

The unique design of Thermo Scientific Carrier Plate enables precise adjustment of height for Cell Culture Inserts in multiwell dishes

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Key Words

Cell culture insert, carrier plate, cell culture, growth media volume

Abstract

The Thermo Scientific™ Cell Culture Insert can be seated in a multiwell dish via either the 1 mm feet at the bottom of the insert or the 3 hanging tabs on the side of the insert. The Thermo Scientific Carrier Plate with the hanging slots allows for adjustment of insert height by engaging different hanging tabs on the insert. Here we determine, through physical measurement of the complete product system, the height of the growth surface of cell culture inserts when hanging in carrier plates. Measurements were taken for all three hanging positions, and recommended growth media volumes were calculated. Inserts were determined to hang with approximately 0.9 mm, 3.3 mm, and 6.3 mm between the well-bottom and insert growth surface for both 12- and 24-well plate formats.

Introduction

To facilitate versatility in the usage of cell culture inserts, carrier plates are designed to hold cell culture inserts in multiple positions above the growth surface of the multi-welled dish containing the insert. An important consideration for cell culture researchers is the height of the growth surface of the insert within the well, and the resulting volume of media required to grow cells at each height. Media height and volume are variables which may need to be controlled to optimize such things as gas exchange, oxygen tension, pH, availability of growth factors, or pH. Adjustment of the insert allows more than one physical position relative to the bottom of the carrier plate. Each position has associated to it minimum requirements of media volume to cover the cells. Physical measurements were made of inserts and carriers and those measurements, as well as recommended media volumes are reported below.



Materials Examined

- 141002 – 24-well carrier plate/multiwell plate, 0.4 μm pore cell culture insert
- 141082 – 12-well carrier plate/multiwell plate, 8.0 μm pore cell culture insert

Methods

To first determine the hanging height in the carrier plate, the distance from bottom surface of the insert to the bottom of each height-adjusting tab on the insert was measured using a height gauge and stationary plate (See Figure 1, A). All 3 tabs on each insert were measured, and for each carrier plate format (12- and 24-well) a sample of $n=3$ inserts was included. Since the top of the polycarbonate film is the growth surface, the thickness of the film must be accounted for in measuring height (Figure 1, B). This was measured using a thickness gauge, and the film thickness was subtracted from measurement A to determine the distance from the bottom of the height-adjusting tab to the insert growth surface.

When placed in the carrier plate, the bottom of the height-adjusting tab rests on the hanging slot of the carrier plate. Therefore, the hanging height of the growth surface (measurement A minus measurement B) is identical to the distance from the bottom of the hanging slot to the insert growth surface. To determine the well height of the insert growth surface from the bottom of the well plate, the height of the hanging slot from the well bottom was measured (Figure 1, C) This was performed

using a height gauge and stationary plate. Three different carrier plate/multiwell dish samples were measured for each plate format, and measurements were taken from three locations in six different wells. Measured wells were chosen to sample as much of the plate as possible, at all four corners and two wells near the plate center (well B2 and B3 in 12-well, B3 and C4 in 24-well). Individual well measurements were averaged, and the calculation $H = C - (A - B)$ was performed using these means for each height-adjusting tab size. The resulting dimensions (height H, see Figure 2 for clarification) represented the height of the cell culture insert growth surface from the bottom interior of the well in each hanging position.

Using height H calculated above, the volume of cell growth media needed to cover the insert growth surface was also calculated. To cover cultures with media 5 mm deep, 5 mm was added to height H for each hanging position. This height was then multiplied by the growth surface area in individual wells for each plate format. The resulting volume is given as the recommended media volume at each hanging position.

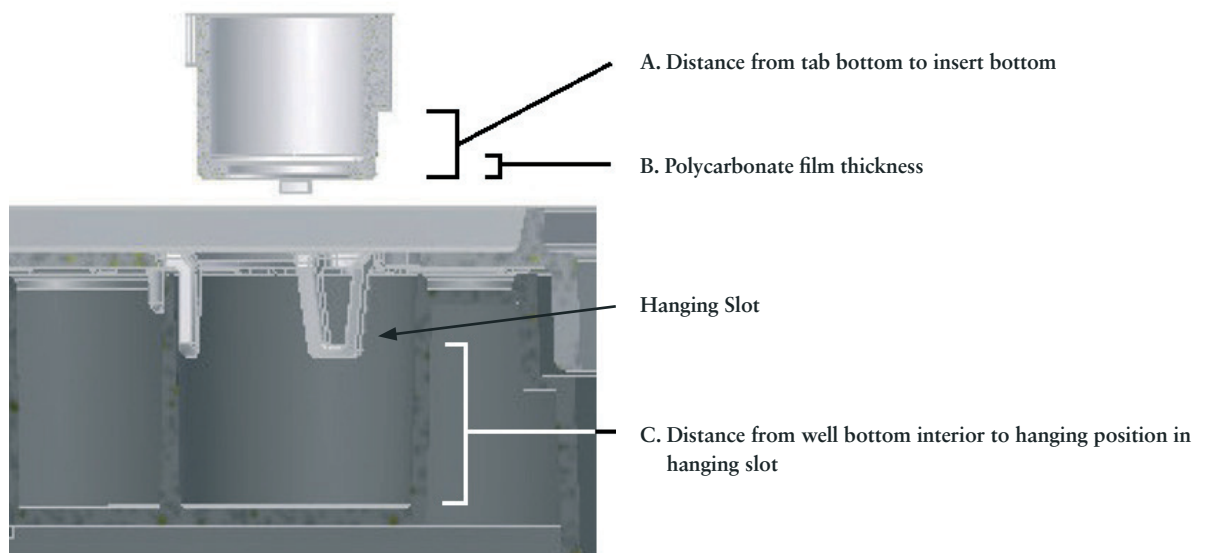


Figure 1.
Depiction of measurements taken from cell culture inserts and carrier plate/multiwell dishes.

Height of the cell culture insert growth surface

$$H = C - (A - B)$$

Results and discussion

Table 1 contains overall results averaged from all plates and inserts for each format. Surface areas used for volume calculations are 3.5 cm² for 12-well plates, and 1.8 cm² for 24-well plates. Working volumes are calculated to give 5 mm growth media over the growth surface. Media volumes shown are suggestions, different volumes may be necessary depending on the cell type and experiment being performed.

Figure 2 shows cell culture inserts in the carrier plate, in all three configurations, with average hanging heights labeled for clarity.

Hanging Position	Measurements	24-well Carrier Plate	12-well Carrier Plate
Low	Height (mm)	0.9 ± 0.1	0.9 ± 0.1
	Working Volume (mL)	1.0	2.0
Medium	Height (mm)	3.3 ± 0.1	3.4 ± 0.1
	Working Volume (mL)	1.5	3.0
High	Height (mm)	6.3 ± 0.1	6.4 ± 0.1
	Working Volume (mL)	2.0	4.0

Table 1.
The height of the cell culture insert growth surface for all 3 hanging positions with recommended working volumes that allow 5 mm medium coverage of the insert.

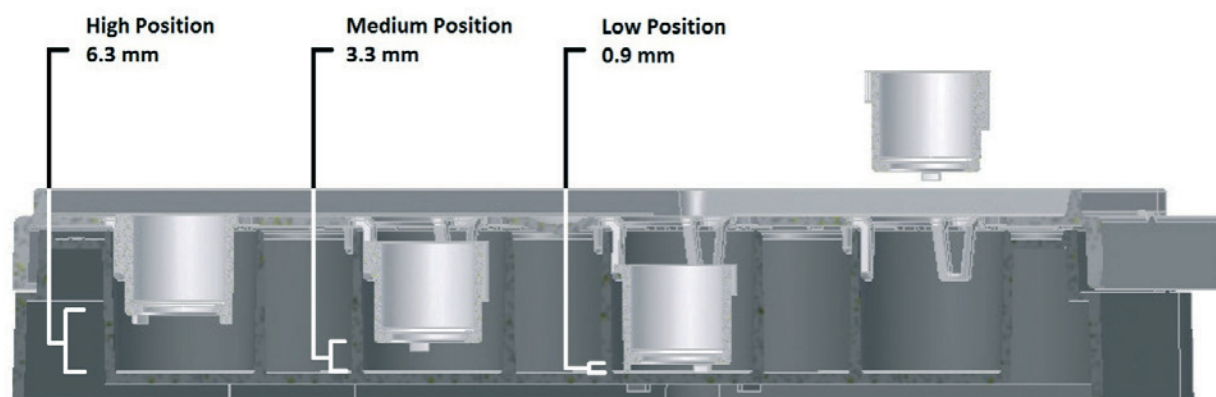


Figure 2.
Depiction of cell culture inserts hanging in carrier plate, showing three different hanging positions. Dimensions given represent the height of the growth surface of the cell culture insert from the interior bottom of the well (Height H). Dimensions in figure are rounded to the tenth of a millimeter.

Conclusion

Carrier Plates are convenient for implementing versatility in the experimental design of cell culture inserts.

The three hanging positions in the Carrier Plate allow for distance of approximately 0.9 mm, 3.3 mm, or 6.3 mm between the well-bottom and insert growth surface for both 12- and 24-well plate formats.

Working volume should be adjusted according to the hanging position to suit the application needs.

Reference

Thermo Scientific Nunc Solutions for Cell Culture and Growth brochure.

Related Applications

In vitro 3-D epidermis and dermis construction

Toxicology study using skin model

Polarized epithelial cell culture at air-liquid interface

Air quality-related research using lung epithelial cells (e.g. Asthma, etc.)

Study of carcinogens of lung cancer

Ordering Information

Nunc Carrier Plate System for 24-well Multi-dish – Polycarbonate Membrane

Cat No.	Pore Size, μm	Pore Density, pores/cm ²	Culture Area, cm ²	No. of inserts/carrier plate	No. of carrier plates/case
141008	-	-	-	0	4
141002	0.4	<0.85 x 10 ⁸	0.47	24	4
141004	3.0	<1.7 x 10 ⁶	0.47	24	4
141006	8.0	<0.85 x 10 ⁵	0.47	24	4

Nunc Carrier Plate System for 12-well Multi-dish – Polycarbonate Membrane

Cat No.	Pore Size, μm	Pore Density, pores/cm ²	Culture Area, cm ²	No. of inserts/carrier plate	No. of carrier plates/case
141086	-	-	-	0	4
141078	0.4	<0.85 x 10 ⁸	1.13	12	4
141080	3.0	<1.7 x 10 ⁶	1.13	12	4
141082	8.0	<0.85 x 10 ⁵	1.13	12	4

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