

REFORAC

Ready for any challenge

REFORAC UPPER BOND

FOAMED ACRYLIC TAPES

TECHNICAL GUIDE





REFORAC UPPER BOND HIGH PERFORMANCE STRUCTURAL BONDING TAPES.

INTRODUCTION

Reforac UPPER BOND Acrylic Foam Tapes are of the highest quality and performance level for the most demanding applications in a wide range of industrial applications where a structural long term bond is required. The tapes are manufactured under TS 16949 quality standards ISO 9001 and ISO 14001; produced using SPC Statistical Process Control. These tapes are ideal for bonding a wide range of materials in demanding external applications where resistance to all weather conditions are required over prolonged periods of time.

REFORAC UPPER BOND ACRYLIC FOAM TAPES FOR GLAZING APPLICATIONS.

Reforac UPPER BOND Acrylic Foam Tapes are ideal for use as structural glazing tapes and for bonding architectural cladding panels, bonding glass to metal frames and metal panels to metal frames.

THERE ARE TWO GRADES SUITABLE FOR THESE APPLICATIONS:

REFORAC UPPER BOND 5200 W	
Adhesive	Acrylic foamed adhesive
Thickness	2 mm (79 mil)
Density	850 kg/m ³ (53 lbs/ft ³)
Liner	Red Polyethylene film
Tape colour	White

2 mm white acrylic foam tape which is a closed cell high-density foam.

PERFORMANCE VALUES	
180° Peel Adhesion	3500 gram/ 25 mm (7,8 lbs/in.)
Tensile Adhesion	6550 gram/cm (93 lbs/in.)
Dynamic Shear	4800 gram/cm (68 lbs/in.)

REFORAC UPPER BOND 7200 G	
Adhesive	Acrylic foamed adhesive
Thickness	2 mm (79 mil)
Density	780 kg/m ³ (49 lbs/ft ³)
Liner	Red polyethylene film
Tape colour	Grijs

PERFORMANCE VALUES	
180° Peel Adhesion	3900 gram/25 mm (8,7 lbs/in.)
Tensile Adhesion	5000 gram/cm (71 lbs/in.)
Dynamic Shear	5300 gram/cm (75 lbs/in.)

Reforac UPPER BOND acrylic foam tapes can replace mechanical fixing systems and structural silicones for structural glazing applications bonding glass to metal frames. The tapes have excellent load-bearing performance in static and dynamic applications subjected to wind shear and long term demanding climatic conditions. The tapes

are resistant to high and low temperatures withstanding low temperatures down to -40°C and up to +160°C short term. The tapes also have excellent resistance to high levels of U.V. exposure and have very good chemical resistance, moisture and humidity resistance. Acrylic foam tape will replace conventional structural glazing fixing methods such as the

use of silicones along with the use of spacer tapes. The spacer tape is used as a temporary fixing medium while the structural silicone is curing which can take up to 24 hours from the time the silicone is applied. The thickness of the tape will determine how much silicone is used in the application; the spacer tapes are an open cell polyurethane tape usually,

which allows the passage of moisture, which generally cures the silicones. The tape does not have any part to play in the application once the silicone has cured. Generally this is an expensive method of securing and fixing curtain wall glazing, with the spacer tape on its own being a costly component.

Features, Benefits and Advantages of Using Reforac UPPER BOND Acrylic Foam Tape.

- Acrylic Foam Tape is precise in thickness and width of tape used.
- Quick and easy to apply productivity gains
- Clean, does not ooze, there is no possibility of spillage and required clean up time
- Cost reduction on materials compared to structural silicones.
- No prolonged curing time as with silicones.

MOISTURE AND SOLVENT RESISTANCE

Reforac UPPER BOND Acrylic Foam Tapes have proven resistance to high levels of humidity and to moisture ingress. Testing over long periods show that the tapes are resistant to high humidity at elevated temperatures.

Test conducted on Glass at +85°C/85% Relative Humidity for 2000 hours continuous. Test piece is 1 inch square piece of tape bonded to glass and aluminium. After the damp heat test the value for dynamic shear adhesion gives a figure of 383.1 Newton = 84 lbs per in² (5,9 Kg/cm²).

Testing the tape submerged in hot water at 70°C for 7 days tested, on glass with 1 inch square of tape gave a value of 29 lbs/in² (2 Kg/cm²) for dynamic shear adhesion.

The tapes are resistant to solvents, detergents and salt water, but not if totally submerged in a solvent, this is not recommended.

REFORAC UPPER BOND STRUCTURAL TAPE APPLICATIONS INITIAL CONSIDERATIONS

This application should be considered as a critical application, where the risk of product failure should be reduced to zero, and with a built in safety factor on the amount of tape used preventing any chance of bond failure. These applications should also allow for

static load support within the design of the window frame, and the curtain wall structure. The glazing panel should not be supported and suspended by the tape on its own as the sole medium for holding the panel. The tape should only be used when the glazing is being fabricated in a workshop and not on site, there are too many chances of surface contamination on a building site with dust and dirt being windblown onto the substrates: there is no control over this problem. Within a workshop environment proper surface preparation and control of temperature, humidity and cleanliness is easier. Proper guidelines and procedures must be followed under a strict code of methodology to apply the tape and to clean and prepare the surfaces in the right manner and to use the correct width and amount of tape.

DESIGN FACTORS - ADHESION

To achieve the best bond strength of the tape it is essential that the surface materials being bonded are understood as to the make-up and the properties that the substrates have. Glass and metals can have coatings that change the surface energy of the material giving different characteristics and affinity to adhesive tapes. Glass is generally a high energy material which lends itself to a high bond strength with acrylic foam tapes, this can change with coated glass be it self-cleaning glass or anti-reflective glass, so it is important to determine what type of glass is actually being used on the project. The same applies with the metal, be it aluminium or galvanized steel. Aluminium can be anodized or have similar treatments or can be painted with different epoxy paints. Galvanized steel can be problematical with a wide range of different zinc coatings: all having different properties. The key issue is to get the optimum bond strength on both substrates, which requires good adhesive "wet out" a term that means maximum surface contact under pressure between the tape and the substrate. Substrates should be tested separately to determine the surface energy of the material.

MATERIALS FOR STRUCTURAL GLAZING GLASS

Standard plain float glass is rarely used now in prestigious structural glazing projects, for curtain wall structural glazing applications glass is more likely to be a coated glass for insulation of the building or a glass with a

self cleaning coating which in effect is a non-stick coating.

Generally thermal insulated glass is coated with a thin layer of metal oxides onto the surface of the glass in the production process when the glass is still very hot, this method ensures that the coating is durable and is classed as a "hard coat". Other forms of coating are classed as "soft coating" this is a thin coating applied when the glass is hard and cold again. They are generally thin coatings of metals such as silver, which are generally not resistant to long term exposure to the atmosphere and are subject to oxygen and acid rain and will be corroded in time and a loss of adhesion to the glass.

The ideal situation is for the structural bonding tape to be applied to the non-coated side of the glass.

It is important that the glass panels have a minimal amount of distortion to the uniformity of the surface area of the panel. Any mismatch of the surface area to be bonded due to a lack of a flat surface area will have a detrimental effect on the adhesion strength of the tape bond.

Reduction of the surface area of the tape in contact with the glass, due to a warped panel, must be avoided. It is recommended that a glass panel should have only 2 mm in variation in the uniformity of flatness over a length of 1 metre.

METAL FRAMES

Aluminium is the metal used extensively for structural glazing framing systems, with stainless steel used in some cases. Aluminium is available with various surface finishes, which are suitable for use with Reforac UPPER BOND Structural Bonding Tape. Anodised aluminium is widely used along with alodine and powder coated paint systems. There is a great variety of epoxy and powder paint systems on the market - some of which have low surface energy properties and these should be tested thoroughly before being approved for use with a structural glazing tape.

Reforac offers a substrate testing service to ensure that the bond strength is suitable for the substrates and materials being used for your structural glazing project.

As with the glass panels, the frames should be consistently flat and uniform over the plane that the tape has to be applied and at the joints. It is common for the frames to be welded at the corner joints and any welding bead and distortion of the metal surface

should be smoothed out by grinding and polishing the surface. A mismatch of no more than 0.3 mm is recommended at the corner joints. Along the length of the frame there should be no more than 0.7 mm for every 1 metre of frame in the variance and uniformity in the flatness of the metal profile.

It is essential that the frame with the tape applied, be aligned parallel to the glass panel giving optimum surface contact of the structural glazing tape. The design of the types of profile being used for structural glazing applications must allow enough flat bonding surface area for the application of the minimum tape width required to bond the size of glass panel being fitted.

The frame profile types most suitable for structural glazing will have a surface area for the application of tape leaving very little or no surface area of glass in contact with the metal frame. Ideally the frame profile will have a design that can incorporate the use of a weather sealant such as Reforac 400 around the perimeter of the panel. Standard frame profiles designed for structural sealants may not be compatible with the use of structural glazing tape and the profile will have to be checked to see if a tape can be applied successfully.

APPLICATION METHODS & PROCESSES

It is recommended that for structural glazing manufacture the panels are produced in a factory environment and that the tape is never applied on site. The panels should be assembled in a factory where proper procedures and methods of working are controlled and are consistent with laid down processes and instructions. The factory unit should be clean and dust free and the temperature of the workplace should be controlled and maintained above 15°C. If the temperature outdoors is below 10°C then the panels, once assembled, should be kept at room temperature for 24 hours before being shipped to site. The panels when bonded together with Reforac UPPER BOND Structural Bonding Tape, can be moved and packed the same day, unlike structural silicone which takes 24 hours at least to cure. The working environment should be dust and dirt free, and maintained at an appropriate level of cleanliness. There should be a minimum amount of airborne contaminants. Dust and dirt will impair the performance of the tape and if present will have an adverse

affect on the integrity and quality of the panels being bonded. The temperature of the workplace should be maintained above 15°C and should be free of fluctuating temperatures caused by open doors and drafts of cold air. If the glass and metal frame profiles are stored outside or in a low temperature warehouse they will have to be conditioned for a minimum of 12 hours at an ambient temperature above 15°C, before they can be used for assembly.

Pressure sensitive adhesive tapes such as Reforac UPPER BOND Structural Bonding Tape are visco-elastic and the best bonding performance is achieved when there is good adhesive wet out which is optimum surface contact under pressure. This is enhanced when the temperature and the surface temperature of the substrates being bonded are above 15°C. This allows the adhesive to flow and key into the surface of the substrates locking the bond. The adhesive strength of the bond builds over a period of 24 hours if the temperature is maintained above 15°C directly after the tape is applied, ensuring that the panel can be subjected to load bearing. Fluctuations in temperature and humidity in the workplace should be avoided in order to maintain a high level of quality control during manufacture of the panels, ensuring the best bond.

SURFACE PREPARATION

It is essential that proper surface preparation of the glass and frame are controlled and set processes and procedures are followed to ensure the best performance of the tape, and optimum bond strength. Prior to the application of the tape, the substrates to be bonded have to be free from surface contamination. Any dirt or grease on the surface acts as a barrier and will impair the level of adhesion. In climates with high humidity a film of condensation can form on the substrates, again impairing the bond strength. Aluminium frames are very susceptible to the formation of moisture film particularly if the frames are cold and are brought into a warmer environment.

PREPARATION OF GLASS

The area of the glass to be bonded should be cleaned with Reforac UPPER BOND glass cleaner. The Reforac UPPER BOND glass cleaner can be sprayed onto the glass in a fine spray and wiped with a clean lint free cloth to stop fibres being left on the glass.

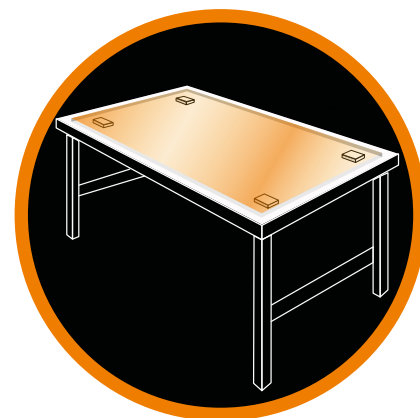


Figure 1. Clean workbench with supporting blocks for in-site application of Reforac UPPER BOND Structural Bonding Tape.

Avoid contamination of the cleaner by pouring onto a cloth or spraying and do not dip the cloth into the solution. The cloth should not be used repeatedly because dirt and contaminants will form on the cloth and will not give the required level of cleaning, the cloth should be used only once and then discarded. The best results are achieved when the wiping motion is in one direction. This prevents dirt being reapplied to the glass.

Directly after the glass has been cleaned it should then be treated with Reforac UPPER BOND Glass primer. The same procedures should be followed when applying the Reforac UPPER BOND Glass primer as with cleaning with the Reforac UPPER BOND glass cleaner. A clean, preferably white lint free cloth should be used. The Reforac UPPER BOND Glass primer can be applied in a fine spray to give a thin coating. Again, the cleaning motion should be in one direction. The best results are achieved when a thin layer of the Reforac UPPER BOND Glass Primer is applied. Large amounts of primer on the surface of the glass do not give the best results and more than one coat is not recommended. To ensure a thin, consistent coating once the primer has been applied, the coated perimeter area should be wiped again in one direction with a clean unused cloth. This should be done immediately - this will remove any excess Reforac UPPER BOND Glass primer. The glass should be left with no residue and be clear in appearance, dry with no clouding evidence of coating. To prevent excess REFORAC Glass primer being applied, the surface of the glass should be clear. Excess primer, manifesting itself in haziness of the glass, should be



Figure 2. Reforac UPPER BOND Glass primer.

removed by wiping with a clean cloth until the glass is clear. Tape should not be applied to the glass when there is evidence of excess primer. The glass panels are almost always double-glazed units and during manufacture silicone or other materials are used as a sealing agent. Any surface contamination of the glass with silicone has to be removed thoroughly follow guidelines from the manufacturer of the glass sealant for cleaning and removal.

The Reforac UPPER BOND Glass Primer should not be applied until any contamination of the glass by the sealant is completely removed. Glass which is untreated is hydrophilic, which means it has an affinity to water and moisture. In climates where there is high humidity or high levels of rainfall and the structural glazing will be subjected to high levels of water contact, then the glass should be treated with Reforac UPPER BOND Glass Primer. If moisture gets between the glass and the tape then the adhesion of the tape can be undermined, weakening the bond, which can lead to adhesive failure. Reforac UPPER BOND Glass Primer acts as a moisture and humidity repellent and prevents a film of moisture forming between the glass and the tape.

SURFACE PREPARATION OF THE FRAMES

In structural glazing, aluminium is by far the most common framing material. There is wide variance in the grades of aluminium and in the different treatments and finishes of the metal. Raw, untreated, mill grade aluminium oxidizes readily and the oxidized layer acts as a barrier and prevents good adhesion. Invariably, structural glazing aluminium frames are treated either: they are anodized or painted, using mainly powder coating paints.

A. Abrasion of Painted Surfaces.

Many powder coated and epoxy paints are low surface energy and are difficult to bond to. If the surface of the paint is abraded using a fine grit abrasive with a rotary motion this will improve the adhesion level. When a surface is abraded, the scratching and rough finish to the surface increase the bond because it increases the surface area giving a finish that Reforac UPPER BOND Structural Bonding tape will key into with better adhesive "wet out".

An orbital hand sander is recommended with a fine 320 grit abrasive being used. The abraded area should only be where the tape is going to be applied and a "no residue" quality masking tape should be used to protect the area of the frame not being abraded. Once the abrading process is complete, thorough cleaning is required. All loose particles of paint and metal grit have to be removed in the cleaning process. The same processes and steps have to be taken as previously mentioned in the cleaning of glass. Often metal profiles have an oil or grease coating as an additional protection. If this is the case, this has to be removed using a high grade degreasing compound. After this, there has to be thorough cleaning using Reforac UPPER BOND Glass Cleaner.



Figure 8. Reforac UPPER BOND Primer 10.

B. Priming

To achieve a very strong bond on low surface energy substrates, it is advisable to use a primer. Reforac UPPER BOND Primer 10 will ensure a very high level of adhesion and a strong bond. Painted frame profiles, and coated glass, should be primed to facilitate the best adhesion levels. The primer should be applied in a thin coating - it can be applied either by brush or a hand held dispenser.

The coating should be even and uniform and areas of excessive coating should be avoided. The primer should be allowed to flash off/evaporate leaving a dry film. Once this has taken place, the tape should be applied as soon as possible to prevent the treated area being contaminated by any airborne particles.

TAPE WIDTH CALCULATION

The required width of the tape can be calculated by using one or two calculations (based on the design of the structural glazing system). If the panel has static support included as part of the design of the framing system, then a dynamic load calculation is all that is required to determine the width of tape required. If static support is not part of the framing system then a static load calculation must also be carried out, and the calculation which produces the greatest width is the one to use.

DYNAMIC LOADS

The amount of tape that is required is dependent on three factors:

1. The size of the glass panel.
2. The wind load requirement for the building.
3. The strength of the tape.

The IEC (International Electrotechnical Commission) requirement for wind force is 2.4 kPa

Reforac UPPER BOND 7200G dynamic shear value is 519 kPa.

A safety factor of 6 is built into the calculation, therefore a figure of 86.5 kPa is used for the dynamic shear value of the tape.

The calculation is:

$0.5 \times \text{short length (mm)} \times \text{wind force}$ divided by shear value of the tape.

So for a panel 1400 mm x 1200 mm the calculation would be:
 $(0.5 \times 1200 \times 2.4) / 86.5 = 16.64$

Round the answer up to the nearest whole number, then for added safety take the measurement to the nearest number divisible by 5. **The answer in this case is 20 mm.**

STATIC LOADS

A design strength guideline for the tape of 25 psi (1.75 x 10⁻⁴ kg/mm²) can be used in static load calculations. This equates to 55 cm² of tape per 1 kg of weight.

The calculation is:

Panel weight (kg) divided by (perimeter in mm x design strength)

So for a panel 1400 mm x 1200 mm with a weight of 12 kg/m² the calculation would be:
 $(1.4 \times 1.2) \times 12 \text{ kg/m}^2 / 2 \times (1400 + 1200) \times 0.000175 = 22.15$

Again, the answer should be rounded up to the nearest 5 mm which comes out at 25 mm.

CONCLUSION:

For a panel with static support built in, a tape width of 20 mm can be used. For a panel without static support a tape width of 25 mm should be used.

APPLYING REFORAC UPPER BOND STRUCTURAL BONDING TAPE

The tape can be applied to either the glass or the frame dependant on what the preference of the fabricator is. If the tape will be visible on the glass then it is advisable to apply the tape to the glass first. This will minimize air being trapped and bubbles of air being visible. Applying the tape to the frame has advantages when the tape is not visible on the glass. Care should be taken to avoid touching the surface of the tape and the tape should be held on the edges.

Any hand contact on the surface of the tape will cause contamination and impair the performance of the tape. The tape should be laid onto the glass starting at the corners and aligned with the edge of the glass. As the tape is placed onto the glass, pressure should be applied to avoid air being trapped. A rubber roller is the ideal tool for applying pressure to the tape. The pressure can be applied evenly along the plane of the tape along the entire length of the glass unit. It is recommended that the tape when applied to the glass should have a small amount overlapping the glass. The tape can be butted together at the corners, or a mitre joint can be cut in the tape in the corners. When butted together, the tape will fuse to itself giving a water tight seal. When the tape has been applied to the glass unit completely, additional pressure should be applied with

TAPE WIDTH CALCULATION

Dynamic loads (kPa)

Windload	3,5	15	15	15	20	20	25	25	30	30	35
	3,4	10	15	15	20	20	20	25	30	30	30
	3,3	10	15	15	20	20	20	25	25	30	30
	3,2	10	15	15	15	20	20	25	25	30	30
	3,1	10	15	15	15	20	20	25	25	30	30
	3,0	10	15	15	15	20	20	25	25	25	30
	2,9	10	15	15	15	20	20	25	25	25	30
	2,8	10	10	15	15	15	20	20	25	25	25
	2,7	10	10	15	15	15	20	20	25	25	25
	2,6	10	10	15	15	15	20	20	20	25	25
	2,5	10	10	15	15	15	15	20	20	25	25
	2,4	10	10	10	15	15	15	20	20	20	25
	2,3	10	10	10	15	15	15	20	20	20	20
	2,2	10	10	10	15	15	15	20	20	20	20
	2,1	10	10	10	10	15	15	15	20	20	20
2,0	10	10	10	10	15	15	15	20	20	20	
1,9	10	10	10	10	10	15	15	15	20	20	
1,8	10	10	10	10	10	15	15	15	15	20	
1,7	5	10	10	10	10	10	15	15	15	15	
1,6	5	10	10	10	10	10	15	15	15	15	
1,5	5	10	10	10	10	10	15	15	15	15	
	500	600	700	800	900	1.000	1.200	1.300	1.400	1.500	
	Short length of panel										

Table showing width of tape required for given wind load. (2.4 is IEC Requirement)

a roller. A firm hand pressure is sufficient to facilitate a good adhesive "wet out" and a strong bond.

JOINING AND CUTTING THE TAPE

When cutting acrylic foam tape a sharp blade should be used to avoid dragging the visco-elastic foam. The best form of joining the tape at the corners is to employ a mitre joining cut making sure that the tape from each side is in contact with the other ensuring that the tape fuses together. The thickness of Reforac UPPER BOND Structural Bonding Tape, 2 mm thick, permits plenty of surface contact with both pieces of tape permitting the tape to fuse together in both a 45° mitre, or in the case of two ends of the tape in a 90° butt joint. It is important that when the tape is applied to either the frame or the glass, that it is fixed precisely and in proper alignment with the edge of the glass or frame, and on the treated areas, either the primed or abraded surface area. It is important that a gap is left between the edge of the glass and the deadload support lip in the frame profile, this will leave enough room for an approved weather sealant like Reforac 400 to be applied around the perimeter of the frame. To help with proper



Figure 3. Application with tape applicator.



Figure 4. Application by hand.

spacing and alignment, shims of the correct thickness can be placed to support the glass in the correct position to give the correct space for the sealants. When the glass and the frame have been bonded together, to finish the bonding process, pressure should be applied around the complete perimeter of the glazing unit. A pressure of 15 psi or 1 kg/cm² should be applied along the full plane of the tape ensuring optimum surface contact on the tape.

WEATHER SEALANT APPLICATION WITH REFORAC 400

To finish the glazing unit, a weather seal like Reforac 400 should be applied to effect a complete seal around the glass, the sealant should be a non-acidic silicone. The weather seal can be applied immediately after the glazing unit has had the final pressure treatment. Acetoxy (acid curing) silicones should be avoided. A high grade fine-line masking tape can be applied to the glass to give a clean edge to the sealant to give a good finish to the weather seal.

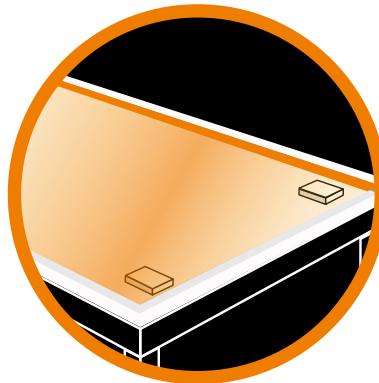


Figure 6. Overlap of tape at the corner.



Figure 10. Corner finishing with pressure towards the splice from both sides.



Figure 7. Overlap of tape at the corner.



Figure 9. Mitre cut makes sure the tape from each side is in contact with the other.



Figure 5. Firm hand pressure with the roller facilitates a strong bond.

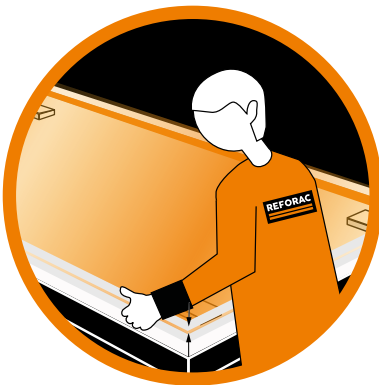
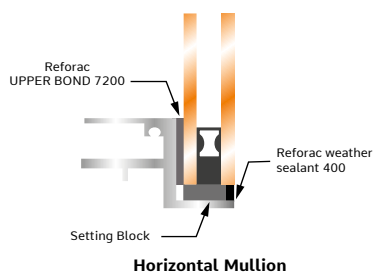
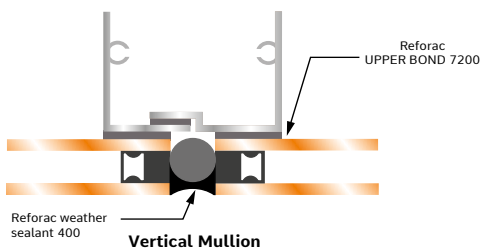


Figure 11 and 12. Bonded frame and application of Reforac 400 weatherseal.



Unless stated otherwise all values given are average. All of the tapes in our range should be thoroughly tested on the substrates in the particular application they are intended for. REFORAC will not be responsible for product failure unless full testing has been completed. The customer has to decide on the tapes suitability for the intended application.



DISCLAIMER:

The contents of this technical guide are purely of general nature and are not subject to any guarantee. Therefore, the above recommendations should be adapted to the materials used and to the specific environmental conditions. This information, based on our expertise and tests, is believed to be reliable and is given in good faith, but without warranty. We cannot accept liability for any

damage, loss, accident, and patent infringement or for operations not under our direct control resulting from the use of this information. We recommend that purchasers carry out their own tests, to determine to their own satisfaction, the suitability of any product for their particular purpose. As this product is used outside of our control, we cannot accept liability for any loss or damage whatsoever.