

METAL BELLOWS COMPARISON

ELECTRODEPOSITED VS. EDGE WELDED VS. HYDROFORMED

MEASUREMENTS

SMALLEST OD (MIN OD)

0.020 inches
(0.5 mm)

VS.

0.358 inches
(9.1 mm)

VS.

0.25 Inches
(6.35 mm)

LARGEST OD (MAX OD)

9 inches
(228 mm)

VS.

26 inches
(660 mm)

VS.

43" (tooled)
50" max (not tooled)

MAX CONVOLUTION LENGTH (One Section)

10 inches
(254 mm)

VS.

96 inches
(2438 mm)

VS.

Varies by ID size and material
Wall thickness 3"- 200 ft.

STROKE

35 % free length (typical)
up to 50% possible for
certain applications

VS.

Certain bellows designs can stroke as long as the free length. Typically with a max 25% of stroke in extension with 75% of stroke in compression. These percentages can be modified with heat treatment.

VS.

Typical 15% compression
10% extension free length
Special design up to 35%
compression/extension

SENSITIVITY

Very Sensitive. Will deflect
with a force as low as
4 grams (0.14 oz.)

VS.

Varies with bellows size,
material thickness, and length.
Spring rates of 1 pound/inch or less
are easily achievable if desired.

VS.

Varies with
material thickness and
convolution design

MINIMUM WALL THICKNESS

0.0002 inch
(0.005 mm)

VS.

0.002 inch
(0.051 mm)

VS.

0.002 inch
(.051 mm)

LEAK RATE

1×10^{-6} cc He/sec @ 1 atm standard
(1×10^{-9} cc He/sec @ 1 atm possible)

VS.

1×10^{-5} to 1×10^{-9} cc He/sec.
(standard based on material)

VS.

1×10^{-9} He/sec

CORROSION RESISTANCE

Servometer Flex Nickel® suited for
air and hydrocarbon environment.
Not recommended for sea water or
acidic environments without Gold
plate or Parylene coating to enhance
corrosion resistance.

VS.

Wide material selection
available for many applications
including seawater, acidic,
alkaline, and downhole
environments

VS.

SS 300 Series- appropriate for
basic corrosion protection;
Hastelloy c276/c22- corrosive resistant;
Monel – seawater;
Inconel – heat & corrosion resistant

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MAXIMUM PRESSURE (Differential)

Depending on design,
up to 10,000 psi

VS.

Certain designs can withstand up to 2,500 psi (external). We have achieved over 15,000 psi (external) with an oil filled (internal) design

VS.

Varies based on wall thickness of material with braid (1,000-3500 PSI)

TEMPERATURE RANGE

HIGH TEMPERATURE

Servometer FlexNickel®:
350°F (177°C) ;
Copper Bellows: 200°F (93°C)

VS.

1500°F (815°C)

VS.

Stainless Steel – 900°F
Inconel over 900° F
(recommended)

LOW TEMPERATURE

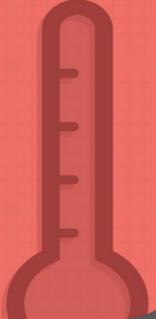
-423°F (-253°C) or lower
may be possible

VS.

-420°F (-251°C)

VS.

-420°F (251°C)



TOOLING COST



Bellows typically have no tooling cost. NRE charges for Leak Test, Spring Rate, and Assembly fixtures may apply.

VS.

For a complete set of new bellows tooling, for OD's between 0.5" and 10", typically ranges between \$4500 to \$8000.

VS.

\$500- 2500

MATERIAL

Servometer FlexNickel®
and Copper Bellows.
Coatings Available: Gold, Silver,
Tin, Parylene

VS.

AM350, 304L SS, 316L SS,
321 SS, 347 SS, Titanium Gr 2,
Haynes 242, Hastelloy® C276,
Inconel® 600, 625, 718,
Aluminum

VS.

Nickel alloys, 321 SS, 316L SS,
Inconel® 600, 625, 718,
Hastelloy® c22,c276, Copper, Brass,
Phosphorous Bronze, Titanium, Monel®

LIFE CYCLES



Up to
1,000,000,000 cycles
(Theoretical "Infinite" Life)

VS.

Many designs guaranteed
up to 3,000,000 with
even greater cycles
achieved in use.

VS.

Varies:
1,000,000 - 30,000,000
or more

These variables represent guidelines for typical user applications and designs.
Consult a technical support engineer for parameters outside these industry best practices