas. Check shape if out-of-round or core is damaged reject the roll.*

Sheets & palletised paper

Sheetfed Press Feeder

The feeder and lay system takes sheets of paper or board from a pile to deliver individual sheets in exactly the same position to the press grippers.

A suction head feeds separated sheets from the top of the pile on to the feedboard. A classic feed suction head uses low-pressure air generated by a vacuum pump and it is adjustable for speed, sheet size and weight. Newer suction head nozzle technology generates vacuum and compressed air directly inside the suction head during each process step for smoother sheet control at all speeds (this system eliminates rotary air valve, hoses and air control, is 50% more energy efficient, and has less wear).

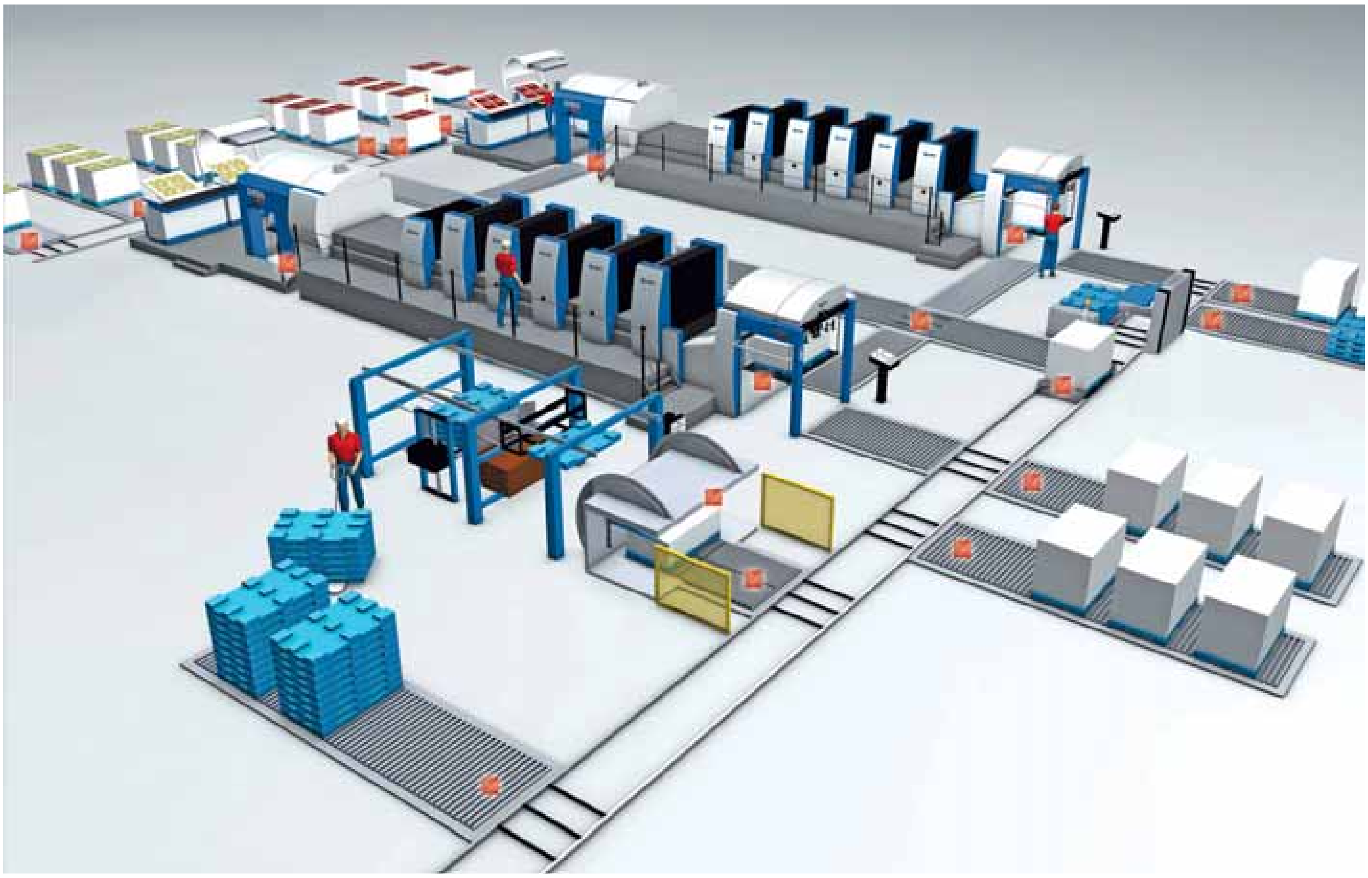
The sheets are then moved down the feedboard by suction belts into the front and side lays to position the sheet accurately before it is taken into the press by the gripper system.

Stream feeders work at a speed slower than that of the press, and the edge of a sheet of paper overlaps the front edge of the successive sheet. This system provides good control of sheet position, to prevent mis-register and paper jams. A double-sheet detector avoids multiple sheets being fed simultaneously.

To ensure continuous press operation on high speed presses and/or those printing on thick substrates, a high pile delivery is available with the option of continuous non-stop pile feeding and automated pile handling.

✅ Optimise paper feeding by keeping paper and board in its protective wrapper until it is required to be used. Condition paper to pressroom climate conditions if these are significantly different to external environment.

Pallet handling with integrated workflow



Defining an optimum logistics solution requires an analysis of the complete workflow from truck unloading to production storage systems, through to shipment of finished products. This might include automated pallet handling and interfaces to ERP and MIS control systems. Source KBA

Source: KBA.

Roll-To-Sheet Feeder

This system allows paper rolls to be run on sheetfed presses with improved process performance because there is no sheet separation step. This reduces the number of stops and sheets transported at an angle; it also prevents double sheet feeding as each is cut in-line, transported individually and delivered directly to the feed roller of the press (the suction head is not used during roll-fed operation). This provides uninterrupted printing and higher process speeds, particularly of lightweight papers down to 35 gsm, and processing of materials that are available only on rolls, like plastic film for labels. No pile changing is required. The roll holds up to five times the number of sheets than a comparable pile.

Roll-to-sheet feeding is particularly appropriate for any press using relatively large quantities of a restricted range of paper weights and grades. This makes them suitable for most perfecting publication printing, particularly on double-decker perfecting presses because the second gripper edge is not required, reducing paper use by 2%. Other paper savings are derived from substrate rolls being generally 5 - 25% cheaper than sheets, only using the exact cut-off length needed, and using very light papers efficiently.

Roll-to-sheet feeding reduces the effects of electrostatic charges. The system runs plastics efficiently and an optional Corona treatment ensures ink receptivity on plastics.

- ✅ Use best practice techniques for roll handling described earlier in this Module and also in Modules 4 and 5.
- ✅ Roll on pallets — see page M7-

Two KBA sheetfed presses equipped with roll-to-sheet feeders. The MABEG device is retrofitable to all brands of presses and available for sheet sizes widths up to 1420 mm. Source: MABEG.

Printers who do not have roll handling clamp trucks require their rolls to be supplied on pallets that can be handled manually and with conventional forklift equipment.

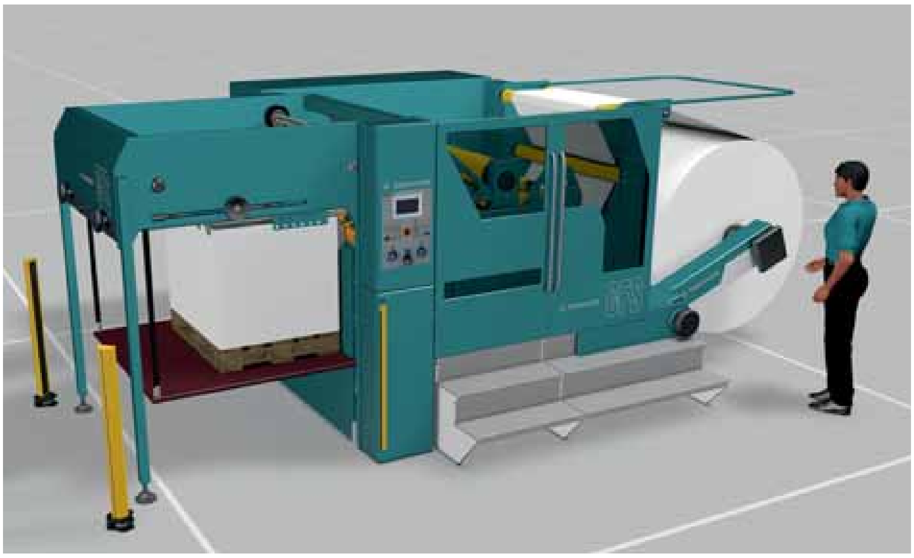
✅ Use forklifts with angled clamps to better handle standing rolls that otherwise may risk being deformed on the bottom that can lead to unwinding problems.

Roll loaded on to an electric truck equipped with angled forks. Source: Mabeg.

Source: Mabeg.

1. The paper web coming from an unwinder runs through an infeed into the cutting unit
2. A shearing system ensures a clean cut and precise angles. The web tension is controlled automatically.
3. A decurler can be activated to achieve sheet flatness if necessary.
4. Running out of the crosscutter the sheets are overlapped in the stream feeding device and the shingled sheets conveyed on the transport table of the press's sheet feeder. The sheeter can be moved aside when conventional pile feeding is required.

Crosscutter Roll Sheeting Systems



Source: Beiliomatic.

Roll-to-sheet systems are also for used in different converting applications to convert rolls of paper, carton and foil into sheets that are delivered into a stacker to create a sheet pile. Some systems allow preprinted rolls to be processed in register and without leaving marks. Crosscutters are used by paper wholesalers, packaging suppliers and printers.

✅ Use best practice techniques for roll handling described earlier in this Module and also in Modules 4 and 5.

SHEET PAPER PROBLEMS ON PRESS RELATED TO STORAGE AND HANDLING		
Problem	**Causes**	**Solutions**
Feeder Misses or Doubles	Misses — Paper pile too high	Lower feeder pile
	Doubles — Paper pile too low	Raise feeder pile
	Too much separation air blast	Adjust air blast nozzle to correct height
		and reduce air pressure
	Suckers malfunction	Clean if dirty
		Replace if worn
		Check and adjust suckers if needed*
		Check vacuum timing*
	Sheets are stuck together	Air the paper, flip through to unstick
	Sheets not separating — burred edges	Poor guillotine blade
	Poor sheet separation and feeding	Paper curl, wavy edges, out of square
	Static in paper	Insert ionizing air cartridges in air blast lines
		Maintain RH above 35%, ideally 50%+/-5
Uneven Forwarding	Too much or too little air under top sheet	Use just enough air to float top few sheets
		Or repile and roll the lifts to free sheets
	Dirty rotary valve	Clean any clogged powder, oil and debris
	Air blast nozzles incorrectly aligned	Align nozzles correctly
Stains on Sheets	Compressor overheated or over oiled	Needs preventive maintenance*
Conveyor Cocking/Jamming	Single sheet feeder forwarding wheels	Adjust wheel timing
	Forwarding wheels in poor condition	Put new rubber on wheels and re-set*
	Transfer tapes in poor condition	Replace tapes
	Rust or moisture on feedboard	Clean
	Curling of front edges and sheets fails to	Repile, rolling sheets downwards
	enter side guide	to uncurl
	Static build-up in paper or feed tapes	Install static elimination, or RH too low
Front Register Variation	Not enough clearance under hold-down	Adjust clearance*
	springs or fingers	
	Too much clearance under hold-down	Adjust to stop sheet bounce/buckle
	Tail end wheels too far back or forward	Reset. Use only steel or soft brush wheels
	Sheet gripper edge or tail not straight	Replace or retrim the paper
	or sheets vary in length from to back	
	Sheets slip in impression cylinder grippers	Clean and re-set gripper uniform tension*
		Replace worn gripper pads
	Poor synchronisation with grippers	Check for worn parts
	Incorrect timing of overfeed roll	Adjust timing or front stops*
Push Side Guide Variation	Uneven paper trim or out of square	Re-trim paper
	Pusher plate not parallel to edge of sheet	Adjust pusher plate *
	Incorrect clearance buckle plate to sheet	Re-set*
	Side guide touches sheet before it stops	Check and adjust timing of side guide and
	against front guides	slow down
Pull Side Guide Variation	Incorrect guide setting	Re-set*
	Incorrect spring setting of upper to lower	Adjust setting to the paper being printed
	guide rollers	
	Too little sheet clearance at front guides	Adjust clearance of hold-down springs
		Check sheet timing to front stops
Nicked or Torn Gripper	Too much gripper bite	Re-set front guides to reduce bite
Edges	Front guides do not clear sheet edge	Check and adjust front guide timing
	Incorrect sheet transfer synchronisation	Clean, service and re-set gripper systems
Sheets Pull Out of Gripper	Tension of grippers too weak or uneven	Check grippers for uniform timing
and Stick to Blanket	Excessively high ink tack	Reduce ink tack
	Poor release of blanket	Use a quick release blanket
Wrinkles or Creases	Grippers not closing simultaneously	See manufacturers service instructions*
	Out of line front guides	Re-align guides
	Too tight wheel tension on register table	Adjust wheel to minimum tension
	Paper slips out of some (not all) grippers	Clean and service gripper pads
	Wavy edge paper from unwrapping cold	Do not unwrap until at room remperature.
	paper, or if press room RH too high	Consider dehumidifier or air conditioning
	Tight edged paper	Occurs if paper left unwrapped in dry area
		Humidify press room
Poor Fit at Tail Edge	Side edges of sheets pick up moisture	Place moisture vapour-proof cover over
	between printings & become longer	pile after first printing
Poor Multi Colour Fit	Wavy or tight edged paper	Use flat paper to prevent distortion

**Follow manufacturer's instructions*

Air humidification systems improve productivity when humidity is too low. Source PDI.

Climate and Sheet Paper/Edge Problems

Dimension variations: Paper fibres will either absorb or exude moisture depending on RH, causing them to swell or to shrink, particularly in the cross direction of the paper rather than in the machine direction. A 10% change in RH causes paper to "grow" 0.1% to 0.2% across the width, which will cause printing mis-register.

Humidity and curling: Curling is closely connected to fluctuations in humidity that cause the paper fibres to expand and shrink in the cross direction. If paper is moistened on one side, the fibres expand in one direction, causing the paper to curl toward the dry side. As soon as a balance in humidity within the paper structure has been restored, the effect is cancelled out.

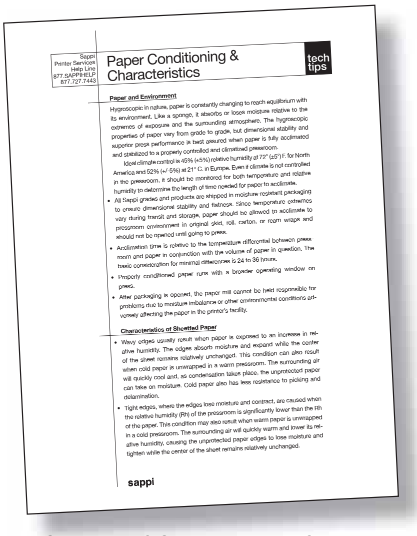
Stack humidity and temperature on ink drying: A high humidity balance of the paper stack can significantly extend ink drying times. The effect is pronounced above 60% RH, leading to drying times up to three times as long as normal. Extended drying times can also occur when the stack of printed paper is too cold. *See also Modules 1, 3 and 7.*

Edge Problems

Wavy edges: Usually caused when paper is exposed to an increase in relative humidity and the edges absorb moisture and expand while the centre of the sheet remains relatively unchanged. Causes include excessively dry paper; extremely high air humidity in the pressroom; damp-proof wrapping not used during transport or storage in humid conditions; cold paper unwrapped in a warm pressroom (cold paper also has less resistance to picking and delamination).

Tight edges: Occurs when sheets of normally humid paper are subjected to exceedingly dry air humidity. In this case, moisture is absorbed from the edges of the sheets, which, as a result, shrink in relation to the centre. This mainly occurs during winter if the RH of air in heated, non-conditioned or non-humidified working spaces drops significantly. When warm paper is unwrapped in a cold pressroom the immediate surrounding air warms quickly and lowers its RH, causing the unprotected paper edges to lose moisture and tighten while the centre of the sheet remains relatively unchanged.

For either problem, it can be helpful to cut out the blanket packing on the outer non-image edges to allow the sheet some relief during impression squeeze.



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Help Line
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877.727.7443

Paper Conditioning & Characteristics

tech tips

Paper and Environment

Hygroscopic in nature, paper is constantly changing to reach equilibrium with its environment. Like a sponge, it absorbs or loses moisture relative to the extremes of exposure and the surrounding atmosphere. The hygroscopic properties of paper vary from grade to grade, but dimensional stability and superior press performance is best assured when paper is fully acclimated and stabilized to a properly controlled and climatized pressroom.

Ideal climate control is 45% (±5%) relative humidity at 72° (±5°) F. for North America and 52% (+/-5%) at 21° C. in Europe. Even if climate is not controlled in the pressroom, it should be monitored for both temperature and relative humidity to determine the length of time needed for paper to acclimate.

- All Sappi grades and products are shipped in moisture-resistant packaging to ensure dimensional stability and flatness. Since temperature extremes vary during transit and storage, paper should be allowed to acclimate to pressroom environment in original skid, roll, carton, or ream wraps and should not be opened until going to press.
- Acclimation time is relative to the temperature differential between pressroom and paper in conjunction with the volume of paper in question. The basic consideration for minimal differences is 24 to 36 hours.
- Properly conditioned paper runs with a broader operating window on press.
- After packaging is opened, the paper mill cannot be held responsible for problems due to moisture imbalance or other environmental conditions adversely affecting the paper in the printer's facility.

Characteristics of Sheetfed Paper

- Wavy edges usually result when paper is exposed to an increase in relative humidity. The edges absorb moisture and expand while the center of the sheet remains relatively unchanged. This condition can also result when cold paper is unwrapped in a warm pressroom. The surrounding air will quickly cool and, as condensation takes place, the unprotected paper can take on moisture. Cold paper also has less resistance to picking and delamination.
- Tight edges, where the edges lose moisture and contract, are caused when the relative humidity (Rh) of the pressroom is significantly lower than the Rh of the paper. This condition may also result when warm paper is unwrapped in a cold pressroom. The surrounding air will quickly warm and lower its relative humidity, causing the unprotected paper edges to lose moisture and tighten while the center of the sheet remains relatively unchanged.

sappi

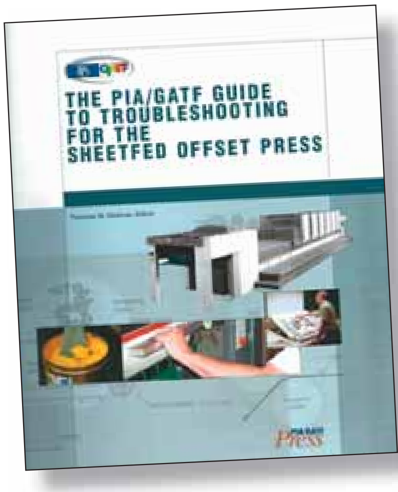
'Paper Conditioning & Characteristics' — Sappi Technical Tip Sheet.
Source: www.ideaexchange.sappi.com

✅ *Optimise press performance by conditioning paper and board to pressroom conditions and keeping it wrapped until it is required to be used.*

☑ Minimise Climate and Paper Problems

Air moisturising systems are commonly used in paper processing environments and are particularly helpful when air humidity is very low during winter. To avoid wavy edged paper when pressroom relative humidity is too high, turn pressroom heat up to a maximum of 29°C (85°F). The RH will decrease as the temperature rises.

- Avoid storing paper in areas that are subject to extreme temperature changes such as heated objects, vents or cold walls. Paper should never be stored in direct contact with concrete, where it may be exposed to moisture or dampness.
- Avoid cutting paper sooner than necessary before printing and protect paper with moisture-proof wrapping immediately after cutting.
- Paper is not an efficient heat conductor. Therefore, allow sufficient time to let the paper adapt itself to the temperature in the workshop. Properly conditioned paper runs with a broader operating window on press. See paper condition times Module 3.
- Do not open the paper wrapping until printing is about to begin. The wrapping protects the paper from fluctuations in temperature and humidity. Avoid damaging the paper wrapping and carefully re-wrap remaining pallets.
- IR and UV Mercury dryers can drastically reduce paper RH and should be used cautiously.
- During drying, the paper should not be exposed to extremely low temperatures as this would significantly extend drying times.
- For wavy edged sheets, try conditioning the paper through the press on impression (without moisture) and pre-warm with the IR dryer or strip heaters above the feedboard.



'Guide to Troubleshooting of Sheetfed Press'
Printing Industries of America.

Static Electricity in Paper

Static charges commonly occur when very dry paper is processed in low air humidity conditions. The critical lower limit is 30-40% RH for both the paper and the pressroom.

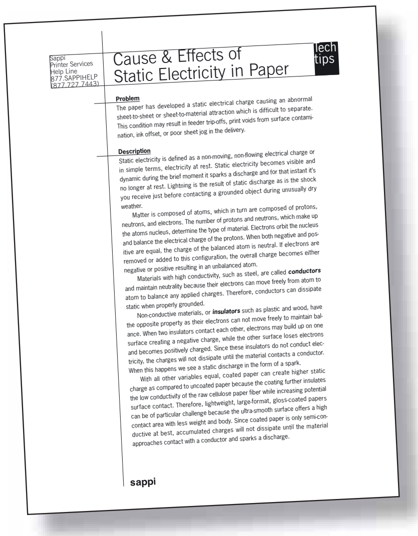
Paper is a non-conductive material that can accumulate static electricity, leading to feeding problems when individual sheets resist separation at the feeder head causing double sheeting and interfering with forwarding and timing into the head stops. A static charge also attracts airborne contaminants onto the paper leading to hickeys or print voids. Paper coating is an insulator that increases the risk of static compared to uncoated paper. Gloss coated papers with large sheet size have the greatest risk because their smooth surface offers a large contact area with low weight. Causes of static:

1. Low air humidity aggravates static charge, particularly below 35% RH. Cold winter temperatures and high altitudes tend to lead to dryer conditions and static build-up.
2. Low paper moisture — cold paper is less conductive and more prone to static build-up than warmer paper acclimatised to recommended pressroom temperature.
3. Incorrectly earthed equipment increases static charges. The potential for static build-up also increases with the contact area and pressure between paper and other surfaces, and with heat.

Static electricity in paper can be managed through a combination of:

- Effective earthing of machinery, ionization, and minimised heat for drying.
- Checking that air blower filters and heads are clean with adequate air pressure and distribution to ensure optimum sheet separation.
- Anti-static or silicone sprays increase conductivity and minimise excessive friction contact with paper transport components (feedboard, transport tapes, wheels).
- Adequate pressroom moisture level increases conductivity, helping dissipate static charge. Recommended humidification (source Sappi) is 45% (± 5%) RH at 22°C (72°F) (± 4%) for North America and 52% (± 5%) RH at 21°C (70°F) for Europe. Moisturising systems help create optimal conditions in storage and pressrooms.
- Do not unwrap paper until printing is about to start. Avoid storing paper close to hot or cold heat sources.

To check static, take about 30 sheets from the top of the pile and then slowly slide the next sheet across the surface without lifting it. If significant resistance is felt, then a static charge is present causing a material attraction.


Sappi
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Cause & Effects of
Static Electricity in Paper

Tech tips

Problem
The paper has developed a static electrical charge causing an abnormal sheet-to-sheet or sheet-to-material attraction which is difficult to separate. This condition may result in feeder trip-offs, print voids from surface contamination, ink offset, or poor sheet jog in the delivery.

Description
Static electricity is defined as a non-moving, non-flowing electrical charge or in simple terms, electricity at rest. Static electricity becomes visible and dynamic during the brief moment it sparks a discharge and for that instant it's no longer at rest. Lightning is the result of static discharge as is the shock you receive just before contacting a grounded object during unusually dry weather.

Matter is composed of atoms, which in turn are composed of protons, neutrons, and electrons. The number of protons and neutrons, which make up the atoms nucleus, determine the type of material. Electrons orbit the nucleus and balance the electrical charge of the protons. When both negative and positive are equal, the charge of the balanced atom is neutral. If electrons are removed or added to this configuration, the overall charge becomes either negative or positive resulting in an unbalanced atom.

Materials with high conductivity, such as steel, are called ***conductors*** and maintain neutrality because their electrons can move freely from atom to atom to balance any applied charges. Therefore, conductors can dissipate static when properly grounded.

Non-conductive materials, or ***insulators*** such as plastic and wood, have the opposite property as their electrons can not move freely to maintain balance. When two insulators contact each other, electrons may build up on one surface creating a negative charge, while the other surface loses electrons and becomes positively charged. Since these insulators do not conduct electricity, the charges will not dissipate until the material contacts a conductor. When this happens we see a static discharge in the form of a spark.

With all other variables equal, coated paper can create higher static charge as compared to uncoated paper because the coating further insulates the low conductivity of the raw cellulose paper fiber while increasing potential surface contact. Therefore, lightweight, large-format, gloss-coated papers can be of particular challenge because the ultra-smooth surface offers a high contact area with less weight and body. Since coated paper is only semi-conductive at best, accumulated charges will not dissipate until the material approaches contact with a conductor and sparks a discharge.

sappi

'Cause & Effects of Static Electricity in Paper' — Sappi Technical Tip Sheet
Source: www.ideaexchange.sappi.com

Separate And Recycle Waste

Around 40% of paper is made from collected waste paper and board that is turned into recycled pulp. Waste paper is the "urban forest" and a key resource of the sustainable economy.

By collecting, separating and selling their waste, some printers cover the cost of their monthly ink bills.

To manage this resource effectively:

- Separate waste to measure its volume, maximise its recycled value, minimise both actual waste volume and the cost of any residual disposal by incineration or landfill.
- Dispose of contaminated packaging materials by following the rules for the product that polluted it.
- Discuss with recycling companies, government agencies or others to identify the best recycling options.
- Regularly share recycling results with staff.

Collected waste paper for recycled pulp production. Source: UPM.

Separate Waste Paper and Board

There are many different grades and prices for recycled papers. Separate them by grade and into printed and unprinted types. To achieve the best value for the recovered paper in the recycling chain, papers should be sorted into the highest grades possible. Sorting requires good internal co-operation, and success factors include the effective separation of incompatible materials and contamination control.

- White waste (no ink, coating or, glue), from roll stripping at splice preparation, at web-up, and core waste, has a significantly higher value than printed waste.
- Separate printed waste and bale it by grade to maximise its value. Keep separate coated and varnished waste and jobs with very high background tint ink coverage (e.g. directories).
- Brown roll and sheet wrapping can be reused to separate layers of printed product; end caps can be reused to cap pallets of outgoing deliveries; any excess can be shredded and sent to a paper mill for recycling.
- Cores can be shredded and either recycled or incinerated for energy.
- Office paper has a comparatively high value for recycling into other products — treat used office paper as a separate recycling grade.
- Paper cartons from suppliers can be reused for packaging printed material or recycled in a similar manner to paper recycling — keep a separate grade.
- Damaged rolls of paper (not returned to the paper mills) can be fixed into smaller usable rolls or converted into wrapping paper.

Paper and board for recycling are classified by EN 643:2013 into 95 grades in five groups: ordinary, medium, high, craft, and special grades. There are specific requirements for deinking grades, and the list includes grades in which non-deinkable papers count as unwanted material.

Wooden Pallets

Reuse or return to the supplier wherever possible unless sold for reuse.

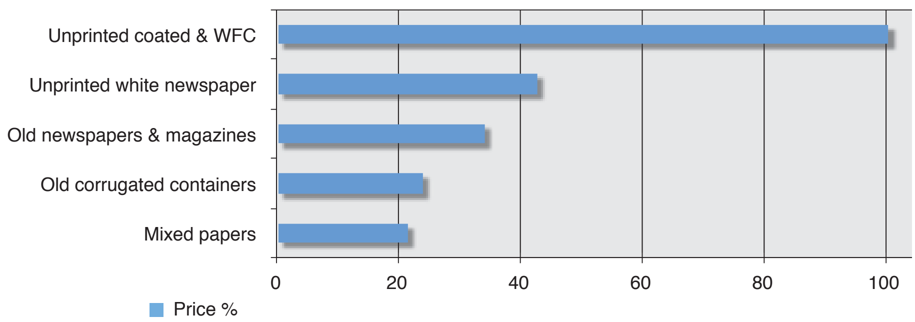
Damaged wooden pallets can be sent to pallet recyclers who either repair them or use the components to assemble new pallets and shred any remaining waste for landscape mulch, boiler fuel, etc.

Remaining scrap should be disposed of by a wood recycler.

Plastic Waste

Availability and conditions for plastic recycling are highly variable and should be assessed locally. Separate plastics into different classes for a higher value recycling.

- PETE strapping— bale used strapping (in the same way as recovered paper) or granulate it (cut into small pieces) for sale to either the manufacturer or a certified recycler.
- ABS and PS plastic spools (primarily from postpress stitching operations)— sort spools by grade and sell them to a scrap plastic recycler.
- LDPE plastic stretch film— stretch film can be collected and baled in-house and sent to a recycler or broker.
- Clean plastic containers that are not recyclable should be placed in the general industrial waste stream.



This table shows the relative value of different types of paper collected for recycling. Prices increases with whiteness and paper fibre quality. Source:

Standard EN 643:2013 for Paper and Board for Recycling

The revision of European standard EN 643:2013 coincides with a fundamental change in waste legislation. The Waste Framework Directive introduces a procedure for defining End-of-Waste criteria that a given waste stream need to fulfil in order to cease to be waste. (The End-of-Waste criteria require compliance with EN 643, the provision of information on material that has ceased to be waste, and the implementation of a quality management system.)

EN 643 defines what the 95 different grades of paper for recycling may or may not contain. It facilitates trading, and establishes comparable requirements for a material traded inside and outside of Europe. It defines this material as “natural fibre-based paper and board suitable for recycling; consisting of paper and board in any shape or product made predominantly from paper and board, which may include other constituents that cannot be removed by dry sorting, such as coatings, laminates, spiral bindings, etc.”

Recommendations of EN 643 are to use Guidelines for Recovered Paper Quality Control and Responsible Sourcing and the European Recovered Paper Identification System (RPID). This is to identify paper for recycling purchased, received, stored and consumed in paper mills to improve traceability, see www.recoveredpaper-id.eu

Quality Issues

Prohibited materials with zero tolerance: these represent a hazard to health, safety and environment, for example medical waste, contaminated products of personal hygiene, hazardous waste, organic waste including foodstuffs, bitumen, toxic powders and similar.

Unwanted material: not suitable for the production of paper and board (with a tolerance level of 1 - 3% depending on grade) that might include: non-paper components (with tolerance levels of 0,25 - 3%) of paper and board not according to grade definition, or detrimental to production, or not suitable for deinking (when intended for deinking). Non-paper components include: metal, plastic, glass, textiles, wood, sand, building and synthetic materials.

Moisture content: recovered paper and board should have the same moisture as the naturally occurring level. If it is over 10% (of air dried weight) the excess weight may be claimed back.

Deinking: paper products not suitable for deinking belong to unwanted material. This currently refers to most flexographic printing, inkjet, liquid toners and to some UV cured printing. (If paper and board for recycling is not suitable for deinking it is usable in other paper recycling processes.)

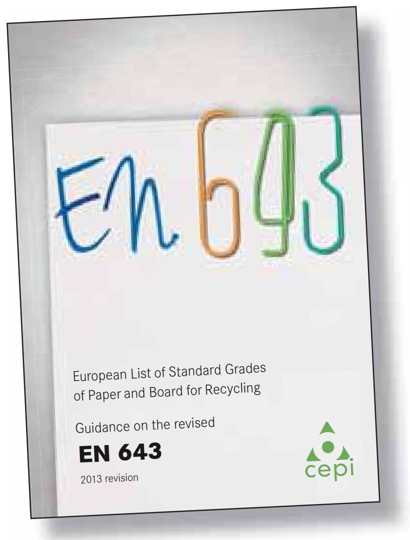
For more information see “Guidance on the revised EN 643” from CEPI.

Waste Storage & Shipping

The shipping area is often the best place to position waste.

Paper waste can be collected automatically by suction or conveyors or manually. Conveyors require sufficiently heavy waste to function correctly. They are energy efficient because they do not aspire air from the factory, conserve the internal temperature, and are quieter than other systems. Compaction is the most efficient system to reduce paper volume but needs careful evaluation of space required, noise impact and cost. Horizontal compaction balers can be fed manually or combined with automated trim extraction systems. These systems generate dust and should be located away from manufacturing. In certain special cases (security printing) waste signatures and makeready sheets may need to be shredded.

Ask your waste collector to evaluate your operation, including the level of sorting (white paper, printed, laminated) to develop an adapted waste management concept for the printing company.



European List of Standard Grades of Paper and Board for Recycling. Guidance on EN 643 revised 2013. Source: CEPI.