

6.4 | HYDRA metal bellows for ANSI valves



Optimised
for ANSI
valves

The correction factors for pressure and load cycles have already been taken into account, so that the number of corrugations can be determined pursuant to

$$n_W = \frac{2\delta}{2\delta_n} \quad (6.1.5.a)$$

BAT: Bellows without connecting pieces
BAT: Bellows with connecting pieces

Bellows description (example):

BAT	60.0	x	82.0	x	6	x	0.3	15W	1.4571
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BAT: Bellows with connecting pieces
 Inside diameter $d_i = 60 \text{ mm}$
 Outside diameter $D_A = 82 \text{ mm}$
 Number of single layers $n_L = 6$
 Individual layers thickness $s = 0.3 \text{ mm}$
 15 corrugations acc. to Section 6.1.5.a
 Material 1.4571

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Pressure ranges as per ANSI B16.34

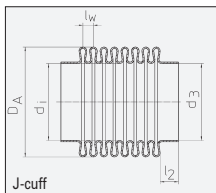
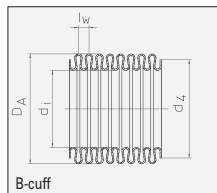
Pressure range (ANSI Class)	Design pressure p_{PR} [bar]	Test pressure p_T [bar]
150	25	37.5
300	50	75
600	100	150
800	134	200
900	150	225
1500	250	375

Table 6.4.1.

Load cycle numbers as per MSS SP-117

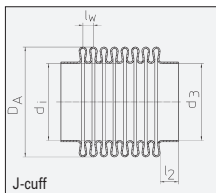
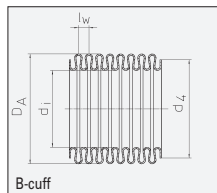
Nominal valve diameter	ANSI pressure range Class 800 and below		ANSI pressure range above Class 800	
	GATE valve	GLOBE valve	GATE valve	GLOBE valve
smaller than 2½"	2,000	5,000	2,000	2,000
2½" to 4"	2,000	5,000	1,000	2,000
larger than 4"	1,000	2,000	1,000	1,000

Table 6.4.2.



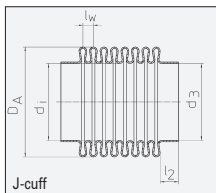
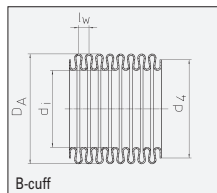
Reference diameter	Max. shaft diam.	ANSI Class	Nominal pressure P _N *	Bellows profile				Material	Corrugation length l _w	Max. no. of corrugations	ØTolerances		B-cuff Ø d ₄	J-cuff		Nominal deflection per corrugation			Axial spring rate per corrugation (± 30%)
				d ₁	D _A	n _L	s				d _i	D _a		Ø inside d ₃	Length l ₂	1,000 Load cycles 2δ _{n,1000}	2,000 Load cycles 2δ _{n,2000}	5,000 Load cycles 2δ _{n,5000}	
mm	mm	-	bar	mm	mm	-	mm	mm	-	d _i	D _a	mm	mm	mm	mm	mm	mm	N/mm	
9	7.5	150	25	9.0 x 14.0	x 2	x 0.10	1.4541 / 1.4571	1.30	235	-0.4/+0.1	±0.3	12.5	9.0	5	±0.26	±0.23	±0.19	115	
		300	50	9.0 x 14.5	x 2	x 0.10	1.4541 / 1.4571	1.75	214	-0.4/+0.1	±0.4	13.0	9.0	5	±0.32	±0.28	±0.23	160	
		600	100	9.0 x 14.0	x 3	x 0.10	1.4541 / 1.4571	1.75	220	-0.4/+0.1	±0.5	12.5	9.0	5	±0.22	±0.19	±0.16	450	
		800/900	150	9.0 x 14.0	x 4	x 0.10	1.4541 / 1.4571	2.00	191	-0.4/+0.1	±0.5	12.5	9.0	5	±0.22	±0.19	±0.16	760	
		1500	250	9.0 x 13.0	x 4	x 0.10	1.4541 / 1.4571	1.50	258	-0.5/+0.1	±0.5	11.7	9.0	5	±0.13	±0.11	±0.09	1230	
16	14.5	150	25	16.6 x 24.0	x 2	x 0.10	1.4541 / 1.4571	2.00	104	-0.4/+0.1	±0.5	21.5	16.6	6	±0.47	±0.41	±0.34	126	
		300	50	16.8 x 24.0	x 2	x 0.15	1.4541 / 1.4571	2.30	106	-0.4/+0.1	±0.5	21.5	16.8	6	±0.35	±0.30	±0.25	420	
		600	100	16.4 x 24.0	x 3	x 0.15	1.4541 / 1.4571	2.50	104	-0.5/+0.1	±0.5	21.5	16.4	6	±0.35	±0.30	±0.25	680	
		800/900	150	16.4 x 24.0	x 4	x 0.15	1.4541 / 1.4571	3.00	103	-0.5/+0.1	±0.5	21.5	16.4	6	±0.31	±0.27	±0.22	1000	
		1500	250	16.0 x 24.5	x 4	x 0.20	1.4541 / 1.4571	3.80	89	-0.5/+0.1	±0.5	21.5	16.0	6	±0.22	±0.19	±0.16	2150	
18	16.5	150	25	18.2 x 26.0	x 2	x 0.10	1.4541 / 1.4571	2.70	97	-0.4/+0.2	±0.5	24.0	18.2	6	±0.61	±0.54	±0.44	154	
		300	50	18.0 x 26.0	x 2	x 0.15	1.4541 / 1.4571	2.60	93	-0.4/+0.2	±0.5	24.0	18.0	6	±0.43	±0.38	±0.31	405	
		600	100	18.0 x 28.0	x 3	x 0.20	1.4541 / 1.4571	3.50	75	-0.4/+0.2	±0.5	25.0	18.0	6	±0.40	±0.35	±0.29	1000	
		800/900	150	18.0 x 28.0	x 3	x 0.25	1.4541 / 1.4571	3.80	75	-0.4/+0.2	±0.5	25.0	18.0	6	±0.35	±0.30	±0.25	1700	
		1500	250	18.0 x 28.0	x 4	x 0.25	1.4541 / 1.4571	3.50	82	-0.4/+0.2	±0.5	25.0	18.0	6	±0.25	±0.22	±0.18	2840	
22	20.5	150	25	22.0 x 32.5	x 2	x 0.15	1.4541 / 1.4571	2.80	73	-0.4/+0.2	±0.5	28.0	22.0	8	±0.63	±0.55	±0.45	217	
		300	50	22.0 x 32.0	x 2	x 0.20	1.4541 / 1.4571	3.20	77	-0.4/+0.2	±0.5	28.0	22.0	8	±0.45	±0.39	±0.32	660	
		600	100	22.0 x 32.0	x 3	x 0.20	1.4541 / 1.4571	3.30	77	-0.4/+0.2	±0.5	28.0	22.0	8	±0.38	±0.33	±0.27	1020	
		800/900	150	22.0 x 34.0	x 4	x 0.25	1.4541 / 1.4571	4.30	59	-0.4/+0.2	±0.8	30.0	22.0	8	±0.38	±0.33	±0.27	1900	
		1500	250	22.0 x 34.0	x 4	x 0.30	1.4541 / 1.4571	4.50	65	-0.4/+0.2	±0.8	30.0	22.0	8	±0.29	±0.26	±0.21	3600	
24	22.5	150	25	24.2 x 35.5	x 2	x 0.15	1.4541 / 1.4571	3.10	71	-0.4/+0.2	±0.5	34.0	24.2	8	±0.75	±0.66	±0.54	200	
		300	50	24.2 x 36.5	x 2	x 0.25	1.4541 / 1.4571	3.30	63	-0.4/+0.2	±0.5	34.0	24.2	8	±0.51	±0.45	±0.37	590	

* outside pressure; in the event of inside pressure loads, column stability must also be guaranteed (buckle resistance)



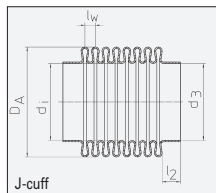
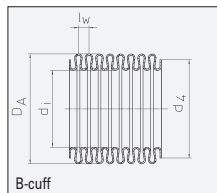
Reference diameter	Max. shaft diam.	ANSI Class	Nominal pressure P _N *	Bellows profile				Material	Corrugation length l _w	Max. no. of corrugations	ØTolerances		B-cuff Ø d ₄	J-cuff		Nominal deflection per corrugation			Axial spring rate per corrugation (± 30%)
				d ₁	D _A	n _L	s				d _i	D _a		Ø inside d ₃	Length l ₂	1,000 Load cycles 2δ _{n,1000}	2,000 Load cycles 2δ _{n,2000}	5,000 Load cycles 2δ _{n,5000}	
mm	mm	-	bar	mm	mm	-	mm	mm	-	d _i	D _a	d ₄	mm	mm	mm	mm	mm	mm	N/mm
24		600	100	24.0 x 36.5	x 3	x 0.25	1.4541 / 1.4571	4.00	62	-0.4/+0.2	±0.5	34.0	24.0	8	±0.49	±0.43	±0.35	860	
		800/900	150	24.0 x 36.0	x 4	x 0.25	1.4541 / 1.4571	4.60	64	-0.4/+0.2	±0.8	34.0	24.0	8	±0.39	±0.34	±0.28	2060	
		1500	250	24.0 x 35.5	x 5	x 0.25	1.4541 / 1.4571	4.80	66	-0.6/+0.2	±0.8	34.0	24.0	8	±0.31	±0.27	±0.22	3650	
27	25.0	150	25	27.0 x 38.0	x 2	x 0.15	1.4541 / 1.4571	2.80	111	-0.4/+0.2	±0.8	34.5	27.0	8	±0.67	±0.58	±0.48	220	
		300	50	27.0 x 40.0	x 2	x 0.25	1.4541 / 1.4571	4.00	88	-0.4/+0.2	±0.8	37.5	27.0	8	±0.56	±0.49	±0.40	660	
		600	100	27.0 x 39.5	x 3	x 0.25	1.4541 / 1.4571	4.00	93	-0.4/+0.2	±0.8	36.5	27.0	8	±0.45	±0.39	±0.32	1250	
		800/900	150	27.0 x 41.0	x 4	x 0.30	1.4541 / 1.4571	5.20	87	-0.6/+0.2	±0.8	37.5	27.0	8	±0.36	±0.32	±0.26	2200	
29	27.0	150	25	29.0 x 43.0	x 2	x 0.20	1.4541 / 1.4571	3.80	83	-0.4/+0.2	±0.8	39.0	29.0	8	±0.83	±0.73	±0.60	260	
		300	50	29.0 x 42.0	x 2	x 0.25	1.4541 / 1.4571	3.80	88	-0.4/+0.2	±0.8	39.0	29.0	8	±0.63	±0.55	±0.45	690	
		600	100	29.0 x 43.0	x 4	x 0.25	1.4541 / 1.4571	5.00	82	-0.6/+0.2	±0.8	39.0	29.0	8	±0.56	±0.49	±0.40	1360	
		800/900	150	29.0 x 41.5	x 4	x 0.25	1.4541 / 1.4571	4.80	88	-0.6/+0.2	±0.8	39.0	29.0	8	±0.49	±0.43	±0.35	2100	
		1500	250	29.0 x 43.0	x 5	x 0.30	1.4541 / 1.4571	5.80	70	-0.6/+0.2	±0.8	39.0	29.0	8	±0.42	±0.37	±0.30	4020	
34	32.0	150	25	34.0 x 49.0	x 2	x 0.20	1.4541 / 1.4571	4.20	73	-0.4/+0.2	±0.8	47.0	34.0	10	±1.00	±0.88	±0.72	270	
		300	50	34.0 x 50.0	x 2	x 0.30	1.4541 / 1.4571	4.60	73	-0.4/+0.2	±0.8	47.0	34.0	10	±0.74	±0.65	±0.53	700	
		600	100	34.0 x 49.0	x 3	x 0.30	1.4541 / 1.4571	5.10	75	-0.6/+0.2	±0.8	47.0	34.0	10	±0.61	±0.54	±0.44	1560	
		800/900	150	34.0 x 48.0	x 4	x 0.30	1.4541 / 1.4571	5.20	78	-0.6/+0.2	±0.8	45.0	34.0	10	±0.49	±0.43	±0.35	2850	
		1500	250	34.0 x 48.0	x 5	x 0.30	1.4541 / 1.4571	5.60	70	-0.6/+0.2	±0.8	45.0	34.0	10	±0.40	±0.35	±0.29	3500	
38	36.2	150	25	38.8 x 53.5	x 2	x 0.20	1.4541 / 1.4571	4.50	83	-0.4/+0.2	±0.8	47.0	38.8	10	±0.97	±0.85	±0.70	310	
		300	50	39.0 x 54.0	x 2	x 0.30	1.4541 / 1.4571	4.40	73	-0.4/+0.2	±0.8	47.0	39.0	10	±0.67	±0.58	±0.48	1000	
		600	100	38.2 x 56.0	x 4	x 0.30	1.4541 / 1.4571	5.50	70	-0.6/+0.2	±0.8	47.0	38.2	10	±0.65	±0.57	±0.47	1400	
		800/900	150	38.2 x 55.0	x 5	x 0.30	1.4541 / 1.4571	6.00	67	-0.6/+0.2	±0.8	47.0	38.2	10	±0.58	±0.51	±0.42	2050	
		1500	250	38.2 x 54.0	x 6	x 0.30	1.4541 / 1.4571	6.40	54	-0.6/+0.2	±0.8	47.0	38.2	10	±0.45	±0.39	±0.32	4550	

* outside pressure; in the event of inside pressure loads, column stability must also be guaranteed (buckle resistance)



Reference diameter	Max. shaft diam.	ANSI Class	Nominal pressure P _N *	Bellows profile				Material	Corrugation length l _w	Max. no. of corrugations	ØTolerances		B-cuff Ø d ₄	J-cuff		Nominal deflection per corrugation			Axial spring rate per corrugation (± 30%)
				d _i	D _A	n _L	s				d _i	D _A		Ø inside d ₃	Length l ₂	1,000 Load cycles 2δ _{n,1000}	2,000 Load cycles 2δ _{n,2000}	5,000 Load cycles 2δ _{n,5000}	
mm	mm	-	bar	mm	mm	-	mm	mm	-	d _i	D _A	mm	mm	mm	mm	mm	mm	mm	N/mm
42	40.0	150	25	42.0 x 60.0	x 2	x 0.25	1.4541 / 1.4571	5.00	63	-0.4/+0.2	±0.8	57.0	42.0	10	±1.14	±1.00	±0.82	380	
		300	50	42.0 x 58.0	x 2	x 0.30	1.4541 / 1.4571	4.80	73	-0.4/+0.2	±0.8	50.5	42.0	10	±0.75	±0.66	±0.54	880	
		600	100	42.0 x 60.0	x 4	x 0.30	1.4541 / 1.4571	6.20	67	-0.4/+0.2	±0.8	50.5	42.0	10	±0.72	±0.63	±0.52	1500	
		800/900	150	42.0 x 61.0	x 6	x 0.30	1.4541 / 1.4571	7.40	59	-0.6/+0.2	±0.8	55.0	42.0	10	±0.61	±0.54	±0.44	2900	
		1500	250	42.0 x 60.0	x 7	x 0.30	1.4541 / 1.4571	8.00	53	-0.6/+0.2	±0.8	55.0	42.0	10	±0.46	±0.40	±0.33	4830	
47	45.4	150	25	47.8 x 66.0	x 2	x 0.25	1.4541 / 1.4571	5.10	63	-0.4/+0.2	±0.8	62.5	47.8	10	±1.21	±1.06	±0.87	320	
		300	50	47.4 x 63.0	x 2	x 0.30	1.4541 / 1.4571	5.00	78	-0.4/+0.2	±0.8	56.5	47.4	10	±0.72	±0.63	±0.52	1025	
		600	100	47.4 x 65.0	x 4	x 0.30	1.4541 / 1.4571	6.30	61	-0.6/+0.2	±0.8	57.0	47.4	10	±0.70	±0.61	±0.50	1850	
		800/900	150	47.4 x 64.0	x 6	x 0.30	1.4541 / 1.4571	7.10	58	-0.6/+0.2	±0.8	57.0	47.4	10	±0.51	±0.45	±0.37	4400	
		1500	250	47.4 x 64.0	x 8	x 0.30	1.4541 / 1.4571	7.70	51	-0.6/+0.2	±0.8	57.0	47.7	10	±0.36	±0.32	±0.26	7000	
53	51.0	1500	250	53.0 x 70.0	x 8	x 0.30	1.4541 / 1.4571	7.70	51	-0.6/+0.2	±0.8	64.0	53.0	10	±0.45	±0.39	±0.32	7700	
56	54.0	150	25	56.1 x 74.5	x 2	x 0.25	1.4541 / 1.4571	5.40	60	-0.6/+0.2	±0.8	68.0	56.1	10	±1.25	±1.10	±0.90	425	
		300	50	56.2 x 76.0	x 3	x 0.30	1.4541 / 1.4571	6.10	56	-0.6/+0.2	±0.8	68.0	56.2	10	±1.00	±0.88	±0.72	990	
		600	100	56.2 x 77.0	x 5	x 0.30	1.4541 / 1.4571	7.20	55	-0.6/+0.2	±0.8	73.0	56.2	10	±0.90	±0.79	±0.65	1600	
60	58.0	800/900	150	60.0 x 79.0	x 6	x 0.30	1.4541 / 1.4571	7.50	52	-0.6/+0.2	±0.8	73.0	60.0	10	±0.58	±0.51	±0.42	3300	
66	63.4	150	25	65.4 x 87.0	x 2	x 0.30	1.4541 / 1.4571	5.80	52	-0.6/+0.2	±0.8	75.0	65.4	10	±1.25	±1.10	±0.90	530	
		300	50	65.4 x 86.0	x 3	x 0.30	1.4541 / 1.4571	6.40	56	-0.6/+0.2	±0.8	82.0	65.4	10	±0.97	±0.85	±0.70	985	
		600	100	65.4 x 88.0	x 6	x 0.30	1.4541 / 1.4571	8.10	53	-0.6/+0.2	±1.0	82.0	65.4	10	±1.04	±0.91	±0.75	2010	
		800/900	150	65.4 x 85.0	x 6	x 0.30	1.4541 / 1.4571	7.10	54	-0.6/+0.2	±1.0	80.0	65.4	10	±0.63	±0.55	±0.45	3300	
70	68.5	150	25	70.5 x 92.0	x 2	x 0.30	1.4541 / 1.4571	6.00	53	-0.6/+0.2	±1.0	85.0	70.5	10	±1.25	±1.10	±0.90	565	
		300	50	70.5 x 90.0	x 3	x 0.30	1.4541 / 1.4571	5.50	61	-0.6/+0.2	±1.0	85.0	70.5	10	±0.97	±0.85	±0.70	1220	
85	83.0	150	25	85.0 x 106.0	x 2	x 0.30	1.4541 / 1.4571	6.00	54	-0.6/+0.2	±1.0	101.0	85.0	10	±1.39	±1.22	±1.00	710	

* outside pressure; in the event of inside pressure loads, column stability must also be guaranteed (buckle resistance)



Reference diameter	Max. shaft diam.	ANSI Class	Nominal pressure P_N^*	Bellows profile				Material	Corrugation length l_w	Max. no. of corrugations	Ø Tolerances		B-cuff Ø d_4	J-cuff		Nominal deflection per corrugation			Axial spring rate per corrugation (± 30%)
				d_i	D_A	n_L	s				d_i	D_A		Ø inside d_3	Length l_2	1,000 Load cycles $2\delta_{n,1000}$	2,000 Load cycles $2\delta_{n,2000}$	5,000 Load cycles $2\delta_{n,5000}$	
mm	mm	-	bar	mm	mm	-	mm	mm	-			mm	mm	mm	mm	mm	mm	mm	N/mm
85	83.0	300	50	85.0 x	105.0 x	3 x	0.30	1.4541 / 1.4571	6.20	58	-0.6/+0.2	±1.0	101.0	85.0	10	±1.04	±0.91	±0.75	1300
			600	100	85.0 x	105.0 x	5 x	0.30	1.4541 / 1.4571	7.20	51	-0.6/+0.2	±1.0	101.0	85.0	10	±0.92	±0.80	±0.66
96	94.0	800/900	150	96.0 x	116.0 x	8 x	0.30	1.4541 / 1.4571	8.20	44	-0.6/+0.2	±1.0	108.0	96.0	10	±0.68	±0.60	±0.49	6100
110	108.2	150	25	110.2 x	130.0 x	2 x	0.30	1.4541 / 1.4571	6.20	50	-0.8/+0.2	±1.5	125.0	110.2	10	±1.20	±1.05	±0.86	950
			300	30	110.2 x	129.0 x	3 x	0.30	1.4541 / 1.4571	7.00	58	-0.8/+0.2	±1.5	125.0	110.2	10	±0.99	±0.86	±0.71

* outside pressure; in the event of inside pressure loads, column stability must also be guaranteed (buckle resistance)