



April, 2005

3M™ VHB™ Adhesive Transfer Tapes F9460PC, F9469PC and F9473PC utilize the high performance of 3M™ Adhesive 100MP, which has excellent long term holding power with much higher adhesion strength than typical pressure sensitive adhesive systems. These VHB adhesive transfer tapes are transparent and are ideal for use in many interior and exterior industrial applications to replace rivets, spot welds, liquid adhesives, and other permanent fasteners.

Electrical and Thermal Properties

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

Products	3M™ VHB™ Adhesive Transfer Tapes								
	F9460PC			F9469PC			F9473PC		
Thermal Coefficient of Expansion	770 x 10 ⁻⁶ mm/mm/°C								
Thermal Conductivity (ASTM C-177)	0.092 BTU-ft/ft ² Hr °F (0.0016 Watts/cm °C)								
Dielectric Strength (Volts per ASTM D-149-97A)	23°C	125°C	175°C	23°C	125°C	175°C	23°C	125°C	175°C
	1200	1000	1000	3000	2600	1900	5500	N/A	N/A
Insulation Resistance (ASTM D-1000)	> 1 x 10 ⁶ megaohms/in ²								
Density	0.04 lb/in ³ (0.98 g/cm ³)								

3M™ VHB™ Adhesive Transfer Tapes with Adhesive 100MP

F9460PC • F9469PC • F9473PC

Dynamic Mechanical Properties

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

For engineers who have to use adhesive properties for modeling and analysis purpose, we suggest a Young's modulus of 4.5×10^2 kPa (measured at 23°C & 1 Hz) and a Poisson's ratio of 0.499. For detailed adhesive modulus and damping properties, please refer to the nomograph for 3M™ VHB™ Adhesive Transfer Tapes, which is available upon request through our technical service group. The nomograph presents adhesive modulus and damping properties as functions of temperature and frequency.

Performance Characteristics

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

These VHB adhesive transfer tapes are made from the same adhesive system and are thermoplastic in nature, becoming softer as temperature increases and firmer as temperature decreases. As the adhesive becomes firmer, the adhesion performance generally increases. At low temperatures (lower than -40°F [-40°C]), the VHB adhesive transfer tapes become very firm and glassy; the ability to absorb impact energy is reduced. In contrast, adhesion strength reduces with increasing temperatures. Typical adhesive strength properties at room temperatures are shown below.

Products	3M™ VHB™ Adhesive Transfer Tapes		
	F9460PC	F9469PC	F9473PC
Peel Adhesion to Stainless Steel (ASTM D3330)	7.0 lb./in. (120 N/10 cm)	8.0 lb./in. (140 N/10 cm)	9.0 lb./in. (160 N/10 cm)
Normal Tensile to Aluminum (T-Block) (ASTM D-897)	100 lb./in. ² (690 kPa)	100 lb./in. ² (690 kPa)	100 lb./in. ² (690 kPa)
Static Shear or Shear Holding Power to Stainless Steel (ASTM D-3654)	Will hold 1000 grams of loading with a time period of more than 10,000 minutes at temperatures up to 300°F (149°C).		
Dynamic Shear to Stainless Steel (ASTM D-1002)	80 lb./in. ² (550 kPa)	80 lb./in. ² (550 kPa)	80 lb./in. ² (550 kPa)
Temperature Tolerance (Short Term)	500°F (260°C): 4-hour conditioning at the indicated temperature with 100 g static load.		
Temperature Tolerance (Long Term)	300°F (149°C): Maximum temperature where tape supports 250 g in static shear for 10,000 minutes.		
Solvent Resistance (3 splash testing cycles: 20 seconds submersion, & 20 seconds air dry.)	No apparent degradation when exposed to splash testing of many common solvents and fluids including gasoline, JP-4 fuel, mineral spirits, motor oil, ammonia cleaner, acetone and methyl ethyl ketone.		
UV Resistance	Excellent UV resistance through outdoor weathering tests and weather-O-meter tests.		

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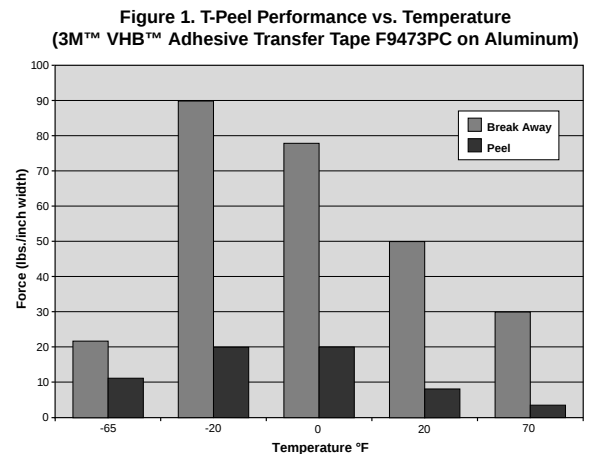
UL 746C Listings (File MH 17478) and Durability Testing

3M™ Adhesive 100MP has UL 746C listings with different temperature ratings on many commonly used substrate materials as indicated in the table below. Qualification for this listing requires high strength retention after extended exposure to high temperatures, humidity, cold, and cyclic conditions.

Substrates	Temperature Rating
Stainless Steel, Glass/Epoxy, Enameled Steel, Ceramic, Phenolic; Nickel Plated Steel (3M™ Adhesive Transfer Tape F9469PC only)	110°C
ABS, Polycarbonate, Aluminum, Galvanized Steel	90°C
Unplasticized PVC	75°C

Our testing has shown that 3M adhesive 100MP yielded 92% retention of peel adhesion after the roll was aged for more than 5 years at an elevated temperature of 150°F (65°C). The initial tack and liner release properties were still excellent. This testing result suggests that the tape is relatively unaffected by long-term exposure to elevated temperatures. Bonds made with 3M adhesive 100MP can tolerate periodic short-term exposures to temperatures up to 500°F (260°C).

3M adhesive 100MP is thermoplastic in nature, becoming softer as temperature increases and firmer as temperature decreases. As the adhesive becomes firmer, the performance generally increases. This performance increase is demonstrated graphically in Figure 1 for 3M™ VHB™ Adhesive Transfer Tape F9473PC. It shows the breakaway and peel forces as a function of temperature. The exception of the performance increase is at very low temperatures when high impact stresses along with high frequencies are encountered. At low temperatures, the tape becomes very firm and glassy; the ability to absorb impact energy is reduced.



Weight Loss and Outgassing Performance

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

The testing was done per ASTM E595-77/84/90 as indicated in the NASA Reference Publication 1124, Revision 4, "Outgassing Data for Selecting Spacecraft Materials", June 1997. The results are reported as percentage of total mass loss (TML) and percentage of Volatile Condensable Materials (VCM), respectively, as shown below.

Products	3M™ VHB™ Adhesive Transfer Tapes F9460PC	F9469PC	F9473PC
TML (%)	0.85	1.29	1.23
VCM (%)	0.00	0.02	0.01

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Application Techniques Bond strength is dependent upon the amount of adhesive-to-surface contact developed. Firm application pressure helps develop better adhesive contact and improve bond strength. To obtain optimum adhesion, the bonding surfaces must be clean, dry, and well unified. Some typical surface cleaning solvents are isopropyl alcohol/water mixture or heptane.*

Ideal tape application temperature range is 70°F to 100°F (21°C to 38°C). Initial tape application to surfaces at temperatures below 50°F (10°C) is not recommended because the adhesive becomes too firm to adhere readily. However, once properly applied, low temperature holding is generally satisfactory.

***Note:** Be sure to follow the manufacturer's precautions and directions for use when using solvents.

Available Sizes	Available Roll Lengths (subject to minimum order requirements):	
	Standard	60 yd. (55 m)
	Maximum in:	
	1/4 in. to 3/8 in. wide	60 yd. (55 m)
	3/8 in. to 1 in. wide	240 yd. (220 m)
	1 in. up to 3 in.	360 yd. (330 m)
	3 in. and wider	360 yd. (330 m)
	Normal Slitting Tolerance	± 1/32 in. (0.8 mm)

Storage Store in original cartons at 70°F (21°C) and 50% relative humidity.

Shelf Life If stored under proper conditions, products retain their performance and properties for 24 months from date of manufacture. If the products have been exposed to severe weather conditions, we suggest to precondition the products at the above storage conditions for at least 24 hours before using them.

Product Use All statements, technical information and recommendations contained in this document are based upon tests or experience that 3M believes are reliable. However, many factors beyond 3M's control can affect the use and performance of a 3M product in a particular application, including the conditions under which the product is used and the time and environmental conditions in which the product is expected to perform. Since these factors are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

Limited Warranty 3M warrants for 24 months from the date of manufacture that 3M™ VHB™ Tape will be free of defects in material and manufacture. 3M MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. This limited warranty does not cover damage resulting from the use or inability to use 3M™ VHB™ Tape due to misuse, workmanship in application, or application or storage not in accordance with 3M recommended procedures.

Limitation of Remedies and Liability If the 3M™ VHB™ Tape is proved to be defective within the warranty period stated above. THE EXCLUSIVE REMEDY, AT 3M'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE 3M™ VHB™ TAPE. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including negligence, warranty, or strict liability.



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