Gasket Terms

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ASPECT RATIO: The aspect ratio of a shape is the ratio of the longer dimension to its shorter dimension. It may be applied to two characteristic dimensions of a three-dimensional shape, such as the ration of the longest and shortest axis, or for symmetrical objects that are described by only two dimensions, such as the length and diameter of a rod. Aspect ratio is often used to describe the properties of fibers and various fillers in gasket materials. The larger the aspect ratio of the primary fiber constituent in the material, the higher the tensile strength and flexibility of the sheet. The term Aspect Ratio is sometimes used to describe the ratio of surface area to volume of a fiber.
WET FILM/DRY FILM (THICKNESS): Commonly used in the application of adhesives or other coatings when the material is applied in a wet state, as most are. Coating and adhesives are most commonly diluted with either a solvent or other diluents like water. These give the substance the proper consistency for uniform application. During the process, these diluents are evaporated off leaving the final thickness of coating or adhesive. The thickness of the final solid coating or adhesive is referred to as the "dry film thickness." The thickness of the proper amount of "wet" material applied to the product to yield the proper "dry" film is called the "wet film thickness." The ratio of the "dry film" to the "wet film" is referred to as the "solids ratio" expressed as a percentage. For example, in the manufacturing of rubber coated steel, a "wet" film thickness of .003" would yield a solid coating of .0006" if the solids ratio were 20%. The figure below illustrates a type of gauge which might be used to measure "wet films."

MD/CMD/Z-STRENGTH: These are common abbreviations for tensile strength properties of most materials used for gaskets. Ideally, the tensile strengths in the X and Y directions of any sheet of material should be the same. In most cases however they are not the same. MD means the tensile strength in the machine direction. Paper in particular is supposed to be random in its' fiber orientation, however, it is run in a continuous process which allows the fibers in the mix to orient themselves, in varying degrees in the direction of machine travel. CMD means the tensile strength in the cross-machine direction. If there are any differences between the tensile values between the MD and CMD tensile values, it is usually due to this orientation of fibers. This can easily be seen when tearing a piece of paper. It will easily tear in a straight line if torn parallel to the machine direction. Tearing at right angles to the MD, the tear will not be anywhere near straight.

Z-STRENGTH is the internal strength of the material. Suppose that the flat surfaces were glued to plates and then these plates pulled apart. Failure should occur within the material itself (cohesive failure). The value of the stress required to fail the material internally. This property manifests itself whenever the gasket material adheres to any flange surface upon removal, leaving material which will require additional removal. In most instances, the use of anti-stick coatings or material with higher Z-Strength will reduce the sticking problem. One material which has relatively poor Z-Strength is expanded graphite.

DENSITY/CLOSEST PACKING DENSITY: The first term is easily recognizable and is used to describe the weight of a material in a prescribed volume, usually reports in pound per cubic foot or in metric at grams per cubic centimeter. Most gasket materials fall in the range of 40 lbs./ft3 to 100 lbs./ft3. Water has a nominal density of 62.4 lbs./ft3. Generally speaking, materials with lower density have higher compressibility, poorer sealability and greater creep relaxation. This is because there is porosity within the material which compress more easily, reducing volume as is compresses.

Another concept which may not be as well-known or reported is the concept of Closest Packing Density or Maximum Density. This occurs when the compressive load is increased, and the material reaches a point at which it cannot continue to compress without changing shape. It becomes a 100% solid mass. Most gasket materials exhibit this property when the density approaches 135-150 lbs./ft3. This number can be calculated if the densities and weights of all of the constituents which make up the material are known but, in general, 135-150 lbs./ft3 is a good approximation for most gasket materials. The effects of reaching the Closest Packing Density are clearly seen if a metal eyelet or grommet is put into a hole in a gasket and flattened to the thickness of the gasket material. If the thickness of the grommet is too thick, the gasket material will start to extrude and distort the gasket once the CPD is exceeded.