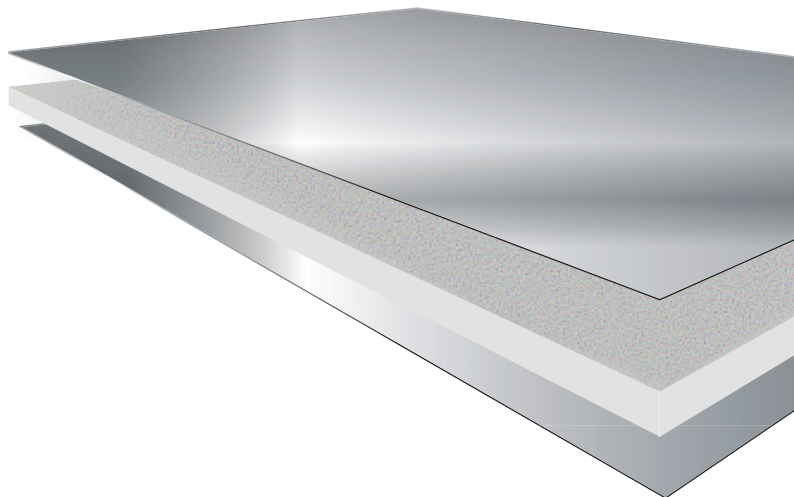




BBVA headquarters in Madrid. Stainless steel skin attached to each panel with 3M VHB™ tape (year 2015)



## The adhesive as an alternative to the mechanical or welded joints

The use of adhesives in the industry progressively opens up as an alternative to traditional mechanical or welded joints. Either by means of liquid adhesives or high-performance adhesive tapes, the reason is that it offers many advantages over those:

- Adhesive joint distributes the stress uniformly throughout the glued surfaces, unlike mechanical joints, which are punctual and therefore cause stress concentration.
- It is more flexible than mechanical or welded joint, with which it behaves better against impacts, vibrations, or stresses due to differential expansions.
- With adhesives there is no problem in joining different materials (example: metal with glass).

- The effect of galvanic couple between different metals is avoided.
- The adhesives seal while they join. In the same step and with the same product, both functions are fulfilled.
- Bonding with adhesives does not damage the substrates. For example, the drills required by the screws and rivets, or the thermal aggression of the weld are eliminated.
- It does not require energy input or specialized personnel, as it happens with welding.
- Aesthetic improvement is considerable since the adhesive bond is invisible.

However, the use of adhesives also has certain limitations:

- When high weights or stresses are present, when the contact area is small, or where there is a high torque, adhesive bond behaves worse than mechanical joints. As a guideline, a typical epoxy adhesive can reach 30-35 MPa

of tensile strength.

- Since the vast majority of industrial adhesives are organic polymers, the heat resistance is limited to 250-300 °C.
- Except for very few specific products, adhesive joints are not removable (although neither are riveted or welded joints).
- Careful preparation of the surfaces is required to ensure durability.

When you want to tackle an adhesive bonding project, it is advisable to carry out the following preliminary analysis:

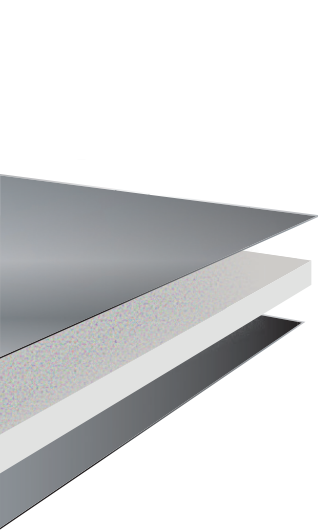
- 1) The materials to be joined must be completely defined from the beginning, both their nature and their surface finish or shape. If any change occurs later on, no matter how small, the work that has been done to date will not be valid.
- 2) Since the adhesive works through the surfaces of the substrates, it is important to

design the assembly so that the area available for adhesive is as large as possible, while the peel and torque stresses are minimized.

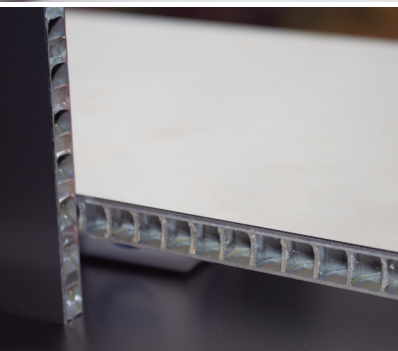
- 3) It is essential to know in advance the stresses that will act on the bond, the environmental conditions, the possible contact with chemical agents, and any other circumstances that could affect the performance of the adhesive.

The analysis just described should allow choosing a limited number of adhesive products as possible candidates for the application. This leads us to the testing stage, which often consists of the following steps:

- 1) Measurement of the initial adhesions (usually peel, shear or tensile tests).
- 2) Aging in a climatic chamber (heat / cold / humidity cycles, with or without UV radiation).
- 3) Measurement of the adhesions after aging.



The Reina Sofia Museum, Madrid. Stainless steel plate glued to stainless steel plate with epoxy adhesive 3M™ Scotch-Weld 7260 B/A (year 2004)



4) Preparation of a prototype on a real scale, to be subjected to “natural aging” in the real conditions of the application for as long as possible.

If the testing phase allows the project to be approved, the time will come to apply the adhesive, which must be carried out correctly, at the risk otherwise of spoiling everything done up to that point:

1) Surfaces must be clean, dry and free of grease, rust, dust or any other contaminant. This is generally achieved by wiping the substrates with rag moistened in a fast-evaporating solvent, such as acetone, methyl ethyl ketone, heptane or isopropyl alcohol. A more effective treatment is abrasion, preceded and followed by the aforementioned cleaning with solvent; Scotch-Brite™ 7447 or P180 or similar grain sandpaper usually give good results.

2) Adhesive must be applied in the necessary amount

(without being short), with the appropriate distribution, and respecting the open time stipulated in its technical sheet. Keep in mind that open time and final curing time vary depending on the ambient temperature (they are shortened when temperature rises, and vice versa).

3) Glued pieces should not be touched while adhesive has not cured enough. This can mean a few minutes or several hours, depending on the product and the weight of the pieces, unless adhesive tapes (instead of liquid adhesives) are used, in which case the pieces become immediately fixed.

There are numerous examples of application of structural adhesives or high performance adhesive tapes, and they can be found in a wide variety of markets, such as manufacture of appliances, electronics, furniture, signage, transportation or construction, among others. In all these cases, adhesive has replaced traditional joints thanks to some of the advantages that have been explained a few paragraphs above.

**SOURCE :**  
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