RICOH

M156/M157/M176/M177 DETAILED DESCRIPTIONS MANUAL

M156/M157/M176/M177 DETAILED DESCRIPTIONS

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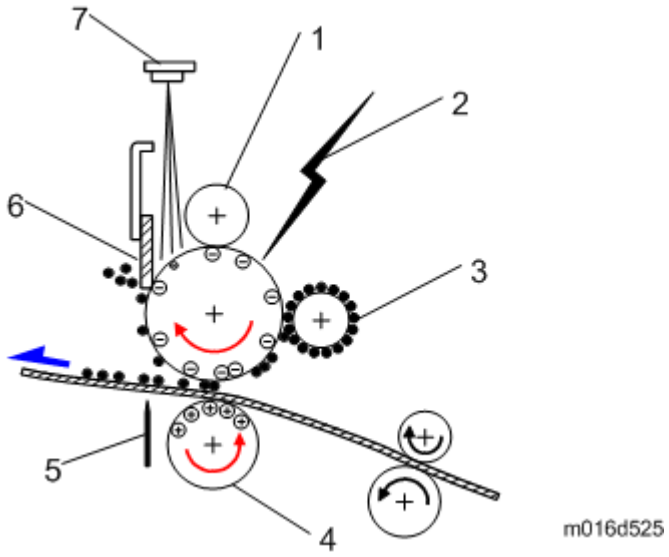
1. PRINTING PROCESS

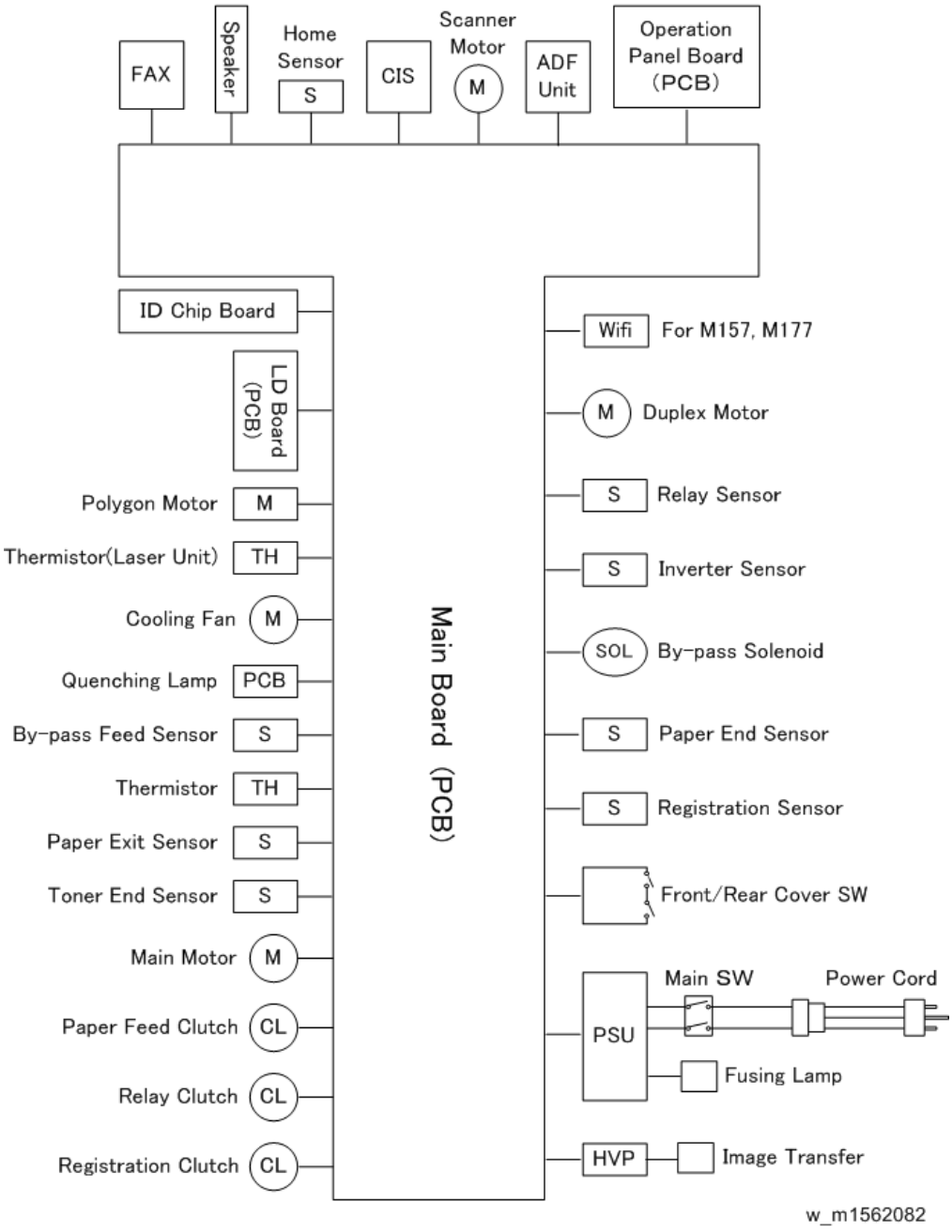
1.1 OVERVIEW



1. **Drum Charge**: The charge roller gives the drum a negative charge.
2. **Laser Exposure**: A laser beam writes the print data on the drum.
3. **Toner**: The development roller moves toner to the latent image on the drum surface.
4. **Image Transfer**: The transfer roller moves the toner from the drum to the paper.
5. **Separation**: The separation plate helps to remove the paper from the drum.
6. **Cleaning**: The cleaning blade removes remaining toner on the drum surface after the image is moved to the paper.
7. **Quenching**: The light from the quenching lamp cancels the charge that stays on the drum.

2. ELECTRICAL COMPONENTS

2.1 BLOCK DIAGRAM



2.2 BOARD FUNCTIONALITIES

2.2.1 MAIN BOARD

Controls overall operation of the printer, mainly:
- SDRAM
- Ethernet (10BASE-T/100BASE-TX)
- USB 2.0
- EEPROM
- Controller I/F
- Engine
- Image data processing
- LD (Laser Diode)

Main Board Specifications
- CPU：ARM926-360MHz
- RAM：128 MB

2.2.2 LDB (LD DRIVE BOARD)

Controls the LD (Laser Diode).

2.2.3 PSU

Supplies DC current to the machine. Also, contains the AC drive that controls the power supply to the fusing lamps.

2.2.4 HVP

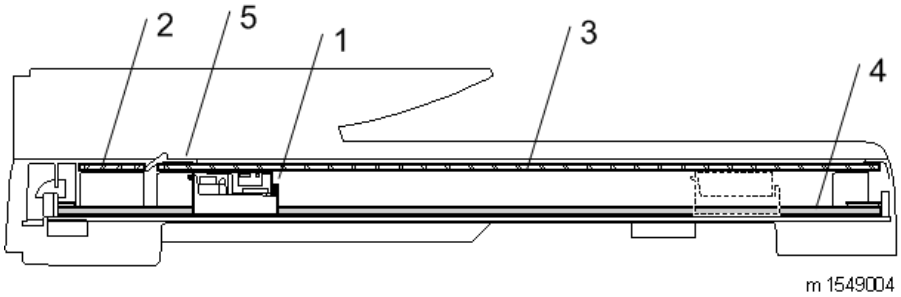
The high voltage power supply provides power to electrical components in the machine.
Generates the high voltage power supply required for the printing process.

2.2.5 WIRELESS LAN BOARD

Connects to the network in the Wireless LAN.

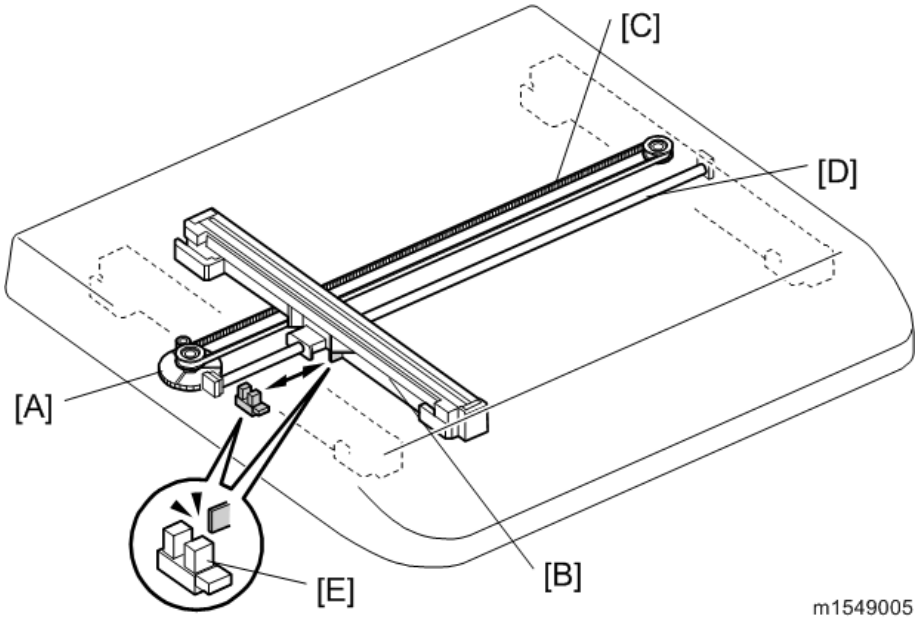
3. SCANNER

3.1 OVERVIEW



1. Scanner Carriage Unit	4. Carriage Drive Shaft
2. DF Exposure Glass	5. White Sheet
3. Scanner Exposure Glass	

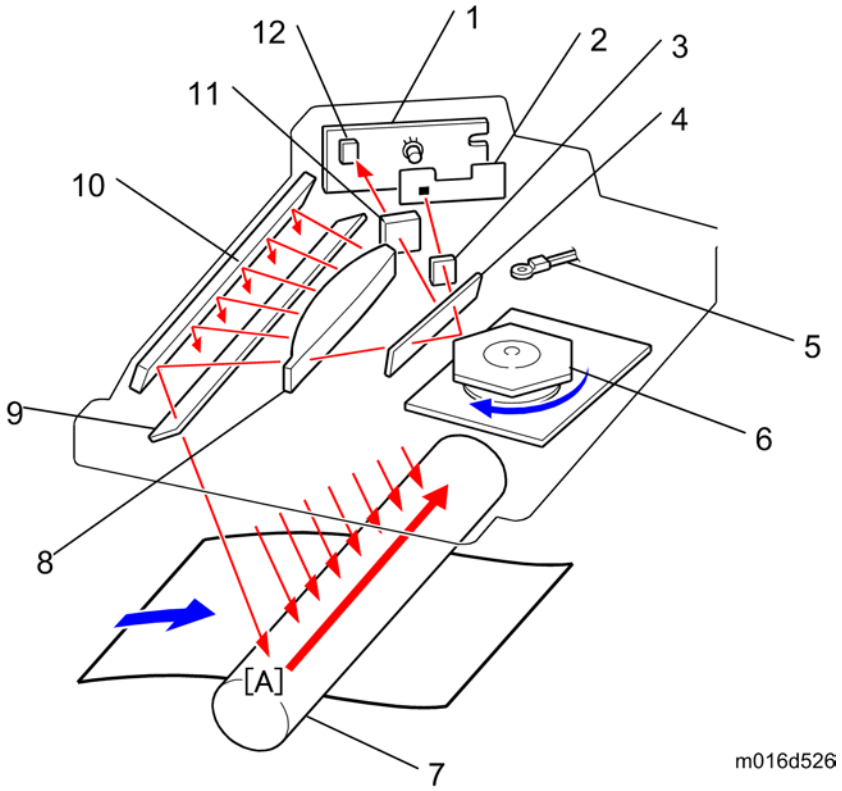
3.2 DRIVE



The scanner motor [A] drives the scanner carriage unit [B] through gears and a timing belt [C]. The scanner carriage unit moves along the carriage drive shaft [D]. The carriage home position sensor [E] in the scanner detects the home position of carriage unit when initializing the scanner or before/after scanning. The scanner carriage unit moves to read the white sheet before every scan mode to adjust white level.

4. LASER EXPOSURE

4.1 OVERVIEW



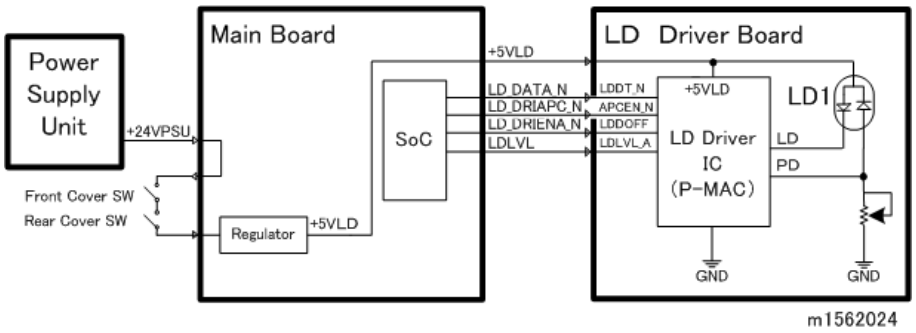
1.	LD unit	7.	Drum
2.	Aperture	8.	FTL lens
3.	Cylindrical lens	9.	Shield glass
4.	Shield glass	10.	Mirror
5.	Thermistor (Laser Unit)	11.	Laser synchronization detector lens
6.	Polygon mirror motor	12.	Synchronization detector

4.2 MECHANISM

4.2.1 SYNCHRONIZATION DETECTOR

The mirror reflects the beam from the LD unit to the synchronization detector.

4.2.2 AUTOMATIC POWER CONTROL (APC)

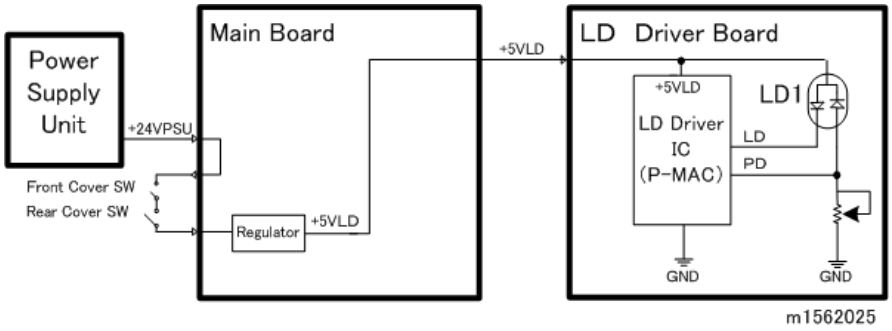


The LD driver on the LD drive board automatically controls power for the laser diodes. The laser diode power is adjusted at the factory.

Note

Never touch variable resistors on the LD unit in the field.

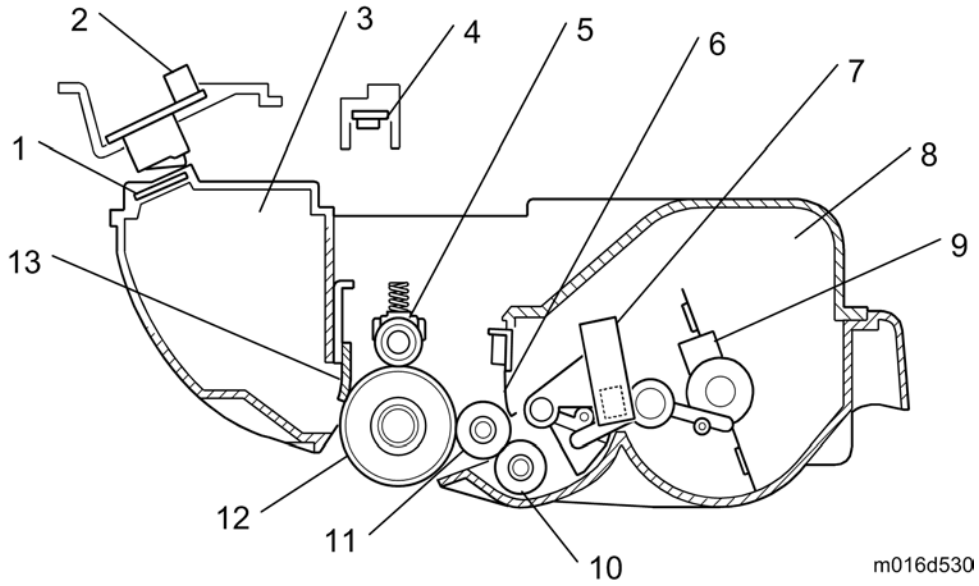
4.2.3 LD SAFETY MECHANISMS



- Laser Safety Switch
  There are safety switches on the front and rear covers. These switches stop the laser while the cover is open. If the user opens one of these covers, the +5VLD power to the laser diodes is stopped.

5. PRINT CARTRIDGE (AIO)

5.1 OVERVIEW

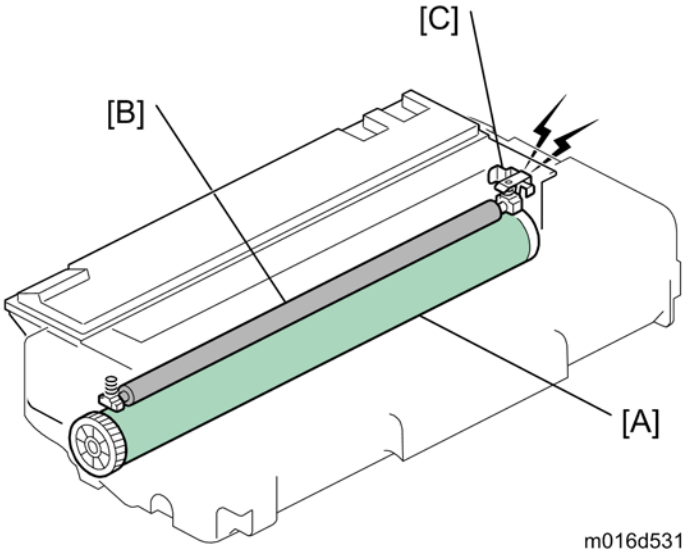


1.	ID Chip	8.	Toner tank
2.	ID chip PCB	9.	Agitator
3.	Waste toner tank	10.	Toner supply roller
4.	Quenching lamp	11.	Development roller
5.	Charge roller	12.	Drum
6.	Scraper	13.	Cleaning blade
7.	Toner end sensor		

This type of cartridge is known as an “All-in One” (AIO) cartridge.

5.2 MECHANISM

5.2.1 DRUM CHARGE



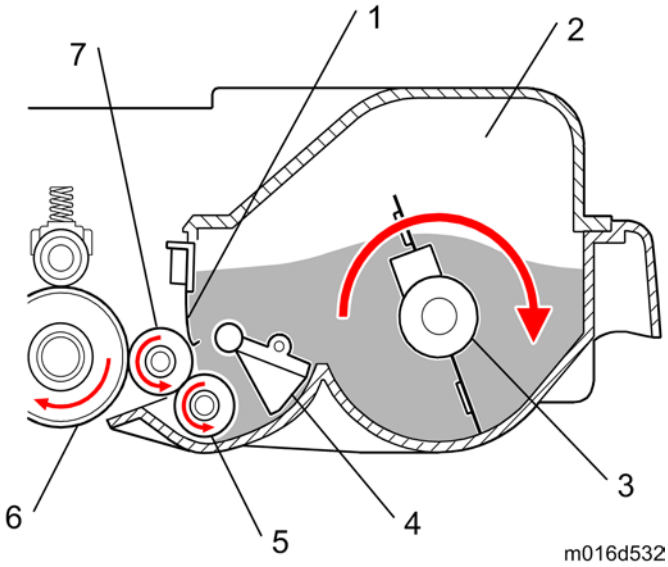
[A] Drum
[B] Charge roller
[C] Bias plate

The charge roller [B] gives the drum surface [A] a negative charge of approximately –550V.

High-voltage from power pack (HVP) flow bias plate [C].

5.2.2 DEVELOPMENT

◆ **Toner Supply and Development**



1.	Scraper	5.	Toner supply motor
2.	Toner tank	6.	Drum
3.	Agitator	7.	Development roller
4.	Toner detection feeler		

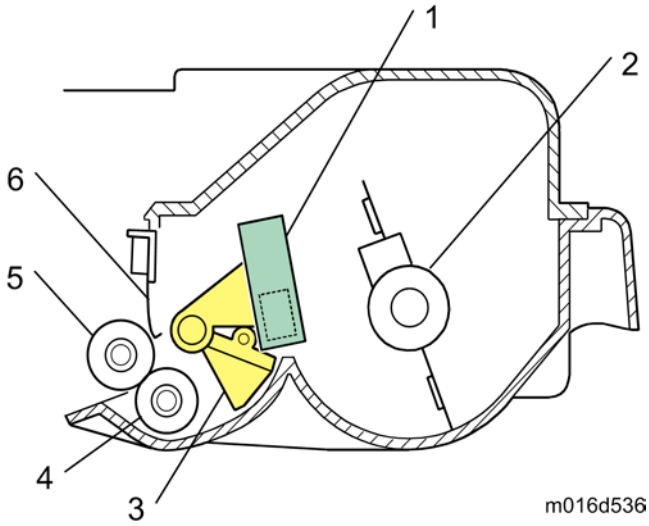
Toner Supply:
The agitator [3] mixes toner and sends it to the toner supply motor [4] and development roller [6].

Toner End:
The toner detection feeler [4] detects toner end. The toner end sensor is on the outside of the development unit.

Development Unit:
This machine uses a one-roller development system. The high voltage supply applies approximately -300V to the development roller.

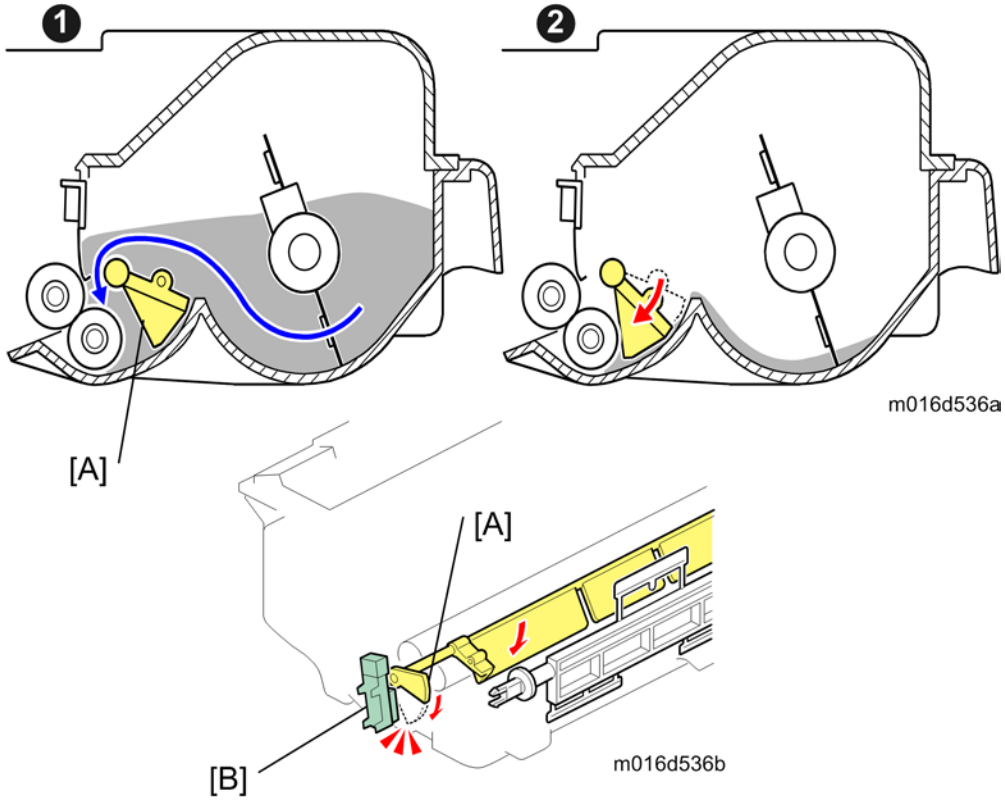
This machine does not use a TD sensor or ID sensor to control toner density. The scraper [1] controls the toner density.

5.2.3 TONER END DETECTION



1.	Toner end sensor	4.	Toner supply motor
2.	Agitator	5.	Development roller
3.	Toner detection feeler	6.	Scraper

◆ **Toner end sensor**



The agitator mixes toner and sends it to the toner supply motor and development roller as shown above [1]. The toner detection feeler comes down when the toner tank is out of toner as shown [2], and then the toner end sensor [B] detects toner end. The toner end sensor detects toner end by the voltage output. When the output from the toner end sensor is below a given level, the machine displays “Replace Required Soon: Print Cartridge”.
After the additional pages have printed, printing stops and then the “Replacement Required: Print Cartridge” message remains on the display.

◆ Main Motor Rotation Count

The time to replace the AIO cartridge can also be determined by the length of time the main motor has been rotating.
When toner end is detected, “Replacement Required: Print Cartridge” is displayed alternately with ‘Ready’.

◆ Toner Overflow Prevention

With the main motor rotation count feature, the machine can be set to stop printing after the print total exceeds a certain set value. If the print count exceeds this value, then “Replacement Required: Print Cartridge” remains in the display. Then a new AIO cartridge must be installed.
This feature is a safety measure to prevent the used toner tank from becoming full (there is no toner overflow detection mechanism).

Why do we need this feature?

- Normally, the AIO is replaced by the user. But some users will refill the old AIO with toner, and use the same AIO again. If this occurs, the used toner tank will not be emptied. So there must be a way to stop users from repeatedly filling the old AIO with fresh toner.

How does the machine know if the AIO is a new one?

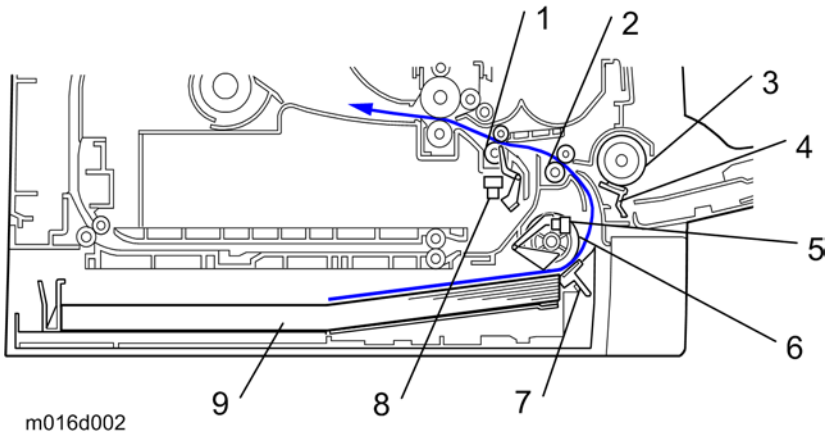
- The AIO has serial number information on a chip. The machine checks this number when the AIO is placed in the machine.

Why is this feature disabled?

- Ricoh does not support the practice of refilling old AIOs with fresh toner, so the feature is disabled by default. But if field service stations know that this practice occurs in their region, or they know a customer who is doing this, then they can enable the feature.

6. PAPER FEED

6.1 OVERVIEW



1.	Registration Roller	6.	Friction pad
2.	Relay Roller	7.	Feed roller
3.	By-pass feed roller	8.	Registration sensor
4.	By-pass friction pad	9.	Paper tray
5.	Paper end sensor		

- The friction pad can not be adjusted.
- The machine makes paper buckle at the registration roller to correct paper skew.
- The paper buckle can be adjusted with SP Mode.

6.1.1 PAPER TRAY

Paper Feed System:	Feed roller and friction pad
Paper Lift Mechanism:	Spring
Paper End Detection:	Paper end sensor
Tray Capacity:	250 sheets
Tray Extension:	Available

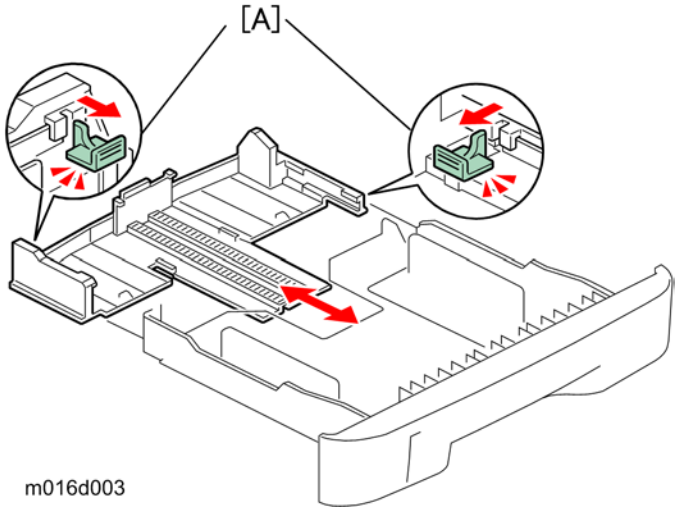
6.1.2 BY-PASS TRAY

Paper Feed System:	Feed roller and friction pad
Paper Lift Mechanism:	Spring
Paper Detection:	By-pass tray paper sensor
Paper Size Detection:	None
Tray Capacity:	50 sheets

6.2 MECHANISM

6.2.1 PAPER TRAY

◆ Tray Extension



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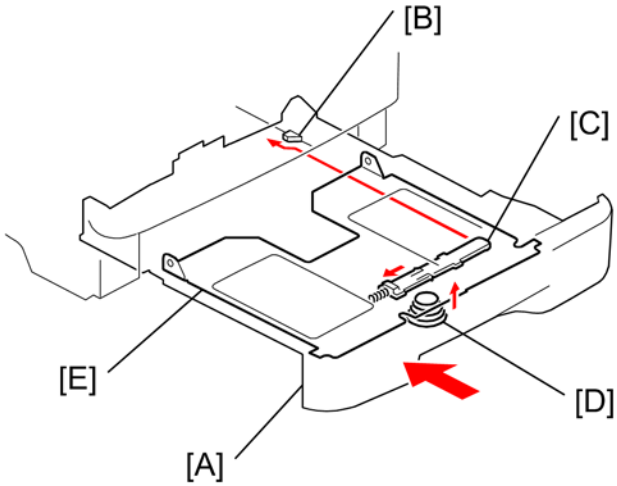
The user can extend the tray manually to hold paper longer than A4/Letter size.
To use longer paper:

- Release the two locks [A]
- Extend the tray and close the locks.

◆ Paper Lift



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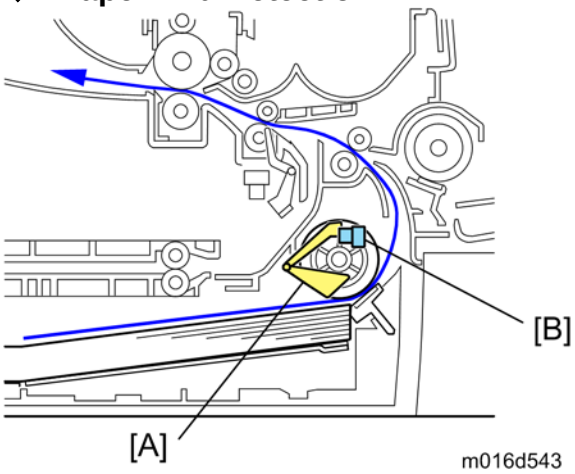
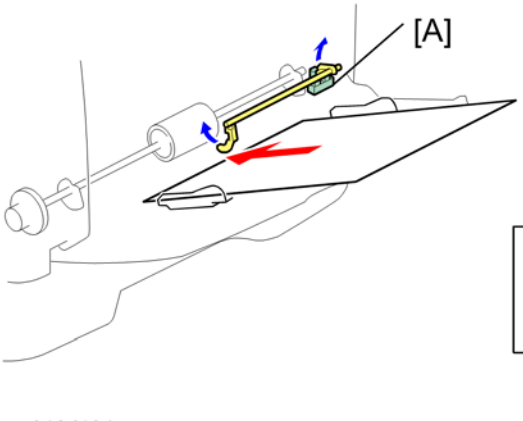
When the paper tray [A] is inserted into the machine, a projection [B] on the copier frame pushes the latch release arm [C] (on the bottom part of the paper tray), enabling the compressed spring [D] to lift the bottom plate [E].

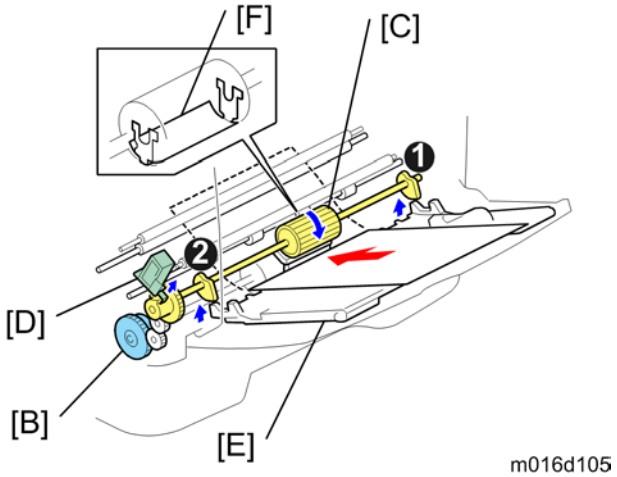
◆ **Paper End Detection**

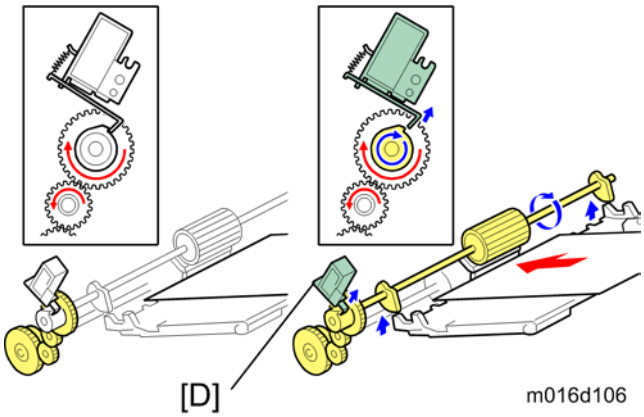


When there is no paper in the tray, the feeler [A] falls into the cutout in the bottom plate, and the paper end sensor [B] comes on.

6.2.2 BY-PASS TRAY







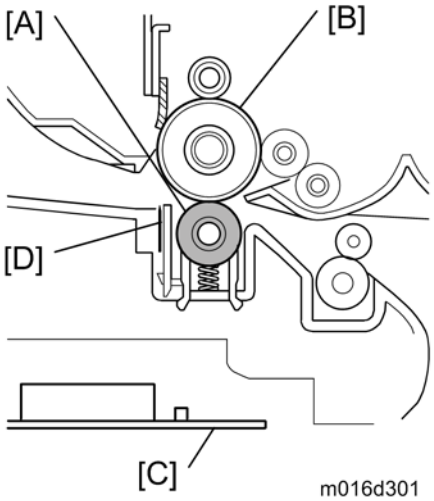
The by-pass paper sensor [A] detects when paper is placed on the tray. Driving power for the paper feed roller is provided from the main motor, via the paper feed clutch [B]. The feed process begins when the release solenoid [D] releases a latch, enabling the by-pass feed roller [C] to turn (powered by main motor rotation delivered via the paper feed clutch [B]). Simultaneously, two cams (#1 & #2) on the by-pass feed roller shaft, lift the by-pass tray [E], pushing the paper up against the by-pass feed roller [C].

The by-pass paper feed roller stops after each rotation due to the on/off movement of the solenoid [D] (when off, spring pressure pulls the latch back down so it catches on a cog). In addition to the two cams allowing the by-pass tray [E] to lower slightly after feeding, a curved metal plate [F] (attached to one side of the by-pass paper feed roller) allows paper to slide past the roller upon completion of each single rotation of the roller while the paper is still feeding

This cycle repeats itself for each sheet of paper.

7. IMAGE TRANSFER

7.1 OVERVIEW



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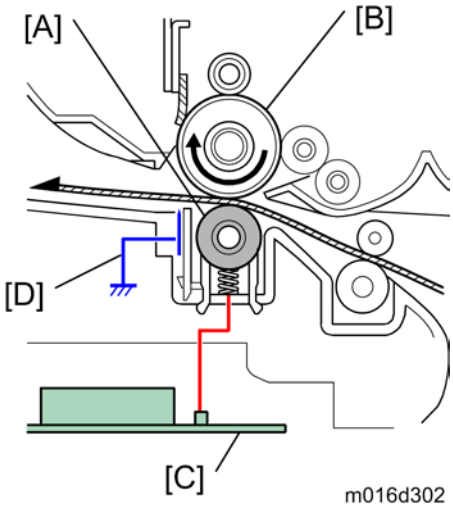


m016d302

The transfer roller [A] is pressed against the OPC drum [B]. The HVP [C] supplies a positive current to the transfer roller, attracting the toner from the drum onto the paper. The current is set in accordance with the paper's type, size, and feed tray.
Separation of the paper from the drum is aided by the drum's own curvature and by a high AC voltage applied to the discharge plate [D].

7.2 IMAGE TRANSFER BELT CLEANING MECHANISM

7.2.1 IMAGE TRANSFER CURRENT TIMING

There are two transfer current levels: low and high.

8. Low level: Before image transfer starts, the HVP supplies +10μA to the transfer roller. This prevents the transfer roller from attracting any positively charged toner on the drum surface.
9. High level: During image transfer, the HVP supplies a high level current to the transfer roller. This enables the transfer roller to attract toner onto the paper.

When the trailing edge of the paper has passed the transfer roller, the HVP stops supplying the transfer current. If the copier is printing more pages, the HVP supplies the low level current.

You can adjust these levels with “Trans. Roller Bias” in the Engine Maintenance Mode.

When increasing a transfer current level, use caution:

- Increasing a transfer current level may produce ghost images–some part of image near the leading edge reappears in other part of the page.
- Increasing a transfer current level might damage the OPC drum.

7.2.2 TRANSFER ROLLER CLEANING

Toner may transfer to the roller surface following a paper jam or if the paper is smaller than the image. Periodic cleaning of the roller is required to prevent this toner from migrating back to the rear of new printouts.

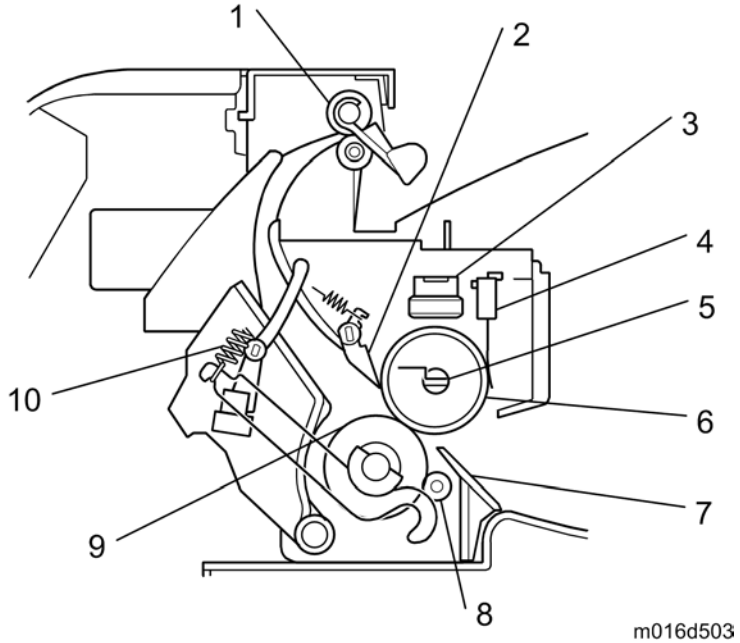
The machine cleans the roller at the following times:

- After initial power on.
- After clearing of a copy jam
- At the end of a job, if at least 10 sheet have been printed since the last cleaning

The HVP first supplies a negative cleaning current (about -4 μA) to the transfer roller, causing negatively charged toner on the roller to move back to the drum. It then applies a positive cleaning current (+5 μA) to the roller, causing any positively charged toner to migrate back to the drum.

8. FUSING AND EXIT

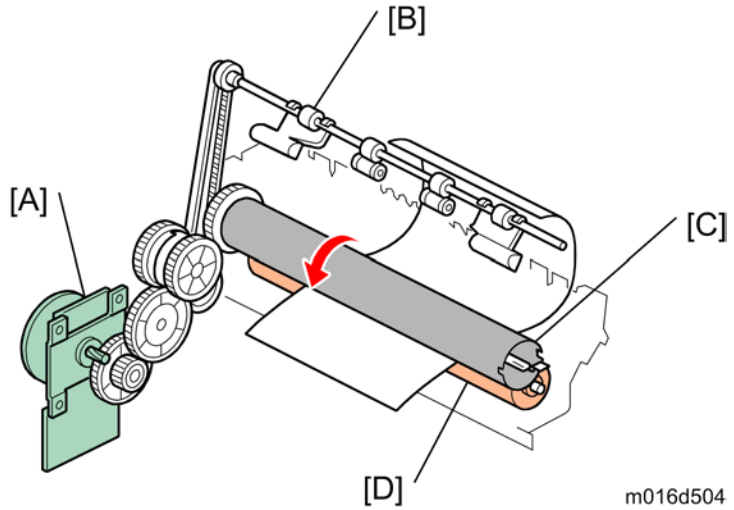
8.1 OVERVIEW



1.	Paper exit roller	6.	Hot roller
2.	Hot roller stripper pawls	7.	Paper entrance guide
3.	Thermostat	8.	Cleaning roller
4.	Thermistor	9.	Pressure roller
5.	Fusing lamp	10.	Pressure spring

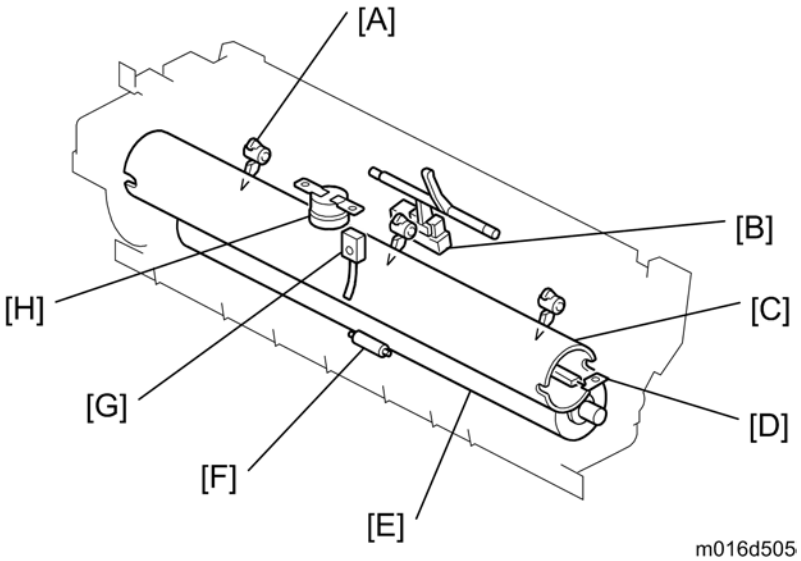
8.2 MECHANISM

8.2.1 FUSING DRIVE



[A]: Main motor
[B]: Paper exit roller
[C]: Hot roller
[D]: Pressure roller
The main motor [A] drives the fusing unit through a gear train.

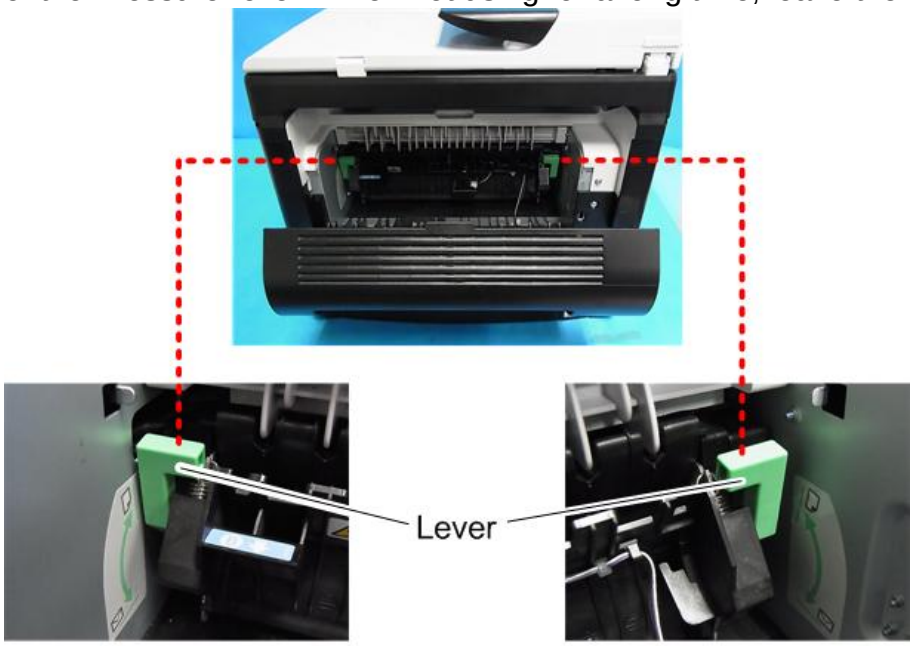
8.2.2 PARTS LAYOUT OF THE FUSING UNIT



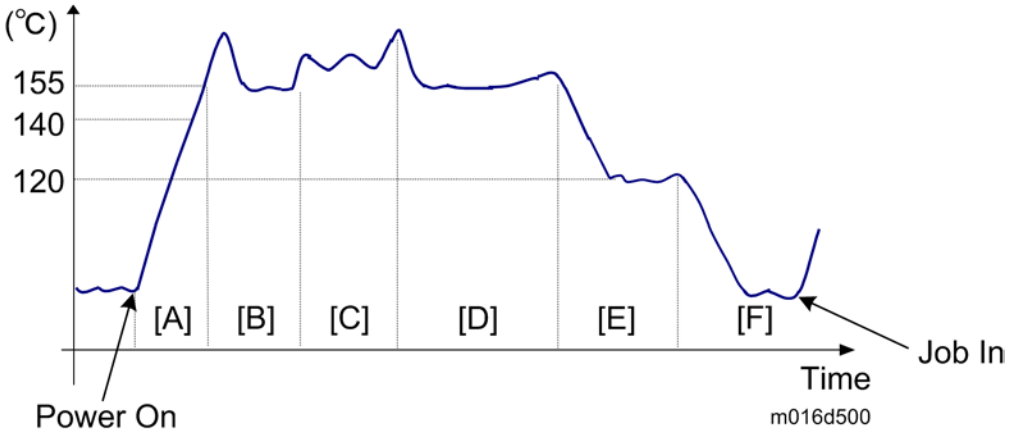
[A]: Hot roller stripper pawls
[B]: Paper exit sensor
[C]: Hot roller
[D]: Fusing lamp
[E]: Pressure roller
[F]: Cleaning roller
[G]: Thermistor
[H]: Thermostat

8.2.3 ENVELOPE LEVER

Envelope Levers are provided on the right and left side of a Fusing Unit. As the lever is pulled down, the fusing pressure decreases (approx. 55% of the usual), and wrinkles on the envelope are controlled. Since no sensor to detect the lever position is provided, make sure to pull up the lever after printing on an envelope.
At the time of shipment, the lever is lowered (Envelope mode) to prevent deformation of the Pressure roller. When not using for a long time, leave the lever down.



8.2.4 FUSING TEMPERATURE CONTROL



- Machine Condition
  [A]: Warm up mode
  [B]: Standby mode
  [C]: Print mode
  [D]: Standby mode
  [E]: Energy saver mode1
  [F]: Energy saver mode2

When the main switch turns on, the CPU turns on the fusing lamp using the soft start process. (The soft start process prevents the room lights from flickering.) The lamp stays on until the thermistor detects the standby temperature. Then the CPU maintains this temperature using on-off control. To start printing, the CPU raises the temperature to the printing temperature.
The fusing temperature for each condition is as follows:

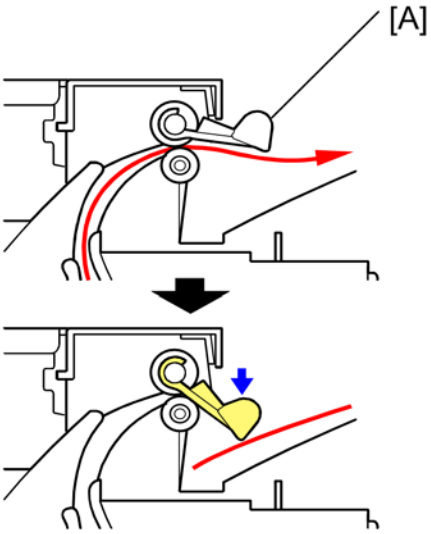
Condition	Temperature (^{o}C)
Standby	155
Energy saver mode1 (Low power)	120
Energy saver mode2	Ambient temperature
Plain paper	175
Thick1 paper	185
Thick2 paper	185
Thin paper	150
Envelope	200
Postcard	185
Recycled	160

The fusing temperature for each condition (except the “Energy saver mode2”) can be adjusted with “Fusing Unit Temperature” in the “Engine Maintenance Mode”.

8.2.5 OVERHEAT PROTECTION

If the hot roller temperature becomes greater than 235 °C, the CPU cuts off the power to the fusing lamp. At this time, SC543 will be generated.
If the thermistor overheat protection fails, there is a thermostat in series with the common ground line of the fusing lamp. If the temperature of the thermostat becomes greater than 210 °C, the thermostat opens, removing power from the fusing lamp. At this time, the machine stops operation.

8.2.6 PAPER EXIT



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The paper exit guide-plate holds down the trailing edge of each sheet of paper after it exits in order to prevent it from obstructing following sheets of paper as they exit.

8.2.7 ENERGY SAVER MODE

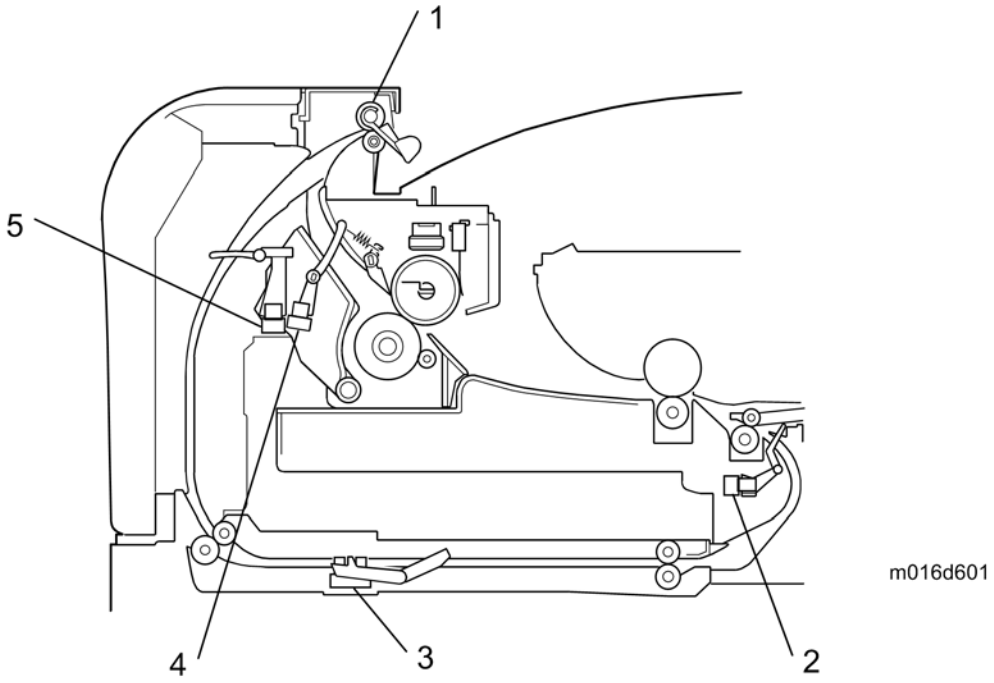
This machine is equipped with the following Energy Saver modes:

- Energy Saver mode 1:
  The machine enters Energy Saver mode 1 if the machine has been idle for about 30 seconds.
- Energy Saver mode 2:
  The machine enters Energy Saver mode 2 after a specified period of time has passed.

If the machine has been idle for a certain period of time, the machine automatically enters Energy Saver mode. Power consumption is lower in Energy Saver mode 2 than in Energy Saver mode 1, but it takes longer to recover from Energy Saver mode 2 than from Energy Saver mode 1.

9. DUPLEX

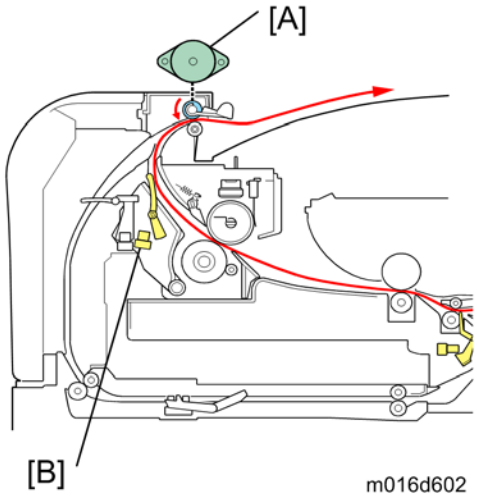
9.1 OVERVIEW

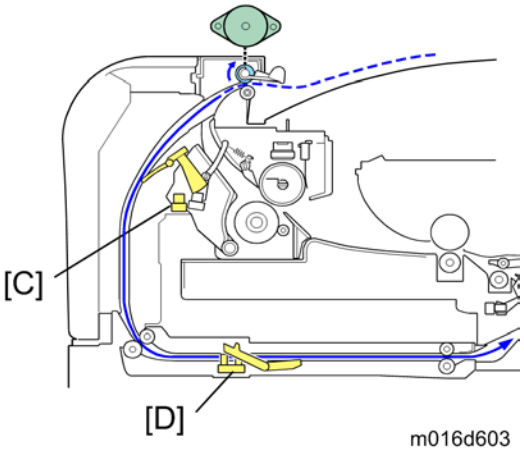


1.	Paper exit roller	4.	Paper exit sensor
2.	Registration sensor	5.	Relay sensor
3.	Inverter sensor		

9.2 MECHANISM

9.2.1 DUPLEX PRINTING PROCESS





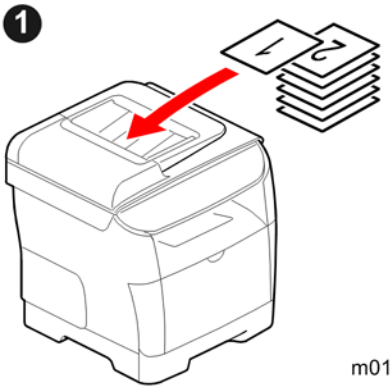
An independent drive motor in the duplex machine handles paper ejection and reversing. Paper from the registration roller is sent to the paper exit roller. The paper exit roller reverses its rotation after the trailing edge of the paper has passed the paper exit sensor (but the paper has not fully exited into the output tray), and then sends the paper into the duplex paper path. When the trailing edge of the paper passes the relay sensor, the paper exit roller again reverses rotation (reverting to its original direction), and ejects the paper into the output tray.

The relay and inverter sensors are also used to detect paper jams.

9.2.2 PRINTING ORDER

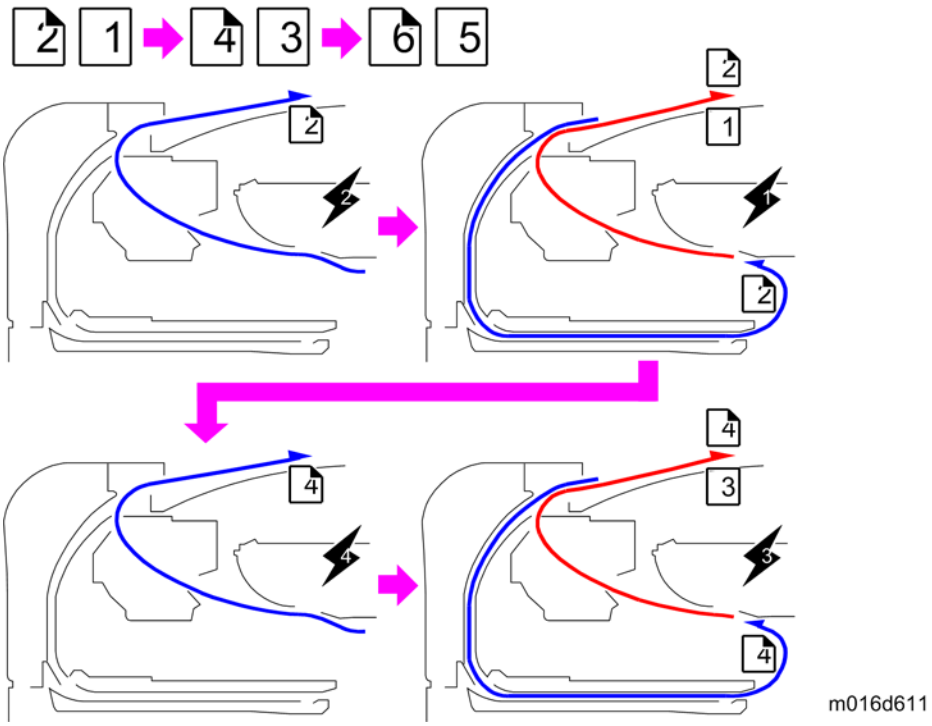
The number [1] shows the page order for a print job. The number [2] shows the printing order.

1



m016d610

2



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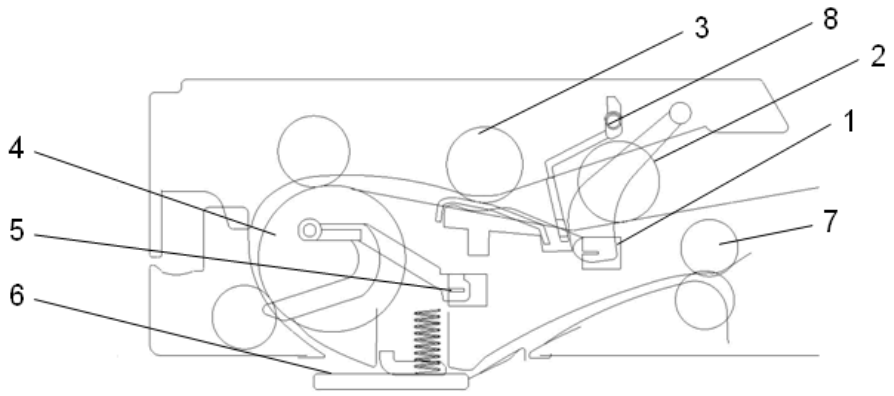
10. ADF

10.1 OVERVIEW



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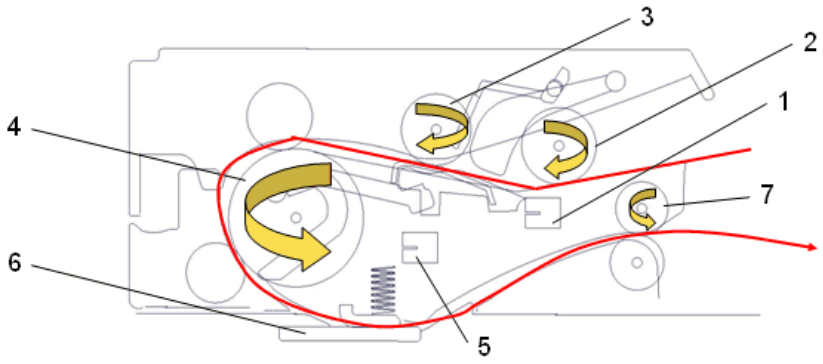
1. Document Sensor	5. Feed Sensor
2. Pick Roller	6. DF Exposure Glass
3. Separation Roller	7. Output Roller
4. Feed Roller	8. Media Stopper

10.2 PAPER PATH



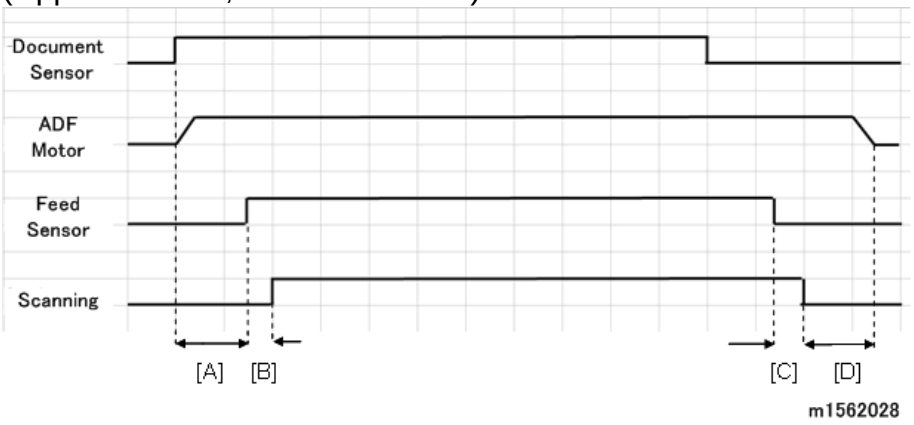
m1562027

When document sensor [1] detects original and machine has copying or scanning job, ADF motor rotates to drive pick roller [2], separation roller [3] and feed roller [4] to feed original sheet to feed sensor [5]. If feed sensor [5] does not detect paper after this sequence, machine determines original jam has occurred. If feed sensor [5] detects paper, then scanning starts by CIS through DF exposure glass [6]. After scanning, the output roller [7] will eject paper and finish the job.

10.3 TIMING CHART

10.3.1 SINGLE PAGE

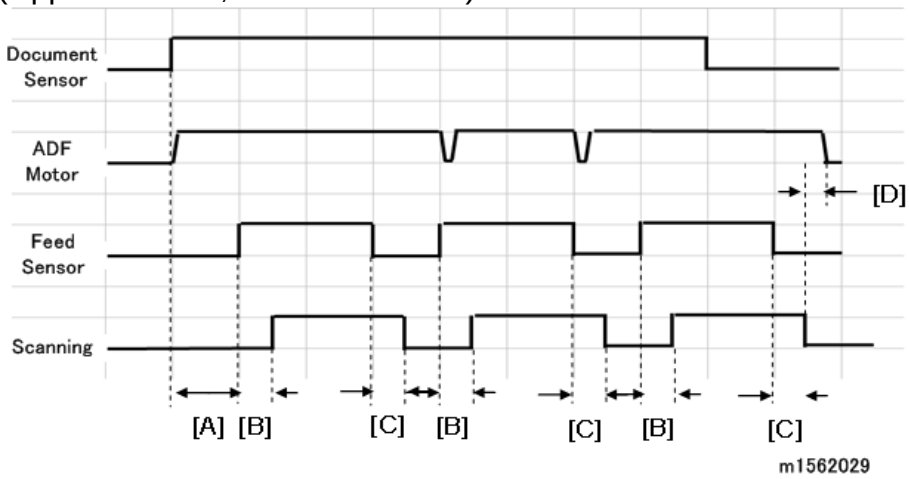
(Upper line: ON, Lower line: OFF)



- [A]: Check for Feed-in jam
- [B]: Number of pulses for motor start to Start Scanning
- [C]: Number of pulses for Feed Sensor off to Stop Scanning
- [D]: Number of pulses for Paper feed out

10.3.2 MULTI PAGE

(Upper line: ON, Lower line: OFF)



- [A]: Check for Feed-in jam
- [B]: Number of pulses for motor start to Start Scanning
- [C]: Number of pulses for Feed Sensor off to Stop Scanning
- [D]: Number of pulses for last Paper feed out