

Thermo-Bond Film

560 and 560 EG

Technical Data

May, 1996

(Supersedes December, 1993)

Product Description

3M™ Thermo-Bond Films 560 and 560 EG are **lower bonding temperature**, flexible, light colored, thermoplastic adhesive bonding films which exhibit good adhesion to a variety of substrates. The bonding film is removable from the release coated paper carrier.

Thermo-Bond Film 560 – 4.0 mil adhesive layer
 Thermo-Bond Film 560 EG – 2.5 mil adhesive layer

Key Features

- Relatively low bonding temperature
- Clear, colorless bondline
- Consistent, uniform adhesive thickness
- Quick fixturing/holding strength
- Suitable for kiss or through die cutting
- Solvent-free

Typical Physical Properties

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Base Resin	Ethylene Vinyl Acetate
Adhesive Thickness	560 – 4 mil (.004 in) 560 EG – 2.5 mil (.0025 in)
Liner Thickness	3 mil (nominal)
Color	Clear
Specific Gravity	1.01
Solids	100%
Ball and Ring Softening Range	170 to 180°F (77 to 82°C)
Tensile Strength @ Break (ASTM D882)	175 psi
Elongation @ Break (ASTM D882)	~175%
Two Lb. Dead Load Heat Resistance	140°F (60°C)

Note 1: The data reported in this data sheet were determined using 4.0 mil film thickness (Thermo-Bond Film 560). Performance values using the 2.5 mil Thermo-Bond Film 560 EG are expected to be similar, but should be tested in user's application before use.

Note 2: As noted above the Thermo-Bond 560 and 560 EG products are 4.0 mil and 2.5 mil thickness, respectively. If required, this bonding film can be supplied in thicknesses from 0.8 to 40 mil. Contact your local 3M sales representative for details.

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Application Equipment Suggestions

Note: Appropriate application equipment can enhance bonding film performance. We suggest the following equipment for the user's evaluation in light of the user's particular purpose and method of application.

The type of application equipment used to bond 3M™ Thermo-Bond Film 560 or 560 EG will depend on the application involved and on the type of equipment available to the user. Thin films and flexible substrates can be bonded using a heated roll laminator where heat and pressure can be varied to suit the application. Larger, thicker substrates can be bonded using a heated static press or, in some cases, an autoclave. For applications where a shaped adhesive is to be transferred to a flat or three-dimensional part, a hot shoe or thermode method may be appropriate.

It is recommended that whatever method of bonding the user chooses, the user should determine the optimum bonding conditions using the specific substrates involved.

Directions For Use

To make a bond using Thermo-Bond Film 560 or 560 EG, remove the liner and place the adhesive film between the two substrates. The bond is then made through heat and pressure using a heated press, a hot roll laminator, a hot shoe thermode method or similar equipment. Alternatively, the adhesive can be first tacked (lightly bonded) to one of the substrates using low heat, then removing the liner and placing the second substrate to the exposed adhesive surface, making the bond using heat and pressure.

Suggested TACKING Conditions

100 to 120°F (38 to 49°C) bondline temperature

1-2 seconds dwell time

5-10 psi pressure

For optimum bonding, heat, pressure and dwell time will depend upon the type and thickness of the substrates being bonded together.

A suggested starting point, however, is to use the conditions shown below.

Suggested BEGINNING Bonding Conditions

160 to 180°F (71 to 82°C) bondline temperature

2-5 seconds dwell time

10-20 psi pressure

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Directions For Use (continued)

One approach to establishing the correct/optimum bonding conditions for a user's application is to evaluate a series of bonding temperatures, for example 150, 180, 210 and even 240°F (66, 82, 99 and 116°C). Time and pressure will be dictated by the thickness of the substrate and the type of substrate being bonded. Thicker substrates and more difficult to bond surfaces will require longer times, higher pressures and higher temperatures.

Once the bond is made, the bondline should be allowed to cool somewhat before stress is applied to the bond. Generally, cooling the bondline below 200°F (93°C) is adequate to allow the bonded parts to be unfixtured/unclamped and handled.

For reference, the following table shows typical bond strengths for bonds made at various temperatures. **Such a table can be used to evaluate optimum bondline temperatures.** It is very important to note that this table is valid only for the specific substrates shown. Varying temperature, pressure, or substrates can affect bond strengths. **User should develop a similar table using the specific substrates involved.** Note: Temperatures shown are bondline temperatures and not heat block or roll settings!

Bondline Temperature	Peel Adhesion Vs Bonding Temperature	
	T-Peel Strength	
	PET/PET (Non-Porous)	Denim/Denim (Porous)
130°F (54°C)	0.4 piw	0.2 piw
140°F (60°C)	2.8 piw	2.6 piw
150°F (66°C)	3.8 piw	3.7 piw
160°F (71°C)	4.9 piw	5.1 piw
170°F (77°C)	5.5 piw	5.6 piw
180°F (82°C)	6.0 piw	5.3 piw
190°F (88°C)	6.1 piw	4.2 piw
200°F (93°C)	6.2 piw	2.6 piw
210°F (99°C)	6.2 piw	2.2 piw
220°F (104°C)	6.1 piw	1.3 piw
230°F (110°C)	6.1 piw	0.4 piw

Note: The reduction in bond strengths above about 198°F (88°C) when using the porous substrate is due to the hotter temperatures allowing the adhesive to excessively soak into the porous substrate resulting in bondline starvation. Lower bondline temperatures and/or lower pressures can reduce this excessive penetration.

- Bonds made using 5 second dwell, 5 lbs pressure.
- Peels done at 90° angle, 2 in/minute, Instron tester.
- PET is 2 mil polyester film, Denim is 10 mil cotton cloth.

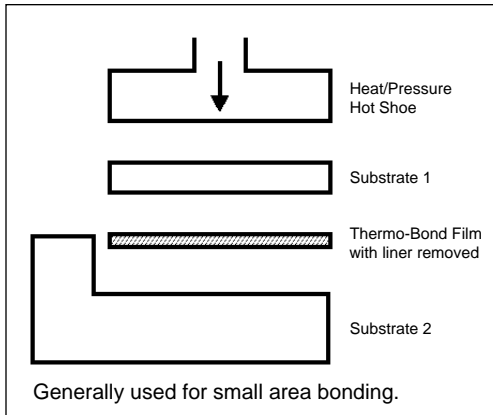
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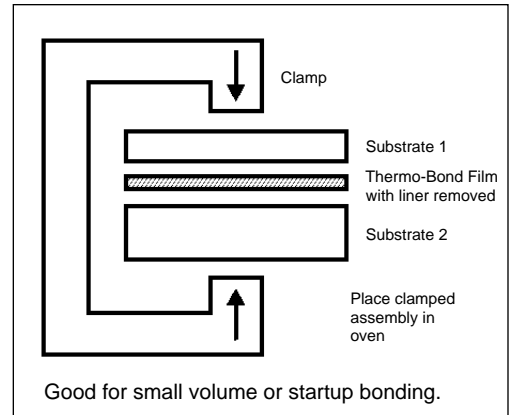
Typical Methods For Bonding 3M™ Thermo-Bond Film Adhesives

The following illustrations show several of the many methods that can be used to make bonds using Thermo-Bond Film adhesives. Such equipment is generally available commercially or can be built or modified by the user to fit a particular application.

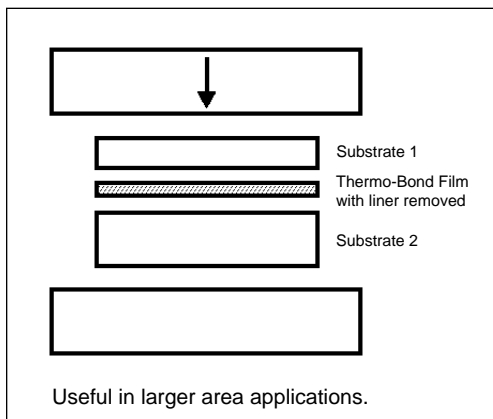
Hot Shoe or Thermode Bonding



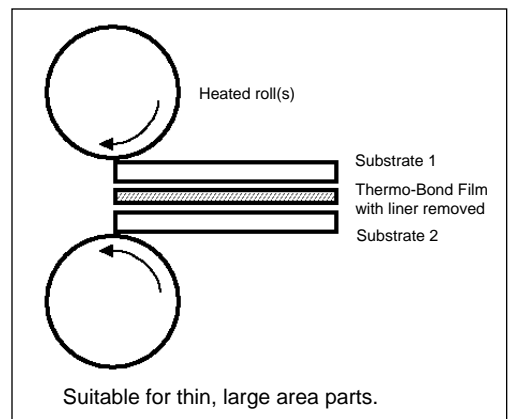
Oven (Static or ConveyORIZED) Bonding



Hydraulic or Mechanical Press Bonding



Lamination Bonding of Thin Substrates



Debonding – Since Thermo-Bond Films are thermoplastic materials, no curing during heating or aging occurs. To debond or open bonded parts, simply heat the bonded part to an adequate temperature (typically 210-230°F/99-110°C) to soften the adhesive and then pry or peel the substrates apart.

Solvents, such as acetone, MEK, toluene and 3M Citrus Based Cleaner will soften these Thermo-Bond Film adhesives and can be used to remove excess adhesive in unwanted areas.* Soaking bonds in these solvents can also aid in debonding operations where appropriate.

***Note:** Before using solvents, extinguish all ignition sources and follow the manufacturer's precautions and directions for use for handling such materials.

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Typical Performance Characteristics

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Test Substrate	Overlap Shear Strength to Various Substrates
	OLS Strength Thermo-Bond Film 560 (4.0 mil)
ABS	260 psi
PVC	250 psi
Polycarbonate	250 psi
HD Polyethylene	260 psi
Polypropylene	280 psi
Fir Wood	220 psi
FR-4 PCB	260 psi
Cold Rolled Steel	250 psi
Etched Aluminum	260 psi

- OLS (overlap shear) bonds made using 0.125 in thick substrates, 220°F (104°C) bonding temperature, 5 second dwell, 5 psi pressure.
- Adhesion determined using Instron tester @ 0.2 in/minute.

Test Substrate	Peel Strength to Various Substrates
	90° Angle Peel Strength
Canvas (40 mil)	3 piw
Denim Fabric (10 mil)	6 piw
Polyester Film (2 mil)	5 piw
Polyimide Film (2 mil)	5 piw

- Peel bonds made using hot roll laminator at 1 FPM, 220°F (104°C) bondline.
- Testing done using Instron tester @ 2 in/minute, 90° peel angle.

Aging Conditions	Environmental Aging Denim/Denim T-Peel	Results
	Control (73°F [23°C] / 40% RH)	
24 hour / 73°F (23°C) water soak and dry before test		4-7 piw
1 week / 90% RH / 90°F (32°C) and dry before test		3-5 piw
Two home laundry cycles (120°F [49°C] wash / 30 min dry)		4-7 piw
		<1 piw

- Peel bonds made using hot roll laminator at 1 FPM, 220°F (104°C) bondline.
- Testing done using Instron tester @ 2 in/min, 90° angle peel.
- Denim is 20 mil cotton cloth.

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Typical Performance Characteristics (continued)

Adhesion Strength <u>TESTED</u> at Various Temperatures	
Test Temperature	Denim/Denim Peel Strength
75°F (24°C)	6.0 piw
85°F (29°C)	3.9 piw
95°F (35°C)	2.1 piw
105°F (41°C)	1.5 piw
115°F (46°C)	0.6 piw
125°F (52°C)	0.2 piw

- Peel bonds made using hot roll laminator at 1 FPM, 220°F (104°C) bondline.
- Testing done using Instron tester @ 2 in/min, 90° angle peel.
- Denim is 20 mil cotton cloth.

Precautionary Information

Refer to Product Label and Material Safety Data Sheet for Health and Safety Information before using this product.

For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550. Address correspondence to: 3M Industrial Tape and Specialties Division, 3M Center, Building 220-7E-01, St. Paul, MN 55144-1000. Our fax number is 612-733-9175. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-809-750-3000. In Mexico, phone: 5-728-2180.

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ISO 9002

This Industrial Tape and Specialties Division product was manufactured under a 3M quality system registered to ISO 9002 standards.

For Additional Product Safety and Health Information, See Material Safety Data Sheet, or call:



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