Application for Skyway System Use Permit
Speaking of Home—St. Paul

MATERIAL SPECIFICATIONS

APPENDIX D

This appendix contains product specifications sheets for the various materials proposed for the St. Paul skyway system as part of the Speaking of Home project.

- Photographic artwork panels: Knit voile, 100% polyester fire-retardant fabric
- Biographical panels and overhead signage: Polycarbonate
- Wall-mounted transom graphics and four informational signage: Adhesive backed vinyl
- Free-standing informational signage: 1/2” Gator board
- 10”x5” Brochure holders: Acrylic
- Installation Hardware
  - 3M Adhesive backed Velcro (hook and loop) for photographic artwork panels, vinyl banners
  - 3M VHB tape for biographical panels and brochure holders
  - Mightee Mount system for free-standing informational signage in U.S. Bank Center
  - No hardware needed for wall mounted informational signage and transoms

TECHNICAL DATA SHEET

GF 4853 SHEER (FR)

MADE IN THE USA

Revised 7/2011

Weight:	1.27 oz/yd^2 (43 g/m^2)
Composition:	100% Polyester
Width:	142”
Construction:	Warp Knit
Printing Compatibility:	Dye Sublimation and UV Printing
Flame Retardancy:	NFPA-701; California Administrative Code Title 19 - Public Safety, Section 1237; Registered in the State of California (CSFM Registration Number: F-91201) and meets Section 13115 of the California Health and Safety Code
Thread Count:	64/65 Courses, 37 Wales
Shrinkage:	Length: 1% Width: 1%
Bursting Strength (ASTM D-3787):	30
Transfer Conditions:	380-390°F 30 P.S.I. 30 Seconds
Care Instructions:	Hand wash cold. Line dry. No bleach.
Durability:	Dependent upon the environment the fabric is exposed to.
Suggested Applications:	Double Sided Banners and Trade Show Exhibits
Note:	The above recommendations and transfer conditions are a result of laboratory testing. Because of variances in transfer equipment, we recommend additional testing in the manufacturing facility prior to printing.

Data are averages achieved for actual production runs. Product safety evaluations may not have been completed for the intended use. Samples of this product should be used for concept evaluations only.

139 Business Park Dr. Indian Trail, NC 28079
Phone 704.821.8870 Fax 704.821.8880
www.fishertextiles.com

Makrolon GP Product Details

MAKROLON® GP polycarbonate sheet is a polished surface, UV stabilized polycarbonate for use in glazing and industrial applications. Offering economy and high performance, MAKROLON GP polycarbonate sheet meets or exceeds the physical properties of any product in its class. MAKROLON GP polycarbonate sheet is backed by a five year warranty against breakage.

APPLICATIONS

MAKROLON GP polycarbonate sheet is used extensively in school and factory glazing for protection against both accidental breakage and deliberate vandalism. In manufacturing environments, this high impact material excels in applications like machine guards, noise abatement shields, clear work station partitions, freight doors, and other in-plant glazing.

Typical Physical Properties

Property	Test Method	Units	MAKROLON
PHYSICAL			
Specific Gravity	ASTM D792	-	1.2
Refractive Index @ 72°F	ASTM D542	-	1.586
Light Transmission, Clear 1/8"	ASTM D1003	%	86
Light Transmission, Gray/Bronze	ASTM D1003	%	50
Light Transmission, Dark Gray	ASTM D1003	%	18
Rockwell Hardness	ASTM D785	-	M70/R118
Water Absorption, Equilibrium, 24 hrs	ASTM D570	%	0.15
MECHANICAL			
Tensile Strength, Yield	ASTM D638	psi	9000
Tensile Strength, Ultimate	ASTM D638	psi	9500
Tensile Modulus	ASTM D638	psi	345000
Flexural Strength	ASTM D790	psi	13500
Flexural Modulus	ASTM D790	psi	345000
Compressive Strength	ASTM D695	psi	12500
Compressive Modulus	ASTM D695	psi	345000
Elongation	ASTM D638	%	110
Poisson's Ratio	-	-	0.38
Izod Impact Strength, Notched @ 1/8"	ASTM D256	Ft-lbs/in	12-16
Izod Impact Strength, Unnotched @ 1/8"	ASTM D256	Ft-lbs/in	60 (No failure)
Instrumented Impact, 1/8"	ASTM D3763	Ft-lbs	>45
Shear Strength, @ Yield	ASTM D732	psi	6000
Shear Strength, Ultimate	ASTM D732	psi	10000
Shear Modulus	ASTM D732	psi	114000
THERMAL			
Coefficient of Thermal Expansion	ASTM D696	In/in/F	3.75 x 10^{-5}
Coefficient of Thermal Conductivity	ASTM C177	Btu-in/hr-ft²-F	1.35
Heat Deflection Temperature, @ 264 psi	ASTM D648	F	270
Heat Deflection Temperature, @ 66 psi	ASTM D648	F	280
Brittle Temperature	ASTM D746	F	-200
Shading Coefficient, Clear 1/8"	ASHRAE	-	1.02
Shading Coefficient Gray, Bronze 1/8"	ASHRAE	-	0.7
U Value 1/4" (summer gain, winter loss)	-	-	0.90, 0.96

Makrolon GP Product Details

HIGH IMPACT STRENGTH

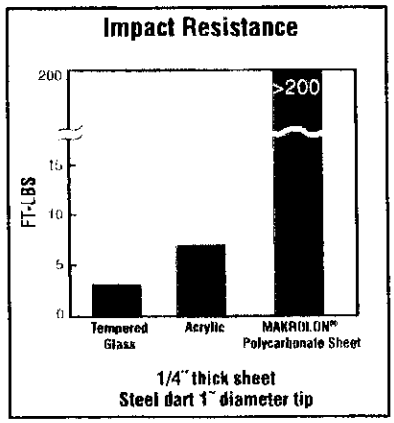
MAKROLON polycarbonate sheet is virtually unbreakable with 250 times the impact strength of float glass and 30 times that of acrylic.

CODE COMPLIANCE

MAKROLON polycarbonate sheet products satisfy major building code requirements for a CC-1 rating in constru tion applications (BOCA, ICBO, SBCCI, and Dade County). MAKROLON polycarbonate sheet products are listed with Underwriters Laboratories for the UL flammability standard and the UL972 standard for burglary resistant glazing materials. Additionally, MAKROLON polyca - bonate sheet is approved for Consumer Product Safety Commission (CPSC 16CFR 1201) categories I & II and ANSI Z97.

Typical Physical Properties *(continued)*

Property	Test Method	Units	MAKROLON
ELECTRICAL			
Dielectric Constant, @ 10 Hz	ASTM D150	-	2.96
Dielectric Constant, @ 60 Hz	ASTM D150	-	3.17
Volume Resistivity	ASTM D257	Ohm-cm	8.2×10^{16}
Dissipation Factor, @ 60 Hz	ASTM D150	-	0.0009
Dissipation Factor, @ 1 MHz	ASTM D150	-	0.01
Arc Resistance	ASTM D495	Seconds	
Stainless Steel Strip Electrode			10-11
Tungsten Electrodes			120
Dielectric Strength, in air, 125 mils	ASTM D149	V/mil	380
FLAMMABILITY			
Horizontal Burn, AEB	ASTM D635	Inches	<1
Ignition Temperature, Self	ASTM D1929	F	1070
Ignition Temperature, Flash	ASTM D1929	F	870
UL 94, Clear @ .060"	UL 94	-	V2
UL 94, Clear @ .220"	UL 94	-	V0



Polycarb : ~~Plastic~~ PAVL

REPORT

ETL TESTING LABORATORIES, INC.

INDUSTRIAL PARK CORTLAND, NEW YORK 13045

Order No. 23634-C Date November 17, 1982

REPORT NO. 457994

SMOKE DENSITY OF PLASTIC MATERIAL

RENDERED TO

GENERAL ELECTRIC

Test

Density of Smoke from the Burning or Decomposition of Plastics - ASTM D-2843

Authorization

Purchase Order No. 147-300-041 dated November 3, 1982

Description of Sample

Three 1 inch x 1 inch x 1/4 inch squares of Lexan S.G. sheet were provided by the client.

Date of Test

November 16, 1982

Equipment Used

Smoke Chamber, containing Photometer, Propane Burner, Timer, Specimen Holder, and Exit Sign - ETL Testing Labs

Test Method

The tests were performed in the smoke chamber listed above. To perform a test, the photometer and Exit Sign were turned on, the photometer was zeroed and the sample was placed in the center of the wire screen on the sample rack. The burner was ignited and the propane pressure was adjusted to 40 psi. The burner was swung under the sample as the timer was activated. Readings of smoke density were recorded every 15 seconds for four minutes. At the end of the test the specimen was removed from the chamber and the photometer windows were cleaned.

Tests were performed on the three specimens provided.

Checked by:SG

Results

A. Readings of Light Absorption (Percent) at 15 Second Intervals

Sec	S.1 Time (min.) 1	2	3	4	S.2 Time (min.) 1	2	3	4	S.3 Time (min.) 1	2	3	4
0	0				0				0			
15	0	50	50	42	4	67	65	55	5	37	40	37
30	11	54	48	41	13	67	64	53	7	43	38	35
45	28	54	46	38	45	70	59	51	15	43	37	35
60	40	52	44	37	62	67	58	50	32	41	37	33

B. Plot of Average Light Absorption vs Time

Attached

C. Maximum Smoke Density in percent, average

56

D. Smoke Density Rating, Percent

39

E. Observations on behavior of material during burning

Degree of melting - low
Degree of charring - high
Degree of dripping - low-dripped as flame extinguished
Color of flame - yellow
Nature of burning - vigorous
Time of burning - ignition - 10 seconds,
extinguished - 55 seconds (approximately)

F. Visibility of Lighted Sign

Excellent

Checked by: SG

IMA R

Conclusion

Since no performance requirements are listed in ASTM D-2843 and none were given to ETL by the client, the results of this testing will be evaluated by the client.

Results Approved by:

Fulvio Bertini, Manager
Chemical Division

Tests Performed by:

Sybil Goodkin, Ph.D.

Copied by: dg
Checked by: SG

LIGHT ABSORPTION versus TIME

RITRAMA PRODUCT GUIDE

Product Code: 3-9096

RI-JET 165

MEDIA

An economical 3-year outdoor durable Matte White film ideal for flat-surface applications. Excellent for use in promotional, point-of-purchase, trade show displays, and window graphics.

Features: 3.4-mil matte white flexible vinyl, permanent acrylic adhesive, 90# polycoated layflat liner.

TECHNICAL DATA

Face Material	3.4-mil flexible vinyl
Color and Finish	Matte White
Adhesive	Medium tack permanent acrylic
Liner	90# polycoated bleached layflat

Typical Characteristics

	15 min.	24 hr.
Target Adhesion Values (PSTC-1, 180° peel @ 12"/min., 73°F, on Stainless Steel)	5.0 lbs./inch	6.0 lbs./inch
Minimum Application Temperature	50°F	
Service Temperature Range	-40°F to +180°F	
Shelf Life (@ 73°F, 50% RH)	2 years	
Outdoor Durability	3 years	

Chemical Resistance

Distilled Water (24 hr)	No Effect
Detergent (24 hr)	No Effect
10% HCl (10 min)	No Effect
10% Ammonium Hydroxide (10 min)	No Effect
Anti-Freeze (24 hr)	No Effect
SAE 20 Motor Oil (24 hr)	No Effect
Gasoline (1 hr)	No Effect

The above information is based on research believed to be reliable, but does not constitute a warranty. All material should be tested by the purchaser to determine suitability of the product for their purposes.
Sept. 07

MATERIAL SAFETY DATA SHEET

SECTION 1 - PRODUCT INFORMATION

PRODUCT NAME:
Gatorfoam®
GatorLite™

PRODUCT SYNONYM:
Light-weight Foam Panel Laminated with Paper

PRODUCT DESCRIPTION:
Styrene foam sheet laminated with white, tan, black or other colored kraft process cellulose paper.

MANUFACTURER'S NAME AND ADDRESS:
ALCAN COMPOSITES
P.O. Box 1839
Statesville, North Carolina 28687-1839
(800) 438-1701 (Eastern Standard Time)

TECHNICAL CONTACT:
Craig Roberson
Manager, Environment, Health & Safety
(704) 838-7038

EMERGENCY TELEPHONE:
Chemtrec (800) 424-9300

SECTION II - HAZARDOUS COMPONENTS

COMPONENT (C.A.S. Number)	WEIGHT PERCENT (%)	OSHA PEL	ACGIH TLV
Formaldehyde (50-00-0)	<0.1	TWA 0.5 ppm (Action Level) TWA 0.75 ppm STEL 2.0 ppm	Ceiling 0.3 ppm

Additional Information:

Product contains condensed urea-formaldehyde based polymeric resin which is classified as a non-hazardous component when polymerized.

Nuisance dust may be generated during cutting or abrading operations. OSHA considers nuisance dust as Particulate Not Otherwise Regulated (PNOR) with an OSHA PEL of 15 mg/m3 (total dust) and 5 mg/m3 (respirable dust). ACGIH considers nuisance dust as Particulates Not Otherwise Classified (PNOC) with an ACGIH TLV of 10 mg/m3 (inhalable particulate) and 3 mg/m3 (respirable particulate).

SECTION III - PHYSICAL PROPERTIES

APPEARANCE AND ODOR:
Rigid cellular plastic panel faced with resin-impregnated paper veneer.

MOLECULAR WEIGHT:
Not applicable to mixture.

SPECIFIC GRAVITY:
Specific gravity less than water.

SOLUBILITY IN WATER:
Not soluble in water.

pH:
Not applicable to solid product.

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT (DEGREES F< PENSKY MARTINS CLOSED CUP):
Not applicable to solid product.

FIRE EXTINGUISHING MEDIA:
For small fires, use water spray, foam, carbon dioxide or dry chemical extinguishers. Larger fires should be extinguished immediately by drenching with water spray from fire hose.

FLAMMABLE LIMITS: LOWER: None UPPER: None

SPECIAL FIRE FIGHTING PROCEDURES:
Wear positive pressure self-contained breathing apparatus and protective turnout clothing when involved in fire fighting activities.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
The fire hazards associated with this product are comparable to those known to exist for normally combustible paper products. The formaldehyde constituent of this product should not increase the fire or explosive hazard nor alter fire fighting procedures. Similar to precautions for all paper products, do not smoke or use open flames, space heaters or other ignition sources near fabrication operations.

HAZARDOUS COMBUSTION PRODUCTS:
During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. In smoldering or flaming conditions, carbon monoxide, carbon dioxide and carbon are generated. Combustion products may include and are not limited to hydrogen chloride, hydrogen bromide and hydrogen fluoride. Studies have shown that the products of combustion of this material are not more acutely toxic than the products of common building materials such as wood.

SECTION V - REACTIVITY DATA

STABILITY:
Stable.

CONDITIONS TO AVOID:
Heat and moisture can result in increased rate of formaldehyde off-gassing from the product.

INCOMPATIBILITY:
None known.

HAZARDOUS DECOMPOSITION PRODUCTS:
Decomposition products can be affected by temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to aromatic compounds, aldehydes, ethyl benzene, hydrogen bromide, hydrogen chloride, hydrogen fluoride, polymer fragments and styrene. Under high heat, non-flaming conditions, small amounts of aromatic hydrocarbons such as styrene and ethyl benzene are generated.

HAZARDOUS POLYMERIZATION:
Hazardous polymerization is not expected to occur. Heat and moisture can result in increased rate of formaldehyde off-gassing from the product.

SECTION VI - HEALTH HAZARD INFORMATION

EXPOSURE FROM ROUTINE USE:
Solid or dust can cause irritation to the eyes, nose, throat, lungs, and skin.

EFFECTS OF OVEREXPOSURE:

SKIN AND EYE CONTACT: Solid or dust may cause irritation or corneal injury due to mechanical action. Formaldehyde gas is an irritant and may cause tearing of the eyes at concentrations above 1 ppm. Effect is immediately reversible when exposure is terminated. Hypersensitive individuals may experience symptoms at concentrations lower than 1 ppm.

INGESTION: Ingestion is unlikely due to physical state.
INHALATION: Exposures of 1 ppm and above of free formaldehyde gas may cause upper respiratory tract irritation. Irritation is reversible when exposure is terminated. Hypersensitive individuals may experience symptoms at concentrations below 1 ppm.

PROBABLE ROUTES OF EXPOSURE:
Skin, eyes, inhalation

EMERGENCY FIRST AID PROCEDURES:

EYE CONTACT: Flush eyes with plenty of water for dust in eyes. Remove affected individual to fresh air if eyes are irritated from chemical gas/vapor.

SKIN CONTACT: Wash off dust with water

INHALATION: Remove to fresh air if effects occur. Consult a physician.

INGESTION: No adverse effects anticipated by this route of exposure.

SECTION VII - TOXICITY DATA

ORAL: No tests have been performed.

DERMAL: No tests have been performed.

INHALATION: No tests have been performed.

EYE: No tests have been performed.

CARCINOGENICITY:
No tests have been conducted on the product, as a whole. Formaldehyde is classified by ACGIH as a suspected human carcinogen (Class A2) of the lung, nasopharnyx, oropharynx and nasal passages when exposure limits are exceeded. EPA, OSHA and NIOSH consider formaldehyde as a probable human carcinogen. Young children and the elderly may be more at risk in the presence of formaldehyde emissions. Those persons with a history of allergies, asthma or lung problems may also be at a greater risk from formaldehyde emissions. Formaldehyde is known to the State of California to cause cancer, birth defects or other reproductive harm. NTP -- Class 2 carcinogen, IARC -- Class 2A.

SECTION VIII - SPECIAL PROTECTION INFORMATION

WORK AND HYGIENE PRACTICES:
Practice good personal hygiene when handling product. After contact with product, wash hands before eating, drinking or smoking. Do not eat, drink or smoke in areas where the product is being cut or sawn. Avoid blowing dust with compressed air.

STORAGE AND HANDLING PRACTICES:
Store in well-ventilated areas. Where dust is stored for disposal, keep in a cool area away from heat and ignition sources.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:
Keep open ignition sources out of areas where dust is generated.

VENTILATION AND ENGINEERING CONTROLS:
Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines. General ventilation is normally sufficient unless the product is subject to hot or humid conditions. If the environment is hot or humid, local exhaust ventilation may be the most effective means of controlling formaldehyde build-up.

RESPIRATORY PROTECTION:
Atmospheric levels should be maintained below the exposure guidelines. When respiratory protection is required for certain operations, use NIOSH-approved air-purifying or supplied air respirators. A full-face respirator may be need for excessively sensitive individual to control upper respiratory tract irritation from formaldehyde gas.

EYE PROTECTION:
Use safety glasses. If there is a potential for exposure to particles, which could cause mechanical injury to the eye, wear chemical goggles. A few excessively sensitive individuals may experience eye irritation, which may require use of a full-face piece respirator appropriate for controlling formaldehyde exposures.

HAND AND BODY PROTECTION:
No skin protection precautions, other than clean body-covering clothing, should be required.

SECTION IX - SPILL, LEAK, AND DISPOSAL PROCEDURES

IN CASE MATERIAL IS SPILLED OR RELEASED:
Do not use compressed air to remove dust. Vacuum or wet mop area.

SECTION X - REGULATORY INFORMATION

DOT: Not Regulated.

Additional Requirements for State of California: Warning: Decorative laminated products contain formaldehyde, a substance known to the State of California to cause cancer. Laminates contain small amounts of residual formaldehyde that may be released in measurable quantities when stored in bulk quantities.

MSDS NUMBER:	GF
Updated:	04/06
Supersedes:	05/04
Provided by:	Alcan Composites US - Environment, Health and Safety

SKU: LHWM40 Buy Now!

4-1/8"w by 1-1/4"d Wall Mount Brochure Holder

- **Literature display comes with stickly pads for fast set-up times.**
- **Clear acrylic exterior provides durability.**
- **4 1/8"w x 6"h x 1 1/4"d model holds standard width pamphlets.**
- **Rear holes allow users to affix to walls with screws.**

Brochure Holder - Single pocket literature holder for 4" wide brochures. This display mounts easily and securely using either your own screws and anchors or our supplied sticky pads.

This literature holder can also be mounted to the side of a ballot box to hold comment cards, etc.

Overall dimensions: 4-1/8"wide x 6"high x 1-1/4"deep.

This Product is also available with
Custom Imprinted LOGOs and TEXT.
Minimum Quantities Apply.

Qty:	20-40	41-131	132-457	458-1299	1300-3296
Each:	$2.44	$2.28	$2.18	$1.92	$1.82

Higher Quantities Call Us!

SHARE

4-1/8"w by 1-1/4"d Wall Mount Brochure Holder

SKU: LHWM40

In Stock: 0

VISA MasterCard American Express Google Checkout

* This item is currently in production. Orders placed for this item have been scheduled to ship in 12 work days.

- * Minimum order quantity of 20 units.

Quantity to Purchase: AddToCart

Forward this product info - enter e-mail address below:
Send this URL

Scotchmate™
Nylon Reclosable Fasteners

Product Selection Guide **March, 2007**

Products

3M™ Scotchmate™ Nylon Reclosable Fasteners

Plainbacked Products

Loop	Hook
SJ3401	SJ3402
SJ3418FR	SJ3419FR

Pressure Sensitive Adhesive Products

Unnapped Loop	Napped Loop	Hook
	SJ3518FR	SJ3519FR
	SJ3523	SJ3522
	SJ3527N	SJ3526N
	SJ3571	SJ3572
SJ3529	SJ3531	SJ3530
	SJ3533N	SJ3532N

Product Description

3M™ Scotchmate™ Reclosable Fasteners offer closure alternatives to zippers, screws, snaps, hooks, bolts and more. They offer greater design flexibility, faster product assembly, smoother and cleaner exterior surfaces and improved product performance in many applications. The hook and loop fasteners consist of two strips of nylon fabric which engage to form a quick fastening attachment. Simply pull the strips apart by hand to disengage.

The woven hook backing is covered with flexible self supporting J shaped hooks, about 300 hooks per square inch (46/sq. cm.) protruding up from a woven backing. The woven loop backing is covered with thousands of soft, pliable loops, providing for thousands of openings and closings (cycles). The loops can be napped or unnapped providing higher cycle life. The hook and loop are preshrunk to insure maximum dimensional stability and flatness.

These Scotchmate reclosable hook and loop fasteners can be coated on the backside with various pressure sensitive adhesives.

Plainbacked Products

3M™ Scotchmate™ Reclosable Fastener SJ3402 Hook • 3M™ Scotchmate™ Reclosable Fastener SJ3401 Loop
Standard Sew-on: These standard products provide a tailored appearance for garments and fabrics. They provide adjustable closure, and are washable and dry cleanable.

3M™ Scotchmate™ Reclosable Fastener SJ3419FR Hook • 3M™ Scotchmate™ Reclosable Fastener SJ3418FR Loop
Flame Resistant Sew-on: Improved flame resistance compared to Scotchmate reclosable fasteners SJ3402/01 hook and loop, meets F.A.R. 25.853 paragraph (a)(1)(i) and (a)(1)(ii). These are 60 and 12 second vertical burn tests, respectively.

Product Description ***(continued)***

Pressure Sensitive Adhesive (PSA) Products

These products allow hook and loop fasteners to be attached to substrates with the convenience and ease of adhesive attachment. Simply peel off the liner and press in place.

3M™ Scotchmate™ Reclosable Fastener SJ3526N Hook • 3M™ Scotchmate™ Reclosable Fastener SJ3527N Loop
General Purpose Rubber PSA: Suitable for indoor applications requiring higher temperature performance than 3M™ Scotchmate™ Reclosable Fasteners SJ3529/31 and SJ3500 These general purpose products offer high adhesive bond to a wide variety of materials, especially low surface energy materials such as polyethylene and polypropylene while providing excellent moisture resistance.

3M™ Scotchmate™ Reclosable Fastener SJ3572 Hook • 3M™ Scotchmate™ Reclosable Fastener SJ3571 Loop
Premium Performance Acrylic PSA: For many static load applications exposed to UV or elevated temperatures. Provides reliable performance over a wide range of temperature and environmental extremes.

3M™ Scotchmate™ Reclosable Fastener SJ3522 Hook • 3M™ Scotchmate™ Reclosable Fastener SJ3523 Loop
Plasticizer Resistant Acrylic PSA: A unique pressure sensitive adhesive which resists adhesive softening or oozing caused by most plasticizer oils in flexible vinyl and similar materials. This offers convenient attachment to many flexible, plasticized vinyls.

3M™ Scotchmate™ Reclosable Fastener SJ3519FR Hook • 3M™ Scotchmate™ Reclosable Fastener SJ3518FR Loop
Flame Resistant Synthetic Rubber PSA: A high performance flame resistant adhesive, enabling these hook and loop fasteners to meet the requirements of F.A.R. 25.853 paragraph (a)(1)(i) and (a)(1)(ii). These are 60 and 12 second vertical burn tests, respectively.

3M™ Scotchmate™ Reclosable Fastener SJ3530 Hook • 3M™ Scotchmate™ Reclosable Fastener SJ3531 Napped Loop • 3M™ Scotchmate™ Reclosable Fastener SJ3529 Unnapped Loop
High Tack Synthetic Rubber PSA: Suitable for many indoor applications, especially to low surface energy materials such as polyethylene and polypropylene.

3M™ Scotchmate™ Reclosable Fastener SJ3532N Hook • 3M™ Scotchmate™ Reclosable Fastener SJ3533N Loop
General Purpose Synthetic Rubber PSA: Suitable for many indoor applications, especially to low surface energy materials such as polyethylene and polypropylene.

3M™ Scotchmate™
Nylon Reclosable Fasteners

Product Description and Availability

	3M™ Scotchmate™ Nylon Reclosable Fasteners							
	Plainbacked		Pressure Sensitive Adhesive Coated					
Hook: Loop: Unnapped Loop:	SJ3402 SJ3401	SJ3419FR SJ3418FR	SJ3526N SJ3527N	SJ3519FR SJ3518FR	SJ3530 SJ3531 SJ3529	SJ3532N SJ3533N	SJ3572 SJ3571	SJ3522 SJ3523
Adhesive Type:	None	None	Rubber[a]	Rubber[a]	Rubber[a]	Rubber[a]	Acrylic	Acrylic
Liner on Adhesive[b]:	None	None PE & Red 3M Logo	White PE & Red 3M Logo	White PE	Yellow PE	Yellow 3.5 mil PP & White 3M Logo	Clear PE	Clear
Standard Widths, Inches (mm)[c]: ± 1/16 in. (1.6 mm)								
1/2 (13)	✔	✔	✔	–	✔	–	✔	✔
5/8 (16)	✔	✔	✔	✔	✔	✔	✔	✔
11/16 (17.5)	–	–	✔	–	–	–	–	–
3/4 (19)	✔	✔	✔	✔	✔	✔	✔	✔
1 (25)	✔	✔	✔	✔	✔	✔	✔	✔
1 1/4 (32)	–	–	✔	–	✔	–	✔	–
1 1/2 (38)	✔	✔	✔	✔	✔	✔	✔	✔
2 (51)	✔	✔	✔	✔	✔	✔	✔	✔
2 1/2 (63.5)	–	–	–	–	–	–	✔	–
3 (76)	✔	–	–	–	–	–	✔	✔
4 (102)	✔	✔	✔	–	✔	–	✔	✔
Standard Colors[d]:	Black Beige White	Black Beige	Black Beige White	Black Beige White	Black Beige White	Black Beige White	Black Beige White	Black Beige White
Standard Roll Length[e], yds. (m):	50 (45.7)	50 (45.7)	50 (45.7)	50 (45.7)	50 (45.7)	50 (45.7)	50 (45.7)	50 (45.7)
Fabricated Forms Available:	Cut Pieces	Cut Pieces	Cut Pieces	Cut Pieces	Cut Pieces	Cut Pieces	Cut Pieces	Cut Pieces
Shelf Life[f]:	2 Years	2 Years	1.5 Years	1.5 Years	1.5 Years	1.5 Years	2 Years	2 Years

a. All of our rubber adhesives contain synthetic rubber with no added latex.

b. PP: Polypropylene; PE: Polyethylene.

c. Not all widths for all products or colors may be available. Contact your 3M sales representative or 3M authorized distributor for widths not listed.

d. Slight tan or yellow may be observed on white with rubber based adhesives. All products are available in additional non-standard colors. Contact your 3M sales representative or 3M authorized distributor for pricing minimum quantities and lead times.

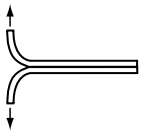
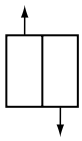
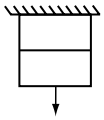
e. Under packaging conditions 70°F (21°C) and 50% R.H.

f. From date of manufacture, when stored in original packaging at 60° to 80°F (16° to 27°C and 40 to 60% relative humidity.

Typical Closure Performance Characteristics

Note: The following technical information and data was collected under controlled laboratory conditions and should be considered representative or typical only and should not be used for specification purposes.

3M™ Scotchmate™ Reclosable Fasteners derive their strength from the area of engagement as well as closure pressure. Vibration or side to side movement tends to improve closure performance. Closure characteristics are indicated by typical values.

Closure Performance for plainback products[a]	Typical
Dynamic T-Peel, lb./inch width (grams/cm width); ASTM D5170: 	2.6 (466)
Dynamic Shear, pounds force/square inch (Newtons/cm^2); ASTM D5169: 	10 (6.9)
Dynamic Tensile, pounds force/square inch (Newtons/cm^2): 	8 (5.5)

a. 3M™ Scotchmate™ Reclosable Fastener Hook and Loop Products were disengaged at a rate of 12" (305 mm)/minute.

Attachment Techniques

The following information is intended to assist the designer considering the use of 3M™ Scotchmate™ Reclosable Fasteners. Final product performance depends on actual conditions, including the fastener selected, the conditions in which the fastener is applied and the time and environmental conditions in which it is expected to perform. Because many of these factors are uniquely within the user's knowledge and control, it is required 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 and desired end use.

As a general rule, four square inches of Scotchmate reclosable fastener area per pound of static load to be supported is suggested as a starting point for evaluation. More or less area may be needed depending on specific conditions or end use applications.

There are typically six different methods for attaching Scotchmate reclosable fasteners to various surfaces.For complete details on techniques and options for attaching fasteners, please see Attachment of 3M™ Scotchmate™ and Dual Lock™ Reclosable Fasteners technical bulletin (70-0709-3929-6). The most important techniques for these Scotchmate reclosable fastener products are summarized on page 5.

Attachment Techniques *(continued)*

Pressure Sensitive Adhesive attachment: The 3M™ Scotchmate™ Reclosable Fasteners and adherend surfaces should have equilibrated for a minimum of 1 hour at temperatures of 68°F (20°C) or greater before application. These adhesive backed Scotchmate reclosable fasteners should be applied to surfaces that are smooth, dry and free of oils, mold release agents or other surface contaminants.

The adherend should be cleaned to remove any surface contaminants with an appropriate cleaning method for the customer's substrate, type and quantity of surface contaminants that need to be removed. **Note:** Follow the manufacturer's precautions and directions for use of the cleaning method(s) chosen.

After the adherend is clean, the liner is removed from the fastener and without touching the adhesive, the Scotchmate reclosable fastener is applied to the surface using firm roller pressure to help ensure complete adhesive contact to substrate. Adhesive bond strength increases with time, as the adhesive flows into the substrate structure. Handling strength is achieved immediately. Approximately 50% of ultimate bond strength is achieved at room temperature in the first 20 minutes, 90% after about 24 hours and 100% after about 72 hours for acrylic adhesives. For the rubber based adhesives, 100% bond strength is obtained in about 24 hours.

Heat (Press) Bonding: 3M™ Scotchmate™ Reclosable Fasteners SJ3526N, SJ3530, SJ3519FR and SJ3532N hook and SJ3527N, SJ3529, SJ3518FR, SJ3531 and SJ3533N loop can be attached to many fabric and foam articles with a technique called press bonding. The Scotchmate reclosable fastener is adhered to the article, as indicated above, and bond strength is increased by typically applying heat and pressure to the adhesive side of the Scotchmate reclosable fastener fastener through the fabric or foam article. Equipment can range from a simple household laundry iron to commercial press units. Product performance will depend on the nature of the fabric or foam and other conditions within any specific application. For this reason it is essential that the user evaluate the Scotchmate reclosable fastener product to determine if it is fit for a particular purpose and suitable for the user's method of application.

Typical press bonding conditions:

Bonding Temperature:	250 to 425°F (121 to 218°C)
Bonding Pressure:	30 to 100 psi (207 to 690 kPa)
Bonding Time:	3 to 30 seconds

Mechanical Attachment: The bond strength can be increased by mechanically attaching it to difficult to adhere to surfaces such as textured plastics and wood by using staples. Alternatively wood products can be sealed and pressure sensitive adhesive backed fastener applied as discussed above.

Sewing
3M™ Scotchmate™ Plainbacked Reclosable Fasteners can be attached with manual or semi-automatic sewing machines, generally utilizing the same thread used in the garment or fabric. Six to ten stitches per inch (25.4 mm) is suggested. These products are washable and dry cleanable.

Ultrasonic Bonding
Scotchmate plainbacked reclosable fasteners can be bonded to themselves or other nylon fabrics with ultrasonic sealing equipment. This method can be used to provide straps and other fabricated forms.

General Information

3M™ Scotchmate™ Pressure Sensitive Reclosable Fasteners can be bonded to a wide variety of materials. Some are listed below. Because product performance will depend on actual conditions within any specific application, it is essential that the user evaluate the Scotchmate product to determine if it is fit for a particular purpose and suitable for the user's method of application.

	3M™ Scotchmate™ Reclosable Fasteners					
Hook:	SJ3526N	SJ3572	SJ3522	SJ3519FR	SJ3530	SJ3532N
Loop:	SJ3527N	SJ3571	SJ3523	SJ3518FR	SJ3531	SJ3533N
Unnapped Loop:					SJ3529	
Bare Metals:	✔	✔	✔	✔	✔	✔
Painted Metals:	✔	✔	✔	✔	✔	✔
Powder Paint:	✔	–	–	✔	✔	✔
Fiberglass:	✔	–	–	✔	✔	✔
Structural Composites:	✔	–	–	✔	✔	✔
Glass:	✔	✔	✔	✔	✔	✔
Sealed Wood:	✔	✔	✔	✔	✔	✔
Plastics –						
ABS:	✔	✔	✔	✔	✔	✔
Acrylic:	✔	✔	✔	✔	✔	✔
Polycarbonate:	✔	✔	✔	✔	✔	✔
Polystyrene	✔	✔	✔	✔	✔	✔
Rigid Vinyl:	✔	✔	✔	✔	✔	✔
Plasticized Vinyl[a]:	–	–	✔	–	–	–
Polypropylene:	✔	–	–	✔	✔	✔
Polyethylene:	✔	–	–	✔	✔	✔

a. When attaching to plasticized vinyl (flexible PVC), evaluation for plasticizer migration is recommended. Adhere the fastener to the vinyl and age for seven days at 158°F (70°C) and inspect for signs of migration of plasticizer oils indicated by softness or oozing of the adhesive.

Choosing Polyester or Nylon Reclosable Fasteners

3M™ Scotchmate™ Reclosable Fasteners are available in polyester or nylon hook and loop configurations. There are performance and use differences that may be experienced when using these products. The following table lists the differences between the two types of fasteners to aid in selecting the best fastener material for the customers final product.

	Nylon	**Polyester***
Cycle Life	5,000	1,000
Moisture Gain (wt%)	<10	<1
Dynamic Closure Tensile (lb_F/sq. in)	7.5	10
Dynamic Closure Shear (lb_F/sq. in)	4.8	18
Wet Strength	Loses strength	Retains strength
Resistance to Sunlight	Fair UV resistance (esp. the loop) Hook - Fair Loop - Good	Very good
Combustion Gases	Polyester may produce less toxic off gases under certain flammability conditions.	

*Please refer to our 3M™ Scotchmate™ Polyester Reclosable Fastener Product Selection Guide to review available polyester hook and loop products.

Certification/ Recognition

MSDS: 3M has not prepared a MSDS for this product which is not subject to the MSDS requirements of the Occupational Safety and Health Administration's Hazard Communication Standard, 29 C.F.R. 1910.1200(b)(6)(v). When used under reasonable conditions or in accordance with the 3M directions for use, the product should not present a health and safety hazard. However, use or processing of the product in a manner not in accordance with the directions for use may affect its performance and present potential health and safety hazards.

TSCA: This product is defined as an article under the Toxic Substances Control Act and therefore, it is exempt from inventory listing requirements.

Military Spec. MIL-F-21840G: All of our nylon hook products described in this publication meet the physical requirements of MIL-F-21840G, Type II Class 1. All of our loop products described in this publication except 3M™ Scotchmate™ Reclosable Fastener SJ3529, meet the physical requirements of MIL-F-21840G, Class 1 or Class 5.

GM 2743M Type II: SJ3571 and SJ3572 meet the requirements of GM2743GM Type II.

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.

Warranty and Limited Remedy

Unless stated otherwise in 3M's product literature, packaging inserts or product packaging for individual products, 3M warrants that each 3M product meets the applicable specifications at the time 3M ships the product. Individual products may have additional or different warranties as stated on product literature, package inserts or product packages. 3M MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's application. If the 3M product is defective within the warranty period, your exclusive remedy and 3M's and seller's sole obligation will be, at 3M's option, to replace the product or refund the purchase price.

Limitation of Liability

Except where prohibited by law, 3M and seller will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

ISO 9001:2000 - ISO/TS 16949:2002

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001:2000 and ISO/TS 16949:2002 standards.

3M

Industrial Business
Industrial Adhesives and Tapes Division

3M Center, Building 21-1W-10, 900 Bush Avenue
St. Paul, MN 55144-1000
800-362-3550 • 877-369-2923 (fax)
www.3M.com/industrial

Recycled Paper
40% pre-consumer
10% post-consumer

VHB™ Tapes

Technical Data **June, 2011**

Product Description:

3M™ VHB™ Tapes provide the convenience and simplicity of a tape fastener and are ideal for use in many interior and exterior bonding applications. In many situations, they can replace rivets, spot welds, liquid adhesives and other permanent fasteners.

These 3M™ VHB™ Tapes are made with acrylic foam which is viscoelastic in nature. This gives the foam energy absorbing and stress relaxing properties which provides these tapes with their unique characteristics. The acrylic chemistry provides outstanding durability performance.

These tapes utilize a variety of specific foam, adhesive, color and release liner types to provide each product/family with specific features. These features can include adhesion to specific or a broad range of materials, conformability, high tensile strength, high shear and peel adhesion, resistance to plasticizer migration, and UL746C recognition. All 3M™ VHB™ Tapes have excellent durability and excellent solvent and moisture resistance.

Note: All 3M™ VHB™ Tapes should be thoroughly evaluated by the end user under actual use conditions with intended substrates to determine whether a specific tape is fit for a particular purpose and suitable for user's method of application, especially if expected use involves extreme environmental conditions or high dead load stress.

3M™ VHB™ Tape Products

Tape Number	Color	Thickness in. (mm)
4611	Dk Gray	0.045 (1.1)
4618	White	0.025 (0.64)
4622	White	0.045 (1.1)
4624	White	0.062 (1.55)
4646	Dk Gray	0.025 (0.64)
4655	Dk Gray	0.062 (1.55)
4905	Clear	0.020 (0.5)
4910	Clear	0.040 (1.0)
4914	White	0.010 (0.25)
4919F	Black	0.025 (0.64)
4920	White	0.015 (0.4)
4926	Gray	0.015 (0.4)
4929	Black	0.025 (0.64)
4930 (F)	White	0.025 (0.64)
4932	White	0.025 (0.64)
4936 (F)	Gray	0.025 (0.64)
4941 (F)	Gray	0.045 (1.1)
4943F	Gray	0.045 (1.1)
4945	White	0.045 (1.1)
4946	White	0.045 (1.1)
4947F	Black	0.045 (1.1)
4949	Black	0.045 (1.1)
4950	White	0.045 (1.1)
4951	White	0.045 (1.1)
4952	White	0.045 (1.1)
4955	White	0.080 (2.0)
4956 (F)	Gray	0.062 (1.55)
4957F	Gray	0.062 (1.55)
4959 (F)	White	0.120 (3.0)
4979F	Black	0.062 (1.55)
4991	Gray	0.090 (2.3)
5915 (P)	Black	0.016 (0.4)
5925 (P)	Black	0.025 (0.64)
5930 (P)	Black	0.032 (0.8)
5952 (P)	Black	0.045 (1.1)
5958FR	Black	0.040 (1.0)
5962 (P)	Black	0.062 (1.55)

(F) or (P) after the product number designate that both a paper and film liner product version are available. [e.g. 4930 (paper liner) and 4930F (film liner), 5915 (film liner) and 5915P (paper liner). See page 3 for specific details.

3M™ VHB™ Tapes Adhesive Types:

Multi-Purpose Acrylic: This adhesive bonds to a wide range of materials including metals, glass, and high and medium surface energy plastics and paints. This unique adhesive also has the ability to resist migration of plasticizers in vinyl substrates.

Modified Acrylic: This adhesive bonds to medium low surface energy paints and plastics, including many powder coated paints in addition to the substrates listed with the multi-purpose acrylic adhesive (except plasticized vinyl).

General Purpose Acrylic: This adhesive bonds to most higher surface energy substrates including metal, glass and high surface energy plastics.

Low Temperature Appliable Acrylic: This adhesive can make bonds down to 32°F (0°C), compared to 50°F (10°C) for most acrylic adhesives. This adhesive system bonds to most high surface energy substrates including metal, glass and high surface energy plastics.

Low Surface Energy: This high performance synthetic adhesive bonds to many lower surface energy substrates, including many plastics and power coated paints, plus smooth general purpose substrates.

3M™ VHB™ Tapes Foam Types:

Conformable: This foam provides high strength with the capability of conforming to the irregularities of rigid substrates, even when there might be slight mismatch.

Very Conformable: This foam provides the highest level of conformability while maintaining high internal strength.

Firm: This foam provides the highest level of foam strength in the 3M™ VHB™ Tapes family.

Clear: Not technically a foam, this solid acrylic material provides excellent clarity.

3M™ VHB™ Tapes

3M™ VHB™ Tape Families:

4941 This family utilizes multi-purpose acrylic adhesive on both sides of conformable foam. The adhesive provides excellent adhesion to a broad range of high and medium surface energy substrates including metals, glass, and a wide variety of plastics, as well as plasticized vinyl. The conformable foam provides good contact, even with mismatched substrates. Available in gray and black.

5952 This family matches the modified acrylic adhesive on both sides of very conformable foam, providing adhesion to the broadest range of substrates, including most powder coated paints. Available in black.

4950 This family has general purpose adhesive on both sides of firm type foam. This family is typically used on metal, glass and high surface energy plastic substrates. Available in white and black.

4945 This family has multi-purpose adhesive on both sides of firm foam. Available in white.

4910 This family of clear tapes is excellent for applications where clear or colorless is desired. The general purpose adhesive on both sides is suitable for high surface energy substrates.

4951 This family of tapes is based around the low temperature appliable acrylic adhesive system, utilized on both firm and conformable foam types. These products are suitable for high surface energy substrates. Available in white (firm foam) and gray (conformable foam).

4952 This family utilizes the low surface energy adhesive on a firm foam. Available in white.

4611 This family has a general purpose adhesive on both sides of firm foam. This family of tapes is typically used on metal substrates, and has the added feature of high temperature resistance, making it often suitable for bonding prior to high temperature paint processing. Available in dark gray.

4622 This family has general purpose adhesive on the face side (the side that typically would be bonded first) and multi-purpose adhesive on the liner side (the side exposed when the release liner is removed) of a conformable foam. Available in white.

3M™ VHB™ Tape Product Family Guide

Thickness inches (mm)	Family ▶	4941		5952	4950		4945	4910	4951		4952	4611	4622
	Color ▶	Gray	Black	Black	White	Black	White	Clear	White	Gray	White	Dk Gray	White
	Foam type ▶	Conform	Conform	Very Conf	Firm	Firm	Firm	n/a	Firm	Conform	Firm	Firm	Conform
	Adhesive ▶	Multi-Purpose		Modified	General Purpose		Multi-Purp	Gen-Purp	Low Temp Apply		LSE	Gen-Purp	Gen/Multi
0.010 (0.25)					4914								
0.015 / 0.016 (0.4)		4926		5915 5915P	4920								
0.020 (0.5)								4905					
0.025 (0.64)		4936 4936F	4919F	5925 5925P	4930 4930F	4929					4932	4646	4618
0.032 (0.8)				5930 5930P									
0.040 (1.0)				5958FR				4910					
0.045 (1.1)		4941 4941F	4947F	5952 5952P	4950	4949	4945 4946		4951	4943	4952	4611	4622
0.062 (1.55)		4956 4956F	4979F	5962 5962P						4957		4655	4624
0.080 (2.0)					4955								
0.090 (2.3)		4991											
0.120 (3.0)					4959 4959F								

NOTE: For easy product comparison, data in this product information page will be organized by product family.

3M™ VHB™ Tapes

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.

3M™ VHB™ Tapes Family	Product Number	Color	Thickness Inches	(mm)	Tolerance	Adhesive Adhesive Type	Foam Type	Density lb/ft³	(kg/m³)	Release Liner Thickness Type	Inches	(mm)	Color
4941	4919F	Black	0.025	(0.64)	± 15%	Multi-Purp	Conform	45	(720)	PE Film	0.005	(0.125)	Red (printed)
	4926	Gray	0.015	(0.4)	± 15%	Multi-Purp	Conform	45	(720)	DK Paper	0.003	(0.08)	White (printed)
	4936	Gray	0.025	(0.64)	± 15%	Multi-Purp	Conform	45	(720)	DK Paper	0.003	(0.08)	White (printed)
	4936F	Gray	0.025	(0.64)	± 15%	Multi-Purp	Conform	45	(720)	PE Film	0.005	(0.125)	Red (printed)
	4941	Gray	0.045	(1.1)	± 10%	Multi-Purp	Conform	45	(720)	DK Paper	0.003	(0.08)	White (printed)
	4941F	Gray	0.045	(1.1)	± 10%	Multi-Purp	Conform	45	(720)	PE Film	0.005	(0.125)	Red
	4947F	Black	0.045	(1.1)	± 10%	Multi-Purp	Conform	45	(720)	PE Film	0.005	(0.125)	Red (printed)
	4956	Gray	0.062	(1.55)	± 10%	Multi-Purp	Conform	45	(720)	DK Paper	0.003	(0.08)	White (printed)
	4956F	Gray	0.062	(1.55)	± 10%	Multi-Purp	Conform	45	(720)	PE Film	0.005	(0.125)	Red (printed)
	4979F	Black	0.062	(1.55)	± 10%	Multi-Purp	Conform	45	(720)	PE Film	0.005	(0.125)	Red (printed)
	4991	Gray	0.090	(2.3)	± 10%	Multi-Purp	Conform	45	(720)	PE Film	0.005	(0.125)	Red (printed)
5952	5915	Black	0.016	(0.4)	± 15%	Modified	Very Conf	43	(690)	PE Film	0.005	(0.125)	Red
	5915P	Black	0.016	(0.4)	± 15%	Modified	Very Conf	43	(690)	PCK Paper	0.004	(0.10)	White (printed)
	5925	Black	0.025	(0.64)	± 15%	Modified	Very Conf	37	(590)	PE Film	0.005	(0.125)	Red
	5925P	Black	0.025	(0.64)	± 15%	Modified	Very Conf	37	(590)	PCK Paper	0.004	(0.10)	White (printed)
	5930	Black	0.032	(0.8)	± 15%	Modified	Very Conf	37	(590)	PE Film	0.005	(0.125)	Red
	5930P	Black	0.032	(0.8)	± 15%	Modified	Very Conf	37	(590)	PCK Paper	0.004	(0.10)	White (printed)
	5952	Black	0.045	(1.1)	± 10%	Modified	Very Conf	37	(590)	PE Film	0.005	(0.125)	Red
	5952P	Black	0.045	(1.1)	± 10%	Modified	Very Conf	37	(590)	PCK Paper	0.004	(0.10)	White (printed)
	5958FR	Black	0.040	(1.0)	± 10%	Modified	Very Conf	50	(800)	PE Film	0.005	(0.125)	Red
	5962	Black	0.062	(1.55)	± 10%	Modified	Very Conf	37	(590)	PE Film	0.005	(0.125)	Red
	5962P	Black	0.062	(1.55)	± 10%	Modified	Very Conf	37	(590)	PCK Paper	0.004	(0.10)	White (printed)
4950	4914	White	0.010	(0.25)	± 15%	Gen Purp	Firm	50	(800)	DK Paper	0.003	(0.08)	White (printed)
	4920	White	0.015	(0.4)	± 15%	Gen Purp	Firm	50	(800)	DK Paper	0.003	(0.08)	White (printed)
	4929	Black	0.025	(0.64)	± 15%	Gen Purp	Firm	50	(800)	Polyester	0.002	(0.05)	Clear
	4930	White	0.025	(0.64)	± 15%	Gen Purp	Firm	50	(800)	DK Paper	0.003	(0.08)	White (printed)
	4930F	White	0.025	(0.64)	± 15%	Gen Purp	Firm	50	(800)	PE Film	0.005	(0.125)	Red
	4949	Black	0.045	(1.1)	± 10%	Gen Purp	Firm	50	(800)	Polyester	0.002	(0.05)	Clear
	4950	White	0.045	(1.1)	± 10%	Gen Purp	Firm	50	(800)	DK Paper	0.003	(0.08)	White (printed)
	4955	White	0.080	(2.0)	± 10%	Gen Purp	Firm	45	(720)	Polyester	0.002	(0.05)	Clear
	4959	White	0.120	(3.0)	± 10%	Gen Purp	Firm	45	(720)	Polyester	0.002	(0.05)	Clear
	4959F	White	0.120	(3.0)	± 10%	Gen Purp	Firm	45	(720)	PE Film	0.005	(0.125)	Red
4945	4945	White	0.045	(1.1)	± 10%	Multi-Purp	Firm	50	(800)	DK Paper	0.003	(0.08)	White (printed)
	4946	White	0.045	(1.1)	± 10%	Multi-Purp	Firm	50	(800)	PE Film	0.005	(0.125)	Clear
4910	4905	Clear	0.020	(0.5)	± 15%	Gen Purp	Solid	60	(960)	PE Film	0.005	(0.125)	Red (printed)
	4910	Clear	0.040	(1.0)	± 10%	Gen Purp	Solid	60	(960)	PE Film	0.005	(0.125)	Red (printed)
4951	4951	White	0.045	(1.1)	± 10%	Low Temp Appl	Firm	50	(800)	Polyester	0.002	(0.05)	Clear
	4943F	Gray	0.045	(1.1)	± 10%	Low Temp Appl	Conform	45	(720)	Polyester	0.002	(0.05)	Clear
	4957F	Gray	0.062	(1.55)	± 10%	Low Temp Appl	Conform	45	(720)	Polyester	0.002	(0.05)	Clear
4952	4932	White	0.025	(0.64)	± 15%	LSE	Firm	50	(800)	DK Paper	0.003	(0.08)	White (printed)
	4952	White	0.045	(1.1)	± 10%	LSE	Firm	50	(800)	DK Paper	0.003	(0.08)	White (printed)
4611	4611	Dk Gray	0.045	(1.1)	± 10%	Gen Purp	Firm	52	(840)	PE Film	0.005	(0.125)	Red
	4646	Dk Gray	0.025	(0.64)	± 15%	Gen Purp	Firm	52	(840)	PE Film	0.005	(0.125)	Red
	4655	Dk Gray	0.062	(1.55)	± 10%	Gen Purp	Firm	52	(840)	PE Film	0.005	(0.125)	Red
4622	4618	White	0.025	(0.64)	± 15%	Gen/Multi Purp	Conform	45	(720)	PE Film	0.004	(0.10)	Green
	4622	White	0.045	(1.1)	± 10%	Gen/Multi Purp	Conform	45	(720)	PE Film	0.004	(0.10)	Green
	4624	White	0.062	(1.55)	± 10%	Gen/Multi Purp	Conform	45	(720)	PE Film	0.004	(0.10)	Green

3M™ VHB™ Tapes

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.

3M™ VHB™ Tapes				Dynamic Adhesion Performance					
				90° Peel Adhesion		Normal Tensile		Dynamic Overlap Shear	
Family	Product Number	Color	Thickness Inches	lb/in	N/100 mm	lb/in²	kPa	lb/in²	kPa
4941	4919F	Black	0.025	17	(300)	90	(620)	80	(550)
	4926	Gray	0.015	14	(245)	95	(655)	90	(620)
	4936 (F)	Gray	0.025	17	(300)	90	(620)	80	(550)
	4941 (F)	Gray	0.045	22	(385)	85	(585)	70	(480)
	4947F	Black	0.045	22	(385)	85	(585)	70	(480)
	4956 (F)	Gray	0.062	22	(385)	80	(550)	70	(480)
	4979F	Black	0.062	22	(385)	80	(550)	70	(480)
	4991	Gray	0.090	22	(385)	70	(480)	65	(450)
5952	5915 (P)	Black	0.016	14	(245)	90	(620)	90	(620)
	5925 (P)	Black	0.025	17	(300)	90	(620)	90	(620)
	5930 (P)	Black	0.032	19	(330)	90	(620)	85	(585)
	5952 (P)	Black	0.045	22	(385)	90	(620)	80	(550)
	5958FR	Black	0.040	20	(350)	100	(690)	100	(690)
	5962 (P)	Black	0.062	22	(385)	90	(620)	80	(550)
4950	4914	White	0.010	13	(230)	130	(830)	130	(830)
	4920	White	0.015	15	(260)	160	(1100)	100	(690)
	4929	Black	0.025	20	(350)	160	(1100)	100	(690)
	4930 (F)	White	0.025	20	(350)	160	(1100)	100	(690)
	4949	Black	0.045	25	(440)	140	(970)	80	(550)
	4950	White	0.045	25	(440)	140	(970)	80	(550)
	4955	White	0.080	20	(350)	95	(655)	70	(480)
	4959 (F)	White	0.120	20	(350)	75	(520)	55	(380)
4945	4945	White	0.045	25	(440)	140	(970)	80	(550)
	4946	White	0.045	25	(440)	140	(970)	80	(550)
4910	4905	Clear	0.020	12	(210)	100	(690)	70	(480)
	4910	Clear	0.040	15	(260)	100	(690)	70	(480)
4951	4951	White	0.045	18	(315)	110	(760)	80	(550)
	4943F	Gray	0.045	20	(350)	85	(585)	70	(480)
	4957F	Gray	0.062	20	(350)	75	(515)	70	(480)
4952	4932	White	0.025	20	(350)	100	(690)	100	(690)
	4952	White	0.045	25	(440)	80	(550)	80	(550)
4611	4611	Dk Gray	0.045	18	(315)	90	(590)	65	(445)
	4646	Dk Gray	0.025	15	(250)	100	(690)	80	(550)
	4655	Dk Gray	0.062	18	(315)	80	(550)	60	(415)
4622	4618	White	0.025	17	(300)	85	(580)	80	(550)
	4622	White	0.045	20	(350)	70	(480)	65	(445)
	4624	White	0.062	20	(350)	55	(380)	60	(410)

90° Peel Adhesion - Based on ASTM D3330 -To stainless steel, room temperature, jaw speed 12 in/min (305 mm/min). Average force to remove is measured. 72 hour dwell.

Normal Tensile (T-Block Tensile) - ASTM D-897 - To aluminum, room temperature, 1 in² (6.45 cm²), jaw speed 2 in/min (50 mm/min.) Peak force to separate is measured. 72 hour dwell.

Dynamic Overlap Shear - ASTM D-1002 - To stainless steel, room temperature, 1 in² (6.45 cm²), jaw speed 0.5 in/min (12.7 mm/min.) Peak force to separate is measured. 72 hour dwell.

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.

Family	3M™ VHB™ Tapes Product Number	Color	Thickness Inches	Static Shear: Weight (grams) that 1/2 square inch will hold 10,000 minutes (7 days) 72°F (22°C)	150°F (66°C)	200°F (93°C)	250°F (121°C)	350°F (177°C)	Temperature Tolerance: Short Term (Minutes, Hours) °F	°C	Long Term (Days, Weeks) °F	°C
4941	4919F	Black	0.025	1000	500	500			300	(149)	200	(93)
	4926	Gray	0.015	1000	500	500			300	(149)	200	(93)
	4936 (F)	Gray	0.025	1000	500	500			300	(149)	200	(93)
	4941 (F)	Gray	0.045	1000	500	500			300	(149)	200	(93)
	4947F	Black	0.045	1000	500	500			300	(149)	200	(93)
	4956 (F)	Gray	0.062	1000	500	500			300	(149)	200	(93)
	4979F	Black	0.062	1000	500	500			300	(149)	200	(93)
	4991	Gray	0.090	1000	500	500			250	(121)	200	(93)
5952	5915 (P)	Black	0.016	1000	500	500	250		300	(149)	250	(121)
	5925 (P)	Black	0.025	1000	500	500	250		300	(149)	250	(121)
	5930 (P)	Black	0.032	1000	500	500	250		300	(149)	250	(121)
	5952 (P)	Black	0.045	1000	500	500	250		300	(149)	250	(121)
	5958FR	Black	0.040	1000	350	250			300	(149)	200	(93)
	5962 (P)	Black	0.062	1000	500	500	250		300	(149)	250	(121)
4950	4914	White	0.010	1500	500	500			300	(149)	200	(93)
	4920	White	0.015	1500	500	500			300	(149)	200	(93)
	4929	Black	0.025	1500	500	500			300	(149)	200	(93)
	4930 (F)	White	0.025	1500	500	500			300	(149)	200	(93)
	4949	Black	0.045	1500	500	500			300	(149)	200	(93)
	4950	White	0.045	1500	500	500			300	(149)	200	(93)
	4955	White	0.080	1500	1000	750	750	750	400	(204)	300	(149)
	4959 (F)	White	0.120	1500	1000	750	750	750	400	(204)	300	(149)
4945	4945	White	0.045	1500	500	500			300	(149)	200	(93)
	4946	White	0.045	1500	500	500			300	(149)	200	(93)
4910	4905	Clear	0.020	1000	500	500			300	(149)	200	(93)
	4910	Clear	0.040	1000	500	500			300	(149)	200	(93)
4951	4951	White	0.045	1250	500	500			300	(149)	200	(93)
	4943F	Gray	0.045	1000	500	500			300	(149)	200	(93)
	4957F	Gray	0.062	1000	500	500			300	(149)	200	(93)
4952	4932	White	0.025	1500	500				200	(93)	160	(71)
	4952	White	0.045	1500	500				200	(93)	160	(71)
4611	4611	Dk Gray	0.045	1500	750	750	750	750	450	(232)	300	(149)
	4646	Dk Gray	0.025	1500	750	750	750	750	450	(232)	300	(149)
	4655	Dk Gray	0.062	1500	750	750	750	750	450	(232)	300	(149)
4622	4618	White	0.025	1000	250	250			250	(121)	200	(93)
	4622	White	0.045	1000	250	250			250	(121)	200	(93)
	4624	White	0.062	1000	250	250			250	(121)	200	(93)

Static Shear - ASTM D3654 - To stainless steel, tested at various temperatures and gram loadings. 0.5 in^2 (3.22 cm^2). Will hold listed weight for 10,000 minutes (approximately 7 days). Conversion: 1500 g/0.5 in^2 equals 6.6 lb/in^2; 500 g/0.5 in^2 = 2.2 lb/in^2.

Short Term Temperature Tolerance - No change in room temperature dynamic shear properties following 4 hours conditioning at indicated temperature with 100 g/static load. (Represents minutes, hours in a process type temperature exposure).

Long Term Temperature Tolerance - Maximum temperature where tape supports at least 250 g load per 0.5 in^2 in static shear for 10,000 minutes. (Represents continuous exposure for days or weeks).

3M™ VHB™ Tapes

Available Sizes

Tape Thickness		Standard Length		Minimum Width		Maximum Width		Maximum Roll Length					
								Width 1/4"up to 3/8" (6.4mm up to 9.5mm)		Width >3/8" up to 1/2" (>9.5mm up to 12.7mm)		Width 1/2" and wider (12.7mm and wider)	
inches	(mm)	yards	(meters)	inches	(mm)	inches	(mm)	yards	(meters)	yards	(meters)	yards	(meters)
0.010	(0.25)	72	(65.8)	0.25	(6.4)	48	(1220)	72	(65.8)	144	(131.6)	360	(330)
0.015/0.016	(0.4)	72	(65.8)	0.25	(6.4)	48*	(1220)	144	(131.6)	175	(160)	360	(330)
0.020	(0.5)	72	(65.8)	0.25	(6.4)	48*	(1220)	72	(65.8)	108	(98.8)	175	(160)
0.025	(0.64)	72	(65.8)	0.25	(6.4)	48	(1220)	72	(65.8)	108	(98.8)	175	(160)
0.032	(0.8)	72	(65.8)	0.25	(6.4)	48	(1220)	72	(65.8)	108	(98.8)	175	(160)
0.040	(1.0)	36	(32.9)	0.25	(6.4)	48	(1220)	72	(65.8)	108	(98.8)	144	(131.6)
0.045	(1.1)	36	(32.9)	0.25	(6.4)	48	(1220)	72	(65.8)	108	(98.8)	144	(131.6)
0.062	(1.55)	36	(32.9)	0.25	(6.4)	46	(1170)	72	(65.8)	72	(65.8)	108	(98.8)
0.080	(2.0)	36	(32.9)	0.25	(6.4)	46	(1170)	36	(32.9)	36	(32.9)	72	(65.8)
0.090	(2.3)	36	(32.9)	0.25	(6.4)	46	(1170)	36	(32.9)	36	(32.9)	72	(65.8)
0.120 (4959)	(3.0)	36	(32.9)	0.5	(12.7)	46	(1170)	N/A	N/A	N/A	N/A	36	(32.9)
0.120 (4959F)	(3.0)	36	(32.9)	0.25	(6.4)	46	(1170)	36	(32.9)	36	(32.9)	36	(32.9)

*Exception – 5915 (P) max. width 46 inches (1170 mm); 5925 (P) max. width 47 inches (1195 mm).

Slitting Tolerance

Standard slitting tolerance ± 1/32 inch (± 0.031 inch, ± 0.8 mm).

Precision slitting with slitting tolerance of ± 1/64 inch (± 0.016 in., ± 0.44 mm) is available on select products with minimum order of full web increments.

Core Size

All products are provided on a 3 inch ID Core (76.2 mm).

Converted Parts

In addition to standard and custom roll sizes available from 3M through the distribution network, 3M™ VHB™ Tapes are also available in limitless shapes and sizes through the 3M Converter network. For additional information, contact 3M Converter Markets at 1-800-223-7427 or on the web at www.3M.com/converter.

Shelf Life

All 3M™ VHB™ Tapes have a shelf life of 24 months from date of manufacture when stored at 40°F to 100°F (4°C to 38°C) and 0-95% relative humidity. The optimum storage conditions are 72°F (22°C) and 50% relative humidity.

Performance of tapes is not projected to change even after shelf life expires; however, 3M does suggest that 3M™ VHB™ Tapes are used prior to the shelf life date whenever possible.

The manufacturing date is available on all 3M™ VHB™ Tape cores as the lot number. The lot number, typically a 4 digit code, is a Julian date (Y D D D). The first digit refers to the year of manufacture, the last 3 digits refer to the days after January 1. Example: A lot number of 9266 would translate to a date of manufacture of Sept. 22 (266th day of year) in 2009. On most products this is found as the 4 digits after the “9” following the product number. For tapes printed continuously around the core (e.g. 3M™ VHB™ Tape 5952 family) the lot number typically will be the string of 4 digits preceding the product number.

Additional 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.

Outgassing:

3M™ VHB™ Tapes	% TML	%VCM	%WVR
4930	0.77	0.01	0.21
4932	2.41	0.66	0.23
4945	1.24	0.01	0.19

TML - Total Mass Loss

VCM - Volatile Condensible Materials

WVR - Water Vapor Regained

NASA Reference Publication, "Outgassing Data for Selecting Spacecraft Materials", (11/18/2004) Available online at http://outgassing.nasa.gov

Dielectric Constant
(ASTM D150)

3M™ VHB™ Tapes	Dielectric Constant	Dissipation Factor
4941 at 1 kHz	2.29	0.0245
at 1 MHz	1.99	0.0374
5952 at 1 kHz	2.14	0.0065
at 1 MHz	1.95	0.0506
4950 at 1 kHz	2.28	0.0227
at 1 MHz	1.99	0.0370
4910 at 1 kHz	3.21	0.0214
at 1 MHz	2.68	0.0595
4611 at 1 kHz	2.80	0.0130
at 1 MHz	2.43	0.0564

Resistivity
(ASTM D257)

3M™ VHB™ Tapes	Volume Resistivity (in ohm-cm)	Surface Resistance (in ohms/square)
4914	1.7×10^{11}	$>10^{16}$
4941	2.1×10^{14}	2.7×10^{14}
5952	2.5×10^{14}	$>10^{16}$
4950	1.5×10^{15}	$>10^{16}$
4920	1.7×10^{15}	$>10^{16}$
4910	3.1×10^{15}	$>10^{16}$
4611	1.4×10^{15}	$>10^{16}$

Water Vapor Transmission Rate (WVTR)
(ASTM F1249) at 38°C/100% RH

3M™ VHB™ Tapes	
4950	14.0 g/(m^2 day)
4941	25.6 g/(m^2 day)
5952	37.1 g/(m^2 day)

Typical 3M™ VHB™ Tape Properties for Modeling

Thermal Coefficient of Expansion
1×10^{-4} in/in/°F
1.8×10^{-4} mm/mm/°C

Shear Modulus (@25°C, 1 Hz)
4950 Family: 6×10^5 Pa
4941 Family: 3×10^5 Pa
(Shear Modulus is both temperature and frequency dependent).

Youngs Modulus: For VHB tapes the Youngs Modulus will be about 3 times the Shear Modulus.

Poisson's Ratio
0.49

Burn Characteristics 3M™ VHB™ Tape 5958FR

Meets FAR 25.853 (a) 12 second vertical burn, Appendix F, Part I (a)(ii).

Meets NBS Smoking Density (ASTM F814/E662).

Meets Toxicity (Draeger Tube ABD0031, AITM 3.0005)

Dielectric Breakdown Strength
(ASTM D149)

3M™ VHB™ Tapes	(in volts/mil)
4941	360
4926	330
5952	455
5925	520
4950	460
4920	640
4910	630
4611	330

Thermal Conductivity - K-value

3M™ VHB™ Tapes	BTU in/ hr ft^2 °F	(w/mK)
4941	0.53	(0.08)
5952	0.37	(0.05)
4950/4945	0.63	(0.09)
4910	1.09	(0.16)
4611	0.77	(0.11)

$$\text{R-Value} = \frac{\text{thickness}}{\text{K-value}}$$

(When units of K-value are BTU-in/hr ft^2 °F and thickness is given in inches.)

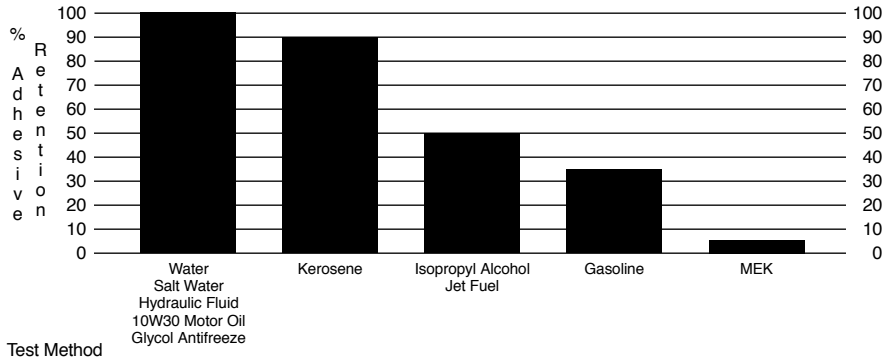
3M™ VHB™ Tapes
UL746C Listings - File MH 17478

Category QOQW2 Component - Polymeric Adhesive Systems, Electrical Equipment

3M™ VHB™ Tapes/ Product Families	Substrates	Temperature Rating Minimum	Maximum
4919F, 4926, 4936, 4936F, 4941, 4941F, 4947F, 4956, 4956F, 4979F	Ceramic	-35°C	110°C
	Aluminum, Galvanized steel, stainless steel, enameled steel, nickel coated ABS, glass (with or without silane coating) PVC, glass/epoxy, PBT, polycarbonate, acrylic/polyurethane paint, polyester paint	-35°C	90°C
	ABS	-35°C	75°C
4914, 4920, 4930, 4950	Aluminum, galvanized steel, enameled steel, stainless steel, ceramic, glass/epoxy	-35°C	110°C
	PBT, Acrylic	-35°C	90°C
	ABS, Polycarbonate, Rigid PVC	-35°C	75°C
4945, 4946	Phenolic, aluminum, galvanized steel, alkyd enamel	-35°C	110°C
	ABS, polycarbonate, polyimide, stainless steel, acrylic/polyurethane paint, polyester paint	-35°C	90°C
	unplasticized PVC	-35°C	75°C
5915, 5915P, 5925, 5925P, 5930, 5930P, 5952, 5952P 5962, 5962P	Polycarbonate, Primer 94 coated polycarbonate, aluminum, acrylic/ polyurethane paint, galvanized steel, steel, polyester paint, epoxy/polyester paint, epoxy paint, glass (with or without silane coating), stainless steel, enameled steel, glass epoxy, polybutylene terephthalate, Nylon®, Noryl® (PPE) polyphenenlene ether	-35°C	90°C
	Rigid PVC, ABS	-35°C	75°C
5915, 5925, 5930, 5952	Acrylic	-35°C	90°C
5962	Acrylic	-35°C	80°C
5952	Cellulose Acetate Butyrate	-35°C	90°C
4991	Polycarbonate, aluminum, acrylic/ polyurethane paint, polyester paint	-35°C	90°C
4611, 4646, 4655	Stainless steel, aluminum, galvanized steel, glass, glass/epoxy, phenolic	-35°C	110°C
	Nylon, polycarbonate	-35°C	90°C
	ABS, rigid PVC	-35°C	75°C
4905, 4910	Polycarbonate, aluminum, acrylic/polyurethane paint	-35°C	90°C

A current list can be found at www.ul.com (select certifications, search file MH17478)

Solvent and Fuel Resistance



Test Method
- Tape between stainless steel and aluminum foil.
- 72 hours dwell at room temperature.
- Solvent immersion for 72 hours.
- Test within 45 minutes after removing from solvent.
- 90° peel angle.
- 12 in./min. rate of peel.
- Peel adhesion compared to control.

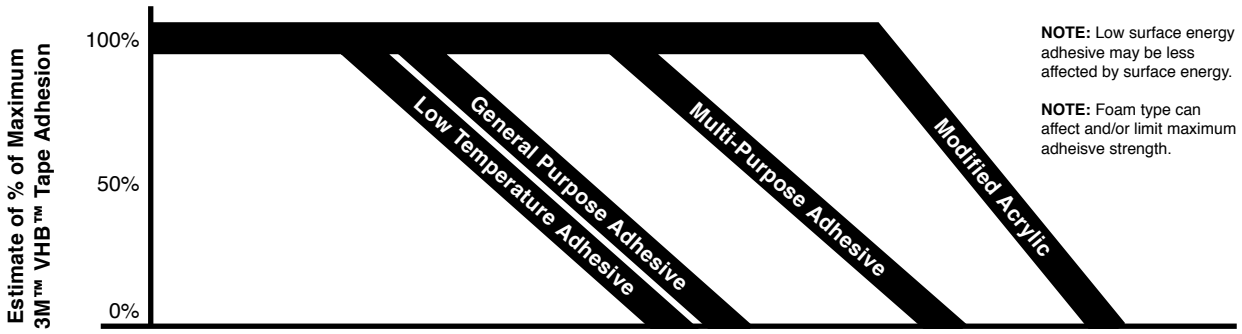
Note: Continuous submersion in chemical solutions is not recommended. The above information is presented to show that occasional chemical contact should not be detrimental to tape performance in most applications in ordinary use.

Design and Tape Selection Considerations

► **Choose the right tape for the substrate:** Adhesives must flow onto the substrate surfaces in order to achieve intimate contact area and allow the molecular force of attraction to develop. The degree of flow of the adhesive on the substrate is largely determined by the surface energy of the substrate.

This illustration demonstrates the effect of surface energy on adhesive interfacial contact. High surface energy materials draw the adhesive closer for high bond strength.

Relationship of Adhesion and Surface Energy for 3M™ VHB™ Tape Adhesive Families



HIGH		MEDIUM		LOW
400-1100	42-50	38-39	36-37	18-33
Aluminum	Kapton®	ABS	PVA	EVA
Stainless Steel	Phenolic	Polycarbonate (Lexan®)	Polystyrene	Polyethylene
Copper	Nylon	PVC	Acetal	Polypropylene
Zinc	Alkyd Enamel	Noryl®	Kynar® Paint	Tedlar®
Tin	Polyester	Acrylic	Powder Paint	Silicone
Lead	Epoxy Paint	Polane® Paint		PTFE
Anodized Aluminum	Polyurethane	Powder Paint		
Glass				

NOTES: There are a wide variety of formulations, surfaces finishes and surface treatments available on substrate materials which can affect adhesion. This chart is intended to provide only a rough estimate of the adhesion levels which can be expected on some common materials relative to a reference surface such as aluminum. Light abrasion of surface will significantly increase adhesion levels on many materials, except when using tapes 4952/4932.

► **Use the right tape thickness:** The necessary thickness of tape depends on the rigidity of substrates and their flatness irregularity. While the 3M™ VHB™ Tapes will conform to a certain amount of irregularity, they will not flow to fill gaps between the materials. For bonding rigid materials with normal flatness, consider use of tapes with thickness of 45 mils (1.1 mm) or greater. As the substrate flexibility increases thinner tapes can be considered.

► **Use the right amount of tape:** Because 3M™ VHB™ Tapes are viscoelastic by nature their strength and stiffness is a function of the rate at which they are stressed. They behave stronger with relatively faster rate of stress load (dynamic stresses) and will tend to show creep behavior with stress load acting over a long period of time (static stresses). As a general rule, for **static loads,** approximately four square inches of tape should be used for each pound of weight to be supported in order to prevent excessive creep. For **dynamic loads,** the dynamic performance characteristics provided on page 4 should be useful, factoring in the appropriate safety factors.

► **Allow for thermal expansion/contraction:** 3M™ VHB™ Tapes can perform well in applications where two bonded surfaces may expand and contract differentially. Assuming good adhesion to the substrates, the tapes can typically tolerate differential movement in the shear plane up to 3 times their thickness.

► **Bond Flexibility:** While an advantage for many applications where allowing differential movement is a benefit, the tape bonds are typically more flexible than alternative bonding methods. Suitable design modifications or periodic use of rigid fasteners or adhesives may be needed if additional stiffness is required.

► **Severe Cold Temperature:** Applications which require performance at severe cold temperatures must be thoroughly evaluated by the user if the intended use will subject the tape product to high impact stresses. A technical bulletin "3M™ VHB™ Tape Cold Temperature Performance" (70-0707-3991-0) is available for additional information.

Application Techniques

► **Clean:** Most substrates are best prepared by cleaning with a 50:50 mixture of isopropyl alcohol (IPA*) and water prior to applying 3M™ VHB™ Tapes.

Exceptions to the general procedure that may require additional surface preparation include:

- **Heavy Oils:** A degreaser or solvent-based cleaner may be required to remove heavy oil or grease from a surface and should be followed by cleaning with IPA/water.
- **Abrasion:** Abrading a surface, followed by cleaning with IPA/water, can remove heavy dirt or oxidation and can increase surface area to improve adhesion.
- **Adhesion Promoters:** Priming a surface can significantly improve initial and ultimate adhesion to many materials such as plastics and paints.
- **Porous surfaces:** Most porous and fibered materials such as wood, particleboard, concrete, etc. need to be sealed to provide a unified surface.
- **Unique Materials:** Special surface preparation may be needed for glass and glass-like materials, copper and copper containing metals, and plastics or rubber that contain components that migrate (e.g. plasticizers).

Refer to 3M Technical Bulletin "Surface Preparation for 3M™ VHB™ Tape Applications" for additional details and suggestions. (70-0704-8701-5)

***Note:** These cleaner solutions contain greater than 250 g/l of volatile organic compounds (VOC). Please consult your local Air Quality Regulations to be sure the cleaner is compliant. When using solvents, be sure to follow the manufacturer's precautions and directions for use when handling such materials.

► **Pressure:** Bond strength is dependent upon the amount of adhesive-to-surface contact developed. Firm application pressure develops better adhesive contact and helps improve bond strength. Typically, good surface contact can be attained by applying enough pressure to insure that the tape experiences approximately 15 psi (100 kPa) pressure. Either roller or platen pressure can be used. Note that rigid surfaces may require 2 or 3 times that much pressure to make the tape experience 15 psi.

► **Temperature:** Ideal application temperature range is 70°F to 100°F (21°C to 38°C). Pressure sensitive adhesives use viscous flow to achieve substrate contact area. Minimum suggested application temperatures:

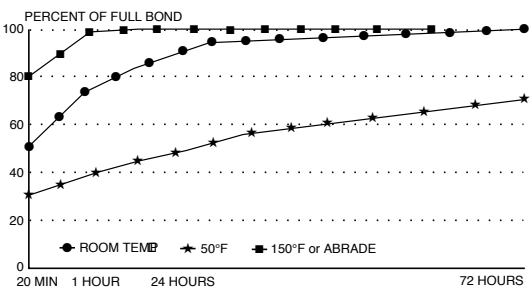
- 50°F (10°C): 3M™ VHB™ Tapes 4950, 5952, 4910, 4952, 4611, 4622 families.
- 60°F (15°C): 3M™ VHB™ Tapes 4941, 4945 families.
- 32°F (0°C): 3M™ VHB™ Tape 4951 families.

Note: Initial tape application to surfaces at temperatures below these suggested minimums is not recommended because the adhesive becomes too firm to adhere readily. However, once properly applied, low temperature holding is generally satisfactory.

To obtain good performance with all 3M™ VHB™ Tapes, it is important to ensure that the surfaces are dry and free of condensed moisture.

► **Time:** After application, the bond strength will increase as the adhesive flows onto the surface (also referred to as "wet out"). At room temperature approximately 50% of ultimate bond strength will be achieved after 20 minutes, 90% after 24 hours and 100% after 72 hours. This flow is faster at higher temperatures and slower at lower temperatures. Ultimate bond strength can be achieved more quickly (and in some cases bond strength can be increased) by exposure of the bond to elevated temperatures (e.g. 150°F [66°C] for 1 hour). This can provide better adhesive wetout onto the substrates. Abrasion of the surfaces or the use of primers/ adhesion promoters can also have the effect of increasing bond strength and achieving ultimate bond strength more quickly.

Bond Typical Build vs. Time



Special Cases:

Rough Surfaces with 3M™ VHB™ Tapes 4932/4952 – 3M™ VHB™ Tapes 4932/4952 were designed to adhere to many low surface energy substrates. Rough surfaces created by light abrasion or textured molds are typically detrimental to bond strength with this tape family.

Plasticized Vinyl – Plasticizers compounded in soft vinyl can migrate into adhesives and significantly change their performance characteristics. 3M™ VHB™ Tapes 4941 and 4945 families have very good plasticizer resistance and adhesion to many vinyl formulations. Because of the wide variation in vinyl formulations, however, evaluation by the user must be conducted with the specific vinyl used to ensure that performance will be satisfactory over time. Problems related to plasticizer migration can often be predicted by accelerated aging of assembled parts at 150°F (66°C) for one week).

Technical Information

The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use

Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for 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. AN APPLICATION WARRANTY EXPRESSLY APPROVED AND ISSUED BY 3M IS AN EXCEPTION. THE CUSTOMER MUST APPLY FOR A SPECIFIC APPLICATION WARRANTY AND MEET ALL WARRANTY AND PROCESS REQUIREMENTS TO OBTAIN AN APPLICATION WARRANTY. CONTACT 3M FOR MORE INFORMATION ON APPLICATION WARRANTY TERMS AND CONDITIONS.

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.

ISO 9001:2008

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001:2008 standards.

3M

Industrial Adhesives and Tapes Division

3M Center, Building 225-3S-06
St. Paul, MN 55144-1000
800-362-3550 • 877-369-2923 (Fax)
www.3M.com/vhb

Recycled Paper
40% pre-consumer
10% post-consumer

Mightee Mounts

1. (if using graphic with holes) Sandwich graphic in between Mightee Mounts and screw together with wingnuts and carriage bolts (fig. A).
2. (if using graphic without holes) Screw Mightee Mounts together with wingnuts and carriage bolts and rest graphic on top of screws (fig. B).

Applicable Products:

MM12 MM36 MM60
MM24 MM48

For Graphic Sizing (all dimensions from center hole):

7/32" Holes - MM12
1/4" Holes - MM24, MM36
MM48, MM60