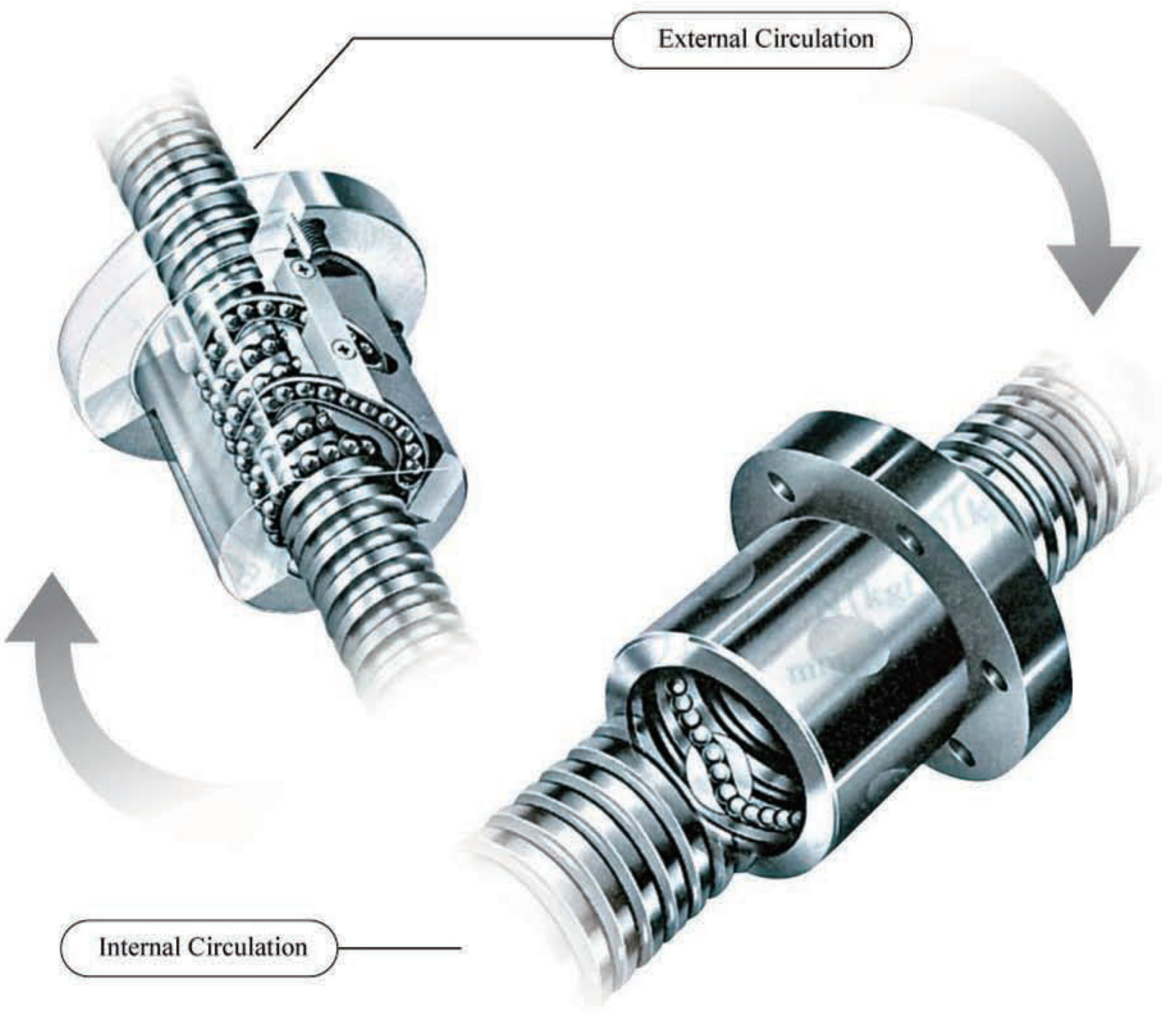
Circulation Types

Basically, Leadteam has 3 kinds of recirculartions in design

1.External Circulation Type: A tube is used to circulate balls. The tube scoops balls from the screw shaft passing through the return tube to their original position.

2.External Circulation Type: The deflector changes the route of ball movement as a ball override the thread crest and return to original position thus maintaining perpetual motion.



3. Endcap Circulation Type:

Accessories
Included : Screw , Nut, Ball, and Both Endcaps

Turns
Ball enters the tangential direction of the nut thread, through axial hole back to the other endcap into the screw thread.

High Smoothness
Due to the ball reflow in and out by the tangential direction. Leadteam uses longer patented design guidance path can come up with the best smoothness.

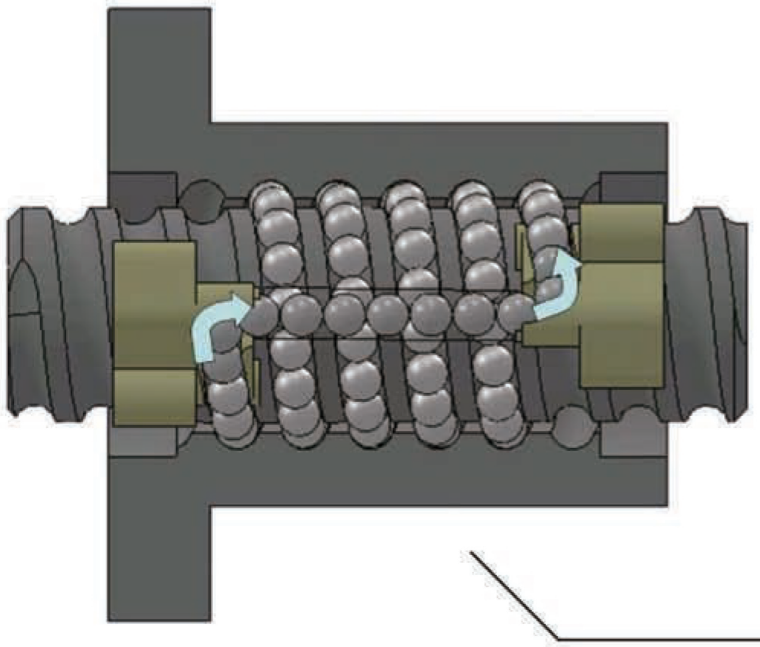
Silent
The single loop endcap reduces collision and loop is covered by nut to reduce the noise effectively.

Endcap strcuture Stable and Durable
High strength, larger type and double screw patened design can effectively stable endcap, reduce vibration loosening, and the usage of reinforced platic to increase the wear resistance.

Load
Same nut lenght can add more balls to endure larger loads.

Space
The Nut OD and lenght are shortening, so the volume can be reduced and the weight can be lighter.

Apllication
CNC Machine Tool Machinery, Cars, Elektronic, and Medical Automatic Production equipment.

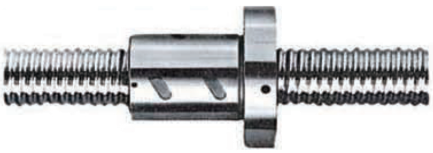


Ball Nut Selection

RSI: Single Round ,
Internal Nut

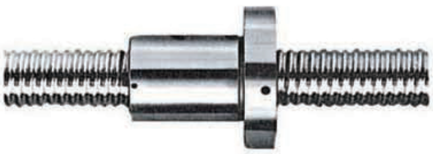
RSI: Double Round ,
Internal Nut

FSI: Single Found ,
Internal Nut



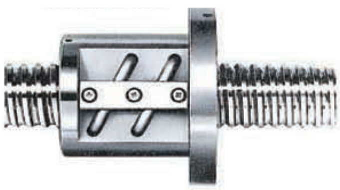
FDI: Double Flange,
Internal Nut

FSE: Flange Single Endcap



FDE: Flange Double Endcap

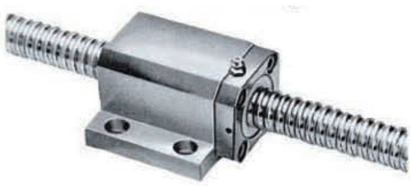
FSW: Single Flange,
External Nut



DFI: Double Flange,
Internal Nut

FDH: Double Flange Nut with
Housing

FRH: Flange Cylindrical
Nut with Housing



Internal Type Nomenclature

R80	X	20B3	X	FDW	X	6000	X	7000	X	C5
1		2		3		4		5		6

1 Screw Denote	A: Direction of Turn R:Right Hand L: Left Hand RL: Right and Hand on same screw B:Screw Shaft OD: 16. 20. 25. 28. 32. 36. 45. 50. 55. 63. 80. 100
2 Lead and Turns	A: Lead Metric: 4. 5. 6. 8. 10. 12. 16. 20... Inch :5.08/5TPI ;6.35/4TPI;12.7/2TPI B:Circuits : A.Per Circulate Has 1.5 Turns of Balls B.Per Circulate Has 2.5 Turns of Balls C.Per Circulate Has 3.5 Turns of Balls C: Number of Tubes Expressed By 1,2,3
3 Nut Shape	A: F: Flange Type R: Round Type S: Square Type G: Nut with Gear B: S:Single Nut D:Double Nut C: W: Tubes Within Nut Body V: Tubes above Nut Body
4 Thread Lenght	Unit : mm
5 Overall Lenght	Unit : mm
6 Accuracy Grade	Expressed by e_{300} C1 : 0.005 C2 : 0.007 C3 : 0.008 C4 : 0.012 C5 : 0.018 C6 : 0.023 C7 : 0.50 C10 : 0.120
7 Suitable for Use	Economical Mass Production High Lead Two Stats Larger external diameter of lead / Screw Shaft

Internal Type Nomenclature

R80	X	20T4	X	FDI	X	6000	X	7000	X	C5
1		2		3		4		5		6

1 Screw Denote	A: Direction of Turn R:Right Hand L: Left Hand RL: Right and Hand on same screw B:Screw Shaft OD: 16. 20. 25. 28. 32. 36. 45. 50. 55. 63. 80. 100
2 Lead and Turns	A: Lead Metric: 4. 5. 6. 8. 10. 12. 16. 20... Inch :5.08/5TPI ;6.35/4TPI;12.7/2TPI B: Circuits : T3 3 Turns of Balls per Nut T4 4 Turns of Balls per Nut T5 5 Turns of Balls per Nut T6 6 Turns of Balls per Nut
3 Nut Shape	A: F: Flange Type R: Round Type S: Square Type G: Nut with Gear B: S:Single Nut D:Double Nut C: Internal Deflector Nut
4 Thread Lenght	Unit : mm
5 Overall Lenght	Unit : mm
6 Accuracy Grade	Expressed by e_{300} C1 : 0.005 C2 : 0.007 C3 : 0.008 C4 : 0.012 C5 : 0.018 C6 : 0.023 C7 : 0.50 C10 : 0.120
7 Suitable for Use	Compact Miniature Screw

Internal Type Nomenclature

R63	X	10T4	X	FDE	X	6000	X	7000	X	C5
1		2		3		4		5		6

1 Screw Denote	A: Direction of Turn R:Right Hand L: Left Hand RL: Right and Hand on same screw B:Screw Shaft OD: 16. 20. 25. 32. 40. 45. 50. 63. . .
2 Lead and Turns	A: Lead Metric: 5. 10. 12... Inch :5.08/5TPI ;6.35/4TPI;12.7/2TPI B:Circuits: T4 4Turns of Balls per Nut T5 5Turns of Balls per Nut
3 Nut Shape	A: F: Flange Type B: S:Single Nut D:Double Nut C : E: Endcap
4 Thread Lenght	Unit : mm
5 Overall Lenght	Unit : mm
6 Accuracy Grade	Expressed by e_{300} C1 : 0.005 C2 : 0.007 C3 : 0.008 C4 : 0.012 C5 : 0.018 C6 : 0.023 C7 : 0.50 C10 : 0.120
7 Suitable for Use	All transmission machinery devices and equipments.

Installation and Maintenance

1 While the ballsscrew exits factory, it should be cleaned and lubricated, in order to prevent rust eclipse.
The thread groove which can't have any sharp iron scraps or dirty matters antering the nut should be attention to inspect.
After all, the ballscrew should be anstalled into the machine.

2 Selecting appropriate grade ballscrew to meet the design requirements, high precision grade ballscrew are used in high position accuracy, smooth running. And long servise life, like CNC machinr tools or precision measurement equipment. On other hand, comercial grade or rolled ballscrew are used in less accuracy or low end machine, like traditional or industrial machine.

3 To maximize the lifetimeof ballscrew , goodlubrication is required. We suggest using the higher EP lubricant. Oil mist bath or drip feeds are acceptable at any time into the nut.

4 Be caution. While installing the ballscrew into the machine, the nut ot the return tube can't be knocked. Don't make the ballnut run off the screw shaft, the bullnut might be damaged if it falls off the shaft.

5 Please select suitable shaft to fit . ($\alpha = 60^{o}$) angular bearings is suitable on CNC machine. Therefore, it can reeduce the gap while installing.

6 An overrun stopper should be considered at the end to prevent the nut from over traveling, due to the malfunction or human error.

7 Dust and foreign matter that enter the ballscrew may cause accelerated wear and breakage. Therefore installing the protection cover to the ballscrew , rpevent foreign matters or iron chips from entering the nut and the screw thread groove.

Precaution for Designing

1 When you choose to use internalş type of balscrew , one end of the ball thread must be cut throught to the end surface. The adjeacent diameter close to end jounal must be 0.5 ~1.0 mm lewss the thread root diameter. This will be more convenience of installing balls into nuts and shafts.

2 The screw shaft is hardened by MF induction (HRC58-62). On the ends of thread there are two teeth of thread of which hardness are slightly low the degree of hardness. While designing the effective stroke of the travel lenght, please considerate this phenomenon.

3 While designing ballscrew , should avoid radial load or moment as possible as it can. If radial load or moment is applted to the ballscrew, it is adversely affects ballscrew function and turn down life. It is especially important to eliminate misaligment or tilt between the screw shaft supported porton and the nut, or it could cause malfunction and reduce the life.

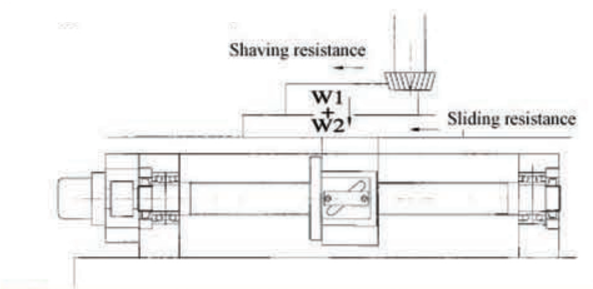
4 Over preload will increase the torque of machine running . it will generate heat and turn down life. On the hand, less preload will increase backlash and turn down rigidity. LTM suggests that preload do not exceed 8% of the rated basic dynamic load (10^6 Revs) in CNC machine tools.Please fill in the technical date sheel. If you have any questions, please contact our technology dept. We will suggest you the best preload value.

Item	AISI	JIS	DIN	BSI	Heat Treatment	Hardness
Shaft	4150H	SCM450H	50CrMo4	EN19C	MF ınduction	HRC 58-62
Nut	8620H	SNCM220H	20NiCrMo2	EN36	Carburizing	HRC 58-62
Ball	52100	SUJ2	100Cr6	EN31	Hardening	HRC 62-65

Before selection size of ballscrews, confirming the inspecting test usage of condition is must. Then, to decide its specification based on the this condition . Considering:A.Load of machine. B. stroke, C.torque, D. positioning accuracy, E.misplaced F.stiffness, G. turns, H. screw OD.

Design calculation process

Using customer's requirement



Instance of calculation

1.Work bench weight 300kg
2.Work piece weight 400kg
3.Turns needed 700kg
4.Max. feed 10 M/mm
5.Min. feed 10 μM/PULSE
6.Motor (Max1000RPM)
7.Sliding resistance (Resistance coefficient μ=0.05 ~0.15)
8.Processing time ratio
9.Accuracy test

1 Creating processing condition

(a) Assuming lifetime of machineH(hr)

H= [ ] processing time hour/day x [ ] processing time day/year x [ ] expecting lifetime year x [ ] processing time ratio

(b) Processing condition

Condition / Type	Rate/speed	Shaving	Obj. Resis	Time Ratio
Max Feed	rpm	kgf	kgf	%
Light Load				
Medium Load				
Heavy Load				

(C) Positioning accuracy
Determind by the motor resolution of level
$e_{2\pi}$. e_{300}

(D) Misplaced
Positioning accuracy error caused by the forward-reverse must consider the stiffness system of screw, nut, bearing, and nut block.

$\frac{\text{Misplaced amount}}{2} \geq$ One-way system of institutions all variants volume

Creating processing condition

(a) Assuming lifetime of machineH(hr)
H=12hrx250dayx10yearsx0.6
working ratio = 1800 hr

(b) Processing condition

Condition / Type	Rate/speed	Shaving	Obj. Resis	Time Ratio
Max Feed	1000	0	70	10
Light Load	600	50	70	50
Medium Load	200	100	70	30
Heavy Load	100	200	70	10

Axial force= Shaving force+(workbench weight) x friction resistance

Workbench resistance(Fa)=(300+400)x0.1=70kgf

Design Case Explanation

1 Design carculation process

Calculating turns

(assuming ballscrew is connected with motor directly)

$$L \geqq \frac{\text{Max feed (m/min)x1000}}{\text{Motor max. speed (rpm)}}$$

3 Carculating revolution per minute Nm(rpm)

$$Nm=\frac{n_1 t_1 + n_2 t_2 + n_3 t_3 \ldots n_n t_n}{n_1 t_2 + t_3 \ldots t_n}$$

$n_1 n_2 n_3 n_4 \ldots$ speed (rpm)

$n_1 n_2 n_3 n_n \ldots$ time ratio (%)

$t_1\ t_2\ t_3\ t_n \ldots = 100$

4 Carculating average load Fm (kgf)

$$Fm=\left\{\frac{F_1^3\ n_1 t_1 + F_2^3 n_2 t_2 + \ldots F_n^3 n_n t_n}{n_1 + n_2 t_2 + n_3 t_3 \ldots n_n t_n}\right\}^{\frac{1}{3}}$$

5 Carculating risk

$$n_{max} \leqq f\frac{dr}{L^2} x10^{-7} mm$$

$$dr \geqq \frac{n_{max}\ L^2}{f}$$

Support-Support	f=9.7
Fixed-Support	f=15.1
Fixed-Fixed	f=21.9
Fixed-Free	f=3.4

6 Carculating DN value

$$DN \leqq \frac{100000}{n_{max}}$$

2 Design turns

$$L \geqq \frac{10x1000}{1000}\ 10mm$$

$$\text{feed ratio} = \frac{10mm}{100pulse} = 0.01mm/pulse$$

Choosing encorder of 100pulse /rpm encorder

2 Calculating revoluting per minute Nm(rpm)

$$Nm=\frac{1000x10+600x50+200x30x+100x10}{100}$$

$$= \frac{4.7x10^4}{100}$$

$$= 470rpm$$

4 Carculating average load Fm (kgf)

$$Fm=\left\{\frac{70^3 x1000x10+120^3 x600x50+170^3 x200x30+270^3 x100x10}{1000x10+600x50+200x30x100x10}\right\}^{\frac{1}{3}}$$

$=130kgf$

5 Carculating risk

$$n_{max} \leqq f\frac{dr}{L^2} x10^{-7} mm$$

$$dr \geqq \frac{n_{max}\ L^2}{f} x10^{-7} mm$$

$$= \frac{1000x970^2}{21.9} x10^{-7} = 4.3mm$$

6 Carculating DN value

$$DN \leqq \frac{100000}{n_{max}}$$

$$DN \leqq \frac{100000}{1000} = 100mm$$

Design Case Explanation

Design calculation process

7 Dynamic load RATİNG Cd(kgf)

$Cd \geqq (60NmLt)^{1/3} Fm \cdot fdx10^{-2}$ (kgf)

fd No impact, smooth operation	1.2~1.2
Normal operation	1.2~1.5
With impact and vibration	1.5~3.0

Instance of calculation

7 Dynamic load rating Cd calculation

$Cd \geqq (60x470x18000)^{1/3} x130x2x10^{-2}$ (kgf)

$Cd \geqq 1254$ kgf

8 Selection of screw OD.(Combiantion of point 5.6.7)

DN ≦ Screw pitch circle Dia dr ≧ Screw inner Dia.
Selection ballscrew OD.32 mm Lead 10mm

9 Selection nut type

C>Cd

C Basic dynamic load rating > Cd dynamic load rating

9 Selecting nut type

According to data sheet 32x10T4

C=3850 kgf Cd=1245 kgf

C > Cd

10 Choosing screw installation distance

Thread lenght= Max. stroke+nut lebght+safety distance

Total lenght = installation clearance+shoulder lenght(provided by customers)

10 Choosing screw installation distance

700+158+2x56=970mm

11

Focusing on required misplace amount, setting ball screw system (nut, screw and supporting bearing)the key elements of misplace amount is 20μ mx0.8=16μ m to review elastic deformation of ball screw system key elements at this time. $\Delta L \leqq 8\mu m$

12 Stiffness of screw : Ks

Elastic deformation : △ Ls

$$Ks=\frac{\pi dr \cdot E}{Ls} x10^{-3} (kgf/\mu m)$$

$$\Delta Ls=\frac{Fa}{Ks} = \frac{Fa \cdot L}{\pi dr^2 \cdot E} X10 (\mu m)$$

Fa: Sliding resistance dr.Inner Dia Of screw
E: Young 's modulus $2.1x10^4$ kgf/mm^2

12 Stiffness of screw : Ks

Elastic deformation : △ Ls

$$Ks=\frac{\pi 26.9^2 x2.1x10^4}{970} x10^{-3} 49.2(kgf/\mu m)$$

$$\Delta Ls=\frac{70x970}{\pi 26.9^2 x2.1x10^4} x10^{-3} 49.2(kgf/\mu m)$$

13 Stiffness of nut :Kn

Elastic deformation : △ LN

Using 1/3 of the max. shaft direction load as preload

$$F_{ao}=\frac{F_{max}}{3} (kgf)$$

$$K_N=0.8XK(\frac{F_{ao}}{0.1C})$$

$$\Delta L_N=\frac{Fa}{K_N}$$

13 Stiffness of nut :Kn

Elastic deformation : △ LN

$$F_{ao}=\frac{F_{max}}{3} (kgf)=\frac{270}{3}=90(kgf)$$

$$K_N=0.8X88(\frac{90}{0.1X3850})^{1/3} =43 (kgf/\mu m)$$

$$\Delta L_N=\frac{70}{43}=1.6 (\mu m)$$

K=88 (checking data sheet)

Design carculation process

14 Stiffness of supporting bearing(Elastc deforation : ΔL_B

$$\Delta L_B = \frac{Fa}{2K_B}$$

K_B=Bearing stiffness

$$\Delta L_B = \frac{70}{2x100} \quad 0.35\ (\mu\ m)$$

15

Combination of point 10.11.12.13. misplaced amount should smaller than 8 μm

$\Delta L_S + \Delta L_N + \Delta L_B = 0.7\ \mu m + 1.6\ \mu m + 0.35\ \mu m = 2.65\ \mu m \leqq 8\ \mu m$

16 Inspecting thermal displacement : $\Delta \ell$ (mm)

$\Delta \ell = \rho \theta L$

ρ:Coefficient of expansion $11.7x10^{-6}$ mm/M°C

θ:Temp. rised°C

L:Thread lenght

Usually the temperature rise under normal operation of the machine is 2 5 C , If temp, rised more than 3 C, the thermal displacement will be

$\Delta \ell = 11.7x10^{-6} x\ 3x700$

$= 0.024$ mm

}}}

17 Pre pulling foorce: F (kgf)

$$F = \frac{\Delta \ell x E x\ \pi dr^2}{4L}\ kgf$$

$$F = \frac{0.024x2.1x10^4 x\ \ 26.9^2}{4x700}\ kgf$$

=410kgf

18 Preload amount : Tp (kg-cm)

$$Tp = K\frac{Fao \cdot \ell}{2\pi}\ kgf$$

K=0.1~0.3

ℓ:Lead cm

$$Tp = K\frac{Fao \cdot \ell}{2\pi}\ (kg\text{-}cm)$$

$$K = 0.3x\frac{90x1}{2\pi}$$

=4.3kg-cm

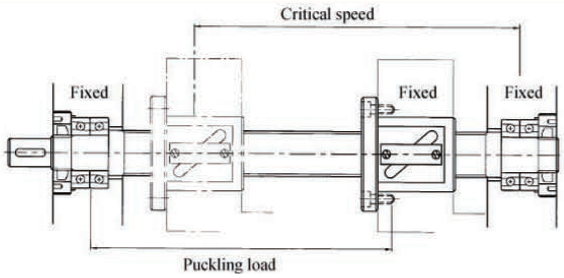
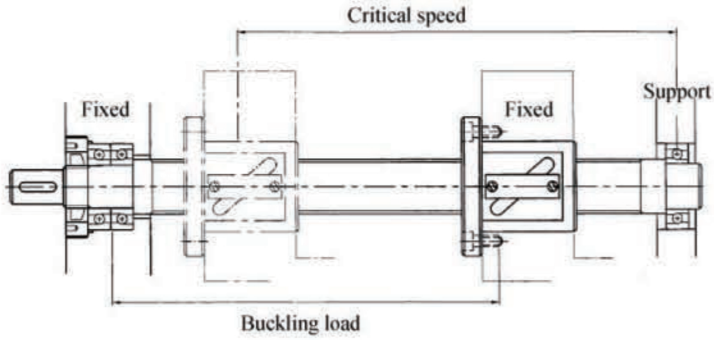
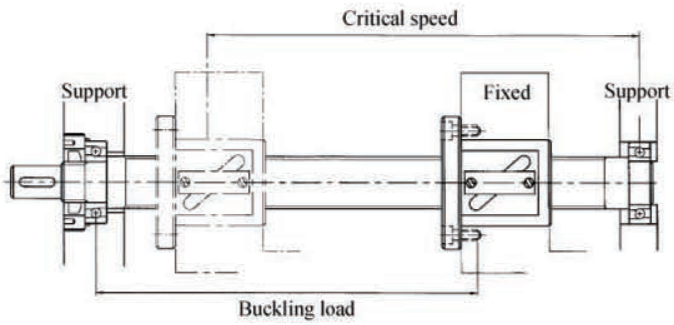
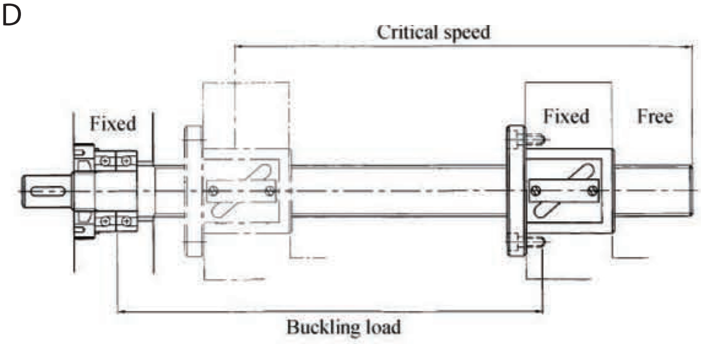
19 Expecting lifetime

$$Lt = \left(\frac{C}{fd \cdot Fm}\right)^3 x10^6\ x\ \frac{1}{60 \cdot Nm}\ hr$$

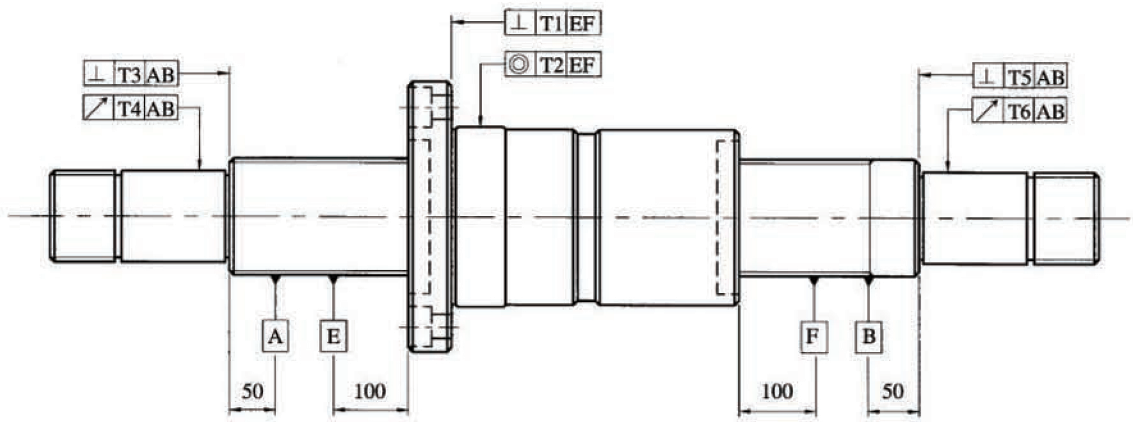
$$Lt = \left(\frac{3850}{1.2 \cdot 130}\right) x10\ x\ \frac{1}{60 \cdot 470}\ hr$$

$= 533000hr \geqq 18000hr$

The Typical Four Kinds Mounting Methods in Machine Tool Applications Are Shown Below.

	Mounting Methods	Application
A		◎High Rotation ◎ High Rigidity F-F
B		◎Medium Rotation ◎ Medium Rigidity F-S
C		◎General Mounting ◎ Medium Rotation S-S
D		◎ Low Rotation ◎ Shorter Shaft F-O

Accuracy of The BAllscrew Geometrical



T1 Perpendicularity of the Flange Mounting Surface to the Screw Shaft.

unit : μ m

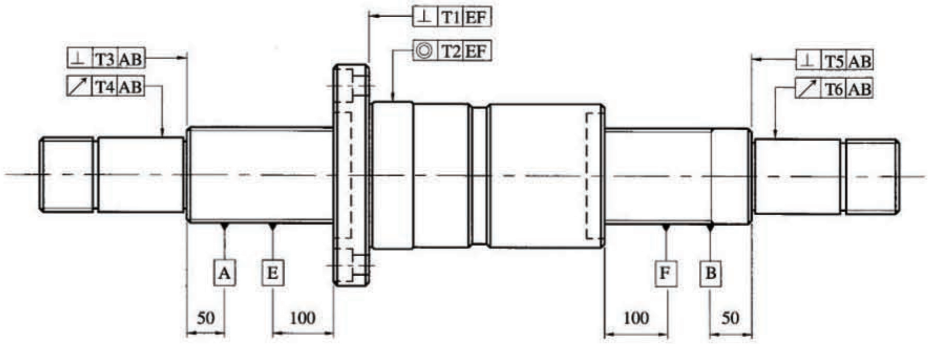
Nut.OD. (mm) Over	To (İncl.)	C1	C2	C3	C4	C5	C6
-	18	6	7	8	9	10	11
18	30	6	7	8	9	10	12
30	50	7	7	8	10	11	13
50	80	8	9	10	11	13	15
80	120	9	10	12	13	15	1720
120	150	10	1	13	14	17	23
150	180	11	12	14	15	18	27
180	250	12	13	15	16	20	

T2 Radial Run -Out of the Nut Circumference in Respect to the Screw Shaft.

unit : μ m

Nut.OD. (mm) Over	To (İncl.)	C1	C2	C3	C4	C5	C6
-	18	6	7	9	10	12	15
18	30	7	8	10	11	12	16
30	50	8	10	12	13	15	18
50	80	10	12	15	14	19	23
80	120	12	14	16	17	27	29
120	150	13	17	18	19	30	34
150	180	16	21	22	23	34	40
180	250	18	25	25	25	38	45

Accuracy of The BAllscrew Geometrical



T1 Perpendicularity of the Flange Mounting Surface to the Screw Shaft.

unit : μ m

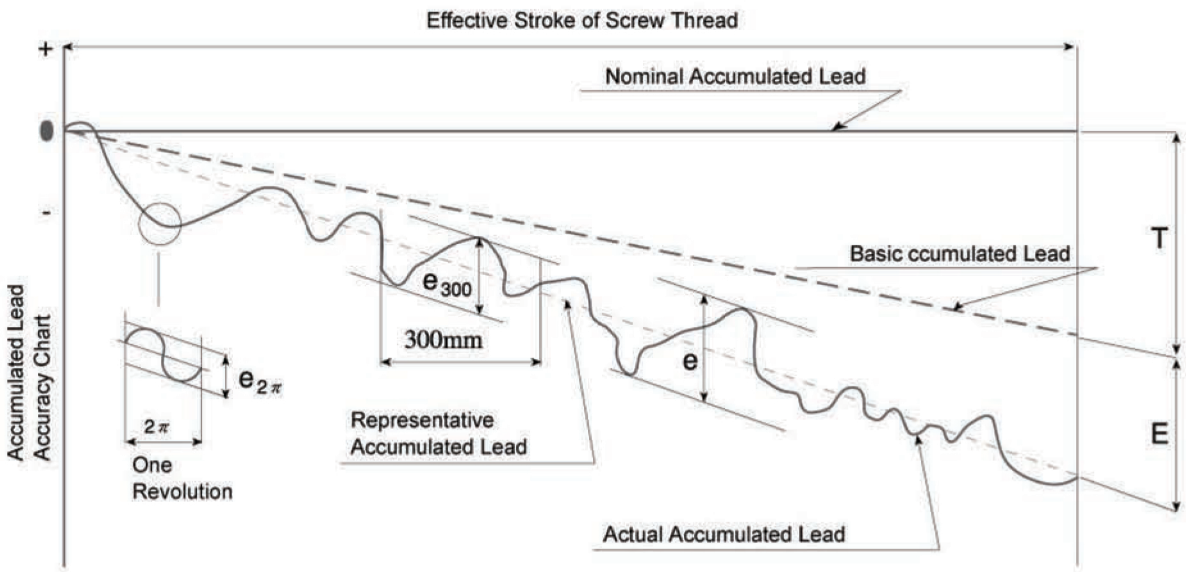
Nut.OD. (mm) Over	To (İncl.)	C1	C2	C3	C4	C5	C6
-	8	3	4	5	6	8	10
8	12	3	4	5	6	8	10
12	20	3	4	5	6	8	10
20	32	3	4	6	7	9	11
32	50	3	5	6	7	10	12
50	80	4	5	6	8	13	15
80	125	4	5	7	9	13	15

T4.T6 Radial Run-Out of the Circumference of the Screw Shaft in Respect to its Bearing Portion

unit : μ m

Nut.OD. (mm) Over	To (İncl.)	C1	C2	C3	C4	C5	C6
-	8	5	6	8	9	10	12
8	12	5	6	8	9	11	13
12	20	6	7	9	10	12	15
20	32	7	8	10	11	13	16
32	50	8	10	12	13	15	18
50	80	9	11	13	14	17	21
80	120	10	13	15	16	20	25

Laser, Lead Accuracy Chart



T±E	Resresentative Accumulated Lead	This Is The Straight Line Represent The Acrual Accumulated Lead. Derived By Min. Square Root Method From The Actual Leaser Measured Datum.
a	Actual Accumulated Lead	This Is The Actual Lead Error Record Measured By Laser.
T	Basic Accumulated Lead (T)	Within Effective Stroke Of Screw Thread. The Designer Should Consider The Heat Generation. The Elactic Deformation During Rotation In Advance. Mondify The Nominal Accumulated Lead, Pass The Modification Value (T). To The Ballscrew Maker. The Experimental T Value (mm/m) CNC Lathe X AXIS (-0.10-0.20) Z AXIS (-0.10-0.15) CNC Machining X. Y AXIS (-0.10-0.20) Center Z AXIS (-0.15-0.25)
E	Representative Accumulated Lead Error(E)	The Allowable Tolerance Between Representative Accumulated Lead And Basic Accumulated Lead.
e	Lead Variation (e)	
e_{300}	300 mm Variation < e_{300} >	The Max. Lead Variation Of random 300mm Within Effective Stroke.
$e_{2\pi}$	Singkle Pitch Variation<$e_{2\pi}$>	The Max. Lead Variation Of Random One Revolution

Laser, Lead Accuracy Chart

Varition per 300mm of Thread Lenght and per Turn of the Screw Shaft

unit : μ m

Accuracy	C0	C1	C2	C3	C4	C5
e_{300}	3,5	5	7	8	12	18
$e_{2\pi}$	2,5	4	5	6	7	8

T2 Radial Run -Out of the Nut Circumference in Respect to the Screw Shaft.

unit : μ m

Accuracy		C0		C1		C2		C3		C4		C5	
Thread Lenght / item		±E	e	±E	e	±E	e	±E	e	±E	e	±E	e
over	To (İncl.)												
-	315	4	3.5	6	5	8	7	12	8	16	12	23	18
345	400	5	3.5	7	5	9	7	13	10	18	14	25	20
400	500	6	4	8	5	10	7	15	10	20	14	27	20
500	630	6	4	9	6	11	8	16	12	22	16	30	23
630	800	7	5	10	7	13	9	18	13	25	18	35	25
800	1000	8	6	11	8	15	10	21	15	29	20	40	27
1000	1250	9	6	13	9	18	11	24	16	34	22	46	30
1250	1600	11	7	15	10	21	13	29	18	40	25	54	35
1600	2000			18	11	25	15	35	21	48	29	65	40
2000	2500			22	13	30	18	41	24	57	34	77	46
2500	3150			26	15	36	21	50	29	69	40	93	54
3150	4000			30	18	44	25	60	35	85	48	115	65
4000	5000					52	30	72	41	76	49	140	77
5000	6300					65	36	90	50	100	60	170	93
6300	8000							110	60	125	75	210	115

Laser, Lead Accuracy Chart

Permissible Range for the Preload Drag Torqne

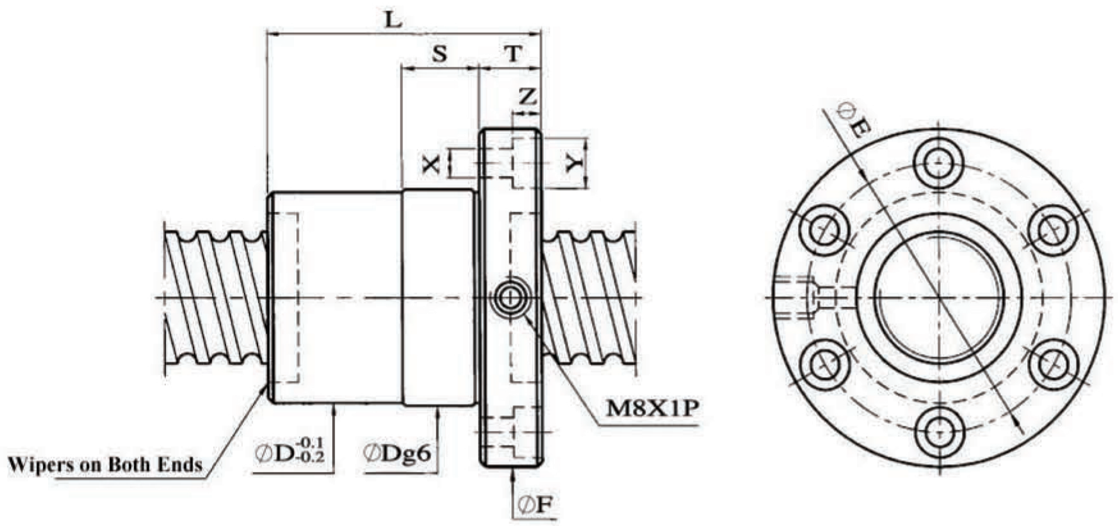
Basic Drag Torque Kgf-cm		Thread Lenght ≤ 4000mm									
		Slender Ratio≤ 40					40 <Slender Ratio<60				
over	To (Incl.)	C0	C1	C2	C3	C5	C0	C1	C2	C3	C5
-	1.0	±35%	±40%	±55%	±60%	±60%	±45%	±45%	±65%	±70%	±70%
1.0	2.0	±35%	±40%	±45%	±55%	±60%	±45%	±45%	±55%	±65%	±70%
2.0	4.0	±35%	±40%	±45%	±50%	±55%	±45%	±45%	±55%	±60%	±65%
4.0	6.0	±25%	±30%	±35%	±40%	±45%	±38%	±38%	±45%	±45%	±50%
6.0	10	±20%	±25%	±30%	±30%	±35%	±30%	±30%	±35%	±35%	±40%
10	25	±15%	±20%	±25%	±25%	±30%	±25%	±25%	±30%	±30%	±35%
25	63	±10%	±15%	±20%	±20%	±25%	±20%	±20%	±25%	±25%	±30%
63	100			±10%	±15%	±20%			±20%	±20%	±25%

Slender Ratio = Thread Lenght / Screw Shaft OD.

Accuracy Grades of Ballscrew and their Application

Grade / kinds	CNC Machine Tool																											
	CNC Lathe		Machining Center		Jig Borer M / C		Wire Cuter		Grinder M / C		Milling M / C		EDM		Drilling M / C		Wood M / C	Milling Borer		EDM		Special Purpose	Laser M / C	
Axis	X	Z	XY	Z	XY	Z	XY	UV	X	Z	XY	Z	XY	Z	XY	Z	XYZ	XY	Z	XY	Z	XYZ	XY	Z
C0					○	○			○															
C1					○	○	○	○	○	○														
C2	○		○		○	○	○	○	○	○	○		○											
C3	○	○	○	○			○	○		○	○	○	○	○									○	○
C4	○	○	○	○				○			○	○	○	○	○			○	○	○	○	○	○	○
C5	○	○	○	○							○	○	○	○	○	○	○	○	○	○	○	○	○	○
C6		○		○								○		○	○	○	○	○	○	○	○	○	○	○
C7																○	○	○	○	○	○	○		
C10																	○							

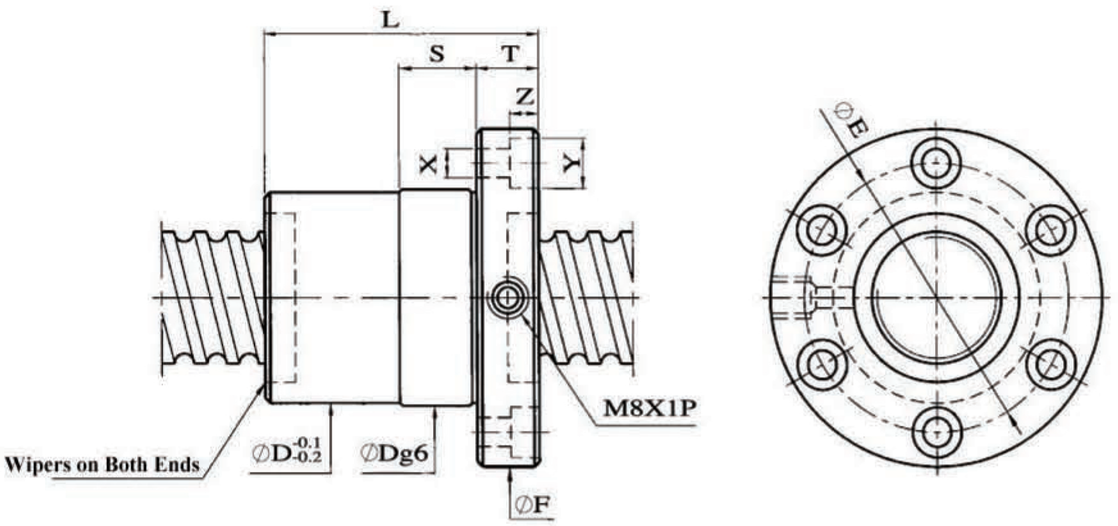
FSI Type Nut



Unit : mm

Accuracy		C0		C1		C3		C4		C5	
item / Thread Lenght		± E	e	± E	e	± E	e	± E	e	± E	e
over	tl(incl.)										
-	315	4	3.5	6	5	12	8	16	12	23	18
315	400	5	3.5	7	5	13	10	18	14	25	20
400	500	6	4	8	5	15	10	20	14	27	20
500	630	6	4	9	6	16	12	22	16	30	23
630	800	7	5	10	7	18	13	25	18	35	25
800	1000	8	6	11	8	21	15	29	20	40	27
1000	1250	9	6	13	9	24	16	34	22	46	30
1250	1600	11	7	15	10	29	18	40	25	54	35
1600	2000			18	11	35	21	48	29	65	40
2000	2500			22	13	41	24	57	34	77	46
2500	3250			26	15	50	29	69	40	93	54
3150	4000			30	18	60	35	85	48	115	65
4000	5000					72	41	76	49	140	77
5000	6300					90	50	100	60	170	93
6300	8000					110	60	125	75	210	115

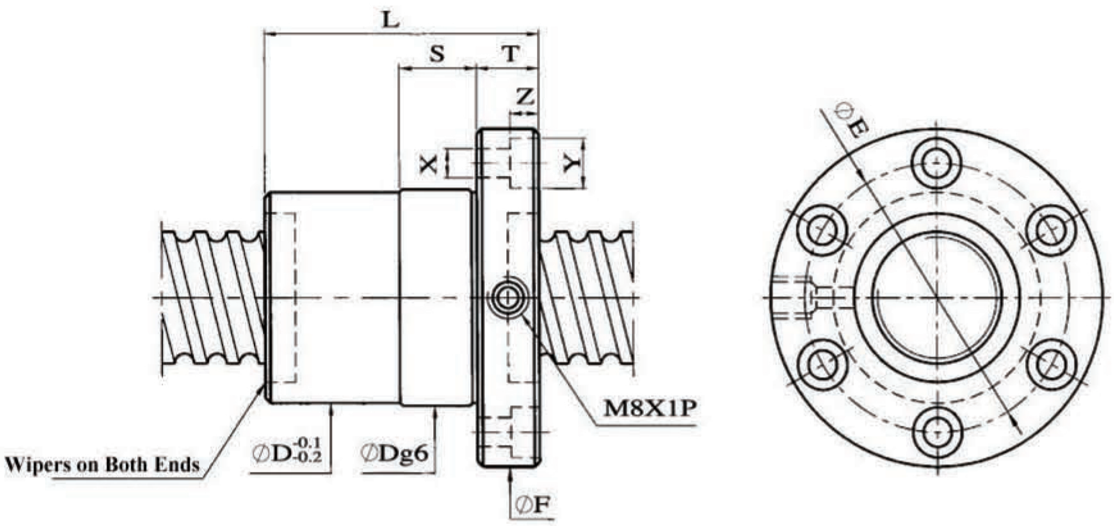
FSI Type Nut



Unit : mm

Dimension: Nominal Dia.	Dimension: Lead	Ball Dia	Turns	Dynamic Load C 10^6Revs. Kgf	Static Load Co Kgf	Stiffness Kgf/um	Nut: Dg6	Nut: L	Flamge: F	Flamge: T	Flamge: E	Bolt: X	Bolt: Y	Bolt: Z	Compact Lenght: S
16	5	3.175	4	1010	2200	11	30	50	49	10	39	4.5	8	4.5	12
20	5	3.175	4	1320	3000	26	34	53	57	12	45	5.5	9.5	5.5	12
	6	3.969	4	1640	3500	26	34	61	57	12	45	5.5	9.5	5.5	12
25	5	3.175	3	1210	2340	25	40	46	64	12	51	5.5	9.5	5.5	15
			4	1550	4100	33		53							
	6	3.969	3	1540	2790	25	40	53	64	12	51	5.5	9.5	5.5	15
			4	1970	4800	32		61							
	10	4.763	3	1650	3270	25	40	64	64	12	51	5.5	9.5	5.5	15
32	5	3.175	4	1810	5500	41	48	53	74	12	60	6.6	11	6.5	15
			6	2570	8300	60		63							
	6	3.969	4	2390	6700	42	48	61	74	12	60	6.6	11	6.5	15
	8	4.763	4	2880	7400	40	50	76	84	15	66	9	14	8.5	15
	10	6.350	3	3000	6700	30	56	80	88	16	72	9	14	8.5	15
			4	3850	9000	40		90							
40	5	3.175	4	2060	7100	50	55	56	90	16	72	9	14	8.5	20
			6	2920	7990	74		66							
	6	3.969	4	2700	8600	50	56	65	90	16	72	9	14	8.5	20
	10	6.350	3	3600	9200	38	65	83	106	18	84	11	17.5	11	20
			4	4610	12300	50		93							

FSI Type Nut



Unit : mm

Dimension: Nominal Dia.	Lead	Ball Dia	Turns	Dynamic Load C 10^6Revs. Kgf	Static Load Co Kgf	Stiffness Kgf/um	Nut: Dg6	Nut: L	Flamge: F	Flamge: T	Flamge: E	Bolt: X	Bolt: Y	Bolt: Z	Compact Lenght: S
50	5	3.175	4	2320	9200	61	75	56	110	16	92	9	14	8.5	15
			6	3290	13800	89		66							
	10	6.350	4	5400	16400	62	75	93	116	18	94	11	17.5	11	20
			6	7660	24600	92		112							
	12	7.938	4	6890	19200	62	75	111	121	22	97	14	20	13	20
	20	7.938	3	4570	11200	47	75	146	121	28	97	14	20	13	25
63	10	6.350	4	6330	22200	78	88	95	134	20	110	14	20	13	20
			6	8970	33000	115		114							
	12	7.938	4	8060	25700	77	90	111	136	22	112	14	20	13	20
			6	11430	38500	113		136							
	20	9.525	3	8540	23700	75	95	146	153	28	123	18	26	17.5	25
80	10	6.350	4	7180	28700	95	105	97	152	22	127	14	20	13	20
			6	13380	52000	140		116							
	12	7.935	4	7550	25900	96	110	111	156	22	132	14	20	13	20
			6	13380	52000	142		136							
	20	9.525	3	9360	3050	125	115	146	173	28	143	18	26	17.5	25
			4	11980	40700	175		168							
100	10	6.350	6	9920	47190	170	125	118	171	22	147	14	20	13	20
	12	7.938	6	11835	49750	174	130	142	188	28	158	18	26	17.5	25
	20	9.525	4	14985	58520	153	135	172	205	32	169	22	32	21.5	30