Technibond

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Glazing Tapes for Infill Door Panels

Introduction

Technibond supply a number of double sided tapes to the **Infill Door Panel Industry**. These tapes are used for glazing sealed glass units into the door, where they perform a bonding and sealing function between the glass and the inside of the door skin.

It is important to recognize that the foam core of the door panel only partly supports the glass unit, and the tape does support most of the weight of the glass. As glass units have become heavier through increased size and the addition of decorative lead and bevel effects, this aspect of performance has become even more important. In addition, the moulded door skin is rarely completely flat, and the tape needs sufficient strength to hold this semi-rigid material in place.

Tapes that are used for this application need good shear adhesive strength to the inside of the door skin, plus good weathering and long-term performance. In the case of woodgrain effect doors, the tape also needs good performance at high temperatures, as these doors can heat up to 80°C in direct sun. This causes thermal movement and distortion of the door. It is also important that the tape is of the correct thickness, to adequately fill the space between the glass and door skin, to absorb this thermal distortion, and sometimes to provide a recess for a silicone mastic.

Finally, a white colour is generally preferred on white doors, and a black colour on woodgrain doors. This industry has suffered a significant number of glazing failures in the past, especially on woodgrain doors. Many of the failures have been due to poor vacuum forming or poor assembly, but some have been caused by the wrong choice of tape.

Many tapes do not have sufficient shear adhesion strength or high temperature performance for this robust application, and this is especially true of the cheaper double-sided tapes. Using the correct grade of tape, these doors can be glazed completely satisfactorily.

Tape Testing

We tested the performance of three of our most popular tapes for this application, **HPA**, **HDP***, and **HSA**, to a variety of commercially available door skins.

We obtained samples of white and woodgrain materials, mostly in PVC, and we tested the white versions of our tapes to the white plastics, and our black versions to the woodgrain plastics. In all cases we tested to the inside surface of the door skin, not to the decorative outside. We tested the tapes for both peel adhesion and shear adhesion.

Peel adhesion measures a cleavage bond strength, but shear is a better long-term test as this is more representative of the weight loading support function expected of these bonding tapes.

* The **HDP** product is supplied with a quality paper liner. It is also available with a *production aid film liner*, and is referred to as **HDF**. Both products have identical bonding properties.

Test Results

In all these tests the door skin material was tested as received, with no cleaning, as we are aware that cleaning is often not carried out. We also investigated the effect of cleaning on shear strength, using a single wipe with a tissue moistened with iso-propanol (propan-2-ol). We also subjectively assessed the roughness of the door skin surface, as there were clear differences between the different materials, which would be expected to influence the results.

Peel Adhesion Results

Door Skin	Roughness	Peel Adhesion (N/25mm)		
		HPAF 1.6mm	HSA 1.6mm	HDP 2mm
White PVC (1	Rough	10.4	7.3	9.3
White PVC (2)	Rough	23.0 *	12.1	13.4
White PVC (3)	Smooth	25.0 *	18.0	15.3
White PVC (4)	Medium	23.5 *	14.0 *	16.4 *
White PVC (5)	Rough			20.8
White PVC (6)	Smooth			21.7
Woodgrain PVC	Rough	14.1	12.7	12.7
Woodgrain Polycarb	Smooth			19.2
Woodgrain ABS (1)	Rough	10.3	9.3	25.3
Woodgrain ABS (2)	Rough			21.1

* *These samples failed by foam tear, indicating that the adhesive strength was higher than this but the foam core split, limiting the result.*

Shear Adhesion Results

Door Skin	Shear Adhesion @ 30N/625mm^2 / Hours			
	HPAF 1.6mm	HSA 1.6mm	HDP 2mm	HDP 2mm (*after cleaning*)
White PVC (1)	0.6	4.8	6.4	7.3
White PVC (2)	0.5	10.8	7.2	31.0
White PVC (3)	1.2	2.3	23.7	68.1
White PVC (4)	1.4	22.6	26.8	39.7
White PVC (5)			7.5	25.4
White PVC (6)			10.8	15.1
Woodgrain PVC	0.4	2.3	2.5	4.1
Woodgrain Polycarb			8.1	12.5
Woodgrain ABS (1)	0.2	1.4	6.5	10.0
Woodgrain ABS (2)			21.1	34.0

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Comments

From the overall adhesion results, several comments can be made. There is a large difference between the various PVC door skins, which cannot be accounted for by surface roughness alone, and is likely to be due to the actual PVC formulation.

This matches our experience with extruded PVC in other industries, where significant differences in adhesion between different grades of PVC have been found. Looking at the tapes, overall our **HPA** (*High Peel Acrylic*) gave the best peel adhesion result, followed by **HSA** and **HDP,** (both high shear adhesive products) which were similar to one another. This is much as one would expected.

Our **HPA** is a modified acrylic, which is designed to give high bond strengths, especially to more difficult surfaces. **HSA** and **HDP** are pure acrylics, which will show advantages in the longer term, but generally give slightly lower initial peel adhesion results.

All results with **HDP** were, however, satisfactory. The results with woodgrain and white were similar to one another.

The shear results are even more interesting. Comparing the different door skins, the correlation between the shear and peel adhesion result is close to zero, indicating that these results are independent of one another. The two lowest results on peel adhesion were also the lowest two on shear, however, suggesting that some grades of PVC might give poor results overall.

There appears to be some correlation between shear adhesion results and the smoothness of the surface, especially for the cleaned surfaces.

This effect does not account for all the differences between the different skins, so the grade of material again has a large effect. In contrast to the shear adhesion results, however **HPA** gave the poorest shear results, **HSA** gave much better results, and **HDP** gave the best results.

We strongly believe that in an application such as this, shear adhesive strength is a more important property than peel adhesive strength, so on balance, the much higher shear strength of **HDP** more than compensates for its slightly lower peel adhesion.

We would expect **HPA,** our modified acrylic, to give the lowest shear result, as this is the inevitable result of improving the adhesive strength. Our pure acrylics show dramatic improvements, and our **HDP** is significantly better than our **HSA**, which shows that not all pure acrylics are the same.

Technibond HDP was developed to give improved results compared to existing products, and it features an improved adhesive and a much stronger foam than comparable products. These results confirm the improvement and demonstrate its validity in this particular application.

There is no evidence from these results that the woodgrain gives poorer results than the white skins.

Cleaning = Improved Results

Cleaning, in all cases, improved the shear results, typically by 50% but in some cases by up to 400%, and would of course give better standardization of results. On this evidence we would definitely recommend cleaning as a routine measure.

See Page 9 for additional information on cleaning

Other features of HDP

We have performed extensive testing of our **HDP** product for other glazing applications (*see our Georgian Bar report*). During this testing we subjected the product to weathering and thermal cycling to test its long-term performance in outdoor conditions, and its resistance to thermal movements.

Weathering tests were performed in our QUV Weatherometer over a period of months (equivalent to many years under natural conditions). We used a test cycle of 8 hours hot condensation and 16 hours UV light to reproduce natural weathering. No failures or other negative effects were found, showing that the tape withstands severe weathering conditions.

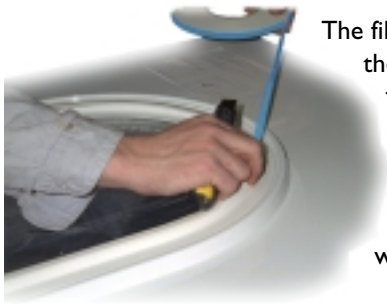
Thermal cycling was performed in a laboratory oven, using a temperature range up to 70°C, with 3 cycles / day for 2 weeks. Again, no problems or failures were found, showing that the tape withstands the movement caused by thermal expansion and contraction. Other tapes failed this test quite quickly.

The combination of a pure acrylic adhesive with a closed-cell polyethylene foam gives a product of great stability, strength and long term environmental resistance.

There are several other features of our **HDP** that make it unique. The foam has been specially developed to give high strength and high elasticity. It is typically 50% stronger than similar competitive foams, to withstand the shocks of a door being slammed shut.

The foam is a true 2mm thick foam for improved gap-filling compared to 1.6mm foams, which we believe adds security to the application. When woodgrain doors heat up in the sun, the outside skin expands while the inner one does not, so the door warps slightly. A 2mm tape will take up this warping more effectively than a thinner tape. The same **HDP** product is available in black and white versions for woodgrain and white doors respectively.

The **HDP** product is also available with our production aid film liner (referred to as **Technibond HDF**) which adds two further benefits:



The film gives the product flexibility to allow it to be fed around curves without wrinkling.

The film also allows the glass unit to be positioned accurately on the door skin Once correctly aligned, the film is simply pulled out from between the two surfaces

Competitive Products

Most of our competitors' products are modified acrylics, usually with a much lower shear adhesion strength than even our **HPA**, which itself is much lower than the performance of our **HDP** product; and we believe this to be a potential cause of failure. Some of these products appear very "*sticky*" to the touch, which is characteristic of low shear products. Most of these products use a much weaker foam than our **HDP**, and generally they do not have the same environmental resistance.

Some competitive products are based on PVC rather than polyethylene foam, which has problems of its own. PVC foams are usually used for sealing rather than bonding purposes. They are a mixture of PVC, fillers and plasticizers, and the material is not always well controlled.

The plasticizer has inherent problems, as it will migrate into the adhesive, reducing the shear performance further. This effect increases with time, giving a gradual deterioration of performance. Also, white PVC foams are not a very pure white colour, and may discolour with time.

Conclusions and Recommendations

1) We recommend **Technibond 2mm HDP** for this application, as it gives the best performance in shear plus good peel adhesion to a wide range of typical door skin materials. It has good temperature resistance and has been tested in our QUV Weatherometer to show that it will resist outdoor weathering.

2) We also recommend cleaning the door skin before application of the tape, as this procedure significantly improves all results.

3) There is a very large difference between different grades of PVC door skin, which may account for some problems in the field.

4) The moulds used for vacuum forming the door skins are often sandblasted, which gives a texture to the inside of the skin, mirroring the surface of the mould. It would be preferable to reduce this texture as much as possible, but it does not appear to be the major contributor to performance.

5) There is no evidence that woodgrain skins give poorer adhesive performance than white skins, so the reported failures of these doors is due to environmental conditions, probably heat, which causes thermal movement and reduces the adhesive strength. **HDP** with its pure acrylic adhesive will give the best performance in this situation.

Application Guidance

This is a guide to the correct use of the **Technibond** products when bonding plastic, metal or wood to glass.

Technibond HDF PE Foam product with **PURE Acrylic Adhesive** is now approved by many of the larger Window Systems companies.

HDF 1mm thick (White or Black)
2mm thick (White or Black)

HDF is supplied with a ***Production Aid Film Liner.*** **HDP** is supplied with a crisp, easy to remove paper liner. *(Same basic products but with different release liners - hereafter for simplicity sakes, it is referred to as* **HDF***, but bonding performance for both references are identical)*

PURE Acrylic Adhesives

This adhesive if applied correctly, will perform well in exposed environmental conditions for many years. However, it is a very dry and hard adhesive hence its good high shear bonding capability, as it does take time to fully adhere.

Once correctly bonded, the **HDF** adhesive will perform in external conditions for many years without degradation. However, under constant peel conditions they can, in time, release their bond from the applied substrate. It is therefore, important to apply the tape to flat, smooth surfaces and avoid any bowing or distortion in the sheet materials

Correct Application

T. C. P. T.

Time *Clean* *Pressure* *Temperature*

Time

Pure Acrylic adhesives take time to flow (wet out) and fully bond to the substrate. In cold conditions this will take longer than in warmer environments. Preferably, allow at least 4 hours to rest and condition before using in the final application.
Best results will be obtained after 24 hours.

Clean

To ensure a full adhesive contact, all surfaces must be clean and dust free and any oil residues should be removed with an Isopropanol wipe.

See our recommendations on Page 9

Also, be aware of condensation factors, especially in high humidity conditions – a dry clean cloth can be used to clean surfaces.

Pressure

These products are '*pressure sensitive*' and overall pressure must be applied to ensure that the adhesive has made full contact with the receiving surface

Be aware that the tape should be able to compress to allow the adhesive make full contact with the receiving surface

Temperature

For the adhesive to perform correctly, the tape must be applied in temperatures above 15°C. The ideal temperature is between 20- 25°C

In cool conditions (below 15°C) the adhesive does not quickly flow and 'wet out' to form a high initial bond, so increased pressure and time should be allowed. In colder conditions (below 10°C) the adhesive may not give satisfactory results.

For best results, ensure both the tape and the application surfaces are kept in warm conditions – be aware of the cold '*Monday morning - opening up*' conditions.

Expansion and Contraction Factors

The effect of these movement factors, especially in constant varying temperature conditions, can be considerable. Fortunately, the extensible PE Foam carrier does, to some extent, compensate for these differential movement factors.

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Full Surface Contact

Full, flat overall contact must be made with the both surfaces. If there is any distortion in the skin or glass unit, a peel force may be created which will eventually result in bond failure. No matter how many times the two surfaces are pushed back together, the peel force will continue to open up the bond.

Difficult Surfaces

Glass, PVCu and most Metals are '***high energy surfaces***' and are normally good substrates for high quality adhesion

Plastics such as Polyester (Pe), Polypropylene (Pp), Polyurethane (Pu), and Nylon are '***low energy surfaces***' and can be difficult to form good adhesion. We have alternative adhesive systems bonding to these problem plastics.

Storage

To keep the tape in good condition, keep in its original carton, upright and in warm conditions until required for use.
If the tape is already applied to the door skin - bring into a warm work area 24 hours before use.

Availability

Rolls Slit to any width
normally in 50 metres length rolls

Pads Any size, available with
Butt edges or Fingerlift liners

Sheets Any dimension

Diecuts Any shape to match components

Bobbins Long length rolls (1000+ metres)

Technical Support

Please contact either our Technical Department or one of our Technical Sales Team for further details on product availability and advice on your particular application requirements.

Technical Support can be reached on :

Tel : 01628 642800

Fax : 01628 642801

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Technibond Ltd, Millboard Road
Bourne End, Bucks., SL8 5XD

The bonding tape has to support heavy glazed units for the operational life of the door.

Panel with curved top section which may require specially Diecut pieces for ease of assembly.

Technibond Recommends....Cleaning

Clean surfaces are one of the most important factors in achieving good adhesion results. This is because adhesion is a surface attraction, so any contamination of the surface affects the bond. The adhesive is likely to stick to the contaminant but not to the surface below, and the contaminant is not normally bonded firmly to the surface.

We have made hundreds of investigations in our lab in the course of our technical service work over the last few years, and we have found that most materials are contaminated to some extent and do respond to cleaning.

The commonest contaminants are dust, general dirt, water, fingerprints and mould release agents. In addition, metals are often contaminated by oil or grease, plastics are often contaminated by processing additives and modifiers that migrate to the surface, and rubbers may be dusted with talc.

Some contaminants can be removed or reduced by wiping with a dry or wet cloth, but most require more aggressive cleaning for best results. The following options are available:

Abrasion usually causes more problems than it solves and we do not recommend it.

Water based cleaners, such as domestic spray and cream cleaners are very safe and can be quite effective, but these products contain detergents which are highly surface active. They require removal by washing with clean water, then drying with a clean dry cloth. Cream cleaners can be difficult to remove properly so we do not recommend them.

Solvent cleaners are very effective but should be used with care after reading the appropriate Health and Safety data sheet and assessing the hazard. Also, check that the solvent will not affect the material being cleaned.

We recommend two cleaners, **Isopropanol** and **DE-SOLV-IT 1000FD**, as these solvents are relatively gentle, non-hazardous and do not leave a deposit. **Isopropanol** will flash off quickly, is a good general purpose cleaner for light contamination, but is rated "highly flammable". We have not found any substrates adversely affected by brief contact with **Isopropanol**.

De-Solv-IT 1000FD is a stronger solvent more suitable for heavy contamination and for oils and greases, and still relatively non-hazardous.

It is also quite effective at removing adhesive residues, but many of our adhesives are solvent resistant and require soaking for some time. This product is rated "flammable", and flashes off slightly more slowly than isopropanol. It is compatible with most surfaces.

Water/alcohol mixtures are sometimes used, and while better than nothing, we have not found these products very effective, and they are slow drying.

White spirit - not recommended as it can leave a greasy residue.

Proprietary cleaners vary widely so we cannot make general comment, but we will evaluate any widely used cleaners that customers wish to use.

Use of Solvent Cleaners

All solvent cleaners should be used in well ventilated areas with rubber gloves to avoid repeated skin contact. See the appropriate health and safety data sheet. We recommend ordinary white tissues (e.g. Kleenex) wetted with isopropanol or de-solv-it 1000FD and wiped once across the surface. If the tissue is visibly soiled, a second wipe with a fresh tissue may be required. A dry wipe is not necessary, but the solvent must be given time to flash off; isopropanol will only take a few seconds.

Rough surfaces may abrade paper tissues leaving fibres on the surface, in which case a disposable nonwoven or cloth must be used.

Cold conditions or high humidity may cause the evaporation of the solvent which could chill the surface and may even cause condensation.

Sources of Solvent Cleaners

Isopropanol is also known as iso-propyl alcohol, propan-2-ol, IPA, IPS. It is no longer available over the counter but can be bought from virtually all chemical suppliers. Request the "pure" grade, which is 99.5% pure.

DE-SOLV-IT 1000FD is made by:

Mykal Industries Ltd
Farnsworth House
Morris Close
Park Farm Ind Estate
Wellingborough
Northants
NN8 6XF 01933 402822

It is available as liquid, as impregnated tissues (Myquip high performance wipes) and as an aerosol (fast dry precision cleaner). Contact the company for details of a local distributor.

ISO 9001
Certificate Number FM 12158

Application Reports

Report Title

Bonding Glazed Units in Infill Door Panels

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Introduction

We have prepared this report to demonstrate the ability of the **Technibond** **HDF**, **HDP** and **HPAF** products for bonding glazed units in Infill Door Panels and Composite Doors.

It contains results of tests made in our own laboratories specific to this application sector, and results of tests made for similar outdoor applications,

HDP and **HDF** are the tapes we recommend for this application. Both use the highest specification crosslinked Pure Acrylic adhesive, capable of passing the established motor industry tests for mounting exterior badges and body side mouldings.

The high quality PURE Acrylic adhesive is coated on a special crosslinked PE foam that is very flexible to ensure good gap-filling between the glazed units and the door skin, but which has improved strength over other similar products to provide an extremely strong bond. This construction gives the most reliable results in this application with high shear bond strength, UV resistance and weathering.

HDF is also provided with our '*production aid film liner*,' which allows accurate location of the glazed units before exposing the adhesive to form the bond. The film liner also allows the tape to be applied around curved apertures for easy application.

As with all our tests, we have tried to make them as realistic of actual end use conditions as possible.

January 2000