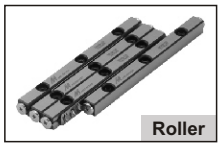
Order example

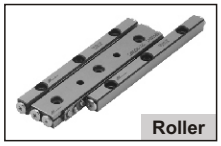
MGRVG – 03 – 75 – S – H

Model

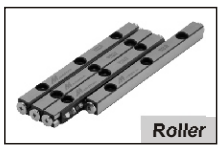
MGRV : SUS304 Retainer



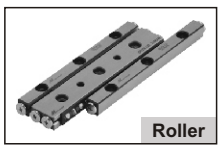
MGRD : SUS304 Retainer



MGRVP : POM Retainer

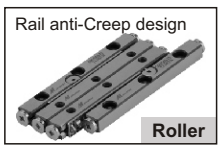


MGRDP : POM Retainer

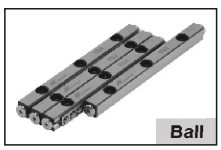


MGRVG :

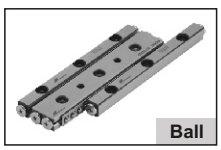
Rail anti-Creep design



MGBV : SUS304 Retainer



MGBD : SUS304 Retainer



Diameter

MGRV (mm)	
00	ϕ1.0
01	ϕ1.5
02	ϕ2.0
03	ϕ3.0
04	ϕ4.0
06	ϕ6.0
09	ϕ9.0
12	ϕ12.0

MGRD	
01	ϕ1.5
02	ϕ2.0
03	ϕ3.0
04	ϕ4.0

MGRVP	
01	ϕ1.5
02	ϕ2.0
03	ϕ3.0
04	ϕ4.0
06	ϕ6.0

MGRDP	
01	ϕ1.5
02	ϕ2.0
03	ϕ3.0
04	ϕ4.0

MGRVG	
02	ϕ2.0
03	ϕ3.0
04	ϕ4.0
06	ϕ6.0

MGBV	
01	ϕ1.5
02	ϕ2.0
03	ϕ3.0
04	ϕ4.0
06	ϕ6.0

MGBD	
01	ϕ1.5
02	ϕ2.0
03	ϕ3.0
04	ϕ4.0

Length

MGRV (mm)	
00	20~80
01	20~80
02	30~180
03	50~300
04	80~480
06	100~600
09	200~1200
12	200~1200

MGRD	
01	20~80
02	30~180
03	50~300
04	80~480

MGRVP	
01	20~80
02	30~180
03	50~300
04	80~480
06	100~600

MGRDP	
01	20~80
02	30~180
03	50~300
04	80~480

MGRVG	
02	30~180
03	50~300
04	80~480
06	100~600

MGBV	
01	20~80
02	30~180
03	50~300
04	80~480
06	100~600

MGBD	
01	20~80
02	30~180
03	50~300
04	80~480

※ Length selection as specification table.

Rail material

—	Standard
S	SUS440C+Ni

Precision level

H	High grade
P	Precision grade

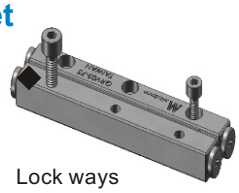
Material

Model	Material			
	Rail	Retainer	Roller	Ball bearing
MGRV	SUJ2	SUS304	SUJ2	X
MGRD				
MGRV-S	SUS440C+Ni	SUS304	SUS440C	X
MGRVG-S		Brass+Ni-plating		
MGRD-S		SUS304		
MGRVP	SUJ2	POM	SUJ2	X
MFRVG		Brass		
MGRDP		POM		
MGBV	SUJ2	Phosphor bronze (C5191)	X	SUJ2
MGBD				

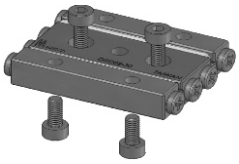
Remark:
1.MGR*-S series are suitable for application to clean rooms.
2.Rails have been finished with cryogenic treatment (refer to O-65~66)

Selection procedure- crossed roller slide rail set

1.Rolling element retainer selection upon load request:
2.Heavy duty → roller or light duty → ball bearing
3.To decide "rolling element diameter"
4.Model type selected per installation way.
5.Specification confirmed.
6.Material selection per environment: SUJ2 or SUS440C.



Lock ways
in form of 2 sets:
Span hole unlimited



In whole set:
Span hole limited

Crossed roller slide rail set

Composed of two pieces of stainless steel rails with V-grooves, been hardened and ground forming precisely, and rolling elements.Roller type moves in connective 90 degrees alternately to meet requirement of high parallelism and high flatness.In construction, rolling elements are transmitted in cross-contact by precise roller and V-grooves in rails, and in non-circulation.
Variation caused by friction resistance is little as well,even almost no difference between starting friction resistance and dynamic friction resistance in light duty. High accuracy moving and loading capacity could be performed.
※ Comparison of roller and ball bearing character (refer to O-70)

Crossed roller slide rail set application

Wildly applied to accuracy moving device in heavy duty or light duty、in variety of measuring instrument、printed circuit board drilling machine…etc, or slide table used in optical measuring instrument、precise gauge in optical experiment、precision fine tuning optical stage、operation mechanism、survey device, precise positioning, quantitative movement、X-ray device & Micro-hole EDM.

Lubrication

Linear motion needs effective lubrication. Abrasion increase of rolling elements and life decrease would be caused in running without lubrication.

Function of lubrication：
1.Reduce friction between running parts greatly, so that it could prevent lock and decrease abrasion.
2.Forming oilfilm on rolling surface to reduce abrasion of metal medium to extend life of rolling elements.
3.Covering on metal surface to prevent rust.
Relevant request of lubricant fitness (refer to O-70) .

Roller type

MGRV (MGRV-S)

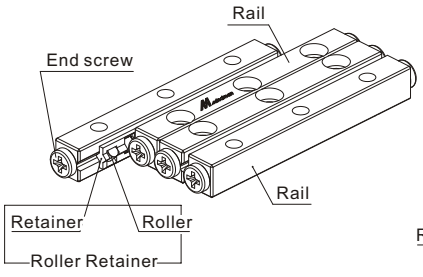
MGRD (GMGRD-S)

MGRVP

MGRVG

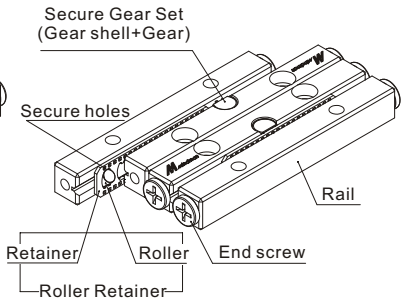
MGRDP

- **MGRV / MGRD / MGRV-S / MGRD-S / MGRVG / MGRVG-S / MGRVP / MGRDP** are composed of precise crossed rollers with hardened steel formed precisely to be V-grooves rail guides to create linear motion element in high accuracy.
- Limited stroke linear motion system with high rigidity, mid-hard load and spry moment.



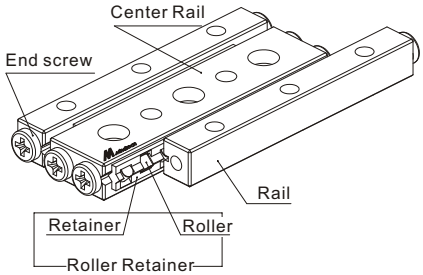
MGRV / MGRV-S / MGRVP

1set=
4 rails + 2 roller retainers
+ 8 end screws



MGRVG / MGRVG-S

1set=
4 rails + 2 roller retainers
+ 8 end screws



MGRD / MGRD-S / MGRDP

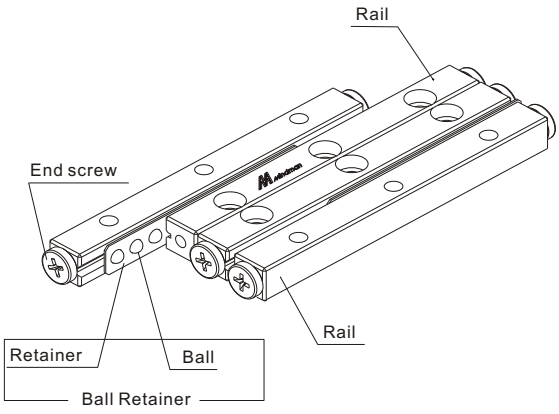
1set=
1 center rail 2 rails + 2 roller retainers
+ 8 end screws

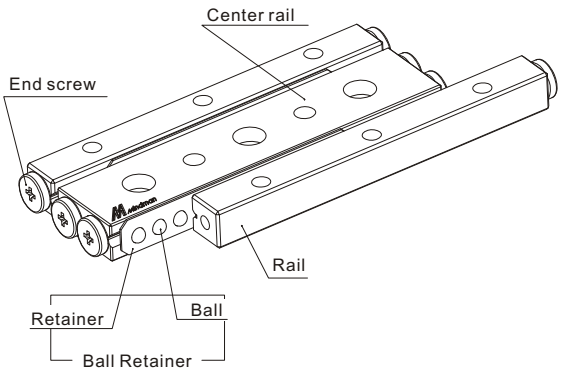
Ball type

MGBV

MGBD

- **MGBV / MGRD** are composed of ball retainer combined with precise ball bearings arranged in smaller clearance, with the exclusive rails been heat treatment and cryogenic finish, then, forming precisely grinding V-grooves.
- Limited stroke linear motion system with low friction, light load and high accuracy.





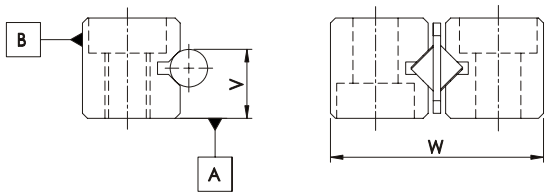
MGBV

1set=
4 rails + 2 ball retainers + 8 end screws

MGBD

1set=
4 rails + 2 ball retainer + 8 end screws

Measure way



Accuracy level

Item	High-level	Precise level
	H	P
Parallelism of rolling plane to A&B	As shoen drawing	
Allowable dimension tolerance to Height V	±0.02	±0.01
Paired mutual tolerance to Height V	0.01	0.005
Allowable dimension tolerance to Height W	0 -0.20	0 -0.10

Straightnrss

High-level (H)

(Ra0.2μm)

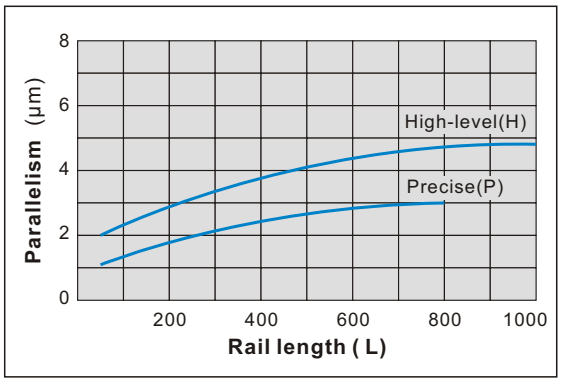
Length (mm)		Straightness (μm)
Above	Below	
—	50	2.0
50	100	2.0
100	160	3.0
160	310	3.0
310	510	4.0
510	600	4.0

Precise-level (P)

(Ra0.1μm)

Length (mm)		Straightness (μm)
Above	Below	
—	50	1.0
50	100	1.0
100	160	2.0
160	310	2.0
310	510	3.0
510	600	3.0

Rail length and parallelism of rolling plane



Advantages

Suited to micro-movement

Due to tiny friction resistance, and almost no difference between starting friction resistance and dynamic friction resistance. In case of tiny movement could also maintain correct trace perform high precision on the linear motion mechanism.

Stability in low speed

Even in case of light loading, its variation of friction resistance is also tiny, so stability from low to high speed could be kept.

High rigidity、high loading capacity

Comparison of roller and ball bearing,larger contact area , less elasticity deformation, and non-circulation, great number of units rotating effectively, so high rigidity and large load capacity.

Low noise

Crossed roller slide rail set has no circulated rotating, no noise occurred.Using roller slide way with roller retainer makes no noise caused by contact friction in between each rolling uint movesalternately, to ensure a quiet movement motion.

● In selecting slide rail set, stroke length and roller quantity shall be taken into accout besides accuracy, load capacity and rated capacity.

Maximum stroke length calculation and selection

EX: In case of using cross roller slide rail set side by side, which specification should be chosen?

Specification.....MGRV04
Loading.....P=4000N
Stroke length.....SW=120mm

SOL: Expected stroke length lower than 80% of rail stroke length, required stroke length could be calculated by formula as below.

SW ≦ 0.8 S S ：Stroke length, mm
SW: Stroke length in use, mm

If SW=120 mm S ≧ (1 / 0.8) x 120 = 150

As rail shown in catalog, the maximum stroke would be 154mm, product model no. is **MGRV-04-200**.

Allowable load calculation

$$F = 2\,(Z/2)\,FU$$

Z ：Roller quantity
Z／2：Integer, no remainder
FU ：Load capacity (N) for each roller (as catalog statistic)

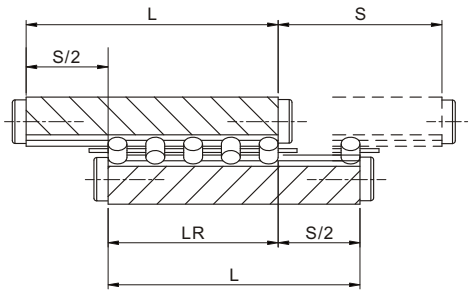
SOL: Searched from catalog
FU=390, F=2(18/2) × 390 =7020 N
So allowed load F is bigger than loading P=4000 N
Load ratio =4000/7020×100=56.98%
It's mid-load to product spec, model no. **MGRV-04-200**.

Calculation of retainer length and roller quantity

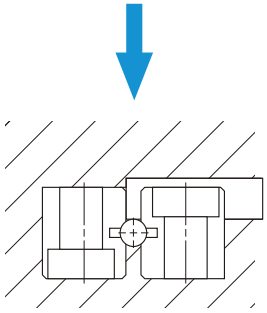
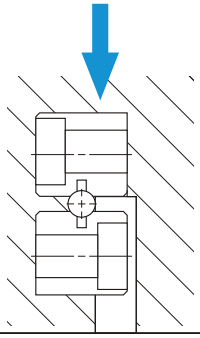
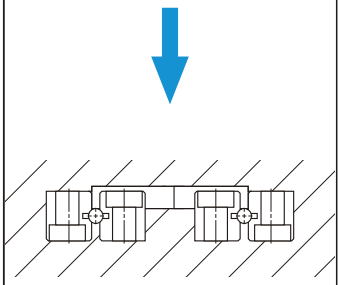
Guide length is decided by stroke length and max. slide length, and calculation depends on end screws and stopper specification. Distance between two end rollers in the retainer is to have stroke length deduct half of max. stroke length.

$$LR = L - \frac{S}{2}$$

LR：rated distance between two rollers in ends of retainer, mm
L：rail length, mm
S：stroke length, mm

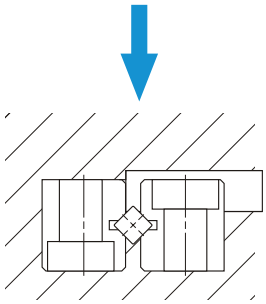
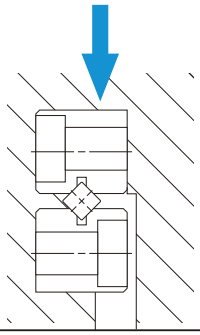
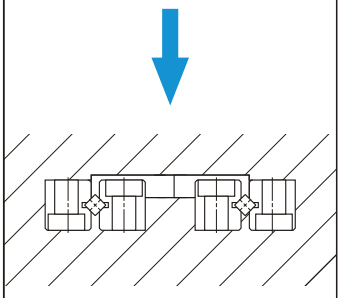


Londition of ball bearing

Condition	Single-axis use	Single-axis vertical use	Dual-axes abreast use
Loading direction			
Basic dybamic load rating ΣC	$B^{3/4} * \cos\frac{\pi}{4} * C$	$B^{3/4} * 2^{7/9} * \cos\frac{\pi}{4} * C$	
Basic static load rating ΣCo	$B * \cos\frac{\pi}{4} * Co$	$B * 2^{7/9} * Co$	

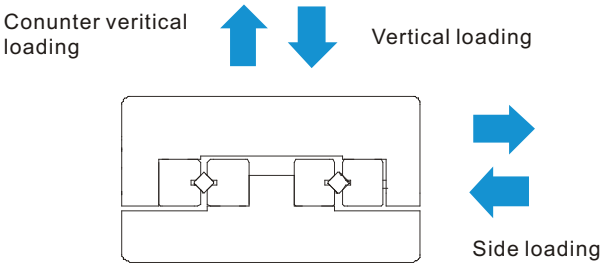
C：basic dynamic load trting (N)　　**Co**：basic static load rating (N)
B：ball bearing quantity in sigle row

Load capacity of roller

Condition	Single-axis use	Single-axis vertical use	Dual-axes abreast use
Loading direction			
Basic dybamic load rating ΣC	$C = (\frac{R}{2})^{3/4} * C$	$C = (\frac{R}{2})^{3/4} * C * 2^{7/9}$	
Basic static load rating ΣCo	$Co = \frac{R}{2} * Co$	$Co = R * Co$	

C：basic dynamic load trting (N)　　**Co**：basic static load rating (N)
B：ball bearing quantity in sigle row　　**R/2**: Integer, no remainder

Safety factory Fd in different loading direction



Classification	Loading direction	Fd
Basic dynamic loading	Vertical	1.0
	Side	0.9
	Counter vertical	0.8
Basic static loading	Vertical	1.0
	Side	0.9
	Counter vertical	0.8

Safety factor Fv in varable loading

Running condition	Fv
Normal running	1~0.5
Smooth motion required	0.5~0.25
Vibration、shck	0.3~0.2

Common contact facto Fc in single rail

Quantity of linear system assembled in single shaft	Conact factor Fc
1	1.00
2	0.81
3	0.72
4	0.66
5	0.61

Life calculation

Ball

$$L=(F_d * F_v * \frac{\sum C}{P})^{10/3} * 50$$

Roller

$$L=(F_d * F_v * \frac{\sum C}{P})^{3} * 50$$

L：Usage life(km) **Fd**：Safety factor in loading direction

P：Loadong **Fv**：Safety factor in variable loading

Rail stroke(S), stroke in use(Sw)

Stroke in use is less or equal to 80% of rail stroke

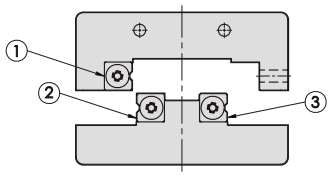
$$Sw \leqq 0.8S$$

Rail length(L)

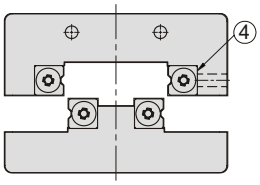
Rail length shall be higher than 1.5 times to stroke length in use, or 1.2 times to rail stroke length.

$$L \geqq 1.5Sw \quad or \quad L \geqq 1.2S$$

(1) Lay oil low viscosity on contact planes,fix rall (code ①~③)with regular torque.

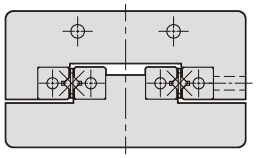


(2) Tempoarily lock rail in adjusted side(code ④)



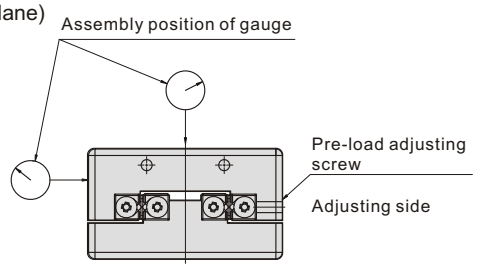
(2) Disassemble end screw from end of one side, and carefully insert roller retainer to nearby center of the rail.

(3-1) Lock the end screw again.
(3-2) Slowly move table bach and forth to the rail end, and adjust roller retainer position to rail center.

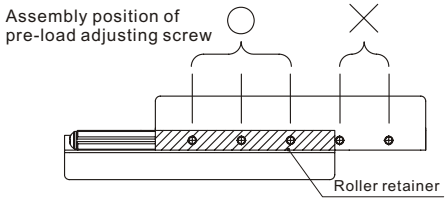


Instll roller retainer

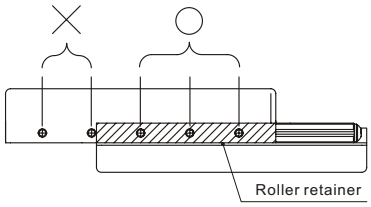
(4) Fix gauges both in center and side of the table (Level plane)



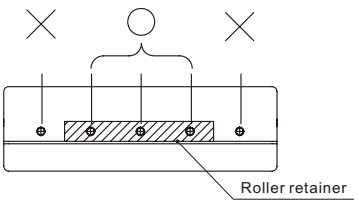
(5) Move table to end of one side, and lock pre-load adjusting screw slightly.



(6) Move table to the end of another side, as above description, and lock pre-load adjusting screw slightly.

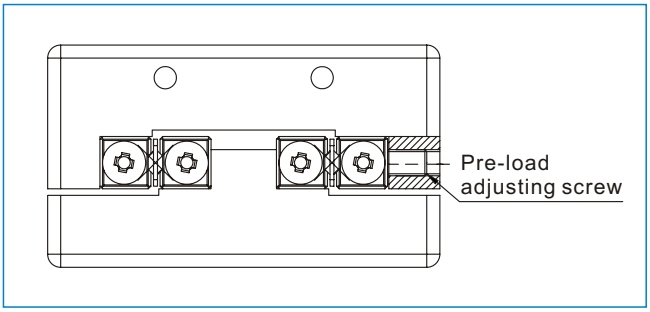


(7) Return table back to center and lock pre-loads adjusting screw slightly. Adjust clearance of table to zero. In case of clearance free, move table back and forth, and index change performance on the fixed gauge would be smallest. Notice that last adjustment of preloading is to set correct torque value with torque wrench and prepare to lock rail fix screw.

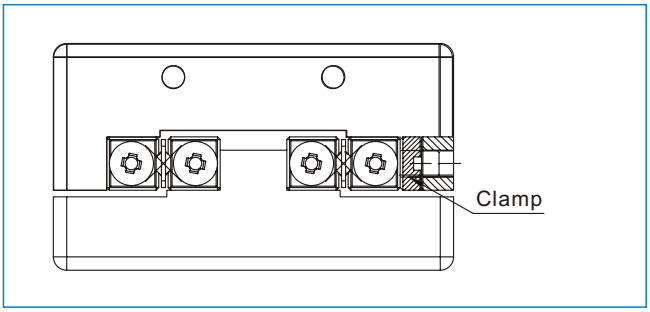


(8) Finally surely lock the rail (code 4).As steps of screw adjustment, move table bach and forth, then have the table over roller retainer, and lock screws in order.

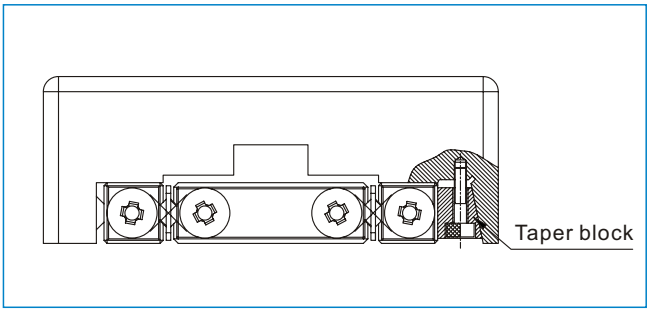
O: Loading on to pre-load adjusting screw.
X: Loading off to pre-load adjusting screw.



Pre-load adjusting screw-set screw is used to do normal adjustment.



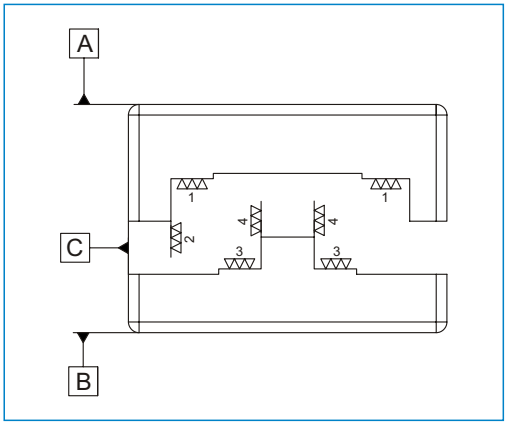
Use clamp to meet require of accuracy and rigidity.



Use taper block to meet special requirementof high rigidity and high accuracy.

Installation remark

- In order to let crossed roller slide rail set perform its excellent product function, it's recommended to install assembly planes with accuracy same as parallelism precisely processed in crossed roller slide rail set.
- All burrs, dent, dust, miscellaneous objects on the rail of table and base need to be cleaned spotlessly and keep eyeson assembly operation application.
- Preload adjustment, too much preload would cause press damage to reduce life; it's normally recommended to use zero or tiny preload.



Accuracy of intallation assembly plane

Pre-load adjusting lock torque (unit / N.m)

Specification	Screw size	Lock torque
MGRV01	M2	0.008
MGRV02	M3	0.012
MGRV03	M4	0.05
MGRV04	M4	0.08
MGRV06	M5	0.2
MGRV09	M6	0.4

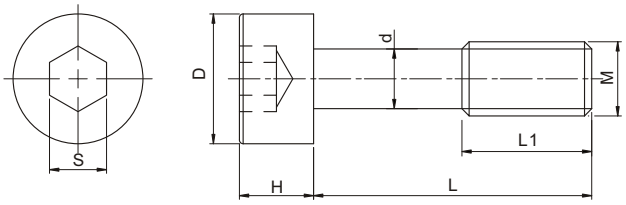
Fix screw lock torque (unit / N.m)

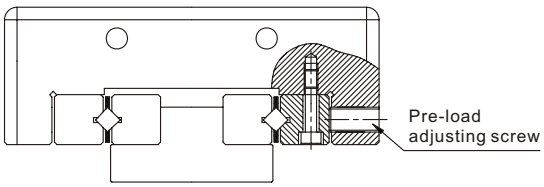
Specification	Lock torque
M2	0.28
M3	1.02
M4	2.37
M5	4.77
M6	8.14
M8	19.69

(Use steel alloy screw)

Reserved lock screw

Crossed roller slide rail set, used in sink screw hole assembly, it's recommended to use reserved lock screw.





Reserved lock screw

(mm)

Model	M	d	D	H	L	L1	S
MGRV03	M3	2.3	5	3	12	5	2.5
MGRV04	M4	3.1	5.8	4	15	7	3
MGRV06	M5	3.9	8	5	20	8	4
MGRV09	M6	4.6	8.5	6	30	12	5
MGRV12	M8	6.25	11.3	8	40	17	6

Adjustment

Operating under situations of improper accuracy of assembly plane & preload adjustment, would cause running in low accuracy and slip-out to affect usage life. notice more in adjustment.

Retainer deviation

Crossed roller slide rail set, in high speed or off-center load,vibration load, Mmight cause retainer deviation. Please keep enough space for strokedesign, and Not to have over pre-load set.

End screw

Ends of crossed roller slide rail set are located with end screws, but this function is to prevent retainer falling off, instead of stopping mechanism. If requirement of stopping function, it's recommended to design reserved block mechanism.

Careful operation

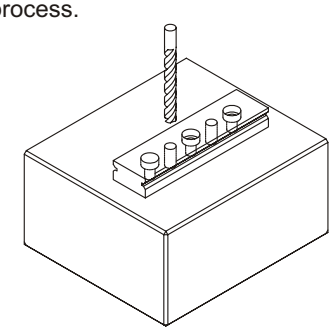
Any carelessness of falling off crossed roller slide rail set or unusual collision and extruding , would appear indentation made by contact of V-groove and rollers (ball bearings), to cause non-smooth motion, affected accuracy. Please be more careful in operation.

Whole set match principle

Crossed roller slide rail set accuracy is made by whole set as unit to precisely control it's error range.
different sets of slide rail set mixed use may result in accuracy variation. please notice more in assembling.

Locating pin hole

Crossed roller slide rail set, application series **MGRD** & **MGBD** series, locating pin hole processing needsto fix center rail on the plane, and drilling process. Be sure to clean all cutting bits out, and washing if necessary after pin hole process.



Locating pin hole processing