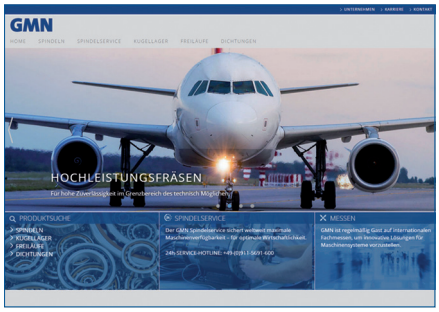
GMN

Precision belt driven spindles

2506 0917 ENG



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.

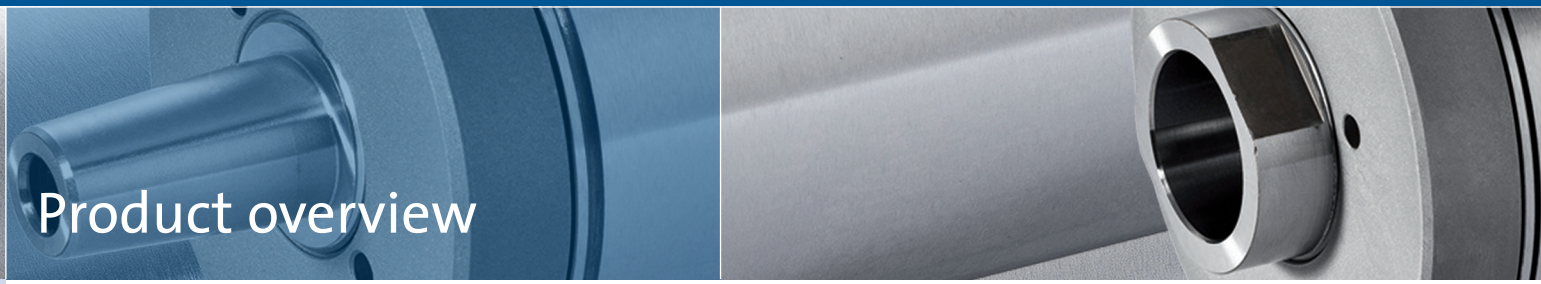
GMN Quality management - tested and certified.

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.

Contents:



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

TSAV

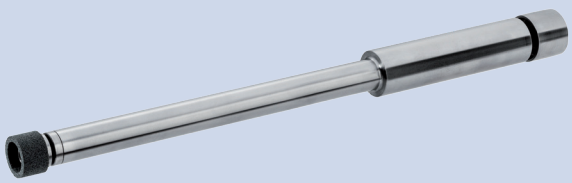
External taper, belt driven

- 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



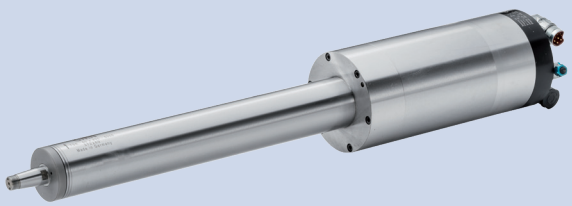
External taper and stepped spindle housing, for deep internal bore grinding, belt driven

- 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

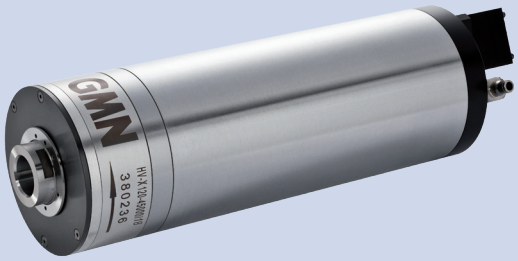
Applications

- 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

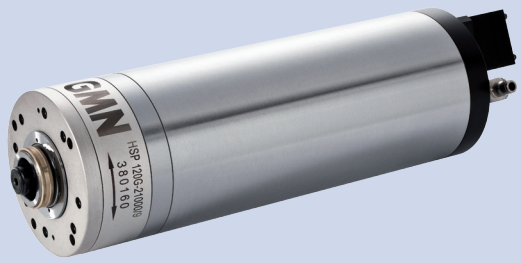


High frequency spindles with integral asynchronous motor for manual tool change

- 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

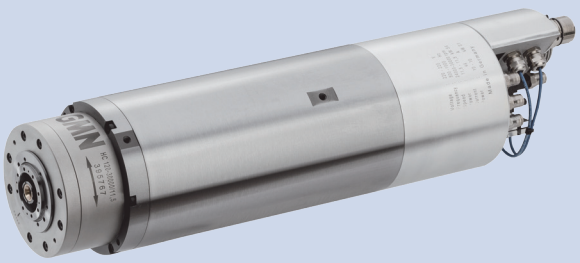


High frequency spindles with integral asynchronous motor for manual tool change

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

Please ask for catalog # 2508.

HC, HCS

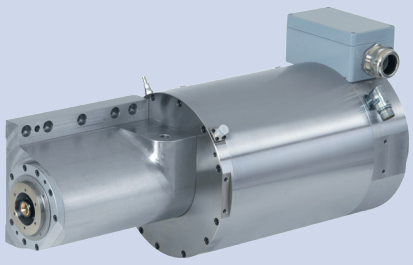


High frequency spindles with integral asynchronous motor for automatic tool change

- 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

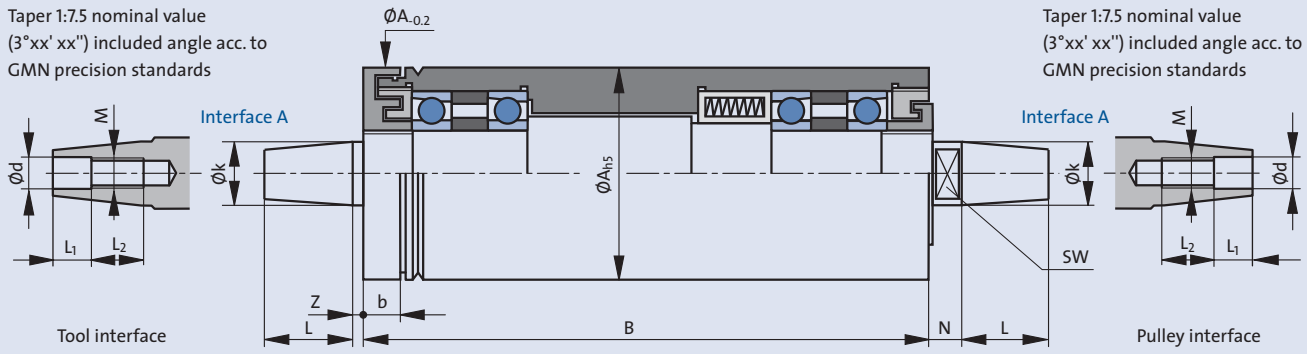
Please ask for catalog # 2505.

Special spindles



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

TSA series



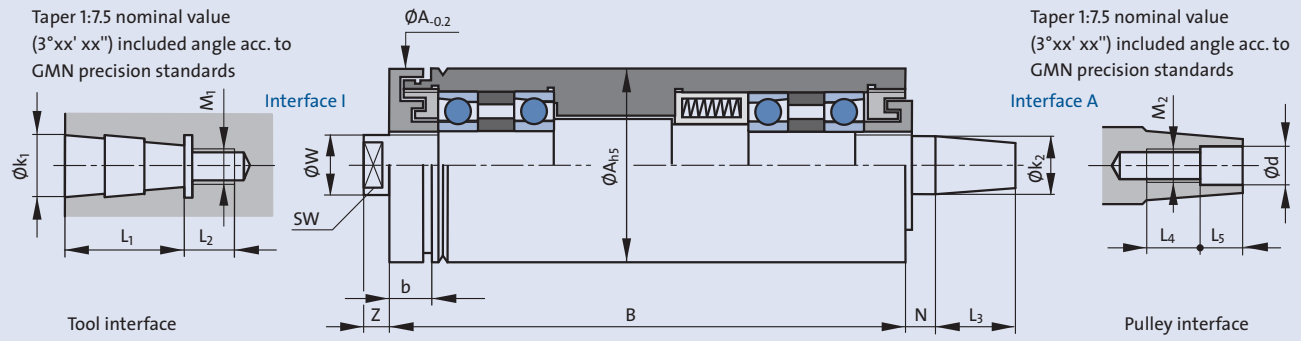
Designation	Interface A [mm]						Dimensions [mm]				Max. speed* for bearing types [rpm]	
A c d B	k	L	d	M	L_1	L_2	Z	b	N	SW	Steel	Hybrid
TSA 20 x 125	A 07						2	5	7	6	80000	+
TSA 20 x 160	7.5	10	4	M4	5	7						
TSA 20 x 200											60000	+
TSA 20 x 250												
TSA 26 x 125	A 08						2	6.5	7	7	60000	+
TSA 26 x 160	8	11.25	4	M4	5	7						
TSA 26 x 200												
TSA 26 x 250											40000	+
TSA 26 x 315											30000	+
TSA 32 x 125	A 10						2.5	6	8	8	60000	+
TSA 32 x 160												
TSA 32 x 200											40000	+
TSA 32 x 250	10	15	5	M5	7	8						
TSA 32 x 315											30000	+
TSA 32 x 355												
TSA 40 ■ ■ x 160	A 10						2.5	9.5	7	8	45000	55000
TSA 40 ■ ■ x 200	10	15	5	M5	7	8						
TSA 40 ■ ■ x 250												
TSA 50 ■ ■ x 160	A 13						3	10.5	8	11	35000	42000
TSA 50 ■ ■ x 200	13.5	20	6	M6	8	12						
TSA 50 ■ ■ x 250												
TSA 60 ■ ■ x 160	A 18						3	10.5	9	15	30000	35000
TSA 60 ■ ■ x 200	18	25	8	M8	11	14						
TSA 60 ■ ■ x 250												
TSA 60 ■ ■ x 315												
TSA 80 ■ ■ x 200	A 27						4	14.5	12	24	20000	25000
TSA 80 ■ ■ x 250	27.67	35	12	M12	13	21						
TSA 80 ■ ■ x 315												
TSA 100 ■ ■ x 250	A 38						4	16	15	32	15000	20000
TSA 100 ■ ■ x 315	38	52.5	16	M16	25	25						
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



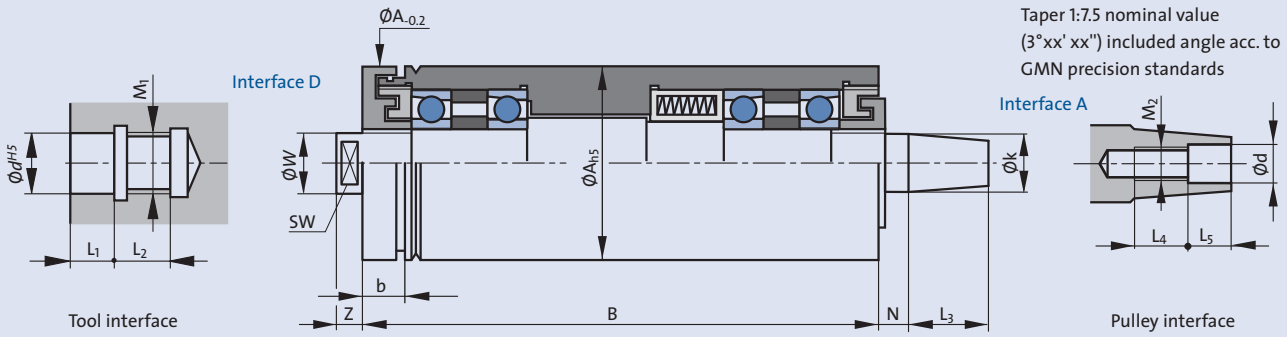
Designation	Interface I [mm]				Dimensions [mm]					Interface A [mm]						Max. speed* for bearing types [rpm]	
A c d B	k_1	L_1	L_2	M_1	W	Z	SW	b	N	k_2	L_3	d	M_2	L_4	L_5	Steel	Hybrid
TSI 40 ■ ■ x 160	I 10				19	6	17	9.5	6	A 10						45000	55000
TSI 40 ■ ■ x 200	10	26	16	M6						10	15	5	M5	8	7		
TSI 40 ■ ■ 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



Tool interface

Pulley interface

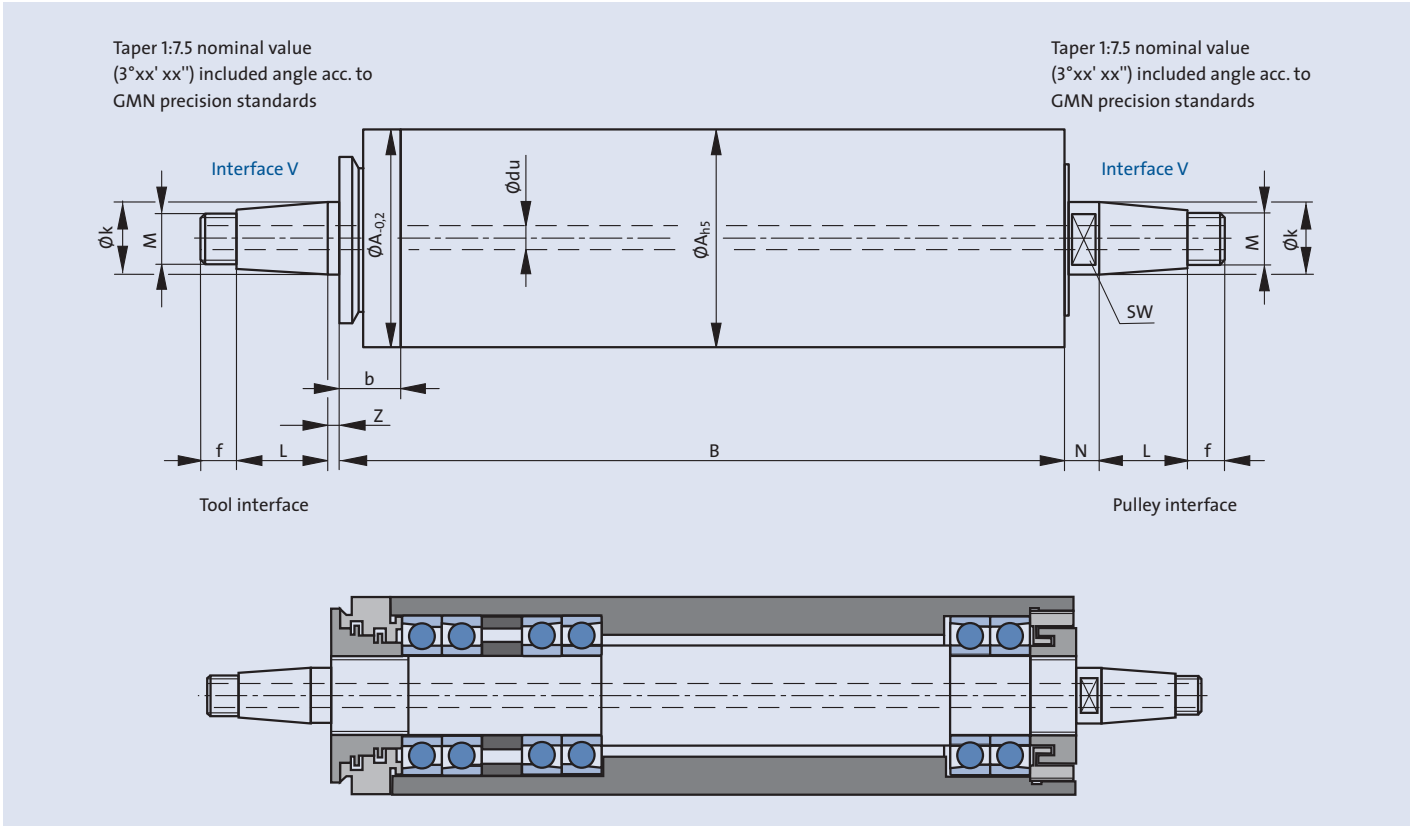
Designation	Interface D				Dimensions				Interface A						Max. speed* for bearing types [rpm]	
	[mm]				[mm]				[mm]							
A c d B	D [d]/[W]	L_1	L_2	M_1	b	Z	SW	N	k	L_3	d_1	M_2	L_4	L_5	Steel	Hybrid
TSP 40 ■ ■ x 160	D 08/14	12	14	M8	9.5	6	13	6	A 10						45000	55000
TSP 40 ■ ■ x 200									10	15	5	M5	8	7		
TSP 40 ■ ■ x 250																
TSP 50 ■ ■ x 160	D 10/18	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	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	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	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																

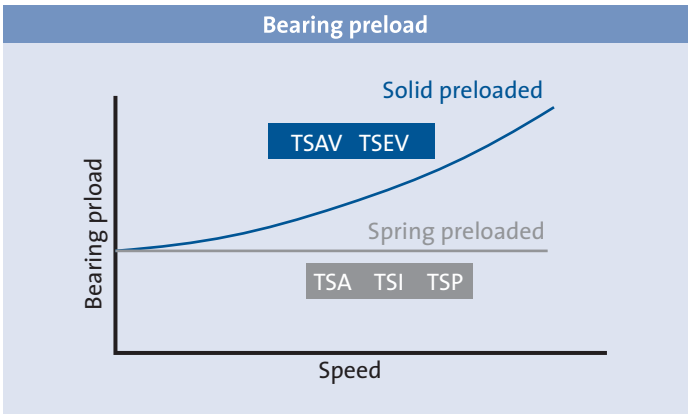
Designation:
A = Housing diameter
B = Housing length
c = Hybrid bearings
d = Sealing shields
Preference types are in bold.

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

Please state direction of rotation.

TSAV series





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.

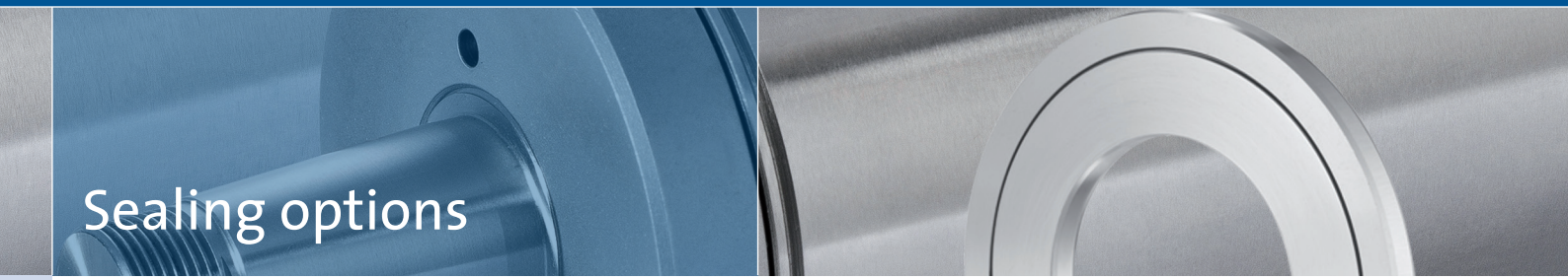
Designation						Interface [mm]			Dimensions [mm]						Max. speed* [rpm]	
A	du	h	vr	B		k	L	M	f	Z	b	N	SW	du**	Standard execution	Modification
TSAV 40	■	■	■	x	160		V 12									
TSAV 40	■	■	■	**x**	**200**											32000
TSAV 40	■	■	■	x	250	12.83	15	M10x1	7	2.5	9.5	7	10	6	13000	
TSAV 40	■	■	■	x	315											20000
TSAV 40	■	■	■	x	355											
TSAV 50	■	■	■	x	200		V 15									
TSAV 50	■	■	■	**x**	**250**											26000
TSAV 50	■	■	■	x	315	15.5	20	M12x1	7	3	11.5	8	13	8	10500	
TSAV 50	■	■	■	x	355											15000
TSAV 50	■	■	■	x	400											
TSAV 60	■	■	■	**x**	**200**		V 20									
TSAV 60	■	■	■	**x**	**250**											20000
TSAV 60	■	■	■	x	315											
TSAV 60	■	■	■	x	355	20	25	M16x1	10	3	10.5	9	17	10	8500	
TSAV 60	■	■	■	x	400											12000
TSAV 60	■	■	■	x	500											
TSAV 60	■	■	■	x	630											
TSAV 80	■	■	■	x	250		V 27									
TSAV 80	■	■	■	**x**	**315**											15000
TSAV 80	■	■	■	x	355											
TSAV 80	■	■	■	x	400	27.67	35	M20x1	12	4	14	12	24	14	6500	12000
TSAV 80	■	■	■	x	500											
TSAV 80	■	■	■	x	630											9000
TSAV 100	■	■	■	**x**	**315**		V 38									
TSAV 100	■	■	■	x	355											11000
TSAV 100	■	■	■	x	400											
TSAV 100	■	■	■	x	500	38	52.5	M30x1	12.5	4	17	15	32	20	5500	10000
TSAV 100	■	■	■	x	630											
TSAV 100	■	■	■	x	800											7000
TSAV 120	■	■	■	x	355		V 52									
TSAV 120	■	■	■	x	400											7000
TSAV 120	■	■	■	x	500											
TSAV 120	■	■	■	x	630	52	65	M36x1	17.5	5	28	18	46	25	4500	
TSAV 120	■	■	■	x	800											6000
TSAV 120	■	■	■	x	1000											
TSAV 140	■	■	■	x	400		V 56									
TSAV 140	■	■	■	x	500											6000
TSAV 140	■	■	■	x	630	56	75	M40x1.5	17.5	5	32.5	18	48	30	3500	
TSAV 140	■	■	■	x	800											4000
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											3000
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											2000

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 aask for max. speed for „vr“.

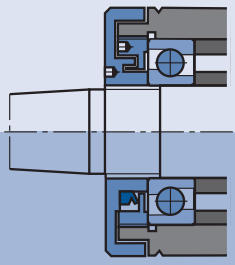
Please state direction of rotation.
Option „Anti-rotation“ for dual rotation.



Sealing options

Standard: Labyrinth seal

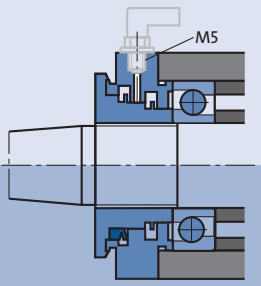
up to TSAV 100



Option: Axial lip seal

Standard: Labyrinth seal with connection for air purge

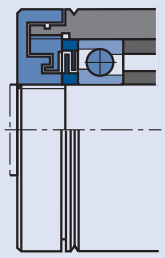
from TSAV 120



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 additon of an air purge port.
Spindle operating plane must be advised at the time of an order.

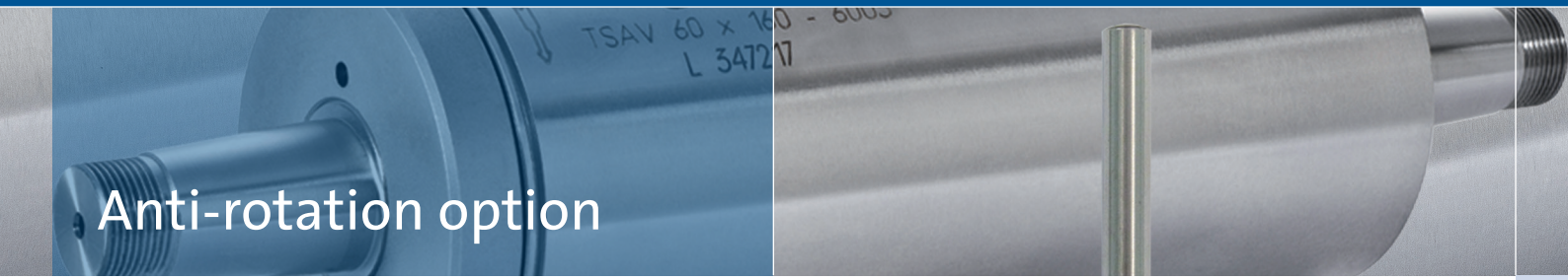
Optional sealing variant

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

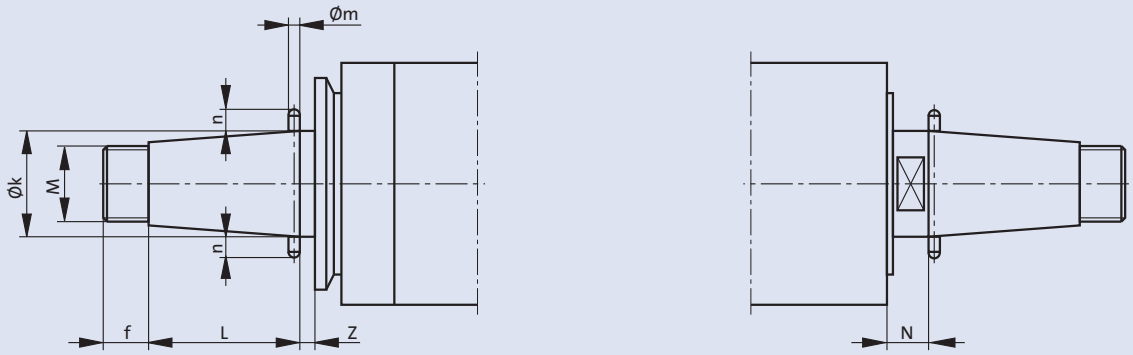
Spindle	Speed limit (Sliding seal) [rpm]
TSAV 40	6300
TSAV 50	5000
TSAV 60	4100
TSAV 80	3100
TSAV 100	2400
TSAV 120	1700
TSAV 140	1600
TSAV 160	1300
TSAV 200	1000

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.



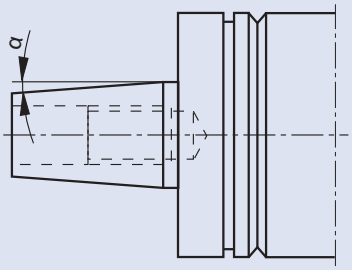
Anti-rotation option



Spindle	Interface V				Dimensions [mm]				
	Designation	[mm] k	[mm] L	[mm] 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

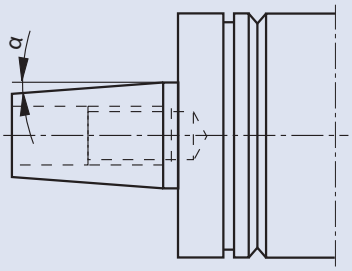
Taper specifications

TSA tool interface



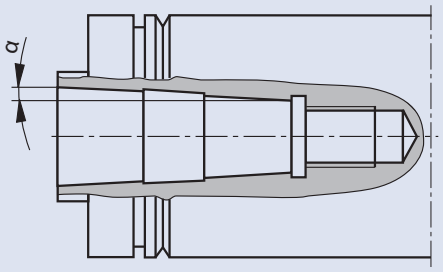
Spindle	Interface	Taper angle α
TSA 20	A 07	3°50'03"
TSA 26	A 08	3°49'33"
TSA 32	A 10	3°49'19"
TSA 40	A 10	3°49'19"
TSA 50	A 13	3°48'28"
TSA 60	A 18	3°48'13"
TSA 80	A 27	3°48'55"
TSA 100	A 38	3°50'28"

TSAV tool interface



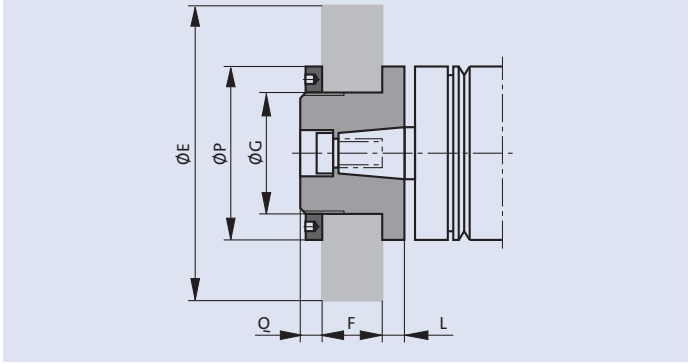
Spindle	Interface	Taper angle α
TSAV 40	V 12	3°49'15"
TSAV 50	V 15	3°49'06"
TSAV 60	V 20	3°48'51"
TSAV 80	V 27	3°48'55"
TSAV 100	V 38	3°50'28"
TSAV 120	V 52	3°48'51"
TSAV 140	V 56	3°49'27"
TSAV 160	V 87	3°48'48"
TSAV 200	V 87	3°48'48"

TSI tool interface

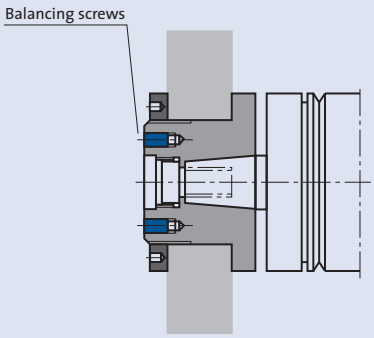


Spindle	Interface	Taper angle α
TSI 40	I 10	3°49'00"
TSI 50	I 14	3°48'42"
TSI 60	I 18	3°48'52"
TSI 80	I 25	3°48'49"
TSI 100	I 32	3°49'00"

TSA
Grinding wheel flanges



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:
G_{f7} for Corundum or Non diamond
G_{h4} for Diamant or CBN

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

Ordering information

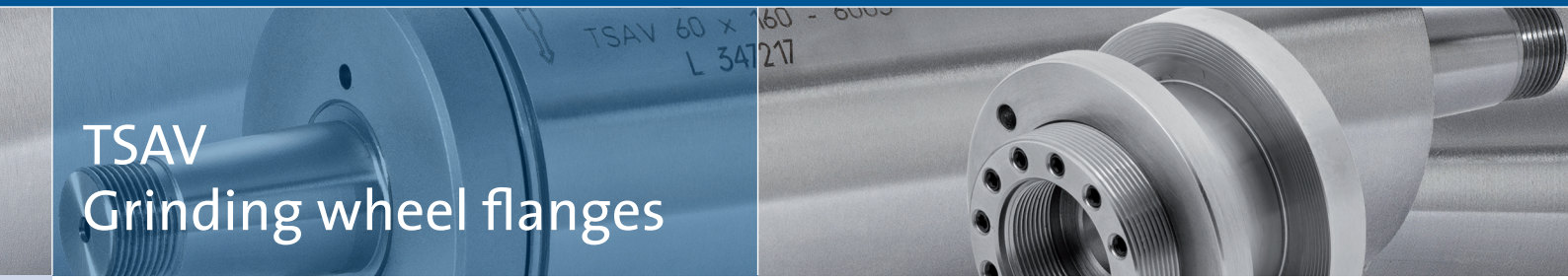
Flange A ■ / ■ / ■
- ■ = D = Diamant or CBN; K = Corundum or Non diamond
- ■ = Flange style MO / MS
- ■ = Interface A 07 / A 08 / ...

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

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

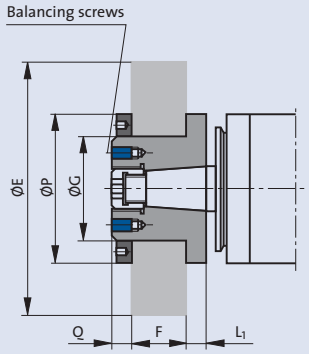
Please state direction of rotation, see page 31, when ordering.

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.

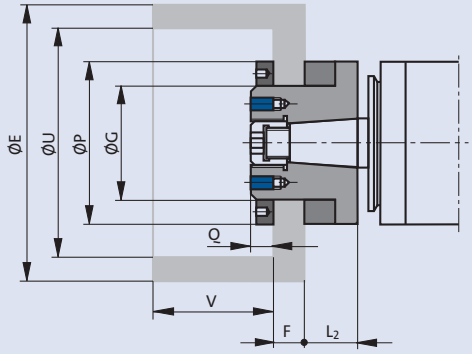


TSAV
Grinding wheel flanges

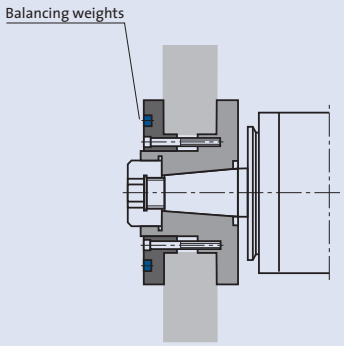
Flange style MS - *Fig. 1*



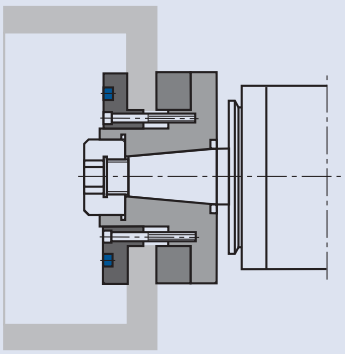
Flange style MS - *Fig. 2*



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 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:
G_{f7} for Corundum or Non diamond
G_{h4} for Diamant or CBN

** *Attention!* Wheel selection must be in accordance with the manufacturer's recommandation 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 / ...

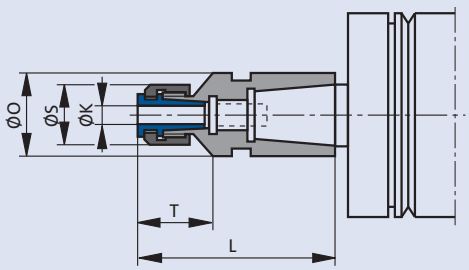
Puller for flange V 12 / V 15 / ...

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

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

Tool interfaces

TSA collet chuck



Spindle	Interface A	Dimensions [mm]				
		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

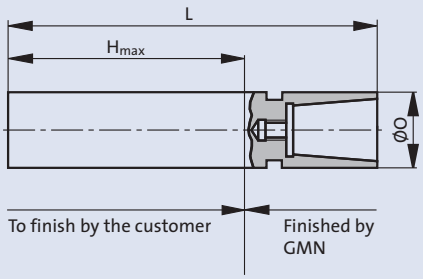
Ordering information

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

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

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

TSA grinding quill semifinished



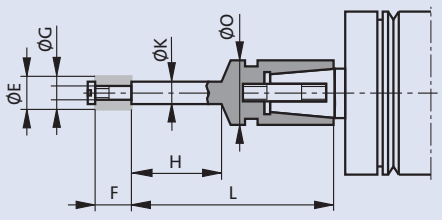
Spindle	Interface A	Dimensions [mm]		
		Hmax	L	O
TSA 40	A 10	82	110	13.5
TSA 50	A 13	98	135	18
TSA 60	A 18	136	180	23
TSA 80	A 27	172	233	34
TSA 100	A 38	190	280	48

Ordering information

E. g. Grinding quill semifinished A 10

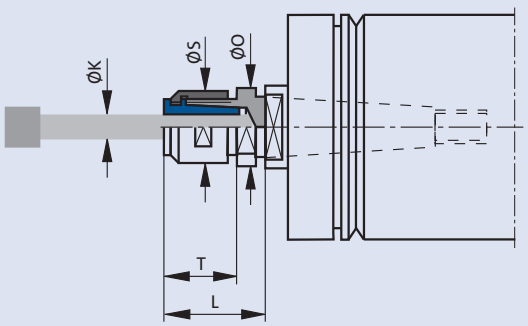
Please state direction of rotation, see page 31, when ordering.

Example for TSA quill application



Manufacturing according to application specification

TSI collet chuck



Spindle	Interface I	Dimensions [mm]				
		K	T	L	S	O
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

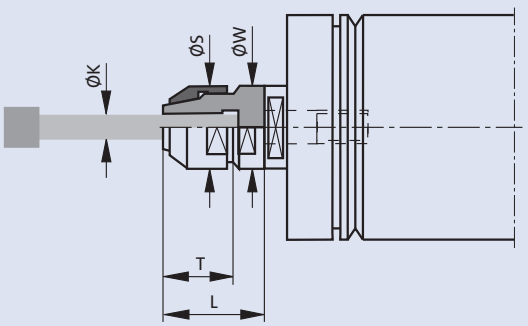
Ordering information

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.

TSP clamping chuck



Spindle	Interface D	Dimensions [mm]			
	D [d]/[W]	K	T	L	S
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 / ...

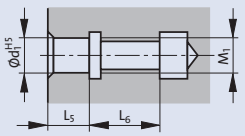
Please state direction of rotation, see page 31, when ordering.

TSP/TSI
Grinding quills

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

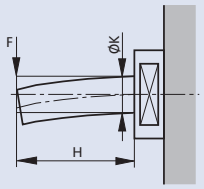
For wheel dimensions [mm]	E	8	10	13	16	20	25	32	40	50
	F	10	10	13	16	20	25	25	32	40
	G	3	3	4	6	8	10	13	16	20
Quill diameter [mm]	K	5	6	8	10	13	16	20	25	32
Wheel mount		KI	KI	PS	PS	PS	PS	PS	MU	MU
see page 21, fig.		1	1	2+3	2+3	2+3	2+3	2+3	4	4
Close-fit hole attachment [mm]	d_1			4	6	8	10	13		
	M_1			M3	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



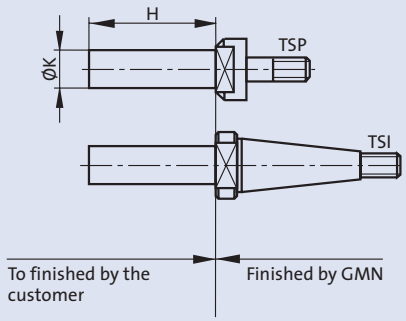
Quill stiffness [N/µm]		Grinding quill diameter K [mm]								
		5	6	8	10	13	16	20	25	32
Grinding quill length H [mm]	16	4.7	9.8							
	20	2.4	5.0	15.8	38.7					
	25	1.2	2.6	8.1	19.8	56.5				
	32			3.9	9.4	27	61.9	151		
	40				4.8	13.8	31.7	77.3	189	
	50					7.1	16.2	39.6	96.6	259
	63						8.1	19.8	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)

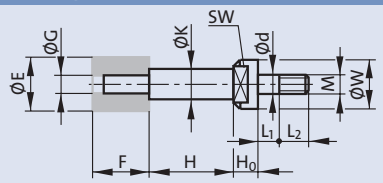


Fig. 2: Close-fit wheel screw (PS)

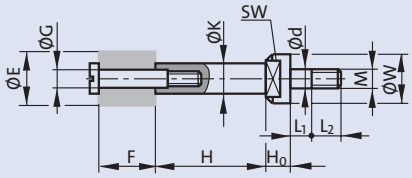


Fig. 3: Threaded wheel studs (PS)

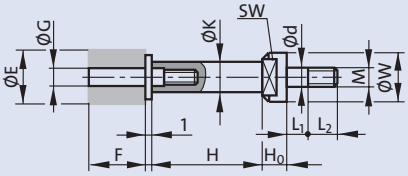
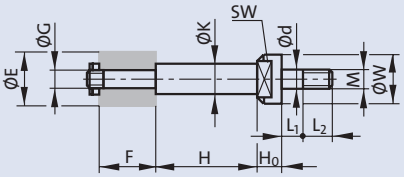


Fig 4: Quills with nut (MU)



Examples for TSI grinding quill application

(Manufacturing according to application specification)

Fig. 1: Cemented wheel (KI)

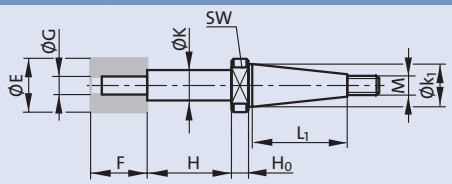


Fig. 2: Close-fit wheel screw (PS)

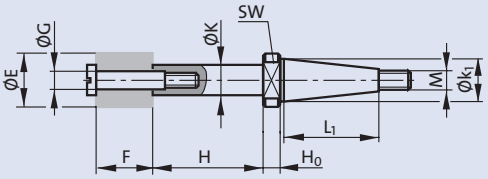


Fig. 3: Threaded wheel studs (PS)

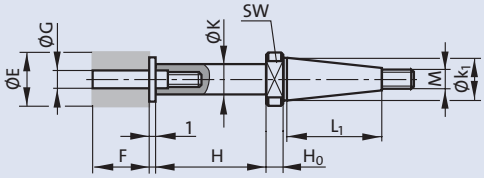
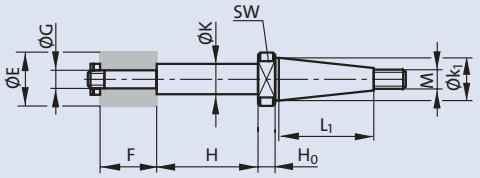


Fig. 4: Quills with nut (MU)

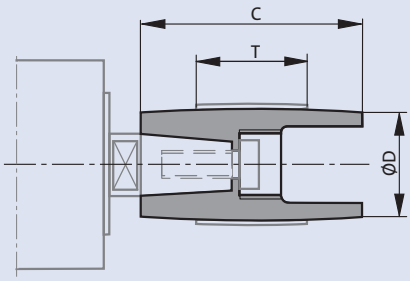


Grinding quill selection data

	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



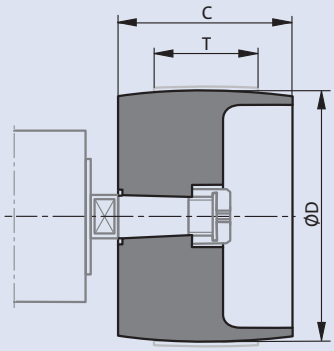
Spindle	Interface A	Dimensions [mm]		
		D	C	T
TSA 20	A 07	14; 28	20	10
TSA 26	A 08	16; 36	25	15
TSA 32 TSA 40 TSI 40 TSP 40	A 10	18; 50	30	20
		17; 20; 25; 63	40	
TSA 50 TSI 50 TSP 50	A 13	20; 25; 32; 80	50	30
TSA 60 TSI 60 TSP 60	A 18	25; 32; 40; 100	60	40
TSA 80 TSI 80 TSP 80	A 27	40; 45; 50; 56; 125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

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 TSAV 200	V 87	280	130	100

Ordering information

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

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

Anti-rotation slot

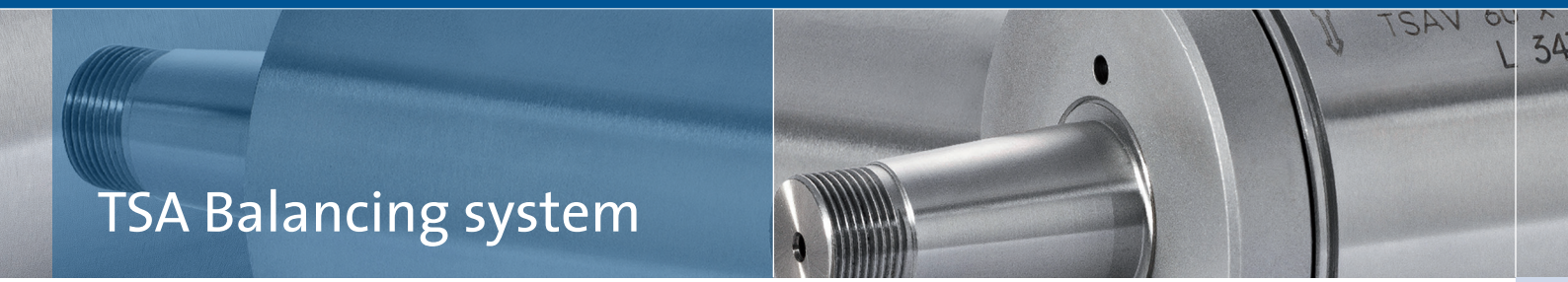
- Option
  Interfaces V 15 up to V 27 (TSAV 50 up to TSAV 80)
- Standard
  from interface V 38 (TSAV 100)

Cutting speed

Spindle speed n	Cutting speed v_c [m/s] Wheel diameter E [mm]																	
[rpm]	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									11.7	14.7	18.3	23.1	29.3	36.7	45.8	64.1	73.3	91.6
6000									10.1	12.6	15.7	19.8	25.1	31.4	39.3	55.0	62.8	78.5
5500										11.5	14.4	18.1	23.0	28.8	36.0	50.4	57.6	72.0
5000										10.5	13.1	16.5	20.9	26.2	32.7	45.8	52.4	65.4
4000											10.5	13.2	16.8	20.9	26.2	36.7	41.9	52.4
2860													12.0	15.0	18.4	26.2	29.9	37.4
1440																13.2	15.1	18.8

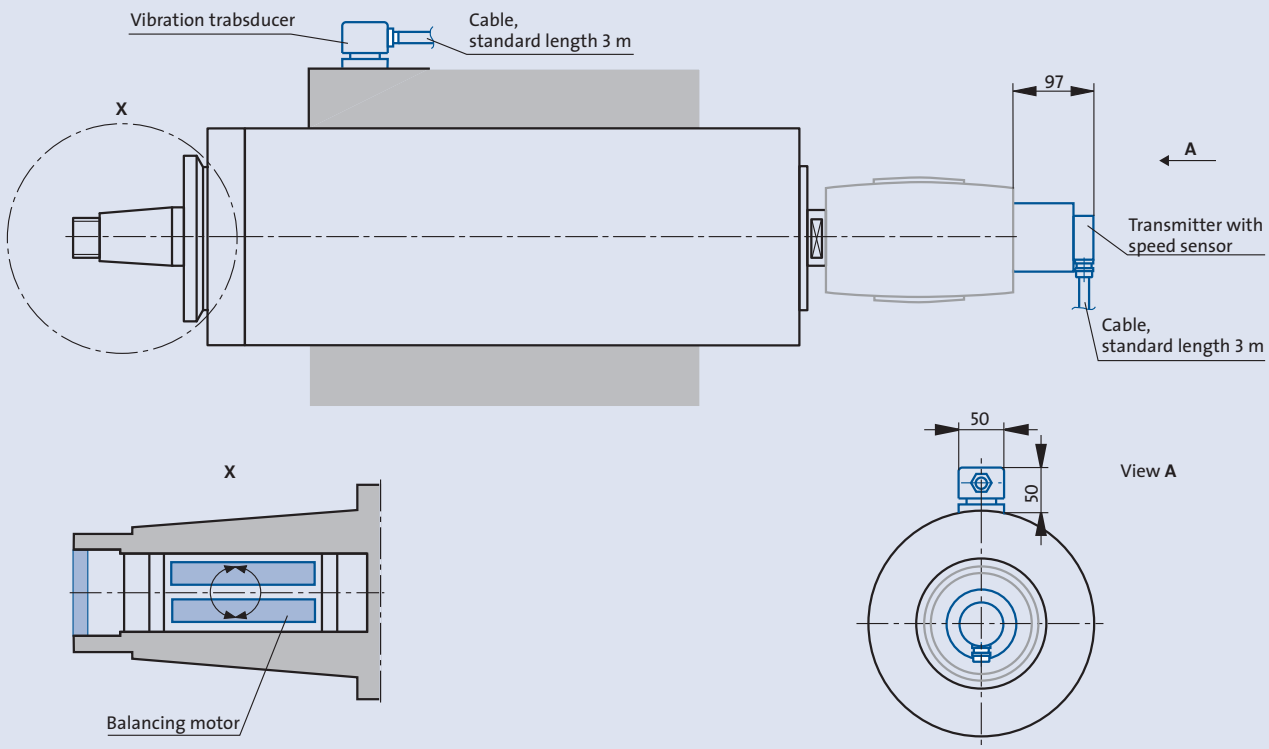
$$v_c = \frac{E \cdot \pi \cdot n}{60 \cdot 1000} \quad [m/s]$$

E = Wheel diameter [mm]
n = Spindle speed [rpm]



TSA Balancing system

Electromechanical 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

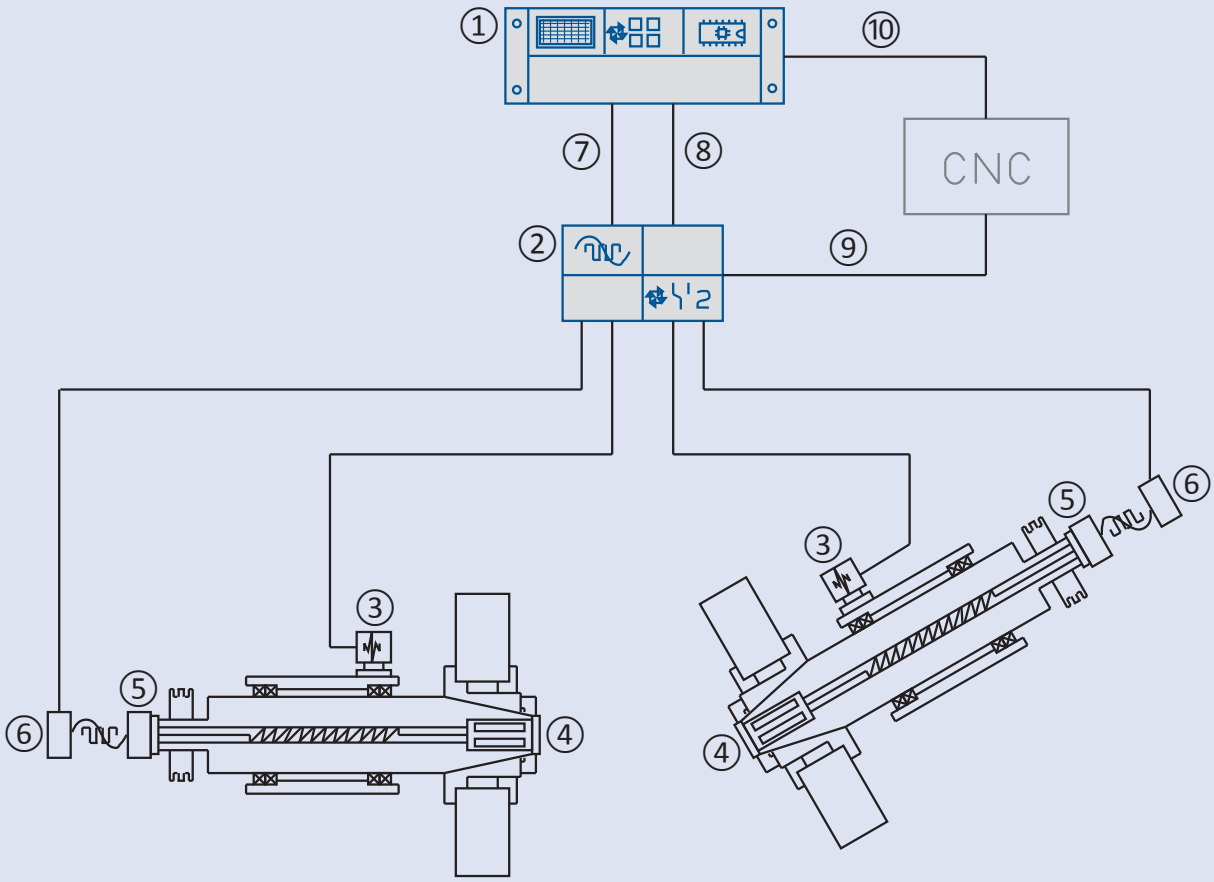
Options

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

Electronic control, see page 26.

Balancing system

Automatic 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

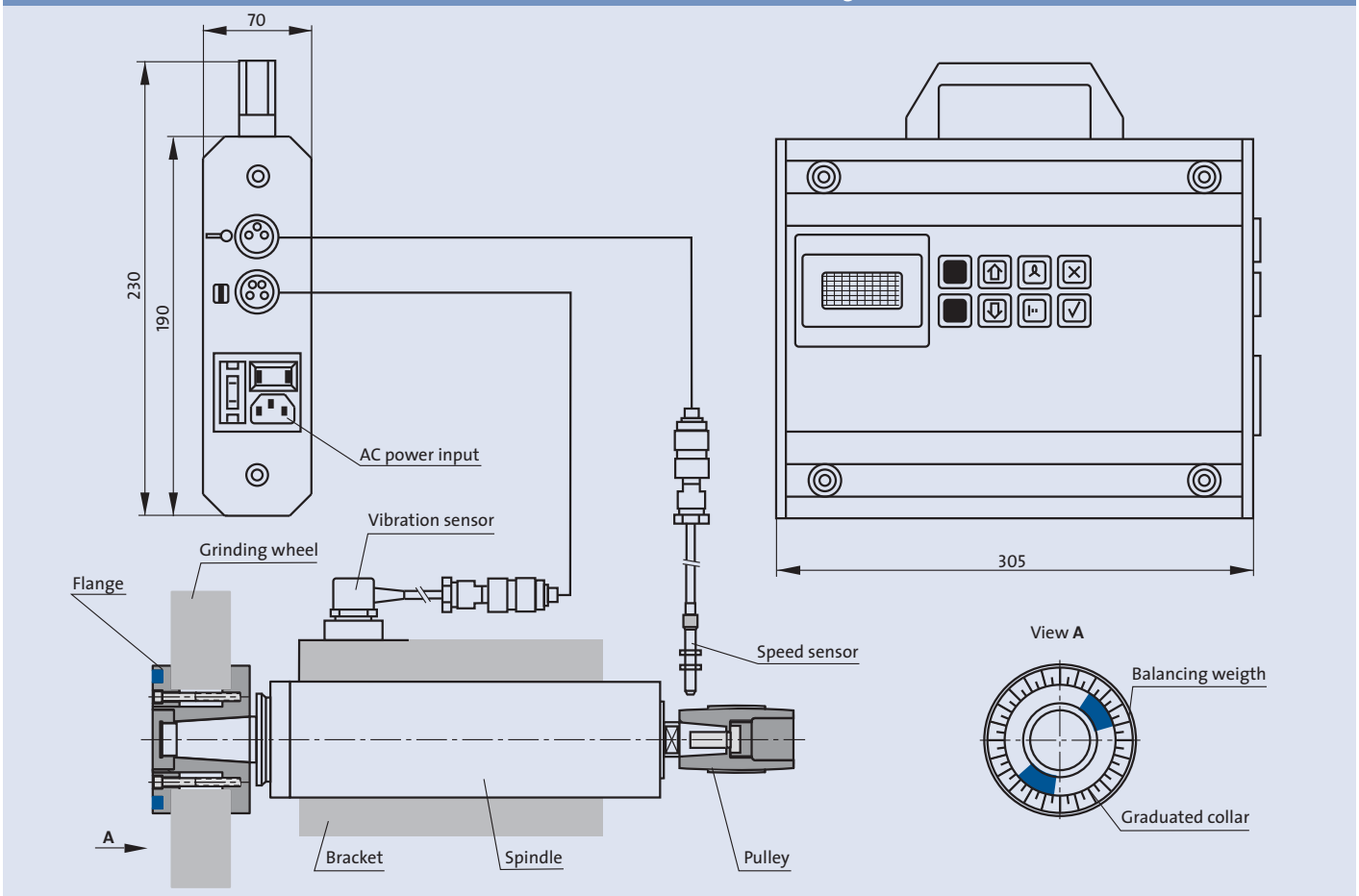
Included in the delivery of the spindle:

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.

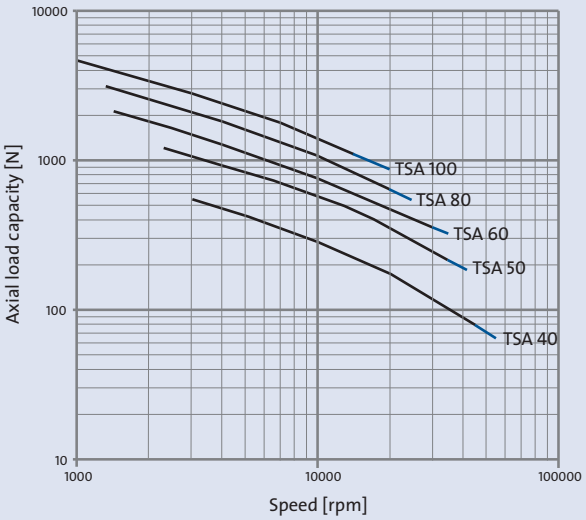
As a result of higher cutting speeds this process is also required for tools.

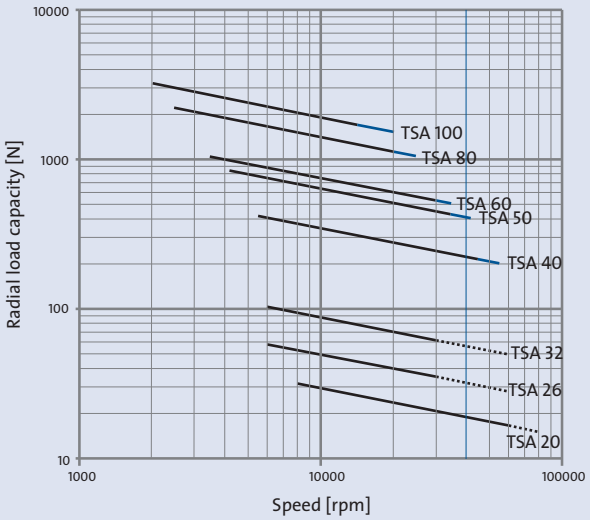
For large spindles automatic balancing systems are available.
We recommend the portable balancing system for smaller spindles.

Process

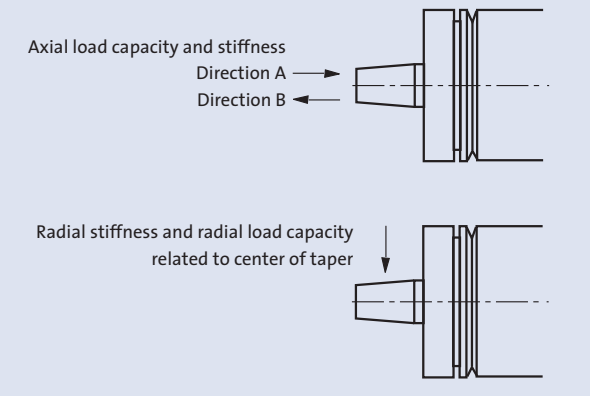
- The vibration transducer with a magnetic base is attached to either the spindle housing of mounting bracket
- Speed sensor must be positioned to read the speed of the spindle
- Portable unit automatically:
  - Records the spindle speed
  - Records vibration levels
  - Indicates the amount and position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

Stiffness - Load capacity



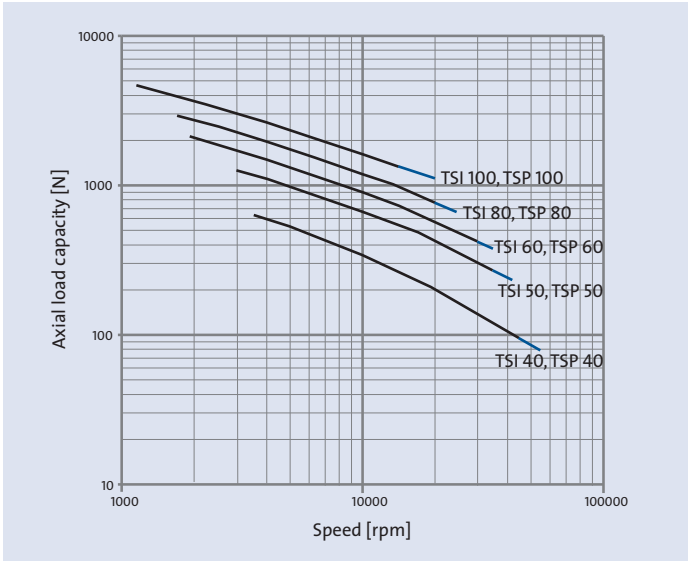


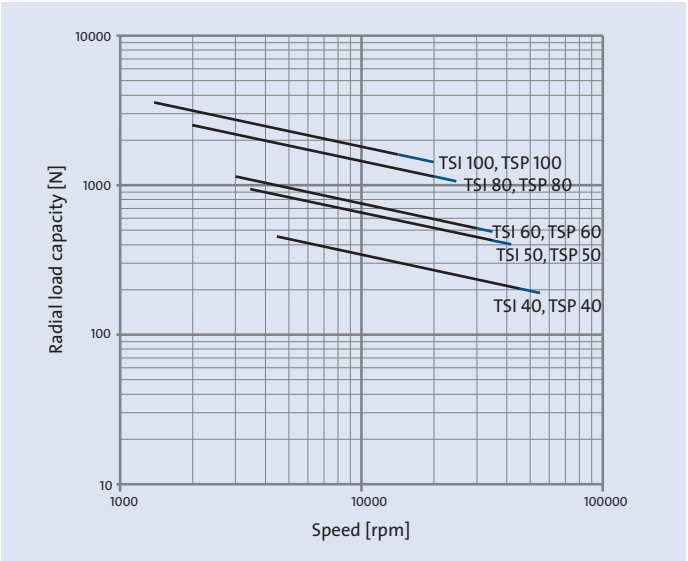
Spindle	Stiffness [N/µm]		Load capacity [N]		
	axial	radial	axial		radial
	A and B		A	B	
TSA 20 x 125	12	3.5	70**	35**	
TSA 20 x 160					
TSA 20 x 200	17	3.5	70**	70**	
TSA 20 x 250					
TSA 26 x 125					see diagram
TSA 26 x 160	14	5.0	70**	35**	
TSA 26 x 200					
TSA 26 x 250	20	5.0	70**	70**	
TSA 26 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.

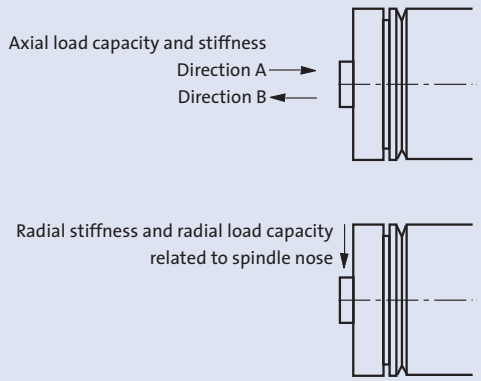
** For low speed operation (< 0.4 catalog specified speed). Axial load of 2 to 3 times higher then indicated can be applied, for short periods, depending on noise and vibration levels.





Spindle	Stiffness [N/µm]		Load capacity [N]		
	axial	radial	axial		radial
	A and B		A	B	
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.

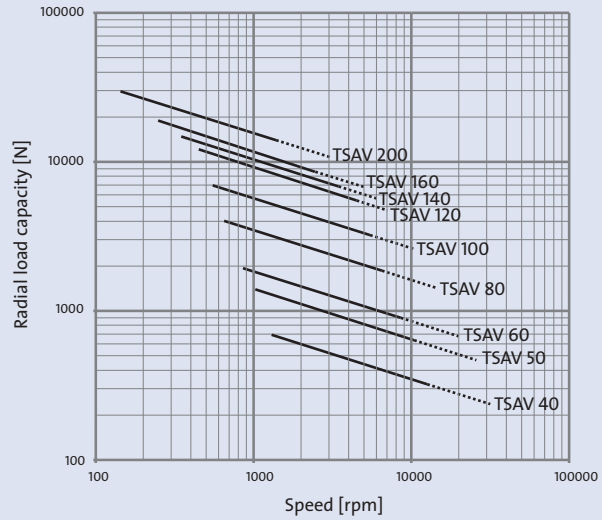
The load capacities provided are for either pure radial or axial loads. Combined loads can not be used at the maximium values. Application should be analyzed by GMN Engineering Department for proper spindle selection.

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.

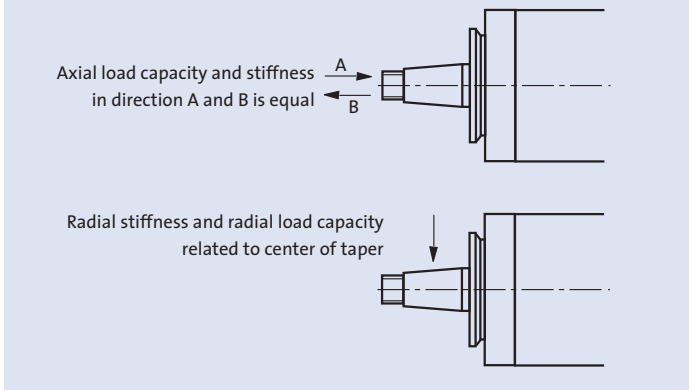
Stiffness - Load capacity



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



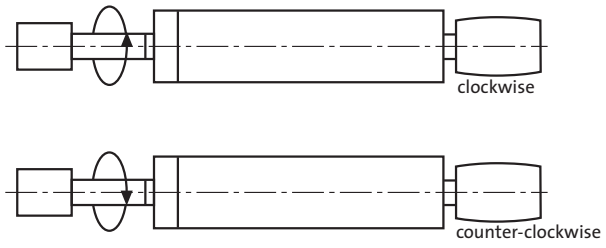
General safety rules

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.

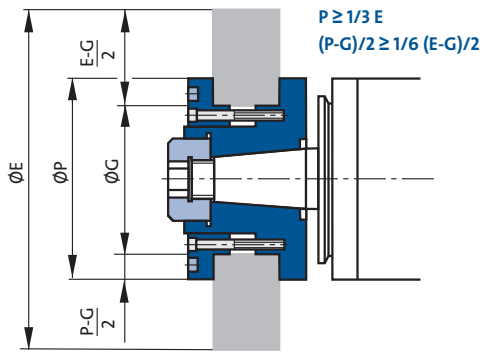
Grinding wheel speeds and use must adhere to the corresponding regulations for safety. ANSI B7.1 "Safety Requirements for USE, Care and Protection of Abrasive Wheels".

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 then 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.



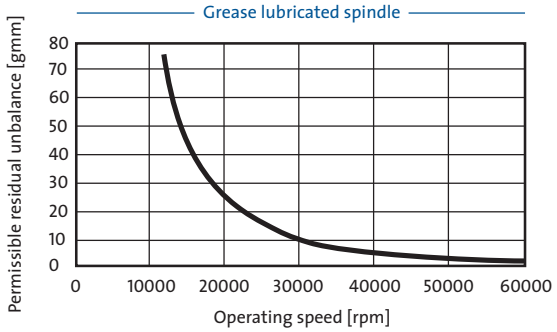
Very small diameter wheels

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 locknuts, and a quieter operation, and smoother performance.

General safety rules

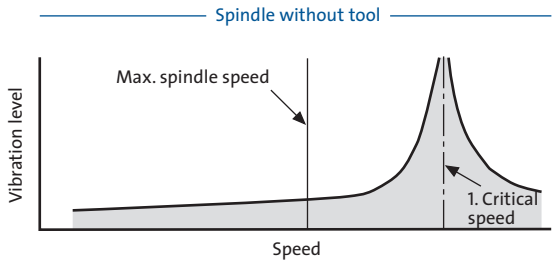
Guidelines

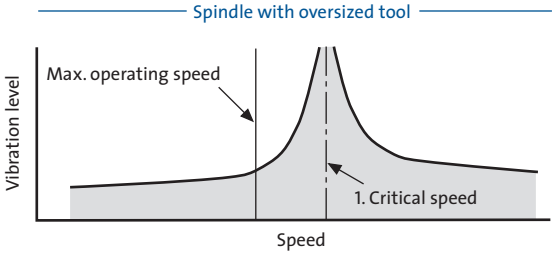
Every spindle shaft and every tool incorporates a degree of unbalance, which causes sinuous vibration during rotation. To reduce the effect of unbalancing forces, the unbalancing mass of all rotating parts has to be limited. Shafts of GMN high frequency spindles are always balanced. As a result of higher 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:



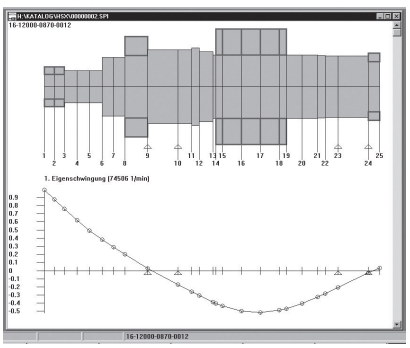
Critical speed

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 analyses 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

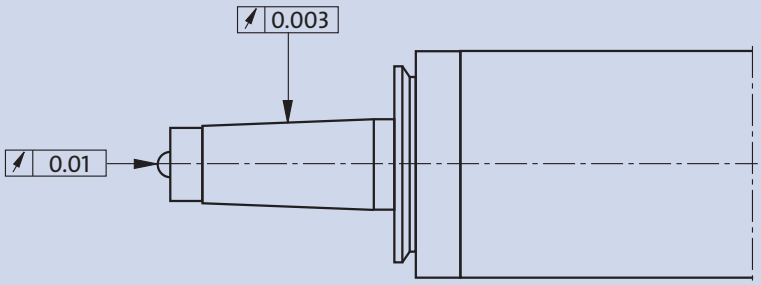
Centrifugal forces created by high rotating speed not only act as unbalancing forces but also induce stress into the tool. Insert type milling cutters are the worst case scenario, with the weakening of the screws or clamps, the carbide inserts can become projectiles.

Vibration monitoring

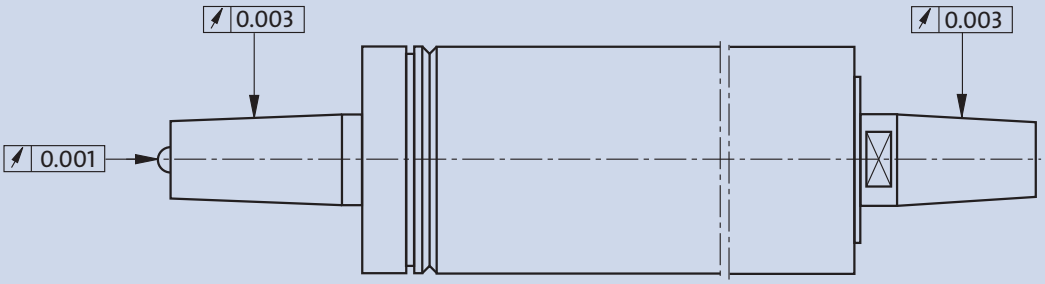
Vibration monitoring equipment can less the risk of damage to both the spindle and machine, and also help prevent personnel injury by early detection of wear and looseness in both the spindle and tooling. When selecting and installing monitoring equipment it should be noted that vibration from the machine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

Radial and axial runout

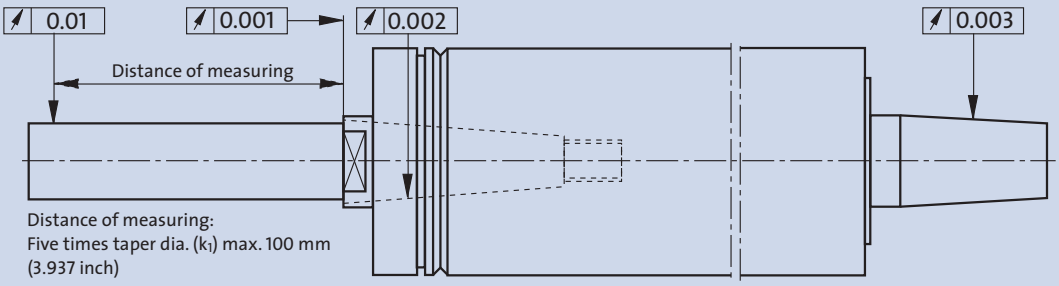
TSAV



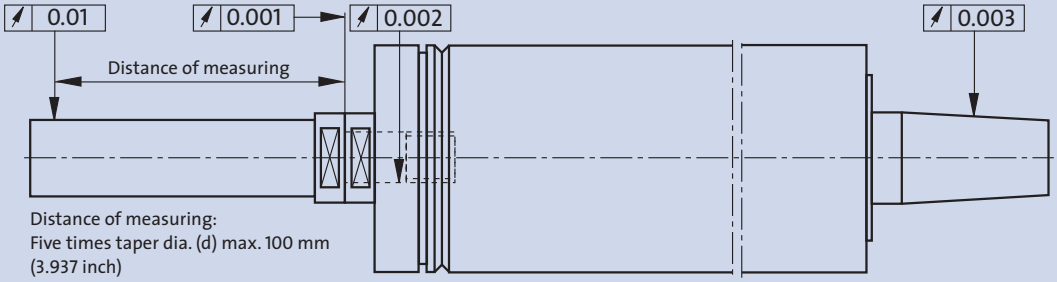
TSA



TSI



TSP



Spindles with increased radial and axial runout on request.

Spindle selection

Figure 1

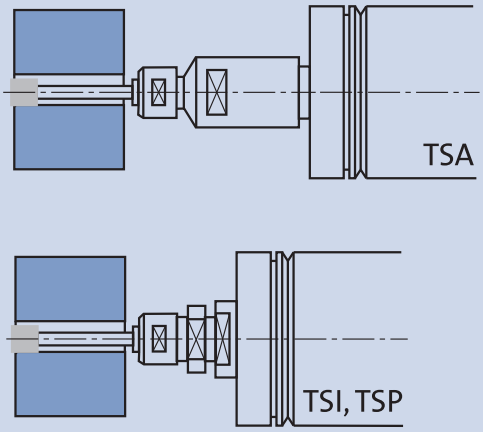
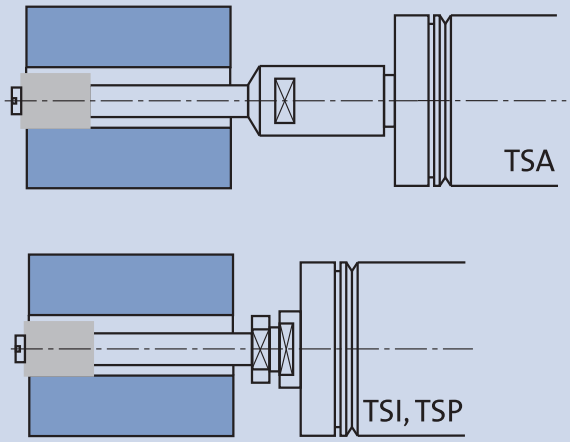
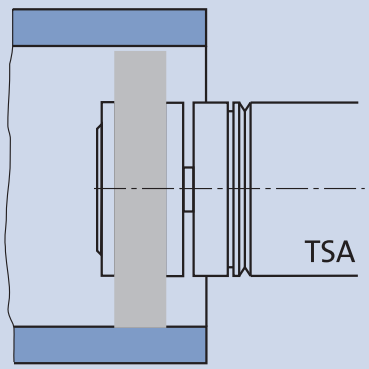


Figure 2



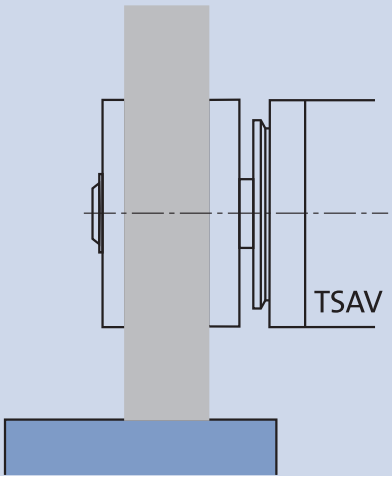
For grinding bores smaller then the outside diameter of the chosen spindle style (Fig. 1 + 2), the TSI or TSP spindle is recommended, because the wheel will be mounted closer to the bearing complement for better rigidity..

Figure 3



For grinding bores larger then 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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