

Sealing Guideline (updated on Oct 13, 2015)

1. Introduction

This Viva Tube Sealing Guideline is the 2nd edition, with expanded information on the sealing temperature of different sealing head design. This guideline seeks to provide the knowledge needed to optimize the sealing process for Viva Healthcare's Injection-molded tubes with in-mold labels. In addition, more adjustment / problem solving techniques have been included.

Here are some general guidelines for handling the tubes prior to filling and sealing. When filler receives the tube products:

- Do not fold the tube at the label-edge seam
- Do not double stack the pallets
- Do not drop carton box
- Store and fill at room temperature (some acclimatization may be necessary)

2. Sealing temperature

The sealing head from different machines have different air-hole diameter and configuration. Sealing temperature is the most critical factor affecting the sealing end strength. Four common types of sealing head were tested thoroughly.



~1.0mm Dia, 4 rows (Viva Original)



~0.7mm Dia, 4 rows



~0.7mm Dia, 2+2 rows



~0.5mm Dia, 4 rows

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2.1 Air-hole Sizes and Hot Air Temperature

Viva internal blow test indicates that the smaller the air-hole size, the lower the temperature required to achieve optimal sealing performance. The table below shows the reference temperature used across different air-hole sizes. The exact temperature has to be decided per different machine and process. The results are based on Viva's machine which is equipped with 'Leister Type 3000' sealing head.

Optimal sealing temperature for different air-hole sizes:

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

	Sealing Temperature				
1.0mm x 4R	320	360	400	440	480
Result	0.0%	81.3%	100.0%	100.0%	0.0%
0.7mm x 4R	260	300	340	380	420
Result	0.0%	0.0%	100.0%	100.0%	93.8%
0.7mm x (2+2)R	260	300	340	380	420
Result	0.0%	100.0%	100.0%	100.0%	43.8%
0.5mm x 4R	260	300	340	380	420
Result	0.0%	100.0%	100.0%	100.0%	87.5%

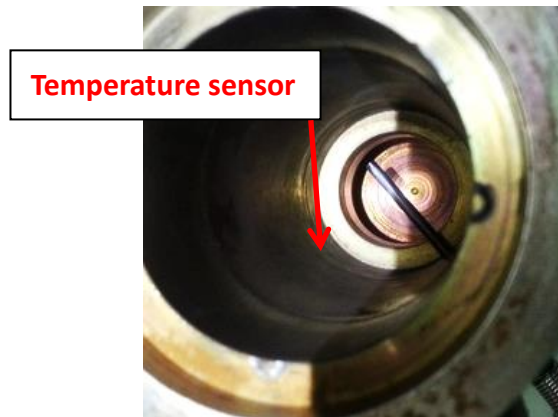
2.2 Other sealing parameters:

Sealing speed (tubes per minutes)	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

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2.3 Other factors:

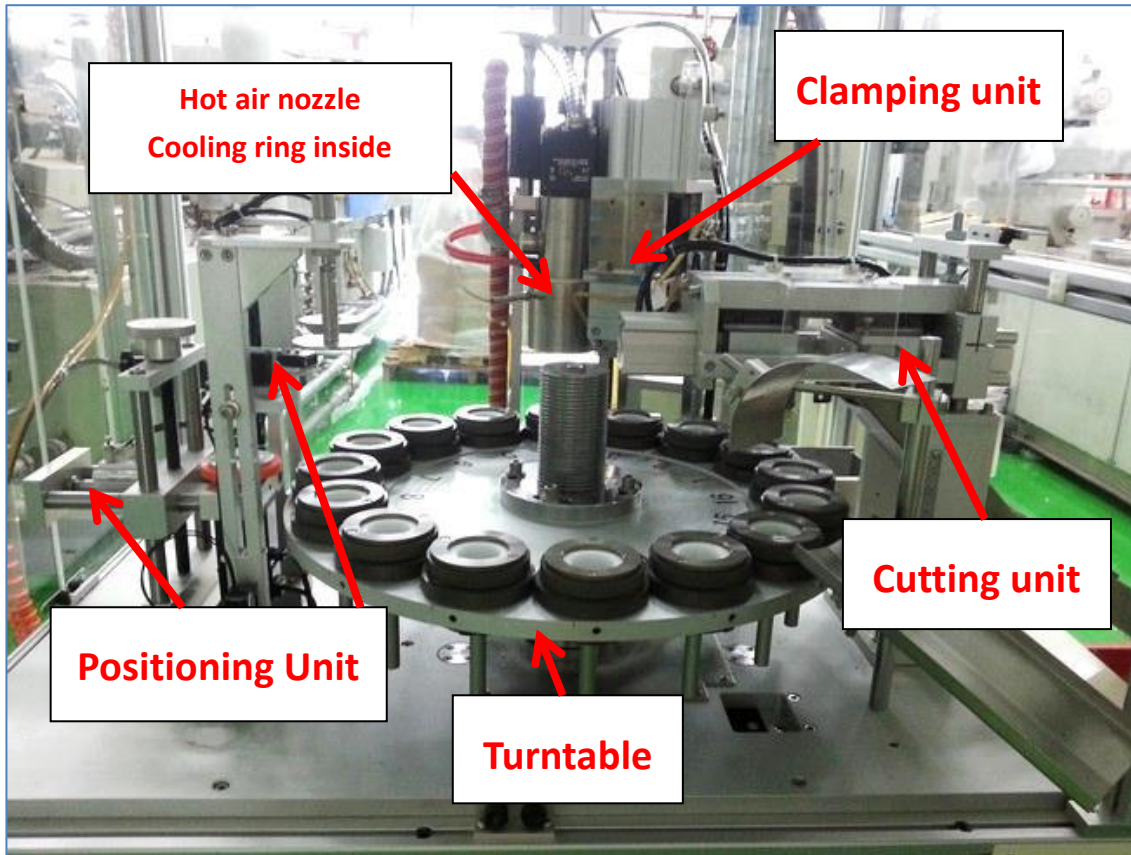
- **Tube material / wall thickness:** The above results assume Viva tube of PP material (CPP/Foil/EVOH label) with approximately 0.5mm tube wall thickness.
- **Sealing time:** Each machine should be adjusted accordingly.
- **Tube inner wall and sealing head space clearance:** There must be at least 1mm space to allow for tube dimension tolerance and to avoid nozzle head touching the tube.
- **Location of the temperature sensor:** If the sensor head or body touches the nozzle case, the measured temperature will be much lower than if sensor is placed in the middle.



Pic 1, temperature sensor inside the hot air nozzle

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3. Adjustment of the sealing machine (example below is Viva in-house sealing machine)



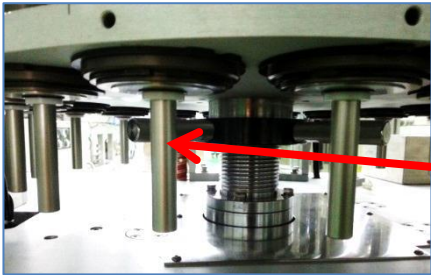
Typical sealing machine consists of the following major parts:

1. Turntable – to turn the tubes into each station.
2. Positioning unit – to check and position the tube into the cup.
3. Hot air nozzle – to blow hot air into the tube to melt sealing surface. Cooling ring function to fix tube in centered position and cool outer surface of the tube.
4. Clamping unit – to seal the tube end by clamping mechanism.
5. Cutting unit – to trim the sealed tube end.

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3.1 Major sealing height adjustment

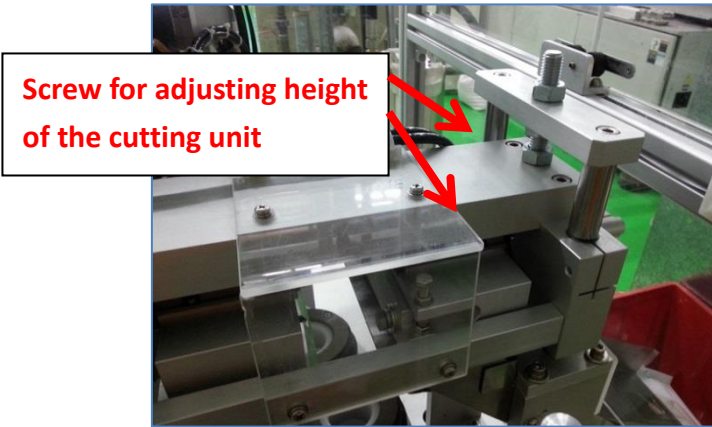
The major height adjustment is controlled by the turntable. Typical sealing machine is equipped with a handle underneath to adjust the height.



Handle for adjusting the height

3.2 Other way to adjust sealing height

Other than the turntable, minor height adjustments could be made by moving the cutting unit up or down.



Screw for adjusting height of the cutting unit

Crimp height is approximately 6 to 7mm:



6mm to 7mm

- Shorter total height with same content level – This can be achieved by lowering the whole cutting unit. Tube content volume can remain the same.
- Same total height with higher content level – This can be achieved by lowering the whole turntable and cutting unit by a few mm. Tube volume will be increased, but the total height will remain the same.

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Reference tube

Tube with same content level, but shorter height



Reference tube

Tube with same height, but higher content level

4. Troubleshooting

4.1 Sealing Line Thickness

The sealing line thickness (red arrow below) should be approximately 75-85% of the total thickness of the tube. If the tube wall is 0.5mm, then the total crimp thickness is 1.0mm. A good sealed crimp thickness will be around 0.75 – 0.85mm.



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

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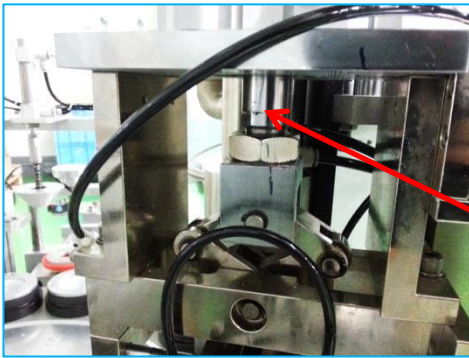
4.2 Earing

Problem: plastic residue on both sides or one side of the sealing line



Cause 1: clamping unit gap width is too tight thus squeezing and deforming the tube. If the earing appears only on one side, then the clamping unit is not parallel.

Recommendations: clamping unit can be adjusted by turning the screw at the top.



Tighten / loosen the clamping unit

Cause 2: hot air temperature too high.

Recommendations: reduce the hot air temperature.

4.3 Residue material

Problem: residue material build up at the tube crimp area



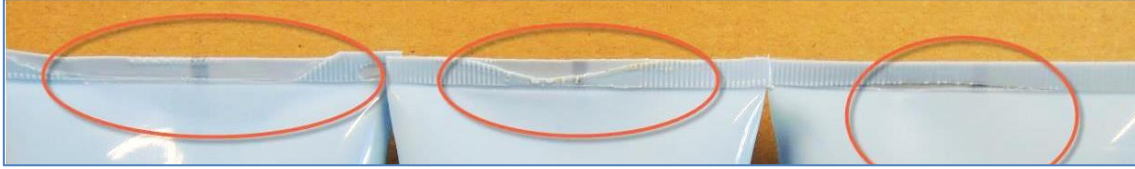
Cause: nozzle head touches the tube inner surface because it is larger than the tube's inner diameter or nozzle head is not centered to the tube body (cooling ring too large, and not holding the tube centered). As the nozzle head melts the tube and consistently scrapes the inner wall of the tube, residue material builds-up on the nozzle and transfers the melted plastic onto the next tube, as shown on the photo.

Recommendations: reduce the diameter of the nozzle head to allow 1mm clearance, or the cooling ring so that the ring contacts the tube surface around the perimeter of the tube.

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4.4 Tube crimp area damage

Problem: crimp area melted and burnt (plastic becomes brownish color like the middle tube).



Cause: nozzle head touches the tube inner surface because it is larger than the tube's inner diameter or nozzle head is not centered to the tube body (cooling ring too large, and not holding the tube centered). Even if the hot air temperature is too high, the plastics will not be melted and burnt like this.

Recommendations: reduce the diameter of the nozzle head to allow 1mm clearance, or the cooling ring so that the ring contacts the tube surface around the perimeter of the tube.

4.5 Leakage at tube seamline

Problem: seamline burst with possible product leaking out

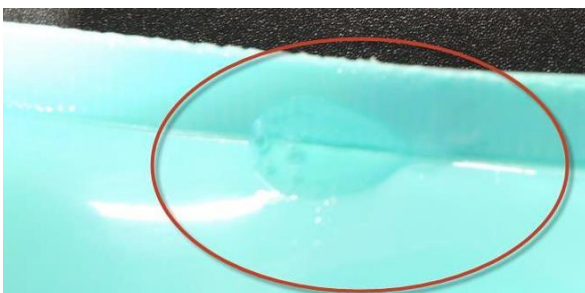


Cause: tube sealed with label seamline too close to the tube edge. The folded edge is causing the label seamline to fold or bend, where the strength is compromised. The label seamline must be at least 5mm away from the tube edge to prevent folding.

Recommendations: adjust the eyemark to exact center

4.6 Leakage at tube sealing line

Problem: sealing line bursts and product leaking out



Cause: sealing line too thin thus weakening the sealing strength.

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Recommendations: refer to 'Sealing Line Thickness' section.

4.7 Tube seamline break before sealing

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



Cause: At the positioning unit, the conical part that pushes the tube into the cup is either too big, the pressure is too high, or the tube is positioned too high. The pressure from the cone pushes too hard on the tube, damaging the tube at the label seamline.

Recommendations: adjust conical part size or pressure, or adjust the height of the tube by lowering the turntable.