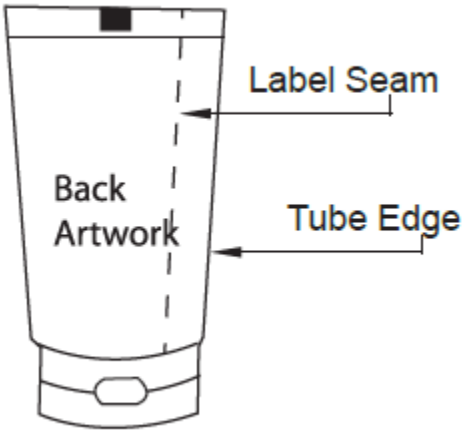
# Sealing Guidelines for Injection-Molded Polypropylene Tubes

## Introduction

This guide is designed to provide essential knowledge for optimizing the sealing process of Viva's injection-molded polypropylene tubes with in-mold label decoration. It also includes additional adjustment and troubleshooting techniques to help ensure the highest quality seals.

When handling Viva tubes prior to filling and sealing, please follow these general guidelines to maintain the integrity of the product:

- Hot Jaws are not recommended for sealing polypropylene tubes.
- Do not fold the tube at the artwork seam.
    - The artwork seam is meant to be positioned approximately 5mm from the right-hand side when looking at the back panel.




- Do not double stack pallets.
- Handle carton boxes with care; avoid dropping them.
- Fill tubes within a year of production.
- Fill and store tubes at room temperature in a dust-free environment (some acclimatization may be necessary).

## Sealing Temperature

The sealing temperature is the most critical factor in achieving optimal seal strength. The performance of the sealing heads can vary depending on the sealing machine's air-hole diameter and configuration. Below, we've outlined four common types of sealing heads for your reference.

~1.0mm Dia, 4 rows (Viva Original)

~0.7mm Dia, 4 rows

~0.7mm Dia, 2+2 rows

~0.5mm Dia, 4 rows

## Air-hole Sizes and Hot Air Temperatures

Viva's internal blow tests have shown that smaller air-hole sizes generally require lower temperatures to achieve optimal sealing performance. The table below provides reference temperatures for different air-hole sizes. Please note that the exact temperature settings will vary depending on the specific machine and process in use. The results presented are based on Viva's equipment, which utilizes a 'Leister Type 3000' sealing head.

**Optimal Sealing Temperatures for Different Air-Hole Sizes:**

- 1.0mm x 4 rows = 410 – 430° C
- 0.7mm x 4 rows = 350 – 370° C
- 0.7mm x (2+2) rows = 320 – 340° C
- 0.5mm x 4 rows = 320 – 340° C

**Sealing Temperature vs. Performance**

| 1.0 mm x 4R | 320 | 360 | 400 | 440 | 480 |
|---|---|---|---|---|---|
| Result (%) | 0 | 81.3 | 100 | 100 | 0 |
| 0.7 mm x 4R | 260 | 300 | 340 | 380 | 420 |
| Result (%) | 0 | 0 | 100 | 100 | 93.8 |
| 0.7 mm x (2+2)R | 260 | 300 | 340 | 380 | 420 |
| Result (%) | 0 | 100 | 100 | 100 | 43.8 |
| 0.5 mm x 4R | 260 | 300 | 340 | 380 | 420 |
| Result (%) | 0 | 100 | 100 | 100 | 87.5 |

**Other Sealing Parameters to Consider**

| **Sealing Speed** (tubes per minute) | **Hot Air Blow Time** (seconds) | **Hot Air Flow Rate** (L/min) | **Sealing Clamp Time** (seconds) |
|---|---|---|---|
| **45** | 0.8 - 1.2 | ~330 | As long as possible |
| **60** | 0.5 - 0.8 | ~330 | As long as possible |

**Additional Factors to Consider**

- **Tube Material / Wall Thickness**

  The parameters above assume the use of Viva's PP tube with a CPP/Foil/EVOH label and a tube wall thickness of approximately 0.5mm.

- **Sealing Time**

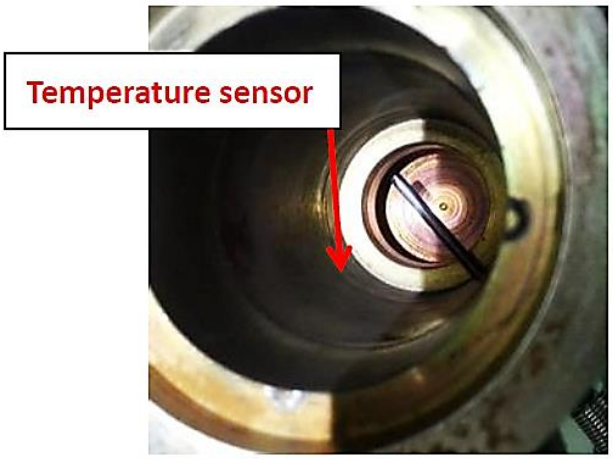
  Sealing time should be adjusted according to the specific machine in use.

- **Tube Inner Wall and Sealing Head Space Clearance**

  Ensure there is at least a 1mm gap to accommodate tube dimensional tolerance and to prevent the nozzle head from contacting the tube.

- **Location of the Temperature Sensor**

  The position of the temperature sensor is crucial. If the sensor head or body touches the nozzle case, the temperature reading will be significantly lower than if the sensor is placed in the middle. (Refer to the image below for proper sensor placement.)



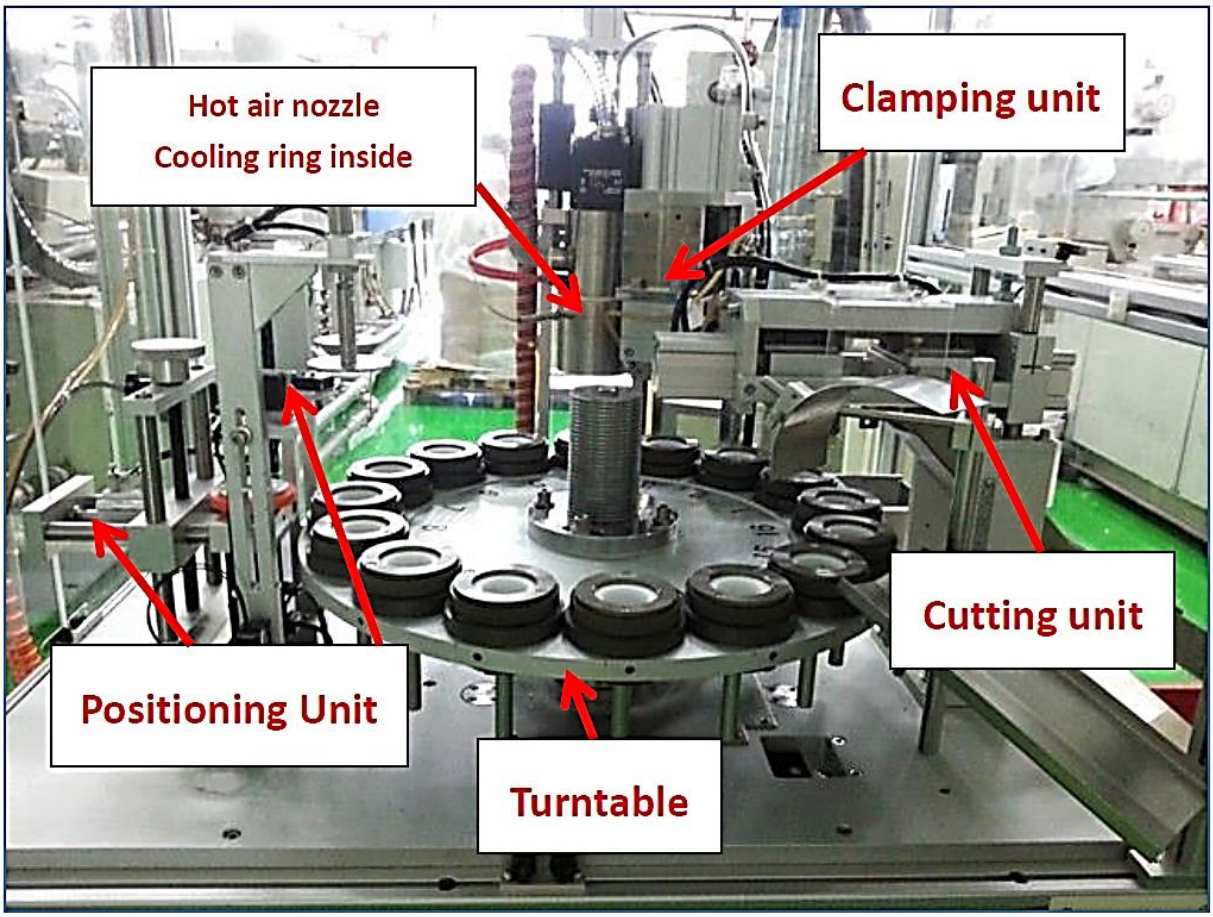

**Temperature Sensor Inside the Hot Air Nozzle**

### Adjusting the Sealing Machine

Typical sealing machines consist of several key components, as outlined below (refer to the accompanying photo for visual reference):

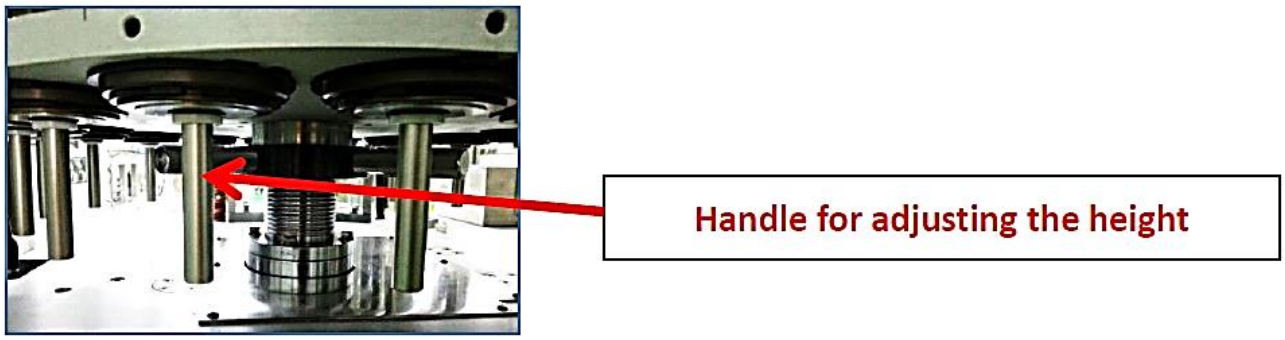
1. **Turntable:**
   Rotates the tubes, moving them sequentially through each station.
2. **Positioning Unit:**
   Ensures proper alignment and placement of the tube within the cup.
3. **Hot Air Nozzle:**
   Directs hot air into the tube to melt the sealing surface. This unit may also include a cooling ring, which stabilizes the tube in a centered position and cools the outer surface post-sealing.
4. **Clamping Unit:**
   Utilizes a clamping mechanism to seal the tube's end securely.
5. **Cutting Unit:**
   Trims the sealed end of the tube to achieve a clean finish.

**Sealing Machine**



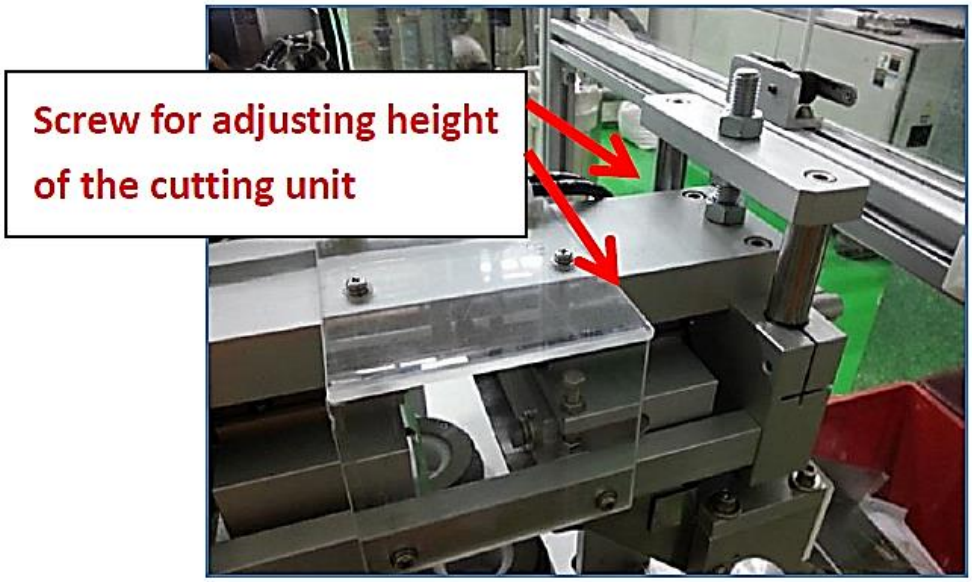

**Sealing Height Adjustment**

The primary height adjustment on typical sealing machines is managed by the turntable. A handle located underneath the machine allows for easy height modifications.



### Additional Methods for Sealing Height Adjustment

Minor adjustments to the sealing height can also be made by moving the cutting unit up or down.




### Crimp Height Considerations

The standard crimp height is approximately 6 to 7 mm.


- **To Shorten the Total Height While Maintaining Content Volume:**

  Lower the entire cutting unit. This adjustment allows the tube content volume to remain unchanged.

- **To Maintain Total Height With Increased Content Volume:**

  Lower both the turntable and the cutting unit by a few millimeters. This modification will increase the tube's content capacity while keeping the overall height consistent.

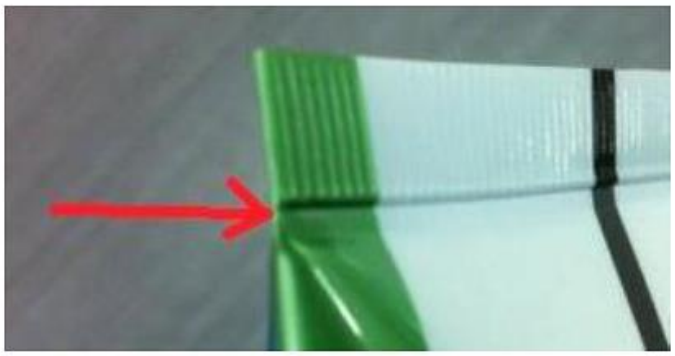

| Reference tube | Tube with same content level, but shorter height |
|---|---|


| Reference tube | Tube with same height, but higher content level |
|---|---|

**Troubleshooting Guide for Polypropylene Tube Sealing**

## A. Sealing Line Thickness

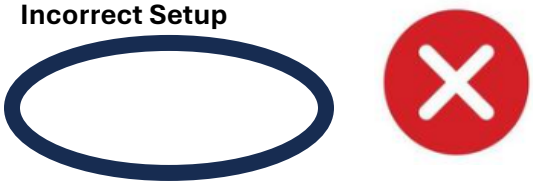
The sealing line thickness should be approximately 75-85% of the total tube wall thickness. For example, if the tube wall is 0.5 mm thick, the sealed crimp should be around 0.75 – 0.85 mm.



| Sealing Line Problem | Cause | Recommendations |
|---|---|---|
| **Too Thin** (e.g., sealing line burst) | Clamping unit gap width too tight | Loosen the clamping unit |
| | Hot air temperature too high | Reduce the hot air temperature |
| | Hot air blow time too long | Reduce the hot air blow time |
| **Too Thick** (e.g., tube end burst) | Clamping unit gap width too wide | Tighten the clamping unit |
| | Hot air temperature too low | Increase the hot air temperature |
| | Hot air blow time too short | Increase the hot air blow time |
| **Variation Between Left and Right Edge** | Clamping unit gap not parallel | Adjust the left and right side of the clamping unit |
| | Sealing clamp damaged | Replace a new clamp unit |

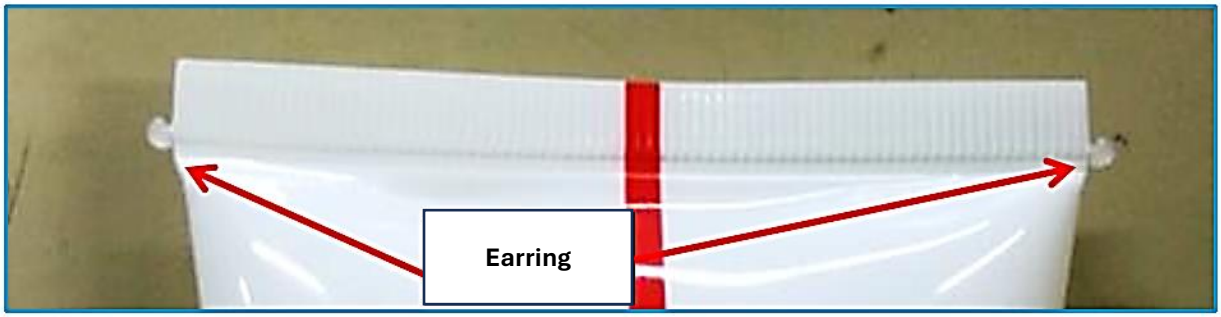
- **Proper Setup**

- **Incorrect Setup**

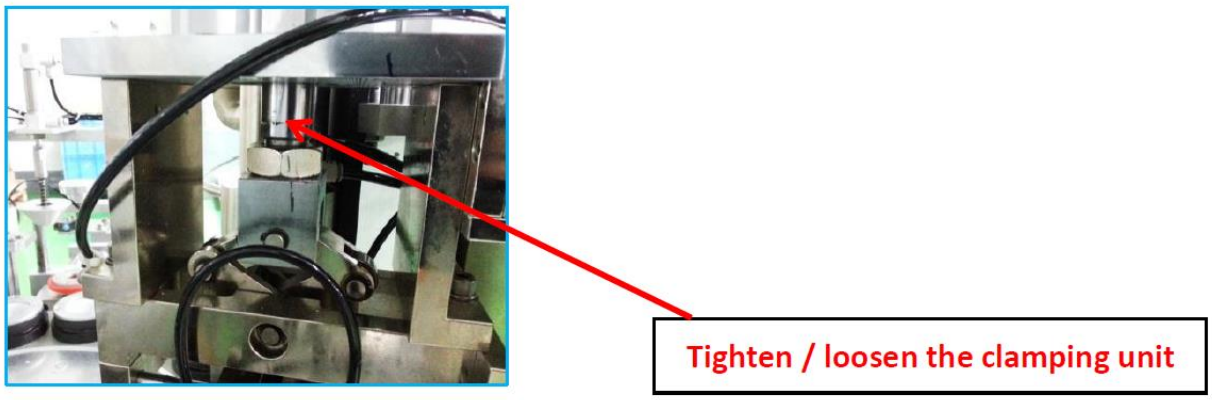


## B. Earring

**Problem**: Plastic residue appears on one or both sides of the sealing line.

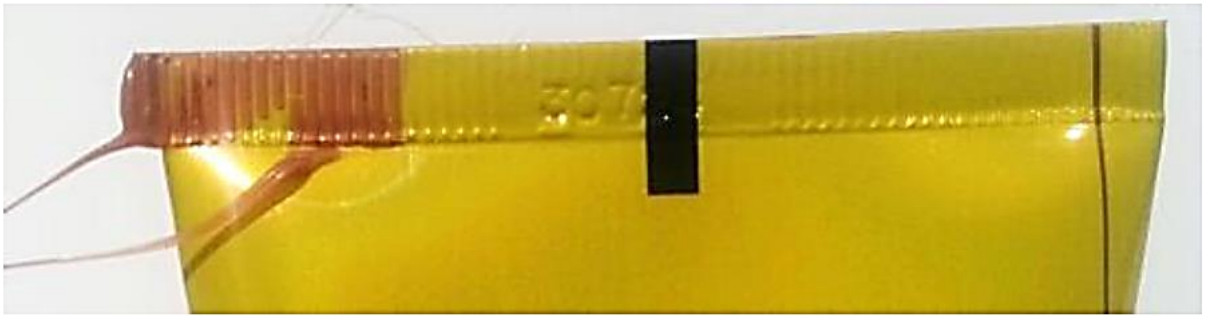



| Cause | Recommendations |
|---|---|
| Clamping unit gap too tight, causing tube deformation | Adjust the clamping unit by turning the screw at the top. |
| Clamping unit not parallel (earring on one side only) | Adjust the clamping unit to ensure parallel alignment. |
| Hot air temperature too high | Reduce the hot air temperature. |



### C. Residual Material Build-Up

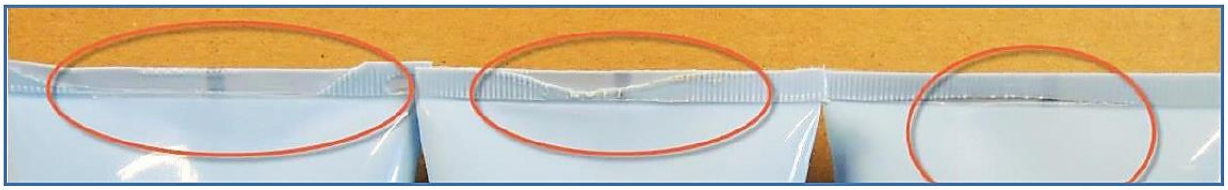
**Problem**: Residue material accumulates in the tube crimp area.



| Cause | Recommendations |
|---|---|
| Nozzle head touches the inner surface of the tube | Reduce the nozzle head diameter and ensure proper centering of the nozzle head within the tube to allow for a 1mm clearance. |
| Cooling ring too large, not holding the tube centered | Adjust the cooling ring to maintain proper alignment of the tube. |
| Hot air temperature too high | Note that high temperature alone won't cause this issue; it's more about contact with the tube. |

### D. Crimp Area Damage

**Problem:** The crimp area melts or burns, turning brown.



| Cause | Recommendations |
|---|---|
| Nozzle head touches inner surface of the tube | Reduce the nozzle head diameter to allow for a 1mm clearance. |
| Nozzle head not centered to the tube body | Ensure proper centering of the nozzle head within the tube. |
| Cooling ring too large, not holding the tube centered | Adjust the cooling ring to maintain proper alignment of the tube. |
| Hot air temperature too high | Note that high temperature alone won't cause this issue; it's more about contact. |

### E. Leakage at Tube Seamline

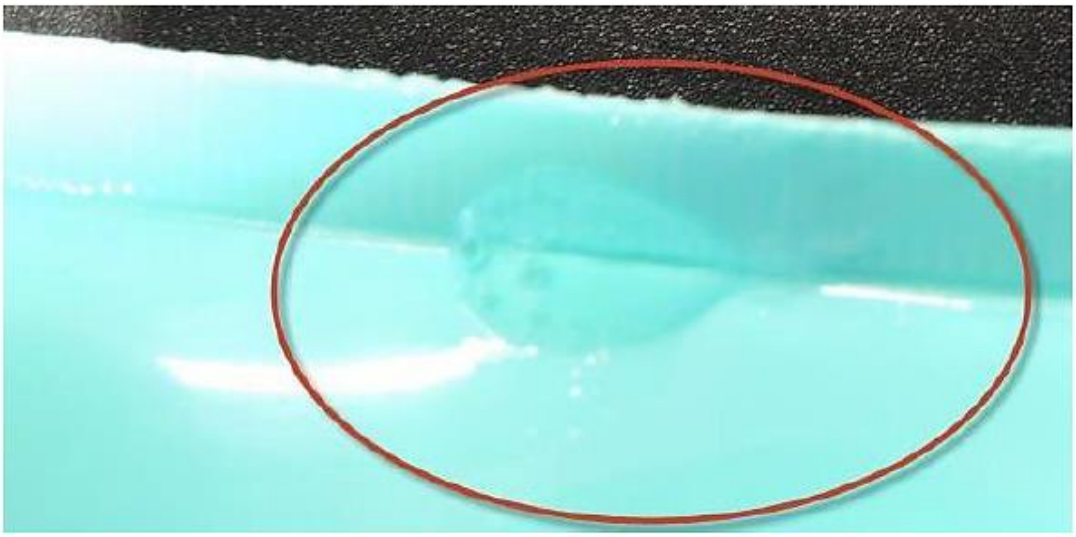
**Problem:** Seamline bursts, causing product leakage

| Cause | Recommendations |
|---|---|
| Tube sealed with artwork seam too close to the edge | Ensure the label seamline is at least 5mm away from the tube edge to prevent folding. |
| Folded edge compromises the strength of the seamline | Adjust the eyemark to the exact center of the back of the tube. |

### F. Leakage at Tube Sealing Line

**Problem:** Sealing line bursts, causing product leakage

| Cause | Recommendations |
|---|---|
| Sealing line is too thin, weakening its strength | Refer to the 'Sealing Line Thickness' section. |



### G. Tube Seamline Breaks Before Sealing

**Problem:** The label seamline breaks when fixing the tube in position before filling.

| Cause | Recommendations |
|---|---|
| Conical part of the positioning unit is too large, the pressure is too high, or the tube is positioned too high. | Adjust the size or pressure of the conical part, or lower the turntable to reduce stress on the tube. |

If you have any questions about these guidelines, please contact your Viva team at **(416) 321-0622**.