SMPTE 238M-1998
Revision of
ANSI/SMPTE 238M-1992

SMPTE STANDARD

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

1 Scope

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

2 Test conditions

2.1 Tests and measurements shall be made under the following conditions unless otherwise stated:

– Temperature	20°C ± 1°C
– Relative humidity	(50 ± 2)%
– Stabilization time	24 hours

2.2 Dimensions shall be as specified in the figures and tables (see annex B).

3 Mechanical characteristics of video cassettes

3.1 Outside dimensions

3.1.1 Two cassette sizes shall be identified as shown in table 1.

Table 1 – Cassette identification

Model	Outside dimensions (mm)	Figures
S – Small cassette	96 × 156 × 25	1 to 9
L – Large cassette	145 × 254 × 25	10 to 18
NOTE – For purposes of drawing clarity, the S cassette shell is represented as two different shells — oxide tape and metal-particle tape shells. It is the manufacturer's choice to manufacture single or dual shells.		

3.2 Datum planes

3.2.1 Datum plane Z is determined by three datum spots, A, B, and C, as indicated in figures 3A and 12A.

3.2.2 Datum plane X shall be orthogonal to datum plane Z and include the center of datum holes (a) and (b), as shown in figures 2A/2B and 11.

3.2.3 Datum plane Y shall be orthogonal to both datum planes X and Z and include the center of datum hole (a), as shown in figures 2A/2B and 11.

3.3 Window area and label area

The crosshatched areas in figures 1A/1B and 10, defined as the label/window area, shall not protrude beyond the height of the cassette surface.

3.4 Manufacturer's identification holes

Three manufacturer's holes, referred to as recognition holes, shall be provided (refer to figures 2A/2B and 11).

3.4.1 Tape type identification hole

Hole one shall identify the tape type within the cassette. The detected state "1" shall indicate metal-oxide tape; detected state "0" shall indicate metal-particle tape. Detection of tape type by the machine shall determine mode 1 or mode 2 operation.

3.4.2 Tape thickness identification hole

Hole two shall identify tape thickness. Detected state "1" shall identify 20 μm tape; detected state "0" shall identify 15 μm tape.

Approved
December 7, 1998

3.4.3 Reel hub diameter identification hole

Hole three shall identify the reel hub diameter. Detected state “1" shall identify a small hub; detected state ”0" shall identify a large hub (see figures 6 and 15 for details concerning usage).

3.5 Safety tab and plug

3.5.1 Usage

Use of the safety tab (for oxide) and safety plug (for metal) is intended to activate or produce a record lock-out condition in the event the safety tab or plug is activated.

3.5.2 S cassette

The S cassette may contain either oxide or metal-particle tape. When loaded with oxide tape, the safety tab (for oxide), as shown in figures 2A/2B, shall activate the mode 1 record lock-out condition if the tab is removed. A hole 10 mm minimum deep from datum plane Z (CC in figures 2A/2B) defines the mechanical tolerances for the sensing device.

When loaded with metal-particle tape, the safety tab (for oxide) shall be removed (preventing the record condition for machines capable of mode 1 operation). The safety plug defined by DD in figure 2B defines the mechanical tolerances for the sensing device. Detection of no hole shall cause the record lock-out condition for mode 2 to exist.

3.5.3 L cassette

The L cassette contains only one safety plug. If the safety plug is removed, both mode 1 and mode 2 record lock-out is activated. Dimensions of the safety plug are shown in C-C of figure 11. The cassette may be loaded with either oxide or metal-particle tape.

3.5.4 Deformation

The safety tab and plug shall not be deformed over 0.3 mm when a force of 2.0 N is applied, using a 2.5-mm diameter rod.

3.6 Reels

3.6.1 The dimensions of the reels shall be in accordance with those given in figures 6 and 15.

3.6.2 The reels shall be locked automatically when the cassette is ejected from the video tape recorder or player unit.

3.6.3 The reels shall be unlocked automatically when the cassette is inserted into the video tape recorder/player unit. The reel shall be completely released when the cassette lid is opened 27.5 mm or more from datum plane Z.

3.6.4 The reels in the cassette shall be pressed by the reel spring with a specified force under the conditions specified in figures 7 and 16. The reel spring shape shall conform to figure 7 for the S cassette and figure 16 for the L cassette. The spring force shall be 1.5 N ± 0.5 N for the S cassette and 3.4 N ± 0.5 N for the L cassette when the reel is depressed to 2.0 mm +0.2 mm – 0.1 mm above datum plane Z.

3.6.5 Dimensions specified in this standard apply to the cassette only; no transport dimensions should be derived from this standard.

3.7 Cassette lid

3.7.1 The cassette shall be provided with a lid that is unlocked automatically when the cassette is inserted into the video tape recorder/player unit and locked automatically when the cassette is ejected.

3.7.2 The force needed to open the lid shall be 1.5 N or less (see figures 9 and 18).

3.7.3 The lid shall open 29.0 mm, as shown in figures 4 and 13, when the cassette is inserted into the video tape recorder/player unit.

3.7.4 The lid shall be unlocked when the lid lock lever is shifted in either direction A or B, as illustrated in figures 8 and 17. The force needed to unlock the lid shall not be greater than 1 N in the A direction and not greater than 1.5 N in the B direction.

4 Magnetic tape

4.1 Type

The magnetic tape used for 1/2-in type L helical-scan video tape recorders shall be either oxide tape or metal-particle tape.

4.2 Base material

The base material shall be polyester or its equivalent.

4.3 Tape width

The width of the magnetic tape shall be 12.65 mm ± 0.01 mm.

4.4 Tape thickness

The thickness of the magnetic tape shall be as shown in table 2.

4.5 Coercivity

Two levels of coercivity shall be permitted: Class 720 tape (mode 1 operation) oxide; class 1500 tape (mode 2 operation) metal particle.

4.6 Transmissivity

Transmissivity shall be less than 5% measured over the range of wavelengths 700 nm to 900 nm.

4.7 Offset yield strength

The offset yield strength shall be greater than 19.6 N.

4.8 Residual elongation

The residual elongation of the magnetic tape shall be less than 0.15%. (Test method: Apply a 13.9 N load to a 1 m long and 12.65 mm wide test tape for 10 minutes. Remove the load and measure the tape length after a 0.2 N load is applied continuously for another 10 minutes.)

4.9 Magnetic orientation

The magnetic particles shall be longitudinally oriented.

5 Leader and trailer tape

5.1 Mechanical characteristics

The leader and trailer tape shall contain a metal foil providing conductivity per centimeter of more than 200 S (mho) so that the magnetic tape automatically stops running when this end is detected in the recorder.

5.2 Leader and trailer tape dimensions

5.2.1 Tape width

The width of the leader and trailer tape shall be 12.65 mm ± 0.03 mm.

5.2.2 Tape thickness

The thickness of the leader and trailer tape shall be less than 45 μm.

5.2.3 Tape length

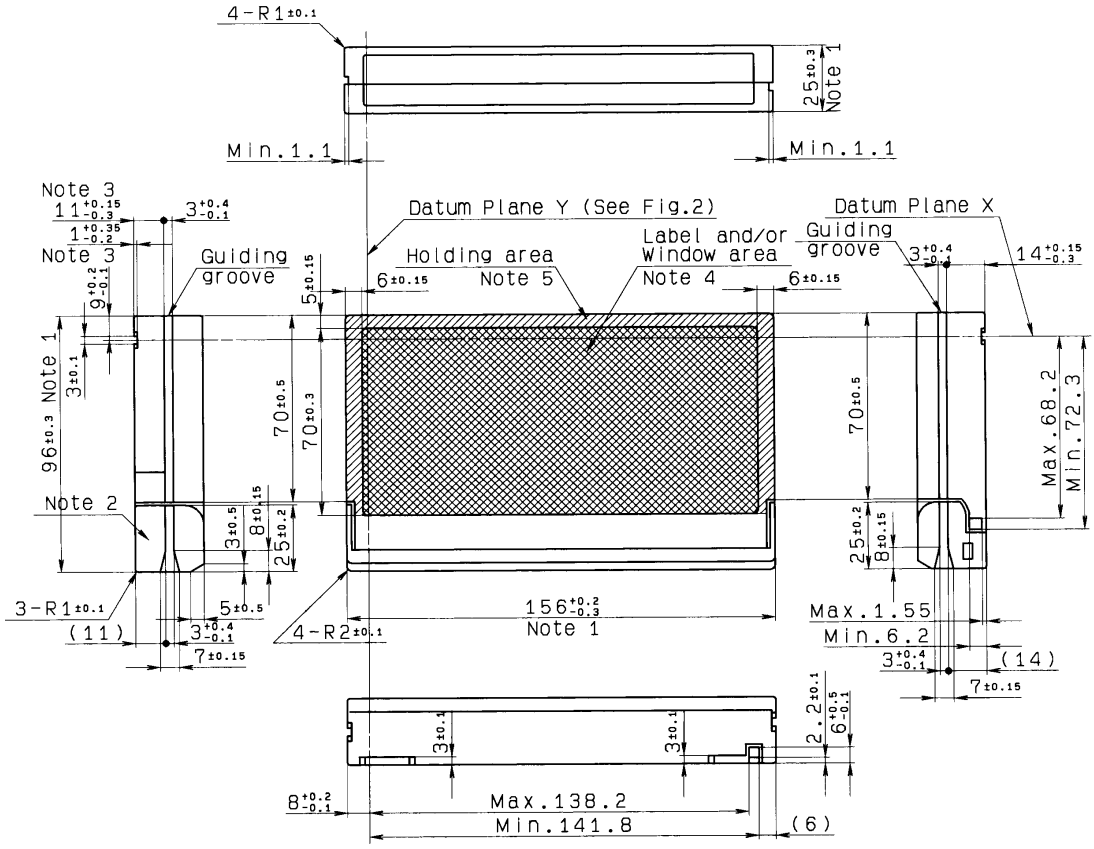
The length of the leader tape, L_1, and the trailer tape, L_2, specified in figure 19, shall be as shown in table 3.

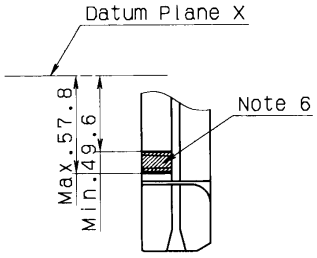
5.3 Offset yield strength

The offset yield strength of the leader and trailer tape shall be greater than 29.4 N.

5.4 Splicing break strength

The spliced portion between the magnetic tape and the leader or trailer tape shall withstand a tension of 14.7 N.



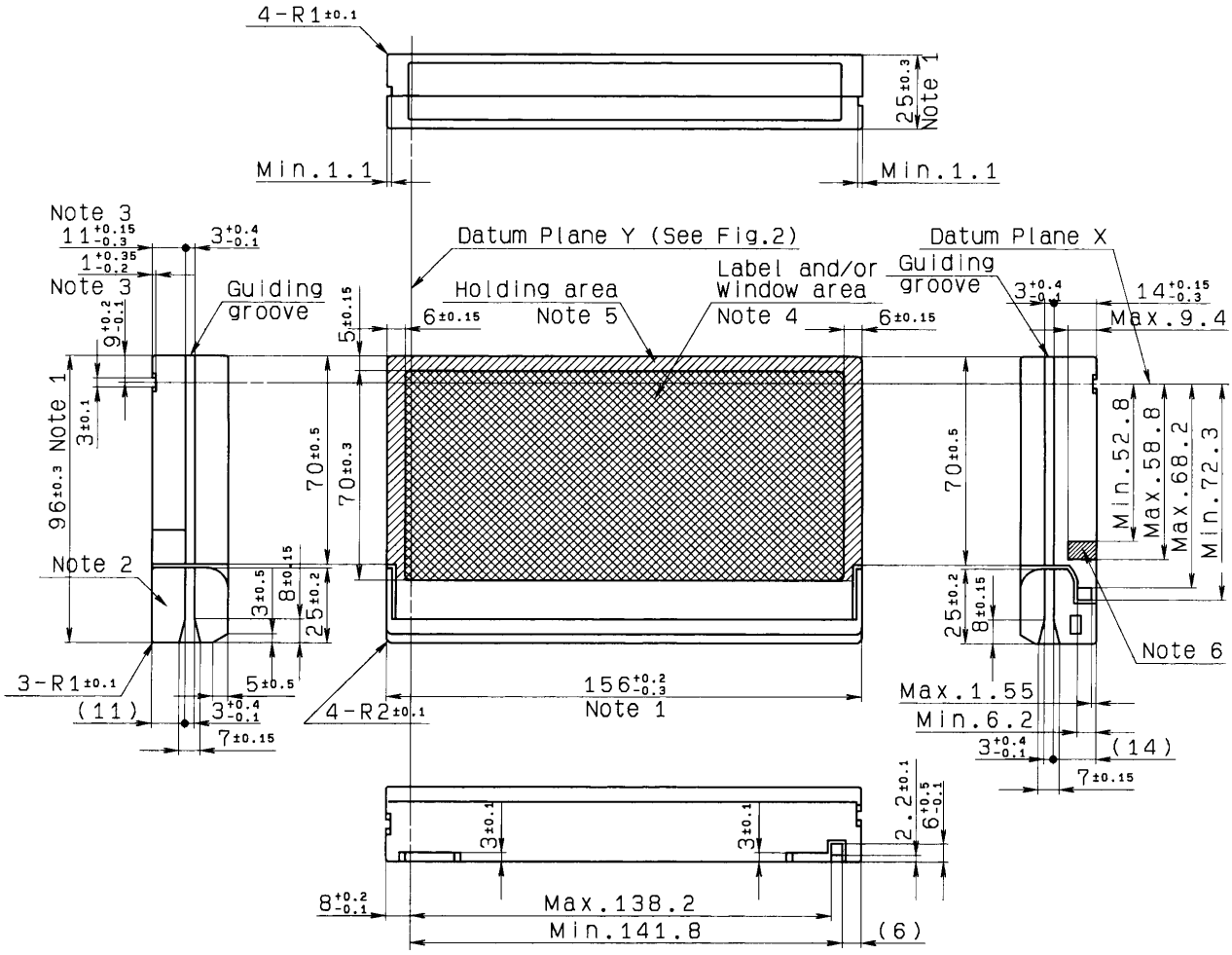


Safety plug Type

NOTES

1 The dimensions are inspected by using limit gauges.
2 No part of the lid shall protrude beyond the bottom plane of the cassette during the opening and closing motion of the lid.
3 This dimension shall be specified from datum plane Z.
4 Label and/or window area is available for the label and/or window (crosshatched area).
5 The cassette may be held in position by the recorder and/or player unit on this holding area (hatched area).
6 The fine hatched area shows the acceptable range of the plug notch position and depth at the side when the plug is used.

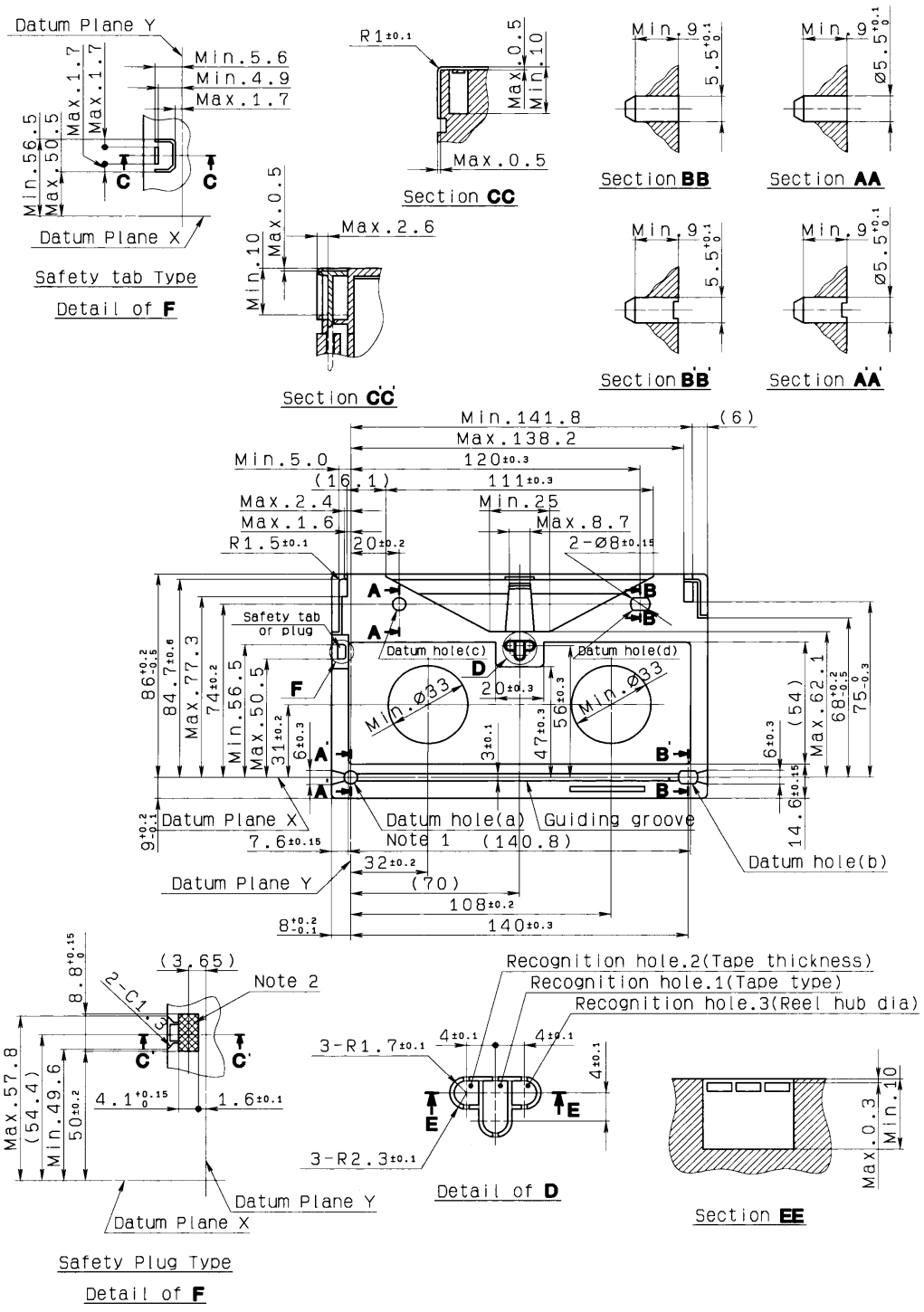
Figure 1A — Appearance of video cassette top and side view (oxide tape S cassette)



NOTES

1 The dimensions are inspected by using limit gauges.
2 No part of the lid shall protrude beyond the bottom plane of the cassette during the opening and closing motion of the lid.
3 This dimension shall be specified from datum plane Z.
4 Label and/or window area is available for the label and/or window (crosshatched area).
5 The cassette may be held in position by the recorder and/or player unit on this holding area (hatched area).
6 The fine hatched area shows the acceptable range of the plug notch position and depth at the side when the plug is used.

Figure 1B — Appearance of video cassette top and side view (metal tape S cassette)

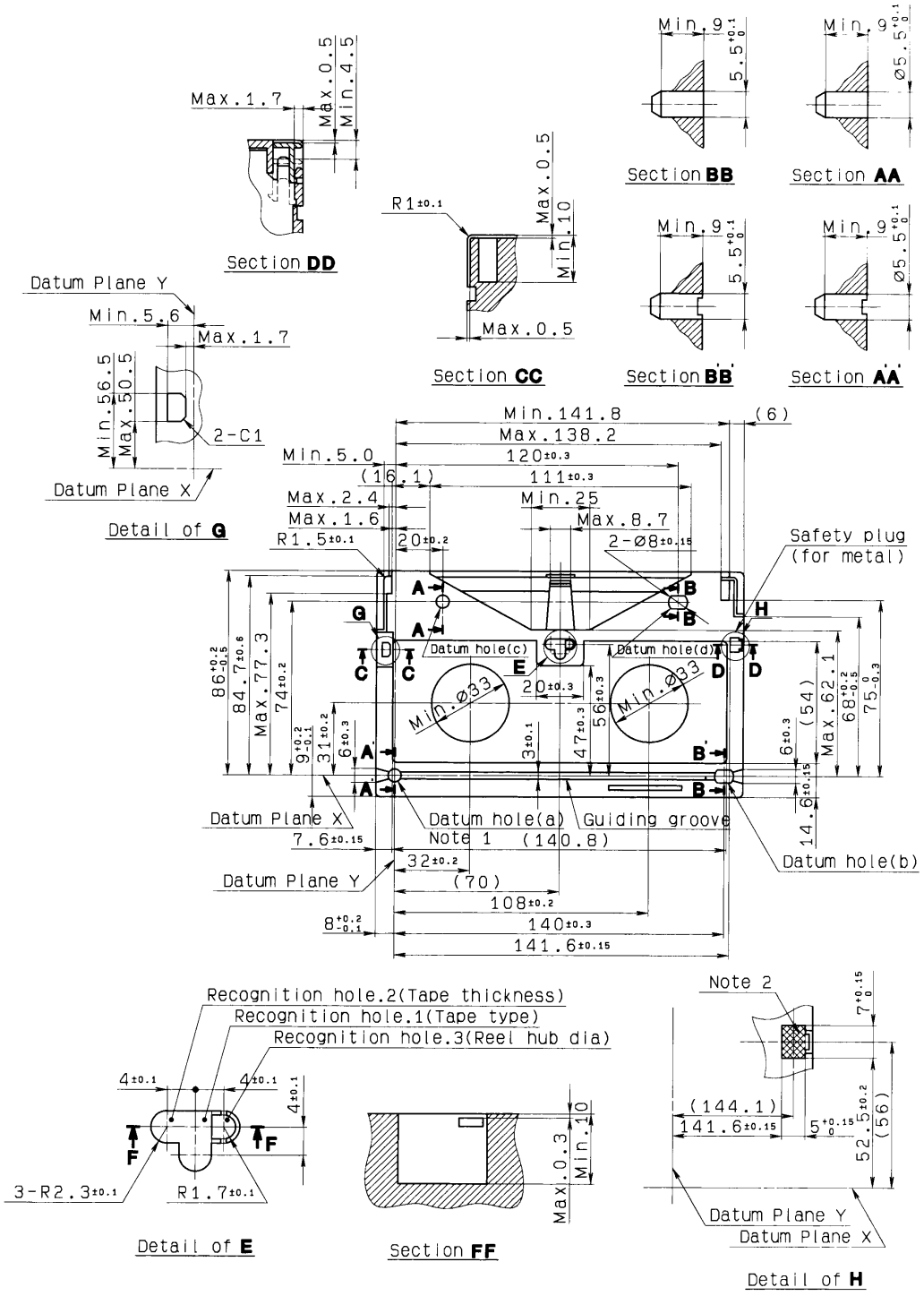


NOTES

1 Datum hole (a) is primary.

2 The crosshatched area shows the VTR detection area.

Figure 2A — Appearance of video cassette bottom view (oxide tape S cassette)

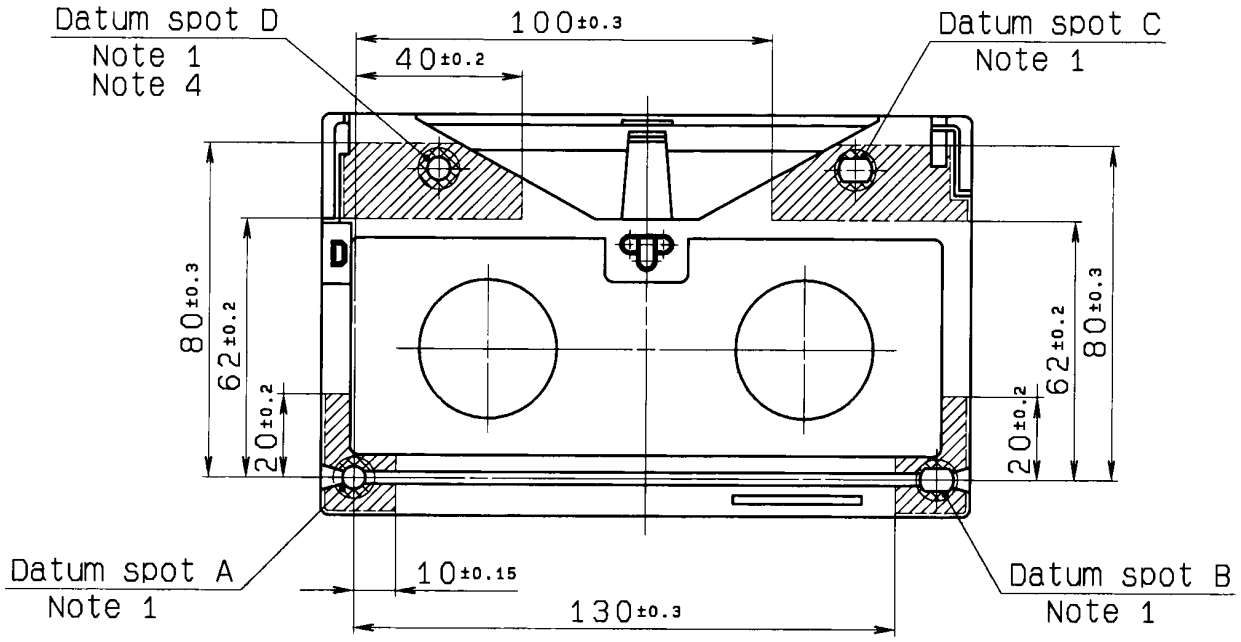


NOTES

1 Datum hole (a) is primary.

2 The crosshatched area shows the VTR detection area.

Figure 2B — Appearance of video cassette bottom view (metal tape S cassette)

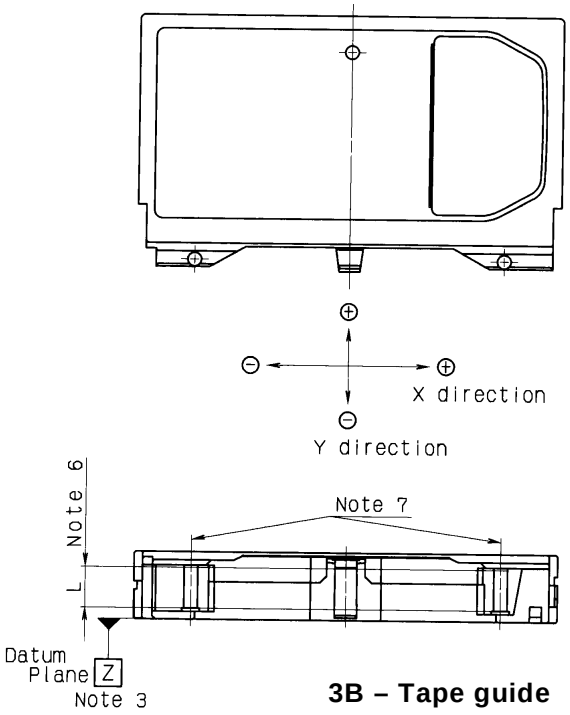


3A – Datum spots and supported areas

NOTES
1 Datum spots shall be 10 mm in diameter.
2 The four hatched areas, which are supported areas, shall be coplanar within 0.05 mm of each datum spot.
3 Datum plane Z shall be determined by the three datum spots, A, B, and C.
4 Datum spot D shall be coplanar within 0.3 mm of datum plane Z.
5 Areas within 1 mm from the edge of the cassette shall not be used as supported areas.
6 Reel flange clearance, L: 15 mm.
7 Perpendicularity of tape guides (even if they are tapered) is specified as follows:

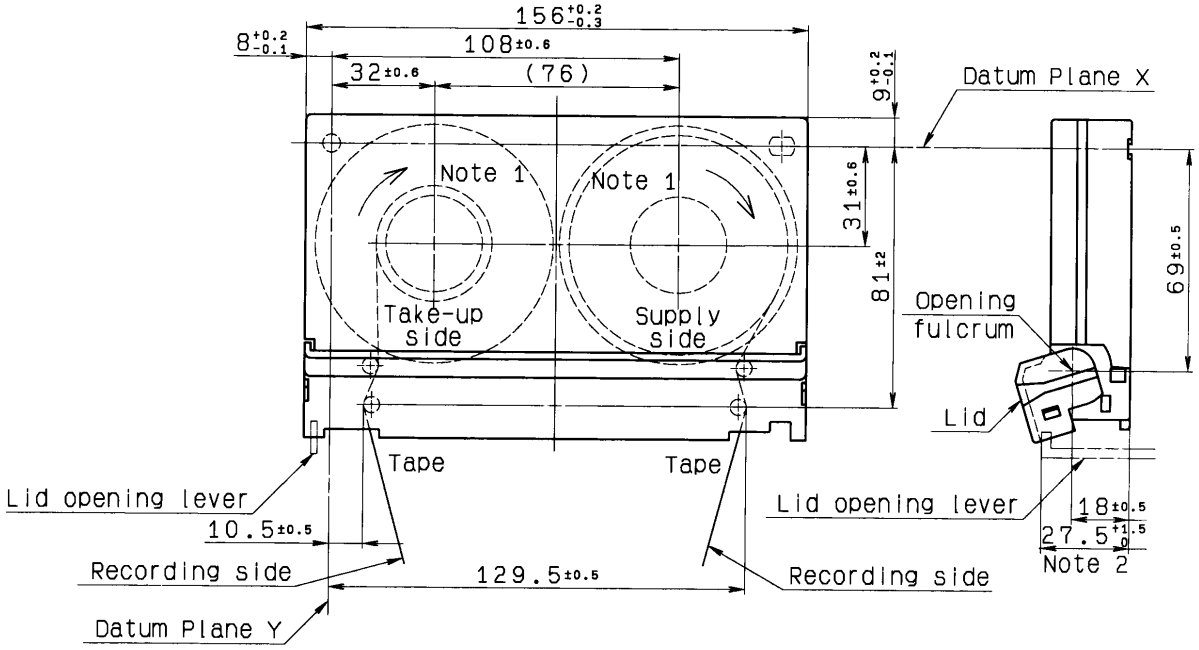
	Direction	
Guide	X	Y
Supply side	0 ± 0.15 mm	0 ± 0.15 mm
Take-up side	0 ± 0.15 mm	0 ± 0.15 mm

X and Y are the coordinates of the projection of the upper center of tape guides on the plane which includes the lower center of tape guides as the origin and are parallel to datum plane Z.



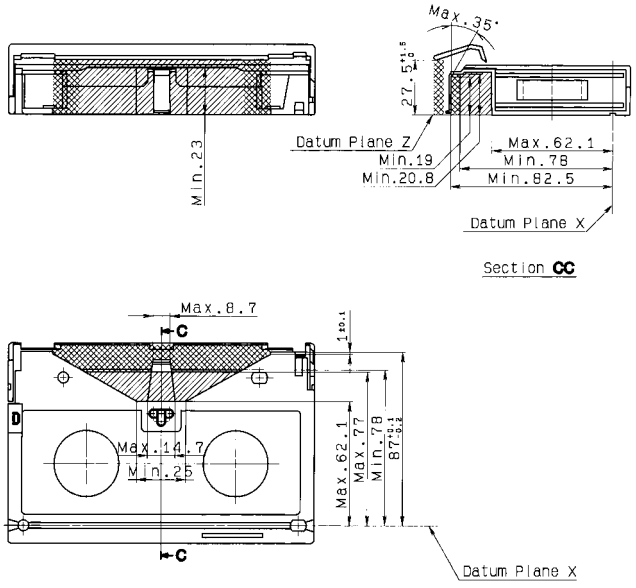
3B – Tape guide

Figure 3 — Datum spots, supported areas and tape guides (S cassette)



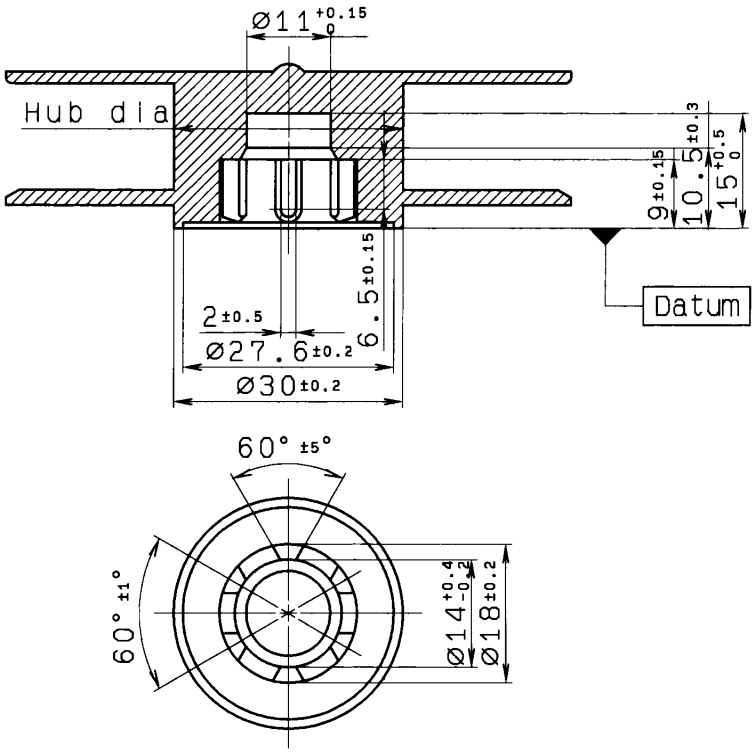
NOTES
1 Rotating direction during forward operation.
2 The opening range of the lid in the recorder or player unit is 27.5 mm +1.5 mm –0.0 mm.

Figure 4 — Location of cassette reels in the recorder and/or player (S cassette)



NOTES
1 The hatched area is where the loading mechanism of the video tape recorder and/or player unit positions the video cassette when it is inserted.
2 The hatched and crosshatched areas are so designed that the loading mechanism of the video tape recorder and/or player unit unwinds and extends the magnetic tape toward the drum head after the lid opens.

Figure 5 — Protecting lid of cassette (S cassette)



Nominal recording time	Hub diameter of reels
≦10Min.	Ø53.3±0.2 mm
>10Min.	Ø30±0.2 mm

NOTE – Recording time is specified for a tape speed of 118.582 mm/s.

Figure 6 — Reel of cassette (S cassette)

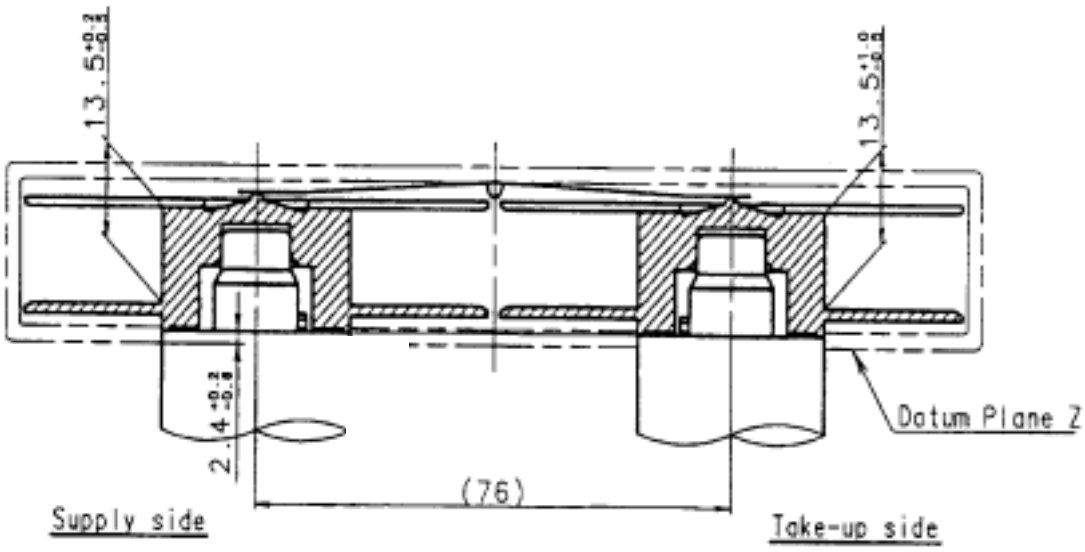
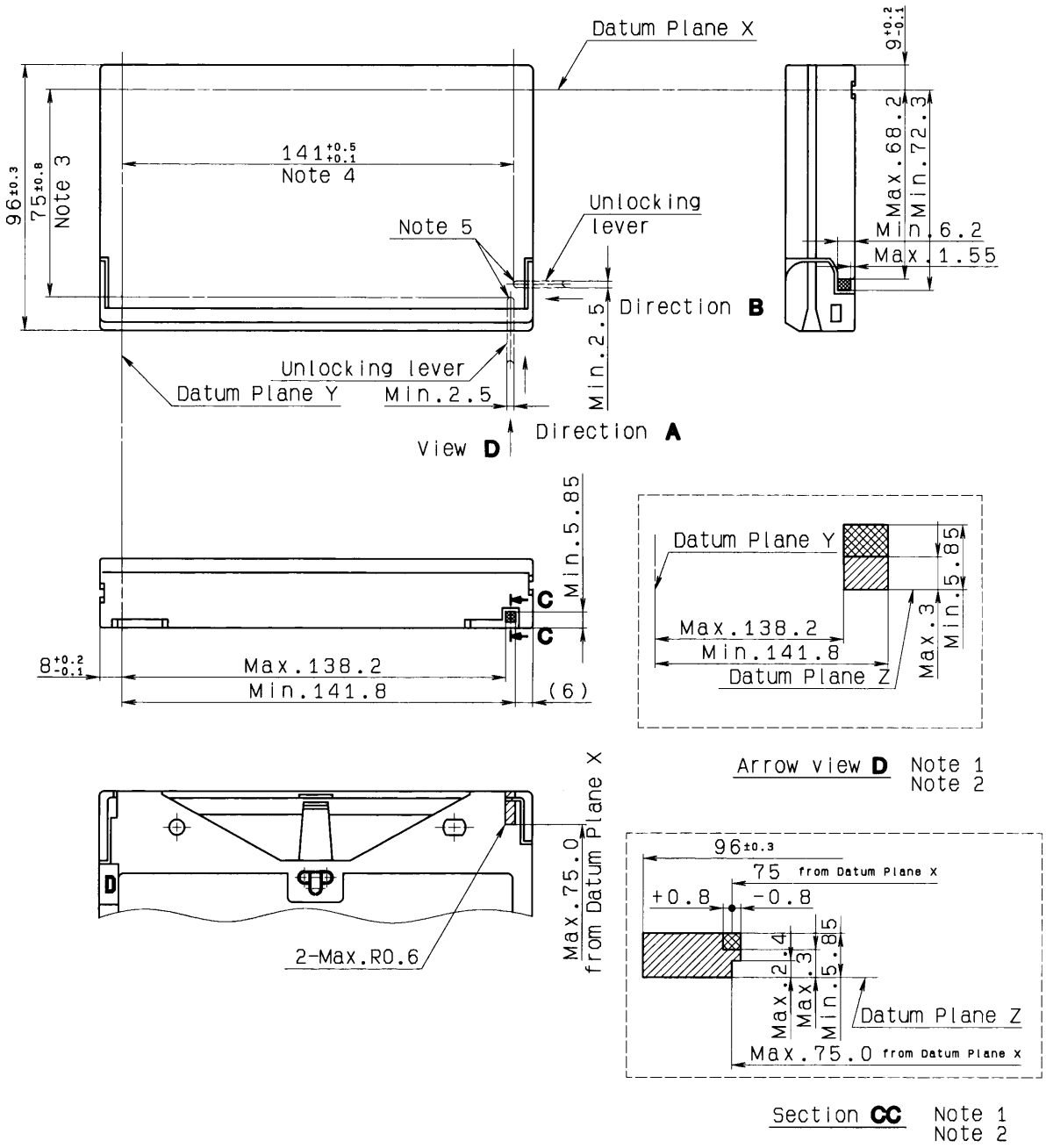


Figure 7 — Height of reels upon rotation (S cassette)



NOTES

1 The crosshatched and hatched areas show the allowable total areas where the unlocking lever, extending from the video tape recorder and/or player unit, can be inserted into a cassette.

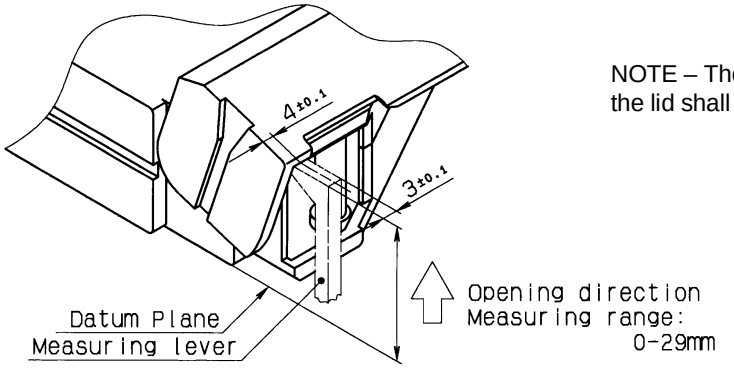
2 The crosshatched area shows the range of the unlocking lever insertion which permits the lid to be unlocked.

3 Allowable range within which the unlocking lever can be inserted in A direction.

4 Allowable range within which the unlocking lever can be inserted in B direction.

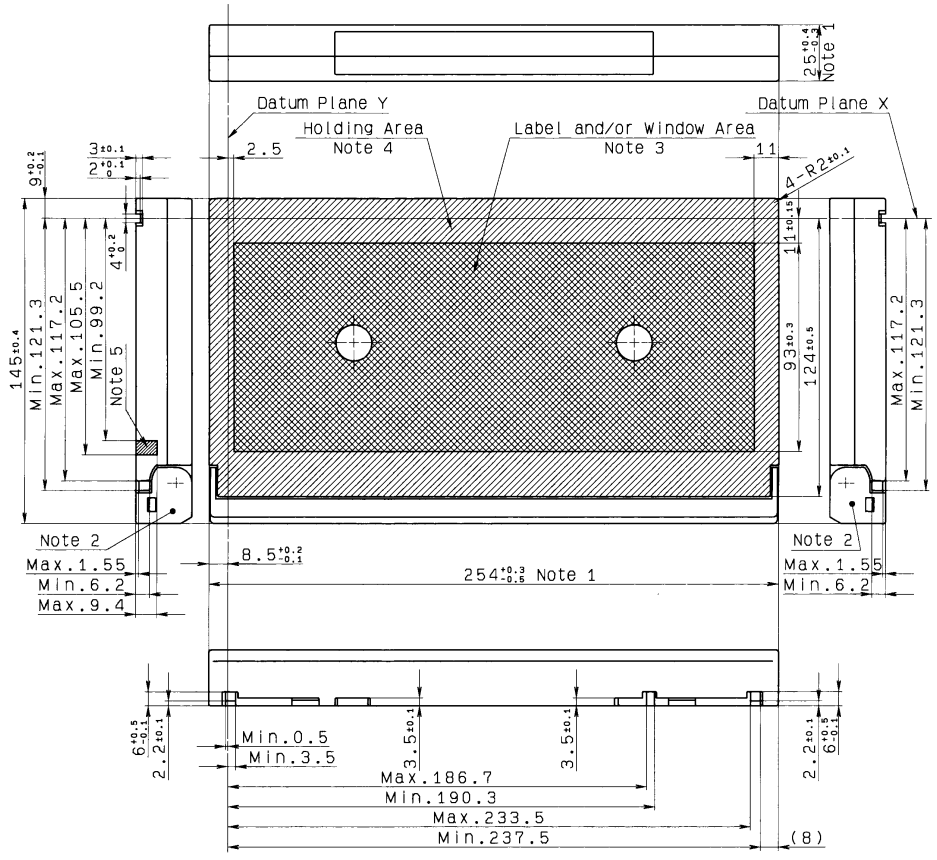
5 The tip of the unlocking lever shall be shaped into a semicircle or hemisphere of which the radius is one half the unlocking lever width.

Figure 8 — Allowable and operating ranges for unlocking the cassette lid lever (S cassette)



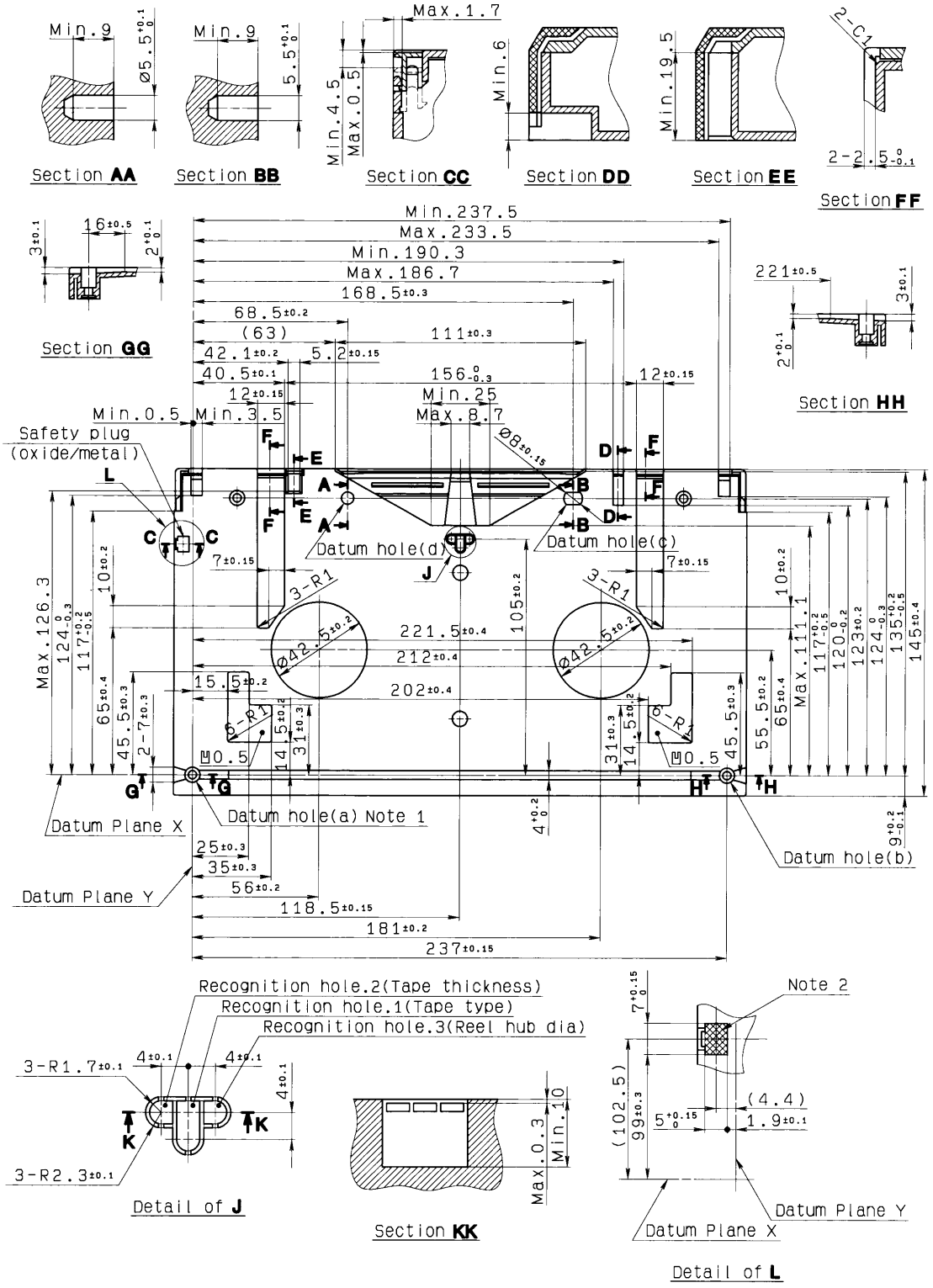
NOTE – The maximum force to open the lid shall be 1.5 N.

Figure 9 — Force needed to open the lid (S cassette)



NOTES
1 The dimensions are inspected by using limit gauges.
2 No part of the lid shall protrude beyond the bottom plane of the cassette during the opening and closing motion of the lid.
3 Label and/or window area is available for the label and/or window (crosshatched area).
4 The cassette may be held in position by the recorder and/or player unit on this holding area (hatched area).
5 The fine hatched area shows the acceptable range of the plug notch position and depth at the side when the plug is used.

Figure 10 — Appearance of video cassette top and side view (oxide and metal L cassette)

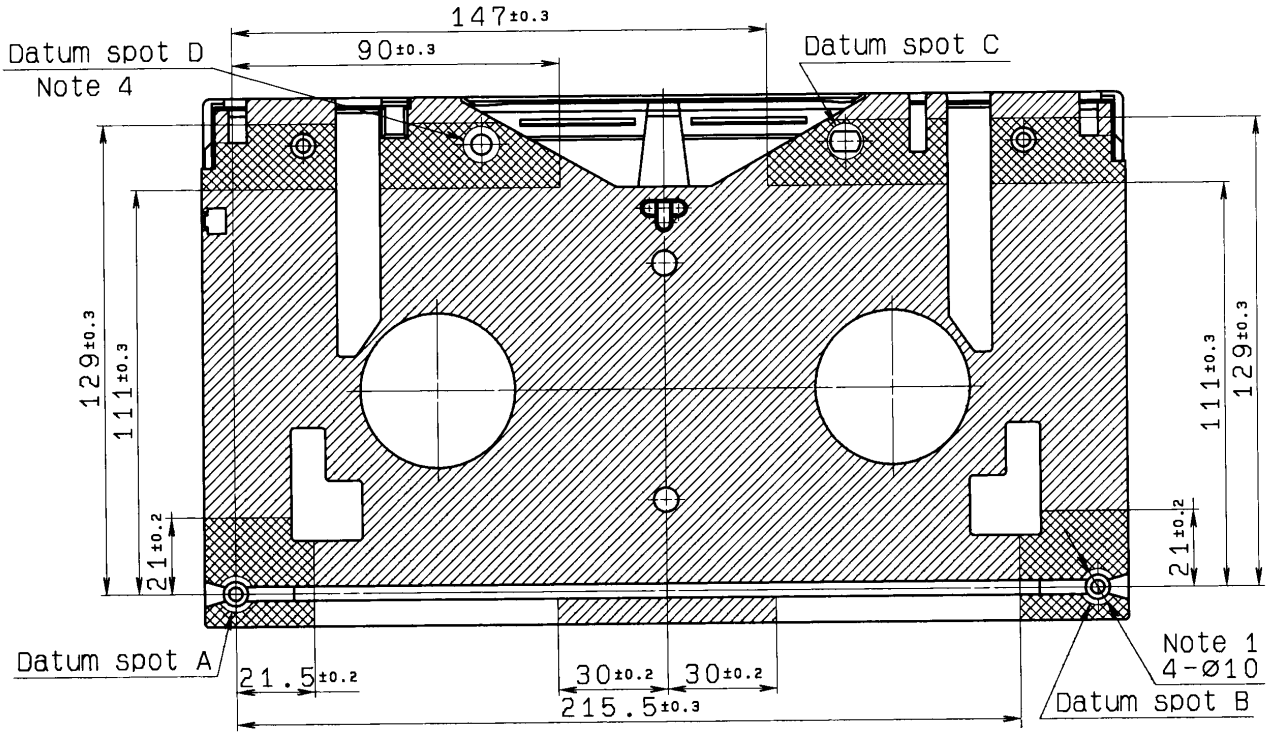


NOTES

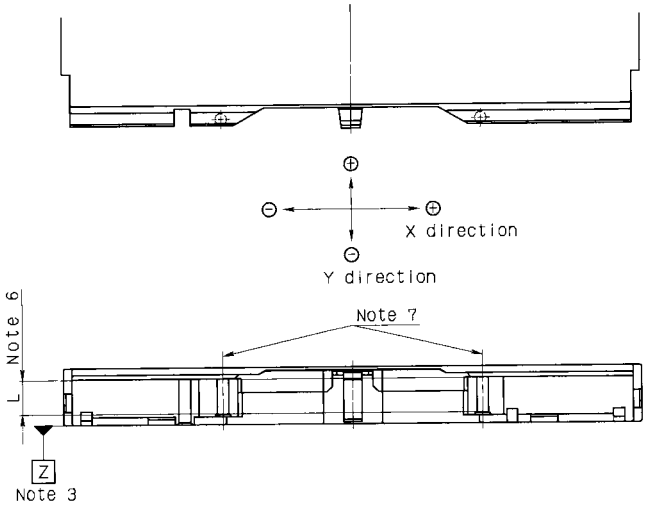
1 Datum hole (a) is primary.

2 The crosshatched area shows the VTR detection area.

Figure 11 — Appearance of video cassette bottom view (oxide and metal L cassette)



12A — Datum spots and supported areas



12B — Tape guide

NOTES

1 Datum spots shall be 10 mm in diameter.

2 The four crosshatched areas, which are supported areas, shall be coplanar within 0.05 mm of each datum spot. The four crosshatched areas shall be coplanar with the hatched area.

3 Datum plane Z shall be determined by the three datum spots, A, B, and C.

4 Datum spot D shall be coplanar within 0.3 mm of datum plane Z.

5 Areas within 1 mm from the edge of the cassette shall not be used as supported areas.

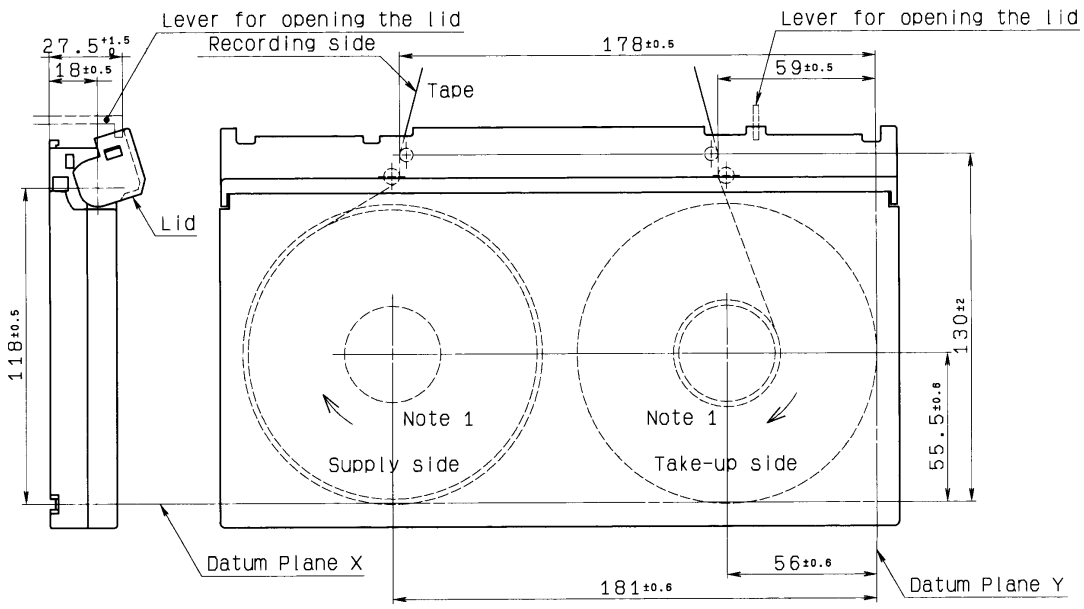
6 Reel flange clearance, L: 15 mm.

7 Perpendicularity of tape guides (even if they are tapered) is specified as follows:

	Direction	
Guide	X	Y
Supply side	0 ± 0.15 mm	0 ± 0.15 mm
Take-up side	0 ± 0.15 mm	0 ± 0.15 mm

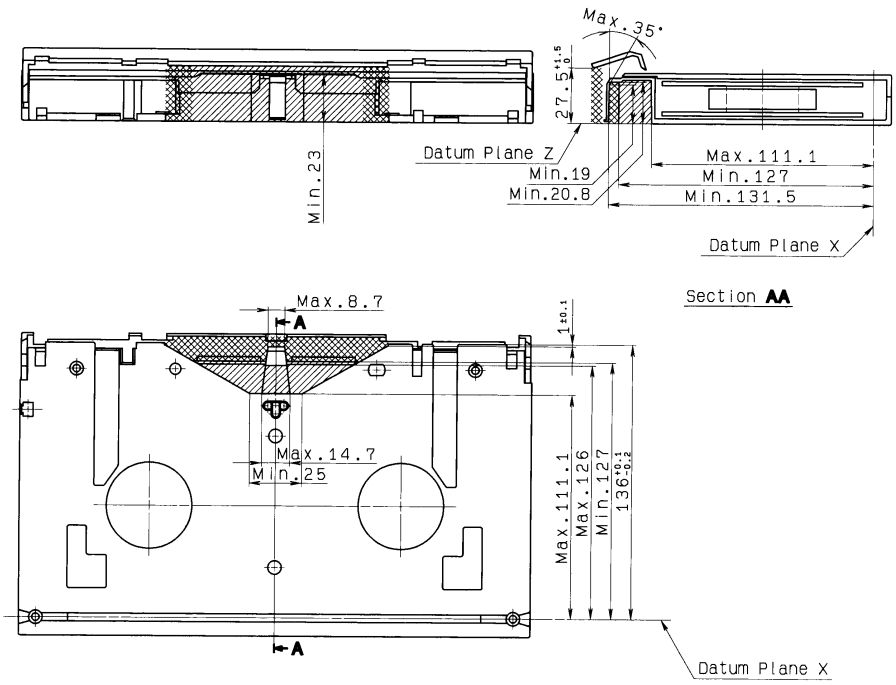
X and Y are the coordinates of the projection of the upper center of tape guides on the plane which includes the lower center of tape guides as the origin and are parallel to datum plane Z.

Figure 12 — Datum spots, supported areas and tape guides (L cassette)



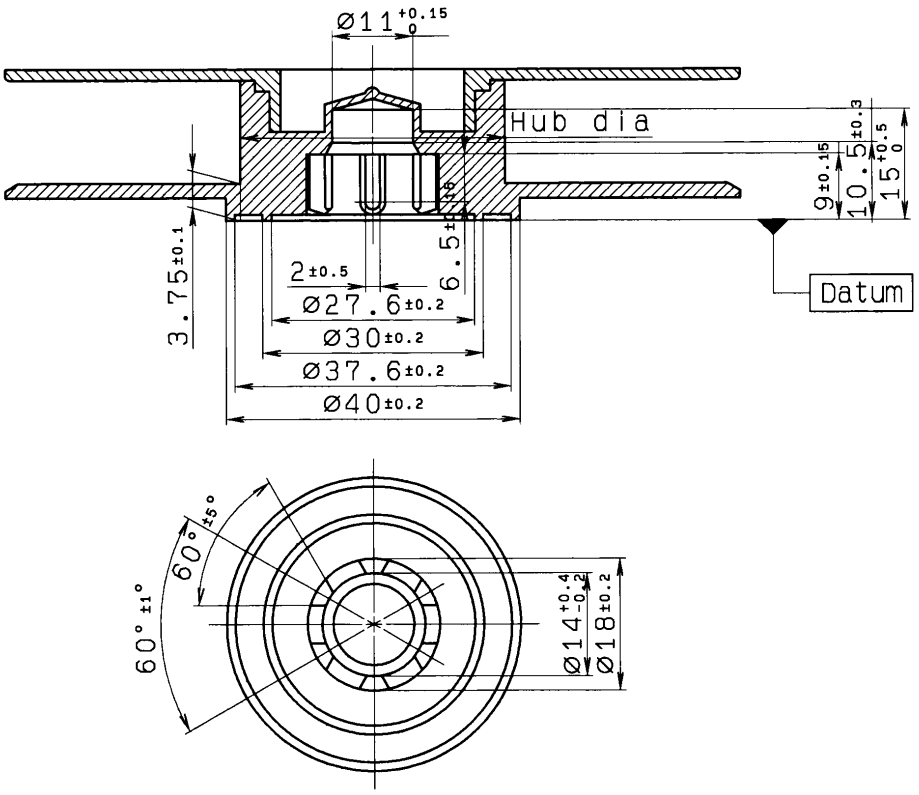
NOTES
1 Rotating direction during forward operation.
2 The opening range of the lid in the recorder and/or player unit is 27.5 mm +1.5 mm –0 mm.

Figure 13 — Location of cassette reels in the recorder and/or player (L cassette)



NOTES
1 The hatched area is where the loading mechanism of the video tape recorder and/or player unit positions the video cassette when it is inserted.
2 The hatched and crosshatched areas are so designed that the loading mechanism of the video tape recorder and/or player unit unwinds and extends the magnetic tape toward the drum head after the lid opens.

Figure 14 — Protecting lid of cassette (L cassette)



Nominal recording time	Hub diameter of reels
≦ 30Min.	Ø53.3±0.2 mm
≧ 60Min.	Ø36±0.2 mm

NOTES
1 Recording time is specified for a tape speed of 118.582 mm/s.
2 Cassettes with playing time between 30 and 60 minutes are not available at present.

Figure 15 – Reel of cassette (L cassette)

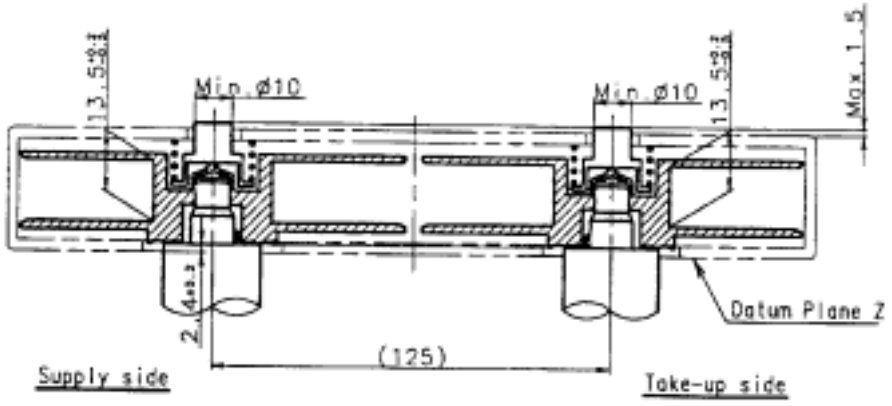
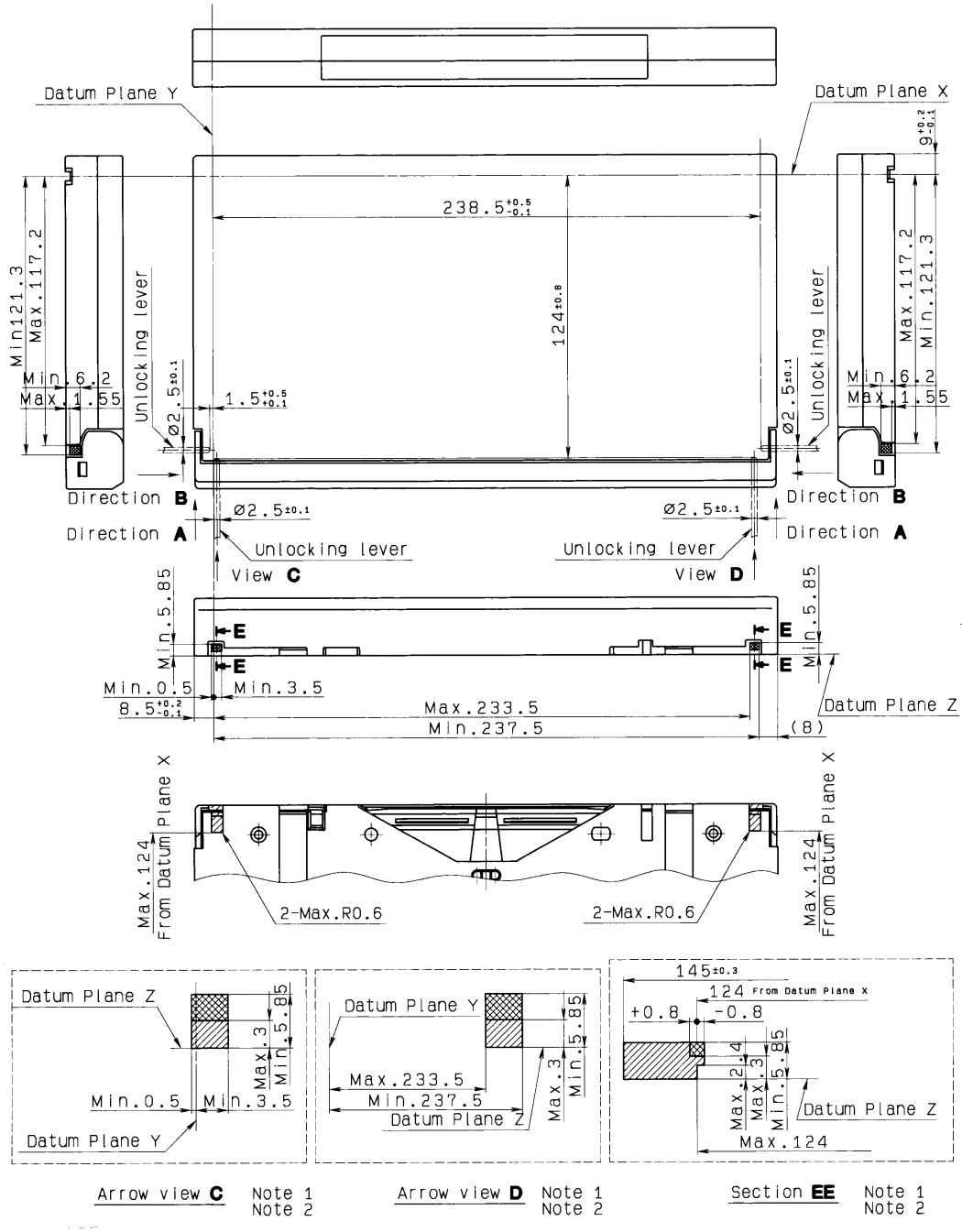


Figure 16 — Height of reels upon rotation (L cassette)



NOTES

1 The crosshatched and hatched areas show the allowable total area where the unlocking lever, extending from the video tape recorder and/or player unit, can be inserted into a cassette.

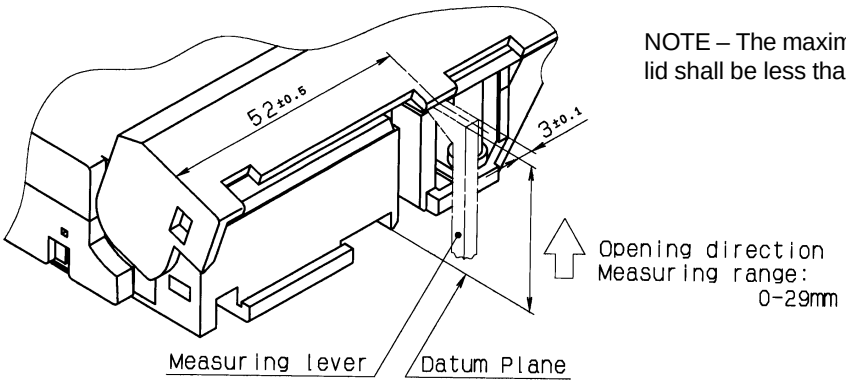
2 The crosshatched area shows the range of the unlocking lever insertion which permits the lid to be unlocked.

3 Allowable range within which the unlocking lever can be inserted in A direction.

4 Allowable range within which the unlocking lever can be inserted in B direction.

5 The tip of the unlocking lever shall be shaped into a semicircle or hemisphere of which the radius is one half the unlocking lever width.

Figure 17 — Allowable and operating ranges for unlocking the cassette lid lever (L cassette)



NOTE – The maximum force to open the lid shall be less than 1.5 N.

Figure 18 — Force needed to open the lid (L cassette)

Table 2 — Tape thickness

S cassette			L cassette		
Nominal recording time (min)	Magnetic tape thickness (μm)		Nominal recording time (min)	Magnetic tape thickness (μm)	
	Oxide tape	Metal-particle tape		Oxide tape	Metal-particle tape
5	19.0 to 21.0	14.1 to 15.3	5	19.0 to 21.0	14.1 to 15.3
10			10		
15			15		
20			20		
30	14.1 to 15.3		30		
			60	14.1 to 15.3	
			90		

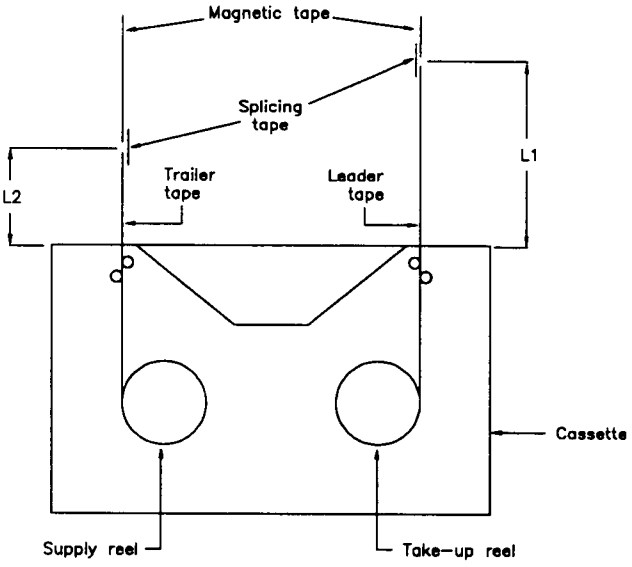


Table 3 — Leader and trailer tape length

Length (mm)	S cassette	L cassette
L_1	250 ± 30	280 ± 20
L_2	70^{+10}_{-20}	90^{+10}_{-20}

Figure 19 — Leader and trailer tape

Annex A (informative)
Cassette use

Cassettes in use prior to the revision of ANSI/SMPTE 238M-1992 remain compatible with the revised dimensions.

Annex B (informative)
Bibliography

ANSI/SMPTE 229M-1996, Television Analog Recording — 1/2-in Type L — Records

ANSI/SMPTE 230M-1996, Television Analog Recording — 1/2-in Type L — Electrical Parameters, Control Code and Tracking Control

SMPTE RP 144-1995, Basic System and Transport Geometry Parameters for 1/2-in Type L Format