

## Minimum Service Temperature of KYDEX® Thermoplastic Sheet TB - 121-B

### Introduction

At room temperature, most plastics exhibit their typical properties as listed on the technical data sheets. This includes the plastic's ability to withstand impacts without cracking or failing as conveyed through Izod or Drop Dart impact values. As the temperature decreases most plastics rapidly lose this ability to resist cracking and become brittle. Low temperatures are typically more harmful to plastics and their surroundings than high temperatures because this is where shattering occurs as opposed to deformation at high temperatures. This is sometimes referred to as the Glass Transition Temperature or Tg. Tg for plastics often refers to the temperature region where plastics exhibit 50% brittle failures as opposed to a flexible or ductile failure (the region where the polymer exhibits brittle failures similar to glass).

Tg varies greatly between polymers and can be changed dramatically when modified with certain additives. Tg is not usually a specific temperature, but often a range where the plastic begins to exhibit brittle failures to the point where all brittle failures occur. After a plastic falls below this temperature, there is little change to the polymer and inherent impact properties will determine the strength of the plastic. It is important to note that Tg does not specify a low service temperature limit but simply indicates the point where a brittle fracture is the dominant failure type.

KYDEX® sheet, like all other thermoplastics becomes brittle at lower temperatures. Below are two tables that show typical impact values for several grades of KYDEX® sheet at various temperatures.

**Table 1**

Table 1 shows typical values for Notched Izod Impact as per ASTM D256 at 3.18mm (0.125") thick. At -29.0°C (-20°F) KYDEX® sheet exhibits all brittle breaks. Below this temperature, the impact does not drop much further. The Notched Izod test requires a 2.54mm (0.100") deep notch be cut into the sample that is then struck with a swinging pendulum. This type of impact would more closely match a part that is already fractured and then experiences an additional impact. The results of this test method are mainly used to compare one plastic to another under very controlled test parameters and are very difficult to transfer to real-life situations.

Product	73°F (23°C)	-20°F (-29°C)
KYDEX® 100	18.0 ft-lb/in (961 J/m)	1.5 ft-lb/in (80 J/m)
KYDEX® 430	3.4 ft-lb/in (182 J/m)	1.3 ft-lb/in (69 J/m)
KYDEX® T	15.0 ft-lb/in (801 J/m)	2.8 ft-lb/in (149 J/m)

Typical Notched Izod Values at Various Temperatures  
ASTM D-256

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**Table 2**

Table 2 shows typical values for Gardner Dropdart Impact as per ASTM D5420, Geometry GE, 3.18mm (0.125") thick at -20°F (-29°C). A dropdart impact comes closest to a realistic impact that a part may experience in daily use.

KYDEX® sheet has been used in many cold temperature applications successfully without incident. With the proper part design, selected thickness, and product choice, it can be used for many cold temperature applications successfully.

Note: It is important to test KYDEX® sheet in the appropriate environment to verify its suitability.

Product	73°F (23°C)	-20°F (-29°C)
KYDEX® 100	576 in-lbf (65.1 J)	54 in-lbf (6.1 J)
KYDEX® 430	581 in-lbf (65.6 J)	52 in-lbf (5.9 J)
KYDEX® T	>627 in-lbf (70.8 J)	92 in-lbf (10.4 J)

Typical Dropdart Values at Various Temperatures  
ASTM D-5420, Geometry GE, 3.18mm (0.125")

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