# Dual Lock™ Reclosable Fasteners
## Attachment using Pressure Sensitive Adhesives or Heat Bonding

**Technical Bulletin** **March, 2007**

**Introduction**

3M™ Dual Lock™ Reclosable Fasteners are comprised of continuous thick film backing with stems protruding from one side of the backing. The self supporting flexible stems have mushroom shaped heads. The base film, the stems and mushroom heads are manufactured from polyolefin materials. There are three types of Dual Lock reclosable fasteners (type 170, type 250 and type 400). The type refers to the approximate number of stems per square inch. A product constructed with similar materials and configuration but much thinner is 3M™ Dual Lock™ Low Profile Reclosable Fastener which has approximately 705 stems per square inch.

Dual Lock reclosable fasteners can be engaged in the following combinations of increasing strength: type 170 to type 250, type 170 to type 400, type 250 to type 250 and type 250 to type 400. Dual Lock reclosable fasteners and 3M™ Dual Lock™ Low Profile Reclosable Fasteners can also engage with many loop materials such as 3M™ Scotchmate™ Reclosable Fastener Loop. This combination allows a quick grab closure with high strength, but reduced cycle life. We do not recommend that standard height Dual Lock reclosable fasteners be engaged with Dual Lock low profile reclosable fasteners as performance characteristics have not been well studied.

When two pieces of Dual Lock reclosable fasteners are pressed together, the stems flex and the mushroom heads slide past each other. After passing the mushroom heads on the opposing mating piece, the stems snap back into their original position, interlocking with the mushroom heads on the opposing piece. The audible SNAP indicates engagement has occurred. This provides a strong reclosable attachment system. These fasteners can provide high tensile strength but the fasteners can easily be opened by simply cleaving or peeling open the closure.

Dual Lock reclosable fasteners can reduce the number of, or replace, conventional fasteners such as screws, clips, rivets, snaps and bolts in many applications. This product is well suited to many applications where a high strength, reclosable fastening system is required. Many Dual Lock reclosable fastener products have good performance even after exposure to ultraviolet radiation, high moisture levels and wide temperature ranges up to approximately 220°F (105°C). Refer to specific technical data pages for product performance under various temperature, weight and loading conditions.

Dual Lock reclosable fasteners have many options for attaching to various surfaces and materials. The table below summarizes the backing options available and method commonly used for attachment. Details on procedures for attaching Dual Lock reclosable fasteners using various methods suitable for the different backing types are summarized on respective technical bulletins.

| **Roll good backing type** | | | | | |
|---|---|---|---|---|---|
| **Backing Type** | Pressure Sensitive Adhesives | | Non-woven | None (Plainback) | Ultrasonic* (Semi-rigid) |
| | Acrylic adhesive | Rubber adhesive | | | |
| **Attachment Method Technical Bulletin** | | | | | |
| Pressure Sensitive Adhesive | ✔ | ✔ | | | |
| Heat bonding | | ✔ | | | |
| Curable Liquid Adhesives | | | ✔ | | |
| Hot Melt | | | ✔ | | |
| Sewing | | | | ✔ | ✔ |
| Mechanical | | | ✔ | ✔ | ✔ |
| Ultrasonic* | | | | | ✔ |

*To polypropylene type materials.

**Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.**

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**Design Considerations when using 3M™ Dual Lock™ Reclosable Fasteners**

Many factors can affect the application, engagement and use of 3M™ Dual Lock™ Reclosable Fasteners. Before applying, engaging, or using the Dual Lock reclosable fasteners the customer should consult the technical bulletin, *3M™ Dual Lock™ Reclosable Fasteners – Roll Goods Design Criteria* (70-0709-4009-6).

**Surface Preparation**

The amount and type of surface preparation required will depend upon the attachment method used to attach the Dual Lock reclosable fasteners and the surface to which they will be attached. Refer to the specific attachment methods below for recommended surface preparation methods depending upon the backing attachment option being used.

**Attachment Methods**

Dual Lock reclosable fasteners with a pre-applied pressure sensitive adhesive can be applied using standard methods for pressure sensitive adhesives or using a method called heat bonding. These methods are summarized below. Some of these methods may be amenable to automated application and attachment techniques. Contact your 3M Sales Representative to discuss automated equipment options or to assist in determining which Dual Lock reclosable fastener would be best suited for your particular material and expected used conditions.

1) **Dual Lock reclosable fasteners with Pressure Sensitive Adhesive:**
The use of pressure sensitive adhesive eliminates or reduces the need for sewing, solvent activation, dielectric or ultrasonic bonding and bulk adhesive bonding. This can result in simplicity, greater safety and lower installation costs. Dual Lock reclosable fasteners supplied with 3M's unique pressure sensitive adhesive backings can conveniently be bonded to a wide variety of materials. Pressure sensitive products can be applied manually or automatically using the five steps outlined below.

[Equilibrate ➤ Surface ➤ Preparation Remove Liner & Apply Adhesive ➤ Apply Pressure ➤ Dwell]

**Equilibration:**
To obtain an optimum adhesive bond to any surface, the Dual Lock reclosable fasteners and the materials to which the fasteners will be adhered should have equilibrated at temperatures between 60° to 100°F (15° to 38°C) for a minimum of one hour before application. Bringing materials from a cold area into a warm, humid location may cause moisture condensation. The pressure sensitive adhesives on the back of Dual Lock reclosable fasteners have poor adhesion to wet surfaces. Initial tape application to surfaces at temperatures below 60°F (15°C) is not recommended because many of the adhesives are too form to readily adhere to the surface. However, once properly applied the holding strength under humid conditions and low temperature are usually very excellent. Refer to specific product information pages for specific performance information.

**Surface Preparation:**
In general, highly textured surfaces may reduce the ultimate adhesion levels and care should be given to minimize or reduce surface texture or roughness. Adhesive backed Dual Lock reclosable fasteners should be applied to surfaces that are clean, dry and free of condensed moisture, oil, rust, grease, dust, mold release agents or other contaminants that could reduce the adhesion. The removal of materials containing plasticizers, other low molecular weight compounds and other materials on the surface to which the adhesive will be bonded will increase the ultimate and long term adhesive performance and strength. It is recommended to remove any surface contaminants that may reduce adhesion by using a method suited for the type and quantity of surface contaminants present. Be sure to use cleaning cloths that are free of moisturizers, fragrances or other additives, to prevent leaving a film on the surface after cleaning which may reduce the bond strength. The cleaning cloth or tissue must be changed frequently based upon the amount of contaminants removed from the surface. Not doing so, will only smear surface contaminants, or contaminate an already clean surface. Additionally, if a liquid cleaning solution is used. it is important that the cleaners not contain surfactants, fragrances or other additives which may not fully evaporate leaving an undesirable film on the material which will reduce the adhesive bond strength.

**Attachment Methods *(continued)***

**Special surface characteristics:**

Some materials or use conditions may affect the adhesive performance. The most common materials and surfaces are discussed in greater detail below. If your material has one or more of these attributes, extra care should be given when applying pressure sensitive adhesives. Some adhesives are specially designed for use with specific surface characteristics, such as low surface energy materials. Knowing the design performance for the chosen adhesive will help determine any special surface preparation steps necessary. All surface cleaning procedures must be followed by a final cleaning to remove any loose particles.

Porous or fibered surfaces

Most porous (e.g. concrete, foam) or fibrous (e.g. wood, OSB, paper, particleboard, cardboard) materials should have the surfaces sealed to provide a unified surface, fill any surface pores, or lock the fibers into a three dimensional network. The type of sealant used for sealing porous and fibrous surfaces, will depend on both the surface and the environmental conditions the product will be exposed to during use. Many marine grade varnishes or high performance contact adhesives, such as 3M™ Scotch-Weld™ Contact Adhesive 1357 or 3M™ Rubber and Vinyl Adhesive 80 can be a starting point for evaluation. The acrylic adhesives on the back of 3M™ Dual Lock™ Reclosable Fasteners have been shown to produce good bond strengths using these products in many applications.

Glass, tile and hydrophilic surfaces

Bonding to glass, stone, ceramic tile or other hydrophilic surfaces in a high humidity environment may require the use of a silane primer to help ensure a long-term bond. Refer to the technical bulletin, *3M™ VHB™ Tape Glass Bonding and Silane Coupling Agents* (70-0702-9983-2) for additional details on this procedure for the acrylic adhesives on the back of the Dual Lock reclosable fastener.

Heavily textured surfaces

Heavily textured surfaces can reduce the ultimate bond strength, especially for thin or very firm adhesives. Abrading the surface***** can be used to smooth very rough or textured surfaces often creating a micro surface area which may improve surface contact with an adhesive thus enhancing adhesion. Except for adhesives designed for application to very smooth surfaces, it is important for the adhesives to have a slightly roughened surface. Very small scratches in the surface, generated with a circular motion rather than straight line motion are most desirable. A surface with micro-scratches can have up to 40% additional available surface area for the adhesive to make a bond. This can translate to higher ultimate strength and greater initial adhesion, where a higher level of performance is required in a short time period. The most important factors are to have a fine abrasive and to clean up the surface prior to applying the adhesive. 3M™ Scotch-Brite™ Pad 7447, or 220 grit or finer abrasive paper can be a starting point for evaluation.

***Note:** When using abrasives, it is important to follow all manufacturers precautions and directions for use as well as government regulations or customer requirements.

Abrasion may have negative results with some adhesives designed for use on very smooth or glossy surfaces. Soft plastics, such polypropylene and polyethylene may leave polymer fibers or hairs on the surface, which are usually more difficult to bond to than a smooth surface which is primed. See the section on low surface energy materials for a discussion on primers. All abrasion processes should be followed by a solvent clean-up step to remove any residue or film.

An alternative method for reducing the surface texture, especially for molded or formed plastics, is to change the mold design, removing the heavy texturing. This procedure would need to be evaluated to ensure the resulting surface provides the necessary bond strength as well as finished part performance.

**Attachment Methods** ***(continued)***

Low surface energy materials

Materials with low surface energy surfaces may require the application of a primer or a technique to increase the surfacer energy such as corona treatment. Additionally, some adhesives are designed for use on low surface energy surfaces. An example is the rubber based adhesive on the back of 3M™ Dual Lock™ Reclosable Fastener SJ3540 or the acrylic on the back of 3M™ Dual Lock™ Reclosable Fastener SJ3245. Some plastics or paint coatings may have additives which contain low surface energy materials that can reduce the ultimate adhesive strength. Some plastics such as polypropylene, polystyrene, ABS, etc. may contain flow agents such as calcium or zinc stearate, or mold release agents. These materials may migrate to the surface also reducing adhesion.

Cleaning procedures designed to remove the specific materials present should be used. Priming is another method used to increase the surface energy of a material, allowing a wider variety of adhesives to be applied. 3M™ Tape Primer 94 has been applied to many low surface energy materials such as polyethylene or polypropylene when an acrylic adhesive will be used. The technical bulletin, *3M™ Tape Primer 94* (70-0705-7546-2) provides use and application details. Refer to the technical bulletin, *3M™ VHB™ Tape Primers* (70-0704-8702-3) for additional information on various primers to consider for use with acrylic adhesive or specific surfaces.

Removal of heavy oils, greases, coatings*

Surfaces with high amounts of oils, grease or other coatings may need to be degreased first using a procedure suitable for the material being removed from the surface.

When removing hard film, dirt, oxidized paint or metal, silicone mold release agents or rough surfaces, it may be necessary to sand or abrade the surface to optimize bond performance. Surface abrasion can serve several functions. It can be used to remove caked-on dirt or oxides, remove surface coatings from paints, hard plastics and similar materials that may reduce the ultimate adhesive strength. Procedures similar to those discussed for abrading heavily textured surfaces can be evaluated. All abrasion processes should be followed by a solvent clean-up step to remove any residue or film.

***Note:** When using abrasives, degreasing or cleaning solutions it is important to follow all manufacturers precautions and directions for use as well as government regulations or customer requirements.

Materials containing plasticizers or other low molecular weight materials

Plasticizers commonly added to vinyl, which make it flexible will often migrate into rubber based adhesives within a year causing premature adhesive failure. Often many plastics may contain low molecular weight materials that may also cause premature adhesive failure. The actual affect on adhesive performance will depend upon the type of plasticizer or low molecular weight material, and the amount present and environmental conditions during use. A good test for predicting the effects of these potential contaminates on final adhesive performance is to expose a sample of the applied fastener to the adherend for one week at 158°F (70°C), with or without an applied load, typically one to two pounds per square inch (78 to 156 grams per square centimeter). Adhesive oozing, softening, running, discoloration or the fastener adhesive being unable to support the load is a sign that undesirable performance may occur.

Therefore rubber based adhesives, such as those on 3M™ Dual Lock™ Reclosable Fasteners SJ3540, SJ3541 and SJ3542 should not be attached to flexible vinyl or similar materials. Products with adhesives designed for use on plasticized vinyl, such as 3M™ Dual Lock™ Reclosable Fasteners SJ3901/4926 or SJ3901/SJ4956 and similar products from our Mix and Match program could be evaluated. The use of 3M™ Adhesion Promoter 2262T has also been useful when applying acrylic adhesives to flexible vinyl or plasticized materials. 3M adhesion promoter 2262T is applied like a primer, and after drying, the Dual Lock reclosable fastener with an acrylic adhesive is applied as discussed for pressure sensitive adhesives. Additional information is available in the technical bulletin, *3M™ Adhesion Promoter 2262T* (75-3467-9984-6).

**Attachment Methods** ***(continued)***

Copper, brass, galvanized steel, aluminum and similar materials or coatings
Materials such as copper, brass and similar metals are prone to oxidation, which may undercut and weaken the adhesive bond after application of the adhesive. A surface sealer or primer may be required to reduce surface oxidation and ensure long term adhesive performance. It is critical to test the desired adhesive bonded to the desired surfaces under expected use conditions or accelerated aging tests, to observe any potential negative interaction or performance. Refer to the technical bulletin, *3M™ VHB™ Tape Primers* (70-0704-8702-3), for additional information on various primers to consider for use with acrylic adhesives to specific surfaces.

Some metals such as galvanized steel, aluminum and similar metals may obtain high adhesion levels under most conditions, but they may experience reduced adhesion if the adhesive is applied to these metals with oxidized surfaces. The oxidation can be removed by abrasion or other oxide removal procedures discussed above and that are acceptable to your operations. The use of a surface sealer may be required to prevent reduced adhesive performance from oxide build-up with time.

**Liner removal and adhesive attachment:**
After the surface has been cleaned, the 3M™ Dual Lock™ Reclosable Fastener and adherend have equilibrated to similar environmental conditions the protective adhesive liner should be removed and the adhesive attached. If the material that the Dual Lock reclosable fastener will be attached to is flexible, make sure the material is laying on a hard flat surface to permit uniform application of pressure to the adhesive.

For small pieces, less than about two by two inches (five by five centimeters) the entire liner is removed from the adhesive. Without touching the adhesive, the Dual Lock reclosable fastener is applied to the equililbrated, pre-cleaned, dry, prepared surface using light finger pressure. This provides initial contact between the adhesive and the surface, allowing parts to be immediately handled, but should not have a load applied until after the required application of pressure and dwell time.

For long strips, the liner is removed from the adhesive as the attachment is made. Without touching the adhesive the Dual Lock reclosable fastener is aligned on the adherend surface. One end of the Dual Lock reclosable fastener strip is pressed down (tabbed) to the adherend, while holding the other end of the strip under light tension. TheDual Lock reclosable fastener strip is slowly applied to the entire length of the strip from the tabbed end using finger pressure, taking care not to trap air bubbles under the adhesive and not to crush the Dual Lock reclosable fastener stems.

The applied Dual Lock reclosable fastener must now be rolled down with a rubber covered hand roller, being careful not to crush the Dual Lock reclosable fastener stems and dwelled as described below before a load can be applied or the product put into use.

**Apply pressure:**
One factor affecting the ultimate bond strength is dependent upon the amount of adhesive to surface contact. Firm application pressure provides increased contact of the adhesive with the surface and helps improve the bond strength. It is suggested to roll down the fastener at least once in each direction applying 5 to 15 pounds per square inch (50 to 150 kPa) of pressure. Extra care must be exercised when rolling down Dual Lock reclosable fasteners to prevent bending or crushing of the stems which can compromise the closure strength. The Dual Lock reclosable fastener is carefully rolled down by one of two methods discussed below increasing contact of the adhesive with the material's surface. These methods allow adequate pressure to be applied to Dual Lock reclosable fasteners while minimizing or eliminating stem damage.

a) The first method uses a rubber covered hand roller, with the wheel covered with a Dual Lock reclosable fastener Type 170 with a pre-applied adhesive such as 3M™ Dual Lock™ Reclosable Fastener SJ3542. The roller covered with Dual Lock reclosable fastener SJ3542 is rolled down at least one time in each direction over the Dual Lock reclosable fastener adhered to the surface. The Dual Lock reclosable fastener will engage and disengage as the product is rolled down, allowing pressure to be applied to the adhesive.

**Attachment Methods** ***(continued)***

b) The second method consists of placing a strip of plain back 3M™ Dual Lock™ Reclosable Fastener Type 170, such as 3M™ Dual Lock™ Reclosable Fastener SJ3442 or SJ3742 to the previously adhered Dual Lock reclosable fastener. A rubber covered hand roller with no Dual Lock reclosable fastener on the roller is rolled over the backside of the plain back material. This will engage the two Dual Lock reclosable fastener pieces. After rolling down at least one time in each direction, the strip of plain back Dual Lock reclosable fastener can be removed and used to roll down the next piece of Dual Lock reclosable fastener in similar manner. Alternatively this strip or piece can be left in place during subsequent handling or shipping to prevent damage to the stems and mushroom heads, being removed at the point of use.

c) This option is similar to option b) above, but the mating Dual Lock reclosable fastener piece will be used in the final application. If this method is used, care must be exercised in making sure the liner and adhesive or backing for plain back products on this second piece will not be damaged during the pressurization step.

Typically Dual Lock reclosable fasteners with acrylic adhesives can tolerate differential movement in the shear plane of approximately three times the adhesive thickness. Dual Lock reclosable fastener products with thin adhesives will be more affected by surface irregularities, thermal expansion or contraction of parts than Dual Lock reclosable fasteners with more conformable or thicker adhesives. When applying Dual Lock reclosable fasteners with thin adhesives, such as 3M™ Dual Lock™ Reclosable Fasteners SJ3773, SJ3782, SJ3787, SJ3785, SJ3534, SJ3535, SJ3538 and others with thin or very firm adhesives it is very important to carefully observe all surface preparation and sample application procedures to ensure good adhesive contact with the material surface.

**Dwell Time before handling or applying a load:**

Properly chosen and applied Dual Lock reclosable fasteners with pressure sensitive adhesives bond on contact and the parts can be handled immediately, but a load should not be applied until pressure has been applied to the adhesive and sufficient dwell-time. Adhesive bond strength increases with time after application, pressure and/or temperature, as the adhesive further wets out the material surface. Dwell time is important for achieving a firm adhesive bond before applying a load or force. Once attached to the surface after applying pressure, acrylic adhesives achieves approximately 50% of the ultimate bond strength within 1 hour, 90% after 24 hours and the ultimate bond strength is obtained within 72 hours at 72°F (22°C) and 50% relative humidity. Increasing the temperature after bonding, e.g. to 150°F (66°C) without an applied load or the use of primers and adhesion promoters may reduce the time required to achieve the ultimate bond strength. In some cases, the ultimate bond strength to certain materials may also be higher than without the use of primers or adhesion promoters.

The rubber based adhesives used on 3M™ Dual Lock™ Reclosable Fasteners SJ3540, SJ3541 and SJ3542 achieves approximately 50% of the ultimate bond strength within 20 minutes, 90% after 1 hour and the ultimate bond strength is obtained within 24 hours at 72°F (22°C) and 50% relative humidity. A minimum of one hour dwell time is recommended for rubber based adhesives before applying a load of disengaging assembled parts.

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**Heat or Press Bonding**

3M™ Dual Lock™ Reclosable Fasteners SJ3540, SJ3541 and SJ3542 with rubber based adhesives can be attached to many thin fabrics, foams, paper and similar materials using a technique called a press or heat bonding. This process heats and softens the adhesive allowing the adhesive to flow deeper into the pores and openings of the above materials. Upon cooling the adhesive can form a strong bond with more of the material.

More than one piece of 3M™ Dual Lock™ Reclosable Fastener may be bonded at a time depending upon the size of the press bonding equipment. Material thickness, heat conductivity and other factors need to be considered in choosing heat bonding conditions. It is important to make sure the material you will be bonding to will be able to withstand the temperature and pressure of this process.

The important parameters in press bonding are bonding temperature, pressure and time. Equipment can range from a simple household laundry iron to commercial press units. Suitable equipment includes label and fusing presses, such as the Thermopress™ Adhesive mending system model HP8 or HP10A.

Typical Press Bonding Conditions:

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

The Dual Lock reclosable fastener is first attached to the material as discussed for attaching pressure sensitive adhesives. Usually many of the cleaning or priming and surface steps may be eliminated when heat bonding. The bond strength is then increased by applying heat and pressure for a given time period. The material to be bonded, with the attached Dual Lock reclosable fastener, is placed between two platens (or a platen and a solid base). The upper platen is typically heated and the material to be bonded is placed against the heated surface platen. The lower platen should be covered with a silicone rubber pad or other suitable cushioning material. The lower pad could also be covered with a carding cloth (wire stems protruding from a backing of cloth, rubber or other suitable material. This provides even pressure distribution and minimizes damage to the mushroom shaped stems.

Heat is applied, through the thin article to the adhesive side of the Dual Lock reclosable fastener. In this case, the bonding temperature is the platen temperature and the bonding time is the time required for sufficient heat to penetrate through the thin article to the adhesive layer. Temperature and pressure are adjusted to provide maximum adhesive flow at the adhesive/substrate layer to minimize bonding time. It is not recommended to apply heat from the side of the mushroom stems for Dual Lock reclosable fasteners as closure performance may be adversely affected.

An ordinary household electric hand iron can also be used to bond Dual Lock reclosable fasteners to various materials. Because thermostats are variable, temperatures may vary by ± 25°F using this technique. This technique is suggested for demonstrating the technique or making prototype samples, but usually is not suitable for production quantities. Thermostat settings at the high side of wash and wear will generally produce acceptable results for bonding in Dual Lock reclosable fasteners to wool, cotton duck, polyester double knits, cotton knit, cotton corduroy and denim. Velour (nylon acetate) and thin synthetics such as nylon body suit material can be bonded at slightly lower wash and wear settings. The heat should be applied to the fabric side with uniform pressure. Standard heat bonding equipment discussed above is recommended for typical production situations.

Care must be exercised to avoid adhesive bleed through, adhesive oozing at the edges of the fastener or fabric distortion during press bonding. Upper heated platen temperatures of 350°F (177°C), with 25 psi of pressure and a three second hold have not caused visual damage to stems or heads for a 1" wide product. The amount of pressure needs to be measured per square area of the fastener, as opposed to the square area of the platens. Too much pressure or too high heat may damage the thin material, or the Dual Lock reclosable fasteners stems or heads, which may compromise the performance and appearance.

Product performance will depend on the nature of the fabric or foam and other conditions within any specific application. For this reason it is essential that the user evaluate the 3M™ Dual Lock™ Reclosable Fastener product to determine if it is fit for a particular purpose and suitable for the user's method of application.

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**Product Use**

All statements, technical information and recommendations contained in this document are based upon tests or experience that 3M believes are reliable. However, many factors beyond 3M's control can affect the use and performance of a 3M product in a particular application, including the conditions under which the product is used and the time and environmental conditions in which the product is expected to perform. Since these factors are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

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