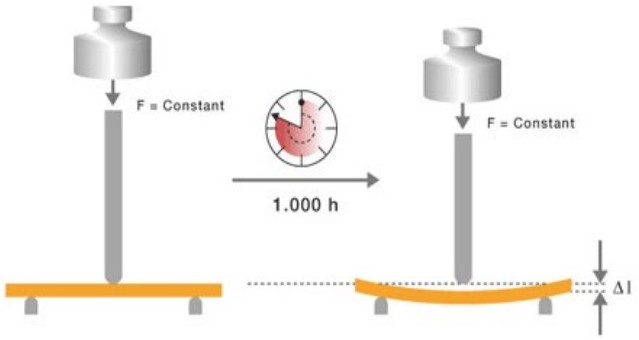
Explanation of Creep versus Heat Distortion Temperature

OVERVIEW

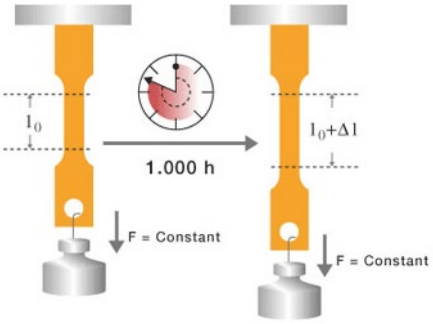
Creep and Heat Distortion Temperature (HDT) are both meaningful tools for comparing the relative performance of thermoplastics and in designing parts.

DEFINITIONS

Creep is defined by several ASTM test methods, the most pertinent to thermoplastics being contained within ASTM D2990. These tests involve an applied load and a tensile or flexural fixture to measure any change in the material's dimensions while it is under load in an elevated-temperature environment.

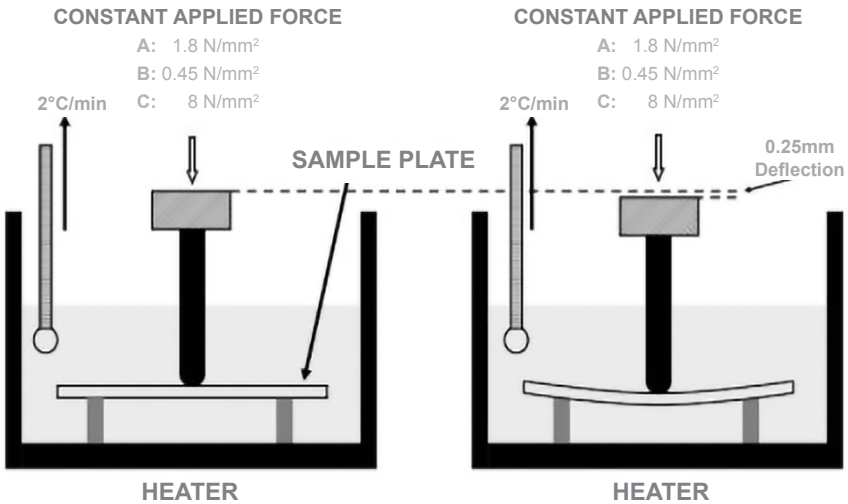


FLEXURAL CREEP



TENSILE CREEP

Heat Distortion Temperature (HDT) is a specific test described in ASTM D648 and ISO 75. A prescribed load is applied to a sample and the surrounding temperature is raised until the sample deflects by 0.010"/0.25mm. This deflection temperature is also known as the 'deflection temperature under load' (DTUL) or 'heat deflection temperature'; all are equally valid terms as long as the same test method is being described.



HEATER HEATER

Customer Collaboration
1305 Lincoln Ave. Holland MI 49423 USA
Phone: 800.823.1305, +1.616.694.3808
Email: info@sekisui-spi.com

appLab™
Phone: 800.682.8758
Email: applab@sekisui-spi.com

sekisui-spi.com

Explanation of Creep vs Heat Distortion Temperature

SIMILARITIES

Both creep and HDT involve elevated temperatures and an applied load. Both are valuable tools for characterizing and comparing the relative physical properties of thermoplastic materials and the environments in which they will be used.

DIFFERENCES

Creep relates to long-term fatigue, whereas HDT is a short-term test. There are multiple types of creep testing, while there are only two HDT standards (ASTM D648 and ISO 75). Tensile, flexural, compressive, and chemical resistance are the most common creep testing with thermoplastics.

CASE STUDY EXAMPLE

A small tractor roof: material selection based on HDT or creep alone won't determine how the final part will hold up to increased temperature and direct sunlight while under physical stress. Part design, thermoform design (twin-sheeting), internal supports, or application of FRP/SMC on the inside will affect how external stresses can deform the final part while in the field.

While proper material selection is certainly important, the overall design criteria have to be taken as a whole to make an educated decision about how the completed part will weather extended use.

CONCLUSION

Materials and applications determine the proper use of creep or HDT data. The deflection temperature test results are a useful measure of relative service temperature for a thermoplastics when used in load-bearing parts. However, the deflection temperature test is short-term and should not be used alone for product design. Other factors such as the time of exposure to elevated temperature, the rate of temperature increase, and the part geometry also affect performance.

Customer Collaboration
1305 Lincoln Ave. Holland MI 49423 USA
Phone: 800.823.1305, +1.616.694.3808
Email: info@sekisui-spi.com

appLab™
Phone: 800.682.8758
Email: applab@sekisui-spi.com

sekisui-spi.com