SII
Seiko Instruments Inc.

LTPA245 SERIES
LINE THERMAL PRINTER MECHANISM
TECHNICAL REFERENCE

U00060425801

LTPA245 SERIES TECHNICAL REFERENCE

Document Number U00060425801

First Edition June 2001
Second Edition July 2003

PREFACE

This reference manual describes the specifications and basic operating procedures for the LTPA245 Series Line Thermal Printer Mechanisms (hereinafter referred to as “LTPA245” or “printer”).

The LTPA245 consists of the following four printer models, which differ by the shape of the lever for removing/installing the platen block, the shape of FPC (Flexible Printed Circuit) and so on:

- LTPA245A
- LTPA245B
- LTPA245C
- LTPA245D

This technical reference, unless otherwise specified, provides information common to the LTPA245 series printers. Where the information differs depending on the printer model, the name of the relevant model is specified.

Chapter 1 “Precautions” describes safety, design and operational precautions. Read it thoroughly before designing in order to ensure proper use of the printer.

SII has not investigated the intellectual property rights related to the sample circuits included in this technical reference. Fully investigate the intellectual property rights related to these circuits before use. Moreover, when designing any circuit based on the sample circuits described in this reference manual, use such circuit only after careful verification.

CHAPTER 1

PRECAUTIONS

Read through this manual to design and operate the printer properly.
Pay special attention to the precautions noted in each section.

1.1 SAFETY PRECAUTIONS

Follow these precautions when designing a product using the printer, and include any necessary precautions and warning labels to ensure the safe operation of your product by users.

- **Preventing the thermal head from overheating**
  When electricity is continuously supplied to the thermal head heat element by a CPU or other malfunction, the thermal head may overheat, causing smoke and fire.
  Follow the method described in **Section 3.6.10** to monitor the temperature of the thermal head to prevent overheating.
  Turn the printer off immediately if any abnormal conditions occur.

- **Preventing the user from touching the thermal head**
  This printer has no platen position detector. Attach a detector to the outer case to monitor whether or not the platen block is properly secured. Also, design the product so that the thermal head is not driven when the platen block is open.
  Warn the user not to touch the thermal head or its periphery as they are very hot during and immediately after printing.
  Also, allow cooling by designing clearance between the head and the outer case.

- **Preventing the user from touching the motor**
  Design the outer case so that the user cannot touch the motor as the motor are very hot during and immediately after operating.
  Also, allow cooling by designing clearance between the motor and the outer case.
  Drive the motor within the continuous drive time and pause time described in **Section 3.4.3**.

- **Preventing the user from touching the rotary drive portion**
  This printer has no platen position detector. Attach a detector to the outer case to monitor whether or not the platen block is properly set. Also, design the product so that the motor does not operate when the platen block is open, to prevent the user from getting caught in the motor because the drive gear is exposed.

- **Preventing the user from touching the sharp edges of the printer**
  Design the product so that during handling the user cannot touch the edges of the printer, particularly the cut surfaces of metal parts because of the risk of injury. Implement a design that prevents such contact, or provide ample warnings.

1.2 DESIGN AND HANDLING PRECAUTIONS

To maintain the initial level of performance of the printer and to prevent future problems from occurring, observe the following precautions.

1.2.1 Design Precautions

- This technical reference provides the LTPA245 specifications and basic drive method. The specifications are assured under the recommended drive circuit, drive method, and installation. If damage occurs by using any method other than the described herein, we are not responsible for such damage.

- This technical reference, unless otherwise specified, provides information common to the LTPA245 series printers. Where the information differs depending on the printer model, the name of the relevant model is specified.

- If too much energy is applied to the thermal head, it may overheat and become damaged. Always use the printer with the specified amount of energy.

- Use C-MOS IC chips (74HC240 or equivalent) for interfacing the CLK, LATCH, DAT and DST signals of the thermal head.

- When turning the power on or off, always DISABLE (put in “Low” state) the DST terminals.

- To prevent the thermal head from being damaged by static electricity:

  - Fix the FG plate as shown in **Figure 6-2** to the Frame Ground (FG). For details on how to mount an FG cable, see **Section 6.1.2**. The FG cable and FG cable lock screw should be prepared in advance.
  - Connect the GND terminal (SG) to FG through 1 MΩ resistor so that the electric potential of the SG of the thermal head and the FG of the printer are equal.

- Keep the Vp power off when not printing to prevent the thermal head from becoming electrically corroded. In addition, design the printer so that the signal GND of the thermal head and the frame GND of the printer mechanism become the same electric potential.

- Wire resistance should be 50 mΩ or less (however the less the better) between the power supply and the Vp, and the GND terminals on the thermal head controller.

- The surge voltage between Vp and GND should not exceed 10 V.

- As a noise countermeasure, connect the capacitor noted below between the Vdd and GND terminals near the thermal head control connector.

Vp ↔ GND:	10μF	Aluminum electrolytic capacitor
Vdd ↔ GND:	0.1μF	Laminated ceramic capacitor

- When turning the power on or off, perform the Vp and Vdd simultaneously or in the order of 1) and 2) as follows:

At power ON:	1) Vdd	→	2) Vp
At power OFF:	1) Vp	→	2) Vdd

- Always monitor the output of the paper detector. Incorrect activation of the thermal head may damage and reduce the longevity of the thermal head and the platen.
  Since a reflection type photo interrupter is used in the paper detector, the detector may be affected by light from outside. Design the outer case so that the paper detector is not affected by light from outside.
- Allow for movement of the FPC when designing the outer case because the FPC connected will shift 1 to 2 mm from the thermal head moving. Also, design the outer case so that it prevents the paper feed out from being caught in the platen.

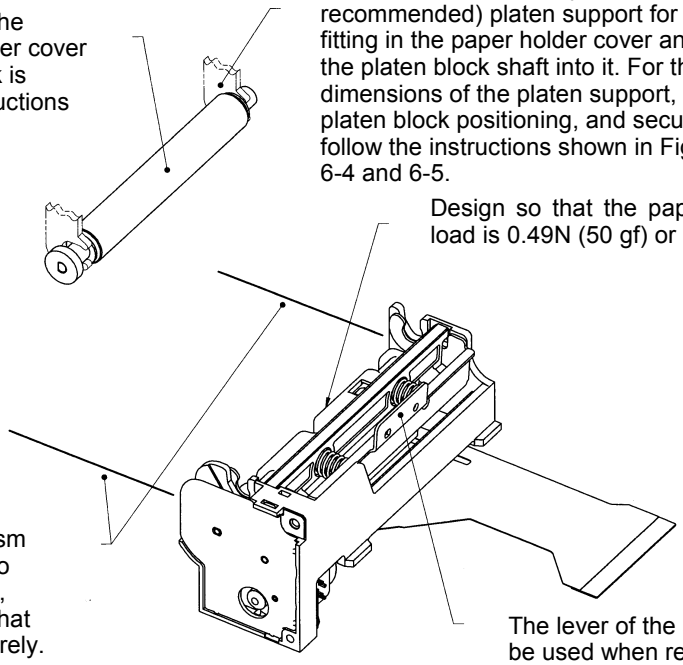
- Since this printer does not have a platen position detector, mount a detector to the outer case to monitor whether or not the platen is properly set. When the platen is not properly set, the printer cannot feed paper and print normally. Incorrect setting of the thermal head may reduce the longevity of the thermal head.

- <u>When using the LTPA245A:</u>
  The printer has no platen block support function. For the platen block support, prepare the plastic (poly-carbonate is recommended) platen support for snap fitting in the paper holder cover and fit the platen block shaft into it. For the dimensions of the platen support, the platen block positioning, and securing, follow the instructions shown in **Figures 6-4** and **6-5**. Metal or aluminum platen support cannot fit the platen block shaft.

- <u>When using the LTPA245A:</u>
  When removing the platen block, follow the instructions shown in **Figure 7-4** and continue to press the lock arm lever until the A portion of the lock arm (see **Figure 7-4**) comes up against the head block. If the lock arm lever is not pressed until the end, it may not be possible to remove the platen block. Design the outer case so that such lock arm lever operation can be performed.

Platen support:
Prepare the plastic (poly-carbonate is recommended) platen support for snap fitting in the paper holder cover and fit the platen block shaft into it. For the dimensions of the platen support, the platen block positioning, and securing, follow the instructions shown in Figures 6-4 and 6-5.

Regarding the center of the rotation of the paper holder cover on which the platen block is mounted, follow the instructions shown in Figure 7-1.

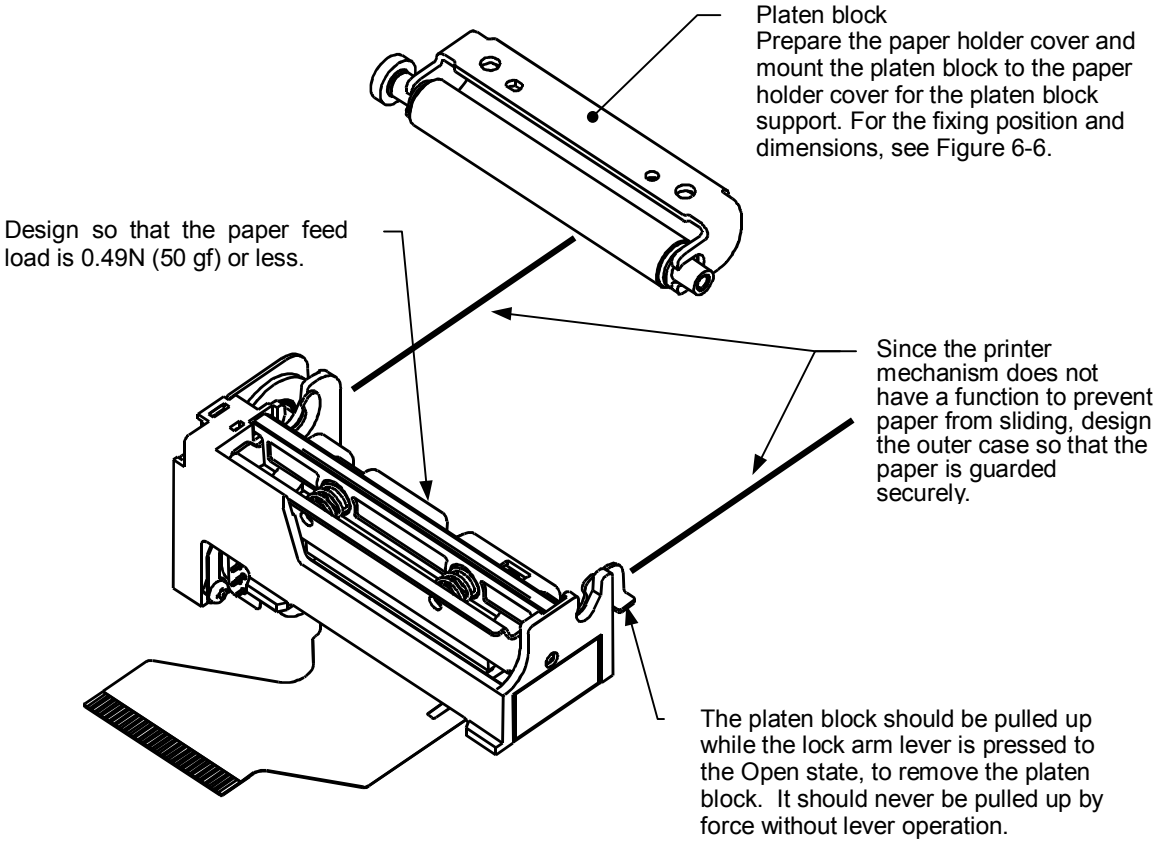


Design so that the paper feed load is 0.49N (50 gf) or less.

Since the printer mechanism does not have a function to prevent paper from sliding, design the outer case so that the paper is guarded securely.

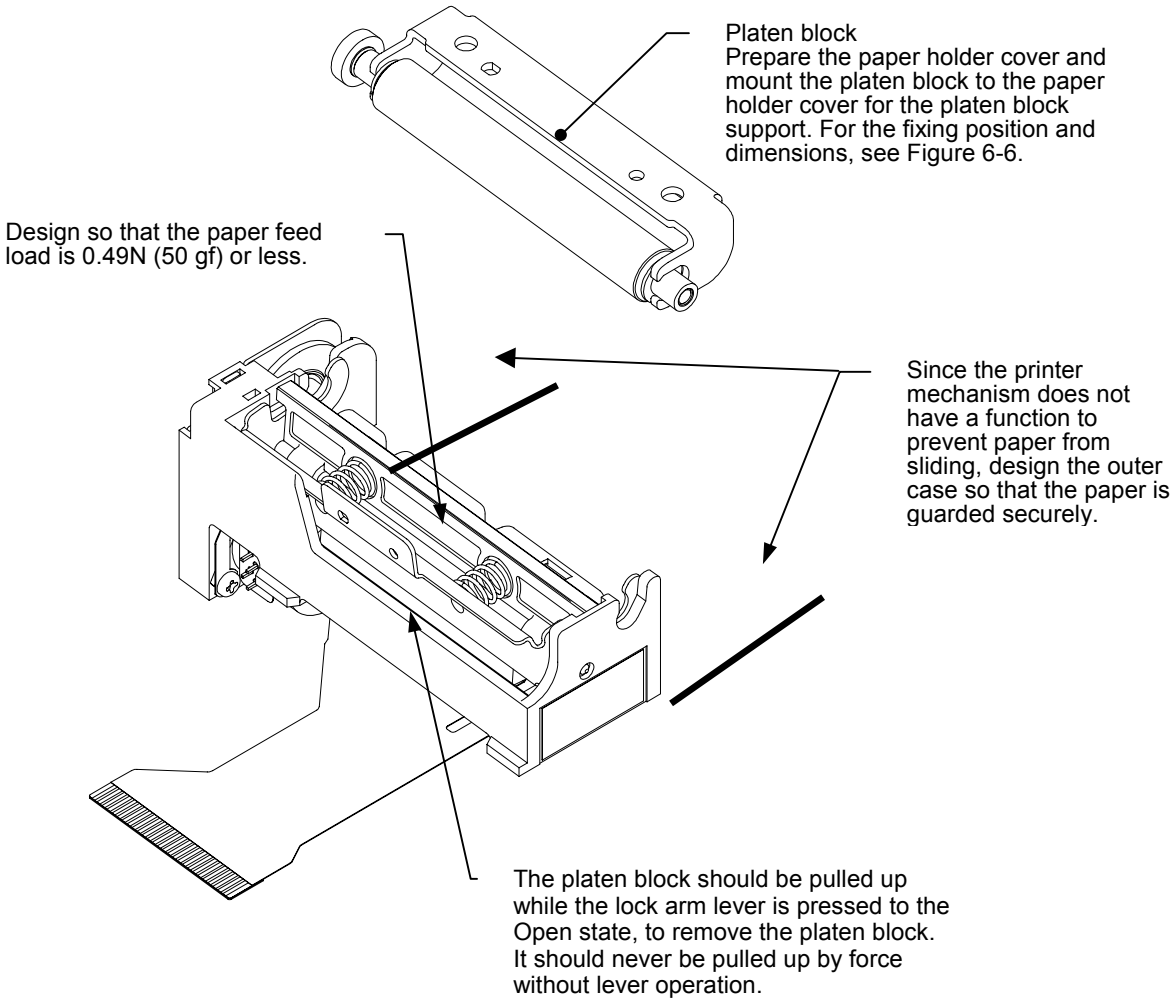
The lever of the lock arm should be used when removing the platen block. It should never be pulled up by force.

- When using the LTPA245B and LTPA245C:
  The printer does not have a platen block support function. Prepare the paper holder cover and fix the platen block to the cover. For the dimensions for mounting the platen block, see **Figure 6-6**.



- When using the LTPA245D:
  The printer does not have a platen block support function. Prepare the paper holder cover and fix the platen block to the cover. For the dimensions for mounting the platen block, see **Figure 6-6**.

  When removing the platen block, follow the instructions shown in **Figure 7-4** and continue to press the lock arm lever until the A portion of the lock arm (see **Figure 7-4**) comes up against the head block. If the lock arm lever is not pressed until the end, it may not be possible to remove the platen block. Design the outer case so that such lock arm lever operation can be performed.



1.2.2 Handling Precautions

To maintain the initial level of performance of the printer and to prevent future problems from occurring, observe the following precautions.
Also, include any necessary precautions to ensure the safe operation of your product by users.

- To protect the heat elements, ICs, etc. from static electricity, discharge all static electricity before handling the printer.
  Pay special attention to the thermal head control terminals when handling.

- Do not apply stress to the thermal head control terminals (FPC): Doing so may damage the FPC.

- Using anything other than the specified paper may cause the following:
  - Poor printing quality
  - Abrasion of the thermal head
  - The thermal surface of the paper and the thermal head may stick together
  - Excessive noise
  - Fading print
  - Corroded thermal head

- Always print or feed with the specified paper inserted to protect the platen, thermal head, and reduction gear. Also, incorrect paper feed puts a load on the reduction gear and may shorten the longevity of the gear.

- Do not hit or scratch the surface of the thermal head with sharp or hard objects as it may damage the heat element.

- If the thermal head remains in contact with the platen, the platen may become deformed and deteriorate print quality.
  If the platen is deformed, the uneven surface of the platen can be recovered by feeding paper for a while.

- Never connect or disconnect cables with the power on. Always power off the printer first.

- When printing a black or checkered pattern at a high print rate in a low temperature or high humidity environment, the vapor from the paper during printing may cause condensation to form on the printer or may soil the paper.
  If water condenses on the printer, keep the thermal head away from water drops as it may corrode the thermal head, and turn Vp off until it dries.

- Prevent contact with water and do not operate with wet hands as it may damage the printer or cause a short circuit or fire.

- Never use the printer in a dusty place, as it may damage the thermal head and paper feeder.

1.2.3 Precautions on Discarding

When discarding used printers, discard them according to disposal regulations and rules of each respective district.

CHAPTER 2

FEATURES

The LTPA245 Line Thermal Printer Mechanism is a compact, high-speed thermal line dot printing mechanism. It can be used with a measuring instrument and analyzer, a POS, a communication device, or a data terminal device. Since the printer can be battery driven, it can easily be mounted onto a portable device such as a hand-held terminal.

The LTPA245 has the following features:

- **Battery drive**
  Since the range of operating voltage of 4.5V to 8.5V is wide, four to six Ni-Cd batteries or Ni-MH batteries or two Lithium-ion batteries can also be used.

- **Compact and light weight** [1]
  The mechanism is compact and light: 69.2 mm in width, 28.3 mm in depth, 31.7 mm in height, and approximately 41 g (LTPA245A) and 43 g (LTPA245B, LTPA245C, and LTPA245D) in mass.

- **Improved operability**
  The platen roller can be released easily by lever operation allowing easy paper installation and head cleaning.

- **High resolution printing**
  A high-density print head of 8 dots/mm produces clear and precise printing.

- **Longevity**
  The mechanism is maintenance-free with a long life of 50 km print length and/or 100 million pulses.

- **High speed printing** [2]
  A maximum print speed of 427 dot lines per second (53.4 mm per second) at 5 V, 616 dot lines per second (77 mm per second) at 7.2 V, and 720 dot lines per second (90 mm per second) at 8.5 V are attainable.

- **Low noise**
  Thermal line dot printing is used to guarantee low-noise printing.

- **Realizing easy design of outer case**
  The printer mechanism is designed to fit easily into the outer case, allowing for reduced number of outer case parts.

[1] The external dimensions exclude those of the lever of the lock arm and the platen block. 41 g in mass includes all parts.

[2] Print speed differs depending on working and environmental conditions.

CHAPTER 3

SPECIFICATIONS

3.1 GENERAL SPECIFICATIONS

Table 3-1 General Specifications

Item	Specification
Print method	Thermal dot line printing
Dots per line	384 dots
Resolution	8 dots/mm × 16 dots/mm (W × H)
Print width	48 mm
Maximum printing speed	427 dot lines/s (53.4 mm/s) (at 5 V) [1] 616 dot lines/s (77 mm/s) (at 7.2 V) [1] 720 dot lines/s (90 mm/s) (at 8.5 V) [1]
Paper feed pitch	0.0625 mm
Head temperature detection	Via thermistor
Out-of-paper detection	Via photo interrupter
Operating voltage range	
V_P line (for head and motor drive)	4.5 V to 8.5 V (equivalent to four through six Ni-Cd or Ni-MH batteries, or two lithium-ion batteries)
V_{dd} line (for head logic)	2.7 V to 5.25 V
Current consumption	
For driving the head (V_P)	Average: 1.48 A (at 5 V), 2.13 A (at 7.2 V), 2.51 A (at 8.5 V) [2] Maximum: 1.53 A (at 5 V), 2.20 A (at 7.2 V), 2.60 A (at 8.5 V) [2]
For driving the motor (V_P)	Maximum 0.60 A
For head logic (V_{dd})	Maximum 54 mA

[1] Maximum printing speed is attained with the following conditions:
- When the driving voltage is 5 V, the character size is a 24-dot font, the line spacing is 16 dots, the temperature of the head is 50°C or more, the number of simultaneously activated dots is 64 dots or less and the head division driving is not performed.
- When the driving voltage is 7.2 V, the temperature of the head is 10°C or more, the number of simultaneously activated dots is 64 dots or less and the head division driving is not performed.
- When the driving voltage is 8.5 V, the number of simultaneously activated dots is 64 dots or less and the head division driving is not performed.

[2] When the number of simultaneously activated dots in the head is specified as 64.

Table 3-1 General Specifications (Continued)

Item	Specification
Operating temperature range	0°C to 50°C [3] No condensation
Storage temperature range	-25°C to 70°C [3] No condensation
Longevity (at 25°C and rated energy) Activation pulse resistance Abrasion resistance	 100 million pulses or more (print ratio=12.5%) 50 km or more
Paper width	58^{+0}_{-1} mm
Paper feeding force	0.49N (50 gf) or more
Paper holding force	0.78N (80 gf) or more
Dimensions (width×depth×height)	69.2 × 28.3 × 31.7 mm (excluding lever of lock arm and platen block)
Mass	Approximately 41 g (LTPA245A), 43 g (LTPA245B, LTPA245C, and LTPA245D)
Recommended thermal paper [4]	TF50KS-E2D (59 μm paper) from Nippon Paper Industries Co.,Ltd.

[3] Outside this range, prining may blot or be light.

[4] The paper roll should be placed facing the thermal surface outward (See **Figure 6-6**). Also, do not use paper with edges that are pasted or have turnups at the start of the roll. If they need to be used unavoidably, replace with new paper roll as soon as possible before the entire roll is used up.

3.2 HEAT ELEMENT DIMENSIONS

The printer contains a thermal head with 384 heat elements (dot-size).

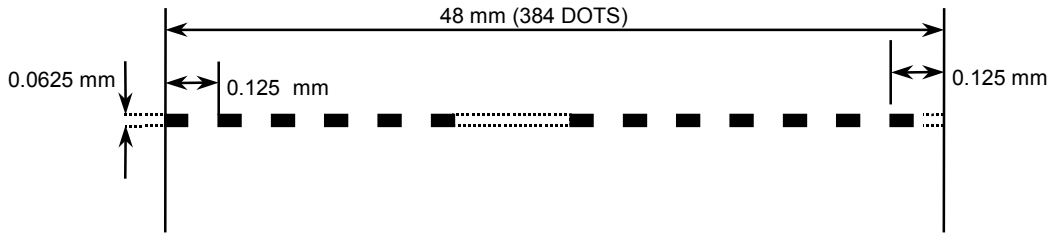


Figure 3-1 Heat Element Dimensions

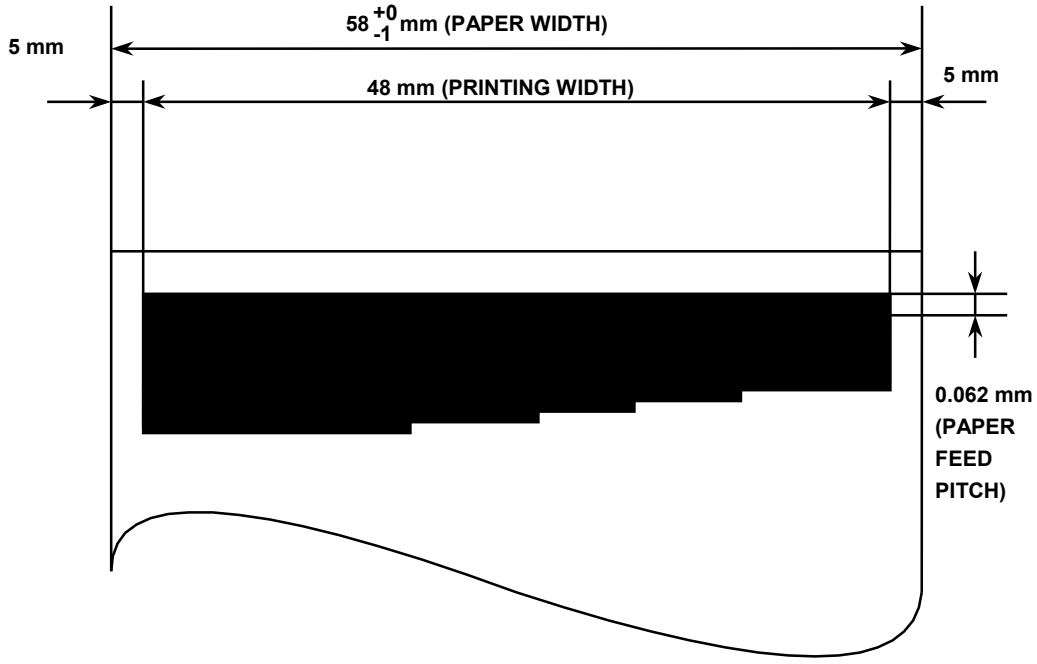


Figure 3-2 Print Area

3.3 PAPER FEED CHARACTERISTICS

- Paper is fed in a forward direction when the motor shaft is rotating in the normal direction (anticlockwise) when seen from the motor gear side.

- The motor is driven by a 2-2 phase excitation, constant current chopper method and feeds paper 0.0625 mm (equivalent to 0.5 dot pitch) every one step of the motor drive signal.

- To prevent deterioration in printing quality due to backlash of the paper feed system, the motor should be rotated 20 steps anticlockwise (the backlash absorption step should be input) when seen from the motor gear side, after initialization, after opening or closing the platen block, or after cutting thermal paper with the autocutter or tear bar (hand cutter). Be sure to start printing after such operation.

- During paper feeding, the motor should be driven lower than the value obtained by equation (1) and (2).

  Equation (1):

  $Vp > 5.5$ V
  $Vp \times 160 + 80$ (pps)
  (Max. 1440 (pps))

  Equation (2):

  $Vp \leq 5.5$ V
  $Vp \times 210 - 195$ (pps)

- During printing, the motor drive frequency should be adjusted according to working conditions such as voltage, temperature, number of activated dots, etc. (For details, see **CHAPTER 5 DRIVE METHOD**.)

- Do not rotate the motor anticlockwise when seen from the motor gear side.

Table 3-2 Sample Motor Drive Frequency

Operating Voltage	Drive Frequency (Paper feed)	Motor Pulse Width	Feed Speed
4.5 V	750 pps	1333.3 µs	46.9 mm/s
5 V	855 pps	1169.6 µs	53.4 mm/s
6 V	1040 pps	961.5 µs	65 mm/s
7.2 V	1232 pps	811.7 µs	77 mm/s
8 V	1360 pps	735.3 µs	85 mm/s
8.5 V	1440 pps	694.4 µs	90 mm/s

3.4 STEP MOTOR CHARACTERISTICS

Table 3-3 General Specifications of the Motor

Item	Specification
Type	PM
Drive method	Bipolar chopper
Excitation	2-2 phase
Winding resistance per phase	14 Ω ±10%
Rated voltage	4.5 - 8.5 V
Rated current	0.30 A/phase
Maximum current consumption	0.60 A
Drive frequency	200 - 1440 pps (according to drive voltage)

3.4.1 Motor Drive Circuit

(1) Sample Drive Circuit

Sample drive circuit for the motor is shown in **Figure 3-3**.

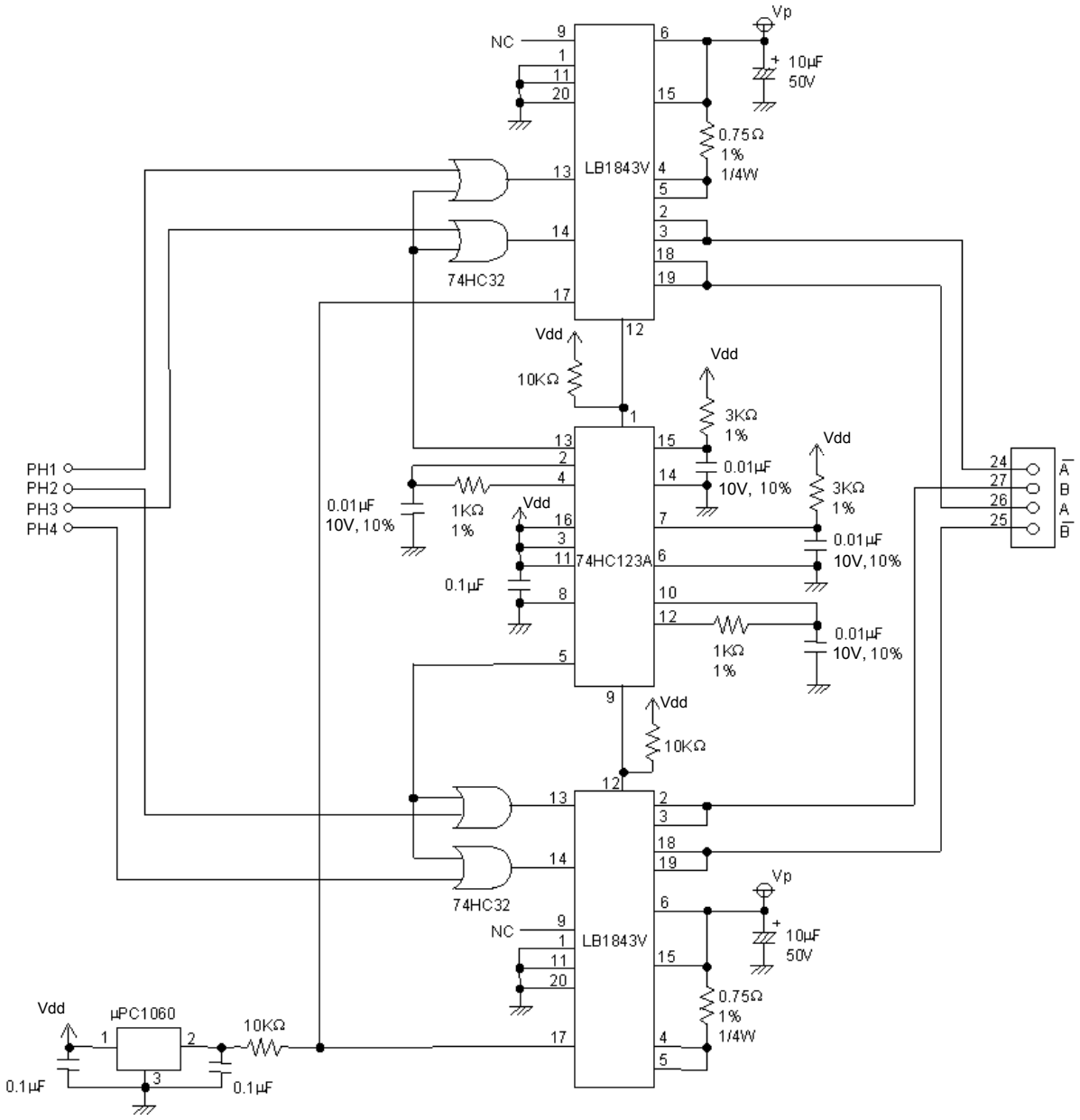


Figure 3-3 Sample Drive Circuit

(2) Excitation Sequence

As shown in **Table 3-4**, the printer feeds paper in the normal direction when the motor is excited in the order of step 1, step 2, step 3, step 4, step 1, step 2, ... Do not feed paper in the reverse direction.

Table 3-4 Excitation Sequence

Signal Name	Sequence			
	Step 1	Step 2	Step 3	Step 4
A	Low	High	High	Low
B	High	High	Low	Low
$\overline{A}$	High	Low	Low	High
$\overline{B}$	Low	Low	High	High

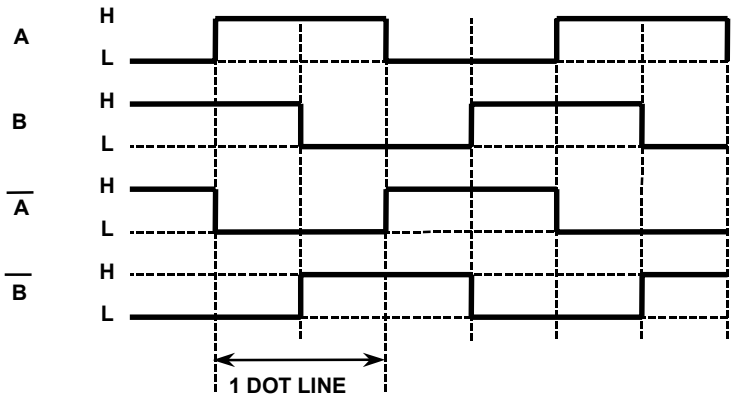


Figure 3-4 Input Voltage Signals for the Sample Drive Circuit

3.4.2 Motor Timing

Refer to the timing chart in **Figure 3-5** when designing the control circuit and/or software for starting and stopping the motor. Also take note of the following precautions:

Precautions for Designing the Motor Control Circuit and Software

(1) Stop step

- To stop the motor, excite for 5 ms with a phase that is the same as the final one in the printing step.

(2) Pause state

- In the pause state, do not excite the step motor to prevent the motor from overheating. Even when the step motor is not excited, it maintains a holding force to prevent paper from sliding.

(3) Start step

- To restart the motor from the stop step, shift the motor into the printing sequence.
- To restart the motor from the pause (no excitation) state, shift the motor into the printing sequence after outputting for 5 ms a phase that is the same as that of the stop step.

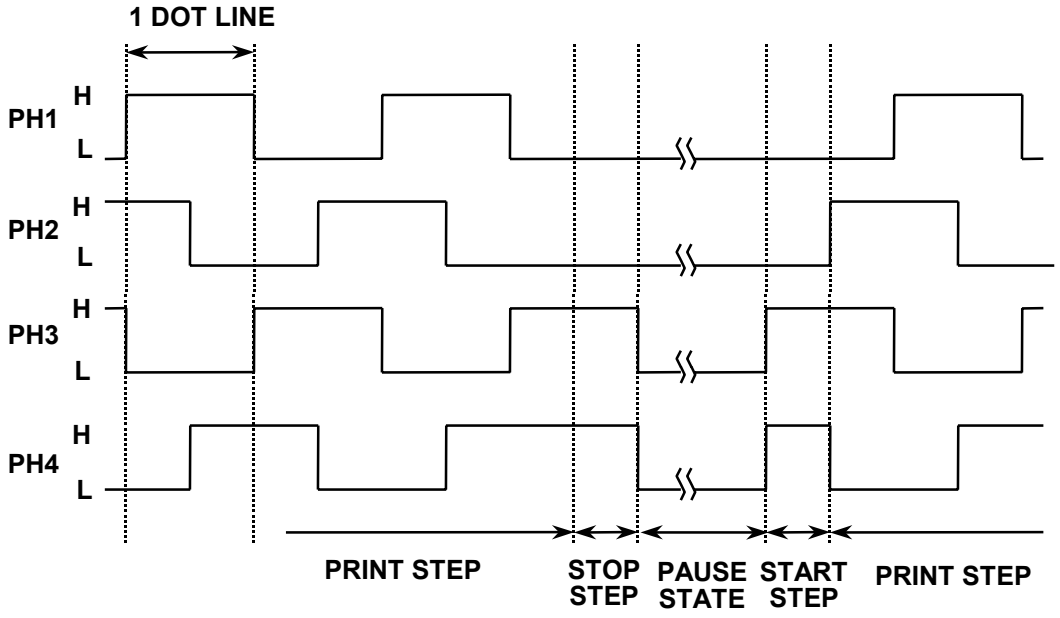


Figure 3-5 Motor Start/Stop Timing

(4) Others

- To print characters and bit images, always follow the start step and stop step.
- When the motor step is stopped in the dot lines where head activation was performed, the thermal head may stick to the surface of the paper and cause paper feed problems. Therefore, stop the motor drive in the dot lines where head activation is not performed.

3.4.3 Precautions for Driving the Motor

(1) Motor Current Control

When the motor speed decreases during printing because of the division drive method, the contents of print data, or input data transfer speed, noise and overheating of the motor may occur due to over-torque of the motor.
To prevent these symptoms from occurring, control the motor current as follows:
When driving the motor, always set the motor current for each phase at 300 mA or less.

(2) Acceleration Control

When driving the motor, acceleration control is needed to start paper feeding. When the motor is to be driven at the motor drive frequency that is calculated using equations (1) and (2) calculated in **Section 3.3**, the motor may come out of step under heavy load.
Drive the motor to the maximum driving speed that is calculated using equations (1) and (2), according to the acceleration steps in **Table 3-5**.

The method for accelerating the motor is as follows;

1. Output start step for 5000 μs.
2. Output first step for the first acceleration step time
3. Output second step for the second acceleration step time
4. Output nth step for the nth step acceleration time
5. After outputting the time calculated using equations (1) and (2), the motor is driven at a constant speed.

The printer can print during acceleration.

Table 3-5 Acceleration Steps

Number of Steps	Speed (pps)	Step Time (μs)
start	—	5000
1	205	4875
2	332	3013
3	430	2327
4	512	1953
5	584	1712
6	649	1541
7	708	1412
8	763	1310
9	815	1227
10	864	1158
11	910	1099
12	954	1048
13	996	1004
14	1037	964
15	1076	929
16	1114	898
17	1150	869
18	1186	843
19	1220	819
20	1254	798
21	1287	777
22	1318	758
23	1350	741
24	1380	725
25	1410	709
26	1440	694

(3) Preventing Overheating

To prevent the motor from overheating, continuous driving of the printer should be 1.5 m or less in print length. Set the pause time for 30 seconds or more after driving the printer. (Dynamic division 64 dots driving, print ratio 33.3 % or less)

3.5 THERMAL HEAD

3.5.1 Structure of the Thermal Head

As shown in **Figure 3-6**, the thermal head of the printer consists of 384 heat elements, and head drivers to drive the heat elements.

Serial printing data input from the DAT terminal is transferred to the shift register synchronously with the CLK signal, then stored in the latch register with the timing of the LATCH signal.

Inputting the head activation signal (DST 1 to 6) activates heat elements in accordance with the printing data stored in the latch register.

A maximum of six division printing is available for the printer.
Table 3-6 shows the relationship between DST signals and heat elements.

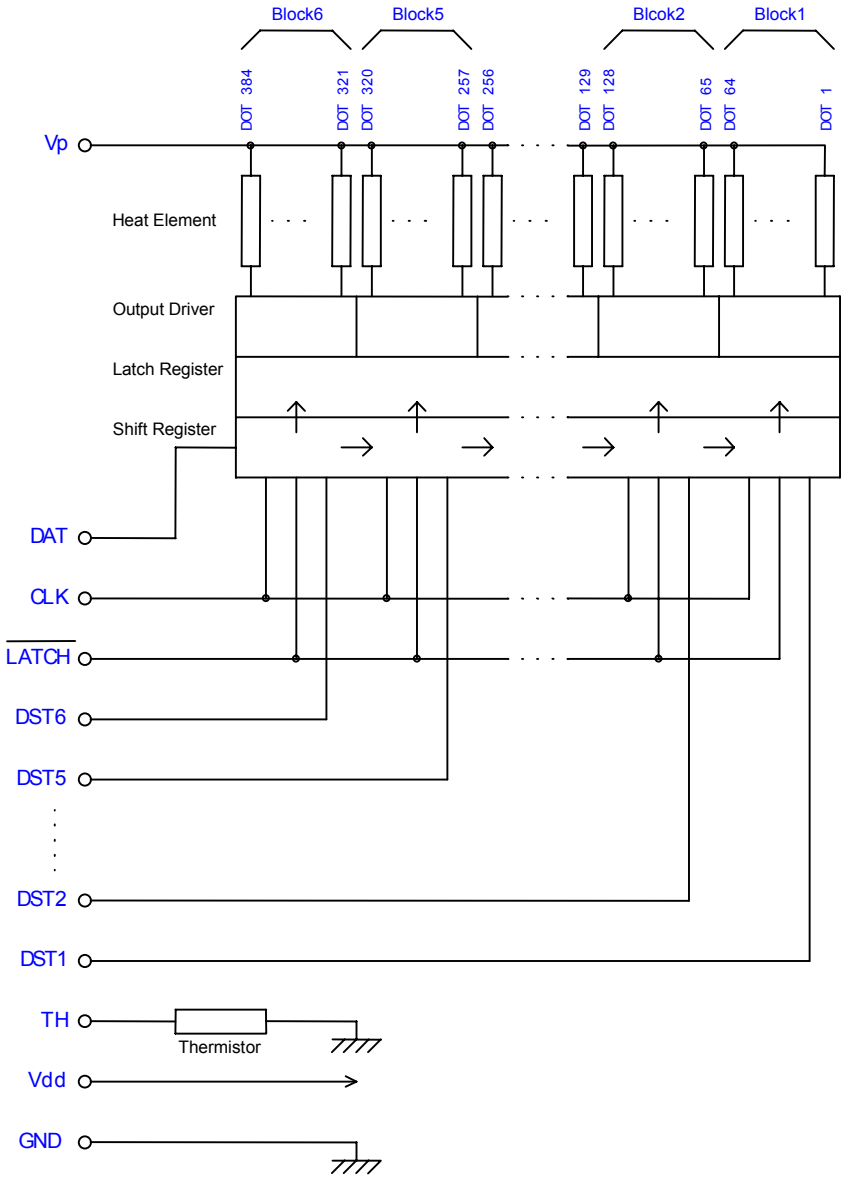


Figure 3-6 Thermal Head Block Diagram

Table 3-6 Blocks and Activated Heat Elements

Block Number	Heat Element Number	Dots/DST
1	1 - 64	64
2	65 - 128	64
3	129 - 192	64
4	193 - 256	64
5	257 - 320	64
6	321 - 384	64

3.5.2 Printed Position of the Data

Data dots from 1 to 384 which are transferred through DAT are printed as shown in **Figure 3-7**.

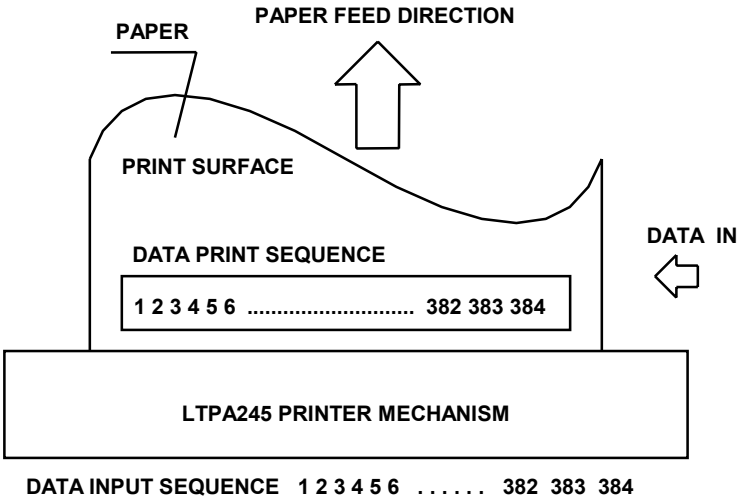


Figure 3-7 Printed Position of the Data

3.5.3 Head Voltage

The printer has a built-in head driver IC. **Table 3-7** shows the head voltage.

Table 3-7 Head Voltage

Item		Voltage Range
Head drive voltage	Vp	4.5 to 8.5 V
Head logic voltage	Vdd	2.7 to 5.25 V

3.5.4 Peak Current

Since the peak current (maximum current) may reach the values calculated using equation (3) shown below when the thermal head is driven, make sure that the allowable current for the cable material and the voltage drop on the cables are well within the specified range.

Equation (3):

$$Ip = \frac{N \times Vp \times RH}{(RH + 16 + 0.05 \times N)^2}$$

Ip: Peak current (A)
N: Number of dots that are driven simultaneously
Vp: Head drive voltage (V)
RH: Head resistance (Ω)

3.5.5 Thermal Head Electrical Characteristics

Table 3-8 LTPA245 Thermal Head Electrical Characteristics

Environmental temperature Ta=25°C

Item		Simbol	Conditions	Rated Values			Unit
				MIN	TYP	MAX	
Head average resistance		RH		168	176	183	Ω
Head drive voltage		Vp		4.5	-	8.5	V
Head drive current		Ip	max. simultaneously activated dot 64	-	-	2.6	A
Logic block voltage		Vdd		2.7	-	5.25	V
Logic block current		Idd	fclk=8 MHz, DAT=1/2fclk	-	-	54	mA
"High" input voltage		Vih	CLK, DAT, $\overline{\text{LATCH}}$, DST	0.8×Vdd	-	Vdd	V
"Low" input voltage		Vil	CLK, DAT, $\overline{\text{LATCH}}$, DST	0	-	0.2×Vdd	V
"High" input current	CLK	Iih	Vdd=5.0(V) Vih=5.0(V)	-	-	3	μA
	DAT			-	-	0.5	μA
	$\overline{\text{LATCH}}$			-	-	3	μA
	DST			-	-	30	μA
"Low" input current	CLK	Iil	Vdd=5.0(V) Vil=0(V)	-	-	-3	μA
	DAT			-	-	-0.5	μA
	$\overline{\text{LATCH}}$			-	-	-3	μA
	DST			-	-	-0.5	μA
CLK frequency		fclk	3.0 V ≤ Vdd ≤ 5.25 V	-	-	8	MHz
			2.7 V ≤ Vdd < 3.0 V	-	-	5	MHz
CLK pulse width		t1	See the Timing Chart	30	-	-	ns
DAT setup time		t2	See the Timing Chart	30	-	-	ns
DAT hold time		t3	See the Timing Chart	10	-	-	ns
LATCH setup time		t4	See the Timing Chart	200	-	-	ns
LATCH pulse width		t5	See the Timing Chart	100	-	-	ns
LATCH hold time		t6	See the Timing Chart	50	-	-	ns
DST setup time		t7	See the Timing Chart	300	-	-	ns
DATO delay time		t8	3.0 V ≤ Vdd ≤ 5.25 V See the Timing Chart	-	-	120	ns
			2.7 V ≤ Vdd < 3.0 V See the Timing Chart	-	-	150	ns

3.5.6 Timing Chart

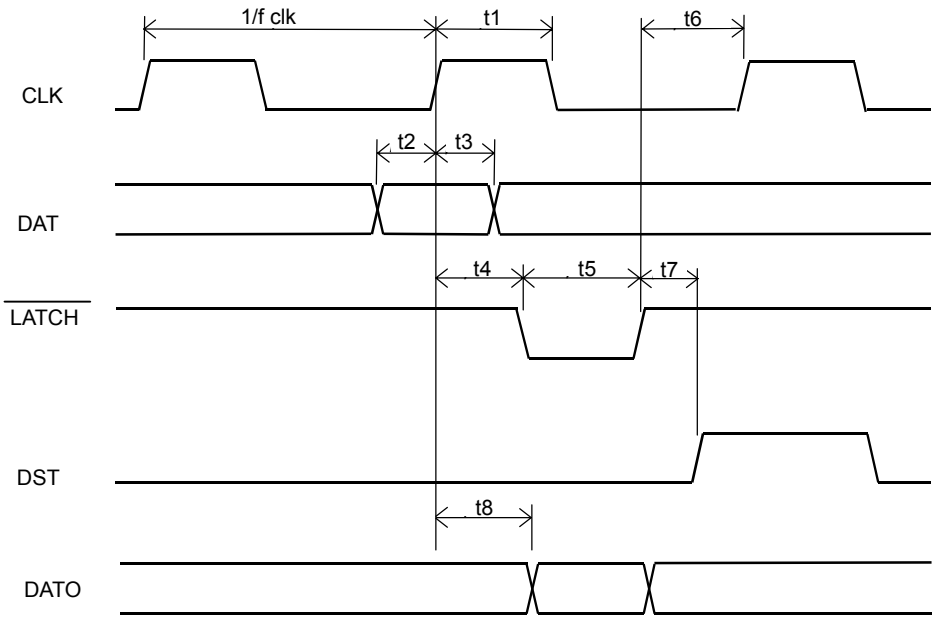


Figure 3-8 Timing Chart

3.6 CONTROLLING THE HEAD ACTIVATION (DST) PULSE WIDTH

3.6.1 Calculation of Head Activation Pulse Width

Head activation pulse width is calculated using the following equation (4).
To execute high quality printing using the printer, the value that is calculated using the following equation (4) must be adjusted according to the environment the printer is used in. Calculate each value used according to the steps in **Sections 3.6.2** to **3.6.7** and control them so that the pulse width with the t value obtained by substituting each value into the equation (4) is applied.
Printing using too high of a voltage or too long of a pulse width may shorten the longevity of the thermal head.

Equation (4):

$$t = \frac{E \times R}{V^2} \times C \times D$$

t : Head pulse width (ms)
E : Standard applied energy (mj) See **Section 3.6.2**.
V : Applied voltage (V) See **Section 3.6.3**.
R : Head resistance (Ω) See **Section 3.6.4**.
C : Head pulse term coefficient See **Section 3.6.6**.
D : Heat storage coefficient See **Section 3.6.7**.

3.6.2 Calculation of Applied Energy

Applied energy should be in accordance with the temperature of the thermal head and the environment the printer is used in.
The thermal head has a built-in thermistor. Measure the temperature using thermistor resistance. Standard applied energy is based on a temperature of 25°C. Calculate the printing energy using equation (5).

Equation (5):

$$E = (0.160 - T_C \times (T_X - 25))$$

T_X: Detected temperature using the thermistor (°C) [1]
T_C : Temperature coefficient 0.00192

1 The thermistor resistance value at T_X (°C). See **Section 3.6.9**.

3.6.3 Calculation of Head Activation Voltage

Calculate the applied voltage using equation (6).

Equation (6):

$$V = Vp \times 1.2 - 1.3$$

Vp: Head activation voltage (V)

3.6.4 Calculation of Head Resistance

A drop in voltage occurs depending on the wiring resistance. Calculate the head resistance using equation (7).

Equation (7):

$$R = \frac{(RH + 16 + (R_C + r_C) \times N)^2}{RH}$$

RH: Head average resistance
176 Ω ± 4 %
16: Wiring resistance in the thermal head (Ω)
R_C: Common terminal wiring resistance in the thermal head: 0.05 (Ω)
r_C: Wiring resistance between V_P and GND (Ω) [1]
N: Number of dots driven simultaneously

[1] It indicates a series resistance of wire and relay switching circuits used between the FPC terminals and power supply.

3.6.5 Head Activation Pulse Term Coefficient

Make adjustments using the head activation pulse term coefficient (equal motor drive frequency) as the printing density changes by the printing speed.
According to equations (8), calculate compensation coefficient C of the activation pulse.

Equation (8):

$$C = 1 - 0.5/(0.8 + W)$$

W = (1000/motor drive frequency) – activation pulse for the previous 1 block

3.6.6 Determination of Activation Pause Time

In order to protect the thermal head heat elements, when the same heat element dots are activated continuously on the successive dot line, determine the pause period (the time from the end of the the preceding activation to the start of the current activation) which meets equation (9) to secure the pause time.

Equation (9):

$$W' > 0.15 \text{ (ms)}$$

W': Activation pause time for 1 dot line (ms)

3.6.7 Heat Storage Coefficient

In high speed printing, a difference in temperature arises between the rise in temperature of the thermal head due to head activation and the temperature detected by the thermistor. Therefore, the activation pulse must be corrected by simulating a rise in the temperature of the thermal head.
No correction is needed when the print ratio is low. When correction is not needed, set “1” as the heat storage coefficient.

The heat storage coefficient is calculated as follows:

1) Prepare the heat storage software counters to simulate heat storage.

   (a) Heat storage due to head activation
   The heat storage counter counts up in each print cycle as follows.

   $$T' = T + \frac{N}{6}$$

   T: Heat storage counter value
   N: Number of the activated dots

   (b) Radiation
   The heat storage counter value is multiplied by the radiation coefficient in each 2 ms.

   $$T' = T \times K$$

   K: Radiation coefficient 0.99

2) Calculate the heat storage coefficient with the following equation (10).

   Equation (10)

   $$D = 1 - \frac{T}{27510}$$

3.6.8 Calculation Sample for the Head Activation Pulse Width

Table 3-9 lists the calculation sample of the head activation pulse width that was calculated substituting the values obtained using equations (5) to (9) and the heat storage coefficient when D=1 for equation (4).

Table 3-9 Activation Pulse Width

Head Drive Voltage (V)	Thermistor Temperature	Motor Drive Frequency (PPS)														
		Start	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1440
4.5	0	2679	2249	1757	/////	/////	/////	/////								
	10	2432	2070	1716	1031	/////	/////	/////								
	20	2184	1881	1623	1205	/////	/////	/////								
	30	1937	1686	1495	1226	814	/////	/////								
	40	1690	1484	1343	1165	928	/////	/////								
	50	1442	1276	1174	1054	911	738	/////								
	60	1195	1065	991	911	822	725	617								
	70	948	850	799	746	692	636	578								
	80	701	632	598	566	534	502	471								
5.0	0	2039	1767	1551	1230	/////	/////	/////	/////							
	10	1850	1615	1445	1212	876	/////	/////	/////							
	20	1662	1461	1325	1154	931	629	/////	/////							
	30	1474	1303	1196	1070	918	731	/////	/////							
	40	1286	1143	1060	966	861	741	604	/////							
	50	1098	981	917	848	775	696	612	521							
	60	909	816	768	719	669	617	565	511							
	70	721	650	615	581	548	514	482	450							
	80	533	482	459	437	415	395	376	357							
6.0	0	1294	1150	1065	971	864	742	602	/////	/////	/////					
	10	1174	1047	975	898	813	720	617	504	/////	/////					
	20	1055	943	883	820	752	681	605	525	439	/////					
	30	935	839	789	737	684	630	574	516	456	394					
	40	816	734	693	651	610	569	527	485	443	401					
	50	697	628	595	563	531	500	469	439	410	381					
	60	577	522	496	471	447	424	402	381	361	341					
	70	458	415	395	377	360	344	328	314	300	287					
	80	338	307	294	281	270	259	249	239	231	223					
7.2	0	836	751	709	666	623	579	536	491	447	402	357	/////			
	10	759	683	646	609	573	536	500	465	429	394	359	325			
	20	682	615	583	551	520	490	461	432	404	377	350	323			
	30	604	546	519	492	467	442	418	395	373	351	331	311			
	40	527	477	454	432	411	391	372	354	337	320	304	289			
	50	450	408	389	371	354	338	323	309	296	283	271	260			
	60	373	338	323	309	296	284	272	262	252	242	233	225			
	70	296	269	257	246	237	228	219	211	204	197	191	185			
	80	219	199	191	183	176	170	164	159	154	149	145	141			
8.0	0	654	590	560	530	501	473	446	419	394	368	344	320	297		
	10	593	536	509	484	459	435	412	390	368	347	327	308	289		
	20	533	482	459	437	415	395	376	357	339	323	306	291	276		
	30	473	428	408	389	371	354	338	323	308	294	281	269	257		
	40	412	374	357	341	326	312	299	286	275	264	253	243	234		
	50	352	320	305	292	280	269	258	248	239	230	222	215	207		
	60	292	265	254	243	233	225	216	209	202	195	189	183	177		
	70	231	210	202	194	186	179	173	168	162	158	153	149	145		
	80	171	156	149	144	138	134	129	125	122	118	115	112	110		
8.5	0	568	514	489	464	441	419	397	376	357	338	319	301	284	268	261
	10	516	467	445	423	403	384	365	348	331	315	300	285	271	257	252
	20	464	420	400	382	364	348	332	317	303	290	277	265	254	243	239
	30	411	373	356	340	325	311	298	286	274	263	253	243	234	225	221
	40	359	326	311	298	285	273	263	252	243	234	226	218	210	203	201
	50	306	278	266	255	245	235	226	218	211	204	197	191	185	179	177
	60	254	231	221	212	204	196	189	183	177	172	166	162	157	153	151
	70	201	183	176	169	162	157	151	147	142	138	134	131	128	125	123
	80	149	135	130	125	121	117	113	110	106	104	101	99	96	94	93

Do not use this area because paper feed errors may occur because of the motor torque.

Note)

The above table shows values for recommended 65 μ thermal paper, resistance 176Ω and number of activation dots=64.
In the shaded area, the drive pulse width exceeds the allowable activation pulse width or the activation pulse width exceeds the motor drive frequency. Therefore, use the motor drive frequency shown in the unshaded areas.

3.6.9 Thermistor Resistance

The resistance of the thermistor at the operating temperature T_X (°C) is determined using the following equation (11).

Equation (11):

$$R_X = R_{25} \times EXP \left\{ B \times \left(\frac{1}{273 + T_X} - \frac{1}{298} \right) \right\}$$

R_X: Resistance at operating temperature Tx (°C)
R_{25}: 30 kΩ ± 5% (25°C)
B: 3950 k ± 2%
T_X: Operating temperature (°C)
EXP (A): The Ath power of natural logarithm e (2.71828)

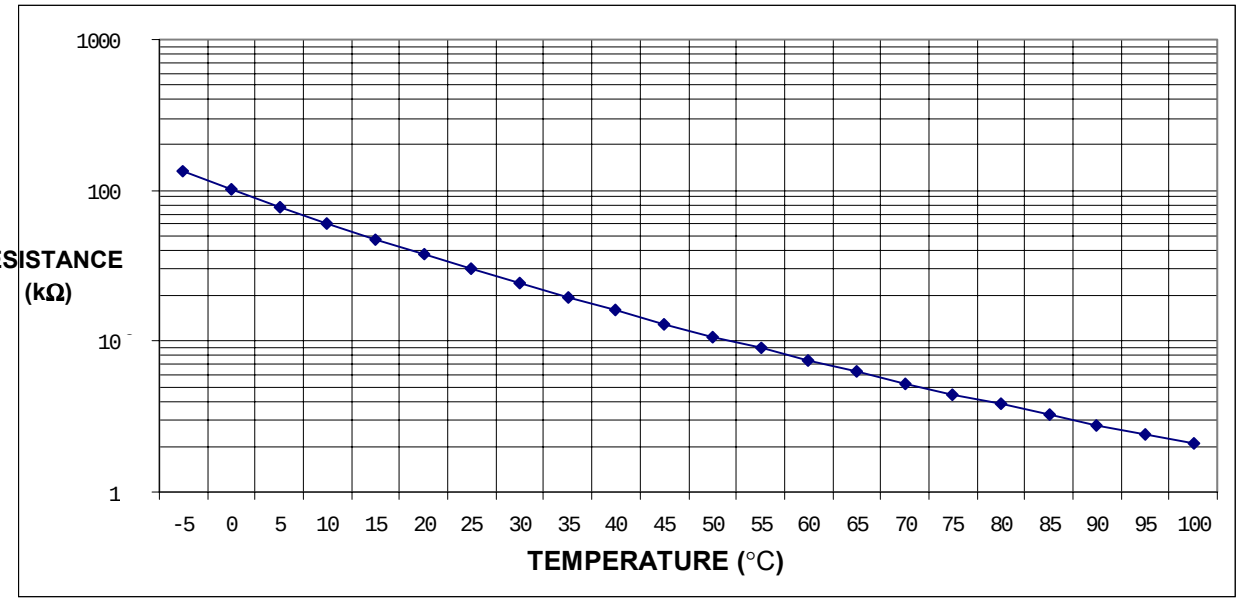


Figure 3-9 Thermistor Resistance vs. Temperature

Table 3-10 Temperature and Thermistor Resistance

Temperature (°C)	Thermistor Resistance (kΩ)	Temperature (°C)	Thermistor Resistance (kΩ)
-5	132.3	50	10.8
0	101.0	55	8.9
5	77.9	60	7.4
10	60.6	65	6.2
15	47.5	70	5.3
20	37.6	75	4.5
25	30.0	80	3.8
30	24.1	85	3.3
35	19.5	90	2.8
40	15.9	95	2.4
45	13.0	100	2.1

3.6.10 Detecting Abnormal Temperatures of the Thermal Head

To protect the thermal head and to ensure personal safety, abnormal thermal head temperatures must be detected by both hardware and software as follows:

- **Detecting abnormal temperatures by software**

  Design software that will deactivate the heat elements if the thermal head thermistor (TH) detects a temperature 80°C or higher (thermistor resistance RTH ≤ 3.80 kΩ), and reactivate the heat elements when a temperature of 60°C or lower (RTH ≥ 7.45 kΩ) is detected. If the thermal head continues to be activated at a temperature higher than 80°C, the longevity of the thermal head may be shortened significantly.

- **Detecting abnormal temperatures by hardware**

  If the control unit (CPU) malfunctions, the software for detecting abnormal temperatures may not function properly, resulting in overheating of the thermal head. Overheating of the thermal head may cause damage to the thermal head or may cause burns to the user upon contact.
  Always use hardware in conjunction with software for detecting abnormal temperatures to ensure personal safety. (If the control unit malfunctions, it may be impossible to prevent damage to the thermal head even if a detection of abnormal temperature is detected by hardware.)

  Using a window comparator circuit or similar detector, design hardware that detects the following abnormal conditions:

  (a) Overheating of the thermal head (approximately 90°C or higher (RTH ≤ 2.79 kΩ)).

  (b) Faulty thermistor connection (the thermistor may be open or short-circuited).

  If (a) and (b) are detected, immediately deactivate the heat elements. Reactivate the heat elements after the temperature of the thermal head has returned to normal.

3.7 PAPER DETECTOR

The printer has a built-in paper detector (reflection type photo interrupter) to detect whether paper is present or not.

An external circuit should be designed so that it detects output from the paper detector and does not activate the thermal head and motor when there is no paper. Doing not so may cause damage to the thermal head or platen roller or shorten the longevity of the head significantly. If the motor is drived when it is out-of-paper, a load is put on the reduction gear and the longevity of the gear may be shortened.

3.7.1 General Specifications

Table 3-11 Absolute Maximum Ratings of Detectors

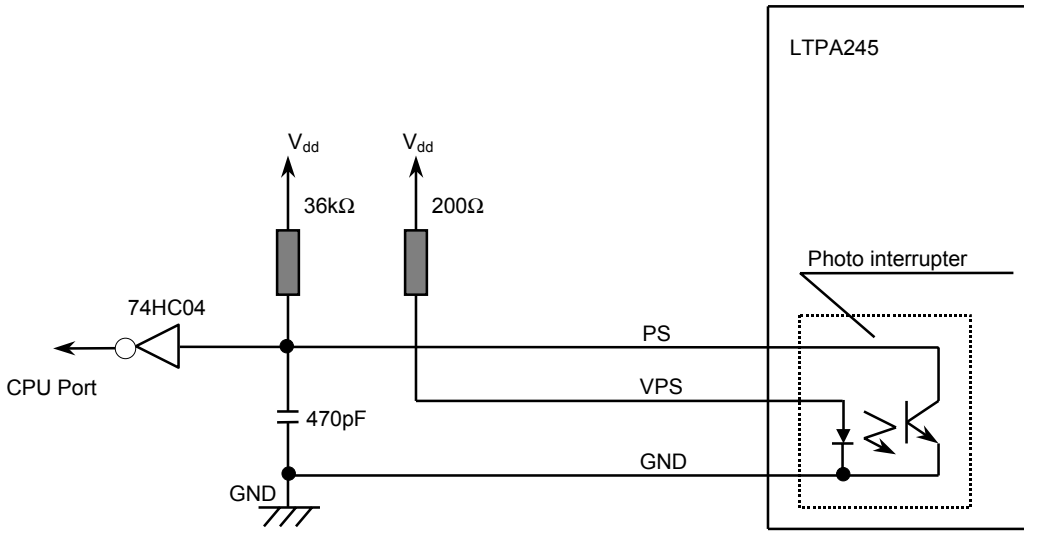
(at 25°C)

Item		Symbol	Rating
LED (input)	Forward current	I_F	50 mA
	Reverse voltage	V_R	5 V
	Allowable current loss	P	70 mW
Phototransistor (output)	Collector-to-emitter voltage	V_{CEO}	20 V
	Emitter-to-collector voltage	V_{ECO}	5 V
	Collector current	I_C	20 mA
	Collector loss	P_C	70 mW
Operating temperature		T_{opr}	-20°C to + 80°C
Storage temperature		T_{stg}	-30°C to + 100°C

Table 3-12 Paper Detectors Input/Output Conditions

Item		Symbol	Conditions	Standard	Max.
LED (input)	Forward voltage	V_F	I_F=10mA	1.2V	1.6V
	Reverse current	I_R	V_R=5V	–	10μA
Photo-transistor (output)	Dark current	I_{CEO}	If=0mA, V_{CE}=10V	–	200nA
Transfer characteristics	Photo electric current	I_C	I_F=10mA, V_{CE}=5V	–	350μA
	Leak current	I_{LEAK}	I_F=10mA, V_{CE}=5V	–	1μA
	Collector saturation voltage	V_{CE}(sat)	I_F=10mA, I_C=50μA	–	0.5V
	Response time (at rise)	t_r	I_C=1mA, V_{CC}=5V	5μs	–
	Response time (at fall)	t_f	R_L=100Ω	5μs	–

3.7.2 Sample External Circuit



* The PS signal is high when there is no paper.

Figure 3-10 Sample External Circuit of the Paper Detector

CHAPTER 4

CONNECTING EXTERNAL CIRCUITS

The printer has an FPC type connector with 1-mm pitch pins.

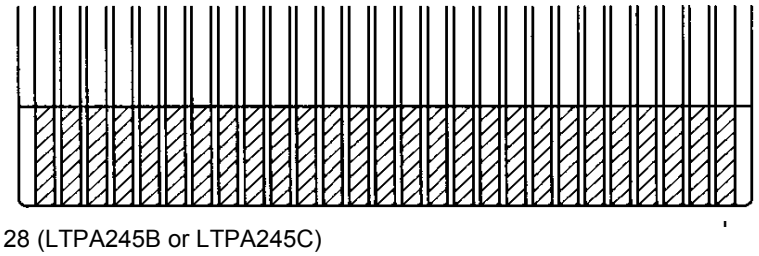
Use the recommended connectors listed in **Table 4-1** to connect the printer firmly to the external circuits.

Table 4-1 Recommended Connectors

No.	External Circuit Functions	Number of Pins	Recommended Connectors (in the external circuit side)
1	Thermal head control (LTPA245A or LTPA245D)	27	Molex Co., Ltd. 52807-2710 (horizontal type) 52806-2710 (vertical type)
2	Thermal head control (LTPA245B or LTPA245C)	28	Molex Co., Ltd. 52807-2810 (horizontal type) 52806-2810 (vertical type)

4.1 THERMAL HEAD CONTROL TERMINALS

Figure 4-1 shows the terminals configuration of the FPC thermal head control terminals.



Terminal Numbers 1 to 27 (LTPA245A or LTPA245D)
Terminal Numbers 1 to 28 (LTPA245B or LTPA245C)

Figure 4-1 Thermal Head Control Terminals

Table 4-2 Thermal Head Control Terminal Assignments [*1]

Terminal Number	Signal Name	Input/ Output	Function
1	PS	Output	Paper detector receiving photo collector output
2	VPS	Input	Paper detector luminous portion
3	GND	—	Paper detector GND
4	Vp	—	Thermal head drive voltage
5	Vp	—	Thermal head drive voltage
6	DAT	Input	Print data input (serial input)
7	DST6	Input	Thermal head print activation instruction signal
8	DST5	Input	Thermal head print activation instruction signal
9	DST4	Input	Thermal head print activation instruction signal
10	GND	—	GND
11	GND	—	GND
12	GND	—	GND
13	GND	—	GND
14	TH	Output	Thermistor
15	DST3	Input	Thermal head print activation instruction signal
16	DST2	Input	Thermal head print activation instruction signal
17	DST1	Input	Thermal head print activation instruction signal
18	Vdd	—	Logic power supply
19	CLK	Input	Synchronizing signal for print data transfer
20	LATCH	Input	Print data latch (memory storage)
21	DAT0	Output	Print data output (serial output)
22	Vp	—	Thermal head drive voltage
23	Vp	—	Thermal head drive voltage
24	A	Input	Motor drive signal
25	B	Input	Motor drive signal
26	A	Input	Motor drive signal
27	B	Input	Motor drive signal
28 [*2]	NC	—	No connection

(Note)

[*1] The assignments of terminal numbers 1 to 27 are common to the LTPA245A and the LTPA245B.

[*2] When either LTPA245B or LTPA245C is used, terminal numbers 1 to 28 must be assigned.

4.2 CAUTION IN CONNECTION

Pay attention to the following during installation of the printer.

- Always remove or install the thermal head controls vertically while holding the reinforcement portion of the FPC.
- Do not bend the FPC. If the FPC must be bent unavoidably, try to do so without removing the reinforcement sheet from the reinforcement portion of the FPC.

If the connectors are not connected properly, it may damage the printer, FPC or connectors.

CHAPTER 5

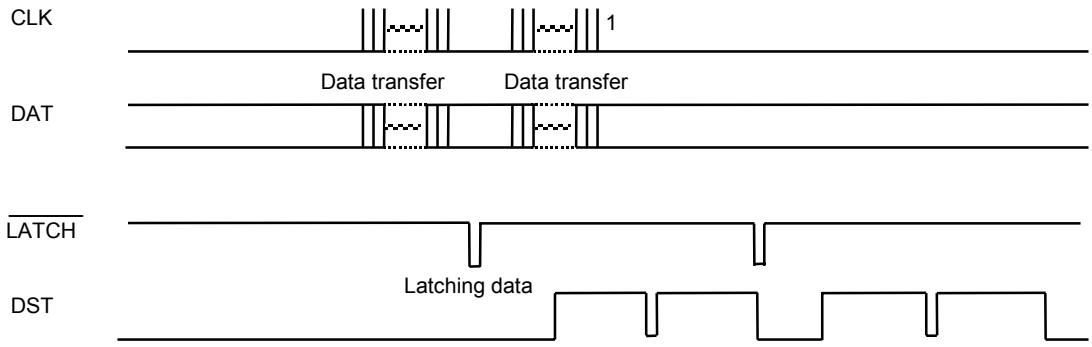
DRIVE METHOD

5.1 THERMAL HEAD DRIVE TIMING

- **Input of print data**
  Input of DAT and CLK transfer the print data to the shift register in the serial input. “High” means printing and “Low” means no-printing in DAT. DAT data is read in at the rising edge of the CLK inputs. The transferred line of data is stored in the latch register by turning LATCH to “Low”.

- **Input of the head activation pulse**
  Setting the DST on "High" drives the heat elements of the thermal head. Select the block to be activated and drive for the time calculated using the formula shown in **"3.6 CONTROLLING THE HEAD ACTIVATION (DST) PULSE WIDTH"**, then set the DST to "Low".

Figure 5-1 shows the example of timing chart of the thermal head driving.



1: The print data for next dot line can be transferred immediately after storing the print data into the latch register.

Figure 5-1 Example of Timing Chart of the Thermal Head Driving

5.2 MOTOR DRIVE TIMING

To print, the phase of motors need to be synchronized with that of the thermal head.
As example, the print method which divides one dot line to two groups; the block 1,3, and 5 and the block 2,4, and 6, and prints each group data for each step of the motor is described below.

The basic pulse width of the motor drive pulse, Tm, is a value (unit: msec) of the reciprocal number of the driving frequency calculated using equation (1) and (2) of **"3.3 PAPER FEED CHARACTERISTICS"**.

- **Pause State**
  Transfer the print data to the thermal head according to **"5.1 THERMAL HEAD DRIVE TIMING"**.

- **Start up phase**
  Excite the phase which is output just before the motor stops for 5 ms.

- **1st dot line, 1st step**
  Drive the motor by one step (1st step). The step time should be the acceleration 1st step time or Tm, whichever is longer.
  Set DST for blocks 1, 3, and 5 to "High" in synchronization with the motor drive.
  After setting DST to "High", set DST to "Low" when the driving time calculated in **"3.6 CONTROLLING THE HEAD ACTIVATION (DST) PULSE WIDTH"** has passed.
  Next, set DST for blocks 2,4 and 6 to "High" and set DST to "Low" after the activation of all the blocks has been completed.
  Move to the 2nd step after completion of the 1st step time of the motor and the activation of all blocks.

- **1st dot line, 2nd step**
  Drive the motor by one step (2nd step). As to how much step time is output, compare Tm with the time that was taken in the previous step.

  (1) In case Tm < the time that was taken in the previous step,

  the next closest acceleration step time to the previous step time or Tm, which is longer, is output.

  (2) in case Tm > the time that was taken in the previous step,
  the closest acceleration step time to Tm and the acceleration step time that is larger than Tm, are output.

  Set DST for blocks 1, 3, and 5 to "High" in synchronization with the motor drive. After setting DST to "High", set DST to "Low" after completion of the head activation time. Transfer the print data of the next dot line to the thermal head after completion of printing for all blocks.
  Move to the 2nd dot line after completion of the 2nd step time of the motor and the transfer of print data for the next dot line.

- **2nd dot line, 1st step**
  Drive the motor by one step (3rd step). As to how much step time is output, compare Tm with the time that was taken in the previous step.

  (1) in case Tm < the time that was taken in the previous step
  the next closest acceleration step time to the previous step time or Tm, which is longer, is output.

  (2) in case Tm > the time that was taken in the previous step
  the closest acceleration step time to Tm and the acceleration step time that is larger than Tm, are output.

  Activate all blocks in the same manner as the 1st dot line.

- **2nd dot line, 2nd step**
  Drive the motor by one step (4th step). As to how much step time is output, compare Tm with the time that was taken in the previous step.

  (1) in case Tm < the time that was taken in the previous step
  the next closest acceleration step time to the previous step time or Tm, which is longer, is output.

  (2) in case Tm > the time that was taken in the previous step
  the closest acceleration step time to Tm and the acceleration step time that is larger than Tm, are output.

  Activate all blocks in the same manner as the 1st dot line, then transfer the next dot line data.

Print each dot line continuously in the same manner, always making the blocks to be printed the same in the 1st and 2nd step.

Figure 5-2 shows an example of the motor drive timing chart.

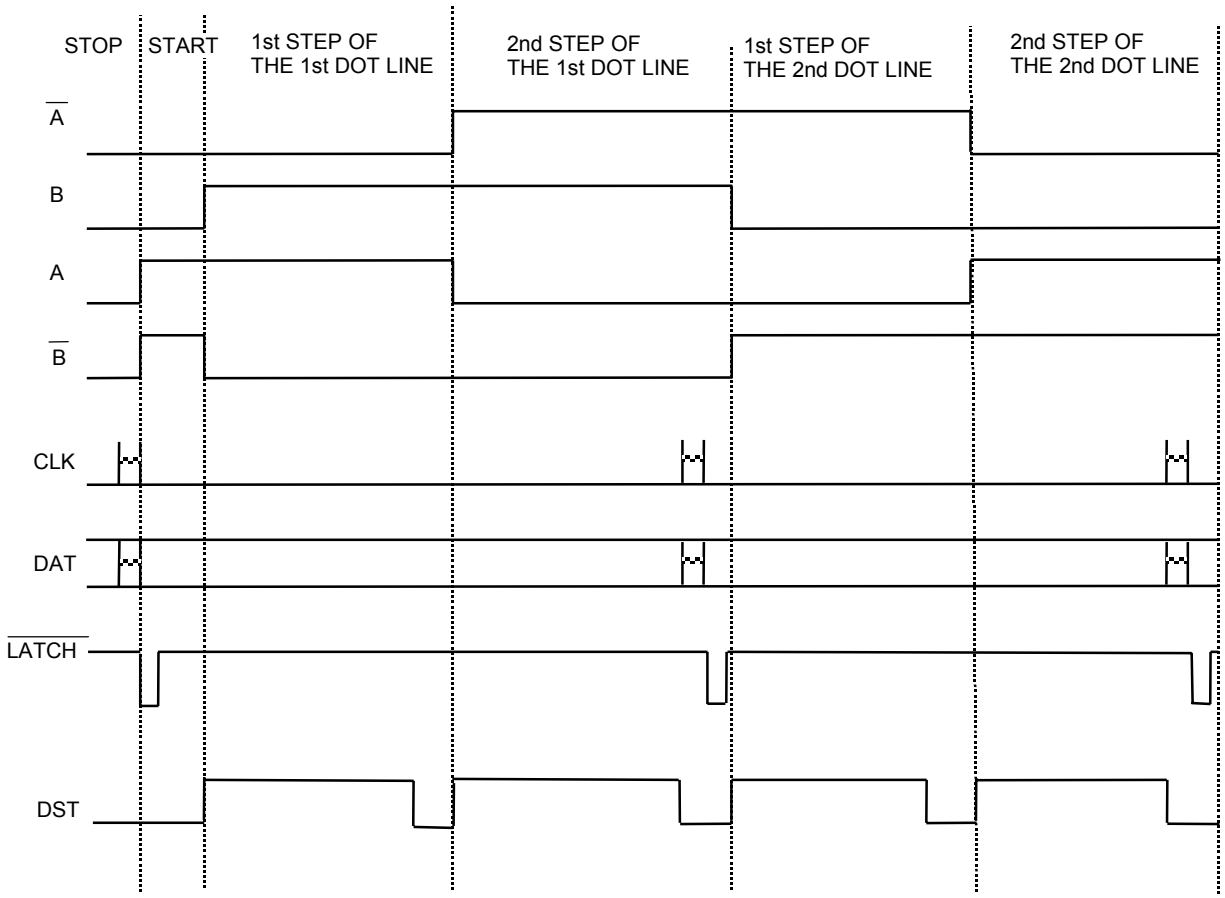


Figure 5-2 Example of Motor Drive Timing Chart

CHAPTER 6

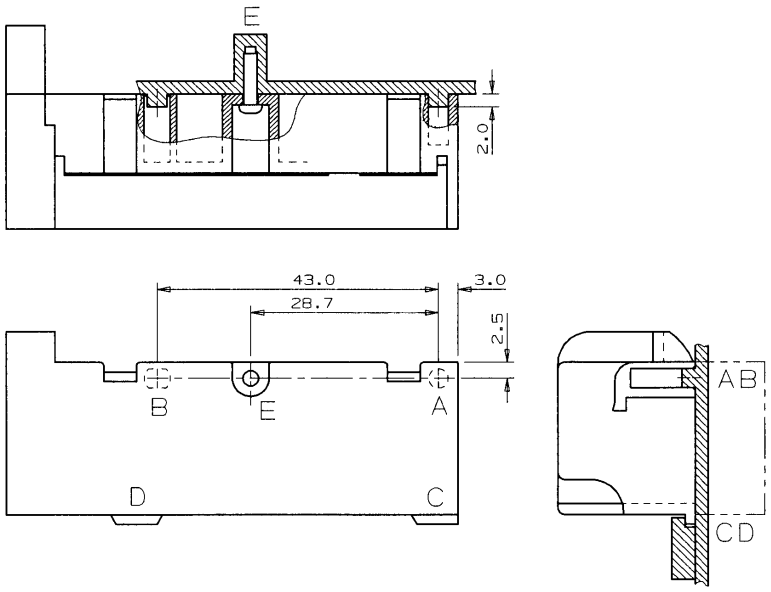
HOUSING DESIGN GUIDE

6.1 SECURING THE PRINTER

The main body of the printer and platen block must be secured to the outer case separately with screws.

6.1.1 Printer Mounting Method

Secure the printer with a hole E and 2 pawls (C, D), as shown below. Holes A and B are used for positioning the body of the printer. Design bosses for positioning holes A and B precisely in the outer case.
See **"CHAPTER 7 APPEARANCE AND DIMENSIONS"** for locations and dimensions.



Unit: mm

Figure 6-1 How to Secure the Printer

Recommended Screws

The recommended mounting screws are as follows:

1) Screw: JIS B1111 cross-recessed pan head machine screw: M2.0

2) Screw: Cross-recessed pan head tapping screw to secure resinated material: nominal size 2 mm

6.1.2 Connecting FG Cable

Connect the FG cable to the FG plate of the printer with the FG cable lock screw.
Prepare the FG cable and FG cable lock screw of the types shown in **Figure 6-2**.
For the application terminals of the FG cable, the type shown in **Figure 6-3** is recommended.

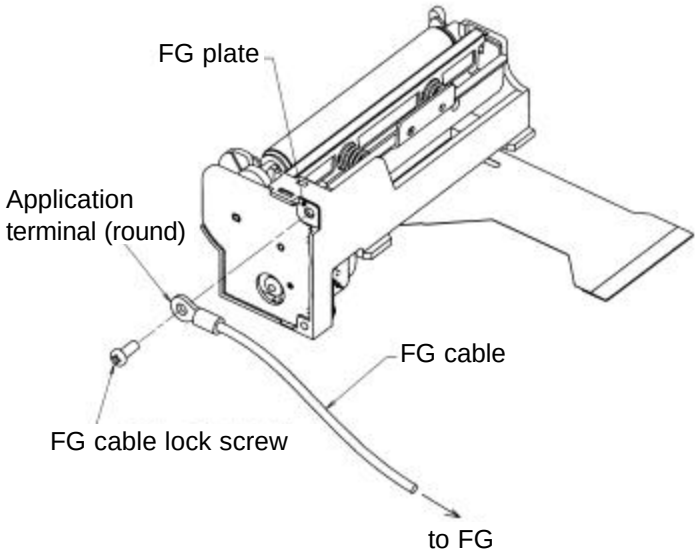


Figure 6-2 Connecting FG Cable

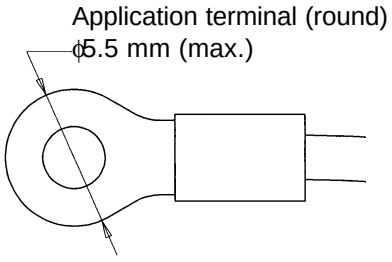


Figure 6-3 FG Cable Application Terminal

Recommended Screw

The recommended mounting screw is as follows:

Screw: Cross-recessed pan head tapping screw to secure resinated material (nickel plating)
nominal size: 2 mm, length from below the head: 5 mm

Screw Fastening Torque

Reference value: 2.4 to 3.0 kgf-cm

Fasten the screw on a flat surface, placing the FG plate surface of the printer upward from above.

6.1.3 Mounting Platen Block

(1) When using the LTPA245A:

The printer does not have a platen block support function. For the platen block support, prepare the plastic (poly-carbonate is recommended) platen support for snap fitting in the paper holder cover and fit the platen block shaft into it. For the dimensions of the platen support, the platen block positioning, and sitting, follow the instructions shown in **Figures 6-4** and **6-5**. Metal or aluminum platen support cannot fit the platen block shaft.

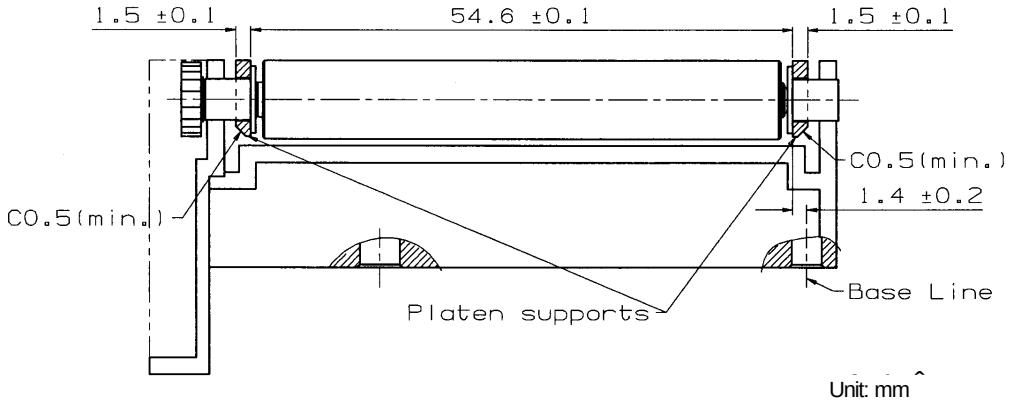
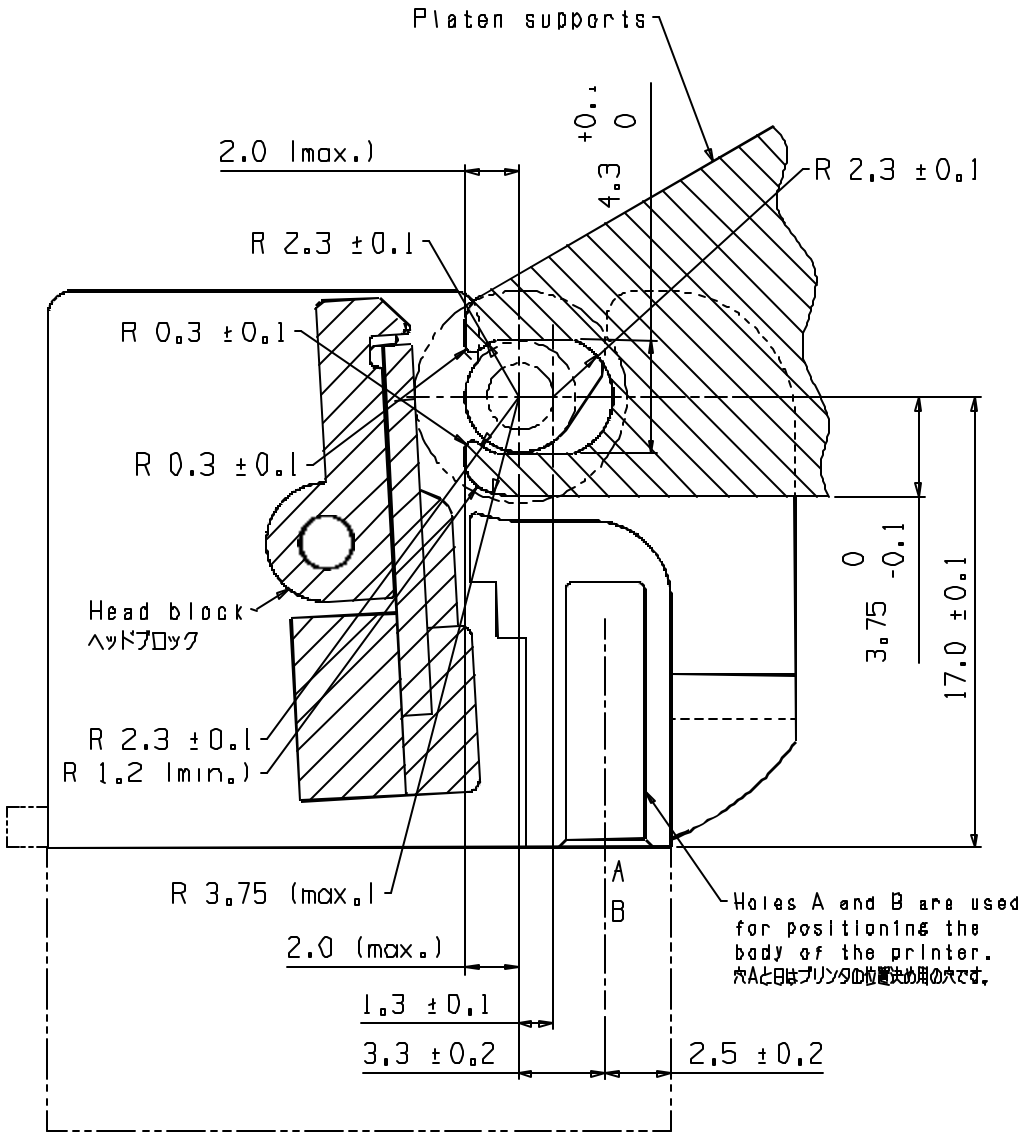


Figure 6-4 How to Secure the Platen Block (LTPA245A: (1))

Referring to **Figure 6-5,** design the shape of the platen support so that the platen support does not come in contact with the head block.
For the operational sizes of the lock arm lever and head block, see **Figure 7-4**.



Unit: mm

Figure 6-5 How to Secure the Platen Block (LTPA245A: (2))

(2) When using LTPA245B, LTPA245C or LTPA245D:

Prepare the paper holder cover and provide it with the two screw holes (H, I) and the two boss shapes (F, G) for positioning as shown in **Figure 6-6,** to secure the platen block. When designing the paper holder cover, use the dimensions shown below. For the dimensions and for the operational sizes of the lock arm lever and platen block, see **CHAPTER 7 APPEARANCE AND DIMENSIONS**.

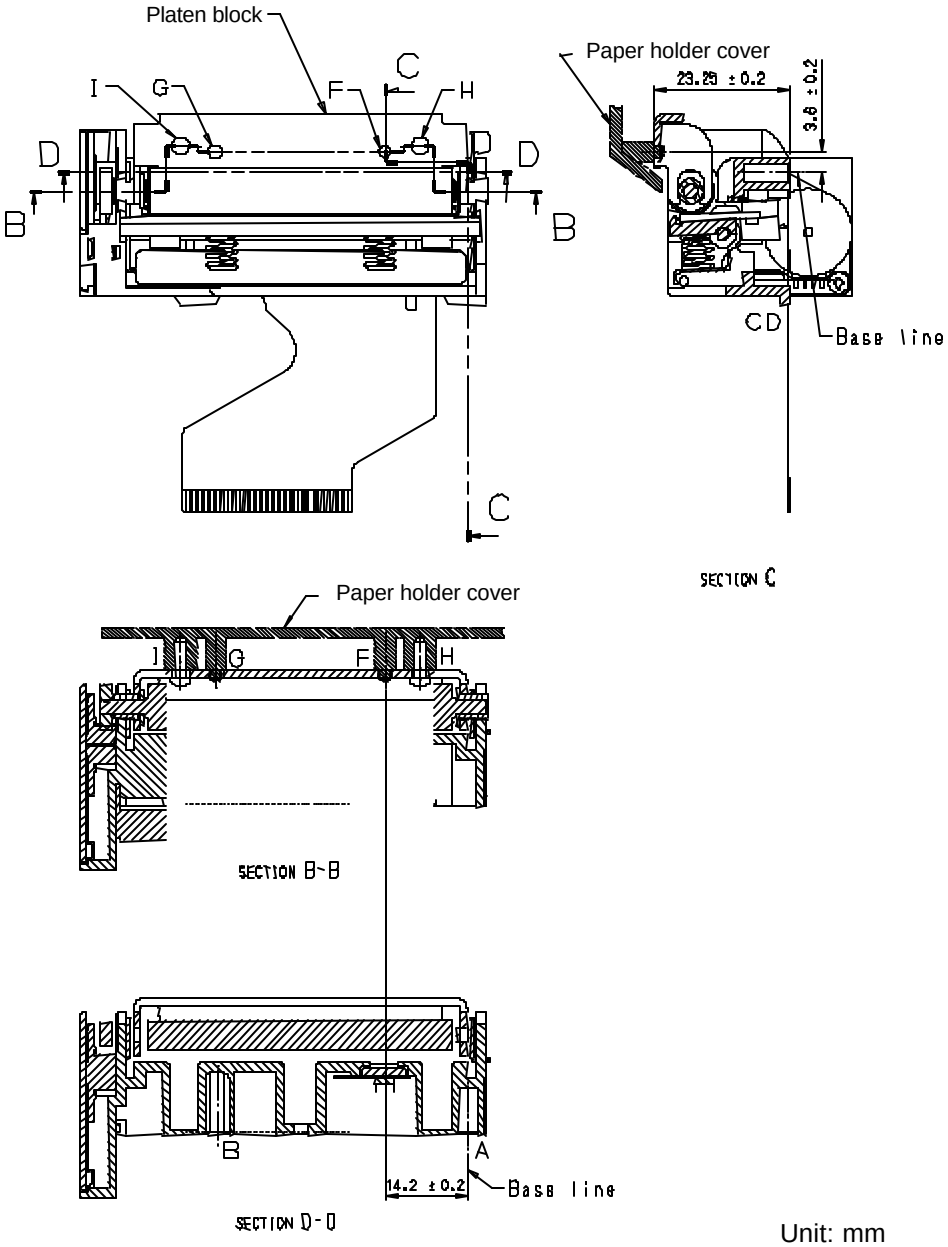


Figure 6-6 How to Secure the Platen Block (LTPA245B, LTPA245C, or LTPA245D)

Recommended Screws

The recommended mounting screws are as follows:

1) Screw: JIS B1111 cross-recessed pan head machine screw: M2.5 to 2.6

2) Screw: Cross-recessed pan head tapping screw to secure resinated material:
nominal 2.5 to 2.6 mm

6.1.4 Precautions for Securing the Printer

Pay attention to the following when designing the case and securing the printer. Failure to follow these instructions may cause deterioration of print quality, paper skew, paper jam, noise or damage.

- Prevent excessive force or torsion when securing the printer.
- Remove the platen block before securing the printer.
- Fasten the printer to the solid base with screws, where the position of the printer does not change even during lever operation when removing the platen block. If the position of the printer changes during lever operation, it may not be possible to remove the platen block normally.
- Design the outer case so that the thermal head control terminals (FPC) can move 1 to 2 mm to compensate for the head moving.
- If the FPC for the thermal head control touches the bottom of the outer case strongly, it causes disconnection or a short circuit. Leave a space of approximately 0.3 mm between the bottom of the outer case where the FPC passes through and the bottom of the printer.
- Secure the platen block to the printer correctly as shown in **CHAPTER 6 HOUSING DESIGN GUIDE** and **CHAPTER 7 APPEARANCE AND DIMENSIONS**.
  Also, in such case, check the print quality and other operating conditions fully before use of the platen block.
- If the mounting position of the platen block rotation support, etc., is not correct, an engagement failure of the printer and platen block will occur, resulting in printing problems.
- The shipping inspection of the main body of the printer and the platen block is performed in combination of the main body of the printer and the platen block packed for the shipping. Therefore, do not change the combination of the main body of the printer and the platen block when installing them to the outer case.

6.2 LAYOUT OF PRINTER AND PAPER

The printer can be laid out as shown in **Figure 6-7** according to the loading direction of the paper.

- Design the paper outlet with an angle of 60 to 90°.
- Design the paper inlet with an angle of 90 to 150°.

Design the printer so that the paper feed force is 0.49N (50 gf) or less.

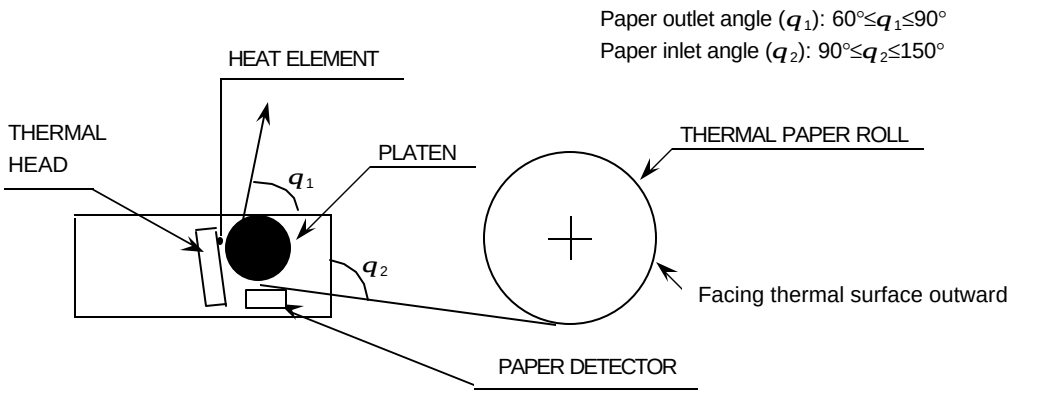


Figure 6-7 Paper Path

6.3 WHERE TO MOUNT THE PAPER HOLDER COVER

When determining the layout of the paper holder cover, note the following:

- Hold the paper so that the paper is straight to the paper inlet without any horizontal shifting, and the center axis of the paper roll is parallel with the printer.
- Keep the paper feed force to 0.49 N (50 gf) or less.
- When the LTPA245A is used, provide the shape of the platen support for the paper holder cover. Also, mount the platen block to its shape of the platen support on the paper holder cover. For the rotation support point, follow the position shown in **CHAPTER 7 APPEARANCE AND DIMENSIONS**.
- When the LTPA245B, LTPA245C, or LTPA245D is used, secure the platen block to the paper holder cover.

6.4 SETTING THE PAPER

Follow these precautions when setting the paper.

- Be sure to use the recommended paper described in this technical reference.
- Place the paper roll into the holder facing the thermal surface outward. Also, do not use paper with edges that are pasted or have turnups at the start of the roll. If they need to be used unavoidably, replace with new paper roll as soon as possible before the entire roll is used up.
- Keep the paper feed force to 0.49 N (50 gf) or less.

6.5 POSITIONING THE PAPER CUTTER

Design the position of the paper cutter so that the paper cutter is within the recommended range as shown below.
If the distance between the edge of the paper cutter and position reference hole A of the printer is less than 6.9 mm, the paper cutter may interfere with the platen block when it is opened or closed. If the distance between them is more than 7.5 mm, the paper is not pressed against the cutter edge and it is difficult to cut.
Figure 6-8 shows the recommended position

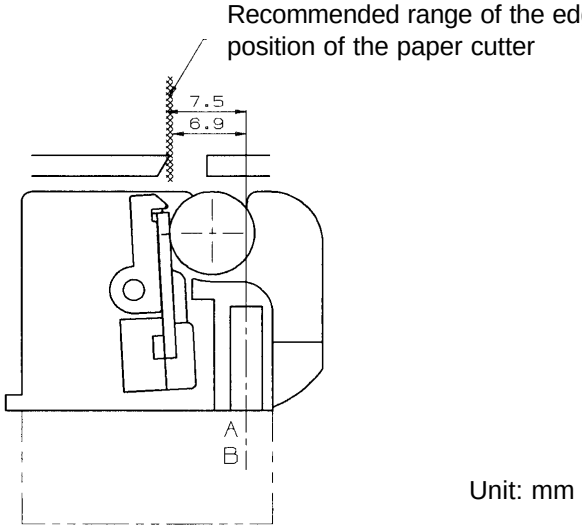


Figure 6-8 Paper Cutter Mounting Position

- Use a cutter with a sharp edge so that paper can be cut easily without excessive force.

Figure 6-9 shows the shape of the blade of the paper cutter that should be used.

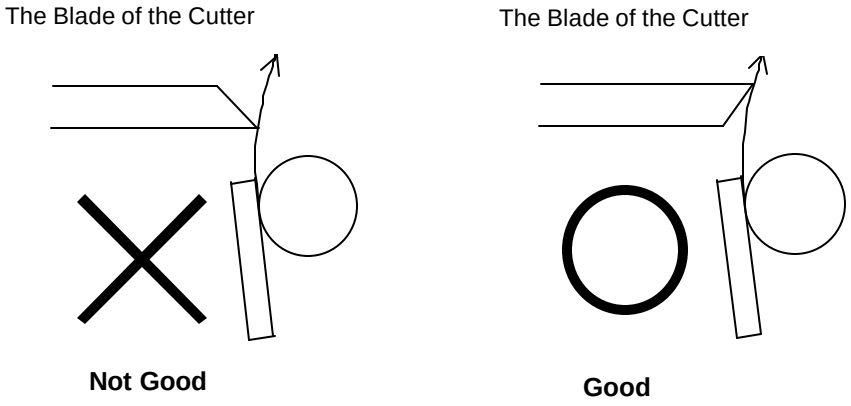


Figure 6-9 The Blade of the Paper Cutter

In the left cutter of **Figure 6-9**, the cut paper may be caught by the blade of the cutter and rolled inside. Therefore, use a cutter with the shape of a blade that will not catch the cut paper as in **Figure 6-9** to the right.

CHAPTER 7

APPEARANCE AND DIMENSIONS

Figures 7-1, 7-2, 7-3, 7-4, 7-5, 7-6, 7-7, 7-8, 7-9, 7-10, 7-11, 7-12, and **7-13** show the appearance and external dimensions of the LTPA245.

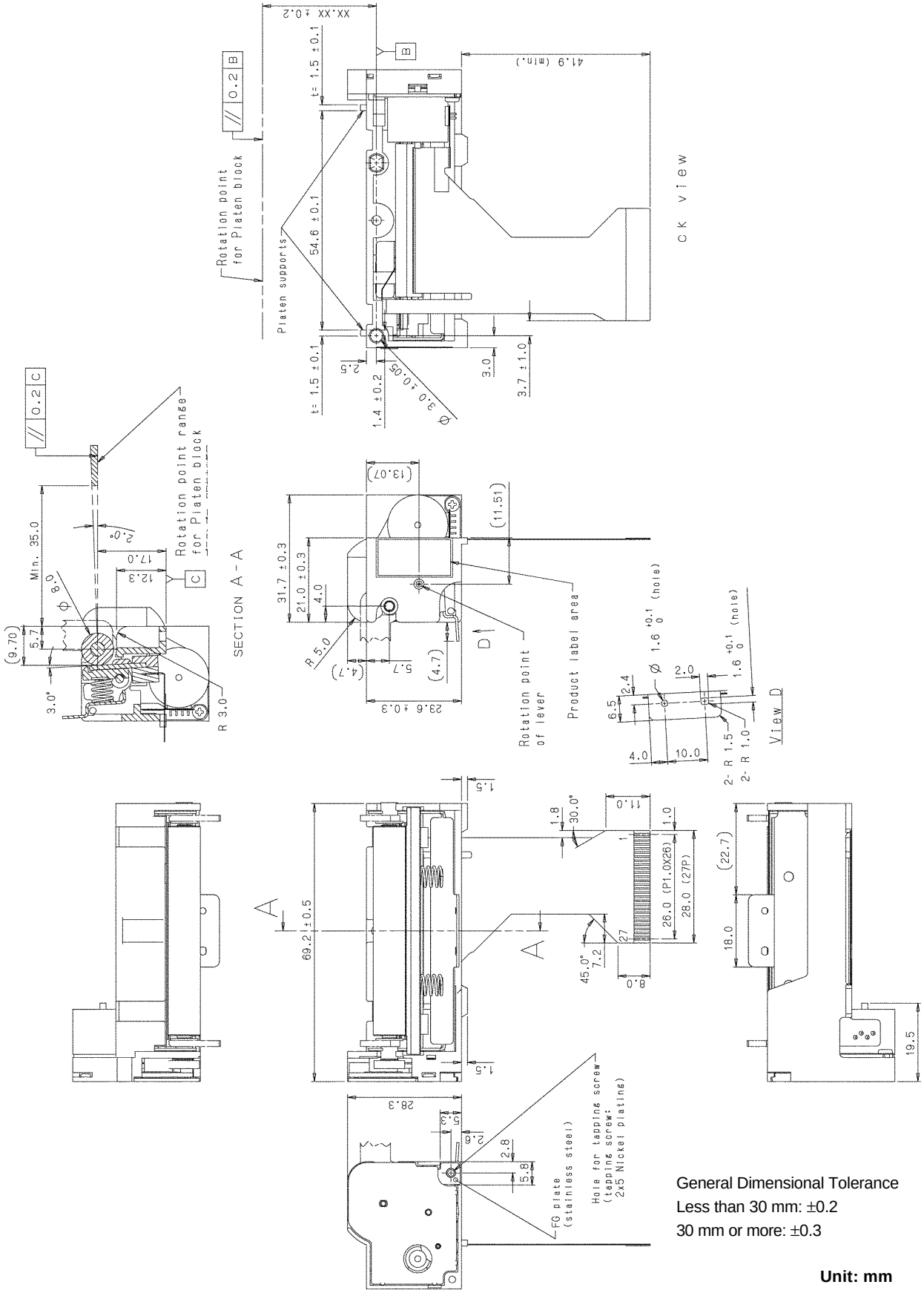
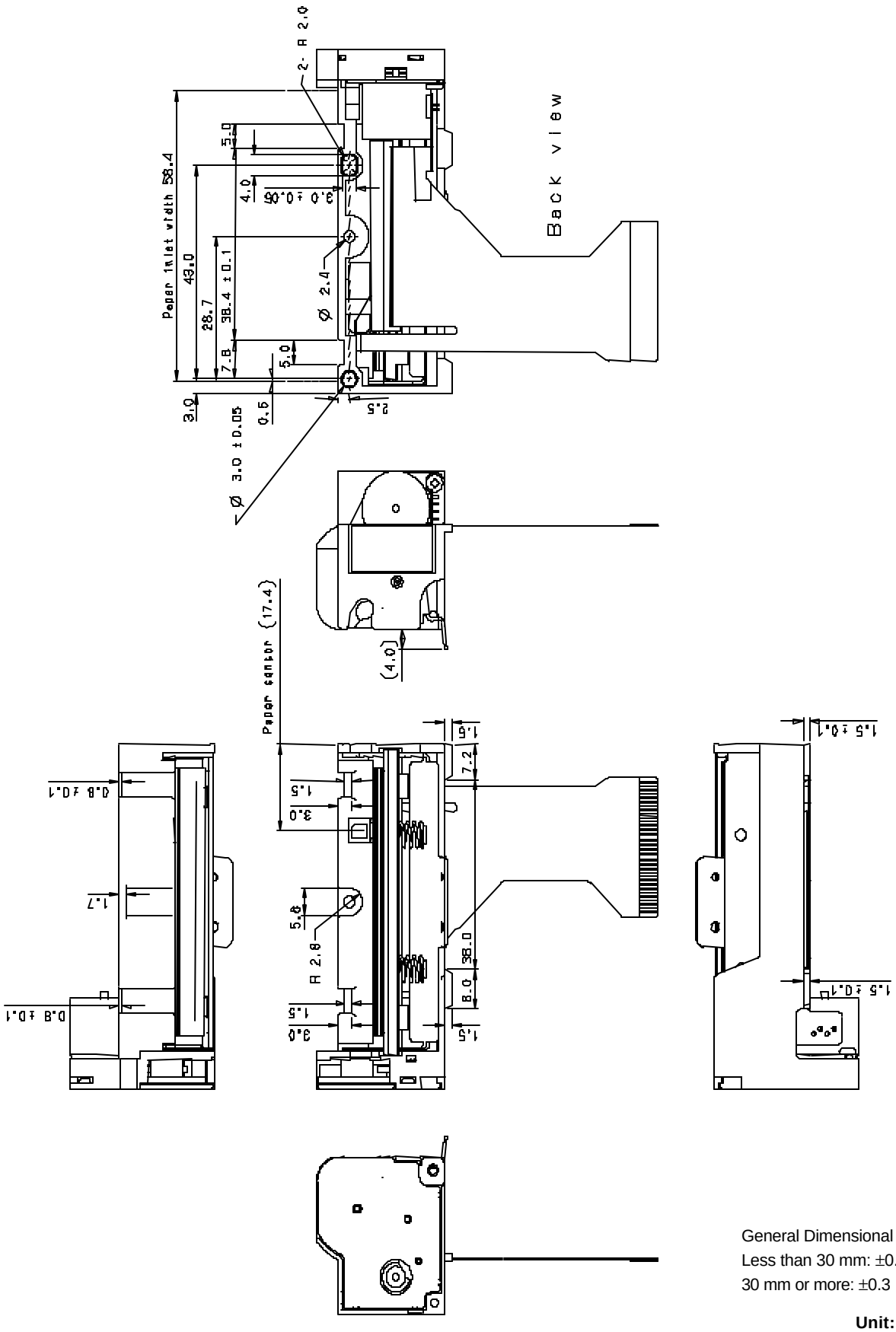


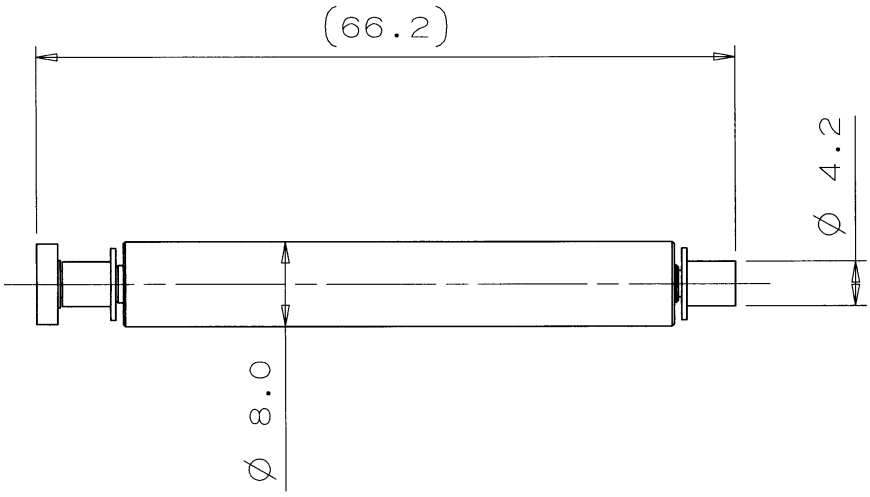
Figure 7-1 LTPA245A Appearance and Dimensions



General Dimensional Tolerance
Less than 30 mm: ±0.2
30 mm or more: ±0.3

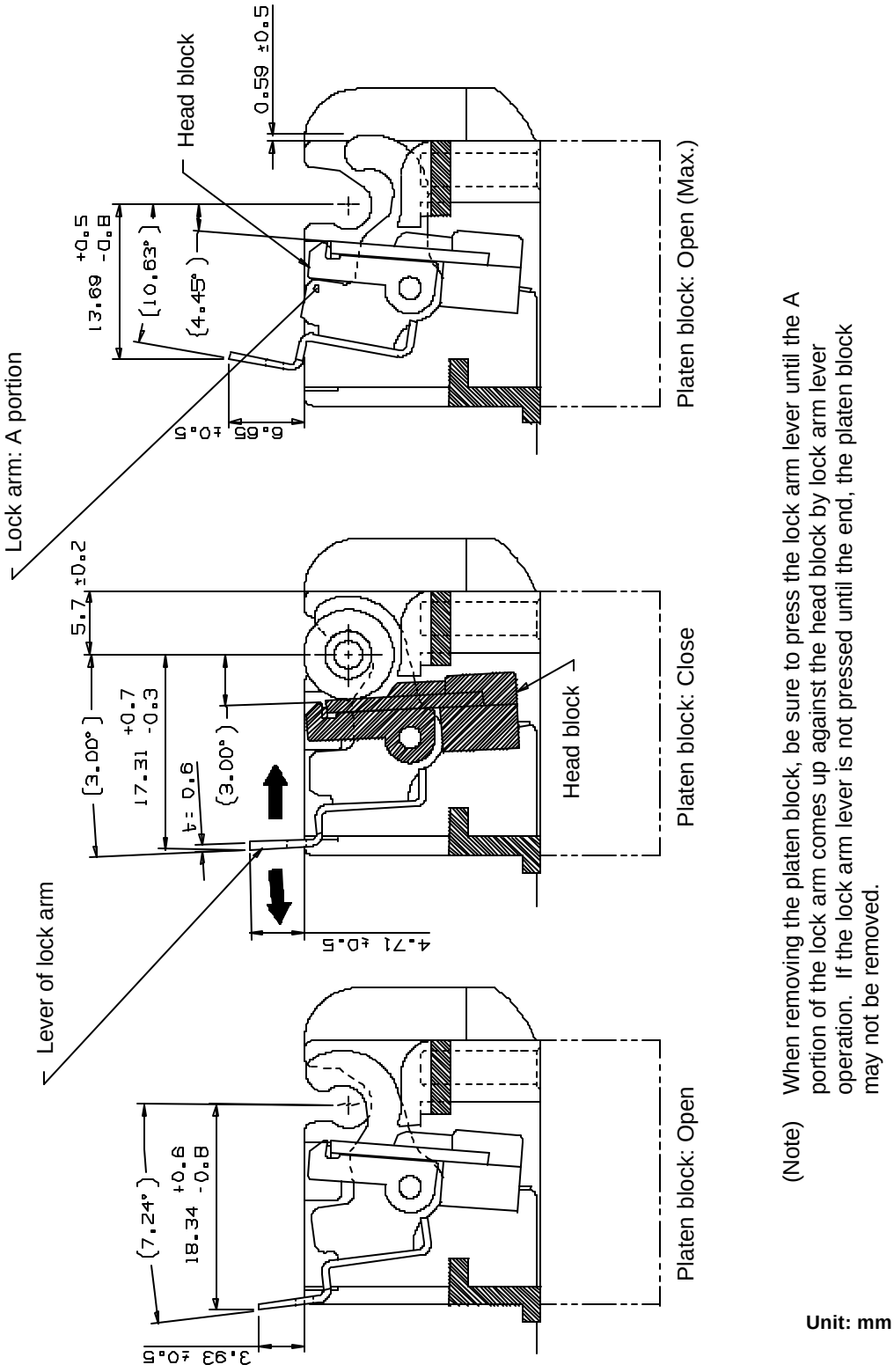
Unit: mm

Figure 7-2 LTPA245A Printer Main Body Appearance and Dimensions



Unit: mm

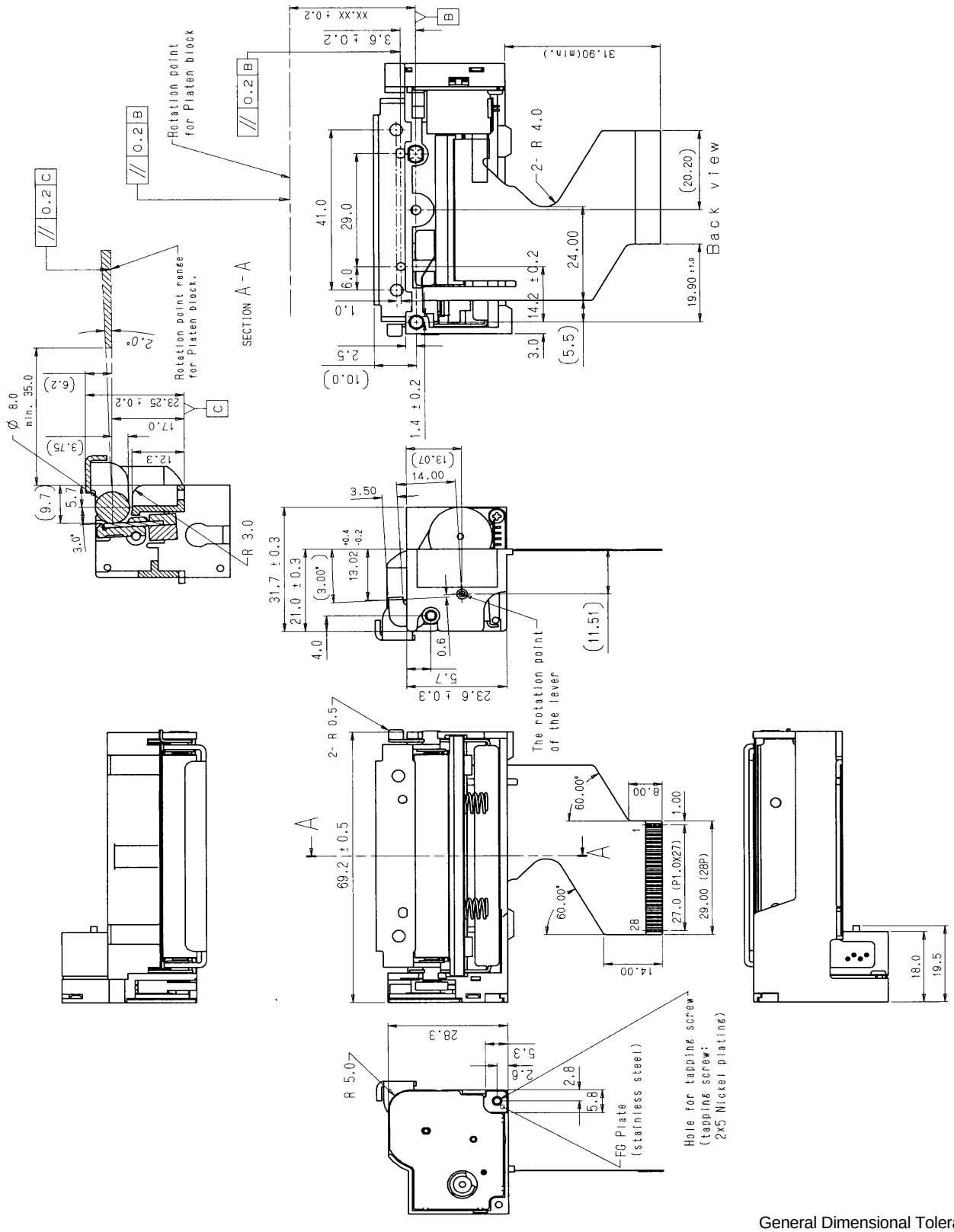
Figure 7-3 LTPA245A Platen Block Appearance and Dimensions



(Note) When removing the platen block, be sure to press the lock arm lever until the A portion of the lock arm comes up against the head block by lock arm lever operation. If the lock arm lever is not pressed until the end, the platen block may not be removed.

Unit: mm

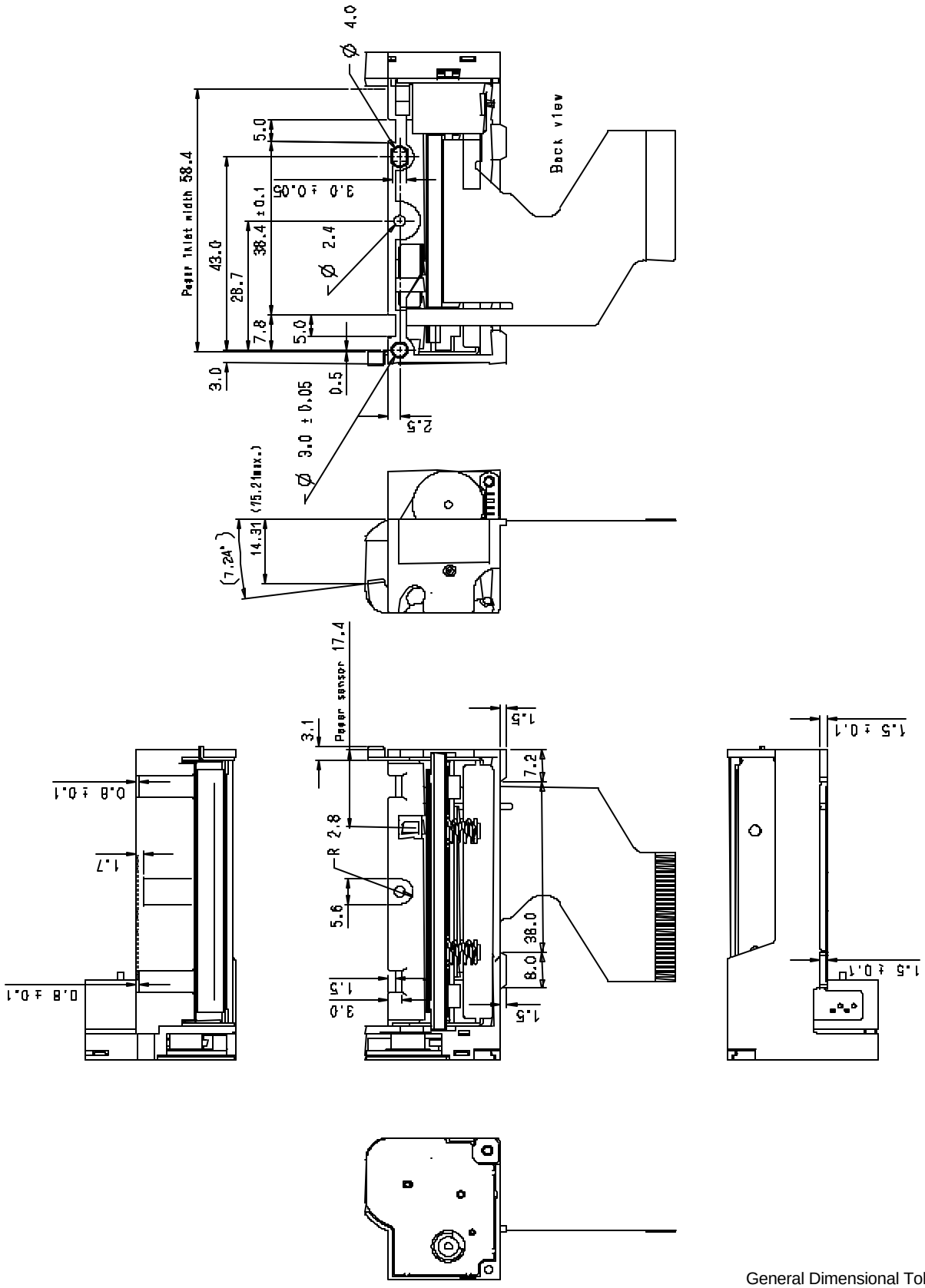
Figure 7-4 Lever of LTPA245A and LTPA245D Lock Arm and Head Block Operations



General Dimensional Tolerance
Less than 30 mm: ±0.2
30 mm or more: ±0.3

Unit: mm

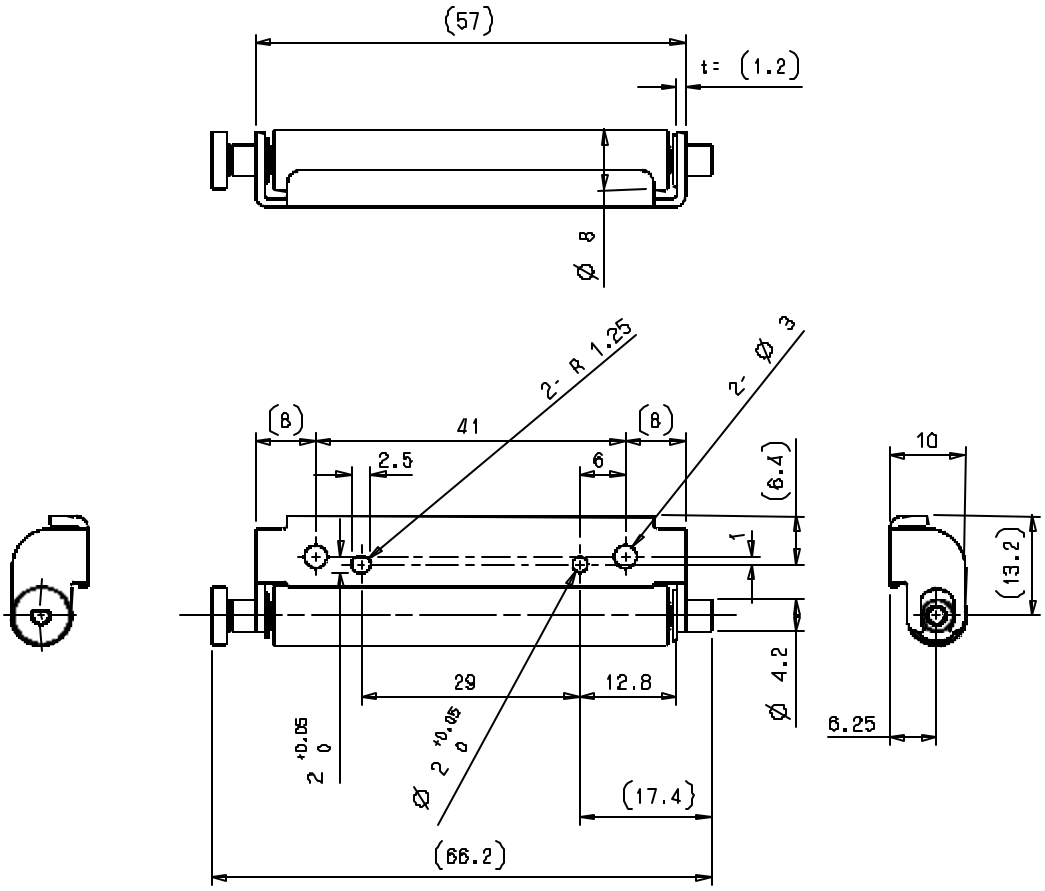
Figure 7-5 LTPA245B Appearance and Dimensions



General Dimensional Tolerance
Less than 30 mm: ±0.2
30 mm or more: ±0.3

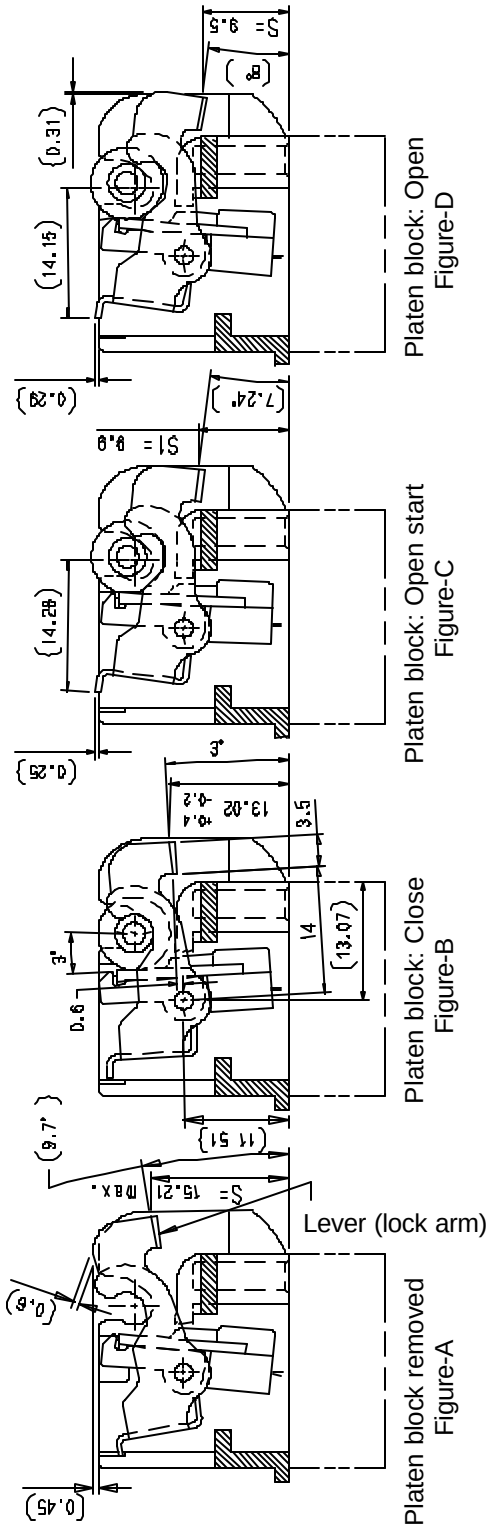
Unit: mm

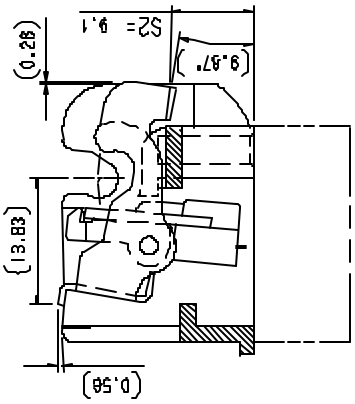
Figure 7-6 LTPA245B Printer Main Body Appearance and Dimensions



Unit: mm

Figure 7-7 LTPA245B, LTPA245C, and LTPA245D Platen Block Appearance and Dimensions





- Do not lower the lever at S2=9.1 mm or below as shown in Figure E. Doing so may cause function problems including lever deformation. To avoid it, provide the shape of a stopper on the operation lever or operation knob side when you design the lever and knob.
  If its shape is provided on the lever side of the printer, the lever will get deformed. (Figure E.)
- The range in which the platen block can be opened is S1=9.1 to S2=9.9 mm. (S=9.5±0.4 mm) (Figures C, D, E)
  When the platen block is opened, lift the platen block upward when the lever is placed within this range.

Unit: mm

Figure 7-8 Lever of LTPA245B Lock Arm and Head Block Operations

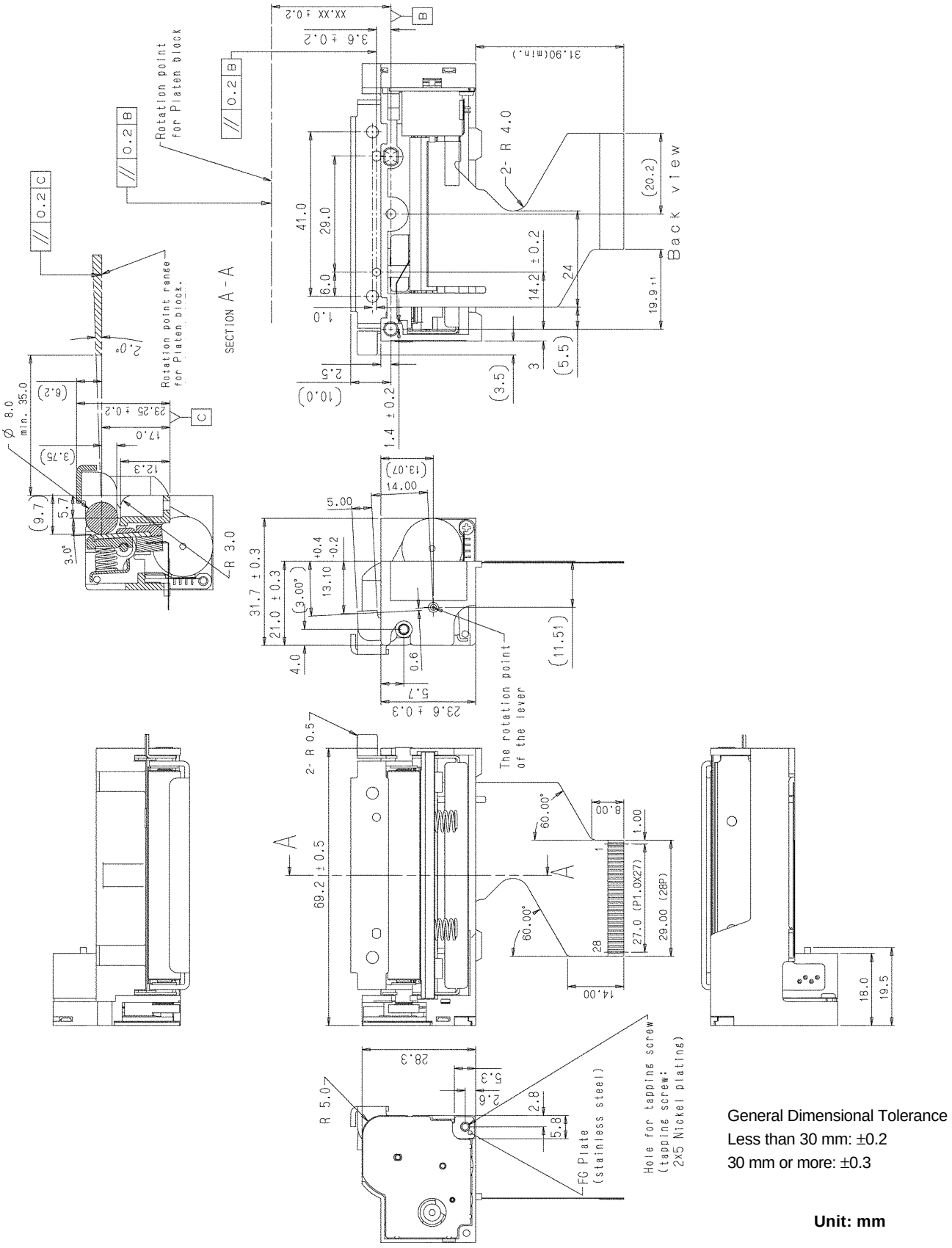


Figure 7-9 LTPA245C Appearance and Dimensions

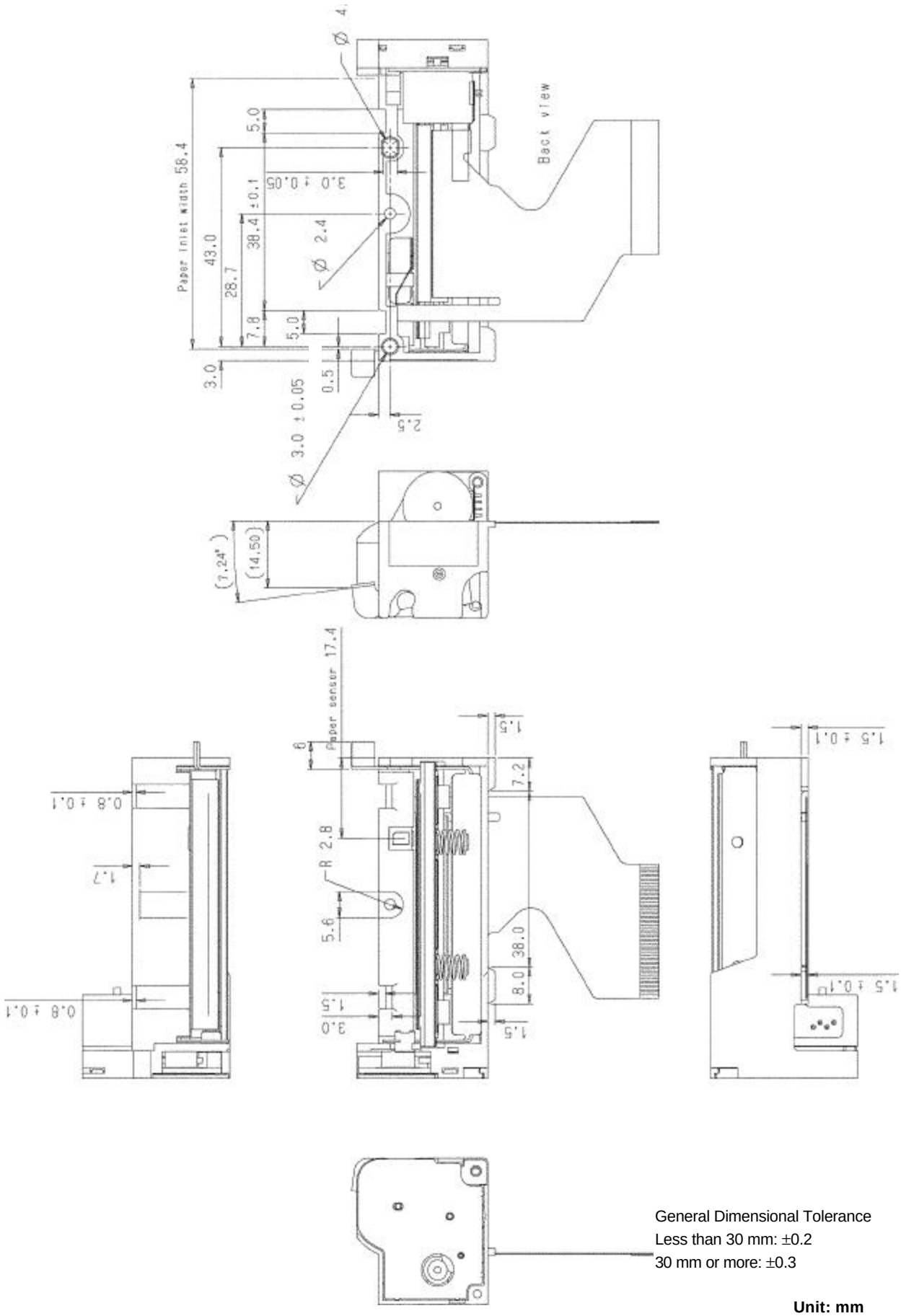
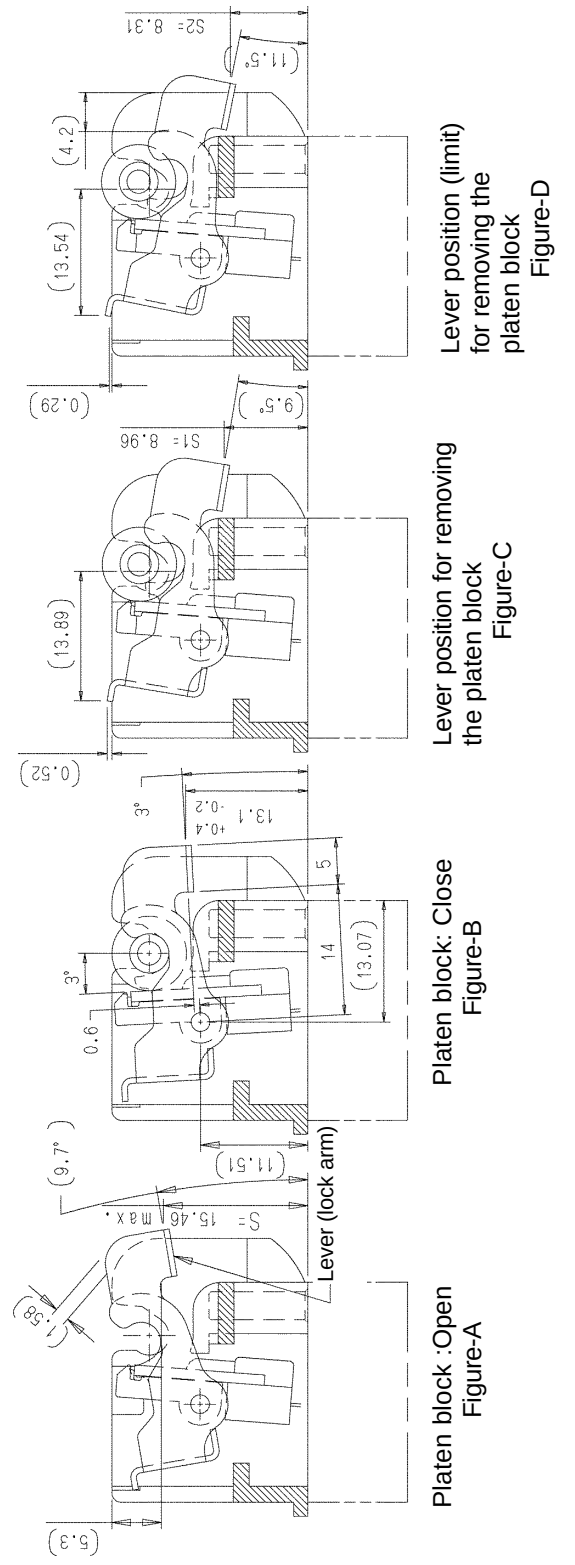


Figure 7-10 LTPA245C Printer Main Body Appearance and Dimensions



- Do not lower the lever at S2=8.31 mm or below as shown in Figure D. Doing so may cause function problems including lever deformation. To avoid it, provide the shape of a stopper on the operation lever or operation knob side when you design the lever and knob.
  If its shape is provided on the lever side of the printer, the lever will get deformed. (Figure D.)
- The range in which the platen block can be opened is S2=8.31 to S1=8.96 mm. (Figures C and D)

General Dimensional Tolerance
Less than 30 mm: ±0.2
30 mm or more: ±0.3

Unit: mm

Figure 7-11 Lever of LTPA245C Lock Arm and Head Block Operations

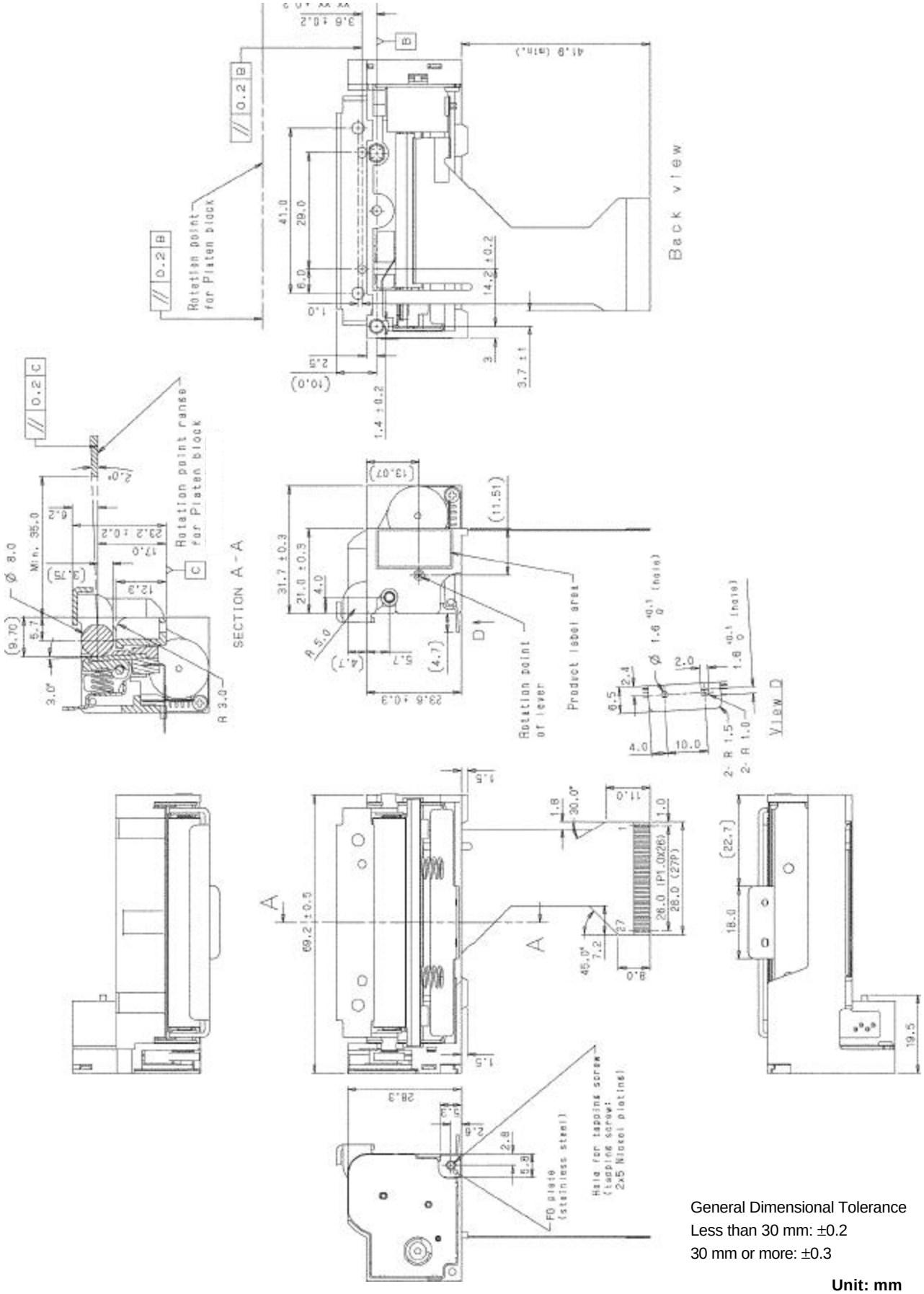


Figure 7-12 LTPA245D Appearance and Dimensions

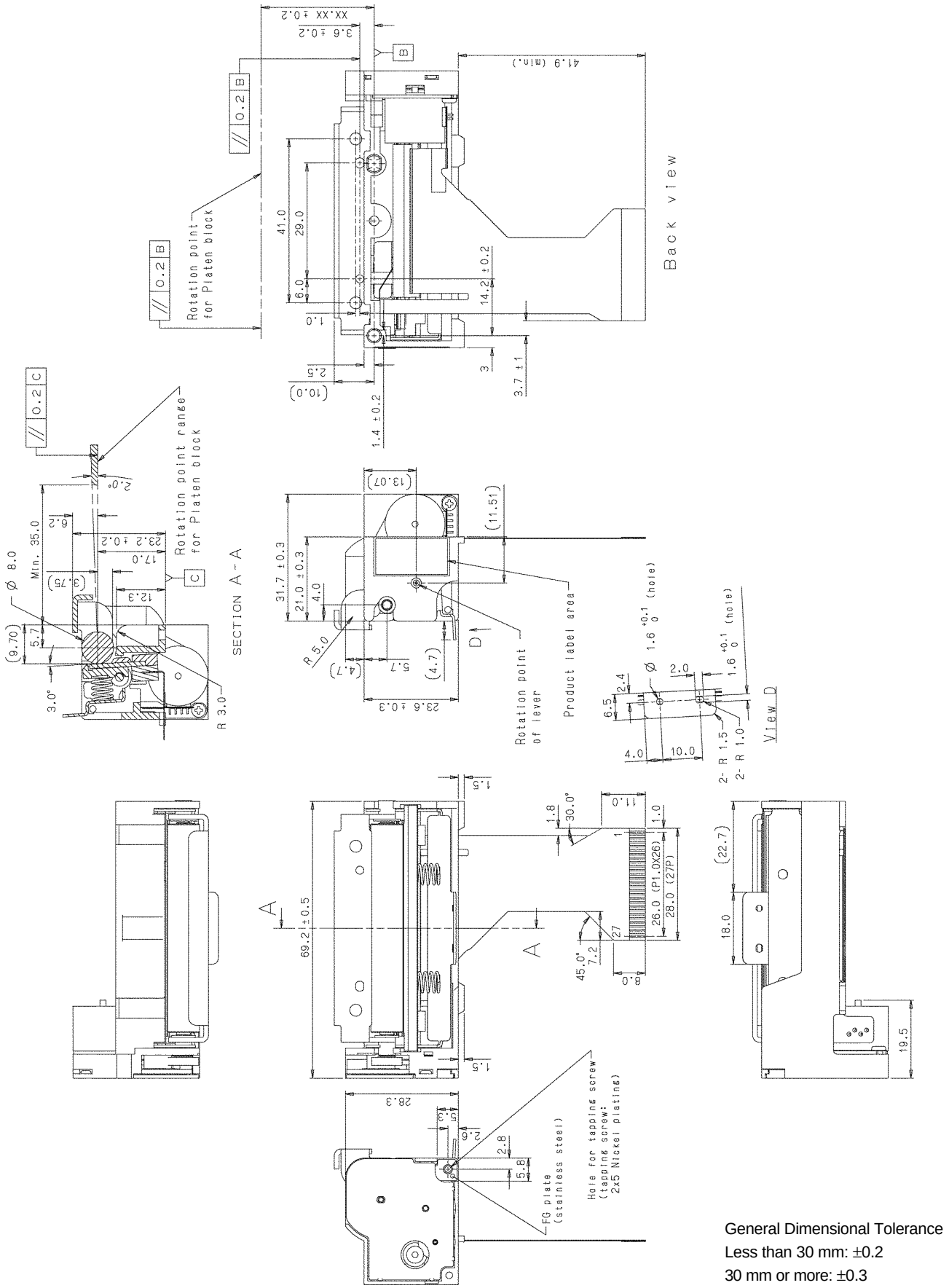


Figure 7-13 LTPA245D Printer Main Body Appearance and Dimensions

CHAPTER 8

LOADING/UNLOADING PAPER AND HEAD CLEANING

8.1 LOADING/UNLOADING PAPER PRECAUTIONS

8.1.1 LTPA245A and LTPA245D Procedures for Loading/Unloading Paper

1) Loading paper

- Turn the lever (projection) of the lock arm in the direction of the arrow shown in **Figure 8-1**.

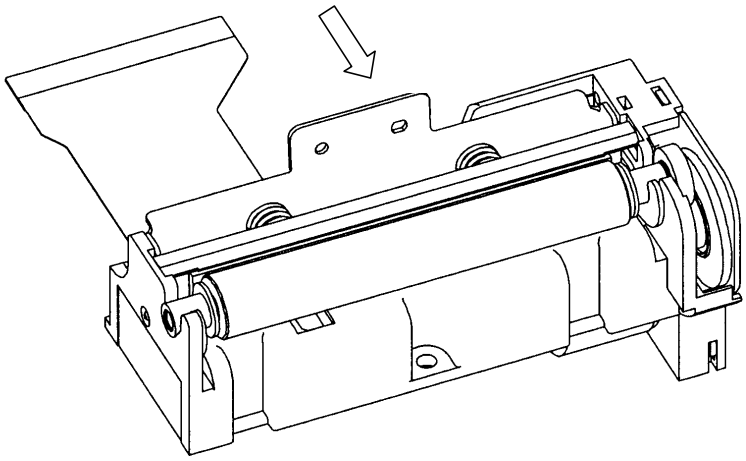


Figure 8-1 Loading Paper (1)

- After confirming that the platen block has separated from the printer mechanism, lift the platen block up (Open state).

- Insert the paper vertically into the printer. (See **Figure 8-2**).
  Pull the paper outside the paper outlet and place the platen block into the printer mechanism firmly. Make sure that the platen block locks with a click (Close state).

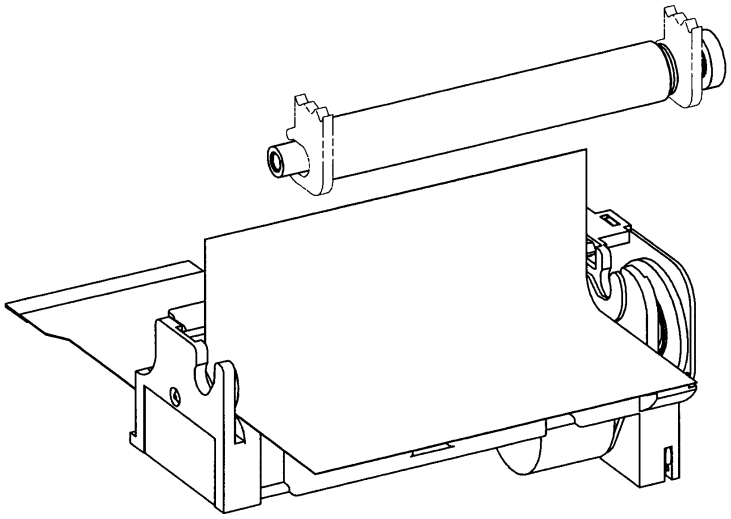


Figure 8-2 Loading Paper (2)

- Opening the platen block exposes the reduction gear. Since damage to the gear will cause paper feed problem, take care not to damage the gear during handling. Moreover, make sure there is no foreign matter on the gear.

- The paper detector (photo interrupter) may not operate properly if covered with foreign matter. Therefore, if you find foreign matter on the detector, remove it and clean the detector.

- If the paper skews, feed the paper so that it returns to normal, first, then take it out and set it again.

2) Unloading paper

- Open the platen block and remove the paper.

3) Removing jammed paper

- Open the platen block and remove any jammed paper.

- Do not pull the paper by force.

8.1.2 LTPA245B and LTPA245C Procedures for Loading/Unloading Paper

1) Loading paper

- Turn the lever (projection) of the lock arm in the direction of the arrow shown in **Figure 8-3**. (for LTPA245B)
- Turn the lever (projection) of the lock arm in the direction of the arrow shown in **Figure 8-3** to open the platen block. (for LTPA245C)

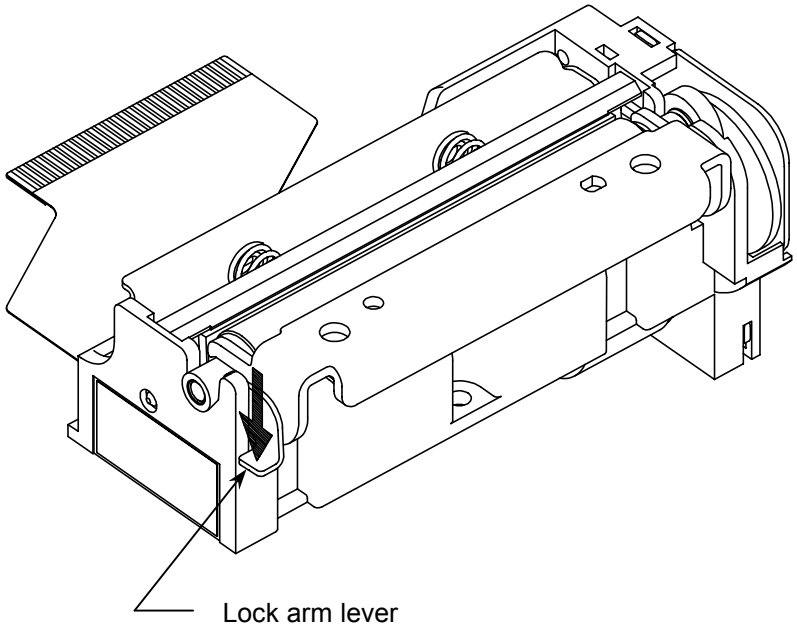


Figure 8-3 Loading Paper (1)

- While the lever of the lock arm is pressed down until the open position of the platen block, lift the platen block up (LTPA245B: Open state).
- After confirming that the platen block has separated from the printer mechanism, lift the platen block up (LTPA245C: Open state).
- Insert the paper vertically into the printer. (See **Figure 8-4.**)
  Pull the tip of the paper outside the paper outlet and place the platen block firmly into the printer mechanism. Make sure that the platen block locks with a click (Close state).

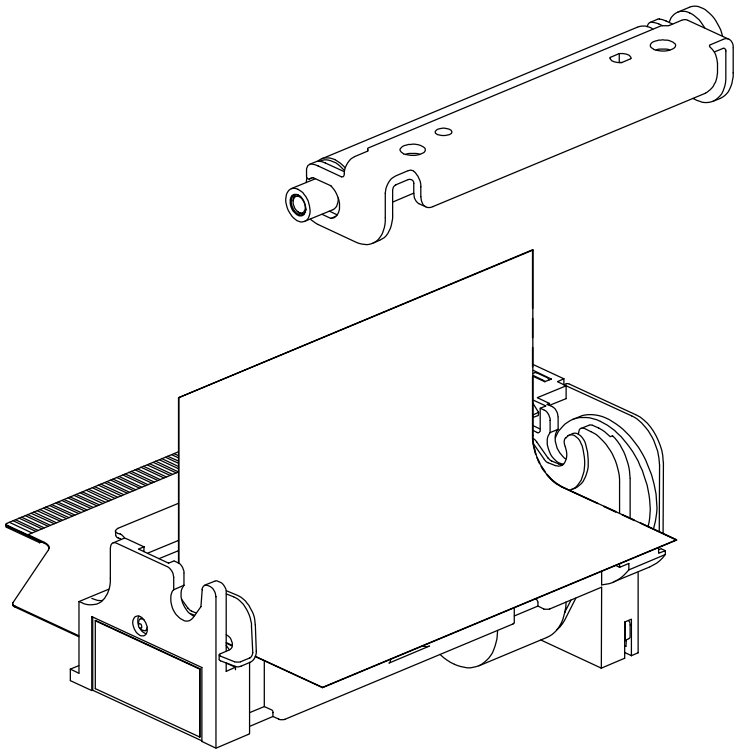


Figure 8-4 Loading Paper (2)

- A reduction gear exposes in the open position of the platen block. Operate the reduction gear carefully so as not to be damaged. The reduction gear damage affects paper feed difficulties. Verify no foreign substances on the reduction gear.
- If foreign substances are attached to or accumulated on the paper sensor (photo-interrupter), a detection error may occur.
- If the paper is skewed, feed the paper until the paper is set straight or mount the paper again.

2) Unloading paper

- Unload the paper in the open position of the platen block.

3) Removing jamming paper

- Remove the jamming paper in the open position of the platen block.
- Do not pull the paper by force.

8.2 HEAD CLEANING PROCEDURE AND PRECAUTIONS

8.2.1 Precautions

1) Do not clean the thermal head immediately after printing because thermal head and its periphery are hot during and after printing.

2) Do not use sandpaper, cutter knives etc. when cleaning. They will damage the heat elements.

8.2.2 Procedures

1) Set the platen block to the Open state following the procedure for loading paper described in **Sections 8.1.1 1)** and **8.1.2 1)**.

2) Clean the heat elements using a cotton swab soaked in ethyl or isopropyl alcohol.

3) Wait until the alcohol dries and close the platen block (Close state).

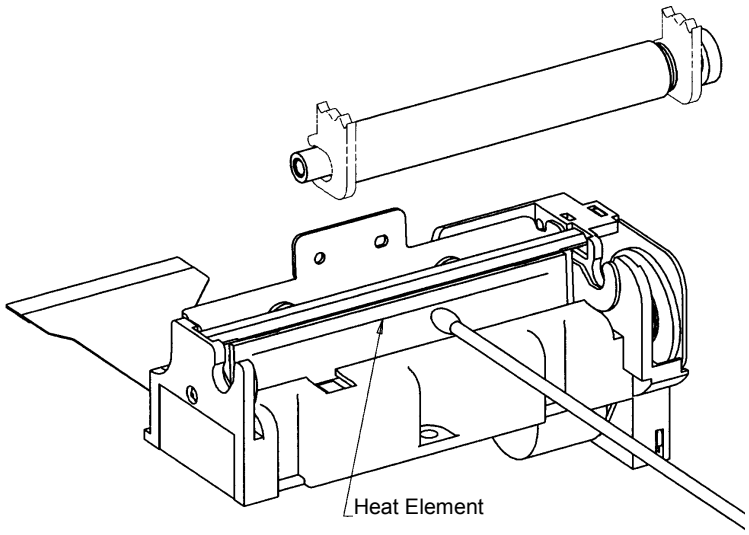


Figure 8-5 Head Cleaning Procedure