

# Development of a New Sheet-fed Offset Press, the “DIAMOND V3000” Series

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When the sheet-fed offset press was developed the main focus was on speeding up the printing process. However, with the recent state of product diversification and the trend towards smaller lot runs, the speed-up offered by a sheet-fed offset press does not necessarily result in increased productivity. The DIAMOND V3000 sheet-fed offset press was developed to realize substantial productivity improvements. In the past, the operation rate was improved through shortening the make-ready time and improving the maximum printing speed. The DIAMOND V3000 minimizes the required down time and improves the operation rate not only by shortening the make-ready time but also by reducing the time required for maintenance and checking. By modifying the appearance of the press and tidying up the arrangement of pipes and cables, the press status can be easily determined from an LED panel. The DIAMOND V3000 was exhibited in Japan in September 2007 and in Germany in June 2008. We will explain the advantages of the new press in this report and will promote its sales in the future.

## 1. Introduction

When the sheet-fed offset press was developed, the main focus was on speeding up the printing process. Even though Mitsubishi Heavy Industries, Ltd. (MHI) has realized 13,000 sph with the MITSUBISHI 3F, and 16,000 sph with the DIAMOND 3000, the resulting speed-up does not necessarily improve productivity due to the recent state of product diversification and the trend towards smaller lot runs. The DIAMOND V3000 press was developed for such situations, and is intended to realize substantial productivity improvements.

## 2. Concept of the DIAMOND V3000

The development concept of the DIAMOND V3000 was a “Net Production Nets Profits.” With the recent state of product diversification and the trend towards smaller lot

runs, the down time of a press is relatively long, which lowers the operation rate (see Fig. 1). Presses are shutdown to allow for make-ready time, adjustment, cleaning, and maintenance. To reduce these shutdown factors, various improvements were made to the DIAMOND V3000, such as the realization of some lubricant-free components, and the introduction of a design that provides for easier lubrication, cleaning, and checking/adjustment (see Fig. 2). We describe the main advantages of MHI's new printing press, the DIAMOND V3000, in the following sections.

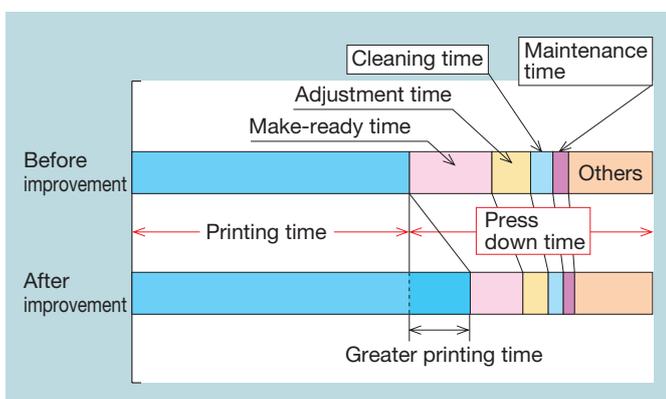


Fig. 1 Times for various tasks performed during daily work

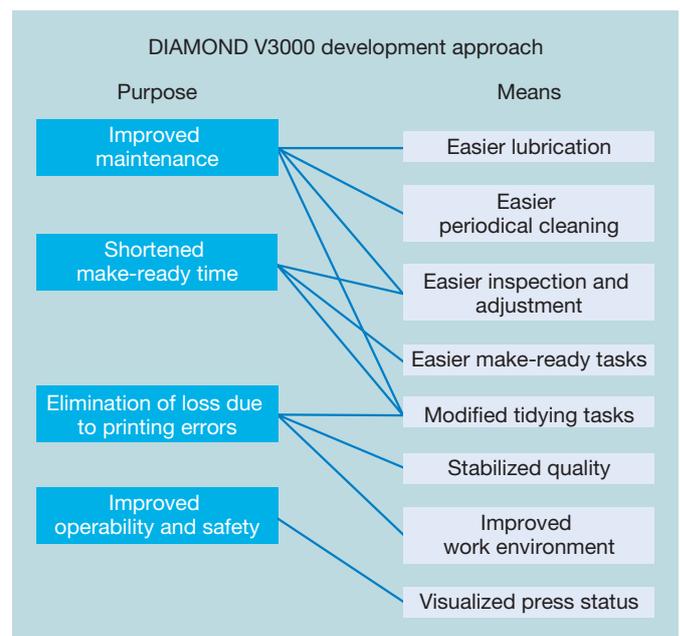


Fig. 2 DIAMOND V3000 development approach

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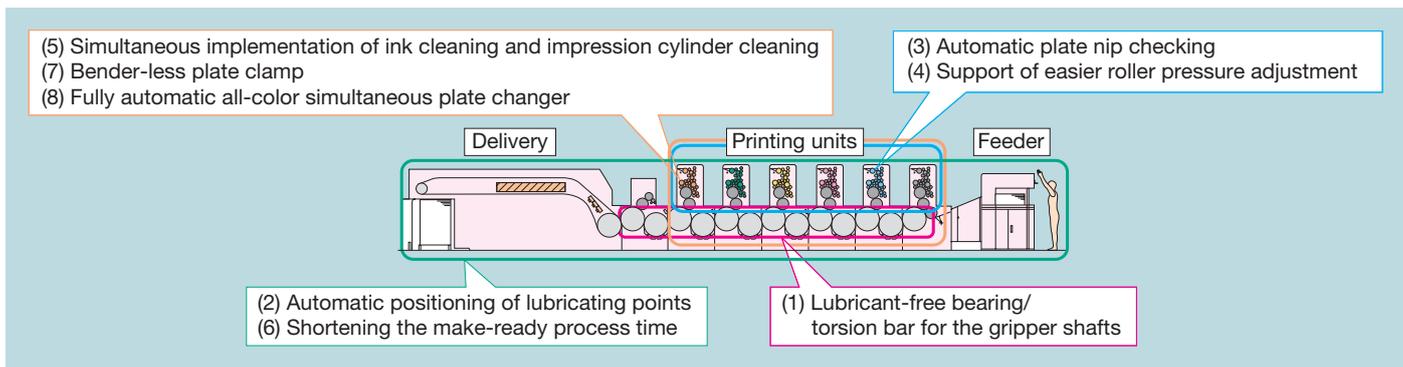


Fig. 3 Major productivity improvement items

### 3. Productivity improvement items

We made various improvements to substantially increase the productivity of the press. Here, we will explain the main productivity improvement items (see Fig. 3).

#### (1) Lubricant-free bearing/torsion bar for the gripper shafts

A sheet-fed offset press transfers paper by delivering it from cylinder (impression cylinder/transfer cylinder) to cylinder with a gripper. For the DIAMOND V3000, the amount of lubrication around the gripper was reduced by

- adopting a lubricant-free bearing for the gripper shaft, and
- replacing a coil spring installed on the gripper shaft with a torsion bar.

Owing to elimination of these two items, lubrication that was required at 120 locations once every two weeks has been eliminated, and there is no longer a concern over splattering excessive grease onto the sheet, which was a problem with previous sheet-fed presses.

#### (2) Automatic positioning of lubricating points

The cylinder must be rotated to a specified position during lubrication. The DIAMOND V3000 automatically positions the lubricating points, a procedure performed visually by the user in the past. When a button on each unit is pressed, the cylinder rotates to the lubricating position, thereby enabling the work to start and reducing the amount of time required.



Fig. 4 Printing results using the automatic plate nip checking

#### (3) Automatic plate nip checking

The nip between the ink form roller and plate cylinder is very important with respect to the printing quality. The nip width is checked by contacting the ink form roller with the plate cylinder and measuring the nip transferred onto the plate cylinder. The DIAMOND V3000 automatically performs this task for each printing unit, which was carried out by the user in the past, and prints the nip between the plate cylinder and form roller onto the paper (see Fig. 4). As a result of this automation, the user is able to check the nip periodically throughout the printing process rather than following up after a printing quality problem occurs. At the same time, the user can perform periodical and numerical nip control tasks by printing and outputting the nip onto the paper, thereby improving the control of the printing press.

#### (4) Easier roller pressure adjustment

The nip between the ink oscillating roller and the ink form roller is also important with respect to the printing quality. Conventionally, the stripe-shaped nip on the ink oscillating roller was measured when adjusting the roller pressure. Experience was required to judge from which roller the nip came because multiple nips contacted one roller. For the DIAMOND V3000, the positioning of the nip location on the ink oscillating roller is performed in a specified sequence by pushing a button on each printing unit, in the same manner as the automatic positioning of the lubricating points. Even an operator with less experience can easily judge from which roller the nip appears (see Fig. 5).

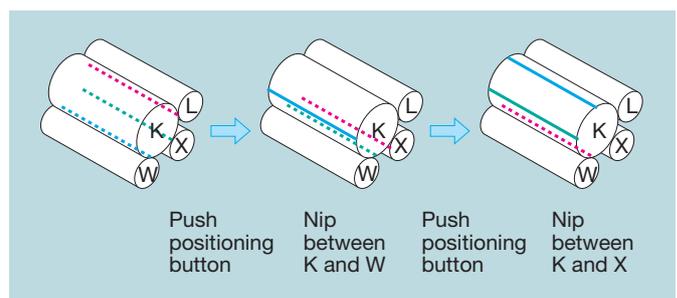


Fig. 5 Movement using the easier roller pressure adjustment

(5) Simultaneous implementation of ink cleaning and blanket cleaning

Ink cleaning, blanket cleaning, and impression cylinder cleaning must be performed after completing a printing task. In the past, ink cleaning and blanket cleaning were carried out separately. They are carried out simultaneously for the DIAMOND V3000 so that the press downtime between ink cleaning and impression cylinder cleaning is eliminated. This shortens the cleaning time by 20 % (see Fig. 6).

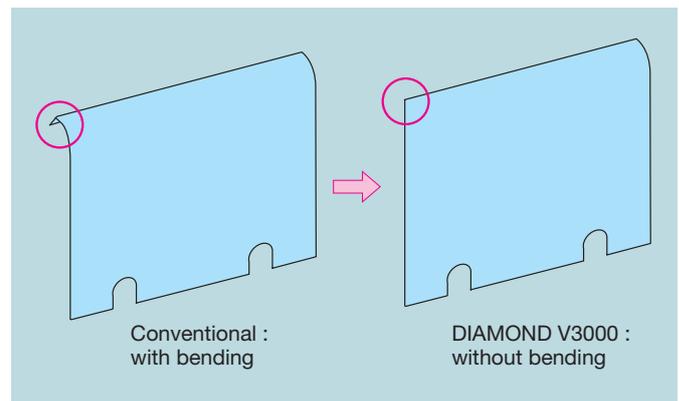


Fig. 8 Existence of plate bending

(7) Bender-less plate clamp

In an offset printing press, a plate is attached to the plate cylinder. The pattern to be printed changes for each job. In the past, one side of the plate was bent before attachment. This bending task has been eliminated by changing the plate-fixing device (see Fig. 8). Thus, the working time for the plate-bending task has been eliminated (30 seconds/color), and a plate bender is no longer required.

(8) Fully automatic all-color simultaneous plate changer

In the past, the impression cylinder for each print color had a different phase during printing. The plate-changing task was therefore carried out for each color. However, the DIAMOND V3000 realizes an all-color simultaneous plate change by synchronizing the phases of the impression cylinders during the plate change. This shortens the required change time to 75 seconds from the 4 minutes it took to change the plates of a four-color press. Because the change time (of 75 seconds) no longer depends on the number of printing units, the amount of time saved increases with the number of printing colors

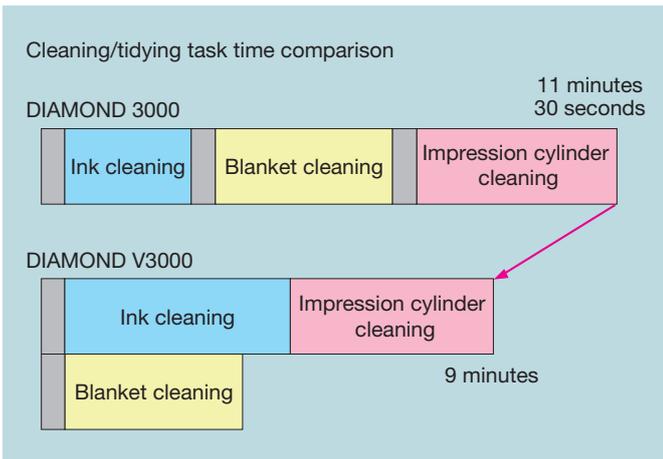


Fig. 6 Effect of simultaneous cleaning

(6) Shortening the make-ready process time

We improved the conventional simultaneous make-ready process by

- eliminating the press stop between cleaning and proofing, and
- performing the ink key preset and blanket cleaning simultaneously (see Fig. 7).

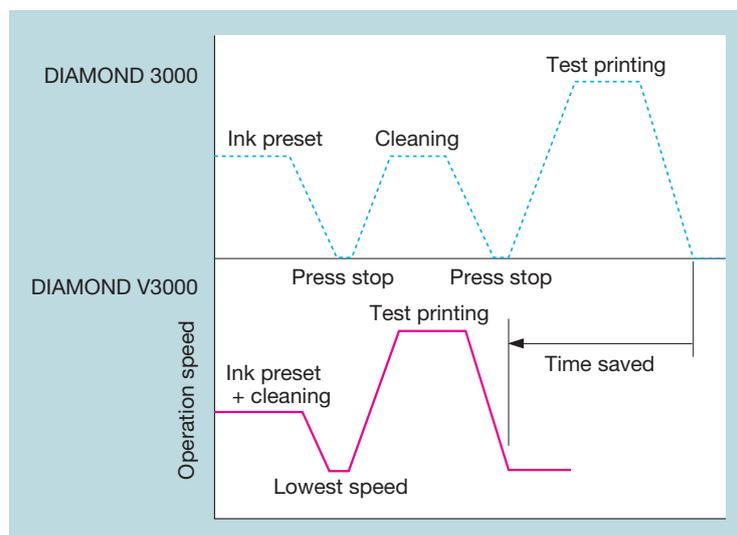


Fig. 7 Effect of control review

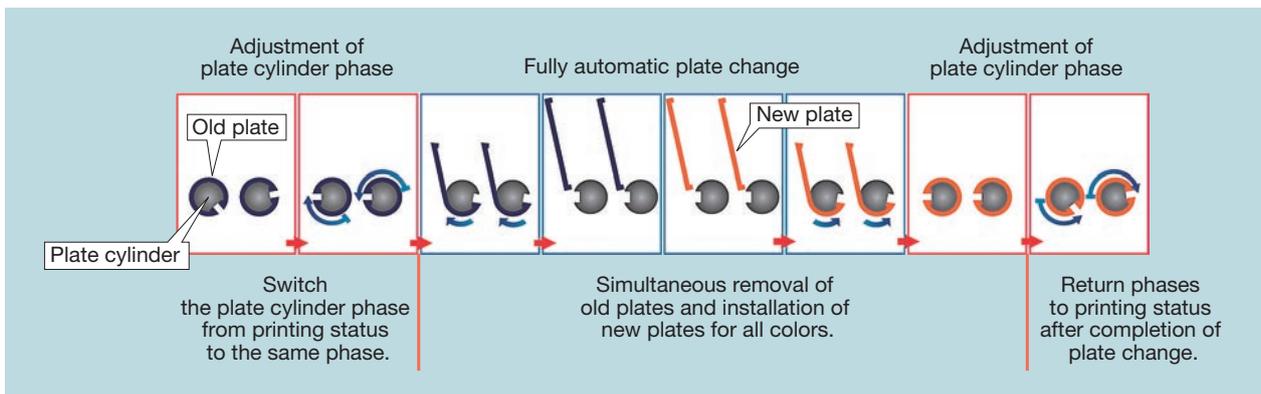


Fig. 9 Sequence of simultaneous all-color plate change

used. Figure 9 shows the sequence followed during the simultaneous all-color plate change.

#### 4. Design refurbishment

The appearance and operation panel of the DIAMOND V3000 were also modified to provide the following improvements.

##### (1) LED indication of press status

LEDs allocated on the operations side of the printing component indicate the press status and accent the press design. They are normally not illuminated. When anomaly occurs or the press is undergoing cleaning or preset task, they change color and blink according to a prescribed pattern to indicate the problem and press status (see Fig. 10).

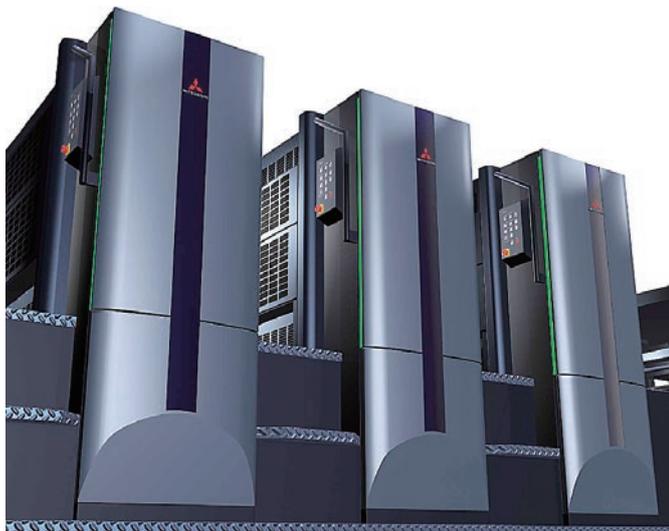


Fig. 10 Indication of press status by blinking LED

##### (2) Press arrangement

In previous press designs, devices that required periodic maintenance were installed on the press drive side. But access was difficult because numerous wires were routed on the floor surface, resulting in confusion. For the DIAMOND V3000, a wiring rack was installed on the drive side, eliminating wiring on the floor. Also, the workability of wash fluid was improved and the area underneath the drive-side catwalk was tidied up by moving the cleaning device tank, which requires frequent maintenance, to a position underneath the operation-side catwalk.

#### 5. Conclusion

A single-side DIAMOND V3000 printing press was publicly exhibited at the International Graphic Arts Show 2007 (IGAS 2007) held in Japan in September, 2007, and a dedicated one-pass perfecting press and single/double side combined-use press were exhibited at DRUPA 2008, the largest printing material exhibition in the world, held in Germany in June, 2008. Visiting customers appreciated the productivity improvement items and overall design.

We will continue to predict market trends and develop new products to meet customers' needs in the future.



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