THE GUND COMPANY
MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS
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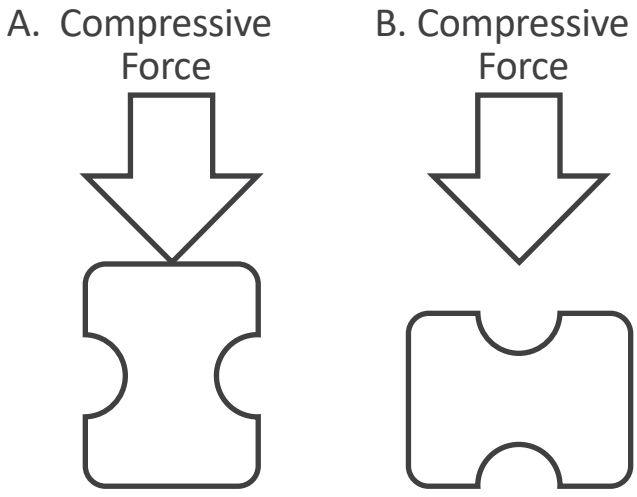
Transformer Spacer Stick Compressive Strength Study

How much does compressive strength decrease at 150C?

The Gund Company is consistently testing the products we manufacture and sell in order to provide engineers with the data they need. While it is widely known that the strength of a material is reduced at higher temperatures, the data for specific properties and configurations is not always available. The most common property tested at higher temperature is flexural strength, however some mechanical properties are more negatively impacted by increasing temperature than others. For example, tensile strength is a reinforcement driven property and typically does not show as strong a response to temperature as compressive strength, a matrix driven property.

Dry type transformer rod spacer sticks, often called "dogbone" because of their unique shape, provide space for air cooling within the wound layers of the transformer coil. The forces exerted on this rod during coil winding and while in service are typically compressive in one of the two directions (shown right).



While in service, dogbone spacer sticks will undergo thermal and compressive stress simultaneously. Electromagnetic forces from current faults can test the high temperature compressive strength of dogbone spacer sticks. Therefore, compressive strength at high temperatures is a critical property in this application and needs to be investigated thoroughly when making a choice of spacer stick.

Experiment Description:

A common profile for dogbone spacer stick is 3/8" x ½". Five grades of materials were tested, each having this same profile: Gund N155, Gund N220, Glastic SG200, Liberty Supersil, Iten G1GP10. All test pieces were cut to a standard length of 0.50".

Prior to performing high temperature compressive strength testing, a short study was performed to determine the difference in strength between dogbone orientation A and orientation B.

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For the same length piece, our testing has shown that configuration B has 30-60% lower breaking force. See the results for Gund Grades N155 and N220 shown in Table 1 below.

Breaking Force (lbf)	N155	N220
Flat Edge Strength, A	1920	1564
Curved Edge Strength, B	1231	947
Difference lbf	689	618
% Reduced	36%	39%

Since the curved edge test provided the worst case scenario, all five grades were tested at room temperature and at 150C. Chart 1 provides the results of the 150C test.

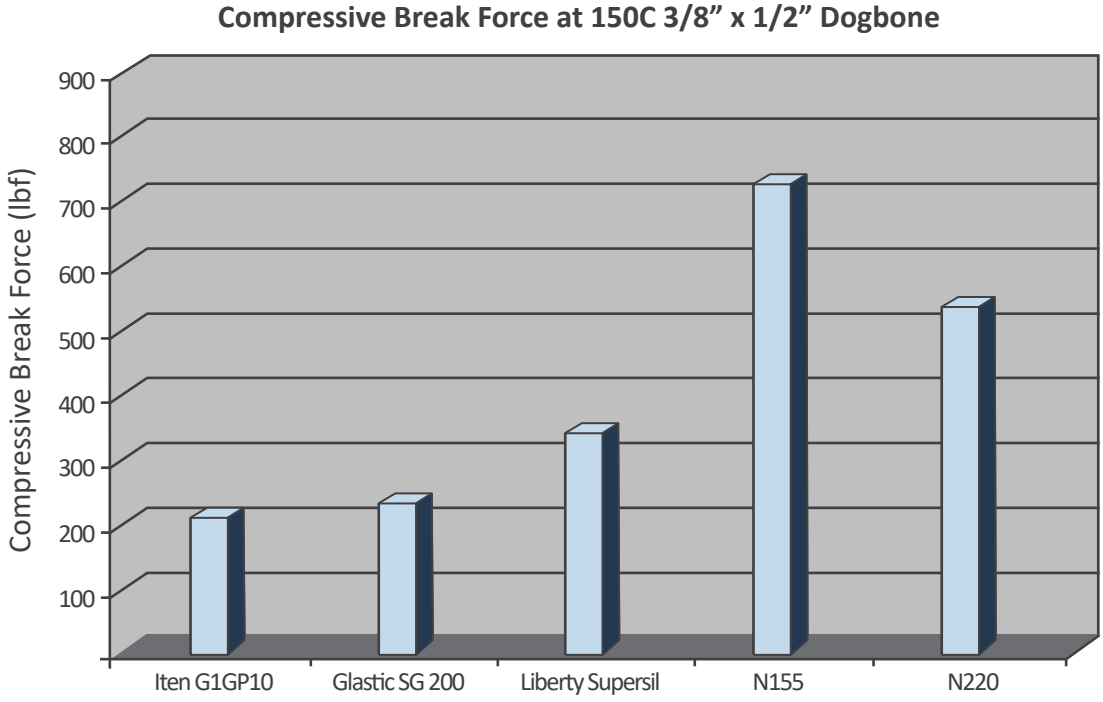

Chart 1- Compressive break force at 150C

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The Gund company grades N155 and N220 retained more than 50% of the original room temperature compressive strength while the other three grades fell below 30% retention. See chart 2 for the detailed retention results.

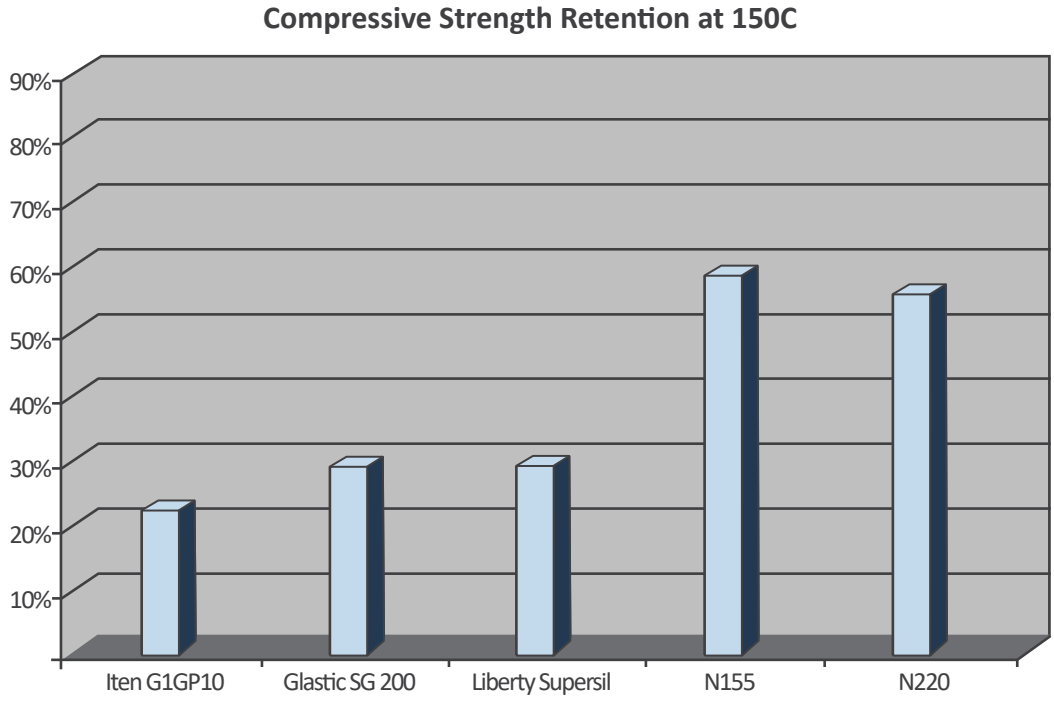

Chart 2 – Compressive strength retention at 150C

For further assistance with dry type transformer insulation systems or if you have further questions related to this study, please contact us at *transformers@thegundcompany.com*

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