Pressure You Can Cope With — Once You Understand It

The line pressure in your heat seal machine is measured in PSI, but it's only one factor in getting ID tapes to stick. Here's a guide to understanding the factors that guide successful sealing

By Stewart Callner, Monogram Embroidery Co., Northbrook, Ill.

How valuable is the most sophisticated ID tape you can print if it begins to peel off the pants after four washings?

If it's noticed, you can retag the pants (and maybe the entire account). If it goes unnoticed, the tapes wind up in the bottom of the wash wheel.

When this happened five to 10 years ago, the stockroom manager would call the tape vendor and say there's something wrong with the tape. Today, most people realize it's usually not the tape's fault. They're more likely to suggest there may be a problem with a heat seal machine and ask for help in solving it.

Many people realize the proper sealing of ID tapes (bonding) requires that all three elements of the "bonding pie" shown in *Figure 1* need to be in balance and within specific parameters. The three elements are compensative, but only slight deficiencies in one can be made up with an increase in either or both of the other two.

If the temperature is too low for the adhesive to "liquify," no increase in pressure or time will force it into the garment fibers.

If the pressure is too low, the press can't squeeze enough of the adhesive into the garment fibers for a good bond, regardless of increases in time or temperature.

If the time is too short, the adhesive can't move far enough into the fibers to produce a good bond, regardless of how high the temperature and pressure.

There are upper limits to all three as well. Different combinations of excess can result in scorching, slow production, or overbonding. The latter occurs when too much adhesive is forced into garment fibers, leaving an insufficient amount of adhesive left *between* the fibers of the label tape and the garment fibers.

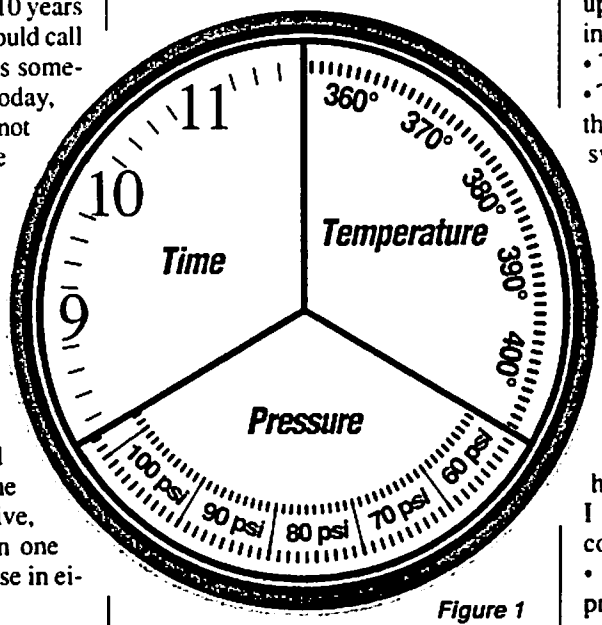

Figure 1

A few things that have nothing to do with heat seal machinery can contribute to bonding failures:

- The operator can short-time the machine to increase production.
- The finish on the garment material can be improperly cured or there can be too much sizing left in the fabric.
- Some ID tape can be made with an improperly formulated adhesive.

However, in our industry, there's a much higher incidence of heat seal machines being improperly used, set up, or maintained and therefore fostering ID bonding problems:

- Temperatures can be set too low.
- Temperatures can be set properly, but thermostat failures create too wide a swing in temperatures between power off and on cycles. Instead of plus or minus 5 degrees, a bad thermostat can cause fluctuations of plus or minus 25 to 30. This can cause scorching and bond failures just a few minutes apart.
- Timers can be set too short.
- Timers can be properly set, but not accurate. They should be periodically checked with a stopwatch. (If I had a nickel for everyone who did this, I would have trouble buying a cup of coffee.)
- Insufficient inter platen clamping pressure.

Understanding Pressure

Most people fully understand the concepts of time and temperature. But few grasp the concept of pressure as it applies to successful heat seal bonding. It's truly a difficult and *non-intuitive* concept, compared with the other two. We're taught every aspect of time and temperature from childhood. But we →

usually don't address the concept of pressure before high school physics, if at all. It may never be discussed until tapes fall off.

When asked to give the pressure of their machines, people usually respond with a *line* pressure number, such as 80 pounds per square inch (PSI). Few understand that the critical number is the *inter platen clamping* (IPC) pressure, also expressed in PSI.

This is the amount of pressure, or actual force, between the machine's two platens. Not many operators know how the IPC pressure is determined or the actual bonding requirements.

Put simply, IPC pressure is determined by three factors:

- PSI in the line
- Press cylinder diameter
- Platen size

Figure 2 illustrates how it's derived. Here's how you'd calculate it:

Line pressure x piston area/platen area

or:

Line PSI x (3.14 x cylinder radius^2)/platen length x width.

Figure 3 will probably save you the calculation. Look inside your machine to see the cylinder size. If it's older, you may be surprised by how small it is. Measure your platens. Then go to the chart to see what IPC pressure you've got.

This chart assumes a line pressure of 80 PSI. If it's 60, multiply the chart numbers by .75; if it's 100, by 1.25.

Here's what the numbers mean (assuming the four conditions below are met):

12 PSI IPC. This is the floor. You might bond a tape on in 15 to 25 seconds, but below that, there's just not enough pressure to squeeze the adhesive into the garment fibers, regardless of temperature or time.

15 PSI IPC. This is low, but about 15 seconds will work with most tapes on most fabrics.

20 PSI IPC. This is a common range. Most tapes bond well in 10 to 12 seconds on most fabrics.

30 PSI IPC. With pressure this high, you can cut the time down to around eight seconds and still get good bonds on most fabrics with most tapes.

40 PSI IPC. Like above, but you can cut the time down to about six or seven seconds.

Under six to eight seconds, depending on fabric and tape, is really cutting it close, even with high IPC pressure. The adhesive needs a certain amount of time to "liquify" and flow into the garment fibers, regardless of temperature and pressure. Also, a one-second error in time at six seconds becomes a lot more critical than the same error at 10 to 12 seconds.

INTER PLATEN CLAMPING PRESSURE

WITH 80 PSI LINE PRESSURE

PLATEN SIZE	CYLINDER DIAMETER					
	1.5"	2.0"	2.25"	3.0"	3.25"	4.0"
2 x 4	17.7	31.4	39.8	70.7	83.0	125.7
3 x 5	9.4	16.8	21.2	37.7	44.2	67.0
4 x 5	7.1	12.6	15.9	28.3	33.2	50.3
4 x 6	5.9	10.5	13.3	23.6	27.7	41.9
5 x 6	4.7	8.4	10.6	18.8	22.1	33.5
5 x 7	4.0	7.2	9.1	16.2	19.0	28.7
6 x 6	3.9	7.0	8.8	15.7	18.4	27.9
6 x 7	3.4	6.0	7.6	13.5	15.8	23.9
6" circle	5.0	8.9	11.2	20.0	23.5	35.6

Figure 3

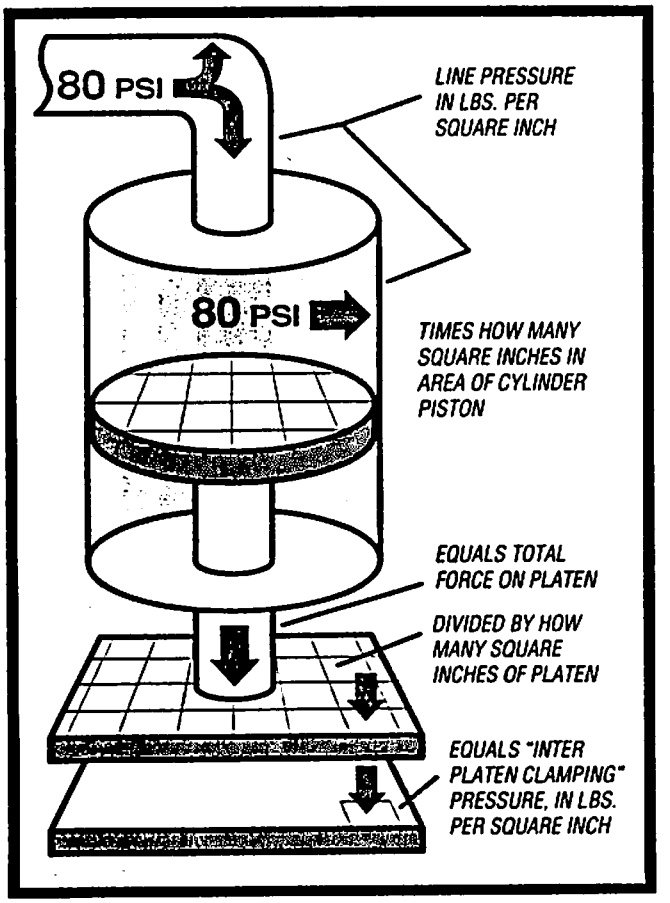

Figure 2

Conditions

Here are the conditions required for these numbers to be meaningful:

1. With ID tapes, the shortest route for the heat to get to the adhesive is through the top—through the material of the label tape. You can't seal tapes with the primary heat coming from the bottom through the many layers of fabric in waistbands and collars. It's therefore imperative that the top platen be covered and protected with a teflon-covered aluminum shield that's clean and in good condition.

If the platen is gouged or nicked from contact with snaps, hangers, and buttons, there are likely to be spots where there will be little or no pressure. These can appear as small bubbles on the tape. If the teflon shield has residue or dirt built up on it, this additional material can act as insulation, lowering the temperature of the heat that's delivered to the tape.

2. The bottom platen must be covered with a silicone sponge rubber pad that is clean and in good condition. It must be clamped to the platen

→

and not covered with a teflon sheet. Quality silicone sponge rubber will push up the uneven layers of fabric to meet the top platen with even, uniform pressure. Hard or coarse soft rubber with large air bubbles in it will not do this.

Covering this rubber with a teflon sheet defeats the function of its "sponginess" and can be *very* detrimental to good bonding. For example, ID tapes on waistbands that are near belt loops often start to peel at the end of the tape near the loop. This is caused by having a stiff teflon sheet covering the sponge rubber on the bottom platen. The problem can be solved by removing it *(Figure 4)*.

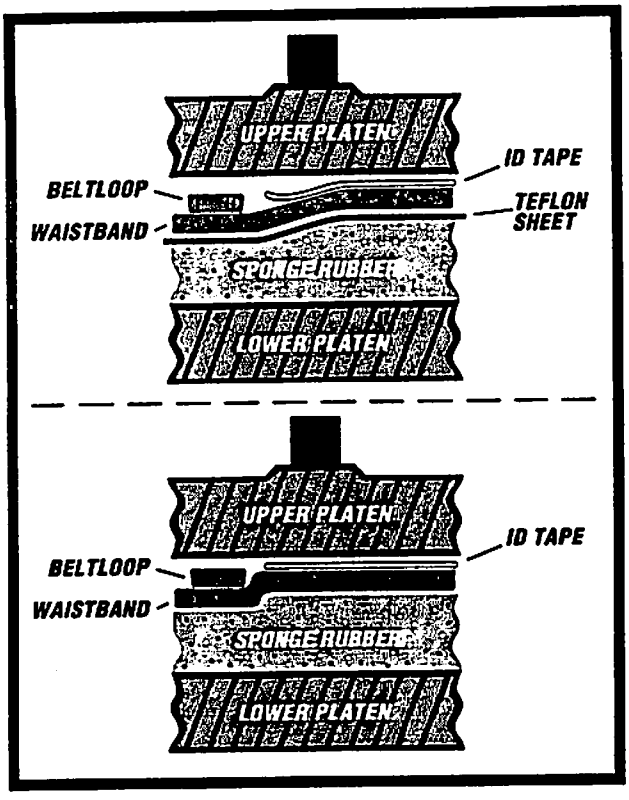

Figure 4

3. The adhesive used in tapes is formulated to flow at a relatively high 400 degrees to assure they don't come off during hot water washing and pressing. The top platen must be at 400 degrees. Don't assume it's 400 because the dial is set there or the "turkey probe" says so. Check it with a good pyrometer.

The bottom heat's function is to keep the sandwich warm as it all comes together. It allows the heat of the upper bonding platen to stay on the label and not be drawn off into the garment. Its exact temperature isn't critical, but it should be approximately 350. Higher temperatures can greatly reduce the life of the silicone sponge rubber pad.

4. Both the upper and lower thermostats must be operating properly (plus or minus 5 degrees maximum). Not all thermostats live forever. When one is going bad, it may (before it dies completely) allow a much wider swing in its heating and cooling cycle than the plus or minus 5 degrees that good bonding requires.

The only way to detect this is to check it with a pyrometer by leaving it on the platen for several minutes. People rarely take the time to do this, but watching the dial through a complete heating and cooling cycle is the only way to know for sure that you're bonding label tapes at 395 to 405 degrees, not 360 to 440.

Why Bother?

Understanding the IPC pressure can benefit you in three ways:

To better evaluate a heat seal machine to determine if it's really appropriate for the job. Many machines in use today for bonding on ID tapes were designed for other less demanding applications.

Computer printed ID tapes have only been around for about 10 years. But patching and mending in linen rooms and hospitals have been going on for eons. Too much of the antique machinery in those areas has crept into the stockrooms of uniform rental laundries.

To adapt to change when it arrives. Changes happen everywhere, every day, as a function of growth. No matter what you do, someone will want to change it down the road. A good understanding of the bonding pie can help to head off and deal with bonding problems that occur due to someone else's changing what you've set up.

The proper sealing of ID tapes (bonding) requires that all three elements of the "bonding pie" need to be in balance and within specific parameters.

To experiment with shorter bonding times or smaller platen sizes to improve production. In some cases, this is appropriate. There's no need to bond in 12 seconds if your equipment is capable of doing a good job in 10 seconds or less. It would be wise to thoroughly test tapes on all different fabrics before making any changes. But it could be worth it; those 2-second savings add up by the end of a year.

Cutting down the size of the platen increases the IPC pressure in pounds per square inch by reducing the number of square inches. If you reduce the platen size by 25 percent, for example, you will increase the IPC pressure by 33 percent.

A fish scale obtained from a sporting goods store combined with a one-inch C-clamp makes an excellent peel strength tester for label ID tapes. Get one and use the information in this article to check out your equipment and you'll start to save headaches and money.

Stewart Callner is the owner of Monogram Embroidery Co. in Northbrook, Ill. Monogram is an embroidered emblem manufacturer and distributor of computer ID tapes and systems for Therma Data, Inc.