Konica Minolta's Production Printing System

Akihiro Owada, Imaging Products R&D Headquarters, Konica Minolta Business Technologies, Inc., Hachioji-shi, Tokyo, Japan

Abstract

Since 1999, Konica Minolta has participated in the production printing business by launching 7075 and its successor, 7085. In the market, customers' demands have been increasing such as for meeting an individual workflow, for applying various print media, for robustness and productivity against high-volume printout. Development of a strong product has been expected for matching these demands.

Konica Minolta bizhub PRO 1050/1050P system, released in 2004, is a newly designed model, which is exclusively arranged for the production printing to meet the demands in the market. In this paper, several advantages of this product are discussed such as a large capacity sheet input/output system, a high-volume toner feeding system, high-quality printout including precious two sides image registration accuracy and improvement of multi-task processing capacity. Further, a professional finishing system is introduced, which can flexibly conform to various output forms including multiple folding, punching, side stitching, saddle stitching, front trimming and so on.

Market Trends

High-volume printing market in United States is classified in three regions by monthly print volume (PV) shown in Figure 1. Products specification required in each region is also differed from one another as well as PV. In the recent office market, color MFP is becoming popular, which causes rapid inclement of colorization ratio above 30 percent in the business office. However, in the production printing (PP) market, the printouts covered by the conventional offset press machines are partially replaced with the on-demand printouts by some electrophotographic (EP) printing products. In a part of the graphic market, color EP products are now on distribution, and in the mid-volume printing market, gradual inclement of B/W printing products has been still continued. Figure 2 shows a projection of the Seg. -6 market. It is expected that the B/W products will occupy the most part of the growth of this segment.

Output forms required in the high-volume printing market are diversified according to the subdivided markets, such as the commercial prints, CRD, DC and PFP. In the PFP market, a quick delivery to the final consumers has priority, and a saddle stitcher is one of the important finishing devices. In the CRD market, a large capacity side stitcher and multi-functions including inserter are required for producing meeting materials and so on. Further, in a high-volume printing market, where the DC and the off-line finishers are played, a large capacity stacker is mostly required for utilizing the existing finishers for the offset press machine efficiently.

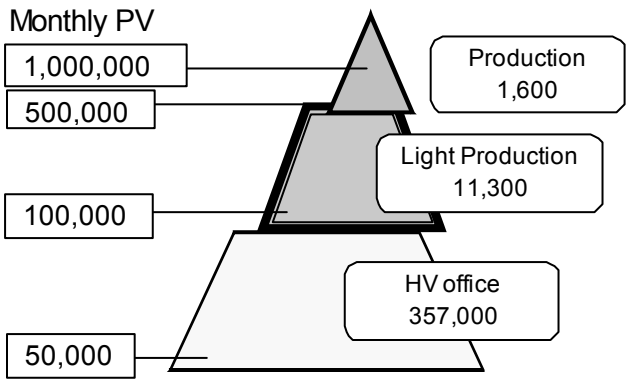

Figure 1. Scale of the high-volume printing market in the United States

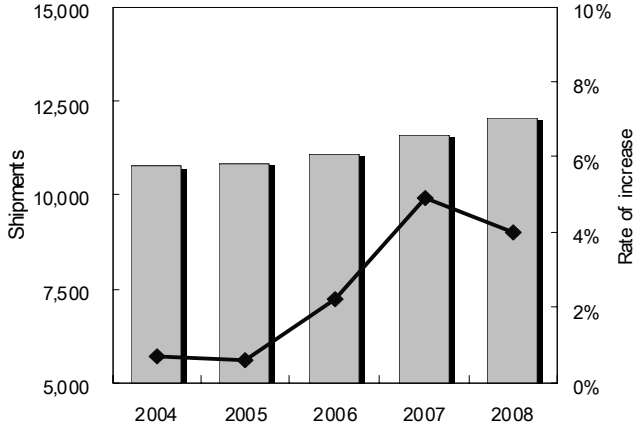

Figure 2. Projection of the Seg. 6 MFP machines in the field

Performance Required in the PP Market

Adaptation to the existing workflow is needless to say. Further improvement of reliability for managing a large print volume and prolongation of a maintenance cycle are becoming important. Supposing 500,000 prints per month, 30,000,000 to 40,000,000 prints durability is required for 5 to 7 years machine life cycle. Handling for the fundamental functions such as operation, jam, toner replenishment and paper supply should be designed for minimizing its down time. Customization is also required for the operators who manage the machine as convenient as their manners. For example, some functions, which are tuned by service engineers, such as feeding timing, staple position and so on are opened for the operators in Bizhub PRO 1050.

Outline of Bizhub PRO 1050

Bizhub PRO 1050 is a newly designed model by Konica Minolta for the purpose of our earnest entry to the PP market, which is exclusively arranged for the production printing. Its print speed is as fast as 105 pages per minute for 8.5x11 inches, and 59 pages even for 11x17 inches. The feeding capacity is prepared up to 9,000 sheets by combination of the main body and an optional feeding unit, and the stacking capacity is realized 10,000 sheets by doubly adaptation of optional stackers to fit the demand of the market for the larger PV.

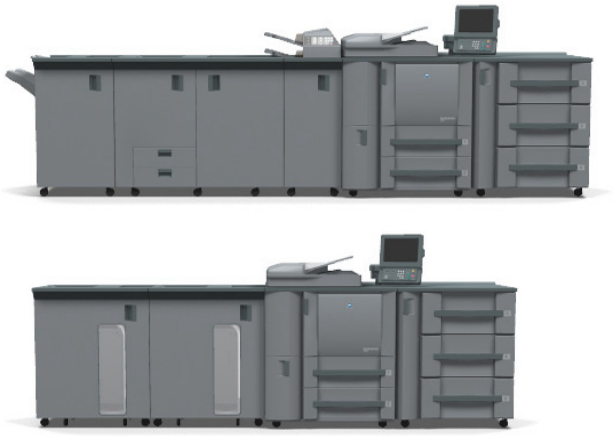

Figure 3. Bizhub PRO 1050 systems

The maximum print width allows 314mm, and the sheet size limitation is expanded up to 324x460mm for the purpose of adaptation to various output such as unfixed size sheet, flexible page layout and so on. The standard PV per month is assumed from 300,000 to 500,000. The machine durability is designed for monthly 1,500,000 PV and the machine endurance is 40,000,000 pages, which is 4 to 5 times as large as the conventional Konica Minolta products ever released to the market. High durable photoconductor and developer are employed for the reduction of cost per print (CPP). A toner recycle system is applied together for realizing further reduction of toner consumption.

Main Engine Technology for Durability

Air-assist Paper Feed

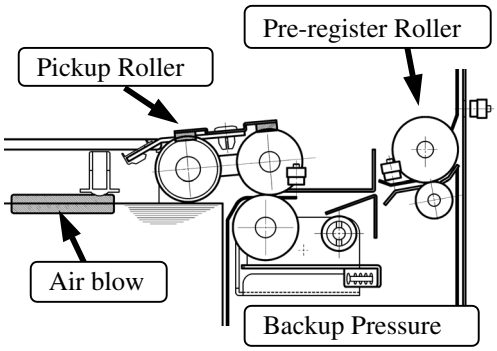

Figure 4.Cross section of feeding mechanism

Both the main body and PF701 the optional large capacity feed unit provide universal trays, each of which is adjustable to the sheet size easily by operators. An air assist feeding mechanism is equipped to increase feeding performance for the variety of media material. The air assistance works effectively supporting such as coated paper and previously printed paper. Figure 4 shows details of the feeding mechanism. A pair of pre-register rollers is mounted in correspondence with each feeding tray. A feeding roller is well controlled by an additional weight. Coefficient of friction of the roller is restrained to decrease by placing a brush. Further, operation of the air-assistance is controlled according to the paper feeding time so as to maintain the feeding performance in the best condition against the variation of the paper.

Multi-Feed Detection

In the PP market, it is highly expected that mis-insertion of blank sheets should be eradicated because the output may be merchandise as booklets or brochures. Conventional copiers need not any features for multi-feed detection because multi-feed is thought as not an important trouble compared with a jam. Multi-feed detection is necessary not only for the main body but also for the ADF. Bizhub PRO 1050 equips three standard sensors including the post inserter. Each sensor detects transmittance of ultrasonic wave signal as shown in figure 5.

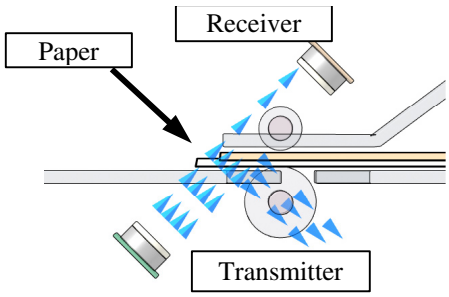

Figure 5. Multi-feed detection mechanism

When a multi-feed is detected, the mis-fed paper is forced to a turnout tray, the operation panel instructs an appropriate handling, and then the job can be recovered. The detecting capacity is designed for the range of paper weight from 60 to 200g/m^2 without any individual adjustment. 200g over is undetectable because multi-feed does not occur.

Image Registration Accuracy

Registration accuracy between face and back side is one of the most important feature required in PP market. Under 0.5mm registration is requested in case of some severe customers. When a face side is printed, the paper should be strained by heat and pressure in the fusing unit. IF the back side might be printed without any correction, the position would not be agree with the face side. This type of shift is adjustable by offsetting the imaging position to the base line of paper position. However, we cannot adjust the back side position by above method if the face side is fed with a skew. To conquer the problem, the register unit position can be adjusted to the photoconductor drum position in Bizhub PRO 1050 to prevent leaning the paper position to the imaging

position. Additionally, the registration rollers are controlled to rotate reversely before feeding to prevent biting the paper edge. Figure 6 shows a result of the above measures. Accuracy of paper shape such as the squareness also affects the registration accuracy because the imaging position is based on the leading edge of paper. Under 0.5mm registration accuracy is available by using such paper, which is assured the cutting accuracy.

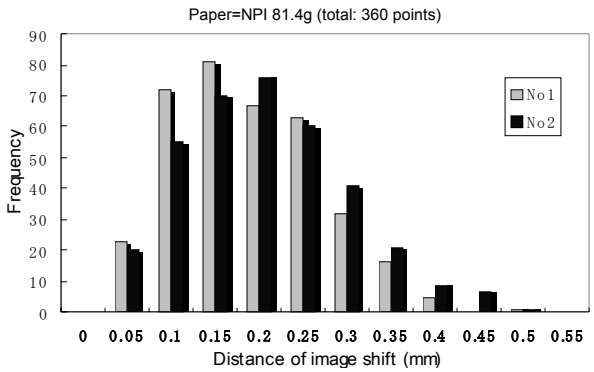

Figure 6. Distance of image shift distribution

Large Capacity Toner Storage

To suite continual large jobs, a new toner supplying system is designed for enabling large capacity toner supply. In this system, two bottles of toner can be mounted and 160,000 prints job by a standard chart (6% coverage) is available without adding toner. An air-transport system is equipped to be consistent large toner storage with a compact body. A closed loop circulation is composed by using two pumps to conveying toner. The system works stably because exchange of ventilation filters is unnecessary. To relax a pressure difference between the pumps, a decompression film is adopted at an air separation chamber. A rotary valve is equipped not to affect the fluctuation of pressure at the exit of supplying system toward the developing unit.

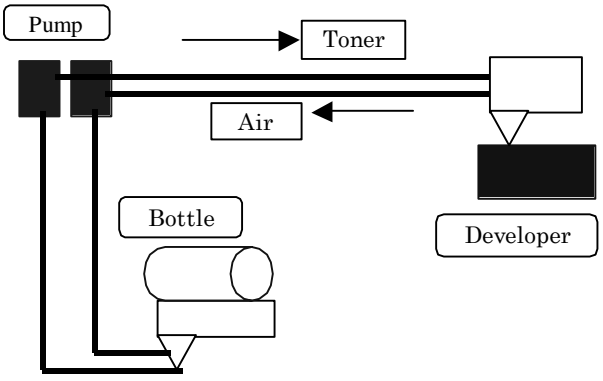

Figure 7. Toner conveying system

Image Quality and Stabilization System

Line and halftone quality is improved by optimization of developer and by modifying developing unit. Additionally, in the PP market, duplex is ordinary matter and difference of appearance between both side image qualities should be minimized. By employing a transfer backup component and by optimizing the condition of developing and transfer, equality of image quality between face and back side is achieved. To preserve the well-conditioned image quality, durability of developer, photoconductor and any replacement parts are improved. Further, an optimization control is enforced for the potential, maximum density and dot diameter by respective sensors periodically.

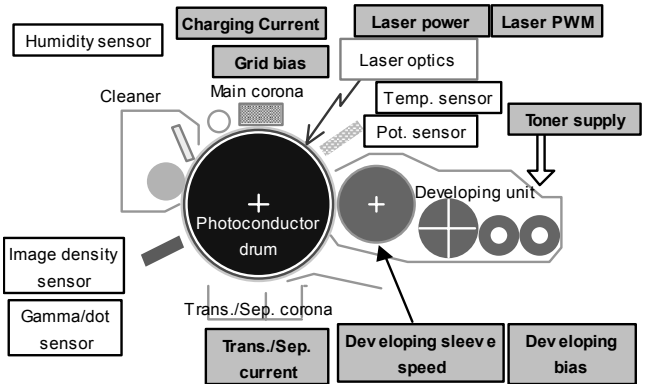

Figure 8. Process control system

Finishers and its Flexibility of Output Forms

Four types of finisher are prepared. In the PP market, it is necessary to finish the output to merchandise at post-press, as the customer requires. The required output forms are various, however productivity of the finishers should keep the maximum performance of the main body. Bizhub PRO 1050 meets the demands in the market of CRD, DC, PFP and CP by arranging an in-line system including 100-sheet side stitching, insertion and folding, continual large capacity stacking and saddle stitching up to 50 sheets. The line-up of these finishers is intended to meet individual requests of customers by flexible combination of stackers such as side stitching and stack, or saddle stitching and insertion. Each finisher is uniquely separated with individual feature.

Finishers Line-up

Features of the four finishers are follows;

1. SD-501 Saddle-Stitch Unit
   - Up to 50 sheets for 200-page booklet is available
   - Improved folding strength
   - Including standard guillotine (front trimming)
2. FD-501 Multi-Folding Unit
   - Six folding types are available
   - (Letter fold-in and double parallel is firstly in-lined)
   - 2 or 3 holes punching, tab paper or up to 200g-weight paper insertion
3. LS-501 Large Capacity Stacker
   - Maximum 10,000-sheet stacking is available by coupling LS-502

4. FS-503 Stapler/ Stacker Unit
   - Up to 100-sheet stapling is available
   - Staple cut-off type, in-line clinching

SD-501

Conventionally, nearly all of in-line saddle-stitch units for MFP employed the leaf gathering system, which proceeds from jogging, stitching to folding together. This system is unfit to commercial booklet because the folding edge becomes rounded by all means. SD-501 equipped the fold section gathering system, which is popular in the bookbinding industry.

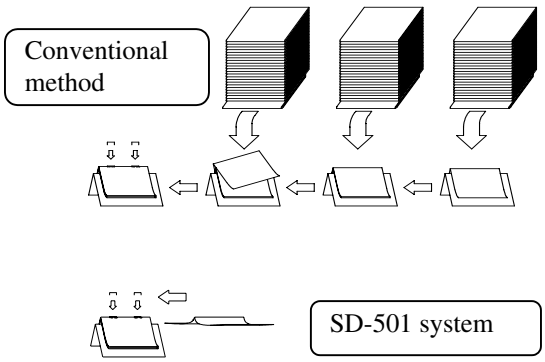

Figure 9. Saddle-stitching methods

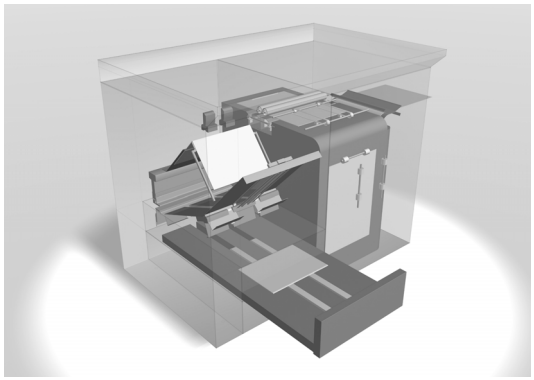

Figure 10. Layout of SD-501

Basic system of SD-501 consists of five processes; direction changing, folding, saddle-stitching, trimming and outputting. A new method is applied where the folding and saddle-stitching processes are connected directly. In this method, after the paper is folded in the center of paper, each fold section is glided to gathered to one side of the saddle. The knife style folding method is employed to improve the accuracy. To keep the processing speed, a pre-process to gather two sheets each is prepared, and then they are folded at once.

Furthermore, a cutting board method is employed at the trimming process because it gives neat finishing and its mechanism provides compact and low-power consumption.

FD-501

FD-501 is a single sheet-finishing machine including folding, punching and insertion. In this paper, details of the folding function are introduced because the letter fold-in and the double parallel are firstly equipped among the in-line finishers.

A buckle folding is one of the popular folding machines in the bookbinding industry. This system is affected by the paper property and it is easy to occur dog-ears. Especially, as the paper outputted from the digital MFP is given heat, it may be curled or waved, and then dog-ears would be more often occurred if the buckle folding unit would be equipped. FD-501 employs a unique grip roller folding method, which is developed originally to prevent dog-ears. Figure 11 shows a layout of the folding roller. Three pairs of rollers are arranged in the vertical direction and a by-pass is arranged including the second pair of rollers to shorten the width of the unit. Ordinary small-sized buckle folding machine is around 800mm width, while FD-501 is 400mm width even including punching unit, where 1/2 of downsizing is achieved.

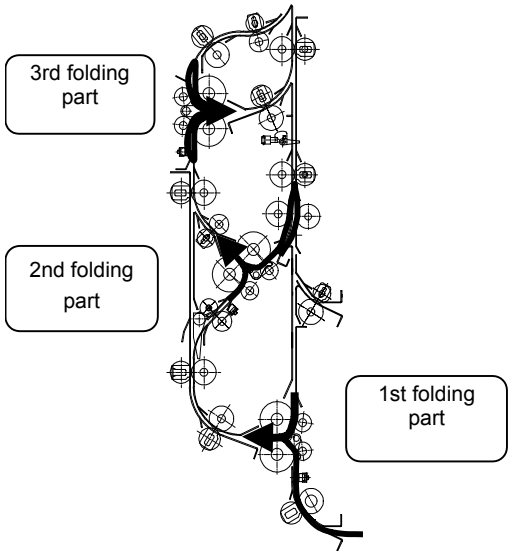

Figure 11. Layout of folding rollers

Conclusion and Future

An outline of Bizhub PRO 1050 is introduced, which is firstly released by Konica Minolta as an exclusive model for the production printing market.

In the PP market, B&W printing machine is expected to be still growing. Konica Minolta will accelerate the future growth by improving features, productivity and image quality.

Author Biography

Akihiro Owada majored in thermal engineering in Tokyo Institute in Technology, and received the B.E. degree of industrial mechanical engineering in 1982. In that year he joined Konishiroku Photo Industry Co., Ltd. After he was engaged in designing fuser units and process units for analog high-speed copiers, he held a developing team leader for an analog 92-page-per-minute copier and successively a leader for a digital 85 pages-per-minute MFP. Since 2001, he has been engaged in developing bizhub PRO 1050 and accomplished to release the product in 2004. He holds the present post since 2004.