

GMN



Precision belt driven spindles



Internet

At our Internet site www.gmn.de we provide comprehensive product information that can be downloaded.

GMN

GMN Paul Müller Industrie GmbH & Co. KG manufactures high precision ball bearings, machine spindles, freewheel clutches and seals for a broad spectrum of applications at its Nuremberg, Germany plant.

On the basis of long experience in the development and production of machine components, GMN has specialized in the manufacture of high quality products in the field of high precision ball bearings and, beyond a comprehensive standard product line, also offers customer-oriented special solutions.

A global GMN service network offers competent customer consultation and individualized solutions.



GMN Quality management - tested and certified.

GMN guarantees utmost quality for its products and services that is based on long-term reliability. Highly modern development and production methods ensure products that always represent state-of-the-art technology. All GMN corporate divisions are structured for transparency and clear organizational workflows to ensure customer-oriented services and economic security.

All GMN corporate divisions are certified to DIN ISO 9001:2008.

GMN - safeguarding the future.

For GMN, progress means the best possible customer support combined with performance-oriented optimization of its technical products.

This claim is realized at GMN under especially strict observance of national and international environmental standards with regard to efficient, responsible utilization of ecological resources.





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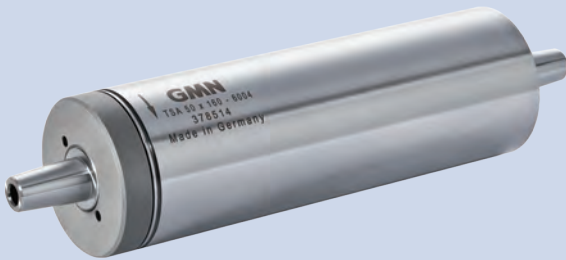
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Product overview

TSA, TSA..c



External taper, belt driven

- Duplex pair of GMN precision bearings
- TSA..c with [hybrid ceramic bearings](#)
- Permanently grease lubricated
- Spring preloaded design

Applications

- High speed grinding
- Wide speed range
- Small, medium and large bores

TSI, TSI..c



Internal taper, belt driven

- Duplex pair of GMN precision bearings
- TSI..c with [hybrid ceramic bearings](#)
- Permanently grease lubricated
- Spring preloaded design

Applications

- High speed grinding
- Wide speed range
- Small, medium and large bores

TSP, TSP..c



Internal cylindrical pilot with draw thread and face clamping, belt driven

- Duplex pair of GMN precision bearings
- TSP..c with [hybrid ceramic bearings](#)
- Permanently grease lubricated
- Spring preloaded design

Applications

- High speed grinding
- Wide speed range
- Small, medium and large bores

Made in Germany

Made in Germany

TSAV



External taper, belt driven

- Quad set of precision bearings at nose end solid preload design
- Permanently grease lubricated

Applications

- Large deep bores
- For high loads
- For high stiffness requirements

TSL



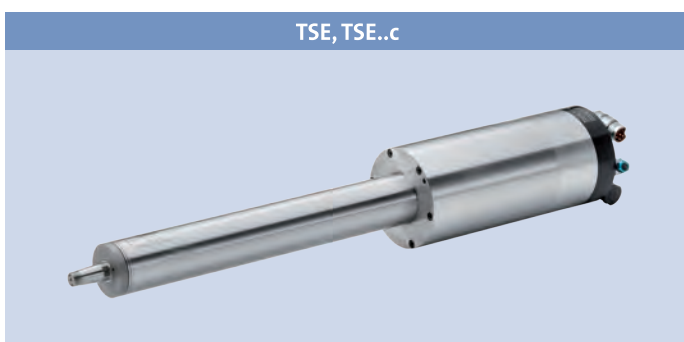
External taper and stepped spindle housing, for deep internal bore grinding, belt driven

- Quad set of precision bearings at nose end solid preload design
- Permanently grease lubricated

Applications

- Medium and large, deep bores

TSE, TSE..c



With flanged liquid-cooled motor

- Tool interface: HSK-C, integrated collet nose, all GMN standard tool interfaces, according to customer's requirements
- Precision bearings
- TSE..c with [hybrid ceramic bearings](#)
- Permanent oil/air or grease lubrication
- Clamping on cylindrical housing

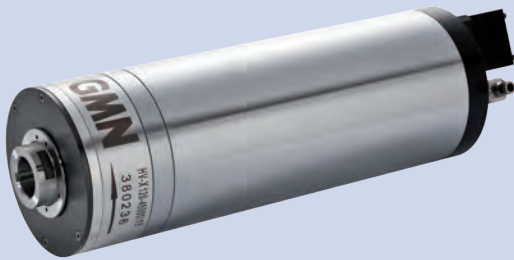
Applications

- With high speeds

TSE spindles are replacement for no longer available TSEV spindles. Please name us the engraved serial number of the existing TSEV spindle in case of replacement demand.

Product overview

HS, HSX, HV-X, UHS

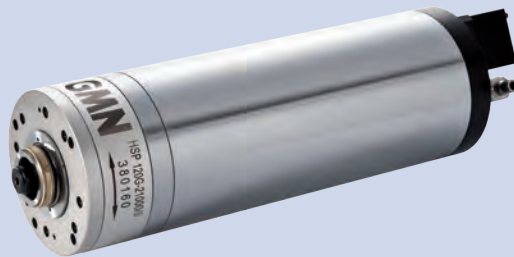


High frequency spindles with integral asynchronous motor for manual tool change

- Tool interface: GMN standard tool interface - fitting bore with flat contact face
- Ultra precision ball bearings
- Hybrid ceramic bearings
- Oil/air lubricated

Please ask for catalog # 2508.

HSP, HSP.g, HV-P

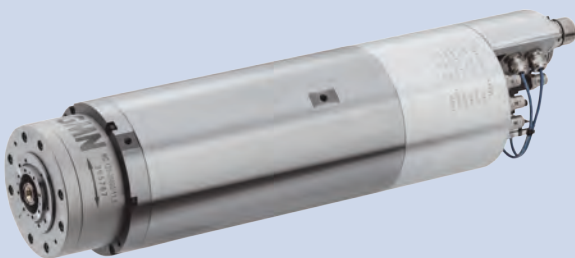


High frequency spindles with integral asynchronous motor for manual tool change

- Tool interface: HSK-C
- Ultra precision ball bearings
- Hybrid ceramic bearings
- Oil/air or permanently grease lubricated

Please ask for catalog # 2508.

HC, HCS

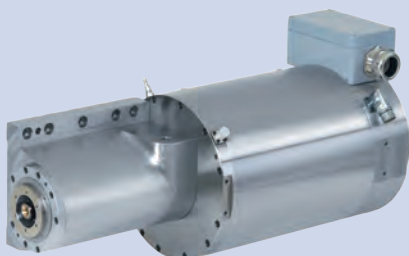


High frequency spindles with integral asynchronous motor for automatic tool change

- Asynchronous or synchronous motor
- Open-loop or closed-loop drive
- Tool interface: HSK-A/-B/-E/-F/-T, SK, BT, PSC
- Ultra precision ball bearings
- Hybrid ceramic bearings
- Oil/air or permanently grease lubricated

Please ask for catalog # 2505.

Special spindles

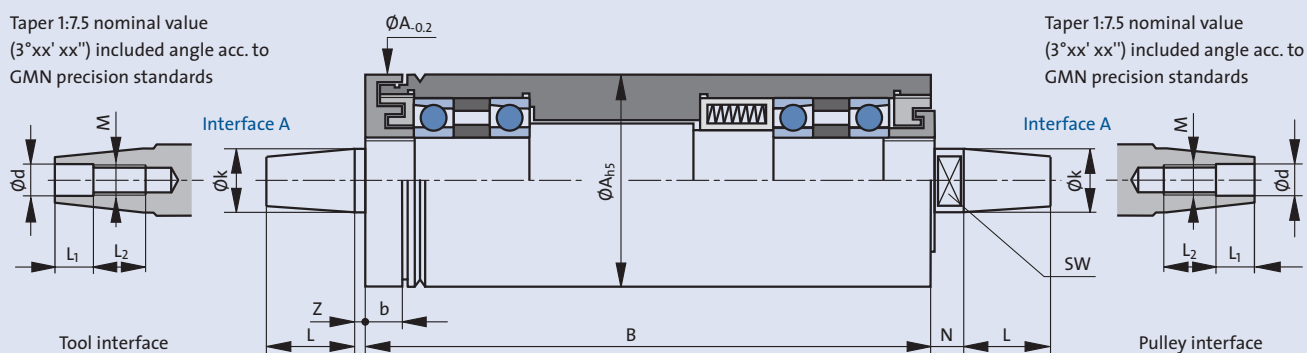


GMN offers the perfect solution for customer's requirements. Please contact us.

TSA series



Taper 1:7.5 nominal value
(3°xx' xx'') included angle acc. to
GMN precision standards



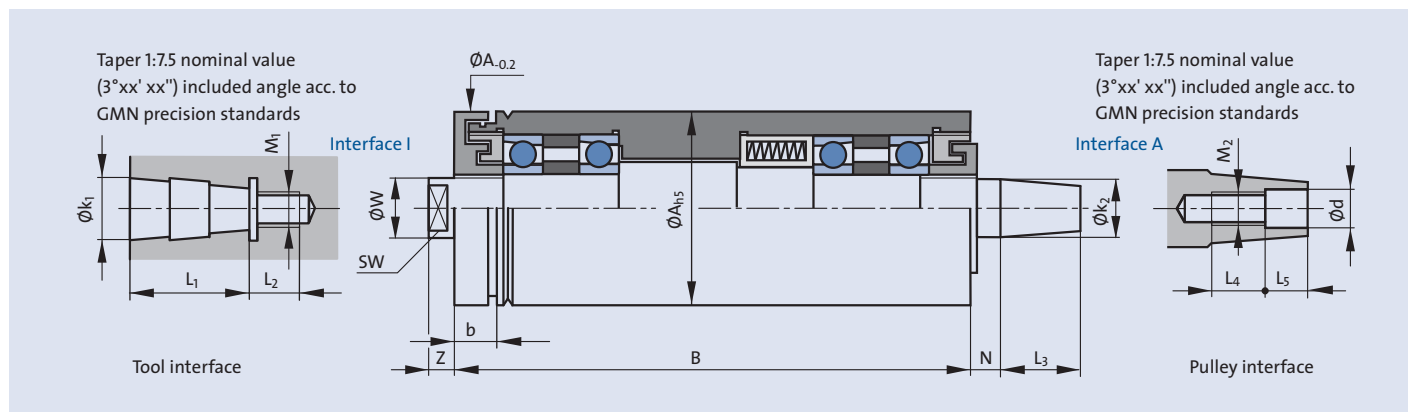
Designation	Interface A						Dimensions				Max. speed*					
	[mm]						[mm]				for bearing types [rpm]					
A	c	d	B	k	L	d	M	L ₁	L ₂	Z	b	N	SW	Steel	Hybrid	
TSA 20	x	125	A 07						2	5	7	6	80000	+		
TSA 20	x	160	7.5	10	4	M4	5	7					60000	+		
TSA 20	x	200														
TSA 20	x	250														
TSA 26	x	125	A 08						2	6.5	7	7	60000	+		
TSA 26	x	160	8	11.25	4	M4	5	7					40000	+		
TSA 26	x	200											30000	+		
TSA 26	x	250														
TSA 26	x	315														
TSA 32	x	125	A 10						2.5	6	8	8	60000	+		
TSA 32	x	160	10	15	5	M5	7	8					40000	+		
TSA 32	x	200														
TSA 32	x	250														
TSA 32	x	315														
TSA 32	x	355	A 10						2.5	9.5	7	8	45000	55000		
TSA 40	■ ■ ■	x 160	10	15	5	M5	7	8					42000	42000		
TSA 40	■ ■ ■	x 200														
TSA 40	■ ■ ■	x 250	A 13						3	10.5	8	11	35000	35000		
TSA 50	■ ■ ■	x 160	13.5	20	6	M6	8	12					30000		25000	
TSA 50	■ ■ ■	x 200														
TSA 50	■ ■ ■	x 250	A 18						3	10.5	9	15	20000	25000		
TSA 60	■ ■ ■	x 160	18	25	8	M8	11	14							30000	20000
TSA 60	■ ■ ■	x 200														
TSA 60	■ ■ ■	x 250														
TSA 60	■ ■ ■	x 315	A 27						4	14.5	12	24	15000	20000		
TSA 80	■ ■ ■	x 200	27.67	35	12	M12	13	21							20000	25000
TSA 80	■ ■ ■	x 250														
TSA 80	■ ■ ■	x 315	A 38						4	16	15	32	15000	20000		
TSA 100	■ ■ ■	x 250	38	52.5	16	M16	25	25							15000	20000
TSA 100	■ ■ ■	x 315														
TSA 100	■ ■ ■	x 355														





































Designation:
A = Housing diameter
B = Housing length
c = Hybrid bearings
d = Sealing shields
Preference types are in bold.

Max. speed:
* Without tool
+ Ceramic balls on request
Depending on tool design
and weight the maximum
operating speed may be
reduced.

Please state direction of
rotation.

TSI series



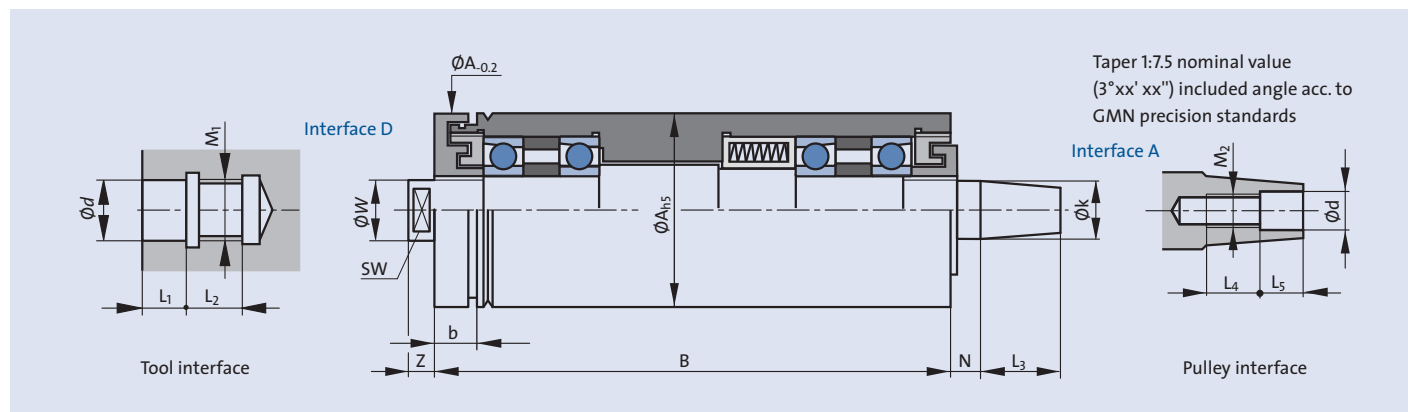
Designation	Interface I				Dimensions [mm]						Interface A						Max. speed* for bearing types [rpm]	
	A	c	d	B							k ₁	L ₁	L ₂	M ₁	k ₂	L ₃		
TSI 40   x 160	I 10				19	6	17	9.5	6	A 10						45000	55000	
TSI 40   x 200	10	26	16	M6						10	15	5	M5	8	7			
TSI 40   x 250																		
TSI 50   x 160	I 14				22	6	19	10.5	7	A 13						35000	42000	
TSI 50   x 200	14	35	17	M8						13.5	20	6	M6	12	8			
TSI 50   x 250																		
TSI 60   x 160	I 18				27	8	24	10.5	7	A 18						30000	35000	
TSI 60   x 200	18	45	19	M10						18	25	8	M8	14	11			
TSI 60   x 250																		
TSI 60   x 315																		
TSI 60   x 355																		
TSI 80   x 200	I 25				33.7	11	30	14.5	8	A 27						20000	25000	
TSI 80   x 250	25	63	25	M12						27.67	35	12	M12	21	13			
TSI 80   x 315																		
TSI 80   x 355																		
TSI 100   x 250	I 32				43.7	13	41	16	12	A 38						15000	20000	
TSI 100   x 315	32	80	34	M20						38	52.5	16	M16	25	25			
TSI 100   x 355																		





































Designation:
A = Housing diameter
B = Housing length
c = Hybrid bearings
d = Sealing shields
Preference types are in bold.

Max. speed:
* Without tool
Depending on tool design and weight the maximum operating speed may be reduced.

Please state direction of rotation.

TSP series



Designation	Interface D											Dimensions [mm]				Interface A							Max. speed*	
	A	c	d	B	D [d]/[W]	[mm] d	[μm] d Tolerance	W	L ₁	L ₂	M ₁					k	L ₃	d ₁	M ₂	L ₄	L ₅	Steel	Hybrid	
TSP 40   x 160	D 08/14	8	+ 5 / + 2	14	12	14	M8	9.5	6	13	6	A 10							45000	55000				
TSP 40   x 200												10	15	5	M5	8	7							
TSP 40   x 250																								
TSP 50   x 160	D 10/18	10	+ 5 / + 2	18	15	19	M10	10.5	8	15	7	A 13							35000	42000				
TSP 50   x 200												13.5	20	6	M6	12	8							
TSP 50   x 250																								
TSP 60   x 160	D 14/23	14	+ 7 / + 2	23	20	19	M14x1.5	10.7	10	19	7	A 18							30000	35000				
TSP 60   x 200												18	25	8	M8	14	11							
TSP 60   x 250																								
TSP 60   x 315																								
TSP 60   x 355																								
TSP 80   x 200	D 16/33	16	+ 7 / + 2	33	24	19	M16x1.5	14.5	11	27	8	A 27							20000	25000				
TSP 80   x 250												27.67	35	12	M12	21	13							
TSP 80   x 315																								
TSP 80   x 355																								
TSP 100   x 250	D 28/43	28	+ 8 / + 3	43	42	25	M28x2	16	13	36	12	A 38							15000	20000				
TSP 100   x 315												38	52.5	16	M16	25	25							
TSP 100   x 355																								

Designation:
A = Housing diameter
B = Housing length
c = Hybrid bearings
d = Sealing shields
Preference types are in bold.

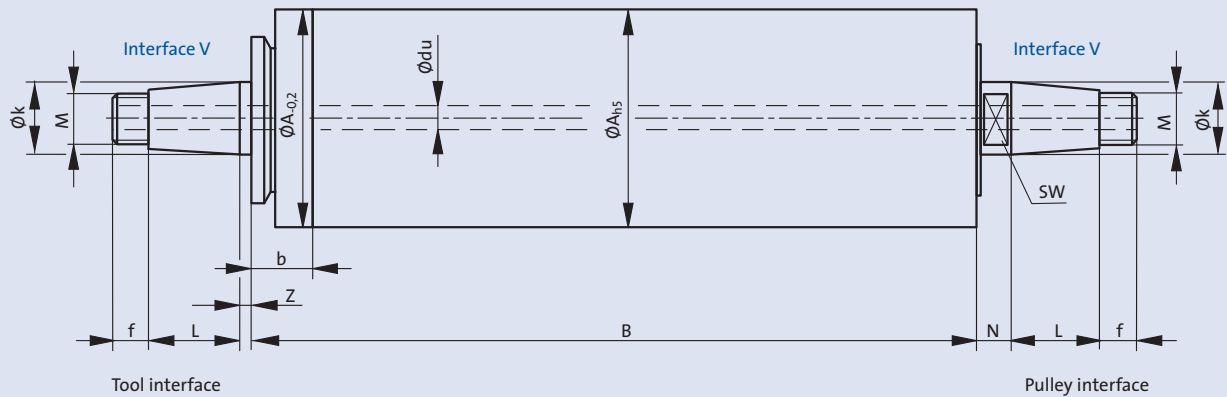
Max. speed:
* Without tool
Depending on tool design
and weight the maximum
operating speed may be
reduced.

Please state direction
of rotation.

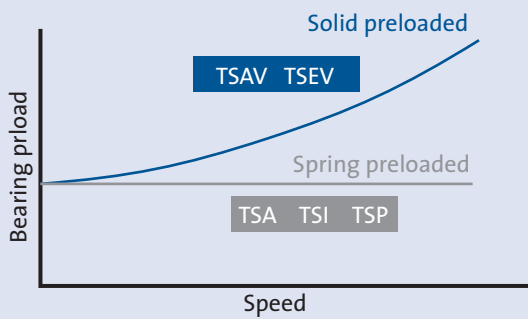
TSAV series

Taper 1:7.5 nominal value
(3°xx' xx'') included angle acc. to
GMN precision standards

Taper 1:7.5 nominal value
(3°xx' xx'') included angle acc. to
GMN precision standards



Bearing preload



Bearing preload

TSAV and TSEV spindle styles have a solid bearing arrangement as opposed to the other belt driven designs which are spring preloaded. The solid bearing mounting provides for higher spindle stiffness and load carrying capacity at maximum spindle speed. This arrangement limits the spindle speed in comparison to the same bearing bore sizes used in the TSA, TSI, TSP and TSE spindles. Another advantage is low axial shaft movement, which is required for face grinding. Higher speeds are available, but with reduced preload.

Hollow shaft

Hollow shaft is an option for allowing low pressure coolant through to the work piece.

High pressure rotary union

TSAV spindles with high pressure rotary union are available, starting at 100 mm housing diameter.



Designation					Interface			Dimensions [mm]						Max. speed* [rpm]	
					[mm]									Standard execution	Modification
A	du	h	vr	B	k	L	M	f	Z	b	N	SW	du**		
TSAV 40	■ ■ ■ ■	x	160		V 12										
TSAV 40	■ ■ ■ ■	x	200		12.83	15	M10x1	7	2.5	9.5	7	10	6	13000	32000
TSAV 40	■ ■ ■ ■	x	250												
TSAV 40	■ ■ ■ ■	x	315												
TSAV 40	■ ■ ■ ■	x	355												
TSAV 50	■ ■ ■ ■	x	200		V 15										
TSAV 50	■ ■ ■ ■	x	250		15.5	20	M12x1	7	3	11.5	8	13	8	10500	26000
TSAV 50	■ ■ ■ ■	x	315												
TSAV 50	■ ■ ■ ■	x	355												
TSAV 50	■ ■ ■ ■	x	400												
TSAV 60	■ ■ ■ ■	x	200		V 20										
TSAV 60	■ ■ ■ ■	x	250		20	25	M16x1	10	3	10.5	9	17	10	8500	20000
TSAV 60	■ ■ ■ ■	x	315												
TSAV 60	■ ■ ■ ■	x	355												
TSAV 60	■ ■ ■ ■	x	400												
TSAV 60	■ ■ ■ ■	x	500												
TSAV 60	■ ■ ■ ■	x	630												
TSAV 80	■ ■ ■ ■	x	250		V 27										
TSAV 80	■ ■ ■ ■	x	315		27.67	35	M20x1	12	4	14	12	24	14	6500	15000
TSAV 80	■ ■ ■ ■	x	355												
TSAV 80	■ ■ ■ ■	x	400												
TSAV 80	■ ■ ■ ■	x	500												
TSAV 80	■ ■ ■ ■	x	630												
TSAV 100	■ ■ ■ ■	x	315		V 38										
TSAV 100	■ ■ ■ ■	x	355		38	52.5	M30x1	12.5	4	17	15	32	20	5500	11000
TSAV 100	■ ■ ■ ■	x	400												
TSAV 100	■ ■ ■ ■	x	500												
TSAV 100	■ ■ ■ ■	x	630												
TSAV 100	■ ■ ■ ■	x	800												
TSAV 120	■ ■ ■ ■	x	355		V 52										
TSAV 120	■ ■ ■ ■	x	400		52	65	M36x1	17.5	5	28	18	46	25	4500	7000
TSAV 120	■ ■ ■ ■	x	500												
TSAV 120	■ ■ ■ ■	x	630												
TSAV 120	■ ■ ■ ■	x	800												
TSAV 120	■ ■ ■ ■	x	1000												
TSAV 140	■ ■ ■ ■	x	400		V 56										
TSAV 140	■ ■ ■ ■	x	500		56	75	M40x1.5	17.5	5	32.5	18	48	30	3500	6000
TSAV 140	■ ■ ■ ■	x	630												
TSAV 140	■ ■ ■ ■	x	800												
TSAV 140	■ ■ ■ ■	x	1000												
TSAV 160	■ ■ ■ ■	x	400		V 87										
TSAV 160	■ ■ ■ ■	x	500		87	110	M65x1.5	20	6	33.5	21	60	35	2500	5000
TSAV 160	■ ■ ■ ■	x	630												
TSAV 200	■ ■ ■ ■	x	400		V 87										
TSAV 200	■ ■ ■ ■	x	500		87	110	M65x1.5	20	6	35	24	75	40	1500	3000
TSAV 200	■ ■ ■ ■	x	630												

Designation:
 A = Housing diameter
 B = Housing length
 du = Hollow shaft
 h = Modified for higher operating speed
 vr = Standard labyrinth with axial lip seal
 Preference types are in bold.

Dimensions:
 ** Option: du

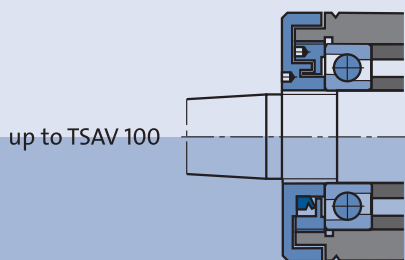
Max. speed:
 * Without tool
 Depending on tool design and weight the maximum operating speed may be reduced.

Please ask for max. speed for „vr“.

Please state direction of rotation.
 Option „Anti-rotation“ for dual rotation.

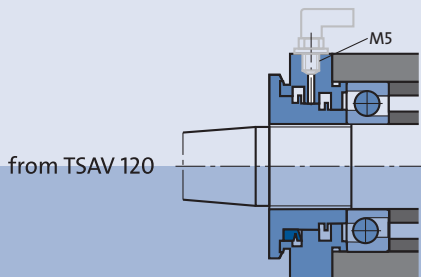
Sealing options

Standard: Labyrinth seal



Option: Axial lip seal

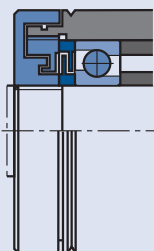
Standard: Labyrinth seal with connection for air purge



Option: Labyrinth seal with axial lip seal

Option: Sealing shields

from TSA 40
TSI 40
TSP 40



Standard seal

The mechanical labyrinth seal design protects bearing system against the ingress of contamination during operation. The seal can be enhanced by the addition of an air purge port. Spindle operating plane must be advised at the time of an order.

Optional sealing variant

Contact type seals are available, dependent upon maximum speed (see table below).

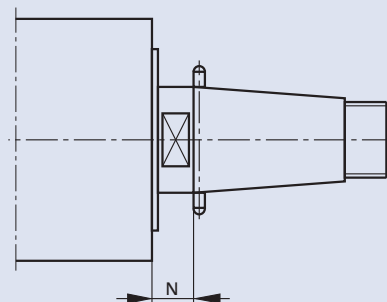
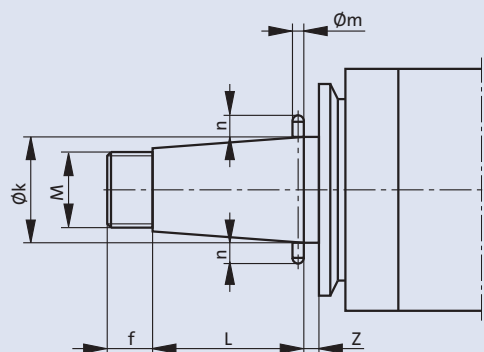
Spindle	Speed limit (Sliding seal) [rpm]
TSAV 40	6300
TSAV 50	5000
TSAV 60	4100
TSAV 80	3100
TSAV 100	2400
TSAV 120	1700
TSAV 140	1600
TSAV 160	1300
TSAV 200	1000

Sealing shields

Closely machined sealing shields can be incorporated into the TSA, TSI and TSP spindles, to improve the sealing effects of the standard labyrinth seals.

Radial stiffness will be slightly reduced.

Anti-rotation option

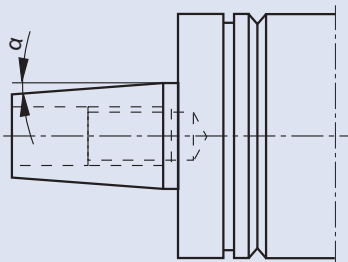


Spindle	Interface V				Dimensions				
	Designation	k	L	M	f	m	n	Z	N
TSAV 50	V 15	15.5	20	M12x1	7	3	3	3	8
TSAV 60	V 20	20	25	M16x1	10	3	3	3	9
TSAV 80	V 27	27.67	35	M20x1	12	4	3	4	12
TSAV 100	V 38	38	52.5	M30x1	12.5	5	4	4	15
TSAV 120	V 52	52	65	M36x1	17.5	6	5	5	18
TSAV 140	V 56	56	75	M40x1.5	17.5	6	5	5	18
TSAV 160	V 87	87	110	M65x1.5	20	8	6	6	21
TSAV 200	V 87	87	110	M65x1.5	20	8	6	6	24

Taper specifications

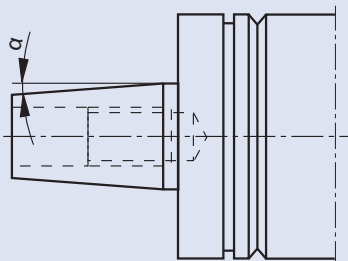
378514
Made in Germany

TSA tool interface



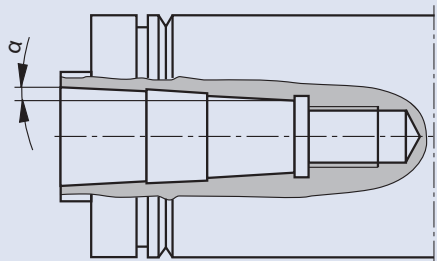
Spindle	Interface	Taper angle α
TSA 20	A 07	3°50'03"
TSA 26	A 08	3°49'33"
TSA 32	A 10	3°49'19"
TSA 40	A 10	3°49'19"
TSA 50	A 13	3°48'28"
TSA 60	A 18	3°48'13"
TSA 80	A 27	3°48'55"
TSA 100	A 38	3°50'28"

TSAV tool interface



Spindle	Interface	Taper angle α
TSAV 40	V 12	3°49'15"
TSAV 50	V 15	3°49'06"
TSAV 60	V 20	3°48'51"
TSAV 80	V 27	3°48'55"
TSAV 100	V 38	3°50'28"
TSAV 120	V 52	3°48'51"
TSAV 140	V 56	3°49'27"
TSAV 160	V 87	3°48'48"
TSAV 200	V 87	3°48'48"

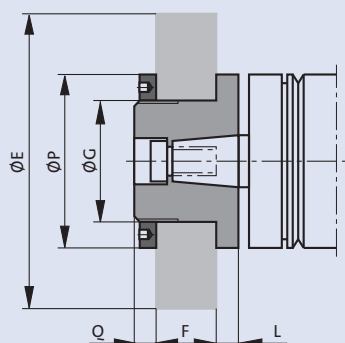
TSI tool interface



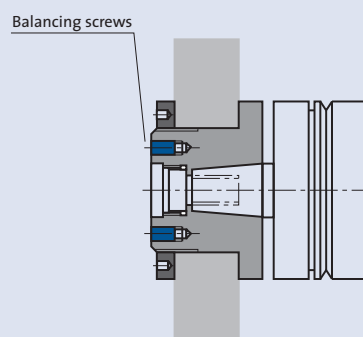
Spindle	Interface	Taper angle α
TSI 40	I 10	3°49'00"
TSI 50	I 14	3°48'42"
TSI 60	I 18	3°48'52"
TSI 80	I 25	3°48'49"
TSI 100	I 32	3°49'00"

TSA Grinding wheel flanges

TSA 50 x 160 - 6004
378514
Made in Germany



Flange style MS



Spindle	Interface A	Flange style	Flange dimensions [mm]			Grinding wheel [mm]			Max. speed** [rpm]
			P	Q	L	E	F	G*	
TSA 20	A 07	MO	20	6.5	1.5	25	8	13	27000
TSA 26	A 08	MO	26	5.5	3.5	36	10	16	20000
TSA 32	A 10	MO	32	6.5	3.5	50	13	20	15000
TSA 40	A 10	MS	40	6	6	63	16	25	12000
TSA 50	A 13	MS	50	6	9	80	20	32	10000
TSA 60	A 18	MS	60	7	9	100	25	32	8000
TSA 80	A 27	MS	80	9	10	125	32	51	6000
TSA 100	A 38	MS	100	15	13	150	40	76	5000

* Wheel bore fits:
G₁₇ for Corundum or Non diamond
G₁₄ for Diamant or CBN

** Attention! Wheel selection must be in accordance with the manufacturer's recommendation for maximum speed. Compliance with ANSI Safety Requirements B 7.1 must be adhered to.

Ordering information

Flange A ■ / ■ / ■
 D = Diamant or CBN
 K = Corundum or Non diamond
 Flange style MO / MS
 Interface A 07 / A 08 / ...

Puller for flange A ■ / ■
 Flange style MO / MS
 Interface A 07 / A 08 / ...

Balancing quill for flange A ■
 Interface A 07 / A 08 / ...

Please state direction of rotation, see page 31, when ordering.

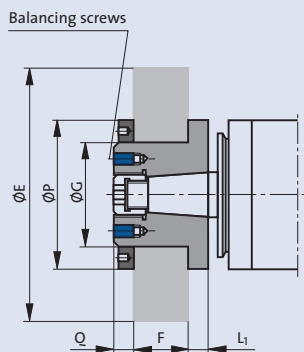
Attention! For safety reasons, noise levels, and finish quality all rotating components including the grinding wheels must be balanced.

GMN recommend balancing the system within G 2.5 level, according to ISO 1940.

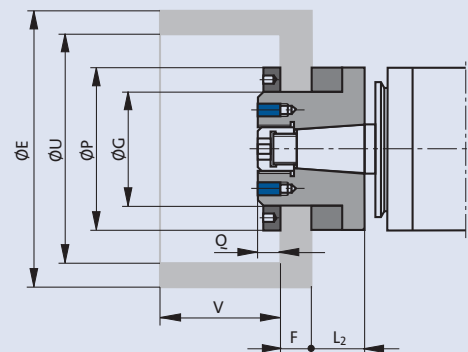
TSAV Grinding wheel flanges



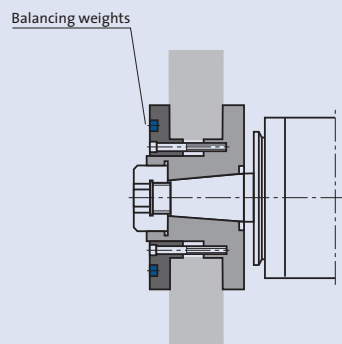
Flange style MS - Fig. 1



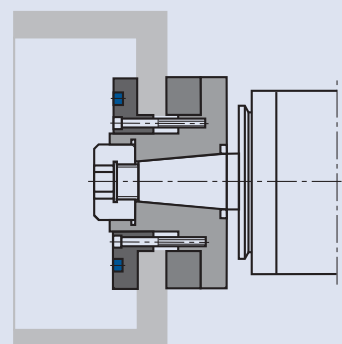
Flange style MS - Fig. 2



Flange style SN - Fig. 3



Flange style SN - Fig. 4



Anti-rotation slot

- Option: Flange style MS (Fig. 1, 2)
for TSAV 50 up to TSAV 80
- Standard: Flange style SN (Fig. 3, 4)
from TSAV 100



Spindle	Interface V	Fig.	Flange dimensions [mm]				Grinding wheel [mm]					Speed at $v_c = 35 \text{ m/s}^{**}$ [rpm]
			P	Q	L ₁	L ₂	E	G*	F	U	V	
TSAV 40	V 12	1	40	6	6	-	80	25	11-16	-	-	8300
		2	40	6	6	14	100	25	3-8	90	42	6600
TSAV 50	V 15	1	50	6	9	-	100	32	14-20	-	-	6600
		2	50	6	9	19	125	32	4-10	110	53	5300
TSAV 60	V 20	1	60	7	9	-	125	40	17-25	-	-	5300
		2	60	7	9	21	150	40	5-13	130	67	4400
TSAV 80	V 27	1	80	9	10	-	150	51	21-32	-	-	4400
		2	80	9	10	22	200	51	9-20	170	80	3300
TSAV 100	V 38	1	110	13.5	13	-	175	76	30-40	-	-	3800
		2	110	13.5	13	30	175	76	13-23	190	100	3800
		3	110	13	13	-	250	76	20-40	-	-	2600
		4	110	13	13	28	250	76	5-25	190	100	2600
TSAV 120	V 52	1	120	15	16	-	200	76	45-60	-	-	3300
		3	165	16	16	-	350	127	25-60	-	-	1900
		4	165	16	16	44	350	127	7-32	235	118	1900
TSAV 140	V 56	1	140	14	18	-	250	76	46-60	-	-	2600
		3	180	18	18	-	450	127	32-60	-	-	1400
		4	180	18	18	46	450	127	14-32	260	118	1400
TSAV 160	V 87	3	270	28	22	-	600	203	40-80	-	-	1100
TSAV 200	V 87	3	270	28	22	-	600	203	40-80	-	-	1100

* Wheel bore fits:
G₇ for Corundum or Non diamond
G_{h4} for Diamant or CBN

** Attention! Wheel selection must be in accordance with the manufacturer's recommendation for maximum speed. Compliance with ANSI Safety Requirements B 7.1 must be adhered to.

Ordering information

Flange V ■ / ■ / ■ / ■

D = Diamant or CBN
K = Corundum or Non diamond
G = Straight wheel
T = Cup wheel
Flange style MS / ...
Interface V 12 / V 15 / ...

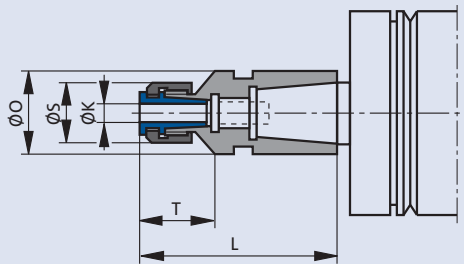
Puller for flange V 12 / V 15 / ...

Balancing quill for flange V 12 / V 15 / ...

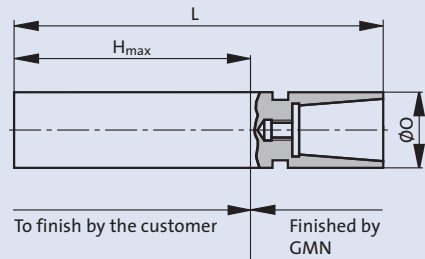
Please state direction of rotation, see page 31, when ordering.

Tool interfaces

TSA collet chuck



TSA grinding quill semifinished



Spindle	Interface A	Dimensions				
		K	T	L	S	O
TSA 20	A 07	2; 3; 4	13.5	36	14	10.5
TSA 26	A 08	2; 3; 4	13.5	37	14	12
TSA 32	A 10	2; 3; 4	13.5	37	14	13.5
TSA 40	A 10	3; 4; 5; 6	15.5	42	16	13.5
TSA 50	A 13	3; 4; 5; 6	15.5	47	16	18
TSA 60	A 18	3; 4; 5; 6	15.5	54	16	23
TSA 80	A 27	6; 8; 10; 12	27	87	35	34

Spindle	Interface A	Dimensions		
		H _{max}	L	O
TSA 40	A 10	82	110	13.5
TSA 50	A 13	98	135	18
TSA 60	A 18	136	180	23
TSA 80	A 27	172	233	34
TSA 100	A 38	190	280	48

Ordering information

E. g. Grinding quill semifinished A 10

Please state direction of rotation, see page 31, when ordering.

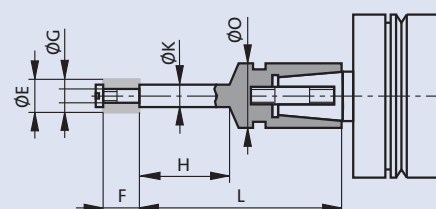
Ordering information

Collet chuck A ■ / ■
Housing diameter 20 / 26 ...
Interface A 07 / A 08 / ...

Clamping chuck
for collet chuck A ■ / ■ - ■
Figure of column K
Housing diameter 20 / 26 ...
Interface A 07 / A 08 / ...

Please state direction of rotation, see page 31, when ordering.

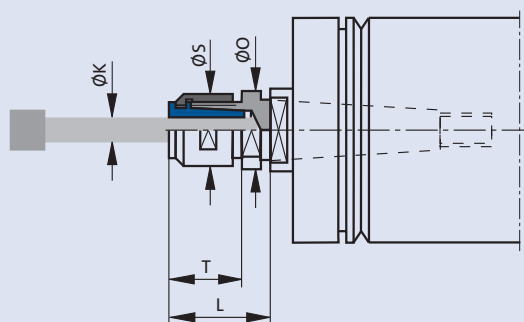
Example for TSA quill application



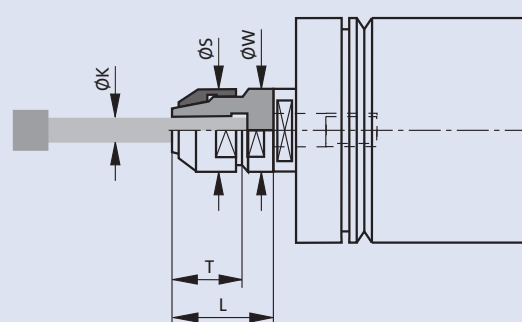
Manufacturing according to application specification



TSP collet chuck



TSP clamping chuck



Spindle	Interface I	Dimensions				
		K	T	L	S	O
		[mm]				
TSI 40	I 10	3; 4; 5; 6	15.5	25	16	13.5
TSI 50	I 14	3; 4; 5; 6	15.5	25	16	18
TSI 60	I 18	3; 4; 5; 6	15.5	28	16	23
TSI 80	I 25	6; 8; 10; 12	36	43	35	34

Ordering information

Collet chuck I ■
Interface I 10 / I 14 / ...

Clamping chuck
for collet chuck I ■ - ■
Figure of column K
Interface I 10 / I 14 / ...

Please state direction of rotation, see page 31, when ordering.

Spindle	Interface D	Dimensions			
		K	T	L	S
		[mm]			
TSP 40	D 08/14	3	20	26	14
TSP 50	D 10/18	6	20	30	18
TSP 60	D 14/23	6	20	30	23

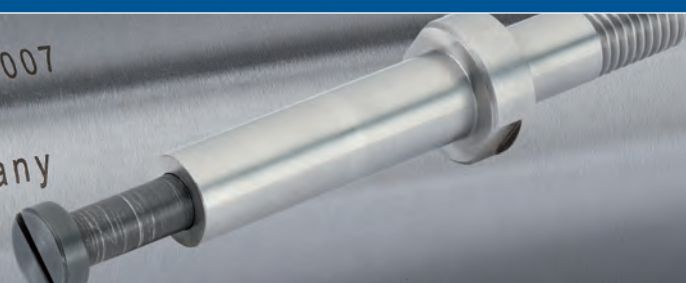
Ordering information

Clamping chuck D 08/14 / ...

Please state direction of rotation, see page 31, when ordering.

TSP/TSI Grinding quills

TSP 80 c x 250 - 6007
380168
Made in Germany

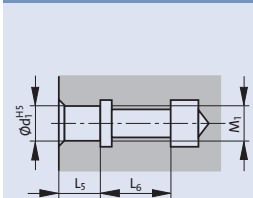


Spindle	Surface speed [m/s] at maximum spindle speed									Spindle nose		
										Designation	H ₀	SW
TSP 40c	23	29	37							D 08/14	6	13
TSP 40	19	24	31							D 08/14	6	13
TSP 50c		22	29	35	44					D 10/18	8	16
TSP 50		18	24	29	37					D 10/18	8	16
TSP 60c			24	29	37	46				D 14/23	8	21
TSP 60			20	25	31	39				D 14/23	8	21
TSP 80c				21	26	33	42			D 16/33	10	27
TSP 80				17	21	26	34			D 16/33	10	27
TSP 100c						26	34	42	52	D 28/43	12	38
TSP 100						20	25	31	39	D 28/43	12	38

TSI 40c	23	29	37							I 10	5	11
TSI 40	19	24	31							I 10	5	11
TSI 50c		22	29	35	44					I 14	6	15
TSI 50		18	24	29	37					I 14	6	15
TSI 60c			24	29	37	46				I 18	6	19
TSI 60			20	25	31	39				I 18	6	19
TSI 80c				21	26	33	42			I 25	8	27
TSI 80				17	21	26	34			I 25	8	27
TSI 100c						26	34	42	52	I 32	10	41
TSI 100						20	25	31	39	I 32	10	41

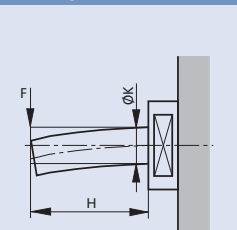
For wheel dimensions [mm]	E	8	10	13	16	20	25	32	40	50
	F	10	10	13	16	20	25	25	32	40
	G	3	3	4	6	8	10	13	16	20
Quill diameter [mm]	K	5	6	8	10	13	16	20	25	32
Wheel mount		KI	KI	PS	PS	PS	PS	PS	MU	MU
see page 21, fig.										
Close-fit hole attachment [mm]	d ₁	1	1	2+3	2+3	2+3	2+3	2+3	4	4
	M ₁			M3	M5	M6	M8	M12		
	L ₅			5	7	9	12	13		
	L ₆			8	11	12	14	17		

Close-fit hole for fig. 2+3



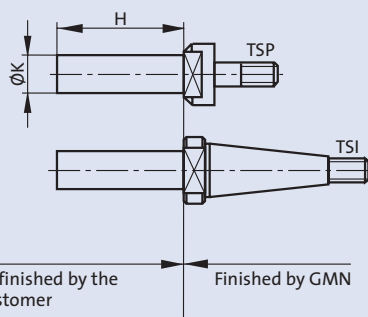
Quill stiffness [N/μm]		Grinding quill diameter K [mm]								
		5	6	8	10	13	16	20	25	32
Grinding quill length H [mm]	16	4.7	9.8							
	20	2.4	5.0	15.8	38.7					
	25	1.2	2.6	8.1	19.8	56.5				
	32			3.9	9.4	27				
	40				4.8	13.8	61.9	151		
	50					7.1	16.2	39.6	96.6	259
	63						8.1	19.8	48.3	130
	80								23.6	63.3
	100									32.4

Quill stiffness



TSP/TSI Grinding quills semifinished

TSP/TSI grinding quills semifinished



for Spindle	Interface D	for Spindle	Interface I	Dimensions [mm]	
	D [d]/[W]			K	H
TSP 40*	D 08/14	TSI 40**	I 10	13*/13,5**	70
TSP 50	D 10/18	TSI 50	I 14	18	90
TSP 60	D 14/23	TSI 60	I 18	23	135
TSP 80*	D 16/33	TSI 80**	I 25	33*/34**	180
TSP 100*	D 28/43	TSI 100**	I 32	43*/48**	240

Ordering information

E. g. Grinding quill semifinished D 08/14 or I 10 Please state direction of rotation, see page 31, when ordering.

Examples for TSP grinding quill application

(Manufacturing according to application specification)

Fig. 1: Cemented wheel (KI)

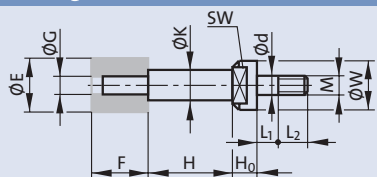


Fig. 2: Close-fit wheel screw (PS)

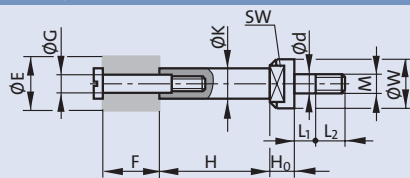


Fig. 3: Threaded wheel studs (PS)

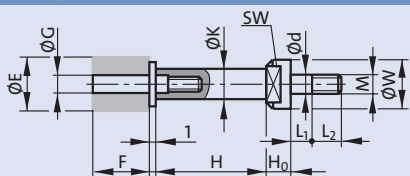
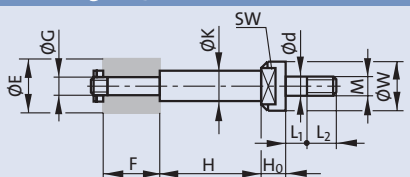


Fig 4: Quills with nut (MU)



Examples for TSI grinding quill application

(Manufacturing according to application specification)

Fig. 1: Cemented wheel (KI)

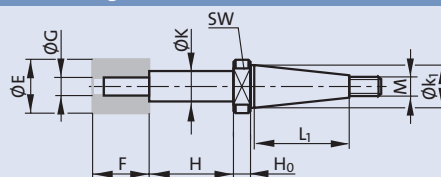


Fig. 2: Close-fit wheel screw (PS)

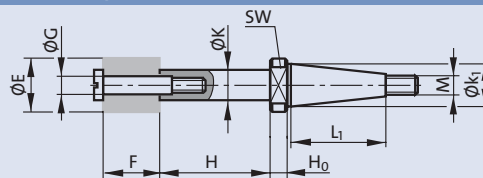


Fig. 3: Threaded wheel studs (PS)

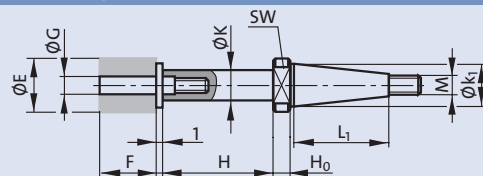
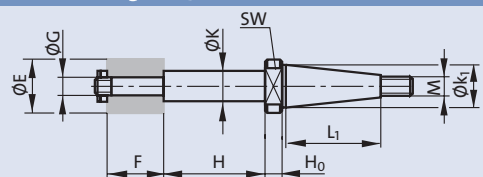
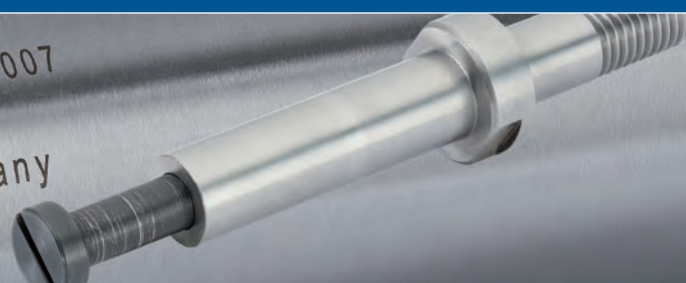


Fig. 4: Quills with nut (MU)



Grinding quill selection data

TSP 80 c x 250 - 6007
380168
Made in Germany

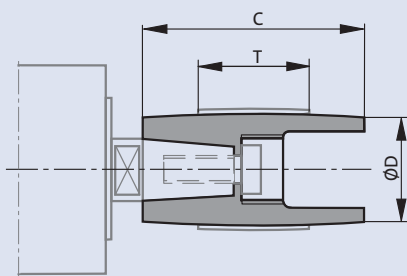


	Spindle nose interface			H [mm]				
	D 08/14	I 10	Grinding quill Ø K [mm]	< 16	20	25	32	
Spindle	TSP 40c	TSI 40c	5	54000				Maximum speed [rpm]
			6	55000	53000			
			8	55000	55000	52000	50000	
	TSP 40	TSI 40	5	45000				
			6	45000	45000			
			8	45000	45000	45000	45000	
	Spindle nose interface			H [mm]				
D 10/18	I 14	Grinding quill Ø K [mm]	< 25	32	40			
Spindle	TSP 50c	TSI 50c	6	42000				Maximum speed [rpm]
			8	42000	42000			
			10	42000	42000	42000		
	TSP 50	TSI 50	6	35000				
			8	35000	35000			
			10	35000	35000	35000		
	Spindle nose interface			H [mm]				
D 14/23	I 18	Grinding quill Ø K [mm]	< 32	40	50	63		
Spindle	TSP 60c	TSI 60c	8	35000				Maximum speed [rpm]
			10	35000	35000	30000		
			13	35000	35000	30000		
			16	35000	35000	30000	35000	
	TSP 60	TSI 60	8	30000				
			10	30000	30000	30000		
			13	30000	30000	30000		
			16	30000	30000	30000	35000	
	Spindle nose interface			H [mm]				
D 16/33	I 25	Grinding quill Ø K [mm]	< 63	80				
Spindle	TSP 80c	TSI 80c	10	25000				Maximum speed [rpm]
			13	25000	25000			
			16	25000	25000			
			20	25000	25000			
	TSP 80	TSI 80	10	20000				
			13	20000	20000			
			16	20000	25000			
			20	20000	20000			
	Spindle nose interface			H [mm]				
D 28/43	I 32	Grinding quill Ø K [mm]	< 80	100	125	160		
Spindle	TSP 100c	TSI 100c	16	20000				Maximum speed [rpm]
			20	20000	20000			
			25	20000	20000	18000		
			32	20000	20000	20000	18000	
	TSP 100	TSI 100	16	15000				
			20	15000	15000			
			25	15000	15000	15000		
			32	15000	15000	15000	15000	



Pulleys

Pulley for interface A



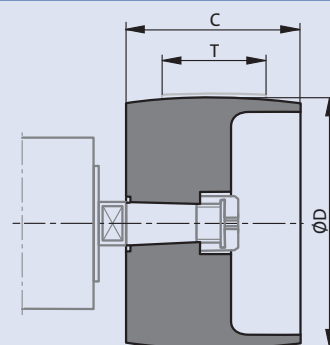
Spindle	Interface A	Dimensions		
		[mm]		
		D	C	T
TSA 20	A 07	14; 28	20	10
TSA 26	A 08	16; 36	25	15
TSA 32	A 10	18; 50	30	20
TSA 40		17; 20; 25; 63	40	
TSI 40				
TSP 40				
TSA 50	A 13	20; 25; 32; 80	50	30
TSI 50				
TSP 50				
TSA 60	A 18	25; 32; 40; 100	60	40
TSI 60				
TSP 60				
TSA 80	A 27	40; 45; 50; 56; 125	70	50
TSI 80				
TSP 80				
TSA 100	A 38	50; 63; 160	80	60
TSI 100				
TSP 100				

Ordering information

Pulley A ■ - ■
Figure of column D
Interface A 07 / A 08 / ...

Puller for pulley A 07 / A 08 / ...

Pulley for interface V



Spindle	Interface V	Dimensions		
		[mm]		
		D	C	T
TSAV 40	V 12	40; 50	40	30
TSAV 50	V 15	50; 63	50	40
TSAV 60	V 20	63; 80	60	50
TSAV 80	V 27	80; 100	70	60
TSAV 100	V 38	80; 125	80	70
TSAV 120	V 52	90; 160	100	80
TSAV 140	V 56	120; 210	100	80
TSAV 160	V 87	280	130	100
TSAV 200				

Ordering information

Pulley V ■ - ■
Figure of column D
Interface V 12 / V 15 / ...

Puller for pulley V 12 / V 15 / ...

Anti-rotation slot

- Option
Interfaces V 15 up to V 27 (TSAV 50 up to TSAV 80)
- Standard
from interface V 38 (TSAV 100)

Cutting speed

TSP 80 c x 250 - 6007
380168
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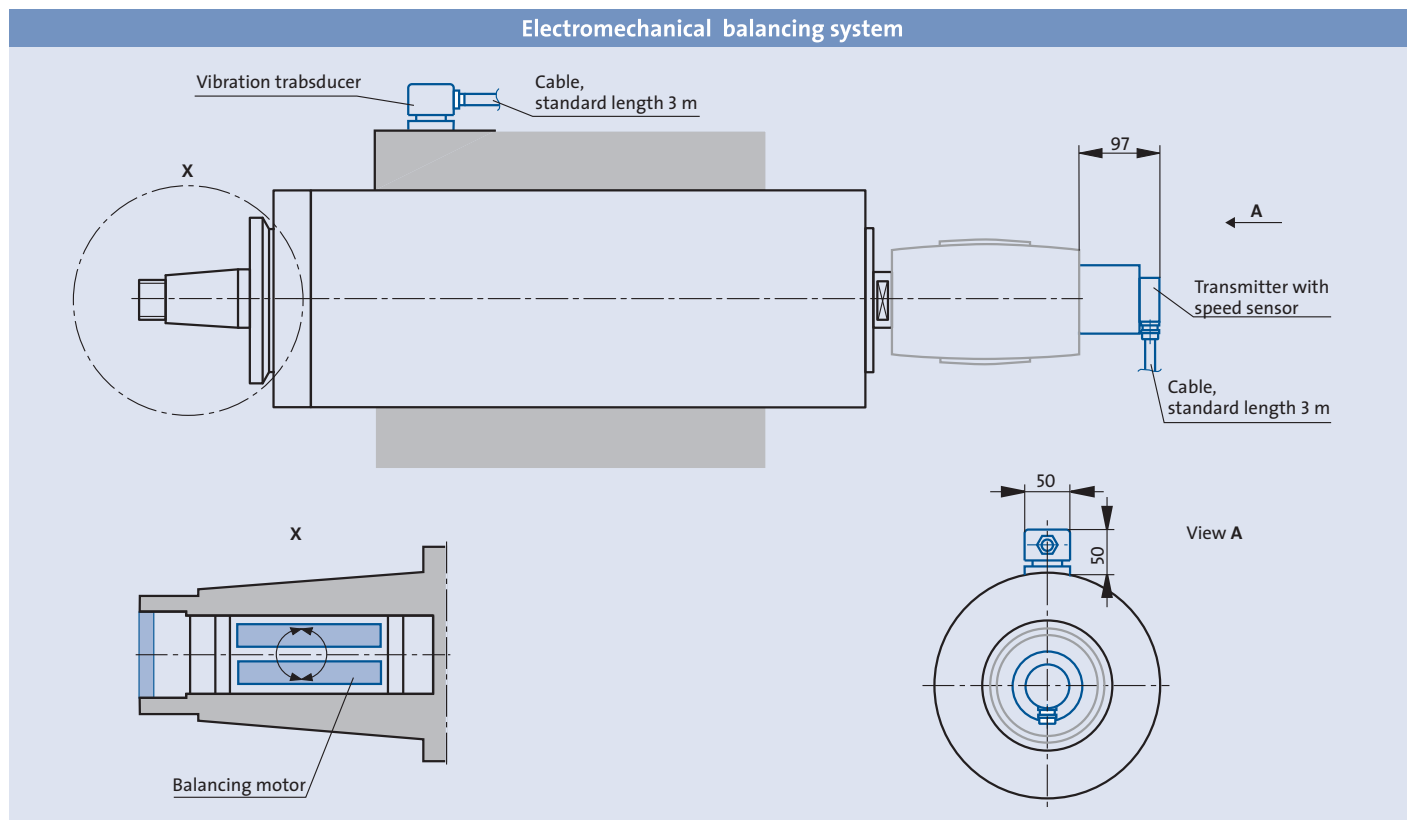
Spindle speed n [rpm]	Cutting speed v _c [m/s]																	
	Wheel diameter E [mm]																	
	4	5	6	8	10	13	16	20	32	40	50	63	80	100	125	175	200	250
80000	16.8	20.9	25.1	33.5	41.9	54.5	67.0	83.8										
70000	14.7	18.3	22.0	29.3	36.7	47.6	58.6	73.3										
70000	12.6	15.7	18.8	25.1	31.4	40.8	50.3	62.8										
55000	11.5	14.4	17.3	23.0	28.8	37.4	46.1	57.6	92.2									
50000	10.5	1.1	15.7	20.9	26.2	34.0	41.9	52.4	83.8									
45000		11.8	14.1	18.8	23.6	30.6	37.7	47.1	75.4	94.2								
40000		10.5	12.6	16.8	20.9	27.2	33.5	41.9	67.0	83.8								
35000			11.0	14.7	18.3	23.8	29.3	36.7	58.6	73.3	91.6							
33000			10.4	13.8	17.3	22.5	27.6	34.6	55.3	69.7	86.4							
32000			10.1	13.4	16.8	21.8	26.8	33.5	53.6	67.0	83.8							
30000				12.6	15.7	20.4	25.1	31.4	50.3	62.8	78.5	99.0						
27000				11.3	14.1	18.4	22.6	28.3	45.2	56.5	70.7	89.1						
25000				10.5	13.1	17.0	20.9	26.2	41.9	52.4	65.4	82.5						
24000				10.1	12.6	16.3	20.1	25.1	40.2	50.3	62.8	79.2						
23000					12.0	15.7	19.3	24.1	38.5	48.2	60.2	75.9	96.3					
22500					11.8	15.3	18.8	23.6	37.7	47.1	58.9	74.2	94.2					
21000					11.0	14.3	17.6	22.0	35.2	44.0	55.0	69.3	88.0					
20000					10.5	13.6	16.8	20.9	33.5	41.9	52.4	66.0	83.8					
19000						12.9	15.9	19.9	31.8	39.8	49.7	62.7	79.6	99.5				
18000						12.3	15.1	18.8	30.2	37.7	47.1	59.4	75.4	94.2				
16000						10.9	13.4	16.8	26.8	33.5	41.9	52.8	67.0	83.8				
15000							12.6	15.7	25.1	31.4	39.3	49.5	62.8	78.5	98.2			
14000							11.7	14.7	23.5	29.3	36.7	46.2	58.6	73.3	91.6			
13500							11.3	14.1	22.6	28.3	35.3	44.5	56.5	70.7	88.4			
13000							10.9	13.6	21.8	27.2	34.0	42.9	54.5	68.1	85.1			
12500							10.5	13.1	20.9	26.2	32.7	41.2	52.4	65.4	81.8			
12000							10.1	12.6	20.1	25.1	31.4	39.6	50.3	62.8	78.5			
11500								12.0	19.3	24.1	30.1	37.9	48.2	60.2	75.3			
11000								11.5	18.4	23.0	28.8	36.3	46.1	57.6	72.0			
10500								11.0	17.6	22.0	27.5	34.6	44.0	55.0	68.7	96.2		
10000								10.5	16.8	20.9	26.2	33.0	41.9	52.4	65.4	91.6		
9000									15.1	18.8	23.6	29.7	37.7	47.1	58.9	82.5	94.2	
8000									13.4	16.8	20.9	26.4	33.5	41.9	52.4	73.3	83.8	
7500									12.6	15.7	19.6	24.7	31.4	39.3	49.1	68.7	78.5	98.2
7000	<div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div><div><div></div><div></div><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$$v_c = \frac{E \cdot \pi \cdot n}{60 \cdot 1000} \text{ [m/s]}$$

E = Wheel diameter [mm]

n = Spindle speed [rpm]

TSA Balancing system



For TSAV spindles with housing diameter 160 and 200 mm

TSAV 160 x 400	TSAV 200 x 400
TSAV 160 x 500	TSAV 200 x 500
TSAV 160 x 630	TSAV 200 x 630

Consisting of

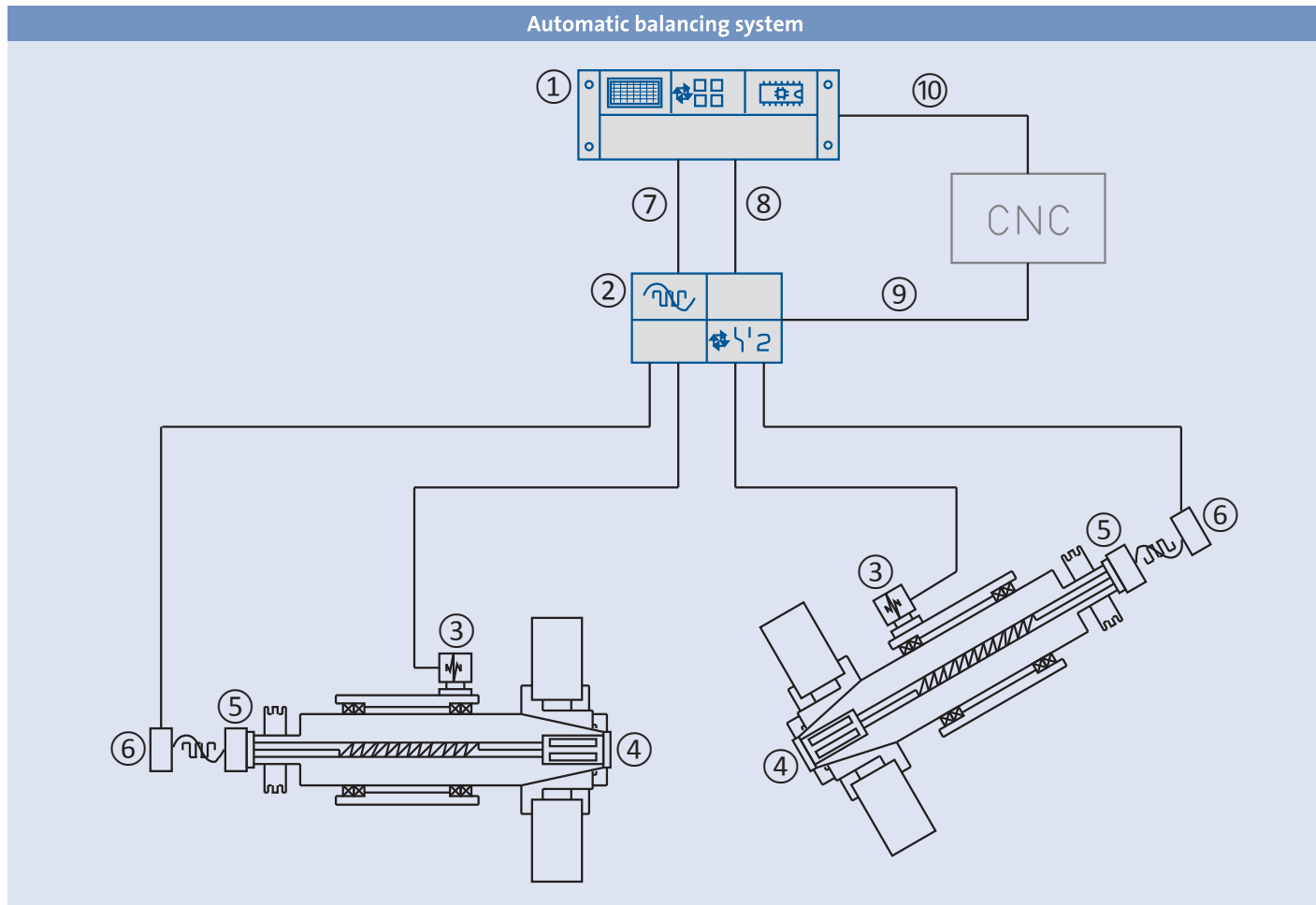
- Balancing motor
- Vibration transducer
- Transmitter with speed sensor

Options

- Extension cable for vibration transducer
- Vibration transducer for balancing motor

Electronic control, see page 26.

Balancing system



If a condition of unbalance, e.g. in the series production of grinding disks, should be determined, monitored and eliminated, then the application of automatic counterbalancing electronics is recommended.

In this case it is also possible under economic aspects to monitor two spindles in alternating operation using one indication and control device as well as one switchover unit.

A few features of counterbalance systems for installation:

- Suitable for fitting in all grinding machines with hollow spindle
- Incorporation without problems
- Fully automatic balancing mass positioning
- Collision-free balancing masses in quietly running 1-level-technique
- For speeds up to approx. 12,000 rpm

① Electronic control

② Multiplexer is required for multi spindle machines

Included in the delivery of the spindle:

③ Vibration transducer with 3 m cable

Option: Extension cable

④ Internal balancing sensor

⑤ Receiver

⑥ Transmitter with integrated speed sensor 3 m cable

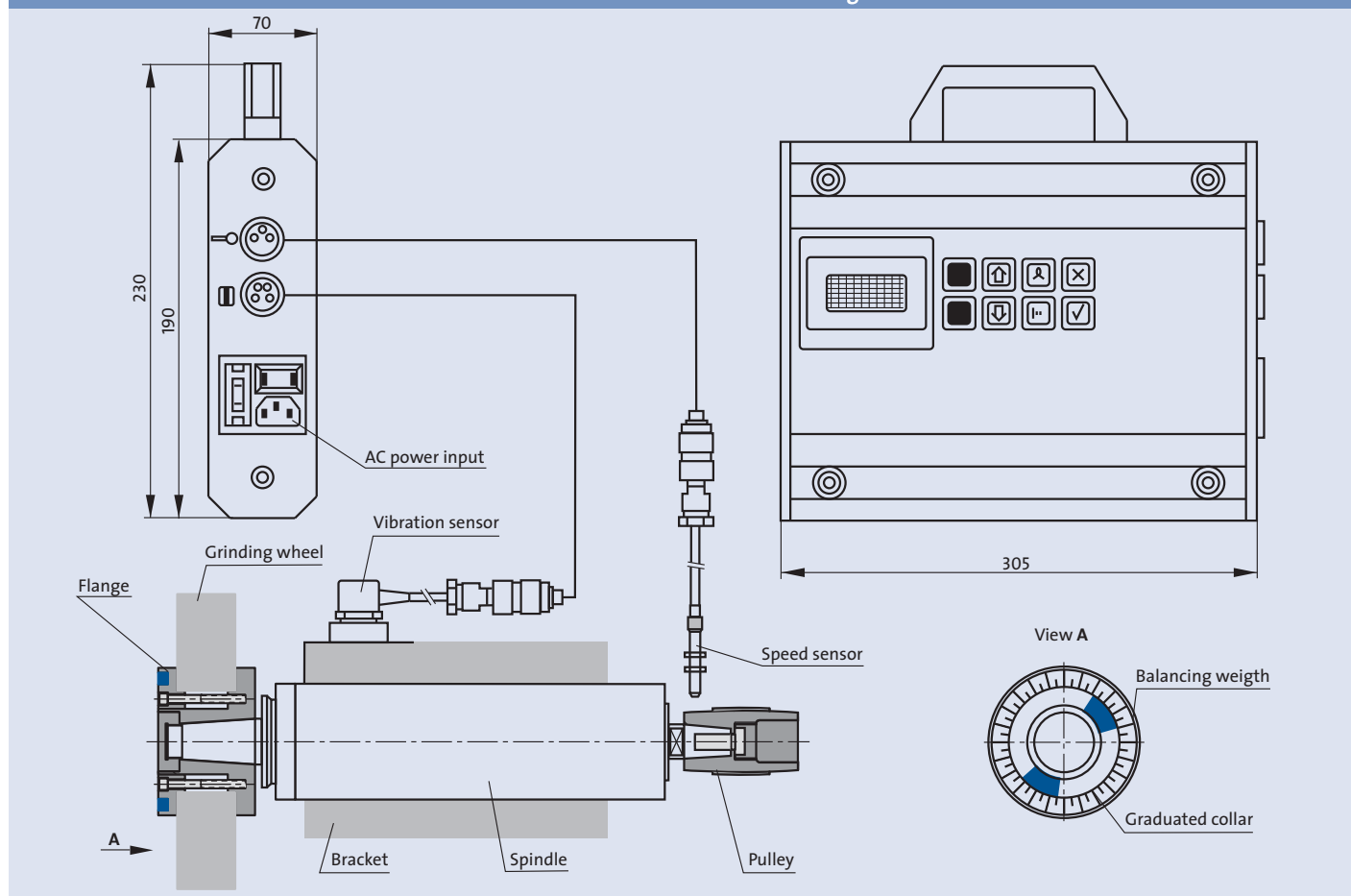
Option: Extension cable

Accessories:

⑦⑧⑨⑩ Extension cable. Please state length when ordering.



Portable unit for manual balancing



Every rotating part incorporates a degree of unbalance, which causes sinuous vibration during rotation. To reduce the effect of unbalancing forces, the unbalancing mass of all rotating parts has to be limited.

Shafts and all rotating components of GMN high precision spindles are always balanced.

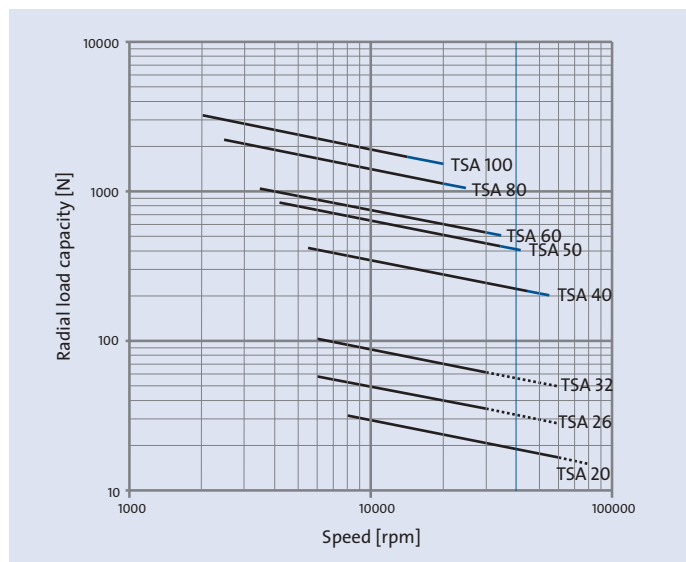
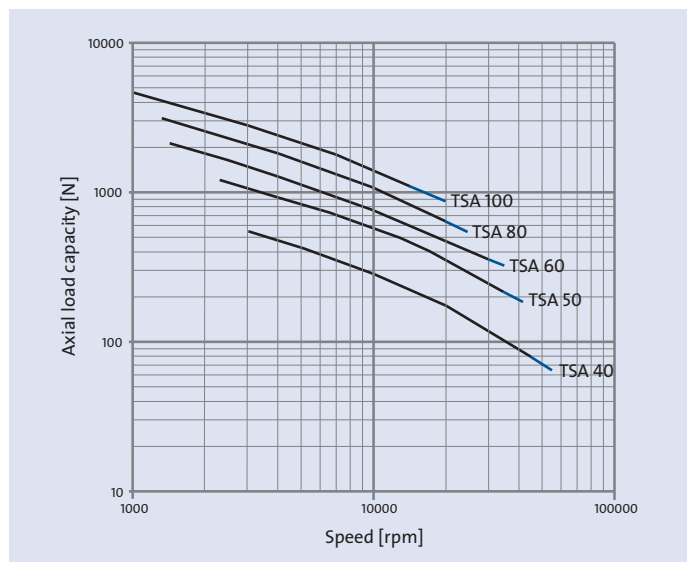
As a result of higher cutting speeds this process is also required for tools.

For large spindles automatic balancing systems are available. We recommend the portable balancing system for smaller spindles.

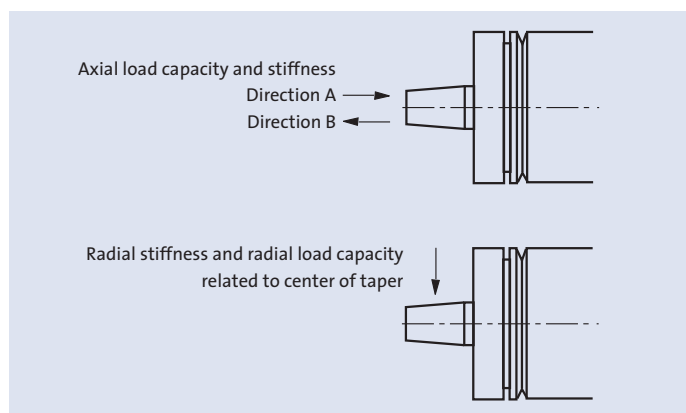
Process

- The vibration transducer with a magnetic base is attached to either the spindle housing of mounting bracket
- Speed sensor must be positioned to read the speed of the spindle
- Portable unit automatically:
 - Records the spindle speed
 - Records vibration levels
 - Indicates the amount and position of unbalance
 - Calculates and indicates the corrected results
- To fix the balancing weight
- Control and if necessary correction

Stiffness - Load capacity

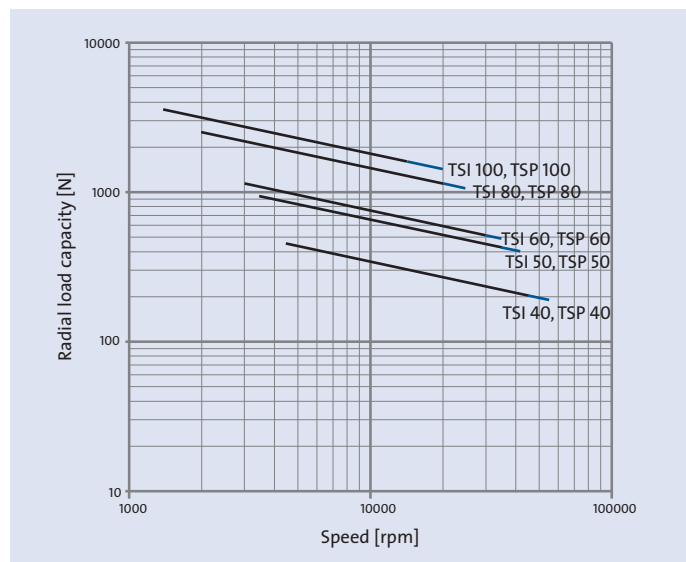
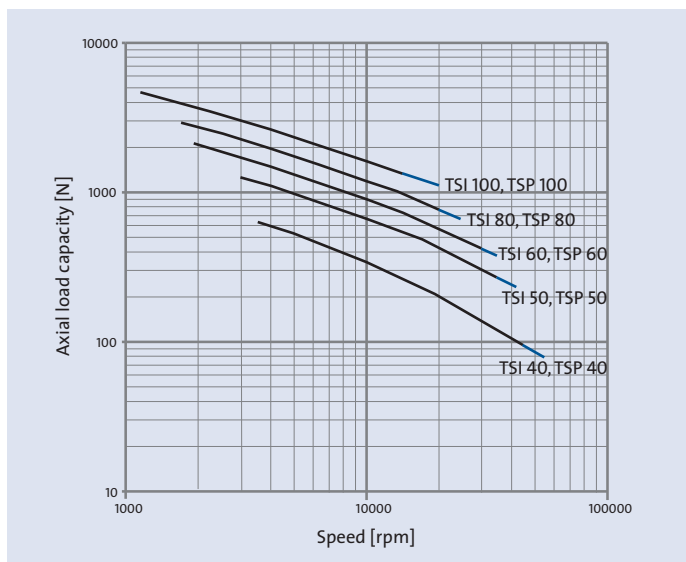


Spindle	Stiffness [N/μm]		Load capacity [N]		
	axial A and B	radial	axial A	B	radial
TSA 20 x 125	12	3.5	70**	35**	
TSA 20 x 160					
TSA 20 x 200					
TSA 20 x 250	17	3.5	70**	70**	
TSA 26 x 125	14	5.0	70**	35**	
TSA 26 x 160					
TSA 26 x 200					
TSA 26 x 250	20	5.0	70**	70**	
TSA 26 x 315					
TSA 32 x 125					
TSA 32 x 160	15	8.0	70**	35**	
TSA 32 x 200					
TSA 32 x 250					
TSA 32 x 315	21	8.0	70**	70**	
TSA 32 x 355					
TSA 40*	32	25	see diagram	150	
TSA 50*	41	41		225	
TSA 60*	51	57		300	
TSA 80*	67	96		450	
TSA 100*	78	113		540	



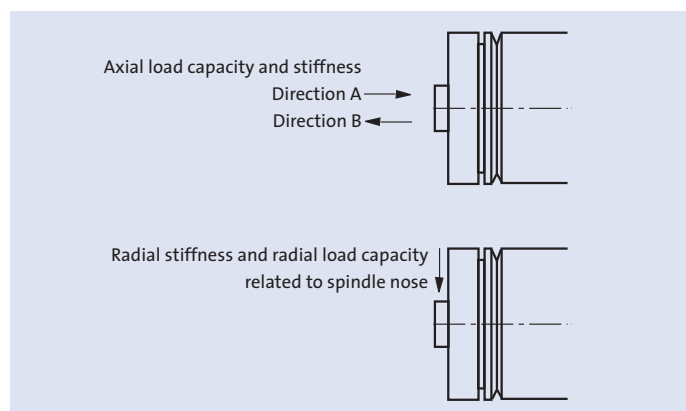
* Data applicable to all spindle length.

** For low speed operation (< 0.4 catalog specified speed). Axial load of 2 to 3 times higher than indicated can be applied, for short periods, depending on noise and vibration levels.



Spindle	Stiffness [N/μm]		Load capacity [N]		
	axial A and B	radial	axial A	B	radial
TSI / TSP 40	32	36	see diagram	150	see diagram
TSI / TSP 50	41	65		225	
TSI / TSP 60	51	85		300	
TSI / TSP 80	67	140		450	
TSI / TSP 100	78	170		540	

Data applicable to all spindle length.



The data provided is to serve as a guide for the proper selection of spindles for a particular application.

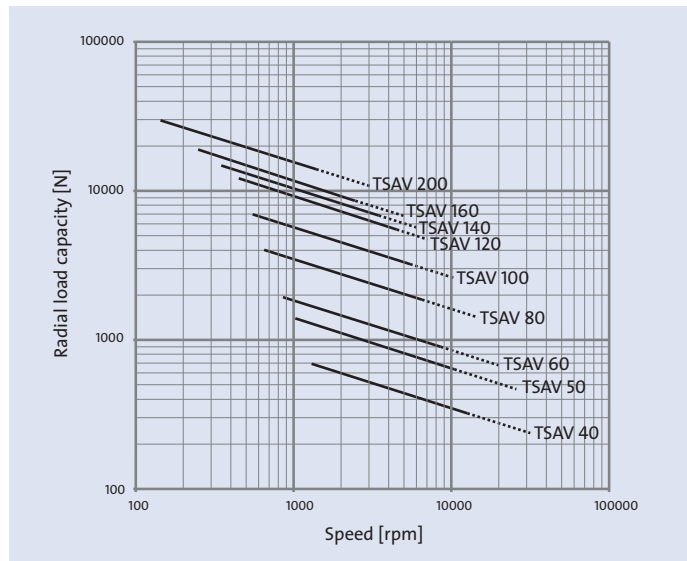
The load capacities provided are for either pure radial or axial loads. Combined loads can not be used at the maximum values. Application should be analyzed by GMN Engineering Department for proper spindle selection.

The data can be used as a reference to suit your application and selection of a spindle to meet your requirements. GMN Engineering should be provided with all pertinent data to review each application to provide the optimum spindle for your application.

5000 hours of bearing life were used as a minimum for the calculation of spindle capacity.

Axial and radial stiffness' calculation are static values.

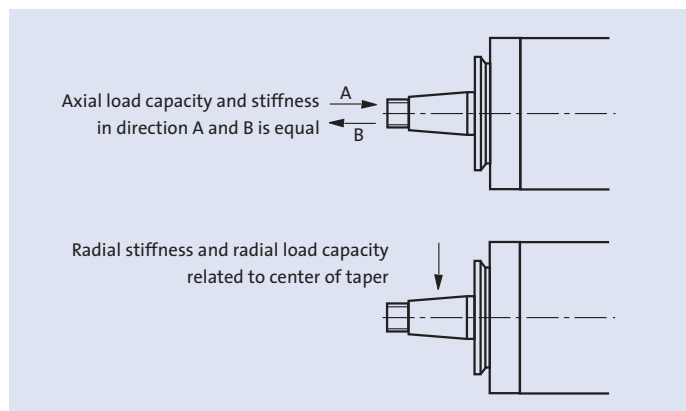
Stiffness - Load capacity



Spindle	Stiffness [N/μm]		Load capacity [N]	
	axial	radial	axial*	radial
TS 40	56	29	300	
TS 50	75	37	600	
TS 60	90	60	600	
TS 80	133	75	1500	see diagram
TS 100	165	108	2400	
TS 120	212	170	3000	
TS 140	230	170	3600	
TS 160	300	245	4800	
TS 200	345	342	6000	

Data applicable to all spindle length.

* Axial load of 2 to 3 times higher then indicated can be applied, depending on noise and vibration levels.





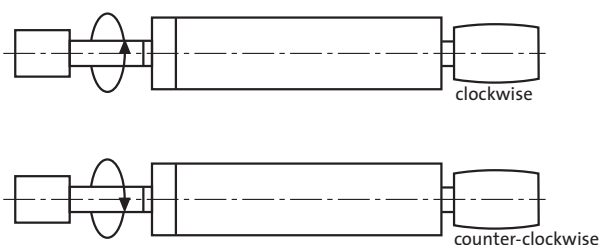
General safety rules

Guidelines

Choosing the proper spindle and accessories is essential in obtaining quality grinding performance, long operating life, and operator safety. GMN's extensive manufacturing program can satisfy all your requirements.

Selection criteria:

1. Choose the spindle with the largest diameter and the shortest length possible.
2. Choose quills, flanges and other wheel mounting accessories as large, robust and compact as possible.
3. Choose the largest spindle, with the necessary speed requirements, as recommended by the wheel manufacturer, or a spindle with slightly higher capabilities. This will assure maximum bearing life.
4. If possible always select a direct motorized style over the belt driven design. The total system is more compact, speed changes are effortless, and belt tensioning is eliminated.
5. Always provide the direction of rotation of the wheel, when looking into the pulley end of the spindle.



Grinding wheels

The grinding wheel sizes illustrated in the catalog correspond to DIN 69 120 standards.

To select the proper wheel for each application, please consult with the wheel manufacturer.

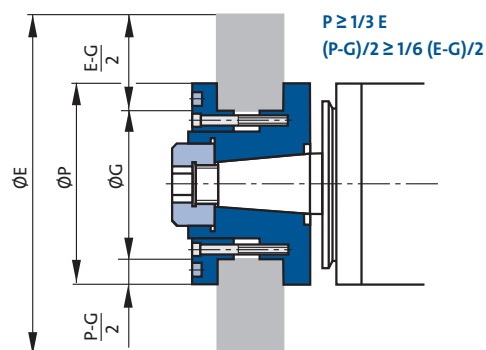
Grinding wheel speeds and use must adhere to the corresponding regulations for safety. ANSI B7.1 "Safety Requirements for USE, Care and Protection of Abrasive Wheels".

Accident prevention measures

Safety guards or protection hoods must be used when the wheel size reaches a 2 inch diameter and larger. For all internal grinding applications, hinged or swivel type wheel guards are required to protect the operator.

Wheels must be mounted between steel or cast iron flanges, in compliance with the minimum dimensional size at various points, bearing area, reliefs and commonality as specified in the ANSI or DIN standards. Both flanges must be alike in diameter and bearing area. Mounting of wheels between dissimilar flanges is one of the most common causes of wheel failure. Flange diameters must not be less than 1/3 of the grinding wheel diameter.

Wheels must be properly fit to spindles or mounting devices. Never force a wheel onto the mounting surface, also the fits should not be too loose. The clearances should be between 0.002" to 0.003" for small wheels and 0.010" to 0.012" for larger bores. Blotters (compressible washers – paper) shall always be used between the flanges and grinding wheels. Most wheels are supplied with blotters already mounted.



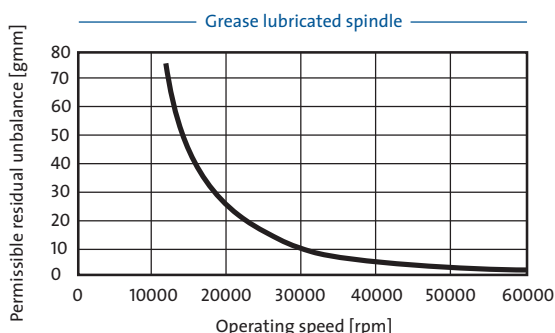
Very small diameter wheels

Small diameter wheels are cemented to the quill or arbors, which provides the following advantages. No wheel breakage, due to tightening, better balance quality due to the elimination of lock-nuts, and a quieter operation, and smoother performance.

General safety rules

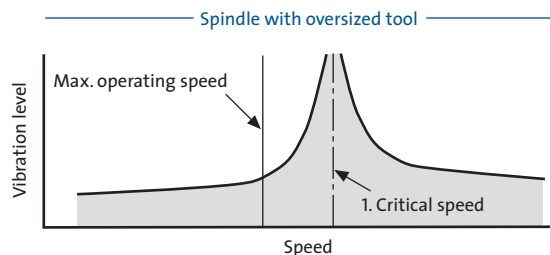
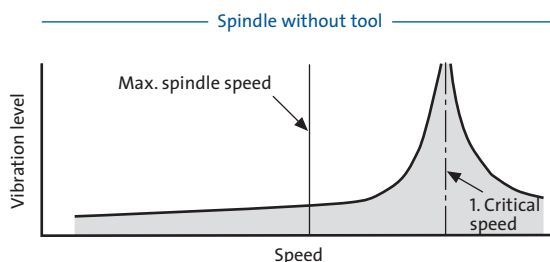
Guidelines

Every spindle shaft and every tool incorporates a degree of unbalance, which causes sinuous vibration during rotation. To reduce the effect of unbalancing forces, the unbalancing mass of all rotating parts has to be limited. Shafts of GMN high frequency spindles are always balanced. As a result of higher cutting speeds this process is also required for tools. We recommend for precision cutting a permissible residual unbalance for tools according to the following diagram:

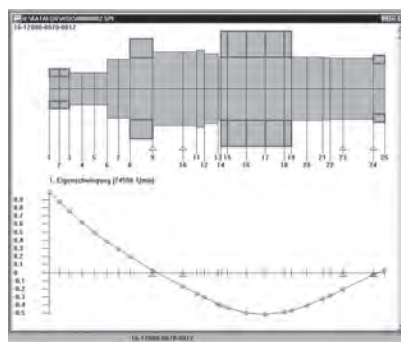


Critical speed

GMN machining spindles are designed so that the critical speeds remain above the maximum speed. When using inappropriate tooling the critical speed can be decreased to a level within the operating speed range. This can lead to poor part quality, decreased spindle performance, as well as jeopardizing the safety of the operator and machine.



We recommend consulting our application engineering staff when tools which are extremely long and heavy are to be used. Let GMN analyse your spindle and tooling requirements with our specifically designed computer software. In addition to the critical frequencies the static and dynamic stiffness and load carrying capacity of each single bearing can be calculated. Through proper analysis the correct spindle can be selected or tips for improvement of tools can be made.



Centrifugal forces acting on tools

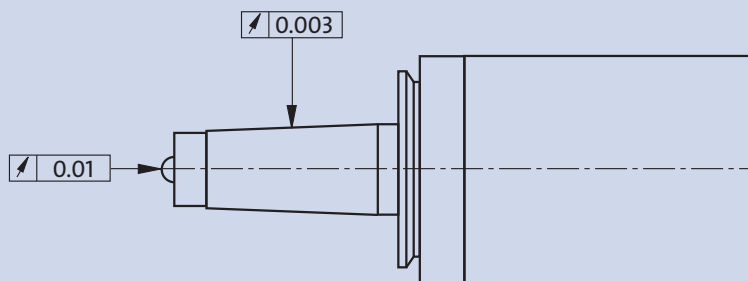
Centrifugal forces created by high rotating speed not only act as unbalancing forces but also induce stress into the tool. Insert type milling cutters are the worst case scenario, with the weakening of the screws or clamps, the carbide inserts can become projectiles.

Vibration monitoring

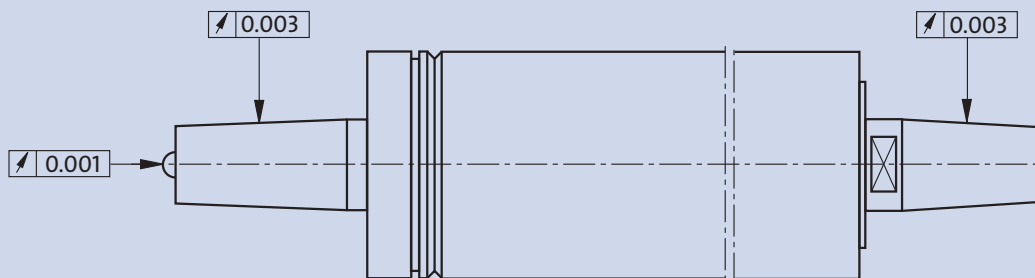
Vibration monitoring equipment can less the risk of damage to both the spindle and machine, and also help prevent personnel injury by early detection of wear and looseness in both the spindle and tooling. When selecting and installing monitoring equipment it should be noted that vibration from the machine and related components must be filtered out or ignored, so as to prevent unnecessary shut down of the machine.

Radial and axial runout

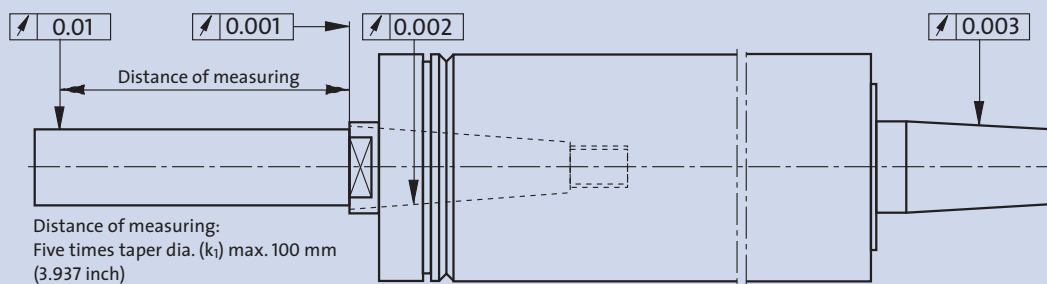
TSAV



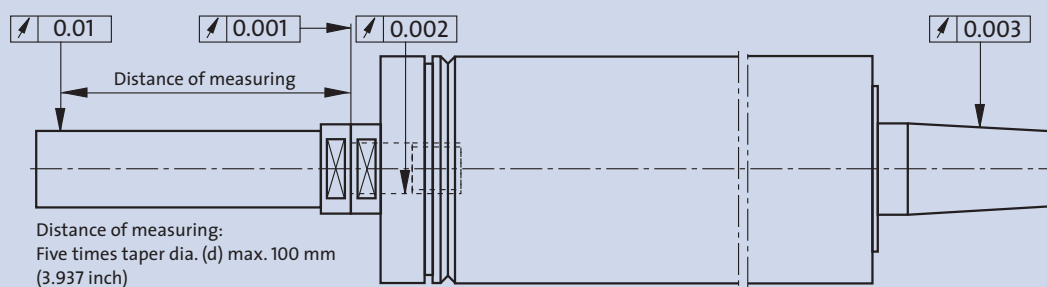
TSA



TSI



TSP



Spindles with increased radial and axial runout on request.

Spindle selection

Figure 1

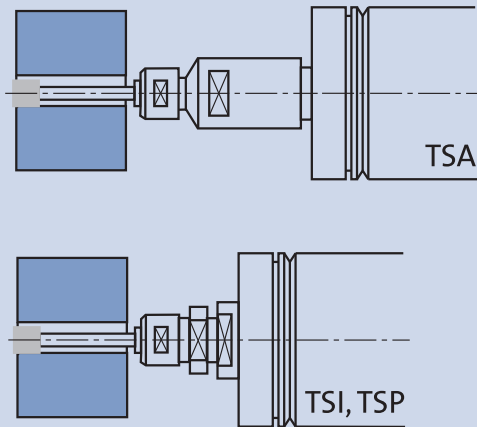
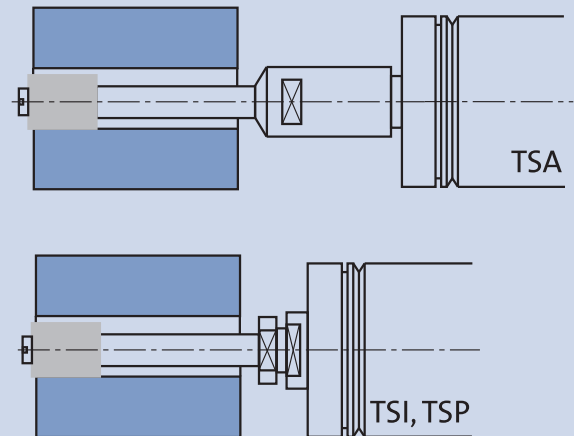
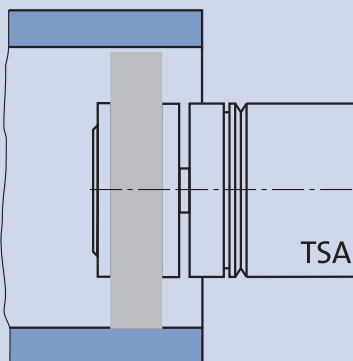


Figure 2



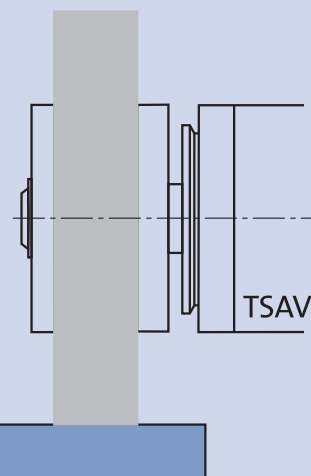
For grinding bores smaller than the outside diameter of the chosen spindle style (Fig. 1 + 2), the TSI or TSP spindle is recommended, because the wheel will be mounted closer to the bearing complement for better rigidity..

Figure 3



For grinding bores larger than the outside diameter of the chosen spindle style (Fig. 3), the TSA spindle is recommended, because the wheel will be mounted closer to the bearing complement for better rigidity.

Figure 4



For external and surface grinding the TSAV spindle is recommended (Fig. 4), because the quad bearing arrangement, and external taper provide higher rigidity, and the uses of larger diameter wheels.



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High precision ball bearings
Spindle technology
Freewheel clutches
Non-contact seals

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