



**Designers and manufacturers of high temperature metal seals for the aerospace and associated industries.**

The Sigma Seal is designed a low load flexible metal seal for use at high temperatures and pressures. It is ideally suited to those applications where large thermal movements occur, or where large tolerance stack-ups need to be accommodated.

**Applications include:**

- Rolls-Royce RB211 engine series.
- Pratt & Whitney Canada PT6 engine series.
- BMW Rolls-Royce BR700 engine series.

Manufacturing is in accordance with Quality System ISO 9002 and SBAC Technical Specification 157.

**Throughout these pages imperial dimensions are in inches, metric dimensions are in millimetres and are shown on a blue background (see below), except where otherwise stated.**

INCHES .010

MILLIMETRES 254

**Features**

The Sigma Seal is available in different types of section as shown on page 3. The standard sections are suitable for use in most applications. The two specialised sections will produce seals which exert a greater specific load at the area of contact than the standard sections, which can be useful for higher pressure applications. The section shown in figure 1 also allows certain extreme cavity conditions to be accommodated.

Variations in the size and shape of space envelopes for the seals require a certain degree of adaptability in seal design. The Sigma Seal design allows this adaptability without adversely affecting seal performance. It is particularly suitable for use where the available envelope radial width is limited or where the ratio of envelope radial width to cross section height is less than one.

The central spine can be extended and used to locate the seal and to prevent the sealing areas fouling on the envelope corner radii or from leaving the envelope contact areas.

Sigma Seals can be designed to seal either internal or external pressure. They are available in large diameters; for example 40 inches/1000 millimetres diameter. Typical installations are shown on page 6.

## Technical Information

### Seal Sections/Diameters

Sigma Seals are designed on an individual basis to suit the customer's application, they can be manufactured in a wide range of sections and to virtually any diameter, therefore we do not produce a standard parts list for this product. However, there are three standard sections available which are suited to many applications that utilise industry standard flanges. The details of the three standard sections and their corresponding cavity dimensions are shown on pages 4 & 5. For all other applications where standard sections are not appropriate we will design an alternative section to suit your particular requirements, so please consult us.

### Materials

Materials are selected according to service requirements, they include high strength nickel alloys such as inconels, nimonics, Waspaloy; and cobalt based alloys such as Haynes 25. Stainless steel can be used in less arduous conditions. Normally the material thickness used is within the range .006 [.152](#) to .015 [.381](#)

### Heat Treatment

Where necessary full heat treatment is applied to the seal to ensure maximum use of the material properties.

### Coatings

The standard Sigma Seal is uncoated, a silver plate or an alternative coating such as nickel or PTFE can be supplied as required. Plating or coating can help by filling the voids and irregularities in the flange sealing surfaces.

Tribaloy (cobalt based) coating can be used to protect the seal in extremely arduous conditions.

### Surface Finish of Mating Hardware

The surface finish of the mating hardware should ideally have a circular lay and be N6 (32 microinches, 0.8 micrometres) or smoother. The smoother the finish, the better the sealing. High temperature/high pressure applications and vacuum applications require smoother flange surface finishes.

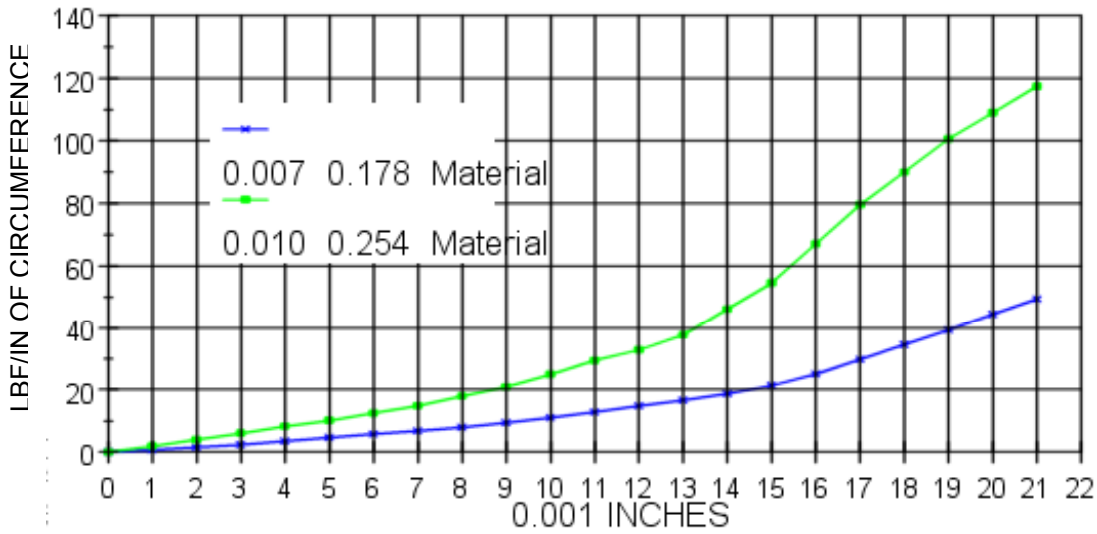
### Seating Load

The Sigma Seal is a flexible low load seal with good recovery. The seating load is dependant upon the free height, material type and thickness, heat treatment and cavity depth. Ideally the seal should be compressed to a value within the range 5%–20% of its free height.

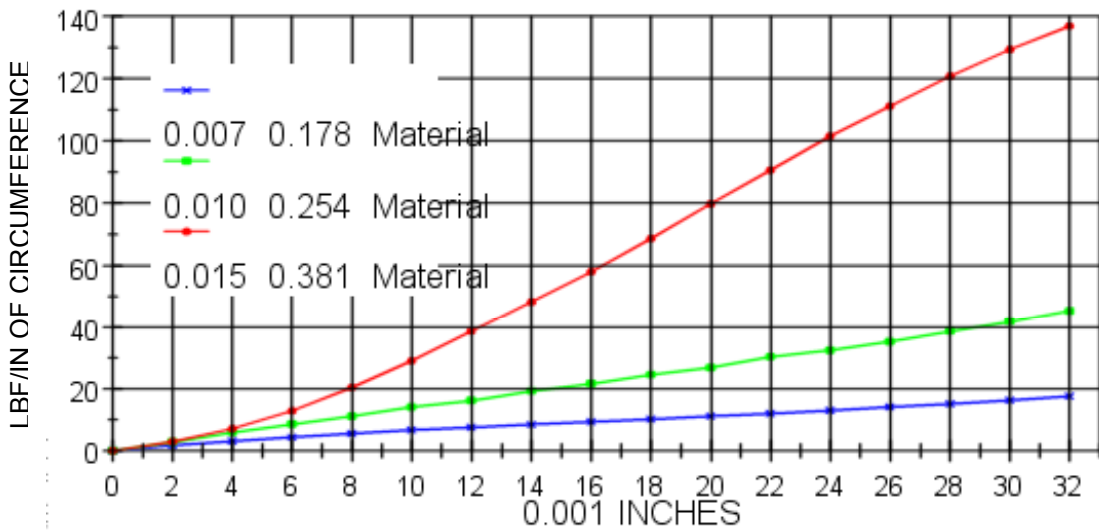
Typical load deflection data for the three standard Sigma Seal sections are shown on the following page. The figures shown are for fully heat treated parts in various material thicknesses. These figures are for guidance only; tolerances and variations in material thickness, properties, coatings and platings along with seal diameter will have a significant effect on these values.

# LOAD DEFLECTION CURVES

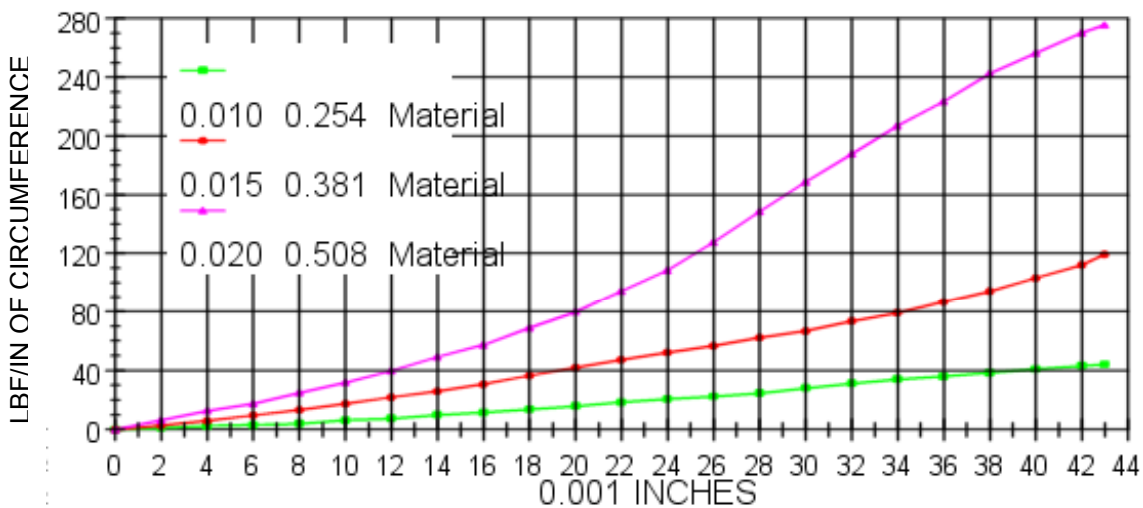
## 1/8 3.0 SECTION



## 3/16 4.5 SECTION

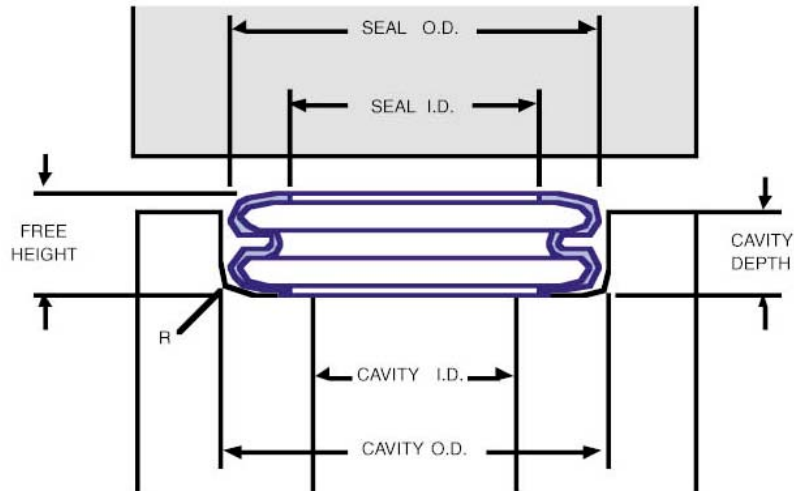


## 1/4 6.0 SECTION



# STANDARD SIGMA SEAL SELECTIONS

## INTERNAL PRESSURE



NOMINAL SIZE	CAVITY				SEAL			
	DEPTH	O/D (MIN)	I/D (MAX)	CORNER RADIUS (MAX) R	FREE HEIGHT	RADIAL WIDTH W	O/D (MAX) A	I/D (MIN) B
1/8	.116 / .120	A + .010	$B - (.020 + T_2 + T_4)$	.030	.134 / .144	$.083 \pm T_3$	A	A - 2WMAX
3.0	2.946 / 3.048	A + .254	$B - (.508 + T_2 + T_4)$	.762	3.40 / 3.66	$2.108 \pm T_3$	A	A - 2WMAX
3/16	.179 / .183	A + .010	$B - (.020 + T_2 + T_4)$	.030	.208 / .218	$.120 \pm T_3$	A	A - 2WMAX
4.5	4.547 / 4.648	A + .254	$B - (.508 + T_2 + T_4)$	.762	5.28 / 5.54	$3.048 \pm T_3$	A	A - 2WMAX
1/4	.242 / .246	A + .010	$B - (.020 + T_2 + T_4)$	.060	.282 / .292	$.167 \pm T_3$	A	A - 2WMAX
6.0	6.147 / 6.248	A + .254	$B - (.508 + T_2 + T_4)$	1.524	7.16 / 7.42	$4.242 \pm T_3$	A	A - 2WMAX

## TOLERANCES FOR SEAL DESIGN

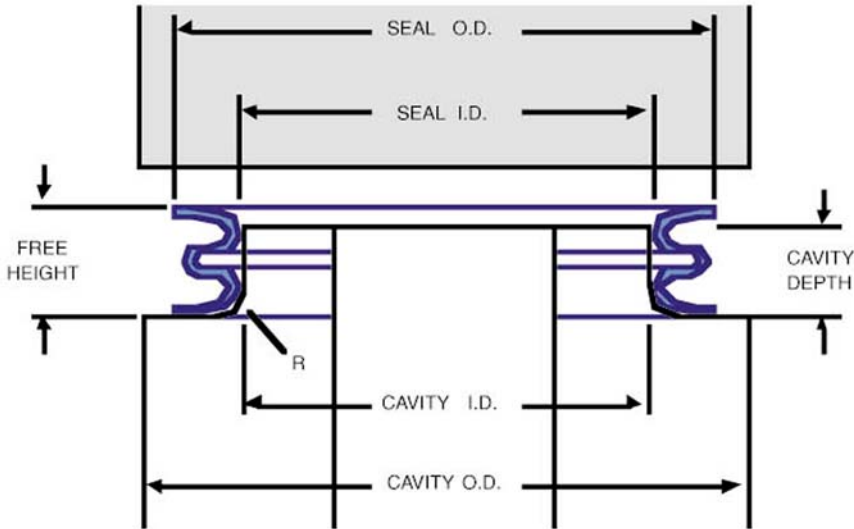
SEAL DIAMETER				SEAL O/D TOL $T_1$ + .000		SEAL I/D TOL $T_2$ - .000		SEAL RADIAL WIDTH W TOL $T_3$	
Up		to 10.000	254.0	- .010	- .254	+ .010	+ .254	± .005	± .127
10.001	254.0	to 20.000	508.0	- .020	- .508	+ .020	+ .508	± .010	± .254
20.001	508.0	to 30.000	762.0	- .030	- .762	+ .030	+ .762	± .015	± .381
30.001	762.0	and above		- .040	- 1.016	+ .040	+ 1.016	± .020	± .508

N.B.  $T_4$  is the total tolerance on the cavity O/D

If you cavity configuration differs from those illustrated above, or if you experience difficulties with your seal design please consult us.

# STANDARD SIGMA SEAL SELECTIONS

## EXTERNAL PRESSURE



NOMINAL SIZE	CAVITY				SEAL			
	DEPTH	O/D (MIN)	I/D (MAX)	CORNER RADIUS (MAX) R	FREE HEIGHT	RADIAL WIDTH W	O/D (MAX) A	I/D (MIN) B
1/8	.116 / .120	$A + (.020 + T_2 + T_5)$	$B - .010$	.030	.134 / .144	$.083 \pm T_3$	$B + 2W_{MAX}$	B
3.0	2.946 / 3.048	$A + (.508 + T_2 + T_5)$	$B - .254$	.762	3.40 / 3.66	$2.108 \pm T_3$	$B + 2W_{MAX}$	B
3/16	.179 / .183	$A + (.020 + T_2 + T_5)$	$B - .010$	.030	.208 / .218	$.120 \pm T_3$	$B + 2W_{MAX}$	B
4.5	4.547 / 4.648	$A + (.508 + T_2 + T_5)$	$B - .254$	.762	5.28 / 5.54	$3.048 \pm T_3$	$B + 2W_{MAX}$	B
1/4	.242 / .246	$A + (.020 + T_2 + T_5)$	$B - .010$	.060	.282 / .292	$.167 \pm T_3$	$B + 2W_{MAX}$	B
6.0	6.147 / 6.248	$A + (.508 + T_2 + T_5)$	$B - .254$	1.524	7.16 / 7.42	$4.242 \pm T_3$	$B + 2W_{MAX}$	B

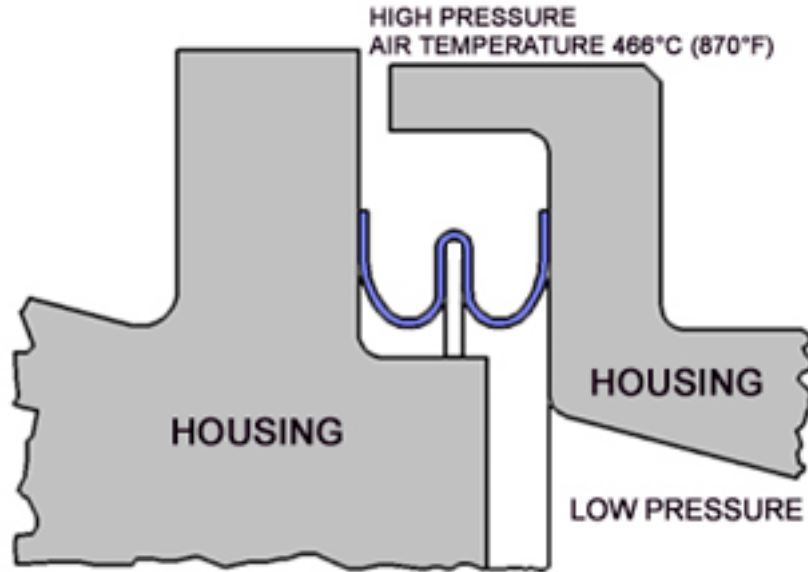
## TOLERANCES FOR SEAL DESIGN

SEAL DIAMETER				SEAL O/D TOL $T_1$ + .000		SEAL I/D TOL $T_2$ - .000		SEAL RADIAL WIDTH W TOL $T_3$	
Up		to 10.000	254.0	- .010	- .254	+ .010	+ .254	$\pm .005$	$\pm .127$
10.001	254.0	to 20.000	508.0	- .020	- .508	+ .020	+ .508	$\pm .010$	$\pm .254$
20.001	508.0	to 30.000	762.0	- .030	- .762	+ .030	+ .762	$\pm .015$	$\pm .381$
30.001	762.0	and above		- .040	- 1.016	+ .040	+ 1.016	$\pm .020$	$\pm .508$

N.B.  $T_5$  is the total tolerance on the cavity I/D

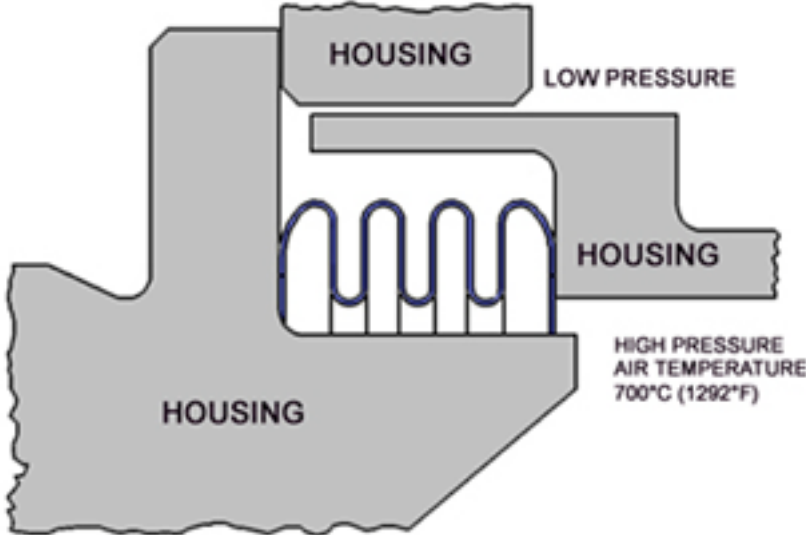
If you cavity configuration differs from those illustrated above, or if you experience difficulties with your seal design please consult us.

# TYPICAL INSTALLATIONS



## 8 INCHES / 200 MILLIMETRES DIAMETER SIGMA SEAL

Material: .010 [.254](#) Inconel 718 to AMS 5596.  
Sealing external pressure.  
Accommodating .022 [.560](#) movement of housing in the axial direction.  
Seal located off cavity inner diameter.  
Cobalt based coating used to protect the sealing surfaces against the effects of the extreme temperature conditions.



## 40 INCHES / 1000 MILLIMETRES DIAMETER SIGMA SEAL

Material: .007 [.178](#) Waspaloy to AMS 5544.  
Triple bellows section.  
Sealing internal pressure.  
Accommodating .070 [1.778](#) movement of housing in the axial direction.  
Seal located off cavity inner diameter.