



Mitsubishi Variable-Size Commercial Web Offset Press, DIAMOND MAX-V, Realizing a Dream of the Printing Industry

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1. Introduction

Commercial offset presses for printing magazines and advertising inserts on the market can be roughly classified by the paper conveying method into sheetfed offset presses using sheet paper already cut and aligned, and printing on each side or both sides individually, and web offset presses using a web, printing on both sides continuously, cutting to a specified size, folding and producing prints. In offset presses, an image plate of thin aluminum plate is wound on a plate cylinder and rotated to print on the paper. In the sheetfed offset press for holding only the tip of the sheet paper, by selection of the paper size according to the image size, printing continues without causing loss of paper. In the web offset press, however, since the paper for the portion of circumferential length of the plate cylinder is always printed, a printing press suited to the production size must be prepared in order to avoid wasting paper (**Fig.1**).

In web offset presses, since continuous paper is used, high-speed operation is possible and productivity is more than three times higher than that of sheetfed offset presses. Printing size flexibility, which is difficult to achieve and for which expectations are high, has long been a dream of the printing industry. Mitsubishi Heavy Industries, Ltd. (MHI) has newly developed a variable-size commercial web offset press, DIAMOND MAX-V, which is easily capable of replacing the plate cylinder and other important parts. A prototype of this press was exhibited at the print media messe "drupa 2004" (Dusseldorf). Subsequently, a full set machine was operated in public (2005, in Japan), and was highly evaluated by the printing business both in Japan and abroad.

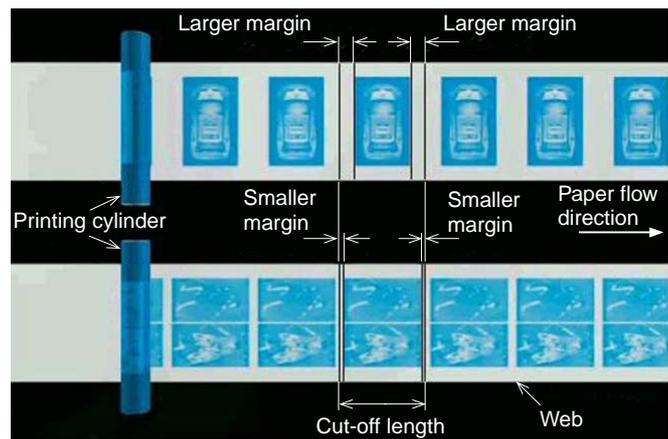


Fig. 1 Relation between machine size and production size (Top: inappropriate size, bottom: appropriate size)

2. Existing variable-size presses

Although it was not for general commercial printing, there was a business form web offset press capable of exchanging all printing cylinders, but it took a half day to change the size. The cost of the exchange cylinder is also very high and the machine is not in widespread use. Around 2000, by contrast, two models of an offset press capable of replacing only the outer periphery of the printing cylinder of the sleeve were successively presented by two manufacturers in Europe (**Table 1**). However, the applications of these offset presses are not for commercial printing, and their productivity and quality are not suited to the demand of the commercial printing field.

Table 1 Comparison of sleeve type web offset presses

Manufacturer	MHI	MAN Roland (Germany)	Drent Goebel (Holland)
Model name	MAX-V	DICO web	VSOP 850
Category	Commercial printing	On-demand printing	Form printing
Printed product	Commercial printing in general	Small page tabloid	Business form
Printing system	Offset printing on both sides	Offset printing on both sides	Offset printing on one side
Productivity	48 000 copies/hour	20 000 copies/hour	31 500 copies/hour
Cut-off size	546 - 625 mm	576 - 1 260 mm	381 - 762 mm
Applicable web width	625 - 1 030 mm	300 - 520 mm	425 - 850 mm

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3. Fundamental technology of DIAMOND MAX-V

The background to development of a variable-size commercial offset press applicable to commercial printing in general for the first time in the industry is made up of three pillar-technologies of MHI. DIAMOND MAX-V is the product of a high degree of completion based on experienced fundamental technology.

(1) Changing technology of printing length: sleeve blanket technology

The sleeve blanket offset press technology using tubular sleeve blankets that has been employed in products for a decade is applied in the size changing mechanism of the printing unit.

(2) Changing technology of cut-off length: shaftless drive technology

Different speed control technology used in shaftless drive commercial offset presses for driving each device by an independent motor is applied in the circumferential speed adjustment of each driving roller.

(3) Stable transfer technology of cut-off printed products: pinless technology

Stable transfer technology of cut-off printed products in pinless folder used for sleeve blanket offset presses is applied for preventing lags between cut-off products when accelerating the printed product during change of the cut-off size of the folder.

4. Mechanism of change of cut-off size

(1) Printing unit

The printing cylinder has a sleeve mounted on the cylinder main body. By replacement of the sleeve, the circumferential length of the cylinder and the cut-off size are changed. The two most popular sizes in Japan, 546 mm and 625 mm, are the minimum and maximum sizes, and the structure is applicable to any size between them.



Fig. 2 Sleeve exchange operation

To exchange sleeves, the operation side sub-frame is set aside to the waiting position, an exchange space is reserved, the sleeve inner wall is dilated by high pressure air, and the sleeve is then removed and replaced with the desired one. Required time for one sleeve is about a minute (Fig. 2).

(2) Folder

The folder consists of an accelerating transfer belt device developed and a tip jaw device as a cut-off size changing mechanism a folding cylinder and others of the conventional technology, and the dimensions of each size are designed with the maximum cut-off size of 625 mm. In the variable size folder, the printing edge and cutting position must be matched, and the printing cylinder and cutting cylinder of the folder are synchronized in rotation (Fig. 3). Thus, when the sleeve diameter is changed, the paper speed is changed, but the cutting timing is unchanged, and the cut-off length of the paper is always the same as the circumferential length of the printing unit sleeve. If the cut-off size is smaller than 625 mm, it is controlled so that the tip of the paper can be held at the proper time in the tip jaw device of the folding cylinder.

5. Merits of variable-size commercial web offset presses

The variable-size commercial web offset press realizes the following merits.

(1) Applicable to intermediate size, not limited to A or B format

Of the commercial web offset presses presently installed in Japan, JIS B size machines account for 65% (for advertising inserts in newspaper, B5 size magazines, etc.), and JIS A size machines occupy 15% (for A4 size magazines, catalogues, etc.), but printing demands often vary - the A size demand increases or B size demand increases, or equipment shortage may occur. However, the variable-size machine can solve these problems without installing new machines.

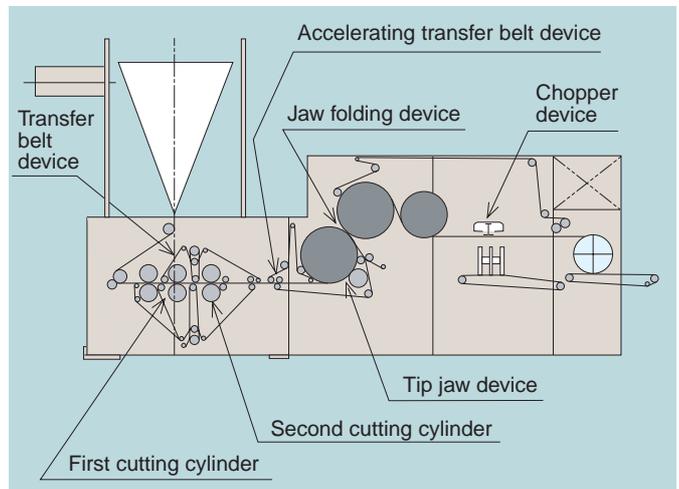


Fig. 3 Variable-size folder

In addition, the production size can be selected freely, the range of proposals by printing companies can be extended, and more printing orders can be received. Thus, depending on the proposal of irregular size books or the required print quality, jobs of sheetfed press can be also received.

(2) Improved operation rate

A size jobs and B size jobs are reportedly different in peak season, and presses may be idle depending on the season. However, by changing the print size according to the season, the peak and low point of jobs can be leveled, and the machines can be operated at full capacity throughout the year.

(3) Reduction of paper wastage

In printed matters of different heights such as magazines, by selecting the cut-off size according to the production size, paper wastage in binding can be minimized. For example, in recent magazines, the A4 modified size is the most popular, occupying about 40% (B5 size is 35%), and about 95% of the volume is believed to be 285 mm in height. In case of printing the A4 modified size magazines by a conventional commercial offset press, naturally, the A size machine is used. In the binding process, the trimming margin in this case is more than 24 mm larger per copy than the A4 regular format magazine (297 mm in height), and theoretically paper consumption can be reduced by more than 5%. This saving is impossible with the conventional printing process.

6. Conclusions

The first machine was installed in a printing company in Japan and started commercial operation in late October 2005. This fact has been taken note of by the printing industries in Japan and overseas, as it is the world's first variable-size commercial web offset press with features superior to conventional commercial printing presses. Further automated devices and equipment will be developed for the Diamond MAX-V to improve its value.



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