



Cycletime Tips - General

Volume 6: The Data Sheet - Part 1

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This is the first of two CycleTime Tips to help you understand the information found on a typical plastic Data Sheet for thermoplastic resins. This issue will cover the purpose of the sheet and the information it provides regarding mechanical properties.

What is a Data Sheet?

A Data Sheet is a numerical representation of the physical properties of a plastic, based on laboratory testing. It includes mechanical properties, thermal properties, and general properties such as flammability rating, mold shrinkage and specific gravity. A Data Sheet can be used to compare two similar plastics, preferably from the same family, because each plastic family has inherent characteristics that make it hard to compare (such as comparing an amorphous resin to a crystalline resin on notched Izod impact because the crystalline materials are more notch sensitive). The values on a Data Sheet are typical, i.e., the average of what you can expect from the production. The test results may change due to:

- **Molding Conditions:** Specimens molded a certain way may have a better Izod impact but not the highest value in tensile.
- **Laboratory:** From one to another, there may be variations in the testing methods. So you may obtain different results even if both tests are based on the same test standard, i.e., Europe versus North America.
- **Color:** The results may vary if the resin is natural versus colored.
- **Testing Conditions:** These are not the same for every thermoplastic, i.e., melt flow index for polypropylene is at 230°C with a weight of 2160 gr., and for polyethylene it is 190°C with a weight of 2160 gr. How can you compare the melt flow index of a polypropylene to a melt index of a polyethylene?

Mechanical Properties

On a Data Sheet you may find the following mechanical properties: tensile strength, tensile modulus, elongation, flexural strength, flexural modulus and Izod impact.

Tensile Properties (ASTM D-638):

The tensile properties are the most important indication of the strength of a plastic. A specimen molded or made by compression of 18" is put between two jaws which move apart at a certain rate, and the stress is plotted against the strain (elongation) automatically on graph paper or computer screen.

Tensile Modulus (ASTM D-638):

This is the ratio of stress to strain below the proportional limit of the material. With the

same test, the elongation is found. The rate at which the test is performed (crosshead speed) may affect the results.

Flexural Properties (ASTM D-790):

The specimens can be molded or cut from a plaque. The specimen is placed on two supports spaced 4 inches apart. A load is applied at a specific rate in the center. The load at which the part breaks is called flexural strength. The higher the value, the stiffer the material. The rate at which the test is performed (crosshead speed) may affect the results.

Notched Izod Impact (ASTM D-256):

A molded or cut piece of plastic measuring 18" x 12" x 2" is notched in the narrow face and clamped in the base of a pendulum testing machine. A pendulum is released, and the force consumed in breaking the specimen is calculated from the height the pendulum reaches on the follow-through. This test does not give a true value of impact characteristics because:

- the radius of the notch greatly affects the results, a sharper radius giving a lower result
- some polymers are more sensitive to the notch, like crystalline versus amorphous
- the thickness of the sample may affect the results.

However in real life, how often do we have a part that needs to break at a specific area with a specific amount of energy?

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