SLIDE SHAFT SPINDLE SHAFT

SLIDE SHAFT

SPINDLE SHAFT/SPINDLE UNIT

GENERAL MACHINE SHAFTING

SHAFT

The NB shaft can be used in a wide range of applications as a mechanical component from straight shaft to spindle shaft. NB's expertise in machining and heat-treatment turns into manufacturing spindle shaft, roll shaft, and general machinery shaft for rotational motion. NB's high accuracy technology answers various shaft machining requirements.

ADVANTAGES

Advanced Machining Technology

NB performs a wide variety of highly accurate machining processes to provide custom shafting from relatively simple machining, such as tapping and shaft stepping to the more demanding high-speed rotating shafts and spindles. NB can also answer the special grinding and bore machining requirements.

Excellent Wear Resistance

Most commonly used materials are high-carbon chromium bearing steel (SUJ2) and martensite stainless steel (SUS440C or equivalent). NB's advanced heat-treatment technology gives these materials an excellent wear resistance by quenching and tempering to achieve a uniform hardened layer in the circumferential and axial directions. The cross-sectional picture below shows the hardened layer-depth of the NB shaft.

Hardened Layer
(cross section)

Surface Roughness

Precision grinding results in a surface roughness of less than Ra0.4.

Wide Selection of Shaft Types

SN type, SNS type, SNT type,
SNB, SNSB type (Center-lined tapped shaft)
SNW, SNWS type (Inch shaft)
SNW-PD, SNWS-PD type (Inch, pre-drilled shaft)
Spindle shaft, roll shaft

Special Requirements

Based on the customer drawings and specifications NB will answer the customer requirements in material (SCM, SKS etc.), heat-treatment, surface treatment, etc.

Shaft Supporter and Shaft Support Rail
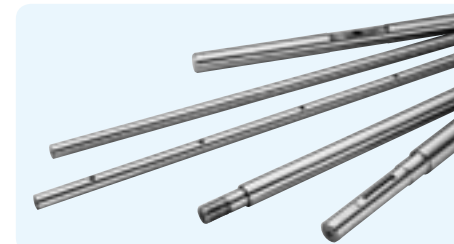
These components ease the shaft installation and help save the design/assembling time. (refer to page F-14)

FIT Series
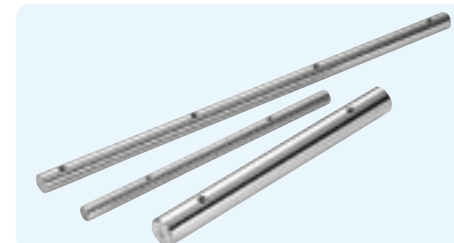
This series is a set of NB slide bush and NB shaft. By precise shaft-grinding, FIT series achieves the best-fit clearance adjustment for a smooth, high accuracy linear motion. (refer to page F-24)

TYPES

### SN/SNS/SNT type (NB Shaft)
SNW/SNWS type (Inch Shaft)

SNB/SNSB type (NB Center-lined Tapped Shaft)
SNW-PD/SNWS-PD type (Inch Shaft, Pre-drilled Shaft)

Shaft Supporter and Shaft Support Rail

SH-A type	SH type	SHF type SHF-FC type	SA type
P.F-15	P.F-16	P.F-17	P.F-18

WH-A type	WA type	LWA type
P.F-20	P.F-22	P.F-23

Special Specifications

P.F-26

NB shaft is a high-precision shaft that can be used with slide bush or any other bearings. A wide range of machining is provided for customer drawings and requirements.

Table F-1 Specifications

type	SN type	SNS type	SNT type
material	SUJ2	equivalent to SUS440C	SUJ2 (hollow shaft)
outer diameter tolerance	g6 or to be specified		
hardness	60HRC or more	56HRC or more	60HRC or more
surface roughness	Ra0.4 or less		
page	page F-6	page F-7	page F-8
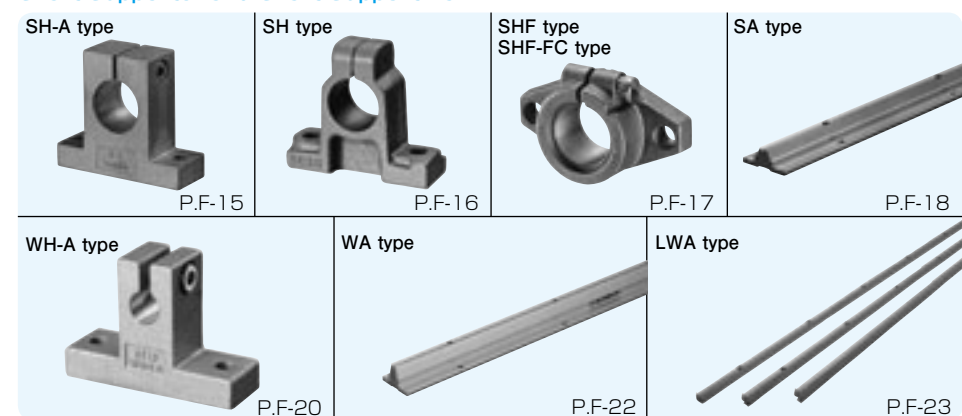
Center-lined tapped shafts are standardized series for easy selection that can be used with the SA shaft support rails. (refer to page F-18)

Table F-2 Specifications
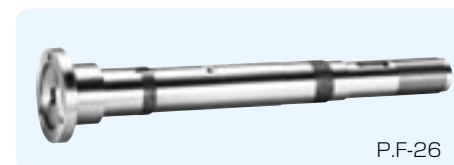
type	SNB type	SNSB type
material	SUJ2	equivalent to SUS440C
outer diameter tolerance	g6 or to be specified	
hardness	60HRC or more	56HRC or more
surface roughness	Ra0.4 or less	
page	page F-9	

The SNW and SNWS types are inch dimensional shafts with the same specifications as SN/SNS type (refer to page F-10,11). SNW-PD and SNWS-PD types are standardized series that can be used with the WA shaft support rails. (refer to page F-12,13,22)

Based on drawings and specifications, NB manufactures spindle shafts, and roll shafts for the rotary motion application. Material, heat-treatment (hardening/tempering), surface treatment, etc, NB meets customer requirements. Please contact NB for details.

CALCULATION OF DEFLECTION AND DEFLECTION ANGLE

The following formulas are used to obtain the deflection and its angle of the shaft. Typical conditions are listed in Table F-3.

Table F-3 Formulas for Calculating Deflection and Deflection Angle

	support method	specification	formula for deflection	formula for deflection angle
1	support ∥ support	ℓ/2, P	$\delta_{max}=\dfrac{P\ell^3}{48EI}=P\ell^3C$	$i_1=0$ $i_2=\dfrac{P\ell^2}{16EI}=3P\ell^2C$
2	fixed ∥ fixed	ℓ/2, P	$\delta_{max}=\dfrac{P\ell^3}{192EI}=\dfrac{1}{4}P\ell^3C$	$i_1=0$ $i_2=0$
3	support ∥ support	uniformly distributed load p	$\delta_{max}=\dfrac{5p\ell^4}{384EI}=\dfrac{5}{8}p\ell^4C$	$i_2=\dfrac{p\ell^3}{24EI}=2p\ell^3C$
4	fixed ∥ fixed	uniformly distributed load p	$\delta_{max}=\dfrac{p\ell^4}{384EI}=\dfrac{1}{8}p\ell^4C$	$i_2=0$
5	support ∥ support	a, b, a, P, P	$\delta_1=\dfrac{Pa^3}{6EI}\left(2+\dfrac{3b}{a}\right)=8Pa^3\left(2+\dfrac{3b}{a}\right)C$ $\delta_{max}=\dfrac{Pa^3}{24EI}\left(\dfrac{3\ell^2}{a^2}-4\right)=2Pa^3\left(\dfrac{3\ell^2}{a^2}-4\right)C$	$i_1=\dfrac{Pab}{2EI}=24PabC$ $i_2=\dfrac{Pa(a+b)}{2EI}=24Pa(a+b)C$
6	fixed ∥ fixed	a, b, a, P, P	$\delta_1=\dfrac{Pa^3}{6EI}\left(2-\dfrac{3a}{\ell}\right)=8Pa^3\left(2-\dfrac{3a}{\ell}\right)C$ $\delta_{max}=\dfrac{Pa^3}{24EI}\left(2+\dfrac{3b}{a}\right)=2Pa^3\left(2+\dfrac{3b}{a}\right)C$	$i_1=\dfrac{Pa^2b}{2EI\ell}=\dfrac{24Pa^2bC}{\ell}$ $i_2=0$
7	fixed ∥ free	P	$\delta_{max}=\dfrac{P\ell^3}{3EI}=16P\ell^3C$	$i_1=\dfrac{P\ell^2}{2EI}=24P\ell^2C$ $i_2=0$
8	fixed ∥ free	uniformly distributed load p	$\delta_{max}=\dfrac{p\ell^4}{8EI}=6p\ell^4C$	$i_1=\dfrac{p\ell^3}{6EI}=8p\ell^3C$ $i_2=0$
9	support ∥ support	ℓ/2, Mo	$\delta_{max}=\dfrac{\sqrt{3}Mo\ell^2}{216EI}=\dfrac{2\sqrt{3}}{9}Mo\ell^2C$	$i_1=\dfrac{Mo\ell}{12EI}=4Mo\ell C$ $i_2=\dfrac{Mo\ell}{24EI}=2Mo\ell C$
10	fixed ∥ fixed	ℓ/2, Mo	$\delta_{max}=\dfrac{Mo\ell^2}{216EI}=\dfrac{2}{9}Mo\ell^2C$	$i_1=\dfrac{Mo\ell}{16EI}=3Mo\ell C$ $i_2=0$

δ_1: deflection at the concentrated load point (mm) δ_{max}: maximum deflection (mm) i_1: deflection angle at the concentrated load point (rad)
i_2: deflection angle at the support point (rad)   Mo: moment (N・mm)   P: concentrated load (N)
p: uniformly distributed load (N/mm)   a,b: concentrated load point distance (mm)   ℓ: span (mm)   I: moment of inertia of area (mm⁴)
E: modulus of longitudinal elasticity (SUJ2) 2.06×10⁵ (N/mm²) (SUS) 2.0×10⁵ (N/mm²)   C: 1/48EI (1/N・mm²)

The moment of inertia of area (I) is obtained using the following formulas:

● For solid shaft

$$I=\frac{\pi D^4}{64}$$

● For hollow shaft

$$I=\frac{\pi}{64}(D^4-d^4)$$

I: moment of inertia of area (mm⁴)
D: outer diameter (mm)   d: inner diameter (mm)

The values of the moment of inertia of area and C (=1/48 EI) for NB shafts are listed in Table F-4 and F-5.

Calculation Examples

1. Calculating the maximum deflection of a 30mm shaft with a 500mm span when a concentrated load of 980 N is applied at the mid-point of the shaft … (neglecting the shaft weight)

① In case the support method is support-support:
From the given conditions, P = 980 N, ℓ = 500mm
From Table F-4, C for an outer diameter of 30 mm, C=2.54×10⁻¹² (N・mm²).
Substituting these values into the corresponding formula (No. 1) in Table F-3,
$\delta_{max}=P\ell^3C=0.31$ (mm)

② In case the support method is fixed-fixed:
Substituting the values into the corresponding formula (No. 2) given in Table F-3,
$\delta_{max}=\dfrac{1}{4}P\ell^3C=0.08$ (mm)

2. Calculating the maximum deflection of a 60mm shaft with an inner diameter of 32 mm and a 2,000 mm span by its own weight …

From Table F-5, C for an outer diameter of 60 mm, C=1.73×10⁻¹³ (N・mm²)
The mass per unit length of a shaft with an outer diameter of 60 mm and an inner diameter of 32 mm is 15.9kg/m. Therefore, a uniformly distributed load of 0.156 N/mm is applied. Substituting these values into the formula (No. 3) given in Table F-3.
$\delta_{max}=\dfrac{5}{8}p\ell^4C=0.27$ (mm)

Table F-4 Solid Shaft

outer diameter D (mm)	moment of inertia of area I (mm⁴)	C=1/48EI (1/N・mm²) SUJ2	C=1/48EI (1/N・mm²) equivalent to SUS440C
3	3.98	2.54×10⁻⁸	2.62×10⁻⁸
4	1.26×10	8.05×10⁻⁹	8.29×10⁻⁹
5	3.07×10	3.30×10⁻⁹	3.40×10⁻⁹
6	6.36×10	1.59×10⁻⁹	1.64×10⁻⁹
8	2.01×10²	5.03×10⁻¹⁰	5.18×10⁻¹⁰
10	4.91×10²	2.06×10⁻¹⁰	2.12×10⁻¹⁰
12	1.02×10³	9.94×10⁻¹¹	1.02×10⁻¹⁰
13	1.40×10³	7.21×10⁻¹¹	7.43×10⁻¹¹
15	2.49×10³	4.07×10⁻¹¹	4.19×10⁻¹¹
16	3.22×10³	3.14×10⁻¹¹	3.24×10⁻¹¹
20	7.85×10³	1.29×10⁻¹¹	1.33×10⁻¹¹
25	1.92×10⁴	5.27×10⁻¹²	5.43×10⁻¹²
30	3.98×10⁴	2.54×10⁻¹²	2.62×10⁻¹²
35	7.37×10⁴	1.37×10⁻¹²	1.41×10⁻¹²
40	1.26×10⁵	8.05×10⁻¹³	8.29×10⁻¹³
50	3.07×10⁵	3.30×10⁻¹³	3.40×10⁻¹³
60	6.36×10⁵	1.59×10⁻¹³	1.64×10⁻¹³
80	2.01×10⁶	5.03×10⁻¹⁴	5.18×10⁻¹⁴
100	4.91×10⁶	2.06×10⁻¹⁴	—
120	1.02×10⁷	9.94×10⁻¹⁵	—
150	2.49×10⁷	4.07×10⁻¹⁵	—
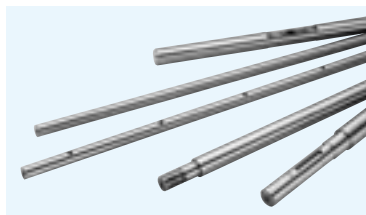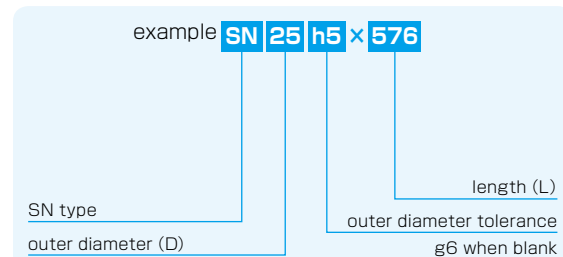
Table F-5 Hollow Shaft

outer diameter D (mm)	inner diameter d (mm)	moment of inertia of area I (mm⁴)	C=1/48EI (1/N・mm²)
6	2	6.28×10	1.61×10⁻⁹
8	3	1.97×10²	5.13×10⁻¹⁰
10	4	4.78×10²	2.11×10⁻¹⁰
12	5	9.87×10²	1.02×10⁻¹⁰
13	6	1.34×10³	7.55×10⁻¹¹
16	8	3.02×10³	3.36×10⁻¹¹
20	10	7.36×10³	1.37×10⁻¹¹
25	15	1.67×10⁴	6.06×10⁻¹²
30	16	3.65×10⁴	2.77×10⁻¹²
35	19	6.73×10⁴	1.50×10⁻¹²
40	20	1.18×10⁵	8.57×10⁻¹³
50	26	2.84×10⁵	3.56×10⁻¹³
60	32	5.85×10⁵	1.73×10⁻¹³
80	48	1.75×10⁶	5.78×10⁻¹⁴
100	60	4.27×10⁶	2.37×10⁻¹⁴
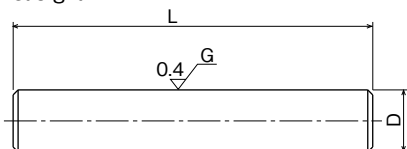
SHAFT

SN TYPE
– NB Shaft –

part number structure

example **SN** **25** **h5** × **576**

SN type
outer diameter (D)
outer diameter tolerance
g6 when blank
length (L)

straight
machined (example)

L
0.4 G
D
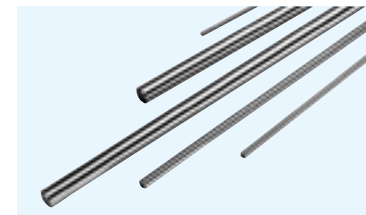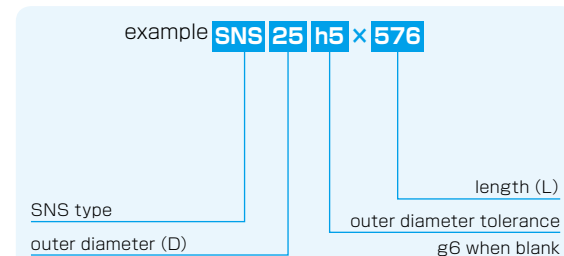
part number	outer diameter D mm	tolerance g6 μm	length L mm		mass Kg/m
SN 3	3	−2/−8	50 ←→ 400		0.06
SN 4	4	− 4 −12	100 ←→ 500		0.10
SN 5	5		100 ←→ 700		0.16
SN 6	6		100 ←→ 1000		0.23
SN 8	8	− 5 −14	200 ←→ 1500		0.40
SN 10	10		200 ←→ 2000		0.62
SN 12	12	− 6 −17	200 →3000		0.89
SN 13	13		200 →3000		1.04
SN 15	15		300 ←→ 4000		1.39
SN 16	16		300 ←→ 4000		1.58
SN 20	20	− 7 −20	300 ←→ 5000		2.47
SN 25	25		300 ←→ 6000		3.85
SN 30	30		300 ←→ 6000		5.55
SN 35	35	− 9 −25	400 ←→ 6000		7.55
SN 40	40		400 ←→ 6000		9.87
SN 50	50		500 ←→ 6000		15.4
SN 60	60	−10	600 ←→ 6000		22.2
SN 80	80	−29	800 ←→ 6000		39.5
SN100	100	−12	1000 ←→ 6000		61.7
SN120	120	−34	1500 ←→ 4500		88.8
SN150	150	−14/−39	1500 ←→ 4500		139

material: high-carbon chromium bearing steel (SUJ2) hardness: 60HRC (HV697) or more
Tolerances other than g6 are available upon request.
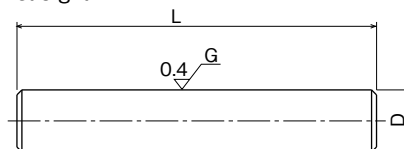
SNS TYPE
– NB Stainless Steel Shaft –

part number structure

example **SNS** **25** **h5** × **576**

SNS type
outer diameter (D)
outer diameter tolerance
g6 when blank
length (L)

straight
machined (example)

L
0.4 G
D

part number	outer diameter D mm	tolerance g6 μm	length L mm		mass Kg/m
SNS 3	3	−2/−8	50 ←→ 300		0.06
SNS 4	4	− 4 −12	100 ←→ 400		0.10
SNS 5	5		100 ←→ 500		0.16
SNS 6	6		100 ←→ 600		0.22
SNS 8	8	− 5 −14	200 ←→ 1000		0.39
SNS 10	10		200 ←→ 1500		0.61
SNS 12	12	− 6 −17	200 →2500		0.88
SNS 13	13		200 ←→ 3000		1.03
SNS 16	16		300 →4000		1.56
SNS 20	20	− 7 −20	300 ←→ 5000		2.43
SNS 25	25		300 ←→ 6000		3.80
SNS 30	30		300 ←→ 6000		5.48
SNS 35	35	− 9 −25	400 ←→ 6000		7.46
SNS 40	40		400 ←→ 6000		9.75
SNS 50	50		500 ←→ 6000		15.2
SNS 60	60	−10	600 ←→ 6000		21.9
SNS 80	80	−29	800 ←→ 6000		39.0
SNS100	100	−12/−34	1000 ←→ 6000		60.9
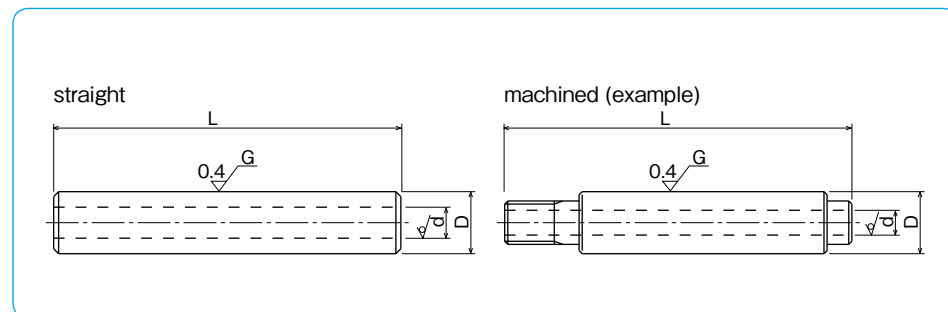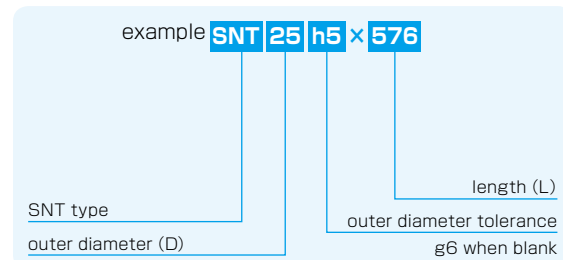
material: martensite stainless steel (equivalent to SUS440C)
hardness: 56HRC (HV613) or more
The maximum length of hardening is up to 4500mm for shafts with diameter over 80mm.
Tolerances other than g6 are available upon request.

SHAFT

SNT TYPE
— NB Hollow Shaft —

part number structure

example **SNT** **25** **h5** × **576**

- SNT type
- outer diameter (D)
- outer diameter tolerance
  g6 when blank
- length (L)

straight

machined (example)

part number	outer diameter D	tolerance g6	inner diameter d	length L	mass
	mm	μm	mm	mm	Kg/m
SNT 6	6	−4/−12	2	100 ← → 400	0.20
SNT 8	8	− 5	3	200 ← → 600	0.34
SNT 10	10	−14	4	200 ← → 1000	0.52
SNT 12	12	− 6	5	200 ← → 1500	0.73
SNT 13	13	−17	6	200 ← → 1500	0.82
SNT 16	16		8	300 ← → 2500	1.18
SNT 20	20	− 7	10	300 ← → 4000	1.85
SNT 25	25	−20	15	300 ← → 4000	2.46
SNT 30	30		16	300 ← → 4500	3.97
SNT 35	35	− 9	19	400 ← → 4500	5.32
SNT 40	40	−25	20	400 ← → 4500	7.39
SNT 50	50		26	500 ← → 4500	11.3
SNT 60	60	−10	32	600 ← → 4500	15.9
SNT 80	80	−29	48	800 ← → 4500	25.3
SNT100	100	−12/−34	60	1000 ← → 4500	39.5
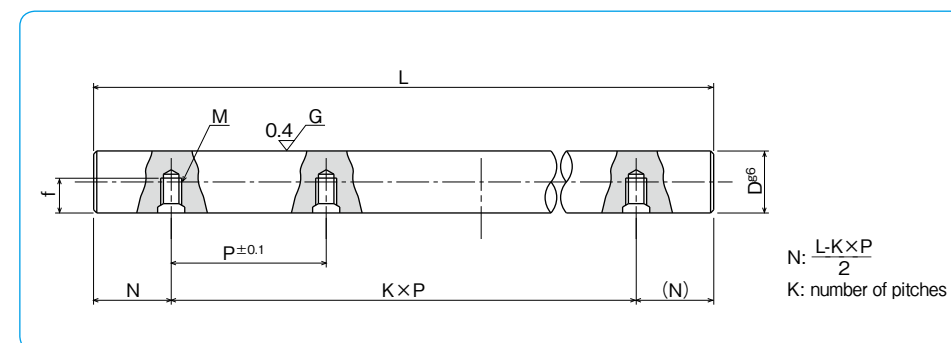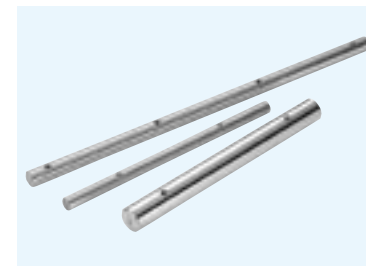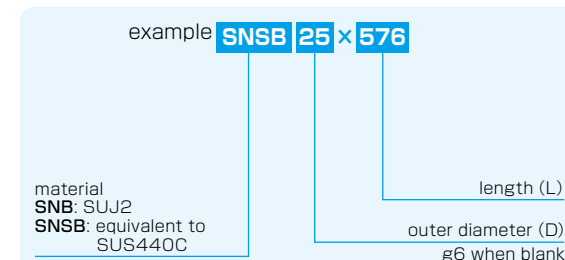
material: high-carbon chromium bearing steel (SUJ2)
hardness: 60HRC (HV697) or more
Tolerances other than g6 are available upon request.

NB CENTER-LINED TAPPED SHAFT

A larger diameter shaft can overcome problems in maintaining precision functionality when a high or unbalanced load is applied. A combination of the center-lined tapped shaft together with the SA type support rail is ideal in such cases. (see pages F-18,19) The center-lined tapped shaft is standardized to simplify shaft selection.

part number structure

example **SNSB** **25** × **576**

- material
  SNB: SUJ2
  SNSB: equivalent to SUS440C
- outer diameter (D)
  g6 when blank
- length (L)

$$N: \frac{L-K \times P}{2}$$
K: number of pitches

NB Center-Lined Tapped Shaft

part number	outer diameter D	tolerance g6*	pitch P	screw size M	tap depth f	maximum length L_max
	mm	μm	mm		mm	mm
SNB10	10	−5/−14	100	M4	4.5	1,500
SNB12	12	− 6	100	M4	5.5	1,800
SNB13	13	−17	100	M4	6	2,000
SNB16	16		150	M5	7	2,000
SNB20	20	− 7	150	M6	9	3,000
SNB25	25	−20	200	M6	12	4,000
SNB30	30		200	M8	15	4,500
SNB35	35	− 9	200	M8	15	5,000
SNB40	40	−25	300	M8	18	6,000
SNB50	50		300	M10	22	6,000

material: high-carbon chromium bearing steel (SUJ2)
hardness: 60HRC (HV697) or more
*g6 is a standard tolerance of the outer diameter.

NB Center-Lined Tapped Stainless Steel Shaft

part number	outer diameter D	tolerance g6*	pitch P	screw size M	tap depth f	maximum length L_max
	mm	μm	mm		mm	mm
SNSB16	16	−6/−17	150	M5	7	2,000
SNSB20	20	− 7	150	M6	9	3,000
SNSB25	25	−20	200	M6	12	4,000
SNSB30	30		200	M8	15	4,500
SNSB35	35	− 9	200	M8	15	5,000
SNSB40	40	−25	300	M8	18	6,000
SNSB50	50		300	M10	22	6,000
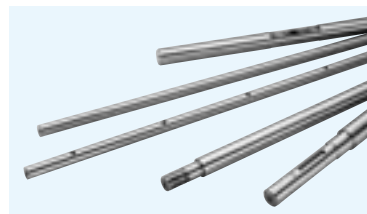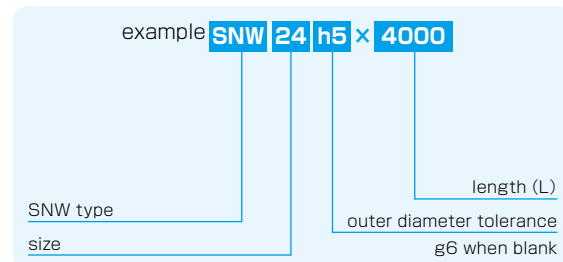
material: martensite stainless steel (equivalent to SUS440C)
hardness: 56HRC (HV613) or more
*g6 is a standard tolerance of the outer diameter.
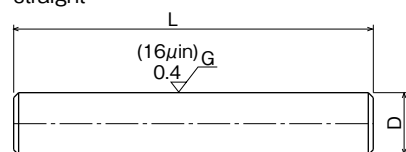
SNW TYPE
— NB Inch Shaft —
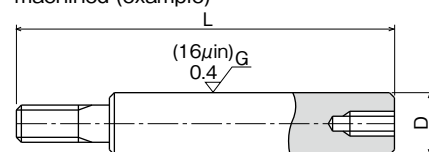
part number structure

example **SNW** **24** **h5** × **4000**

- SNW type
- size
- outer diameter tolerance
  g6 when blank
- length (L)

straight   machined (example)

(16µin)G 0.4

part number	outer diameter		length	mass
	D inch / mm	tolerance g6 inch/µm	L inch / mm	lbs/inch Kg/m
SNW 4	1/4 / 6.350	−.0002 / −.0006	3.94 → 39.37 / 100 → 1000	0.014 / 0.25
SNW 6	3/8 / 9.525	−5 / −14	7.84 → 59.06 / 200 → 1500	0.031 / 0.56
SNW 8	1/2 / 12.700	−.0002 / −.0007	7.84 → 118.11 / 200 → 3000	0.056 / 0.99
SNW10	5/8 / 15.875	−6 / −17	7.84 → 157.48 / 200 → 4000	0.086 / 1.55
SNW12	3/4 / 19.050	−.0003 / −.0008	11.81 → 157.48 / 300 → 4000	0.125 / 2.24
SNW16	1 / 25.400	−7 / −20	11.81 → 157.48 / 300 → 4000	0.222 / 3.98
SNW20	1-1/4 / 31.750	−.0004 / −.0010	11.81 → 157.48 / 300 → 4000	0.348 / 6.22
SNW24	1-1/2 / 38.100	−9 / −25	15.75 → 157.48 / 400 → 4000	0.500 / 8.95
SNW32	2 / 50.800	−.0004 / −.0011 −10 / −29	19.69 → 157.48 / 500 → 4000	0.890 / 15.91
SNW40	2-1/2 / 63.500		23.62 → 157.48 / 600 → 4000	1.391 / 25.00
SNW48	3 / 76.200		23.62 → 157.48 / 600 → 4000	2.003 / 37.92
SNW64	4 / 101.600	−.0005 / −.0013 −12 / −34	39.37 → 157.48 / 1000 → 4000	3.560 / 64.02
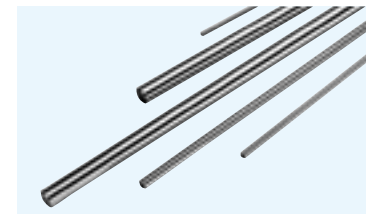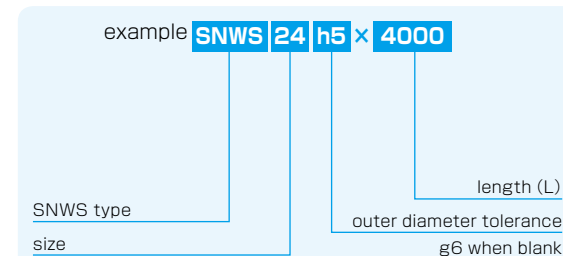
material: high-carbon chromium bearing steel (SUJ2)
hardness: 60HRC (HV697) or more
Tolerances other than g6 are available upon request.

1kg≒2.205lbs
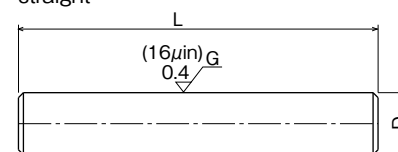
SNWS TYPE
— NB Inch Stainless Steel Shaft —
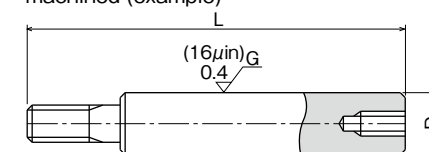
part number structure

example **SNWS** **24** **h5** × **4000**

- SNWS type
- size
- outer diameter tolerance
  g6 when blank
- length (L)

straight   machined (example)

(16µin)G 0.4

part number	outer diameter		length	mass
	D inch / mm	tolerance g6 inch/µm	L inch / mm	lbs/inch Kg/m
SNWS 4	1/4 / 6.350	−.0002 / −.0006	3.94 → 23.62 / 100 → 600	0.014 / 0.25
SNWS 6	3/8 / 9.525	−5 / −14	7.84 → 39.37 / 200 → 1000	0.031 / 0.55
SNWS 8	1/2 / 12.700	−.0002 / −.0007	7.84 → 98.43 / 200 → 2500	0.056 / 0.98
SNWS10	5/8 / 15.875	−6 / −17	7.84 → 118.11 / 200 → 3000	0.086 / 1.54
SNWS12	3/4 / 19.050	−.0003 / −.0008	11.81 → 157.48 / 300 → 4000	0.125 / 2.22
SNWS16	1 / 25.400	−7 / −20	11.81 → 157.48 / 300 → 4000	0.222 / 3.95
SNWS20	1-1/4 / 31.750	−.0004 / −.0010	11.81 → 157.48 / 300 → 4000	0.420 / 6.16
SNWS24	1-1/2 / 38.100	−9 / −25	15.75 → 157.48 / 400 → 4000	0.500 / 8.88
SNWS32	2 / 50.800	−.0004/−.0011 −10/−29	19.69 → 157.48 / 500 → 4000	0.890 / 15.78

material: martensite stainless steel (equivalent to SUS440C)
hardness: 56HRC (HV613) or more
Tolerances other than g6 are available upon request.

1kg≒2.205lbs

SNW-PD
— NB Inch Pre-Drilled Shaft —

part number structure
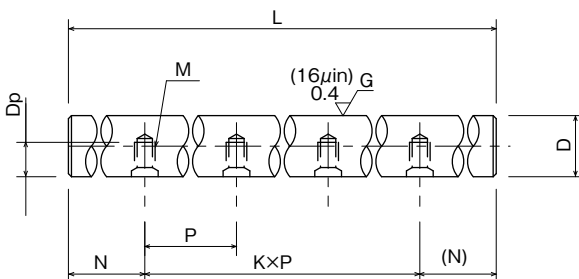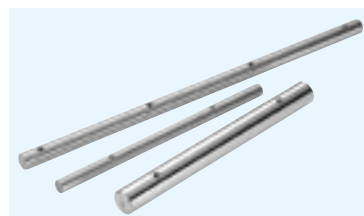
example **SNW** **24** **h5** × **72** - **PD**

SNW type
size
outer diameter tolerance
g6 when blank
length (L in inches)
pre-drilled shaft

$N: \dfrac{L-K\times P}{2}$
K: number of pitches

| part number | outer diameter | | pitch | bolt size | tapped hole depth | maximum length |
	D inch mm	tolerance g6* inch/μm	P inch/mm	M	Dp inch/mm	L inch/mm
SNW 8-PD	1/2 12.700	−.0002 −.0007	4 101.6	# 6-32	0.280 7.1	
SNW10-PD	5/8 15.875	−6 −17		# 8-32	0.350 8.9	
SNW12-PD	3/4 19.050	−.0003 −.0008	6 152.4	# 10-32	0.400 10.2	
SNW16-PD	1 25.400	−7 −20		1/4-20	0.500 12.7	72 1,828.8
SNW20-PD	1-1/4 31.750	−.0004 −.0010		5/16-18	0.650 16.5	
SNW24-PD	1/1/2 38.100	−9 −25	8 203.2	3/8-16	0.700 17.8	
SNW32-PD	2 50.800	−.0004/−.0011 −10/−29		1/2-13	0.850 21.6	

1kg≒2.205lbs

material: high-carbon chromium bearing steel (SUJ2)
hardness: 60HRC (HV697) or more
Tolerances other than *g6 are available upon request.
Longer lengths are also available.

SNWS-PD
— NB Inch Pre-Drilled Stainless Steel Shaft —
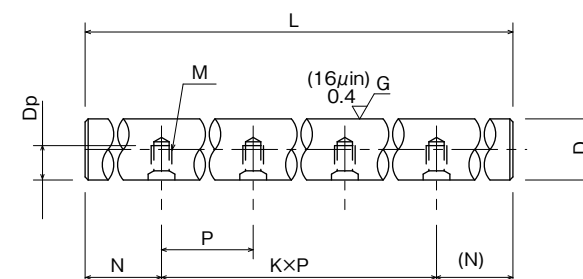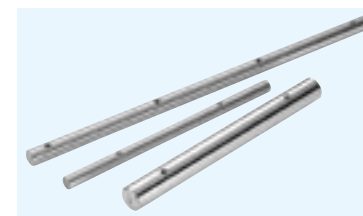
part number structure

example **SNWS** **24** **h5** × **72** - **PD**

SNWS type
size
outer diameter tolerance
g6 when blank
length (L in inches)
pre-drilled shaft

$N: \dfrac{L-K\times P}{2}$
K: number of pitches

| part number | outer diameter | | pitch | bolt size | tapped hole depth | maximum length |
	D inch mm	tolerance g6* inch/μm	P inch/mm	M	Dp inch/mm	L inch/mm
SNWS12-PD	3/4 19.050	−.0003 −.0008	6 152.4	#10−32	0.400 10.2	
SNWS16-PD	1 25.400	−7 −20		1/4−20	0.500 12.7	
SNWS20-PD	1-1/4 31.750	−.0004 −.0010		5/16−18	0.650 16.5	72 1,828.8
SNWS24-PD	1-1/2 38.100	−9 −25	8 203.2	3/8−16	0.700 17.8	
SNWS32-PD	2 50.800	−.0004/−.0011 −10/−29		1/2−13	0.850 21.6	

material: martensite stainless steel (equivalent to SUS440C)
hardness: 56HRC (HV613) or more
Tolerances other than *g6 are available upon request.
Longer lengths are also available.

SHAFT SUPPORTER AND SHAFT SUPPORT RAIL

These components save design/assembling time and ease shaft installation.

SH・SH-A・WH-A type

These are most commonly used compact shaft supporters. SH type is made of cast iron and SH-A/WH-A type is made of aluminum alloy.

|	
SH-A type	P.F-15
SH type	P.F-16
WH-A type	P.F-20
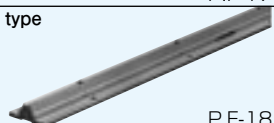
SHF・SHF-FC type

These are flanged type shaft supporters for a compact design. SHF is made of aluminum alloy and SHF-FC (shaft diameter 35 and over) is made of cast iron.

SHF type SHF-FC type	P.F-17
SA type	P.F-18

SA・WA・LWA type (shaft support rail)

These support rails support shafts from below to avoid shaft deflection for a long-stroke/high load application. This type is made of aluminum alloy.
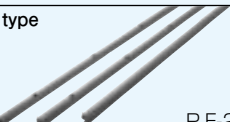
WA type	P.F-22
LWA type	P.F-23

ACCURACY OF SA TYPE SUPPORT RAIL

The accuracy of the SA support rails are measured as shown in Figure F-1.

Figure F-1 Measurement Method
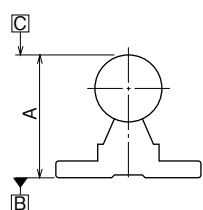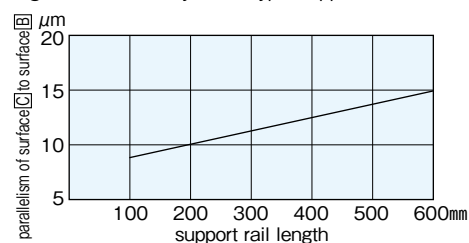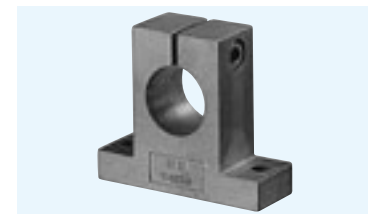
Figure F-2 Accuracy of SA type Support Rail

SH-A TYPE
− Shaft Supporter −
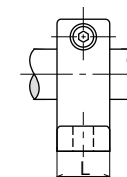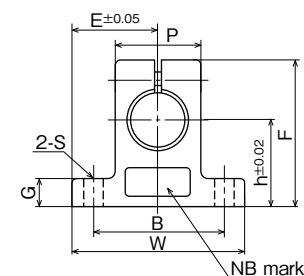
part number structure

example **SH 25 A**

SH-A type

shaft diameter

part number	shaft diameter mm	major dimensions									tightening screw		mass
		h mm	E mm	W mm	L mm	F mm	G mm	P mm	B mm	S mm	size	recommended torque N·m	g
SH 8A	8	20	21	42	14	32.8	6	18	32	5.5 (M5)	M4	2	24
SH10A	10	20	21	42	14	32.8	6	18	32	5.5 (M5)	M4	2	24
SH12A	12	23	21	42	14	37.5	6	20	32	5.5 (M5)	M4	2	30
SH13A	13	23	21	42	14	37.5	6	20	32	5.5 (M5)	M4	2	30
SH16A	16	27	24	48	16	44	8	25	38	5.5 (M5)	M4	2	40
SH20A	20	31	30	60	20	51	10	30	45	6.6 (M6)	M5	3	70
SH25A	25	35	35	70	24	60	12	38	56	6.6 (M6)	M6	5.5	130
SH30A	30	42	42	84	28	70	12	44	64	9 (M8)	M6	5.5	180
SH35A	35	50	49	98	32	82	15	50	74	11 (M10)	M8	13.5	270
SH40A	40	60	57	114	36	96	15	60	90	11 (M10)	M8	13.5	420
SH50A	50	70	63	126	40	120	18	74	100	14 (M12)	M12	29	750
SH60A	60	80	74	148	45	136	18	90	120	14 (M12)	M12	29	1,100

SH TYPE
— Shaft Supporter —
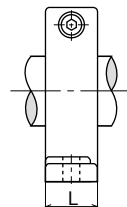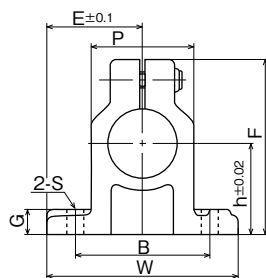
part number structure

example **SH** **25**

SH type   shaft diameter

part number	shaft diameter mm	h mm	E mm	W mm	L mm	F mm	G mm	P mm	B mm	S mm		tightening screw size	recommended torque N·m	mass g
SH10	10	20	22	44	15	35	7	19	32	4.5	(M4)	M4	2	80
SH13	13	23	25	50	17	40	8	17	32	7	(M5)	M4	2	120
SH16	16	27	27.5	55	17	45	10	25	38	7	(M5)	M4	2	120
SH20	20	31	32.5	65	20	53	12	30	45	8	(M6)	M5	3	190
SH25	25	35	38	76	24	61	12	35	56	8	(M6)	M6	5.5	300
SH30	30	42	42.5	85	28	73	15	42	64	10	(M8)	M6	5.5	490
SH35	35	50	50	100	32	87	15	50	74	12	(M10)	M8	13.5	690
SH40	40	60	60	120	36	104	18	58	90	12	(M10)	M10	29	1,200
SH50	50	70	70	140	40	122	20	68	100	14	(M12)	M12	29	1,700
SH60	60	80	82.5	165	45	140	23	80	120	14	(M12)	M12	29	2,500

SHF TYPE
— Shaft Supporter Flange Type —
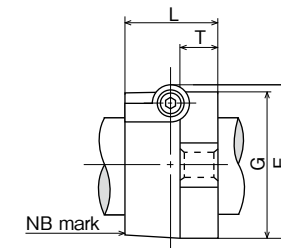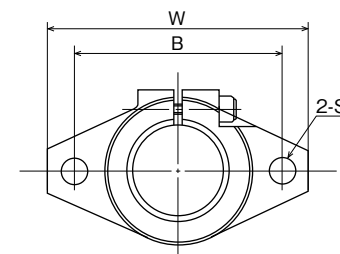
part number structure

example **SHF** **35** **FC**

SHF type

shaft diameter
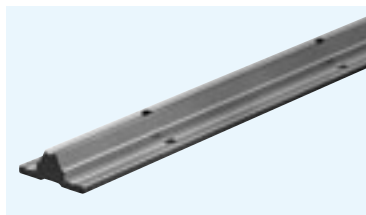
blank: aluminum alloy
FC: cast iron

part number aluminum alloy	cast iron	shaft diameter mm	W mm	L mm	T mm	F mm	G mm	B mm	S mm		tightening screw size	recommended torque N·m	mass g aluminum alloy	cast iron
SHF10	—	10	43	10	5	24	20	32	5.5	(M5)	M4	2	13	—
SHF12	—	12	47	13	7	28	25	36	5.5	(M5)	M4	2	20	—
SHF13	—	13	47	13	7	28	25	36	5.5	(M5)	M4	2	20	—
SHF16	—	16	50	16	8	31	28	40	5.5	(M5)	M4	2	27	—
SHF20	—	20	60	20	8	37	34	48	7	(M6)	M5	3	40	—
SHF25	—	25	70	25	10	42	40	56	7	(M6)	M5	3	60	—
SHF30	—	30	80	30	12	50	46	64	9	(M8)	M6	5.5	110	—
SHF35	SHF35FC	35	92	35	14	58	50	72	12	(M10)	M8	13.5	140	380
SHF40	SHF40FC	40	102	40	16	67	56	80	12	(M10)	M10	29	205	510
SHF50	SHF50FC	50	122	50	19	83	70	96	14	(M12)	M12	29	360	890
SHF60	SHF60FC	60	140	60	23	95	82	112	14	(M12)	M12	29	530	1,500

SA TYPE
— Shaft Support Rail —

part number structure
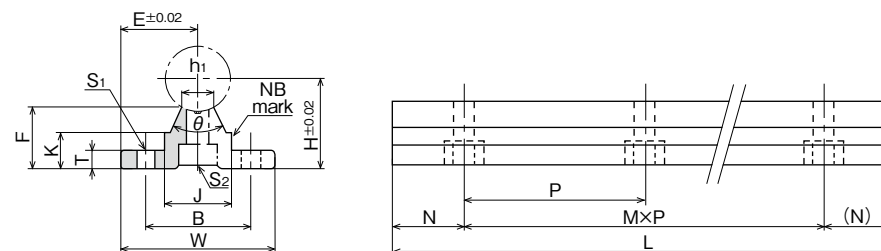
example **SA** **25** - **500**

- total length
- SA type
- shaft diameter

※ Mounting screws for the SN(S)B center-lined tapped shaft are included.

part number	shaft diameter mm	major dimensions															mass
		H mm	E mm	W mm	L mm	F mm	T mm	K mm	J mm	h₁ mm	θ	B mm	N mm	M×P mm	S₁ mm	S₂ mm	g
SA10-200					200								50	1×100			110
SA10-300					300								50	2×100			160
SA10-400	10	18	16	32	400	13.5	4	8.9	12.4	4.7	80°	22	50	3×100	4.5	M4	220
SA10-500					500								50	4×100			270
SA10-600					600								50	5×100			330
SA13-200					200								50	1×100			140
SA13-300					300								50	2×100			210
SA13-400	13	21	17	34	400	15	4.5	9.8	15	6	80°	25	50	3×100	4.5	M4	280
SA13-500					500								50	4×100			350
SA13-600					600								50	5×100			420
SA16-200					200								25	1×150			200
SA16-300					300								75	1×150			300
SA16-400	16	25	20	40	400	17.8	5	11.7	18.5	8	80°	30	50	2×150	5.5	M5	400
SA16-500					500								25	3×150			500
SA16-600					600								75	3×150			600
SA20-200					200								25	1×150			200
SA20-300					300								75	1×150			300
SA20-400	20	27	22.5	45	400	17.7	5	10	19	8	50°	30	50	2×150	5.5	M6	400
SA20-500					500								25	3×150			510
SA20-600					600								75	3×150			610
SA25-200					200								25	1×150			290
SA25-300					300								50	1×200			430
SA25-400	25	33	27.5	55	400	21	6	12	21.5	8	50°	35	100	1×200	6.5	M6	580
SA25-500					500								50	2×200			730
SA25-600					600								100	2×200			880

part number	shaft diameter mm	major dimensions															mass
		H mm	E mm	W mm	L mm	F mm	T mm	K mm	J mm	h₁ mm	θ	B mm	N mm	M×P mm	S₁ mm	S₂ mm	g
SA30-200					200								25	1×150			360
SA30-300					300								50	1×200			550
SA30-400	30	37	30	60	400	22.8	7	13	26.5	10.3	50°	40	100	1×200	6.5	M8	730
SA30-500					500								50	2×200			920
SA30-600					600								100	2×200			1,100
SA35-200					200								25	1×150			460
SA35-300					300								50	1×200			700
SA35-400	35	43	32.5	65	400	26.5	8	15.5	28	13	50°	45	100	1×200	9	M8	950
SA35-500					500								50	2×200			1,190
SA35-600					600								100	2×200			1,420
SA40-200					200								25	1×150			630
SA40-300					300								75	1×150			960
SA40-400	40	48	37.5	75	400	29.4	9	17	38	16	50°	55	50	1×300	9	M8	1,290
SA40-500					500								100	1×300			1,610
SA40-600					600								150	1×300			1,950
SA50-200					200								25	1×150			1,000
SA50-300					300								75	1×150			1,500
SA50-400	50	62	47.5	95	400	38.8	11	21	45	20	50°	70	50	1×300	11	M10	2,000
SA50-500					500								100	1×300			2,500
SA50-600					600								150	1×300			3,000

SHAFT

WH-A TYPE
− Shaft Supporter −
(Inch Standard)
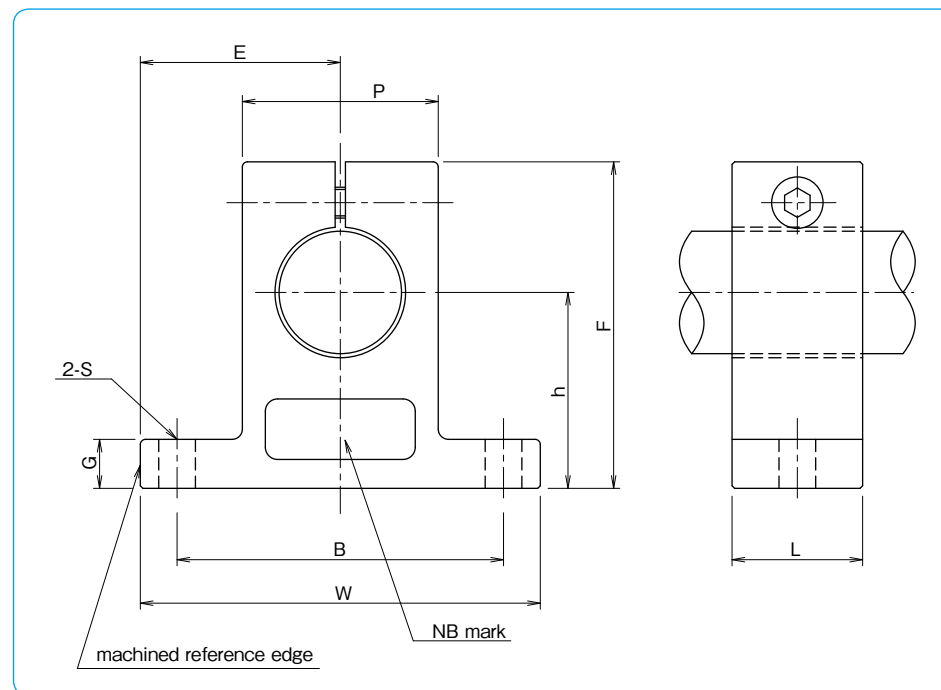
part number structure

example WH 24 A

WH-A type

size

machined reference edge

NB mark

part number	shaft diameter	major dimensions				
		h ±.001	E ±.005	W	L	F
	inch	inch	inch	inch	inch	inch
WH 4A	.2500	.6875	.7500	1.500	.500	1.063
WH 6A	.3750	.7500	.8125	1.625	.563	1.187
WH 8A	.5000	1.0000	1.0000	2.000	.625	1.625
WH 10A	.6250	1.0000	1.2500	2.500	.688	1.750
WH 12A	.7500	1.2500	1.2500	2.500	.750	2.063
WH 16A	1.0000	1.5000	1.5315	3.063	1.000	2.500
WH 20A	1.2500	1.7500	1.8750	3.750	1.125	3.000
WH 24A	1.5000	2.0000	2.1875	4.375	1.250	3.437
WH 32A	2.0000	2.5000	2.7500	5.500	1.500	4.375
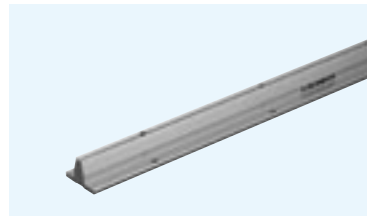
major dimensions					mass	part number
G	P	B ±.01	S	bolt#		
inch	inch	inch	inch	inch	lbs	
.250	.500	1.125	.156	# 6	.033	WH 4A
.250	.688	1.250	.156	# 6	.044	WH 6A
.250	.875	1.500	.188	# 8	.075	WH 8A
.313	1.000	1.875	.218	#10	.106	WH 10A
.313	1.250	2.000	.218	#10	.156	WH 12A
.375	1.500	2.500	.281	1/4	.294	WH 16A
.438	2.000	3.000	.346	5/16	.531	WH 20A
.500	2.250	3.500	.346	5/16	.725	WH 24A
.625	3.000	4.500	.406	3/8	1.400	WH 32A
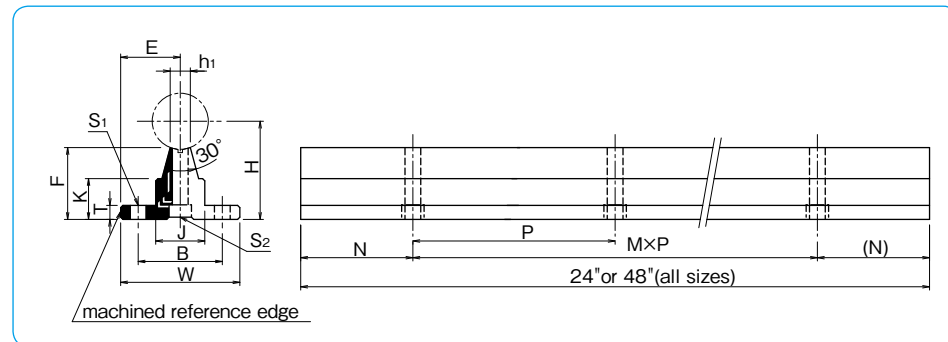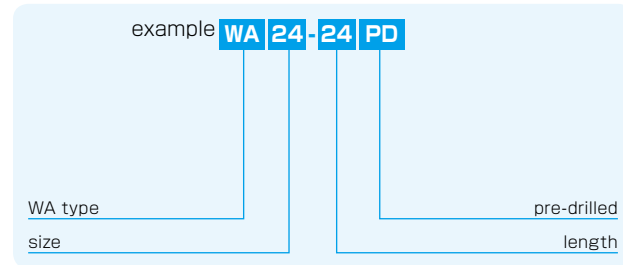
1kg≒2.205lbs
1lb≒0.454kg

SHAFT

WA TYPE
— Shaft Support Rail —

(Inch Standard)

part number structure

example **WA** **24**-**24** **PD**

WA type — pre-drilled
size — length

machined reference edge
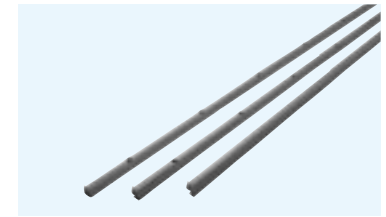
part number		shaft diameter	major dimensions								B ±.01	N	mounting dimensions					mass
			H ±.001	E ±.005	W	F	T	K	J	h1			M×P	S1 hole	S1 bolt#	S2 hole	S2 bolt#	
		inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	lbs
WA 8-	24PD	.5000	1.125	.7500	1.500	.903	.188	.466	.500	.255	1.000	2	5×4	.169	#6	.169	#6	1.326
	48PD												11×4					2.652
WA10-	24PD	.6250	1.125	.8125	1.625	.841	.250	.423	.500	.276	1.125	2	5×4	.193	#8	.193	#8	1.488
	48PD												11×4					2.976
WA12-	24PD	.7500	1.500	.8750	1.750	1.158	.250	.592	.625	.322	1.250	3	3×6	.221	#10	.221	#10	2.100
	48PD												7×6					4.200
WA16-	24PD	1.0000	1.750	1.0625	2.125	1.280	.250	.727	.875	.359	1.500	3	3×6	.281	1/4	.281	1/4	2.776
	48PD												7×6					5.552
WA20-	24PD	1.2500	2.125	1.2500	2.500	1.537	.313	.799	1.100	.437	1.875	3	3×6	.343	5/16	.343	5/16	4.060
	48PD												7×6					8.120
WA24-	24PD	1.5000	2.500	1.5000	3.000	1.798	.375	.922	1.375	.558	2.250	4	2×8	.343	5/16	.406	3/8	5.840
	48PD												5×8					11.680
WA32-	24PD	2.0000	3.250	1.8750	3.750	2.322	.500	1.450	1.500	.800	2.750	4	2×8	.406	3/8	.531	1/2	9.500
	48PD												5×8					19.000

All sizes are also available without pre-drilled mounting holes.
Complete shaft-rail assemblies are also available as well as custom drilling and lengths.
Please send drawings with customer specifications.
Product of NB Corporation of America
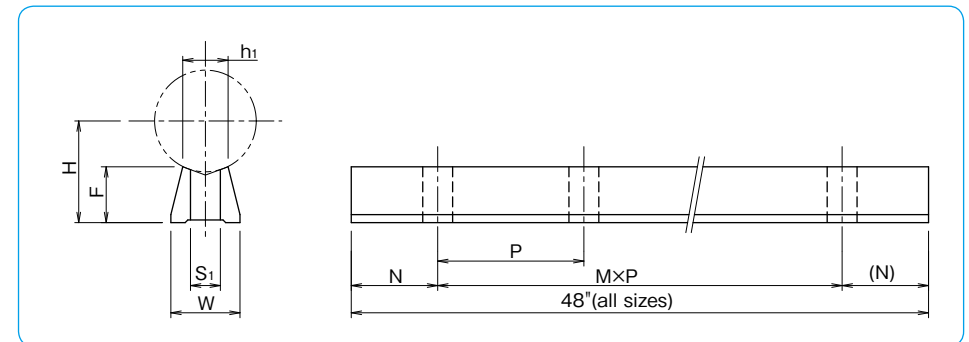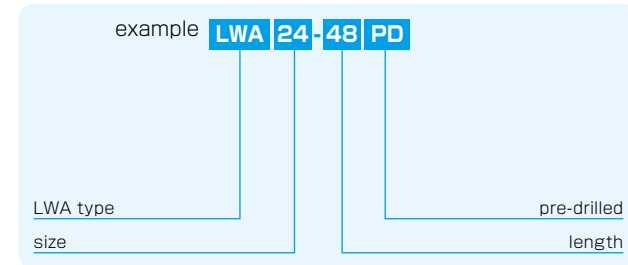
1kg≒2.205lbs
1lb≒0.454kg

LWA TYPE
— Low Shaft Support Rail —

(Inch Standard)

part number structure

example **LWA** **24**-**48** **PD**

LWA type — pre-drilled
size — length

part number	shaft diameter	major dimensions			major dimensions			S1	mass
		H ±.002	W	F	N	M×P	h1		
	inch	inch	inch	inch	inch	inch	inch	inch	lb
LWA 8-48 PD	.5000	.5625	.37	.341	2	11×4	0.25	.169	0.11
LWA 10-48 PD	.6250	.6875	.45	.405	2	11×4	0.276	.193	0.17
LWA 12-48 PD	.7500	.7500	.51	.409	3	7×6	0.317	.224	0.20
LWA 16-48 PD	1.0000	1.0000	.69	.545	3	7×6	0.422	.281	0.35
LWA 20-48 PD	1.2500	1.1875	.78	.617	3	7×6	0.520	.343	0.44
LWA 24-48 PD	1.5000	1.3750	.96	.691	4	5×8	0.630	.406	0.58
LWA 32-48 PD	2.0000	1.7500	1.18	.836	4	5×8	0.824	.531	0.89

Product of NB Corporation of America

1kg≒2.205lbs
1lb≒0.454kg

SHAFT

FIT SERIES

Due to the combined tolerances of the bush's bore and the shaft's diameter, accuracy can be affected by clearance or increased dynamic friction caused by preloading.
NB's FIT Series takes advantages of the lower cost slide bush and the precision ground shaft to achieve a target clearance in order for the linear system to produce a smooth, high-accuracy performance.

part number structure

example   F— SMS25GUU ×1 ／ SNS25×550

FIT series
slide bush part number
shaft part number
number of slide bush on one shaft

・Please refer to corresponding catalog pages for details.
・Please specify on the drawing about the shaft machining, radial clearance, match-marking, etc.

Recommended Radial Clearance

Depending on the type of application, the clearance range varies, please use the chart below as a guideline.

| target	clearance (+)	←	0	→	clearance (−)
light motion					
high accuracy					
no play					
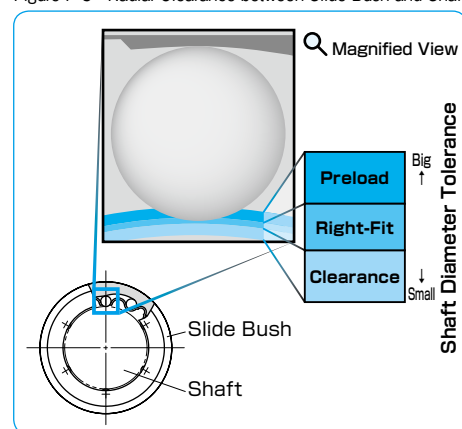
Slide Bush, Radial Clearance (−) , Negative Limit

Negative clearance is opted to reduce backlash. Please refer to the chart below for the negative clearance limits.

size	3～8	10～13	16～25	30～35	40	50～60
radial clearance limit	−3μm	−4μm	−6μm	−8μm	−10μm	−13μm

・ The off-center of the housing causes uneven loading on the slide bush, please pay special attention to the centering of the housing especially when negative clearance is a requirement.
・ Please contact NB for details on the extra preloading requirement or on other part numbers like SRE, SR, etc.

Figure F-3 Radial Clearance between Slide Bush and Shaft

🔍 Magnified View

Shaft Diameter Tolerance

Big ↑
Preload
Right-Fit
Clearance
Small ↓

Slide Bush
Shaft
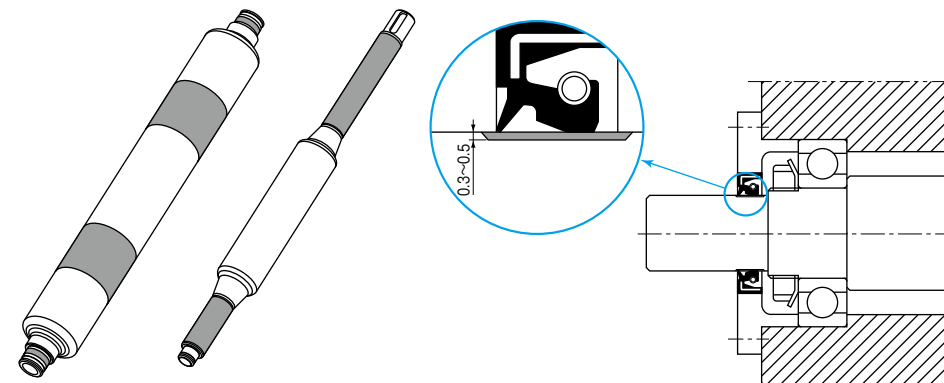
THERMAL-SPRAYING CERAMIC-COATING SPECIFICATIONS

ADVANTAGES

Parts that require wear and corrosion resistance can be thermal-sprayed with a ceramic material per NB's ceramic-coating specifications. Ceramic-coating can be applied to a wide variety of materials. The pores in the coated layer result in good lubrication characteristics and can be sealed to achieve high corrosion resistance.

APPLICATION EXAMPLE

0.3~0.5

Application of a ceramic coating to oil-sealing parts, rollers, and roll shafts results in good lubrication and high wear/corrosion resistance characteristics.
Note: Ceramic coated surface cannot be used as the inner race for a slide bush.

REFERENCE

Standard Coating Materials

High-carbon chromium bearing steel (SUJ2)	Martensite stainless steel (equivalent to SUS440C)
Chrome molybdenum steel (SCM415, 435)	Austenite stainless steel (SUS303, 304)
Carbon steel for machinery (S45C)	Tool steel (SKS3, SK4)

Proper heat treatment can be done on your request. Thermal-spraying ceramic-coating is applicable to other materials as well.
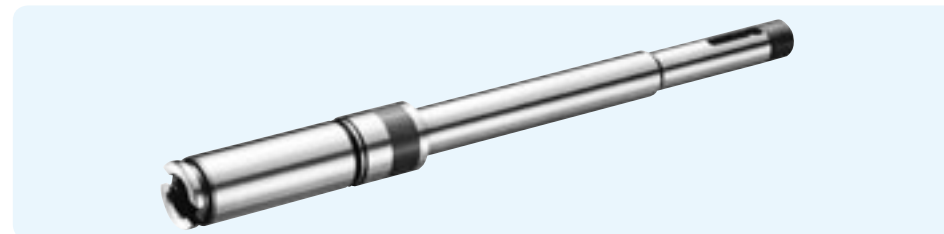
Standard Ceramic for Thermal-Spraying

main component	specific gravity	hardness	characteristics
TiO_2 titanium dioxide	4.7	58HRC	max. temp. 540℃ color: black wear resistant fine coating fine surface finish

thermal-spraying layer thickness: 0.3-0.5mm
Other types of ceramic materials can be thermal-sprayed. Contact NB for more information.

Example of Ceramic Coating

SPINDLE SHAFT & SPINDLE UNIT

NB Spindle Shaft is back by decades of precision manufacturing experience as well as up to date manufacturing facility to meet the demands. NB is capable of handling all your spindle needs such as manufacturing of bearing case and spindle base, design and manufacturing of spindle unit, and overhauling of spindles.

ADVANTAGES

Spindle Unit
NB provides overhauling, engineering services as well as manufacturing of spindle unit.

Ultra Precision Machining
Spindle manufacturing facility is controlled to a constant temperature throughout the year for precision manufacturing of spindles.

Various Machining Solution Available
BT, BBT, HSK inner tapers, gauge and bearing matching, thread grinding, and many other spindle related machining are available.

Surface Treatments
Various surface treatments are available such as hard chrome and ceramic coating. Repairing a damaged spindle with replating and grinding is also available.
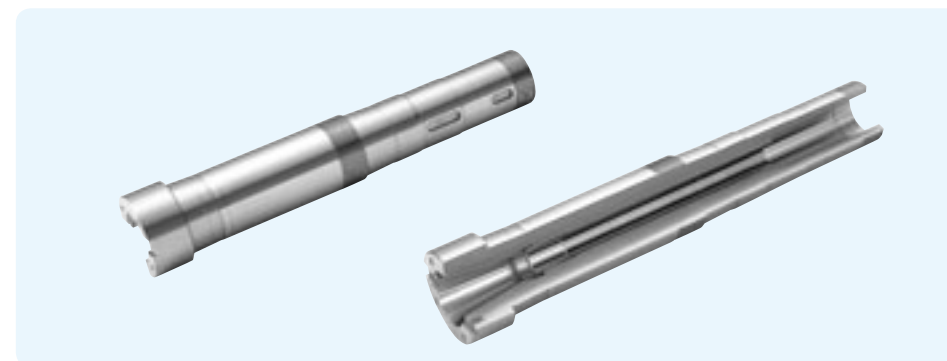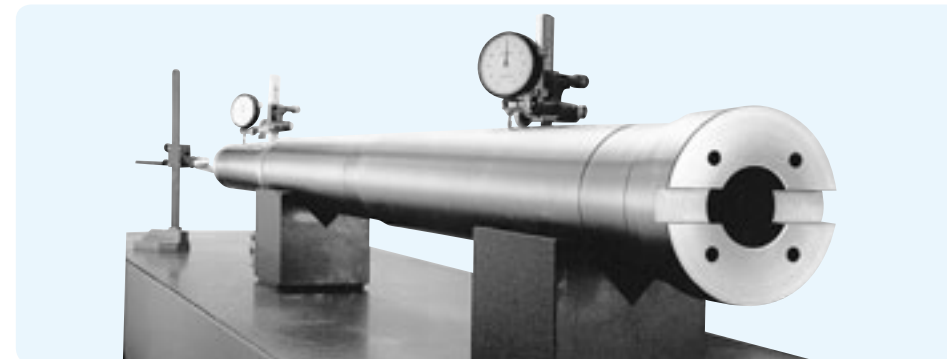
EXAMPLE OF SPINDLE UNIT DESIGN AND MACHINING
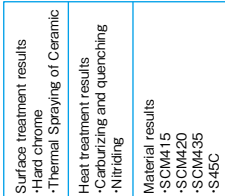
| Example of spindle unit specification	
Machine used	Machining center
Mounting orientation	Vertical
Rotational Speed	Max. 10,000 rpm (Max. 700 rpm without tooling attached)
Spindle taper size	♯30
Lubrication methods	Grease lubrication
Lubricant	ISOFLEX NBU15 (NOK Corporation)
Tool clamping power	400 kgf (theoretical)
Estimated drive power	3.5kW
Estimated weight	31kg

EXAMPLES OF MACHINING

Spindle

EXAMPLE OF DRAWING ①

This sample drawing is shown for a specification example purpose only. Please contact NB for manufacturing details.

Oil hole machining is available
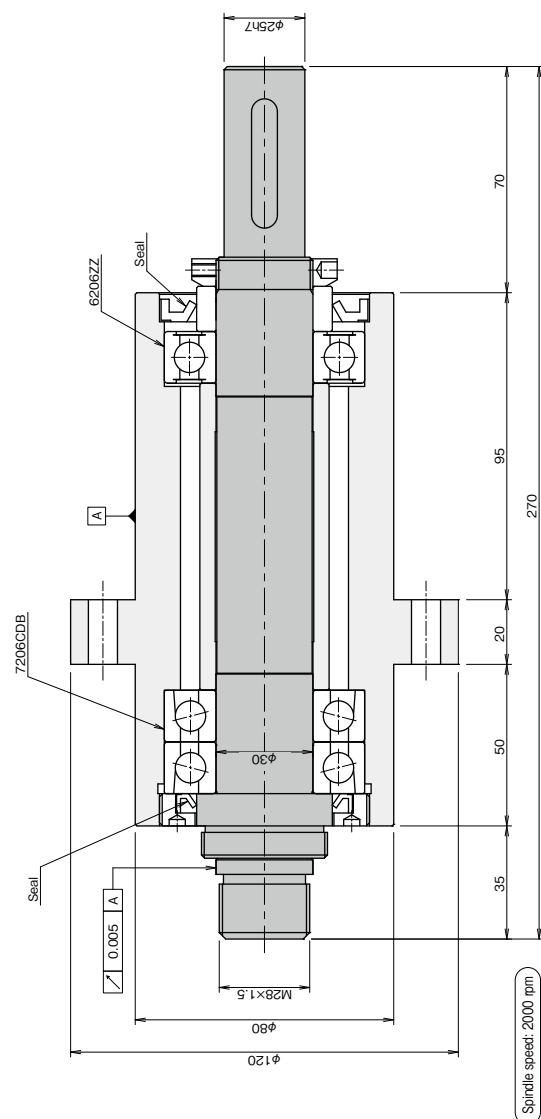
Up to BT50 internal taper grinding is available. Please contact NB for taper larger than BT60. Also, BTT, HSK and other taper standards are available.

2×ϕ5 thru, depth 81

7/24 Taper gauge matching

Shaft cross section

Gauging with customer supplied bearings available

1/12 Taper (gauge matching)

Up to 800 mm pitch between grinder wheel for thread grinding is available. Also, gauge match grinding available.

M70XP2

M90XP2.0

Surface treatment results
·Hard chrome
·Thermal Spraying of Ceramic

Heat treatment results
·Carburizing and quenching
·Nitriding

Material results
·SCM415
·SCM420
·SCM435
·S45C

F-28

EXAMPLE OF DRAWING ②

This sample drawing is shown for a specification example purpose only. Please contact NB for manufacturing details.

8-M10depth22

P.C.D.265

P.C.D.320

8-ϕ14 THRU, ϕ20 C.BORE, DEPTH 12

45°

Material results
·S45C
·SCM435

F-29

SHAFT

EXAMPLE OF DRAWING ③

6206ZZ

Seal

7206CDB

Seal

φ25h7

70

95

270

20

50

35

φ30

M28×1.5

φ80

φ120

A

0.005 A

Spindle speed: 2000 rpm

Custom design and manufacturing service for various spindle units is available. Please contact NB for details.

This sample drawing is shown for a specification example purpose only. Please contact NB for manufacturing details.

GENERAL MACHINE SHAFTING

NB general machine shafts are made to customer drawings. Integrated production from material sourcing, machining, heat treatments, surface treatments and final inspection, NB does it all.

ADVANTAGES

Small Lot Production Accepted
One piece custom accepted.

Variety of Machining Capabilities
From small to large, various shaft and spindle machining is available.

Surface Treatment
Various surface treatments are available such as hard chrome, electroless nickel plating, and low temperature black chrome.

Heat Treatment
Various heat treatments are available such as carburizing and induction hardening.

Materials	High Carbon Chromium Bearing Steel (SUJ2)
	Chrome Molybdenum Steel (JIS SCM415, 420, 435)
	Structural Carbon Steel (JIS S45C)
	Martensite Stainless Steel (SUS440)
	Austenite Stainless Steel (SUS303, 304)
	Tool Steel (JIS SK4)
	Tool Steel (JIS SKS3)
Heat Treatment	Induction Hardening
	Induction Hardening (deep)
	Carburizing and quenching
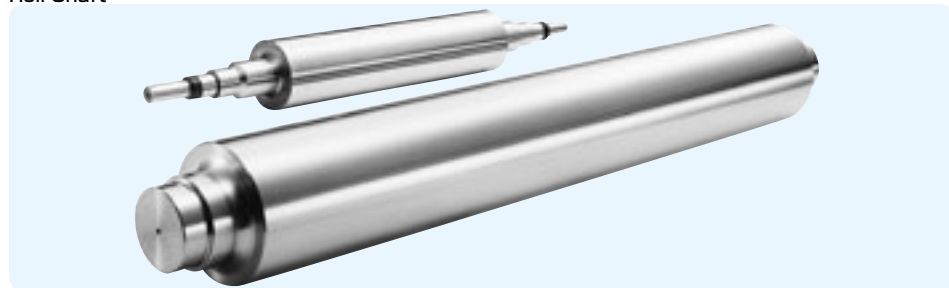
Surface Treatment	Hard Chrome
	Low Temperature Black Chrome
	Electroless Nickel Plating
	Thermal Spray Ceramic Coating
Others	Gauging with customer supplied nuts and bearings
	Triangular and trapezoidal thread grinding available

|	Process Details / Manufacturing Contents	Maximum Machinable Diameter	Maximum Machinable Length	Remarks / Notes
Machining Ability	Centerless Grinding	φ60 mm outer diameter	4000mm	
	External Grinder	φ640 mm outer diameter	6000mm	
	Internal Grinder	φ200 mm inner diameter	300mm	Allowable work length: up to 1100 mm
	Vertical Grinder	φ350 mm inner diameter	300mm	
		φ630 mm outer diameter	300mm	
	Lathe	φ400	3800mm	
	Horizontal Machining Center	φ350	2000mm	Up to 3000 kg
	Vertical Machining Center	φ300	3000mm	Up to 3000 kg
	BT / Gun Drilling	φ80	2000mm	Up to 4000 mm long with both end machining for less than φ120 Up to 2000 mm long for φ120 and over
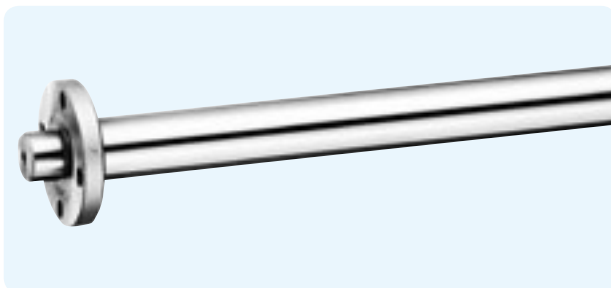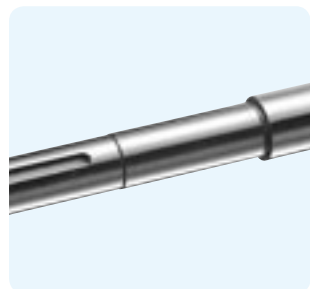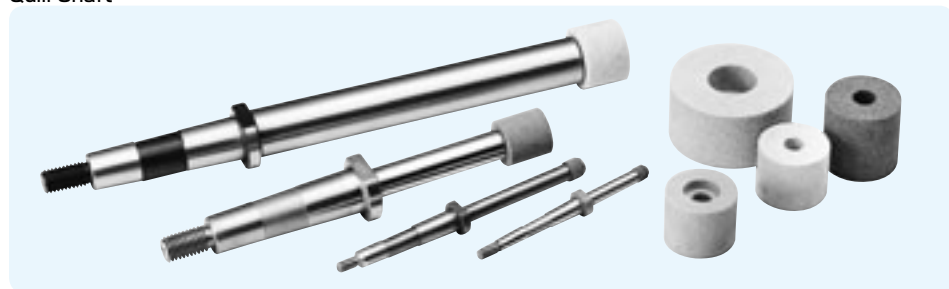
SHAFT

EXAMPLES OF MACHINING ①
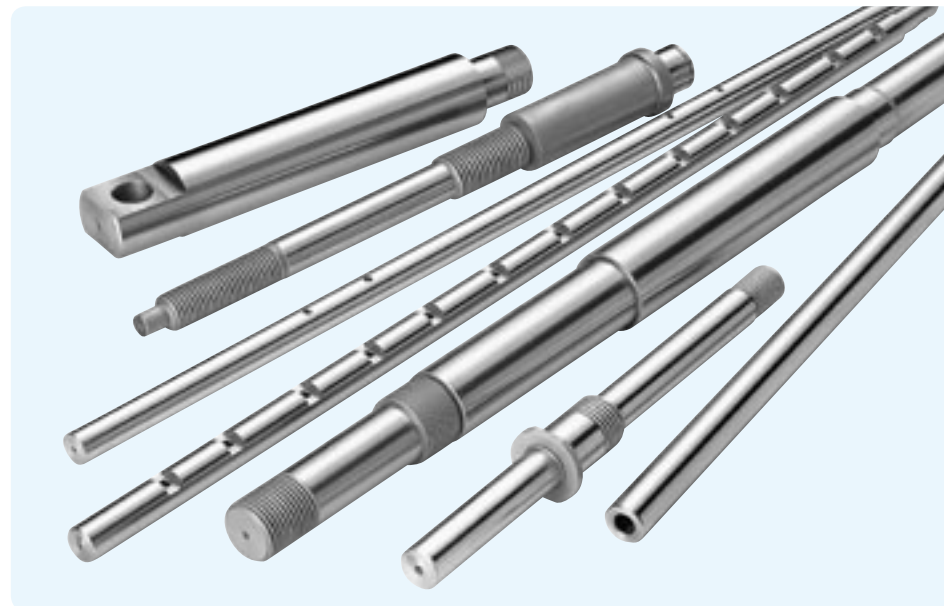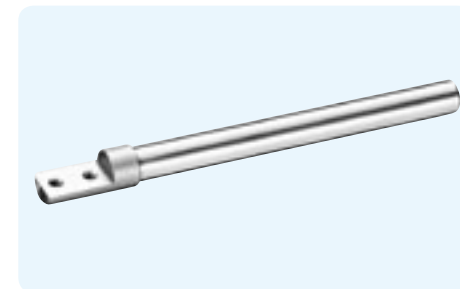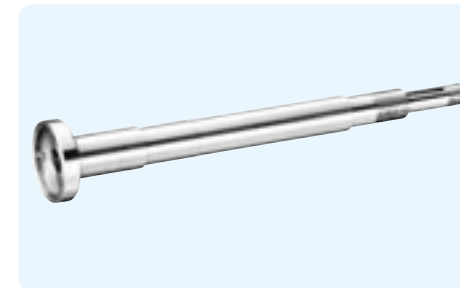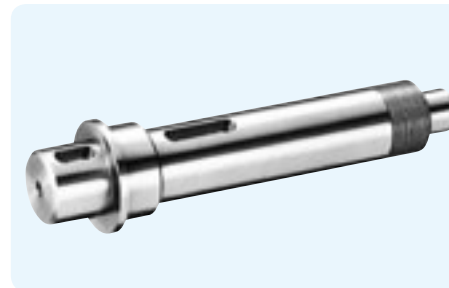
Roll Shaft

Quill Shaft

EXAMPLES OF MACHINING ②

Please visit at NB Website for more examples of machining.

SHAFT