Automotive Structural Bonding Tape

Technical Bulletin February 2006

Best practices for use in glazing applications

Introduction:

This bulletin is intended to describe “best practice” application / processing at customer locations for heat curable, 3M™ Structural Bonding Tapes (SBT) # 9214 and # 9270 used as custom pre-cut tape pads for permanent attachment of metal and plastic fittings to automotive glass substrates. Examples are “buttons” for rear view mirrors and “brackets” for rain, light, and condensation sensors.

3M™ SBT # 9263 is used exclusively for pre-taped mirror button assemblies as supplied by 3M in the USA to their North American customers. SBT # 9263 is therefore not normally available to European customers. However in the past and because of the geographical needs and circumstances of certain OEM / Tier suppliers, some programs using # 9263 have been supplied via the 3M European sales & marketing organisation.

Summary:

This bulletin assumes that a 3M manufacturing site converts SBT master rolls into pre-cut, pre-spaced weeded pads, usually on the original liner and as a roll to the desired length for application within a specified customer process. Tape pads supplied to customers in this format enables the product to be applied in many different situations and environments allowing maximum process flexibility with superior field performance.

The information contained herein has been compiled from European sources and is intended as a general processing guide to supplement existing data sheets and bulletins. Although most applications will conform to this guide, product and process suitability should always be verified as there will always be exceptions to the rule which may require special or even unique solutions! Additional information regarding the properties of components and glass substrates has also been included for those unfamiliar with automotive glass processing.
Processing:

1. Delivery of pre-cut SBT parts to customer locations

- **Guarantee**
  The 3M manufacturing plant that converts jumbo materials into roll goods will give a guarantee of 6 months from date of delivery to the customer but only if those roll goods are stored at the customer location according to the recommended storage conditions (see below).

- **Expiry / best before date**
  The customer is strongly advised to use SBT materials on a “first in - first out” basis and of course before the expiry date, more often called best before (BB) date, clearly printed on the roll cores and packaging and to be stored at 3M recommended conditions.

- **Recommended storage conditions**
  Structural bonding tapes are sensitive to temperature / humidity and will gradually lose curing abilities of the active components with a consequent reduction in performance characteristics.

  - Delivered roll goods must be stored at < 5°C in a suitable refrigerator / refrigerated room to comply with the 6 month shelf life guarantee.
  
  - Materials stored at > 5°C up to and including ambient conditions will allow only three months of guaranteed shelf life from date of delivery.

2. Typical substrate materials used with 3M™ SBT applications

- **Mirror buttons**
  Powder metallurgy (P/M) technologies are used to manufacture a wide range of small, intricate parts with high strength for a variety of automotive applications including mirror buttons.

Numerous types and combinations of powder metal granules can be compressed together with lubricants under conditions of heat and pressure within moulds or dies to form alloy parts. Sintering of these formed parts takes place via a diffusion process to eliminate the lubricants and increase the integral strength, which can be enhanced by controlled shrinkage using a heat treatment process and further by surface finishing.
Plain sintered steel and stainless steel buttons are the most common types used but are porous and may be susceptible to humidity influences. Sand blasted sintered stainless steel buttons provide a larger surface area for improved adhesion with many bonding systems. Steel types can be organically coated (black) to avoid corrosion.

More recently, inorganic chemical treatments and organic coatings result in buttons with a dark grey/black appearance and becoming popular with increasing numbers of OEMs. These coatings make the button less susceptible to the effects of humidity / water absorption before and during application.

- **Brackets** - Aluminium die-castings, sintered metal alloys, injection molded PA or PBT rigid plastic parts, being significantly larger than mirror buttons are often pre-shaped to match the windshield curvature. Because of shapes, tolerances and lower volumes, off-line attachment of SBT to the substrate is usually preferred.

- **Glass and Glazing**

  - Glass properties – typical upper limit glass transition temperature for soda/lime float glass is around 550°C. At around 600°C the glass may be termed as visco-plastic becoming soft enough to bend into various shapes for automotive glazing. Glass may be annealed to become more amorphous or tempered to become more crystalline thus providing varying degrees of strength and breakage properties depending on the glazing application requirement.

  - PVB interlayer films – Poly-(vinylbutyral) film sheeting has been available for around 70 years and is the most common material used as the bonding medium for laminated glazing constructions. PVB is a tough, elastic material, providing excellent impact performance properties after curing in laminated glazing constructions which is crucial to fulfilling global windshield regulations.
Low temperature processing of infrared reflecting (IRR) interlayer films. When metal coated IRR interlayer films* such as Southwall XIR<sup>TM</sup>, are used in glazing constructions, the temperature during autoclave processing is typically around 125°C. 3M<sup>TM</sup> SBT # 9270 may be processed at lower temperatures and in such cases preferable to # 9214 / 9263.

*3M<sup>TM</sup> Solar Reflecting Film (SRF1100) – a non-metallic IRR interlayer film may be processed with all three SBT types at higher temperatures up to 145°C.

Black printed ceramic frit

During the heat curing process SBT changes from black to a peppery grey colour. This generally undesirable colour needs to be hidden behind an opaque black “frit” which is screen printed as a ceramic paste directly to # 2 and / or # 4 glass surfaces for cosmetic and design reasons.

The example pictured above shows part of the printed frit for a combination mirror housing (mirror mount, light sensor and rain sensor). The frit is initially oven dried using either UV or IR radiant lamps and later on becomes fully cured or “fired” at temperatures around 600°C during the glass bending process. Whether the SBT is to be attached to plain glass or to the printed frit on # 4 glass surface, both provide a keyed surface for excellent bonding.

Glazing geometry
- **Windshield cross curvature** – the arc curvature when a straight line drawn from the top edge to the bottom edge of a windshield glazing and is the dimension in mm of the resulting gap

- **Windshield main curvature** – the radius of the windshield in mm when measured from left to right not including the “side wings” which are usually of a smaller and thus different radius

  ✓ Compensation of circular mirror buttons to match the glazing curvature is not usually necessary but as the diameter increases >25mm or the area increases >500mm² or the glazing curvature becomes more extreme, shaping of the button to compensate may become necessary

  ✓ Rectangular mirror buttons for which the longest side is bonded to the windshield in a vertical direction (cross curvature), compensation is not usually needed

  ✓ Brackets are typically larger rectangular shapes into which the sensor unit is clipped in place. Continuous loads of up to 40N can be exerted on the bracket and may mean that some shaping is needed to match the windshield curvature

  ✓ The button / bracket supplier should ideally manufacture the castings with a “crowned” radius slightly smaller than the glazing. Alternatively using a thicker calliper 3M™ SBT such as # 9263 or # 9270 may achieve better surface contact (see also tips for improving wet out)

  ✓ The use of # 9270 for mirror buttons and brackets which is good for sintered stainless steel parts may not always be satisfactory with aluminium bracket castings and may cause some de-wetting effects due to the different coefficients of expansion

3. **Preparation of components before use**

   - **Cleaning of sinter metal buttons and brackets**
     Generally, a cleaning operation for plain or sandblasted sintered stainless steel buttons / brackets before application to the SBT is not necessary and even the major suppliers of sinter metal buttons do not usually recommend cleaning.

     If under exceptional circumstance a cleaning operation must be used, then only with buttons which are coated, such as the black chromated, stainless steel types making them impervious to the influences of humidity. Isopropyl alcohol should be the preferred solvent drying the buttons for at least 4 hours at 120°C before use.

   - **Cleaning of aluminium bracket castings**
     Consult with vendor or run internal trials to determine suitability
• **Conditioning of SBT roll goods**
  After removal from cold storage and before use, the SBT materials should be allowed time to condition to ambient temperature in the original sealed packaging to avoid water condensation on the adhesive surface. The time involved will depend on the mass of the stock taken from cold storage.

  After use / re-use, the remaining SBT materials must be re-placed in closable polybags and returned immediately to the refrigerator.

  In many cases laminated glazing parts will already be above ambient temperature due to previous processes which use heat to create a the initial bonding of the PVB interlayer(s) to the glass.

4. **Application processes**

• **Manual processes for application of pre-cut 3M™ SBT to mirror buttons**

  For low volume applications, a manual application using jigs or templates for accuracy and repeatability, wound on to a reel or magazine, may be of advantage for batch processing at Tier 2 or 3 supplier/converters.

  ![Image](# 11-Fiat manuale in rotolo.mpg)

• **Semi-automatic processes for application of 3M™ SBT to mirror buttons**

  Sintered steel buttons may be applied to windshields in a number of process steps in-line or off-line using equipment of the type shown at right.

  The buttons are fed from a hopper and stacked into a conveyer. The pre-cut pads are simultaneously fed towards the application head usually as a continuous roll and at pre-determined intervals. The pre-cut pads and the buttons are mated together at the application head using controlled pressure sometimes using a heated platen.

  To aid smooth removal of the taped mirror button, the liner, is reversed over a specially designed shoe and simply displaced onto a conveyer.
Finally, the taped mirror button is transported by a conveyor and applied to the glazing in a further on-line process using fully automatic application equipment.

- **Fully-automatic processes for application of 3M™ SBT to mirror buttons and taped mirror button assemblies to windshields**

In most cases a fully automatic in-line process is the preferred process by the glass manufacturers to increase productivity and lower manufacturing costs. Unless pre-taped buttons are purchased externally already loaded for use on reels or in magazines the processes described previously for semi-automatic applications will be the first part of a fully integrated automatic process.

In-line mirror button applications on glass substrates are often made directly after the nip roll lamination /de-airing process where the temperature of the glass surface is between 80 - 90°C. Multi-axial robots are ideally suited to this kind of process. In a typical example the mirror buttons are fed to a position where the robot arm picks up the button from the conveyor and moves to a position where application of the button to the pre-cut SBT pad still attached to its release liner takes place.

The pre-cut SBT adhesive pads usually provided on a roll, are moved forward one at a time to a controlled pre-defined position using an LED /photo sensor where the robot arm then pressurizes the button to the pad and then lifts the mirror button /pad assembly away from the liner*. The robot arm then moves the mirror button assembly again into a controlled position just above the ceramic printed button frit
on the windshield and is applied with controlled pneumatic pressure to the glass. Application temperatures are typically between 80 – 90°C at the glass surface.

* In an actual case study, a change from 25mm diameter # 9214 (plaid paper liner) to 28mm diameter # 9270 (PET liner) caused some problems for the robot arm to remove the button/pad assembly cleanly away from the liner in a vertical direction without liner buckling and partial SBT lifting. This was mainly due to two factors:

1. PET liner is stiffer than paper and also has higher adhesion to the SBT
2. The 28mm diameter SBT pad has a higher adhesion because of its greater surface area than with the previous smaller diameter

It was not possible to change the machine parameters or redesign to allow the liner to move over a reverse roller at the moment of pick up and allow an easy release. The problem was solved by simultaneously replacing the # 9270 PET release liner at the 3M manufacturing source with a paper type release liner with inherently lower adhesion and stiffness similar to that of # 9214.

5. Curing of 3M™ SBT applied to mirror buttons on glass substrates

- **Autoclave curing process (on line batch process)**
  
  Autoclave processes used for laminated glass manufacture are almost perfect for curing SBT. Not only can the autoclave be held at a constant high temperature between 125–145°C for at least 30 minutes but can achieve pressures up to 13 bar enabling close to 100% wet out and cure of the taped button to the glass. This is a very important factor determining the final strength of the structural bond.

  Severe humidity ageing requirements included in some OEM specifications when using plain sinter metal buttons with # 9270 may show failures in spite of higher humidity resistance properties. Use of sandblasted sintered stainless steel buttons give a higher surface area for adhesion or black chromated buttons create a (humidity) barrier at the surface and have successfully passed very severe humidity tests. Such combinations of taped button are therefore preferred by many OEMs.

- **Fast oven curing process at elevated temperatures (off line batch process)**
  
  Under certain circumstances small, high power batch ovens may be needed where for example a converter or customer has no access to an autoclave / autoclave process. Usually the taped mirror button assembly is applied at ambient or room temperature (>23°C) to the glass substrate. In this case the 3M™ SBT is effectively being used as a pressure sensitive adhesive tape and it is imperative that the button assembly is sufficiently pressurised (> 5Kg/cm) to achieve a minimum surface contact (wet-out) before using the oven process to cure the adhesive for maximising the bond strength. It is to be expected that the final bond strength with this method will be slightly lower than with the autoclave process but still sufficient for most applications. Check carefully the customer requirements when using this application.
Ambient high humidity conditions during the fast curing process can negatively affect final cured adhesion leading to failures in certain humidity tests. Many fast curing trials have been tried out at European OEMs under high humidity conditions > 90%. Drying plain or sand blasted sintered (stainless) steel buttons in an oven before processing can be advantageous to prevent such issues. Alternatively using more recently introduced black chromated stainless steel types can improve adhesion values under most humidity ageing conditions.

<table>
<thead>
<tr>
<th>Typical minimum cure conditions (Either /or)</th>
<th># 9214</th>
<th># 9263</th>
<th># 9270</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min at 150°C</td>
<td>15 min at 150°C</td>
<td>20 min at 140°C</td>
<td></td>
</tr>
<tr>
<td>25 min at 140°C</td>
<td>25 min at 140°C</td>
<td>25 min at 130°C</td>
<td></td>
</tr>
</tbody>
</table>

- **Induction curing process (repair process)**

Originally developed for # 9214, this process is most frequently used for repair and for some after market applications where only single or limited numbers of buttons need to be considered.

After liner removal the mirror button assembly is placed in a matched holder (for any specific mirror button type), located in the application head which is integrated with an induction heater. The application head is then positioned to the glass and a vacuum is applied. A rubber lip seals the application head and as the air is evacuated the button is pulled to the glass surface. The induction heater raises the temperature of the taped mirror button and curing takes place. The process takes around 30 minutes peaking at a maximum indicated temperature of 190°C.

![Fast curing portable 26 formati.mpg](image)

- **Important process tips for achieving optimal bond strength and maximizing wet out** (proportion of contact area to glass substrate)

1. Apply a constant pressure during the initial application of mirror button to glass substrates > 5,0 Kg/cm² cold (>23°C ) and > 2,0 Kg/cm² warm (>40°C)

2. Apply uniform pressure using a negative die of the button / bracket geometry

3. It is usually preferable to apply the complete mirror button assembly to “warm” rather than “cold” glass surfaces to achieve a good initial wet out.

However mirror buttons are commonly applied to glass substrates directly after the pre-lamination/de-airing process when the glass surface temperature can be anywhere between 70-80°C depending on the time delay and the type of process used. Mirror button applications at temperatures above 80°C may lead to air bubbles between SBT and glass causing poor wet out and visible appearance issues (if there is no printed ceramic frit on #2 or #4 glass surfaces)
4. It is important to remember that when mirror buttons using 3M™ SBT are applied to glass substrates at temperatures > 60°C the epoxy adhesive will rapidly begin its curing process. Once curing has started the process will continue slowly with time even at lower or ambient temperatures. Remember also that 9270 cures more quickly and will also begin the curing process at lower temperatures than 9214.

It is therefore imperative that if the mirror button has been applied to glass at elevated temperatures there should be a minimum delay before final batch processing in either an autoclave or in a high temperature oven in order to keep better control of the overall curing process.

If for any reason the curing process becomes “uncontrolled” as described above this can lead at worst, to mirror button failures or at best to poor bond strength and de-wetting issues especially with the faster curing 9270.

5. Care should be taken when removing the 9214 paper or 9270 PET release liner from the pre-taped mirror button assembly. This can be more critical with semi or fully automatic applications because of a) the natural adhesion of the SBT to the release liner and b) the PET being more rigid than a paper liner. Both factors can potentially cause a mirror button assembly, especially with a 9270 SBT precut to lift poorly and awkwardly if the equipment is not properly designed or not designed to take care of such issues.

6. Mirror button or sensor bracket should match glazing curvature (see substrates / glass geometry) to achieve the largest surface contact during pressure application of button assembly.

- **How to measure wet out** – A simple measurement of bond strength, for example using a test that measures torque (see on-line testing at customer locations) can be used as a reliable method to measure wet out or in other words the effective surface contact area of the SBT to the glass.

The image to the right shows button failure with low torque values after normal curing. As the failure mode is cohesive (at least in the center) and with the clean adhesive break at the button periphery only a partial structural bond was achieved across the total surface. Poor wet out during the pressure application to glass was the reason for failure and the root cause was found to be that the button crown was outside normal tolerances.

Individual /moving range (I/MR) charts for continuous recording of Nm force data can be established using “Minitab” or “Statistica” statistical software programs. When enough data points have been recorded, $3\sigma$ upper and lower control limits are automatically generated from the average of the moving values. The upper
control limit (UCL) value can be used as the 100% or maximum value for wet out using the chosen application/curing process for any specific mirror button.

Before assigning the 100% value, a measurement systems analysis (MSA) should be run to determine repeatability and reliability of equipment and operators.

6. On-line testing at customer locations

For new applications at customer locations, European OEMs are increasingly recommending their suppliers to use a torque test using a suitably calibrated torque wrench and integrated into the manufacturing control plans.

Such simple tests can easily be used as a continuous indicator to show that the process of mirror button application and process is in control throughout the pre-production phase and into production. Values for torque in Nm after autoclave, will depend on the individual application (circular pre-cut pads will tend to give higher values than rectangular pre-cut pads), but targets should be > 12Nm / 100mm² SBT after suitable application and processing. Furthermore, autoclave processed mirror button applications will always generate slightly higher adhesion values than for any other type of processing.

7. Off-line product testing at customer or 3M laboratory locations

Off line test requirements will of course be determined by individual customer specifications but all will include the need to test most or all of the following:

- Dynamic or overlap shear - Aluminium plates applied with the required SBT are prepared and cured according to the sketch below. The sample plates are clamped between the jaws of a tensile tester (Zwick or Instron) and pulled apart with a crosshead speed of 5,0mm /min

![Sketch of test setup]

- 3 mm thick Aluminium panel
- Surface preparation with Scotch Brite 7447
- 3M Structural Bonding Tape 9270
- Bonding Area 12,7 x 25 mm
- 3 mm thick Aluminium panel
- Surface preparation with Scotch Brite 7447
Typical values for SBTs when applied to 3.0mm E-coated steel plates

<table>
<thead>
<tr>
<th></th>
<th># 9214</th>
<th># 9263</th>
<th># 9270</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without ageing at room temp.</td>
<td>117 Kg/cm²</td>
<td>106 Kg/cm²</td>
<td>96 Kg/cm²</td>
</tr>
<tr>
<td>7 days at 50°C/95%RH</td>
<td>61 Kg/cm²</td>
<td>55 Kg/cm²</td>
<td>94 Kg/cm²</td>
</tr>
<tr>
<td>4 weeks heat ageing at 80°C</td>
<td>129 Kg/cm²</td>
<td>115 Kg/cm²</td>
<td>130 Kg/cm²</td>
</tr>
<tr>
<td>1 hour at -40°C</td>
<td>75 Kg/cm²</td>
<td>53 Kg/cm²</td>
<td>104 Kg/cm²</td>
</tr>
</tbody>
</table>

Cleavage – A fulcrum is attached to the mirror button already applied and cured to a glass plate which is then secured in position. At a distance of 70mm to the glass surface the fulcrum is pulled at a cross head speed of 2.5mm/min in a suitable tensile tester (Zwick or Instron) until breakage occurs and the torque force recorded. (Applied force in Newtons x 0.07meter = Nm)

Cleavage Test set up

Typical results for a 550mm² pre-cut pad applied to sintered stainless steel mirror buttons and 6.0mm tempered glass substrate.

<table>
<thead>
<tr>
<th></th>
<th># 9214</th>
<th># 9263</th>
<th># 9270</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without ageing at Room Temp.</td>
<td>&gt; 50 Nm</td>
<td>&gt; 50 Nm</td>
<td>&gt; 50 Nm</td>
</tr>
<tr>
<td>7 days at 37°C/100%RH</td>
<td>47 Nm</td>
<td>43 Nm</td>
<td>&gt; 50 Nm</td>
</tr>
<tr>
<td>4 day water immersion at 80°C</td>
<td>47 Nm</td>
<td>36 Nm</td>
<td>43 Nm</td>
</tr>
</tbody>
</table>

N.B. using this test method buttons attached to thin (1.8 – 2.5mm) annealed glasses as used in windshield laminates, glass breakage will nearly always occur before failure of the SBT bond therefore values obtained for this kind of glass will usually be < 20 Nm.
Static or dead load – mirror buttons are applied to a suitable glass plate and cured before attaching a 2.7Kg load to the mirror button. The assembly is placed in a climate chamber at a 45° angle and left for a period of time at the desired conditions.

Typical times to failure for a 550mm² pre-cut pad when applied and cured to sintered stainless steel mirror buttons

<table>
<thead>
<tr>
<th>Load</th>
<th>2.7 Kg load at 50°C and 95%RH</th>
</tr>
</thead>
<tbody>
<tr>
<td># 9214</td>
<td>1800 hour</td>
</tr>
<tr>
<td># 9263</td>
<td>1800 hour</td>
</tr>
<tr>
<td># 9270</td>
<td>3000 hour</td>
</tr>
</tbody>
</table>

Crash simulation – most OEMs simulate crash situations by simply applying a large dynamic force using a hammer of suitable mass to the complete mirror assembly causing breakage between the glass and mounting system.

The preferred failure mode at break for all of the above test methods is always for a cohesive failure within the SBT, sometimes called “foam split”.

8. Competitive Technologies

- **PVB adhesive materials** – Poly-Vinylbutyral is used as the bonding medium for almost all the global production of laminated safety glass. PVB extruded film is therefore a relatively cheap and readily available material for the glass manufacturers to use as the bonding medium for mirror buttons. It is not universally used but may be chosen when large volume applications need to be processed on-line and fully automated systems are used to heat and tackify the PVB pads before an accurate pressured application to the glass. More recently opaque black PVB has become available specifically for those applications where a ceramic printed frit on the glass is absent.
As PVB absorbs water quite readily there may be some issues with humidity resistance and therefore for some applications not suitable. Furthermore PVB is not approved by a number of OEMs. As PVB pre-cut pads need to be 100% autoclave cured it does not offer the flexibility of 3M™ Structural Bonding Tape or PU/ PUR adhesives which allow for off-line application at sub-contractors for both medium and small volume applications.

**Polyurethane adhesive materials**

**Liquid 2K PUR** - will achieve effective bonding but again do not offer the flexibility as when using 3M™ Structural Bonding Tapes. Leading systems are usually transparent and supplied as separate cartouches of a polyol and isocyanate which can be applied to the plastic or metal components using a special application gun. The component is pressure applied to the glass substrate and left to cure often at room temperature. Bonded components can be handled after about 60 minutes cure time. Mirror button or rain sensor components applied to glass substrates using this system will usually have raised ribs on the front side to allow a controlled thickness between 0.1 - 0.3mm of the adhesive material between button and glass depending on the application.

In spite of the relative ease of application many still consider a polyurethane adhesive process to be messy and sometimes difficult to use for larger volume programs. Such PUR adhesives can take up seven days to fully cure and reach their final adhesion which will meet customers specification requirements and therefore suitable for delivery to OEM end customers. When fully cured, PUR materials exhibit good resistance to the effects of humidity.

**Solid 1K PU adhesives** – This kind of adhesive is a "dry" system, needing only a short heating/cycle time to apply and cure. Mirror buttons and rain sensors are applied with adhesive "segments" by way of a very coarse mesh screen printing technique. The adhesive segments have a dry coated thickness of < 1,0mm). As the pre-assembled mirror buttons or rain sensors are heated to relatively high temperatures, the pre-determined adhesive mass will melt and flow outwards maximising the available surface area with the final thickness controlled by spacers designed into the glass side surface of the MB or RSN. Cross linking is very rapid and the adhesive is almost fully cured within 60 minutes of the application.

Mirror buttons and rain sensors which use this type of adhesive system are usually equipped with ribs or spacers to control the thickness and also incorporate barrier features such as lips or dykes to limit the flow of the adhesive melt. The nominal cured thickness of the adhesive is 0,3mm.....thinner will cause a weaker adhesive bond and thicker will cause a weaker cohesive bond. Application temperatures using induction heating to initiate cross linking and curing has a process window between 170°C – 190°C for both MB and RSN assemblies. Very little pressure (< 2 bar) is required during the application as would be expected from a "melt" type of adhesive system and because of the spacers.
Conclusion:

3M™ Structural Bonding Tape has proven time and again to be a highly reliable attachment system for all mirror button and most sensor bracket applications to glass, meeting and exceeding end customer performance requirements. 3M™ Structural Bonding Tape is adaptable to a wide range of heat curing parameters allowing a high degree of processing flexibility at all levels of component and glazing manufacture. 3M technical support is always available to help and advise with customer needs and requirements and if necessary, specialist engineering support can also be made available for unique design of application equipment and its realisation into customer production lines.

Related documents

File folder attachment to this document - “SBT equipment applications”
- # 11-Fiat manuale in rotolo.mpg
- # 1-Nissan.mpg
- Fast curing portatile 26 formati.mpg

Other documents

3M Product data sheets for SBT 9214, SBT 9263 and SBT 9270

Important notice to purchaser

All statements, technical information and recommendations herein are based on tests we believe to reliable, but the accuracy or completeness thereof is not guaranteed. Please ensure before using our product that it is suitable for your intended use. All questions of liability relating to this product are governed by the Terms of Sale, subject where applicable, to the prevailing law.