MELCO™ T-5000 Tape

When MELCO™ tape T-5000 is applied onto 3-ply waterproof materials with high rubber-elasticity (for example, wetsuit material: the three layers consist of nylon jersey/neoprene foam sheet/nylon jersey), it requires a more sophisticated welding technique than MELCO™ tape T-2000, for the following reasons:

a) The surface that is being welded upon is nylon jersey knit, which has a much more complex construction than nylon tricot.

b) The material being welded is elastic not only horizontally, but also vertically. Indeed, the material stretches in all three dimensions.

c) MELCO™ tape T-5000 itself is also highly elastic.

One of the two keys to a successful weld is to ensure that the adhesive of the tape penetrates and saturates the nylon jersey layer completely. The fact that the jersey has a tight knit and a fluffy surface makes the penetration of the adhesive all the more difficult. Due to the tight-knit texture of the nylon jersey, more of the heat energy that is being applied to the weld will be dissipated by the surrounding knit fabric, instead of being available to melt the adhesive of the tape. Therefore, when welding MELCO™ tape T-5000, one must pay careful attention to the amount of heat energy and pressure being applied to the weld. If the nylon jersey layer is not saturated with adhesive, the tape will eventually come off. This is because *unsaturated* nylon jersey fibers *change size* slightly with repeated use, due to cycles of water absorption and dehydration, thereby loosening the glue.

Because of the porous fluffy surface, it is difficult to judge the exact degree of penetration. It is easy to think that the weld is okay, when, in reality, there is superficial or uneven penetration/adhesion (for instance, onto the fluffy outer surface of the nylon jersey layer only).

If either the tape or the material, or both of them, are stretched during welding, the stretchability of the welded portion will be decreased, and either a convex or concave shape will result, or else the performance of the adhesive will be inadequate.

The fact that the material (nylon jersey) stretches in three dimensions, including the compression that results from the pressure of the welding process, increases the potential problems in welding technique. Note that not all the pressure applied over the weld will force the adhesive of the tape into the jersey layer. A certain amount of pressure will be consumed in compressing the neoprene foam sheet of the material.

1. Heat Press Welding for MELCO T-5000 Tape

Heat press welding is the preferred method for applying MELCO™ T-5000 tape onto wetsuits material. The heat press welding method will provide consistently even tape welding, and will allow as broad range of applications as possible, for example, welding with narrow tape, welding on a convex/concave surface without losing stretchability.

To address the problem discussed above effectively, and to achieve maximum efficiency when welding MELCO™ T-5000 tape using a heat-press machine, the following basic welding conditions must be met:

Net welding temperature:	155 ~ 165℃
Pressure on the weld:	0.7 ~ 1.0 kg/cm^2
Duration of the welding process:	5 ~ 7 seconds

Note: The duration includes the time required to compress the neoprene foam sheet . Therefore, it will vary slightly according to the thickness of the neoprene foam sheet.

The only drawback of this welding method is that productivity appears at first to be rather slow. However, due to its ability to achieve consistently perfect tape welding, the heat-press welding method is actually quite efficient for the production of wetsuits, since productivity must necessarily take into account not only the speed of the production line, but also the quality and dependability of the product.

2. Hot-Air Welding for MELCO™ T-5000 Tape

The only other welding method that can be used to apply MELCO™ tape T-5000 is hot-air welding. To achieve a perfect weld, the hot-air sealing machine must be set according to the basic welding conditions described above (Heat Press Welding for MELCO™ Tape T-5000) as closely as possible.

Following are some problems you might encounter during hot-air welding. These problems result from the fact that the heat from the nozzle of the machine is high-temperature, radiant heat.

a) Problems relating to the color of tape/material

Thermal efficiency varies slightly according to the color of the tape/material: the darker the color, the higher the absorption of radiant heat. Therefore, it is advisable not to set the machine at its lowest possible heat level that will still allow welding to occur, but instead to set it a little more towards the "center" of the limits for achieving good welds.

b) Problems relating to the stretching of the nylon jersey

If the nylon jersey is laminated to the neoprene foam sheet while it is stretched, its absorption of radiant heat will be somewhat greater due to the effect of the black neoprene foam sheet (middle layer). This may result in deterioration of the nylon jersey due to heat. This must be taken into account when setting the distance from the material to the bottom of the nozzle.

Close attention must also be paid to the construction of the backing fabric (nylon jersey), because it will affect the saturation of the tape adhesive into the fabric layer. For example, material composed of pile fabric differs from material utilizing elastic yarn jersey knit.

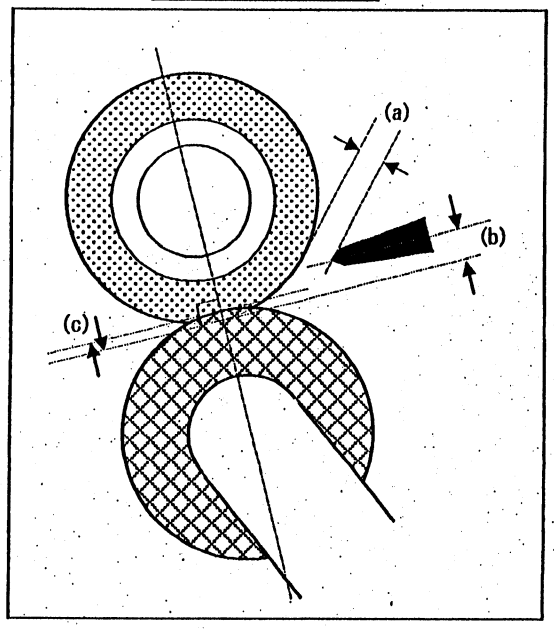
When using a hot-air sealing machine, it is important to be familiar with the machine's structural characteristics. Acquaint yourself with all of the adjustments you will be required to make, based on environmental variables, welding variables, etc. These adjustments greatly affect the integrity of the welds.

The following are two different welding conditions set for the two different types of hot-air sealing machines. The one is the machine without a heated upper roller such as commonly used PFAFF, and the other is Queen Light with a heated upper roller.

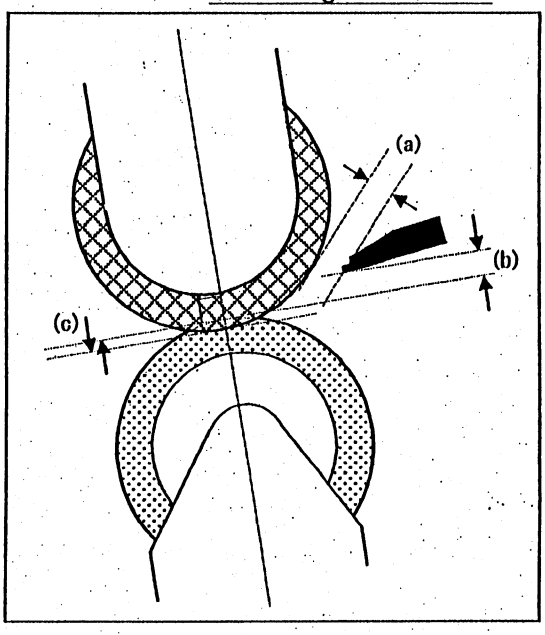
When machine is not equipped with a heated upper roller, as in PFAFF, you should do some dry runs until the upper roller heats up to at least 50℃ before doing actual welding at the beginning of a day, or after a break. This will disperse the heat across the upper roller, minimizing lost heat energy (Please note that some heat will dissipate in the upper roller and surrounding air).

[Machine Settings & Welding Conditions]

PFAFF : 8304-005



Queen Light : QHP905



	PFAFF 8304-005	Queen Light QHP905
Heater Capacity	3.0KW	2.0KW
Constitution of rollers: (standard specification) upper roller	Silicone rubber (hardness : 50)	metal (equipped with heater)
bottom roller	metal	silicone rubber (hardness : 55)
Distance between nozzle and tape (a)	3.0m/m	2.0m/m
Distance from material to nozzle bottom (b)	Distance will vary a lot according to the condition of the nylon jersey layer of the neoprene foam sheet. *1	
Distance between upper and lower rollers (c)	The distance should be set according to the thickness/characteristics of the applied material. *1	
Nozzle air volume	0.5 bar	0.06 MPa
Nozzle temperature	550 - 600℃	500 - 550℃
Upper roller temperature	——— *2	135±5℃
Roller air pressure	4.0 – 5.0 bar	0.4 – 0.5 MPa
Feed speed of rollers	2.5 m/min	3.0 m/min

1MPa = 10.0bar = 10.2Kg/cm^2

*1) Theoretically, distance between upper and lower rollers should be set slightly smaller than the thickness of material being welded, allowing the upper roller to exert the proper pressure against the weld. However, it needs to be adjusted according to the thickness of the material, the hardness of rubber in the neoprene foam sheet, and the amount of foam in the neoprene sheet.

*2) The upper roller should be heated up to about 50℃, by doing some dry runs. The temperature of the upper roller is a key factor in obtaining successful weld.

The above machine settings are merely recommendations based on assumed conditions, as the specific welding conditions required for a particular situation will be different depending on various factors such as a placement of a nozzle, the exact model of the machine being used, room temperature, humidity, the material being welded, the sewing method employed on the material being welded, etc. Therefore, please make sure to do enough testing for your specific situation. The above conditions serve as a guide, and should not be understood as absolute.

If distance is too great, sufficient pressure will not be applied on the weld. On the other hand, if distance is set too narrow, both the tape and the material being welded will be compressed too much, stretching them during the welding process.

Precise control over the pressure is one of the most important factors when welding MELCO^{TM} tape T-5000. However, distance between two rollers cannot be specified in advance but must instead be set on, based on the experience of the operator. Adjustments will need to be made every time the material is changed, and testing needs to be done to insure the best weld.