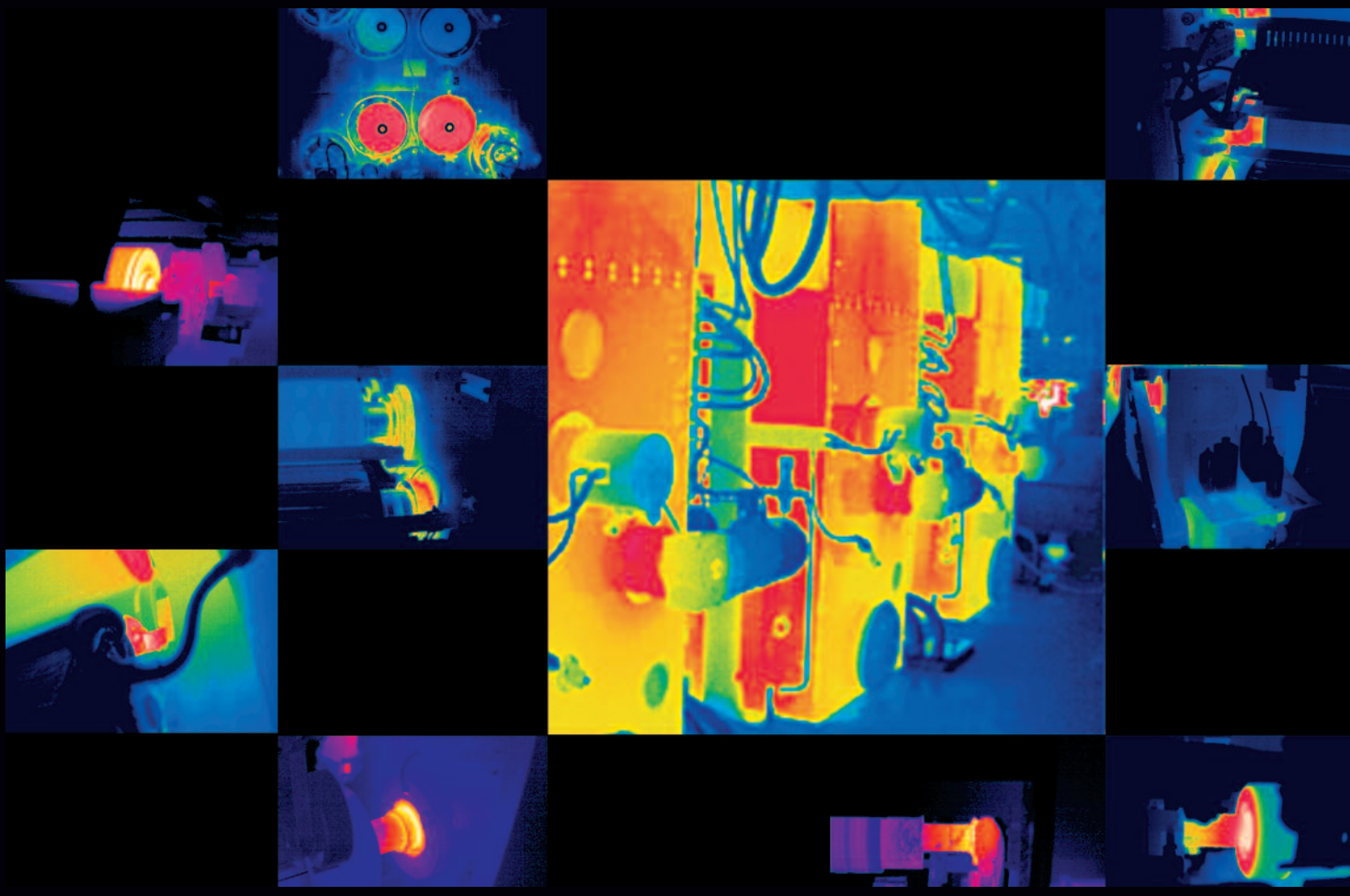
LEITFADEN BEWÄHRTER PRAKTIKEN FÜR ROLLENOFFSETDRUCKER

Wartung zur Steigerung der Produktivität

Wie man Druckmaschinen länger, leistungsfähiger und schneller betreibt



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Aylesford Newsprint, Kodak GCG, manroland, MEGTEC, Müller Martini, Nitto, QuadTech, SCA, Sun Chemical, Trelleborg Printing Solutions

Wartung zur Steigerung der Produktivität
Wie man Druckmaschinen länger, leistungsfähiger und schneller betreibt
Leitfaden bewährter Praktiken für Rollenoffsetdrucker

Aylesford Newsprint, Kodak GCG, manroland, MEGTEC, Müller Martini, Nitto, QuadTech, SCA, Sun Chemical, Trelleborg Printing Solutions,
Inhalt und Wert dieser Veröffentlichung sind in hohem Maße der Unterstützung durch Einzelpersonen, Druckereien und Verbände aus der ganzen Welt zu verdanken, die ihre Zeit und Sachkenntnisse zur Überarbeitung und Verbesserung dieser Anleitung bereitwillig gaben und diese so bedeutend verbessert haben.

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BEST PRACTICE **Leitfaden N° 4**

Die Wartung hat einen hohen Einfluß auf die Produktivität in der Druckproduktion. Trotzdem wird diesem Thema oft nicht die notwendige Aufmerksamkeit zuteil. Die Bedeutung der Wartung betonte Grant Miller, Technologiechef von RR Donnelly & Sons auf der TAGA Konferenz in seiner programmatischen Rede. Als Hauptgründe für Zeitverluste und Kostensteigerungen nannte er Maschinenausfälle, Einrichten und Einstellungen, Leerlauf und kleinere Produktionsunter brechungen, verringerte Geschwindigkeit, Ausfälle beim Auflagendruck und beim Anfahren sowie zu geringe Nettoproduktion. Seine Kernaussage war : "Im Großen und Ganzen gibt es bei der Effektivität der Maschinen noch ein hohes Verbesserungspotential." Der 2001 veröffentlichte WAN-IFRA Spezial Report 3.33 zur Produktivitätsoptimierung bemerkt : "In aller Regel liegt die einzige Möglichkeit der Produktivitätssteigerung darin, die Zeit zu verringern, in der die Druckmaschine steht – entweder durch schnelleres Rüsten oder durch das Vermeiden von Störungen beim Auflagendruck. Störungen kosten entweder Produktionszeit oder sie erhöhen die Makulaturrate. Es gibt drei Arten von Störungen : plötzliche Ereignisse, die die Maschine stoppen (z.B. der Ausfall von Teilen, der Ausfall der Steuerungselektronik, Bahnbrüche), anwachsende Störungen, bei denen der Drucker entscheiden kann, wann die Maschine anzuhalten ist (z.B. Aufbauen) und Störungen, die die Produktionsgeschwindigkeit oder die Qualität verringern (z.B. Registerdifferenzen, Faltenbildung)." Die Studie kommt zu folgenden Ergebnissen :

- Die Bediener (und ihre Ausbildung) haben den höchsten Einfluss auf die Produktivität
- Die Produktivität kann durch verringerte Qualität nicht gesteigert werden
- Für systematische Wartung müssen ausreichend Zeit und Mittel bereitgestellt werden
- Die Materialien müssen den Anforderungen der Maschine und den Anforderungen an die Qualität entsprechen
- Die Vorstufe übt einen wichtigen Einfluß auf die Produktion aus (rechtzeitige Plattenlieferung und Qualität)

Es gibt einen inneren Zusammenhang zwischen Produktivität, Zuverlässigkeit und Wartung. Ein weiterer Faktor für die Erhöhung der Produktivität ist es, den Druck auf das Produktionspersonal, der Maschinenausfälle verursacht, zu verringern. Eine Studie der Web Offset Champion Group bei Druckereien, die proaktive Wartungssysteme eingeführt haben, belegt deutliche Leistungserhöhungen durch :

- Weniger ungeplante Maschinenstillstände
- Eine höhere Nettoproduktionsleistung der Druckmaschine
- Weniger Makulatur
- Einheitlichere Qualität
- Weniger Unfälle

Die erprobten Praktiken sind ein Werkzeug, das die Gesamtleistung erhöht. Die daran beteiligten Firmen spielen eine tragende Rolle in der vernetzten Produktionskette. Deshalb ist die Kombination ihres Sachverstandes ein guter Weg, die Leistungsfähigkeit des Gesamtprozesses zu erhöhen. Der Zweck dieses Leitfadens ist es, Rollenoffsetdruckern die Wartung als Teil des Produktions systems darzustellen und praktische Hilfe dabei zu leisten, die Wartung effektiver zu gestalten. Der Leitfaden beruft sich stark auf der Methode des Total Productive Maintenance (TPM), die von Seiichi Nakajima entwickelt wurde. Sie führt die vorbeugende und die vorhersagende Wartung sowie die Qualitäts- und die autonome Wartung zu einem System zusammen.

WICHTIGER SICHERHEITSHINWEIS!

Stellen Sie immer sicher, dass die Maschine im Status „Sicher Aus" ist, ehe Sie an irgendeiner Komponente arbeiten (z.B. dass Druckluft-, Strom- und Gaszufuhr unterbrochen sind). Nur geschultes Wartungspersonal, das mit den Sicherheitsbestimmungen vertraut ist, darf Wartungsarbeiten ausführen. Ein allgemeiner Leitfaden kann nicht die spezifischen Eigenschaften sämtlicher Produkte und Verfahren berücksichtigen. Wir weisen deshalb ausdrücklich darauf hin, dass dieser Leitfaden nur als Ergänzung der Informationen Ihres Lieferanten verwendet werden soll. Dessen Anweisungen zur Sicherheit, zur Bedienung und zur Wartung haben Vorrang vor diesem Leitfaden.

INHALT

Dieser Leitfaden ist für Drucker auf der ganzen Welt gedacht. Es kann jedoch regionale Unterschiede bei der Terminologie, bei den Materialien und bei der Bedienungsweise geben, die nicht berücksichtigt wurden.

Als Hilfe für den Leser verwenden wir eine Reihe von Symbolen, die auf die Hauptpunkte hinweisen:


Bewährte Praktiken


Schlechte Praktiken


Maschinenstopp


Schlechte Laufeigenschaften


Vermeidbare Kosten

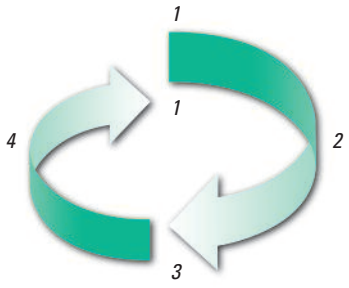

Sicherheitsrisiko


Qualitätsthema

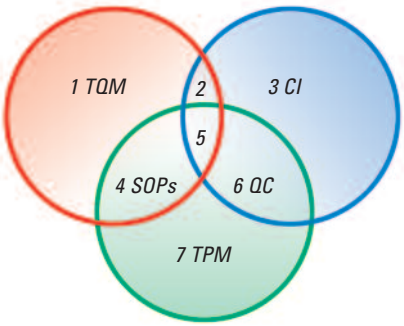
Why maintain?

Evolution of maintenance

Period	*Strategy*	*Human health care*	*Machine health care*
< 1950	Breakdown	Heart attack	Large budget, correct when broken
< 1970	Preventive	By-pass surgery	Periodic component replacement
> 1970	Predictive	Heart disease detection	Condition monitoring, fix early
> 1980	Proactive	Cholesterol & blood pressure monitoring Root cause diet control	Performance monitoring Contamination control TPM (Total Productive Maintenance)



"Spiral of breakdown despair"
1 Production loss from breakdowns and low productivity
2 Work equipment harder to recover lost production
3 Increased breakdowns and more lost time
4 Increased production pressure reduces maintenance time



Most leading industrial companies use overlapping techniques to improve their performance:
1 Total Quality Maintenance
2 Cross functional teamwork
3 Continuous improvement
4 Standard Operating Procedures
5 5Cs (Clear, Configure, Clean, Check, Conform)
6 Quick Change development
7 Total Productive Maintenance

There is an intrinsic relationship between productivity, reliability and maintenance. The primary dividends from effective maintenance are reduced total operating costs, on-time delivery and consistent product quality. In addition, maintenance preserves capital assets and fulfils safety, insurance and regulatory obligations. A further benefit is to reduce the stress on production staff generated by breakdowns. Printers who have introduced pro active maintenance systems unanimously report significant performance improvements from fewer unscheduled press stops, higher press net output, less waste, more consistent quality and fewer accidents.

The preservation of expensive equipment assets is another economic factor. Good maintenance both preserves these assets and reduces their lifetime operating costs by minimising wear and replacement of parts.

Many printers continue to operate only corrective crisis maintenance despite the strong reasons to integrate effective maintenance. Experience shows that the loss of substantial productivity is rarely due to acute problems. It is usually associated with a collection of regular chronic problems that companies live with in order to keep presses running. Many printers have accepted breakdowns as part of a reactive operating culture "if its not broken, do not fix it". These consequences are defined by Total Productive Maintenance (TPM) as the "big six losers" that undermine productivity and profitability:

1 High equipment failures: Sporadic or Chronic.

2 Slow job changeover and makeready: Total time and waste to good copies.

3 Frequent idling and minor stoppages: A major cause of lost time is from bad materials, readjustments, cleaning plates or sensors, etc. External causes include late and incorrect plates, proofs missing job instructions, waiting for the customer.

4 Reduced speeds: From poor materials and machine condition, drying or registration problems.

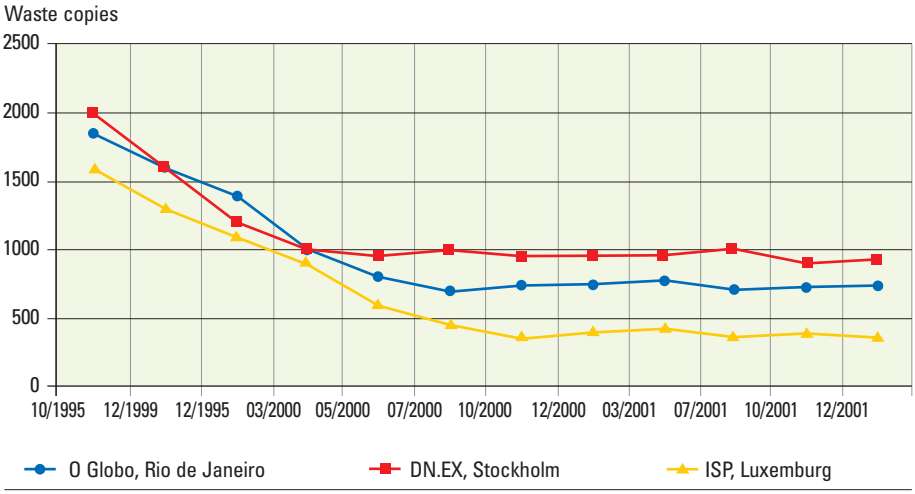
5 Excessive quality defects: Time, materials and cost to handle non-conforming products and re-runs.

6 Slow start-up and reduced yields: High waste and low speed from printing problems (e.g. colour variation, plate scumming, folder register) or maintenance related problems (folder jam).

According to Kenneth E. Rizzo (GATF "Total Productive Maintenance") the main causes of these productivity losses are 'fix it when it breaks' maintenance combined with operational inefficiency (inadequate control, training and operating procedures). An accelerating competitive climate requires working leaner, faster and smarter by adapting best industrial practice techniques and tools. TPM integrates preventive, planned and condition maintenance with quality management and continuous improvement to provide a total manufacturing system. Its discipline is a foundation for the development of lean and flexible manufacturing.

A cost or an investment?

Newspaper start-up waste



An example of TPM to reduce makeready waste at three newspapers with identical presses. Waste reduction was achieved from the combination of best practice maintenance and operating procedures.
Source Eurografica

Effective maintenance should begin with some fundamental financial management questions: Is maintenance regarded as a 'necessary evil' or as an investment to increase productivity and reduce total operating costs? Are malfunctions only accounted for as direct repair costs, or is their total loss calculated (repairs, plus the costs of lost production, increased materials consumption and consequential costs such as overtime)?

Progressive industrial companies incorporate maintenance as a total production cost variable and include down time and consequential costs in their calculations. This financial management approach provides substantial opportunities to reduce costs and increase profitability. A further benefit is that more saleable production capacity becomes available that can be converted to either increased sales or reduce capital investment (fewer presses) to achieve the same output.

The gap between poor and best practice can be substantial. The experience of companies who significantly cut costs by reducing maintenance is that their reliability and efficiency gradually decline over the first year and then drops away dramatically with higher costs for breakdown (spares, lost production, materials waste and overtime). The inertia of poor reliability means it takes much longer to recover lost productivity than to lose it, even when substantial resources are added back.

The industry's diversity does not allow a simple time-cost formula to define 'adequate' maintenance resources. This is a function of press type, age and operating hours. In 24-hour per day commercial printing, the experience of press manufactures and GATF is that about 5% of total press operating hours is needed for a solid maintenance programme. The most important issue is not the time or budget allowed, but the effectiveness of the maintenance investment to improve productivity and reduce total operating costs. Secondly, that the time and budget are measured and monitored for their effectiveness.

The payback from a successful pro active maintenance strategy is improved productivity. Experience of implementing programmes such as TPM, TQM and autonomous maintenance is that they need about 3 years to become fully established as part of a company's operating culture. Some users report improvements of over 20% longer running time between press stops, around 25% higher net average printing speed and up to 50% reduction in paper waste. Other benefits are extended equipment life and a higher return on investment with improved internal and external customer satisfaction.

Key Performance Indicators (KPIs)

Should be developed and evaluated by the staff who will use them.

Production line output KPIs:
Available press time for production
Average net copies per hour
Average makeready time
Average waste (quality related)
Web break rate

Maintenance indicators KPIs:
Non-scheduled/unplanned repair stops
% Down time due to breakdown
% Re-work (a major cause of high maintenance),
Mean time between failures
Cost of parts and consumables used

These two sets of data should be regularly evaluated to make the effectiveness of production and maintenance transparent. Coherent and clearly presented data provides operators, maintenance, managers and suppliers with an objective assessment of performance gaps and results.

Regular weekly review allows maintenance resources to be prioritised and planned to address specific areas needing improvement. KPIs should be distributed to staff at all levels so that they can see the evolution of performance over time. This helps encourage joint ownership and responsibility for assets maintenance.

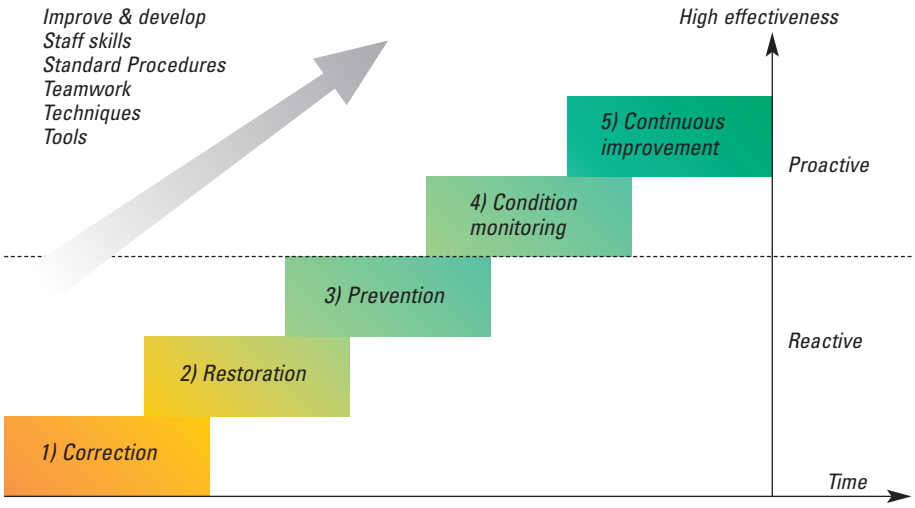
Maintenance strategy

Maintenance is a series of progressive organised steps over time to improve operational effectiveness. The key step is the transition to proactive working.

An autonomous maintenance board is kept up to date by the press crew to help prioritise their maintenance actions. These are made either at planned maintenance periods with smaller tasks during press stops. Photo Quad Graphics.

Operator autonomous maintenance: Operators know their machines better than anyone else does. Operator involved maintenance is a standard industrial approach to give crews a better understanding to prevent problems and release maintenance resources. Implementation requires a series of small steps over time, delegation of responsibility, continuous improvement and teamwork with maintenance and scheduling staff. Basic work includes:

- Regular cleaning and inspection.
- Routine lubrication and fastener checks (nuts, bolts, and lockdowns).
- Regular monitoring of equipment condition.
- Understand and apply correct maintenance and operating procedures.



1. Corrective maintenance: Safety is the highest priority to prevent accidents. Most resources at this level are devoted to fixing emergency and chronic problems to keep presses running ("fix it when it breaks").

2. Restoration maintenance: Return equipment to its original condition so it can be maintained normally. Firstly focus on chronic minor breakdowns that collectively often total the highest amount of lost time. A sudden sporadic breakdown with long down time is usually the result of deterioration over time — restoration is the main way to reduce this.

3. Planned preventive maintenance: Routine cycle of scheduled maintenance using standards, procedures and reporting to minimise failures. Track failure rates of wear parts, build a repair history database and develop a parts inventory from it. Introduce autonomous operator maintenance programme.

4. Condition monitoring: Few components have a specific lifetime. Usually there is a long failure development period before a breakdown occurs. Condition monitoring uses different tools to identify deterioration earlier to initiate maintenance sooner so that remedial action is cheaper, faster and without unplanned production stops.

5. Continuous improvement: Best practice is a virtuous circle of evaluation, development, instruction, monitoring, management and improvement. The objectives are to focus on high cost priorities to simplify systems, increase efficiency, provide cost effective maintenance, extending equipment reliability and productivity. Each issue needs a champion responsible to set objectives, document actions and results and lead a cross functional team. A wide variety of techniques are used including Kaizen, Six Sigma and Root Cause Analysis.

Life Cycle Analysis (LCA) integrates all lifetime operating factors (energy consumption, down time, production speed, maintenance, parts, waste, buildings, etc.) into an economic system to optimise total cost. The significant potential to reduce overall costs has been recognised by some printers who use LCA with TPM programmes to help decide purchase, operating and general plant conditions.

Developing a strategy

Strategy objectives should be results oriented with a 'product' of improved equipment reliability, productivity and assets preservation delivered through maintenance services in co-operation with production. The desired results should be defined along with measurements of target improvement e.g.:

- Maximise production capacity and consistent quality.

• Minimum scheduled and no unscheduled down time.
• Minimise total production costs and materials waste and accidents.
• Optimise maintenance costs.

A basic strategy should begin with an audit to define current plant status and identify the factors that limit performance. Prioritise the key performance gaps to be reduced over time. Adapt strategy to the age and technology of equipment, operating hours and type of work. The difference between better and poorer performing companies is that the best 'do it'. It is no good having good plans and strategies unless they are put into operation.

Outsourcing of standard services (e.g. forklift trucks, compressors, general electrical) is a pure value decision. However, externalising core maintenance of printing equipment requires a serious assessment. In most circumstances it is recommended to maintain core specialist maintenance staff who can be supplemented with assistance from external suppliers as needed.

Key factors for success

1. Senior management champion: Effective maintenance needs support that is visible, vocal and continuous to motivate staff at all levels for a successful mid to long term strategy.

2. Planned time: Access to equipment is the biggest problem. Maintenance should be planned as part of production scheduling that respects times, priorities and procedures.

3. Adequate staff, training and tools: Continuous training is an absolute requirement to optimise plant performance and profitability (use programmes from suppliers). Ensure each department has adequate tools and manuals that are available 24 hours a day.

4. Monitor KPIs: Adjust planned maintenance to priorities. Communicate results to all.

5. Involve all key departments: People are more than half the solution. Recognise their efforts and ensure effective teamwork between operations, maintenance, planning and finance.

6. Documentation: Clear maintenance checklists for each equipment line and each time period, that are signed-off by the individual who completes the task. Clear and precise maintenance request procedures.

7. SMP & SOP Procedures: Standard Maintenance and Operating Procedures improve staff effectiveness by making tasks systematic, easier to understand and reinforce safety.

8. Use different skill levels: Allocate tasks to match the best use of operator, maintenance and external suppliers different skill levels.

9. Stock key parts: Anticipate life of wear parts to avoid press time lost from parts not in stock. Build a parts consumption data base. Suppliers can also provide parts lists.

10. How to fail quickly: Lack of long term senior management commitment, work on maintenance in isolation, do not use KPIs, abandon allocated maintenance slots.

TPM steps to improve equipment effectiveness are:

1. Restore equipment to original specifications and eliminate causes of deterioration.
2. Scheduled preventive maintenance programme with standards, procedures and reporting.
3. Predictive maintenance to identify components needing maintenance before they fail.
4. Develop an autonomous operator maintenance programme.
5. Improve operating conditions to equal or surpass industry standards.

Other TPM steps to improve operations include:

6. Eliminate production workflow bottlenecks.
7. Quality assurance of materials.
8. Audit and control each process step using standards and control tools.
9. Implement best practices with written Standard Operating Procedures.
10. Develop a quick makeready programme.
11. Eliminate defective products.

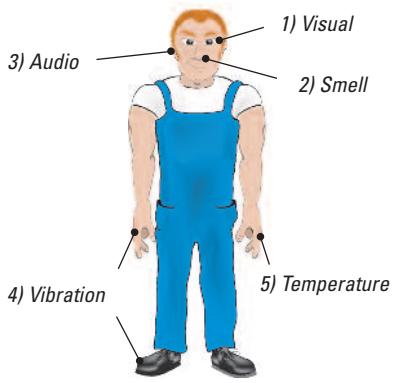
New press technologies reduce maintenance in some areas (automatic lubrication, self-cleaning sensors, roller and blanket was-up devices).

Higher automation means that operators are now at the press less frequently, and smaller crews and faster makeready time tends to reduce operator maintenance opportunities.

If pre-setting systems are to deliver efficient results they require continuous and rigorous maintenance of inking and dampening systems.

Condition monitoring

Condition monitoring devices	Operator's senses	Infra Red heat gun	Ultrasonic detector	Accelero-meter	Thermographic camera	Oil analysis
Used by operator if trained	✔	✔				
Used by trained technician	✔	✔	✔	✔	✔	✔
Data export and trending		✔	✔	✔	✔	✔
Frequency of use	Continuous	Weekly	Weekly	3 months	3 months	1-3 months
Early warning detection efficiency	Low-Mid	Mid-High	High	High	High	High
Cost (approx. range) in Euros	_	1200	2000-4000	1000-12000	5000-30000	



Humans have a built-in condition monitoring system that can feel, hear, see or smell small changes. Operators and maintenance staff senses should be trained to identify printing press running condition.

Digital technologies can assist in condition monitoring to detect faults before their symptoms become physically apparent.

Regular condition monitoring helps detect faults early where their time and cost of remedial action is lowest. The first step is to establish normal operating levels of component characteristics and the time between detection of abnormal conditions and failure. The keys are:

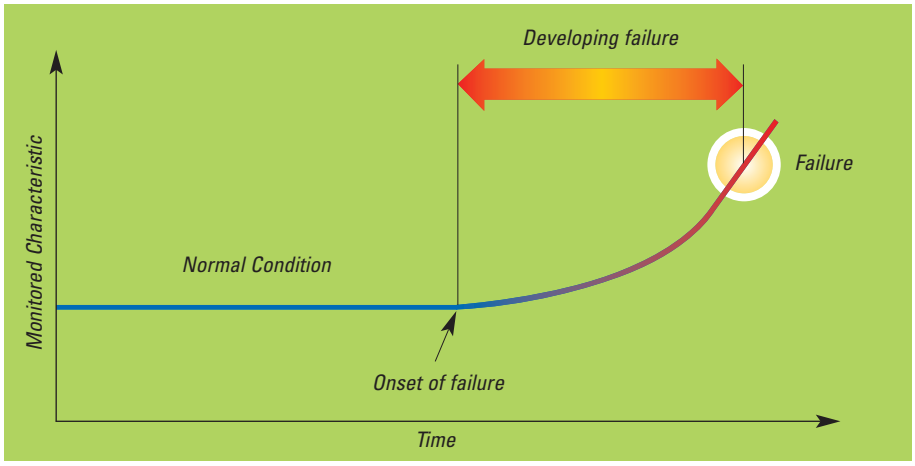
- Detection: At the onset of change to active deterioration.
- Diagnosis: Type, severity and location.
- Decision: What to do and when.

Monitoring methods include: Performance data (KPIs), vibration monitoring, power consumption, lubricant and wear debris monitoring, visual and sensual inspection – including thermography and Infra Red (IR).

Firstly begin with staff. People are the most important maintenance assets who are naturally equipped with built-in sensor devices. If correctly trained, they can identify deterioration in equipment operating condition. Detecting problems is more difficult in plants using sound proof operating booths and some audio symptoms are difficult to hear next to a running press. Staff will become more efficient if suitable monitoring tools are available to them.

The cost of digital monitoring devices has fallen. Most allow measurements to be recorded and exported to a computer system to simplify trend analysis. Before buying a tool check with other printers, or suppliers, on which models offer good value, are reliable and easy of use. Some considerations include:

- Select 1 or 2 tools for key needs and work with them for about a year until their utility is demonstrated (introducing too many tools simultaneously often leads to poor use and unrealised expectations).
- Tools must be used correctly with appropriate and on-going user training and tool calibration.
- Use the tools regularly and record their readings into a data format that allows useful trend analysis to help plan future actions and provide feedback to management and staff.



Monitoring components and detecting the onset of failure characteristics (higher vibration, operating temperature, power consumption, changed oil condition) allows scheduled repair prior to break down.
Source Tim Claypole, University of Wales.

Data records and analysis: There is no point in collecting data unless it is analysed, used in planning and distributed to all people concerned, including press operators. Most monitoring devices can export data in a digital format that allows it to be trended, analysed on an oscilloscope or stored as sound. Any of this data can then be sent over the Internet if expert help is needed to solve problems. There is enormous potential from an integrated database where ultrasound, vibration and temperature data are all kept together and can be cross referenced.

CMMS (Computer Managed Maintenance Systems): A wide variety of systems are available for maintenance management, condition monitoring, parts inventory and purchasing, staff management.

Thermographic devices: Temperature variations have a significant effect on press performance. IR (infra red) guns and cameras convert thermal radiation from equipment into data or images of operating temperatures. Benchmark readings (from operator and drive side) should be recorded when the press is running correctly and regular measuring will identify any deviations that are early symptoms of problems.
IR guns are highly portable and can be tuned to specific wavelengths to measure surface temperatures of components (rollers, dampening solution, pans, plates, blankets, dryer, chill rolls), to localise loose electrical connections, hot motors, bad bearings and indicate the surface temperature of the web throughout the press.
Thermographic cameras provide detailed temperature images that can be analysed to give an early warning of mechanical wear, insufficient lubrication, broken fasteners, poor ventilation, faulty fuses, etc. (but cannot monitor bearings inside closed gear casings). New thermal imaging software can be interfaced with all makes of camera and high resolution models can give images of an entire machine. Inspection and analysis is often made by specialist suppliers because of equipment cost and expertise needed to interpret data.

Digital ultrasonic scanner: An efficient tool to identify compressed air leaks and assess rolling element bearing condition. High frequency ultrasound is converted into audible sound that can be stored. Data can be trended to optimise lubrication and identify potential failures. When equipped with earphones they allow operators to hear the vibration patterns of different components (a modern version of a stethoscope). Ultrasound is a good technique to determine optimum lubrication. Acoustic vibration is low when a bearing is properly lubricated and increases as the film breaks down. The ultrasound signal changes during greasing and pumping is stopped when the sound level returns to its normal benchmark level.

Accelerometer: Particularly suitable for high frequency vibration (e.g. rotating system bearings). They normally require good physical contact with what is being measured.

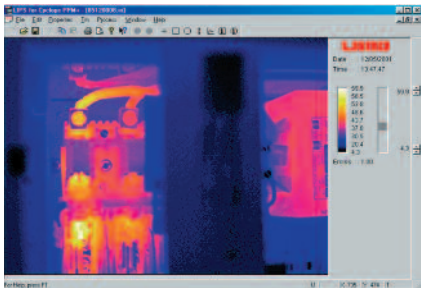
Vibration monitoring: Routine measurement with hand-held or fixed devices is a powerful tool to diagnose running problems. This technique requires much more training than ultrasound, but the depth of analysis is considerable for motor, gearbox and bearing diagnostics, misalignment and imbalance.

Monitoring points: Uniquely identifies monitoring positions with a simple coded plastic marker. Emerging electronic tag systems provide automatic identification and the possibility to download data.

Oil analysis: Regular oil analysis indicates the condition of closed lubrication systems, indicates wear (metal particles), oil contamination (silicone, water) and early detection of drive problems. Samples should be taken immediately after a press stop and are usually analysed by a specialist laboratory service.

Stroboscope: Used for rapid inspection of moving parts such as belts, chains, cylinders and folder to detect wear or abnormal performance. Application depends on guards being either transparent or open grills.

Crack detection: Magni-Flux techniques can reveal cracks in shafts, pumps, journals and side frames. Normally used when equipment is dismantled.



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***1-** New thermal imaging software can be interfaced with all makes of camera and high resolution models can give images of an entire machine.*

***2-** Regular infra red temperature measurements will identify abnormal temperatures that are early symptoms of problems. Photo Sun Chemical.*

***3-** Digital ultrasonic scanner will identify compressed air leaks and assess bearing condition. Photo Tom Adash*

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1- A simple visual inspection of oil can quickly reveal a lot about its condition (new, used and failed oil). Photo Swansea Tribology Services.

2- Some printers and their suppliers are using a digital web cam with a wireless transmitter and a broadband Internet link to more rapidly identify and solve problems on press from remote service centres. This example is ServiceVision from manroland.

3- Other monitoring tools include digital conductivity meter, Digital pH meter, Digital thermometer, Hydrometer (IPA %), water hardness tester, Shore hardness meter, roller stripe measuring card, blanket packing and thickness gauges. Photo Sun Chemical.

Strain gauge: A specialist service to identify local loading of individual components, it can be used to look at the effect of shock loading, e.g. splices passing through the press.

Manometer: Measures airflow restriction to objectively assess when an air filter should be changed (as a function of its resistance). Similar devices can measure pressure drop across water filters.

Laser alignment: Incorrect alignment of press components, rollers, chains, drives belts and pulleys are a major cause of rapid deterioration and operating problems.

Digital camera: Record images of maintenance procedures and problems (images can be sent by Internet to help diagnose complex problems more quickly and reliably). A video camera with electronic shutter is useful to analyse paster and folder operation.

Remote site services: Many suppliers have modem services to monitor equipment running trends and review fault reports to provide an early warning of down time risk and to plan preventive action. An extension of this is the use of Internet web cams that allow a live link between the press and a remote service centre.

Information availability: Manuals should be available to all staff at all times (with back-up duplicates stored separately). Production and maintenance staffs need access to a broad range of complex and diverse information that is often dispersed, difficult to access and to maintain. The centralisation of all information (including multi media) into a single database allows easy searching and incorporation of any new material.

Test forms: Measures impression performance of a press (FOGRA, Systems Brunner, GATF, and WAN-IFRA). Uses include analysing a specific quality problem, monitoring output quality annually and materials testing (assess colour reproduction characteristics and variables between different inks and papers).

Ambient environment conditions

Large and frequent variations in pressroom temperature, humidity, air flows and dust levels are significant contributors to both accelerated equipment deterioration, poor consumables performance (ink, paper, glue, pasting tabs and tapes) and press operating efficiency (see also Guide 2, pages 10 and 11).

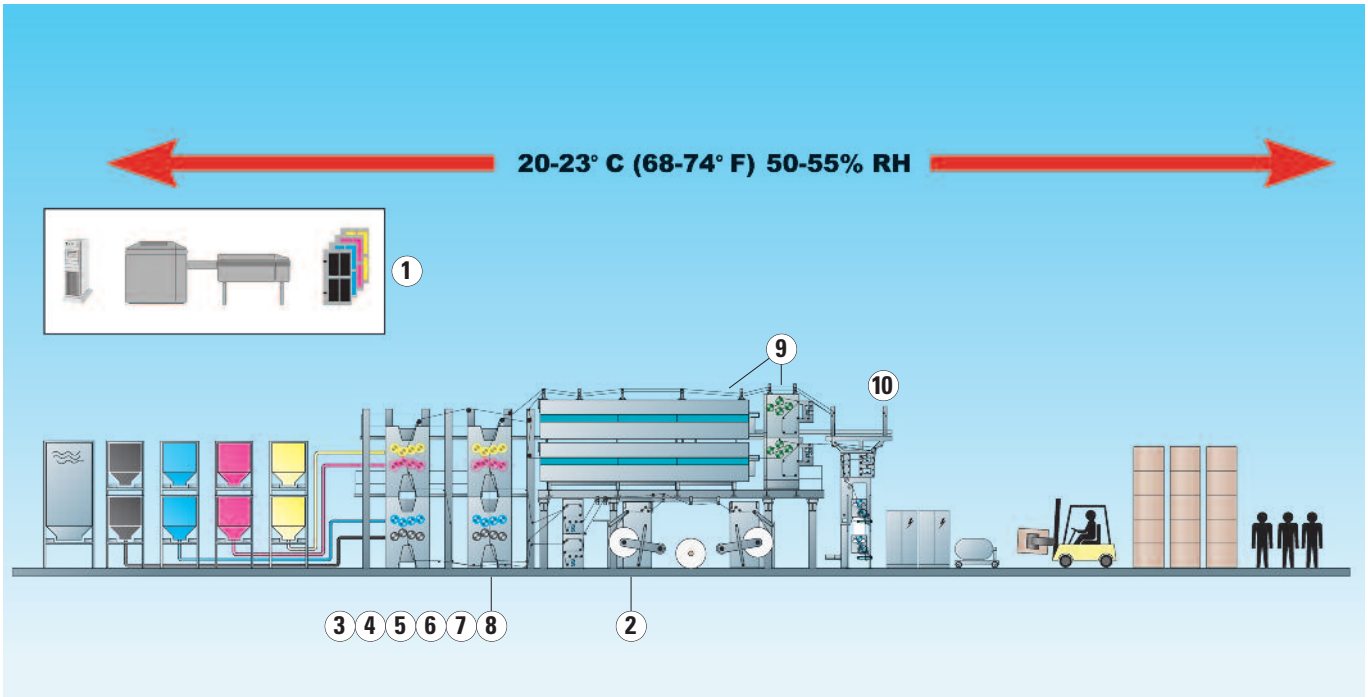
Temperature variations have a significant effect on press performance and reduce component life — a dirty electric motor running at a 10°C higher temperature from blocked airways may have its life reduced by 50%.

Monitor the condition of air filters. The ambient environment in plants may be 'dirtier' or 'cleaner' than the average and filter change periods should be adapted if necessary.

Use an IR gun to monitor temperatures.

Certain printers (particularly in Japan) demonstrate that good plant design and construction improves press productivity and maintenance by providing optimum ambient environment and layout conditions.

Systems & components



These priority areas for productivity maintenance was determined from a survey of 30 heatset and coldset printers and Web Offset Champion Group members maintenance staff.

10 key component and consumable areas

1. Plate making conditions and control
2. Paster (brushes/foam rollers, knives, photo cells)
3. Dampening system & solution
4. Roller wash-up, setting and care
5. Ink duct, metering, maintenance & cleaning
6. Blanket and packing inspection, adjustment and change
7. Plate & blanket cylinder cleaning
8. Control ink fly/drops
9. Dryer/chills cleaning and inspection
10. Folder: Slitter knives, trolley, anvil, settings & jams

10 critical system-wide factors

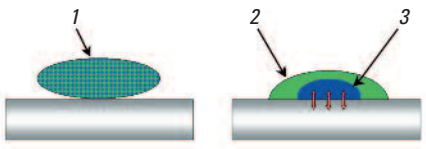
- Ambient temperature, humidity & water supply
- Compatibility of consumables and chemicals
- Clean, Check and Calibrate equipment
- Lubricate, check & change all filters
- Web tension
- Air system (clean and dry air)
- Electrical and Drive systems
- Level, parallel and clean idle (pipe) rollers
- Eliminate leaks (air, ink, oil, and water)
- Operator procedures and on-going staff training

Reliable production requires good maintenance and a clean environment.

	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality
General check and clean										
Galleries, stairs and footplates	✔								S	
Remove paper debris, vacuum clean	✔						●	⊛	S	
Physical check, visual, noise, odour	✔									
Drops of oil, water, ink falling on to web	✔							⊛		Q
Clean signs & indicator lights	✔								S	
Clean sensors	✔							⊛		
Use the right solvents							●	⊛	S	Q
Lubrication and Mechanical drives										
Systematic greasing/oiling schedule								⊛		
Check oil levels and change filters	✔							⊛		
Chains				✔			●			
Pulleys				✔			●			
Belts			✔				●			
Gears and bearings						✔				Q
Idler (pipe) roller cleaning		✔								Q
Motors & Electrical systems										
Ensure air cooling passages are clean		✔					●	⊛		
Clean filters of motors & electrical cabinets		✔					●	⊛		
Turn collector and change brushes						✔				
Monitor motors	✔							⊛		
Follow motors maintenance as specified								⊛		
Replace batteries in PLC						✔		⊛		

Frequency *Related problems:* ● *Slow running,* ⊛ *Machine stop,* S *Safety,* Q *Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

Untidy working environments, dirty equipment, liquid leaks and loose parts reduce component life from accelerated wear, high temperatures and contamination. These all undermine press productivity. The first condition of effective maintenance is to implement effective cleaning and chec0king routines. To be effective they require available time along with clear procedures and training.



Solvent encapsulated water droplets (right) cannot evaporate and will attack the metal surface causing corrosion. Source Böttcher.
1 Emulsion
2 Solvent
3 Water

3C's Clean, Check & Calibrate

Cleaning: Eliminate dirt, dust and contamination that increases abrasion, clogs feed lines and reduces cooling of motors and electrical cabinets. Only use compressed air for cleaning where specifically recommended as its high pressure can damage sensitive components and the disturbed debris is not removed. Use an industrial vacuum cleaner. Use the right materials and solvents (see below). Clean any liquid off of the floor and steps to avoid high risk of injury from slipping and falling. Cleaning made simultaneously with lubrication avoids excessive lubrication being left on components.

Sensors: Clean all press line sensors daily to avoid malfunctions and press stops. Clean lens and reflectors with a dry anti-static cloth. For deeper cleaning use a soft cloth soaked in alcohol but do not use organic or hydrocarbon solvents that will destroy the cells.

Solvents: Health, safety and environmental legislation (see DIN standards 16 621 and 52 521) have led to cleaning solvents with a higher flashpoint and lower VOC (volatile organic component). These washes are less aggressive, more "oily", often mix with water and require correct dosage. Therefore some changes are needed to cleaning methods. Do not "soak" cleaning cloths with a large quantity of low evaporation VOC wash, or too much solvent will be applied to the roller or blanket. The surplus will remain as an oily film and cause problems when re-starting the press. Drips of solvent-water emulsions on to metal surfaces may cause corrosion.

Check tightness: A loose component can cause abnormal vibrations and may eventually break or come loose. In the worst case these can fall into another part of a machine with massive damage potential.

Correct calibrations and settings: This will avoid many chronic small press stops, improve print quality, makeready efficiency and reduce waste. Key areas: Web tension, printing pressures (including the right plate-blanket squeeze), ink dampening solution and ink key slides, roller settings and durometer, dampening chemistry. Record benchmark settings and check them regularly. Each unit should have best operating conditions recorded and readily available to consult.

Lubrication and Mechanical drives

Component wear is caused by abrasion, corrosion and direct metal to metal contact. Correct lubrication will reduce wear and prevent failures. Over and under lubrication is a major threat to component life and seals.

- Use a systematic lubrication schedule (with a clear responsibility) using only the recommended lubricant (substitutes may not meet all specifications).
- Ensure grease guns and oil cans are the right type, work properly and the lubricant is clean. Consider colour coding lubrication points and their matching grease guns/oil cans.

Oil filters and changes: Use the supplier's schedule. Change the oil and filter together.
Automatic lubrication systems: These have a tendency to be overlooked and require periodic attention.
Oil analysis: Regular oil analysis indicates the condition of closed loop lubrication systems. Samples should be taken immediately after a press stop and are usually analysed by a specialist laboratory service.
Chains: Have a high number of mechanical parts and links that require frequent lubrication and cleaning to prevent failure.
Pulleys: Periodically clean, lubricate and check alignment. Check walls are smooth and square in profile.
Belts: Inspect regularly for wear, cracking and tension. Under tension reduces power transmission and over tension can damage drive motors. Loosen tension when changing to avoid stretching or damage. Check alignment and use belt tension testers to reduce pulley wear and extend belt life. Never use lubricants on belts and always use specified belt type.
Gears: Maintenance depends on their type and use. Follow manufacturers recommendations.
Bearings: Each bearing type has a specific lubrication profile and only recommended lubricants should be used at scheduled intervals.
Idle (pipe) rollers: Periodically check they are parallel, nip settings are correct and bearings run free.

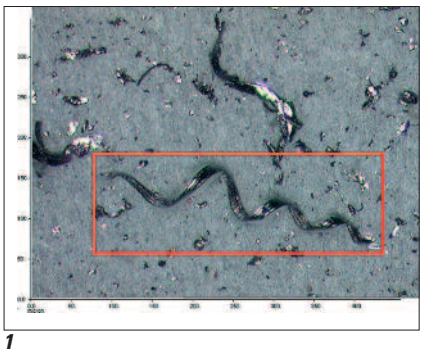
Motors and electrical components

The keys to long motor (and pump) life is good cleaning and maintenance. Up to 80% of malfunctions are caused by dirt and dust contamination that acts as an insulator and blocks air intakes causing excessively high temperatures.

- Clean air intakes frequently, preferably with a vacuum cleaner. Clean or replace filter screens regularly.
- Check motors daily for unusual noise or heat. Measure benchmark levels of ultrasound, vibration, bearing temperature and power consumption, any deviations indicate deterioration.
- Turn collector and change brushes every 5 000 - 15 000 hours according to their condition.
- Qualified staff should rigorously follow recommended maintenance schedules.

Electrical cabinets: Correct cleaning (with power off!) prevents overheating and extends component life. Remove filters for cleaning and replace as needed. Vacuum out dust (never use compressed air) and clean relays with a contact cleaner that does not deteriorate plastic. Check connections are tight, as press vibrations can loosen them.

PLC back-up batteries: A low battery can lead to loss of programme. Replace every 1 or 2 years following supplier's instructions.



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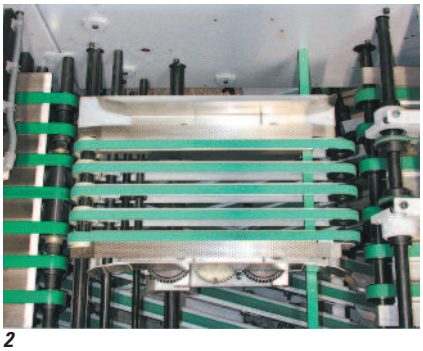

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***1-** Swarf wear debris particles in the oil indicate the beginning of a component failure.* Photo University of Wales.

***2-** Inspect belts regularly for wear, cracking and correct tension. Under tension reduces power transmission and over tension can damage drive motors.* Photo Müller Martini.

***3-** Dust around the press is sucked into the electrical cabinet and trapped by the filter. If the filter is not cleaned, electrical components will over-heat and damage them and may even cause a fire.* Photo MEGTEC.

Liquid systems	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality
Compressed air: Check oil level	✔									
Drain water condensation valves	✔									
Clean or replace filters		✔								
Check safety and relief valves		✔								
Check contamination indicator		✔								
Check pressure settings		✔								
Check compressor and hoses for leaks			✔							
Change oil and inspect for contamination			✔							
Check for rust and corrosion			✔							
Record noise level			✔							
Water: Check incoming quality		✔								
Cooling systems: Clean water filters		✔								
Check for leaks & system pressure	✔									
Check rotary unions			✔							
Compare temperature with set-points		✔								
Vent system & refill					✔					
Clean cooling tower/condenser				✔						
Complete system service						✔				

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

Chilled water systems

Regular optical and acoustic check for leaks, pressure levels, abnormal noises or vibrations will reduce the risk of damage and lost production.

Rotary unions: Inspect regularly for leaks. Follow hose pipe fitting procedures at replacement and ensure that a flexible hose is always used to connect the coupling and rigid supply pipe.

Check temperatures: Deviations from the desired value may cause condensation on the chill rolls, ink viscosity and misting, or poor heat evacuation from press components. Insufficient web cooling after the dryer may cause marking. Incorrect temperatures can damage rotary unions.

Vent system & refill: Cooling systems work in a closed loop and have to be vented regularly to ensure sufficient water circulation and heat transfer. Water inside the system may stop the refrigeration unit and raise temperatures, in the worst case, the complete cooling system will fail.

Clean cooling tower/condenser: Remove dust particles and mud to ensure maximum cooling capacity.

Water filters: Clean regularly to prevent restriction of water circulation. Missing or damaged filters can harm rotary unions.

Compressed air

Compressed air often contains scale, rust and other contaminant that under pressure enlarges existing leaks and create new ones. To compensate, air pressure is frequently increased which only makes the problem worse. Commonly up to 10-25% of air is lost representing an expensive energy cost. Leaks are invisible and odourless and their hissing sound is often lost in background noise. Use an ultrasound unit to locate and fix air leaks. Check oil levels daily, open and drain water condensation valves and listen for abnormal noises or vibrations. Weekly, check air pressure and contamination indicator if fitted, clean or replace air filters (filters are available to remove both moisture and oil vapour from the incoming air), check safety and relief valves. Monthly inspect compressor and hoses for leaks, change oil and inspect for contamination, check rust and corrosion, record noise level.

Water

The quality of water has a significant impact on many parts of the printing process and on maintenance requirements. These range from dampening solution efficiency to deterioration of plates, blankets and rollers, bacteria growth, corrosion, build-up of scale (corrosive salts) in pipes, chilled rolls and cylinders that reduce energy transfer. Water is a complex fluid with a highly variable composition that changes between localities and over time. Best practice is to regularly analyse the suitability of mains water for printing at each site. Where water treatment is required (softening, demineralisation, reverse osmosis) then define what additives are needed to provide a balanced water for printing (range of pH 4,8-5,3 in Europe / pH 3.5-4,0 in USA) and constant conductivity.

The dampening solution water will require other additives to stabilise its pH value to ensure good printing and other critical characteristics. Buffer system additives inhibit equipment corrosion, control bacteria growth and alkaline impurities. Whilst conductivity has no impact on printing, high concentrations may cause press corrosion above < 1500mS. The extremely pure water from reverse osmosis is very aggressive against metal and requires additives to harden-neutralise it before leaving its plastic storage tank.

Bacteria growth can restrict the flow of dampening water (particularly through spray nozzles), reduce dampening solution pH and significantly impair the printing process. Dampening system solutions contain a biocide to kill most algae, to be effective, the strength of the solution must be maintained within the manufacturer's tolerances. Check concentration regularly. If the problem is severe, it may be necessary to drain down the system and flush it through with a special solution *(For more information see "Dampening solution fundamentals of offset dampening" published by Sun Chemical Hartmann).*

Materials storage conditions	Keep in packaging	Storage position	Sensitive to UV	Sensitive to Ozone	Max. storage time/months
Paper	✔	On end	✔		6
Pasting tabs & tapes	✔	On side	✔		6
Inks	✔		✔		3
Blankets	Unroll	Flat	✔	✔	6
Rollers	✔	Vertical	✔	✔	3
Plates	✔	Flat	✔	✔	12
Chemicals	✔	Vertical	✔	✔	3-6
Optimum storage and operating environment		***Temperature 20-25°C (68-77°F)*** ***Relative humidity 50-55% RH***			

Materials selection and care

Check before change: Changing any consumable materials in a stable process may upset the chemical balance on the press. Only change one consumable element at a time. Prior to any change, test the chemical compatibility of blankets, roller rubber, ink, dampening solution and solvent chemistry.

Inspect incoming materials: Ensure packaging integrity and that delivery conforms to specification ordered. Use a digital camera to record any damage.

Control inventory: All materials should be used on first-in first-out basis to avoid deterioration over time, reduce risk of damage and make better use of use of working capital.

Poor storage conditions increased risk of damage and deterioration to materials and unscheduled press stop. All consumables should be stored (and used) in an ambient environment range of 20-25°C (68-77°F) and 50-55% RH to maintain dimensional stability, minimise static and avoid premature ageing. Most consumables will deteriorate if stored near electric motors, appliances or switch cabinets that create ozone. Storage areas should be dust, draught free and conform to all safety, fire and other regulations.

Correct storage

Paper: Keep rolls wrapped until they are prepared for splicing. Store on a dry, clean and level floor with a temperature similar to the pressroom. Rolls should be stacked in bays on their ends in straight lines with the same unwind direction. Protect outer rolls with guards and allow sufficient working space for handling.

Pasting tabs and tapes: Keep in packaging until used. Their adhesive properties are strongly influenced by excessive temperature and humidity variations.

Ink: Is a poor heat conductor and adjusts to temperature changes slowly. Below 18°C (64°F) ink viscosity rises causing pumping difficulties, over 30°C (86°F) the viscosity drops leading to running problems.

Plates: Store in their packaging until they are required to minimise static and dimensional instability.

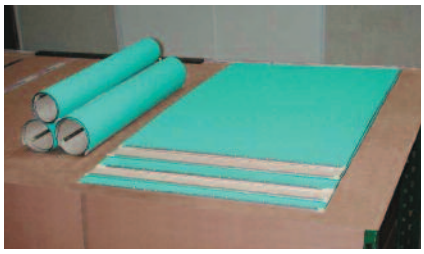
Blankets: Unpack rolled-up blankets and check their thickness is correct and the bars are parallel. Ideally they should be stored flat to prevent an against-the-print-direction set that makes them harder to mount. It is important that nothing rests on them as they may become deformed. Stack blankets alternately face-to-face and fabric-to-fabric to a maximum of 14 blankets in a pile to avoid damaging the lower ones. If it is not possible to store the blankets flat they can be kept rolled vertically in their delivery tubes. Rolled up blankets should never be stored horizontally, as this will deform into them. Blanket stocks should be rotated to avoid any blanket being stored for more than 6 months. Sleeves should be stored vertically in their delivery boxes.

Rollers: Should remain in their special protective wrapper until they are installed in the printing unit. Keep them in cool and dry conditions and away from UV light and ozone to avoid the premature ageing of their rubber. Store in vertical racks (supported by their journals or cores) to avoid permanent deformations (low spots). If stored for long periods change from top to bottom every month.

Many productivity problems are related to the incorrect selection, combination and storage of consumables. Purchase specifications should be based on quality, compatibility and performance during the printing process. Low performance consumables can increase total production cost out of all proportion to any purchase cost savings.

• Ideally an internal team (production, purchase, and maintenance staff) should work with qualified suppliers to define written specifications that conform to printing needs for all consumable materials. A data sheet for each should be available to press crews.

• Each machine should have a list of consumable parts (filters, belts, etc.) to be always available in store.



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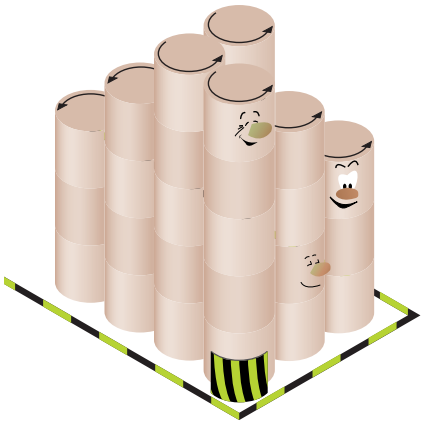

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1- *Blankets should be stored flat to prevent an against-the-print-direction set that makes them harder to mount. It is important that nothing rests on blankets as they will become deformed.*

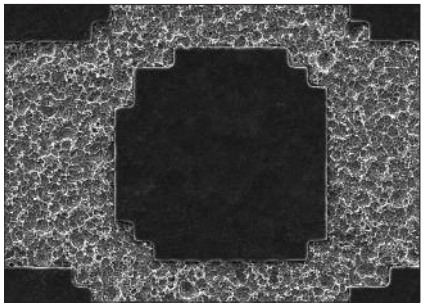
2- *Rolls should be stacked in bays on their ends in straight lines with the same unwind direction. Protect outer rolls with guards.*

Prepress & Plates

	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality
1 ***Conventional:*** Check vacuum frame			✔					⛔		🔍
2 ***CTP:*** Check Platesetter calibration			✔					⛔		🔍
3 Check Platesetter image quality	✔							⛔		🔍
4 Platesetter maintenance		✔						⛔		🔍
- Check & Clean rollers	✔							⛔		🔍
- Check air filters		✔						⛔		🔍
Plate production line										
5 Check & Clean plate punch dies		✔						⛔		🔍
6 Clean plate bender		✔						⛔	$	
7 Check chemistry activity	✔							⛔		🔍
Check chemistry bottles	✔							⛔		
Change developer		✔	✔							🔍
8 Check finisher	✔							⛔		🔍
9 Clean processor rollers	✔							⛔		🔍
Replace processor filters		✔	✔					⛔		🔍
Check processor chiller		✔						⛔		🔍
10 Check baking oven			✔					⛔	$	🔍

Frequency *Related problems:* *Slow running,* *Machine stop,* *Safety,* *Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

$ Lost production due to prepress equipment failure is lost production to the entire plant workflow.
About 1-3% of unplanned down time is from waiting for plates. Plate remaking is about 3% for CTP and 6% for conventional. About 50% of problems are operator errors and 50% come from other causes. The combination of preventative maintenance, controlled chemistry and plate inspection will avoid most productivity losses.



CTP has improved on press predictability of lithography by providing a very sharp edge first generation dot that reduces error when inking the image.

Conventional film plate making

1. Check vacuum frame: Uneven light distribution (centre to outer edges of the frame) causes: Negative plates to suffer premature image wear (under exposure may not completely harden the coating). Positive plates may show variable reproduction characteristics.

✌ Check consistent exposure over the entire frame by exposing multiple control wedges from the centre to outer edges. Record readings from all wedges and compare results.

Air leaks in vacuum frames cause uneven film to plate contact and slow drawdown (positive plates may have poor reproduction and some negative plates reduced run length).

✌ Check the frame for any damage to the vacuum seal and inspect the vacuum pump.

CTP plate making

2. Platesetter calibration: Each CTP technology has different reproduction characteristics. It is important to adjust the Platesetter calibration curves to achieve linearity (see Guide N°3).

✌ Check calibration using manufacturer's test targets and set up procedures. A digital tool to measure and test plates is available from UGRA/FOGRA.

3. Platesetter imaging quality: Use the manufacturer's test target files daily to ensure good and even reproduction.

4. Platesetter maintenance: Follow the maintenance manual. Some simple and important actions include:

✌ **Rollers:** Daily check transport rollers and clean off aluminium particles (from on-line punching station) that can damage the plate (marks are often only visible during printing).

✌ **Filters:** Poor air supply can cause strange image effects. Check air filters weekly and replace regularly (particularly where plate setters are inline to processors that emit corrosive fumes).

Plate production line

5. Plate punch dies: Bent punches will wear on the die causing a loose fit between it and the punch. The result is misregister or skewed plates that will not fit on press. Camera oriented bending devices with fine tolerances are very effective for CTP.

Inspect the punch die assembly weekly and remove any aluminium particles. Apply grease at nipples and clean away any excess (grease will sensitise plates).

6. Clean plate bender: Plates can be damaged from the bender acting on debris between its bed or arm and the plate. This will cause a non-parallel bend leading to misregister and poor fit to the plate cylinder. Other causes are loose or worn register pins and bending arm pivot pins.

Badly fitted plates are a safety risk because they can crack and fly off the cylinder whilst the press is running. On press diagnosis is too late. Preventive maintenance will also avoid plate re-makes and press waiting time. (Other plate cracking causes are excessive hardness / setting of ink rollers, a loose or over-tight blanket).

7. Processor developer activity: Different plates have variable chemistry maintenance that need to be matched to the volumes and speed of production at each plant.

Use supplier's guidelines and tools to maintain optimum process conditions. Some best practices include:

- Use recommended plate control strips.
- Check developer bottles daily (or sensors on processors with empty bottle alarms).
- Check chemistry filters at recommended intervals (use a surface area volume tool to identify when to change).
- Maintain developer activity by regeneration using the supplier's recommend dosage of liquid volume to surface area.
- Keep the wash section water supply clean to minimise developer carry-over and bacteria growth. Use supplier's guidelines to maintain filters, chemical, UV or biocide systems.

8. Finisher section: Avoid press sensitivity problems by ensuring the plate background is free of contaminants from the gumming and finishing sections.

Control specific gravity and accurate roller settings to prevent over, or uneven, application. Maintain finisher activity by using recommended dilution rates. Always change the finisher and clean the section at recommended intervals (2-4 weeks). At the end of every shift clean the exit rollers with a cloth soaked in water.

9. Check processor chill unit: Maintain developer temperature within recommended parameters.

Check weekly unit operation, water level and circulation.

10. Baking ovens: Most heatset positive and thermal plates are baked for long run lengths. Check correct operating temperature. Consistent heat transfer over the plate can often only be verified by a technician.

Regularly check air flows and replace exhaust filters to avoid build up of hot spots in the oven. Maintain heater elements, electric fans, openings, exhaust ducts and check fan vibration effects.

Automatic plate processing lines are frequently unattended and a jam will cause a substantial delay.

After cleaning the system, follow a plate through the line to identify

- any miss-alignment,
- obstructions, loose rollers, or supports,
- that the plate is delivered parallel to the exit table.

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1- Plate inspection is a key quality control to reduce press down time. Photo KPG.

2- Plate inspection is a key quality control to reduce press down time. Photo KPG.

Paper handling system

		Daily	Weekly	months 1	2/3	6	12	Slow	Stop	Safety	Quality	Time minutes
1	***Roll handling truck clamps***	✔										< 5
	All system components											
2	Check & Clean sensors	✔										< 5
3	Check & Clean all rollers		✔									< 15
4	Check motors and filters			✔								< 30
5	Lubrication as specified				✔							< 30
6	Clean & check web-up chains			✔								< 30
7	Brakes: Pneumatic, clean and check pads			✔								< 30
	Brakes: Electric, clean and re-set					✔						< 60
8	Clean, check tension of drive belts				✔							< 30
	Replace drive belts						✔					< 60
9	Check encoder belts				✔							< 30
10	Check linear compensating belts				✔							< 15
11	Clean chucks			✔								< 15
	Lubricate chucks					✔						< 30
12	Check lugs and bladders of airshafts		✔									< 15
13	***Flying paster:*** Clean & check pasting brush/roller		✔									< 15
	Check setting of brush/roller			✔								< 15
14	***Zero speed: Check dancer operation***		✔									< 15
	Check dancer air pressure		✔									< 15
15	***Infeed & web guide***											
	Check setting of nip roller			✔								< 30
	Check rollers are parallel				✔							< 30
	Check timing belts				✔							< 30
16	***Web catching device*** (if fitted)											
	Clean nozzles			✔								< 15
	Check adjustment dimensions						✔					< 30

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

Many splicing problems and paster stops are related to atmospheric conditions, paper problems, splice preparation, consumables and maintenance. First check these areas before looking for machine-related causes.

See also "Roll to Web Processing" (new edition 2002) and "Web break prevention and diagnosis".

1. Roll handling

Good handling avoids roll damage that frequently leads to excessive paper waste and web breaks.

Inspect and clean roll clamp blades on lift trucks daily (corners and edges should be well rounded, grind smooth damaged edges). Check clamp pressure regularly (if too low rolls can drop out; excessive pressure will deform rolls out-of-round).

All system components

1. Clean and inspect: Remove loose paper and dust from the entire system using a vacuum cleaner.

2. Sensors: Regularly clean sensors to avoid splice cycle failure.

3. Rollers: Regularly clean all rollers and check they rotate freely. Debris build up on roller edges can cause creases leading to web breaks. Remove any residue of pasting tape left on metal rollers with solvent (do not use solvent on foam paster roller). Periodically check alignment and bearings of all rollers.

4-5. Motors, lubrication and filters: Follow manufacturers instructions (see pages 131).

6. Web-up chains: Clean, check adjustment and lubricate.

Pasters and Splicers

7. Brakes: Clean pneumatic brake discs/pads and check adjustment. Change pads when they approach recommended minimum thickness (worn brakes cause web breaks and running problems). Do not use substitute pads that do not conform to specifications (e.g. automotive). Check diaphragms for leaks (symptom is hissing air when the press is stopped).
Electro magnetic brakes: Clean and reset following supplier's instructions.

8. External belt drives: Check condition for wear and tension. Replace worn belts with recommended models (non-conforming belts are a source of operating problems that are difficult to identify) (see page 131).

9 & 10. Motor drives: Follow supplier's instructions to check and replace encoder and linear compensating belts.

11. Chucks: Clean jaws each month using a brush soaked in a cleaning solvent and then lightly oil. Every 6 months disassemble chuck, clean and lubricate assembly. Check bearing condition yearly.

12. Airshafts: Check lugs and air bladders for correct expansion, replace as required. Ensure a clean and dry air supply to avoid deterioration of air bladders; check and adjust air pressure to correct setting.

13. Flying pasters

Pasting roller: A dirty, worn or incorrectly set foam roller (or brush) will not apply enough pressure to the splice tape leading to a splice failure.

Vacuum clean rollers then wash by hand to eliminate glue residues. On foam rollers use an industrial degreaser but not solvent. Clean brushes with a commercial solvent. Check roller re-bound and surface condition yearly and replace when necessary.

Knife timing: Regularly check splices from each arm to see that they are consistent.

14. Zero speed splicers

Dancer rollers: Check alignment of rollers and measure bearings periodically (non-parallel rollers and worn bearings cause web breaks and reduce running speed). Level the dancer and clean slides to ensure smooth motion.

Dancer chain: Clean and lubricate. Check chain and sprockets for wear.

Dancer air cylinders: Check pressure setting regularly. Locate and fix air leaks.

Infeed and web guide

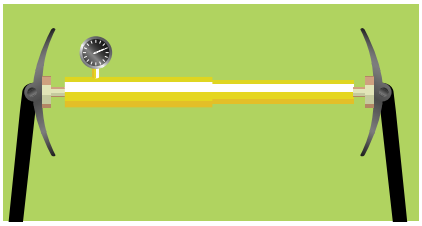
15. If the draw (tension) across the web is uneven it will cause excessive web wander. Check nip roller adjustment to make sure it is parallel with correct pressure.

Rubber coated nip roller surface becomes harder with age leading to unstable tension with slippage. Check surface hardness with a Durometer.

Too rapid movement (pumping) of the infeed compensator or web guide, will cause high tension fluctuations often leading to web breaks. Service technician to regulate.

A web guide carriage jammed at maximum correction causes creases and excessive web shift leading to a downstream web break. Causes may include a defect in the web guide, or incorrect position of roll in the paster, or loss of tension at any press drive point.

16. Web catcher severer: This is a device to minimise equipment damage from web breaks. For it to work reliably it needs to be cleaned regularly and the settings periodically checked. Clean severing device rubber bellows, finger guard and roller.



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1- *Clean and inspect roll clamp blades daily. Ensure corners and edges are well rounded and that clamp pressure is correct. Photo MEGTEC.*

2- *Good re-bound of the foam pasting roller is essential for efficient splicing. Photo MEGTEC.*

3- *Worn brake pads cause web breaks and running problems. Change them when they approach their recommended minimum thickness. Photo MEGTEC.*

4- *The result of no chuck maintenance is severe wear requiring very early replacement of components. Photo MEGTEC.*

Ink & dampening

	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality
1 Ink supply (pump and piping)			✔				◔			🔍
2 Ink supply (pump line filters)		✔			✔					🔍
3 Dampening fountain unit	✔									
4 Clean dampening system, change filters		✔					◔	⛔		🔍
5 Refresh dapening water		✔	✔				◔	⛔		🔍
6 Annual system overhaul						✔	◔	⛔		🔍

Frequency *Related problems: ◔ Slow running, ⛔ Machine stop, ⚠ Safety, 🔍 Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

Dampening systems are continually contaminated from paper and ink particles, organic pollution and blanket washing solvents. A poor quality solution causes difficult ink/water balance, higher chemistry costs, environmental problems, debris build-up on rollers, plate and blanket cylinders.

1

1- Dampening system monitoring tools include digital conductivity meter, pH meter and probe thermometer (digital devices are more accurate and easier to calibrate), a hydrometer to test IPA % and a water hardness tester. Photo Sun Chemical.

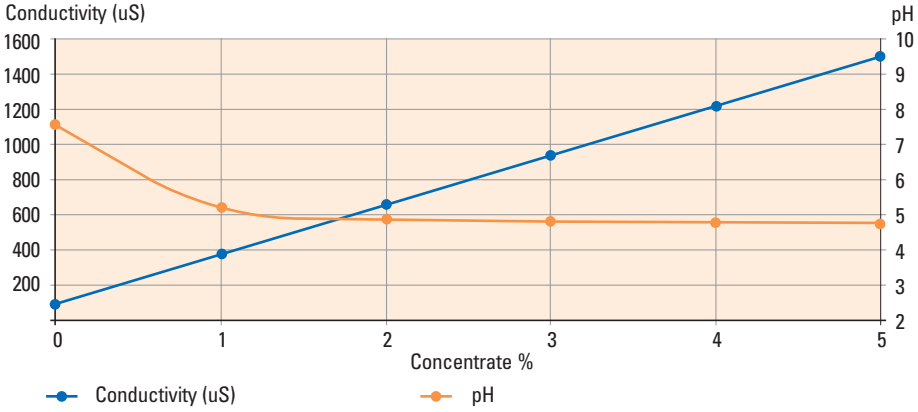
• The first productivity step is to ensure the right combination of ink and dampening solution to match the press, papers, IPA level and water quality at each plant.
• The second step is rigorous preventive maintenance of the dampening system and its chemistry.

1-2. Ink supply: Check pumps and lines each month for leaks and malfunctions. Most lines have a series of filters to catch any particles that would cause problems on press. Clean and inspect all filters every six months to avoid a build-up that could break through the filter and feed through to the ink duct. To reduce the risk of an unscheduled stop from running out of ink each pump should have an alarm at the press to indicate when a barrel or silo needs to be changed.

Dampening system

Incoming water should have a stable pH and constant conductivity suitable for printing. The dampening solution requires additives to stabilise water pH value to ensure good printing, control plate corrosion, prevent roller stripping and blanket piling, improve surface tension properties and reduce IPA content. Buffer systems additives inhibit equipment corrosion, control bacteria growth and alkaline impurities from papers and other contaminants.
Conductivity measures the quantity of dampening solution additive. This value is influenced by IPA concentration and paper and ink impurities. A normal conductivity range for newspaper printing is 1000-1200 m/cm, heatset printing is more variable depending upon IPA content (values can be higher or lower but they need to be stable ± 50 micros m/cm). A reference value can only be measured when mixing fresh solution. Subsequent readings will identify solution pollution level (conductivity increases with contamination from paper and non water resistant ink pigments; decreases with contamination from blanket wash, ink binder ingredients and paper dust). For more information see "Dampening solution fundamentals of offset dampening" published by Sun Chemical Hartmann.

Chemistry Line Graph - Control of dampening system.



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***2-** Conductivity will rise continually as the dampening solution dose is increased in buffered solutions. When the pH reaches its buffer level it will become stable even though the concentration of the solution continues to increase. Chart: Sun Chemical.*

Maintenance

3. Daily: Check temperature, conductivity, pH value and alcohol content.

4. Weekly cleaning: Solution tanks and pans for optimum water receptivity.
- Drain system pans, lines and tanks. Refill with hot water.
- Add prepared dampening system cleaner, and pump into pans to circulate.
- Maintain flow of cleaning solution through system until only discoloration of the solution is visible, and no large particles are left.
- After system is clean, drain, flush with clean water, drain, and wipe out pans and tanks.
- Change all filters before refilling with dampening solution.
- Before dampening solution is pumped into pans clean all damper rollers and etched chrome rollers.
- Desensitise roller surfaces by cleaning and etching them (rubber, chrome and ceramic rollers).

For recommended temperatures for heatset printing (see page 115).

5. Refresh dampening water: Each 2 weeks for alcohol-free solutions; each 4 weeks for IPA solutions.

6. Annual maintenance
1 Empty the dampening system and remove all filters.
2 Sufficiently fill the reservoir with cleaning solution to ensure a smooth circulation.
3 Circulate 2 to 3 hours. (Turn off freezer unit and run warm whilst cleaning).
4 Empty the reservoir and rinse with water for at least 10 minutes.
5 Re-empty the reservoir and rinse with water and 2,5% of dampening solution additive.
6 Empty the reservoir and re-fill with dampening water, ready for use.

Common maintenance related problems

Dampening solution is not circulated (or low flow rate): Blocked filters (feed pump inlet or between pump and heat exchanger). Incorrect pump direction or insufficient power: Check phase rotation of pump motor and change if necessary. Dampening solution level inside the tank is too low: Check fresh water supply and clean fresh water inline filter.

Air cooling not working: High pressure malfunction: Clean condenser plates and ensure free air flow throughout the unit; verify room temperature is not over 40°C/104°F. Press reset button on high pressure switch.

Water cooling system not working: High pressure malfunction: Ensure circulation of chill water is correct and filter is clean; verify chill water inlet temperature is about 25°C/77°F. Press reset button on pressure switch.

Additive dosing system not working: Interruption of fresh water supply: Check additive dosage mode is activated; clean fresh water inline filter; ensure fresh water supply pressure (min. 1 bar/26 GBH) and flow rate (min. 100 l/h / 14,7 psi). Interrupted additive supply: Blocked foot filter at the end of the suction pipe or insufficient additive in container.

Too low alcohol level in dampening solution: Check if alcohol dosage mode is activated; blocked foot filter at the end of the suction pipe; insufficient alcohol in container; blocked ejector nozzles of alcohol stabiliser.

Too high alcohol rate in dampening solution: Dirty or broken alcohol supply solenoid valve.

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1- *Dirt build-up on the alcohol stabiliser float adds to its weight and can change the alcohol content in the dampening solution. Photo Technotrans.*

2- *Corrosion of mechanical parts from using incorrect or aggressive additive or low quality alcohol. Photo Technotrans.*

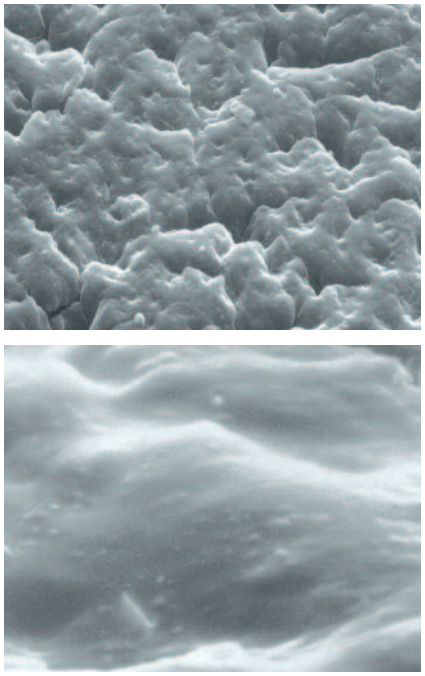
3- *An in line ejector nozzle contaminated with ink from either using the wrong filter element or poor maintenance. Photo Technotrans.*

4- *Overload of a poorly maintained intermediate tank. Photo Technotrans.*

Rubber rollers

Inking and damping rollers	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality
1 Hardness and visual surface check				✔						
2 Roller setting check			✔							
3 Roller cleaning	✔									
4 Roller decalcifying		✔								
5 Roller deep cleaning		✔								
6 Bearing check				✔						
7 Bearing replacement and seat check						✔				

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.



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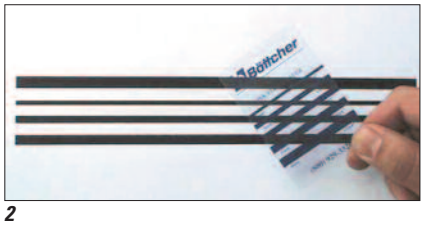

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1- *Clean and glazed roller surfaces viewed under a microscope. Photo Böttcher.*

2- *Always ensure the stripe is parallel across the width of the press and check settings using a card with pre-printed roller stripes. Photo Böttcher.*

Press rollers are deformed up to 100 compressions per second and interact with ink, dampening solution and the plate generating high dynamic, thermal and chemical stress. Only the correct selection, setting, cleaning and care of rollers will provide printing quality, productivity and long life.

1. Hardness and visual check: Check the durometer (hardness) of a roller regularly in relation to the type and sensitivity of the application (every 4-8 weeks for newspaper presses; high speed commercial presses may need checks every 1 or 2 weeks). Carefully check the yellow and red units of heatset presses as these often run hotter and use inks with higher swell rates than other units.

Rollers harden over time from exposure to inks, founts, solvents and the atmosphere. Rubber with an original durometer of 30° Shore-A may harden to 33-35° Shore on a newspaper press during the first few months of use. A high reading, or accelerated hardening, indicates that some materials in the process are not compatible. Accelerated hardening can indicate that rollers are progressively shrinking. Re-setting a shrunk and hardened roller to its original stripe will restore its transfer capabilities and should solve density problems. However, the nip becomes harder than before, which increases its pressures and raises running temperature. An increased durometer can also be a sign that a hard film has accumulated on the roller leading to a glazed surface.

2. Roller setting check: Always ensure the stripe is parallel across the width of the press.

Check settings using a card with pre-printed roller stripes.

Setting rollers too heavily on one side causes uneven ink and water transfer to the plate and roller damage from heat overload.

Rollers that are too tight, or have excessive hardness, may cause plate cracking.

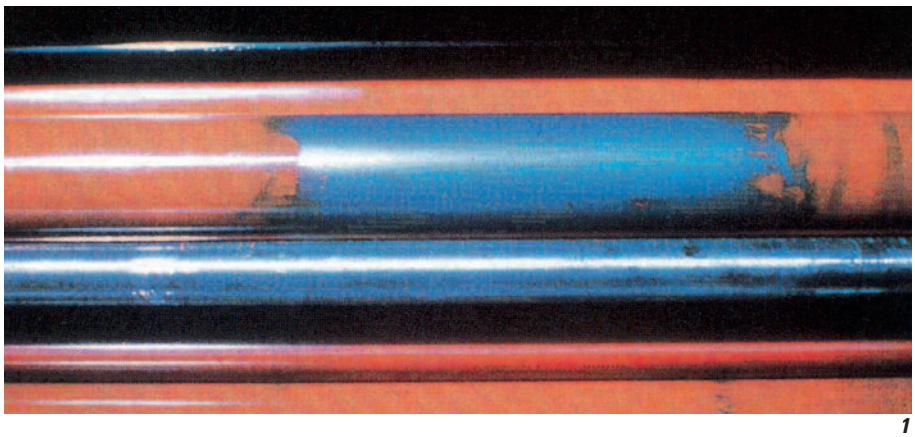
3. Daily roller cleaning: Use a compatible solvent (see page 130). Deposits of paper fibres, dust (lint), fillers and hard kaolin clay (from coated stock) are best removed with water.

4. Roller decalcifying: Regularly remove harder deposits (such as calcium carbonate) with a special decalcifying agent.

5. Roller deep cleaning: If the hard film accumulated on the roller surface is not removed regularly, the roller will glaze over and its ability to transfer ink and water can be drastically reduced.

Caution: consult your roller manufacturer before using "deep-cleaning" products to ensure there are no negative long-term effects on the rubber (swell or shrinkage).
Use recommended products to rejuvenate rollers every 6 months.

6. Bearing check: Spin bearing by hand and listen and feel for rough spots. Rock bearing from side to side and compare movement with a new one. A bearing that fits well should not move on the shaft.



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7. Bearing replacement and seat check: If the roller is to run to its full performance it is important to use only the right parts that are correctly assembled.

- Always use the bearings specified by the manufacturer. Bearings of inferior quality can run warm and seize up on press, causing considerable damage. (Caution: A DIN/ISO reference number covers only dimensions and does not mean that all bearings with this number are of equal quality.)
- Always fit new bearings when a roller is removed from the press and re-covered. Worn bearings and shafts will not run smoothly and can lead to excessive vibration, which may show up as stripes in the print copy. Roller suppliers can advise on which parts are re-usable and which should be mounted only once.
- To ensure a snug and straight fit, always use appropriate tools when mounting or dismantling bearings and other parts.
- A major cause of running problems is hammering on bearings with the shaft resting on a concrete floor.

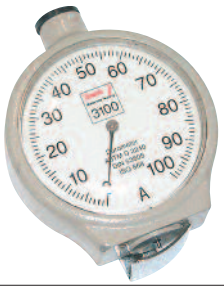
Running narrow webs: Avoid printing difficulties and damage to rollers by:

- Heatset presses: Use a fine screen on the plate edges to remove ink from the rollers. Keep the water ducts open across the full width of the press and reduce the amount of ink outside the web area. Do not allow ink to accumulate and dry up on the roller edges (causes ink fly/misting, rubber picking and roller disintegration).
- Newspaper presses: Use "blind plates" outside the print area. Keep the water open over the full press width. Lubricate inking rollers with a roller protection paste or oil.

Roller swelling and shrinkage: Caused by chemical incompatibility of roller rubber with ink, dampening solution additives and solvents that change the roller dimensions deteriorating print quality and consistency. Some printers mistakenly fit rollers with a lower durometer that often accelerates shrinking and hardening. Shrink-resistant rubber grades are available but it is important to test their chemistry compatibility before using them.

- Swelling: Ink form rollers squeeze more water off the plate, causing the plate to pick up more ink and scum in non-image areas.
- Shrinkage: A gradual and continuous loss of transfer pressure and quality making it difficult to maintain ink/water balance. Shrinkage over a long period often develops a "flare" on the outer edges.

- Roller suppliers can determine the specific roller covering with the highest level of chemical compatibility to provide dimensional stability of the rubber.



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***1-** Rollers that are not cleaned correctly become glazed and hardened.* Photo Böttcher.

***2-** Use only a hardness measuring instrument conforming to DIN EN ISO R868. To ensure an accurate reading requires the gauge to be held vertically and the reading made after waiting 3 seconds.* Photo Böttcher.

***3-** Roller damaged due to uneven setting that has significantly increased running temperature.* Photo Böttcher.

***4-** Always use the right tools to ensure a snug and straight fit of bearings.* Photo Böttcher.

Blankets

	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality	Time minutes
1 Clean blankets at end of run and inspect	✔										< 5
2 Use correct washing solvents											
3 Check blanket packing thickness on press			✔								< 5
4 Replace blanket and packing correctly				✔							
5 Tension correctly											

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

The blanket is central to good offset printing and requires careful selection, packing, tensioning and washing to ensure printing quality, durability and minimum press down time.

1. Clean and inspect blankets at end of each run: Adapt washing frequency to paper grade and quality.

Hand wash as soon as possible after production. Firstly remove paper lint and coating residue with water, then remove remaining ink with a suitable wash. Dry blankets immediately as damp blankets have increased risk of swelling or fluid permeating into the carcass. Inspect lock-up and check blanket condition during cleaning.

Automatic washing systems using low evaporation (non-VOC) washes have a high risk of fluid entry and swelling of blankets. Adjust programmes to use the minimum solvent possible and start wash cycle just before the next run to minimise the time the blanket is left wet.

2. Washing solvent: The wash must be chemically compatible with the blanket and conform to health and safety standards (see page 130).

Avoid using washes with polar solvents that are health hazards and will damage the blanket. Generally any wash that dries quickly and cleans extremely well is probably harmful to the blanket. Rejuvenators should only be used if the surface rubber is glazed and no more than once a week.

3. Thickness and height on press: All blankets rapidly lose some thickness as they settle in (a loss of about 1,5 to 3% of original thickness is generally acceptable, but over 4% often causes problems). The total height of blanket and packing can be measured on press with a Blanket Watch pin gauge or an Elcometer. The blanket impression profile across the cylinder can be assessed using a special carbon paper run through the nip with impression on (this test does not measure compression).

4. Correct blanket and packing change: Most printers run blankets until they are damaged (except 4-high blanket-to-blanket presses where registration is the critical change factor). Many daily newspapers change blankets every 3 months, but changes on heatset presses are more frequent because of surface damage from edge cutting or piling. Some guidelines include:

Change only the damaged blanket if others are in good condition.

- Change both blankets in a double width newspaper unit after a paper jam (keep the good one for later use with another blanket of the same thickness).
- Use blankets from the same manufacturer and type in a press. Do not mix them as different blankets have variable transport behaviour (unless advised by your blanket manufacturer).
- Clean and check the packing.

All elements should be measured prior to fitting on press because they have variable tolerances (the thickness printed on the blanket may not be absolutely correct). The amount of packing for different blanket types is rarely identical (differences in elongation, compressibility and compressible layer and the exact blanket height depends on:

1. The amount of blanket squeeze needed at blanket-to-plate and blanket-to-paper nips.
2. Cylinder diameter.
3. Weight of paper (except self-adhesive foils)
4. The brand and type of blanket (the most important factor).

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1- Use a blanket watch to measure blanket height on the press cylinder. Photo manroland.

2- A spring gauge measures blanket thickness outside the press.
Photo Trelleborg Printing Solutions.

Packing height: Many printing problems are related to the height of the blanket over the bearers:

Overpacked
- Change in web feed
- Premature plate wear or cracking
- Excessive tone value increase (TVI)
- Damage to blanket
- Contamination of succeeding inks
- Excessive web tension increase leading to a break
- Splices break in the first printing unit

Underpacked
- Change in web feed
- Poor solids
- Tone value decrease
- Excessive ink and paper piling
- Increased web break risk

It is also important that cylinder bearers are correctly set and regularly checked. If streaks become visible mechanical damage may have already occurred.

Self- adhesive packing foils do not swell and are changed less frequently than paper based materials and are rarely adjusted for papers between 32-150 gsm (22-100 lbs). Blanket washing solutions can dissolve the foils along the edges and in channels. Change them when the blue coloured glue is visible through the transparent foil and apply anti-corrosion treatment to the cylinder (foils cannot be re-used once removed from the cylinder). Beware of foil migration towards the gap that can lead to cracking.

Replace packing correctly: All blankets should be evenly packed to the same height from unit-to-unit to equalise the draw between units.

Position packing 0,5 mm (0,02") from the gap to ease the path of the blanket into the gap.

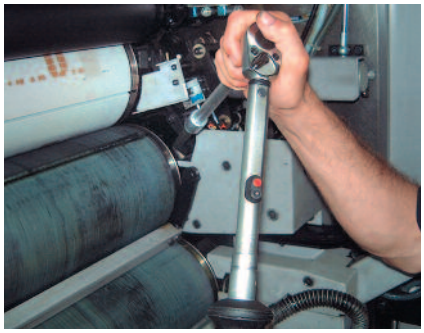
Do not mix packing thickness, or use thickness different from those recommended by the press manufacturer (unless advised by the blanket manufacturer).

5. Correct attachment and tension: Incorrect attachment may create a tension peak across the web. A loose blanket is immediately visible and audible but deterioration from over-tension shows over time with lower smash resistance, sinking and even tearing at the gap.

Follow the press manufacturer's tension specifications. When recommended, use a torque wrench (regularly calibrated) and never exceed recommended torque because the blanket may lose thickness around the gap. Mechanisms with bolts must be adjusted evenly because over-tightening the end bolts may pull the bars off the blanket, tighten from the centre out to avoid distortion. Make sure screws are clean and lubricated to avoid any hard point that may alter torque reading.

When new blankets are run for the first time they lose height and grow a little in length. They should be re-tensioned after 20 000 to 50 000 revolutions to avoid the trailing edge becoming slack causing doubling (also possible blanket cracking or tearing).

Do not re-tension again, as this will over stress the blanket.



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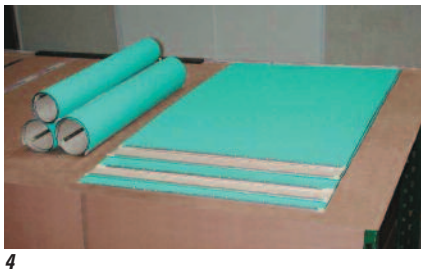

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***1-** Make sure torque wrenches used for tensioning blanket are regularly calibrated. Photo manroland.*

***2-** Tensioning blanket with a small torque wrench. Photo Trelleborg Printing Solutions.*

***3-** Incorrectly stored blankets will be damaged and often cannot be used. See page 133 for correct storage.*
Photo Trelleborg Printing Solutions.

***4-** Blankets should be stored flat to prevent an against-the-print-direction set that makes them harder to mount.*

Printing unit

		Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality	Time minutes
1	***Cleaning routines***	✔	✔						⏻		🔍	
	Clean all sensors	✔							⏻		🔍	< 5
	Clean bustle wheels & web guide rollers		✔								🔍	< 5
	Clean and check safety guards			✔						⚠	🔍	< 60
2	***Blanket***: Clean and inspect	✔									🔍	< 5
	Inspect blanket condition and tightness		✔								🔍	< 30
3	***Ink rollers: Clean and inspect***	✔									🔍	< 30
4	***Ink blade, fountain and film roller***			✔							🔍	< 60
	Clean roller wash-up device		✔								🔍	< 5
	Roller wash-up doctor blade, check wear			✔							🔍	< 60
	Clean ink duct level detecors		✔						⏻			< 5
	Finger guards, clean and check gaps		✔							⚠		< 30
5	***Dampening system on press***	✔									🔍	
6	***Plate & blanket cylinders cleaning***		✔								🔍	< 10
	Plate lock-up clamps, clean and inspect		✔							⚠		< 10
	Clean bearer rings, check lubrication	✔										< 30
	Check bearer ring pre-tension					✔					🔍	< 60
	Rotary union, check for leaks			✔					⏻			< 10
	Print unit brake maintenance						✔			⚠		< 30
7	***Check oil circulation indicator***	✔							⏻			< 5
	Inspect lubrication system & oil level		✔						⏻			< 15
	Central lubrication check for leaks			✔					⏻			< 60
	Greasing as specified				✔							< 60
	Clean drive motors				✔				⏻			< 60
	Replace oil filter						✔		⏻			< 60

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

Accumulated ink and paper debris is a major cause of unscheduled stops and malfunctions. The cylinder bearer surfaces must be kept clean and lubricated at all times to avoid premature wear. Photo manroland.

Maintenance

1. Cleaning routine: The accumulation of dirt and debris is a major cause of unscheduled stops and malfunctions (see pages 130-131). Special attention to clean all safety guards and check their correct operation.

2. Blankets (see pages 142-143)

3. Rubber roller (see pages 140-141)

4. Printing couple: A major condition for efficient press pre-setting is that inking and dampening systems are correctly set and consistently maintained.

INKING SYSTEM

Ink blade, dampening solution and film roller: Follow the manufacturer's instructions to check their settings each month after cleaning: fill dampening solution with ink to ensure the pressure on the blade is correct; set all ink keys to zero and put a minimum ink film on to the dampening roller; then check if the minimum film is correct thickness and adjust if needed. Ensure the film roller does not touch the dampening roller. For inking and dampening roller stripe width (see rollers page 140-141).

Clean roller wash-up device: Remove the doctor blade and trough for cleaning. Remove any hard residues that can damage the blade or oscillator roller and check blade for wear. Make sure the doctor blade never runs dry.

Ink oscillator rollers: Clean regularly to prevent build-up of a contaminated film that can glaze the rollers causing poor ink transfer (an unstable ink-dampening solution may also glaze rollers). Rapid anti-glaze remedies include cleaning with a mildly abrasive roller cleaner, or a mild acid (citric or acetic), or strong dampening solution, or spray common vinegar on to the effected spots.

Finger guards: Clean the guards and check the gaps to minimise ink drips and blobs that are a source of web breaks and marking. Daily: When the press is stopped wipe over with a cloth. Weekly: Clear any large amounts of build-up.

5. Dampening systems

Always clean the inking unit first. Weekly: Close, clean and check the feed and return lines, remove and clean trough. Always keep spray bars and dampening solution rollers horizontal when dismounting (see page 138).

Spray dampening: Protect the nozzles whilst cleaning the inside and outside of spray bars (avoid high pressure that can drive water into electrical components). Check the nozzles are clean with a magnifying glass and clean only with compressed air or ultrasound. Rinse thoroughly and allow to dry. Safeguard electrical components with a protective wax. After re-assembly check the gap is correct.

Film dampening: Daily: Spray rollers repeatedly with washing solution before cleaning them.

Weekly: Clean forme and dampening roller, rinse with water and check for damage. Rub the dampening oscillator roller with plate cleaner (or activation solution) for 3 minutes and rinse, then apply gum arabic and leave overnight to react, rinse with water and allow to dry before starting production. Dry ceramic rollers and apply gum arabic if the press does not run for 3 hours. Avoid contamination by lubricants that deteriorate wetting properties, if needed, degrease with a plate cleaner.

Dampening solution pan: Ensure pipes are clear of obstructions and pans are clean with a strong flow along their entire length to help maintain temperature from input to output within ± 2-3C°.

6. Plate & blanket cylinders

The cylinder bearer surfaces must be kept clean and lubricated at all times to avoid premature wear (change felt pads weekly). Only clean them when the press is stopped. Each week clean the shafts, bearings and side frames. Only the press manufacturer can check the bearer ring pre-tension.

Plate cylinders: Clean surfaces and channels at every plate change with a non-linting cloth and suitable washing agent without damaging the surface. Apply anti-corrosion treatment.

Blanket cylinders: Clean surfaces, clamps, and channels. Apply anti-corrosion treatment.

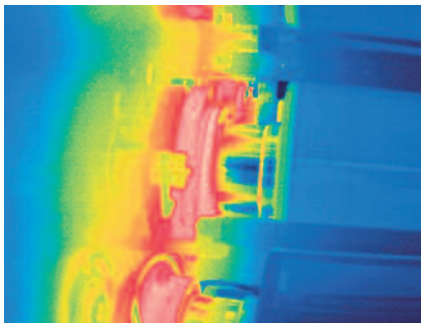
Plate lock-up clamps: Weekly: Clean, inspect and lubricate (acid-free low viscosity oil) work the lock-up mechanism to aid oil penetration and clean excess oil. Monthly, check that clamping bar system screws are tight.

Corrosion: Risk is related to the type of cylinder coating material, water conductivity level (see page 132) and cleaning efficiency. Each week apply anti-corrosion concentrate that is compatible to the cylinder surfaces and channels (spray on, rub in, wipe off after 30 minutes and dry with a dry non-linting cloth). Inspect blanket cylinders for corrosion when changing blankets and apply anti-corrosion treatment. Caution, because self-adhesive packing foils cannot be removed and re-used, they reduce recommended prevention frequency and increase risk.

Automatic blanket washers: Each time the cloth roll is changed, clean the water hose gap, end of cloth sensor, bracket slides and check for smooth rotation.
Print unit brake maintenance: Clean, inspect, replace wear parts following manufacturer's instructions.

7. Lubrication and drive motors: Follow supplier's instructions (see also page 131).

1



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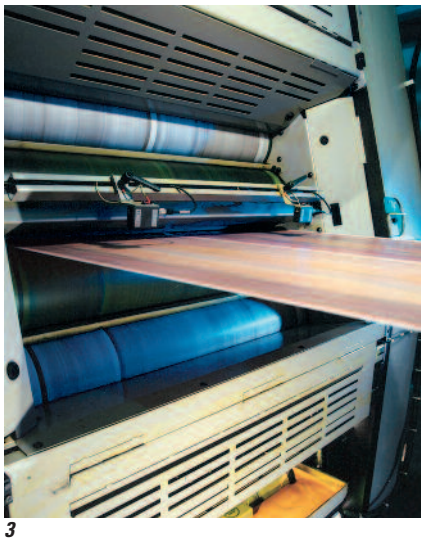


3

***1-** Dirty finger guards with incorrect gaps allow ink to drip on to the causing and marking and web breaks.* Photo manroland.

***2-** Thermographic image of print unit cylinders and bearers that shows the running temperatures of different components.*
Photo manroland.

***3-** Efficient press pre-setting requires that the inking and dampening systems are correctly set and consistently maintained.*
Photo manroland.

Heatset system

	Hot air dryer	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality	Time minutes
1	Compressed air filter(s)	✔										< 15
2	Dryer, Gas manifold: Test for leaks				✔							< 15
	Clean the filter						✔					< 30
3	Burner: Measure flame current				✔							< 15
	Test flame safety devices					✔						< 30
	Change ignition spark plug						✔					< 30
	Replace UV detection cell						✔					< 30
4	Clean & check electrical cabinets	✔										< 30
5	Controls: Clean optical pyrometer			✔								< 30
	Check pressure switches						✔					< 60
	Change thermocouples						✔					< 60
6	Recirculation: Check transmissions				✔							< 60
	Check belt tension				✔							> 60
	Supplying lubricant to bearings			✔								< 30
	Lubricate motors				✔							< 30
7	Clean nozzles			✔								< 30
	Remove paper debris & clean screens		✔									< 30
8	Integrated oxidiser: Service and testing						✔					
9	***Chill rolls***: Clean cylinder surfaces	✔	✔									
	Check rotary unions			✔								
	Check cylinders for wear & damage					✔						
	Check pressure roller & pneumatic setting			✔								
	Internal scale removal from cylinders						✔					

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

1

2

1- *The result of poor burner maintenance and/or incorrect setting of air-gas mixture can destroy the burner. Photo MEGTEC.*

2- *Ink deposit formation can happen on all dryers if the paper screens are not cleaned regularly. If ink deposits are not removed they will lead to marking, edge tearing and web breaks. Photo MEGTEC.*

Heatset dryer

1. Clean air filters: To avoid disturbance of the infrared camera and the UV cell.

2. Gas manifold: Safety first as gas leaks can cause an explosion. Always turn OFF gas supply before taking any action. Only gas certified personnel can work on the gas train and lines.
- Test gas manifold for leaks using a foaming liquid or gas leak detector. Repair if needed.
- Clean the gas filter, a blocked filter can lead to flameout and to slow heat-up time.
- Test pressure continuance every two years as fluctuation can lead to problems of flameout, heat-up, or temperature control.

3. Burner and combustion chamber: Avoid flameout and press down time by testing flame safety devices regularly (follow supplier's instructions). A defective UV cell, or amplifier, indicates degradation of the flame safety current. Check the flame controller to ensure the signal is correct (remove UV cell and note the flame failure signal). When changing the ignitor replace it in exactly the same position. Replace and test UV cell. The UV cell and burner sight glasses should be checked and cleaned with a dry cloth when the dryer electrical power is switched off.

4. Electrical cabinets and motor maintenance: Follow supplier's recommendations (see page 131).

5. Control: The optical pyrometer must be kept clean to avoid contamination effecting its readings. Dismount the pyrometer and clean carefully to avoid damage. Gently blow off fine particles, then remove others with a flexible brush, clean off any remaining dirt with a cotton wool bud soaked in distilled water (add a little soap to remove oil or fingerprints). Leave to dry in the air. Do not use compressed air, solvents or solutions that attack plastics and avoid spilling any liquid around the lens.

Pressure switches should be removed and cleaned following supplier's instructions (never use compressed air in the direction of pressure switches). Check them by measuring their pressure and compare readings to manufacturer's setting instructions (only qualified personnel can replace and calibrate these switches). Immediately replace any faulty switches. Replace all thermocouples by qualified personnel (note the type and order before replacement).

6. Recirculation: Check transmission, bearings and universal joint. Tighten and adjust if needed. Measure the belt tension and adjust to supplier's instructions and replace as needed. Periodically grease all bearings and replace each two years.

7. Inside the dryer: Web breaks and marking are frequently caused by loose paper sticking on filter screens. This burns and disintegrates into fine particles that pass through the screen into the air bars.

Thoroughly remove paper debris after a web break with a vacuum cleaner. Use a wire brush or scraper to remove build-up from the air bars. Periodically remove the nozzles and clean any paper and ink deposits, ensure correct position when replacing them.

Annually: Check all gaskets inside the plenum for leaks and correct if necessary. Verify that settings of safety devices and temperature regulation match the original settings and record the data. Reset if needed.

Web-up doors: Check the safety bar operation at recommended intervals. Inspect door seals for binding, wear, blow-by or abrasion.

8. Dryers with integrated oxidiser: Check inside the burner chamber to verify the condition of the insulation and ductwork and the function of the hot air damper. Check plenum temperature, regulation, safety, vibration. Inspect the heat exchanger facade. Correct any discrepancies. Oxidisers normally require an annual emission test, contact the supplier or authorities to verify the readings.

Chill roll system

9. Cleaning chill roll surface: Use a soft cloth and solvent to remove any contamination. Sources of chill roll deposits are resin drops, ink fly and solvent condensation (see page 84 for more information).

10. Rotary unions: Check for leaks and lubricate if required (unless maintenance-free type).

11. Cylinders: Check for wear and damage.

12. Internal scaling: Water contaminants build-up scale that progressively reduce energy transfer leading to marking and speed limitation. An uneven temperature profile across the chill cylinder indicates restricted flow. Cleaning frequency depends on water quality (minimum yearly). Because cleaning uses a hydrochloric acid mixture (or substitute) it is essential to follow recommended procedures and safety precautions.

13. Nip roller: Check it is parallel otherwise draw across the web will be uneven leading to excessive web wander. The chill acts like an outfeed and regulates the web speed by gain of a driven cylinder that must be coherent with the press line

☞ *For more information on dryer and chill roll operation see pages 82-85 and pages 114-115.*

1

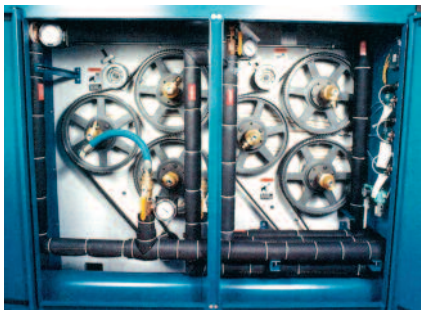
2

3

1- *Paper-ink debris can form hard and sharp growths that project out of the air bar slots leading to smearing and web breaks.*

2- *If paper sticking to filter screens is not removed it will burn and disintegrate into fine particles leading to a pressure switch fault stopping production or cause condensation.*

3- *Paper sticking to the supply fan filter screen will burn and disintegrate into fine particles that pass through the screen and into the air bars leading to a pressure drop and marking. Photos MEGTEC.*



Adjust chill rolls temperatures with the dryer. Ideally each outlet port should be equipped with a thermometer to check temperature (or use an IR gun). Chill roll temperatures should be monitored to ensure settings do not deviate from their optimum profiles. Photo MEGTEC.

Folder

	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality	Time minutes
1 Clean mechanical elements	✔							●		●	< 10
2 Clean detector sensors	✔							●			< 5
3 Cutting cylinders, check knives and block	✔									●	< 5
4 Check slitter assembly		✔						●		●	< 5
5 Clean conveyor system		✔								●	< 10
6 Lubrication system oil level, check		✔						●			< 5
7 Jaw cylinder brushes, check			✔							●	< 5
8 Folder tapes, check			✔							●	< 30
9 Belt delivery tapes, check			✔							●	< 5
10 Safety devices, check			✔						●		< 30
11 Delivery fan & stepping wheel, check				✔				●			< 30
12 Folder guides, check dimensions				✔						●	< 30
13 Timing belt, check				✔			●				< 30
14 Disc brakes, check				✔				●	●		< 5

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

A strobe scope is a useful tool to help identify running problems on moving equipment. Photo manroland.

Most folder problems and web breaks can be avoided by:

- Following preventive maintenance routines in the supplier's manual.
- Correct and regular setting of critical components (slitters, tabloid slitters and nipping sections).
- Correct faults as they occur using a common sense approach.
- Change consumable parts in time to avoid slow running and press down time (slitters, knives, cutting bars, pins, belts, and trolleys).

1. Clean mechanical elements: Clean the mechanical elements, signs and indicator lights. The accumulation of dirt and debris is a major cause of unscheduled stops and malfunctions. Debris build-up on former and turner bars is a frequent cause of creasing leading to web breaks. Use an industrial vacuum cleaner daily to eliminate dust and debris.

2. Sensors: Clean the folder jam and web break detectors.

3. Cutting cylinders: Check knives and block (folding blade and rollers, cutting rubber, jaws, knife pins). Follow the manufacturer's instructions for set-up and replacement parts. Adjust collecting or tucker blade cylinders diameters correctly.

4. Slitter: Poor cutting leads to jams. Ensure the assembly is correctly set and blade sharp (the correct blade setting should be just contact-free from the cutting block).

5. Clean conveyor components: Ensure belt, tape roller, tension pulleys are correctly set. Replace when worn or damaged.

6. Lubrication system: Follow manufacturer's recommendations. Check oil level and filter, change at specified intervals.

7. Jaw cylinder brushes: Check for wear and damage.

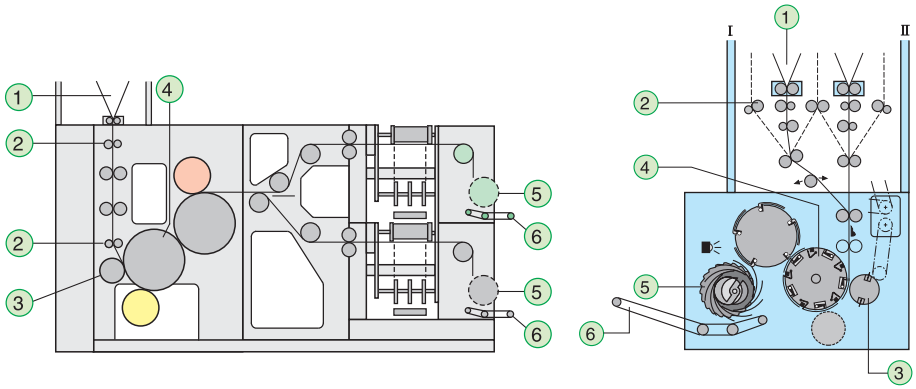
8. Folder tapes: Check for wear, damage and tension.

9. Belt delivery tapes: Check for wear, damage and tension.

10. Safety devices: Check that mountings are secure, correctly aligned and complete.

11. Delivery fan and stepping wheel: Dirty, damaged or incorrect adjustment may result in a jam.

Commercial combination folder and newspaper folder



1. Former - 2. Nip rollers - 3. Cutting or folding cylinder - 4. Collecting or tucker blade cylinders
5. Delivery fan - 6. Transport belts

12. Folder guides: Check dimensions against the reference dimensions.

13. Timing belt: Check tension, inspect for wear, damage and oil contamination.

14. Disc brakes: See manufacturers schedule. Check thickness of pads; inspect for wear, damage and oil contamination.

Common maintenance related folder problems

Superstructure draw (drag) rollers: Adjust trolleys to just touch the web (tears in the ribbons are caused by a too high pull, a pull too low causes uneven web tension leading to web wander).

Nip rollers: Ensure they are parallel with even pressure across web. When setting them place a second piece of the paper into the nip and pull it until it tears to determine correct pressure. Nip rollers should also be regularly checked for roundness.

Slitter: Poor cutting may result in a jam. Poor slitting will also result in excessive paper lint to clean away.

Former: Incorrect former angle leads to creasing and high web break probabilities. Do not alter the manufacturer's setting – a worn or damaged former nose has the same effect.

Turner bars: Incorrect angle can cause web wander. Use a marker pen to record correct settings on the bars.

Air pressure: Adjust pressure correctly at turner bars and former plates. Too high pressure leads to wandering; too low pressure causes ribbon creasing. (Newer presses use special coatings on the turner bars and no air is needed.) If incoming air is too hot it can soften the ink and cause marking.

Chopper and cylinder folds: Keep the pull roller springs clean and lubricated, ensure rollers do not become clogged with paper particles (particularly from coated paper).

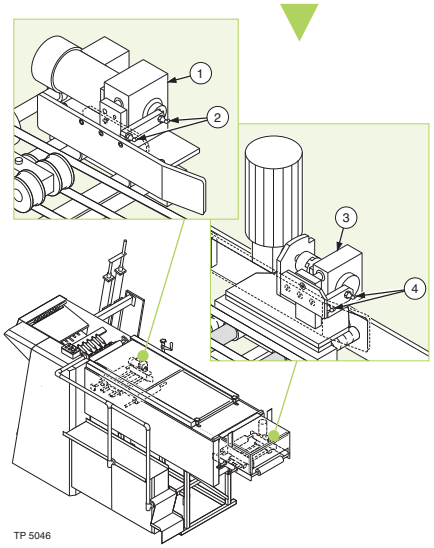
☞ *See also guide N° 2, pages 85-86.*

Stackers

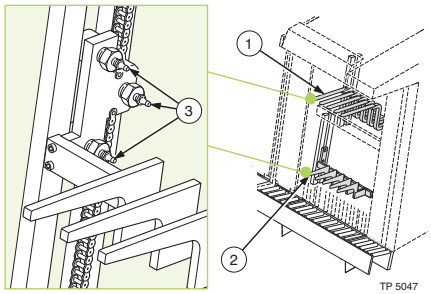
Vertical stackers	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality	Time minutes
1 Remove paper waste	✔						●	●			< 5
2 Clean and check machine & sensors		✔					●	●	▽		< 25
3 Belts, clean, check and replace if worn		✔						●			< 60
4 Check air system for leaks			✔				●	●			< 5
5 Check chains & Sprockets			✔				●	●			< 5
6 Clean air filters	✔							●			< 15
7 Replace end board pneumatic filter		✔									< 10
8 Scheduled lubrication											
- Jogger bearings			✔					●			< 20
- Shaft Bearings			✔					●			< 30
- Cam Bearings					✔			●			< 30
- Check gear box oil level			✔					●			< 60

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

Typical vertical stacker lubrication



Lubricate monthly the waste gate jogger shaft bearings (4) on the waste gate jogger (3) and the blow-out jogger shaft bearings (2) on the blow-out jogger (1).



Lubricate the cam follower bearings (3) on the upper stacking table (1) and the lower stacking table (2) every 6 months. Drawings QuadTech.

All systems

1 & 2. Clean and check routine: A clean machine ensures correct set-up, reduces wear and makes trouble shooting more efficient.
• Daily, removing paper scraps from inside and under machine to avoid jams and component malfunction.
• Use clean soft rags only to clean conveyor belts.
• Clean the lenses of all optical sensors and reflectors.

3. Belts: Check that belts are centred on the guide rollers with tension that ensures consistent signature transport and that belt splices are in good condition.

4. Air system: Check for leaks (see page 132).

5. Chains: If the chain tensioners do not maintain correct tension this will strain the sprockets and the transport speed will become inconsistent.

6. Air filters: Clean and change regularly (see page 132).

7. Control console electrical cabinet: Vacuum clean interior (never use compressed air) and clean or replace the filters (see page 131).

8. Lubrication: Always follow the supplier's instructions as this will prevent premature wear and malfunction. Correct oil level in the central lubrication system protects against premature wear and prevents excessive noise. Change oil at recommended intervals (see page 131).

Vertical stackers

• The critical elements for regular maintenance are air filters.
• Replace weekly the end board pneumatic filter.
• A frequent cause of delivery jams occurs when the stacker or conveyor does not match press speed. It is important that speeds are kept synchronised.

Print Roll systems

	Print Roll systems	Daily	Weekly	months 1	3	6	12	Slow	Stop	Safety	Quality	Time minutes
1	Remove paper waste	✔										< 5
2	Clean and check machine & sensors		✔									< 25
3	Belts, clean, check and replace if worn		✔									< 10
4	Check air system for leaks			✔								< 5
5	Check chains & Sprockets			✔								< 5
6	Control cabinet: Clean /replace filters			✔								< 5
7	Control cabinet: Clean screen & fan					✔						< 5
8	Scheduled lubrication											
	- Aligning units				✔							< 10
	- Door tracks & spur gear drive					✔						< 25
	- Rocker arm roller bearing			✔								< 5
9	Check rocker arm	✔										< 5
10	Roll stand: clean signal tape						✔					< 5
	Roll stand: grease guides						✔					< 5

Frequency *Related problems: Slow running, Machine stop, Safety, Poor quality.*
This is a generic example only. Refer to suppliers recommended procedures and time intervals.

1-7. *See opposite page.*

Double winding and unwinding station

8. Lubrication
Grease the moving parts on the aligning units.
Grease the tracks of the sliding door (allows easier access for operation and set-up to maintain reliable production and consistent product quality).
Grease the spur gear drive to ensure reliable service.
Grease the rocker arm roller bearing to ensure correct functioning and controlled drive.

9. Rocker arm
Clean the belt tensioning and carrier tape guides to prevent belt damage. Check tension of the Poly-V-belts to ensures that signatures are pressed against the drum of the roll stand under constant pressure (for consistent product quality).

10. Roll stands

Clean the signal tape (used for end-of-tape detection) to avoid malfunction or failure of the tensioning belt.
Grease the guides so that they always move freely to ensure gentle control of the tensioning belt and prevent premature belt failure.

1

2

***1-** Reliable production requires good maintenance and a clean environment.*

***2-** Clean rrocker arm carrier straps guides to prevent damage to the roll stand tensioning belts. Photo Muller Martini.*

Glossary

Breakdown, Sporadic Infrequent, sudden and unexpected failures

Breakdown, Chronic Frequent small failures and stops

CBM Condition Based Maintenance

CMMS Computer Managed Maintenance Systems

KPI Key Performance Indicators

LCA (Life cycle Cost Analysis)

MBP Maintenance Best Practice

ME Manufacturing Effectiveness

MIS Management Information System

MTBF Mean Time Between Failures

MTF Mean Time to Failure

MTR Mean Time to Repair

PM Preventive Maintenance: Tasks to minimise breakdowns, or

PM Predictive Maintenance:
Monitor equipment condition to predict maintenance

PPM Planned Preventative Maintenance

Productivity Amount of production (time, copies, value, etc.) compared to input to produce it

OEE Overall Equipment Effectiveness

RCA Root Cause Analysis to identify cause(s) of failure

RCM Reliability Centred Maintenance

SMP Standard Maintenance Procedures

SOP Standard Operating Procedures

TPM Total Productive Maintenance

TQM Total Quality Maintenance

BEST PRACTICE

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www.quadtechworld.com

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