

Registration/ Skewing Problems in the 5Si/8000 and 8100/8150

The most common paper feed problem (indeed, the most common problem of any kind) in any laser printer is the good old "13 paper jam." But there are also some common paper feed problems that don't cause an error code at all – just a printed page that doesn't look quite right. The image on the page may be shifted or skewed from its ideal position, or the paper may be wrinkled or folded, or both.

Before getting into the typical causes of these problems, let's clarify some of the terminology. Some people will use the word "skewing" to refer to any kind of image displacement, but for the purposes of this article, "skewing" means that the image is rotated on the paper – i.e., the edges of the image are not parallel to the edges of the paper. If the image is not rotated, but is shifted in position (usually in the direction of paper movement), we will refer to that as "shifting".

It will also be useful to establish some directional conventions, since we are focusing on the HP LaserJet 5Si/800/8100/8150 series of printers, and paper moves differently in these large printers than in smaller models. In particular, for a standard "letter"-size (8-1/2 inch by 11 inch) sheet of paper, the long edge (i.e., the 11-inch side) is the leading edge as the paper moves through the printer (in smaller printers like the 2000 or 4000 series, the 8-1/2 inch edge would be the leading edge). Figures 1 (an hp LaserJet 8150 Configuration Page) and 2 (a Menu Map from the same printer) should help clarify this. Both of these are on letter-size paper. Figure 1 is in "portrait" mode; figure 2 is in "landscape" mode (these designations have to do with the orientation of the image on the page). In both figures, the red arrow indicates the direction of paper movement through the printer. The point of the arrow is at the leading edge, and the tail of the arrow is at the trailing edge.

Now back to our problems. There are basically three types of things that can cause an image displacement (skewing or shifting):

- (1) Paper feed problems (the paper is not where it's supposed to be when the image is put on it);
- (2) Imaging problems (improper alignment of imaging elements: laser/scanner, toner cartridge, transfer roller);
- (3) Formatting problems (the displaced image is generated that way by the software and/or Formatter board).

Note that each of these categories covers several possibilities, so we end up with a lot of things that can cause skewing or shifting.

Troubleshooting

Because the possible causes of image displacement problems are so numerous, it's essential to do some troubleshooting to narrow it down. Here are some helpful basic tests that you can do:

- (1) Print from different image sources (com-

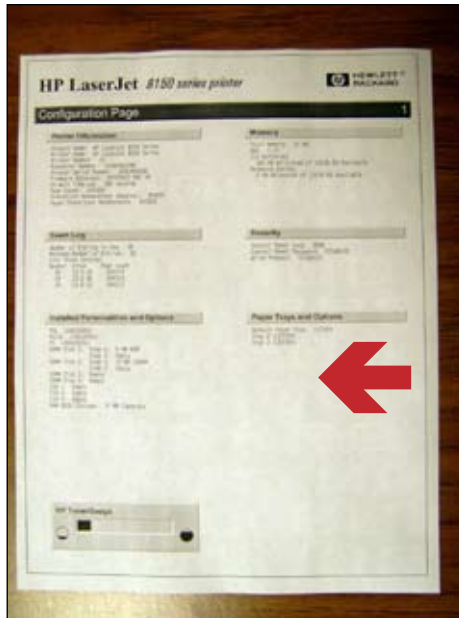


Figure 1: HP LaserJet 8150 Configuration Page, in "portrait" mode (on letter-size paper); arrow indicates direction of paper movement through printer.

Figure 2: HP LaserJet 8150 Menu Map, in "landscape" mode (on letter-size paper); arrow indicates direction of paper movement through printer.

puter, Formatter, engine). A print job sent from the computer exercises the computer software, the printer's Formatter board, and the printer's engine. If you print something from the printer's menu (such as a Menu Map or Configuration Page), you're still exercising the Formatter board and engine, but the computer is out of the picture. And finally, if you print an engine test (the test button is accessible through a small hole in the upper rear corner of the printer's right side panel), the computer and Formatter are both out of the picture, and you're exercising only the engine. These tests can help confirm or eliminate the computer and/or Formatter board as possible sources of the problem.

(2) Print from different paper sources. Each of these printers has a Paper Path Test (in the Test Menu on the 5Si; in the Information Menu on the other models) that allows you to select input source (i.e., tray 1, 2, 3, or 4), output destination, and number of pages printed. By printing from all possible sources, you can often isolate the cause of paper feed problems. If the problem occurs from all sources, look for something that they all have in common (for image displacement problems, this would be the registration assembly, toner cartridge, and transfer roller). If it only occurs from one or two sources, look for something unique to those sources: the tray 1 pickup assembly is used only by tray 1 (the manual or multi-purpose tray); the tray 4 PIU (paper input unit) and VTU (vertical transfer unit) are used only by tray 4 (if the printer has a tray 4); the tray 2/3 PIU is used by all trays except tray 1.

(3) Run a "halfway test" or "stop test." This involves printing something and then stopping the paper halfway through the printer by opening the lid. With a little practice, you can stop the paper at various points along the paper path. For paper feed problems, this test can help pinpoint what part of the paper path is causing the problem.

Now let's look at some examples of specific problems:

Image shifted in the direction of paper movement

This can be the result of faulty paper-size detection (the printer is formatting the image for a different size than the paper's actual size -- we'll get back to this shortly), but more likely it is a registration problem – the paper is not where it's supposed to be when the image is transferred from the toner cartridge to the paper. Paper position is controlled by the registration assembly, so it's the most likely culprit here. If the image is shifted to the right on a portrait-style print (see figure 1) or down on a landscape-style print (see figure 2), the paper is ahead of where it should be, and the registration clutch is probably faulty. If it's shifted the other way (left in portrait, up in landscape), the paper is behind where it should be, and the registration rollers are probably worn. Either way, replacing the registration assembly will usually fix the problem.

If the image is also skewed or stretched, there could be a problem with the seating or alignment of the laser/scanner unit, toner cartridge, and/or transfer roller. This will be discussed in more detail

Registration/Skewing Problems, Continued

when we get to skewing. Note that an image displacement in the direction of paper movement is almost never caused by problems in the input area. The reason for this is that the registration assembly is designed to compensate for minor problems in that area. And if there are major problems – for instance, if the input rollers are slipping so badly that the paper is getting to the registration area late – you will get a “paper jam” error, and nothing at all will print on the page. So if this is a paper feed problem at all, it’s happening in the registration/toner transfer area, which means it should happen from all trays (including the manual tray). If it only happens from one or more cassettes, and not from the manual tray, we would strongly suspect a paper-size detection problem rather than a paper feed problem.

On all of these models except the 5Si, you can check paper-size detection by printing a Configuration Page (print it from Tray 1 if the cassettes are having problems) from the Information Menu. On this page is an information block titled “Paper Trays and Options”. It will list all cassettes, and in parentheses after each one, what paper size the printer is detecting for that cassette. If this doesn’t match what’s actually in the cassette, you know you have a size detection problem. Unfortunately, this information is not shown on the 5Si Configuration Page, so on that printer, you’ll have to go by other things, such as the visual checks described in the next paragraph.

So what can go wrong with paper-size detection? In the back of each cassette is a set of 4 levers that change position when the cassette is adjusted for a different paper size. Behind each cassette is a circuit board with switches that detect the configuration of the levers. This is how the printer knows what size paper is in each tray. There are three ways this system can malfunction: (a) the adjustment plates in the cassette are set incorrectly (most often, the adjustment plate that runs from front to rear will be crooked, so that the front and rear edges of it don’t line up); (b) one or more of the levers on the back of the cassette is broken (this can happen when someone slams the cassette shut); (c) the size-detection board is bad. You can usually detect (a) or (b) by visual inspection; (c) is not so obvious. But if you have this sort of problem, and it only occurs from one cassette, and there are no obvious problems with (a) or (b), it’s probably (c) by process of elimination.

Image shifted perpendicular to the direction of paper movement

In this case, the image would be shifted up or down on figure 1, or left or right on figure 2 (note that the images in these figures actually are shifted slightly in this direction). If there is more than a small amount of shift, this is almost certainly a paper-size detection issue or a formatting problem (the tests described earlier will help you determine which), because the paper path is only slightly wider than the paper itself, and if the position of the paper

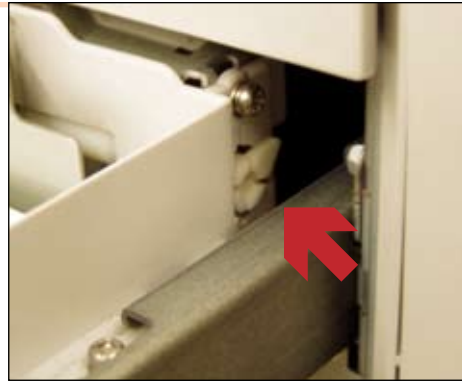


Figure 3: 500-sheet cassette (right rear corner), showing paper position adjustment lever (red arrow)

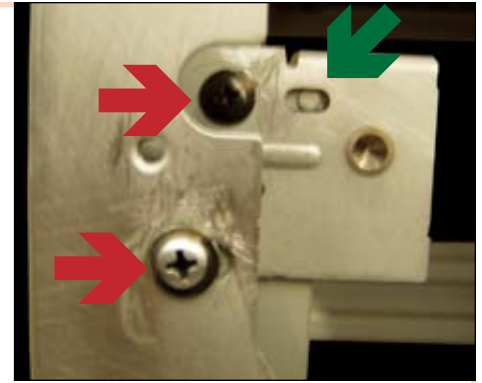


Figure 4: Tray 4 locking bracket (right side), showing screws (red arrows) and locator pin (green arrow)

is off by more than a little bit in this direction, it will hit something and cause a paper jam.

But if the shift is small, as in figure 1 and figure 2, it can usually be corrected by just making an adjustment in the cassette. For 500-sheet cassettes (trays 2 and 3), this adjustment is simple. Pull the cassette all the way out to the stops, and look at the outside of the right rear corner (of the cassette). You should see a small white plastic pointer or lever (see figure 3). Rotating this lever adjusts the position of the paper in the cassette, and can compensate for about 1/8 inch of image shift in the direction we have been describing.

The same sort of adjustment is possible on the 2000-sheet feeder (tray 4), but it’s not nearly as simple. You have to remove the vertical transfer unit and all covers from the feeder, and then make separate adjustments to the two paper tray locking brackets, one on each side of the feeder, near the front (see figure 4). To make the adjustment, loosen the two screws that secure the bracket, and then slide it forward or backward (left or right in the figure); then re-tighten the screws. The default position has the locator pin centered, as shown in the figure. Because there are two adjustments, you have to be careful. Adjusting only one of them, or adjusting them by unequal amounts, can cause skewing (however, by the same reasoning, this adjustment can also be used to correct small amounts of skew, provided that the problem only occurs from this tray). In any case, some trial and error will be required. Because of the complexity of this adjustment, you may want to try making the correction in software instead, if your software has this capability.

Skewing

Skewing of the image is caused by either feed problems (the paper is feeding crooked) or imaging problems (one or more of the imaging elements is misaligned). You can usually tell which of these it is by observing the paper as it comes out of the printer (is it coming out straight or crooked?) and/or by doing a halfway test (described above under “Troubleshooting”). If it is a feed problem, the halfway test (and the paper path test, also described above) will also help you determine where the paper starts to go crooked.

What kinds of things can cause the paper to feed

crooked? Here are some possibilities:

1. Poor paper alignment in the cassette (make sure that the paper-size adjustment plates are snugged up against the paper, so that it can’t move around in the cassette – in the worst case, you may need to replace the cassette).

2. Uneven roller wear. Again, you can use the halfway test to determine which rollers are causing the problem. Pickup, feed, and separation rollers (the first 3 rollers that touch the paper as it leaves the cassette) are inexpensive and easily replaceable. If the problem is occurring later in the path than that, it is usually best to replace an entire assembly (most commonly the tray 2/3 PIU or the registration assembly).

3. Obstructions in the paper path. Be careful, though – this can be an effect of skewing rather than a cause. As mentioned above, the paper path is only a little bit wider than the paper, so if the paper is already skewed because of something else (#1 or #2), it will be more likely to hit something just outside the path.

If the paper is feeding normally and the image is skewed, one or more of the imaging elements (laser/scanner, toner cartridge, transfer roller) is probably misaligned. There are two things to check on the laser/scanner (it’s mounted to the metal plate directly above the toner cartridge; you will have to remove the top cover of the printer to access it): make sure that the assembly is mounted flush and flat, and not tilted in any particular direction (this would normally only happen if the assembly has been removed and replaced); and remove the lid (all you have to do is remove a few screws) to check the alignment of the internal optics. The most common problem here is that the mirror in the front breaks or comes partway out of its mounting brackets. In most cases all you have to do is remount it.

It’s rare for the toner cartridge to be misaligned, but misalignment of the transfer roller is a fairly common problem. Check the joints where the roller and the transfer guide clip into each other and into the printer. Each end of the roller clips into a holding block with a spring under it. If a holding block is broken or a spring is missing, these parts are available individually. If the piece that the holding block clips into is broken, you will have to replace



the entire Feeder Assembly. There is also a bushing on each end of the transfer guide that secures it to the roller (these bushings are available individually), and a clip in the middle that snaps into the Feeder Assembly (if this clip is broken, you would need a new transfer guide). If any of the aforementioned bushings or clips is broken or not clipped in completely, the transfer roller will not seat correctly, and the paper path will be obstructed, resulting in jamming, skewing, or shifting.

You should be especially suspicious of this if a skewing or shifting problem begins after installing a transfer roller or maintenance kit (which includes the transfer roller).

It took us a long time to get this far, but this is really the main point of this article. Recently, we have been seeing an increasing number of image displacement problems caused by improperly installed transfer rollers. In addition to shifting and skewing such as we have described, we have also seen weird effects like stretching (the margin on the leading edge is correct, but the print runs off the page on the trailing edge) and trapezoidal skewing (again, the leading edge looks normal, but the trailing edge is skewed) caused by transfer roller alignment problems.

Of course, all the other things are worth checking, too (and most of this is applicable to paper jams

as well as shifting/skewing problems). But pay special attention to the transfer roller. It's a commonly replaced item (included in every maintenance kit), and easy to install incorrectly. Check it carefully any time you have an image displacement problem that seems to originate in the toner/transfer area – again, especially if the problem begins after installing the transfer roller or maintenance kit.

—Dennis Kosterman

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