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FINISHERS – LET’S “FINISH” THE COPY/PRINT JOB

By VLADIMIR KAMENOV

This series of articles is dedicated to rather exotic and mechanically complicated devices called finishers. They are attached to the exit side of a copier and, like in a sorter, copies are stored there. Sorters were discussed in our previous articles (RechargEast Magazine, August, September 2008). The purpose of finishers is an upgrade of the capabilities of the sorters. The latter simply sort and optionally staple the finished jobs in one fixed position. The finishers can do much more than that.

The finishers are a product of the development of new generation of multifunctional digital copiers. These copiers are not simply copiers. These are also printers, scanners, internet faxes and so on. Often, they have the capability of A3 format handling and duplexing. This means that operators would want to perform much more various jobs on their multifunctional copier other than copying. These can include offset sorting, stapling at various positions, creating of booklets and even punching the finished jobs.

In the present article we will go through the principles of operation of a finisher device. In order to understand the construction of mechanical devices, what the finisher consists of, it is useful to get familiar with the capabilities and features of the device.

FEATURES

1. **Accommodates large quantities of sheets** - normally, the finisher holds a stack of sheets 147 mm in height in its two bins (small-size paper: equivalent to 1000 sheets)/74 mm in height (large-size paper: equivalent to 500 sheets);

2. **Has high paper transportation performance** - the finisher is capable of handling paper between 60 and 200 g/m²;

3. **Offers a job offset function** - the finisher has a job offset function for sorting non-stapled stacks of copies;

4. **Offers four types of auto stapling** - the finisher offers a choice of four stapling modes (1-point stapling at rear, diagonal stapling at front, diagonal stapling at rear, 2-point stapling);

5. **Uses a buffer roller** - The use of a buffer roller enables the finisher to accept copies without interruption from the host machine even during stapling or offset operation;

6. **Has a saddle stitch function (Saddle Finisher)** - the finisher can staple along the center of paper and fold it in two (up to 15 sheets);

7. **Offers a punch function (option)** - the use of the puncher unit enables the finisher to punch sheets for binders before they are output. (The puncher unit is capable of handling papers between 64 and 200 g/m². It cannot handle special paper, postcards and transparencies).
**STAPLING POSITIONS**
*(unit: mm, allowance: ±4mm)*

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**SADDLE STITCHER UNIT SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stapling method</td>
<td>Center binding (double folding)</td>
</tr>
<tr>
<td>Folding position</td>
<td>See Figure 1-202.</td>
</tr>
<tr>
<td>Paper size</td>
<td>A3, B4, A4-R, LD, LT-R</td>
</tr>
<tr>
<td>Capacity</td>
<td>Without binding: 1 sheet With binding: 2 to 15 sheets (including single cover page)</td>
</tr>
<tr>
<td>Paper weight</td>
<td>64 to 80 g/m² (cover page up to 200 g/m²) (Note 1)</td>
</tr>
<tr>
<td>Stacking capacity</td>
<td>10 sets (stack of 11 to 15 sheets), 20 sets (stack of 6 to 10 sheets), 25 sets (stack of 5 sheets or less)</td>
</tr>
<tr>
<td>Stapling</td>
<td>2 points (center distribution; fixed interval)</td>
</tr>
<tr>
<td>Staple accommodation</td>
<td>2000 staples</td>
</tr>
<tr>
<td>Staple supply</td>
<td>Special cartridge</td>
</tr>
<tr>
<td>Staples</td>
<td>Special staples (STAPLE-600)</td>
</tr>
<tr>
<td>Staple detection</td>
<td>Provided</td>
</tr>
<tr>
<td>Manual stapling</td>
<td>Not provided</td>
</tr>
<tr>
<td>Folding</td>
<td>Roller contact</td>
</tr>
<tr>
<td>Folding mode</td>
<td>Double folding</td>
</tr>
<tr>
<td>Folding position</td>
<td>Paper center</td>
</tr>
<tr>
<td>Position adjustment</td>
<td>Provided</td>
</tr>
<tr>
<td>Power supply</td>
<td>From finisher unit (24 VDC, 5 VDC)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>160 W or less</td>
</tr>
</tbody>
</table>

**STAPLE AND FOLDING POSITION**
*(saddle finisher unit)*

Unit: mm, allowance: ±2.5mm

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**PUNCHER UNIT (OPTION) SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punching method</td>
<td>Sequential punching</td>
</tr>
<tr>
<td>Paper size</td>
<td>See the figures below</td>
</tr>
<tr>
<td>Paper weight</td>
<td>64 to 200 g/m² (Note 1)</td>
</tr>
<tr>
<td>Punched hole diameter</td>
<td>See the figures below</td>
</tr>
<tr>
<td>Punched scrap capacity</td>
<td>2 holes: 5,000 sheets</td>
</tr>
<tr>
<td></td>
<td>2 or 3 holes: ≤3,000 sheets (80 g/m² or equivalent)</td>
</tr>
<tr>
<td></td>
<td>4 holes: 5,000 sheets</td>
</tr>
<tr>
<td>Power supply</td>
<td>From the finisher unit (24 VDC, 5 VDC)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>120 W or less</td>
</tr>
</tbody>
</table>
Beneath are given the cross sections of the units of the finisher. Knowing the names of various components on the figure is essential to understanding the repair procedures explained in the service documentation. It is also important to study these names in order to understand the operation principles of the finisher, given below.

**CROSS SECTION**

1. Finisher Unit

[1] Tray 1/2  
[2] Shutter  
[3] Delivery roller  
[4] Swing guide  
[5] Feed roller 2  
[6] Height sensor  
[7] Wrap flapper  
[8] Buffer roller  
[9] Buffer inlet flapper  
[10] Saddle stitcher flapper  
[11] Inlet feed roller  
[12] Feed roller 1  
[13] Vertical path  
[14] Stapler  
[16] Tray lift motor  
[17] Saddle stitcher unit (Saddle Finisher)  
[18] Latch unit  
[19] Inlet feed section
2. Saddle Stitcher Unit

3. Puncher Unit (option)

FINISHER UNIT BASIC OPERATION

FEED/DRIVE SYSTEM

A. Outline

The finisher is designed to operate according to the commands from its host machine to deliver arriving copies to trays in the appropriate mode: simple stacking, job offset, stapling. The figure and the diagram show the three modes of delivery (four for the Saddle Finisher):

1. Normal Delivery

a. Simple Stacking - the finisher delivers copies directly to the tray:

From this moment on, we will divide the finisher into three functional units – finisher, saddle stitch and punch unit and each will be discussed separately. We start with the operation principles of the finishing unit of the Finisher:
b. Job Offset - the finisher forwards all copies of each sort job to the stapling tray.

The first sort job on the stapling tray is delivered with a shift to the front of about 30 mm, and the second sort job is delivered without being shifted. Whether the first copy or the last copy of a sort job should be shifted is determined by the host machine:

c. Stapling - the finisher stacks copies arriving from its host machine on the stapling tray. Then it staples and delivers the copies to the appropriate tray:

2. Saddle Stitch Delivery (Saddle Finisher)

A copy arriving in the finisher from the host machine is routed to the saddle stitcher by the paper deflecting plate. The saddle stitcher executes stitching and saddling operations on the copy and then delivers it to the saddle stitcher tray.

B. Type of Delivery Paths - the finisher has three different paper paths for delivery, each selected to suit paper size and delivery mode.

1. Straight Path

When stacking copies shown in Table below, the copies pass under the buffer roller:

<table>
<thead>
<tr>
<th>Copy size</th>
<th>Length or width 182 mm or less</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical copy examples</td>
<td>A5-R, ST-R, thick stock</td>
</tr>
</tbody>
</table>

2. Buffer Paper Path 1

When stacking copies shown in Table below, the copies pass over the buffer roller, increasing the distance between copies:
Copy size | Length and width 182 mm or more
---|---
Typical copy examples | A3, B4, A4, A4-R, B5, B5-R, LD, LG, LT, LT-R, (excluding transparencies and thick stock)

3. Buffer Paper Path 2
This is the paper path when copy sizes shown in the table are stacked. A maximum of three copies (three originals or more in the stapling mode) are wrapped round the buffer roller, during which job offset and stapling are performed on the stapling tray:

<table>
<thead>
<tr>
<th>Copy size</th>
<th>Length 182 to 232mm, and width 182 to 297mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical copy examples</td>
<td>A4, B5, LT, (excluding transparencies and thick stock)</td>
</tr>
</tbody>
</table>

The following shows paper delivery operation in the case of three originals in the stapling mode:

1) The first copy is moved in the direction of the buffer roller:

2) The first copy wraps around the buffer roller and, at the same time, the second copy arrives from the host machine:

3) The second copy is laid over the first copy and, at the same time, the third copy arrives from the host machine:

4) The first, second and third copies are simultaneously pulled into the stapling tray:

**Note:**
The third copy as explained here is moved through buffer paper path 1. This fact is omitted from the discussion to avoid interrupting the sequence of operations.

C. Feeding and Delivering

The paper paths are equipped with the following four sensors for detection of paper (arrival, passage):
- Inlet sensor (PI1)
- Delivery sensor (PI3)
- Stapling tray sensor (PI4)
- Buffer path paper sensor (PI14)

In addition, each delivery tray is equipped with a sensor designed to detect the presence/absence of paper on it:
- No.1 tray paper sensor (PI11)
- No.2 tray paper sensor (PI12)

Below are the locations and functions of all motors, solenoids and sensors of the finisher:
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