



FLEXIBLE BUSHES

PAULSTRA



HUTCHINSON[®]
WORLDWIDE



FLEXIBLE BUSHES

CONTENTS

I - GENERAL	Page
I.1 The operation of a flexible bush	3
I.2 Static characteristics	4
I.2.1 Radial characteristics	4
I.2.2 Torsional characteristics	4
I.2.3 Axial characteristics	5
I.2.4 Conical characteristics	5
I.3 Dynamic characteristics	6
I.3.1 Dynamic loads	6
I.3.2 Torsion amplitudes	6
II - PRINCIPAL TYPES OF FLEXIBLE BUSHES	
II.1 Simple bushes	7
II.2 Flanged bushes	7
II.3 Laminated bushes	8
II.4 Void bushes	8
II.5 Pivot bushes	8
II.6 Spherical bushes	9
II.7 Other bushes	9
III - OUTER SLEEVE AND CENTRE AXIS	
III.1 Materials used	10
III.2 Protection during storage	10
III.3 Tolerance on Length	10
III.4 Tolerances on Diameter	10
IV - THE SELECTION OF A FLEXIBLE BUSH	11
V - AN EXAMPLE OF A SELECTION	11
VI - INSPECTION OF FLEXIBLE BUSHES	
VI.1 Dimensional control	12
VI.2 Control of stiffness	13
VI.3 Control of bonding	13
VII - CATALOGUE OF FLEXIBLE BUSHES	14/23

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- the contract signed by both parties, or the purchase order and the acknowledgement of receipt,
- eventually, special or specific additional conditions,
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FLEXIBLE BUSHES

I - GENERAL

I.1 - THE OPERATION OF A FLEXIBLE BUSH

A flexible bush has an elastomeric element enclosed between an outer sleeve and a centre axis intended to replace a greased bush.

The improvements achieved in industry due to the use of elastic bushes have been justly compared to the progress achieved in the past by the use of ball joints. In fact, the improvements achieved by the latter by reducing friction and play considerably and reducing wear and noise, have been taken even further by elastomeric rubber bushes which eliminate play completely and isolate high frequency vibrations.



I.1 - STATIC CHARACTERISTICS

I.2.1 - Radial characteristics

The application of a radial force F_R causes an elastic eccentricity X by compression of the elastomer on one side and stretching of the other side.

The bush is characterised by the permissible radial static force and by the corresponding eccentricity.

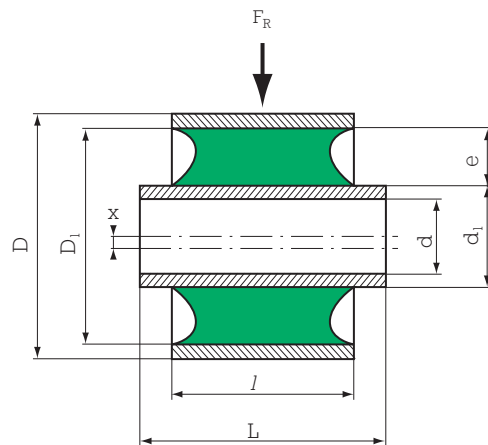
In practice, the permissible radial static forces are estimated by taking the stress rate on the surface area S of the rectangle which represents the projection of part of the elastomer which is in contact with the internal tube.

$$\text{Stress rate} = \frac{F_R}{S} = \frac{F_R}{d_1 \times l} \left(\frac{\text{N}}{\text{m}^2} \right)$$

The permissible stress is a function $\frac{l}{D}$ of the bush and of the specific properties of the elastomer.

It is clear that the permissible deformation for a given radial force will be linked in practice to the thickness of the elastomer.

$$e = \frac{D_1 - d_1}{2}$$



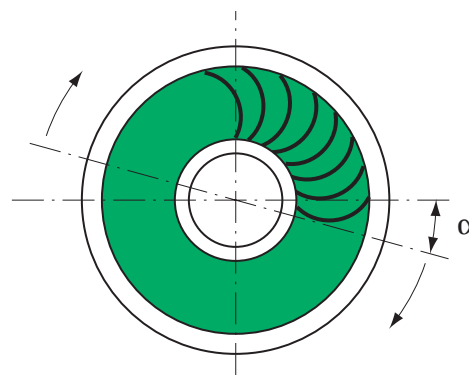
I.2.2 - Torsional characteristics

The application of a torque to the centre axis of revolution of a bush causes an angular displacement α . This displacement produces a torsional reaction expressed in N.m.

The bush is characterised by its maximum torsion angle α and by the corresponding compensating torque.

In practice, the permissible torsion angles are of the order of 20° to 30° . The maximum permissible static torque can be calculated on the basis of the stress rate at the point of contact between the internal tube and the elastomer.

$$C = t \times \pi \frac{d_1^2 l}{2} \quad \text{where} \quad \begin{array}{l} d_1 \text{ and } l \text{ are in cm} \\ C \text{ is in cm.kg} \# 0.1 \text{ N.m} \\ t \text{ is in daN/cm}^2 \end{array}$$



I.2.3 - Axial characteristics

When the external tube is fixed, the application of an axial force F_a on the internal tube will cause an elastic displacement "y" parallel to the axis of the bush, by shearing of the elastomer.

The bush is characterised by the permissible axial load and by the corresponding elastic displacement.

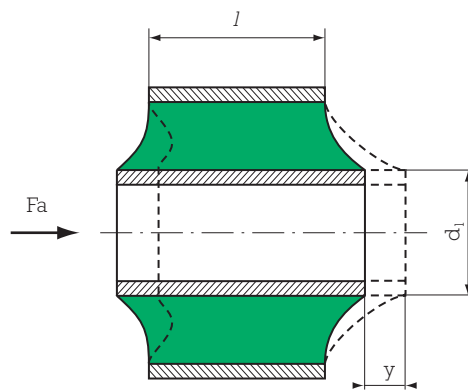
In practice, the permissible static axial loads are estimated by taking the stress rate at the internal tube.

$$F_a = \pi \times d_1 \times l \times t \quad \text{where } d_1 \text{ and } l \text{ are in cm and } F_a \text{ in daN and } t \text{ is in daN/cm}^2$$

The permissible static deflection is a function of the radial thickness of the elastomer.

$$y = k \cdot \frac{D_1 - d_1}{2} \quad (\text{K being between } 0.20 \text{ and } 0.50).$$

The axial breaking load of a bonded part is of the order of 10 times the permissible static load.



Note:

A Prestressed bush which is not fully bonded must not be subjected to a static axial load.

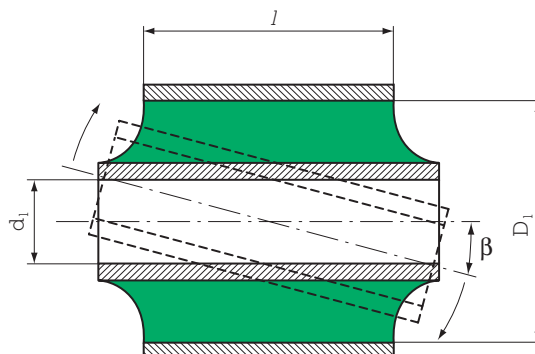
I.2.4 - Conical characteristics

The application of a torque whose axis is perpendicular to the axis of rotation of the bush will cause an angular deformation β .

This deformation will in turn produce a compensating elastic torque expressed in N.m.

The bush is characterised by the permissible conical angle and by the corresponding compensating torque.

In practice, the permissible conical angles are of the order of a few degrees. They vary greatly with the slenderness ratio $\frac{l}{D}$ of the part.

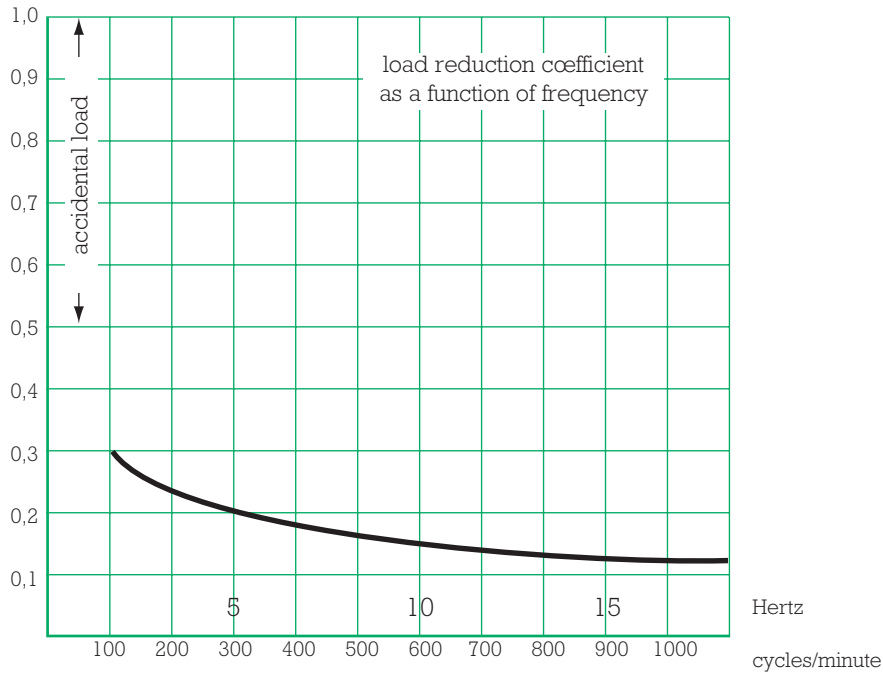


I.3 - DYNAMIC CHARACTERISTICS

I.3.1 - Dynamic loads

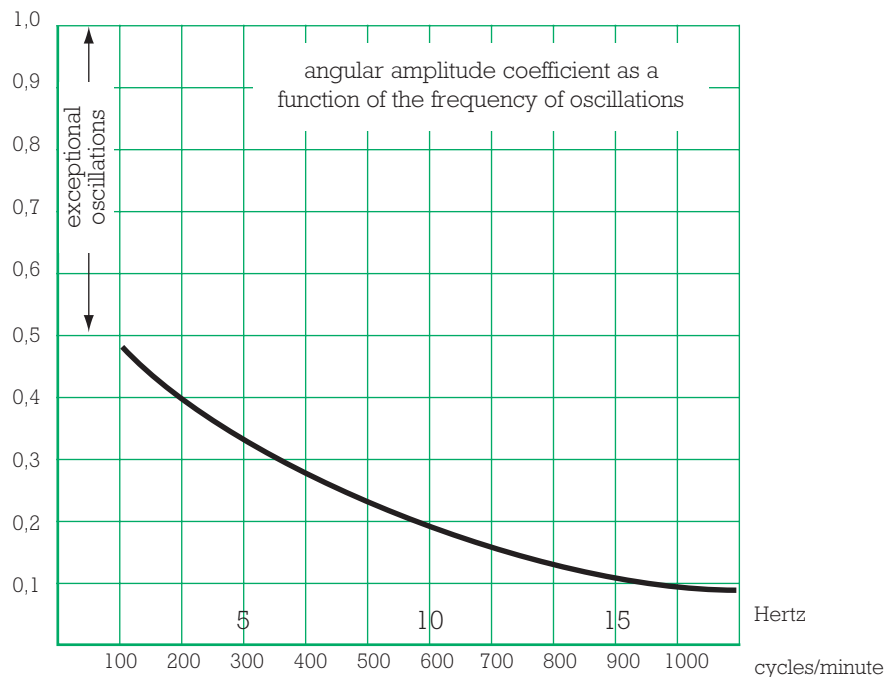
For dynamic loads, the following corrections must be added to the static loads provided in the catalogue :

- For infrequent forces of very short duration (shocks), the loads can be doubled.
- In the case of continuing periodic forces, the loads must be multiplied by a reduction coefficient λ which is a function of the frequency of the forces.



I.3.2 - Torsion amplitudes

The torsion amplitudes provided in the catalogue must be multiplied by a reduction coefficient μ which is a function of the frequency of the oscillations.



II - PRINCIPAL TYPES OF FLEXIBLE BUSHES

II.1 - SIMPLE BUSHES

FLEXIBLOC (fig. 1) - FULLY BONDED

This is a bush made up of 2 concentric tubes between which of elastomer is bonded. Under the effect of external forces or torques, the relative movement of the tubes will cause an elastic deformation of the elastomer. By consulting the service conditions, a bush should be chosen which will remain within its elastic operational limits.

SILENTBLOC (fig. 2) - PRESTRESSED

This is a bush made up of 2 concentric tubes between which a ring of “adhérite®” elastomer is inserted by force. Under the effect of external forces or torques, the relative movement of the tubes will cause an elastic deformation of the elastomer. Above a certain value the adherite will slide in the tubes.

These simple bushes are considered to have lateral stops (fig. 3) when the elastomer protrudes from the external tube in the form of a support surface with various profiles.

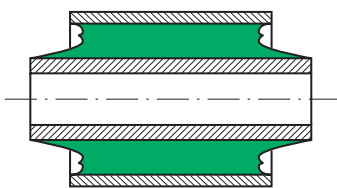


Fig. 1

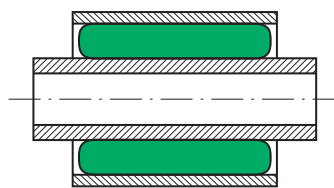


Fig. 2

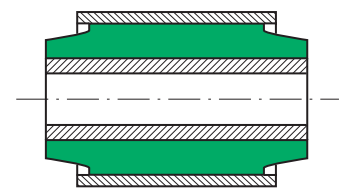
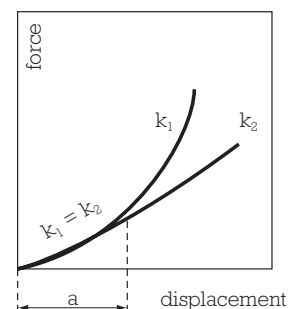
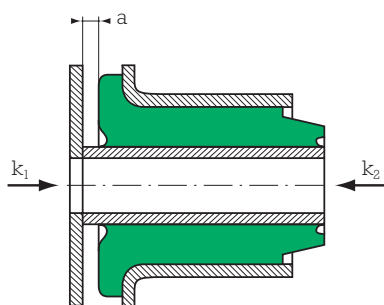


Fig. 3

The lateral stop only comes into operation when the bush is forced off centre by a radial load. This causes the stop to protrude, thus ensuring an “anti-noise” role at the limit of axial movement.

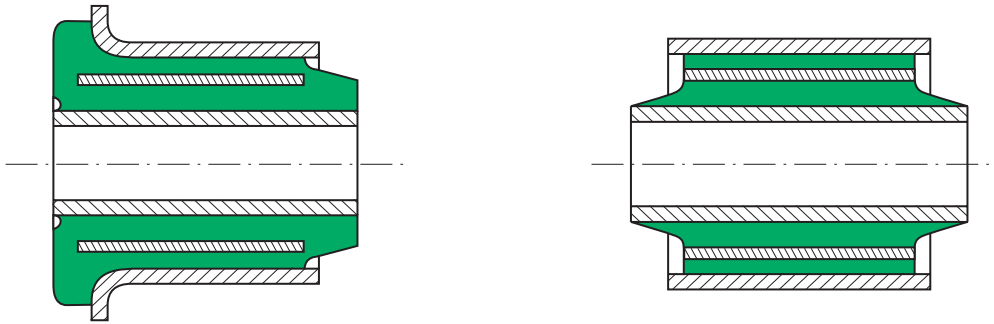
II.2 - FLANGED BUSHES

In this type of bush, one of the tubes is flanged.



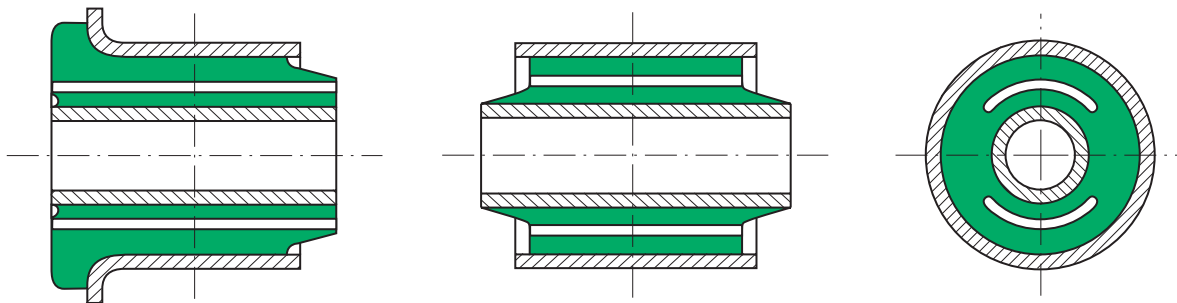
The rigidity k_1 is equal to k_2 if the travel is less than “a”, and it becomes greater than k_2 when the travel is greater than “a”.

II.3 - LAMINATED BUSHES



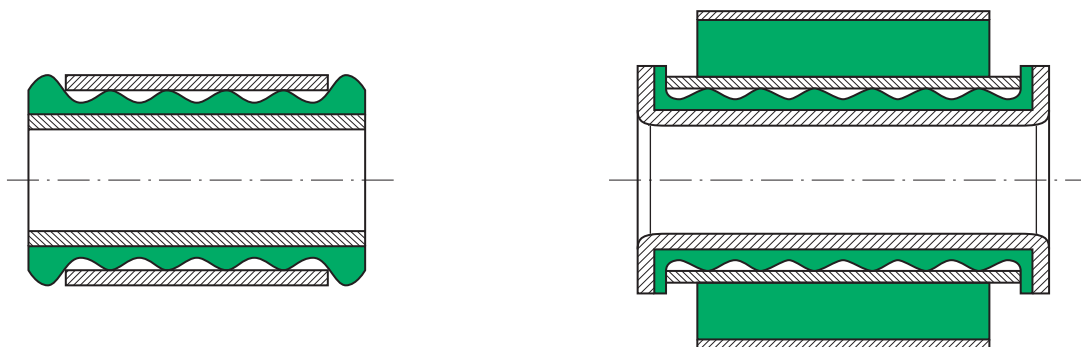
This type of bush has a thin metallic tube between the internal tube and the external tube. The object is to have a higher stiffness radially while keeping practically the same stiffness in torsion. The lamination of a bush also helps to decrease the work rate of the elastomer under high radial loads.

II.4 - VOID BUSHES



A void bush is designed to have radial stiffness which are very different at 90° to each other. The difference in rigidity is governed by the size of the voids, which may or may not run the whole length of the bush.

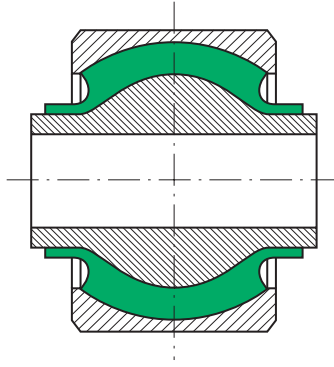
II.5 - PIVOT BUSHES



FLUIDBLOC :

This type of bush is intended to offer minimum resistance to torsion. The elastomer is bonded to only one of the armatures, and a suitable permanent lubricant ensures the lubrication between the elastomer and the second armature ensures a very low torsional resistance. Seals are provided at each end to prevent the lubricant from coming out and stop impurities from getting in. Resistance to axial force is provided by a flange in the elastomer which bears against the side of the outer sleeve, the force being transmitted by a lateral washer.

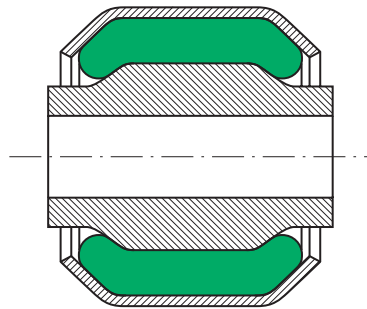
II.6 - SPHERICAL BUSHES



SPHERIFLEX :

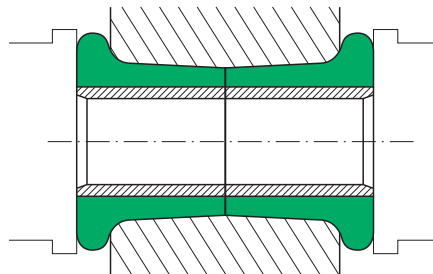
In this bush, the outer sleeve and centre axis are spherical, which enables the bush to resist relatively high radial and axial loads and to obtain a circular rigidity which is independent of the axis of rotation.

II.7 - OTHER BUSHES



“PRESTRESSED BUSHES” with turned down sides :

For the same dimensions, this type of bush provides a radial load capacity which is superior to that of the classic “prestressed”. In addition, versions of relatively short length permit conical movement more easily (reduced torque and increased angle).



CONICAL BUSH :

This takes the form of a rubber sleeve whose external surface is a truncated, and which surrounds a cylindrical internal part to which it adheres strongly by high radial expansion.

Assembly in pairs, in a housing made up of two truncated cones placed small end to small end. By axial pressure, a high compression is created which ensures the external adherence of the rubber and causes lateral cushions to form at each end of the housing. These cushions ensure resistance to axial forces.

III - OUTER SLEEVE AND CENTRE AXIS

III.1 - MATERIALS USED

In general, the outer sleeve and centre axis of flexible bushes are made of :

- Mild steel or polyamide for the external outer sleeve.
- Medium carbon steel for the centre axis.

The reason for the difference has to do with the method of fixation onto the internal armature, which is usually done by forcing from one end. The armature must therefore be both strong and not too thin, to avoid buckling.

III.2 - PROTECTION DURING STORAGE

To avoid corrosion of the steel parts, the parts are protected by a layer of phosphate which gives them a grey appearance, the whole being protected by a layer of oil.

To ease removal of fixing bolts, the internal tubes are also protected on the interior by a layer of phosphate. This protection is good for storage, but it does not constitute a "tropicalised" protection, nor is it intended to resist saline mist.

III.3 - LENGTH TOLERANCES

- Length L (internal tube) : ± 0.1 mm
- Length l (external tube) : JS 15, according to NF E02 100-1 and NF E02 100-2
- Longitudinal overhang : $\frac{L - l}{2} \pm 0.4$ mm

III.4 - DIAMETER TOLERANCES

- On the internal diameter d: H10

d mm	3 to 6	6 to 10	10 to 18	18 to 30	30 to 50
H10	+ 0.048 + 0	+ 0.058 + 0	+ 0.070 + 0	+ 0.084 + 0	+ 0.1 + 0

- On the external diameter D :

D ≤ 25 mm	25 < D ≤ 40 mm	D > 40 mm
+ 0.05 + 0	+ 0.1 + 0	+ 0.15 + 0

- Recommended tolerance for fitting into a bored hole : boring D : N9

D mm	10 to 18	18 to 30	30 to 50	50 to 80	80 to 120
N9	- 0 - 0.043	- 0 - 0.052	- 0 - 0.062	- 0 - 0.074	- 0 - 0.087

IV - THE SELECTION OF A FLEXIBLE BUSH

In order to specify a bush correctly for a given application, the following criteria must be determined :

Basic data

For each of the 4 characteristics of the part (axial, radial, torsion or conical), the following values must be taken into account :

- The maximum static values (of force and/or of deflection) to which the part is subjected.
- The maximum dynamic values and their frequencies.

Fundamental parameters

Depending on the application, determine from the basic data the major fundamental parameter(s) which govern the choice of the bush to be used.

Dimensions

The fundamental parameters enable you to consult the catalogue for the range of dimensions of various bushes.

Stiffness

The final selection of the bush will depend on the required stiffness for the application. In particular, length, diameter and the thickness of the elastomer required for the desired bush will be determined.

Environmental conditions

Most of our standard bushes are in natural rubber. This has been chosen because of its good dynamic qualities.

In normal conditions of use, the types of rubber used guarantee a good life and limit creep in particular.

The following conditions of use are considered abnormal:

- temperatures above 70° C
- prolonged contact with aggressive fluids
- aggressive environments, such as oil or petrol
- prolonged contact with acids or alkalis
- aggressive atmospheres (e.g. ozone, chlorine)

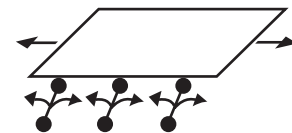
Use in this conditions can accelerated ageing of the bushes, and cause the degradation or even the destruction of the rubber.

An abnormally aggressive environment can, in particular, increase the deformation of the bush (by creep).

Flexible bushes can be made with special elastomers which are capable of surviving the abnormal conditions mentioned above and enabling the bushes to perform well.

Our technical services are at your disposal to reply to your questions about the properties of our various elastomers.

V - AN EXAMPLE OF A SELECTION



For the bushes of a vibrating carpet.

Weight : 120 daN. Number of fixing points : 6

Angle of movement : $\pm 2^\circ$. Frequency : 600 cycles/mn = 10 Hz

Radial load per bush : # 20 daN (evenly loaded).

Amplitude reduction coefficient at 10 Hz : $m = 0.18$. Torsion angle: $\frac{2^\circ}{0.18} = 11^\circ$

In this case, the axial and conical parameters are not of major importance in the selection of the bushes.

Since the fixing diameter of the connecting rods is 10 mm, we would select reference 561 205 from the bush catalogue.

$d = 10 \text{ mm}$ $D = 22 \text{ mm}$ $L = 17 \text{ mm}$ $l = 15 \text{ mm}$ Radial load = 40 daN

Maximum torsion angle = 25°

Therefore, for the given application we would use : 12 Flexibloc 561205 bushes.

VI - INSPECTION OF FLEXIBLE BUSHES

VI.1 - DIMENSIONAL CONTROL

VI.1.1 - External diameter D

This is checked in the region of the middle of length L by means of a minimum-maximum gauge.

VI.1.2 - Internal diameter d

This is checked with a standard length minimum-maximum gauge.

VI.1.3 - Longitudinal overhang $\frac{L - l}{2}$

This is checked with a minimum-maximum gauge.

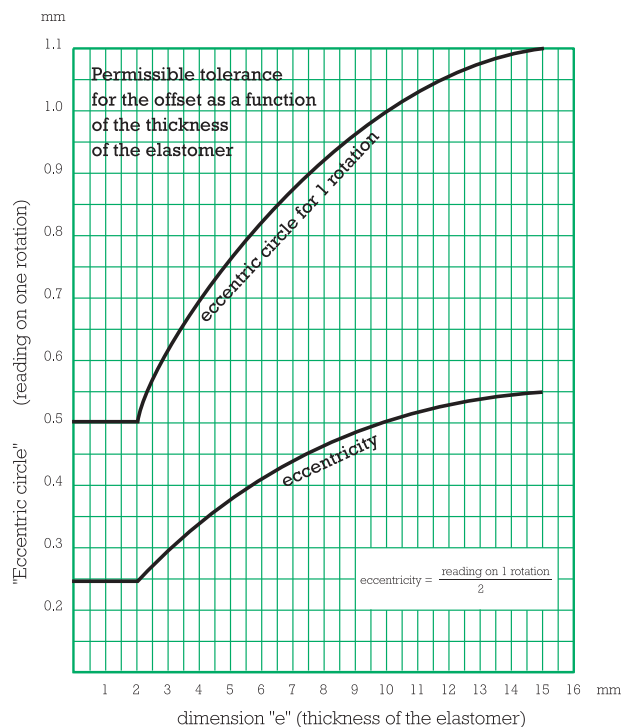
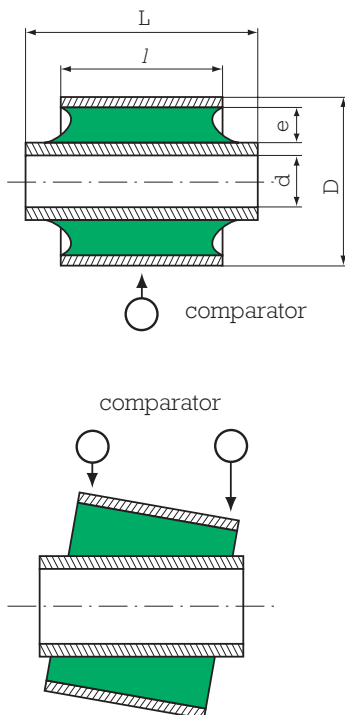
The main purpose of the tolerance on this overhang is to maintain adequate clearance for axial elastic displacement which is an important dimension.

VI.1.4 - Eccentricity

The eccentricity is the average distance between the axes of the internal and external tubes. It is measured in the following manner:

The difference in the readings of a comparator applied to the middle of the length l of the external tube, when the part is turned through a full rotation about the axis of the internal tube, represents the "eccentric circle" which is equal to twice the eccentricity.

In order to take a possible conical deformation into account, one can take the average of two measurements made at the two extremities of the external tube.



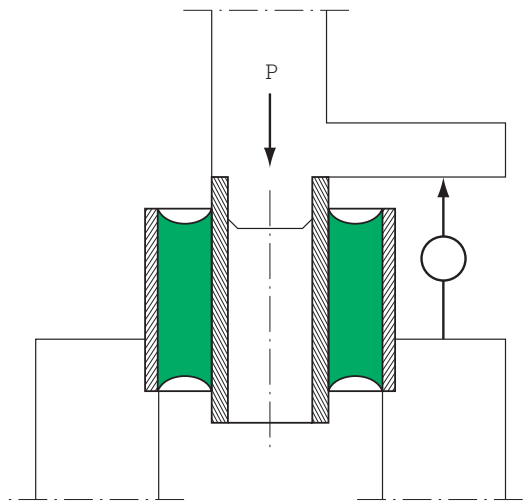
VI.2 - CONTROL OF STIFFNESS

For a given bush, the four stiffness characteristics are linked. It is therefore sufficient to measure one of them. The most convenient is the **axial shear stiffness** (excluding the effect of any axial cushions).

The selected test load P will be the maximum static load F_a , in order on the one hand to operate in the linear part of the stiffness curve, and on the other to avoid having a measured value which is of the same order as any inaccuracies. The test should be done on a frictionless guided assembly.

A pre-load of a few kilograms is first selected to zero the comparator the load $P = F_a$ is then applied, for which the deflection y is noted.

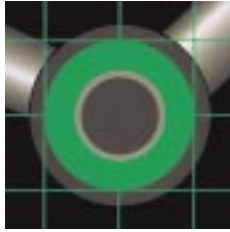
In the case of current manufacture, a tolerance of $\pm 25\%$ or $\pm 30\%$ is generally accepted for this deflection.



Vertically guided assembly on a tension-compression machine.

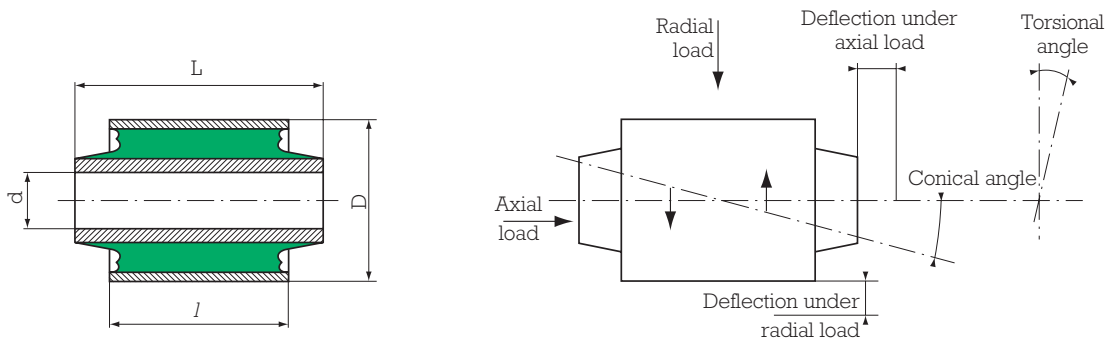
VI.3 - CONTROL OF BONDING

The only test possible is a test of samples taken to breaking point. This test is done in the axial direction. A minimum for the value of the load at rupture of the order of 10 times the static axial load can be accepted.



SIMPLE BUSHES

FLEXIBLOC® AND SILENTBLOC®



FLEXIBLOC - Fully Bonded : The elastomer is bonded to the 2 concentric tubes,
Parts Number 560 ***, 561 ***

SILENTBLOC - Prestressed Elastomer : The ring of “adherite” is inserted by force
between the 2 concentric tubes,
Parts Number 861 ***, 862 ***, 864 ***

BL : Bushes with a lateral stop.

d mm	D mm	L mm	l mm	Obs	RADIAL		TORSION	AXIAL		CONICAL	Reference
					Static Load daN	Deflection mm	Max angle degrees	Static Load daN	Deflection mm	Max angle degrees	
6	16	14	12		10	0.1	25°	10	0.6	5°	561101
	16	14	12		10	0.07	30°	5	0.3	7°	861601
	16	24	20		20	0.05	30°	15	0.4	3°	861602
8	20	22	16		25	0.4	30°	20	2.2	6°	561239
	16	17	15		30	0.1	15°	15	1.3	3°	561102
	16	24	20		50	0.1	10°	15	1	1°	561104
9	16	25	22		55	0.03	20°	35	0.2	1°	861104
	16	28	25		65	0.03	20°	45	0.2	1°	861103
	20	17	15		15	0.1	30°	10	0.3	7°	861603
	20	19	15		20	0.1	30°	10	0.3	7°	861783
	32	23.2	18		30	0.5	35°	20	1.5	6°	561418
9	21	21	17	BL	40	0.2	30°	15	0.8	5°	561258
10	22	17	15		40	0.3	25°	15	0.8	6°	561205

The references kept in stock are written in bold.



d mm	D mm	L mm	l mm	Obs	RADIAL		TORSION	AXIAL		CONICAL	Reference
					Static Load daN	Deflection mm	Max angle degrees	Static Load daN	Deflection mm	Max angle degrees	
10	22	19	15		40	0.3	25°	15	0.8	6°	561206
	22	23	20		55	0.03	20°	35	0.4	1°	861112
	22	24	18		90	0.2	20°	15	0.4	2°	561112
	22	30	25		100	0.2	20°	40	1.5	3°	561207
	22	33	30		110	0.03	20°	70	0.6	1°	861114
	22	34	30		55	0.1	30°	35	0.3	3°	861607
	24	22	18		50	0.4	25°	25	0.2	5°	561209
	24	24	18	BL	70	1.3	30°	25	0.8	3°	561445
	27	22	17		65	0.5	30°	25	1.5	3°	561613
	28	26	20	BL	80	0.6	30°	25	1.5	3°	561150
28	27	20	BL	80	0.5	20°	30	1	5°	561424	
28	32	26	BL	110	0.4	30°	40	0.8	2°	561518	
11.3	19.85	30.2	25.4		45	0.05	10°	35	0.3	2°	561103
	12	25	23	20	55	0.04	20°	25	0.2	3°	861118
12	25	28	25		100	0.2	20°	40	1	4°	561212
	25	34	30		120	0.2	20°	50	0.8	3°	561213
	25	38	35	BL	145	0.04	20°	95	0.4	1°	864105
	25	44	35		145	0.04	20°	95	0.4	1°	861197
	25	54	50		550	0.3	15°	45	0.6	1°	561250
	26	24	20		35	0.06	30°	20	0.4	7°	861611
	26	27	23	BL	90	0.1	15°	50	1.5	4°	561283
	26	34	32		80	0.07	30°	50	0.4	3°	861613
	28	28	25		50	0.07	30°	25	0.4	7°	861614
	28	38	32		120	0.25	20°	60	1.5	3°	561446
28	49	45		130	0.2	30°	60	1.6	4°	561224	
30	30	24		110	0.5	35°	40	1.5	6°	561302	
30	30	24	BL	110	0.5	25°	40	1.5	3°	561341	
30	30	24	BL	70	0.1	5°	25	0.6	4°	864801	
30	42	36	BL	210	0.55	30°	35	1.1	2°	561395	
32	40	24		190	0.55	20°	30	1	2°	560034	
53	46.5	34		140	1.5	50°	50	2	6°	561122	
12.04	41.27	76.03	52		100	1	40°	50	2	4°	561677
	14	27	25	17	60	0.2	20°	30	1.1	3°	561120
14	27	28	25		120	0.2	20°	50	1.8	4°	561227
	27	28	25		90	0.04	20°	45	0.4	3°	861128
	27	33	25		150	0.15	20°	40	1	3°	561747
	27	45	40	BL	120	0.2	25°	80	1.5	2°	561269
	27	49	45		250	0.04	20°	165	0.7	1°	861132
	27	51.5	43.5	BL	250	0.1	10°	80	1	1°	561493
	27	54	50	BL	280	0.04	20°	185	0.5	1°	864109
	27	58	50		350	0.1	20°	80	1	1°	561748
	28	44	40		250	0.1	15°	80	0.7	1°	561458
	28	54	50	BL	250	0.1	15°	70	0.7	1°	561617
29	44	32		120	0.2	20°	50	2.5	2°	561594	
30	28	25		120	0.7	30°	45	1.1	5°	561303	
30	28	25		50	0.08	30°	25	0.4	7°	861618	
30	30	25	BL	80	0.2	25°	50	1.2	5°	561377	
30	30	25		120	0.3	25°	55	1.2	5°	561304	
30	30	25		50	0.08	30°	25	0.4	7°	861619	
30	42	38		150	0.2	30°	70	1.9	3°	561305	
30	42	38		100	0.08	30°	65	0.4	3°	861620	
32	33	30		130	0.4	25°	60	2	4°	561307	
32	46	38	BL	170	0.3	25°	80	2	2°	561492	
32	48	40	BL	250	0.1	15°	100	0.5	2°	561340	
32	54	46	BL	190	0.08	25°	125	0.6	2°	864403	
32	70	65		300	0.2	30°	200	1.1	1°	561309	
14.3	30.2	69.8	63.5		370	0.1	20°	190	0.9	1°	861251
	16	28.1	34	25	30	0.05	20°	15	0.4	1°	861834
30	30	25		200	0.2	5°	35	0.5	1°	561348	
32	26	20		70	0.05	20°	35	0.3	2°	861136	
32	28	22		120	0.2	20°	50	2	5°	561313	
32	28	25		140	0.2	20°	50	1.6	5°	561312	
32	30	22		80	0.05	20°	40	0.3	3°	861138	

The references kept in stock are written in bold.



d mm	D mm	L mm	l mm	Obs	RADIAL		TORSION	AXIAL		CONICAL	Reference		
					Static Load daN	Deflection mm	Max angle degrees	Static Load daN	Deflection mm	Max angle degrees			
16	32	32	28	BL	130	0.05	20°	65	0.4	3°	861141		
	32	54	50		330	0.05	20°	220	0.4	1°	861143		
	32	54	50		330	0.05	20°	220	0.4	1°	864108		
	32	59	55		400	0.05	20°	260	0.4	1°	861145		
	32	66	60		450	0.05	20°	300	0.4	1°	861146		
	32	76	70		500	0.1	20°	180	1.5	1°	561358		
	36	38	35		90	0.1	30°	45	0.5	7°	861624		
	36	43	35		90	0.1	30°	45	0.5	7°	861756		
	40	40	32		200	0.8	30°	45	1.5	2°	561401		
	40	40	32		95	0.6	5°	-	-	4°	861810		
	40	50	32		135	0.6	5°	-	-	4°	861931		
	40	54	50		250	0.5	35°	120	3	3°	561402		
	52	34	30		70	1	40°	30	3.5	7°	561511		
	52	48	40		90	1	40°	50	4	7°	561520		
18	34	33	30	BL	120	0.1	20°	60	1.1	4°	561328		
	34	33	30		150	0.05	20°	75	0.4	3°	861151		
	34	36	32		160	0.05	20°	80	0.4	3°	861152		
	34	54	50		600	0.3	12°	100	1	1°	561455		
	34	66	60		490	0.05	20°	320	1.5	1°	861153		
	34	71	65		540	0.05	20°	360	1.5	1°	861154		
	36	46	40		220	0.04	20°	145	0.4	1°	861156		
	42	38	35		100	0.1	30°	50	0.5	7°	861627		
	70	58	45		225	2.5	50°	100	4	5°	561543		
	20	38	42		38	BL	230	0.2	25°	75	1	3°	561384
38		59	55	300	0.15		20°	50	1	2°	561335		
38		59	55	410	0.04		20°	270	1.5	1°	861160		
38		76	70	400	0.2		15°	200	1	1°	561337		
38		76	70	630	0.04		20°	420	1.5	1°	861162		
38		81	75	700	0.04		20°	465	1.5	1°	861163		
38		90	84	600	0.1		15°	200	1	1°	561382		
40		45	38	70	0.15		25°	35	0.6	2°	861830		
42		42	38	300	0.3		25°	90	1.5	4°	561404		
42		42	38	165	0.08		20°	80	0.5	3°	861165		
44		45	38	210	0.5		25°	90	3	4°	561440		
45.15		42	38	300	0.8		25°	60	1.6	2°	561451		
48		46	33	65	0.2		5°	-	-	4°	861934		
50		50	40	155	0.5		5°	25	0.7	4°	861817		
52		66	60	300	1		25°	150	3	5°	561521		
22		40	45	40	BL		250	0.05	20°	130	0.4	3°	861166
	40	86	80	850		0.06	20°	560	1.5	1°	861167		
24	42	50	45	BL	340	0.06	20°	170	0.4	3°	861169		
	42	55	50		400	0.05	20°	200	0.4	3°	861170		
	42	96	90		1100	0.02	20°	730	1	1°	861171		
	44	58	48		125	0.08	20°	60	0.8	3°	861831		
	48	44	40		160	0.3	20°	110	1.5	2°	561411		
	48	58	50		350	0.3	20°	120	2	2°	561400		
	48	93	85		560	0.15	30°	370	0.7	3°	861634		
	58	58	48		215	1	5°	-	-	4°	861818		
	26	44	66		60	BL	500	0.2	15°	160	1	1°	561454
		48	36		34		315	0.05	20°	160	0.5	3°	861173
28	48	55	50	BL	420	0.05	20°	210	0.5	3°	861174		
	48	66	60		400	0.15	20°	190	1.1	2°	561409		
	48	66	60		540	0.06	20°	270	0.5	3°	861175		
	48	118	110		1500	0.07	20°	900	2	1°	861177		
	52	108	100		800	0.1	30°	500	0.7	3°	861637		
	66	66	56		500	1.5	40°	140	3.5	7°	561601		
	66	66	56		350	1	5°	100	3	4°	861819		
	66	76	70		850	1	30°	320	3	6°	561660		
	30	50	128		120	1900	0.07	20°	1000	2.5	1°	861178	
	32	52	66		60	600	0.15	10°	260	2.2	1°	561503	
52		66	60	600	0.06	20°	300	0.3	3°	861180			

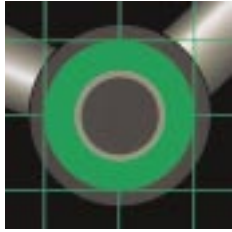
The references kept in stock are written in bold.



d mm	D mm	L mm	l mm	Obs	RADIAL		TORSION	AXIAL		CONICAL	Reference	
					Static Load daN	Deflection mm	Max angle degrees	Static Load daN	Deflection mm	Max angle degrees		
32	56	55	50	SP	310	0.08	30°	150	0.7	7°	861638	
	56	116	108		1000	0.10	30°	650	0.7	3°	861639	
	70	76	70		1100	1.10	25°	190	2.3	2°	561703	
34	50	45	39.5		200	0.20	6°	100	2.5	1°	561141	
36	58	130	120		1900	0.08	20°	1000	1	1°	861182	
	60	60	55		400	0.15	30°	200	0.7	7°	861640	
38	64	76	70		900	0.07	20°	450	0.5	3°	861183	
	64	135	125		2400	0.10	20°	1300	1.5	1°	861184	
42	66	60	55		450	0.10	30°	220	0.7	7°	861642	
	78	66	60		680	0.07	30°	340	1	7°	862601	
	78	86	80		1000	0.50	10°	200	1.6	1°	561701	
44.45	78	86	80		1270	0.08	20°	630	0.8	3°	862101	
	78	140	130		2000	0.60	20°	400	2	1°	561702	
	78	140	130		2800	0.10	20°	1500	2	1°	862102	
	80	85	79		1400	0.10	15°	-	-	3°	862111	
	76.2	63	60		700	0.10	30°	100	0.2	3°	862140	
	46	80	86		80	1500	0.10	15°	-	-	3°	862137
		86	110		100	1400	0.15	20°	700	1.5	1°	862422
50	80	83	79		1500	0.20	15°	150	0.7	1°	862614	
56	93	250	170		2600	0.60	15°	1400	2	0,3°	561901	
58	93	132	117		2000	0.20	15°	200	1.2	2°	862444	
	95	90	83		1600	0.30	15°	-	-	3°	862646	
	60	105	87		90	2000	0.20	15°	200	1.2	2°	862435
110		182	170		4000	0.20	15°	400	0.8	1°	862510	
140		182	170		5400	0.30	15°	360	2	1°	862512	
62	105	120	110		2500	0.20	15°	250	0.8	1°	862421	
68	105	120	110		2500	0.20	15°	250	0.8	1°	561657	
70	120	120	115		3000	0.30	15°	300	0.9	1°	862434	
	120	182	170		4500	0.20	15°	450	0.8	1°	862480	
	80	120	120		110	3000	0.20	15°	300	0.8	1°	561658
140		98	98	3000	0.60	10°	1800	2	2°	561009		
140		98	98	3000	0.30	8°	-	-	2°	561043		
140		98	98	2300	0.20	10°	-	-	1°	862481		
90	140	182	170	5400	0.10	15°	540	0.8	1°	862414		
	145	170	145	5500	0.25	15°	550	0.8	1°	862627		
	170	105	105	1500	2.30	10°	-	-	5°	561956		
110	175	205	190	7500	0.15	12°	750	0.9	1°	862513		
	160	190	170	6000	0.10	12°	600	0.7	1°	561928		
120	160	190	170	4000	0.10	12°	400	0.6	1°	561938		
125	160	185	184	4300	0.10	12°	430	0.4	1°	561913		
138	192	130	124	5500	1	10°	-	-	3°	862810		
150	185	210	209	5500	0.10	10°	550	0.4	1°	561916		
	185	240	239	6500	0.10	10°	650	0.5	1°	561925		
170	210	270	269	8000	0.10	10°	800	0.4	1°	561184		
190	230	270	258	8500	0.10	10°	850	0.4	1°	561003		
210	260	300	290	10500	0.10	10°	1000	0.4	1°	561989		

The references kept in stock are written in bold.





LAMINATED BUSHES

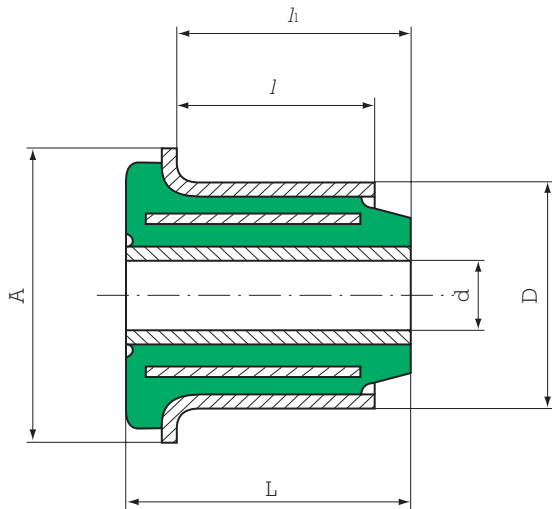


Fig. 1

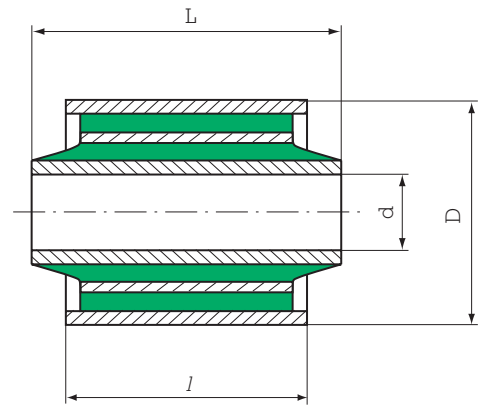


Fig. 2

DIMENSIONS

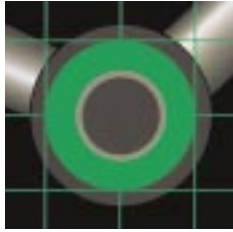
d mm	D mm	A mm	L mm	l mm	h mm	fig.	Reference
12	34	-	48	30	-	2	560033
14	35	-	58.3	43	-	2	561040
14	40	55	27.4	16.3	17	1	531427
16	40	-	46	32	-	2	560062
20	38	-	60	59	-	2	579071

OPERATING CHARACTERISTICS

Reference	Maximum Radial Load		Axial Static Load daN	Torsion	
	Static daN	Dynamic daN		Max Angle	Approx torque N.m
531427*	400	-	130	20°	80
560062	900	-	40	15°	20
560033	750	-	40	20°	10
561040	850	-	50	20°	50
579071	10500	15000		6°	54

* The axial load is measured on the side of the lateral stop.





VOID BUSHES

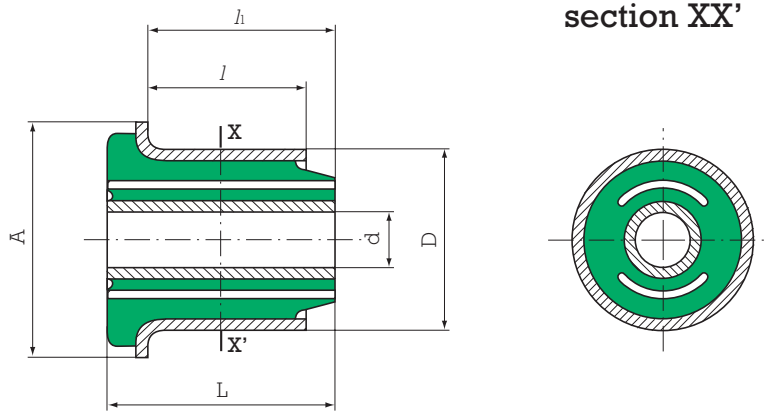


Fig. 1

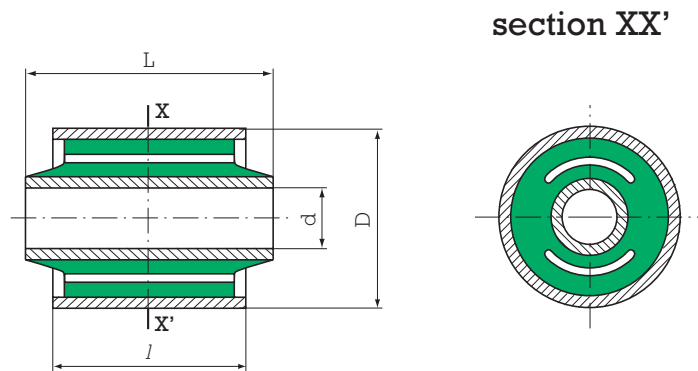
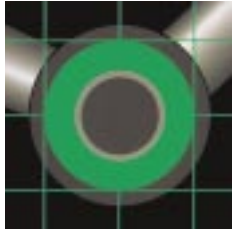


Fig. 2

DIMENSIONS

d mm	D mm	A mm	L mm	l mm	h mm	fig.	Reference
8.5	34	-	44.8	36	-	2	560218
8.5	40	-	44.8	36	-	2	560217
12	40	-	60	40	-	2	560065
12	43	60	41	26.5	32.5	1	531413
12	48.8	57	74.7	62	67.2	1	531376
12.2	30	41	34.1	25.2	26.5	1	531363
12.2	30	41	34.1	25.2	26.5	1	531431



FLANGED BUSHES

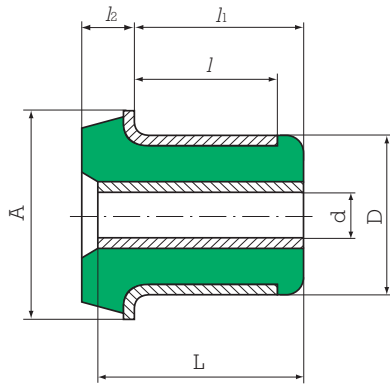


Fig. 1

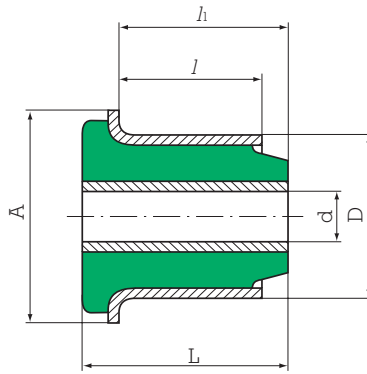


Fig. 2

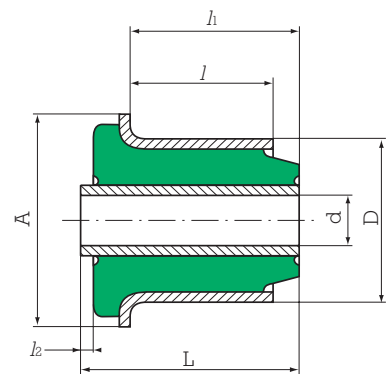


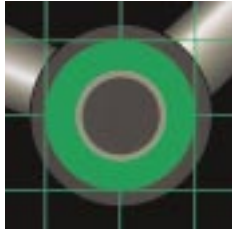
Fig.3

FLANBLOC®

d mm	D mm	A mm	L mm	l mm	l1 mm	l2 mm	Maximum radial load		Dyna- mic axial load	Torsion		Fig.	Reference
							Static daN	Dyna- mic daN		Max angle	Approx torque N.m		
16	32	47	62	48	56.5	9.5	250	Overload coefficient : 3	430	30°	45	2	866016
	32	47	89	48	83.5		250			30°	45	2	866012
	36	46	41	28.8	34.7		60			30°	90	1	867001

SPECIAL S.C.

d mm	D mm	A mm	L mm	l mm	l1 mm	l2 mm	Maximum radial load		Dyna- mic axial load	Torsion		Fig.	Reference
							Static daN	Dyna- mic daN		Max angle	Approx torque N.m		
12	32	43	50	34	40	3	50	Overload coefficient : 3	160	35°	16	3	531300
16	40	50	50	32	40	1	150		120	20°	-	2	531411
-	40	51	83	52	76	1	200		-	20°	-	3	531417



PIVOT BUSHES

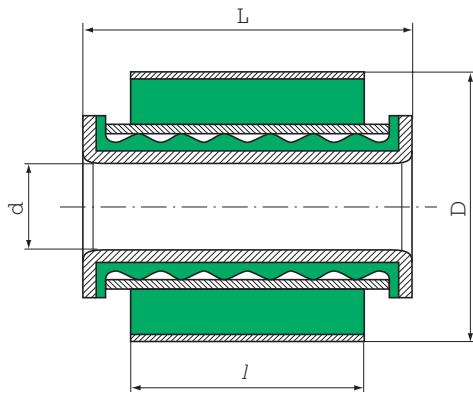


Fig. 1

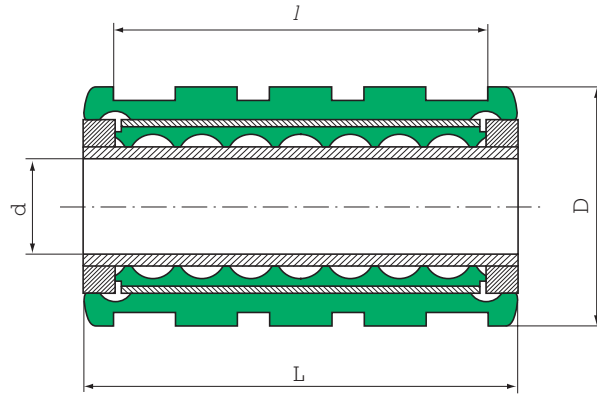


Fig. 2

FLUIDBLOC® AND TOURIFLEX®

These are high precision bushes; they are made of injected polyurethane and can resist oil, water, ozone, etc.

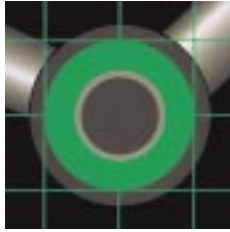
These "PIVOTING" bushes are characterised by their very low torsional resistance (0.1 to 0.2 N.m). They can ensure a complete rotation (360°), and have no requirements for maintenance because they have a permanent lubricant.

They don't need a high precision housing, and the load to remove the bushes is between 1500 and 1800 daN.

There are many applications, such as :

Leaf spring bushes for vehicles not exceeding 5 tons.

d mm	D mm	l mm	L mm	Maximum radial load static daN	Fig.	Reference
16	36	60	70	900	2	566050
16	45	60	70	1100	2	566051
SQUARE AXIS	140	214	304	7000	-	568256
27	70	60	76	1000	1	568247
36	88	70	86	1000	1	568248



SPHERICAL BUSHES

SPHERIFLEX®

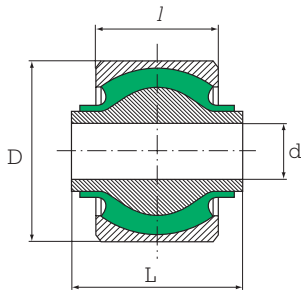


Fig. 1

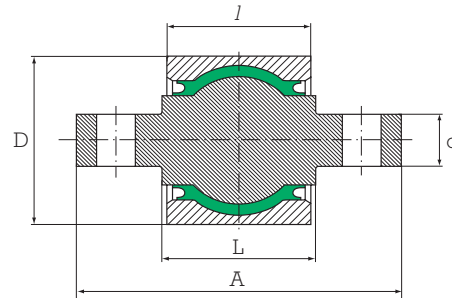
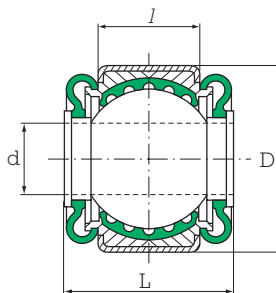


Fig. 2

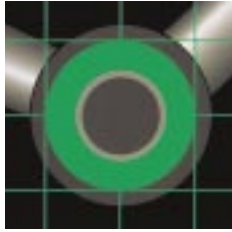
d mm	D mm	L mm	A mm	l mm	Radial load		Torsion		Conical		Fig.	Reference
					Max daN	Stiffness daN/mm	Max degrees	Stiffness N.m radian	Max degrees	Stiffness N.m radian		
35	62	36		36	1000	1600	12	100	8	680	1	563075
24	64	58		30	800	2200	12	22	10	220	1	563489
35	67	35(b)		36	1000	1600	12	100	8	680	1	563559
26	80	72(b)		56	3800	5500	10	220	8	1900	1	563353
26	80	78(b)		56	3800	5500	10	220	8	1900	1	563343
40(a)	80	49(b)		56	3800	5500	10	220	8	1900	1	563354
36	85	80		66.5	3800	3000	12	215	6	1650	1	563317
axis(c)	85	90	170	62	3800	3000	12	215	6	1650	2	563344
axis(c)	85	100	180	71	3800	3000	12	215	6	1650	2	563425
axis(c)	88	75	144	66	3800	3000	12	215	6	1650	2	563253
36.5	90	80		68	4400	5380	12	230	8	3050	1	563316/13
axis(c)	90	90	170	68	4000	5000	12	215	10	2800	2	563345
axis(c)	90	80	172	77	4400	5380	12	230	8	3050	2	563300
axis(c)	90	90	170	77	4400	5380	12	230	8	3050	2	563555
axis(c)	90	100	180	77	4400	5380	12	230	8	3050	2	563426
44	100	114		87.5	7000	6000	12	150	8	2000	1	563571
44	100.2	116		72.5	7000	6000	12	150	8	2000	1	563605

(a) : The internal diameter is shouldered (b) Length L not centered (c) Axis (square or flat ends)

FLUIDBLOC®



d mm	D mm	L mm	l mm	Radial static load daN	Axial static load daN	Sliding torque N.m	Reference
24	64	58	36	850	100	≠10	568184



SPECIAL BUSHES

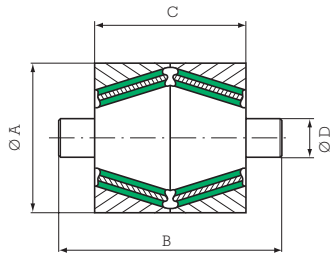


Fig. 1

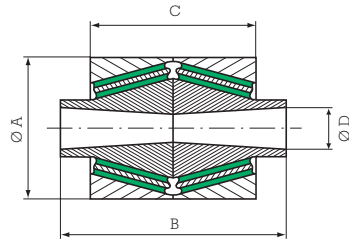


Fig. 2

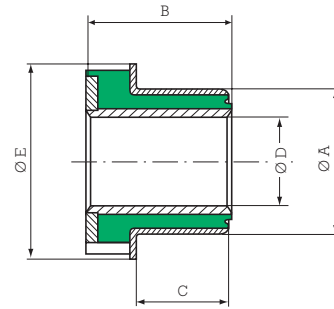
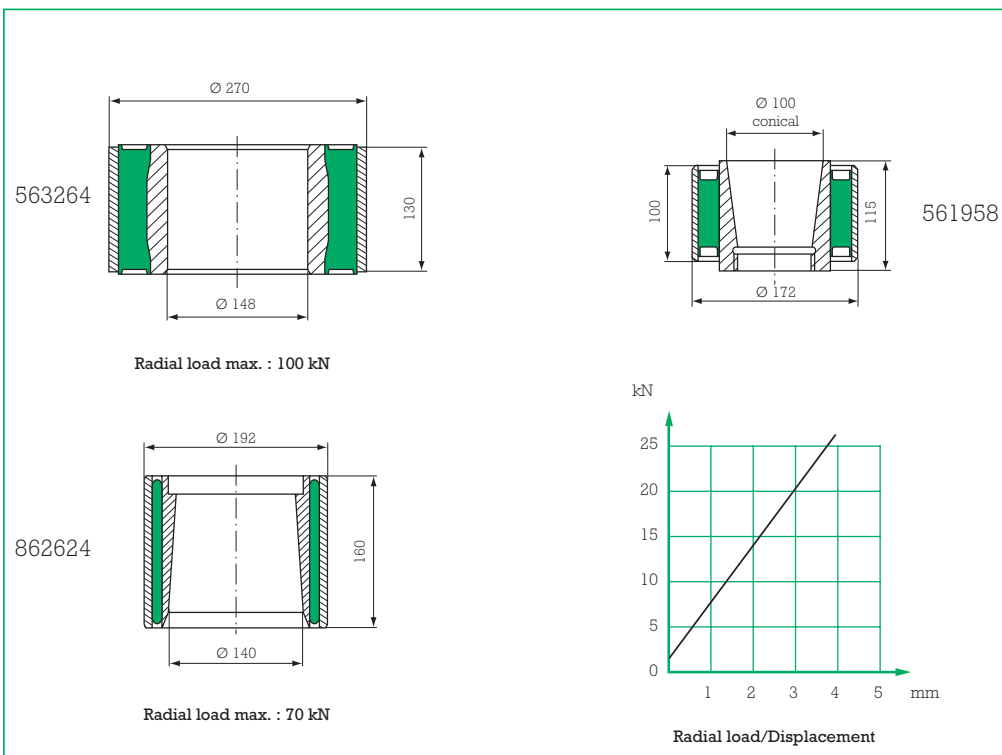


Fig. 3

Reference	Fig.	Ø A mm	B mm	C mm	Ø D mm	Ø E mm	Radial stiffness KN/mm	Axial stiffness KN/mm
563468	2	180	200	140	Ø 68 cone	-	85	10
562908	1	140	254	160	50 x 56	-	85	17
562912	1	140	273	145	Ø 63	-	20	5
563533	2	185	190	150	Ø 70 cone	-	57.5	16.75
563550	2	185	190	150	Ø 68	-	57.5	16.75
563443	2	132	154	136	Ø 70	-	140	5
531293	3	110	55	42	Ø 50	86	17	8
531367	3	110	95	33	Ø 52	150	10	50
531330	3	122	72	54	Ø 70	162	40	30
563352	1	122	254	120	Ø 50	-	4	5

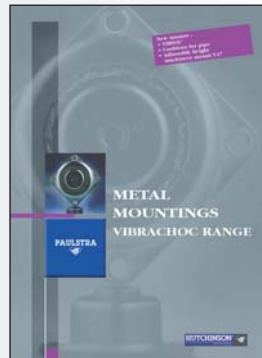


OTHER PAULSTRA DOCUMENTATION

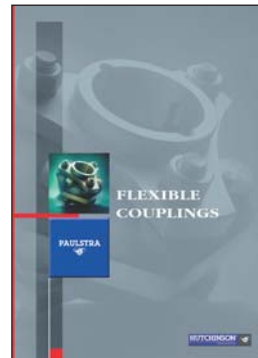
Available upon request



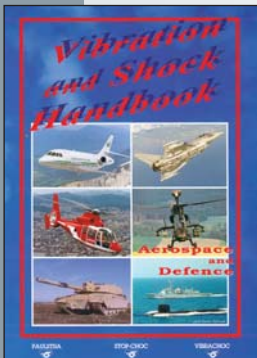
**FLEXIBLE
MOUNTINGS**
CATALOG



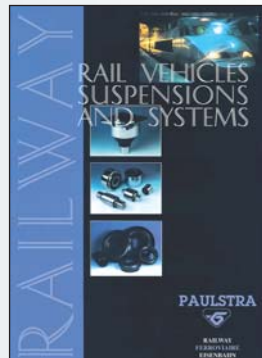
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MOUNTINGS**
CATALOG



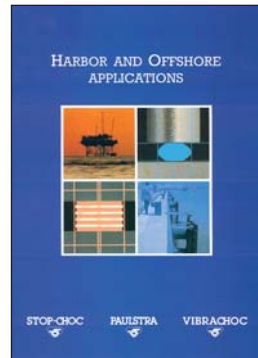
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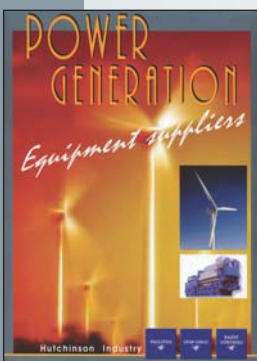
**AEROSPACE
AND DEFENCE**
CATALOG



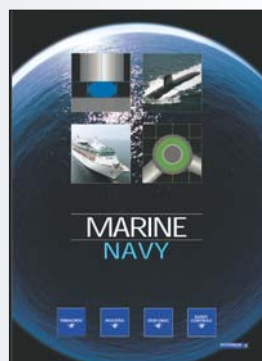
RAILWAY
CATALOG



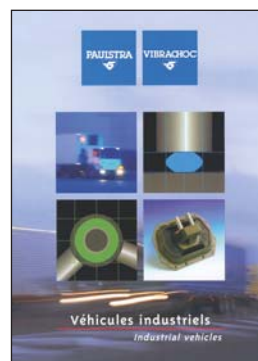
OFFSHORE
CATALOG



**POWER
GENERATION**
LEAFLET



MARINE / NAVY
LEAFLET



**INDUSTRIAL
VEHICLES**
LEAFLET