Reducing Plate Cracking on Web Offset Presses

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Prepress Offset Plates
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Overview of Plate Cracking

The predominant cause of plate cracking is metal fatigue caused by plate flexing during the run. Repeated pressure/no pressure action of the form rollers and blanket cylinder causes the plate to flex, leading to metal fatigue, and plate cracking. Plates should rarely crack if they are mounted to a perfect fit on the cylinder and no uneven or unusual stress is applied to them. Of course, in the real world of web offset printing, many factors contribute to a less than snug fit resulting in the stress on the aluminum substrate.

It should be noted, however, that the plate, plate bender, packing material, blanket, mounting procedure, gauge, and dirt or debris lodged under the plate can be contributing factors resulting in plate cracking. Other factors may also contribute.

The following page provides a summary checklist. Additional detail can be found in the body of this report.
Check List – Plate Cracking

Because it is difficult to isolate the cause or combination of causes that result in plate cracking, the following check list can be useful in identifying and correcting the problem.

- Are the plates the correct size for the press?
- Does the plate have the correct aluminum directionality?
- Is the plate gauge correct for the press and bender?
- Is the plate square and burr free?
- Is the bender square and accurate to attain repeatability?
- Is the plate being bent too fast?
- Is the plate being bent while still warm due to baking or curing?
- Are both sides of the plate being bent at the same time?
- Are the bent angles correct after spring-back?
- Is the proper packing material being used?
- Is the packing thickness correct?
- Are the packing sheets the correct size?
- Are foreign materials in the gap preventing the plate from seating? (dried ink, paper dust, etc.)
- Is the plate clamp mechanism mechanically sound?
- Are the plates being bent twice to correct for register problems?
- Does plate polishing on the lead edge occur prior to cracking?
- Are the drive gears and bearers mechanically sound?
- Are the ink and water form roller pressures set correctly?
- Do the ink and water form rollers have the correct durometer?
- Is the blanket packed correctly?
- Is the blanket snug — not loose?
- Are any units more prone to cracking than others?
- Is the correct edge of the plate used as the bender guide edge?
Grain Direction

One method of reducing cracked plates on a web press is to mount plates with a grain direction that is around the cylinder or perpendicular to the axis of the plate cylinder. This is easily checked.

By viewing the reverse side of a one-sided plate you can see this directionality, which appears as a texture in the aluminum substrate. With magnification or by the unaided eye, there should be no problem discerning grain direction on any lithographic plate. It should be noted that it would be extremely rare for grain direction to have an influence on plate cracking on a sheet fed press.

Plate Cracking and Plate Benders

Plate cracking is one of the most difficult problems to solve because of the number of variables to which cracking can be attributed.

Aluminum memory, otherwise known as spring-back, plays an integral role in the prevention of plate cracking. Thinner gauges of plates have more spring-back than heavier gauges and help determine the final bend angle. Aluminum spring-back, in this case, can prevent the plate from seating correctly onto the cylinder lock-up mechanism if the spring-back is more or less than expected.

It is important to remember that the engineered design and settings of the plate bender corresponds directly to the gauge of plate being bent. A different gauge plate will bend to a different angle using the same settings on the bender.

The final bend angle should be verified on the bent plate.

Cocked Image or Inaccurate Bend

A cocked image exposed on the plate can also lead to a cracked plate if the press operator twists the plate on the cylinder to achieve register. A similar problem can occur if a plate is bent inaccurately. A bender must bend square.

Plate Bender Types

There are two basic types of benders: Braker and Forming. As far as we know the “forming” type of bender only comes as an automatic. An automatic forming bender will solve many of your bending problems. The money saved in improperly registered plates can offset the cost of these benders.

A braker bender stretches the metal as you bend it creating fine cracks in the bend. Since repeated bending increases fractures in the structure of the aluminum, each bend should only be performed once.

As with any other mechanical piece of equipment, the bender should be checked regularly since it plays an important role in registration and should know how to check a bender. The diagrams entitled “Manual
Bender Checks” (page 9), “Two of the most Accurate Tools for Measuring Lead Pinned Plates” (page 10), and “The Method of Checking the Squareness of Tail Pinning to Lead Bend” (page 11), will provide some direction when checking the accuracy of a bender.

Checking the Plate Bend

The diagram entitled “Manual Bender Checks” (page 9), illustrates several simple methods of checking the bend from a manual bender. Some of these checks can also be applied to the automatic bender such as the tramming rod.

The diagram entitled “Two of the Most Accurate Tools for Measuring Lead Pinned Plates” (page 10) covers the method of checking the placement of the register holes in relation to the lead bend. We have seen scales, business cards, pieces of paper, and dial calipers used to do this. The most reliable method is the dial calipers method. This method may give a different reading, depending upon the operator and the angle at which the dial caliper is held.

To solve this problem, refer to the indicators illustrated. These indicators will provide you with a consistent reading, independent of the operator. In addition to checking bender performance, they can also be used to check plates that have been mounted improperly.

There is no accurate method for checking a tail register system. The diagram entitled “The Method of Checking the Squareness of Tail Pinning to Lead Bend” provides some guidance for checking this type of system.

Bending from the Proper Guide Edge

The manufactured cut length of any plate will vary within narrow but normal tolerances. It is important that the critical edge of the plate, usually the lead edge, is used as the guide edge in the plate bender to ensure that the critical bend angles and surface dimensions are met. If done properly, the variability in length will occur on the non-critical, non-guide edge (“wild edge”) of the plate. In the drawing entitled “Guide Edge Vs Wild Edge of the Plate” (page 7), guiding with the wrong edge of the plate will cause variability in the thickness of the critical surface held by the plate clamp. This can lead to plate cracking or even to plates pulling out of the cylinder clamps.

The printer should fully understand the implications of the “wild edge” and track it logically back through the prepress operations to ensure that the correct edge is guided into the plate bender.
Guide Edge Vs. Wild Edge of the Plate

Guiding to the wrong edge will lead to variability in the evenness and width of this critical surface.
Bender Pin Systems
All benders may have one or all of these problems.

As in A and B, some registration control is lost in the curvature of the plate. The operator doing the bending can create the same loss. Diagram C may be the one you are trying for, but you still may have a problem.

Diagram D has more problems than E, because in butting the plate to a guide, the plate can walk away from the stop. Both diagram D and E share a similar problem. In both cases you cannot be sure of repeatability in the placement of the pin to the bend. In some cases you can’t activate both clamps until the pins are down.

The only thing you can control is the relationship of the pin to the bend by using an air type system (gravity type are too loose to be accurate).
Manual Bender Checks

Other than not using vacuum, the three largest problems are:

1. The distance “A” from side to side is not the same (check manufacturer’s specs). If this dimension isn’t the same, you will have a tighter bend on one side than the other. The end result is a bend that won’t fit the cylinder properly creating both register and cracking problems.

2. The surfaces “B” and “C” have to be parallel to give you the same bending arc. If they don’t match, you will create a punching action that results in cracked plates.

Measuring the Bends

3. The anvil’s shifting is always in question. Check to see if the bends are parallel. A tramming rod (as illustrated above) can be used for measuring and setting the distance between the anvils. The fingers on the tramming rod are locked into position with four nuts.
Two of the Most Accurate Tools for Measuring Lead Pinned Plates

Indicator Measuring the Distance Between the Hole and Bend
Method of Checking the Squareness of Tail Pinning to Bend

Method of Checking if the Lead and Tail Bends are Parallel
The Press Room

Press crews should follow the press manufacturer’s standard procedure for bending and mounting plates. Establishing mistake-proof pressroom procedures can also help identify problems that lead to cracking.

For example, in one plant, all three shifts were registering using a different press unit as a reference. All three shifts were having cracking and register problems, but one shift had more than the other two. Was it the press crew or the press?

The plant set up a mounting procedure and a register report sheet. These two items identified the problem as having one unit being out of tram. It was the one unit that the crew with the most problems used for registering. Once the problem was solved, the plant saved $500,000 in paper waste during the first year.

The diagram entitled “Bottoming Out of the Tail in the Reel-Rod” (page 14), illustrates another problem. Some manufacturers recommend doing this to ensure that the plate is mounted squarely. This can cause a problem, however, if the reel-rod twists and does not return parallel to the printing surface.

Also in this section are two diagrams entitled “Center Line Marks on Press” (page 15) and “Which Set of Marks is on A or B?” illustrating views on center marks.

When mounting a plate, it is important to avoid distortion of the lead bend going onto the cylinder. A similar problem can happen by mounting the plate off-center of the press.

Plate packing can also cause problems. A plate that is not packed properly can cause cracking as illustrated in the diagram entitled “Improper Plate Packing Can Cause Cracking” (page 17).

If, in the removal of a used plate, you find the packing has dissolved, you have one of two problems. One of the most common problems of packing being eaten away is from running too much ink creating a need for too much water. The second most common is a faulty damping system.
Plate Mounting Procedure

Pre-mounting checks

1. PLATE PACKING - To be 1/4” narrower than the plate width. Approx. 1/16” shorter than the distance between the lead to tail bend.

2. PLATE CYLINDER GAP - Check for ink and paper dust build up. Check oil once a shift.

3. BLANKETS - No tears, delamination, or looseness at the gap.

Mounting

Follow the manufacturer’s recommendations for loading to ensure that plates conform to the cylinder and that there are no opportunities for the plate to flex. Test the final lock-up by smearing some ink on the blanket cylinder gap and inch the press around twice (under impression). Check the ink impression that was left on the plate to make sure there is an equal blank space on each side of the plate gap. If there isn’t an equal spacing, the cylinders are not gapped properly.
Bottoming Out of the Tail in the Reel-rod
(some manufacturers recommend it)

In some cases, such as Baker-Perkins and any other small (3/16-5/16”) tail bend presses, you have to control the bend length by putting the punch stops on the tail side of the plate. For lead pinning the stops would be placed opposite the punched heads. On the remaining presses, bottoming out of the tail in the reel-rod will cause cracking and register problems. Plate walking up the reel-rod is due to bearing, twisting the reel-rod, or bad pusher springs.

Remedy:

1. Replace reel-rods that are bad.

2. Mount plates under impression to control the sliding.

3. Since the second bend goes into the slot, only put the tail deep enough for the lip of the reel-rod to catch the bend.
Center Line Marks on Press
Which example looks like your mounted plate line ups?

A. If you are fortunate enough to see this on your mountings, did you have to twist the plate?
If you didn’t have to twist the plate, can you guarantee you’ll always get this?

B. The reason for this can be:
1. Imaging of plate registration marks is incorrect
2. The bender is out of adjustment
3. Plate mounting procedure is incorrect
4. Bad reel-rods.

NOTE: Tail mark is not required for mounting.
Plate Mounting

From the center or sides

An operator holding the tail with both hands or two operators holding the plate have an 80% chance of creating a soft spot on the lead and the tail, which will crack. The solution is to pull uniformly from the center and let the sides follow.

A similar situation can happen if a plate is mounted from the sides of the press, as it is commonly done on some presses on the upper cylinder positions. Again, a plate should be mounted from the center of the unit to ensure that the gear side of the plate doesn’t lift up.
Improper Plate Packing Can Cause Cracking
A Properly Packed Plate

The 1/8” under cut of the packing on the sides will reduce the water absorbency that leads to cracked plates. Cutting the packing 1/16” short of the tail reduces the high spot on the tail bend from the packing going into the gap. Not doing this will help create cracking when the cylinders are not gapped properly or there’s a loose blanket.

Short Packed Plates Can Cause Cracking

The soft spots in both A and B will allow the plate to flex which leads to cracking.
Gapping and Timing

One of the things most misunderstood by press crews is gapping and unit-to-unit timing. Many press crews think that these terms mean the same thing — wrong! The two are related and one will affect the other.

So what is “gapping”? Gapping is the relationship of the plate cylinder gap to the blanket cylinder gap of a single unit.

Then what is unit-to-unit timing? This is the relationship of the plate cylinder gap of one unit to the plate cylinder gap of the others. Unit timing has nothing to do with the blanket. The timing of a press can be on, but a unit or units can still be out of gap.

We have seen cases where an operator lost some of his bleed getting a job to fit. This operator took the plate back saying the plate was made wrong. In reality, the cylinders were not gapped properly.

The diagrams, entitled “What is Gapping?” (page 19) and “Two Methods of Checking Gapping” (page 20), give you a better idea of what it’s all about. The first method illustrated in how to check your gapping is something you could do every time you mount a plate. This does not mean you have to shut down for maintenance every time you are out a little. However, you should monitor your gapping so when you are at a critical point it does not cost you.

The best time to gap the press is when you check for timing. In setting your timing use your most commonly used stock. The reason for this is that every weight of stock will run at a different circumferential position.

This difference in circumferential positioning is where the two are related. In some presses this is more prevalent than others. When the plate cylinder’s circumferential position can be moved, but the blanket can’t be moved, the gapping can be thrown out. This is one of the reasons for registering off of the second unit. When registering off the second unit you cut down the amount of circumferential move in one direction allowing the balance to be taken up by the first unit in the opposite direction.
What is Gapping?

Simple! It’s the position of the plate cylinder gap to the blanket gap. This relationship of one to the other can determine print length and be the most significant cause of plate cracking.

The mounting holes of the cylinder gears are usually slotted, so the cylinder can slip on emergency (as with web breaks), to save the teeth of gear:

- **IMPROPERLY GAPPED** – This can be from cylinder slippage, improper unit to unit timing, or both.
- **GAPPED Correctly**
**Two Methods of Checking Gaps**

1 - Smear ink on the blanket gap, and roll the cylinders under impression.

2 - The picture left on the plate cylinder, should show an equal amount of blank space on each side of the gap.

1 - Insert a piece of mylar between the plate and blanket cylinder locking it into position by putting the impression on. Now pull the mylar over the blanket gap and cut a notch the width of the gap.

2 - Now compare the notch to the plate cylinder gap. The gap should be center in the notch.
Blankets

Blankets can also contribute to plate cracking. The diagram entitled “Compressible Blankets” (page 22) illustrates one problem: the swelling of your compressible blanket.

In studying the problem, we found that the lead bend length of three quarters of an inch long was shortening up to seven sixteenths of an inch. This action was creating a soft spot on the tail and would crack out. The only factors that can cause this are the excess tension placed on the plate from pressure and the difference in surface speed of the blanket to the plate. This can be caused by the wicking (the absorption of water in the fiber backing) of the blanket or over swelling of the blanket due to the heat of the press.

Another problem can be in how the blanket bars are attached. The three different methods can be gluing, crimping, or riveting. There is nothing wrong with any one of these methods of attaching the bars to the blankets. In one plant a rivet type did not allow the blanket to be drawn down properly, creating a soft spot on the tail that cracked plates.

So, before you change to a different style blanket, check with the press manufacturer. Then, if an unexplained problem arises, check to see if the type of blanket or a blanket change corresponds to the problem. NOTE: A poorly mounted blanket can also cause problems.
Compressible Blankets

Too Much Pressure from Blanket Swelling

A compressible blanket can swell for two reasons. The first reason is blanket wicking. If the edges of the blanket are sealed, the fiber backing will not absorb water (wicking) and swell the blanket. The second reason is the surface of a compressible blanket swells. The compressed portion of the blanket can return to its original size and this swelling can expand too much in some compressible blankets due to the heat of the press. Either swelling action changes the relationship of the surface speed of the blanket to the plate.

The end result is a fatter dot and a lead bend that may be pulled out of the gap, leading to plate cracking. The solution is to use only the blankets recommended by the press manufacturer.
Plate Lock-Ups

There are many kinds of plate lock-ups on the market and there are variations to each of them. Three kinds of examples are: clamp, spring, and reel-rod lock-ups. The two most common are the spring and reel-rod.

Each type has a purpose and its own set of problems, such as the spring lock-ups. The advantage of the spring lock-up is the speed of mounting the plates. This is needed in newspaper or publication plants. Though they can be used for all types of printing, they need constant maintenance and may allow the plate to slip. The setting of the springs and the plate bend lengths as shown in the diagram entitled “Spring Lock-ups Can Cause Cracking” (page 25) applies to the majority of these types of lock-ups.

The diagram entitled “The Method of Checking and Correcting a Spring Lock-up” (page 26) can be helpful. Too often when you have a cracking problem on a spring lock the manufacturer recommends shortening the bend length between the lead and the tail. If the spring is already holding the plate under tension, more tension is only going to weaken the spring faster. A better choice would be to lengthen this distance and get the first bend of the tail deeper into the gap. This will also allow the blanket cylinder to form the tail to a perfect fit to the cylinder, and, at the same time, interlock the tail and lead bend. The interlocking of the two bends reduces the bouncing action of the spring and the flexing of the plate reducing the opportunity of a cracked plate. The reel-rod type is the most positive acting and seems to work better on long run jobs, though they need more care in mounting the plate. Since this type of lock-up is deep inside a narrow gap, the operator cannot easily see what they are doing or monitor the works of the lockup.

These lock-ups differ from manufacturer to manufacturer. The standard Harris press has a fixed position reel-rod, with an under cut for the lead bend with a double reel-rod set screw lock. As in the diagram entitled “The 5 Reel-Rod Positions” (page 24), the ATF and Hantscho presses have a floating reel-rod (with springs) and the reel-rod is locked into position with two dogs. A Baker Perkins has a fixed position reel-rod with a lead edge large enough to take both the lead and the tail bend before it’s inserted into the reel-rod. There is only one setscrew reel-rod lock. To get the most from your press, you must learn how each part of it works, including the reel-rod. As with the ATF and Hantcho presses, many operators do not use both dogs to lock in the reel-rod. When an operator does this, they are allowing the reel-rod to twist, creating an uneven tension on the plate. This difference in tension will cause the plate to slip. With slipping and the uneven tension, a soft area will form and allow the plate to crack (it may also create register problems). Some of the problems that develop in reel-rod lock-ups are covered throughout this publication.

To get the most out of any lock-up, adequate maintenance should be performed. Once a day, the gap should be washed out with blanket wash and then lubricated. This will get rid of the ink and paper dust that builds up in the gap and reel-rod.
The 5 Reel-Rod Positions for ATF and Hantscho Plate Lock-up and Removal
Spring Lock-Up May Cause Cracking if the Bender is Not Set Properly

This example shows the spring lock-up working at its best. There is tension between the plate and spring. At the same time, the tail side of the plate is locked under the lead edge to eliminate bouncing on the tail. The first tail bend is now in the gap so the plate can conform to the cylinder.

This is a typical example of a spring lock-up with a cracking problem. So much tension is placed on the spring that the tail bend is not locked in the lead. The spring is being pulled back past its most optimum holding position. The tail can now bounce (or flex) causing the plate to crack.

See the next diagram on how to check for the proper bend length.
The Method of Checking and Correcting a Spring Lock-up

Bend a plate as you usually do. Then cut the plate into two pieces, one piece being three inches from the first bend on the tail.

Mount the lead as you normally would under pressure (this will hold the plate in position). Now lock the tailpiece in and measure the distance between the two pieces of the plates. If this distance is more than 1/32”, you should make the distance between the lead and tail longer by an amount equal to the length over 1/32”.
DIAGRAM 1
Correct mounting of lead edge of plate (with and without packing) on the plate cylinder.

DIAGRAM 2
Plate bent too sharp, not allowing it to seat naturally on cylinder lip. The Forces this plate to be reformed.

DIAGRAM 3
Packing not going up to bend in plate.

DIAGRAM 4
Plate not bent sharp to fit cylinder lip.

DIAGRAM 5
Plate bent too far back from edge so that the plate lip bottoms in cylinder gap. This leaves a space between plate and cylinder.
DIAGRAM 6
Correct mounting of the trailing edge of the plate (with and without packing) on the cylinder.

DIAGRAM 7
Plate too short, trailing bend on cylinder surface. This Forces the plate to be reformed. Leaves space between plate and cylinder.

DIAGRAM 8
Plate too long, trailing bend beyond cylinder surface; clamping action creates space between plate and cylinder.

DIAGRAM 9
Packing too short for plate, leaving gap between plate and cylinder.

DIAGRAM 10
Plate of various thicknesses have different springbacks. Thinner plates spring back more. Therefore, a single bender forms different bend angles with plates of different thicknesses.
DIAGRAM 11
Ink position on cylinder used to determine plate fit.

DIAGRAM 12
Ink prints on plate, indicating (a) correct fit, (b) an area of poor contact, and (c) plate not seating on the cylinder lip.

DIAGRAM 13
Plate alignment on cylinder with register, marks opposite each other across the cylinder gap.
Diagnostic Record Forms

Documentation can be used to identify the root cause of plate remakes. Most major press breakdowns and the lost revenue from a downed press can be prevented with general maintenance.

Let’s take a look at our “Plate Make Over Report” form (page 31). This form probably looks similar to your “Remake Request”, or similar forms. We recommend using either form, depending on which one gives you the most information. The value of this information is seen when you compile it on the “Plate Make Over Summary”. With the plate make over report form, the press department supplies the information needed to get a new plate made. Once the requested plate is made, the prepress department evaluates the reason for the bad plate and logs the information onto the summary sheet.

Often a problem with one cylinder or unit can cause unnecessary frustrations. This is where the “Plate Make Over Summary” sheet comes in handy. As an example of a cracking problem, if the top of unit two shows repeated problems in cracking, there might be a gapping or a lock-up problem. If the problem cannot be isolated to just one unit, the problem may be the bender, prepress, or in the method of mounting. By monitoring the summary sheet, problems can be spotted before all of the ink rollers are damaged. It is only through documentation that the problem is resolved.

In a case where a more in-depth study is needed, the “Plate Registration and Make Over Record” should be used. This will help identify everything from prepress, bender, press crew, to press problems from the point of registration. As an example, the repeated twisting of plates on the lower fifth unit is a good indication of a problem with the reel-rod. The repeated need, to cock both the upper and lower plate cylinders of one unit (in the same direction) can mean that the unit needs to be re-trammed. At the same time, this will indicate if a problem can be identified as being from only one crew.

These are just a few examples of the causes of plate cracking and the possible resolutions. With the information in the preceding pages of this document, many of the known issues with plate cracking can be found and corrected.
Plate Make Over Report

Press No.: _____ Time: _____ Date: _____ Impressions: _____ Shift: _____

Name of Job: ___________ Job No.: _____ Form No.: _____ Page No.: _____

Plate Batch #:

☐ Press shut down at normal stop. ☐ Press shut down and wait for plate.

Press shut down at: _____ hours. Press start up at: _____ hours. Foreman: _____

Indicate unit and Cylinder with an „X“

☐ Blind ☐ Contact spot ☐ Register ☐ Cracked ☐ Other ____________

Comments: ______________________________________________________

______________________________________________________________

Signed

PRE-PRESS DEPARTMENT

☐ Position error ☐ Register error ☐ Copy error ☐ Planning error
☐ Plating error ☐ Contacting ☐ Duping ☐ Other ____________

Describe the nature of error: ______________________________________

______________________________________________________________

Type of plate used: ☐ Neg. ☐ Pos. ☐ Other ____________

Original plate made by ________ Shift: ________ Plate checked by ________

Make over plate made by ________ Shift: ________ Plate checked by ________

Type of remake plate: ☐ Neg. ☐ Pos. ☐ Other ____________

Original stripper ________ Shift Stripping checked by ________

Film furnished by: ☐ Inhouse ☐ Customer ☐ Farmout source

Comments: _____________________________________________________

______________________________________________________________

______________________________________________________________
### Plate Make Over Summary

Press No. 

**Code Definition:**
- Bent wrong (10)
- Blind (11)
- Colors transposed (12)
- Cracked (13)
- Dirty (14)
- Hot spots (15)
- Missing text (16)
- Register (17)
- Scratched (18)
- Tracking (19)
- Other (20)

| DATE | FORM | 1T | 1a | 2T | 2a | 3T | 3a | 4T | 4a | 5T | 5a | 6T | 6a | 7T | 7a | 8T | 8a | REASON (other) |
|------|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----------------|
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Plate Registration and Make Over Record

Press No. ________ Time ________ Impressions ________ Shift ________
Name of Job ____________ Job No. ________ Form No. ________ Page No. ________
Unit registered to ________ Blanket packing ________ Plate packing ________
Paper stock __________________ Web width (s) ________

REGISTER MOVES - intousandth of an inch

<table>
<thead>
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<th>Form No.</th>
<th>Plate pos.</th>
<th>Plate hung by - Init.</th>
<th>Twist to O or G</th>
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<th>Lat. O or G</th>
<th>Cock. A or M</th>
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