



# High Shear PSA Cover Tape

Technical Bulletin – January, 2006

## 1.0 Scope

End users of high speed pick and place feeders have experienced delamination of the cover tape from the carrier (“pop-off”) after a feeder remained idle for a period of time (typically overnight or over the weekend). This phenomena occurred only in narrow width tape and reel (cover tape for 8mm carrier tape). Extensive laboratory evaluations uncovered that the shear rate of an adhesive is one of the root causes of delamination. Two other root causes of pop-off are the room temperature in which the feeder operates and the tension of the cover tape between the de-taping mechanism and the take-up reel (or re-winder).

Based on these results, 3M has introduced two new High Shear PSA Cover Tapes with improved performance on high speed pick and place feeders.

## 2.0 Product Availability

3M offers 3M™ Conductive High Shear Pressure Sensitive Adhesive Cover Tape 2668 and 3M™ Non-Conductive High Shear Pressure Sensitive Cover Tape 2658. These cover tapes are available only in the 5.4 mm and 9.3 mm widths.

## 3.0 Product Differences Between Existing PSA and New High Shear PSA Cover Tapes:

The differences between the existing 3M PSA Cover Tapes and the new 3M High Shear PSA Cover Tapes are demonstrated in the chart below.

Property	3M PSA 2656/2666	3M High Shear PSA 2658/2668
Available Widths (mm):	5.4 mm - 120 mm	5.4 mm - 9.3 mm
Adhesive Exposure (per side):	0.7	0.7
<b>Shear strength to 3M Conductive Polycarbonate:</b>		
@23C, 1/2" x 1/2", 1 kg load	100 minutes	>10,000 minutes (20,000 minutes typical)
@40C, 1/2" x 1/2", 1 kg load	20 minutes	>1000 minutes (2,000 minutes typical)
@50C, 1/2" x 1/2", 1 kg load	5 minutes	>100 minutes (200 minutes typical)
<b>Shelf Life:</b>		
Stored @ <35°C, 70% RH in original packing materials	3 years	2 years

All other features of the 3M High Shear PSA Cover Tapes (product construction, material properties, physical properties, electrical properties, product format and packaging) are identical to the existing 3M PSA Cover Tapes.

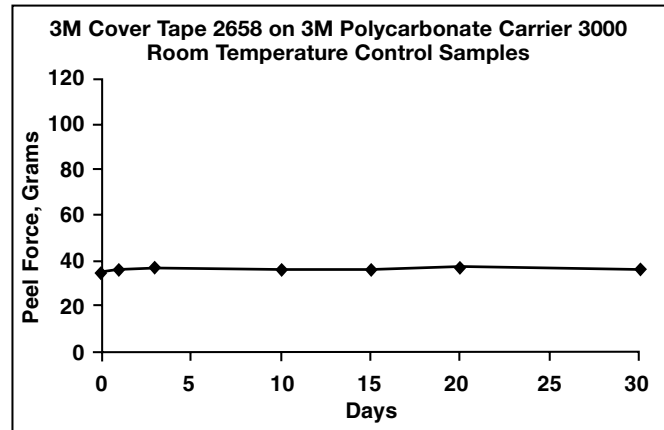
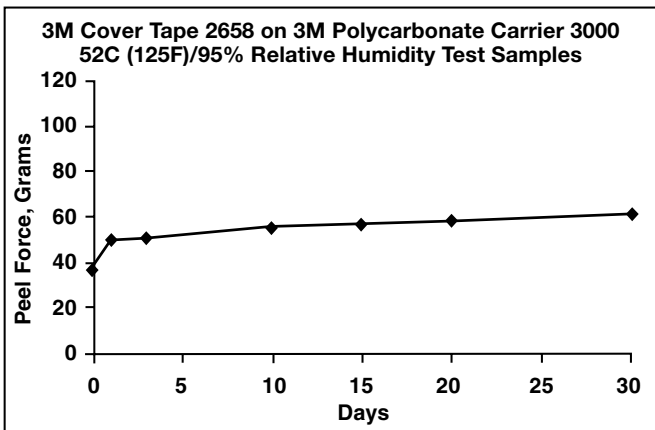
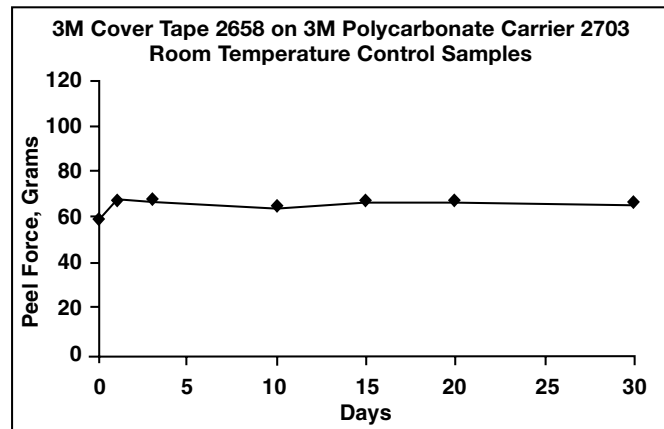
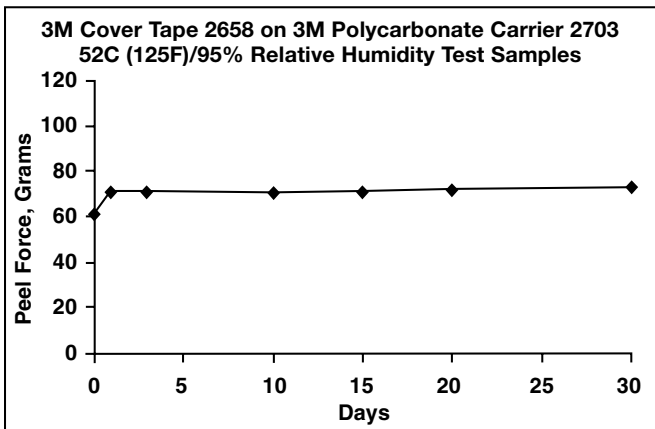
Sealing and aging properties of the 3M High Shear PSA Cover Tapes are comparable to the existing 3M PSA Cover Tapes.

## 4.0 Sealing and Aging Performance:

3M™ High Shear PSA Cover Tapes have a simple process window. Desirable initial peel force values can be achieved through the application of adequate pressure to the non-adhesive surface of the cover tape over the adhesive stripes with a reciprocating shoe or compliant roller mechanism. The following charts depict the typical room temperature and aging characteristics of 3M High Shear PSA Cover Tape after sealing to 3M™ Conductive Polycarbonate Carrier 3000 and 3M™ Non-Conductive Polycarbonate Carrier 2703.

## 4.1 Sealing Parameters

Cover Tape:	3M Non Conductive High Shear PSA Cover Tape 2658, 5.4 mm
Carrier Tapes:	3M Non-Conductive Carrier Tape 2703, 8 mm and 3M Conductive Carrier Tape 3000, 8 mm
Sealing Mode:	Continuous (Rubber Pressure Roller, 50 durometer)
Pressure:	30 psig
Speed:	1.5 lineal meters/minute
Temperature:	Ambient Room Temperature (23°C or 73°F).



## 4.2 Graph Notes

The graphs in this document represent sealing performance attained under the conditions specifically stated in the sealing parameters section. Pressure is the indicated gauge pressure used to achieve the seals and may vary among sealing equipment manufacturer's. The use of a different sealing mechanism, i.e. reciprocating vs. roller, may have an effect upon the performance obtained under otherwise identical conditions due to differences in pressure or pressure distribution. The use of heat is specifically not recommended.

All data presented is representative of peeling studies conducted according to the requirements of the current ANSI/EIA-481-C Standard. Sealed samples used in these studies were stored under the conditions noted in the chart and wound on 180mm diameter reels to simulate typical production use. Samples being tested at elevated temperature and humidity were permitted a minimum equilibration period of four hours at room temperature prior to testing to simulate actual use conditions.

## 5.0 Improved High Speed Pick and Place Performance

End users de-taping 3M™ PSA Cover Tape product with high speed Panasert (MV2C, MSH-2, MD-2C, MD-2F) pick and place feeders have experienced premature PSA delamination (“pop-off”) as shown in Figure 1 below.

### 5.1 Root Causes of “Pop-off” on High Speed Pick and Place Feeders

A designed experiment uncovered three root causes of PSA pop-off:

- High tension on the PSA
- Insufficient cohesive strength of the cover tape to the carrier tape
- High operating temperature of the feeders.

### 5.2 Preventing “Pop-off”

Pop-off can be solved in three ways:

- Using 3M™ High Shear PSA Cover Tape
- Reducing tension on the cover tape by using a weaker spring and/or larger diameter rewind hub (Figure 2)
- Maintaining operating temperatures at or below 35°C

### 5.3. Customer Evaluations of 3M High Shear PSA Cover Tape

End-users who have experienced pop-off with the existing 3M PSA Cover Tapes (2656 or 2666) on their Panasert feeders (single and double style) have reported that pop-off has not occurred with the 3M High Shear PSA Cover Tape.

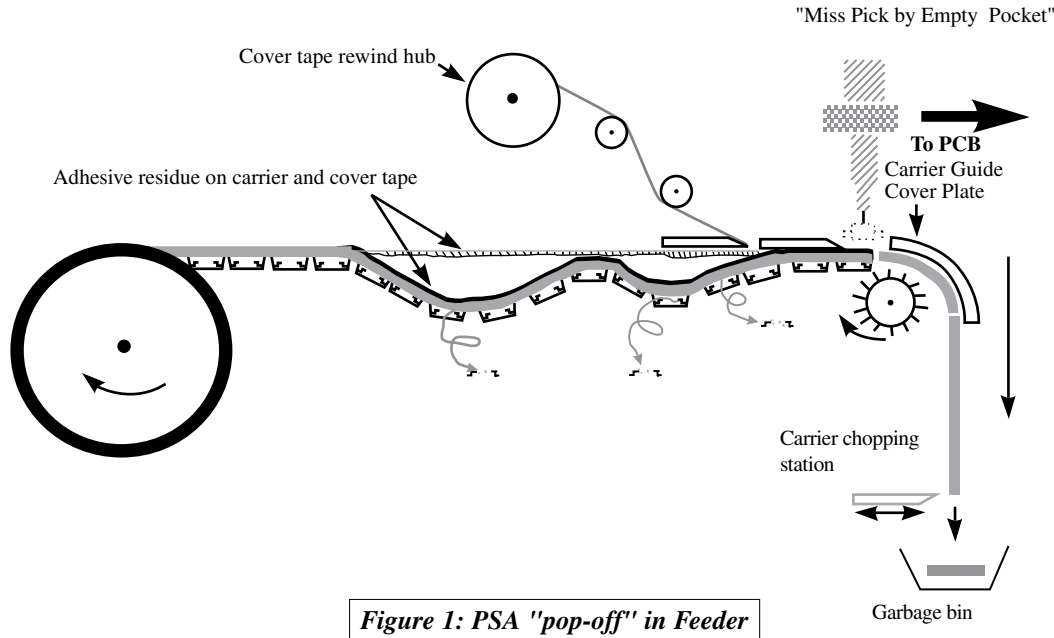


Figure 1: PSA "pop-off" in Feeder

Table I: Panasert MV2C Feeder Results of High Shear PSA Cover Tape on 3M Carriers 2703 and 3000

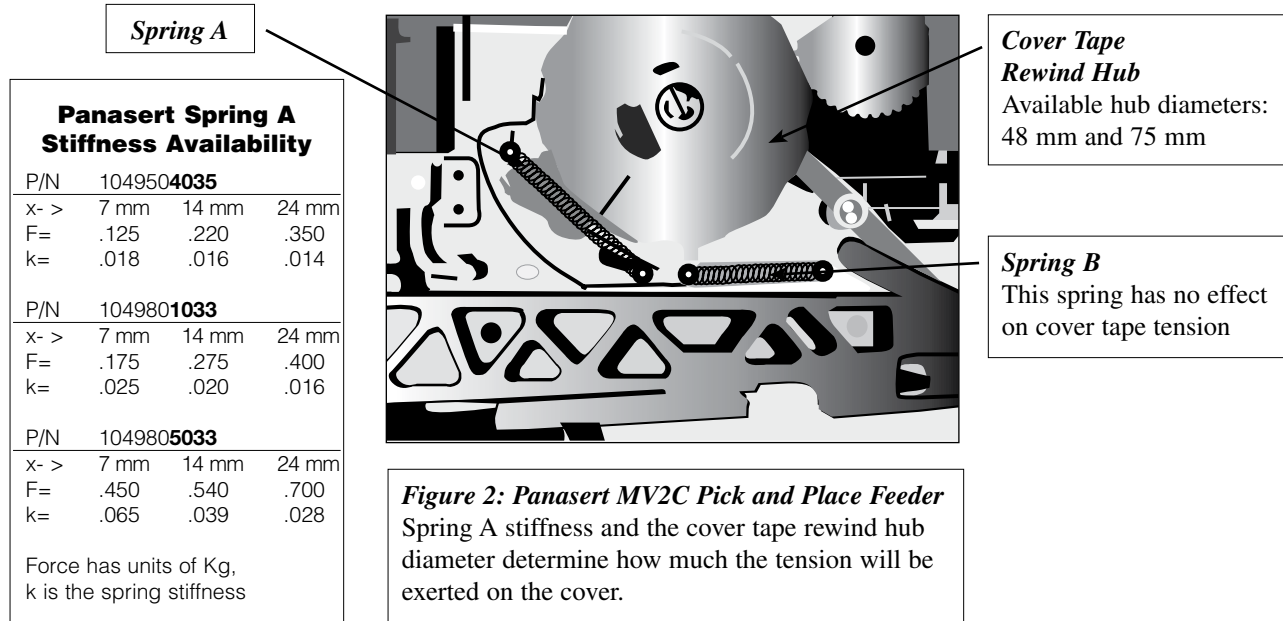
Rewind hub diameter = 48 mm. Spring force = 0.40kg at 24 mm for Spring A.

Environment	Length of Test	Pop-off Observed?	
		3M Carrier 2703	3M Carrier 3000
23°C	3 days	No	No
35°C	1 day	No	No
35°C	2 days	Yes	No
40°C	1 day	Yes	No
50°C	1 day	Yes	No

**Table II: Panasert MV2C Feeder Results of 3M™ Conductive PSA Cover Tape 2666 and 3M™ Conductive High Shear PSA Cover Tape 2668**

Tension (Spring A force and rewind hub diameter) vs. occurrence of “pop-off”

Spring A Stiffness	Rewind Hub dia.(mm)	Pop-off after 24 hours?	
		3M PSA 2666	3M High Shear 2668
0.35 kg at 24 mm	48.0	No	No
0.35 kg at 24 mm	75.0	No	No
0.40 kg at 24 mm	48.0	Yes	No
0.40 kg at 24 mm	75.0	No	No
0.70 kg at 24 mm	48.0	Yes	Yes
0.70 kg at 24 mm	75.0	Yes	No



#### 5.4 Experimental Results:

A full factorial designed experiment was conducted to study the effects of: Spring A stiffness, feeder operating temperature, rewind hub diameter and adhesive shear holding power on pop-off for a Panasert model MV2C feeder. The results are shown in Table V.

In Table III, if the influence is “+”, then as the factor is increased, the response increases; if the influence is -, then as the factor is increased, the response decreases.

3M High Shear Adhesive was found to significantly reduce pop-off.

- With a 75 mm hub diameter, no pop-off occurred.
- With a 48 mm hub diameter, operating temperature of the feeder becomes a critical factor for preventing pop-off. Modeling predicts that if the operating temperature is maintained at or below 32°C pop-off will not occur over a 72 hour period.

**Table III: Factors Studied, Levels and Effect of Factor on Responses Studied:**

Factor	Levels (-, +)	Significant	Influence	Responses Studied
Feeder Operating Temperature	23°C, 32°C	yes	+	Cover tape movement/hour
Adhesive Type	Std Prod, Hi Shear	yes	-	Degree of carrier “snake”
Rewind Hub Diameter	48 mm, 75 mm	yes	-	Occurrence of pop-off
Spring A Stiffness at 24 mm	0.35 kg, 0.40 kg	no		

Note: Std Prod = Conductive 2666. Hi Shear = 3M Conductive High Shear 2668.

### 5.4.1 Designed Experiment Test Method

Seven inch reels of 3M™ Conductive PSA Cover Tape 2666 and 3M™ Conductive High Shear PSA Cover Tape 2668 sealed to 3M Conductive Polycarbonate Carrier 3000 were prepared. At the start of each condition, the cover tape peeled back from the carrier and loaded on a Panasert MV2C feeder. The cover tape was fed onto the rewind hub, and the feeder was advanced until the re-winder rotated 1.25 revolutions to ensure the cover tape would be under high tension. The Starting Point was marked on the cover tape. The reference location for the starting point was at the

beveled edge of the cover plate (Figure 3). The feeder was placed in the appropriate environment (room temperature or 32°C) and sat idle for the duration (e.g. 24 hours). At the conclusion of the condition, the distance the mark moved toward the take up reel from Starting Point was measured. If the movement was clearly less than 1/2 mm, a value of 0.3 mm was assigned. If there was no movement, a value of 0.0 mm was assigned. Judgments were made for the amount the cover tape popped off and the amount that the cover tape snaked. These judgments were assigned a numeric value (Table IV).

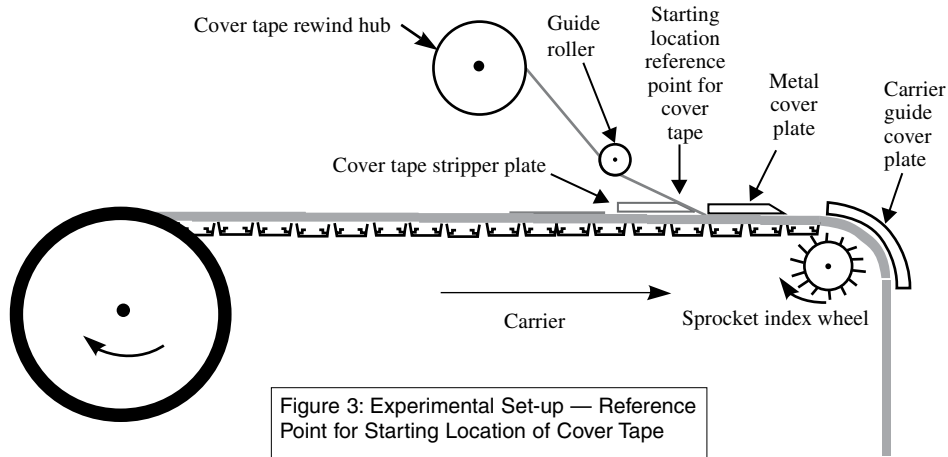


Figure 3: Experimental Set-up — Reference Point for Starting Location of Cover Tape

**Table IV: Numeric Values for Visual Judgments of Pop-Off and Degree of Carrier Snake**

Cover Tape Pop-Off		Degree of Carrier Snake	
Judgment	Numeric Value	Judgment	Numeric Value
Yes	+1	Severe-3 buckles	7
No	-1	Severe-1 buckle	3
		Slight	1
		None	-1

### 5.4.2 Designed Experiment Test Results

**Table V: Designed Experiment test results—adhesive type, spring, hub diameter, and feeder operating temperature vs. responses for cover tape sealed to 3M Carrier 3000.**

Spring A P/N	Operating Temp.	Hub Dia.	Adhesive Type	Movement (mm)	Pop-Off Seen?	Snaked?	Test Notes	Length of Test (hrs.)	Move/Hr (mm/hr)
4035	23°C (RT)	48 mm	Std Prod	0.5	No	Slight	Note 1	24.33	0.020576
4035	23°C (RT)	48 mm	Hi Shear	0.3	No	None	Note 3	23.25	0.012903
4035	23°C (RT)	75 mm	Std Prod	0	No	None	Note 5	24.25	0
4035	23°C (RT)	75 mm	Hi Shear	0	No	None		25.33	0
4035	32°C (Ovn)	48 mm	Std Prod	2.5	Yes	Severe-3	Note 4	24.33	0.102881
4035	32°C (Ovn)	48 mm	Hi Shear	0.3	No	None		26.67	0.011278
4035	32°C (Ovn)	75 mm	Std Prod	0.5	No	None		24.00	0.020833
4035	32°C (Ovn)	75 mm	Hi Shear	0	No	None		43.33	0
1033	23°C (RT)	48 mm	Std Prod	1.5	No	Severe-1	Note 1,6	31.00	0.048387
1033	23°C (RT)	48 mm	Hi Shear	0	No	None	Note 2	25.50	0
1033	23°C (RT)	75 mm	Std Prod	0.5	No	Slight		24.33	0.020576
1033	23°C (RT)	75 mm	Hi Shear	0	No	None		24.00	0
1033	32°C (Ovn)	48 mm	Std Prod	3	Yes	Severe-3	Note 7	26.50	0.113208
1033	32°C (Ovn)	48 mm	Hi Shear	0.5	No	None	Note 1	24.00	0.020833
1033	32°C (Ovn)	75 mm	Std Prod	1	No	None		24.00	0.041667
1033	32°C (Ovn)	75 mm	Hi Shear	0	No	None		25.67	0

Adhesive Type: Std Prod = 3M Conductive PSA Cover Tape 2666  
 Hi Shear = 3M Conductive High Shear PSA Cover Tape 2668  
 Spring A stiffness at 24 mm was: 0.35 kg for P/N 1049504035 and 0.40 kg for P/N 1049801033.  
 A model MV2C Panasert feeder was used.

## Designed Experiment Test Notes:

1. Carrier contacted lower spring at end of test - no pop off or snaking seen.
2. PSA was on edge of white guide roller during test - higher tension may have been present.
3. Starting location of cover tape note noted - no pop off seen, carrier not in contact with lower spring, and adhesive area not stressed.
4. Carrier taped showed three buckles (or two periods).
5. Initial starting position of carrier slightly snaked - carrier did not become further snaked during test.
6. Cover tape bowed, but still attached to the carrier. The carrier showed one buckle (or one period).
7. Carrier taped showed three buckles (or two periods).

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