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Autorisé et notifié conformément à l'article 10 de la directive 89/106/EEC du Conseil, du 21 décembre 1988, relative au rapprochement des dispositions législatives, réglementaires et administratives des Etats membres concernant les produits de construction.

CSTB
le futur en construction

MEMBER OF EOTA

European Technical Approval ETA-09/0024

(English language translation, the original version is in French language)

Trade name: Nom commercial :	**3M™ VHB™ Structural Glazing Tape G/B 23F** Ruban de collage structural VHB 3M G/B 23F
Holder of approval: Titulaire :	**3M Europe** **Hermeslaan 7** **1831 Diegem, Belgium**
Generic type and use of construction product: Type générique et utilisation prévue du produit de construction :	**Acrylic foam tape for structural tape glazing kits** Bande de mousse en acrylique pour collage structurel de vitrage
Validity from/to: Validité du/au :	**From 30/06/2013 to 30/06/2018** Du 30/06/2013 au 30/06/2018
Manufacturing plant: Usine de fabrication :	**3M Germany** **Hilden**
This European Technical Approval contains: Le présent Agrément Technique Européen contient :	**26 pages including 2 annexes** 26 pages incluant 2 annexes **This European Technical Approval replaces ETA-09/0024 with validity from 14/05/2009 to 14/05/2014** Cet Agrément Technique Européen remplace l'ETA-09/0024 valide du 14/05/2009 au 14/05/2014

I LEGAL BASES AND GENERAL CONDITIONS

1 - This European Technical Approval is issued by the Centre Scientifique et Technique du Bâtiment (CSTB) in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by the Council Directive 93/68/EEC of 22 July 1993[2];
- Décret n° 92-647 du 8 juillet 1992[3] concernant l'aptitude à l'usage des produits de construction;
- Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC[4];
- CUAP 04.04/32 Acrylic foam tape for structural glazing or cladding applications October 2008.

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6 - The European Technical Approval is issued by the approval body in its official language. This version fully corresponds to the version circulated within EOTA. Translations into other languages have to be designated as such.

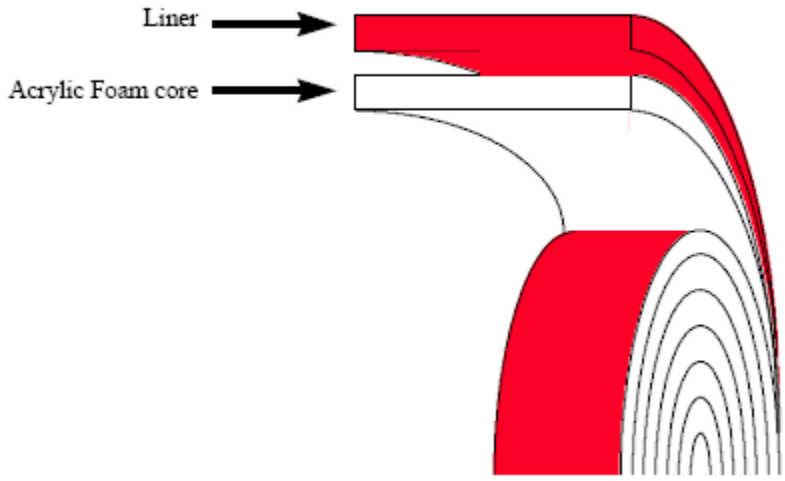
1 Official Journal of the European Communities no. L 40, 11.2.1989, p. 12.
2 Official Journal of the European Communities no. L 220, 30./.1993, p. 1.
3 Journal Officiel de la République française du 14 juillet 1992.
4 Official Journal of the European Communities no. L 17, 20.1.1994, p. 34.

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1. Definition of product and intended use

1.1. Definition of product

3M™ VHB™ Structural Glazing Tape G23F and B23F are an acrylic foam tape used to bond glazing products on a support frame. In the text, it will be named "3M™ VHB™ SG tape". This is an acrylic double coated adhesive foam tape which is 2.3 mm thick, and 10 to 50 mm wide. It is covered with a moisture stable liner for transport and storage.



1.2. Intended use

The 3M™ VHB™ SG tape is primarily for the following applications:

- To bond glazing products or anodised aluminium panels on structural support frame (aluminium or U-PVC profile) to design a SG frame for curtain wall or window application.

- To bond anodised aluminium stiffeners profiles on the back side of anodised aluminium panels for cladding or curtain wall application.

For the whole kit, which includes the tape, another ETA should be required.

The temperature for the intended use is limited to 80°C.

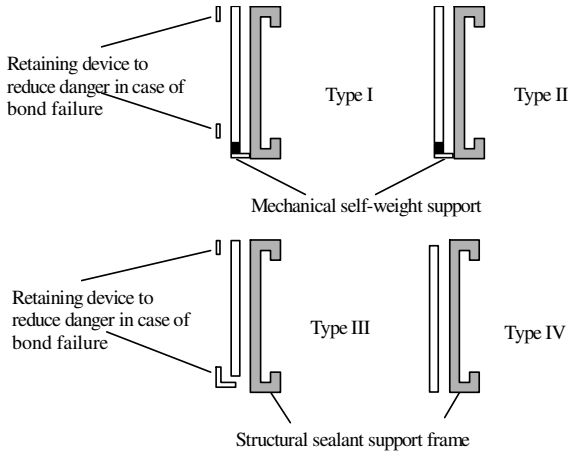
This ETA covers the following intended uses and (assembled) systems, for structural glazing application:

Type I: Mechanical transfer of the self weight of the infill to the sealant-support frame and thence to the structure. The structural tape transfers all other actions. Devices are used to reduce danger in the event of a bond failure.

Type II: Mechanical transfer of the self weight of the infill to the tape-support frame and thence to the structure. The structural tape transfers all other actions and no devices are used to reduce danger in the event of bond failure.

Type III: The structural tape transfers all actions, including the self-weight of the infill to the tape support frame and thence to the structure. Devices are used to reduce danger in the event of a bond failure.

Type IV: The structural tape transfers all actions, including self-weight of the infill to the tape-support frame and thence to the structure. No devices are used to reduce danger in the event of bond failure.



The provisions and the verification and assessment methods included or referred to in this European Technical Approval have been written based upon the assumed working life of the SG tape for the intended use of 25 years when installed in the works (provided that the SG tape is subject to appropriate installation, use and maintenance). These provisions are based upon the current state of the art and the available knowledge and experience.

2. Characteristics of product and methods of verification

2.1. Characteristics of the product

2.1.1. 3M™ VHB™ structural glazing tapes

The product which is subject of the technical approval is identified by:

- Dimension.

  3M™ VHB™ Structural Glazing Tape G23F & B23F: 2.3 mm ± 10% (thickness) and 10 to 50 mm (width)

- Color.

  3M™ VHB™ Structural Glazing Tape G23F – grey core and transparent surface.

  3M™ VHB™ Structural Glazing Tape B23F – grey core and black surface.

- Chemical Nature.

  Acrylic.

- Commercial Designation.

  3M™ VHB™ Structural Glazing Tape G23F and B23F.

- Thermo gravimetric analysis according to ETAG 002 (the curve is kept in the Evaluation Report).

2.1.2. 3M™ primers

Table 1

Trade Name	Appearance	Designated Substrates
3M™ Silane Primer AP 115	Clear Liquid	• Float glass
3M™ Silane Primer	Clear Liquid	• Float glass
3M™ Primer 94	Clear Liquid	• Anodized Aluminum
3M™ Primer 4297	Clear Liquid	• U-PVC

2.1.3. 3M™ surface cleaner

Table 2

Trade Name	Appearance	Designated Substrates
3M™ IPA Cleaner 08986	Clear Liquid	• Float glass • Anodized Aluminum • U-PVC
3M™ Heptane Cleaner	Clear Liquid	• Float glass, finger prints • Anodized Aluminum
3M™ Adhesive Remover 08984	Clear Liquid	• Float glass

2.1.4. Substrates

The generic types of suitable substrates are:

– The float glass conform to EN 572 Glass in Building – Basic Products – Part 1, 2, 4, 5 and the thermally treated glass made from, conform to:

  - EN 1863 Glass in building – Heat strengthened glass.

  - EN 12150 Glass in building – Thermally toughened safety glass.

– Coatings must be totally removed from the structural adhesion surface.

The support frame is made in aluminium or PVC, according to table 3, 4.

Table 3 – Aluminium alloy - Characteristics

Alloy	Mechanical characteristics
Designation	
EN 573-3 EN AW-6060	EN 755-2

Table 4 – Anodising characteristics

Characteristics	Method	Criteria EOTA
Thickness	ETAG 002 § 5.2.2.1.1.	Mean minimum thickness : 15 μm
Sealing :		
Sealing degree Weight lost	ETAG 002 § 5.2.2.1.2	EN 12373-6 : < 30 mg/dm^2
for a given thickness of 20 μm Stain test		EN 12373-4 < 2 on Qualanod scale

Table 5 – PVC characteristics

Method	Results
⇨ Characteristics according to EN 12608	Profil polychlorure de vinyle no plastified
⇨ Supplier – material reference	Tryba Profile ref. 213
⇨ Density according to ISO 1183	1,45 g/cm^2 ± 0,02
⇨ Ash according to ISO 3451-5	7,12 % ± 7 %
⇨ Vicat softening temperature according to EN ISO 306	82,1 °C ± 2

2.2. Methods of verification

Essential Requirement	
ER2 Safety in case of fire	▪ Reaction to fire : Class E.
ER3 Hygiene, health and environment	▪ Water vapour permeability : No performance determined. ▪ Dangerous substances the components manufacturers declare to be conform to the Council Directive 76/769/EEC) published in "Official Journal of the European Communities" of 27/07/1976 and its amendments. In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.
ER4 Safety in use	See table 2 and 3: ▪ Initial mechanical strength. ▪ Immersion in hot water. ▪ Humidity and NaCl. ▪ Façade cleaning products. ▪ Material in contact. ▪ UV exposure. ▪ Mechanical fatigue.
ER5 Protection against noise	▪ Not relevant.
ER6 Energy economy and heat retention	▪ Determination of thermal insulation and susceptibility of condensation. ▪ The calculation can be performed according to EN ISO 10077.

G/B 23F PVC/Glass:

Initial mechanical strength (tension speed) T = 23°C V = 5mm/min V = 50mm/min V = 300mm/min	 $R_{t,v5}$ = 0.322MPa $E_{t,v5}$ = 9.75mm $R_{t,v50}$ = 0.558MPa $E_{t,v50}$ = 10.26mm $R_{t,V300}$ = 0.899MPa $E_{t,v300}$ =6.7mm
Initial mechanical strength (tension speed) V = 5mm/min T = -20°C T = +80°C	 $k_{t,T-20}$ = 8.901 $k_{t,T+80}$ = 0.504
Initial mechanical strength (shear speed) V = 5mm/min T = -20°C T = +23°C T = +80°C	$R_{s,V5}$ = 0.408MPa $E_{s,T+23}$ =17.20mm $E_{s,T-20}$ = 13.27mm $E_{s,T+80}$ = 17.51mm $k_{s,T-20}$ = 1.367 $k_{s,T+80}$ = 0.693
Immersion in hot water	$k_{t,hw\ 504}$ = 1.094 $k_{t,hw\ 1008}$ = 0.855
Humidity and NaCl	$k_{t,NaCl}$ = 1.070
UV exposure	$k_{t,UV1000}$ = 1.01 $k_{t,UV2000}$ = 1.08 $k_{t,UV3000}$ = 1.17 $k_{t,UV4000}$ = 1.31
Mechanical fatigue	$k_{t,MF}$ = 0.754
Characteristic values	$\sigma_k = 0.491\ t^{-0.2303}$ (t in sec) For the wind load, the recommended value is given in Annex1 (method of calculation) $\Gamma_k = 0.965\ t^{-0.2303}$ (t in sec) For the long length action (dead load), the recommended value is given in Annex1 (method of calculation) E_K = 13.27mm T_k = 100°C
Thermal conductivity	K=0.0767 W/m.K

G/B 23F ALU/GLASS

Initial mechanical strength (tension speed) T =23°C V = 5mm/min V = 50mm/min V = 300mm/min	 $R_{t,v5}$ = 0.350MPa $E_{t,v5}$ = 14.05mm $R_{t,v50}$ = 0.625MPa $E_{t,v50}$ = 10.62mm $R_{t,V300}$ = 0.844MPa $E_{t,v300}$ = 7.52mm
Initial mechanical strength (tension speed) V = 5mm/min T = -20°C T = +80°C	 $k_{t,T-20}$ = 7.602 $k_{t,T+80}$ = 0.449
Initial mechanical strenght (shear speed) V = 5mm/min T = -20°C T = +23°C T = +80°C	$R_{s,V5}$ = 0.495MPa $E_{s,T+23}$ =17.60mm $E_{s,T-20}$ = 12.76mm $Es_{,T+80}$ = 17.29mm $k_{s,T-20}$ = 1.256 $k_{s,T+80}$ = 0.728
Immersion in hot water	$k_{t,hw\ 504}$ = 0.971 $k_{t,hw\ 1008}$ = 0.789
Humidity and NaCl	$k_{t,NaCl}$ = 1.010
UV exposure	$k_{t,UV1000}$ = 0.939 $k_{t,UV2000}$ = 0.956 $k_{t,UV3000}$ = 1.024 $k_{t,UV4000}$ = 1.099
Mechanical fatigue	$k_{t,\ MF}$ = 0.754
Characteristic values	$\sigma_k = 0.424\ t^{-0.1878}$ (t en sec) For the wind load, the recommended value is given in Annex1 (method of calculation) $\Gamma_k = 0.984\ t^{-0.1878}$ (t en sec) For the long length action (dead load), the recommended value is given in Annex1 (method of calculation) E_K =12.76mm T_k = 100°C
Thermal conductivity	K=0.0767 W/m.K

3. Evaluation of Conformity and CE marking

3.1. Attestation of conformity system

The systems of attestation of conformity specified by the European Commission detailed in the Commission decision of 24/06/96, published in the EC Official Journal L254 of 08/10/96 :

System 1 (without audit testing of samples) for SSG kits Type II.

System 1

(a) Tasks for the manufacturer:

- factory production control,
- testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan.

(b) Tasks for the approved body:

- initial type testing of the product,
- initial inspection of the factory and of factory production control,
- continuous surveillance, assessment and approval of the factory production control.

3.2. Tasks and responsibilities of the manufacturer and notified bodies

3.2.1. Tasks of the manufacturer

The corner stones of the actions to be undertaken by the manufacturer of the SG tape in the procedure of attestation of conformity are laid down in this table:

Nr	Subject/type of control (product, raw/constituent material, component – indicating characteristic concerned)	Test or control method	Criteria (if any)	Minimum #of samples	Minimum frequency of control
Factory Production Control (FPC)					
1	Check on incoming material	Compliance of the raw materials.			
2	Check during fabrication	Conformity of composition: process control system; each run			
		Viscosity syrup (mPas) TM-88	According to internal criteria	N=1	Each batch
		Density syrup (kg/m^3) TM-1491	According to internal criteria	N=1	Each batch
3	Check on final product	Thickness (mm) TM-405	Min.= 2.16 mm Max.= 2.41 mm	N=2	1/each 2nd jumbo
		Width tolerance (mm) TMG-5581	+/- 0.4 mm	N=1 1st cut/each roll	1/ shift 1/ width
		Density tape (kg/m^3) TM-441	Min= 593 kg/m^3 Max.=753 kg/m^3	N=2	1/each 2nd jumbo
		Peel adhesion 90°, 23°C, 72 hr dwell Stainless Steel (N/100mm) TM-1637LS EN 1939	Min.=278 N/100mm	N=2	1/each 2nd jumbo
		Peel adhesion 90°, 23°C, 72 hr dwell Stainless Steel (N/100mm) TM-1637NLS	Min.=278 N/100mm	N=2	1/each 2nd jumbo
		Static shear 500gm 70°C (hours) TM-1266	Min.= 167 hr	N=1	1/each 4th jumbo
		Aspect (visual) Color & cleanness	Pass or Fail	N=1	1/roll
4	Check SSGK, project, system related surface testing	Peel adhesion 90°, 23°C, 72 hr 300mm/min (N/100mm) AFERA 5001 EN 1939	Min.= 500 Target= na Max.= na 100% cohesive failure	1/profile-lot/jumbo	1 test/sample
4	Surface energy check	Surface energy test pencil	> 38 mN/m	Every frame and glass	1 test/frame and glass

3.2.2. Tasks of notified bodies

The corner stones of the actions to be undertaken by the notified body in the procedure of attestation of conformity for the SG tape are laid down in the following table.

The manufacturer shall exercise permanent internal control of production. All the elements requirements and provisions adopted by the manufacturer shall be documented in a systematic production control system shall ensure that the product is in conformity with the ETA.

Manufacturers having a FPC system complying with EN ISO 9001 : 2000 and addressing the requirements of an ETA are recognized as satisfying the FPC requirements of the Directive (according to CPD – Guidance Paper B).

Nr	Subject/type of control (product, raw/constituent material, component - indicating characteristic concerned)
	Initial type-testing of the product (ITT)
1	For initial type testing, the results of the tests performed as part of the assessment for the ETA shall be used unless there are changes in the production line or plant.
	Initial inspection of factory and factory production control (FPC)
2	The approved body shall ascertain that, in accordance with the prescribed test plan, the factory and the factory production control are suitable to ensure continuous and orderly manufacturing of the SG tape according to the specification given in the ETA.
	Continuous surveillance, judgment and assessment of factory production control (FPC)
3	The approval body shall visit the factory twice* a year. It has to verify the continuing conformity to the ETA, taking into account the prescribed test plan.

* The number of inspections can be reduced to one audit per year for the firms whose quality assurance system is certified by an approved body in accordance with standard NF EN ISO 9001 of December 2000, and provided the quality assurance system is applied to the manufacture of the products covered by the Technical Application Document or the CUAP

3.3. CE marking and accompanying information

According to Council Directive 93/68/EEC the CE marking consists of the letters "CE" in the form laid down in the Directive, followed by the identification number of the notified certification body, where applicable. For products subject to Council Directive 89/106/EEC the identification number of the notified certification body shall be given as system 1 of attestation of conformity applies.

The CE marking of the SG tape shall be accompanied by the following information:

- the name and address of the producer (legal entity responsible for the manufacture),

- the last two digits of the year in which the CE marking was affixed,

Example of CE marking and accompanying information:

CE XXX	"CE" – Symbol. Number of Notified Body.
Any company, Any address	Name and address of the manufacturer or his representative established in the EEA and of the plant where the product was manufactured.
XX XXXX-CPD-XXXX	Two last digits of year of affixing CE Marking. Number of EC certificate of conformity.
ETA N° 08/XXXX	ETA Number.
Use category	Relevant performance characteristics and/or designation code.

4. Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1. Design values

Design stress in dynamic tension σ_{des} : $$\sigma_{des} = MIN\left(\frac{\sigma_k}{\gamma_{Mt}}; \sigma_{declared}\right),$$

With:
- σ_k is the characteristic tension stress determined according annex
- $\gamma_{M\,t} = 1{,}3$ or the value required by the national authorities
- $\sigma_{declared}$ =85 kPa

Design stress in static shear τ_{des} : $$\tau_{des} = MIN\left(\frac{\tau_k}{\gamma_{Ms}}; \tau_{declared}\right)$$

With:
- τ_k is the characteristic shear stress determined according annex
- $\gamma_{MS} = 3$ or the value required by the national authorities
- $\tau_{declared}$ =1.7 kPa

Design elongation in dynamic shear (differential dilatation) E_{des} : $$E_{des} = MIN\left(\frac{E_k}{\gamma_{M\,A}}; E_{declared}\right)$$

With:
- E_k is the characteristic elongation determined according annex
- $\gamma_{M\,A} = 1{,}8$ or the value required by the national authorities
- $E_{declared}$ =6.9 mm

Design temperature T_{des} : $$T_{des} = MIN\left(\frac{T_k}{\gamma_{M\,T}}; T_{declared}\right)$$

With:
- T_k is the maximum temperature (according to § 2.45).
- $\gamma_{M\,T} = 1{,}25$ or the value required by the national authorities
- $T_{declared}$ = 80°C

4.2. Packaging, transport, storage of the product

3M™ VHB™ Structural Glazing tape has to be stored at 21°C and 50% relative humidity in original boxes. When stored under proper conditions product retains its performance and properties for 24 month. When the 3M™ VHB™ SG tape is pre-applied to a substrate and stored prior to the final bonding ensure same storage conditions as for the original boxes. If necessary protect the applied tape from dust or damages. Avoid any compression of the applied tape due to spot/partial loads.

4.3 Installation

4.3.1 Tape width calculation for tensile and shear

The design of the façade element shall be performed case by case taking into account wind load and the size of the frame according to the following formula using the design strength in dynamic tension

$$VHB^{tm}\ tape\ width\ dynamic\ (mm) \geq \frac{windload\ (kPa) \times short\ side\ of\ the\ frame\ \ (mm)}{2 \times \sigma_{des}\ (kPa)}$$

A static load calculation must be performed when no dead load support devices are present. For structural glazing this is only the case for single glass units and based on the static design strength for shear loads.

$$VHB^{tm}\ tape\ width\ static\ (mm) \geq \frac{glass\ weight\ (kg)}{Bondlength\ (mm) \times (\tau_{des}\ \frac{kg}{mm^2})}$$

3M™ VHB™ SG tape is currently available with a thickness of 2.3 mm. Therefore, there is no need for calculation of tape thickness.

The maximum allowable elongation (shear strain) of 3M™ VHB™ SG tape is based on it's thickness of 2.3 mm and should not exceed 300%. This means shear strain of the tape should not exceed E_{des} according to § 4.1. Bonding surfaces with a different thermal expansion rates will create a shear load on the adhesive. The calculation to determine shear strain is done by subtracting the thermal expansion rates and multiplying it with the bond length and the expected thermal differences:

$$Expansion\ (\%) = \frac{\left(\left|\alpha_1 - \alpha_2\right| * \Delta T * \ell_{bt} * 100\right)}{2.3}$$

With:

$\alpha_{1,2} = thermal\ \exp ansion\ coefficient\ of\ both\ substrates$

$\Delta T = \max imum\ deviation\ from\ bonding\ temperature$

$\ell_{0,bt} = original\ length\ of\ the\ substrates\ at\ bonding\ temperature$

$bt = substrate\ temperature\ (typically\ 15 - 25°C)$

For a frame solution it is required to perform this calculation for both sides and include it into the following formula.

$$E_{des}\ (\%) \geq \sqrt{(Differential\ Expansion\ Long\ side)^2 + (Differential\ Expansion\ Short\ Side)^2}$$

The design of the system is then submitted to the relevant rules or standards, national codes of practice, etc… for example regarding the deflection of the supports, deflection of the glue panels (glass pane or opaque panel).

The basic steps involved in a 3M™ VHB™ Structural Glazing Tape process are:

1. Establishment of appropriate work area.
2. Surface preparation – glass and metal frame.
3. Tape application.
4. Joining of parts.
5. Pressure application.
6. Weather sealant gasket application.

4.3.2. The work environment

It is important to establish an appropriate work area before assembly of the structurally glazed glass panels. The workplace should be free from excessive dust, dirt and other airborne contaminants. The 3M™ VHB™ Structural Glazing tape will bond strongly to the surface it contacts. Should there be a layer of dust, dirt, grease, oils, etc., then an inadequate bond will be made to the component surface. The workplace should be at a minimum temperature of 15°C and free from sources of wide temperature variations such as open loading doors.

4.3.3. Surface preparation

Proper surface preparation is the critical first step in the fabrication process. Proper preparation of a surface prior to the application of a pressure sensitive tape is a key factor in ensuring maximum bond strength. Contaminants act as a barrier between the adhesive and substrate. Avoid touching the cleaned and/or primed surfaces as well as the adhesive side of the tape. All products to be used are listed in table no 2 & 3. After Primer application ensure that the Primer is completely dry (depending on the environmental conditions, follow application manual).

4.3.4 Tape application

3M™ VHB™ SG tape has to be applied with 3M™ approved equipment to ensure optimum quality and performance. This step has to be done immediately after surface preparation. The tape equipment is designed to have easy and clean tape application with getting the necessary pressure.

For frame bonding, the overlapping edges have to be cut. As the 3M™ VHB™ SG tape is also tacky on the side, it will bond together and seal the edges nearly 100%. The final seal should be achieved through the outside weather seal. It is also possible to use an approved weather seal directly on the 3M™ VHB™ SG tape to achieve full seal. Typically a “mitre cut” is being made to ensure good contact between both tape ends. This procedure can also be used for tape splicing.

4.3.5. Joining of parts

As the 3M™ VHB™ SG tape is a pressure sensitive adhesive it will immediately bond after initial contact. As this means you cannot re-position the part it is recommended to use guiding blocks (PP or similar) to exactly position the parts. Right before you join the part remove the liner completely. Do not remove the liner if you do not immediately make the bonding.

4.3.6. Pressure application

Once the glass and frame are bonded together, final application pressure must be applied around the entire perimeter of the glass and frame – over the entire bonding area. 3M™ approved Equipment is used to ensure that a roll down pressure of at least 1 kg/cm^2 is applied over the entire bonding area.

4.3.7. Adhesion quality control during kit assembly
Controls are given in the following table:

Company:			Project Reference:		Production Date:
	First Day, third day, fith day		Second Day, fourth Day, sixth day		
	Morning:	Afternoon:	Morning:	Afternoon:	
General: 3M™ Cleaner used:	Reference	Reference	Reference	Reference	
Temperature (°C)	Value	Value	Value	Value	
3M™ VHB™ SG Tape, Code, Lot No.	Reference	Reference	Reference	Reference	
3M™ Primer, Code, Lot No.	Reference	Reference	Reference	Reference	
Glass, type, No.	Reference	Reference	Reference	Reference	
Frame, type, No.	Reference	Reference	Reference	Reference	
Surface Energy check performed:	Value	Value	Value	Value	Passed/Failed

4.4. Use, maintenance, repair

The following procedure is specific for a 3M™ VHB™ Structural Glazing Tape structurally glazed system. The application should be verified as a 3M™ VHB™ Structural Glazing Tape project and the original project specific 3M technical report should be available for reference. Contact your 3M representative if this information is not available. Prior to deglazing an assessment must be made by a 3M representative along with other building and contractor representatives to determine the cause of failure. A written record of this inspection should be retained by all appropriate parties. It is recommended to replace the entire frame and glass panel unit, if possible, with a newly fabricated unit. If this is not possible, follow the deglazing procedure described below.

Cutting through the 3M™ VHB™ Structural Glazing Tape bondline is the most effective way of separating the glass lite from the structural frame. This will require special tools such as piano wire or an automatic sealant cutter or a sharp blade to cut through the 3M™ VHB™ Structural Glazing Tape. Use a lubricant such as liquid soap to quicken cutting through the tape. Care should be exercised to avoid damaging of the frame surface or the glass if they are to be used in the re-glazed unit.

The 3M™ Stripe Off Wheel is a special rubber disk which mounts to a 3/8" electric drill and can be used to remove the adhesive residue from the glass panel and metal frame. When the rotating disk is brought in contact with the adhesive residue, it lifts and removes the adhesive from the surface. The wheel will not damage the surfaces if used properly. It may help to remove the bulk of the adhesive residue with a razor or sharp knife before using the Stripe Off Wheel. Another alternative is to grasp a portion of the adhesive residue and attempt to stretch and release the tape from the frame or glass. This should be attempted before cutting the adhesive residue and often results in a complete and clean removal.

Clean the glass and frame surface with the “two cloth” cleaning procedure utilizing the IPA/water solution described earlier in this technical guide. The original project specific technical report should also be referenced to determine if priming or abrasion is required for maximum bonding performance. Be sure that all the adhesive residue and sealant residue are removed before re-glazing.

The original French version is
signed by the Technical Director
Charles BALOCHE

Annex 1

Method of calculation

1- Determination of σ_k

1.1 Relation between tension stress and strain rate

Clause	Parameter	E_{t,V_i}	R_{t,v_i}	$t_{t,Vi} = \frac{E_{t,V_i}}{v_i}$
§ 2..4.5	v=5mm/min	$E_{t,V5}$	$R_{t,V5}$	$t_{t,V5}$
§ 2..4.5	v=50mm/min	$E_{t,V50}$	$R_{t,V50}$	$t_{t,V50}$
§ 2..4.5	v=300mm/min	$E_{t,V300}$	$R_{t,V300}$	$t_{t,V300}$

Wich R_{t,v_i} $t_{t,i}$, we determine the coefficients σ_0, A for the law $\boxed{\sigma = \sigma_0 t^{-A}}$.

1.2 Influence of the temperature

Clause	Parameter	k_{t,T_i}
§ 2..4.5	T=-20°C (*)	$k_{t,T\ -20} = \Delta X_{mean}$
§ 2..4.5	T=+80°C	$k_{t,T\ +80} = \Delta X_{mean}$
§ 2..4.5	T=+100°C	$k_{t,T\ +100} = \Delta X_{mean}$
		$k_{t,1} = \mathrm{Min}(k_{t,Ti})$

(*) for local climatic temperatures outside these limits can be considered (e.g. in Nordics countries a temperature of -40°C can be applicable).

1.3 Influence of the other parameters

Clause	Parameter	$k_{t_{,i}}$
§ 2..4.6.1	Hot water 504 h	$k_{t,hw504} = \Delta X_{mean}$
§ 2..4.6.1	Hot water 1008 h	$k_{t,hw1008} = \Delta X_{mean}$
§ 2..4.6.2	Humidity and NaCl	$k_{t,Nacl} = \Delta X_{mean}$
§ 2..4.6.3	Façade cleaning product	$k_{t,CP} = \Delta X_{mean}$
§ 2..4.6.4	Effet of material in contact	$k_{t,MC} = \Delta X_{mean}$
§ 2..4.6.5	U.V exposure 1000 h	$k_{t,UV1000} = \Delta X_{mean}$

Clause	Parameter	k_{t_i}
§ 2..4.6.5	U.V exposure 2000 h	$k_{t,UV2000} = \Delta X_{mean}$
§ 2..4.6.5	U.V exposure 3000 h	$k_{t,UV3000} = \Delta X_{mean}$
§ 2..4.6.5	U.V exposure 4000 h	$k_{t,UV4000} = \Delta X_{mean}$
§ 2..4.6.6	Mechanical fatigue	$k_{t,MF} = C_2 \Delta X_{mean}$,with $C_2 = \frac{\sigma_{test}}{\sigma_{des}} \geq 0,75$
		$k_{t,2} = Min(k_{t,i})$

1.4 Law for tensile action

$\sigma_k = k_t \sigma_0 t^{-A}$ with $k_t = Min(k_{t,1}, k_{t,2})$.

2- Determination of τ_k

2.1 Relation between tension stress and shear stress

Clause	Parameter	E_{s,V_i}	R_{s,v_i}	$t_{s,i} = \frac{E_{s,V_i}}{v_i}$	$\tau_0 = \frac{R_{s,v5}}{t_{s,v5}^{-A}}$
§ 2..4.5	v=5mm/min T=+23°C	$E_{s,V5}$	$R_{s,V5}$	$t_{s,V5}$	τ_0

The law in shear is given by $\tau = \tau_0 t^{-A}$.

2.2 Influence of the temperature

Clause	Parameter	k_{s,T_i}
§ 2..4.5	T=-20°C(*)	$k_{s,T\ -20} = \Delta X_{mean}$
§ 2..4.5	T=+80°C	$k_{s,T\ +80} = \Delta X_{mean}$
		$k_{s,1} = Min(k_{s,Ti})$

(*) for local climatic temperatures outside these limits can be considered (e.g. in Nordics countries a temperature of -40°C can be applicable).

2.3 Law for shear action

$\tau_k = k_s \tau_0 t^{-A}$ with $k_s = Min(k_{s,1}, k_{t,2})$.

3- Characteristic elongation E_k

Clause	Parameter	$E_{s,Ti}$
§ 2..4.5	T=-20°C (*)	$E_{s,T-20}$
§ 2..4.5	T=+23°C	$E_{s,T+23}$
§ 2..4.5	T=+80°C	$E_{s,T+80}$
		$E_k = Min(E_{s,Ti})$

(*) for local climatic temperatures outside these limits can be considered (e.g. in Nordics countries a temperature of -40°C can be applicable).

4- Characteristic temperature T_k

T_k is the maximum tmperature according to § 2.45.

5- Load duration

Without required value by national autorities, we recommend the following value:

PVC/GLASS:

σ_k	γ_M	σ_k / γ_M	$\sigma_{declared}$	σ_s
0.113	1.3	86 kPa	85 kPa	85 kPa
τ_k	γ_M	τ_k / γ_M	$\tau_{declared}$	τ_s
8.6	3	2.87 kPa	1.7 kPa	1.7 kPa
E_k	γ_M	E_k / γ_M	$E_{declared}$	E_s
13.27	1.8	7.37	6.9mm	6.9mm

ALU/GLASS:

σ_k	γ_M	σ_k / γ_M	$\sigma_{declared}$	σ_s
0.128	1.3	98 kPa	85 kPa	85 kPa
τ_k	γ_M	τ_k / γ_M	$\tau_{declared}$	τ_s
21	3	7 kPa	1.7 kPa	1.7 kPa
E_k	γ_M	E_k / γ_M	$E_{declared}$	E_s
12.76	1.8	7.09	6.9mm	6.9mm

Annex 2

Determination of Peel Adhesion Properties according to EN 1939:2003

Please find below a summary of EN 1939:2003 which is made for testing of the adhesion properties of pressure sensitive tapes. This method is used to compare:

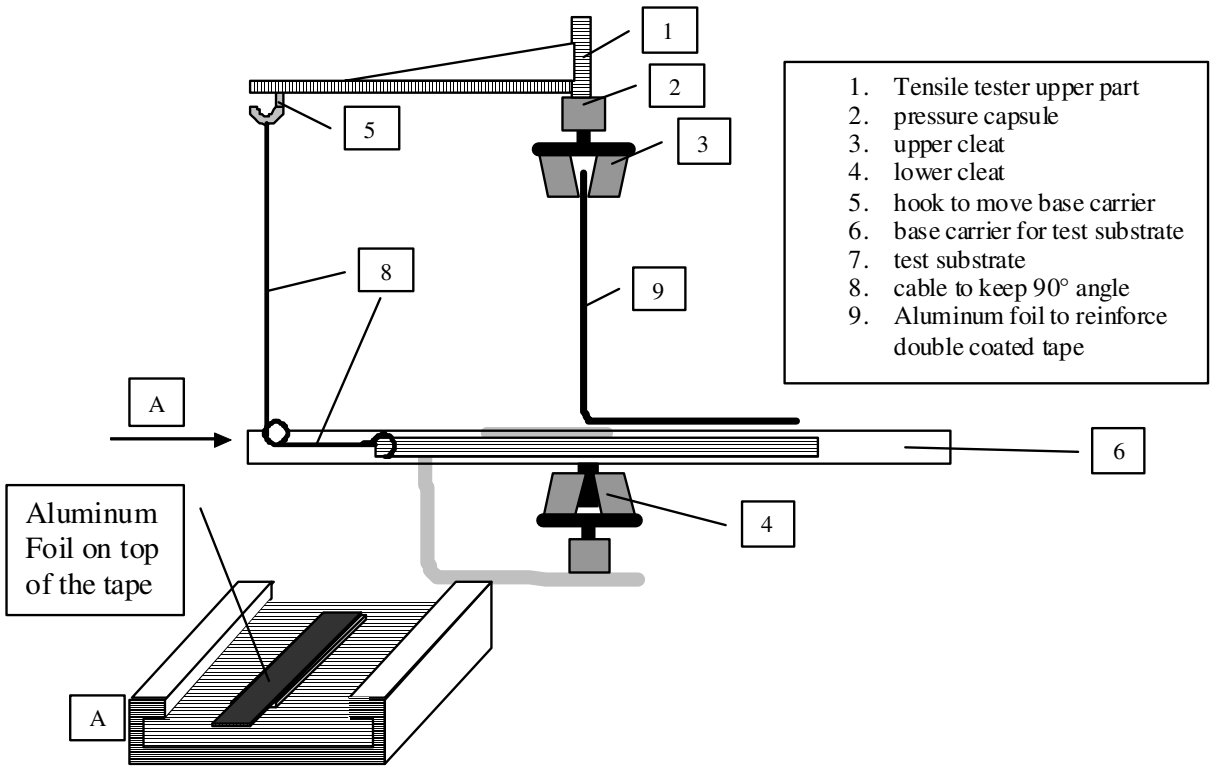
a.) different tapes on a reference substrate (stainless steel, 1.4301, Grade 2R acc. EN 10088-2, polished surface to 50 nm □ 25 nm) or

b.) the adhesion of one tape on different surfaces (main purpose when used with 3M™ VHB™ G/B23F)

For the determination of the adhesion between 3M™ VHB™ G/B 23F and the selected substrates peel test gives significant data. Due to the thickness of the tape an angle of 90° is best to generate significant values. Main target is to achieve a specified peel force (> 50N/cm at 23°C, 50% rel. hum.) combined with a cohesive failure above 90%.

The substrates are prepared as described in section 4 or according to system specific requirements (Schedule A of 3M project/system specific application manual). The test routine is in accordance with EN 1939:2003 and the test speed is set at 300mm/min (23°C, 50% rel. hum.).

As a summary the substrates are cleaned and the tape is laminated onto the substrate (12mm width) and pressed by using a metal roller with a defined weight (2 kg □0,1kg). In the second step a metal backing foil is laminated on top of the tape and the pressure is applied with the same roller. After conditioning for 72 h at 23°C and 50% rel. hum. the aluminum foil is peeled off and the resistance of the tape delivers the peel force.



1. Tensile tester upper part
2. pressure capsule
3. upper cleat
4. lower cleat
5. hook to move base carrier
6. base carrier for test substrate
7. test substrate
8. cable to keep 90° angle
9. Aluminum foil to reinforce double coated tape

The result is given in a peel force (N) per length (typically 10mm).

Determination of Peel Adhesion Properties according to EN 1939:2003	**Annex 2** of European Technical Approval **ETA-09/0024**