RICOH

D143/D144 Detailed Descriptions Manual

D143/D144
DETAILED DESCRIPTIONS

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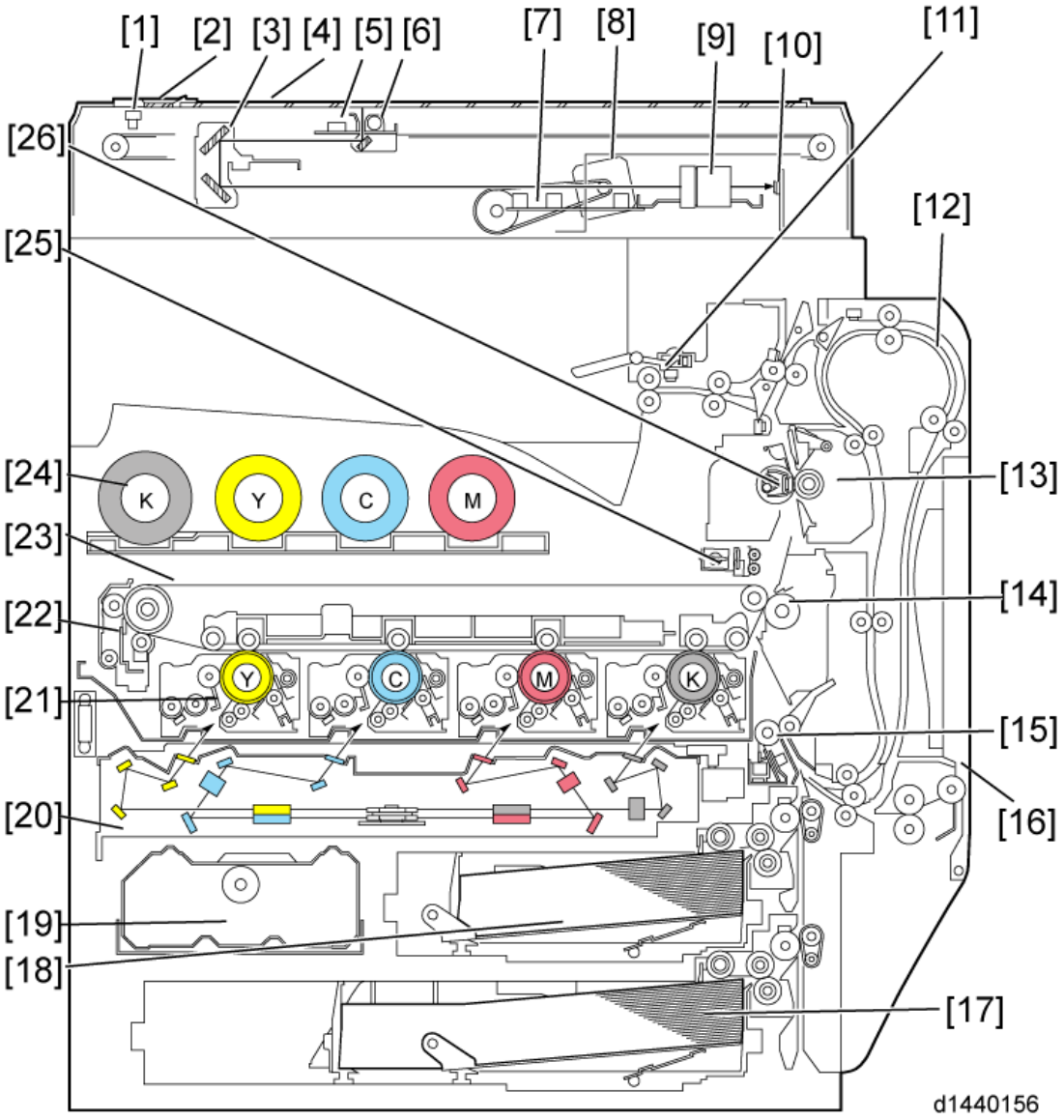
1. OVERVIEW

1.1 COMPONENT LAYOUT



1. Scanner HP sensor	15. Paper transfer roller
2. ADF exposure glass	16. Registration roller
3. 2nd scanner (2nd carriage)	17. By-pass feed table
4. Exposure glass	18. Tray 2
5. 1st scanner (1st carriage)	19. Tray 1
6. Scanner lamp	20. Toner collection bottle
7. Original width sensor	21. Laser optics housing unit
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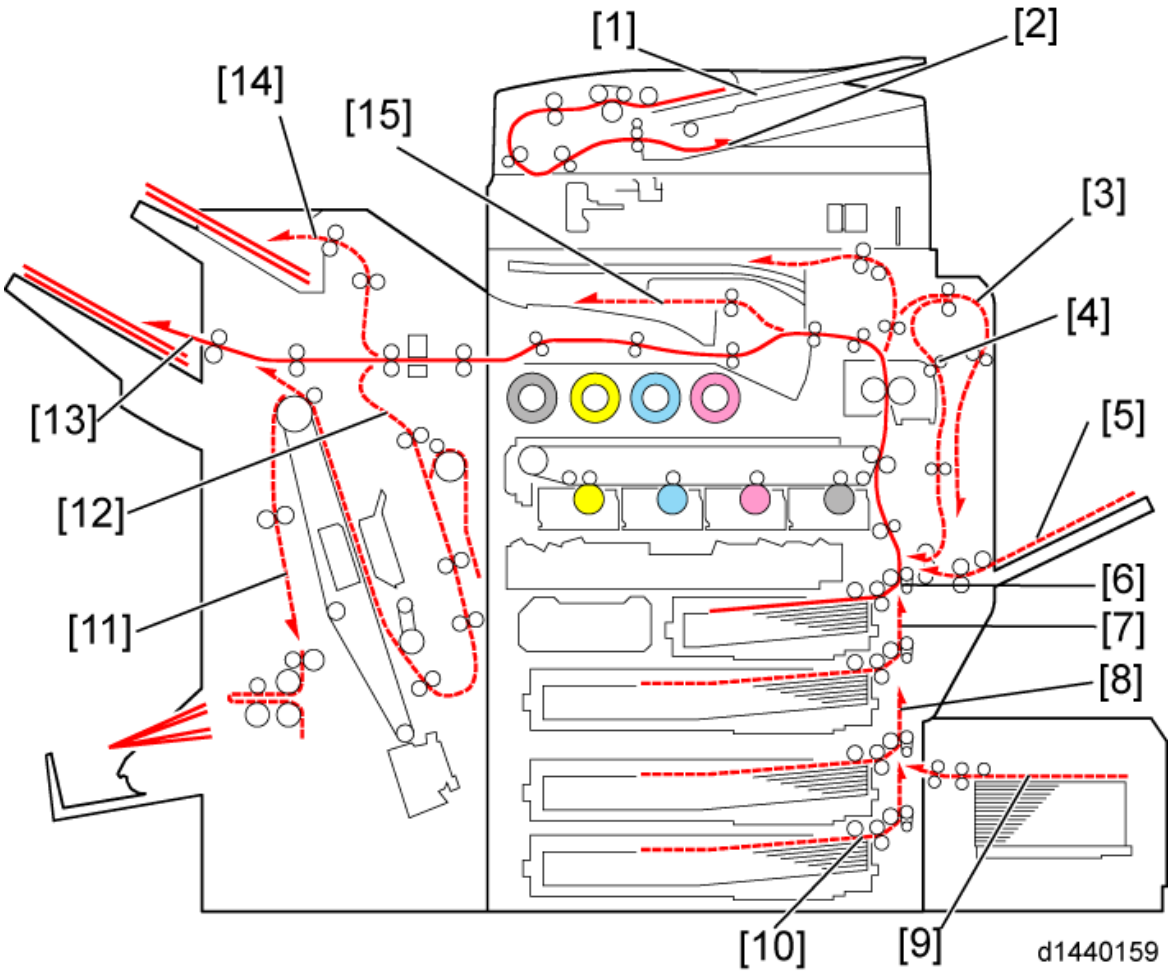
9. Scanner motor	23. Image transfer belt cleaning unit
10. Lens block	24. Image transfer belt unit
11. Sensor board unit (SBU)	25. Toner bottle (4 colors)
12. Paper Exit rollers	26. ID sensor
13. Duplex unit	27. Fusing lamp
14. Fusing unit	

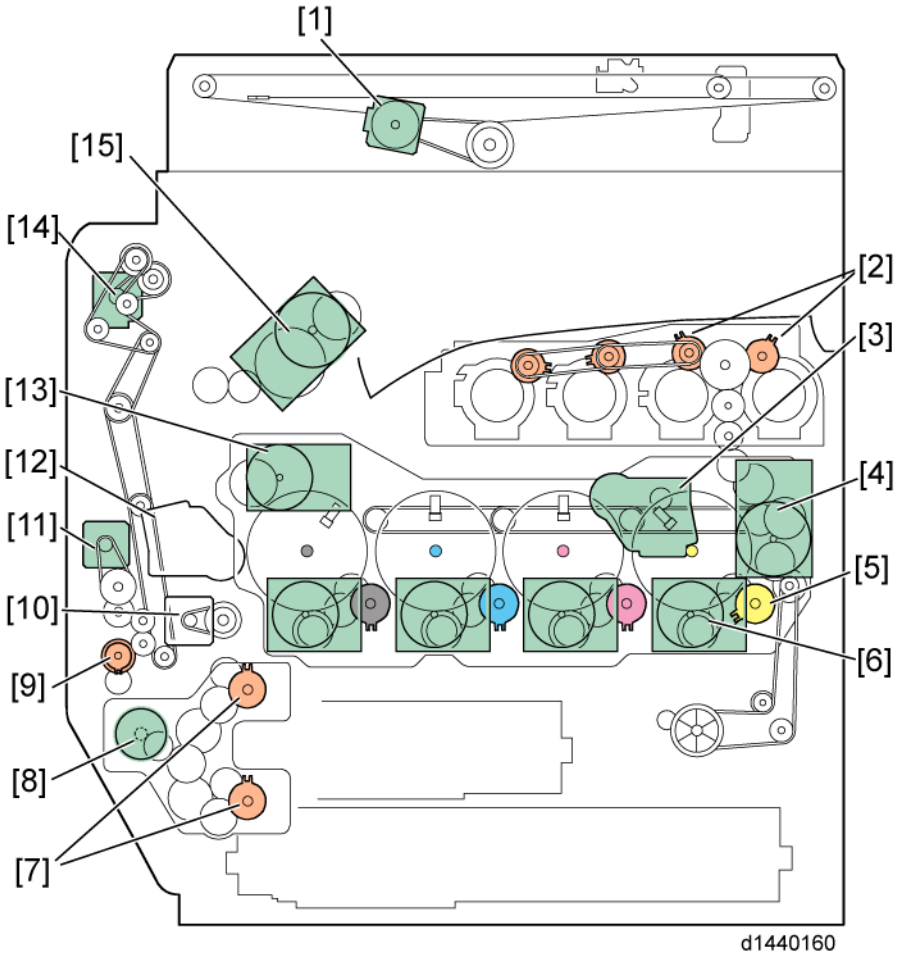
1.2 PAPER PATH



1. Original tray	9. Tray 5: Optional LCT 1200
2. Original exit tray	10. Tray 4: Optional paper feed unit
3. Duplex inverter	11. Finisher booklet stapler (Optional)
4. Duplex feed	12. Finisher stapler (Optional)
5. By-pass tray feed	13. Finisher upper tray (Optional)
6. Tray 1 feed	14. Finisher proof tray (Optional)
7. Tray 2 feed	15. Inner Tray
8. Tray 3: Optional paper feed unit/LCT	

The 2000/3000-sheet (booklet) finisher and 1000-sheet finisher require the bridge unit and one from the two-tray paper feed unit or the LCT.

1.3 DRIVE LAYOUT

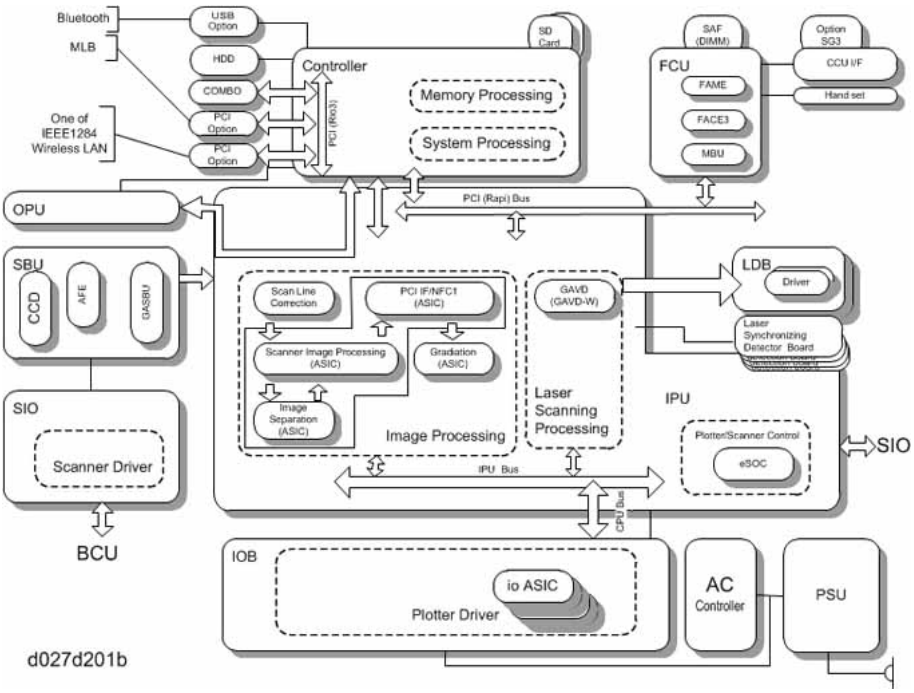


1. Scanner motor:	Drives the scanner unit.
2. Toner supply clutch-K and -CMY:	Turns on/off the drive power to the toner supply unit (K and -CMY).
3.ITB (Image Transfer Belt) contact motor:	Moves the ITB into contact and away from the color PCDUs.
4. Toner transport motor:	Drives the toner attraction pumps and the toner collection coils from the PCDUs, from the transfer belt unit, and inside the toner collection bottle. Also rotates the toner bottles.
5. Development clutch (K, Y, M, C):	Turns on/off the drive power to the development unit (K, Y, M, C).
6. Drum/Development drive motor (K, Y, M, C)	Drives the color drum unit and development unit (K, Y, M, C).
7. Paper feed clutch	Switches the drive power between tray 1 and tray 2.
8. Paper feed motor:	Drives the paper feed mechanisms (tray 1/tray 2).

9. By-pass feed clutch:	Turns on/off the drive power to the by-pass pick-up, feed and separation rollers.
10. Registration motor:	Drives the registration roller.
11. By-pass/duplex feed motor:	Drives the by-pass pick-up, feed and separation roller, and duplex transport rollers.
12. Paper transfer contact motor:	Moves the paper transfer roller in contact with the image transfer belt.
13. ITB drive motor:	Drives the image transfer belt unit.
14. Duplex inverter motor	Drives the duplex inverter rollers and duplex transport rollers.
15. Fusing/paper exit motor:	Drives the fusing unit and paper exit section.

1.4 BOARD STRUCTURE

1.4.1 OVERVIEW



NOTE: In the diagram, 'MLB' is the File Format Converter

Descriptions

BCU (Base Engine Control Unit) and IPU (Image Processing Unit):

The BCU controls all the mechanical components and the following functions:

- Engine sequence
- Engine operation
- Polygon motor control
- Controller board connection

The IPU processes digital signals.

Controller:

The controller connects to the IPU through a PCI bus. The controller handles the following functions:

- Machine-to-host interface
- Operation panel interface

- Network interface
- Interfacing and control of the optional IEEE1284, IEEE802.11a/g, g (wireless LAN), File Format Converter, HDD, and DRAM DIMM
- Interfacing and control of USB and the devices that are connected to USB, such as the Bluetooth unit and the External USB keyboard.

LD Drive Board:

This is the laser diode drive circuit board.

SBU:

The Sensor Board Unit has a CCD (charge-coupled device) and an analog-to-digital conversion circuit.

Operation Panel Board:

This controls the display panel, the LED and the keypad.

Scanner I/O Board (SIO):

The scanner I/O board is a circuit board that transmits control signals and electricity.

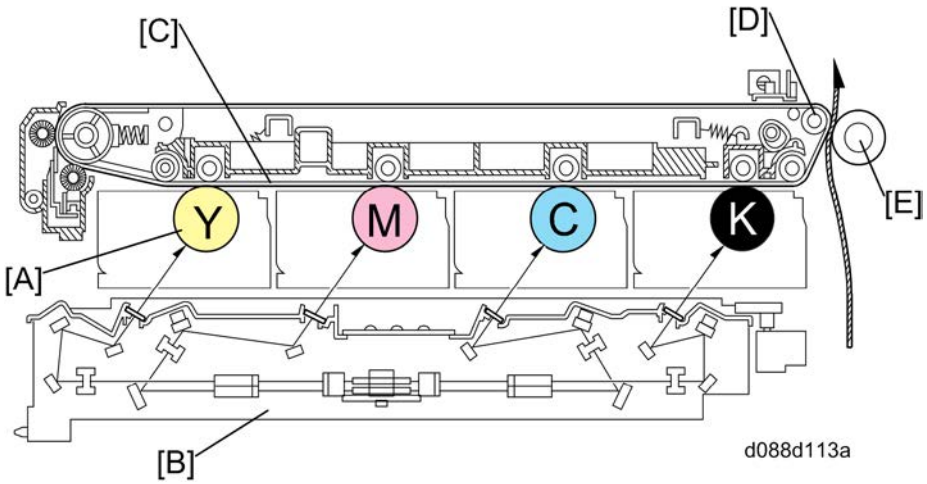
I/O Board (IOB):

Contains drivers for motors and other mechanical components.

Fax Control Unit (FCU):

The fax controller unit (FCU) controls the fax programs and communicates with the controller to share copier resources.

1.5 PRINTING PROCESS

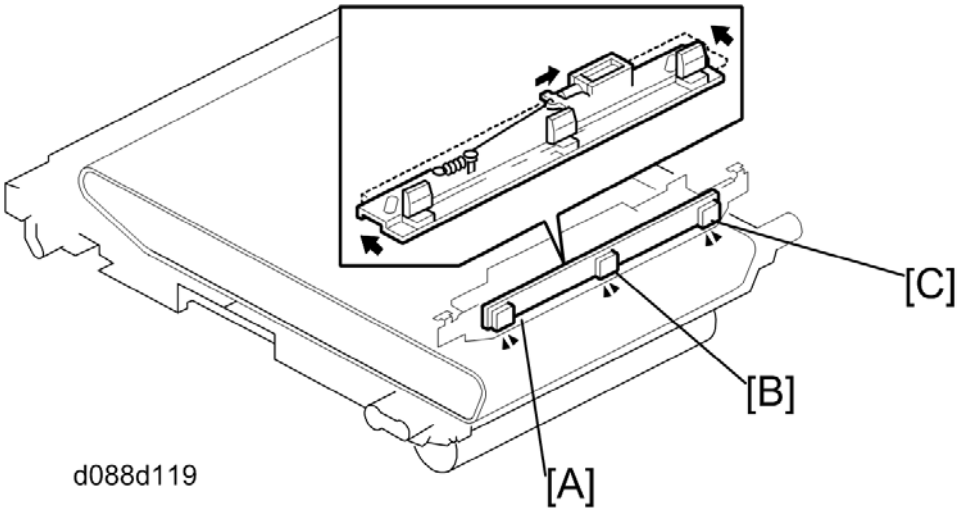


This machine uses four PCDUs, and four laser beams for color printing. Each PCDU consists of the drum unit and the development unit. Each drum unit has a drum, charge roller, cleaning brush, and blade. From the left, the PCDU stations are yellow, magenta, Cyan and Black.

The drum [A] is charged with a negative voltage, and is exposed by the laser from the laser optics housing unit [B]. The laser neutralizes the negative charge on the surface of the drum. So, the white parts of the image correspond to areas of the drum that still have a high negative charge. The toner has a negative charge, and it moves to the areas of the drum that have the smallest negative charge (i.e., the areas written by the laser beam).

The image on each drum is moved to the transfer belt by the positive bias that is applied to the transfer belt [C]. All four toners are put on the belt at the same time. Then, the completed four-color image is moved to the paper by a negative charge applied to the ITB drive roller [D] (the transfer roller [E] is an idle roller).

1. **Drum charge:** The charge roller gives the drum a negative charge
2. **Laser exposure**: The laser beam from the laser diode (LD) goes through the lens and mirrors and reaches the drum. The machine turns the laser beam on and off to make a latent image on the drum.
3. **Development:** The development roller carries negatively charged toner to the latent image on the drum surface. This machine uses four independent development units (one for each color).

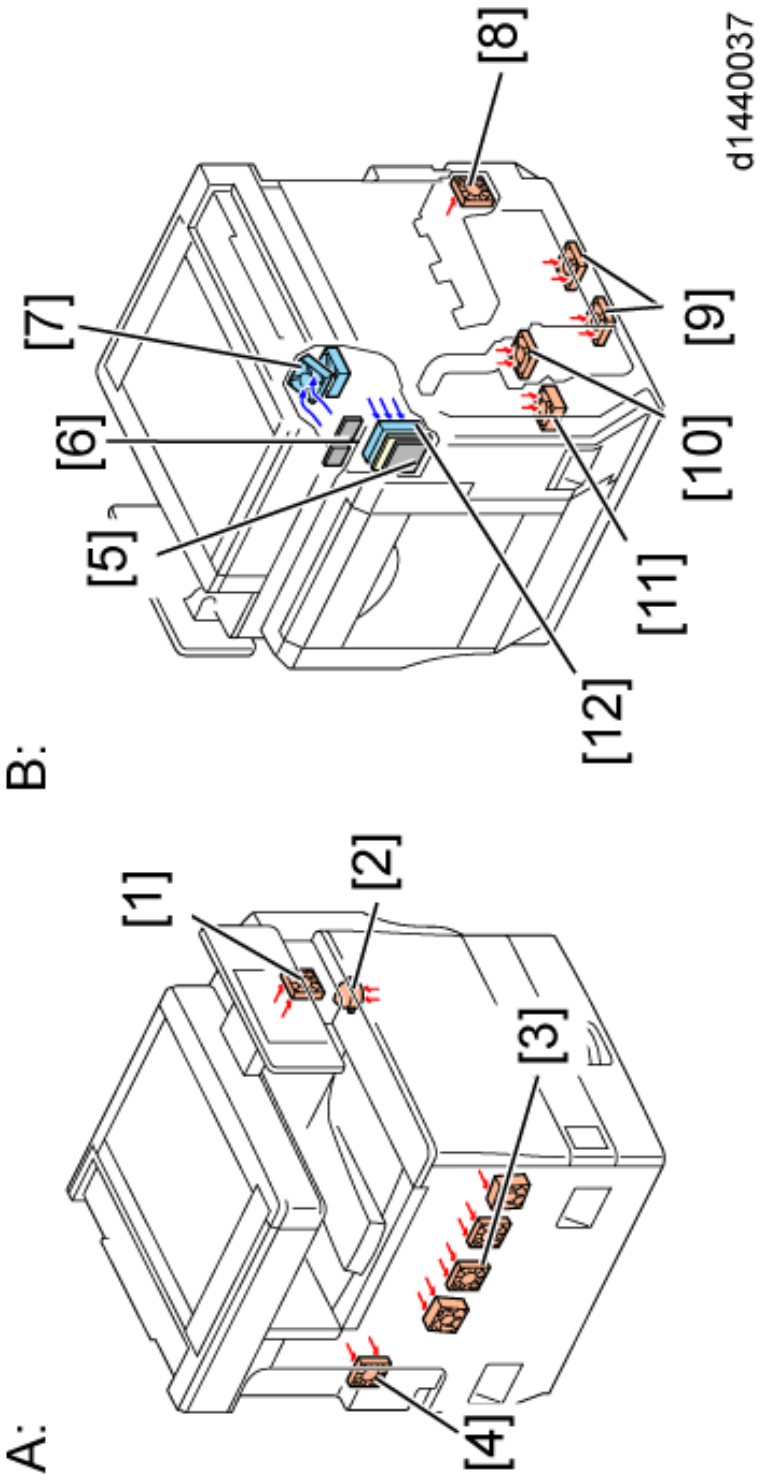
4. **Transfer:**
   Image transfer: Bias rollers opposite the OPC drums transfer toner from the drums to the transfer belt. Four toner images are super-imposed onto the belt.
   Paper transfer: Then, the ITB drive roller pushes the toner from the transfer belt to the paper (the transfer roller is an idle roller).
5. **Cleaning for OPC drum**: The cleaning brush and blade remove remaining toner on the drum surface after image transfer to the paper.
6. **Quenching for OPC drum:** Quenching is done by illuminating the whole area of the drum with the laser at the end of every job.
7. **Cleaning and quenching for transfer belt:** The cleaning brush and blade clean the belt surface. The grounding roller inside the transfer belt unit removes the remaining charge on the belt.
8. 

9. **ID sensors:** The ID sensors detect the patterns for the line position adjustments and the density of ID sensor patterns on the transfer belt.
   All ID sensors are used for the line position adjustment. However, only center ID sensor is used for the process control. On this board, there are 3 ID sensors in total, as follows.
   - [A]: Line position adjustment (front)
   - [B]: Line position adjustment (center) and process control (KCMY)
   - [C]: Line position adjustment (rear)

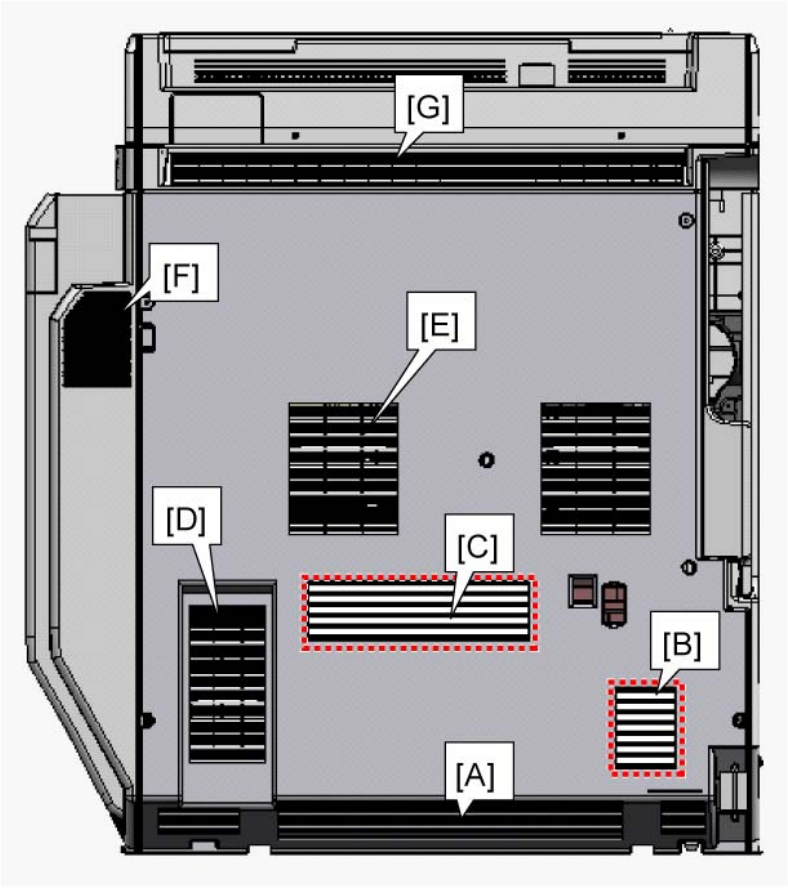
   The ID sensor output is used for the following:
   - Process control and for automatic line position
   - Skew correction
   - Color registration adjustments for the latent image.

2. MACHINE VENTILATION

2.1 OVERVIEW



C:



A: Front view

B: Rear view

C: Rear view (Exterior cover)

No.	Description	Inlet/Outlet	Remarks
1	Paper exit fan	Inlet	
2	QSU heater cooling fan	Inlet	
3	Main fans	Inlet	4 fans
4	Controller unit fan	Inlet	
5	Dusts filter	-	
6	Ozone filters	-	
7	2nd duct fans	Outlet	2 fans
8	1st duct fan (Tube cooling fan)	Inlet	
9	PSU fans	Inlet	
10	3rd duct fan	Inlet	
11	AC controller board fan	Inlet	
12	Fusing fan	Outlet	

2.2 AIRFLOWS

The airflows and the ventilation efficiency of these models are improved over those of the predecessor models.
These extend the acceptable range for temperature to rise inside the machine and improve the printing quality.

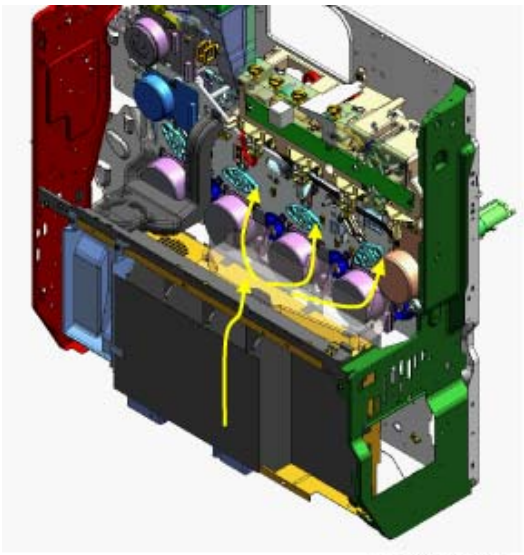
Airflow detail descriptions (☛ Overview)

[4]	→	Development section	→	[1]	-	-	-	-
[4]	→	Face plate rear duct	→	[3]	→	Fusing section rear	→	[1]
[2]	→	Fusing section	→	[12]	-	-	-	-
[8]*/[10]	→	Toner supply section	→	[G]	-	-	-	-
[9]	→	PSU	→	[C]	-	-	-	-
[5]	→	HDD/Controller	→	[G]	-	-	-	-
[11]	→	AC controller	→	[F]	-	-	-	-

* Only for D143/D144

2.2.1 PSU VENTILATION

OLD VERSION



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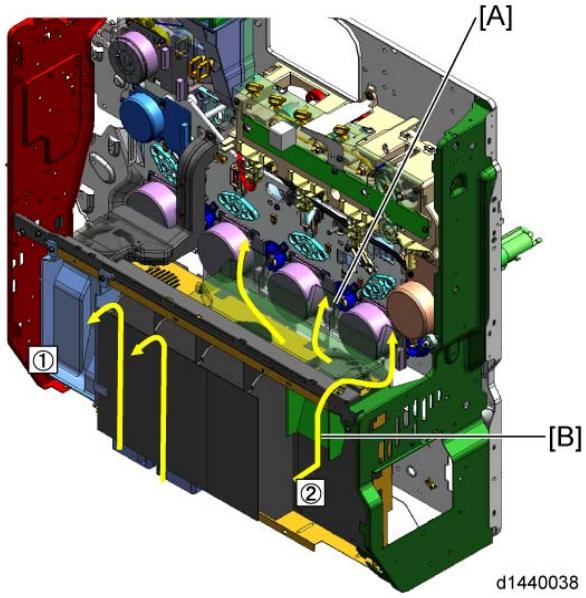
NEW VERSION (D143/D144)



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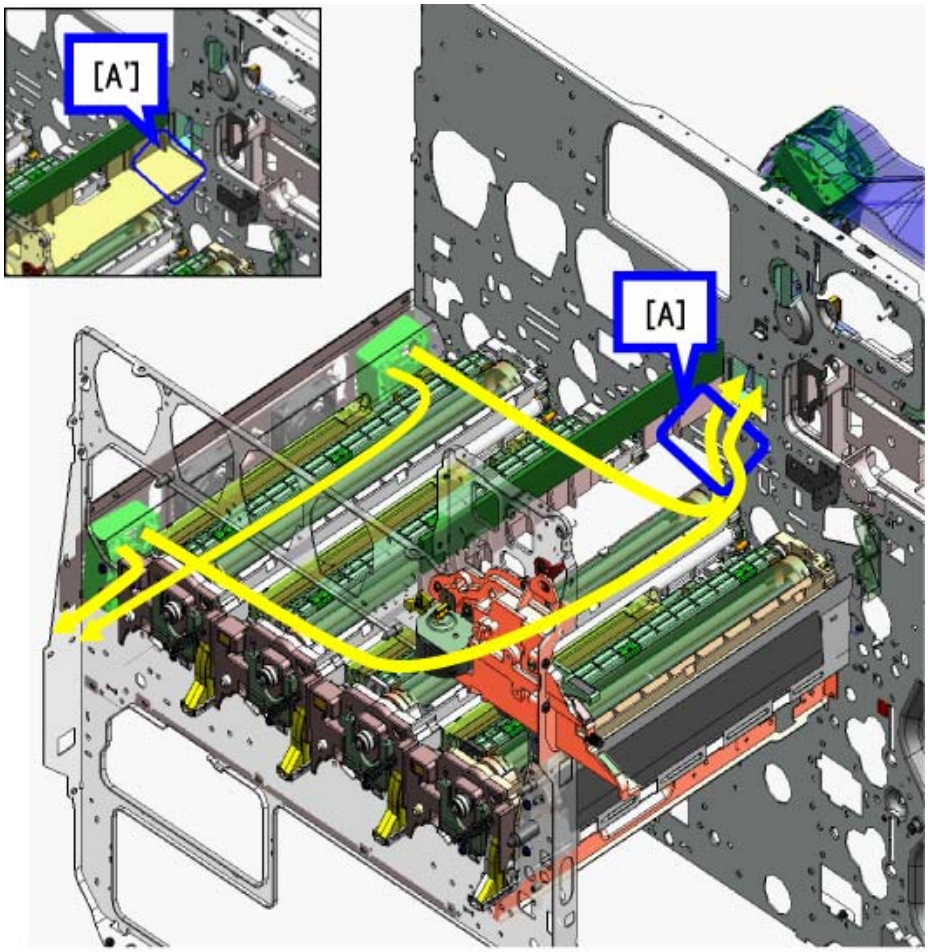
To prevent rising temperature in the toner supply route [A] due to heat from the PSU, the hot air in the power supply unit will be exhausted to the outside directly (①).
To do this, a louver ([C] in the overview) is added and the location of the PSU fan is optimized (moved).

2.2.2 TONER SUPPLY SECTION VENTILATION

- The predecessor machine creates the airflow [A] with the PSU fan. In this model, the louver ([B] in the overview) and the duct ② are added at the rear of the machine to get the external air in. Also, the 1st duct fan is newly added to create the airflow [B] because the PSU fan is used to exhaust only.



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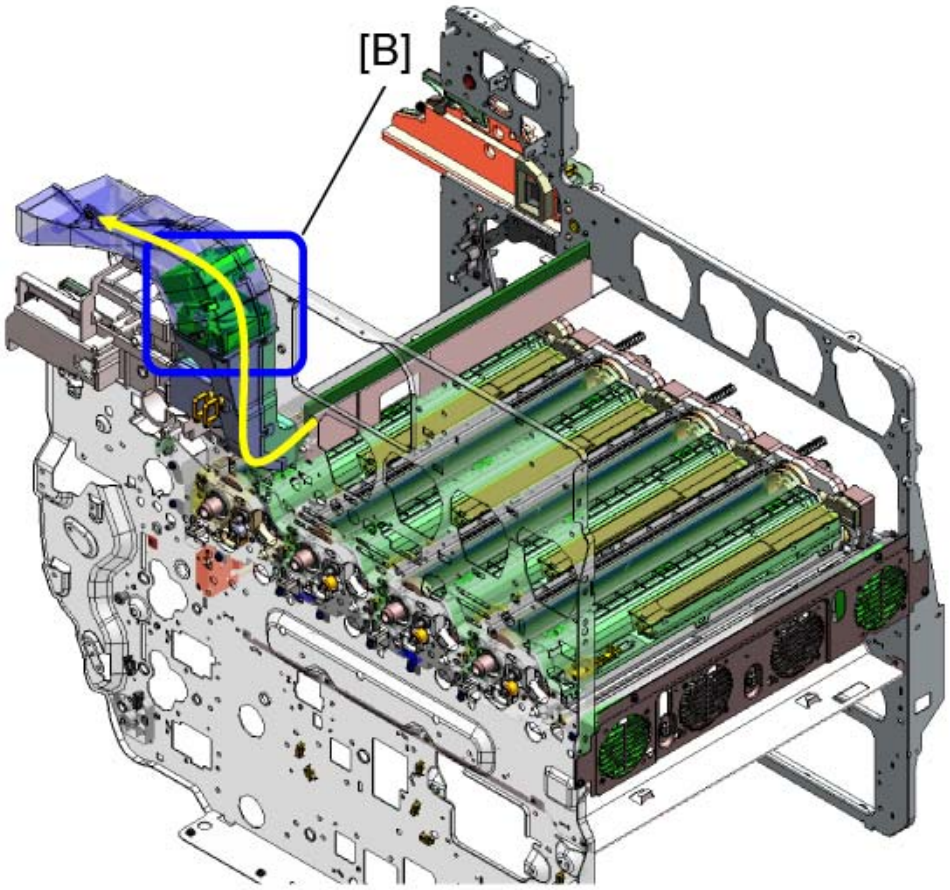
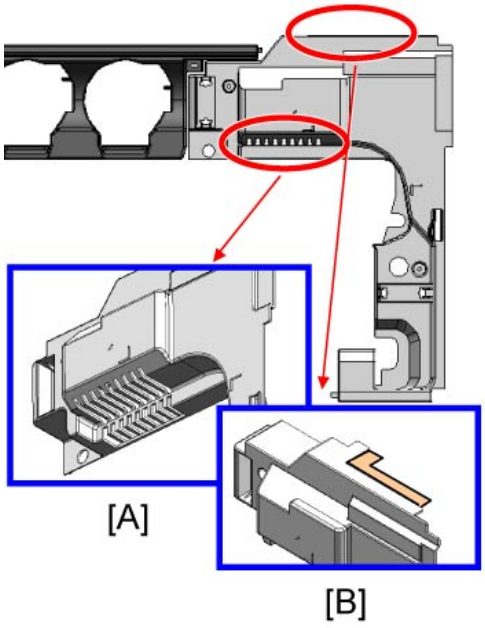
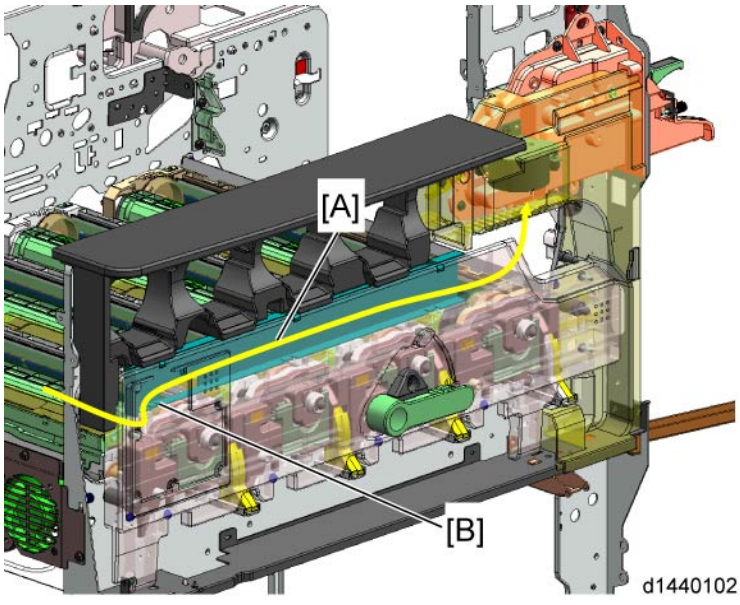


- A cutout [A] is created on the supply guide plate and the 2nd duct fan [B] is doubled in order to exhaust the air from the main fans effectively (The predecessor is [A'].).

2.2.3 AIR CURTAIN VENTILATION AT THE REAR OF THE FUSING SECTION



A duct is added at the rear of the PCDU face plate. This forms an airflow route, and prevents toner from diffusing around the faceplate and the toner bottles. Also, the shape of the inner cover is changed (Larger outlet [A], air leak prevention [B]).



The new duct [A] and the shape of the inner cover can guide the airflow from the main fan smoothly to the QSU fan. The airflow [B] that passes through the rear of the fusing section forms an air curtain between the fusing section and the development section. This curtain prevents increases in the temperature of the development section.

2.3 FAN CONTROL

This machine has "Extra Fan Control" mode to cool down the temperature inside the machine **after** a multiple printing job (more than 1,000 sheets; A4 LEF) and the temperature inside the machine goes beyond a threshold set in the SP mode. When the machine enters the Extra Fan Control mode, all fans are activated and kept operating until the temperature inside the machine goes below a threshold set in the SP mode after the job.

2.3.1 CAN OR CANNOT DURING EXTRA FAN CONTROL MODE

- Normal operation (copy, print, scan, etc.) can be done.
- Operation switch on the operation panel does not work.
- Fan operation cannot be stopped except turning off the main power switch. Extra Fan Control will be resumed if the machine is turned on within 30 minutes after turning off the main power switch.
- The machine cannot enter the energy saver mode during the Extra Fan Control mode.

2.3.2 SP SETTINGS FOR EXTRA FAN CONTROL

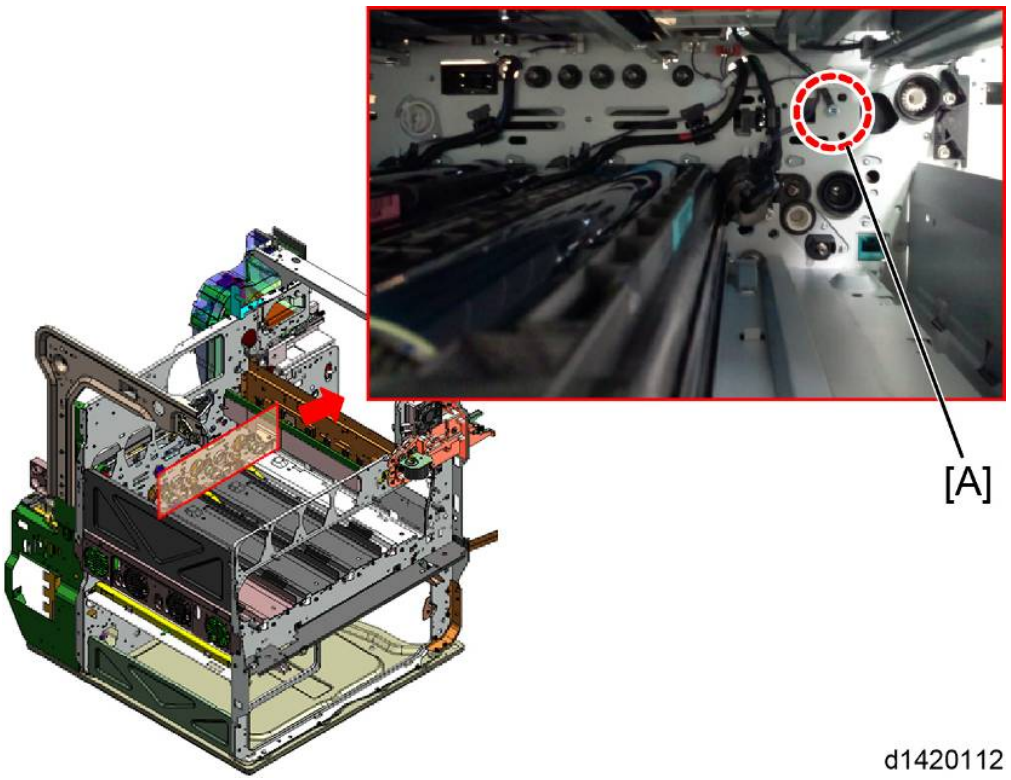
NOTE: Do not touch the following SP modes in the field. These are for design use only.

SP		Description	
SP1-953-001	Extra Fan Cooling State	Displays the status of the extra fan operation. **0: No operation** 1: Operation	**DFU**
SP1-953-006	Extra Fan Control Execution Temp.: Threshold	Sets the execution threshold temperature of the extra fan control. [20 to 70 / **37.3** / 0.1step]	**DFU**
SP1-953-007	Extra Fan Control Cancellation Temp.: Threshold	Sets the cancellation threshold (difference from the execution temperature) temperature of the extra fan control. [0.1 to 20 / **4.5** / 0.1step]	**DFU**
SP1-953-008	Extra Fan Control ON/OFF Setting	Sets the extra fan control on or off. 0: Off **1: On**	**DFU**
SP1-955-001	Fan Control Execution Temp.: Threshold	Sets the execution threshold temperature of the fan control. [20 to 70 / **34.6** / 0.1step]	**DFU**
SP1-955-002	Fan Control Cancellation Temp.: Threshold	Sets the cancellation threshold (difference from the execution temperature) temperature of the fan control. [0.1 to 20 / **1.8** / 0.1step]	**DFU**

2.4 COOLING CONTROL INSIDE THE MACHINE

This machine has a temperature sensor (development thermistor) to perform a cooling operation according to the temperature inside the machine to control the excessive rise of temperature and to keep the machine quality.

2.4.1 LOCATION OF THE TEMPERATURE SENSOR (DEVELOPMENT THERMISTOR)

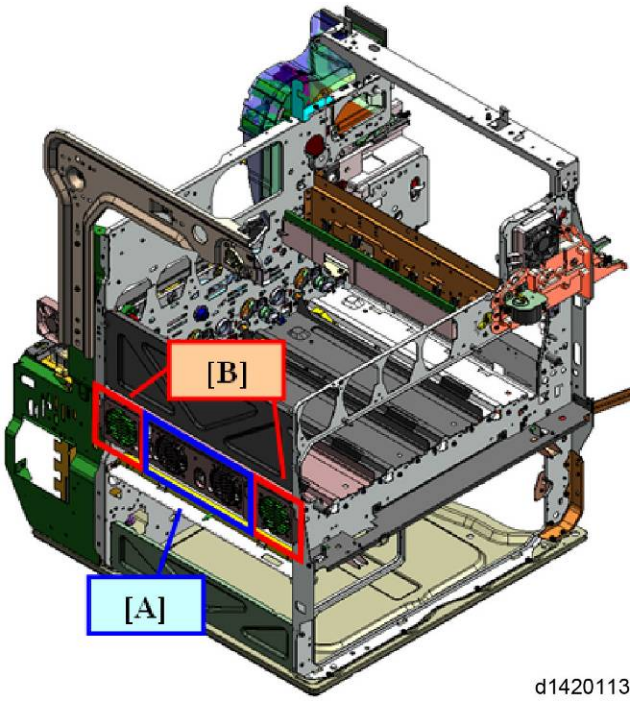


[A]: Temperature sensor (development thermistor)

2.4.2 OVERVIEW OF THE COOLING OPERATION INSIDE THE MACHINE

Fans operate according to the temperature inside the machine which is checked during or after printing to cool the temperature. For example, changing of the fans to rotate; extra rotation of the fans after printing.
Addition to the fans operation, CPM control is performed to cool the temperature when large amount of printing causes extremely high temperature.

Cooling operation during printing



d1420113

Usually the fans [A] of the main fan are used to cool the temperature inside the machine and the temperature sensor checks at regular time intervals.
If the temperature goes beyond an each threshold, the fans [B] operate instead of the fans [A] or both fans [A] and [B] operate at one time because the volume of air of the fans [B] is bigger than that of the fans [A].
Also if the temperature rises even further due to large amount of printing, CPM control is performed.
The table below shows the relationship between the temperature and the performance of the fans and CPM control.

Detected temperature	Fan [A] operation	Fan [B] operation	CPM control
The Highest	Performed	Performed	Performed
Higher	Performed	Performed	Not performed
High	Not performed	Performed	Not performed
Low	Performed	Not performed	Not performed

Cooling operation after printing

Usually the fans operation is stopped after printing. However the high temperature inside the machine keeps the fans rotating even after printing.

3. PROCESS CONTROL

3.1 OVERVIEW

This machine has the following two forms of process control:

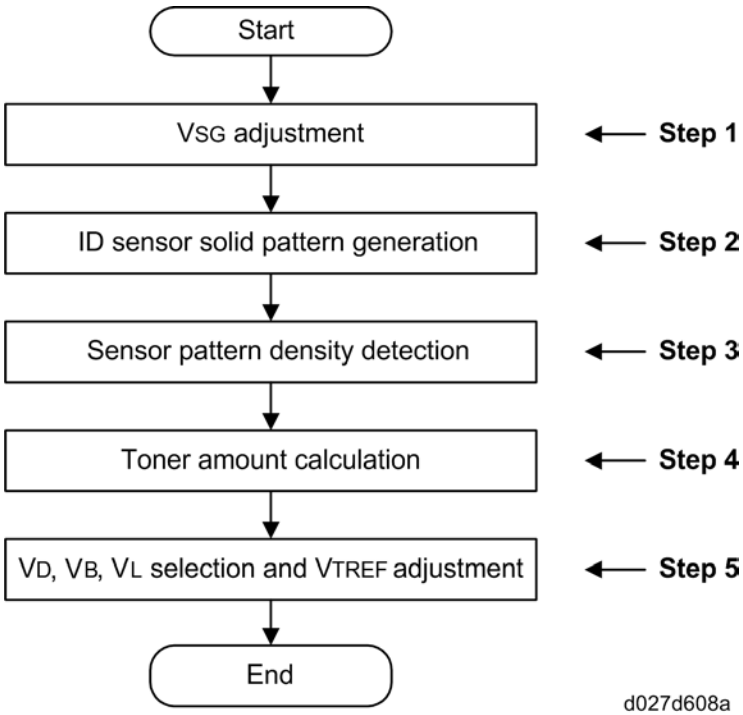
- Potential control
- Toner supply control

The following machine components are used for process control:

- One ID (image density) sensor (black, cyan, magenta and yellow).
- TD sensor.

Normally, process control is not disabled. If process control is disabled, fixed supply mode is used for toner supply, and the V_{TREF} stored in SP 3222 is used.

3.2 PROCESS CONTROL SELF CHECK PROCEDURE



Step 1: VSG Adjustment

This machine uses one ID sensor (direct reflection type) for the process control. The ID sensor detects a pattern for each color (see the 'Printing Process' section).

The ID sensor checks the bare transfer belt's reflectivity. Then the machine calibrates the ID sensor until its output when reading the bare transfer belt (known as VSG) is as follows.

- VSG = 4.0 ± 0.5 Volts

This calibration compensates for the transfer belt's condition and the ID sensor condition. For example, dirt on the surface of the belt or ID sensor.
VSG adjustment is done when process control or MUSIC is done at power-on, recovery from the energy saver mode or cover open-close. And it is only done if the VSG adjustment counter (SP3-510-007) is more than the value set with SP3-511-007 (default: 0) during a job or at job end.
SC370-00 is displayed if VSG is out of adjustment range sequentially 3 times.
SP3-321-010: Forced VSG Adjustment for all sensors
SP 3-325: Shows the results of the VSG adjustment (automatic or forced VSG adjustment) - 3 digits (Front, Center, Rear).

Step 2: ID Sensor Solid Pattern Generation

First, the machine agitates the developer for between 15 and 30 seconds until the fluctuation in TD sensor output becomes less than 0.3V.
Second, the machine makes the 5-grade pattern. This 5-grade pattern is made in black, yellow, cyan, and magenta (20 squares in total).

- The machine makes the 5-grades for each color (20 squares).

The patterns are made by changing the development bias and charge roller voltage. The difference between development bias and charge roller voltage is always the same. But, the development potential changes for each pattern.

- The development potential is the difference between the development bias and the charge remaining on the drum where the laser writes a black area. The development bias changes for each grade, and the charge on black areas of the image is always the same, so the development potential also changes.

Step 3: Sensor Pattern Detection

The ID sensor measures the light reflected from each grade of the pattern, to detect the densities of each grade. This data goes to memory.

Step 4: Toner Amount Calculation

The machine calculates the amount of toner on the transfer belt that is required to make each of the 10 grades of the sensor pattern. To do this, the machine uses the output values of the ID sensor (center) from each grade of the pattern.
The amounts of toner are expressed as M/A (mass per unit area, mg/cm^2)

Step 5: V_D, V_B, V_L Selection and V_{TREF} Adjustment

The machine determines the relationship between the amount of toner on the transfer belt and the development bias for each of the 10 grades.

From this, the machine determines the best V_D to get the target M/A for each color. Then, based on this V_D, the machine determines the best V_B and V_L. This process ensures that enough toner is deposited to make black pixels.

The machine also adjusts V_{TREF} (toner density target) at the same time so that the development gamma used by the machine fall within the target development gamma range stored in the machine's software. If it does not fall within this range, the amount of toner deposited on the latent image will be too high or too low.

3.3 TONER DENSITY ADJUSTMENT MODE

If the toner density becomes too high or too low because of an incorrect development gamma, this is corrected by process control (see the previous section). But sometimes, it takes many copies before the toner density comes to the correct value. Toner density adjustment mode can be used to bring the toner concentration to the correct level much more quickly, if users complain about the toner density.

SP 3-043 controls when the toner density adjustment mode is done.

To do the toner density adjustment mode manually, execute SP 3-011-2.

It is also done automatically before ACC, if SP3-041-4 is set to "2: TC Control" (this is the default setting).

During this procedure, the machine generates ID sensor patterns and detects the current development gamma. The gamma must be within ± 0.2 of the target development gamma.

If the current gamma is too high (above the target by 0.2 or more: 0.2 limit is set with SP3-239-009), the machine consumes toner in the development unit until the development gamma is within the correct range. To consume toner, the machine generates solid patterns.

If the current gamma is too low (below the target by more than 0.2: 0.2 limit is set with SP3-239-012), the machine supplies toner to the development unit until the development gamma is within the correct range.

3.4 TONER SUPPLY CONTROL

3.4.1 OVERVIEW

Toner supply control determines how long the toner supply clutch turns on. This determines the amount of toner supplied. This is done before every development for each color.

Toner supply control uses the following factors:

- Density of the toner in the developer (detected by the TD sensor) - V_{TREF}, V_T
- Pixel count: Determines how much toner was used for the page

The image density is kept constant by adjusting the density of toner in the development unit. At the same time, it accommodates changes in the development conditions through the potential control mechanism. Environmental changes and the number of prints made are also used in the calculation.

The amount of toner supplied is determined by the 'on' time of the toner supply clutch. The total 'on' time for each toner supply clutch is stored in the memory chip for the relevant toner cartridge. The machine supplies the calculated amount of toner for each color.

3.4.2 TONER SUPPLY CONTROL MODES

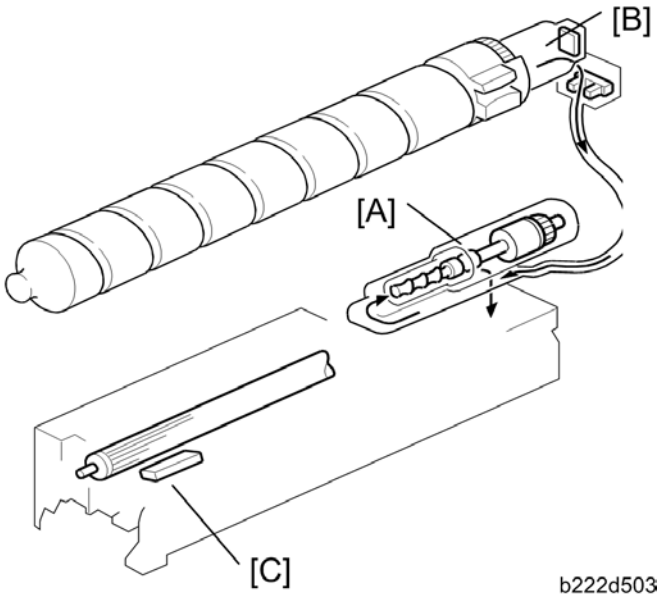
This machine has three toner supply control modes. You can select them with SP3-044-1 to -4.

1. Fixed supply mode
   This mode is used when the TD sensor becomes faulty. You can adjust the amount of toner supply with SP3-401-1 to -4 if the image density is incorrect (the default setting is 5%).
2. PID (Proportional Integral Differential) control mode (Fixed V_{TREF})
   This mode is used when the ID sensor becomes faulty. Only the TD sensor is used to control toner supply. The machine uses the V_{TREF} that is stored in SP3-222-1 to -4.
3. PID (Proportional Integral Differential) control mode
   This mode is used when the ID sensor becomes faulty. The TD sensor, ID sensor, and pixel count are used in this mode. V_{TREF} is adjusted by process control.

4. MBD (ANC*) control mode (Fixed VTREF) * ANC: Active Noise Control
   This mode controls the supply timing of developer to keep unequal concentration of developer at minimum, in addition to PID control above.
5. MBD (ANC*) control mode * ANC: Active Noise Control
   This mode is set by default and controls the supply timing of developer to keep unequal concentration of developer at minimum, in addition to PID control above.

The machine automatically changes the toner supply mode to fixed supply mode if the TD sensor is broken. However, the supply amount will be 70% of the normal fixed value to prevent too high image density.
The machine automatically changes the toner supply mode to PID control mode (Fixed V_{TREF}) if the ID sensors are broken.

3.5 TONER NEAR END/TONER END DETECTION



Toner Near End

The controller considers the following information to determine the toner near end status:

- Operation time counter of the toner attraction pump [A]
- Pixel counter

These values are both stored in the memory chip [B] on the toner cartridge, and copied from the memory chip to the NVRAM on the BCU.
If either value indicates that the amount of remaining toner is 36g (for black) or 30g (for yellow, magenta and cyan), the machine enters the near-end condition.

Toner End

To determine the toner end status, the machine uses the TD sensor [C] in the development unit for black or toner end sensor for yellow, cyan and magenta colors. The machine must first be in a toner near-end condition, or toner end cannot be detected.

Toner end for black is detected if both the following conditions occur:

- $V_T - V_{TREF}$ greater than or equal to "0.5" (SP3-101-021)
- SUM ($V_T - V_{TREF}$) greater than or equal to "10" (SP3-101-026)

Toner end for yellow, magenta and cyan colors is detected if the toner end sensor detects the toner end condition. The machine cannot print until the toner cartridge is replaced after it detects toner end for black. The machine can print in black and white only if cyan, magenta, or yellow are in a toner end condition during standby mode. At this time the machine cannot do color print jobs.

NOTE: If the yellow, magenta or cyan toner ends during a color-printing job, the job is suspended until toner is supplied. If new color toner is not installed, the user can print black-and-white jobs only.

Toner End Recovery

The machine assumes that the toner cartridge has been replaced if either of the following occurs when the near-end or end status exists:

- The front door is opened and closed.
- The main switch is turned off and on.

Then the machine starts to supply toner to the development unit. After supplying toner, the machine clears the toner near-end or end status if the following condition is detected:

- Toner end sensor detects that toner is supplied.

The machine tries to supply toner for a maximum of 5 times (SP 3-102).

3.6 DEVELOPER INITIALIZATION

When is it done?

When you install new developer, you must set the following SPs to "1" before you turn the power off. Then, the machine will reset the PM counters automatically. Developer initialization will also be done automatically.

- Black: SP3902-005
- Yellow: SP3902-006
- Magenta: SP3902-008
- Cyan: SP3902-007

When a new development unit or PCDU is installed, the machine detects the new unit automatically and initializes the developer.

How is it done?

The procedure is as follows.

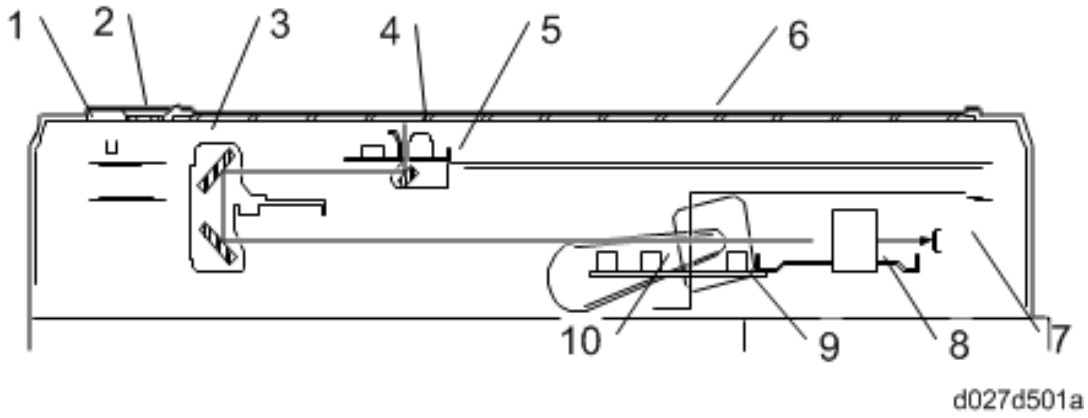
1. The machine agitates the developer for 30 seconds.
2. The machine adjusts V_{CNT} (control voltage for TD sensor) so that V_T (TD sensor output) becomes within 2.3 ± 0.2.
3. The machine keeps this as V_{TREF} if it is successful. SC360-01 to 04 is displayed if it fails sequentially 3 times.

The result of developer initialization can be checked with SP3-014.

During developer initialization, the machine forcibly supplies toner because there is no toner inside the toner transport tube at installation. Then the machine does the process control self check.

4. SCANNING

4.1 OVERVIEW



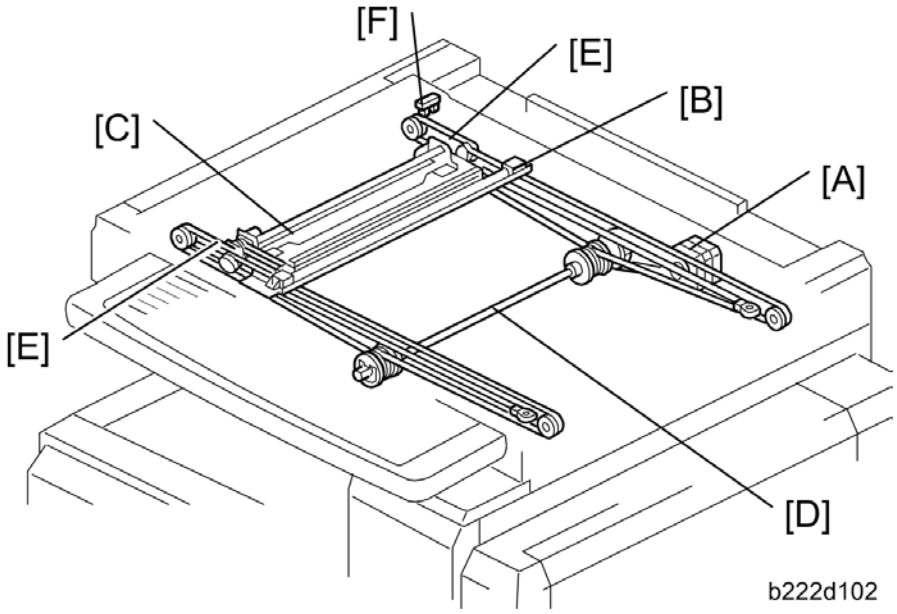
1. Scanner HP sensor	6. Exposure glass
2. ADF exposure glass	7. Sensor board unit (SBU)
3. 2nd scanner (2nd carriage)	8. Lens block
4. Scanner lamp	9. Scanner motor
5. 1st scanner (1st carriage)	10. Original length sensor

The original on the exposure glass or ARDF exposure glass reflects the light emitted from the scanner lamp. The reflected light goes to the CCD on the sensor board by way of the 1st and 2nd scanners. The sensor board converts the CCD analog signals into digital signals.

When the original is manually placed on the exposure glass, the scanner motor pulls the 1st and 2nd scanners via mechanical linkage. The original is scanned from left to right.

When the original is fed from the optional ARDF, it is automatically transported onto the ARDF exposure glass, and to the original exit. The original does not stay on the glass; but goes to the exit. The 1st and 2nd scanners stay at their home positions.

4.2 SCANNER DRIVE



The scanner motor [A] drives the 1st scanner [B] and the 2nd scanner [C] through the scanner drive pulley, scanner drive shaft [D], and two scanner wires [E].

Book mode -

The BCU board controls the scanner drive motor. The 2nd scanner speed is half that of the 1st scanner.

In reduction or enlargement mode, the scanning speed depends on the magnification ratio. The returning speed is always the same, whether in full size or magnification mode. The image length change in the sub scan direction is done by changing the scanner motor speed. In the main scan direction it is done by image processing on the BCU board.

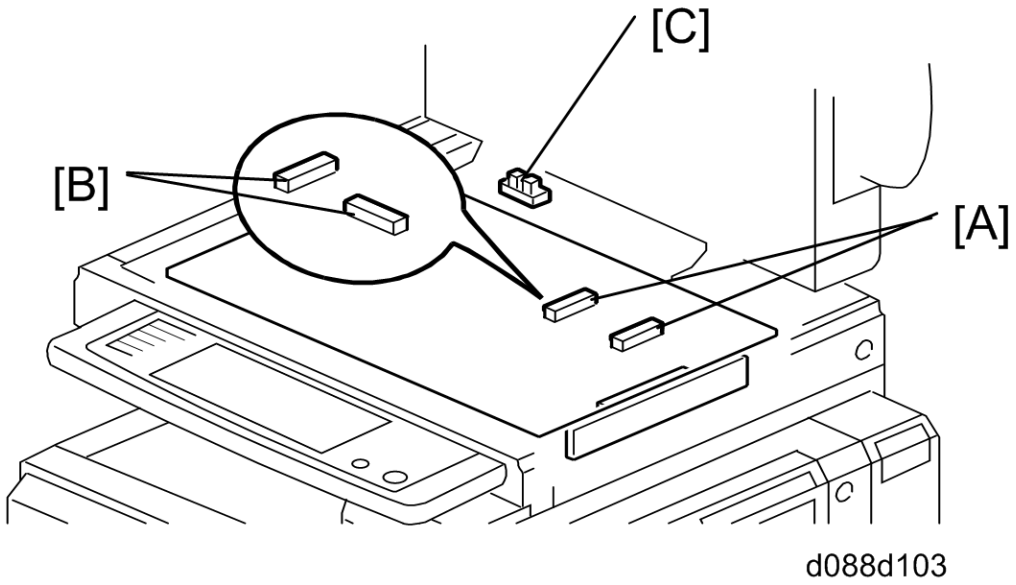
You can adjust the magnification in the sub-scan direction by changing the scanner motor speed with SP4-008.

ARDF mode -

The scanners always stay in their home position (the scanner HP sensor [F] detects the 1st scanner) to scan the original. The ARDF motor feeds the original through the ARDF. In reduction/enlargement mode, the image length change in the sub-scan direction is done by changing the ARDF motor speed. Magnification in the main scan direction is done in the BCU board. This is the same as for book mode.

You can adjust magnification in the sub-scan direction by changing the ARDF motor speed with SP6-017.

4.3 ORIGINAL SIZE DETECTION



- There are no original width sensors in the scanner unit. However, the original width can be detected by CCD. The original length sensors [A] (for EU models) [B] (for NA models) detect the original length.
- The BCU board checks each sensor status when the platen cover sensor [C] is activated as it is closed. It detects the original size by the on/off signals it gets from each sensor.
- If the copy is made with the platen cover fully open, the BCU determines the original size from the sensor outputs after the Start key is pressed.

4.4 ANTI-CONDENSATION HEATER

The anti-condensation heater is available as an optional unit. The anti-condensation heater prevents condensation on the mirrors. Condensation can occur when the scanner unit is, for example, moved from a cold room to a warm room. Condensation can cause abnormal images.

5. IMAGE PROCESSING

5.1 SBU (SENSOR BOARD UNIT)

SBU

The SBU does the following functions:

- Black level correction
- White level correction
- Creating the SBU test pattern

Operation Summary

The signals from the 3-line CCD, one line for each color (R, G, B) and 2 analog signals per line (ODD, EVEN), are sampled by the ASIC and converted to digital signals in the 10-bit A/D converter. This is the first phase of processing the data scanned from the original.

Storing Operation Settings

The controller stores the scanner settings. These values must be restored after the lens block is replaced:

SP4-008-001	Sub Scan Mag.Adjustment	Sub Scan Magnification Adjustment
SP4-010-001	L-Edge Regist Adjustment	Leading Edge Registration Adjustment
SP4-011-001	S-to-S Regist Adjustment	Side to Side Registration Adjustment

SBU Test Mode

There is SP code to create a test pattern which can be used as a diagnostic tool to troubleshoot problems in the SBU:

- SP4807-001 SBU Pattern - Test Pattern

To print the pattern:

- Select the pattern to print.
- Touch "Copy Window" then press the Start key.

5.2 IPU

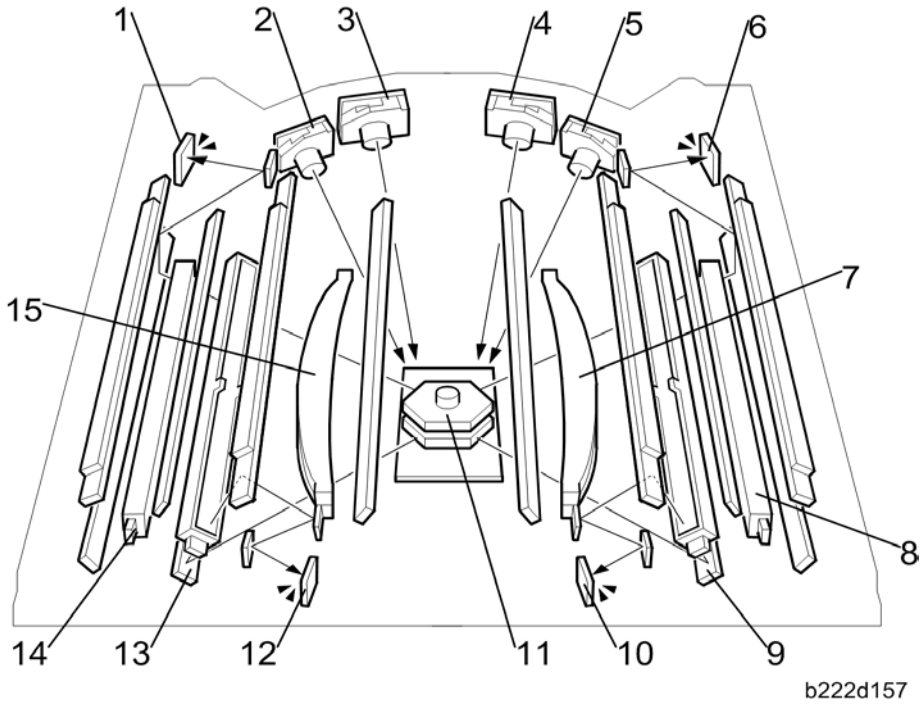
The IPU does the following:

- Controls the scanner
- Processes the image signals from the SBU and sends them over the PCI bus to the controller memory
- Receives the image processing signals sent over the PCI bus from the controller memory, processes them and then, outputs them to the VGAVD.
- Outputs the control signals for the ARDF
- Controls the relay of power and signals

Image processing, ADS correction, and line width correction are done on the IPU board for all the digital data sent from the SBU. Finally, the processed data is sent to the printer as digital signals (4 bits/pixel).

6. LASER EXPOSURE

6.1 OVERVIEW

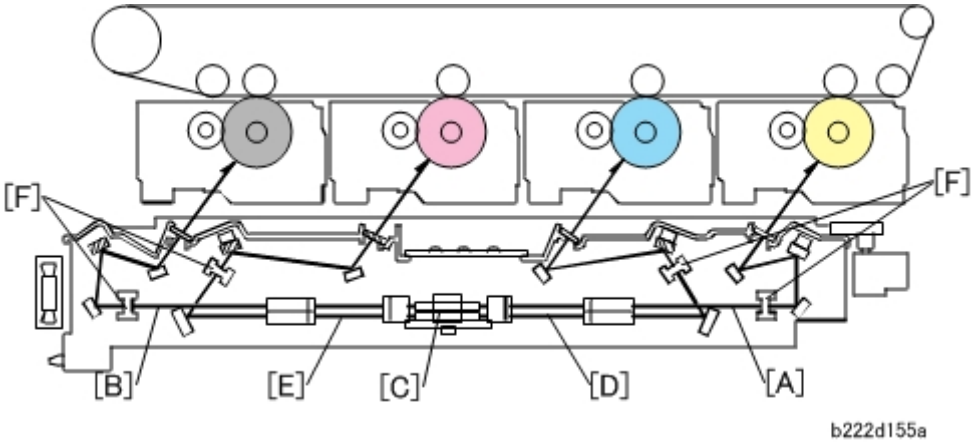


1. Synchronizing detector board: Y/C-E	9. L2 lens-M
2. LD unit-Y	10. Synchronizing detector board:
3. LD unit-C	Bk/M-E
4. LD unit-Bk	11. Polygon mirror motor
5. LD unit-M	12. Synchronizing detector board:
6. Synchronizing detector board: Bk/M-S	Y/C-S
7. L1 lens-Bk/M	13. L2 lens-C
8. L2 lens-Bk	14. L2 lens-Y
	15. L1 lens-Y/C

This machine uses four LD units and one polygon mirror motor to produce latent images on four OPC drums (one drum for each color toner). In the C1d model, two laser beams are used for each color except for OHP/Thick paper type in 600 x 600 dpi mode.

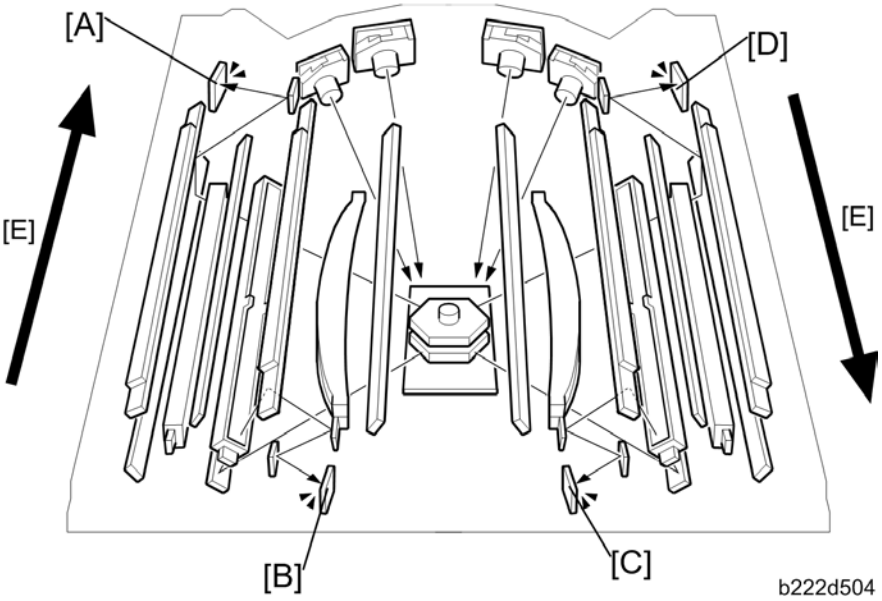
There are two hexagonal mirrors. Each mirror reflects beams from two LD units. Laser exposure for black and magenta starts from the rear side of the drum. But for yellow and cyan it starts from the front side of the drum. This is because the units for black and magenta are on the other side of the polygon mirror from the units for yellow and cyan.

6.2 OPTICAL PATH



The laser beams for black [B] and yellow [A] are directed to the upper part of the polygon mirror [C]. Laser beams for magenta [E] and cyan [D] are directed to the lower part of the polygon mirror [C].
The L2 lens [F] corrects the main scan line. Without this component, the line bends out towards the middle of the main scan. The central bend of the L2 lens is adjusted in the factory.
The speed of the polygon mirror depends on the selected mode and model.

6.3 LASER SYNCHRONIZING DETECTORS



6.3.1 OVERVIEW

The machine has four laser synchronizing detector boards (LSD). There is one at each corner of the laser optics-housing unit.
The four LSD boards detect the following:

- [A]: Scanning end position for yellow and cyan
- [B]: Scanning start position for yellow and cyan
- [C]: Scanning end position for magenta and black
- [D]: Scanning start position for magenta and black.

The machine recognizes each color from the time that they are detected.

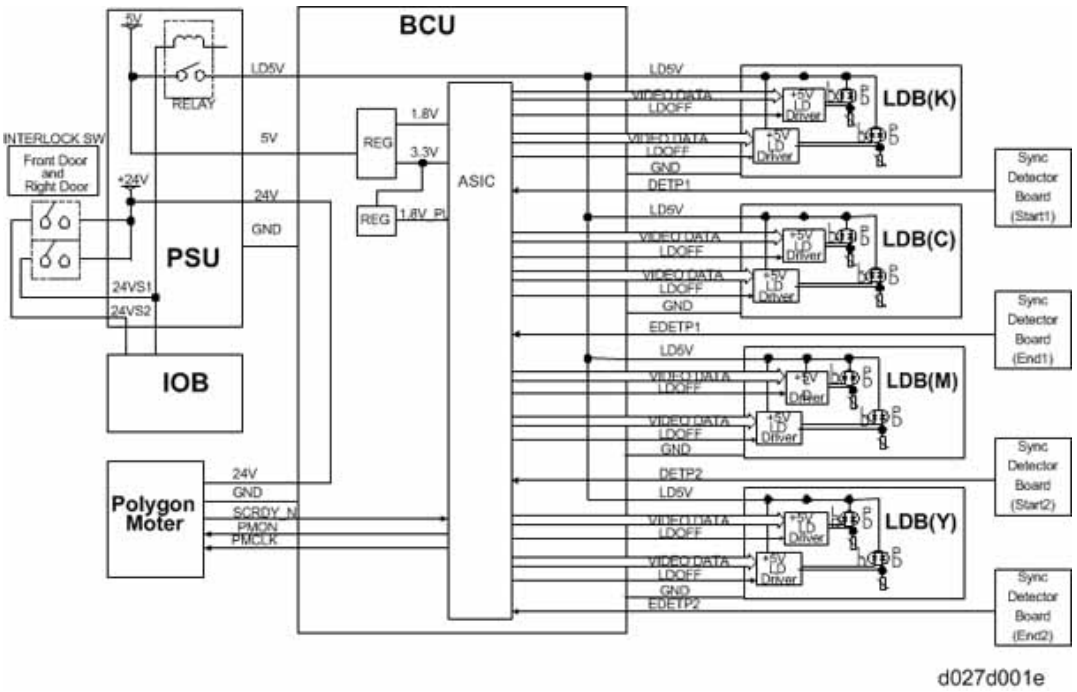
Main Scan Start Detection

For magenta and black, the LSD at the rear detects the start of the main scan. For yellow and cyan, the LSD at the front detects the start of the main scan. The arrow [E] indicates the scanning direction.

Clock Frequency Adjustment

Each LSD ensures that the number of laser clock pulses in the main scan is constant. If the count for one particular beam varies from normal, the LD clock frequency for that beam is adjusted.
If the board at the end position is defective, the clock frequency cannot be adjusted. At this time, you must disable the detection feature with SP2-186-1.

6.4 LD SAFETY SWITCH



A relay on the PSU ensures technician and user safety. It also prevents the laser beam from turning on during servicing. This relay turns off when the front cover, upper left cover, or right door is opened. At this time it cuts the power (+5V) supplied to the LD board for each color through the BCU.

Two safety switches are turned on or off by the front door or right door, and this opens the relay.

- LD Driver: Precise Pulse Modulation ASIC on C-MOS technology
- LDB: LD Drive Board (included in the LD Unit)

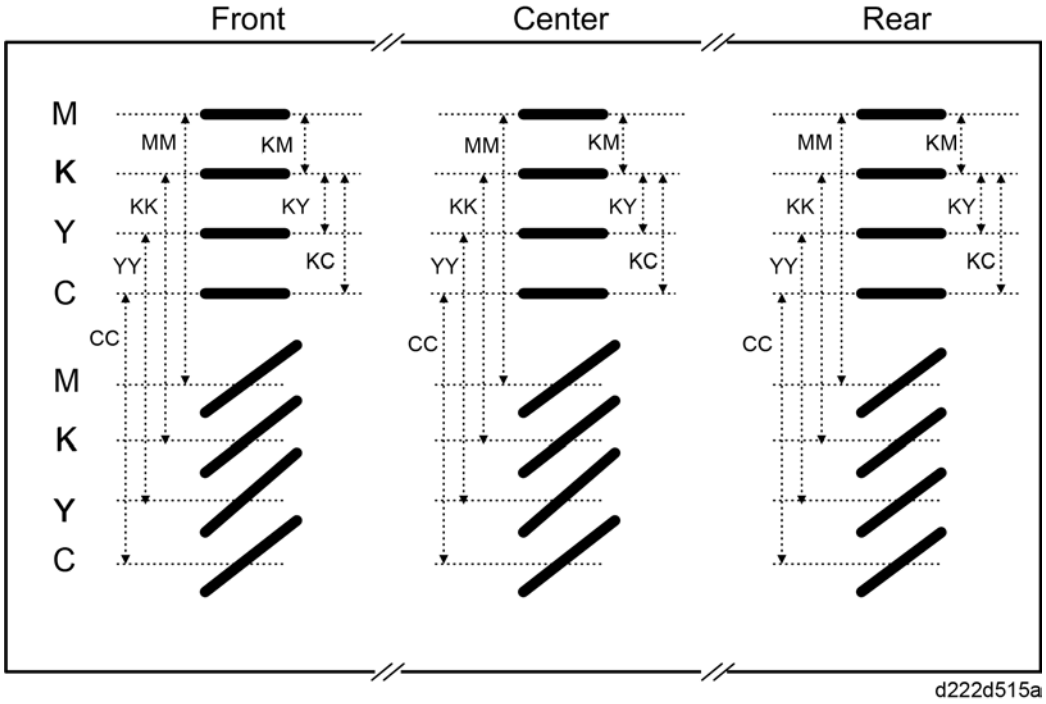
6.4.1 ERROR MESSAGES

Along with other switches, the LD safety switches help show error messages related to external covers. When one or more covers are open, the messages, “Cover is open.” and “Close the indicated cover,” show with a diagram. The diagram shows which cover is open.

6.5 AUTOMATIC LINE POSITION ADJUSTMENT

6.5.1 OVERVIEW

MM, KK, YY, CC: Spaces between two lines of the same color
KM, KY, KC: Spaces between a black line and a color line



During automatic line position adjustment, the line patterns above are created eight times on the transfer belt. The spaces between the lines (MM, KK, YY, CC, KM, KY, KC) are measured by the front, center, and rear ID sensors. The controller takes the average of the spaces. Then it adjusts the following positions and magnification:

- Sub scan line position for YMC
- Main scan line position for YMC
- Magnification ratio for CKYM
- Skew for YMC

The transfer belt-cleaning unit cleans the transfer belt after the patterns are measured. SC285 shows if an error is detected four times consecutively.

6.5.2 SUMMARY OF EACH ADJUSTMENT

Sub scan line position for YMC

The adjustment of the sub-scan line position for YMC is based on the line position for K (color registration). The machine measures the gaps between the lines of each color in the pattern on the transfer belt. If the gaps for a color are not correct, the machine moves the image of the color up or down the sub scan axis. To do this, it changes the laser write timing for that color.

Main scan line position for YMC

If the machine detects that the image is out of position in the main scan direction, it changes the laser write start timing for each scan line.

Magnification adjustment for KYMC

If the machine detects that magnification adjustment is necessary, it changes the LD clock frequency for the required color.

Skew for YMC

The adjustment of the skew for YMC is based on the line position for K.

6.5.3 ADJUSTMENT CONDITIONS

Line position adjustment can be turned on or off with SP2-193-001. However, it is normally recommended to turn on this function.
Line position adjustment timing depends on several SP mode settings. These are described below.
Δt = Time since the last job
ΔT = Temperature change between the temperature of the last job and the current temperature

Forced (SP2-111-001 to -003):

This activates the line position adjustment manually. There are three types of line position adjustment mode. See the SP table for details.

Initial:

This starts automatically when the power is turned on, or when the machine recovers from the energy saver mode.
Line position adjustment is automatically done **twice** if one of these conditions occurs:

4. ∆t > Time threshold (SP2-193-012: [default: 600 minutes])
5. ∆T > Temperature threshold (SP2-193-011: [default: 10°C])

Line position adjustment is automatically done **once** if one of these conditions occurs:

6. ∆t > Time threshold (SP2-193-009: [default: 300 minutes])
7. ∆T > Temperature threshold (SP2-193-008: [default: 5°C])

Interval: During job:

This interrupts printing and then starts automatically if one of these conditions occurs when the machine checks at the sheet interval specified with SP3-512-001 (default: 30 pages).
Line position adjustment is automatically done **once** if one of these conditions occurs:

8. ∆t > Time threshold (SP2-193-009: [default: 300 minutes])
9. ∆T > Temperature threshold (SP2-193-008: [default: 5°C])
10. B/W counter (SP3-510-005) + Color counter (SP3-510-006) > Output threshold for all outputs (SP2-193-004: [default: 200 pages])
11. Color counter > Output threshold for color outputs (SP2-193-005: [default: 200 pages])

Interval: Job end:

This starts automatically at the end of a print job.
Line position adjustment is automatically done **once** if one of these conditions occurs:

12. ∆t > Time threshold (SP2-193-009: [default: 300 minutes])
13. ∆T > Temperature threshold (SP2-193-008: [default: 5°C])
14. B/W counter (SP3-510-005) + Color counter (SP3-510-006) > Output threshold for all outputs (SP2-193-002: [default: 500 pages])
15. Color counter > Output threshold for color outputs (SP2-193-003: [default: 200 pages])

Front door open/close:

This starts automatically when the front door is opened/closed.
Line position adjustment is automatically done **once** if one of these conditions occurs:

16. Δt > Time threshold (SP2-193-009: [default: 300 minutes])
17. ΔT > Temperature threshold (SP2-193-008: [default: 5°C])

In stand-by mode:

This is automatically done **once** if both conditions occur at the same time. However, it is not done if the machine is in the energy saver mode.

18. Δt > Time threshold (SP2-193-009: [default: 300 minutes]) or ΔT > Temperature threshold (SP2-193-008: [default: 5°C])
19. B/W counter (SP3-510-005) > Output threshold for B/W outputs (SP2-193-002: [default: 500 pages]) or Color counter > Output threshold for color outputs (SP2-193-003: [default: 200 pages])

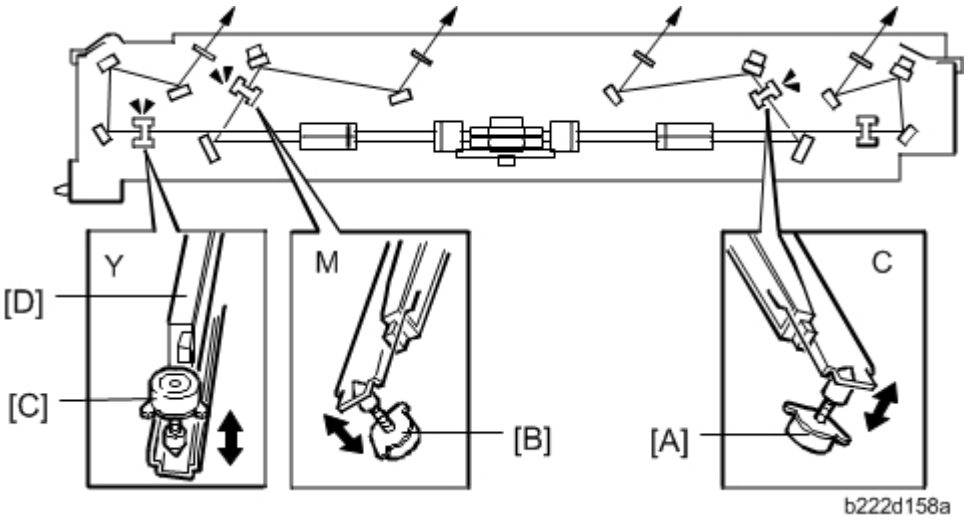
After new PCDU or Image Transfer Belt Unit detection

When the machine detects a new unit (one of the PCDUs or the Image Transfer Belt Unit), line position adjustment is automatically done **twice**.

If the main scan magnification changes

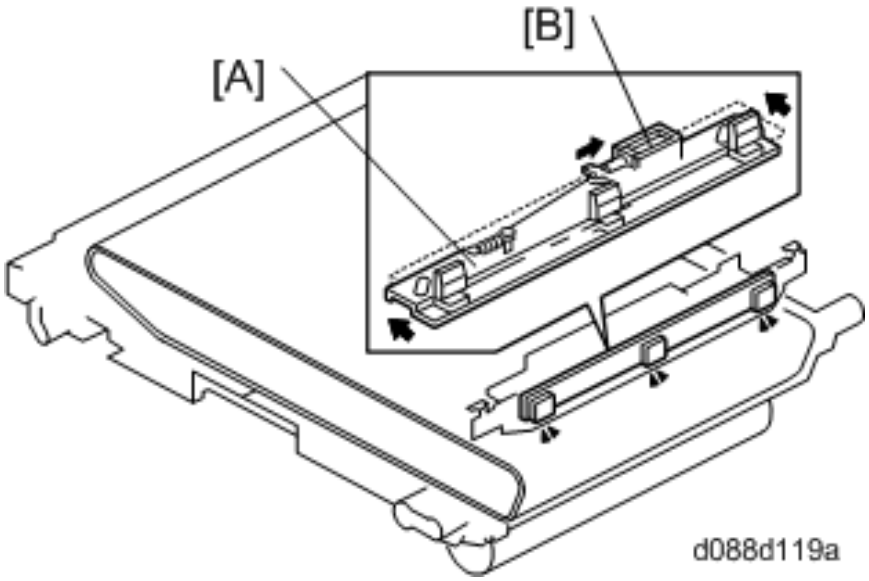
This is detected by the main scan synchronization detectors at each end of the scan line for each color.
If the magnification changes by more than 0.1% (threshold adjustable SP2-193-010), line position adjustment is done again.

6.5.4 MAIN SCAN SKEW ADJUSTMENT



The L2 lens positioning motors for cyan [A], magenta [B], and yellow [C] adjust the angle of the L2 lens [D] respectively, based on the L2 lens position for black. This mechanism corrects main scan skew.

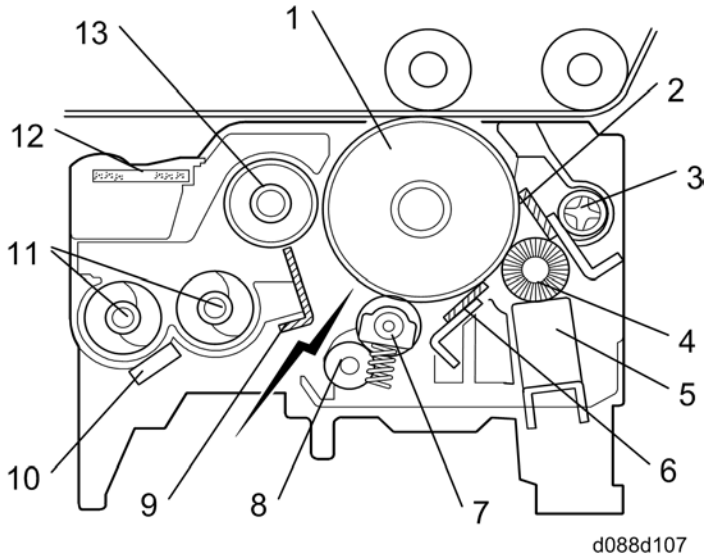
6.5.5 ID SENSORS



There are three ID sensors. One of them is for line position adjustment. Three of them are for process control. All of them are used for both process control and line adjustment. The ID sensor shutter [A] covers the sensors when the machine is idle. When the ID sensor shutter solenoid [B] is activated, ID sensor shutter [A] slides to the left. This mechanism prevents the ID sensors from becoming dirty with toner or dust.

7. PCDU (PHOTO CONDUCTOR AND DEVELOPMENT UNIT)

7.1 OVERVIEW



1. OPC drum	8. Cleaning roller (charge roller)
2. Cleaning blade	9. Doctor blade
3. Toner collection auger	10. TD sensor/ID chip
4. Brush roller	11. Mixing auger
5. Lubricant bar	12. Inner pressure adjustment filter
6. Lubricant application blade	13. Development roller
7. Charge roller (non-contact)	

This machine has four tandem PCDUs. Therefore, four color developments are possible during one paper path. This improves the productivity of outputs in color printing mode. Each PCDU contains identical components (drum unit, development unit and so on), but the PCDUs are not interchangeable.

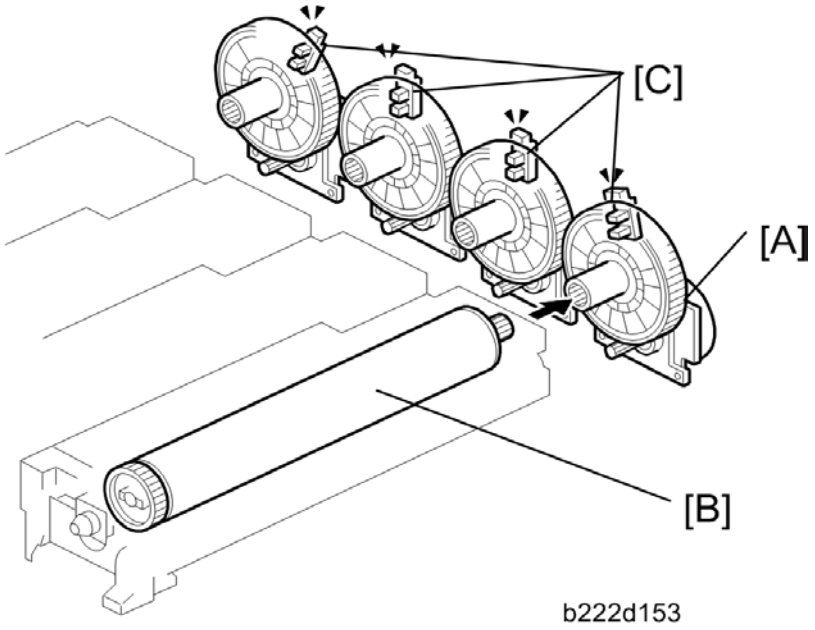
The diameter of the drum is 40 mm (circumference: about 125.7 mm).

The photoconductor gap between a drum and the corresponding development roller is not possible to adjust because these are assembled as a PCDU at the factory.

The ID chip is part of the TD sensor assembly. The ID chip contains counters and other data about the PCDU, drum unit, and development unit. If you replace the development unit with a new one, the counter information for the drum unit is not kept on the new ID chip.

7.2 AROUND THE DRUM

7.2.1 DRUM DRIVE

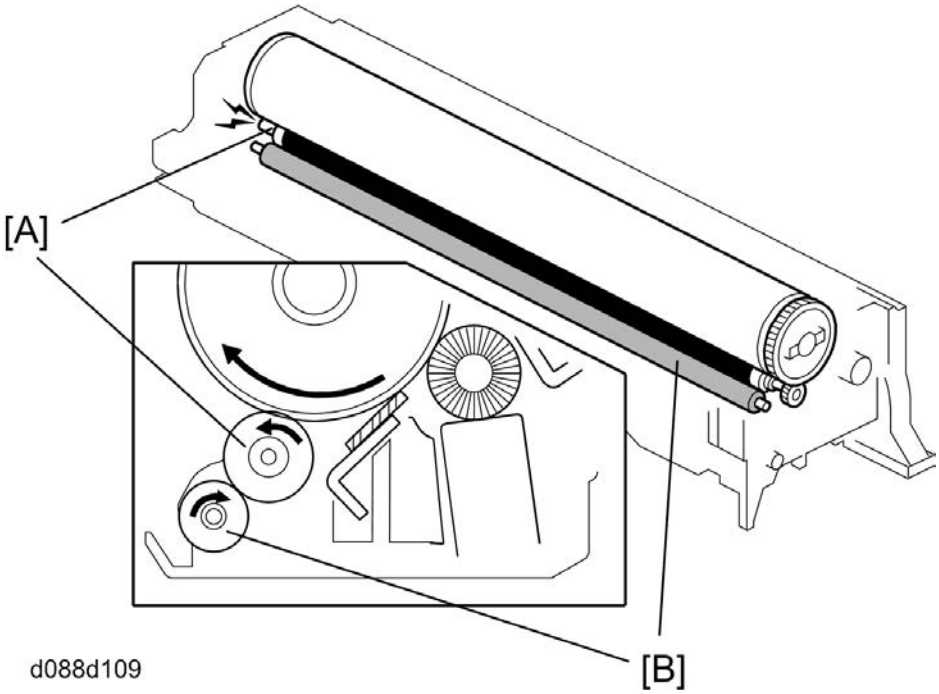


Each PCDU has its own drum/development drive motor [A]. The drum/development motor drives the drum [B] of each PCDU.
Also, each drive gear has its own drum gear position sensor [C]. The drum gear position sensor detects the position of each drum gear, so that the four PCDUs are aligned. The signals from these sensors and ID sensors (MUSIC) are used for "Amplitude Control" as described next. This motor is a brushless DC motor. This helps to reduce the drive noise.

7.2.2 AMPLITUDE CONTROL MECHANISM

The machine controls the drum/development motor speed to reduce phase fluctuation between outputs that is caused by differences among the four drum/development motors. To control the drum/development motor, the machine calculates outputs from the ID sensors for MUSIC at every line position adjustment and uses the drum gear position sensors [C] to detect if the drum motors rotate. As a result, the machine controls the drum/development motors to make sure that output quality does not vary.
There is an interrupter on each drum gear. The drum gear position sensors [C] detect the positions of these interrupters. SC380 shows when it detects that the drum motor is not moving.

7.2.3 DRUM CHARGE AND QUENCHING



This machine uses a non-contact charge roller [A] to reduce ozone. The non-contact charge roller gives the drum surface a negative charge. The C, B high voltage supply board, which is located at the rear of the machine, applies a dc and ac voltage (at a constant current) to the roller. The ac voltage helps to ensure that the charge given to the drum is as uniform as possible.

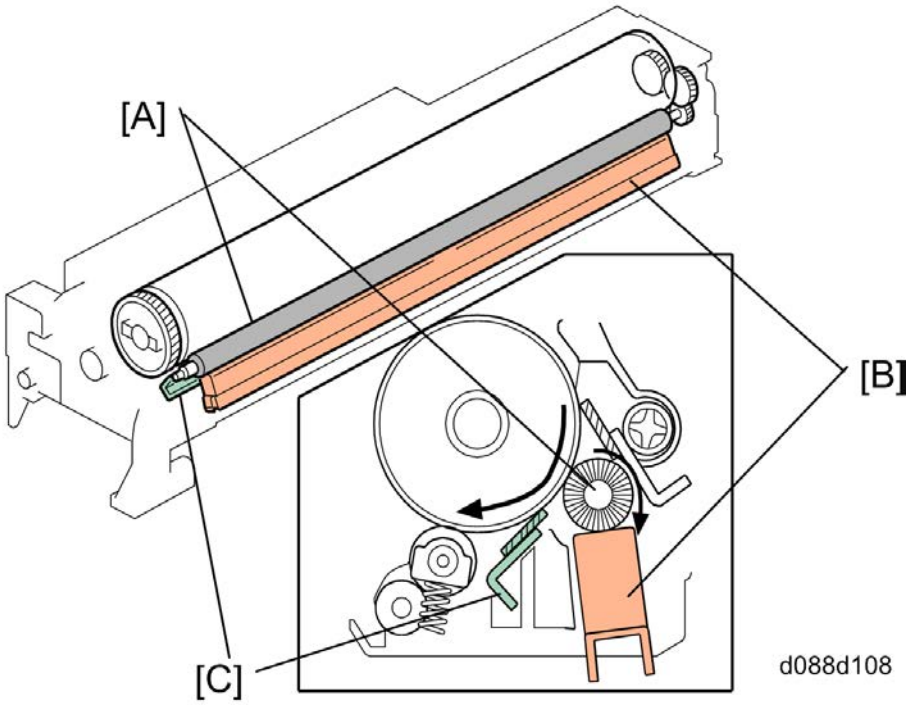
The machine automatically controls the charge roller voltage if automatic process control is enabled (i.e., if SP3-041-1 is set to "CONTROL"). However, if process control is switched off, (i.e., if SP3-041-1 is set to "FIXED"), the dc voltage is the value stored in SP2-005-1 to -12 (do not adjust in the field unless advised to do so).

The diameter of the charge roller is 12.5 mm (circumference about 39.1 mm). The gap between a drum and the corresponding charge roller is about 50 micrometers.

The cleaning roller [B], which always contacts the charge roller, cleans the charge roller.

Quenching is done by illuminating the whole area of the drum with the laser at the end of every job.

7.2.4 DRUM LUBRICATION

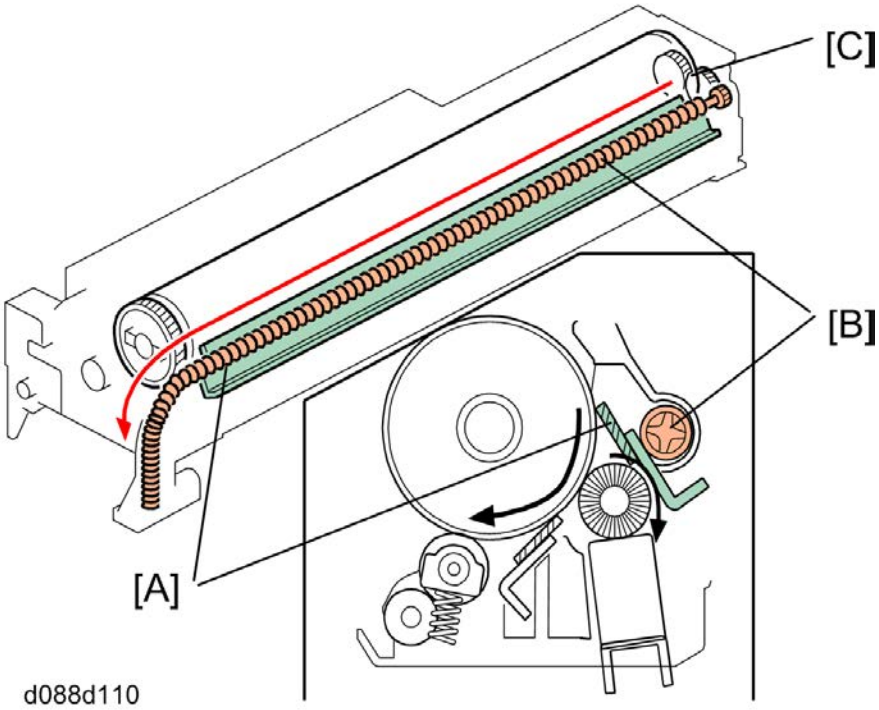


The brush roller [A] applies lubricant to the drum to make toner removal easy the next time the drum rotates past the cleaning blade.

The brush roller rubs against the lubricant bar [B] and lubricates the drum surface.

Lubricant is uniformly applied on the surface of the drum by the lubricant application blade [C].

7.2.5 DRUM CLEANING



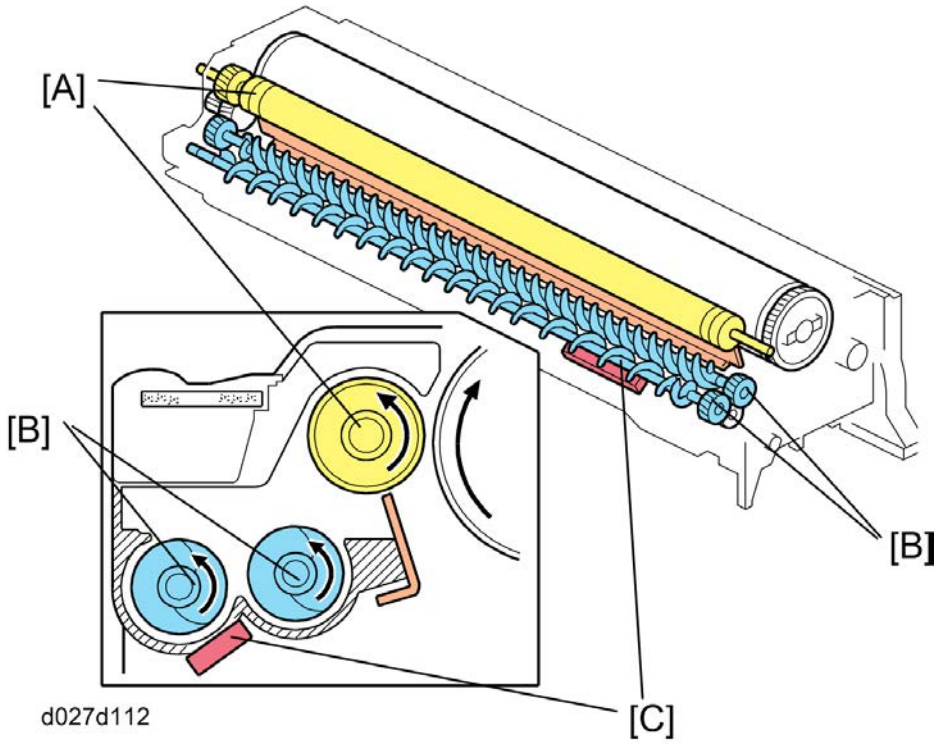
The cleaning blade [A] scrapes off the used toner that stays on the drum. The toner collection auger [B] transports the used toner towards the toner collection duct. Then it goes to the toner collection duct.

If the temperature is above the value of SP3-517, the drum reverses briefly at the end of the job to prevent the blade from flipping over.

The toner collection auger [B] in each PCDU is driven by gears [C] at the end of the drum. This toner then goes to the toner collection bottle (see "Toner Collection Path and Drive" in this section).

7.3 DEVELOPMENT

7.3.1 DEVELOPMENT OPERATION

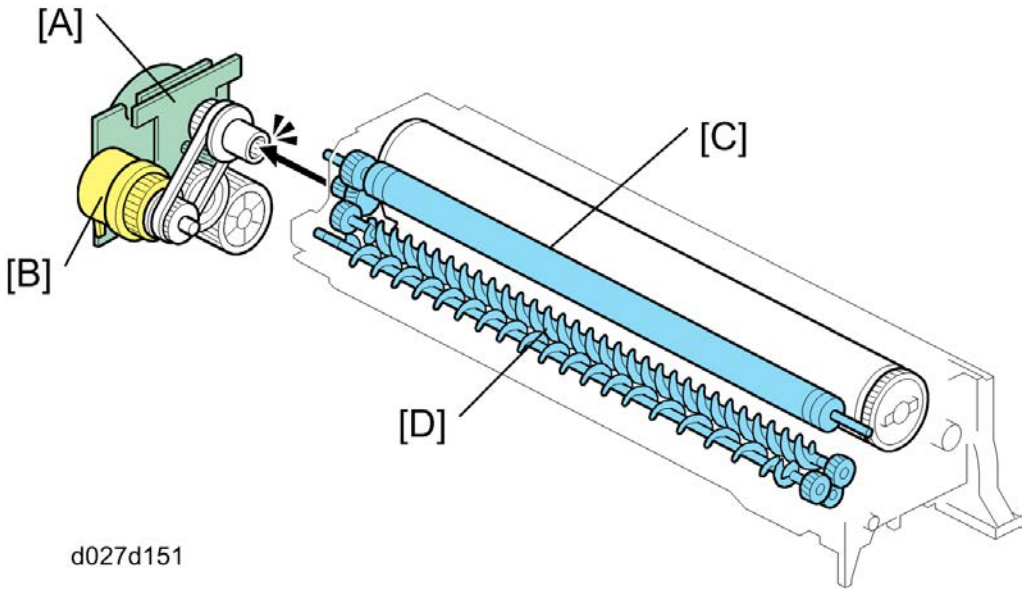


This machine uses a dual-component development system and has four development units (which are included in the drum units), one for each color. Each contains 220 g of developer when it is new. The developer in each unit is supplied to the development roller [A] by the two mixing augers [B] and attracted onto the surface of its roller.

The TD sensor [C] in the development unit and four ID sensors above the ITB control toner density. Each development unit has a TD sensor. The TD sensor contains an ID chip in which some information about the development unit is stored.

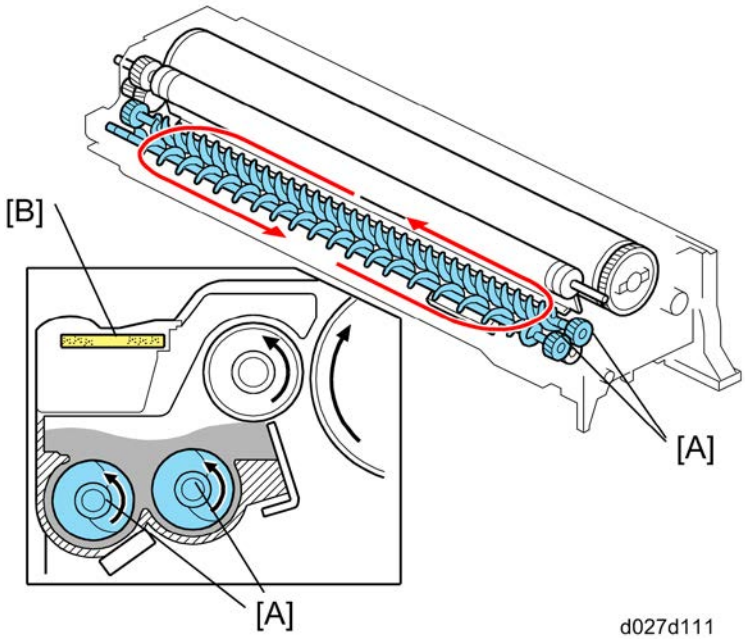
The diameter of the development roller is 18 mm (circumference about 56.5 mm).

7.3.2 DRIVE



Each color (K, Y, M, C) has its own drum/development drive motor [A] and development clutch [B]. Each drum/development motor drives the development roller [C] and mixing augers [D] through gears and development clutch. The gear trains are shown in the diagram.

7.3.3 DEVELOPER AGITATION



Two mixing augers [A] circulate the developer forward and backward to agitate the developer.

This happens at the following times:

- During process control self check
- During toner supply
- During development.

Filters [B] on the top of the developer hopper make sure that the internal pressure does not become too high. These ducts are sealed not to let the toner solidify before installing.

This development unit does not operate very well if it has been placed in the condition of over 50°C during transportation. The toner inside the development unit can become solid at temperatures higher that this value. A developer initialization error shows if the toner does become solid. At this time, you must do the following procedure:

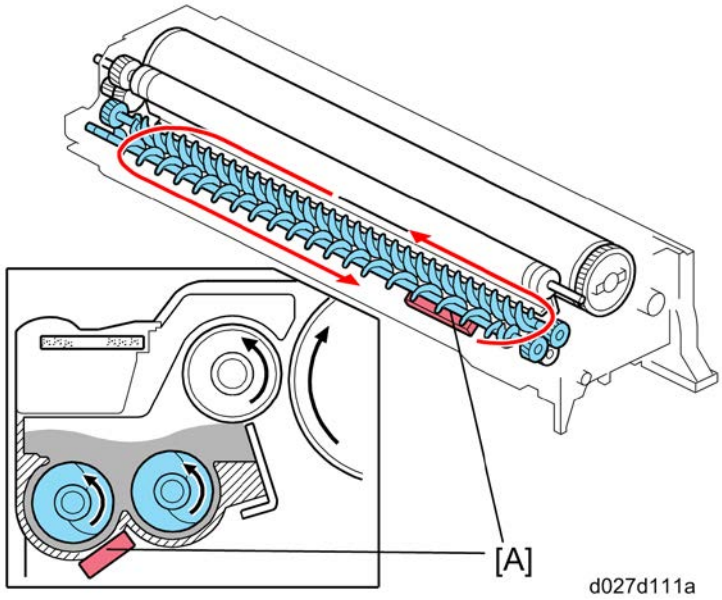
NOTE: You should also do this procedure when you install a new development unit.

20. Remove the (old) development unit.
21. Keep the (new) development unit level and shake it several times from side to side.
22. Install it in the machine.

7.3.4 DEVELOPMENT BIAS

The PSU supplies development bias to the development roller via the receptacle at the rear of each development unit.
There is a dc bias voltage.
The machine automatically controls the dc bias if the automatic process control is enabled (i.e., if SP3-041-001 is set to "1: CONTROL"). However, if process control is switched off, (i.e., if SP3-041-001 is set to "0: FIXED"), the dc bias is the value stored in SP3-621-001 to -012 (do not adjust in the field unless advised to do so).

7.3.5 NEW UNIT DETECTION



The TD sensor [A] in the development unit has an ID chip that contains the new unit detection flag. The machine detects that a PCDU is new if the flag in the ID chip is activated. The machine automatically does the following adjustments when detecting the new unit detection flag.

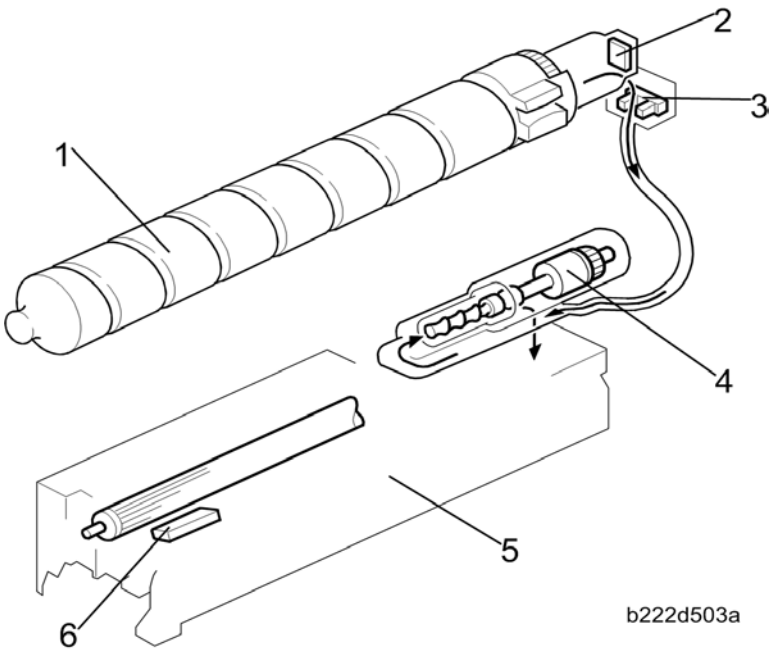
- PM counter clear for items related to the PCDU
- Developer initialization
- Charge roller voltage control
- Process control
- Line position adjustment

If the PM counter clear fails, clear the following SPs manually.

- SP3-902-1 to -4
- SP3-902-5 to -8
- SP3-902-9 to -12

8. TONER SUPPLY

8.1 OVERVIEW



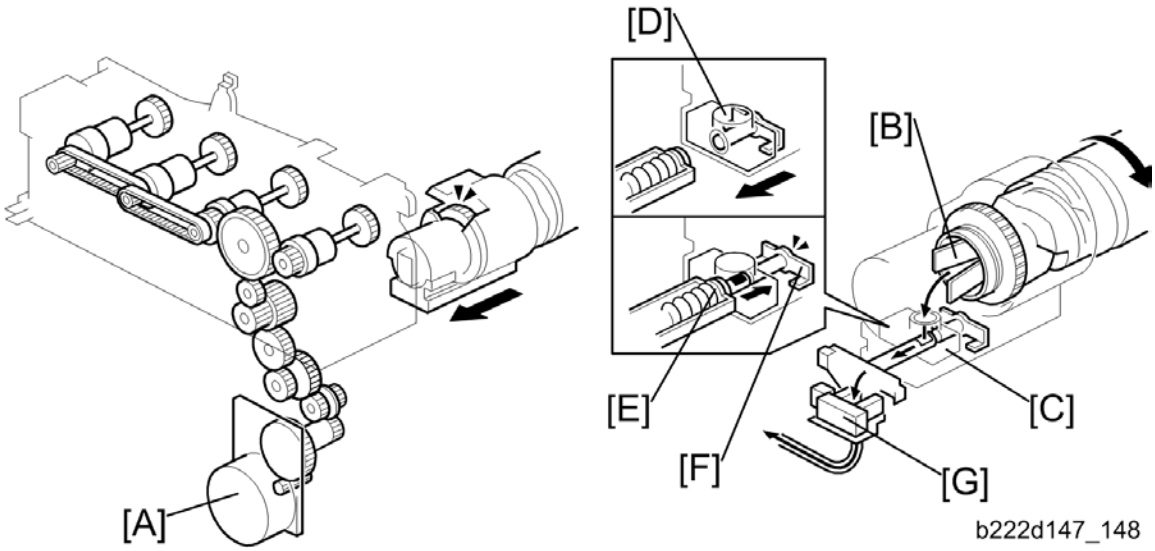
1. Toner bottle (each color)	4. Toner attraction pump (each color)
2. Memory chip (each color)	5. Development unit (each color)
3. Toner end sensor (Y, M, C)	6. TD sensor (each color)

This machine uses four toner bottles. Each bottle has a spiral groove in it and its groove moves toner to the toner attraction pump. And the toner attraction pump transports the toner to the development unit.

The toner end sensor is attached to the toner supply tube except black color. The toner end sensor and the output from the process control define when the machine detects toner end.

8.2 TONER SUPPLY MECHANISM

8.2.1 TONER SUPPLY FROM TONER BOTTLE TO TONER ATTRACTION PUMP

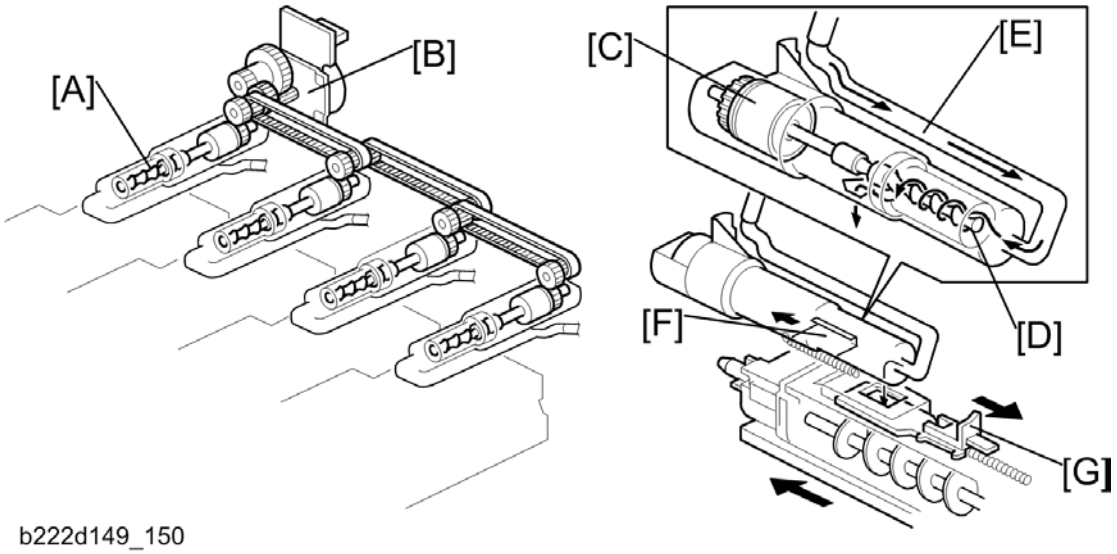


The toner transport motor [A] rotates the toner bottle-Bk via gears and a clutch. It also rotates the toner bottle-Y, -C, -M via gears, clutches and timing belts.
Each bottle has a spiral groove, and this groove moves toner to the mouth [B] of the bottle. Here, toner spills into a hopper [C]. The opening [D] of the toner hopper is normally closed if the toner bottle is not installed in the machine. When the toner bottle is installed in the machine, the transport tube [E] pushes the toner hopper shutter [F] and then the opening of the toner hopper is open.
The toner passes part of the way along the transport tube towards the toner attraction pump. The toner goes through the toner end sensor [G].

8.2.2 TONER NEAR END DETECTION/ TONER END DETECTION

Toner near end is calculated by the rotation time of the toner attraction pump for each color.
The toner end sensors [G] detect toner end conditions for Yellow, Cyan and Magenta. However, no toner end sensor for black color is installed in the entrance of the toner supply tube. The toner end for black color is defined when the TD sensor in the development senses toner end condition.

8.2.3 TONER SUPPLY FROM TONER ATTRACTION PUMP TO DEVELOPMENT UNIT



b222d149_150

Each toner attraction pump [A] is driven by the toner transport motor [B]. Each toner attraction pump has the same mechanism. The pump (toner attraction pump) has the following components:

- Toner supply clutch [C]
- Rubber tube
- Rotor [D]

The above components attract the toner in the toner transport tube [E] toward the development unit.

The toner supply clutch controls the rotor, which draws the toner in from the cartridge and passes it to the development unit. When supplying toner, the clutch turns on and off as many times as necessary to supply the necessary amount of toner. The amount of toner depends on the results of toner supply control.

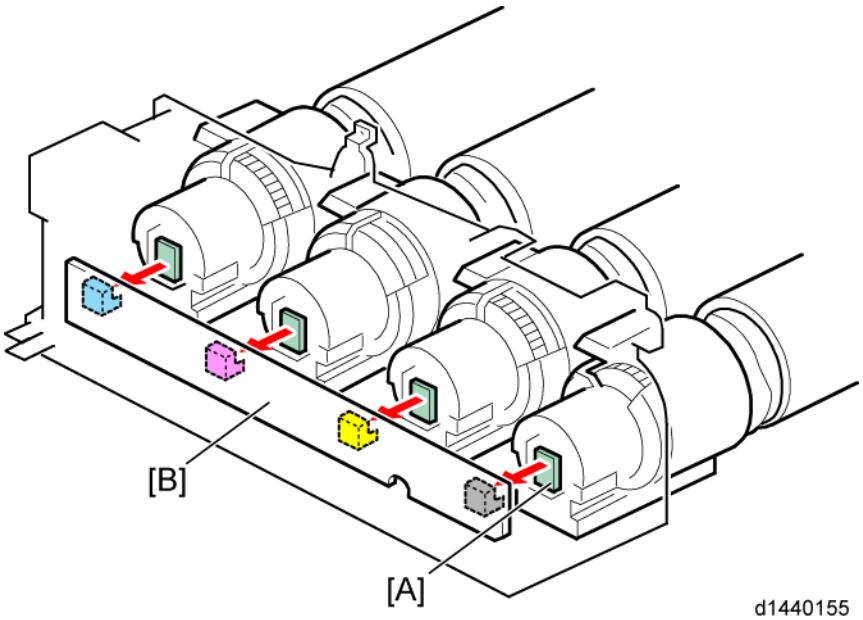
Shutter Mechanism

The development unit and toner attraction pump each have a shutter mechanism. The shutter [F] on the pump opens when the development unit is placed in the machine. At the same time, the pump opens the shutter [G] in the development unit. When both shutters are open, toner can enter the development unit from the toner attraction pump.

The shutter springs pull and close the shutter when the development unit is removed.

8.3 TONER CARTRIDGE

8.3.1 CONTACT ID SENSOR



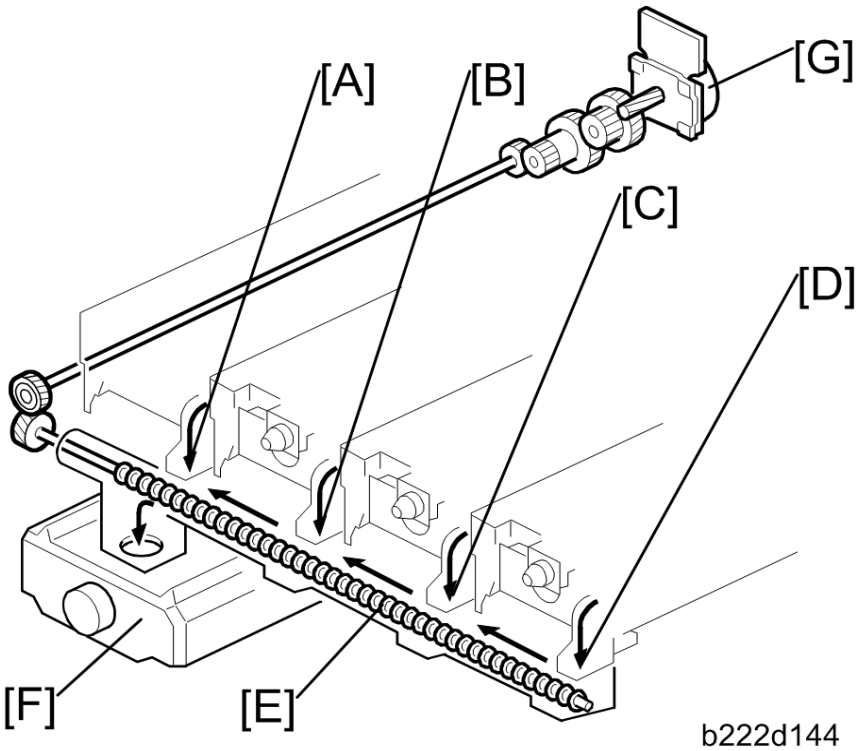
Each toner cartridge of this machine has an ID chip [A]. This stores the total "on" time of the toner supply clutch. This is used to calculate the amount of toner remaining in the toner cartridge. The chip is also used to detect whether the cartridge is installed (if the cartridge is not installed, the machine does not detect a signal from the memory chip).

The ID chip transmits its data to the ID contact board [B].

9. WASTE TONER COLLECTION

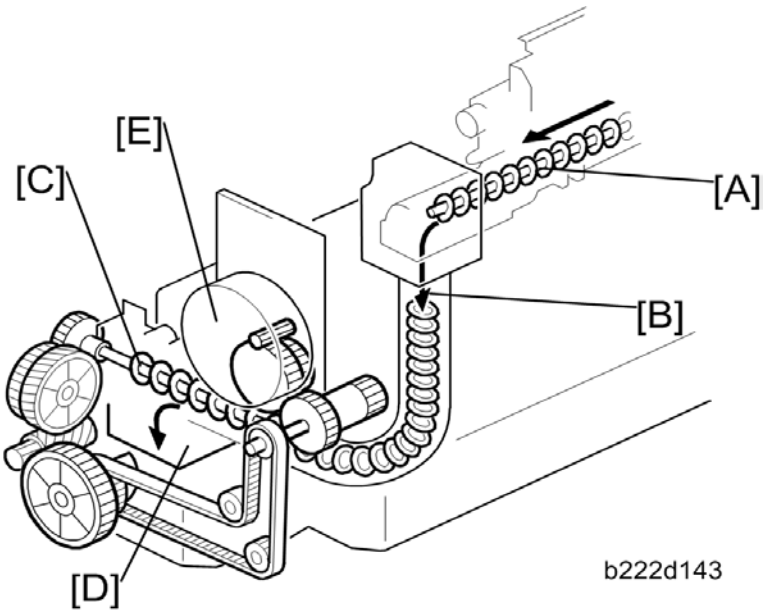
9.1 TONER COLLECTION PATH AND DRIVE

9.1.1 FROM PCDU



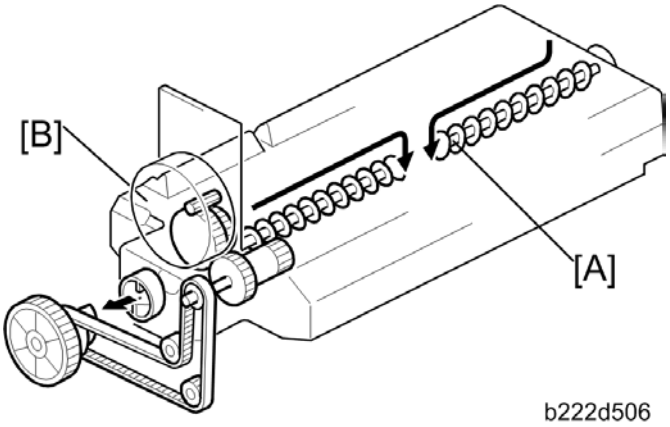
The used toner from the collection augers in the four PCDUs drops into the toner collection duct from the four openings [A], [B], [C], [D] at the front of the PCDUs. The toner collection auger [E] in the duct transports this used toner towards the toner collection bottle [F]. The coil [E] is driven by the toner transport motor [G]. The openings and PCDUs correspond as follows:
Yellow → [A], Magenta → [B], Cyan → [C], Black → [D].

9.1.2 FROM IMAGE TRANSFER BELT UNIT



The toner collection auger [A] moves the used toner from the image transfer belt and the used toner drops into the toner collection duct [B]. The toner collection coil [C] moves the used toner to the opening [D] at the rear of the toner collection bottle. The toner transport motor [E] drives the toner collection coil.

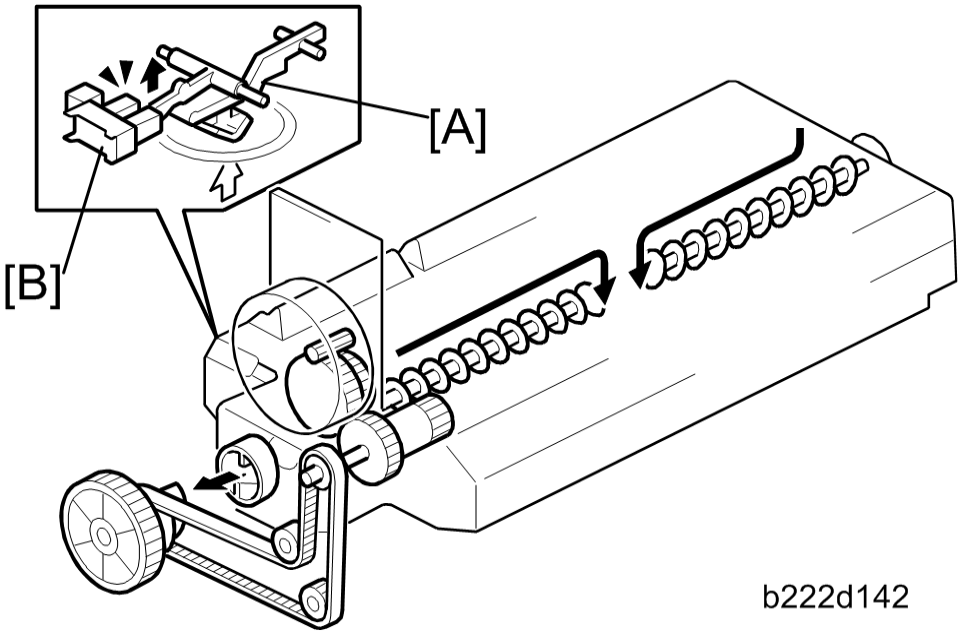
9.1.3 USED TONER DISTRIBUTION MECHANISM



The toner collection bottle has two openings (front and rear). The opening at the front is for the toner from the PCDUs, and the opening at the rear is for the toner from the image transfer belt.

To distribute the toner inside the bottle evenly, the auger [A] moves the toner to the center area. The mixing auger has two spirals in different directions. As a result, it is possible to gather the toner in the center area of the toner collection bottle even if the mixing auger always rotates in the same direction. The toner transport motor [B] drives the mixing auger via a timing belt and gears.

9.2 TONER COLLECTION BOTTLE SET/ NEAR-FULL/ FULL DETECTION

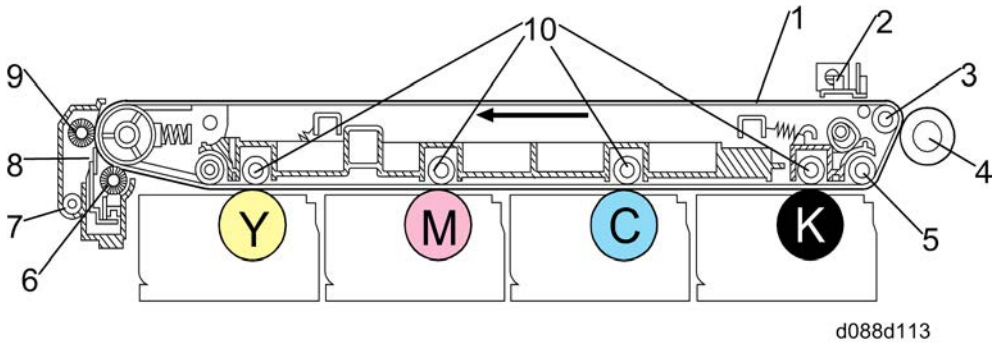


The toner collection bottle has a projection at its rear side. When the toner collection bottle is set, this projection pushes the waste toner bottle set switch at the rear of the machine. As a result, the machine detects that the toner collection bottle is installed.
The bottle near-full/full detection mechanism is above the bottle. When the used toner pushes up the used toner feeler [A], the waste toner sensor [B] turns off.
At this time, the machine determines if the toner collection bottle is almost full by referring to the internal counter for the used toner bottle. If this internal counter reaches the threshold set with SP3800-012 (default: 5 days) after the waste toner sensor has turned off, the machine displays the near-full message on the LCD.
After this, when the machine operates for the threshold days, the machine detects that the toner collection bottle is full, and the machine stops.

10. IMAGE TRANSFER AND PAPER SEPARATION

10.1 IMAGE TRANSFER

10.1.1 OVERVIEW



1. Image transfer belt (ITB)	6. Lubricant application roller
2. ID sensor	7. Toner collection auger
3. ITB drive roller	8. Cleaning blade
4. Paper transfer roller	9. Cleaning roller
5. Rotation encoder	10. Image transfer roller

The toner is moved from the four drums to the ITB by the four image transfer rollers. This is done with one rotation of the ITB (four toner images are super-imposed onto the belt). The arrow above the C and M drums on the diagram shows the direction of ITB rotation.

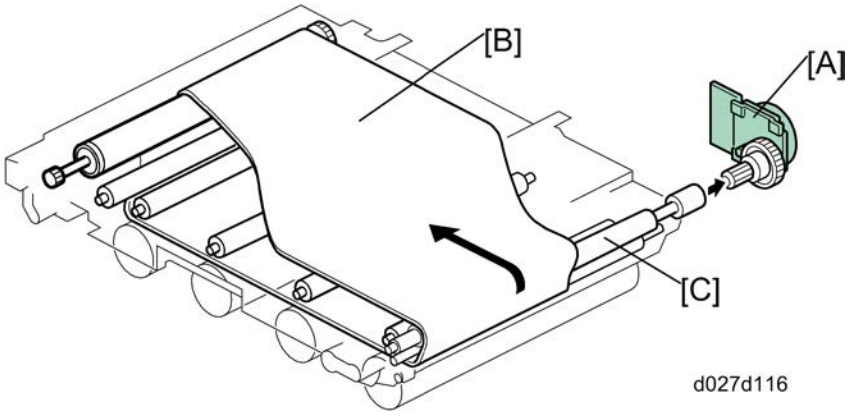
The ITB drive roller then moves the four-color toner image from the transfer belt to the paper. The paper transfer roller is an idle roller.

The cleaning unit in the transfer unit cleans the belt surface with the cleaning blade and roller. The used toner collected from the belt is transported to the toner collection bottle.

There are three ID sensors. All of them are used for the line position adjustment. One of them is used for process control. (The sensor at the center is used for the line position adjustment for the center position and process control for all colors.)

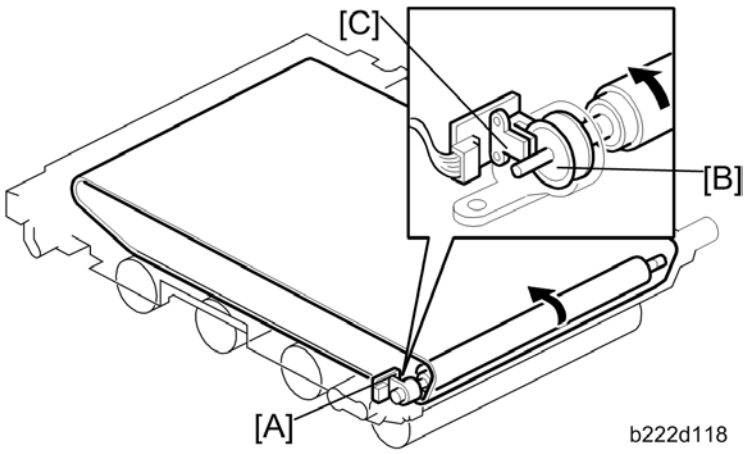
10.1.2 ITB (IMAGE TRANSFER BELT) DRIVE

Drive Motor

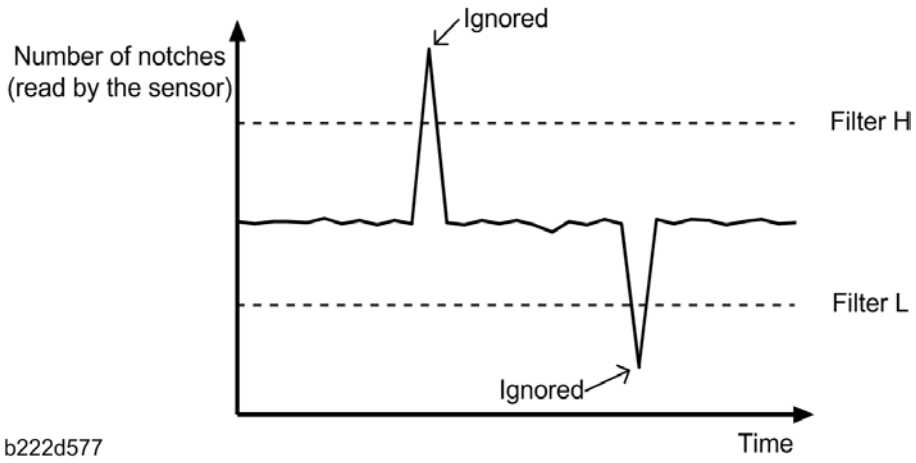


The ITB drive motor [A] drives the image transfer belt [B] and the cleaning unit via the ITB drive roller [C]. The speed of ITB drive depends on the process line speed (see 'Optical Path').

Transfer belt speed control

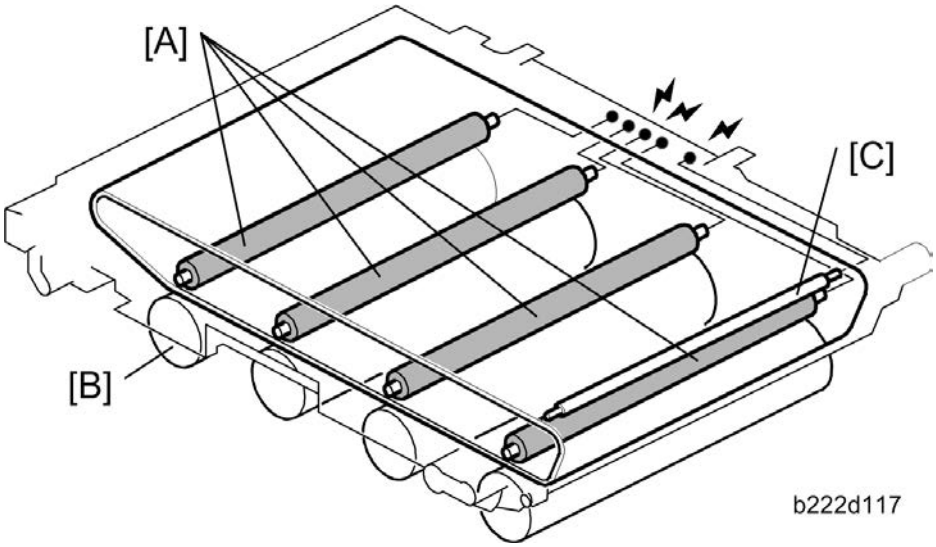


This machine uses the rotation encoder to control the transfer belt speed.
The encoder [A] is on one of the rollers. This encoder checks the rotation speed of the image transfer belt. The controller analyzes the signals from the encoder. Then it adjusts the rotation speed of the image transfer belt.
The encoder contains a disk that has 550 notches on its surface [B]. These notches are read by the sensor [C]. The controller counts the number of notches that the sensor has read in the unit of time. If the sensor has read an unusually large number of notches or an unusually small number of notches, the controller ignores such unusual signals. Therefore, incorrect reading does not affect the rotation speed.



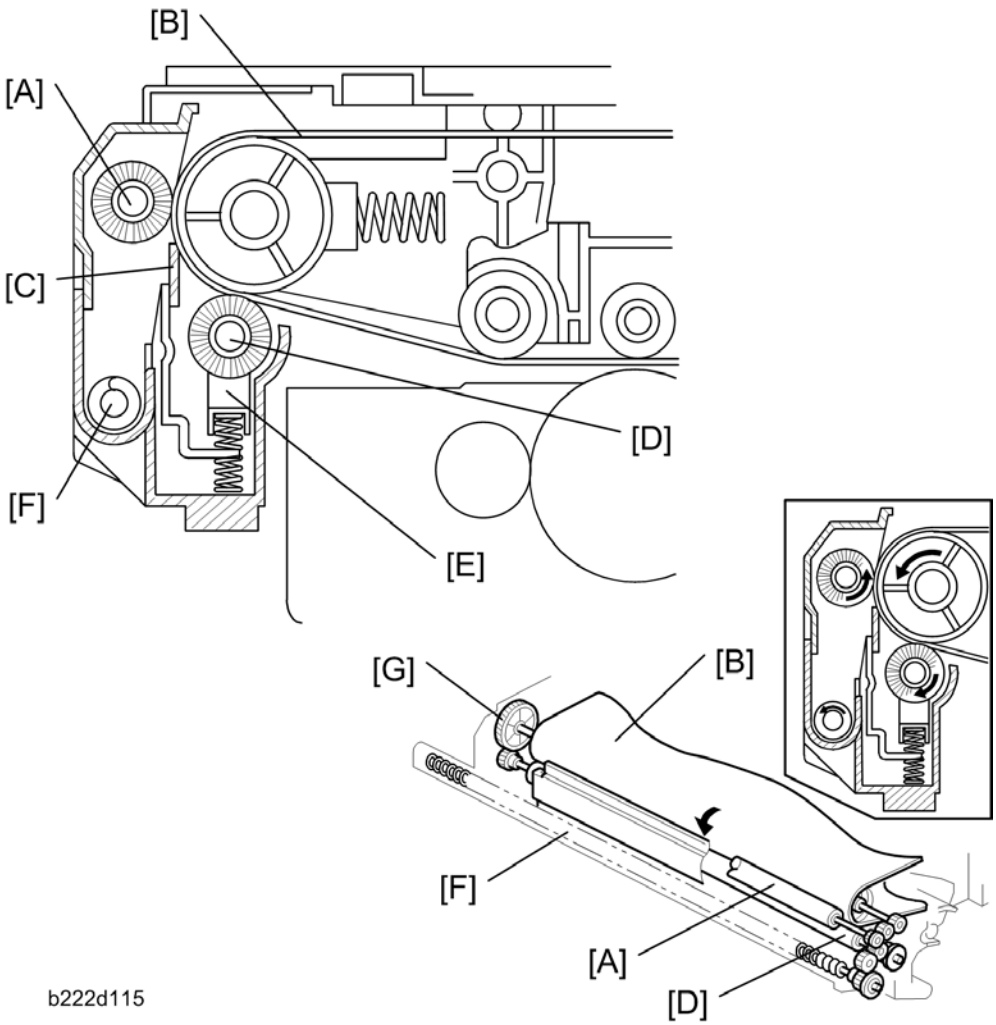
Filter H:
The number of notches read by the sensor when the rotation speed of the transfer belt is at its highest possible value.
Filter L:
The number of notches read by the sensor when the rotation speed of the transfer belt is at its lowest possible value.

10.1.3 ITB CURRENT



Each image transfer roller [A] applies current to the image transfer belt to attract the toner from each drum [B]. The high voltage supply board supplies current to the image transfer rollers and grounds the belt at roller [C].
The bias that is applied to the image transfer belt is automatically corrected for paper size, temperature (measured by the temperature/humidity sensor at the rear lower right side of the machine).
The other rollers are grounded to neutralize the belt surface.

10.1.4 TRANSFER BELT CLEANING



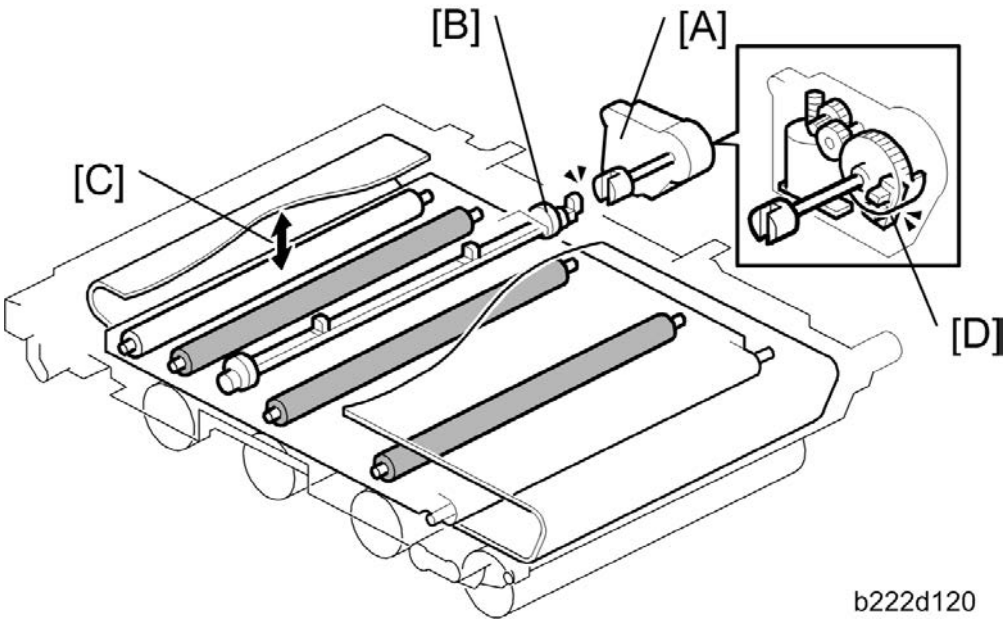
The ITB-cleaning unit removes toner (during printing) and the ID sensor patterns (during process control or automatic line position adjustment) on the belt. Belt cleaning is completed while the image transfer belt makes one rotation. The ITB drive motor drives the ITB-cleaning unit.

The cleaning brush [A] always contacts the image transfer belt [B], and removes used toner from the belt. The cleaning blade [C] in the cleaning unit scrapes the toner off the image transfer belt. Then the toner collection auger [F] transports the toner towards the toner collection duct.

The lubricant application roller [D] applies lubricant [E] to the image transfer belt to make toner removal easy.

To drive the cleaning unit, the transfer belt rotates gear [G], and gears at the front of the transfer unit drive the auger [F] and the rollers [A, D] in the cleaning unit.

10.1.5 ITB (IMAGE TRANSFER BELT) CONTACT



Mechanism

The ITB contact and release mechanism increases the lifetime of the image transfer belt and drums.

The drum for black always contacts the belt. But the image transfer belt moves away from the other drums during monochrome printing.

In the standby mode, the image transfer belt contacts only the black drum. It moves away from the black drum when you turn the release lever counterclockwise.

When the machine prints a color page, the machine waits until the previous page has gone through the paper transfer unit. Then the ITB contact motor [A] turns on and a cam [B] moves the left side [C] of the image transfer belt downward, so that it contacts the other three drums.

The machine does not release the image transfer belt from the color drums during the job, even if a monochrome page comes again. This is because the total printing speed reduces if the ITB changes position.

But, if you change SP2-907-001 away from the default setting of zero, the image transfer belt will move away from the color drums if the number of consecutive black-and-white prints reaches the value of SP 2907-001.

The belt moves away from the color drums if the job is interrupted by any error except a power failure.

The image transfer belt contact sensor [D] detects if the image transfer belt contacts the color PCDUs.

NOTE: If a power failure occurs when the image transfer belt is in contact with the drums, the belt stays in this position. If you want to remove the image transfer belt unit while the power is still off, you must release the belt. To do this, swing out the controller box. Then turn the drive gear [B] manually.

10.1.6 TRANSFER BELT SENSOR

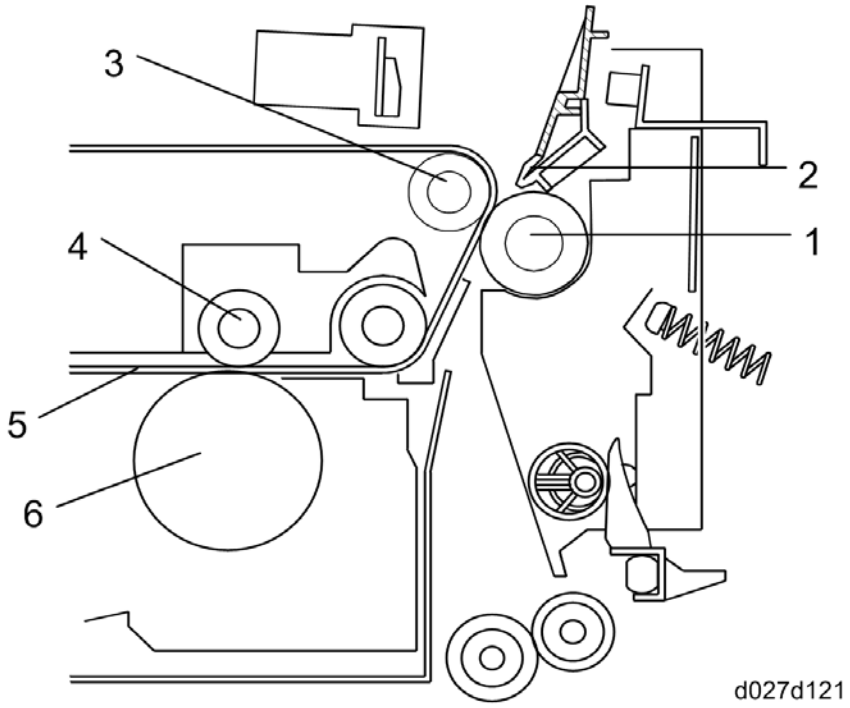
The ITB contact sensor [D] operates as the detection sensor during machine initialization, and also as the position sensor during machine operations.
Before machine initialization, the left side of the image transfer belt is in the home position. When initialization starts, the ITB contact motor lowers the left side until the actuator has passed the sensor. Then ITB contact motor lifts up the left side to its home position. This action actuates the sensor in a certain pattern.
The table lists the sensor actuation patterns.

Machine status		Sensor pattern
Initialization		On → Off → On → Off → On
Operation	Standby (Default)	On
	B/W printing	On
	Color Printing	Off

On: The actuator is out of the sensor.
Off: The actuator is interrupting the sensor.

10.2 PAPER TRANSFER AND SEPARATION

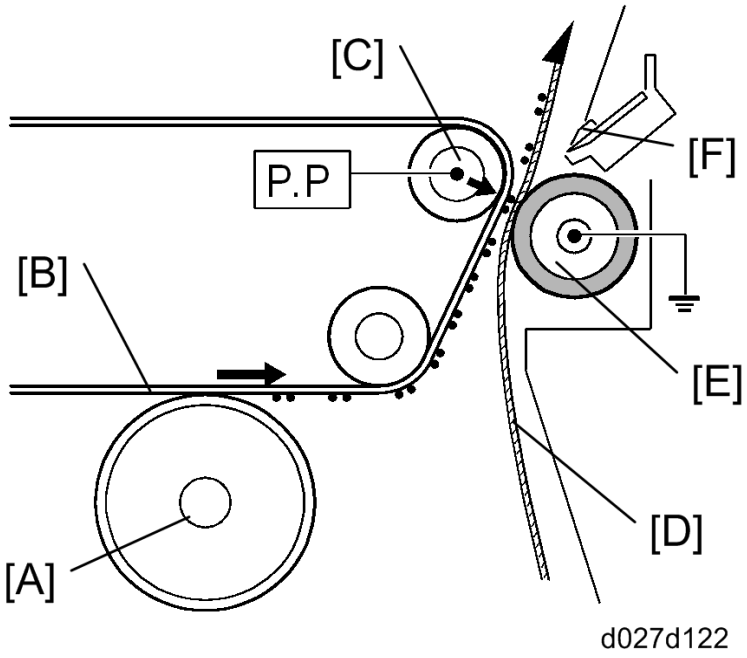
10.2.1 OVERVIEW



1. Paper transfer roller	4. Image transfer roller
2. Discharge plate	5. Image transfer belt
3. ITB drive roller	6. OPC drum

The paper transfer unit consists of the paper transfer roller and discharge plate. This unit completes the toner transfer to the paper.

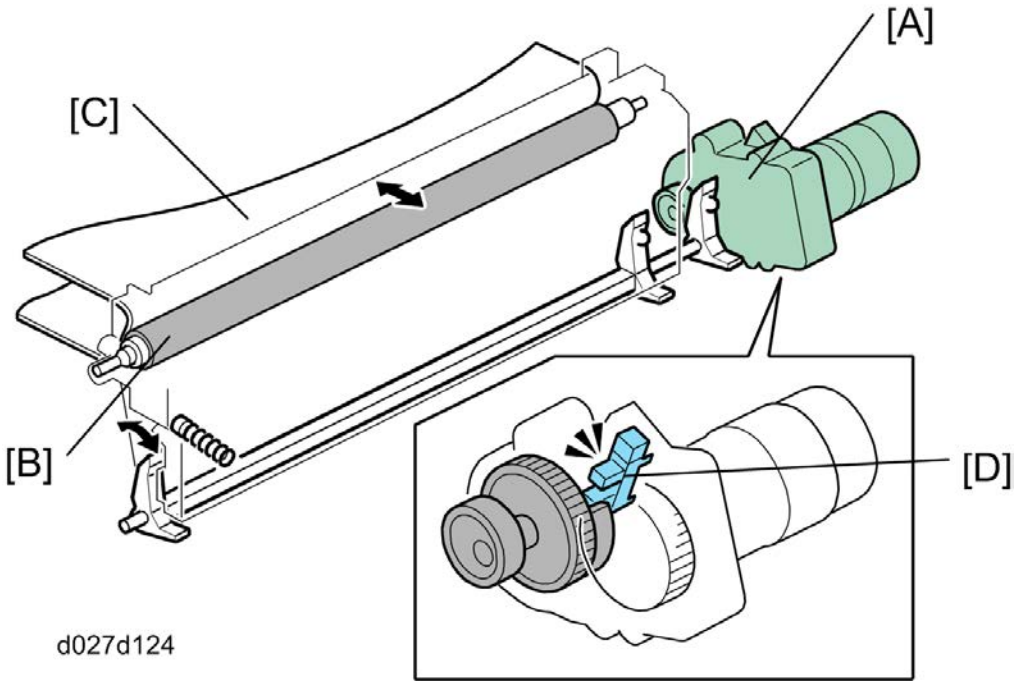
10.2.2 PTR (PAPER TRANSFER ROLLER) DRIVE



NOTE: P.P.: Power Pack (ITB power supply board)

The toner is moved from the OPC [A] onto the surface of the image transfer belt [B] by a positive charge from the image transfer roller (immediately above the drum, not shown here). The ITB drive roller [C], which is given a negative charge, pushes the toner to the paper [D].
The paper transfer roller [E] presses the paper against the image transfer belt [B] (with a spring that is under tension from the paper transfer roller contact motor), and grounds the charge from the ITB drive roller [C]. (The paper transfer roller does not have a drive mechanism. This roller is driven by the image transfer belt.)
Finally, the discharge plate [F] discharges the paper.
The discharge plate receives its charge from a different high voltage power supply board than the ITB drive roller.

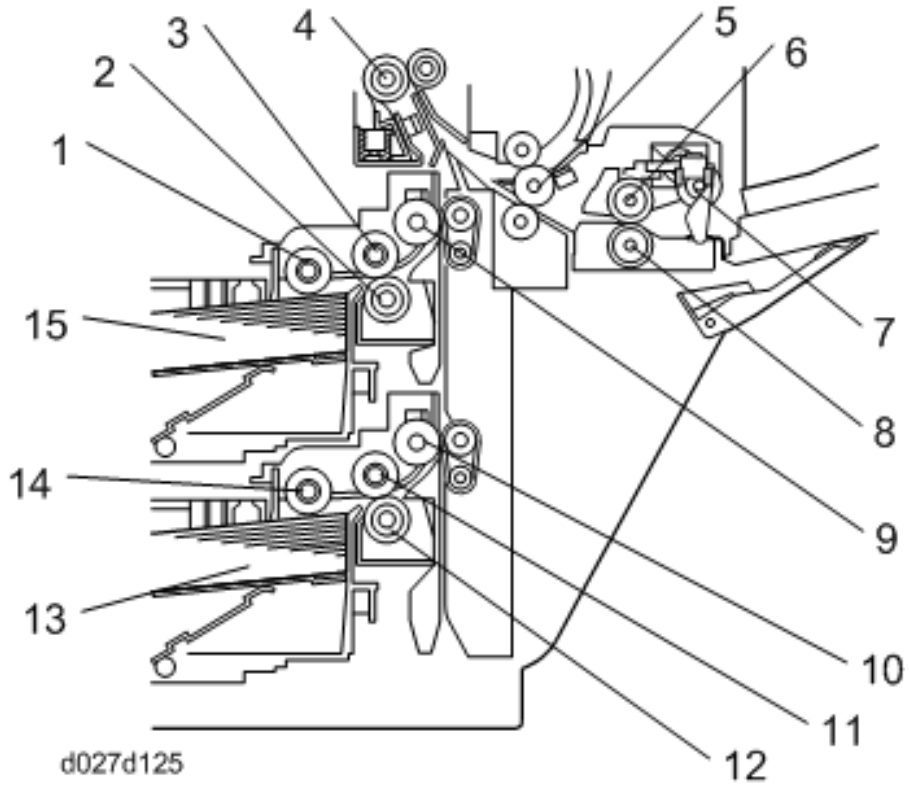
10.2.3 PTR (PAPER TRANSFER ROLLER) CONTACT AND SEPARATION



The paper transfer contact motor [A] keeps the paper transfer roller [B] in contact with the image transfer belt [C]. This motor has the paper transfer HP sensor [D] inside. The paper transfer HP sensor detects if the paper transfer roller is in contact with the image transfer belt. Only when the machine executes the line position adjustment or process control, the paper transfer unit keeps away from the image transfer belt.

11. PAPER FEED

11.1 OVERVIEW

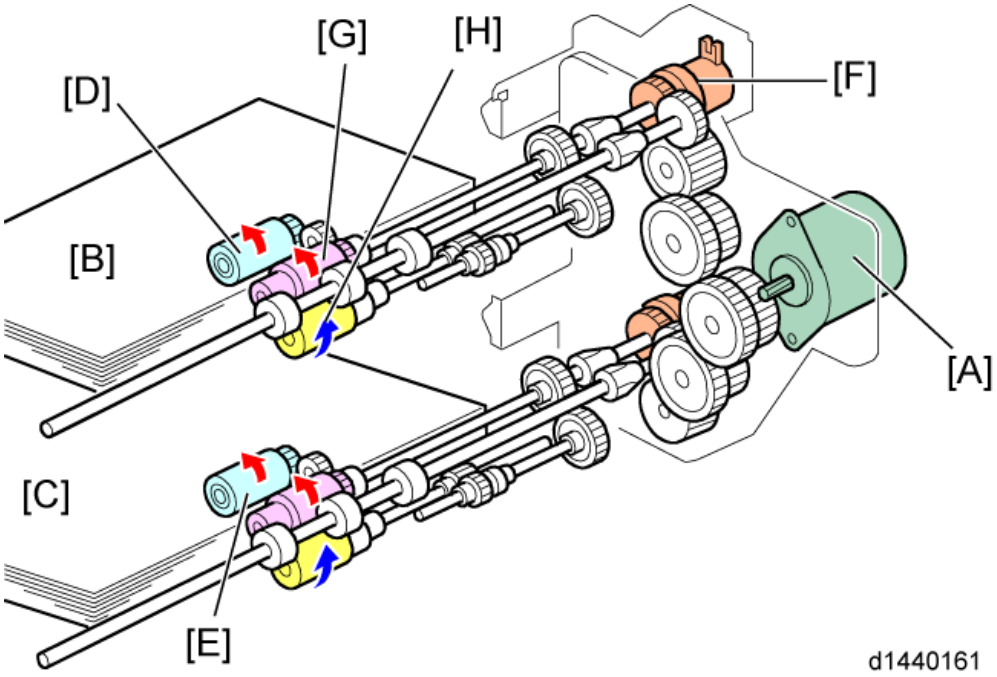


1. Pick-up roller - tray 1	8. Separation roller - By-pass feed
2. Separation roller - tray 1	9. Vertical transport roller 1
3. Feed roller - tray 1	10. Vertical transport roller 2
4. Registration roller	11. Feed roller - tray 2
5. Transport roller - By-pass feed	12. Separation roller - tray 2
6. Feed roller - By-pass feed	13. Paper tray 2
7. Pick-up roller - By-pass feed	14. Pick-up roller - tray 2
	15. Paper tray 1

There are two paper trays (500 sheets each), and a by-pass feed table (100 sheets). The paper feed mechanism uses an FRR system for tray 1, 2 and by-pass tray. Tray 1 can hold A4 or letter paper only. Tray 2 can hold a range of sizes.

11.2 DRIVE – TRAY 1, TRAY 2, AND BY-PASS TRAY

11.2.1 TRAY 1 AND TRAY2



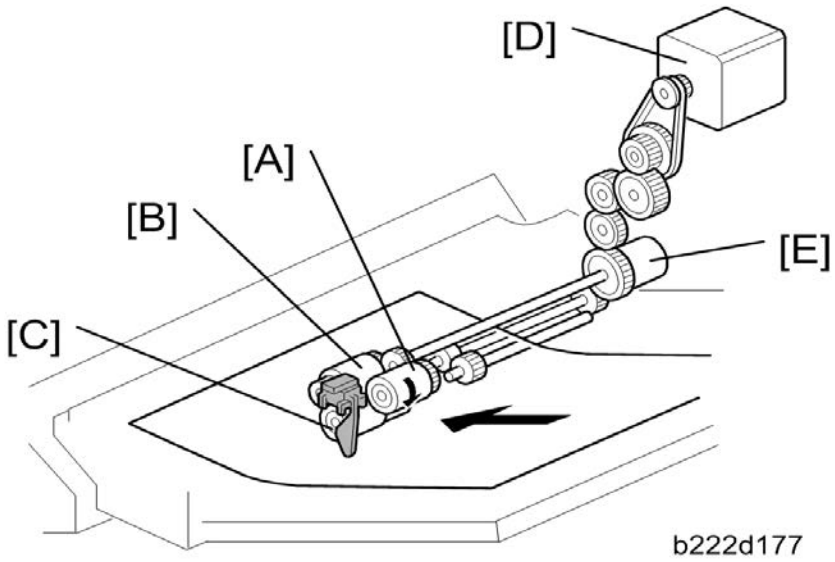
The paper feed motor [A] drives the pick-up and feed mechanisms in tray 1 [B], tray 2 [C]. It uses clutches and complex trains of gears to do this.

When tray 1 and tray 2 are inside the machine, their pick-up rollers [D][E] are always in contact with each top sheet of the paper stack.

When the paper feed clutch [F] for tray 1 turns on, the pick-up, feed [G] and separation [H] rollers start rotating to feed the paper. The paper from tray 2 is also fed in the same way.

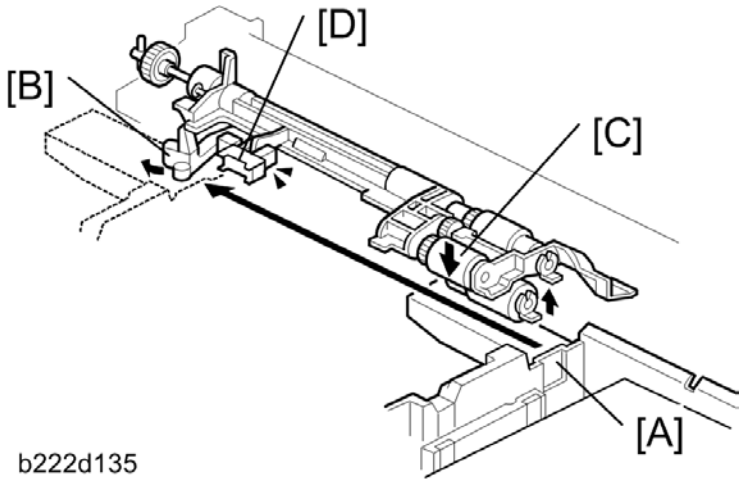
The paper feed clutch stays on until shortly after the registration sensor activates.

11.2.2 BY-PASS TRAY



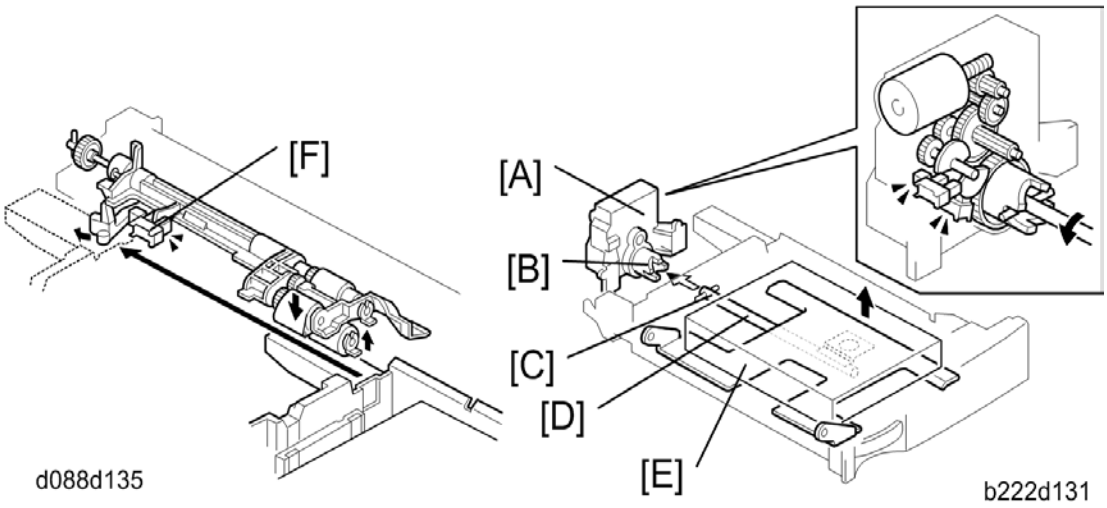
The pick-up roller [A] of the by-pass tray stays away from the top of the stack of paper until the by-pass pick-up solenoid turns on.
The duplex/by-pass motor [D] drives the pick-up, feed [B] and separation roller [C] through the by-pass clutch [E] and gears.

11.3 PAPER PICK-UP



When the tray is installed in the machine, the rear [A] of the tray pushes the lever [B], and this lever pushes down the pick-up roller [C] onto the paper. This turns the paper lift sensor [D] "OFF".

11.4 PAPER LIFT – TRAYS 1 AND 2

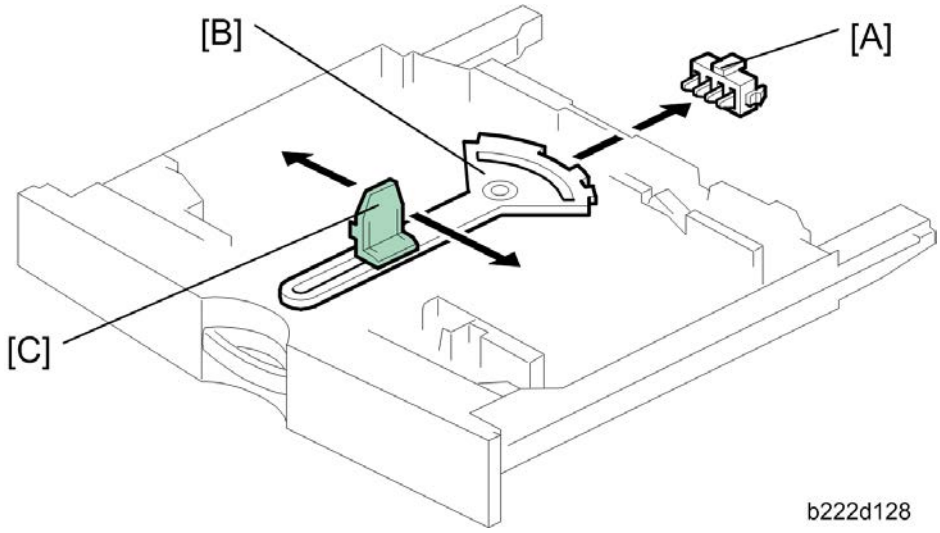


The rear end of the paper tray pushes the tray set switch (for tray 2, this is the paper size switch). As a result, the machine detects that the paper tray is installed.

When the machine detects that a tray has been placed in the machine, the tray lift motor [A] rotates and the coupling gear [B] on the tray lift motor engages the pin [C] on the lift arm shaft [D]. Then the tray lift arm lifts the tray bottom plate [E] until the paper lift sensor [F] for the tray detects that the top of the stack is at the paper feed position.

When the tray is removed from the machine, the connection between the coupling gear and lift arm shaft is disengaged, and the tray bottom plate lowers. After that, the coupling gear is moved to its home position.

11.5 PAPER SIZE DETECTION – TRAYS 1 & 2



There is no size switch for tray 1. The paper size is fixed at either A4 or LT (LEF for both sizes). You can change the size setting with SP5-181-1.

For tray 2, there are four paper size switches [A] working in combination. Switch 1 (right end) is for tray set detection. The other three switches detect the paper size as shown in the table below. The actuator [B] is moved by the end plate [C].

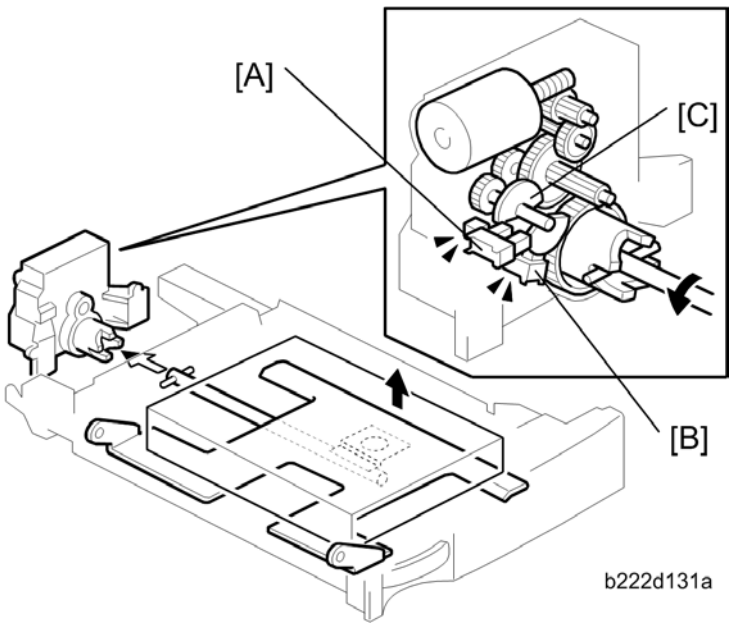
0: Pushed, 1: Not pushed

Models		Switch Location		
North America	**Europe/Asia**	**SW4**	**SW3**	**SW2**
DLT (A3) SEF*[1]	A3 (DLT) SEF*[1]	0	0	1
LG (B4) SEF*[2]	B4 (LG) SEF*[2]	0	0	0
A4 SEF	A4 SEF	1	1	0
LT SEF	LT SEF	1	1	1
B5 SEF	B5 SEF	0	1	1
LT (A4) LEF*[3]	A4 (LT) LEF*[3]	1	0	0
Exe (B5) LEF*[4]	B5 (Exe) LEF*[4]	0	1	0
A5 LEF	A5 LEF	1	0	1

*1: The machine detects either DLT SEF or A3 SEF, depending on the setting of SP5-181-3.
*2: The machine detects either LG SEF or B4 SEF, depending on the setting of SP5-181-4.
*3: The machine detects either LT LEF or A4 LEF, depending on the setting of SP5-181-2.
*4: The machine detects either Exe LEF or B5 LEF, depending on the setting of SP5-181-5
SP 5-181-6 to –13 does similar functions for the optional paper trays.

The machine disables paper feed from a tray if the paper size cannot be detected (if the paper size actuator is broken or no tray is installed).
For non-standard paper sizes, if they are not visible on the user tool screen for selecting paper sizes, then set SP 5112 to "1". If the user selects one of these sizes, auto paper size selection is disabled.

11.6 PAPER HEIGHT DETECTION – TRAYS 1 & 2

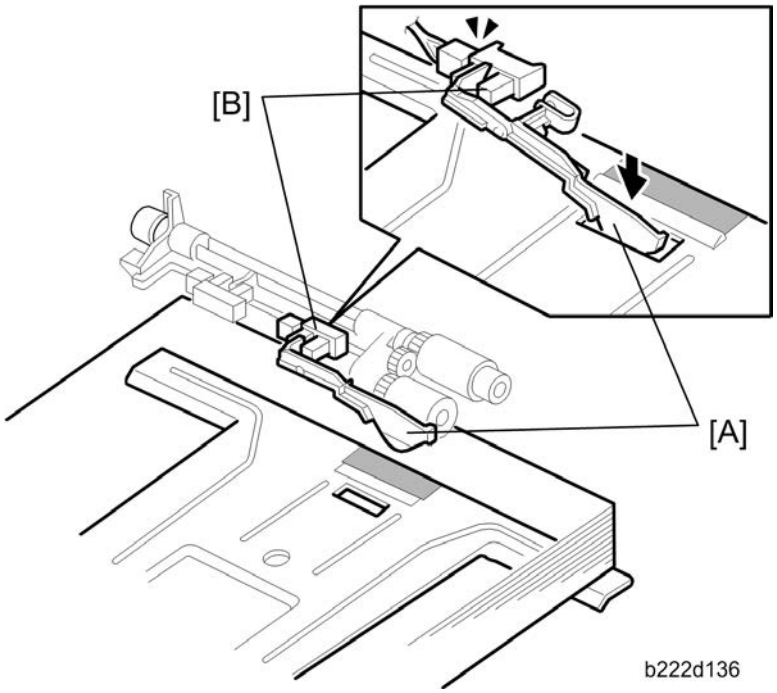


Two paper height sensors [A] [B] and actuator [C] are built into the paper tray lift motor.
The paper height sensors, detect the amount of paper in the tray.
The actuator [C] has two semicircles, and it is engaged with the lift arm shaft via gears.
The paper height sensors detect the paper amount depending on the position of the two semicircles. The list shown below shows the detection combination of the two sensors.
The paper remaining status bar is displayed in the tray selection icon on the LCD.

Remaining paper	Paper height sensor 1 [A]	Paper height sensor 2 [B]
100% (Status bar x 4)	OFF	OFF
70% (Status bar x 3)	ON	OFF
30% (Status bar x 2)	ON	ON
10% (Status bar x 1)	OFF	ON

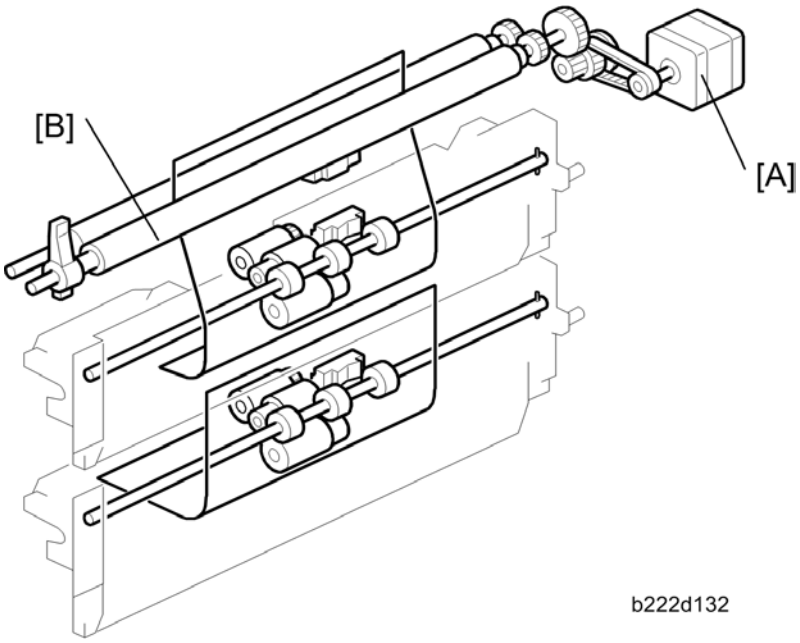
OFF: No actuator

11.7 PAPER END DETECTION – TRAYS 1 & 2



The paper stack raises the paper end feeler [A] and the paper end sensor [B] deactivates if there is some paper in the paper tray.
When the paper tray runs out of paper, the paper end feeler [A] drops into the cutout in the tray bottom plate. At this time the paper end sensor [B] activates.

11.8 REGISTRATION



The registration motor [A] drives the registration roller [B] with a complex train of gears.

The machine makes a paper buckle at the registration roller to correct paper skew. You can adjust the paper buckle with SP1-003.

11.9 PAPER FEED LINE SPEED

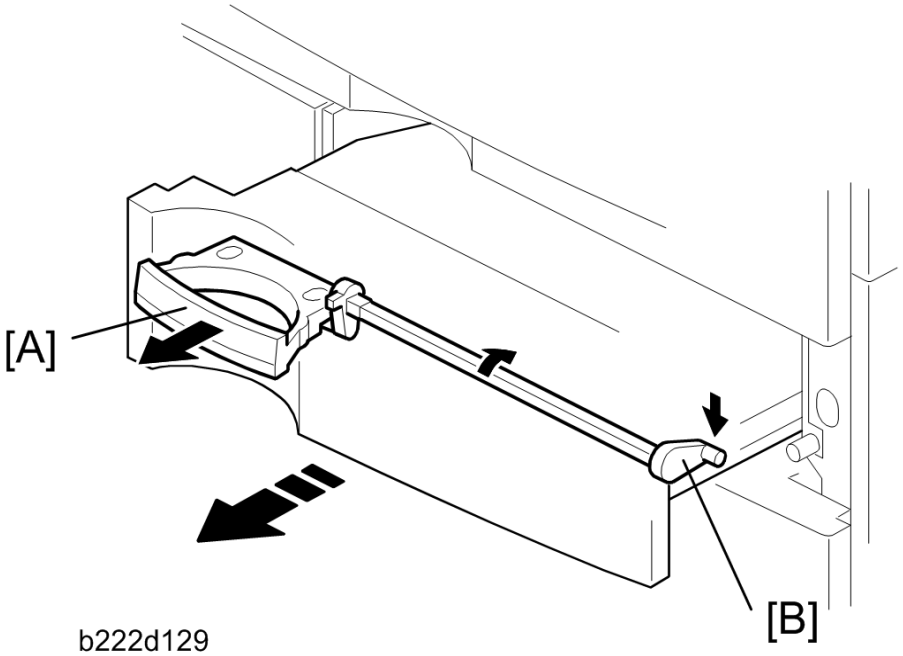
This machine has three process line speeds (for feed from registration roller to fusing unit). The line speeds depend on the selected mode.

Mode	Resolution (dpi)	Process line speed (mm/s)	Copy speed (cpm)
Plain 1/2, M-Thick (B/W, FC)	All except 1200x1200	205	45 cpm 50 cpm
	1200 x 1200	77	22 cpm 25 cpm
Thick 1 (B/W, FC)	All except 1200x1200	154	45 cpm 50 cpm
	1200 x 1200	77	22 cpm 25 cpm
Thick 2/3/4 (B/W, FC)	All	77	25 cpm

11.10 TRAY LOCK MECHANISM

This machine has two types of tray lock mechanism.

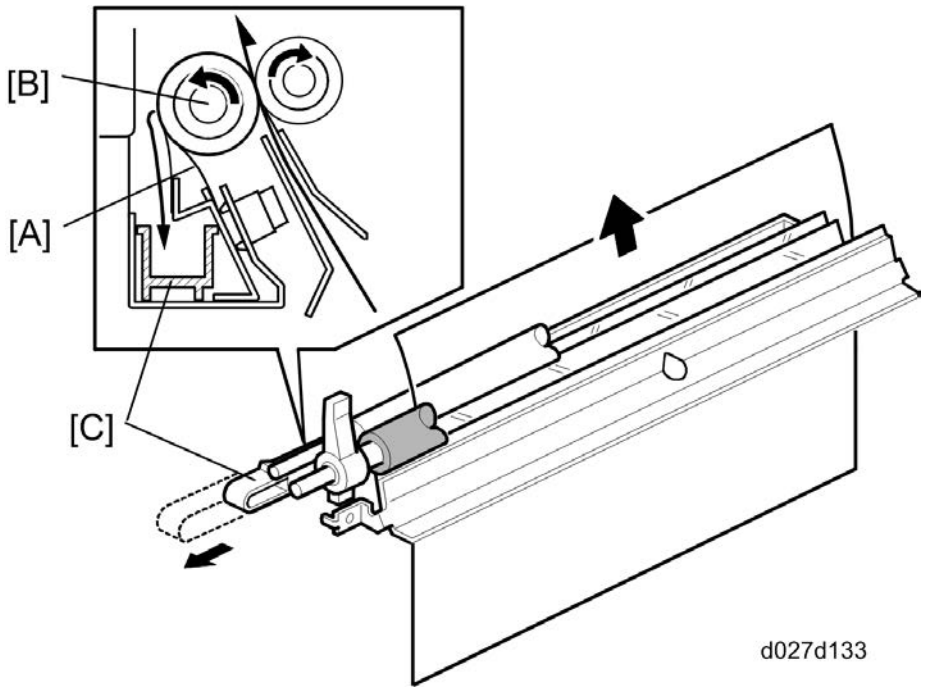
11.10.1 TRAY LOCK AT THE FRONT



b222d129

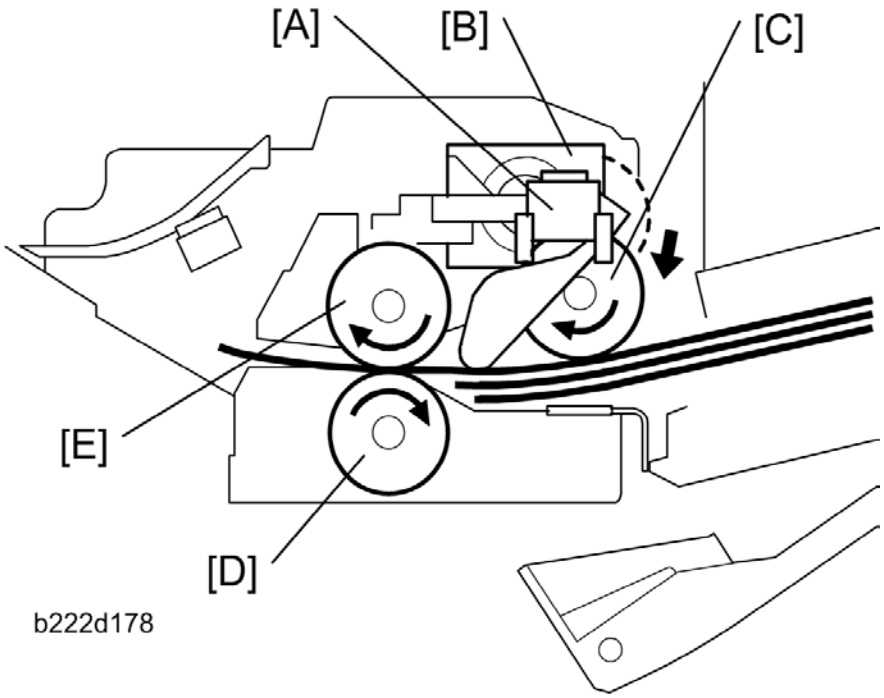
The lock at the front prevents the tray from coming out of the machine during transporting or shipping. When you pull the handle [A], the lock lever [B] is lowered. As a result, you can pull out the tray.

11.11 PAPER DUST COLLECTION



The two mylars [A] scrape the paper dust from the registration idle roller [B]. The paper dust falls down into the paper dust container [C].

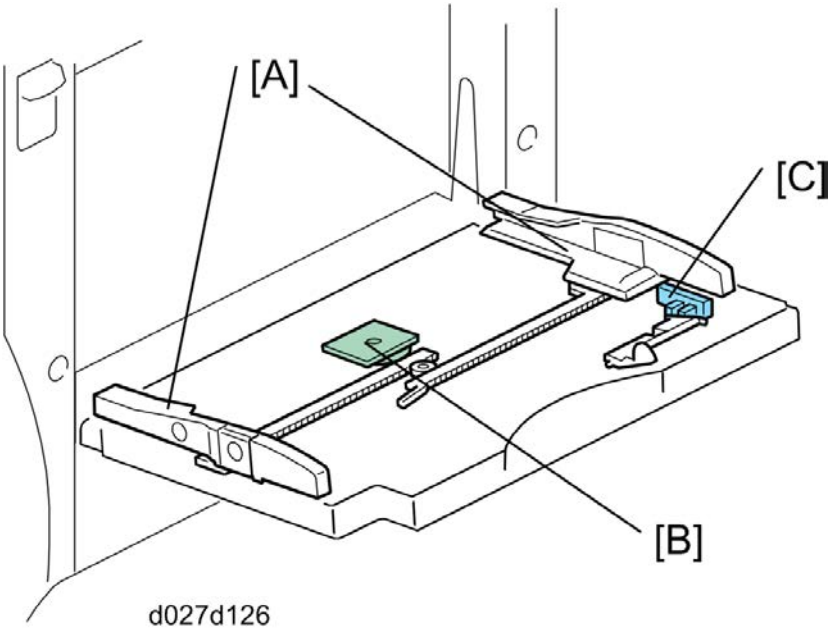
11.12 BY-PASS PAPER SEPARATION



When the by-pass paper detection [A] sensor detects paper and the machine gets a by-pass printing job, the by-pass solenoid [B] drops the pick-up roller [C] onto the top of the paper stack on the by-pass tray. After that, the pick-up roller moves one sheet of paper to the feed roller.

This machine uses an FRR (Feed and Reverse Roller) system for feeding paper. There is friction between the feed roller [E] and separation roller [D]. This friction separates the top sheet of paper from the stack.

11.13 BY-PASS PAPER SIZE DETECTION



There are two paper side plates [A] on the by-pass tray. These connect with the by-pass paper size sensor [B] through a rack-and-pinion mechanism. There is also a paper length sensor [C] on the by-pass tray. This detects the paper length.
The machine determines the paper size on the by-pass tray using these signals from the paper size sensor and paper length sensor.

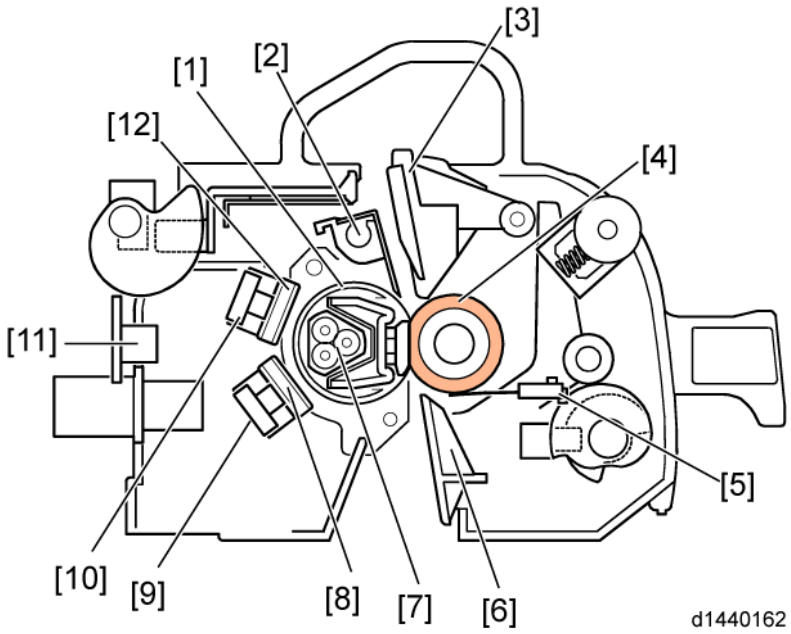
By-pass Paper Size Sensor				Length Sensor	NA	EU/ASIA
bit3	Bit2	Bit1	Bit0			
1	1	1	1	1	HLT SEF	A6 SEF
0	1	1	1	1	HLT SEF	A6 SEF
0	0	1	1	1	HLT SEF	A5 SEF
1	0	1	1	1	HLT SEF	A5 SEF
1	0	0	1	0	LT/LG SEF*[1]	A4 SEF
1	0	0	1	1	LT/LG SEF*[1]	A5 LEF
1	1	0	1	0	LT/LG SEF*[1]	A4 SEF
1	1	0	1	1	LT/LG SEF*[1]	A5 LEF
1	1	0	0	0	DLT SEF	A3 SEF
1	1	0	0	1	LT LEF	A4 LEF
1	1	1	0	0	DLT SEF	A3 SEF
1	1	1	0	1	LT LEF	A4 LEF

0: ON, 1: OFF

*1: The paper size (LT or LG) must be selected with SP1-007-001.

12. FUSING

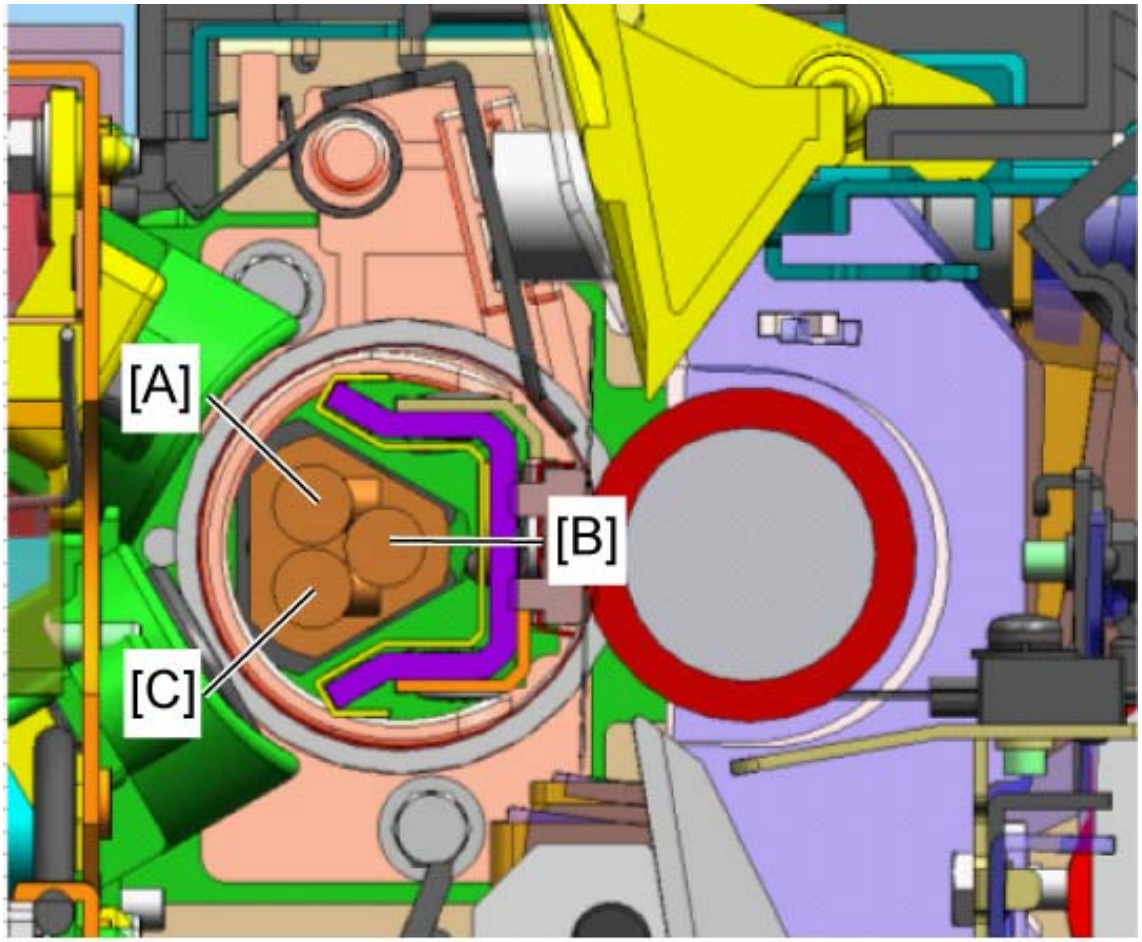
12.1 OVERVIEW



1. Fusing sleeve belt
2. Stripper Plate
3. Exit guide plate
4. Pressure roller
5. Pressure roller thermistor x 2 *Center and end (front end)
6. Entrance guide plate
7. Fusing lamp x 3
8. NC sensor: Lower
9. Thermostat: Lower
10. Thermostat: Upper
11. Thermopiles x 2 (Center and end)
12. NC sensor: Upper

- A free-belt fusing system is used.
- The heating roller contains three lamps. The three lamps in the heating roller are in one assembly, and are removed together. The 1st lamp heats the center and the 2nd lamp heats the ends. The 3rd lamp heats when A4/Letter LEF or a postcard is used.
- The heating belt and pressure roller thermistors, and thermopile control the temperature of heating sleeve belt and pressure roller. The thermopile is a non-contact sensor. The thermopile detects the temperature at the center of the heating sleeve belt, and the thermistors detect the temperature at the end and center of the pressure roller and end of the heating sleeve belt.
- Oil less fusing system

12.2 FUSING LAMP LIGHTING MODE VARIED WITH PAPER SIZES

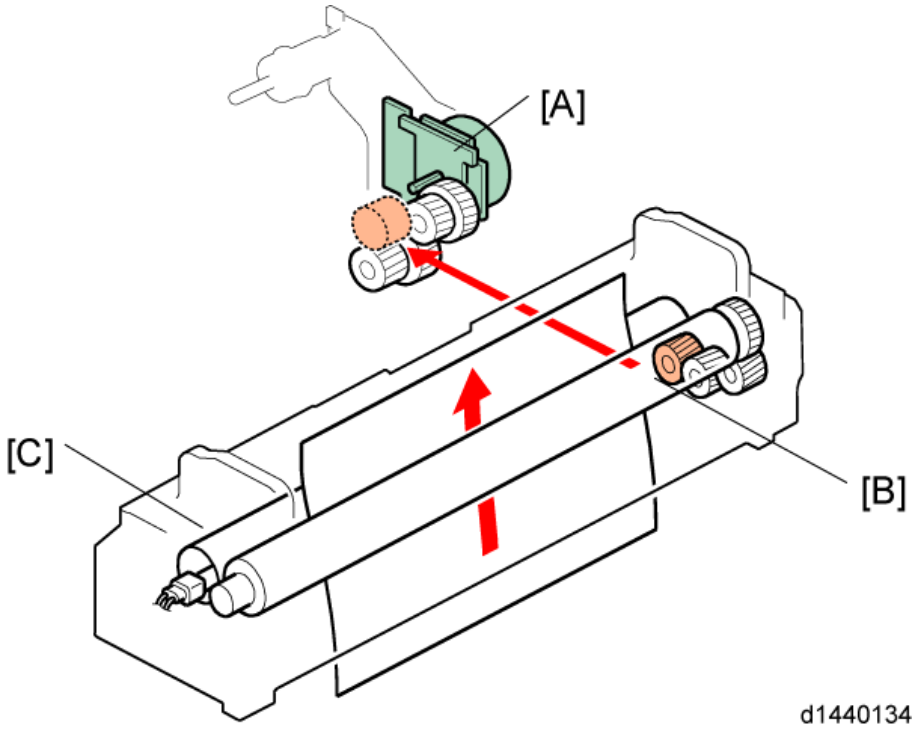


d1440133

The on/off lighting patterns of the fusing lamps [A], [B], [C] depend on the machine destination and the printing paper size. The lamp-on patterns are shown below.

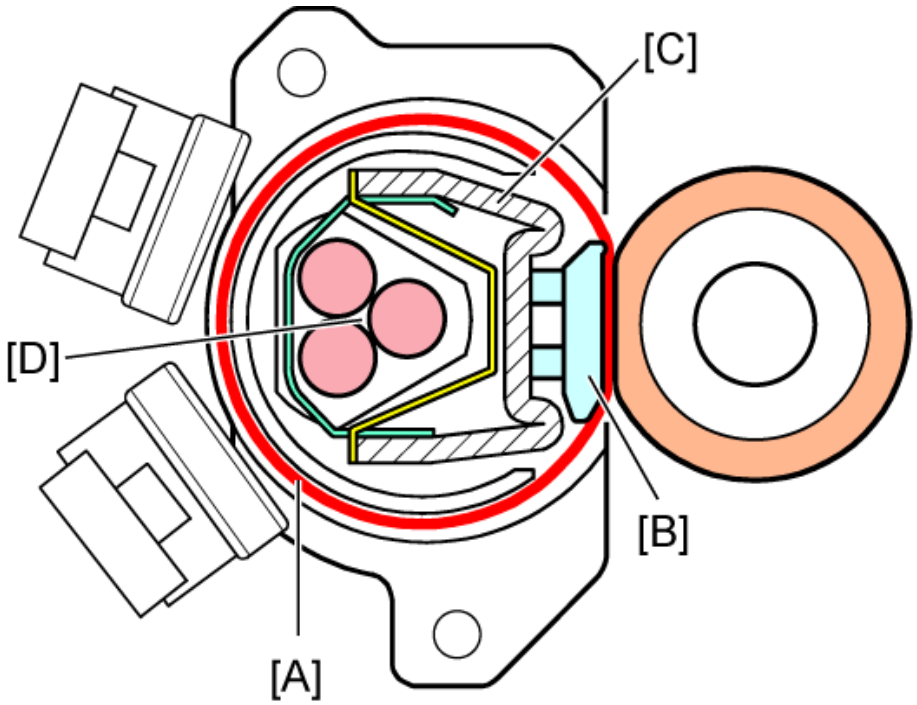
		Paper Sizes	
D143/144 (C3c,d)	Lamps On	NA/Taiwan	EU/AA/China
	[A]	Letter LEF	A4 LEF
	[B]	A4 LEF	Letter LEF
	[C]	Letter SEF	A4 SEF

12.3 FUSING UNIT DRIVE



The fusing/paper exit motor [A] drives the pressure roller [B]. The heating sleeve belt [C] around the fusing lamp is driven by the pressure roller.

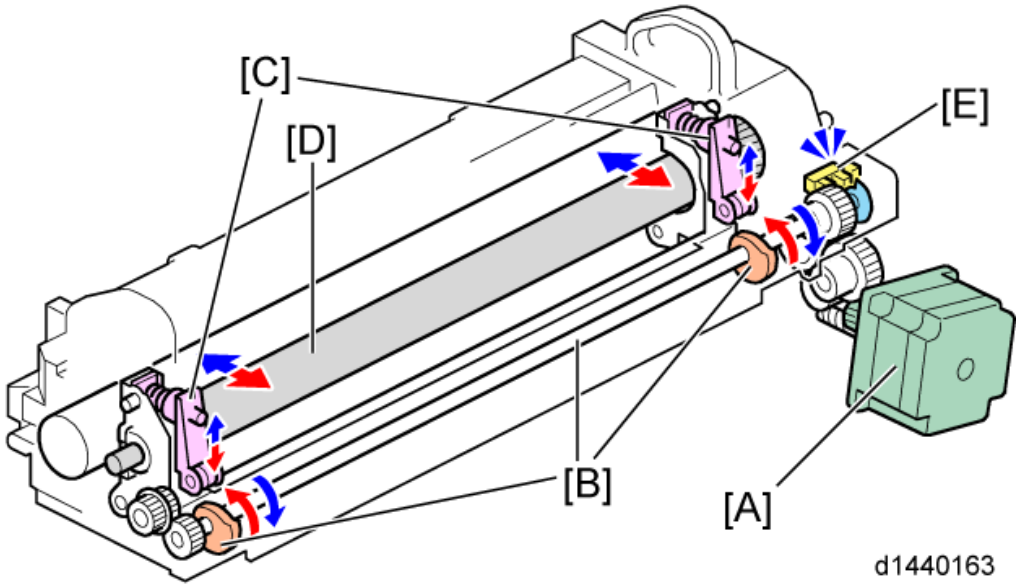
12.4 FREE-BELT FUSING SYSTEM



d1440135

- The heating sleeve [A] rotates freely. It is driven by the pressure roller.
  The nip pad [B] has a low friction cover, and this allows the heating sleeve belt to turn easily.
- The pressure roller presses against the nip pad [B] to form the nip zone, where the image is fused to the paper by heat and pressure.
- The stay [C] holds the nip pad [B] in place.
- The stay has a mirrored surface facing the fusing lamps [D] to concentrate the energy from the lamps directly on the inner surface of the heating sleeve belt [A].

12.5 PRESSURE RELEASE MECHANISM



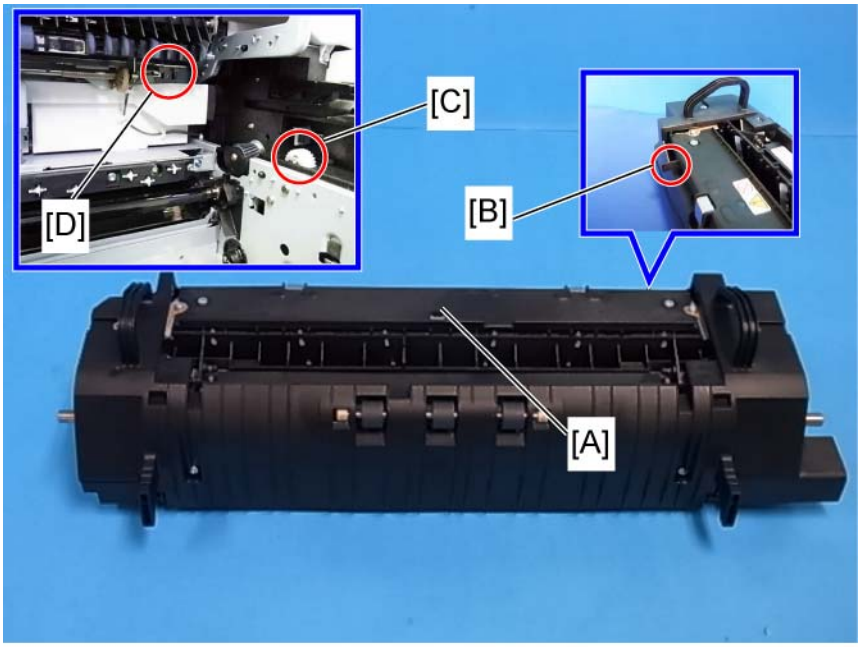
The pressure roller contact motor [A] controls the pressure roller contact shaft [B]. Both edges of this shaft push and release the pressure levers [C] by rotating the pressure roller contact shaft.

The pressure levers [C] put the proper pressure to the nip between the pressure roller [D] and heating sleeve belt. When releasing these levers after job end, the pressure roller moves away from the heating roller.

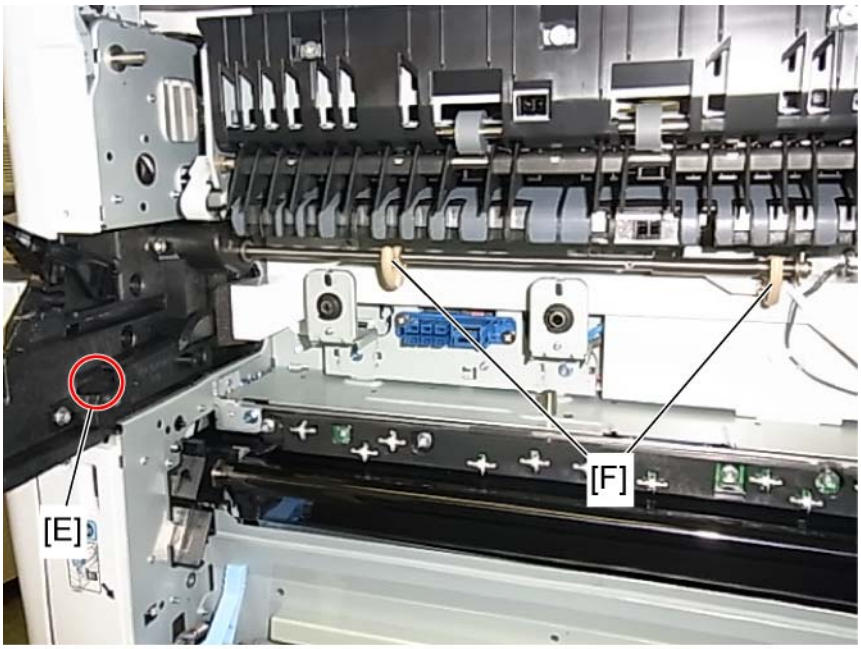
The pressure roller contact sensor [E] detects the actuator, and then determines the pressure roller position. If this sensor does not detect the actuator three times consecutively when initializing the pressure roller position or at job end, SC569 is issued.

If a paper jam occurs in the fusing unit, the pressure roller contact motor releases the pressure roller to allow the user to remove jammed paper easily.

12.6 FUSING UNIT SHUTTER OPEN/CLOSE MECHANISM



d1440137



d1440138

The fusing unit has a shutter plate [A] to improve energy efficiency.

The fusing shutter improves conservation of heat inside the fusing unit, reducing the load on the fusing lamps. It allows a faster first copy time and a smaller TEC value.

The shutter operates in conjunction with fusing pressure release, so the timing of opening/closing is as follows.

Fusing pressure release: shutter closes

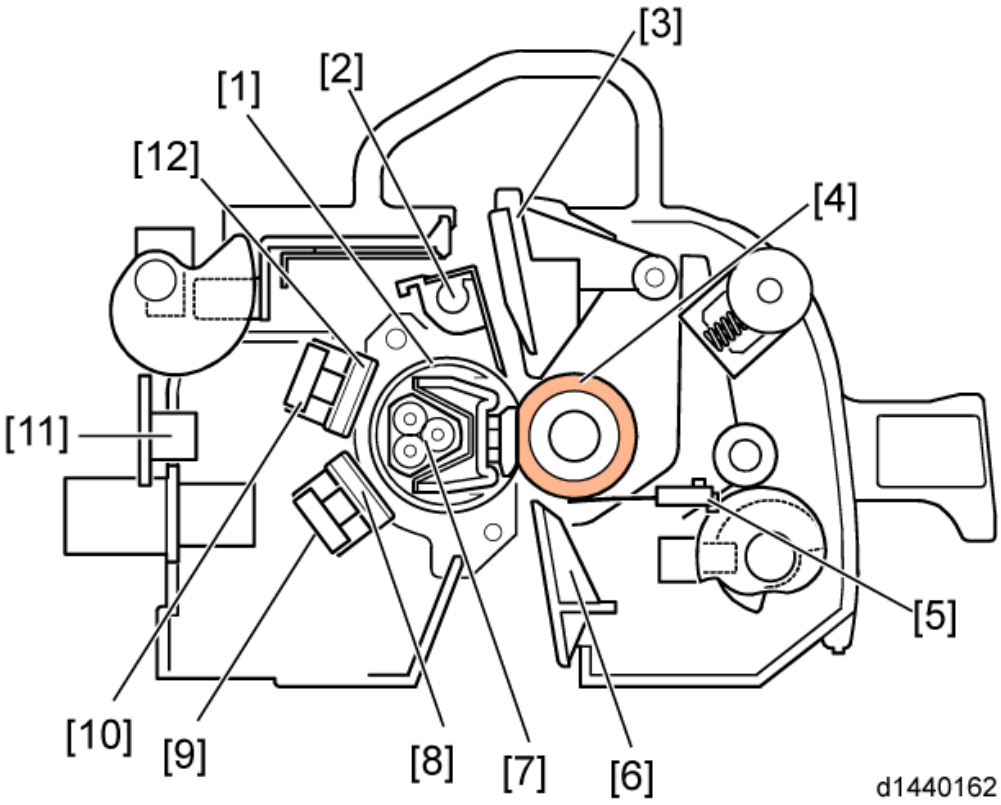
Fusing pressure ON: shutter opens

The fusing unit shutter plate drive motor rotates the shaft inside the fusing unit

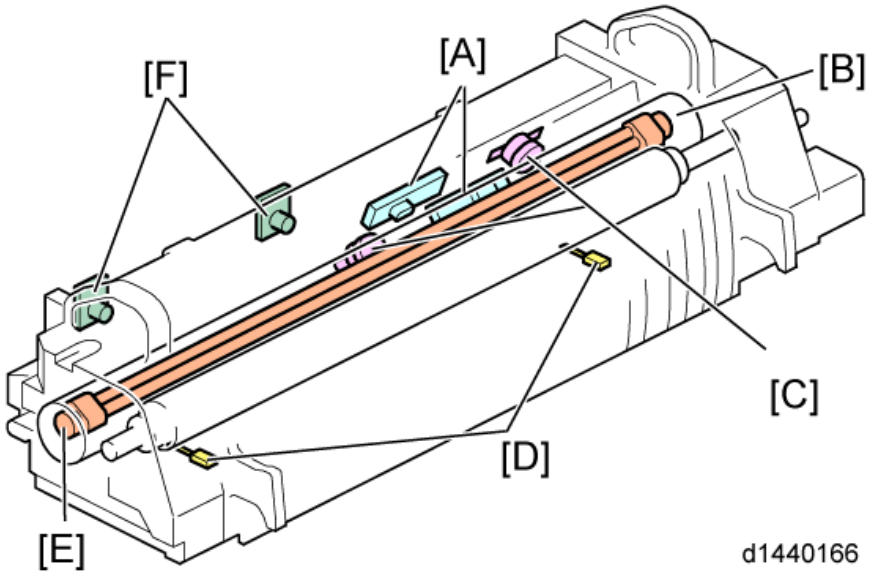
through the gear [C]. This shaft also has a gear at the opposite side of the shaft from gear [C]. This gear rotates another shaft with cams [F] through the gear [E] and the belt. The fusing unit shutter is opened or closed by the cam rotation. The fusing unit shutter home position sensor [D] detects whether the shutter is opened or closed. The home position sensor is a photo detector. The actuator [B] on the shutter plate blocks this photo detector when the shutter is opened.

12.7 FUSING TEMPERATURE CONTROL

12.7.1 COMPONENTS



1. Fusing sleeve belt
2. Stripper Plate
3. Exit guide plate
4. Pressure roller
5. Pressure roller thermistor x 2 *Center and end (front end)
6. Entrance guide plate
7. Fusing lamp x 3
8. NC sensor: Lower
9. Thermostat: Lower
10. Thermostat: Upper
11. Thermopiles x 2 (Center and end)
12. NC sensor: Upper



A: NC sensors x 2 (Upper/Lower)
B: Heating sleeve belt
C: Thermostat x 2 (Center/End)
D: Pressure roller thermistor x 2 *Center and end (front end)
E: Fusing Lamp
F: Thermopiles x 2 (Center/End)

When the main switch turns on, the CPU turns on the heating roller fusing lamp [7][E]. The fusing lamp stays on until the pressure roller thermistors [5][D], NC sensor [8] [12] [A] and thermopile [11] [F] detect the standby temperature. Then the CPU raises the temperature to the printing temperature.
The fusing temperature for each mode is as follows. These are set by SP 1105.
The thermostats [9] [10] [C] for the heating sleeve belt are used for overheat prevention.

12.7.2 FUSING TEMPERATURE CONTROL

The PID control (the phase control) method and On/Off method are adopted as fusing temperature control methods.

12.7.3 HEATING AND PRESSURE TEMPERATURE DETECTION

The heating temperature is detected with the thermopile [F] and the NC sensors [A]. The pressure temperature is detected with the thermistors [D]. The thermostats act as safety switches at the heating sleeve belt unit side.

12.7.4 FUSING TEMPERATURES

The fusing temperature for each mode or each paper type can be adjusted by SP1105. However, the target temperature for each mode has been precisely adjusted at factory. Do not change these settings in the field.

12.7.5 TEMPERATURE CORRECTIONS

- Corrections for ambient temperature (SP 1111) -

- If the room temperature is below 17°C, the heating roller temperature is increased by 5°C with SP1111-005 (default: 10°C).

12.7.6 OVERHEAT PROTECTION

The CPU cuts power to the fusing lamp at the following times:

- The heating roller or pressure roller temperature becomes higher than 240°C for one second or more
  SC 543 and SC 553 for the heating roller or SC 563 and SC 573 for the pressure roller show for this condition.
- The heating roller or pressure roller temperature reaches 250°C.
  SC 544 and SC 554 for the heating roller or SC 564 and SC 574 for the pressure roller show for this condition.

The following components are used if thermistor or thermopile overheat protection fails.

- If one of the thermostat temperatures becomes higher than 185°C, it opens and cuts power to the heating roller fusing lamp.
  If the other thermostat temperature becomes higher than 187°C, it also opens and cuts power to the heating roller fusing lamp.

  Note

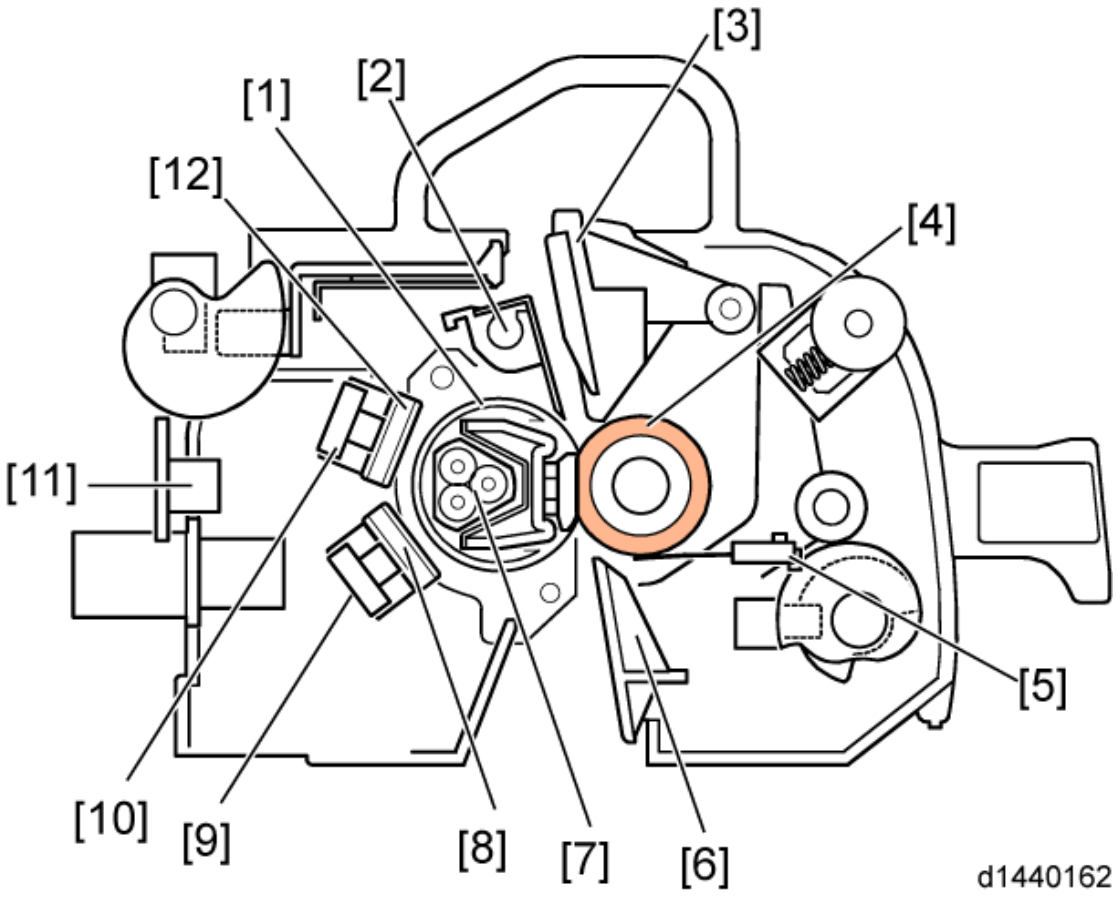
  These thermofuses make a series circuit.

In either case, the machine stops operation.

12.8 CPM CONTROL

12.8.1 OVERVIEW OF CPM CONTROL

This machine has two CPM down modes and slows the printing speed to keep the quality of images and devices. One is the CPM down for low fusing temperature and the other is for high fusing temperature. Both CPM down modes have three levels to slow according to the usage and devices status.



1. Fusing sleeve belt
2. Stripper Plate
3. Exit guide plate
4. Pressure roller
5. Pressure roller thermistor x 2 (Both ends)
6. Entrance guide plate
7. Fusing lamp x 3
8. NC sensor: Lower
9. Thermostat: Lower
10. Thermostat: Upper
11. Thermopiles x 2 (Center and end)
12. NC sensor: Upper

12.8.2 CPM DOWN FOR LOW FUSING TEMPERATURE

The fusing temperature is detected with the thermopile (Center) [11] and checked at regular intervals.
In low ambient temperature, fusing temperature may not be kept at the target temperature due to insufficient heating. To keep at the target temperature, the machine enters the CPM down mode and slows the printing speed by one step if the detected fusing temperature is lower than the threshold. Conversely the machine speeds the printing by one step if the detected fusing temperature is higher than the threshold.
There are three CPM down levels as follows:
(Normal CPM: 100%)
CPM down 1: 80%
CPM down 2: 65%
CPM down 3: 50%.

12.8.3 CPM DOWN FOR HIGH FUSING TEMPERATURE

This machine has fusing unit with low thermal mass system to reduce the first copy time and TEC value. Therefore the temperature of the area on the fusing belt where paper does not pass through (or outside of the paper width) rises easily. Sometimes it rises extremely.
To prevent the fusing belt damage from the heat, CPM down is performed according to the usage conditions.
The decision of CPM down performance depends on the temperature detected with the temperature sensor or the time for paper passing.
CPM down is performed with the following three levels.

NOTE: The following CPM down level is the value when typical paper (plain: A3, DLT, LT, A4) has passed through with SEF. Some paper does not apply to the value based on its size and thick.

(Normal CPM: 100%)
CPM down 1: 80%
CPM down 2: 50%
CPM down 3: 30%

CPM down performance with the temperature sensor

The machine checks each temperature sensor at regular intervals and enters the CPM down mode to slow the printing speed by one step if the detected temperature is higher than the threshold.

Conversely the machine speeds the printing by one step if the detected temperature is lower than the threshold.

The temperature sensor used for the decision of CPM down performance is changed with the paper size because the point where temperature rises easily varies with paper size.

The table below shows the correspondence of paper size and sensor.

Paper width (SEF)	Sensor
A3, DLT, B4	Pressure roller thermistor (End)
LT, A4	Thermopile (End)
B5, A5, B6, A6	Pressure roller thermistor (Center)

CPM down performance with the time condition

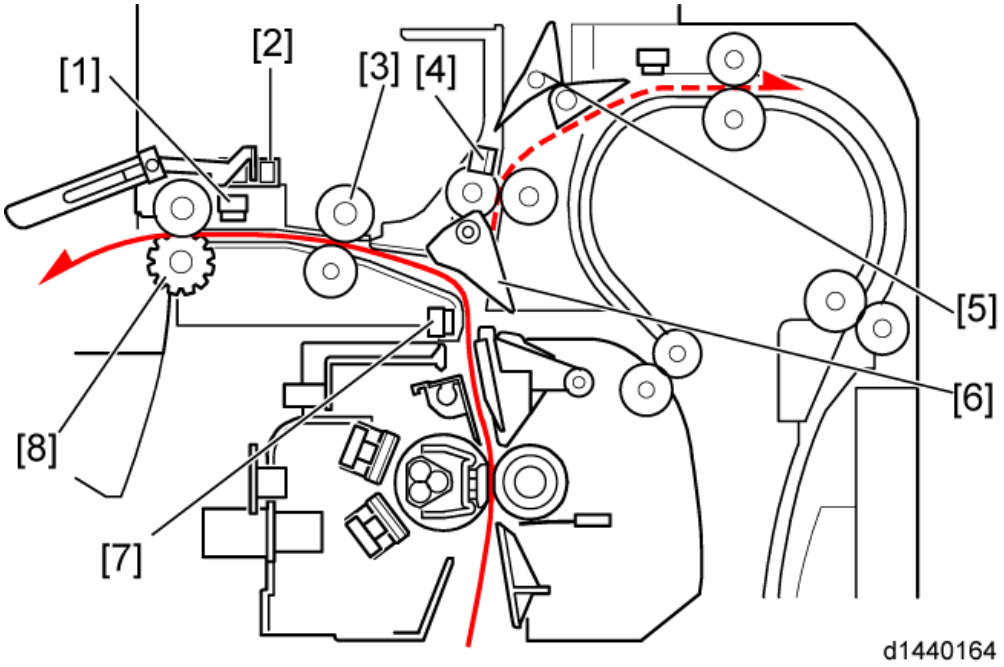
Some paper size prevents sensors from detecting the point where temperature rises easily. In this case time condition is used for the decision of CPM down performance.

The machine enters the CPM down mode by one step to slow the printing speed if the time for continuous paper passing is higher than the threshold.

After that, the printing does not speed when the time condition is used to decide CPM down performance.

13. PAPER EXIT

13.1 OVERVIEW



1. Paper exit sensor	5. Junction gate 2
2. Paper overflow sensor	6. Junction gate 1
3. Paper exit roller	7. Fusing exit sensor
4. Junction gate jam sensor	8: Paper exit roller

This machine has two junction gates:

- Junction gate 1 switches the paper feed direction to the standard output tray path or the duplex unit path/1-bin tray path. This gate is controlled by the junction gate 1 solenoid. When the junction gate 1 solenoid is "OFF", the standard output tray path is open.
- Junction gate 2 switches the paper feed direction to the 1-bin tray path or duplex unit path. This gate is controlled by the junction gate 2 solenoid in the 1-bin tray. If the 1-bin tray is not installed, junction gate 2 does not move (the 1-bin tray path is always closed).

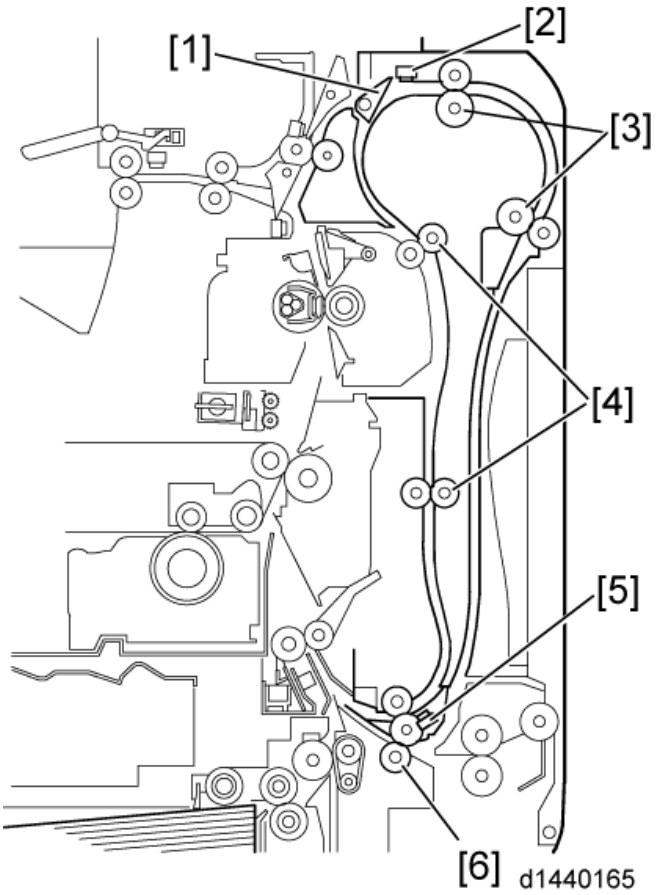
The fusing/paper exit motor drives the paper exit rollers. These rollers transport a sheet of paper to the output tray.

The fusing exit sensor detects paper jams at the fusing exit and the paper exit sensor detects paper jams at the paper exit.

The paper overflow sensor detects if the output tray is full. If this sensor detects that the tray is full, the machine stops.

14. DUPLEX UNIT

14.1 OVERVIEW



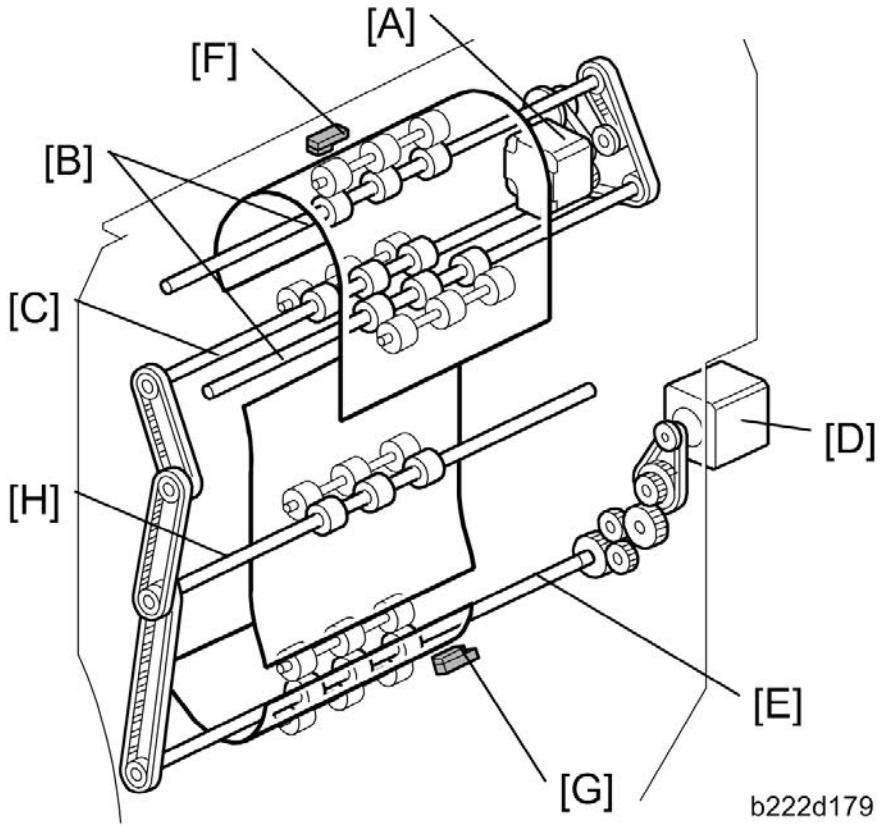
1. Duplex inverter plate
2. Duplex entrance sensor
3. Duplex inverter rollers
4. Duplex transport rollers
5: Duplex exit sensor
6. Duplex/by-pass transport roller

The duplex inverter rollers move the paper to the inverter path, and then feed it backwards to the duplex paper feed path. The duplex transport rollers move paper to the waiting position (just before the duplex/by-pass transport roller).

The duplex/by-pass transport roller moves the paper to the registration roller. This roller is also used for by-pass mode as the by-pass transport roller. But the by-pass tray cannot be used with duplex mode.

The duplex entrance sensor and duplex exit sensor control the timing for duplex paper feed.

14.2 DUPLEX DRIVE



The duplex inverter motor [A] drives the following:

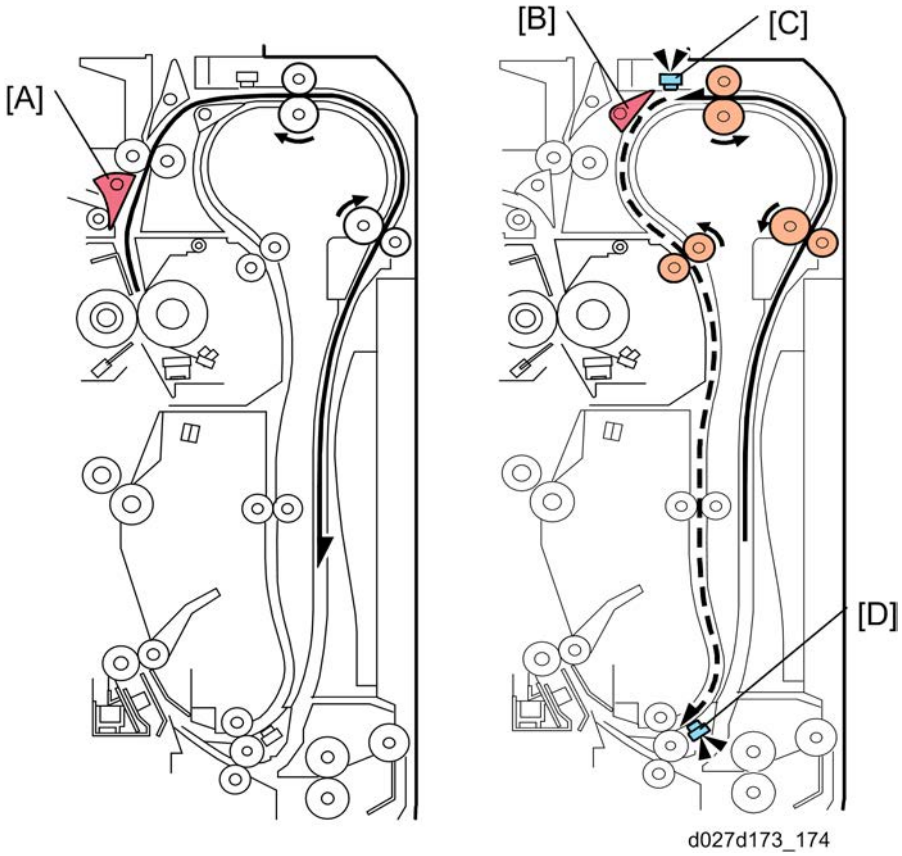
- Duplex inverter rollers [B]
- Duplex transport roller [C]

The duplex/by-pass motor [D] drives the following:

- Duplex/by-pass transport roller [E]
- Duplex transport rollers [C][H]

The duplex entrance sensor [F] and duplex exit sensor [G] control the interleave movement and detect paper jams.

14.3 INVERTER MECHANISM



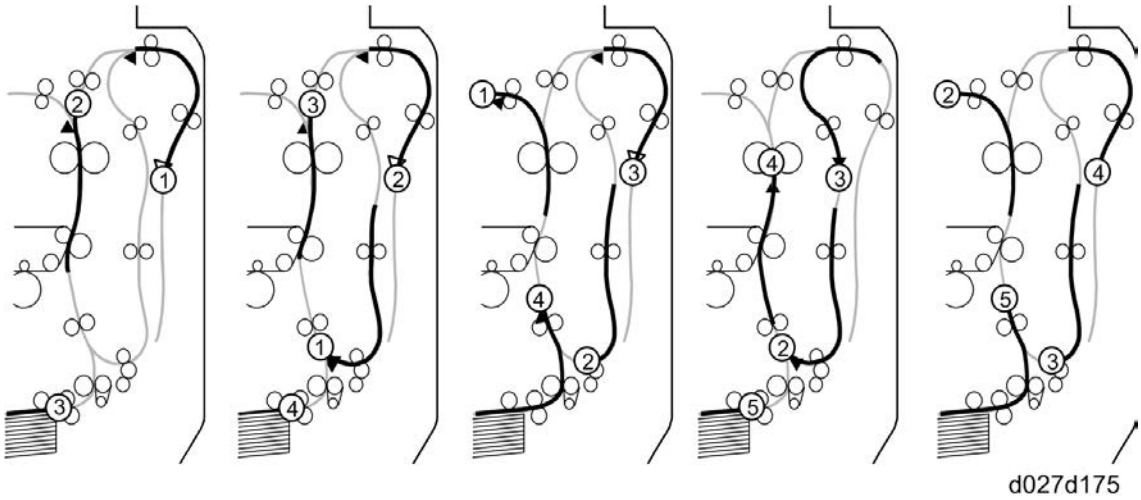
The paper is fed to the duplex path in duplex mode after junction gate 1 [A] opens the duplex path. The duplex inverter motor moves the paper into the inverter, as far as the switching back position. The duplex inverter plate always closes the path to the inverter by spring tension. However, this spring tension is low, so the force from the leading edge of the paper can open the duplex inverter plate.

Then, after the duplex entrance sensor [C] detects the trailing edge of the paper, the duplex inverter motor stops, and the duplex inverter plate [B] opens the duplex feed path (the plate is always open by spring tension). Then, the duplex inverter motor reverses and moves the paper from the switching position to the duplex feed path.

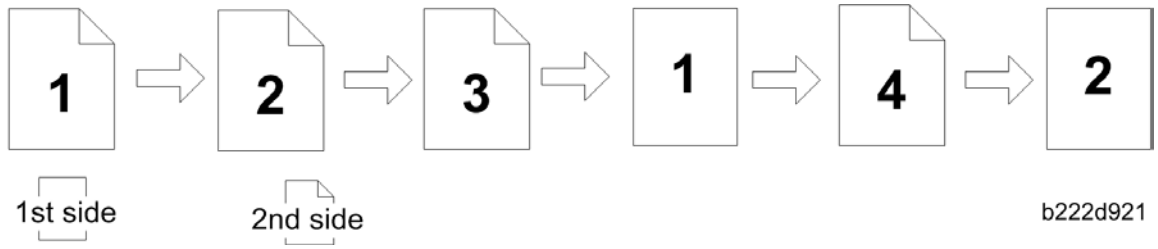
In the duplex feed path, the paper is fed by the transport rollers (these rollers are driven by the duplex inverter motor) and the duplex/by-pass transport roller (this roller is driven by the duplex/by-pass motor). When the machine gets a multi-page duplex printing job, the duplex exit sensor [D] controls the duplex inverter motor and duplex/by-pass motor to synchronize the duplex feed timing.

14.4 DUPLEX OPERATION

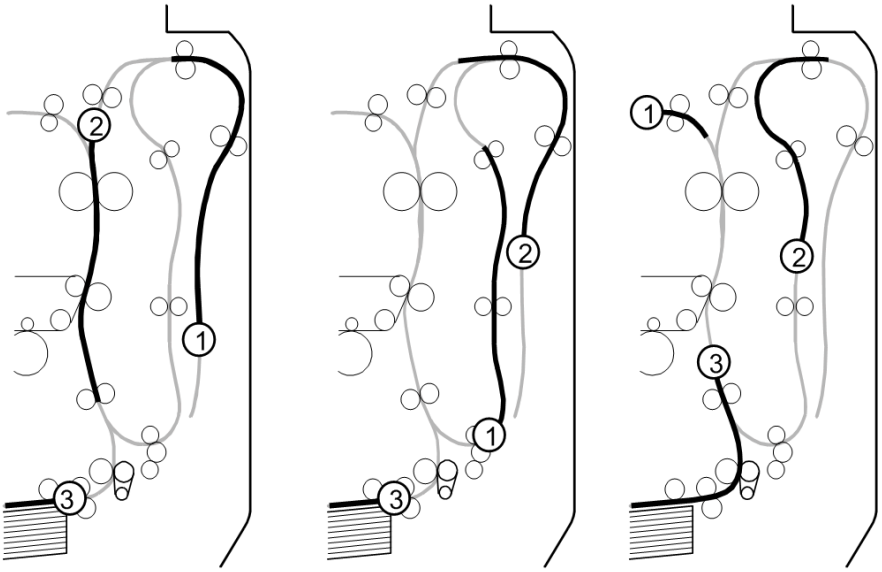
14.4.1 UP TO A4/LT (81/2" X 11") LEF



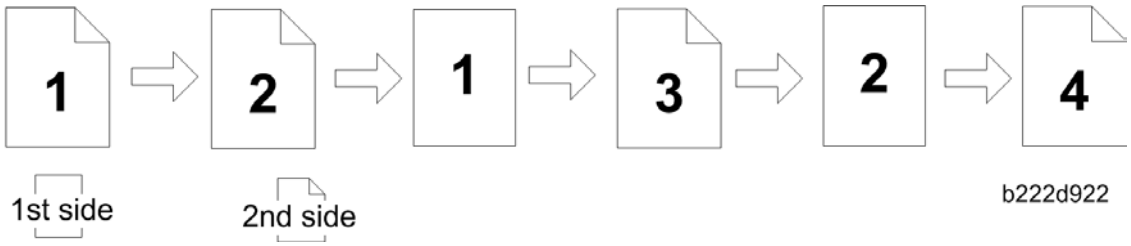
There are three sheets of paper in the paper feed path at the same time. The interleave method is used.
The drawing above shows the paper movement with the interleave method for three sheets of paper. The printing is done as follows:



14.4.2 FROM A4/LT (8 1/2" X 11") LEF TO 400MM LENGTH

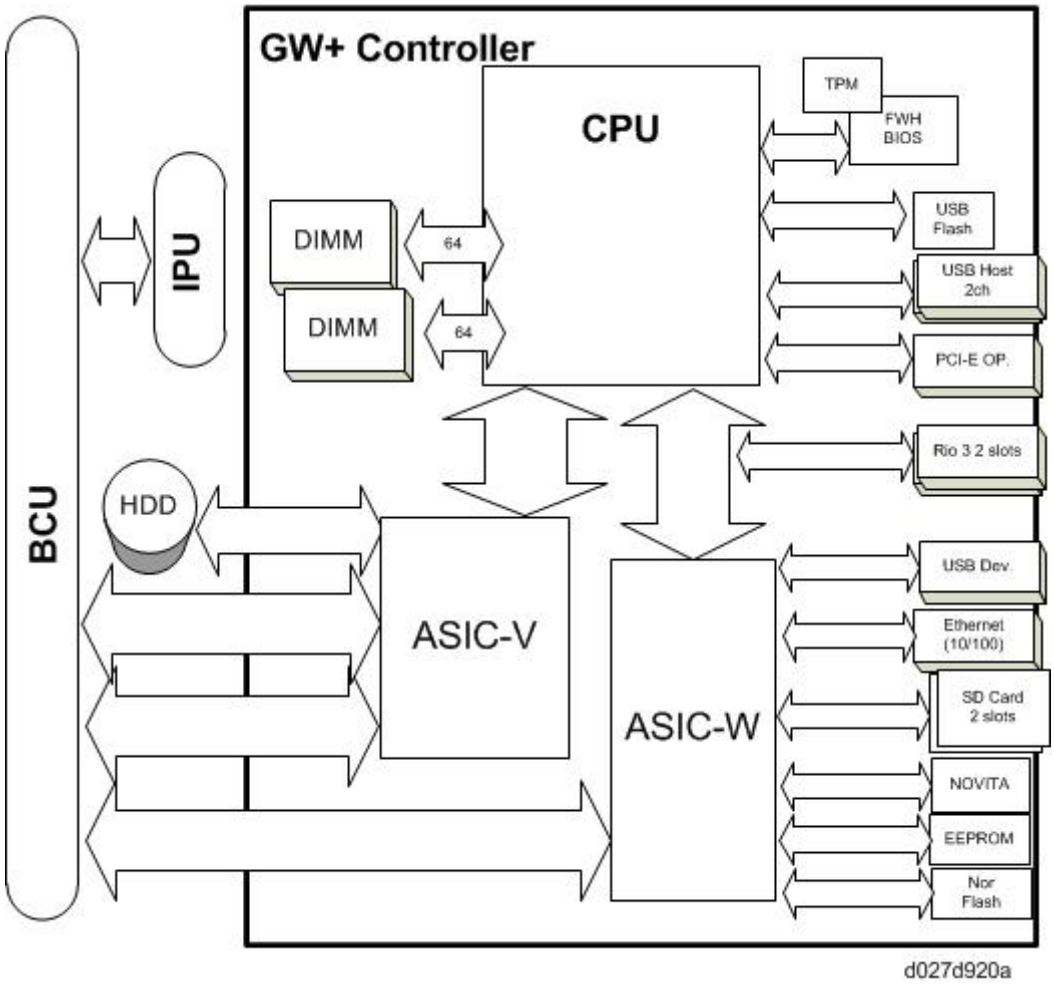


There are two sheets of paper in the paper feed path at the same time. The interleave method is used. For sheets longer than 400 mm, there is no interleaving.
The drawing above shows the paper movement with the interleave method for two sheets of paper. The printing is done as follows:



15. PRINTER FUNCTIONS

15.1 OVERVIEW



The controller is based on the GW architecture.

CPU: 1.0 GHz

ASIC-V:

This is one of the GW+ architecture ASICs:

GW+ architecture ASIC. It controls the interface with the CPU and controls these functions: PCI bus, video data (PCI EXPRESS), HDD for image processing.

ASIC-W:

IO control ASIC. It controls the network, operation panel, USB port, SD cards.

DDR2-SDRAM DIMM (2 slots):

The controller has 2 GB resident DDR2-SDRAM.

NAND Flash ROM:

128 MB flash ROM programmed for the boot system.

NOR Flash ROM:

4 MB flash ROM

EEPROM:

For mac address

NVRAM :

512 KB for the machine parameters, logged data and a record of the number of pages printed for each “User Code”.

SD card:

3 slots are available for application SD cards.

Network Interface:

- 10/100Base Ethernet I/F (On board 1ch)

USB Interface:

- USB 2.0 Device I/F (On-board 1ch)

IEEE 1284 Interface (option):

This is a parallel printer port.

IEEE 802.11a/g (option):

This lets you connect the machine to a wireless network.

Bluetooth (option):

This lets you connect the machine to a Bluetooth network by connecting the USB Bluetooth adapter to the USB port.

I/F Slot	Item
Slot A	IEEE 1284, IEEE 802.11a/g, IEEE 802.11g
Slot B	File format converter

Gigabit Ethernet (Option):

- 1000 Base-T Ethernet I/F

HDD:

2.5” HDD (190 GB*) can be connected using the SATA interface.

* Actually, a 340 GB HDD is equipped, and 190 GB can be available in 340GB of this HDD.

SD Card slots:

- Slot 1: Security SD card (standard) or Optional application (for PostScript 3 or PictBridge)
- Slot 2: VM card (standard), Firmware upgrade or Browser Unit (RDS – Ricoh Document Server)

15.2 CONTROLLER FUNCTIONS

15.2.1 SHUTDOWN FUNCTION

This machine has the power relay board to protect a HDD unit. The power relay board keeps the power supply to the controller until the HDD unit has been shutdown safely after the main power switch of the machine has been turned off. The reference time of the machine's shutdown is described below.

Mode	Status	Details	Reference Time
Stand-by	Stand-by	Stand-by Low power	Less than 10 sec.
		Operation SW off	0 sec.
Operation	Scanning Copying/Printing HDD deleting	-	Less than 20 sec.
	Firmware updating HDD encrypting	-	Less than 360 sec.
Error	SC issued	SC level A, D	Less than 360 sec.
		SC level B, C	Less than 10 sec.
	Application error	Application SD Removed	Less than 360 sec.
Starting up	Starting up	During 1 min. after application screen is displayed	Less than 80 sec.

16. FAN CONTROL

16.1 OVERVIEW

This machine has "Extra Fan Control" mode to cool down the temperature inside the machine **after** a multiple printing job (more than 1,000 sheets; A4 LEF) and the temperature inside the machine goes beyond a threshold set in the SP mode. When the machine enters the Extra Fan Control mode, all fans are activated and kept operating until the temperature inside the machine goes below a threshold set in the SP mode after the job.

16.1.1 CAN OR CANNOT DURING EXTRA FAN CONTROL MODE

- Normal operation (copy, print, scan, etc.) can be done.
- Operation switch on the operation panel does not work.
- Fan operation cannot be stopped except turning off the main power switch. Extra Fan Control will be resumed if the machine is turned on within 30 minutes after turning off the main power switch.
- The machine cannot enter the energy saver mode during the Extra Fan Control mode.

16.1.2 SP SETTINGS FOR EXTRA FAN CONTROL

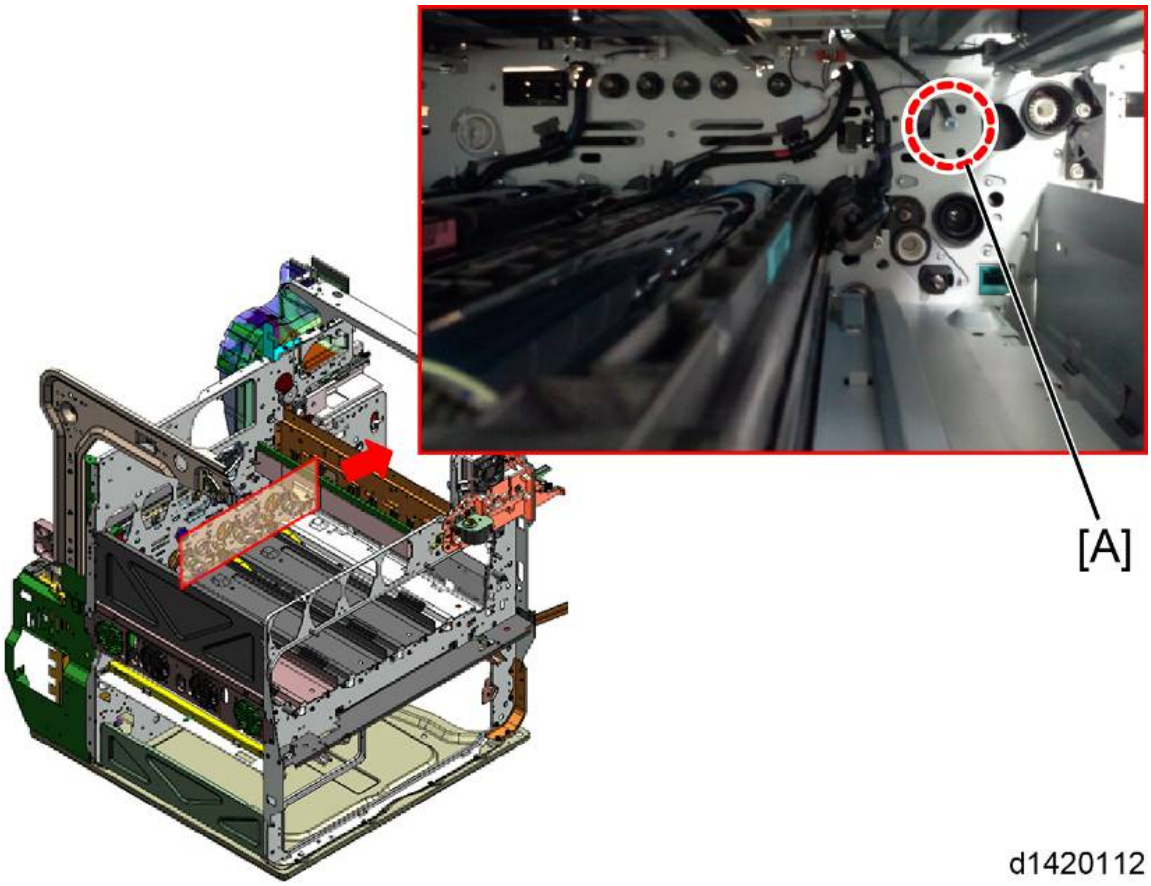
NOTE: Do not touch the following SP modes in the field. These are for design use only.

SP		Description	
SP1-953-001	Extra Fan Cooling State	Displays the status of the extra fan operation. **0: No operation** 1: Operation	**DFU**
SP1-953-006	Extra Fan Control Execution Temp.: Threshold	Sets the execution threshold temperature of the extra fan control. [20 to 70 / **37.3** / 0.1step]	**DFU**
SP1-953-007	Extra Fan Control Cancellation Temp.: Threshold	Sets the cancellation threshold (difference from the execution temperature) temperature of the extra fan control. [0.1 to 20 / **4.5** / 0.1step]	**DFU**
SP1-953-008	Extra Fan Control ON/OFF Setting	Sets the extra fan control ON or OFF. 0: OFF **1: ON**	**DFU**
SP1-955-001	Fan Control Execution Temp.: Threshold	Sets the execution threshold temperature of the fan control. [20 to 70 / **34.6** / 0.1step]	**DFU**
SP1-955-002	Fan Control Cancellation Temp.: Threshold	Sets the cancellation threshold (difference from the execution temperature) temperature of the fan control. [0.1 to 20 / **1.8** / 0.1step]	**DFU**

16.2 COOLING CONTROL INSIDE THE MACHINE

This machine has a temperature sensor (development thermistor) to perform a cooling operation according to the temperature inside the machine to control the excessive rise of temperature and to keep the machine quality.

16.2.1 LOCATION OF THE TEMPERATURE SENSOR (DEVELOPMENT THERMISTOR)

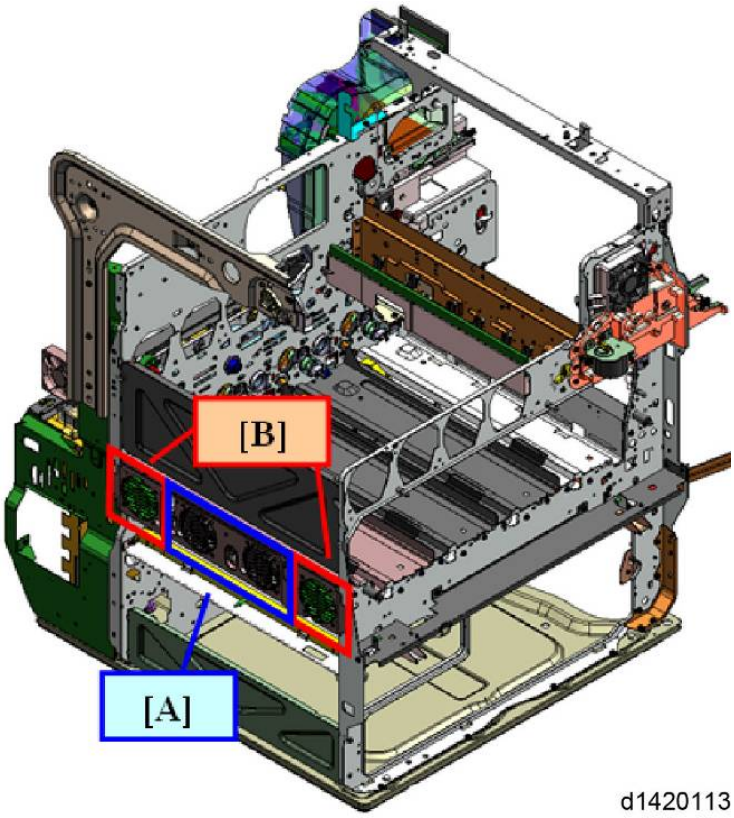


[A]: Temperature sensor (development thermistor)

16.2.2 OVERVIEW OF THE COOLING OPERATION INSIDE THE MACHINE

Fans operate according to the temperature inside the machine which is checked during or after printing to cool the temperature. For example, changing of the fans to rotate; extra rotation of the fans after printing.
Addition to the fans operation, CPM control is performed to cool the temperature when large amount of printing causes extremely high temperature.

Cooling operation during printing



Usually the fans [A] of the main fan are used to cool the temperature inside the machine and the temperature sensor checks at regular time intervals.
If the temperature goes beyond an each threshold, the fans [B] operate instead of the fans [A] or both fans [A] and [B] operate at one time because the volume of air of the fans [B] is bigger than that of the fans [A].
Also if the temperature rises even further due to large amount of printing, CPM control is performed.
The table below shows the relationship between the temperature and the performance of the fans and CPM control.

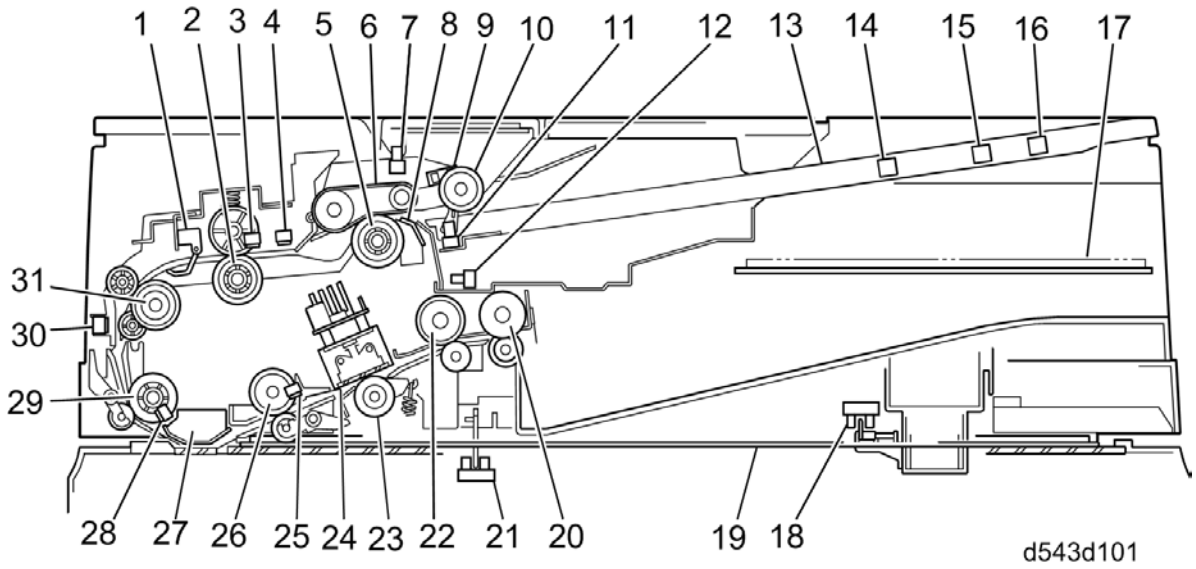
Detected temperature	Fan [A] operation	Fan [B] operation	CPM control
The Highest	Performed	Performed	Performed
Higher	Performed	Performed	Not performed
High	Not performed	Performed	Not performed
Low	Performed	Not performed	Not performed

Cooling operation after printing

Usually the fans operation is stopped after printing. However the high temperature inside the machine keeps the fans rotating even after printing.

17. ADF

17.1 OVERVIEW

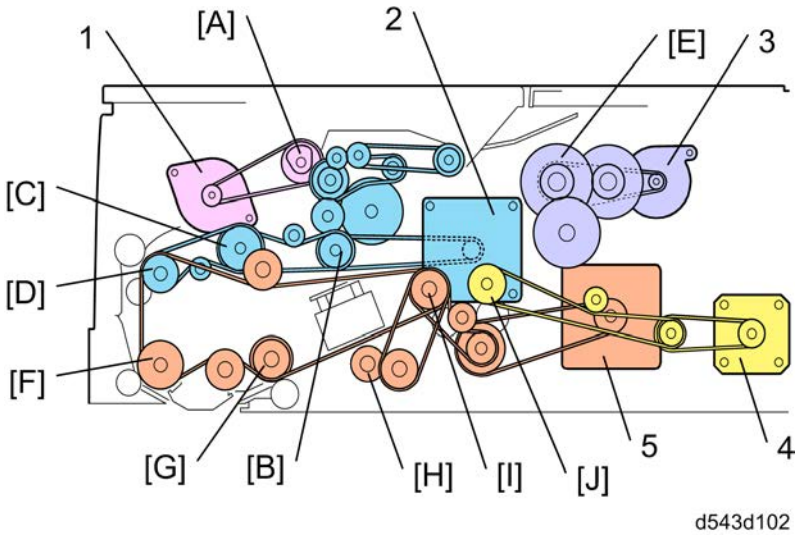


1. Original Width Sensors (x 4)
2. ADF Entrance Roller
3. Original Skew Correction Sensor
4. Original Separation Sensor
5. Separation Roller
6. Feed Belt
7. Feed Cover Sensor
8. Separation Pad
9. Bottom Plate Position Sensor
10. Original Pick-up Roller
11. Original Set Sensor
12. Bottom plate HP Sensor
13. Original Tray
14. Original Length Sensor 1
15. Original Length Sensor 2
16. Original Length Sensor 3
17. Original Exit Tray
18. ADF Lift Sensor
19. Platen Cover
20. ADF Exit Roller
21. APS Start Sensor (Main Machine)
22. 3rd Transport Roller
23. White Platen Roller
24. CIS (Contact Image Sensor)
25. Original Exit Sensor
26. 2nd Transport Roller
27. White Plate Guide
28. Original Registration Sensor
29. Pre-scanning Roller
30. Interval sensor
31. 1st Transport Roller

Some sensors are not shown, but the callouts indicate their approximate locations.

Original Separation and Feed. The standard FRR system for paper separation and feed. A combination of three original length sensors on the original tray and an array of four original width sensors in the paper feed path is used.
Duplex Scanning. The front side of the original is scanned as it passes over the ADF exposure glass below, and the back is scanned by a CIS mounted above the paper path. There is no inverter mechanism for duplex scanning in the ADF.

17.2 ADF DRIVE LAYOUT



23. Original Pick-up Roller Motor
24. Original Feed Motor
25. Bottom Plate Lift Motor
26. Original Exit Motor
27. Original Transport Motor

Original pick-up roller motor: Drives the pick-up roller lift mechanism through gear [A].
Original feed motor: Drives the following:

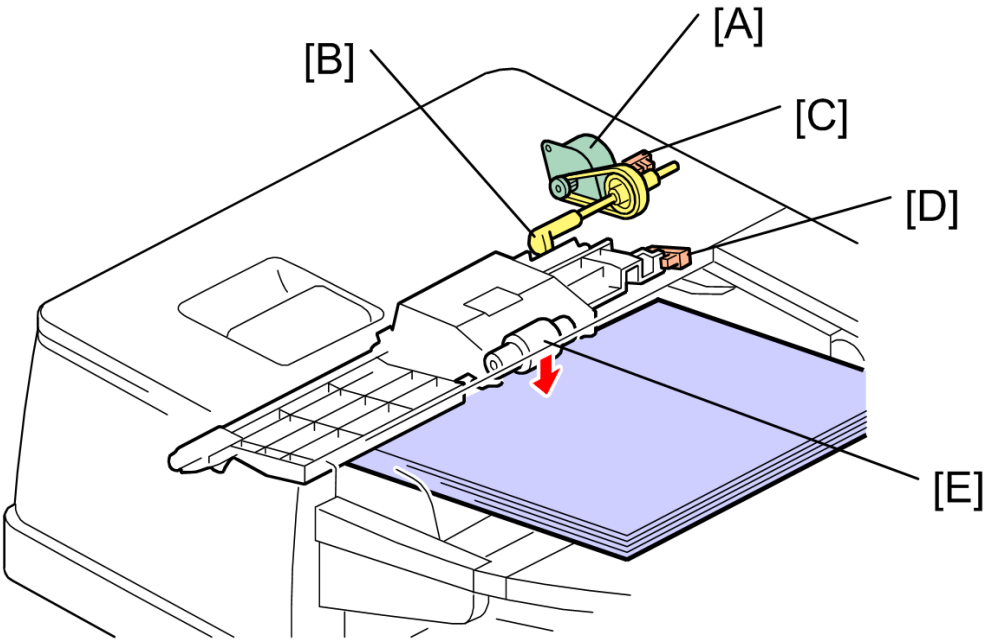
- Pick-up roller and feed belt drive gear [B]
- ADF entrance roller [C] and 1st transport roller [D]

Bottom plate lift motor: Drives the bottom plate lift mechanism through gear [E].
Original transport motor: Drives the following:

- Pre-scanning roller [F]
- 2nd transport roller [G]
- White platen roller [H]
- 3rd transport roller [I]

Original exit motor: Drives the ADF exit roller [J].

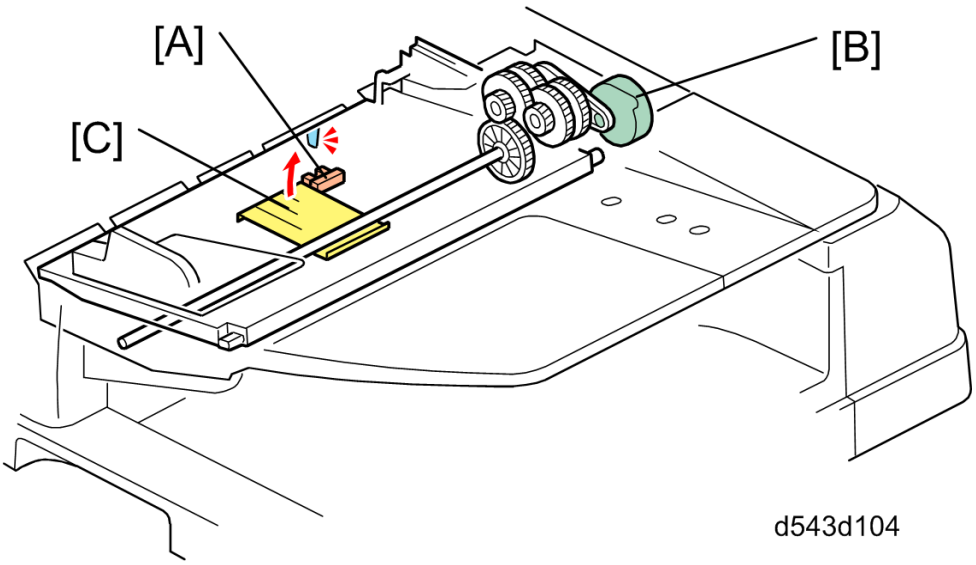
17.3 PICK-UP ROLLER LIFT



[A]: Original pick-up roller motor
[B]: Cam
[C]: Original pick-up roller HP sensor
[D]: Bottom plate position sensor
[E]: Original pick-up roller

When there are no originals: The original pick-up roller [E] remains up (this is the home position which is detected by the original pick-up roller HP sensor).
When an original is placed on the tray: The original set sensor turns on, and this turns on original pick-up roller motor [A] and bottom plate lift motor. The cam [B] releases the original feed unit, and then the pick-up roller [E] drops onto the stack of paper. Meantime, the bottom plate is lifted until the bottom plate position sensor [D] detects the original feed unit. Then the pick-up roller feeds the paper to the feed belt and separation roller.

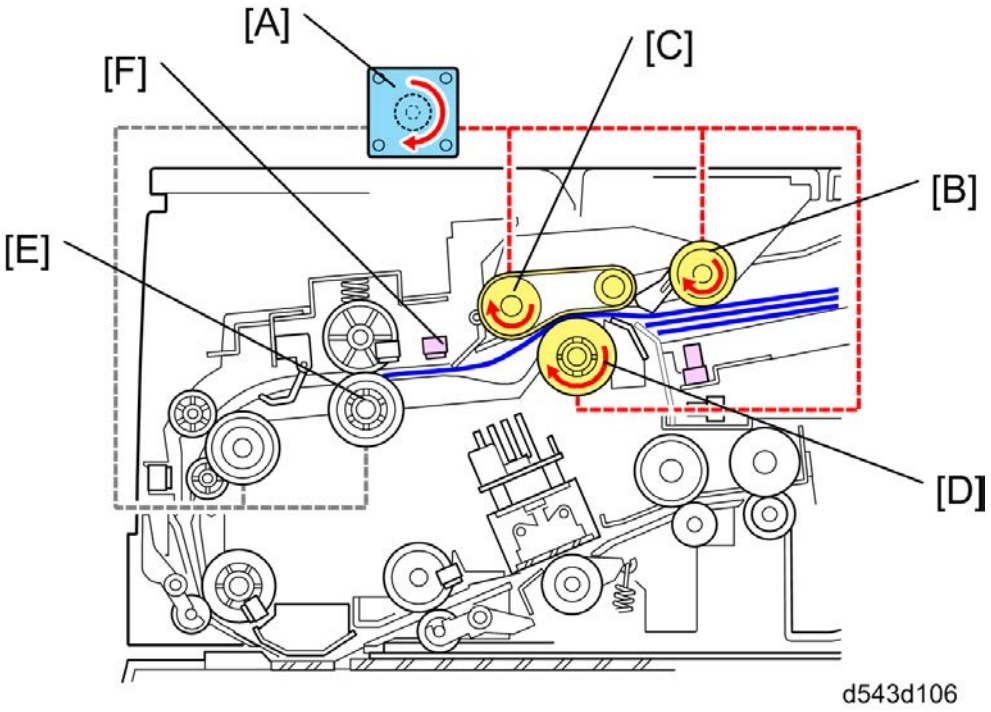
17.4 BOTTOM PLATE LIFT



[A]: Bottom plate HP sensor
[B]: Bottom plate lift motor
[C]: Lift lever

When an original is placed on the original tray: The original set sensor turns on, the pick-up roller drops, and bottom plate HP sensor [A] (on the pick-up roller assembly) turns off. Then, the bottom plate lift motor [B] lifts the lift lever [C], raising the bottom plate.
When the bottom plate reaches the correct feed position: The bottom plate HP sensor [A] turns off and the bottom plate lift motor [B] stops.
During the job, when the top of the stack becomes too low: When the pick-up roller drops low enough to turns on the bottom plate HP sensor [A] again, the bottom plate lift motor [B] turns on again to raise the stack to the correct feed position.

17.5 ORIGINAL SEPARATION

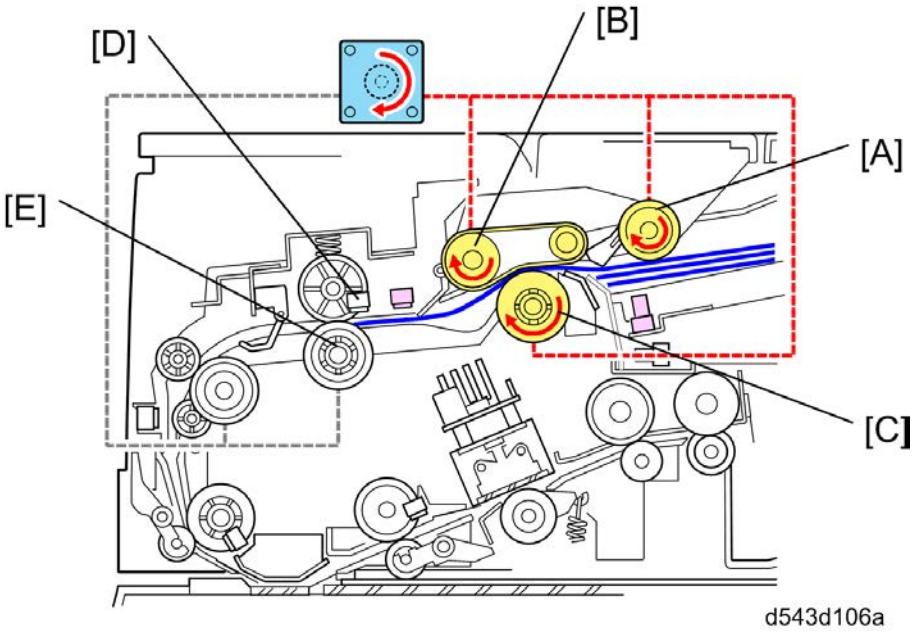


[A]: Original feed motor
[B]: Original pick-up roller
[C]: Original feed belt
[D]: Original separation roller
[E]: ADF entrance roller
[F]: Original separation sensor

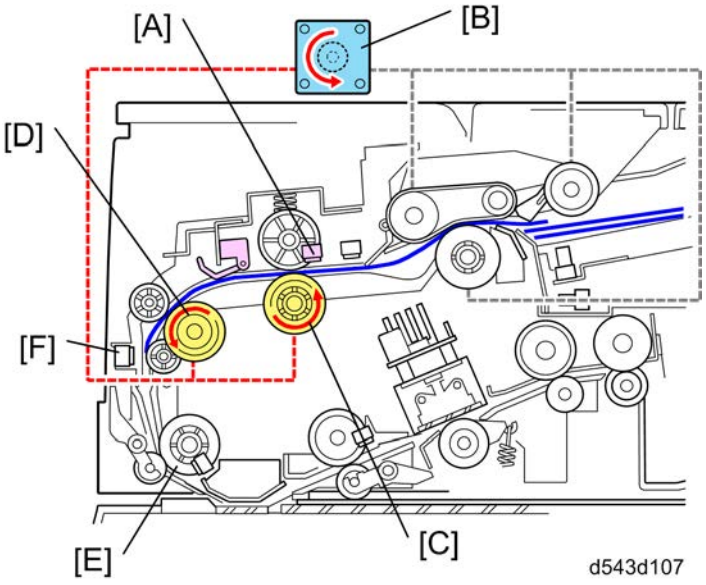
This ADF uses the FRR (feed and reverse roller) with feed belt system. This mechanism prevents feeding more than one sheet at a time. The original feed motor [A] drives the original pick-up roller [B], original geed belt [C] and original separation roller [D]. The original is fed to the ADF entrance roller [E] by the original pick-up roller and original feed roller [E].

When the original separation sensor [F] detects the trailing edge of the original, next original is fed

17.6 ORIGINAL TRANSPORT



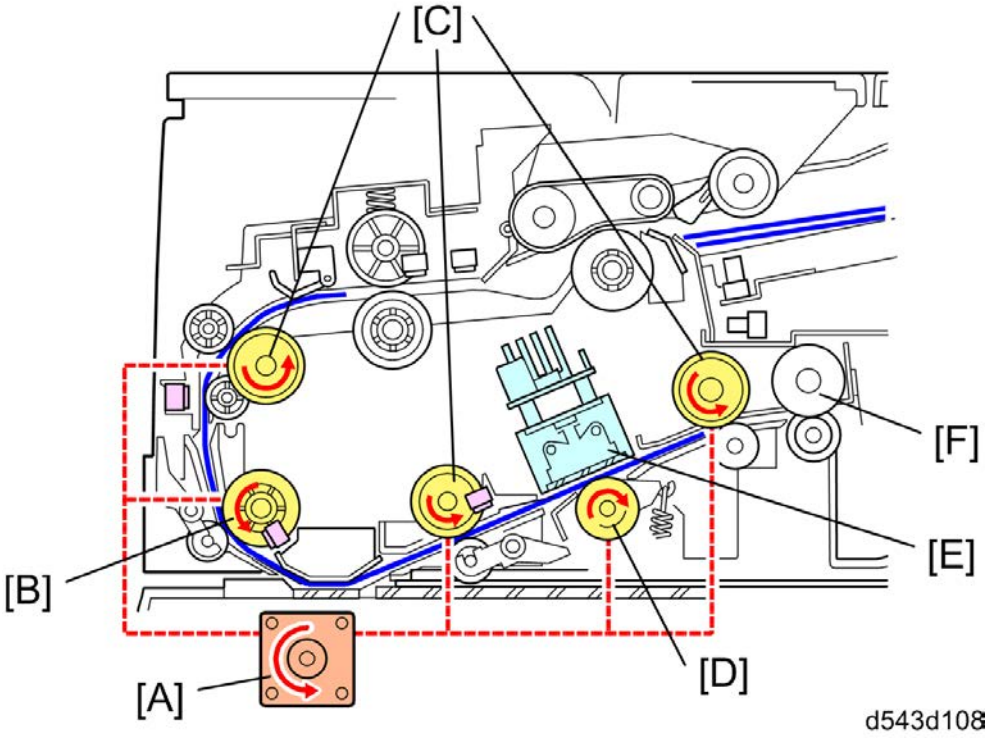
The pick-up roller feeds the original to the feed belt and separation roller [C]. Skew is corrected at the skew correction sensor [D] and entrance roller [E].



When the skew correction sensor [A] detects the leading edge of the original, the original feed motor [B] reverses its rotation, and then drives the ADF entrance roller [C] and 1st transport roller [C]. Also the pre-scanning roller [E] turns on at the same time. Skew is corrected at the pre-scanning roller too. Shading correction, which attempts to compensate for slight distortions caused by the differences in brightness

of the light elements due to wear, temperature variation, or distortion by the lenses, is done for the first sheet:

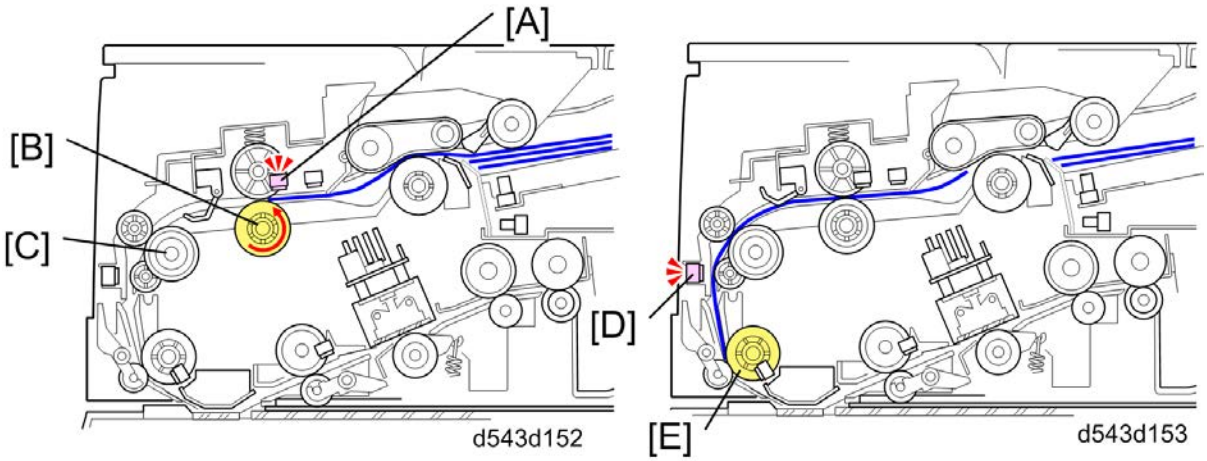
- The original is fed for a few clock pulses after the registration sensor [F] detects the leading edge of the original.
- The original is then delayed slightly at the ADF exposure glass while the CPU uses the white plate to determine the white peak level for the job.



When the interval sensor detects leading edge of the original, the original transport motor starts to drive the pre-scanning roller [A], transport rollers [B] and the white platen roller. These rollers feed the original over the ADF exposure glass and under the CIS [E], until it reaches the ADF exit roller [F].

- If the reverse side of the original is to be scanned, the CPU uses the surface of the white platen roller [D] to determine the white peak level for the job.

17.7 ORIGINAL SKEW CORRECTION



- [A]: Skew correction sensor
- [B]: Entrance roller
- [C]: Feed roller (Transport Roller 1)
- [D]: Interval sensor
- [E]: Pre-scanning roller

After pick-up and separation, the skew correction sensor [A] detects the leading edge of the original and the ADF entrance roller [B] is delayed for the prescribed number of pulses to buckle the original and correct skew.

If the original is B6, A5, or HLT, or during any duplex scanning regardless of original size, when the interval sensor [D] detects the leading edge of the original, the pre-scanning roller [E] is delayed for the prescribed number of pulses to buckle the original and correct skew.

When scanning only the front side of originals larger than A5, after the ADF entrance roller [B] starts rotating, the original feed motor increases the speed of 1st transport roller [C] to reduce the interval between the original just fed and the original ahead being scanned. When the interval sensor [D] detects the leading edge of the original approaching the pre-scanning roller, the pre-scanning roller slows down slightly. The 1st transport roller [C] is still feeding the paper faster than the pre-scanning roller [E], and this slows the original at the leading edge and corrects skew.

Here is a summary of the skew correction methods.

Skew correction sensor/entrance roller

	B6, A5, HLT	Larger Than A5
Duplex Scanning	Yes	Yes
Simplex Scanning	Yes	Yes

NOTE: Skew is always corrected with method ① for every job, regardless of the paper size and mode.

Interval sensor/pre-scanning roller stop correction

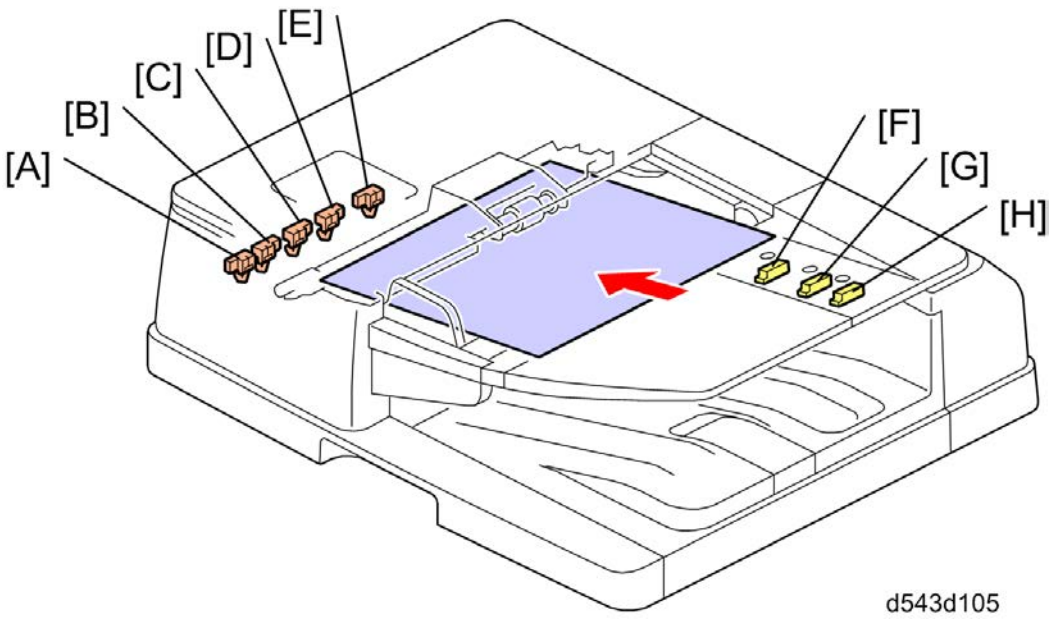
	B6, A5, HLT	Larger Than A5
Duplex Scanning	Yes	Yes
Simplex Scanning	Yes	No

NOTE: Use SP6020 (ADF Contact Mode In/Out) to enable skew correction method ② for all jobs to ensure accurate original feeding. However, switching this feature on slows original feed slightly.

Interval sensor/pre-scanning roller slow-down correction

	B6, A5, HLT	Larger Than A5
Duplex Scanning	No	No
Simplex Scanning	No	Yes

17.8 ORIGINAL SIZE DETECTION



- [A]: Original width sensor 5
- [B]: Original width sensor 4
- [C]: Original width sensor 3
- [D]: Original width sensor 2
- [E]: Original width sensor 1
- [F]: B5 length sensor
- [G]: A4 length sensor
- [H]: LG length sensor

When the leading edge of the paper passes the skew correction sensor, the CPU reads the outputs from the original width and length sensors.
Please refer to the table on the next page.

17.8.1 ORIGINAL SIZE DETECTION TABLE

Size (W x L)	Original Width Sensors					Original Length Sensors				
	1	**2**	**3**	**4**	**5**	**B5**	**A4**	**LG**	**NA**	**EU**
A3 SEF (297 x 420 mm)	1	1	1	1	1	1	1	1	Y	Y
B4 SEF (257 x 364 mm)	1	1	1	0	0	1	1	1	N	Y
A4 SEF (210 x 297 mm)	1	1	0	0	0	1	1	0	Y	Y
A4 LEF (297 x 210 mm)	1	1	1	1	1	0	0	0	Y	Y
B5 SEF (182 x 257 mm)	0	0	0	0	0	1	0	0	N	Y
B5 LEF (257 x 182 mm)	1	1	1	0	0	0	0	0	N	Y
A5 SEF (148 x 210 mm) *1	0	0	0	0	0	0	0	0	N	Y
A5 LEF (210 x 148 mm)	1	0	0	0	0	0	0	0	N	Y
B6 SEF (128 x 182 mm) *1	0	0	0	0	0	0	0	0	N	Y
B6 LEF (182 x 128 mm) *1	0	0	0	0	0	0	0	0	N	Y
11" x 17" SEF (DLT)	1	1	1	1	0	1	1	1	Y	**S**
11" x 15" SEF	1	1	1	1	0	1	1	1	**S**	N
10" x 14" SEF	1	1	1	0	0	1	1	1	Y	N
8 1/2" x 14" SEF (LG)	1	1	0	0	0	1	1	1	Y	N
8 1/2" x 13" SEF (F4)	1	1	0	0	0	1	1	1	**S**	Y
8 1/4" x 13" SEF	1	1	0	0	0	1	1	1	N	N
8" x 13" SEF (F)	1	1	0	0	0	1	1	1	**S**	**S**

8 1/2" x 13 1/4" SEF (F)	1	1	0	0	0	1	1	1	**S**	**S**
8 1/2" x 11" SEF (LT)	1	1	0	0	0	1	0	0	Y	**S**
11" x 8 1/2" LEF (LT)	1	1	1	1	0	0	0	0	Y	**S**
7 1/4" x 10 1/2" SEF	1	1	0	0	0	1	0	0	Y	N
10 1/2" x 7 1/4" LEF	1	1	1	1	0	0	0	0	**S**	N
8" x 10" SEF (F)	1	1	0	0	0	1	0	0	**S**	N
5 1/2" x 8 1/2" SEF (HLT)	0	0	0	0	0	0	0	0	Y	N
8 1/2" x 5 1/2" LEF (HLT)	1	1	0	0	0	0	0	0	Y	N
8 K SEF (267 x 390 mm)	1	1	1	0	0	1	1	1	N	Y
16 K SEF (195 x 267 mm)	1	1	0	0	0	1	0	0	N	Y
16 K LEF (267 x 195 mm)	1	1	1	0	0	0	0	0	N	Y

1: Actuated

0: Not actuated

Y: Yes. Size detected.

N: No. Size not detected.

S: Selectable. Size not detected with default but default can be changed with SP6016 (Original Size Determination Priority) or SP5126 (F Original Size Selection). Refer to the description in the next section.

*1: For A5 SEF, B6 SEF, and B6 LEF, all sensors are off. The machine determines the paper size by measuring the distance between the leading and trailing edges using the skew correction sensor and clock pulses.

17.8.2 CHANGING THE DEFAULT SELECTION WITH SP6016 AND SP5126

Here is a list of paper sizes that can be set for the default to enable detection. The **bold sizes** are the default settings, and the italic sizes are the alternate settings.

North America			Europe/Asia		
64	**DL SEF**	*11" x 15"*	4	**8 K**	*DL SEF*
32	**LT LEF**	*Exec LEF*	2	**16 K SEF**	*LT SEF*
16	**LT SEF**	*8" x 10" SEF*	1	**16 K LEF**	*LT LEF*
8	**LG SEF**	*Set by SP 5126*			

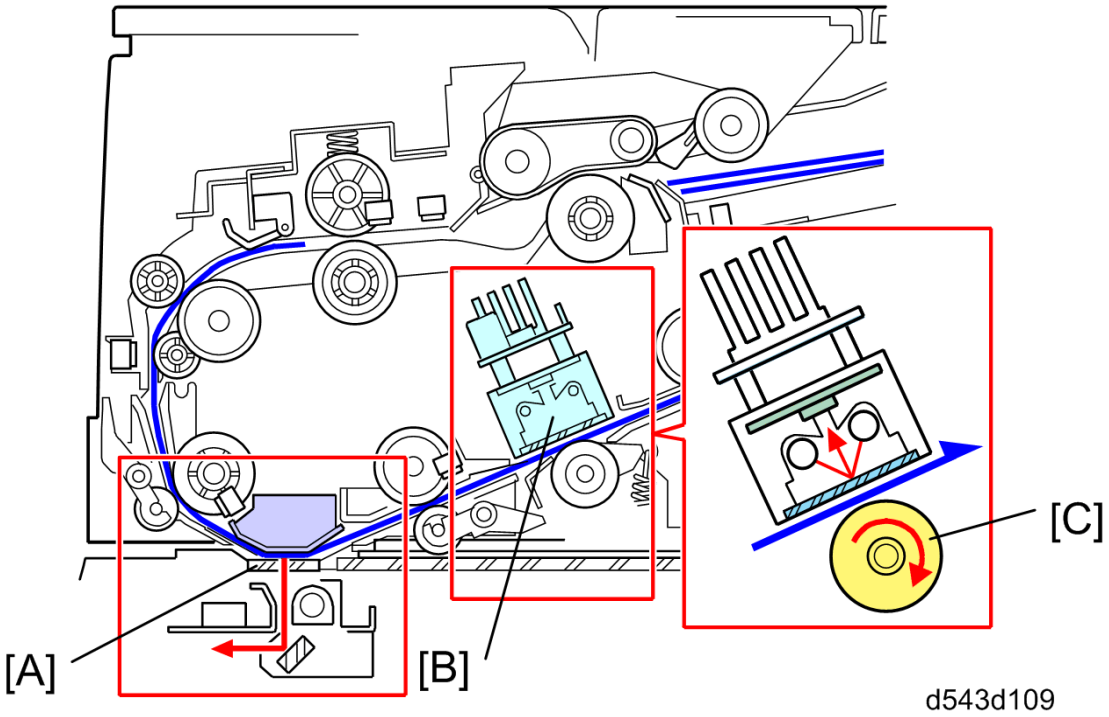
To change the default settings:

28. Enter the SP mode.
29. Select SP6016.
30. Replace the default settings with the alternate settings.
    - In North America, enter 120 to replace the default settings with the alternate settings. The bold settings in the table above are replaced with the italicized settings.
    - In Europe (or Asia), enter 7 to replace the default settings with the alternate settings. The bold settings in the table above are replaced with the italicized settings.
31. To restore all the default settings in either North America or Europe/Asia, enter “0”.

SP 5126

This SP controls the alternative paper sizes that are detected for LG SEF (USA) or 8 ½ x 13" (Europe/Asia).

17.9 ADF SCANNING



The ADF scans both sides of an original without inverting the original:

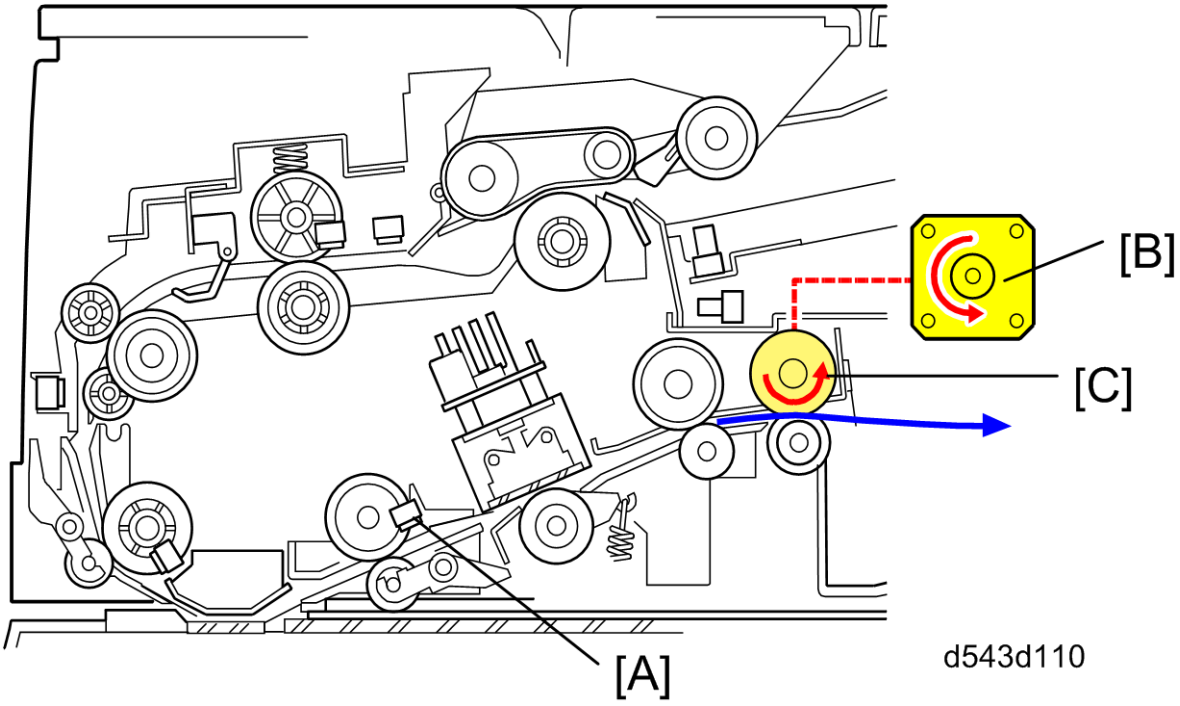
- Front side: Scanned at the ADF exposure glass [A] by a xenon exposure lamp and CCD below the original
- Back side: Scanned by a CIS [B] above the paper path

The CIS can scan a line 306 mm (12") wide at 600 dpi. To increase the scanning speed, the sensors are divided into 13 parallel blocks.

NOTE: Both sides are scanned at 600 dpi. The 600 dpi output is boosted to 1200 dpi by image processing at the IPU.

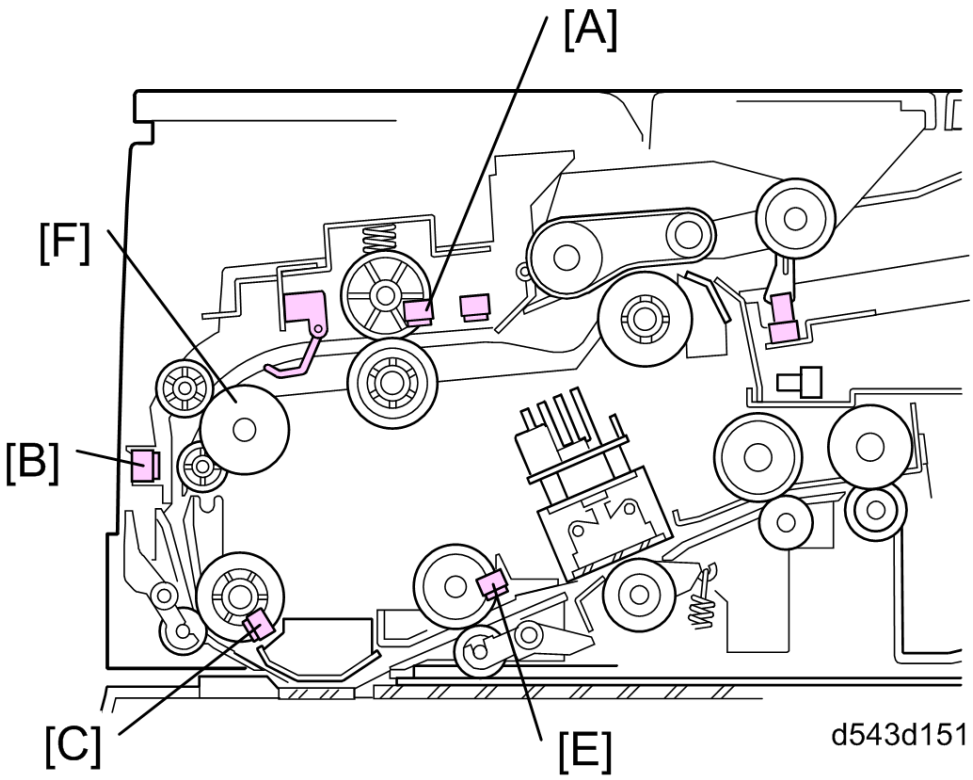
The CIS reads the surface of the white roller [C] and uses this reading (white point =0) as a reference point for density correction.

17.10 ORIGINAL EXIT



When the original exit sensor [A] detects the leading edge of the original, the original exit motor [B] starts to drive the ADF exit roller [C]. The original is fed to the original exit tray by the ADF exit roller.

17.11 JAM DETECTION



Four sensors, the original skew correction sensor [A], interval sensor [B], original registration sensor [C], and original exit sensor [D] detect jams in the paper path. The conditions that trigger a jam detection are listed below.

Jam Type		Cause
Skew correction sensor	Check in failure	Remains off after enough time for the original to feed twice the distance from the original setting position to the skew correction sensor.
Interval sensor	Check in failure	Remains off after enough time for the original to feed twice the distance from the 1st transport roller [E] to the interval sensor.
Registration sensor	Check in failure	Remains off after enough time for the original to feed twice the distance from the skew correction sensor to the registration sensor.

Exit sensor	Check in failure	Remains off after enough time for the original to feed twice the distance from the registration sensor to the exit sensor.
Skew correction sensor	Check out failure	Remains on after enough time for a 610 mm (24") original to feed (except when the user is feeding custom-sized originals, which can be up to 1260 mm).
Interval sensor	Check out failure	Remains on after enough time for the original to feed twice the distance from the interval sensor to the skew correction sensor.
Registration sensor	Check out failure	Remains on after enough time for the original to feed twice the distance from the skew correction sensor to the registration sensor.
Exit sensor	Check out failure	Remains on after enough time for the original to feed twice the distance from the registration sensor to the exit sensor.

NOTE: If a problem occurs in the ADF, either SC700 or SC701 will be issued. For details, please refer to "Service Call Tables - 7" of the Field Service Manual.