

THE EFFECT OF TEMPERATURE ON THE TENSILE STRENGTH AND ELONGATION OF BAL SEAL ENGINEERING MATERIALS

Technical Report
TR-72 (Rev. A; 10-10-01)
(100-47-2)



19650 Pauling
Foothill Ranch, CA 92610-2610
Tel (949) 460-2100
Fax (949) 460-2300
Email: sales@balseal.com
www.balseal.com

Bal Seal Engineering Europe B.V.
Jollemanhof 16, 5th Floor
1019 GW Amsterdam
The Netherlands
Tel +31 20 638 6523
Fax +31 20 625 6018
Email: ordersbv@balseal.nl

TABLE OF CONTENTS

- 1.0 Purpose
- 2.0 Discussion
- 3.0 Tensile strength versus temperature
- 4.0 Elongation versus temperature
- 5.0 Results
- 6.0 References

The information, descriptions, recommendations and opinions set forth herein are offered solely for your consideration, inquiry, and verification and are not, in part or in whole, to be construed as constituting a warranty, expressed or implied, nor shall they form or be a part of the basis of any bargain with Bal Seal Engineering. If any sample or model was shown to or provided by Buyer/User, such sample or model was used merely to illustrate the general description and type of goods. Such use is not to be construed as a warranty that the goods will conform to the sample or model. Furthermore, THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER WARRANTIES, IMPLIED OR EXPRESSED, ARE EXCLUDED AND SHALL NOT APPLY. This document provides product options for further investigation by Buyers/Users having technical expertise. The Buyer/User, through its own analysis and testing, is solely responsible for making the final selection of the products and for assuming that all performance, safety and warning requirements for the application are met. It is recommended that Buyers/Users run evaluation testing under actual service conditions to determine whether proposed Bal Seal products are suitable for the intended purpose. Nothing contained herein or in any of our literature shall be considered a license or recommendation for any use that may infringe patent rights. (LE-17)

PATENTS: The items described in this report include products that are the subject of the following issued United States patents: 5,979,904; 5,994,856; 6,050,572; 5,984,316; 6,161,838 and others, as well as foreign patents or products where patents are pending. (LE-88G)

©Copyright 2001, Bal Seal Engineering Co., Inc. U.S.A.

Use or disclosure of data contained on this sheet is subject to the restrictions contained in the disclaimer located in the Table of Contents of this report.

1.0 PURPOSE

This report describes the effect of temperature on the tensile and elongation of BAL™ Seal PTFE materials.

2.0 DISCUSSION

The following materials were tested.

MATERIAL	DESCRIPTION
T	Virgin PTFE – a General-purpose material typically used when chemical compatibility and low friction is necessary. Light duty service. Not suitable in water but it is compatible with most fluids and gases. Color: white.
G	Graphite-filled PTFE – Used in general purpose application for a greater degree of extrusion / creep resistance. This material is compatible with most fluids and gases. Not for use in vacuum or dry gas. Color: black.
GC	Graphite-carbon filled PTFE – a General-purpose material used where extrusion / creep resistance is important. Resists deformation at high temperatures. Not for general use in vacuum or inert gases. Color: black.
GFPA	Reinforced-graphite-filled PTFE – An excellent wear resistant material for use at higher temperatures, pressures, and speeds. Excellent for use in water and other aqueous solutions. Can be used in continuous duty at high pressure with adequate backing. Color: black.
SP 45	Polymer-filled PTFE – A general-purpose material, usually used in contact with soft shaft materials like 300 series stainless, aluminum, etc., at various pressures, temperature, speeds and media, including vacuum and inert gases. Color: light green.
SP 50	Polymer- PTFE Blend – For general service applications. Excellent wear resistance in gases, air and vacuum. Limited wear resistance in water. Low abrasion to dynamic surfaces. Suitable for high speed low pressure. Color: grayish brown.

The tensile and elongation properties of PTFE BAL Seal materials decrease as the temperature increases, as indicated in the following charts and graphs.

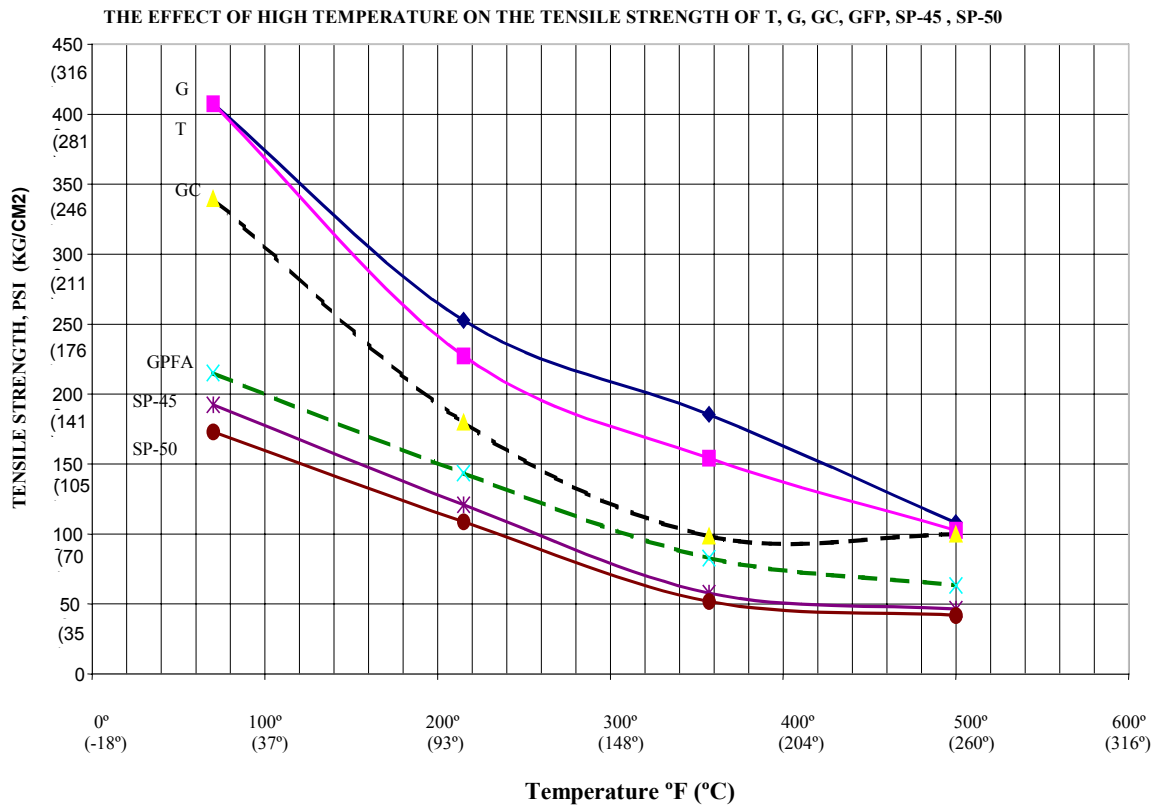
3.0 TENSILE STRENGTH VERSUS TEMPERATURE

There is a rapid decrease in tensile strength for T, G, and GC materials, while the decrease in tensile strength for GFPA, SP-45 and SP-50 is gradual. GFPA and SP-45 maintain their properties substantially better at elevated temperatures.

MATERIAL – TENSILE STRENGTH AT TEMPERATURE (PSI)						
TEMPERATURE (°F)	T	G	GC	GFPA	SP-45	SP-50
70	4075	4075	3396	2151	1924	1731
215	2527	2275	1798	1434	1209	1088
357	1856	1543	984	829	578	520
500	1082	1027	998	633	464	418

*Reference Report #27-7

TABLE 1



GRAPH 1

Use or disclosure of data contained on this sheet is subject to the restrictions contained in the disclaimer located in the Table of Contents of this report.

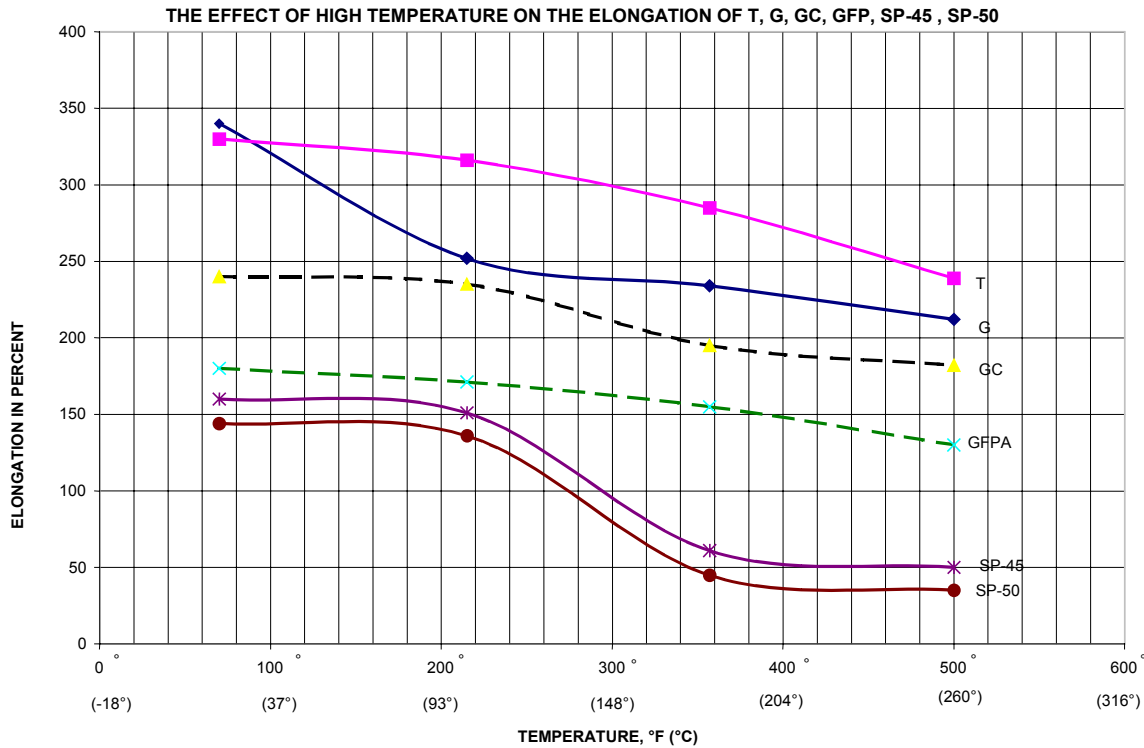
4.0 ELONGATION VERSUS TEMPERATURE

As the temperature increases, the elongation of T, G, GC, GFPA, SP-45 and SP-50 decreases because the materials soften. The elongation of virgin PTFE decreases much more sharply than other materials. GFPA, SP-45 and SP-50 have lower elongation properties than the other materials. See Table 2 and Graph 2.

MATERIAL – ELONGATION AT TEMPERATURE (PSI)						
TEMPERATURE (°F)	T	G	GC	GFPA	SP-45	SP-50
70	340	330	240	180	160	144
215	252	316	235	171	151	136
357	234	285	195	154	61	45
500	212	239	182	130	50	35

*Reference Report #27-7

TABLE 2



GRAPH 2

Use or disclosure of data contained on this sheet is subject to the restrictions contained in the disclaimer located in the Table of Contents of this report.

5.0 RESULTS

The results indicate that G is most stable in conditions where the seal is to be used at elevated temperatures.

6.0 REFERENCES

Bal Seal Engineering Reference Report #27-7 and #100-47.
“Properties of BAL™ Seal PTFE Seal Materials.” Technical Report TR-8A.
Bal Seal Engineering DM-5 “Rotary Seal Catalog.”