INSTRUCTION MANUAL

AND GUIDE

FOR EFFECTIVE WATERPROOFING

OF SEWN SEAMS

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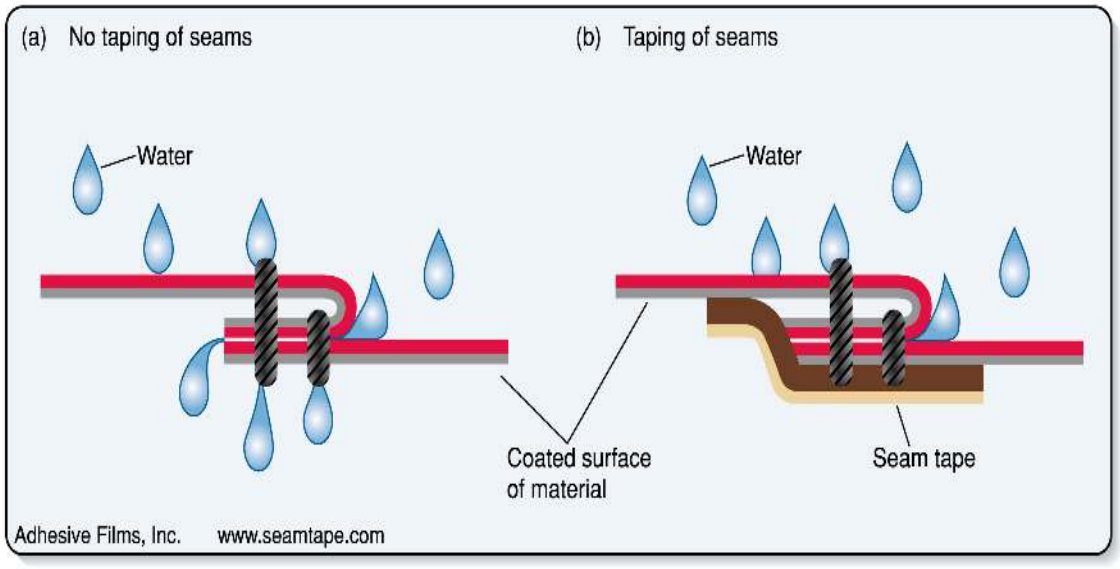
Introduction

Most fabrics used in the manufacture of technical outerwear, tents and many other products combine water repellency or water proofing characteristics with breathability and moisture transmission. These properties are directly incorporated into the fabrics. In addition, most of these fabrics are coated or laminated with a waterproof membrane layer that prevents water transmission through the fabric. Unfortunately, water will soak through the stitch holes created when seams are sewn into the fabric. See Fig 1(a).

To prevent water from entering through the sewn seams, sealing of the seams is required. See Fig 1(b). This is effectively accomplished using a suitable seam sealing tape.

Fig 1



This manual describes the commonly accepted method for taping sewn seams and is applicable to most fabrics and membranes used in the production of technical outerwear, industrial rainwear, kayak wear, tents, firemen's turnout gear, protective wear, filters, footwear, etc.

If you have any questions, suggestions or comments regarding this manual please contact Adhesive Films, Inc.

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STATEMENT OF INTENT

Naturally, Adhesive Films, Inc.'s goal is to sell seam sealing tapes. However, the primary intent of this manual is to help you do a better job of sealing the sewn seams of whatever end product you are producing and without regard to the manufacturer of the tape.

We know our seam tapes are superior to others and if you try them, we think you will agree.

To better understand seam tapes produced by Adhesive Films, Inc. we have listed some of our attributes.

1 Adhesive Films, Inc. manufactures a wide variety of seam tapes in various gauges, widths and styles to suit your individual needs.

2 Our seam tapes possess at least as much elasticity as the fabrics to which they are applied.

3 Since high quality seam tapes are generally of a multi-layer construction, it is important to note that the adhesive and membrane layers of our seam tapes are virtually impossible to delaminate.

4 Our seam tapes are tested extensively for durability and suitability prior to introduction and we continue to perform periodic testing to verify consistency of quality.

5 All of our seam tapes are washable and most are dry cleanable, at least to the limits of the fabric used in the end product.

6 Our seam tapes are wound with the adhesive facing the core for protection and cleanliness.

7 All of our seam tapes carry our exclusive 100% quality guarantee. See actual guarantee below.

8 Adhesive Films, Inc. will provide compatibility and durability testing on your fabric with our seam tapes free of charge. In many cases we have already performed the tests and a report is available. Contact us for up to date test results. See Sec 10 (STANDARD SEAM TAPE TEST METHOD) for an explanation of the tests that we perform.

The management and employees of **ADHESIVE FILMS, INC.** are committed to producing only the highest quality products while maintaining the lowest possible prices. We promise to do everything possible to provide the highest industry standards of quality with unparalleled customer service.

EXCLUSIVE 100% RISK FREE QUALITY GUARANTEE

If we test your fabric / membrane and recommend a seam tape that fails to perform as we promised, when applied according to our recommended conditions we will replace that seam tape at no charge to you, including freight. All we ask is that you return the unused portion to us at our expense. We will ask that you send us a sample of the fabric related to the problem with tape applied for our testing prior to replacement. This enables us to determine what caused the failure so that we may correct it for future customers.

1 TAPE TO USE

Any tape that you use should have the following characteristics:

A. The "hand" or feel of the tape should match that of the fabric as closely as possible.

B. The tape should have sufficient elasticity to move with the fabric and be capable of sealing completely around the tight curve of a shoulder or cuff.

C. The layers of a two layer tape should never delaminate from each other.

D. Tape should be able to withstand dry cleaning and / or washing & drying cycles (per fabric supplier instructions) equivalent to the normal life expectancy of the finished product.

C A U T I O N:

MANY SEAM TAPES CURRENTLY BEING SOLD BY OTHER COMPANIES ARE NOT DRY-CLEANABLE. MANY WON'T EVEN SURVIVE HOME LAUNDRY.

Not everyone selling seam tape is a seam tape expert. It is easy to be confused by all the claims and technical terminology. If you have any questions or problems, contact Adhesive Films, Inc. and we will help.

E. For best results, use a tape that is guaranteed by the manufacturer to be suitable for use on your specified fabric / membrane and for the intended end use.

F. Tape should bond sufficiently to withstand normal usage over the expected lifetime of the product.

G. Adhesive should be wound facing the core for cleanliness and protection.

H. Since taping sewn seams involves the purchase of expensive specialized equipment, cost structure and possibly even a change in your manufacturing procedures, it makes sense to purchase the best seam tape available for your specific production situation. In most cases, purchasing the best does not cost more.

2. HANDLING OF SEAM TAPE

Storing the tape

A. For best results, do not store seam tape in an area that is subject to very high temperature or humidity. Ideal storage conditions are temperatures less than 85°F / 30°C, and relative humidity of 50% or less. This will greatly extend the useful shelf life of the tape.

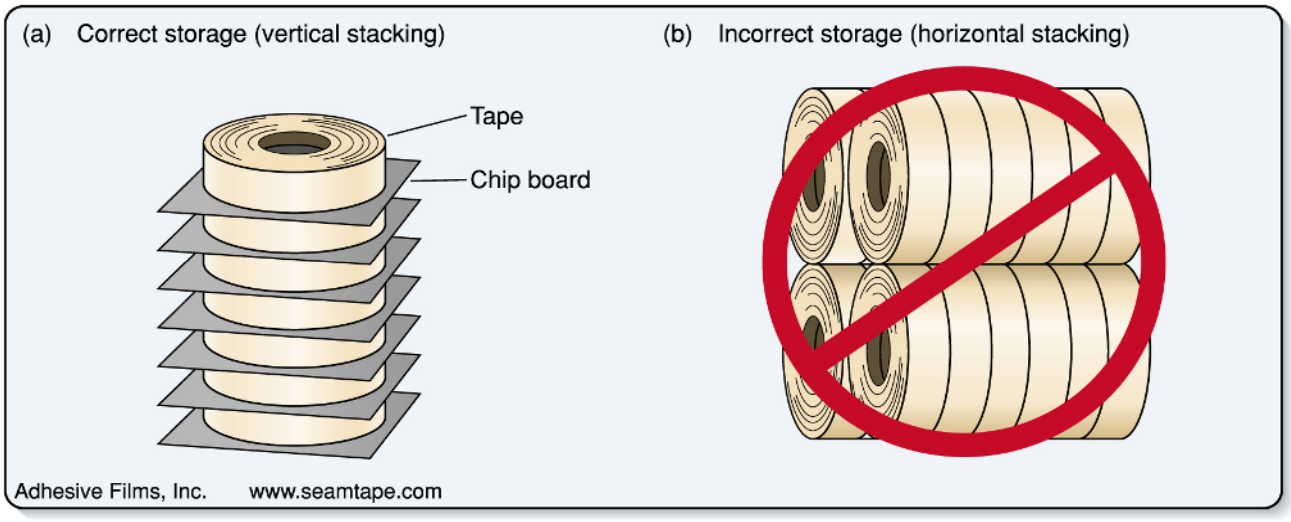
B. To prevent cosmetic discoloring, tape should be stored in a well-ventilated area and not be exposed to ultraviolet (sun) light (**this includes fluorescent lighting**).

C. Store tape in the original sealed shipping carton until ready to use. Tape should always be stored vertically (Fig 2 a). Do not store tape on edge (Fig 2 b). This may cause flat spots and could lead to application difficulties.

D. If you purchase seam tape from a manufacturer who uses an expiration date, be sure to rotate your inventory to maintain FIFO.

E. Seam tapes produced by Adhesive Films, Inc. do **not** have an expiration date. Stored properly, they will remain usable for years.

Fig 2



3. PRE-PRODUCTION PROCEDURES

Getting started

Before cutting any fabric, clean the cutting blade and foot area of the cutter and any thing that might come in contact with the fabric or membrane. Many sealing problems can be traced back to contamination of the fabric or membrane in the cutting or sewing area. The following tests should always be performed to verify the compatibility between the tape and the fabric / coating. See Sec. 8, "TROUBLE SHOOTING" for more information.

Regrettably, there have been numerous cases where the coater, laminator or fabric manufacturer made a slight modification in something to improve the drape or reduce the noise of the fabric, etc. Without realizing it, this caused an unintentional modification in the chemistry of the membrane formulation, which was not discovered until items had been cut and sewn. This resulted in wasted production time and unnecessary expense.

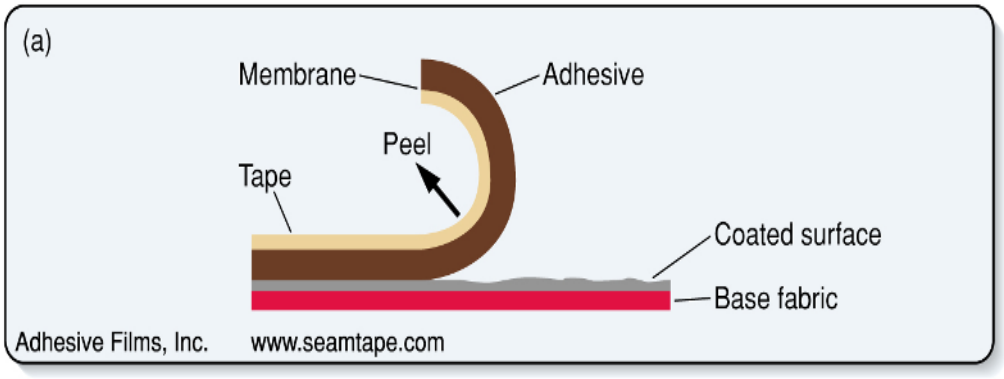
THEREFORE, WE STRONGLY SUGGEST THIS PROCEDURE **ALWAYS** BE PERFORMED WITH EVERY LOT OF FABRIC. Once the fabric has been cut and sewn, it is usually impossible to return for credit.

Perform a standard taping test under the conditions specified by the tape manufacturer for the specific tape and the fabric / membrane that will be used in production.

See Sec.10 "Standard Seam Tape Test Method" and "Test Report" for more information.

To check the effectiveness of the tape bond, refer to Fig 3a below. Using the tape manufacturers suggested sealing conditions, seal a strip of the recommended tape to the membrane side of a small piece of fabric leaving a short (3") area of fabric, and a (3") "**tail**" of tape unsealed. This will allow the fabric and tape to be held in the hands for testing. Allow tape and fabric to cool (approx. 5 minutes), then slowly peel the tape from the fabric at a 180° angle see (Fig 3a).

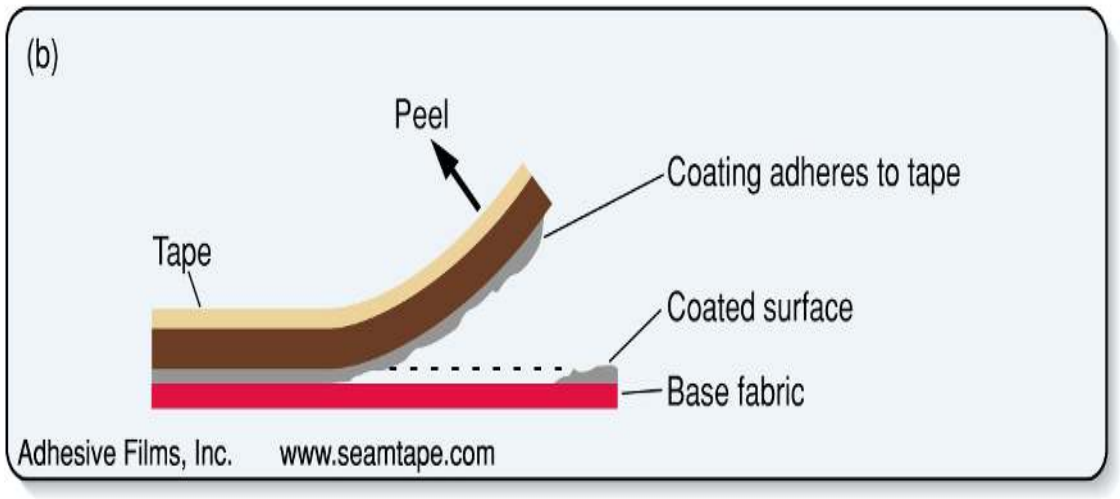
Fig 3a



3. PRE-PRODUCTION PROCEDURES continued

Generally, if the bond is satisfactory, peeling the tape will remove the membrane from the fabric (Fig 3 b). If coating is not removed and tape comes off easily, increase temperature and / or reduce the sealing speed. Repeat taping test operation until satisfactory bond is obtained. Coatings vary from manufacturer to manufacturer, and even from lot to lot from the same manufacturer, a good bond may be realized, but in some instances coating will not be removed.

Fig 3b



Even if membrane is not removed there should be noticeable resistance to peeling. Whether membrane is removed or not, minimum bond strength of 2 lb. (900 Gm) is recommended, with 3 lb. (1362 Gm) or more being desired. Once effective bond has been achieved, production speed may be increased with appropriate increase in temperature.

Record all machine settings for future reference

NOTE: Settings for one machine may not necessarily apply to other machines even if machines are identical brands, models, etc. Individual set up of each machine is normally required.

4. PRODUCTION APPLICATION PROCEDURES

A. After ensuring a sufficient bond has been obtained, prepare a sewn crossover seam of the type planned for actual production.

B. At no time should a silicone spray or any other type of lubricant be used anywhere that might come in contact with the seam area of fabric or tape. The presence of any silicones or lubricants will prevent proper adhesion.

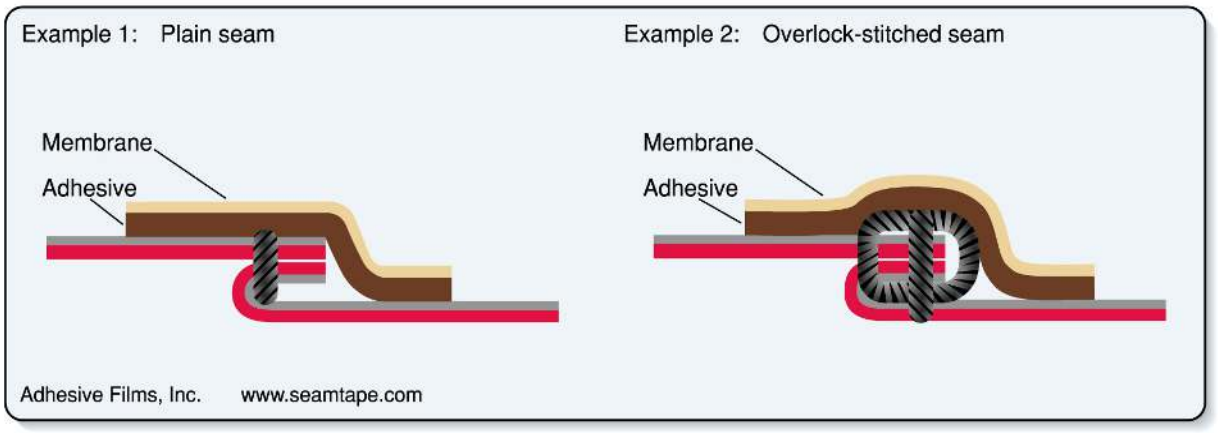
C. All threads must be cut flush. Seam allowance should be no more than 3/8" (1 cm).

D. Apply seam tape according to manufacturers' recommendations.

E. Be very careful not to crease fabric or seam tape. This could result in forming a channel for water to follow, which might cause a leak. After seam has been taped, do not allow tape to come in contact with anything else until taped area has cooled (3-5 minutes). Otherwise, unintentional bonding may result which could damage item.

F. After sample has been prepared, check taped seam for hydrostatic resistance. Fabric with sewn and taped seam should be clamped in a hydrostatic pressure tester and subjected to 1.5 PSI (1050 mm) for five minutes, followed by 3 PSI (2100 mm) for five minutes. This is sufficient for virtually all intended uses. See Fig 4a

Fig 4a

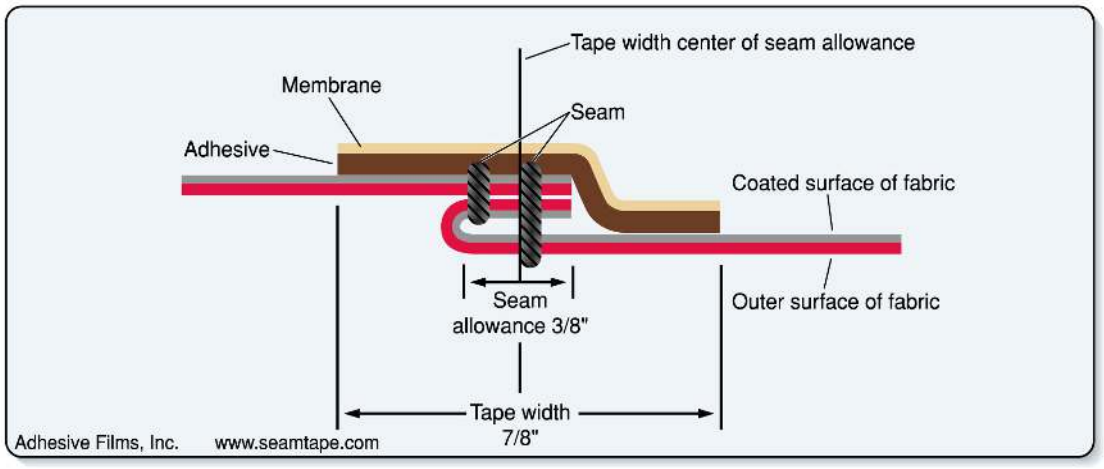


G. We suggest that you always use the oldest tape first to maintain FIFO inventory procedures. If stored according to manufacturers directions, tape should remain usable for many years. Unlike other seam tapes, Adhesive Films, Inc. seam tape has no automatic expiration date.

4. PRODUCTION APPLICATION PROCEDURES - continued

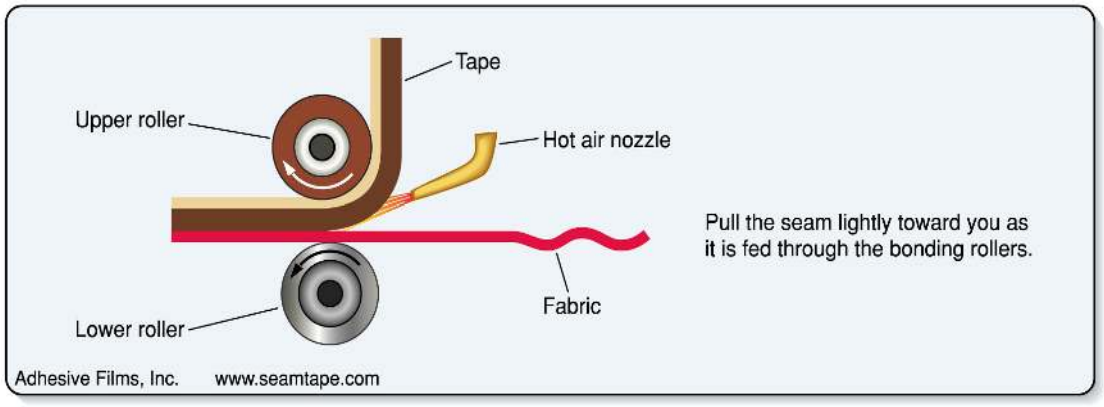
H. To reduce puckering when seams are taped, maintain the smallest possible seam allowance, especially around curves. Generally a 3/8" (1 cm) or smaller seam allowance should provide adequate tape sealing on either side of the seam. See Fig 4b.

Fig 4b



I. To further reduce the occurrence of fabric puckering at the seam, maintain slight tension or backpressure (Fig 5) on the fabric as it feeds through the rollers. **CAUTION:** If too much tension is applied to the fabric, it will tend to stretch the fabric and tape. This results in shrinking of the tape as it cools and is counterproductive.

Fig 5



J. Normally, the tape is applied to the inside (membrane) surface of the fabric in such a manner as to cover the stitching and extend at least 1/4" (6 cm) beyond each side of the seam.

4. PRODUCTION APPLICATION PROCEDURES - continued

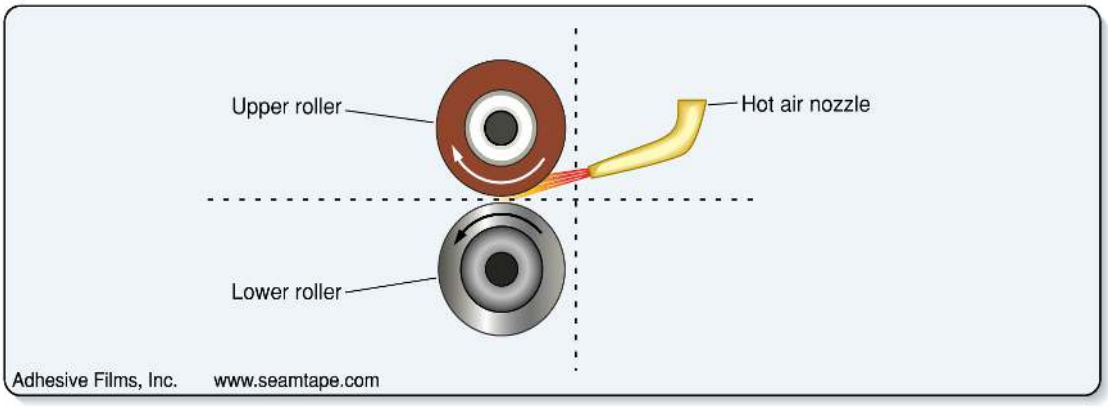
K. If the finished seam is bulky (3 or more layers or heavy fabric), a grooved lower roller is recommended. This allows the seam to be depressed and presents the flattest possible surface to the tape. In certain instances, you may want to purchase a wider tape. Keep in mind however; a wider tape requires a wider air nozzle and wider rollers. Both must be at least 1/8" wider than the tape being used.

L. If your machine is equipped with a heated upper roller, the heat should be reduced to the lowest possible setting. It is not recommended that the heat be turned "OFF", as this tends to cause difficulty in maintaining nozzle air temperature. Since the adhesive is always drawn towards the heat, a heated upper roller is actually counterproductive, as this draws the adhesive up into the membrane.

M. Check to be certain the nozzle and rollers are the proper width for the tape being applied. Both nozzle and rollers should be at least 1/8" (3 mm) wider than the tape to ensure effective sealing. The nozzle should also be centered left to right to cover the width of the tape evenly. Front edge of nozzle should be parallel with the rollers.

N. The correct position of the hot air nozzle is very ***critical***. Incorrect positioning can result in poor sealing, scorching fabric or "burn-through" of the tape. See Fig 6a for recommended 2-layer vertical setting. Bottom front edge of nozzle is almost flush with the vertical line at the front of both rollers and just slightly above the horizontal centerline between the two rollers. If rollers on your machine are angled rather than straight, the nozzle should still be positioned with these 2 lines. This is the proper setting for most 2-layer tapes. In special circumstances, adjustments may need to be made using this position as a starting point.

Fig 6 a

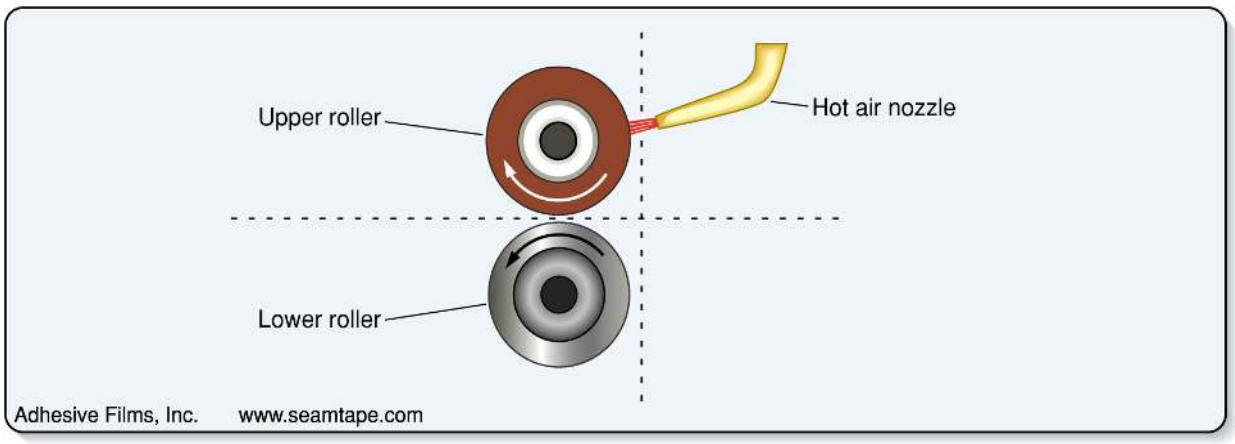


4. PRODUCTION APPLICATION PROCEDURES - continued

O. Nozzle position is even more critical with 3-layer fabrics as they are very fragile and more easily scorched or melted than 2-layer fabrics. The nozzle **must** be raised to the center of the upper roller. This keeps the nozzle away from the tricot lining during sealing. See Fig 6 b for recommended 3-layer vertical setting. Bottom front edge of nozzle should be almost flush with the vertical line at the front of both rollers and even with the center line of the top roller. If your nozzle swivels, it may be lowered slightly and angled upwards to increase the separation from the tricot lining.

P. If the rollers on your machine are angled rather than straight, the nozzle should still be positioned flush with these 2 lines. This is the proper setting for most 3-layer fabrics and tapes. In special circumstances, adjustments may need to be made using this position as a starting point.

Fig 6b



5. RECOMMENDED MACHINES AND APPLICATION CONDITIONS

Use a machine with a temperature range of 0°F-1112°F (600°C) or higher, speed range of 0-40 feet (12 meters) per minute or faster, roller pressure of 0-50 PSI (3.5 Kg/cm^2) or more. Based on our experience as well as that of our customers, we recommend a hot air welding machine rather than ultrasonic, hot wedge or RF due to its versatility and relative ease of use. Although most sealing can be done on these other machines, hot air welding machines have a much higher production rate and are less prone to problems.

It is equally important to choose a machine that will maintain an accurate temperature and set speed, during production. Use of a machine that does not operate at the set speed or temperature can result in damaged products, improper sealing, burn through of tape and various other costly problems.

6. TOUCH UP SEALING & REPAIRS

A. Treatment of sections where seams cross

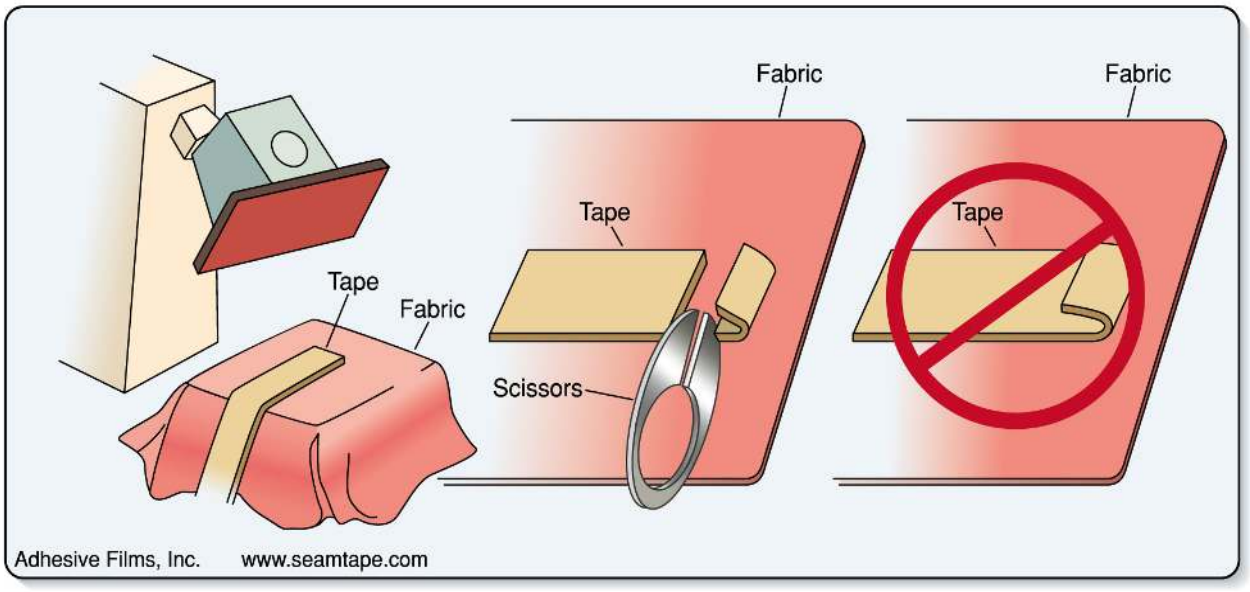
Normally it is not necessary to perform any secondary sealing operations. In very rare instances, it might be necessary in order to improve sealing and hydrostatic resistance after the taping process is completed. This most often occurs where one taped seam crosses another. If leaking occurs at the crossover, use of a thermostatically controlled, crossover type heat press (Fig 7) to seal the crossover area may improve results. It is also possible to run the seam back through the hot air welding machine without applying additional tape.

Note: Heat should be applied to the face side of the fabric rather than the membrane of the tape. Remember that adhesive is drawn towards the heat.

B. Treatment of areas where tape did not bond properly

Never permit any part of the tape to remain unsealed on the finished item.

Fig 7



Treat unsealed areas as follows:

(1) Carefully trim off any excess tape to avoid accidental damage to item.

(2) Press end of tape with the crossover heat press (Fig 7), or feed seam back through the hot air welding machine without applying additional tape.

7. CLEANING AND CARE INSTRUCTIONS

Most technical outerwear fabrics are very durable if properly cared for. Always follow care instructions recommended by the fabric supplier. Adhesive Films, Inc. seam tapes are formulated for use on specific fabrics / membranes and will perform at least as well as the fabric itself under the same conditions.

Generally, fabric manufacturers care instructions are as follows:

- Machine wash in COLD water (75°F/22°C)
- Do not commercially launder.
- **Do not dry clean – especially if the item contains down or feathers. If dry cleaning is permitted by the fabric manufacturer we will supply seam tape that will also survive dry cleaning.**
- Use low phosphate detergent.
- Rinse well (at least twice).
- Re-arrange item in washer between rinse cycles to prevent twisting, wringing, etc.
- Allow to drip dry, either flat or on hanger (do not wring or twist).
- If automatic dryer is used for down or feather filled items, add a clean tennis shoe to help unclump and fluff the feathers.
- Never use chlorine bleach.
- If necessary, touch up wrinkles with a cool iron.
- Never store item if it is wet or dirty.

8. TROUBLE SHOOTING

A special note about this trouble shooting guide:

Many of the problems and solutions listed below are the result of our diagnosing & correcting a problem as well as customers informing us how they solved a problem. Over the years, we have accumulated the list you see here. We would like to expand on this information in an effort to better assist all of our customers. If you have experienced a problem or discovered a solution that is not mentioned here, please let us know and we will include your problem and solution in this list for future reference.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
1. TAPE DOES NOT BOND AT ALL	Roll is mounted backward	Reverse roll - adhesive faces core
	Wrong tape	Contact A.F.I. for assistance
	"DWR" on coating	Contact A.F.I. for assistance
	Wrong sealing conditions	Follow manufacturers' instructions
2. TAPE BOND TO MEMBRANE IS WEAK	Speed is too fast	Decrease speed
	Heat is too low	Increase temperature / nozzle pressure
	Wrong tape	Contact A.F.I. for assistance
	"DWR" on coating	Contact A.F.I. for assistance
3. TAPE STICKS TO UPPER ROLLER	Roll is mounted backward	Reverse roll – adhesive faces core
	Adhesive residue on roller	Clean rollers / Contact A.F.I. for special cleaning material
4. EDGES	Poor roller contact	Adjust roller pressure / alignment
OR	Air nozzle misaligned	Adjust air nozzle (see SEC. 4 F, G & H)
CENTER	Moisture or oil in air supply	Drain air tank and filters daily
NOT SEALING	Lubricant or other contamination on cutting blades, pressure foot, needle, dogs, etc	Clean all objects that may come in contact with fabric, membrane or tape daily
5. TAPE SPLITS AT STITCH	Temperature too high	Lower temperature / nozzle air pressure
	Excessive roller pressure	Reduce roller pressure
	Wrong tape	Contact A.F.I. for assistance

8. TROUBLE SHOOTING – continued

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
6. TAPE BURNS THROUGH / FABRIC CHARS OR MELTS	Temperature too high	Lower temperature / nozzle air pressure
	Speed too slow	Increase speed
	Air nozzle misaligned	Adjust air nozzle (see SEC. 4 F, G & H)
	Wrong tape	Contact A.F.I. for assistance
7. TAPE STICKS TO ITSELF AFTER APPLYING	Temperature is too high	Reduce temperature / nozzle air pressure
	Speed is too slow	Increase speed
	Product was folded while tape is still hot	Keep product flat – do not fold until tape cools
8. TAPE LEAKS AT EDGE (s)	Speed is too fast	Decrease speed
	Temperature is too low	Increase temperature
	Roller pressure is too low	Increase roller pressure
	Wrong tape	Contact A.F.I. for assistance
	Wrong taping technique	Contact A.F.I. for assistance
9. CROSS OVERS LEAK AT CORNER (s)	Speed is too fast	Decrease speed
	Temperature is too low	Increase temperature
	Roller pressure is too low	Increase roller pressure
	Wrong tape	Contact A.F.I. for assistance
	Wrong taping technique	Contact A.F.I. for assistance
10. TAPE LEAKS THROUGH CENTER	Speed is too slow	Increase speed
	Temperature is too high	Decrease temperature
	Roller pressure is too high	Decrease roller pressure
	Wrong Tape	Contact A.F.I. for assistance

8. TROUBLE SHOOTING – continued

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
11. DIFFICULT TO FEED	Binds in auto cutter	Adjust or clean automatic cutter
	Adhesive buildup	Clean affected area
12. TAPE WRAPS AROUND ROLLER (s)	Tape is cut too long	Tape should not extend past nip roller
	Roll is mounted backward	Reverse roll see Problem # 3 above
	Adhesive residue on roller (s)	Clean rollers / Contact A.F.I. for special cleaning material
13. TAPE COMES OFF IN WASH	Wrong tape	Contact A.F.I. for assistance
	Improper wash conditions	Refer to sec. 7
	Poor bond	Refer to # 2 above
14. TAPE FAILS HYDROSTATIC TESTING	Wrong tape	Contact A.F.I. for assistance
	Poor bond	Refer to # 2 above
15. EXCESSIVE PUCKERING	Improper fabric tension	Refer to sec. 4 C & D
	Temperature is too high	Decrease temperature
	Wrong tape	Contact A.F.I. for assistance
16. TAPE STRETCHES	Too much tension on fabric	Decrease tension
	Tape is sticking to guides	Clean / adjust guides
	Tape not releasing from roll	Make sure tape unwinds freely
17. AIR BUBBLES	Low roller pressure	Increase roller pressure
	Water or oil in air lines or on fabric from cutting.	Drain air tank and filters daily Clean all cutting & sewing tools
IN TAPE		Cosmetic defect only
18. TAPE BONDS INTER-MITANTLY	Oil or other lubricant on cutting blade, needles or presser foot.	Clean all areas that might come in contact with tape or membrane. Never allow these areas to become contaminated.

9. TEMPERATURE CONVERSION TABLE

C	F	C	F	C	F	C	F
50	122	255	491	460	860	665	1229
55	131	260	500	465	869	670	1238
60	140	265	509	470	878	675	1247
65	149	270	518	475	887	680	1256
70	158	275	527	480	896	685	1265
75	167	280	536	485	905	690	1274
80	176	285	545	490	914	695	1283
85	185	290	554	495	923	700	1292
90	194	295	563	500	932	705	1301
95	203	300	572	505	941	710	1310
100	212	305	581	510	950	715	1319
105	221	310	590	515	959	720	1328
110	230	315	599	520	968	725	1337
115	239	320	608	525	977	730	1346
120	248	325	617	530	986	735	1355
125	257	330	626	535	995	740	1364
130	266	335	635	540	1004	745	1373
135	275	340	644	545	1013	750	1382
140	284	345	653	550	1022	755	1391
145	293	350	662	555	1031	760	1400
150	302	355	671	560	1040	765	1409
155	311	360	680	565	1049	770	1418
160	320	365	689	570	1058	775	1427
165	329	370	698	575	1067	780	1436
170	338	375	707	580	1076	785	1445
175	347	380	716	585	1085	790	1454
180	356	385	725	590	1094	795	1463
185	365	390	734	595	1103	800	1472
190	374	395	743	600	1112	805	1481
195	383	400	752	605	1121	810	1490
200	392	405	761	610	1130	815	1499
205	401	410	770	615	1139	820	1508
210	410	415	779	620	1148	825	1517
215	419	420	788	625	1157	830	1526
220	428	425	797	630	1166	835	1535
225	437	430	806	635	1175	840	1544
230	446	435	815	640	1184	845	1553
235	455	440	824	645	1193	850	1562
240	464	445	833	650	1202	855	1571
245	473	450	842	655	1211	860	1580
250	482	455	851	660	1220	865	1589

10. STANDARD SEAM TAPE TEST METHOD

In order to determine the suitability of a seam sealing tape to a particular fabric or membrane, Adhesive Films, Inc. employs test methods that are in accordance with one or more of the following standards:

- **U.S. Federal Test Method Standard No. 1911 A 5512, ASTM D413-82,**
- **Canadian 2-4-. 2-M 77 Method 26.5,**
- **European Standard EN 1392:1995E,**
- **Military Specification MIL-P-43907 C.**

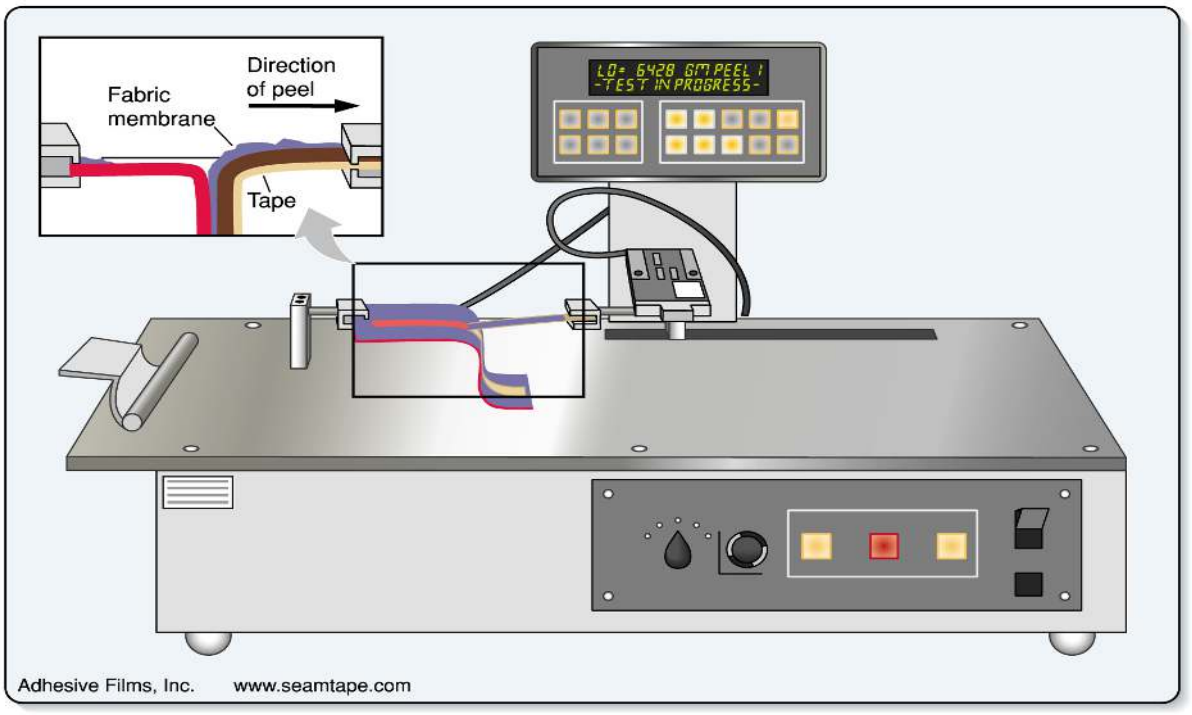
A sample of fabric (1 yard / meter x full width minimum) shall be supplied by the end user for testing with written notation as to:

1. Which side is to be taped
2. Conditions finished product will be subjected to
3. Care instructions
4. Results expected
5. Life expectancy

Sample should contain (along one edge) at least three parallel sewn seams of the type to be used in the production of the finished item. Each seam should be 6" (15 cm) apart, with 90° crossover seams also 6" (15 cm) apart.

Using a standard roll feed hot air welding machine, appropriate seam tapes will be applied to the indicated side of supplied fabric to determine the most effective tape and sealing conditions. After tape(s) have been applied, peel strength of each will be tested in accordance with ASTM D413-82 (European Standard EN 1392:1995E).

Fig 8



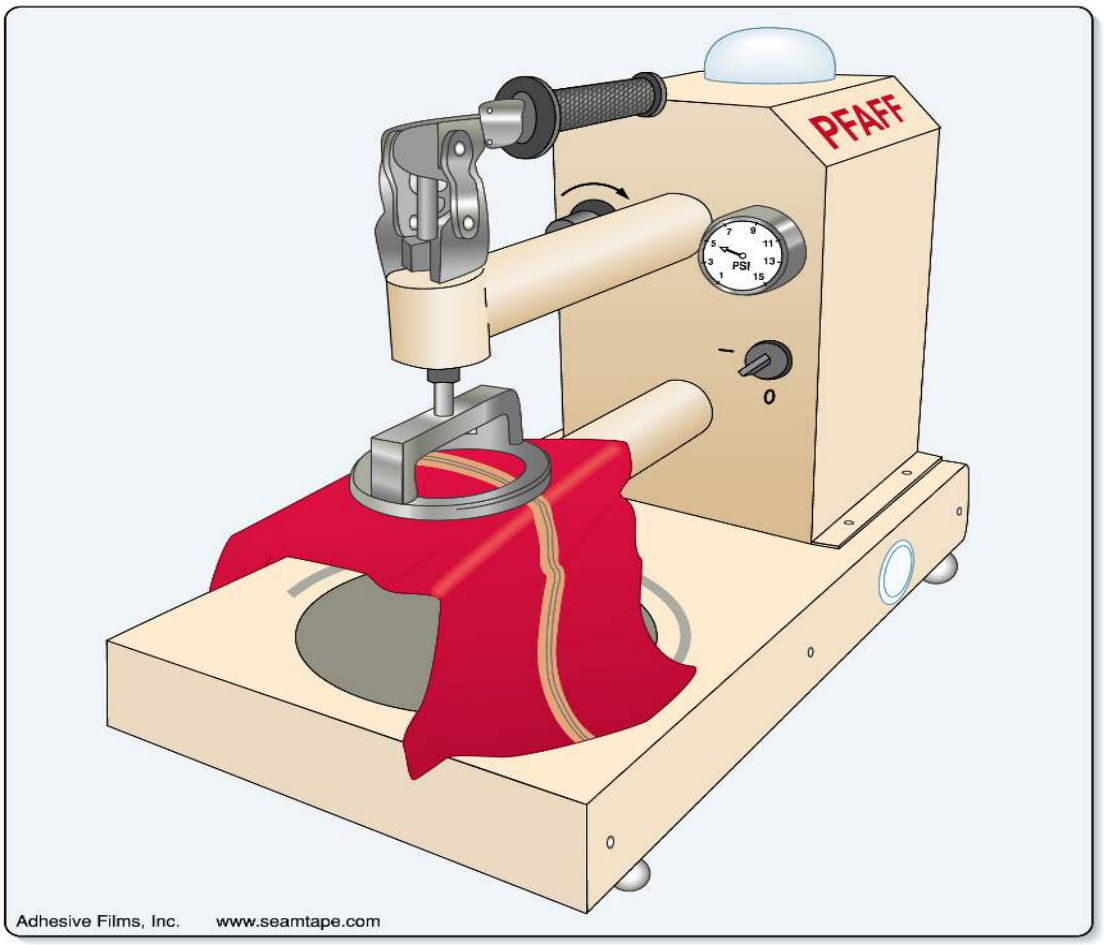
10. STANDARD SEAM TAPE TEST METHOD continued

This is an Instron type machine using a 22 Lb. (10Kg) force gauge to peel the tape from the fabric at a 180° angle, at a rate of 12" (305 mm) per minute (see Fig 8) on preceding page. Minimum acceptable bond strength is 2 lbs (900 Gm), or fabric / membrane separation, with 3 lbs (1350 Gm) or more being desired.

After determining the suitable tape(s) for the fabric / membrane and intended use, a 6" x 6" (15 cm x 15 cm) piece of supplied fabric with sewn seam is sealed with each selected tape. After allowing the sample to cool (approx. 5 minutes), the sealed fabric is then flex tested a minimum of 750 times.

After flexing, the sample is clamped in a constant pressure hydrostatic tester with the seam of the outer surface of fabric between the water and the tape (see Fig 9). The sealed seam is then tested in accordance with U.S. Federal Test Method Standard No. 1911 A 5512 (Canadian 2-4-. 2-M 77 Method 26.5) / (European Standard EN 1392:1995E) for five minutes @ 1.5 PSI, followed by five minutes @ 3 PSI for a total of ten minutes continuous water contact.

Fig 9



Alternatively, the sample could be tested in compliance with Military Specification MIL-P-43907 C. Evidence of leakage in one or more locations is considered a test failure.

These tests are generally performed within 1 hour of tape application and if necessary, again after 24 hours. If results of the two tests differ, the lower results are official, unless otherwise noted. If required by the end user, these tests can be performed after washing & drying and / or dry cleaning as well. The number of wash & dry or dry cleaning cycles is determined by the end user.

In certain instances the end user may require that these tests be modified or additional tests be performed to fit specific applications.

Since Adhesive Films, Inc. has no control over application conditions, changes in fabrics or membranes from lot to lot, etc., we can only certify results of tests performed on samples as supplied by the end user. Any changes in stated sealing conditions or fabric lots are the responsibility of the end user. It is strongly recommended that the end user perform these tests with each lot of fabric and certify the results as consistent with those performed by Adhesive Films, Inc. Failure to perform these tests could void all guarantees.

11. PEEL TEST GRAPH AND FORMAL REPORT

On the following two pages you will find an example of the computerized test graph and the formal test report as furnished to the customer. Although the customer and the product tested are factual, the conditions and results are actually from a different customer and product (in compliance with a formal confidentiality agreement).

ADHESIVE FILMS, INC
R&D
PINE BROOK, NJ

Date: 03/03/2000
Time: 11:12

Test mode: Peel

Description:

Tests performed under the supervision of L. A. Smith (MSc)
All tests conform to ASTM standards.

General Motors (HEEL PAD)
Substrate "A", "B", "C" (EXF-371) 450C @ 100% speed)

FPT settings:

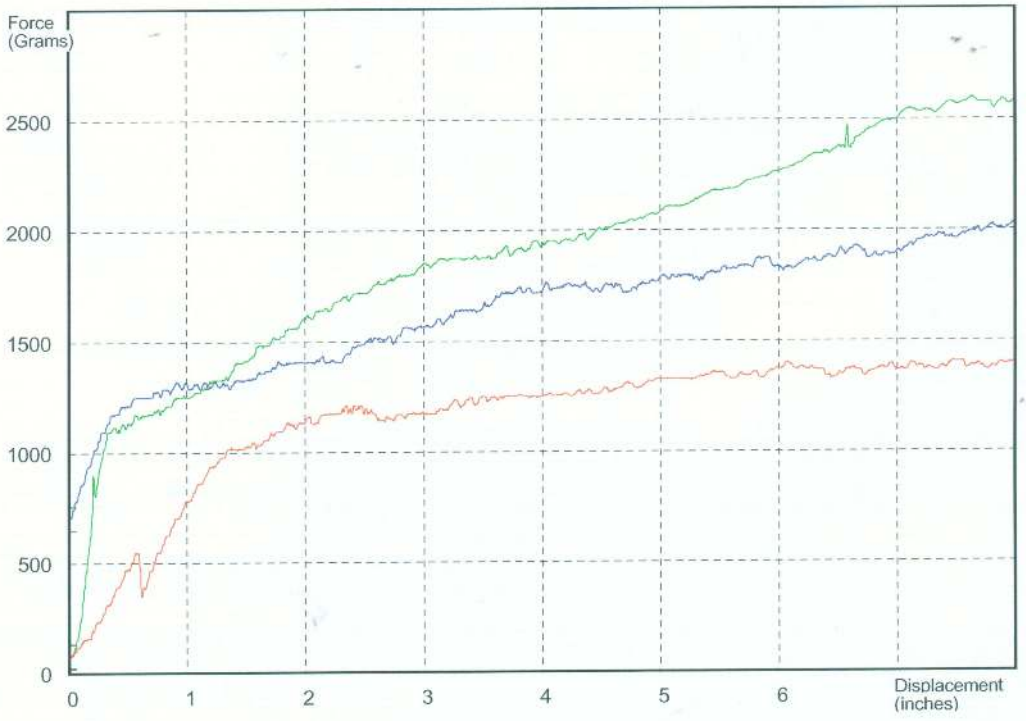
Unit:	Grams
Test time (T1,T2):	40 s (-,-)
Speed:	12 in/min
PrePeel Time:	2 s
Divider value:	1.0

Disk location:

File: 3_manual.fpg
Path: d:\af26cf~1.i\labora~1\talas31\2003

Legend (color, date and time)

- 03/03/2000, 11:12
- 03/03/2000, 11:30
- 03/03/2000, 11:32



ADHESIVE FILMS, INC.

General Motors Corp.

TAPE TESTED: EXF-371 .0025" x 1"
Test Date: March 3, 2003

FABRIC: GM Supplier S-10 Polypropylene Carpet

COATING: GM Supplier S-10 PVC heel pad

TEST MACHINE	**Pfaff Model 8304**
AIR TEMPERATURE	**450 °C**
TAPE SPEED	**41 Ft/Min**
ROLLER PRESSURE	**50 PSI(1 PSI=.0703 Kg/cm ^{2})**
NOZZLE AIR PRESSURE	**12 PSI**
PEEL STRENGTH	**1410 – 2050 - 2625 Gm**

Hydrostatic Pressure: 1 PSI = 700mm [76mm DIA] water column

RESULTS INDICATED ABOVE SHOULD BE OBTAINED IF ALL SEALING CONDITIONS ARE DUPLICATED

Comments:

While EXF-371 on all substrates exceeded GM minimum peel strength of 1000 grams;
Substrate "A" (RED) showed maximum peel strength of 1410 grams. Substrate "B" (BLUE) showed maximum peel strength of 2050 grams. Substrate "C" (GREEN) showed maximum peel strength of 2625 grams. Substrate "C" destroyed the carpeting at approximately 2375 grams.

EXF-371.0025" is recommended for this application.

EXF-371 may be pre-applied to the PVC using a belt or drum lamination system. After diecutting heel pad and stripping matrix, PVC/EXF-371 should be applied to carpeting as needed using a platen type heat press with a dwell time of 1.5-2 seconds, 350°C and 50 PSI.

11. FABRIC / COATING AND TAPE COMPATIBILITY

Adhesive Films, Inc. has performed extensive testing on thousands of fabric and membrane combinations. Although we have created a large database of these tests, it is impossible to maintain an accurate, current listing due to the constant changes and modifications made by the fabric and coating manufacturers. A partial and very generalized listing of fabric / membrane manufacturers' products and applicable seam tapes appears below.

Adhesive Films, Inc. will be happy to provide information on the most suitable tape for any fabric or coating not listed below on an individual request basis. Simply contact Adhesive Films, Inc. with the name of the fabric manufacturer, style name or number of the fabric and the coating name or type. If we have tested that fabric or membrane we will provide you with a copy of the test report, a sample of the proper tape and recommended sealing conditions.

If we have not tested the fabric or membrane, you may send us a sample as specified in the **STANDARD SEAM TAPE TEST METHOD** (Sec. 10) and we will be happy to perform the appropriate tests and provide you with the test report, a sample of the proper tape and recommended sealing conditions.

A partial listing of waterproof fabric manufacturers is below.

Manufacturer	Membrane	Tape
BHA Technologies	PTFE	840, 910
Burlington	Ultrex	840, 864, 870, 882
Burlington	Xalt	840, 864, 870, 920
Consoltex	Husky	864, 870,
Consoltex	Hydroflex	870, 882
Daesung	Various	840, 864, 870
Darlexx	PU/Lycra	840
Gore	Goretex	840, 900, 905, 910, 911, 913, 920
Kolon	Various	864, 870, 882
Helly Hansen	Helly Tech	840, 864, 870
Sympatex	Various	864, 870, 882, 888, 910, 928
Stedfast	Stedair	840, 870, 888, 900, 920
Taiwan Taffeta	Clearcoat	870, 888
Tetratex	PTFE	840, 905, 910, 911
Toray	Entrant	864, 870, 882, 888
Travis	Travtech	840, 864, 870, 882, 888
Triad	Various	864, 870, 882, 913

Additional information may be found on our websites

www.SeamTape.com or www.adhesivefilms.com

TAF- #	Adhesive	Membrane	Top Surface	‡ Melt Temp.	Service Temp.	• STD Gauge	† STD Color	Resists: Washing	Resists: Dry Cleaning	Specific Materials to be Sealed: * DWR	Leather	* Neoprene	Non-wovens	Nylon	Poly-cotton	Polyamide	Polyester	PVC	Polyurethane	* Rubber	* Silicone	Clearcoats
805	P	U	N/A	230	–30 to 180	.007"	Clear	◆			◆		◆		◆		◆					
810	U	U	N/A	160	–20 to 150	.003"	Clear	◆	◆				◆				◆	◆	◆			
840	U	U	N/A	170	–30 to 210	.005" .008"	Clear	◆	◆		◆		◆		◆			◆	◆	◆		
864	U	U	N/A	165	–20 to 170	.004"	Clear/White	◆	◆				◆		◆			◆	◆			
870	U	U	N/A	170	–15 to 165	.005" .008"	Clear/White	◆	◆	◆			◆		◆			◆	◆			◆
882	U	U	N/A	175	–20 to 190	.006"	Clear	◆	◆				◆		◆			◆	◆			
888	U	U	N/A	170	–15 to 185	.007" .009" .011"	Clear	◆	◆				◆		◆			◆	◆			
900	A	U	N/A	245	–55 to 200	.008"	Clear/Amber	◆			◆	◆	◆	◆	◆	◆			◆		◆	

KEY:

Adhesive Layer
A = Polyamide
MU = Modified Polyurethane
N = Nylon
P = Polyester
U = Polyurethane

Membrane Layer
A = Polyamide
F = Polytetrafluoroethylene (ePTFE)
MU = Modified Polyurethane
N = Nylon
P = Polyester
U = Polyurethane
W = Non-woven

Top surface other than membrane
F = Polytetrafluoroethylene (ePTFE)
N = Nylon 66 tricot

* : Many, but not all
‡ : Adhesive begins to melt
◆ : Very good to excellent adhesion

• STD gauge: Refers to total thickness of adhesive and membrane only, does not include fabric or tricot layer, if any.

† STD color: Color pigment may be added to most "clear" seam tapes. Minimum quantities and special pricing may apply.

If you require a non-standard thickness, we will be happy to discuss your specific needs.

TAF- #	Adhesive	Membrane	Top Surface	‡ Melt Temp.	Service Temp.	• STD Gauge	† STD Color	Resists: Washing	Resists: Dry Cleaning	Specific Materials to be Sealed: * DWR	Leather	* Neoprene	Non-wovens	Nylon	Poly-cotton	Polyamide	Polyester	PVC	Polyurethane	* Rubber		* Silicone	Clearcoats
905	A	U	N	245	–50 to 195	.008"	Various Tricot	◆				◆		◆		◆			◆				
908	MU	U	N	185	–25 to 200	.008"	Various Tricot	◆	◆			◆	◆	◆		◆		◆	◆				◆
910	U	MU	N	270	–35 to 210	.008"	Various Tricot	◆	◆		◆		◆		◆			◆	◆	◆			
911	U	F	N	265	–45 to 260	.008"	Various Tricot	◆	◆		◆	◆	◆		◆			◆	◆	◆			
913	A	U	W	240	–50 to 195	.008"	Various Fabric	◆				◆	◆	◆		◆			◆				
920	A	U	N	240	–40 to 190	.008"	Various Tricot	◆				◆		◆		◆			◆				
928	MU	U	N	180	–30 to 200	.008"	Various Tricot	◆	◆			◆	◆					◆	◆				◆

KEY:

Adhesive Layer
A = Polyamide
MU = Modified Polyurethane
N = Nylon
P = Polyester
U = Polyurethane

Membrane Layer
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