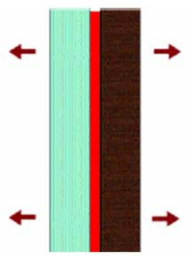
Terminology – Joint Sealants

- **Force & Tension (Tensile Strength);** is a measurement to classify the mechanical properties of an adhesive. The tensile strength is the point at which an adhesive, under the stress of an applied force, snaps, breaks or can no longer maintain its structural integrity. It is, in other words, the amount of force the material can withstand without breaking.
  The maximum load at which this happens is called tensile strength. The unit of tensile strength is MPa (megapascal) or N/mm^2.

  1 Pa = 1 N/m^2, (± 10N equals 1 kg)
  => 1Pa = 0,102 kg/m^2

  1MPa = 1.000.000Pa
  1MPa = 102.000 kg/m^2, or
  1.000.278 N/m^2 or 1N/mm^2 (0.102kg/mm^2)



The tensile strength is determined by pulling 2 materials straight from each other. Hereby the force is spread equally all over the bonded area.

__Force and tension__ are proportionally related.

> ***Example:*** *A standard joint of 50 mm x 12 mm is elongated and a **force of** 240 N (± 24 kg) is measured. The **tension** at this moment is 240/(50x12) = 0,40 N/mm^2*

- **Elasticity Modulus;** expresses the relation between tension (force) and elongation.
  For elastic sealants, the **elasticity modulus** indicates tension (force) required to elongate a specific type of standard joint to 100% - doubling its length. This is expressed in **N/mm^2** (or **MPa**).
  A product with a low modulus **(LM)** requires only limited tension (force) to achieve substantial stretching (high elongation percentage) – comparable to an elastic band. Products with a low modulus are soft/elastic. Their high elongation potential makes them well suited for application in (expansion) joints.
  A product with a high modulus **(HM)** requires high tension (force) for only limited stretch (low percentage elongation). Products with a high E-modulus feel harder. Their low percentage elongation under high tension makes them suitable especially for bonding applications.
  - E-modulus is tested according to DIN 53504 on a specified sealant film for elastic sealants (MS-, PU-

and silicone sealants). For plasto-elastic sealants such as acrylics and plastic sealants such as polybutene this test method is not applicable.

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- **F_{max}**; This is the ***maximum tension*** (force) a sealant can absorb. It indicates the strength of a sealant. **F_{max}** is expressed in **N/mm²**. Often **F_{max}** (maximal strength) is written, but actually

  ?**$_{max}$** (maximum tension) is meant.

  For elastic sealants, **F_{max}** is identical to the force (tension) at breaking point when stretching

  ? A sealant with a high **F_{max}** can absorb a high force and is therefore considered a "strong" sealant.

  - **F_{max}** is tested according to ISO 8339 in standard joints for acrylic sealants
  - **F_{max}** is tested for MS-, PU- and silicone sealants according to
  - ISO 8339 in standard joints
  - DIN 53504 in specified standard sealant film

- **Elongation at Break;** A sealant sample can be elongated to a multiple of its original length before it breaks (again, imagine stretching a rubber band). The elongation at breaking point is called "**Elongation at break**"

  Example: a joint sample of 12 mm will break at an elongation of 60 mm.

  The **elongation at break** is 48 mm or 400%.

  - **F_{max}** is tested according to ISO 8339 in standard joints for acrylic sealants
  - **F_{max}** is tested for MS-, PU- and silicone sealants according to
    - ISO 8339 in standard joints
    - DIN 53504 in specific standard sealant film

  Note: the result if tested according to DIN 53504 will be (much) higher than if tested according to ISO 8339.

- **Force at Break (Tension at Break);** A sealant sample can be elongated to a multiple of its original length before it breaks.

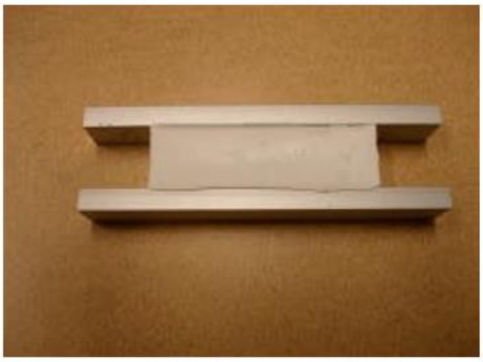
The tension (force) needed for this is called **force (tension) at break**. The **force (tension) at break** can be lower than $\mathbf{F_{max}}$. This if the sealant starts to tear or shows a plastic deformation during the elongation.

- $\mathbf{F_{max}}$ is tested according to ISO 8339 in standard joints for acrylic sealants
- $\mathbf{F_{max}}$ is tested for MS-, PU- and silicone sealants according to
- ISO 8339 in standard joints
- DIN 53504 in specific standard sealant film

- **Elastic Recovery;** A sealant is only "permanently elastic" if its elastic recovery performance is 100%. Usually sealants based on polymer technology (silicones, PU, MS) do not have an elastic recovery of 100%: they do not return to their original dimension after being stretched 100%. The percentage in which these products revert to their original dimension is called **"elastic recovery"**. In other words; a sealant sample has an **elastic recovery** of 100% if it reverts to its original length after being elongated to 100%. If the sample only reverts partially to its original length the elastic recovery is expressed in a lower percentage.

Example: A standard joint of 12 mm is elongated 100% (= 24 mm) and maintained at this dimension by spacer blocks during 24 hours. After the removal of the spacer blocks the joint reverts to 15 mm. Only 75% of the elongation is undone or 'recovered' The **elastical recovery** in this example; (24 mm-15 mm):(24 mm-12 mm) = **75%**

- Tested according to ISO 7389



- **Hardness (Shore A);** The hardness of a material is defined as the material's resistance to permanent indentation. Shore hardness is a characteristic for plastics, rubbers, sealants and adhesives.

  A Durometer (Shore meter) consists of a sharp point attached to a spring, which measures the resistance of the material to indentation. The resistance is shown on a scale from 0 to 100. The higher the result, the harder the product (no or only limited penetration of the point into the material being tested). A low value indicates a soft product (deep penetration of the point into the tested material).

  - For soft(er) material such as sealants Shore A is measured according to ISO 868
  - For hard(er) material such as plastics and adhesives Shore D is measured (sharper point and higher force)