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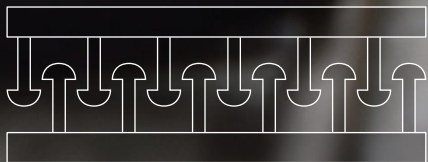
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3M™ Dual Lock™ Reclosable Fasteners

# Rail / Bus Design Guide





This Rail/Bus Design Guide offers general considerations for applying 3M™ Dual Lock™ Reclosable Fasteners, as well as some considerations for more specific applications.

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# Designing with 3M™ Dual Lock™ Reclosable Fasteners

3M™ Dual Lock™ Reclosable Fasteners are an easy way to join two components in the most challenging applications. They do not require special tools for installation and they securely hold interior rail and bus components without visible fasteners to mar the final finish.

## Enhance Designs

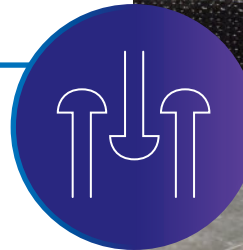
For over 30 years, bus and rail manufacturers have relied on 3M™ Dual Lock™ Reclosable Fasteners for interior fastening. By substituting 3M Dual Lock for traditional mechanical fasteners, including nuts/bolts, screws or clips, a designer can eliminate visible fasteners, reduce noise and vibration, and support light weighting initiatives. These interlocking mechanisms are perfect for achieving secure attachment in a moving vehicle while also allowing two components to be detached easily for occasional service, maintenance or refurbishment.

## Improve Productivity

Production engineers also find opportunities to improve the speed of final production using 3M™ Dual Lock™ Reclosable Fasteners. Because the 3M Dual Lock can be pre-applied upstream or at a Tier supplier, final assembly is a snap (literally). Operators do not need to align screws to screw holes, component tolerances can be less stringent, and no heavy tools are needed to engage 3M™ Dual Lock™ Reclosable Fasteners. These advantages increase the speed of final assembly and can improve ergonomics for operators.

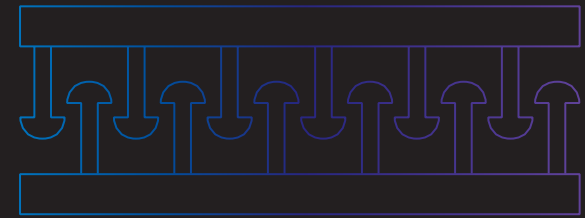
## Many Applications

3M™ Dual Lock™ Reclosable Fasteners can be used in various applications within each rail car or bus. The uses can vary from sidewall/panel attachment, installing ceiling panels, building seats and lighting attachments with new ideas emerging. They all have common techniques for application and there can also be specifics to each area.



# General Guidelines

3M™ Dual Lock™ Reclosable Fasteners can be used in many different interior applications throughout the vehicles — ceiling panel attachment, wall panels, lighting, seating and sign installation. Here are some general guidelines for use:

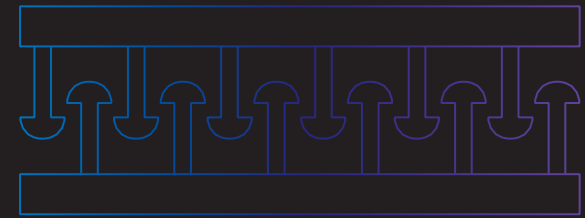


<b>Product</b>	<b>Strength</b>	3M™ Dual Lock™ Reclosable Fasteners have strong disengagement for holding your parts in place and you can vary the strength by interlocking the various stem combinations. There are three types, each with approximately 170, 250 or 400 stems per square inch (or per 6.45 square centimeters). Type 250 to type 250 is a good starting combination for a mid-range attachment strength. Often with moving vehicles, the type 250 to type 400 is used to achieve a stronger attachment. The type 170 is not used as frequently in rail/bus applications because of its low attachment force. See <a href="#">Technical Bulletin</a> . <a href="#">🔗</a>
	<b>Weight</b>	As a general starting point for your project, amount of 3M Dual Lock needed for supporting weight is approximately 60 cm <sup>2</sup> /kg (4 in <sup>2</sup> /lb.).
	<b>Size</b>	When using smaller pads, <b>25 mm x 50 mm (1 in. x 2 in.) minimum</b> is suggested. Use long strips at lengths of 15 cm to 50 cm (6 in. to 20 in.), <b>30 cm (12 in.) length is typical</b> . This size range works well for thermal expansion and one bond failure does not cause failure of the whole panel.
	<b>Special Shapes</b>	Can be die-cut for precise pieces and time savings.
	<b>Round Corners</b>	Round corners on the pieces when possible, this reduces any edge lifting when trying to disengage later.
	<b>Multiple Strips</b>	Using several pieces rather than one long strip will help with engagement and also have safety factors.
	<b>Surface</b>	<b>Prep Surface</b>
<b>Surface Type</b>		Best used on rigid, flat surfaces. (If you have flexible materials sometimes <a href="#">3M™ Hook and Loop Fasteners</a> <a href="#">🔗</a> are a better option.)
<b>Adhesion</b>		Aim for foam split failure when testing for adhesion. You may need to use a surface primer (adhesion promoter), such as: <a href="#">3M™ Primer 94</a> <a href="#">🔗</a> <a href="#">3M™ Universal Primer</a> <a href="#">🔗</a> <a href="#">3M™ Adhesion Promoter 111</a> <a href="#">🔗</a> Please contact your local 3M Representative for primer selection.

# Typical Test Values *(not for specification purposes)*


The following technical information and data is intended as a guideline to assist customers in selecting 3M™ Dual Lock™ Reclosable Fasteners for further evaluation. This technical information is not product release specifications or standards.

Test methods under controlled laboratory conditions of 72°F ± 5°F and 50% ± 10% relative humidity.



3M™ Dual Lock™ Reclosable Fastener	Type to Type	170* to 250	170* to 400	250 to 250	250 to 400
<b>Dynamic Tensile</b> N/cm <sup>2</sup> (Lbs <sub>f</sub> /in <sup>2</sup> )	<b>Engage</b>	9.0 (13)	14.5 (21)	15.2 (22)	21.4 (31)
	<b>Disengage</b>	18.5 (27)	29.6 (43)	29.6 (43)	41.4 (60)
<b>Dynamic Shear</b> N/cm <sup>2</sup> (Lbs <sub>f</sub> /in <sup>2</sup> )		9.8 (14)	14.5 (21)	15 (22)	41.3 (59)
<b>Cleavage Strength</b> N/cm width (Lbs/in width)	<b>Rigid backed from rigid backed</b>	21 (12)	35 (20)	42 (24)	56 (32)

\*Note: 170 typically not used for panel attachment, ceiling, etc.

3M™ Dual Lock™ Reclosable Fasteners have been proven to pass typical aging standards usually required in Rail and Bus applications like ISO 9142 E2 which includes condensed water test climate (“cataplasma”) and ISO 9142 D2/D3 which include thermal cycling between -20°C and +70°C temperatures. Flame, Smoke and Toxicity (FST) Test Information [EN 45545](#). 

# Wall Panel Attachment

Installing wall panels can be quick and easy using 3M™ Dual Lock™ Reclosable Fasteners. Here's what you should consider:



## What is the size and weight of the panel to be attached?

You need enough 3M Dual Lock to support the load: 60 cm<sup>2</sup>/kg. The 3M Dual Lock should be spaced out. It is best if the wall panel can be supported by a ledge or a frame which the panel sits on.

## What are the substrates being attached?

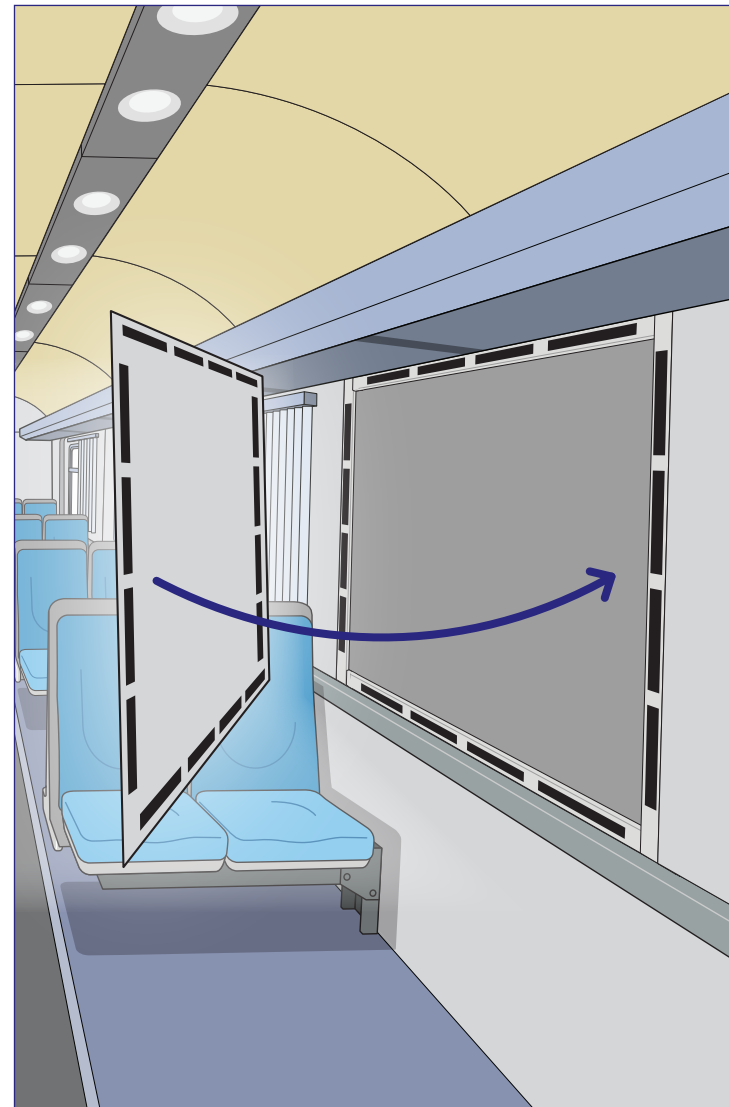
Metals and high surface energy plastics (PC, ABS, Acrylic, among others) typically adhere easily. Low surface energy plastics (Polyethylene, Polypropylene) are challenging and would require special preparation. Bus and Rail substrates can vary, testing is recommended.

## Is there a special shape to be considered?

3M Dual Lock works best on flat rigid surfaces. Start with the perimeter of the panel or frame where the 3M Dual Lock will be in contact. Curves or flexible materials would need special consideration.

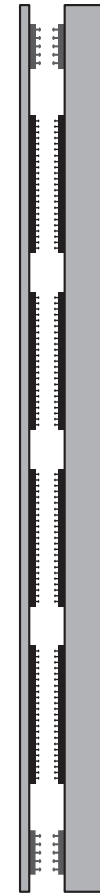
## Will there be mechanical support to the installation?

When possible, a design using channels or ledges to help support the weight of the panel assures a robust design.



 = Placement of 3M Dual Lock Strips

## Wall Panel Application



Panel      Frame

# Ceiling Panel Attachment



Installing ceiling panels can be quick and easy using 3M™ Dual Lock™ Reclosable Fasteners. Here's what you should consider:

## What is the weight or static load of the piece attached to the ceiling?

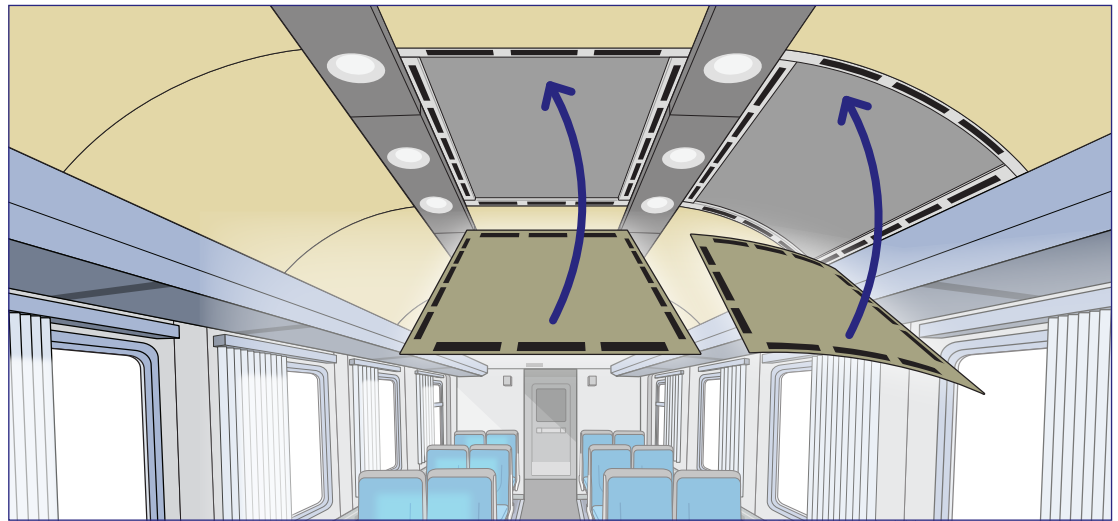
Keep 3M Dual Lock lengths at 15 cm to 50 cm (6 in. to 20 in.), typically 30 cm (12 in.). This works well for thermal expansion and one bond failure does not cause failure of the whole panel.

## Is the ceiling flat or curved?

**Flat Ceilings** can utilize long or short strips of 3M Dual Lock for consistent engagement.

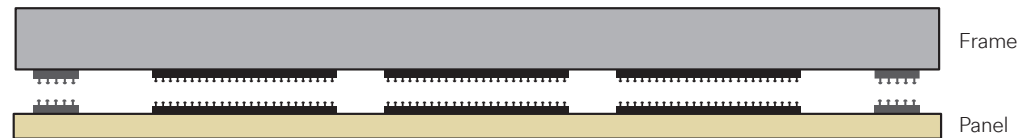
**Curved Ceilings** need more care. Distribute strips down the long side (perpendicular to the curve) as to not put the Dual Lock strips into an exaggerated curve where the stems may not mate properly. Additional pieces of Dual lock are typically added to aid in the vibration dampening of the panel.

The picture shown is exaggerated to illustrate a curved ceiling and not to predict Dual Lock placement.

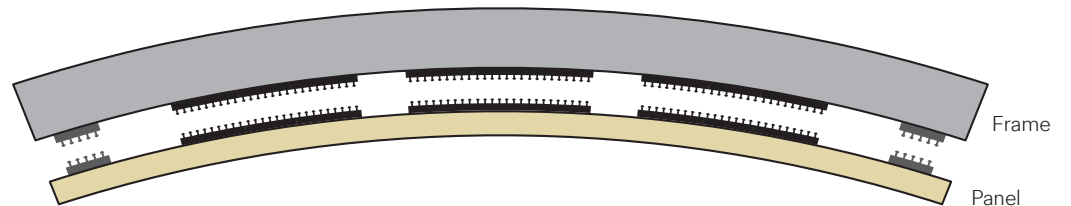


 = Placement of 3M Dual Lock Strips

## Flat Ceiling Panel Application

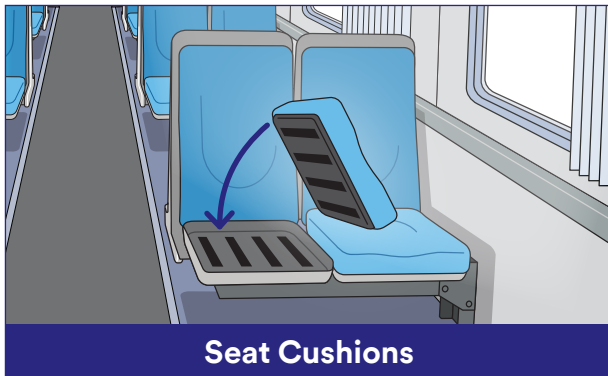


## Curved Ceiling Panel Application



# Other Rail / Bus Applications

Rail and bus OEMs can attach 3M™ Dual Lock™ Reclosable Fasteners in numerous applications without damaging the surfaces, see examples below. Ask your Distributor, Converter, or 3M Representative for a sample of 3M™ Dual Lock™ Reclosable Fasteners and get a feel for what it can do for your design and your production.



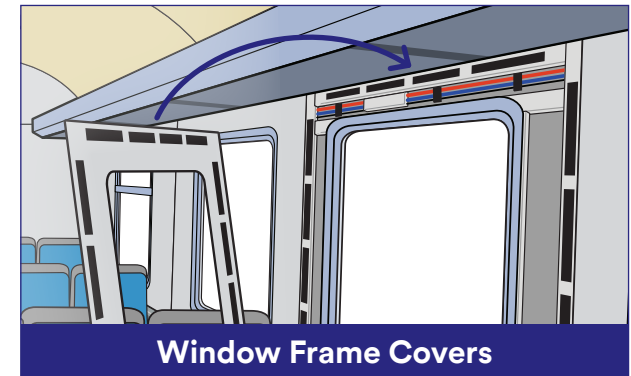
**Seat Cushions**

Fastened tightly to protect from theft or vandalism, yet maintenance friendly. Easily detachable for cleaning or refurbishment.



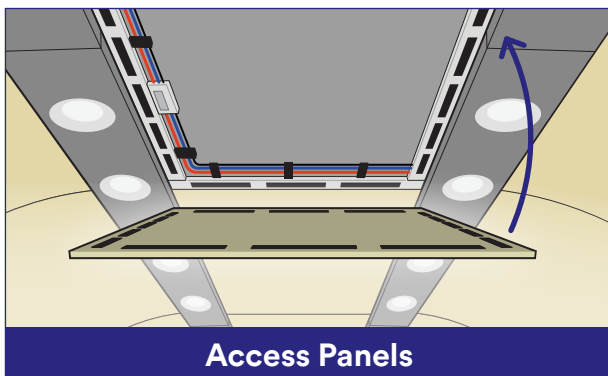
**Window Coverings**

Secure blinds or other coverings to interior windows.



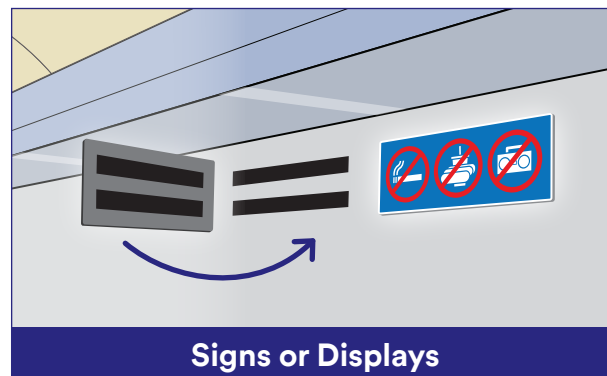
**Window Frame Covers**

For easy access when replacement windows are needed. Can also cover wires, allowing access for service, if needed.



**Access Panels**

Use a removable panel to cover electrical or mechanical components.



**Signs or Displays**

Interchangeable signs or displays in rail/bus interior.

## Application Profiles

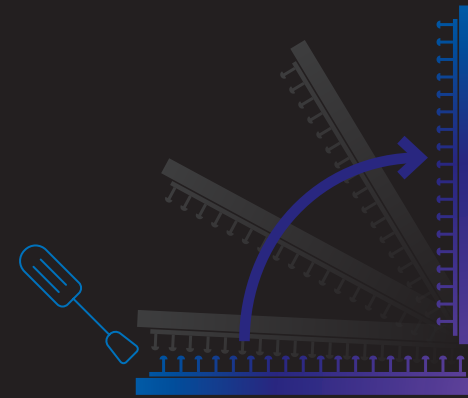
[Seat Cushions](#) 

[Window Coverings](#) 

[Signs or Displays](#) 


# Removability / Disengagement

To disengage we recommend 3M™ Dual Lock™ Reclosable Fasteners be separated at a 90-degree angle. Leave a gap or area where you can apply leverage to put the 3M Dual Lock into a cleavage/peel mode, a screwdriver or stiff spatula can be helpful to separate the parts.



## Simple Application Tips for Disengagement

 = Placement of 3M Dual Lock Strips

 = Where to Disengage 3M Dual Lock Strips

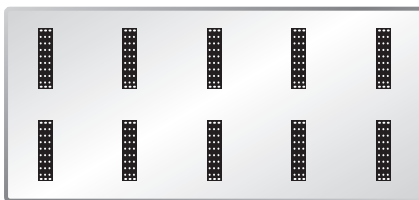
### Horizontal strip placement




Disengage from this side

 Do not disengage from this side

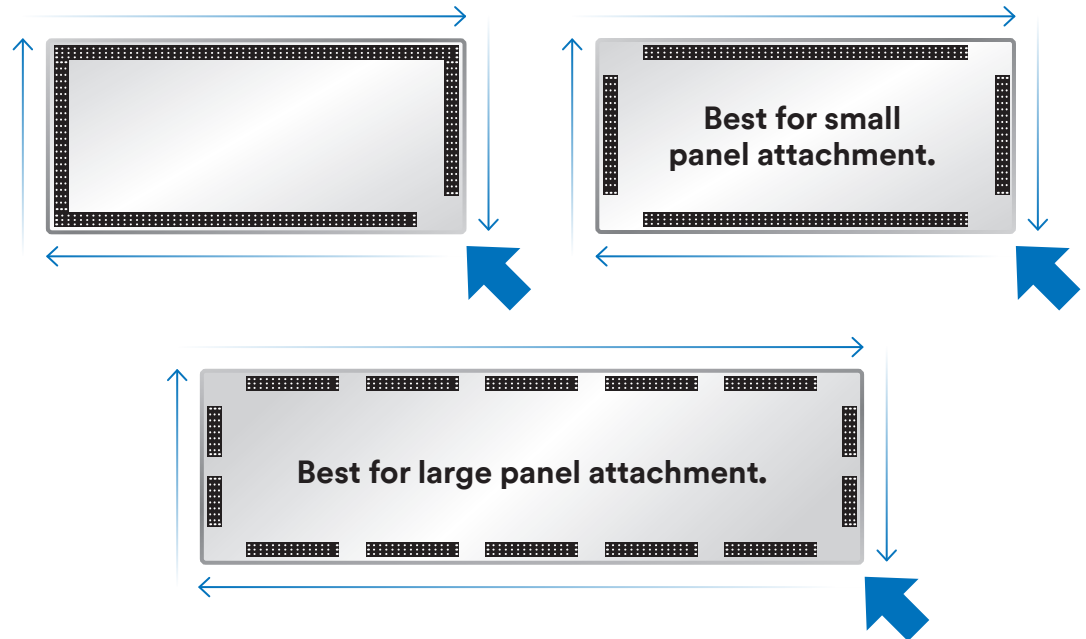
### Vertical strip placement



 Do not disengage from this side

Disengage from this side

### For panel bonding leave an opening corner or 4 opening corners To disengage start from any open corner, always working in one direction



# Hints & Tips

Use these additional recommendations to enhance the use of 3M™ Dual Lock™ Reclosable Fasteners.

## Rounded Corners

Rounded corners will reduce edge/corner lifting (vs. corners). Circles will hold the best. This may be more important for many open/close cycles. Purchase converted pieces from converter, or cut the corners by hand with scissors before applying, especially in the corner where removal will occur.

## Inspect Product

Ensure the stems aren't damaged in the converting or the rolling/applying pressure process, typically evenly applied pressure up to 310 kPa (45 PSI) does not damage the stems.

## Application Pressure

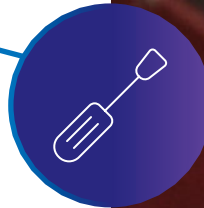
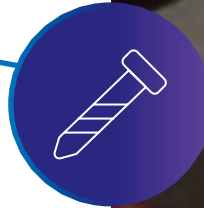
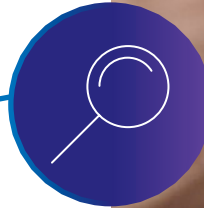
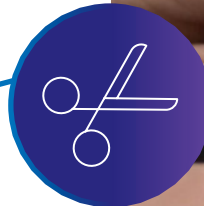
It is very important to apply good, strong even pressure to ensure proper wet out of the adhesive. For more details, see [Application Guide](#).

## Reinforce Attachment

Consider a second form of attachment (screw or rivet or staple through the 3M Dual Lock) as extra safety with heavy panels or in instances where primer is unlikely to be applied correctly or when attaching to plywood/wood.

## Disengagement Set-up

To disengage we recommend 3M Dual Lock be separated at a 90-degree angle. Leave a gap or area where you can apply leverage to put the 3M Dual Lock into a cleavage/peel mode, a screwdriver or stiff spatula can be helpful to separate the parts.

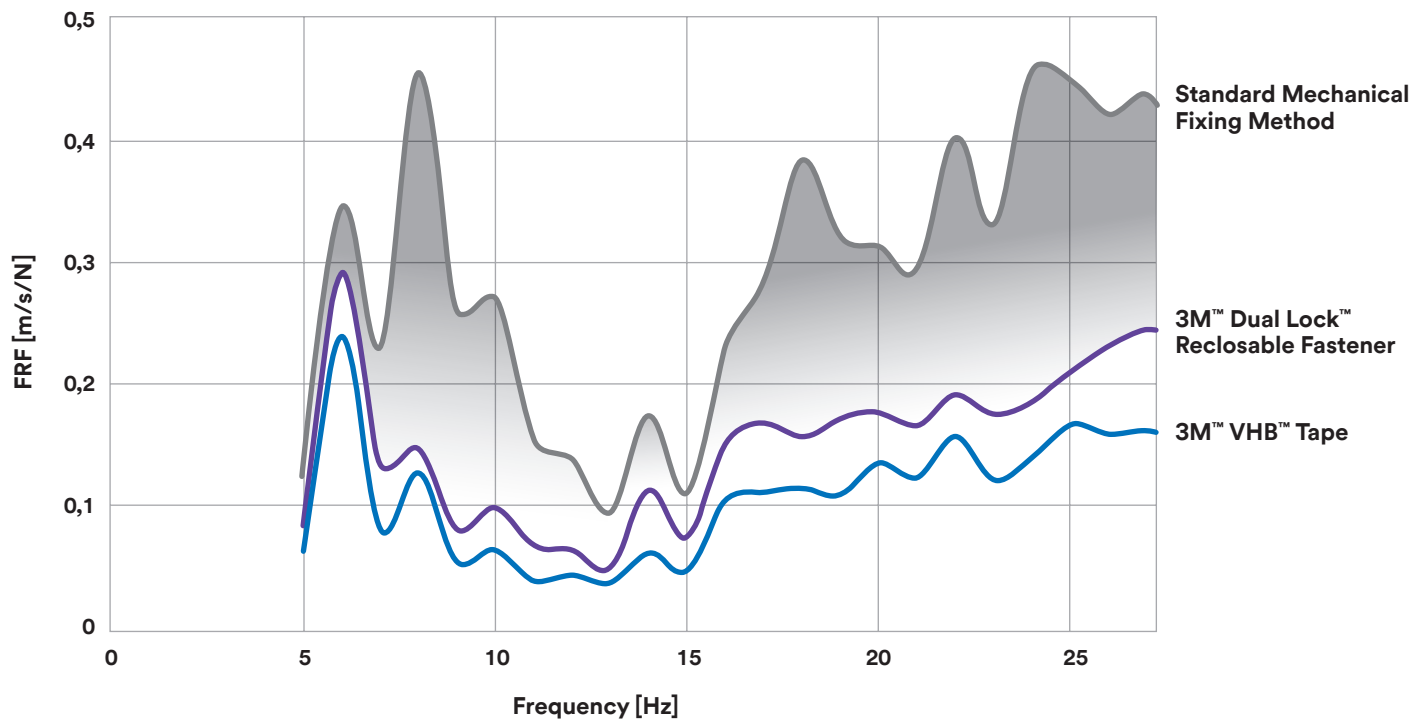


# Increase Passenger Comfort by Reducing Vibration

3M™ Dual Lock™ Reclosable Fasteners and 3M™ VHB™ Tape panel vibration measurements were performed in our labs. Samples were placed as shown in the picture and the distance between strips is around 30 cm

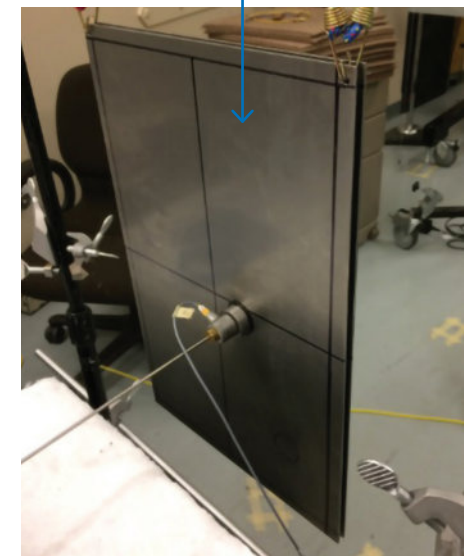
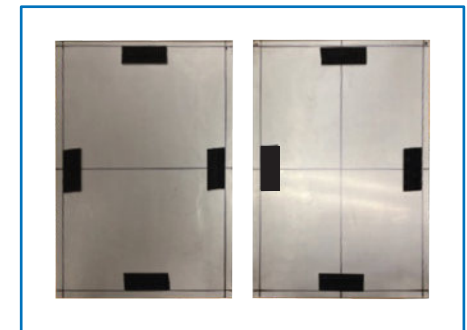
Rail / Bus vehicles  
typical vibration frequencies:  
**10 Hz to 30 Hz**

## 3M™ Dual Lock™ Reclosable Fasteners and 3M™ VHB™ Tapes Vibration Reduction



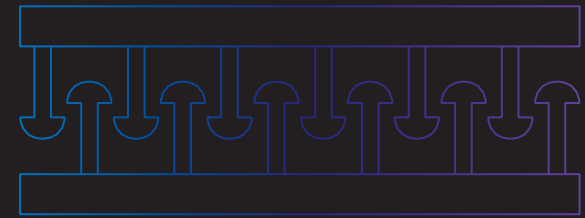
In one case, the panel was attached using 3M™ Dual Lock™ Reclosable Fasteners (3M™ VHB™ Tape Technology), in another case the panel was attached using 3M™ VHB™ Tape and finally a bare panel with a standard mechanical fixing method was tested as a reference. The input panel was stimulated and the vibration response of the output panel was measured. The chart shows the dynamic response of the outer panel in vibration amplitude, also called frequency response function (FRF), and measured between 10 Hz – 30 Hz.

In this chart, 3M Dual Lock and 3M VHB Tape show a significant reduction in vibration amplitude compared to the standard mechanical fixing method.



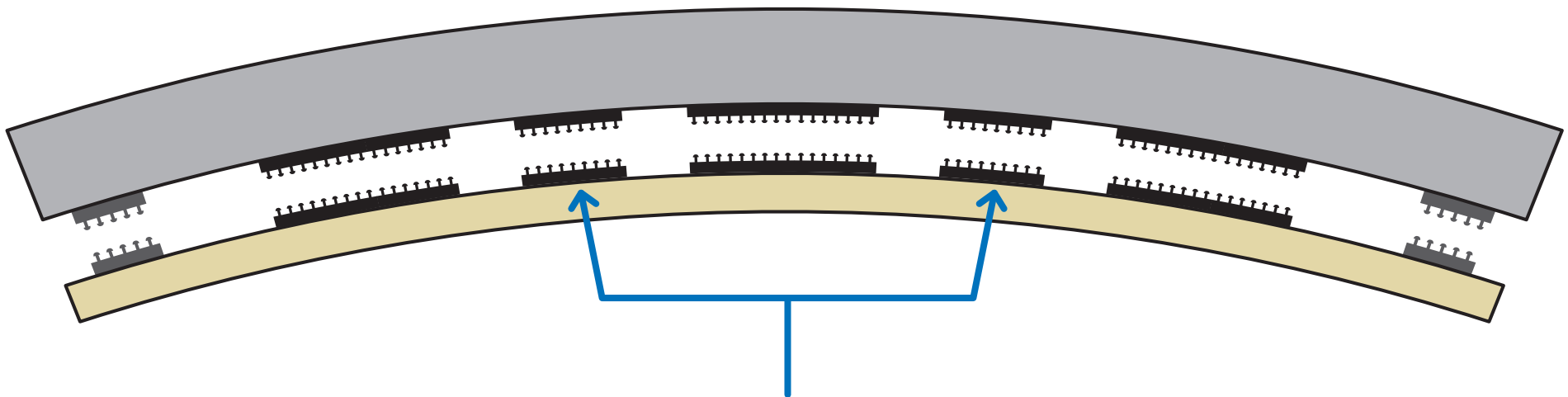
# Example Placement for Reducing Vibration

It depends on the structure, but here is one placement option of 3M™ Dual Lock™ Reclosable Fasteners for reducing vibration.



## Crosswise Application Example

 = Placement of 3M Dual Lock Strips



**Additional 3M™ Dual Lock™ Reclosable Fastener SJ3550 strips can be applied to reduce vibration.**

# 3M™ Dual Lock™ Reclosable Fasteners Global Product Selection

Product Family	Adhesive	Substrate	Indoor	Outdoor	Color (Stems / Adhesive)	170-Type	250-Type	400-Type
SJ3550	Conformable Acrylic	HSE, MSE	•	•	Black / White	<a href="#">SJ3552</a>	<a href="#">SJ3550<sup>†</sup></a>	<a href="#">SJ3551</a>
SJ3560	Firm Acrylic	HSE, MSE	•	•	Clear / Clear	<a href="#">SJ3562</a>	<a href="#">SJ3560<sup>†</sup></a>	<a href="#">SJ3561</a>

<sup>†</sup>Tested against the DIN EN 45545-2, the relevant FST Norm for the Rail Market in Europe.

## Other 3M Adhesive-backed products and non-adhesive backed products are available, including:

- Piece parts: rigid backed 3M™ Dual Lock™ Reclosable Fastener pieces designed to be mechanically fastened to substrates
- Low profile 3M™ Dual Lock™ Reclosable Fastener: minimal engaged thickness and reduced weight limit
- 3M™ Hook & Loop Fasteners: for applications with flexible substrates, where low engagement forces are needed, or where open/close life is over 1,000 cycles

For more information, contact your 3M Representative, 3M Technical Service or scan the QR-Code below..

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### Important Note

Product Selection and Use: Many factors beyond 3M's control and uniquely within users knowledge and control can affect the use and performance of a 3M product in a particular application. As a result, customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customers application, including conducting a workplace hazard assessment and reviewing all applicable regulations and standards (e.g., OSHA, ANSI, etc.). Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.

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