ANSI/SMPTE 250M-1996
Revision of
ANSI/SMPTE 250M-1991

SMPTE STANDARD

for Television Analog Recording — 1/2-in Type M-2 — Tapes and Cassettes

1 Scope

This standard specifies tapes and cassettes for the 1/2-in type M-2 helical-scan video tape recording system.

2 General specifications

2.1 Dimensions are in the metric system.

2.2 Tests and measurements for confirming the requirements of this standard shall be made under the following conditions unless otherwise specified:

- Temperature: 20°C ± 1°C
- Relative humidity: (50 ± 2)%
- Barometric pressure: 86 kPa to 106 kPa

2.3 Specimens shall be stored under the test conditions specified in 2.2 for 24 hours prior to the test.

3 Cassette types

There are two cassette types which are identified by outside dimensions shown below:

- Large cassette (L): 106 x 188 x 25 mm
- Small cassette (S): 87 x 130 x 25 mm

4 Video tape

The video tape shall have the following characteristics:

4.1 Type of video tape: Metal particle

4.2 Base material: Polyethylene terephthalate or its equivalent

4.3 Direction of particle orientation: Longitudinal direction of tape

4.4 Coercivity: Class 1500

4.5 Light transmissivity: 5% or less (measured over the range of wavelengths 700 nm to 900 nm).

4.6 Total thickness: 13.5 µm ± 0.5 µm

4.7 Width: 12.65 mm ± 0.01 mm

4.8 Width fluctuation: 6 µm or less

5 Leader tape and trailer tape

The leader tape and trailer tape shall have the following characteristics:

5.1 Light transmissivity: 50% or more (measured over the range of wavelengths 700 nm to 900 nm)

5.2 Length:

- Large cassette: 170 mm ± 15 mm
- Small cassette: 140 mm ± 10 mm

Length of the leader and trailer tape is defined between the end of the leader or trailer tape to a point where this tape is attached by a splicing tape to the metal particle tape.

5.3 Tape thickness: 13 µm to 36 µm

5.4 Width: 12.65 mm ± 0.02 mm

5.5 Splicing tape length: 13 mm to 20 mm

5.6 Splicing tape thickness: 25 µm or less

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5.7 Splicing strength to reel hub: 20 N or more

5.8 Splicing strength to video tape: 20 N or more

5.9 Breaking strength of leader tape: 30 N or more

5.10 Offset yield strength of leader tape: 18 N or more

6 Video tape length and record/play-back time

Tape length and record/playback time specifications shall be as given in tables 1 and 2.

7 Video cassette

The video cassette shall be specified by the following descriptions:

7.1 Cassette dimensions

Large cassettes shall conform to figures 1 to 8. Small cassettes shall conform to figures 9 to 20.

Table 1 – Definition of play/record time for large cassette

Record/play Time (min)	Tape Length (m)
95	389^{+3}_{0}
65	267^{+3}_{0}
35	145^{+3}_{0}
23	96^{+3}_{0}
12	51^{+3}_{0}

Table 2 – Definition of play/record time for small cassette

Record/play Time (min)	Tape Length (m)
23	96^{+3}_{0}
12	51^{+3}_{0}

7.2 Cassette datum system

7.2.1 Datum holes

Datum holes shall be holes serving as a reference when loading a cassette in the video tape recorder, and shall also be the datum reference of the cassette dimensions (see figures 2 to 4 and 10 to 12).

7.2.2 Datum plane Z

Datum plane Z shall be a plane containing three datum places, A, B, and C, on the cassette bottom (see figures 4 and 12).

7.2.3 Datum plane X

7.2.3.1 Large cassette

This plane shall be orthogonal to datum plane Z containing the centerlines of datum holes A and B (see figures 2 to 4).

7.2.3.2 Small cassette

This plane shall be parallel to the long side face of the cassette and shall be orthogonal to datum plane Z, containing the centerline of datum hole A (see figures 10 to 12).

7.2.4 Datum plane Y

Datum plane Y shall be a plane orthogonal to both datum planes Z and X, containing the centerline of datum hole A (see figures 2 to 4 and 10 to 12).

7.3 Window and label pasting face

Large cassettes shall conform to figure 1 and small cassettes to figure 9.

7.4 Identification holes

Multiple holes shall be provided for identifying the conditions of the cassette (see figures 2 and 10). Each hole may be set in a closed state or an opened state:

– Closed state: The hole depth shall be 0 mm to 0.25 mm and shall withstand a force of 0.5 N.

– Opened state: The hole diameter shall be 3 mm + 0.3 mm -- 0.1 mm. The hole depth shall be 5 mm or more.

7.4.1 Record lock-out identification hole

Large cassettes shall be as specified in figure 2 and small cassettes as in figure 10.

The record lock-out identification hole shall be coupled to the record lock-out mechanism shown in figures 1 and 9, and may be changed between the closed state and the opened state. Each state shall be defined as follows:

– Identification hole closed: Ready to record
– Identification hole opened: Record lock out

7.4.2 Tape type identification hole

Large cassettes shall be as specified in figure 2 and small cassettes as in figure 10.

The closed or opened state of the identification hole shall be defined as follows:

– Identification hole closed : Metal particle tape (coercivity class 1500)

– Identification hole opened: Reserved

7.4.3 Tape thickness identification hole

Large cassettes shall be as specified in figure 2 and small cassettes as in figure 10.

The closed or opened state of the identification hole shall be defined as follows:

– Identification hole closed: Tape total thickness is 13.5 μm ± 0.5 μm

– Identification hole opened: Reserved

7.4.4 Additional identification holes

These holes are provided for future usage. The positions of these reserved holes shall be as follows: Large cassettes shall be as specified in figure 2 (five holes) and small cassettes shall be as specified in figure 10 (two holes).

7.5 Dimensions of the reel shall conform to figures 6, 14, and 15.

7.6 The tape winding method and path shall conform to figures 7 and 16.

7.7 The E value shall be 1.0 mm or more (see note 4 of figure 5 and note 5 of figure 13).

7.8 The structure of the lid shall conform to figures 8 and 17. The lid shall be unlocked when a force of not more than 0.15 N for large cassettes or a force of not more than 0.30 N for small cassettes is applied to the unlocking clutch as given in note 8 of figure 1, note 6 of figure 9, and figure 19.

7.9 The force necessary for opening the lid given in note 7 of figure 3 and figure 17 shall be 1 N or less.

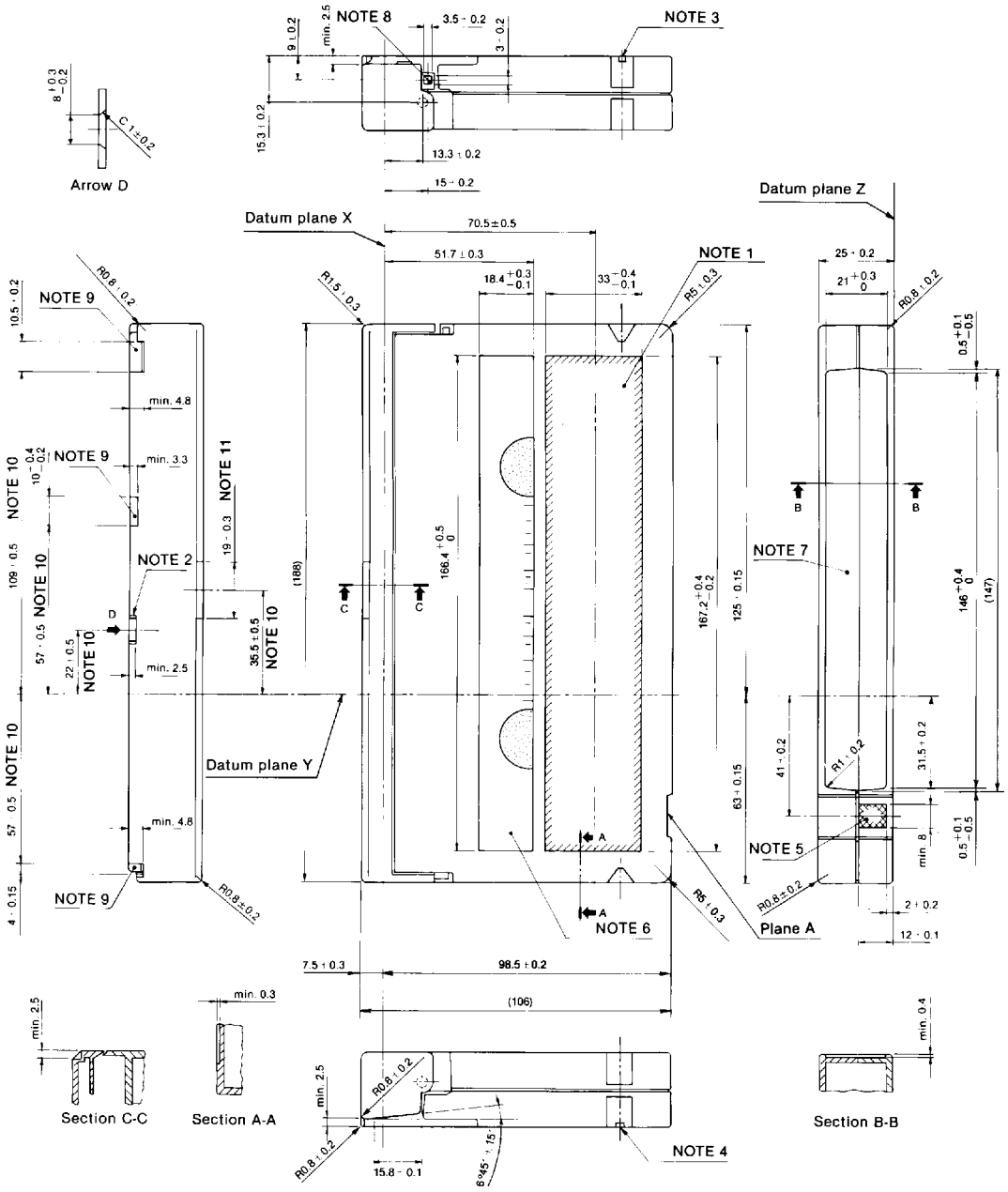
7.10 The reel brakes shall be released by a force of not more than 0.7 N by means of a reel brake unlocking pin as given in note 4 of figure 3 and note 3 of figure 11.

7.11 The cassette reels shall be pushed down by a reel spring with a force of 2.0 N ± 0.3 N for large cassettes and 1.5 N ± 0.3 N for small cassettes, as shown in figure 5(b) and figure 13(b).

7.12 The minimum space required for the recorder and/or player loading mechanism shall be as shown in figure 18.

7.13 Screw positions

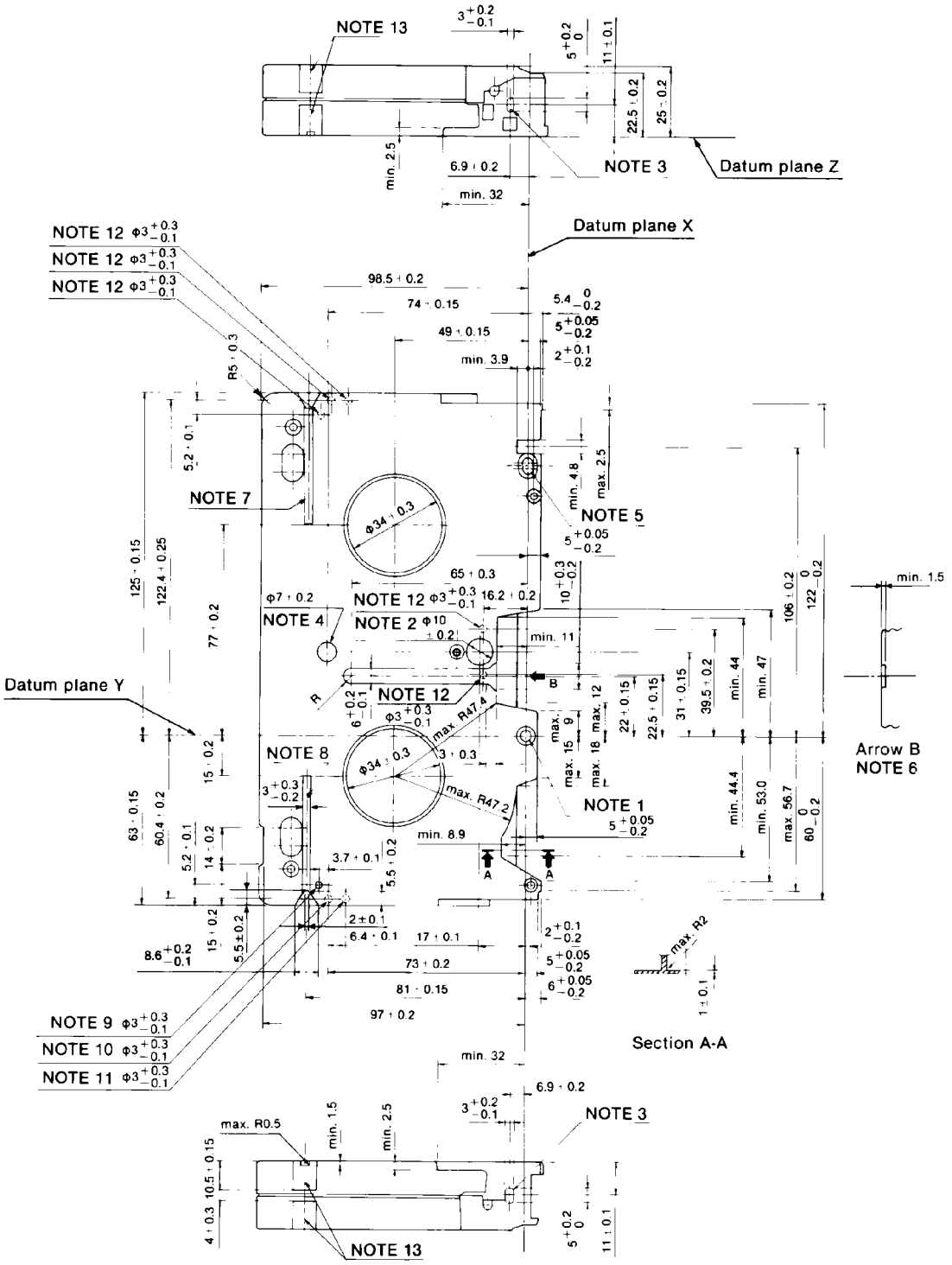
Screw positions for assembling the upper and lower cassette halves should be as shown in figure 8 (large cassette) and figure 20 (small cassette). The diameter of the spot facing for the screw head should be within 3.8 mm to 6.2 mm. The diameter of the spot facing for the screw head described in note 1 of figure 20 shall be 5.3 mm to 5.7 mm. No screw head shall protrude beyond the cassette surface.



NOTES

1 Top label pasting face. The label shall not protrude beyond the cassette height.
2 Guide groove A to prevent misinsertion (dimension at the lid is shown).
3 Guide groove B to prevent misinsertion.
4 Guide groove C to prevent misinsertion.
5 Operation of record lock-out hole. When the record lock-out hole is open, recording should be impossible. The minimum hole depth is 2.9 mm from plane A. When the hole is closed, recording should be possible. The record lock-out mechanism shall be coupled with the identification hole given in note 9 of figure 2.
6 Window. This window shall not protrude beyond the cassette height.
7 Side label face. The label shall not protrude beyond the cassette side.
8 Lid unlocking clutch.
9 Cassette front positioning face.
10 These tolerances include a slight play of the lid.
11 Recess to prevent misinsertion.

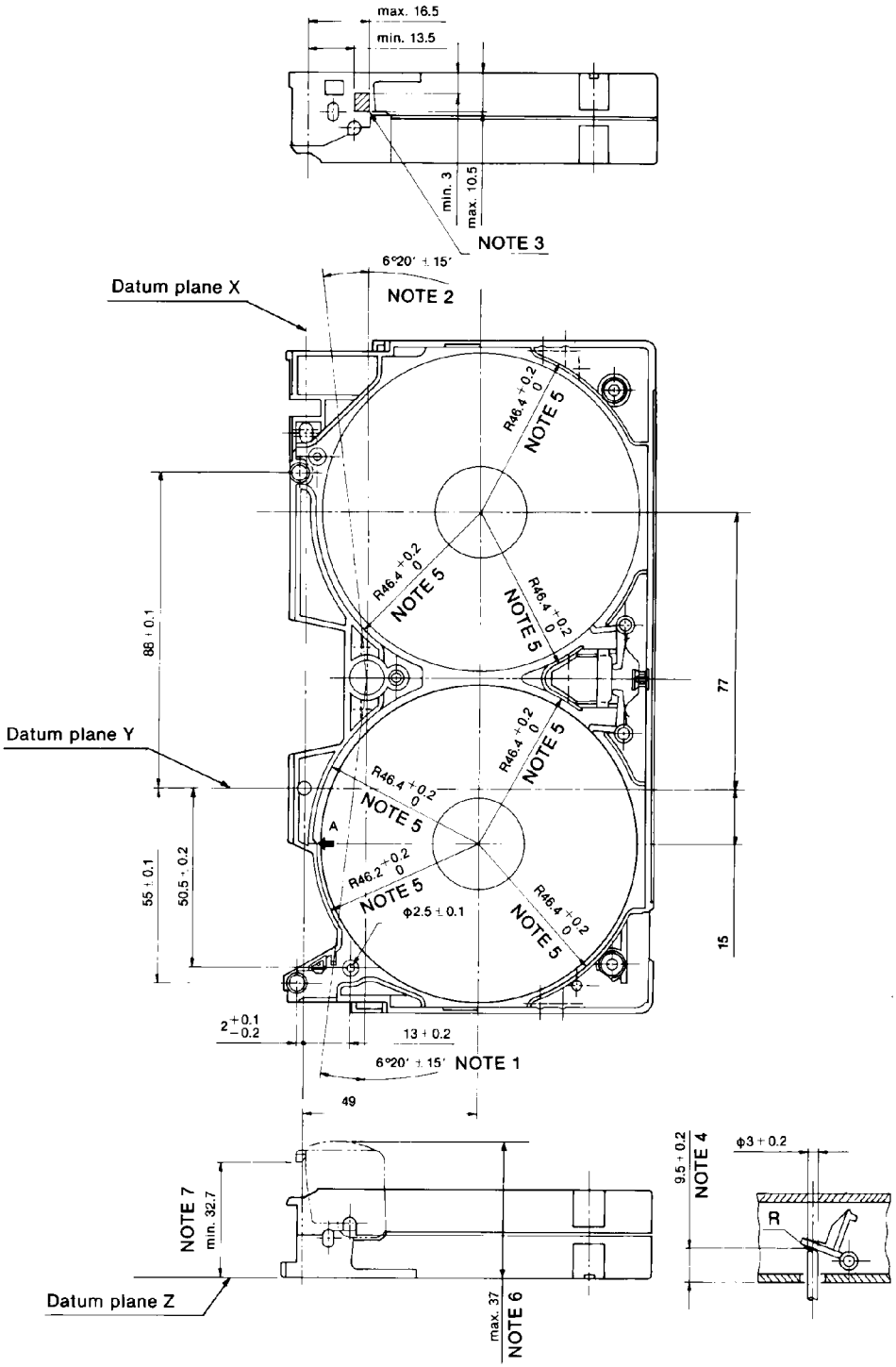
Figure 1 -- Top and side views of large cassette



NOTES

1 Datum hole A.
2 Hole for the sensor lamp.
3 Holes for the sensor optical path.
4 Reel brake unlocking hole.
5 Datum hole B.
6 Guide groove A to prevent misinsertion.
7 Guide groove B to prevent misinsertion.
8 Guide groove C to prevent misinsertion.
9 Record lock-out identification hole.
10 Tape type identification hole.
11 Tape thickness identification hole.
12 Extra identification holes (five holes).
13 Grip for automatic loading machine.

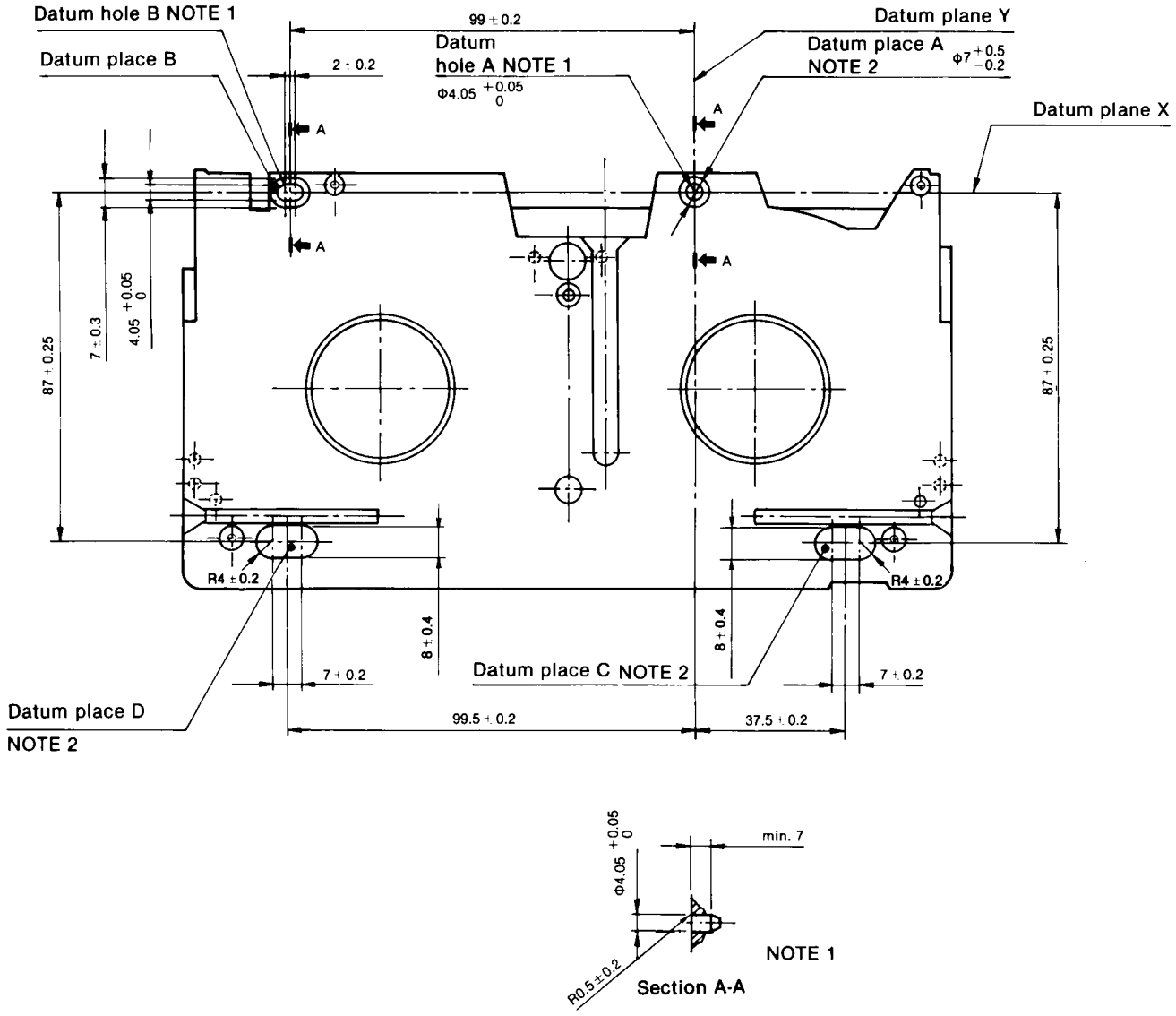
Figure 2 -- Bottom view of large cassette



NOTES

1 Supply side sensor optical path angle.
2 Take-up sensor optical path angle.
3 Pushing position of the lid unlocking device.
4 Position of the brake unlocking pin of the recorder.
5 The space of this dimension shall be maintained throughout the entire circumference of the inner wall.
6 Maximum permissible height when the lid is opened.
7 The lid minimum opening dimension. This dimension shall be applied over the cassette front tape threading range (see figure 7 for tape threading path).

Figure 3 -- Inner structure of large cassette

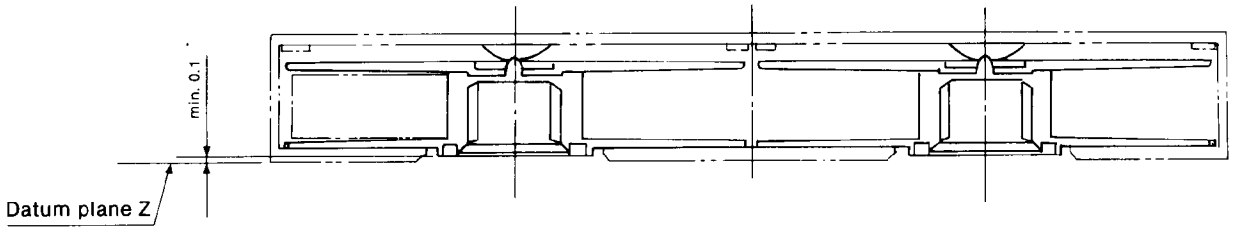


NOTES

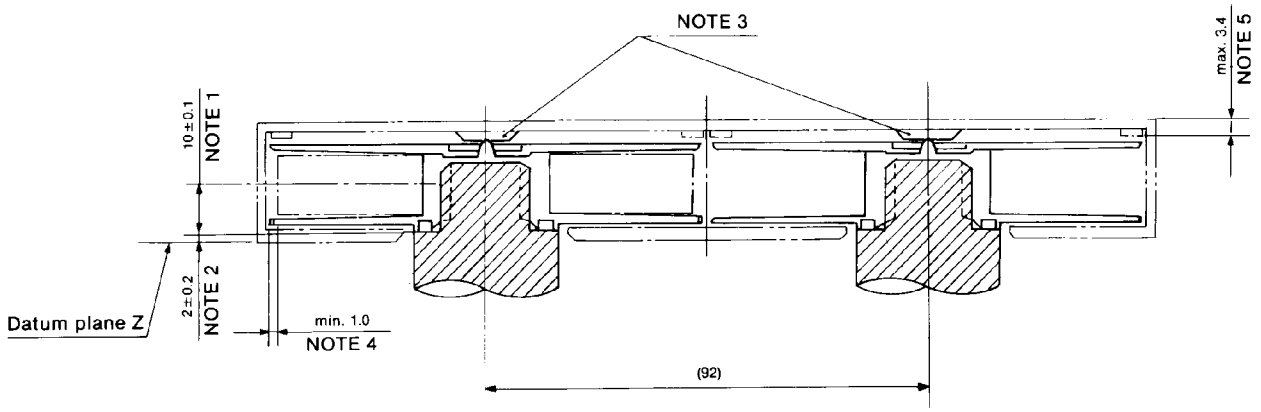
1 The diameter of the datum hole in section A-A shall be 4.05 mm + 0.05 mm – 0.00 mm and 7 mm in depth.
2 The flatness of the four datum places shall be 0.2 mm or less. The datum places are used as the supporting surfaces of the cassette.

Figure 4 -- Datum places and support surfaces of large cassette

(a) Condition off the machine



(b) Condition loaded on the machine



NOTES

1 Centerline of tape.
2 Height of reel stand above cassette datum plane Z. The cassette tape reel shall be smoothly operated at a height of 2.0 mm ± 0.2 mm.
3 Reel springs.
4 E value (a margin between reel flange outside diameter and maximum wound tape diameter).
5 Reel stoppers to limit the play of the reel.

Figure 5 -- Relationship between reels and reel stands for large cassette

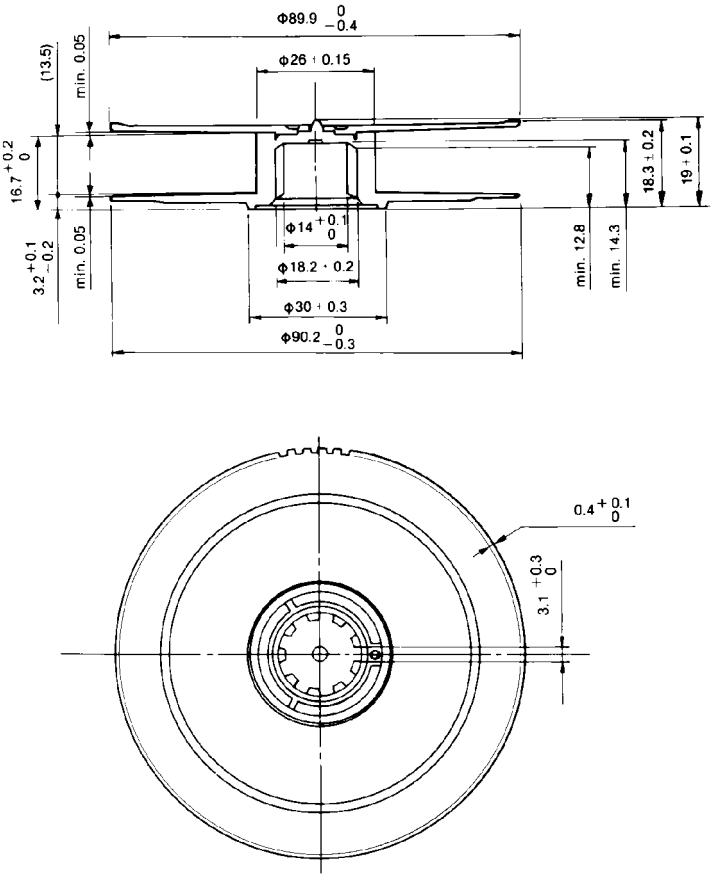


Figure 6 -- Reel dimensions of large cassette

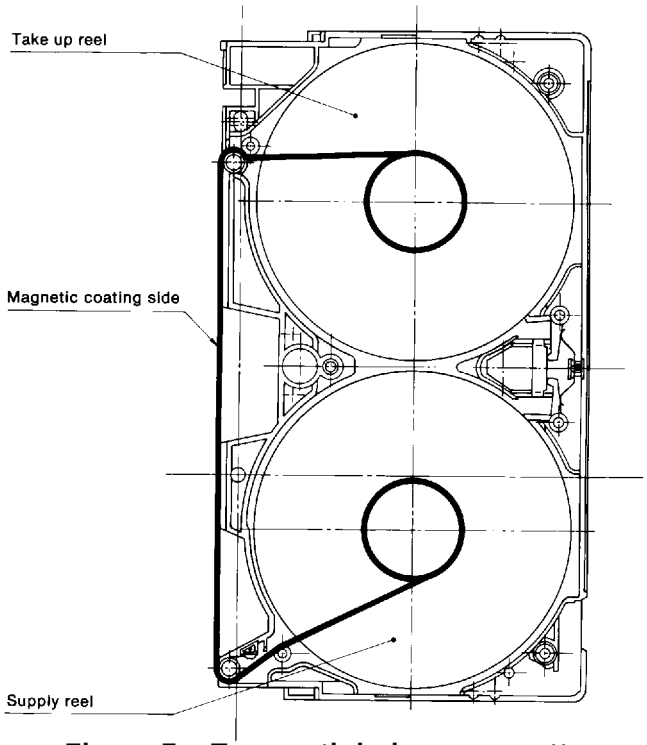
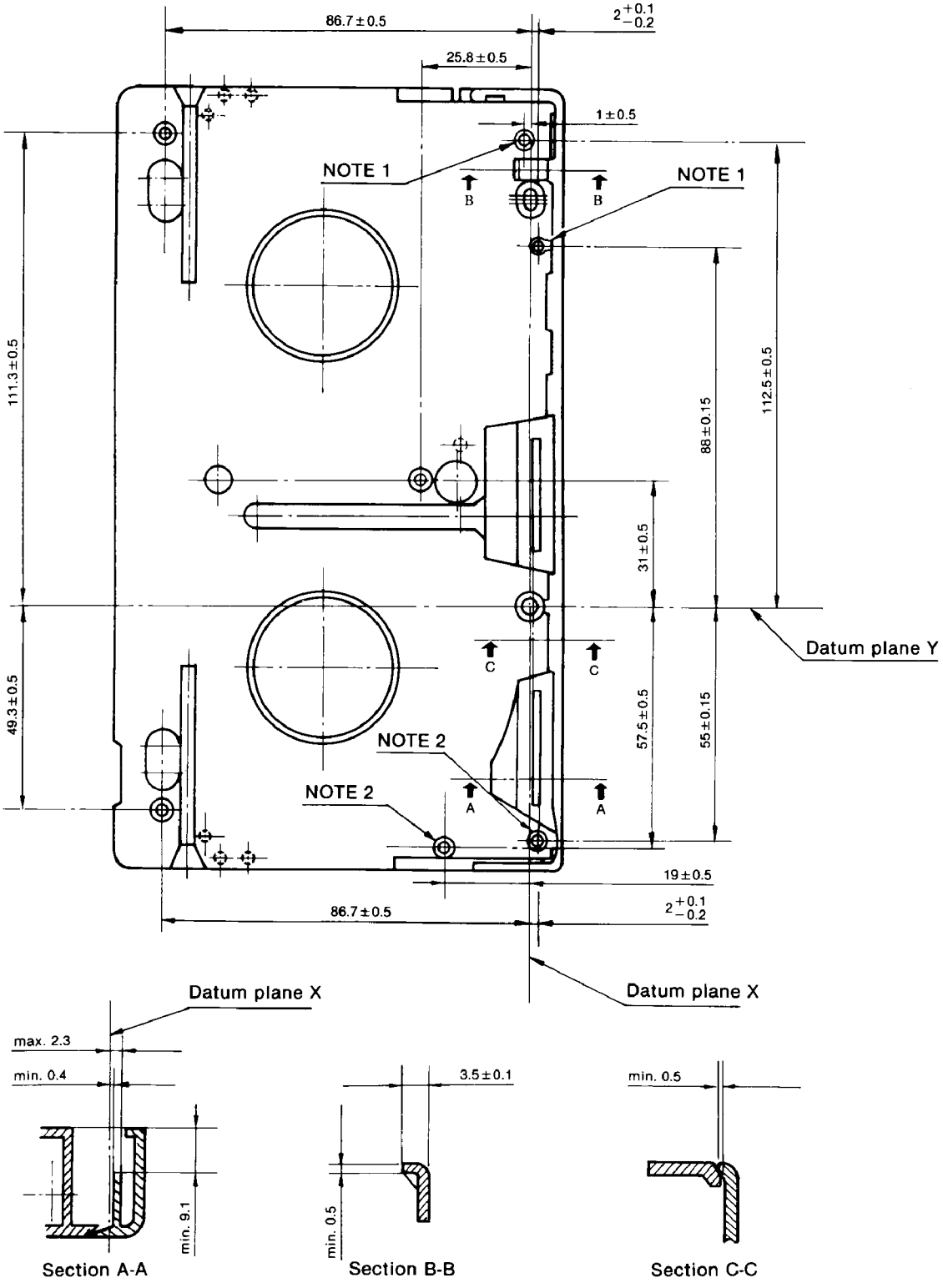
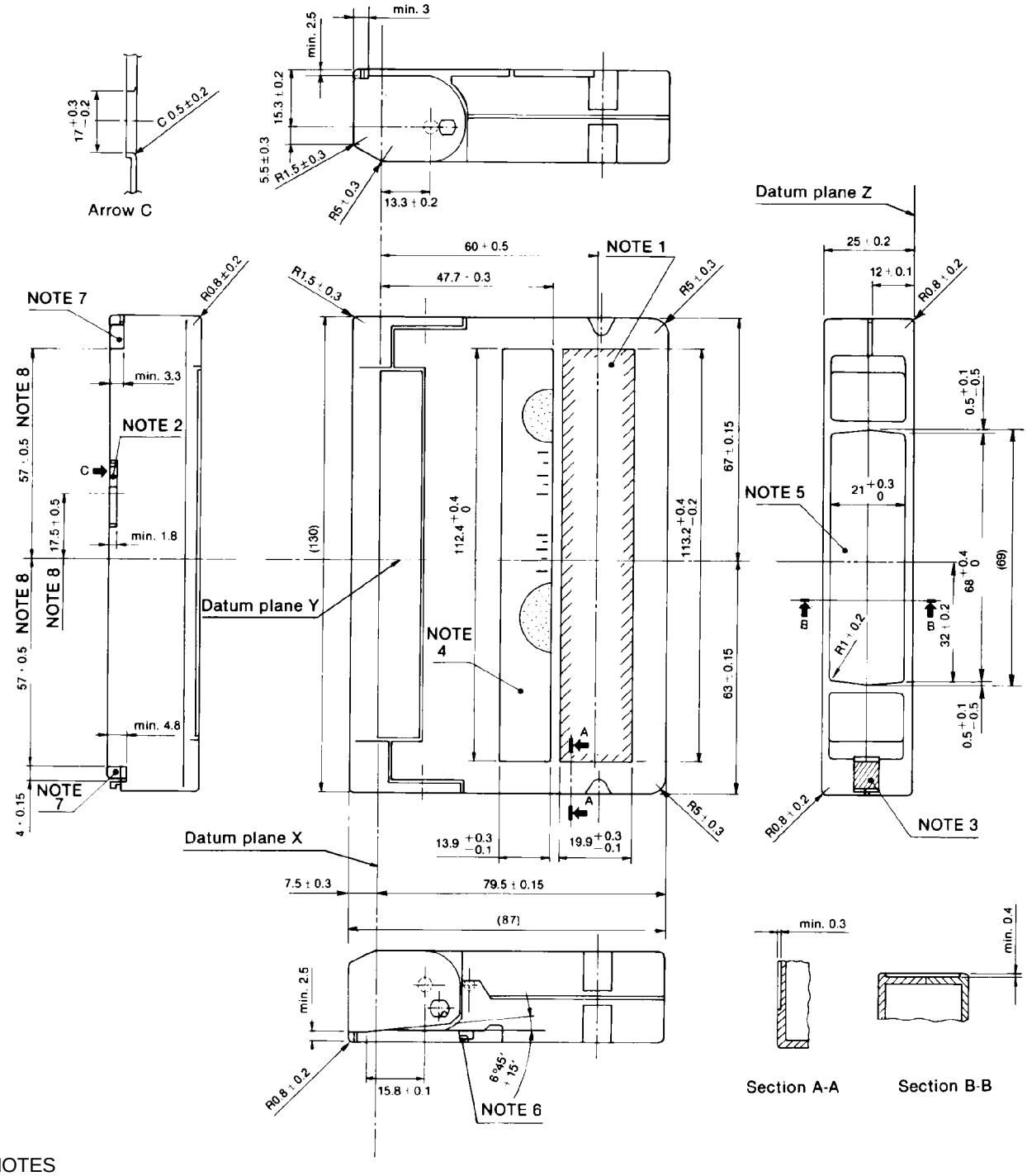


Figure 7 -- Tape path in large cassette



NOTES
1 Either one of two screw positions may be used.
2 Either one of two screw positions may be used.

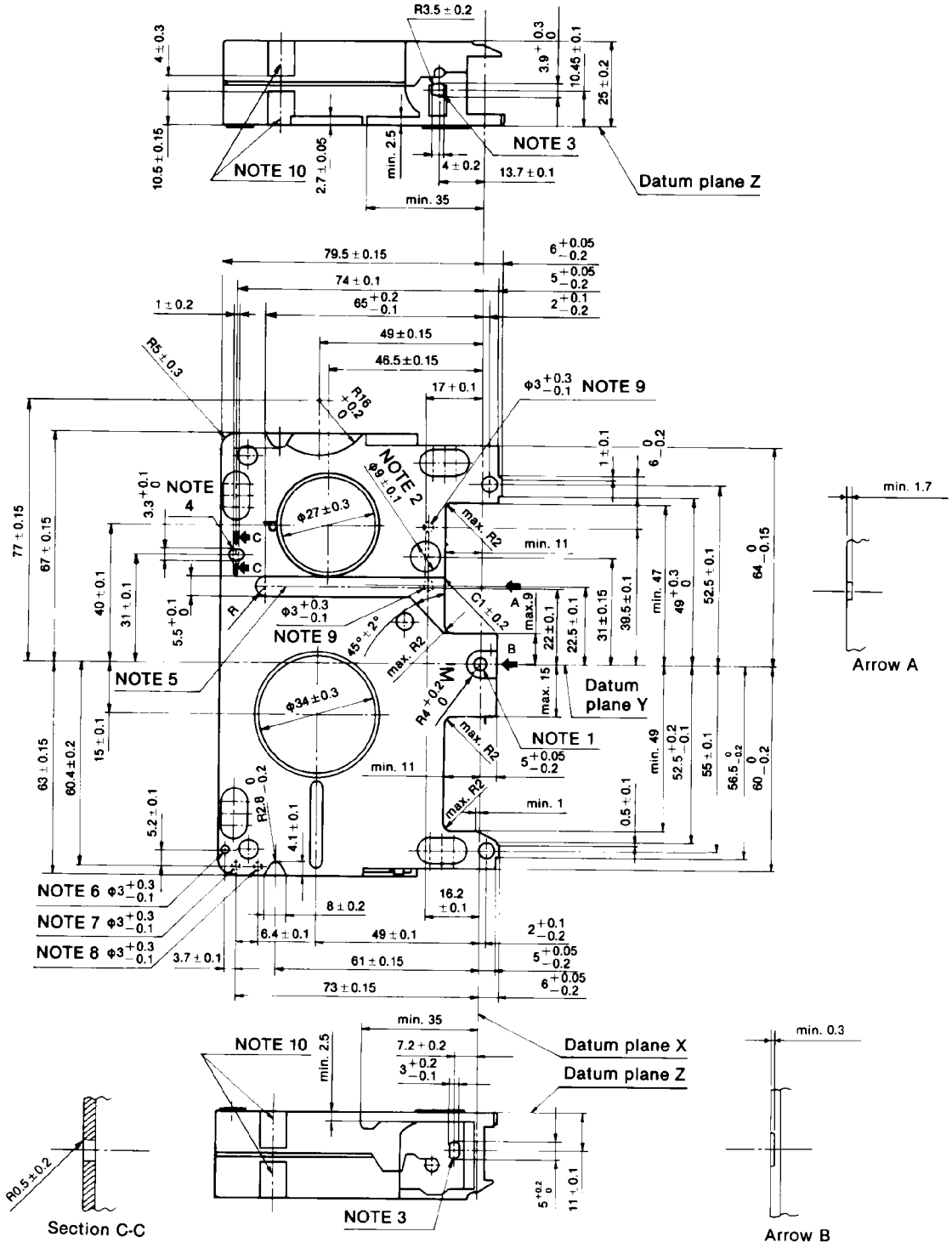
Figure 8 -- Screw positions and lid structure of large cassette



NOTES

1 Top label pasting face. The label shall not protrude beyond the cassette height.
2 Guide groove to prevent misinsertion.
3 Operation of record lock-out hole. When the record lock-out hole is open, recording should be impossible. When the hole is closed, recording should be possible. The record lock-out mechanism shall be coupled with the identification hole shown in figure 10 (note 6).
4 Window. This window shall not protrude beyond the cassette height.
5 Side label pasting face. The label shall not protrude beyond the cassette side.
6 Lid unlocking clutch.
7 Cassette front positioning face.
8 These tolerances include a slight play of the lid.

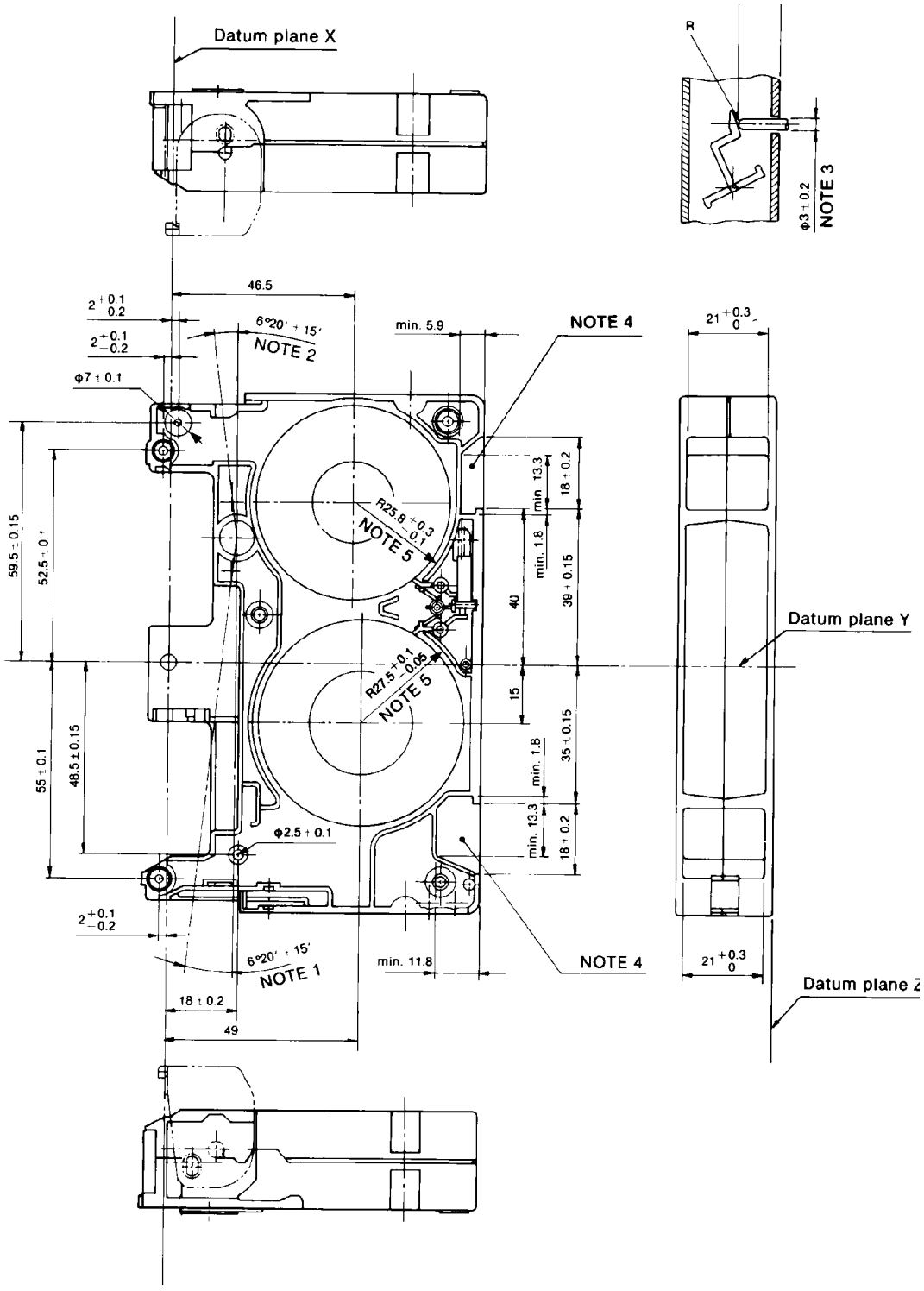
Figure 9 -- Top and side views of small cassette



NOTES

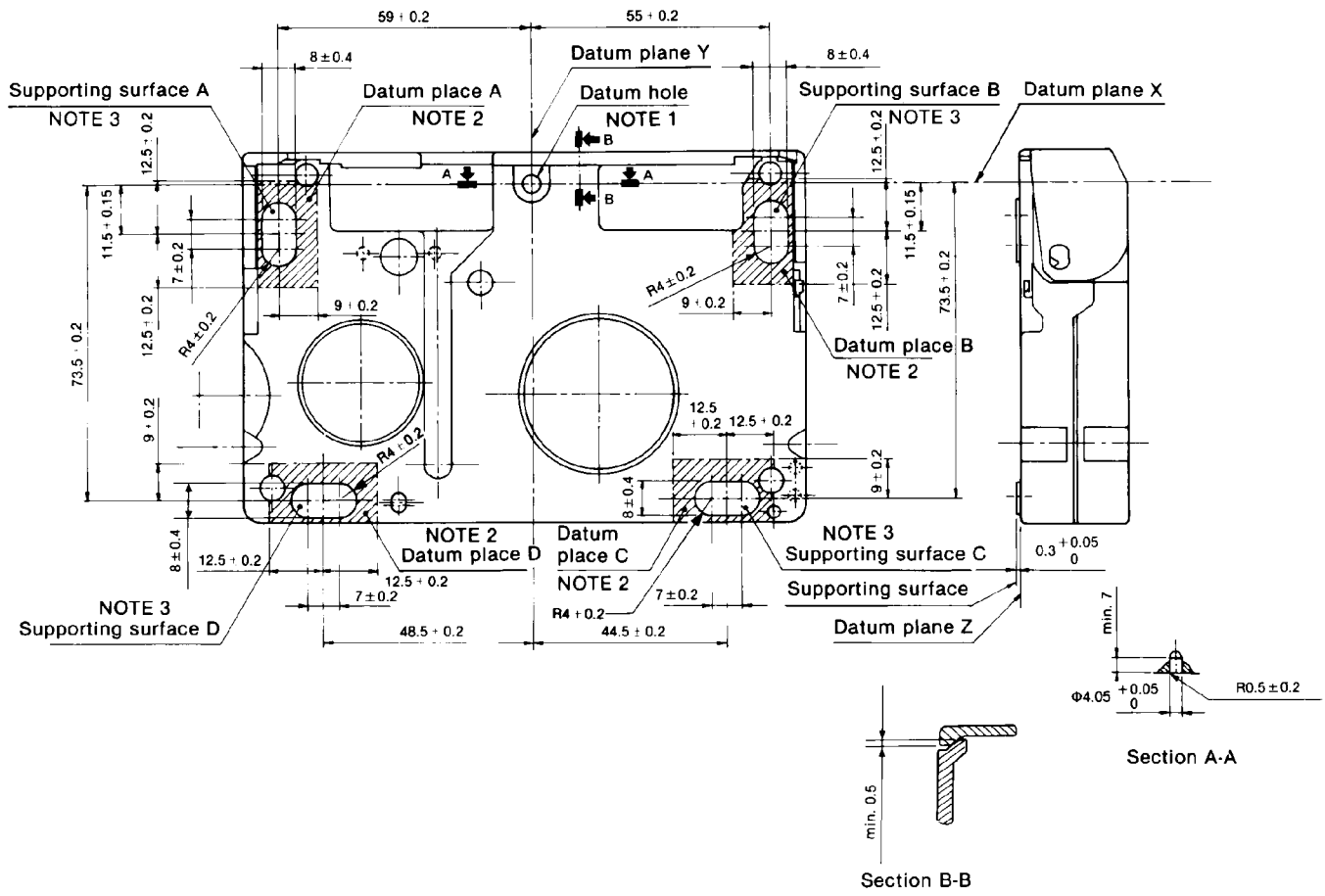
1 Datum hole.
2 Hole for sensor lamp.
3 Holes for sensor optical path.
4 Reel brake unlocking hole.
5 Guide groove to prevent misinsertion.
6 Record lock-out identification hole.
7 Tape type identification hole.
8 Tape thickness identification hole.
9 Extra identification holes (two holes).
10 Grip for automatic loading machine.

Figure 10 -- Bottom view of small cassette



NOTES
1 Supply side sensor optical path angle.
2 Take-up side sensor optical path angle.
3 Position of the brake unlocking pin of the recorder.
4 Finger hole.
5 This dimension shall be maintained throughout the entire circumference of the inner wall.

Figure 11 -- Inner structure of small cassette

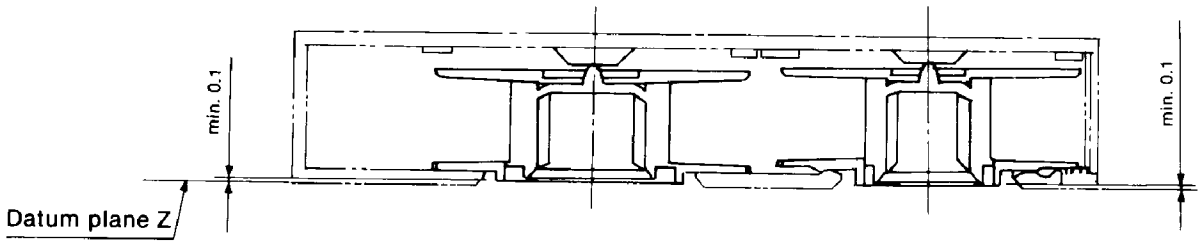


NOTES

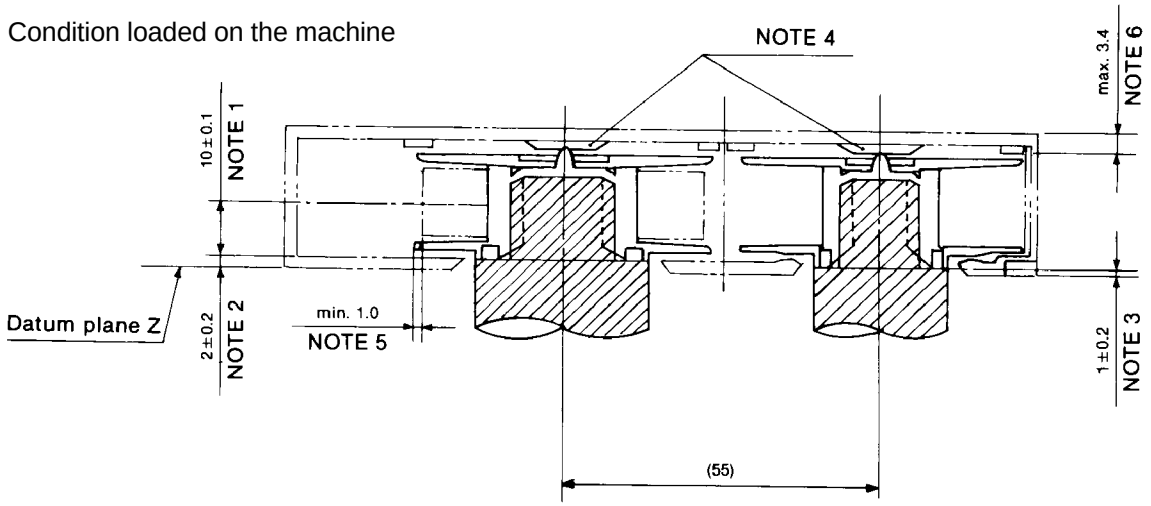
1 The diameter of the datum hole in section A-A shall be 4.05 mm + 0.05 mm – 0.00 mm and 7 mm in depth.
2 The flatness of the four datum places shall be 0.2 mm or less.
3 The flatness of the four supporting surfaces shall be 0.2 mm or less. The supporting surfaces are used as the cassette supporting surfaces for cassette loading.

Figure 12 -- Datum places and supporting surfaces of small cassette

(a) Condition off the machine



(b) Condition loaded on the machine



NOTES

1 Centerline of tape.
2 Height of supply reel stand above cassette datum plane Z. The cassette shall operate smoothly at a height of 2.0 mm ± 0.2 mm.
3 Height of take-up reel stand above cassette datum plane Z. The cassette shall operate smoothly at a height of 1.0 mm ± 0.2 mm.
4 Reel springs.
5 E value (a margin between reel flange outside diameter and maximum wound tape diameter).
6 Reel stoppers to limit the play of the reel.

Figure 13 -- Relationship between reels and reel stands of small cassette

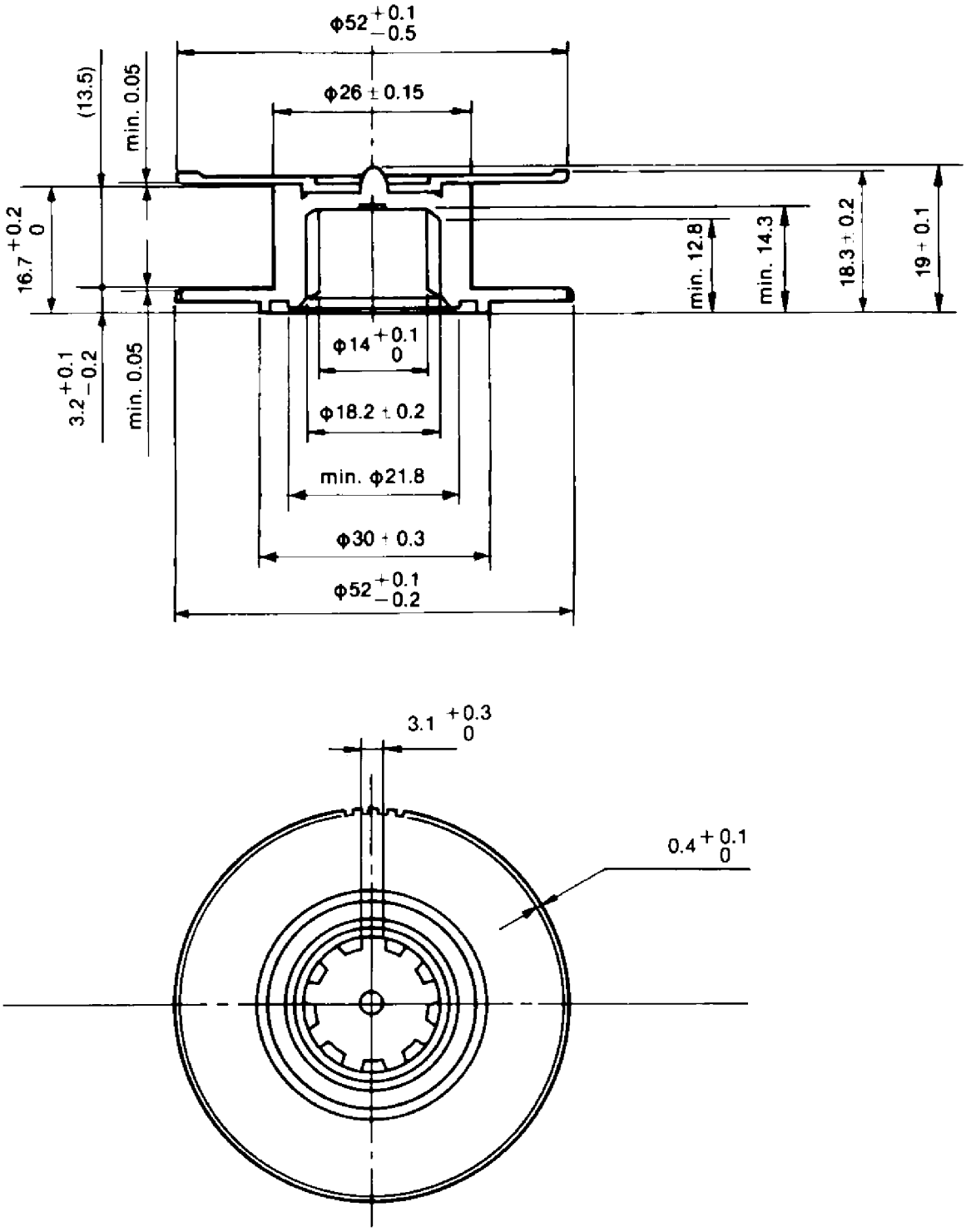


Figure 14 – Supply reel dimensions of small cassette

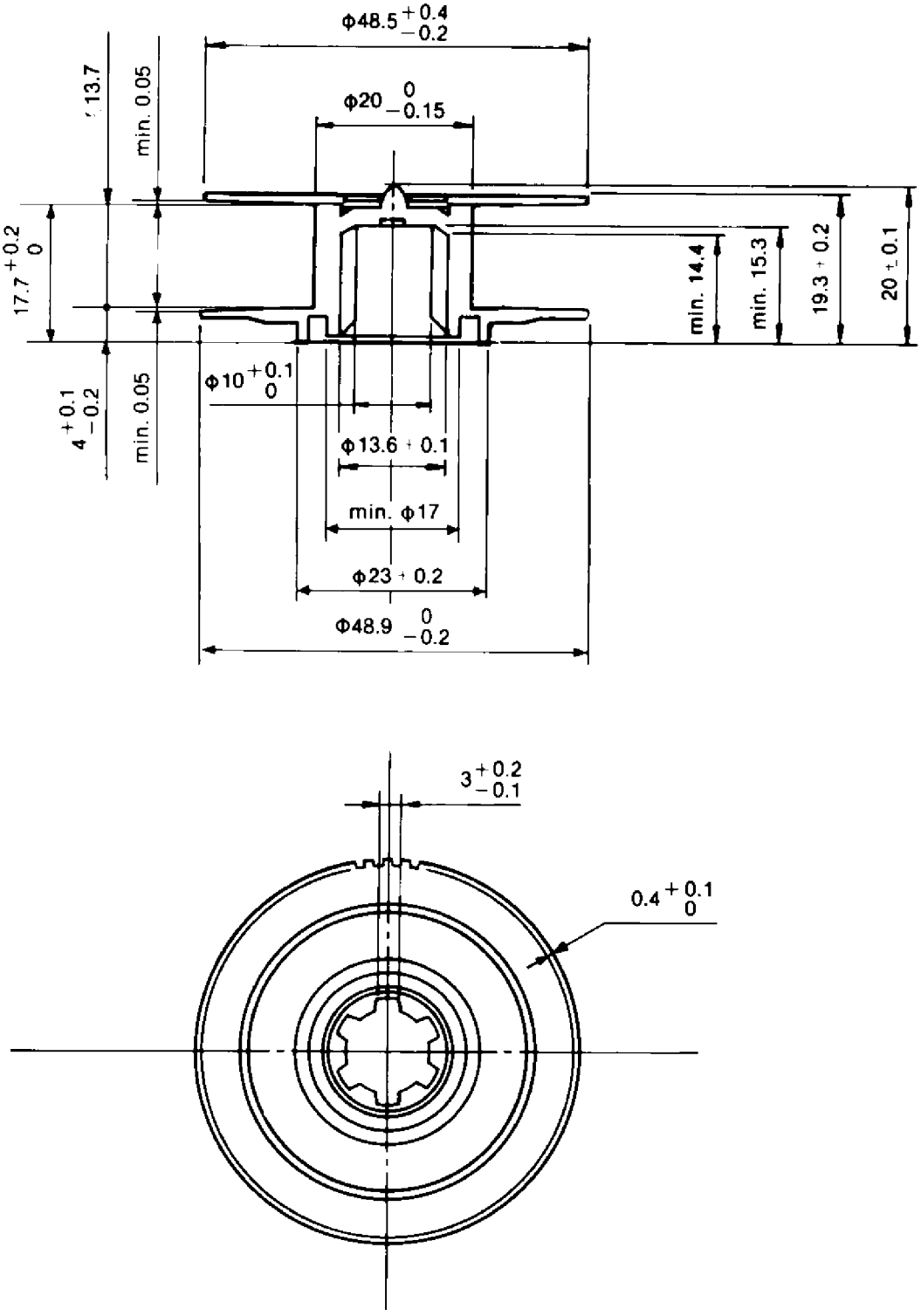


Figure 15 -- Take-up reel dimensions of small cassette

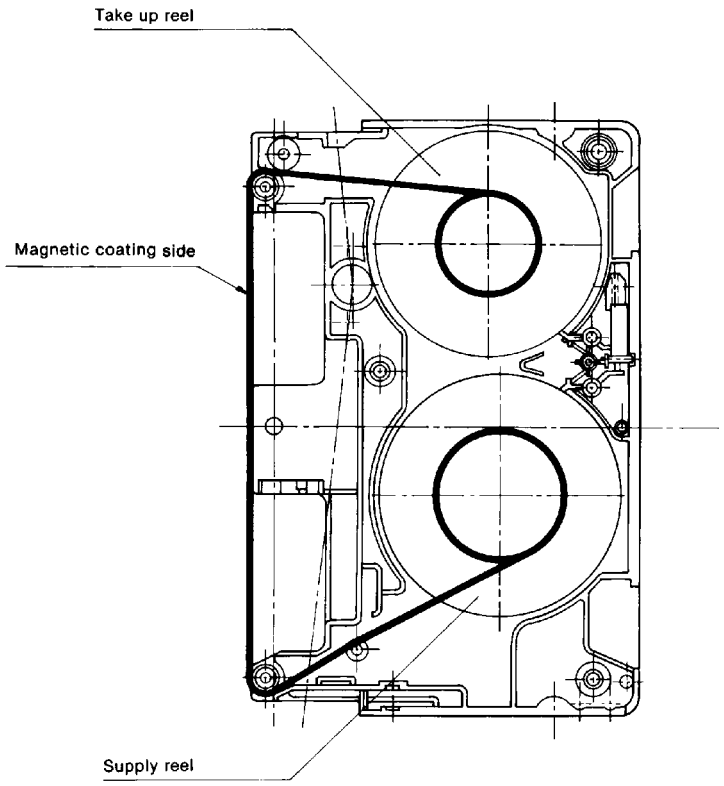
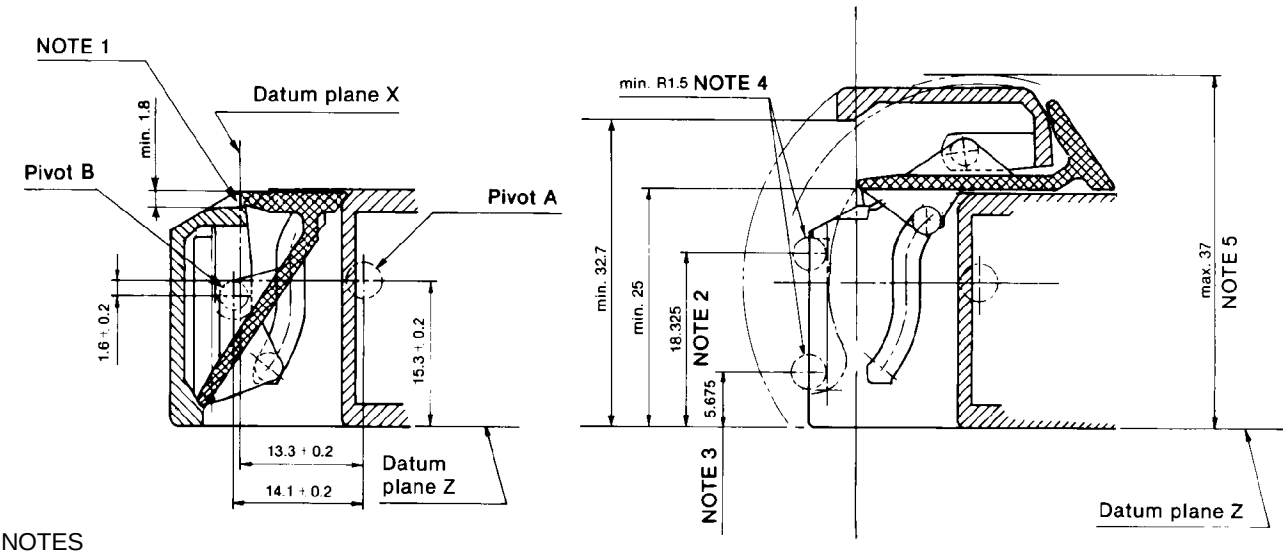


Figure 16 -- Tape path in small cassette



NOTES
1 Recess to prevent misinsertion.
2 Tape upper edge position.
3 Tape lower edge position.
4 Margin for tape position changes shall be 1.5 mm or more.
5 Maximum permissible height when lid is opened.

Figure 17 -- Lid structure of small cassette

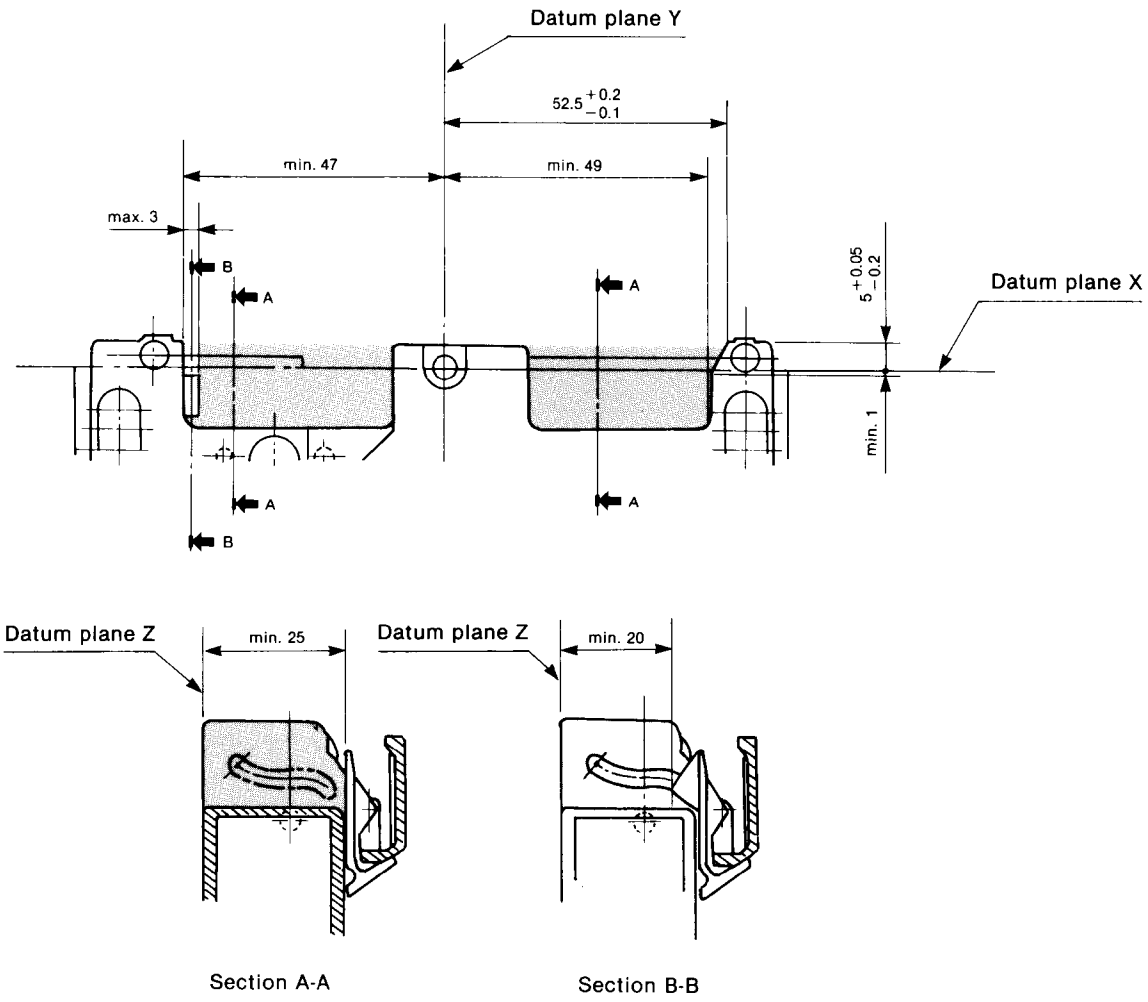
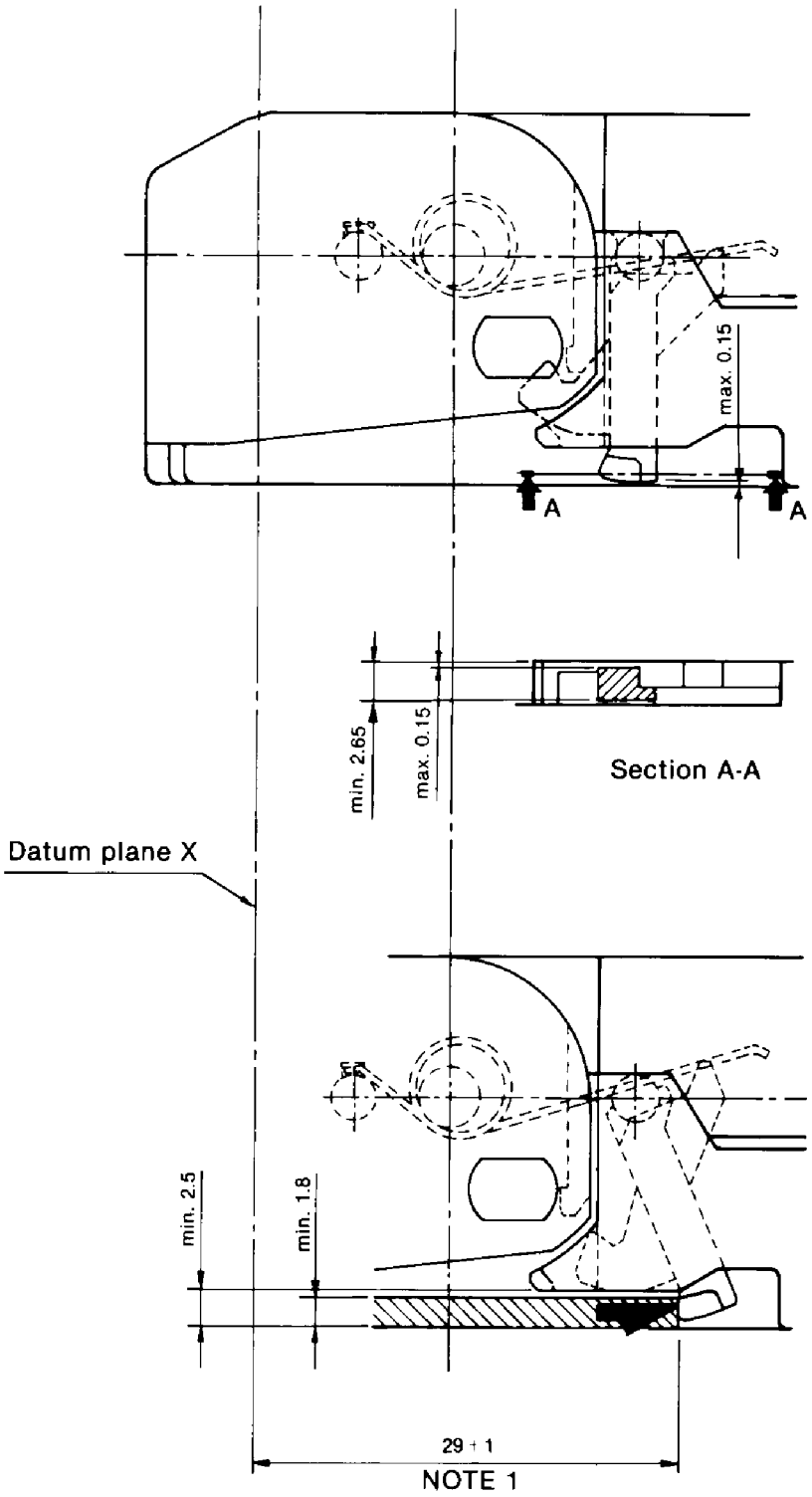
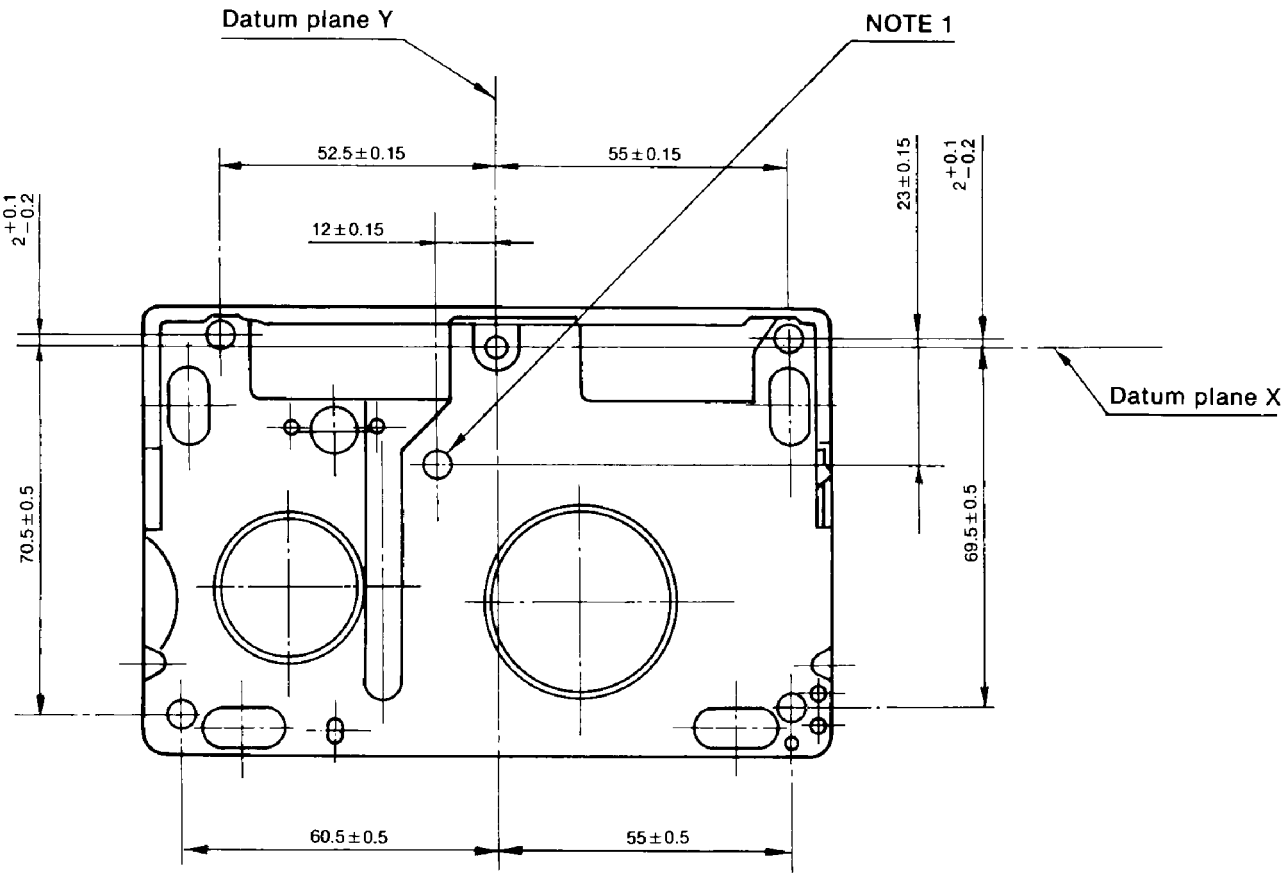


Figure 18 -- Minimum clearance for recorder and player loading mechanism



NOTE 1 – Lid unlocking position

Figure 19 -- Unlocking structure of lid



NOTE 1 – The screw position also serves as the positioning point for mounting a small cassette in video tape recorders. The diameter of the spot facing for the screw head of this portion is 5.3 mm to 5.7 mm, and the depth of the seat to the screw head is 3 mm or more.

Figure 20 -- Screw positions of small cassette