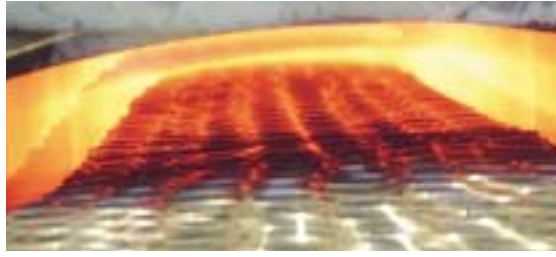


Quality · Precision · Individuality



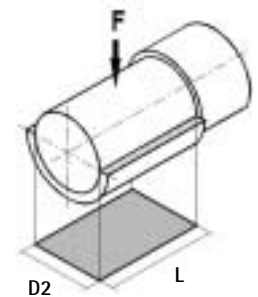
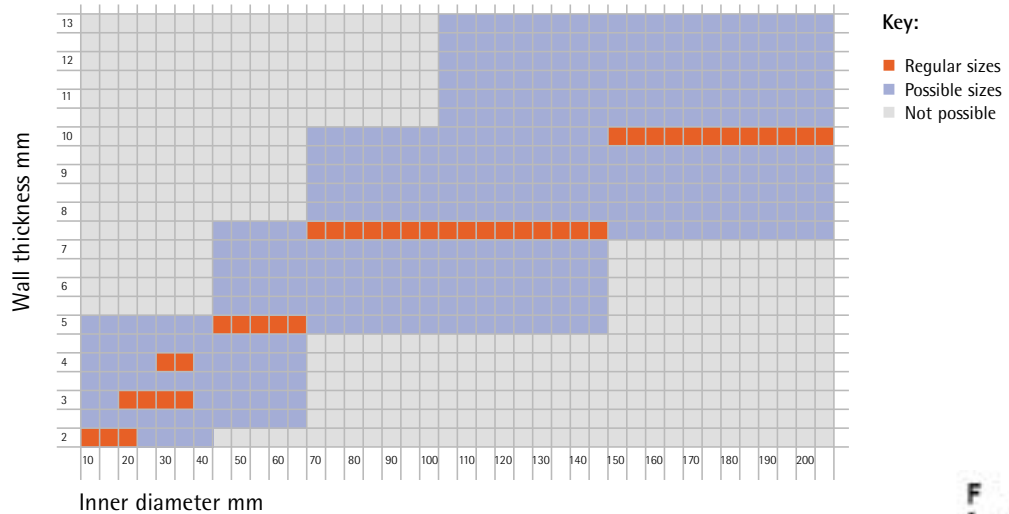


Technical Overview

Note:

All dimensions in mm, though inch sizes are produced daily.

Size range:



Hardness:

All types are offered according to following details.
For heavily loaded Bushes we recommend our "Carburized surface treatment" specification e.g. EG50/40x40 C – PN3000.
All Bushes are "through hardened".

	Rockwell 'C' scale	Vickers hardness	Specification
Standard	42 – 48 HRC	410 – 480	
With carburized surface	50 – 54 HRC	520 – 580	C

Specification: EG 50/40x40 C – PN3000

Design Guidance:

The average contact pressure governs bearing specification. This is calculated as follows:

$$pm \text{ (admissible)} \geq pm = \frac{F}{D2 \times L}$$

pm = average contact pressure N/mm²

F = Load (surface load) N

D2 = Inner diameter of Bush

L = Bush length

Finish

Pentz Bushes are available in two preserving finishes.

	Description	Specification
Oiled (standard)	Reliable protection against corrosion	
Dry lubricant Film (standard for ground Bushes)	MoS ₂ -solid film lubricant extremely resistant to pressure and temperature and improves running-in behaviour whilst reducing surface damage.	M

Further developments of our Bush programme are shown in the following pages....., in particular, types PN5000 & PN7000.

Max. static surface load	600 N/mm ²
Max. dynamic surface load	60 – 80 N/mm ²
Max. temperature	150 °C

The Company

The Pentz Company was founded in 1960, with the aims of producing Tension Bushes to meet the toughest demands, through precision, Material quality and care in production.

With a team of experienced specialists we have developed not only the internationally recognised standard parts but also many customer specific solutions, in particular the Close Joint Bush. With the latter point in mind we continually try to ensure that customers design staff are involved in the early stages of the specification process. This helps to guarantee the most cost effective and technologically superior part available.



Through many patented innovations Pentz has developed new areas of application working with leading manufacturers in the fields of Engineering Construction, Agricultural Machinery, Conveying Systems and other industries where pressures and wear are problems to be solved. Our own Cold Rolling Mill enables us to satisfy

production from unusual material thickness and further gives flexibility to our manufacturing programme.

Make use of our experience and competence.

A warm welcome to Pentz.





Contents:

Inner Tension Bushes
type PN3000 (DIN 1498) pages. 04 - 07

Inner Tension Bushes type PN5000
with Close Joint and Thrust Points pages. 08 - 11

Inner Tension Bushes type PN7000
with Closed Joint pages. 12 - 15

Outer Tension Bushes
type PN3500 (DIN 1499) pages. 16 - 18

Tension Pins page. 19

Special requirements pages. 20 - 21

Assembly and Shaft detail pages. 22 - 23



Inner Tension Bushes

Type PN3000

Inner Tension Bushes are slotted hollow cylinders with a variety of slot forms. They are manufactured from hardened and tempered spring steel strip giving elasticity and extended wear resistance. They are defined by slot type, diameters and length to our factory standard PN3000 (DIN 1498 refers). e.g. EG 50/40 x 40 PN3000 for size requirements see page 1.

PN3000 – Areas of Application

Pentz Inner Tension Bushes are used wherever there is exposure to heavy duty working conditions and high surface forces. They are found in applications of slowly rotating machinery, wave movement operations, assemblies with short cycle reverse rotational functions, and of course they excel when dealing with shock loads!

Such as:

- Construction machines
- Agricultural machines
- Conveying systems
- Machine building Industries
- Railway Industry
- Mining and Digging



PN3000 – Advantages

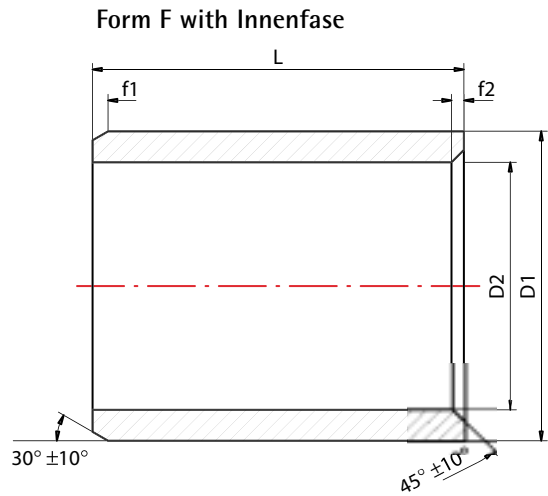
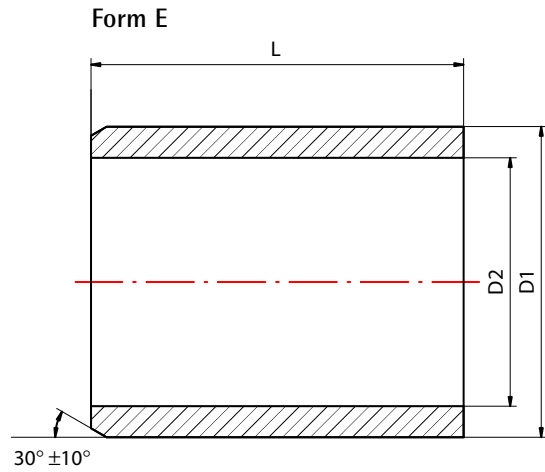
- Easy Assembly
- No further treatment after assembly
- Rescuing expensive parts by re-boring and fitting a Bush
- Low repair costs
- Short down times
- Self locating in housing
- Manufacturing to a hardness giving maximum life
- Minimum maintenance



Inner Tension Bushes Type PN3000

This is type DIN 1498 standard Bush which custom and practice allows us to offer for a host of regular applications.

Diameter D1 is oversize prior to fitting and the pre-tension generated allows the Bush to hold itself into position after assembly, without further mechanical constraint. The pre-tension is product of the wall thickness and Bush length.



EG

- Straight slot, the Most usual form



ES

- Inclined slot, favoured
- For rotary motion



EP

- Arrow slot, again for rotary motion and longer length Bushes

Technical data

Inner diameter – tolerance for Inner Tension Bushes PN3000

Nominal size range of the inner Ø D2		10 to 18			18 to 30			30 to 50			50 to 80			80 to 100			100 to 120			120 to 180			180 to 250	
Bush length (L)		to 50	to 100	to 150	to 50	to 100	to 150	to 50	to 100	to 150	to 50	to 100	to 200	to 50	to 100	to 200	to 100	to 200	to 100	to 200	to 100	to 200		
ISO tolerances of inner Ø D2	D 11	+0,160 +0,050	+0,160 +0,050		+0,195 +0,065	+0,195 +0,065		+0,240 +0,080	+0,240 +0,080		+0,290 +0,100			+0,340 +0,120										
	D 12			+0,230 +0,050			+0,275 +0,065			+0,330 +0,080		+0,400 +0,100		+0,470 +0,120		+0,470 +0,120		+0,545 +0,145		+0,630 +0,170				
	D 13												+0,560 +0,100		+0,660 +0,120		+0,660 +0,120		+0,775 +0,145		+0,890 +0,170			

Minimum oversize before assembly

Inner Ø D2	> 10 to 50	> 50 to 100	> 100 to 250
Oversize Ø D1 in mm	> 0,5	> 0,8	> 1,0

Length tolerance

Inner Ø D2	> 10 to 50	> 50 to 100	> 100 to 250
Length < 100	-1	-1,5	-2
> 100	-1,5	-1,5	-2

Recommendations for housing tolerances


Housing		> 10 to 18	> 18 to 30	> 30 to 50	> 50 to 80	> 80 to 120	> 120 to 180	> 180 to 250
ISO tolerance H8	H 8	+0,027 0	+0,033 0	+0,039 0	+0,046 0	+0,054 0	+0,063 0	+0,072 0





Inner Tension Bushes

Type PN5000 with Close Joint and Thrust Pads



With the fitting of these Pentz Bushes, the slot edges come together compressing the thrust pads and giving a higher surface loading in the housing, ensuring a more stable assembly and longer service life.

PN5000 – Areas of Application

Pentz has developed this Bush to meet growing demand for increased service intervals together with longer working life. The close joint prevents contaminant entering the Bush and keeps the lubricant working longer. They have been tested for some years in:

- Construction machines
- Salvage operations
- Agricultural machines
- Conveying systems
- Building Industry Equipment
- Rail road Industry



PN5000 – Advantages

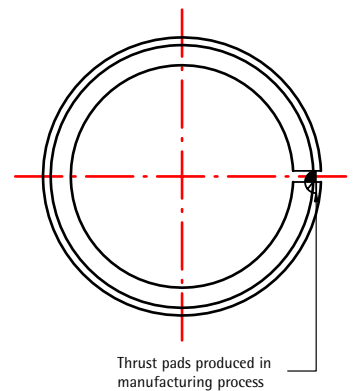
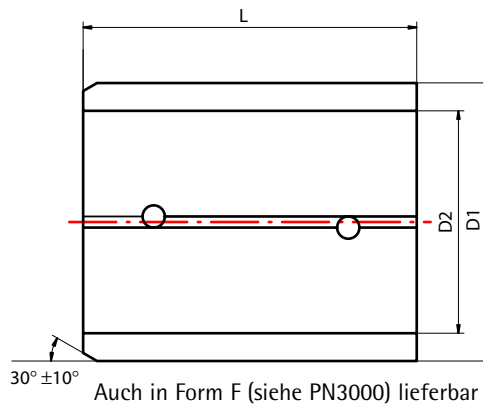
- Security against axial movement even in worn housings
- Security against torsional movement
- Bushes can be ground upon request to fine tolerances
- High retention force in housing
- Cost effective housing manufacture up to tolerance H11
- Easy assembly and removal with standard hydraulic fitment.
- Valuable to reclaim worn housings
- More cost effective due to longer service life
- Minimum maintenance



Inner Tension Bush PN5000 cont'd

The number of thrust pads along the slot can be varied according to Bush length, diameter and desired retention force.

The result of this design feature is a considerable extension of application possibilities.



EGPN1
Inner Tension Bush with closed joint and thrust points

- 1 inner spiral groove, one side running-out into chamfer



EGPN2
Inner Tension Bush with closed joint and thrust points

- To D2 90mm, 3 inner inclined grooves not running-out
- 90 mm Dia upwards 4 similar grooves
- Optionally with 1 inner annular groove



EGPN3
Inner Tension Bush with closed joint and thrust points

- 1 outer annular groove
- 1 inner annular groove
- To D2 90mm Dia. 3 inclined grooves not running out
- From D2 90mm Dia. 4 similar grooves
- 3 or 4 drilled holes



EGPN4
Inner Tension Bush with closed joint and thrust points

- 1 outer groove
- 1 inner groove
- 2 holes through



EGPN5
Inner Tension Bush with closed joint and thrust points

- To D2 90mm, Dia. 3 inner inclined grooves running-out to chamfer
- From D2 90mm Dia. 4 grooves similar



EGPNO
Inner Tension Bush with closed joint and thrust points

- Too customers own design

Technical data

Inner diameter – tolerances for Tension Bush PN5000

Nominal size of inner Ø D2		10			18			30			50			80			100			120			180		
		to 50	to 100	to 150	to 50	to 100	to 150	to 50	to 100	to 150	to 50	to 100	to 200	to 50	to 100	to 200	to 100	to 200	to 100	to 200	to 100	to 200			
ISO tolerances of inner Ø D2	D 11	+0,160 +0,050	+0,160 +0,050		+0,195 +0,065	+0,195 +0,065		+0,240 +0,080	+0,240 +0,080		+0,290 +0,100			+0,340 +0,120											
	D 12			+0,230 +0,050			+0,275 +0,065			+0,330 +0,080		+0,400 +0,100			+0,470 +0,120		+0,470 +0,120		+0,545 +0,145		+0,630 +0,170				
	D 13												+0,560 +0,100			+0,660 +0,120		+0,660 +0,120		+0,775 +0,145		+0,890 +0,170			
	*H 8	+0,027 0,000			+0,033 0,000			+0,039 0,000			+0,046 0,000			+0,054 0,000			+0,054 0,000			+0,063 0,000			+0,072 0,000		
	*F 8	+0,043 +0,016			+0,053 +0,020			+0,064 +0,025			+0,076 +0,030			+0,090 +0,036			+0,090 +0,036			+0,106 +0,043			+0,122 +0,050		
	*E 8	+0,059 +0,032			+0,073 +0,040			+0,089 +0,050			+0,106 +0,060			+0,126 +0,072			+0,126 +0,072			+0,148 +0,085			+0,172 +0,100		

* Tolerances for ground Bushes or others to your specification.

To control the inner diameter note the sum of the tolerances, housing plus tension Bush.

Minimum oversize before assembly (pre-tension)

Inner Ø D2	> 10 to 50	> 50 to 100	> 100 to 250
Oversize D1 in mm	> 0,3	> 0,5	> 0,8

Length tolerances

Inner Ø D2	> 10 to 50	> 50 to 100	> 100 to 250
Length L < 100	-1	-1,5	-2
> 100	-1,5	-1,5	-2


Recommendations for housing tolerances

Housing		> 10 to 18	> 18 to 30	> 30 to 50	> 50 to 80	> 80 to 120	> 120 to 180	> 180 to 250
ISO tolerance	H 11	+0,110 0	+0,130 0	+0,160 0	+0,190 0	+0,220 0	+0,250 0	+0,290 0





Inner Tension Bushes with Closed Joint PN7000



Where extremely high retention forces are required from a Bush then the Pentz type PN7000 with its Closed Joint will rise to this exacting task. Upon assembly the slot edges come together and exert increasing pressure upon the walls of the housing.

PN7000 Applications

Pentz Inner Tension Bushes of this type have been developed to satisfy the need for better performance in the more exacting environments. Fields of application are:

- All the usual machinery previously referred to
- Plus applications where service life is an extra consideration
- Plus e.g. hazardous applications where Bush may not be accessible as often as may be preferred



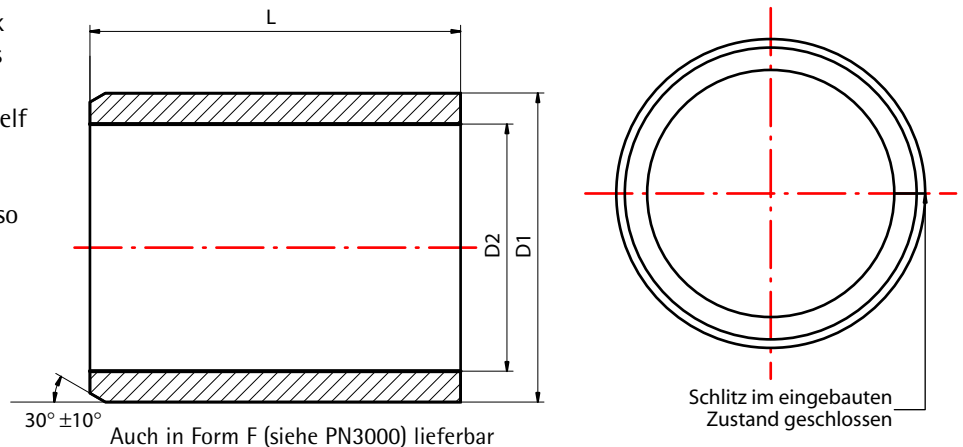
PN7000 Advantages

- No loss of lubricant
- Extra security in housing
- Bushes can be ground upon request offering closer tolerances
- Reduced life costs
- Increased maintenance periods
- Production times as standard Bushes
- Easy assembly and removal with standard hydraulic fitment
- Patented design



Inner Tension Bush PN7000 cont'd

Due to the closed joint of this Bush even shock loadings are more easily dealt with. The Bushes are through hardened and tempered giving all the advantages of a solid Bush together with self retention, press-in forces are agreed with the customer prior to delivery. All Pentz variations of lubrication grooves and though holes are also available on this Bush type also.



EGP1
 Inner Tension with closed joint

- 1 inner spiral groove, one side running-out into chamfer



EGP2
 Inner Tension with closed joint

- To D2 90mm, 3 inner inclined grooves not running-out
- 90mm Dia upwards 4 similar grooves
- Optionally with 1 inner annular groove



EGP3
 Inner Tension with closed joint

- 1 outer annular groove
- 1 inner annular groove
- To D2 90mm Dia. 3 inclined grooves not running out
- From D2 90mm Dia. 4 similar grooves
- 3 or 4 drilled holes



EGP4
 Inner Tension with closed joint

- 1 outer groove
- 1 inner groove
- 2 holes through



EGP5
 Inner Tension with closed joint

- To D2 90mm, Dia. 3 inner inclined grooves running-out to chamfer
- From D2 90mm Dia. 4 grooves similar



EGPO
 Inner Tension with closed joint

- Too customers own design

Technical data

Inner diameter – tolerances for Tension Bushes PN7000

Nominal size of inner Ø D2		10 to 18			18 to 30			30 to 50			50 to 80			80 to 100			100 to 120			120 to 180			180 to 250	
Bush length L		to 50	to 100	to 150	to 50	to 100	to 150	to 50	to 100	to 150	to 50	to 100	to 200	to 50	to 100	to 200	to 100	to 200	to 100	to 200	to 100	to 200		
ISO tolerances of inner Ø D2	D 11	+0,160 +0,050	+0,160 +0,050		+0,195 +0,065	+0,195 +0,065		+0,240 +0,080	+0,240 +0,080		+0,290 +0,100			+0,340 +0,120										
	D 12			+0,230 +0,050			+0,275 +0,065			+0,330 +0,080			+0,400 +0,100			+0,470 +0,120		+0,470 +0,120		+0,545 +0,145		+0,630 +0,170		
	D 13												+0,560 +0,100			+0,660 +0,120		+0,660 +0,120		+0,775 +0,145		+0,890 +0,170		
	*H 8	+0,027 0,000			+0,033 0,000			+0,039 0,000			+0,046 0,000			+0,054 0,000			+0,054 0,000			+0,063 0,000			+0,072 0,000	
	*F 8	+0,043 +0,016			+0,053 +0,020			+0,064 +0,025			+0,076 +0,030			+0,090 +0,036			+0,090 +0,036			+0,106 +0,043			+0,122 +0,050	
	*E 8	+0,059 +0,032			+0,073 +0,040			+0,089 +0,050			+0,106 +0,060			+0,126 +0,072			+0,126 +0,072			+0,148 +0,085			+0,172 +0,100	

*Tolerances for ground Bushes or others to your specification.
To control the inner diameter note the sum of the tolerances, housing plus tension Bush.

Minimum pre-tension sizes not applicable, as this Bush achieves its high retention force from the Closed Joint principle.

Length tolerances

Inner Ø D2	> 10 to 50	> 50 to 100	> 100 to 250
Length L < 100	-1	-1,5	-2
> 100	-1,5	-1,5	-2

Housing tolerances for Bush type PN7000


Housing		> 10 to 18	> 18 to 30	> 30 to 50	> 50 to 80	> 80 to 120	> 120 to 180	> 180 to 250
ISO tolerance	H 8	+0,027 0	+0,033 0	+0,039 0	+0,046 0	+0,054 0	+0,063 0	+0,072 0





Outer Tension Bushes

Type PN3500



Pentz Outer Tension Bushes are slotted hollow cylinders, made in the same way as Inner Bushes previously described. They are pressed onto shafts to achieve an increased hard wearing surface area.



PN3500 – Areas of Application

Pentz Outer Tension Bushes are made in order to increase the longevity of bearings subjected to heavy duty working conditions.

Easy replacement makes for increased life of assembly and minimum maintenance costs.

Assembly is facilitated by the single inner chamfer.

When used in conjunction with Inner Tension Bushes at least one of the Bushes must have slant or arrow shaped slots.

Conveying machinery in harsh environments are a particular application.

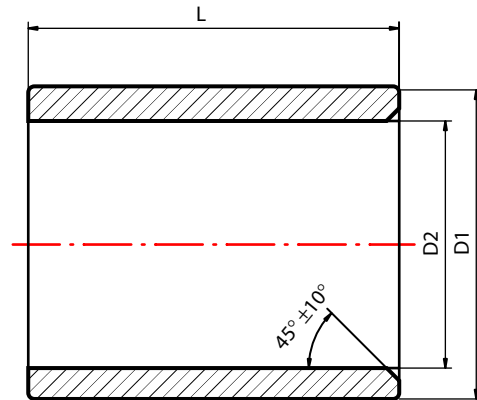


Outer Tension Bushes Type PN3500

The inner diameter of an Outer Tension Bush is smaller by a fixed value than the diameter of the shaft journal.

Its retention force is generated by the Bush diameter, length and wall thickness.

We offer facilities to grind the outer diameter in order to achieve closer tolerances.



Sizes D2	10 to 18	18 to 30	30 to 40	40 to 50	50 to 65	65 to 80	80 to 100	100 to 120	120 to 140	140 to 160	160 to 180	180 to 200	
ISO tolerance D1	a 12	-0,470	-0,510	-0,560	-0,570	-0,640	-0,660	-0,730	-0,760	-0,860	-0,920	-0,980	-1,120
		-0,290	-0,300	-0,310	-0,320	-0,340	-0,360	-0,380	-0,410	-0,460	-0,520	-0,580	-0,660

Tolerance after assembly on shaft, D1 = h8. For more exacting applications tolerance on D2 can be ground up to tolerance H10.

Pre-tension D1 (before assembly)

Sizes D2	10 to 35	35 to 55	55 to 90	90 to 115	115 to 180	
Diameter	D1	-0,5	-0,8	-1,0	-1,3	-1,5

Length tolerances

Sizes D2	> 10 to 50	> 50 to 100	> 100 to 250	
Length L	< 100	-1	-1,5	-2
	> 100	-1,5	-1,5	-2



AG
Straight Slot

- For slow running And oscillating work



AS
Inclined Slot

- For regular rotary motion applications



AP
Arrow Slot

- As Type AS, but mainly used for longer lengths

Spring Tension Pins



Pentz Spring Tension Pins are used wherever two or more parts must be joined together. They can be used in the various functions of: location, hinge, stop, anchor and because they are made to order a choice of material thicknesses can suit the toughest applications.

Only the same high quality spring steel as recommended for this product, 1.5026, 1.8509 is used in their construction.

Special demands are regularly produced and pins to 70 mm diameter and 260 mm long are within our capability.





Special solutions

Our in-house Cold Rolling Mill enables us to convert a special problem into a standard solution very quickly. All our technicians are sensitive to the needs of economic answers to customers enquiries, and it is often the case that we have actual experience in similar applications.

Our Aim is a perfect solution every time!

Fields of Expertise:

- Construction machinery
- Agricultural machinery
- Conveying equipment
- Heavy and light railway systems
- Machine rebuilding services



Inner Tension Bush with Closed Joint and Axial Collar Pads

- Fulfills the demands of a collar but more efficiently manufactured
- 3 axial collar pads secure against axial movement



Traction Eye Bushes

- With added inner thrust pads (PN5000) to secure against axial movement



Special Inner Tension Bush with grease grooves

- Inside and outside diameter ground
- Used as a sleeve in rail industry



Inner Tension Bush with wave slot

- With special groove forms
- Plus additional holes



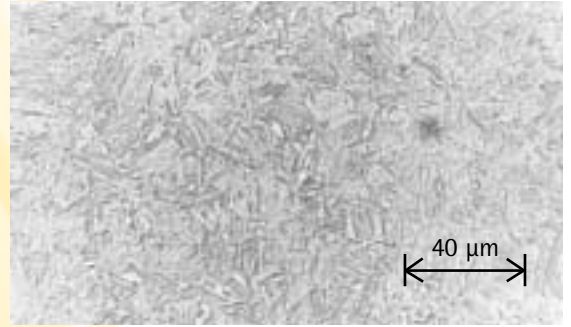
Heavy Duty Tension Bush

- Used as a connection element in the rail industry – ground outside diameter and shot peened



Materials

	37MnB4 1.5224	55 Si7 1.5026	50 CrV4 1.8159
PN3000	X	X	X
PN5000	X		X
PN7000	X		X
PN3500	X	X	X
Tension Pins		X	X
Special requirements	X	X	X



37MnB4 is a modern boron-alloyed steel with outstanding resistance to wear. The spring effect is similar to 55Si7 and 50CrV4.

Micro-section surface 37MnB4

Other materials upon request!

Bush specification

Bush Type	Slot form	Nomenclature	Additions	Number of grooves	Outer Ø	Inner Ø	Length	Hardness	Finish
<ul style="list-style-type: none"> Inner Tension Bush (E) Outer Tension Bush (A) 	<ul style="list-style-type: none"> Straight slot (G) Inclined slot (S) Arrow slot (P) 	<ul style="list-style-type: none"> PN3000 PN3500 PN5000 (PN)* PN7000 (P)* 	<ul style="list-style-type: none"> Ground Inner or Outer dia. (G) 	<ul style="list-style-type: none"> 1,2,3 etc. 	<ul style="list-style-type: none"> PN D1 	<ul style="list-style-type: none"> D2 	<ul style="list-style-type: none"> L 	<ul style="list-style-type: none"> 44-48HRC 50-54 HRC (C) 	<ul style="list-style-type: none"> Oiled Dry film Lubricant (M)
E	G	P		1	70	60	30	C	M
A	S				50	40	80		
E	G	PN	G	4	85	70	70	C	M

* Straight slot form only

The above table will enable you to specify in detail all types of Pentz Bush.



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EP 0222416
US 4770446

Certificate ISO 9001: 2000

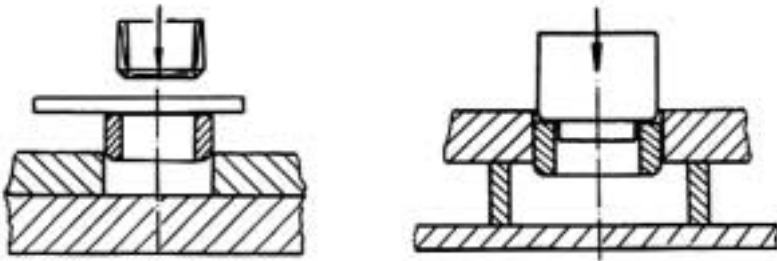
Assembly techniques

Fitting and removal

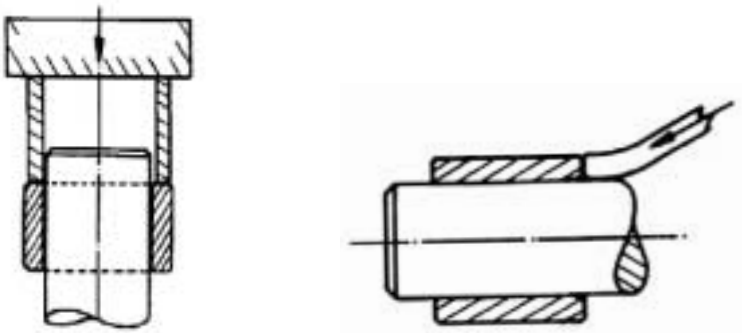
Bushes may be installed and removed by regularly available techniques, e.g. hammer and mandrel, bench press or portable hydraulic ram. For site work it is often possible to arrange to "plug-in" to the machine's hydraulic circuit.

The Bush is entered chamfered end and with the slot orientated at 90° to the direction of force.

Inner Tension Bush



Outer Tension Bush



Advantages:

- Easy assembly and removal
- Tolerance H8 is sufficient
- No cooling is necessary
- Secondary machining not needed
- Bushes may be replaced on site
- Short down times

Bolts, Shafts and Journals

Material	C45, 42CrMo4, CK15, 16MnCr5
Hardness	As far as possible, choose HRC 6-8 higher than Bushes
Surface	Finely turned or ground
Tolerance	e.g. f 8 or h 8





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UK supply



Pentz offers Country-specific distribution points, which helps the regular and consistent availability of parts and information.

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