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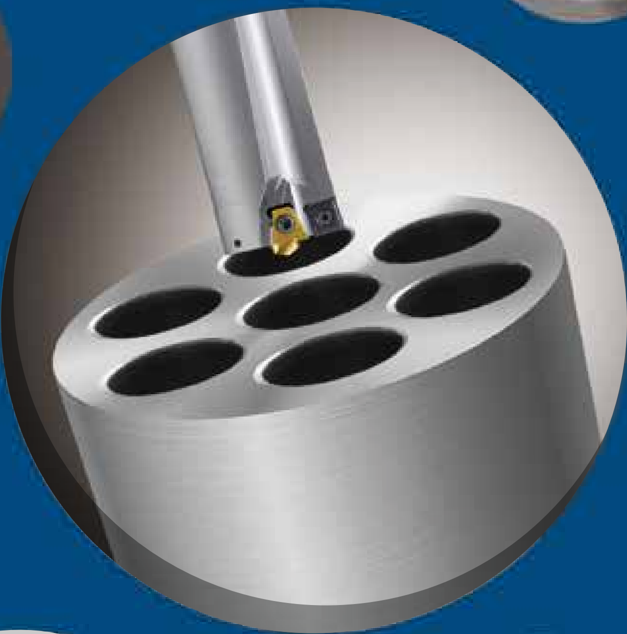
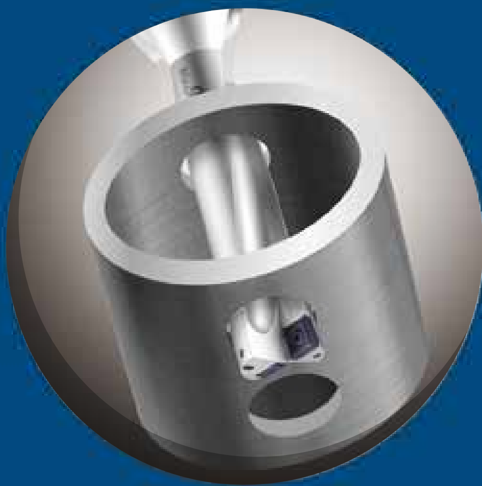
Cat.3a





Super Power Drill
Super Drill

WE HAVE INVESTED RESOURCES IN THE DESIGN & MANUFACTURE OF INSERTED CUTTERS

Our innovative tooling design upgrades productivity and competitive capability while reducing production requirements in a wide range of industries.

The tooling system is designed to benefit users of machining centers and CNC lathe, turning center and special purpose machines.

Our outstanding R&D capabilities combined with fast delivery provide a strong competitive edge.

Contents

Highly Efficient

Long Tool Life

The Winner
is not necessarily the one who runs
the fastest but the one who holds on to the last

Machining Power Requirement for Drilling

5D~10D

Material Classifiction for Calculation

There are an extremely wide range of materials and different machining operations in the metal cutting industry. We follow the ISO material group and color to make brief information for calculation of the required power for super power drill, the main effective parameter is “specified cutting force”, please use following table and formula: (More detail of work piece material classification is listed in our website.)

	Material Group	Material Type and description	Hardness HB	Strength N/mm^2	Specified cutting force kc N/mm^2
P	1.10	Carbon steel C<0.3%, free cutting steels	~125	500-850	1900
	1.20	Carbon steel C>0.3%	~150	850-1000	2100
	1.30	Low alloy steel C<0.3%	180	Up to 750	2100
	1.40	Low alloy steel C>0.3%	200	750-1200	2600
	1.50	High alloy steel	200	800-1200	2600
	1.60	Tool steel, harder steels for toughening. Martensitic stainless steels.	<230	850-1100	2200
	1.70	Casting steel			2900
M	2.10	Free cutting Stainless steel Austenitic stainless steels	200	490-700	2300
	2.20	Difficult Stainless steel Austenitic stainless steels and duplex	175	650-850	2450
K	3.10	Grey casting Iron	180	250-350	1100
	3.20	Malleable casting iron..	230	Up to 600	1200
	3.30	Nodular casting iron	250	Up to 800	1800
N	4.10	Al- alloys(Si<12%)	60	230-310	500
	4.20	Al-alloys(Si>12%)	75	150-200	750
	4.30	Non-ferrous materials, Zirconium, Magnesium, Copper alloys, etc.	100	150-200	800
	4.40	Carbon and graphite composites, plastics, wood, rubbers, etc.	—	—	—
S	5.10	Nickel-based heat-resistant alloys	250		3500
	5.20	Cobalt-based heat resistant alloys	350		4150
	5.30	Iron-based heat resistant alloys	250		3050
H	6.10	Tool steels and hardened steels	55HRC		4500
	6.20	Hardened cast iron	—	—	—

Formulas for Calculation of Machining Power Pc(Kw)

$$Pc(Kw) = \frac{f \times Vc \times D \times Kc}{60 \times 10^3 \times \eta}$$

feed force(KN) Ff

$$Ff = \frac{ap \times f \times Kc}{2000}$$

Drilling torque (Md)
torque=(Nm)

$$Md = \frac{f \times \pi \times D2 \times Kc}{4000} \text{ Nm}$$

f =	feed rate	mm/rev.
Vc =	cutting speed	m/min.
D =	drill diameter	mm
Kc =	specified cutting force	N/mm^2
η =	power transmition efficiency of spindle (75%-85%)	

Technical Guide

Cutting Data

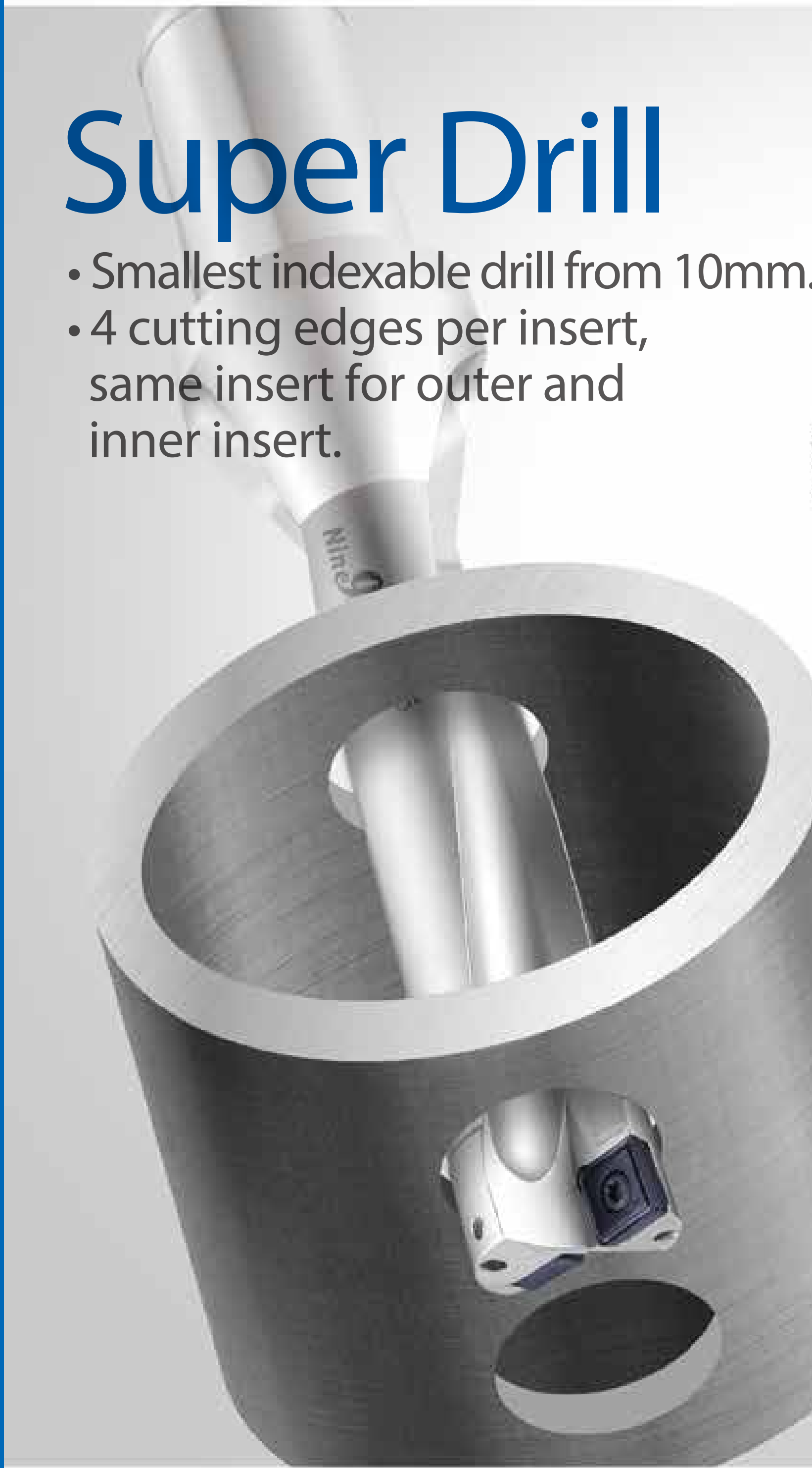
Work piece material	T= Length/ Dia.	Vc (m/min.)	f (mm/rev.) N9GX04T002 Dia.19	f (mm/rev.) N9GX05T103 Dia.20-21	f (mm/rev.) N9GX060204 Dia.22-34	f (mm/rev.) N9GX090308 Dia.35-40	Grade of insert Center	Grade of insert Periphery
Carbon steel C<0.3% Ex.:S25C, SS41	T<7D	80~150	0.03~0.07	0.04~0.08	0.06~0.10	0.08~0.12	NC2032	NC2032
	T>7D	60~120	0.03~0.07	0.04~0.08	0.06~0.10	0.08~0.12		
	T<7D	80~130	—	—	0.06~0.10	0.08~0.12	NC40	NC40
	T>7D	60~100	—	—	0.06~0.10	0.08~0.12		
Carbon steel C>0.3% Ex.:S50C, P5	T<7D	80~150	0.04~0.08	0.04~0.10	0.06~0.12	0.08~0.15	NC40	NC2032
	T>7D	60~120	0.04~0.08	0.04~0.10	0.06~0.12	0.08~0.15		
Low alloy stee C<0.3% Ex.:SCM415	T<7D	60~150	0.04~0.08	0.04~0.10	0.06~0.10	0.08~0.12	NC2032	NC2032
	T>7D	40~120	0.04~0.08	0.04~0.10	0.06~0.10	0.08~0.12		
Low alloy steel C>0.3% Ex.:SCM440	T<7D	60~150	0.04~0.08	0.04~0.10	0.06~0.12	0.08~0.15	NC40	NC2032
	T>7D	40~120	0.04~0.08	0.04~0.10	0.06~0.12	0.08~0.15		
High alloy steel Ex.:SKD11	T<7D	60~120	0.03~0.07	0.04~0.08	0.06~0.10	0.08~0.12	NC40	NC2032
	T>7D	40~100	0.03~0.07	0.04~0.08	0.06~0.10	0.08~0.12		
Casting steel	T<7D	60~120	0.03~0.07	0.04~0.08	0.06~0.10	0.08~0.12	NC40	NC2032
	T>7D	40~100	0.03~0.07	0.04~0.08	0.06~0.10	0.08~0.12		
Stainless steel Ex.:SUS304	T<7D	60~120	0.03~0.06	0.04~0.07	0.05~0.08	0.06~0.10	NC2032	NC2032
	T>7D	40~100	0.03~0.06	0.04~0.07	0.05~0.08	0.06~0.10		
	T<7D	60~120	—	—	0.05~0.08	0.06~0.10	NC40	NC40
	T>7D	40~100	—	—	0.05~0.08	0.06~0.10		
Casting Iron Ex.:FC25	T<7D	60~120	0.04~0.08	0.04~0.10	0.06~0.10	0.08~0.12	NC40	NC2032
	T>7D	40~100	0.04~0.08	0.04~0.10	0.06~0.10	0.08~0.12		
Al, and non-ferrous metal Ex.:A6061	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—
Hardened steel <HRC 50° Ex.:SKD61	T<7D	50~80	0.03~0.06	0.04~0.07	0.05~0.08	0.06~0.10	NC40	NC2032
	T>7D	40~60	0.03~0.06	0.04~0.07	0.05~0.08	0.06~0.10		

Important Information

- Reduce feed rate 50% at the beginning of 3-5 mm.
- The cutting speed relates to the periphery inserts, The feed rate depends on the load of the center pilot insert.
- The best condition will create short cutting chips. The feed rate can be applied ± 25% of the recommended value depended on the shape of the cutting chips.
- Be careful to monitor the spindle power consumption !
  When the spindle load is 15% higher than starting power consumption, please change the periphery insert to next new cutting edge and change a new center pilot insert.
- Minimum coolant pressure is 10 bar (about 150 psi.). Internal coolant is required.
- Increase 20% of the cutting speed and the feed rate for horizontal spindle machine.
- For the CNC lathes, maximum miss-alignment of drill center and spindle center is ±0.05 mm, it is not necessary to drill center hole in advance.

Super Drill

- Smallest indexable drill from 10mm.
- 4 cutting edges per insert, same insert for outer and inner insert.



Ø10
~
Ø30

SMALLEST DIMENSION

3xD : Ø10 to Ø30 mm.
4xD : Ø16 to Ø30 mm.

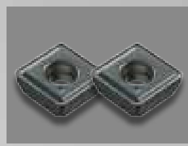
SMALLER CUTTING CHIP

- The center and peripheral inserts are positioned in order to divide the cutting chips into smaller spiral shape.
  It helps the cutting chip to be removed faster and easier.
- Designed for high productivity, high speed cutting.
  Coolant supply is needed.

BETTER SURFACE FINISH AND BETTER DIAMETER ACCURACY

- Special insert positioning to balance the cutting forces, better surface finish and diameter accuracy are achievable.

3xD & 4xD



4 cutting edges insert
AlTiN coated

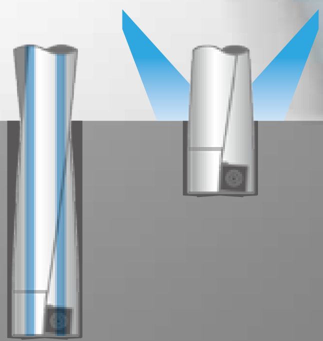
Chip breaker of SPD insert provides excellent chip control property due to its engineered design

Easy and simple change of cutting edge without inconvenience

≃ Flat bottom shape

Angled Surfaces

Possible to drill into angled surfaces without pre-drilling



Coolant

Internal coolant is recommended
In case of external coolant
Cutting depth must be 1xD or less

The coolant is feed directly into the inserts cutting face, cooling the top of the drill and preventing built up edge, which allows for quick and smooth chip evacuation.

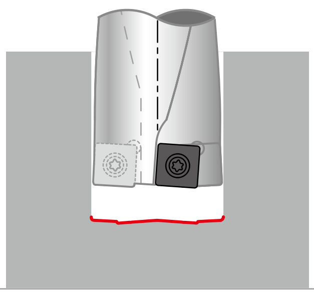
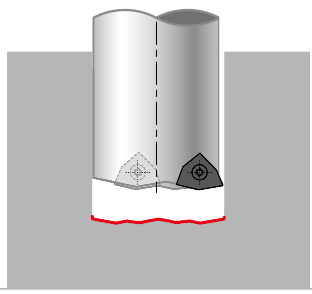
Insert Specification

Periphery Insert

Features

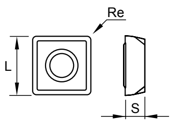
- Fully ground dual-relief insert, for improved surface finish and higher feed rate.
- Primary relief angle is to increase the toughness of the insert, secondary relief angle is to strengthen the axial feed rate.
- Same insert for outer and inner insert.
- Square insert with 4 cutting edges, reducing cost per insert.
- Better surface finish.
- Better diameter accuracy.


NC2032

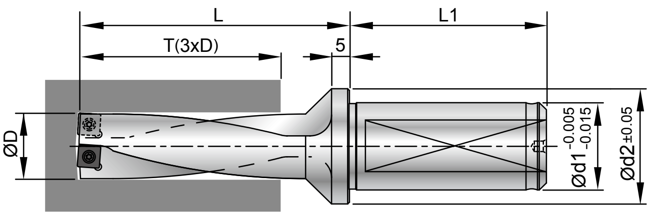
Nine9 SD	Other makers
	

▸ Insert >>

NC2032: K20F grade, AlTiN coated, for carbon steel, alloy steel, casting iron, stainless steel and hardened steel up to HRC 50.

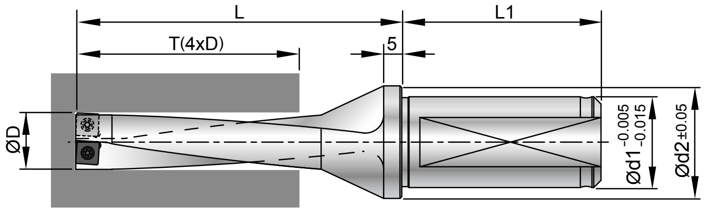
Ordering code				Dimensions			Screw	Key
Code of insert	Grade	Coating		L	S	re		
N9GX04T002	NC2032 K20F	AlTiN		4.07	1.8	0.2	NS-18037 0.6Nm	NK-T6
N9GX05T103	NC2032 K20F	AlTiN		5.07	2.0	0.2	NS-20045 0.8Nm	NK-T6
N9GX060204	NC2032 K20F	AlTiN		6.35	2.38	0.4	NS-22055 0.9Nm	NK-T7
N9GX070304	NC2032 K20F	AlTiN		7.94	3.18	0.4	NS-25060 1.2Nm	NK-T7
N9GX090308	NC2032 K20F	AlTiN		9.52	3.18	0.8	NS-30072 2.0Nm	NK-T9

Holder 3xD 10mm~30mm



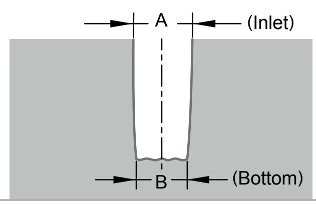
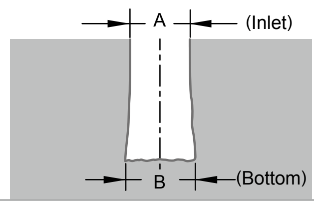
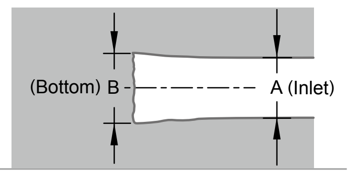
Ordering code	ØD	T	L	d1	d2	L1	Insert Screw / Key	Radial Adjustment	D max
00-99313-10	10.0	30.0	49	20	27	49	N9GX04T002 NS-18037 0.6Nm NK-T6	0.25	10.5
00-99313-10.3	10.3	30.9	52	20	27	49		0.25	10.8
00-99313-10.5	10.5	31.5	52	20	27	49		0.25	11.0
00-99313-11	11.0	33.0	52	20	27	49		0.20	11.4
00-99313-11.5	11.5	34.5	55	20	27	49		0.20	11.9
00-99313-12	12.0	36.0	55	20	27	49		0.15	12.3
00-99313-12.5	12.5	37.5	58	20	27	49		0.15	12.8
00-99313-13	13.0	39.0	58	20	27	49	N9GX05T103 NS-20045 0.8Nm NK-T6	0.30	13.6
00-99313-13.5	13.5	40.5	61	20	27	49		0.30	14.1
00-99313-14	14.0	42.0	61	20	27	49		0.25	14.5
00-99313-14.5	14.5	43.5	64	20	27	49		0.25	15.0
00-99313-15	15.0	45.0	64	20	27	49		0.20	15.4
00-99313-15.5	15.5	46.5	67	20	27	49		0.20	15.9
00-99313-16	16.0	48.0	74	25	31	49	N9GX060204 NS-22055 0.9Nm NK-T7	0.40	16.8
00-99313-16.5	16.5	49.5	76	25	31	55		0.40	17.3
00-99313-17	17.0	51.0	76	25	31	55		0.35	17.7
00-99313-17.5	17.5	52.5	78	25	31	55		0.35	18.2
00-99313-18	18.0	54.0	78	25	31	55		0.30	18.6
00-99313-18.5	18.5	55.5	80	25	31	55		0.30	19.1
00-99313-19	19.0	57.0	80	25	31	55		0.25	19.5
00-99313-19.5	19.5	58.5	85	25	31	55		0.25	20.0
00-99313-20	20.0	60.0	85	25	31	55	N9GX070304 NS-25060 1.2Nm NK-T7	0.50	21.0
00-99313-20.5	20.5	61.5	87	25	31	55		0.50	21.5
00-99313-21	21.0	63.0	87	25	31	55		0.45	21.9
00-99313-21.5	21.5	64.5	88	25	31	55		0.45	22.4
00-99313-22	22.0	66.0	88	25	31	55		0.40	22.8
00-99313-22.5	22.5	67.5	90	25	31	55		0.40	23.3
00-99313-23	23.0	69.0	90	25	31	55		0.35	23.7
00-99313-23.5	23.5	70.5	92	25	31	55		0.35	24.2
00-99313-24	24.0	72.0	92	25	31	55		0.30	24.6
00-99313-25	25.0	75.0	114	32	43	58	N9GX090308 NS-30072 NK-T9 2.0Nm	0.50	26.0
00-99313-26	26.0	78.0	115	32	43	58		0.50	27.0
00-99313-27	27.0	81.0	117	32	43	58		0.40	27.8
00-99313-28	28.0	84.0	126	32	43	58		0.40	28.8
00-99313-29	29.0	87.0	127	32	43	58		0.30	29.6
00-99313-30	30.0	90.0	130	32	43	58		0.30	30.6

Holder 4xD 16mm~30mm



Ordering code	ØD	T	L	Ød1	Ød2	L1	Insert Screw / Key	Radial Adjustment	D max
00-99314-16	16	64	90	25	31	55	N9GX060204 NS-22055 0.9Nm NK-T7	0.40	16.8
00-99314-17	17	68	93	25	31	55		0.35	17.7
00-99314-18	18	72	96	25	31	55		0.30	18.6
00-99314-19	19	76	99	25	31	55		0.25	19.5
00-99314-20	20	80	105	25	31	55	N9GX070304 NS-25060 1.2Nm NK-T7	0.50	21.0
00-99314-21	21	84	108	25	31	55		0.45	21.9
00-99314-22	22	88	110	25	31	55		0.40	22.8
00-99314-23	23	92	113	25	31	55		0.35	23.7
00-99314-24	24	96	116	25	31	55		0.30	24.6
00-99314-25	25	100	139	32	43	58	N9GX090308 NS-30072 2.0Nm NK-T9	0.50	26.0
00-99314-26	26	104	141	32	43	58		0.50	27.0
00-99314-27	27	108	144	32	43	58		0.40	27.8
00-99314-28	28	112	154	32	43	58		0.40	28.8
00-99314-29	29	116	156	32	43	58		0.30	29.6
00-99314-30	30	120	160	32	43	58		0.30	30.6

Trouble Shooting

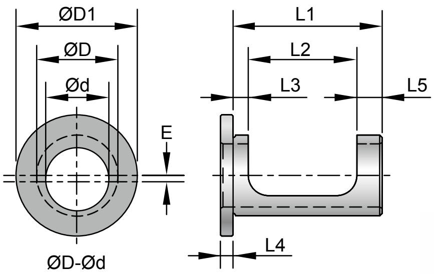
Problem	Hole diameter become smaller at hole bottom	Hole diameter become larger at hole bottom	Hole diameter become smaller from the hole inlet
Details	 **A>B** No problem at hole inlet, but hole diameter decreases gradually	 **A<B** No problem at hole inlet, but hole diameter increases gradually	 **A<B** Hole diameter become smaller from inlet. (at stationary drilling)
Cause	Chip evacuation from inner and outer edge	Chip evacuation from inner edge	Improper cutting dia. adjustment Inner insert is above the center (No core remains)
Countermeasure	Change the cutting conditions ·Increase the cutting speed ·Reduce the feed rate	Change the cutting conditions ·Increase the cutting speed ·Reduce the feed rate	When using with lathe, adjust the hole dia. by moving the tool the in X-axis direction See page 32

Eccentric Ring

for 3xD, 4xD Super Drill

Sleeve Dimension

- For hole diameter adjustment on Machining Center.
- For center height adjustment of CNC Lathe.



Ordering Code	Part No.	Dimension (mm)								Adjustment Range (mm)
		ØD	Ød	ØD1	L1	L2	L3	L4	L5	E
00-99302-2520	LS25-ID20	25	20	41	43	33	3	4	7	+0.2, –0.2
00-99302-3225	LS32-ID25	32	25	48	59	41	6	5	12	
00-99302-4032	LS40-ID32	40	32	58	69	43	6	5	20	

How to Use

- Eccentric Ring is designed for only the small diameter Drill.
- Eccentric Ring is for cutting diameter adjustment only. (up to +0.2mm or -0.2mm)
- Eccentric Ring is not for center height adjustment like a conventional adjustable sleeve.
- Apply Eccentric Ring when adjusting the cutting diameter.
  a. Set the outer edge horizontally: 90° to the marking line on the sleeve (Fig.1)
  b. To adjust to a larger diameter, align the +0.2 mark on the sleeve with the flat on the drill shank.
     To adjust to a smaller diameter, align the -0.2 mark on the sleeve with the flat on the drill shank.
  c. Tighten the bottom screw firmly which is directly touching the drill. Slightly tighten the upper screw which is directly touching the sleeve.

Fig. 1 Diameter Adjustment Method (ex. Ø10 Drill)

To adjust for a Larger Diameter	To adjust for a Smaller Diameter

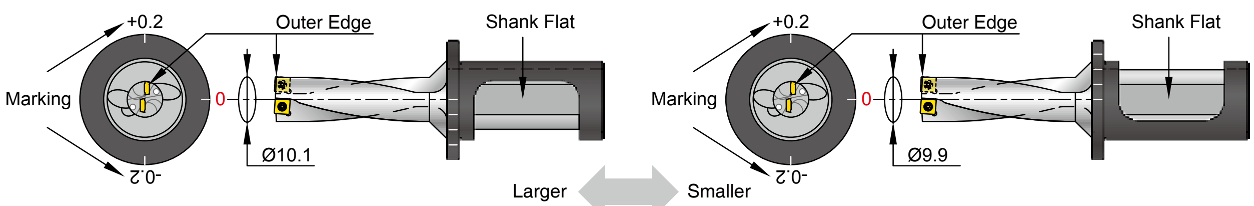
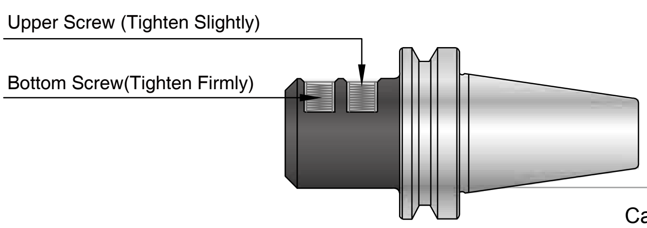


Fig. 2



Caution: Not for use with Collet Chuck type Arbor

Technical Guide
Cutting Data

Work piece material	T= Length/ Dia.	Vc (m/min.)	f (mm/rev.) N9GX 04T002 Dia. 10~12.5	N9GX 05T103 Dia. 13~15.5	N9GX 060204 Dia. 16~19.5	N9GX 070304 Dia. 20~24	N9GX 090308 Dia. 25~30	Grade of insert
Carbon steel C<0.3% Ex.:S25C, SS41	T=3D	80~250	0.03~0.06	0.04~0.08	0.06~0.10	0.06~0.10	0.08~0.12	NC2032
	T=4D	60~180	—	—	0.06~0.10	0.06~0.10	0.08~0.12	
Carbon steel C>0.3% Ex.:S50C, P5	T=3D	80~300	0.04~0.08	0.06~0.10	0.06~0.12	0.08~0.12	0.08~0.15	NC2032
	T=4D	60~150	—	—	0.06~0.12	0.08~0.12	0.08~0.15	
Low alloy steel C<0.3% Ex.:SCM415	T=3D	80~250	0.04~0.08	0.04~0.08	0.06~0.10	0.06~0.10	0.08~0.12	NC2032
	T=4D	60~150	—	—	0.06~0.10	0.06~0.10	0.08~0.12	
Low alloy steel C>0.3% Ex.:SCM440	T=3D	80~250	0.04~0.08	0.04~0.10	0.06~0.12	0.06~0.12	0.08~0.15	NC2032
	T=4D	60~150	—	—	0.06~0.12	0.06~0.12	0.08~0.15	
High alloy steel Ex.:SKD11	T=3D	60~150	0.03~0.06	0.04~0.08	0.06~0.10	0.06~0.10	0.08~0.12	NC2032
	T=4D	50~100	—	—	0.06~0.10	0.06~0.10	0.08~0.12	
Casting steel	T=3D	80~180	0.03~0.06	0.04~0.08	0.06~0.10	0.06~0.10	0.08~0.12	NC2032
	T=4D	60~120	—	—	0.06~0.10	0.06~0.10	0.08~0.12	
Stainless steel Ex.:SUS304	T=3D	60~150	0.03~0.06	0.04~0.08	0.04~0.10	0.06~0.10	0.06~0.12	NC2032
	T=4D	50~100	—	—	0.04~0.10	0.06~0.10	0.06~0.12	
Casting Iron Ex.:FC25	T=3D	80~120	0.04~0.08	0.06~0.08	0.06~0.08	0.06~0.10	0.08~0.12	NC2032
	T=4D	60~100	—	—	0.06~0.08	0.06~0.10	0.08~0.12	
Hardened steel <HRC 50° Ex.:SKD61	T=3D	60~100	0.03~0.06	0.04~0.08	0.05~0.08	0.06~0.08	0.06~0.10	NC2032
	T=4D	40~80	—	—	0.05~0.08	0.06~0.08	0.06~0.10	

* The maximum misalignment of the drill center is +0.2 mm/-0.5 mm on the CNC lathe.

Metric

$$S = \frac{Vc \times 1000}{\pi \times d}$$

F = S x f

d =	diameter -mm
S =	Spindle Speed -r.p.m.
Vc =	Cutting Speed -m/min.
f =	mm/rev.
F =	mm/min.

Inch

$$S = \frac{(3.82 \times SFM)}{d}$$

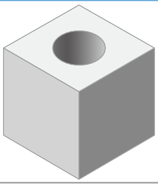
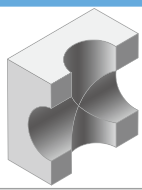
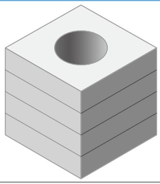
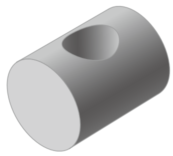
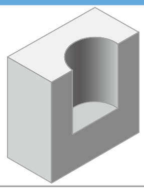
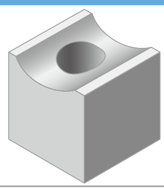
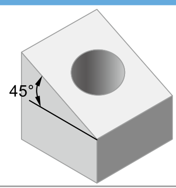
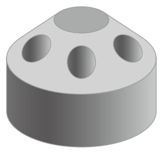
F = f x S

d =	diameter-inch
S =	Spindle Speed-r.p.m.
SFM =	Surface Speed-ft./min. Vc (m/min.) x 3.28
f = IPR =	inch/rev.
F =	IPM=RPM x f / 25.4.

Technical Guide

Application of Drill in Different Conditions

Material Classifiction for Calculation

Application	* Regular Surface	Cross Holes	Stack Drilling	Round Work Piece Offset Drilling
Work Piece Shape				
Cutting Speed Vc (m/min.)	100%	80%	80%~70%	80%~60%
Feed Rate (mm/rev.)	100%	80%	80%~70%	80%~60%
Application	**Plunge Drilling**	**Concave Surfaces**	**Angled Surfaces**	**Cone Work Piece Offset Drilling**
Work Piece Shape				
Cutting Speed Vc (m/min.)	80%	80%	80%~70%	80%~70%
Feed Rate (mm/rev.)	80%	80%	80%~70%	80%~70%

* SPD, SD both are suitable.

Adjustment on CNC Lathe

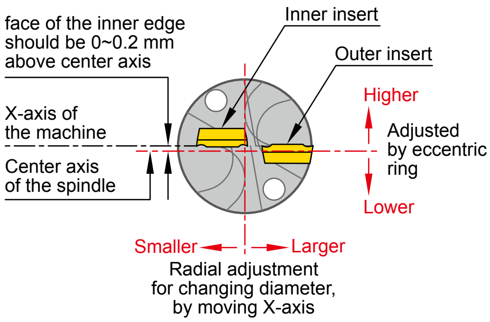
Centre height on the lathe

- The face of the inner edge must be 0-0.2 mm over the centre.
- The height of the inner edge can be adjusted by eccentric ring.

Diameter of the drill

- The diameter of the drilled hole can be adjusted along X-axis of the lathe.
- The maximum radial adjustment is shown on the specification of the product.

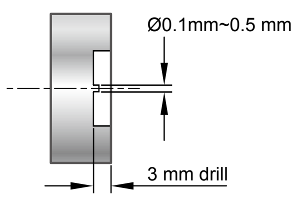
Caution



Check the centre height of the inner insert

- Drill 3 mm depth and check that there is a small pip at the centre of the bottom of the hole.
- The pip should be between 0.1mm and 0.5mm in diameter.
- If there is no pip; the inner insert must be adjusted to be over the centre.
- If the pip is larger than 0.5mm diameter; the centre of the drill should be adjusted lower.

Caution



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