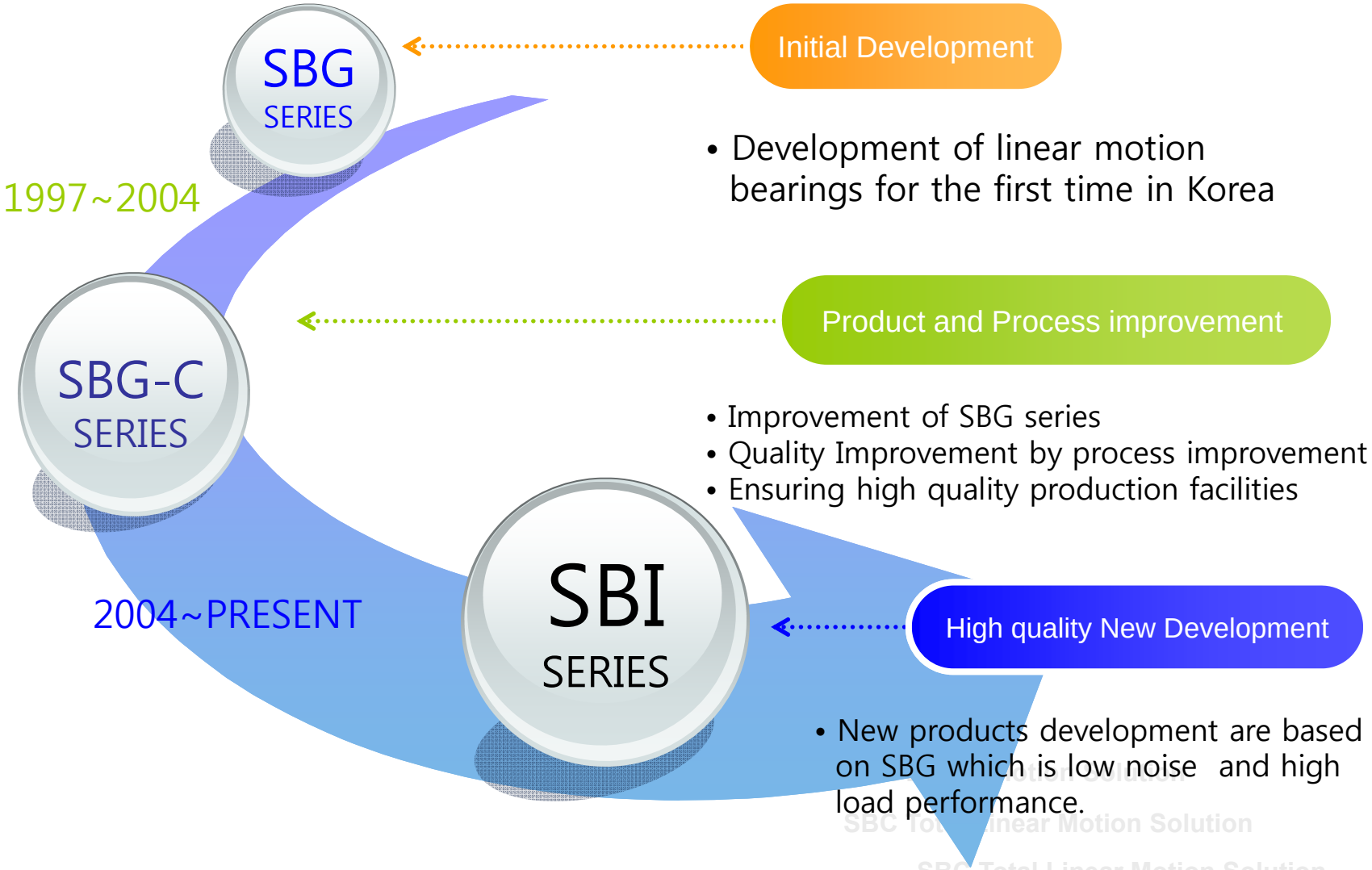
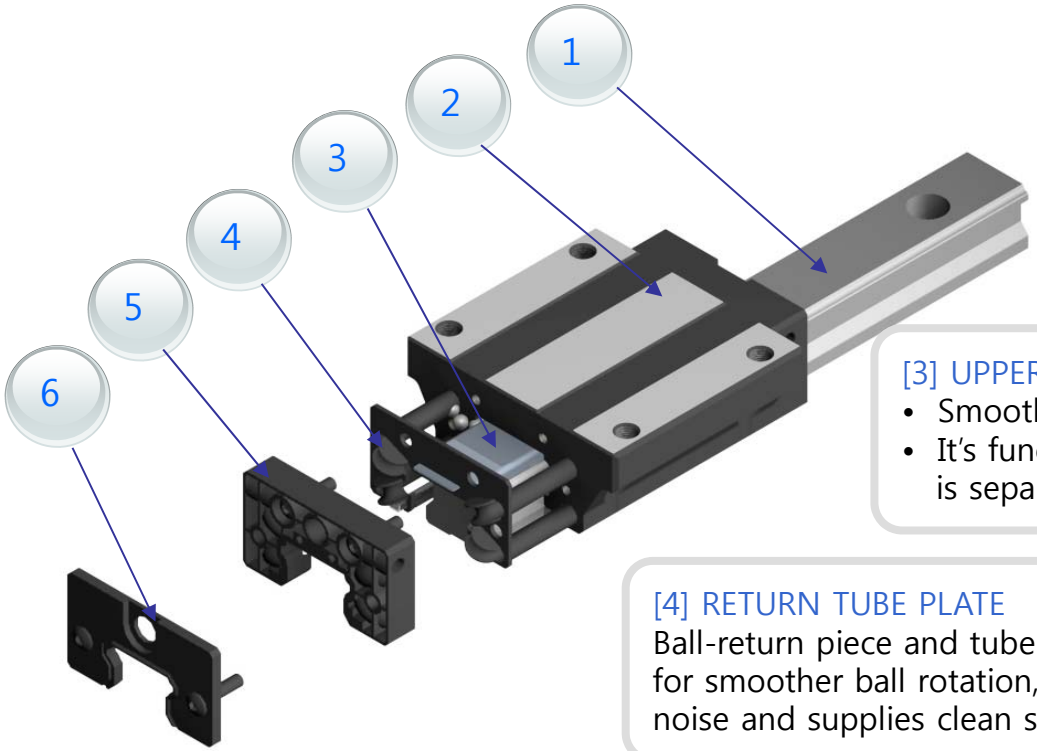
[LINEAR RAIL SYSTEM]

(주)에스비씨 리니어
SBC Linear Co.,Ltd.

SBC LINEAR RAIL SYSTEM ROAD MAP



THE FEATURE OF STRUCTURE



[1] LINEAR RAILS

[2] LINEAR BLOCK

[3] UPPER RETAINER
- Smooth circular movement of ball by SELF-ALIGNMENT.
- It's function is to prevent escape of balls when the block is separated from the rail.

[4] RETURN TUBE PLATE
Ball-return piece and tube are molded as one complete body. This allows for smoother ball rotation, reduces metal friction frictional losses, reduces noise and supplies clean supply of lubrication oil.

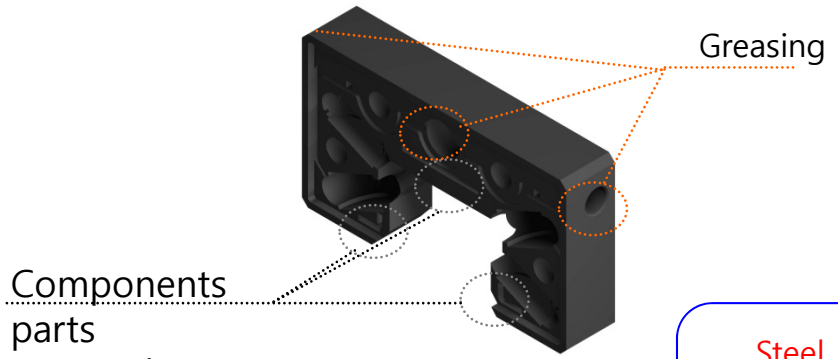
[5] END PLATE
- Designed to be impact resistant. Made of high rigidity engineered plastic.
- Lubricate flow in different directions such as Left/Right/Front.

[6] END SEAL
New double lip structure which improves resistance to dust and particle contamination.

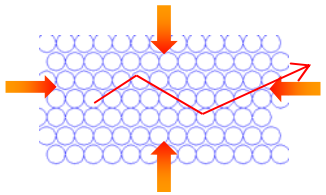
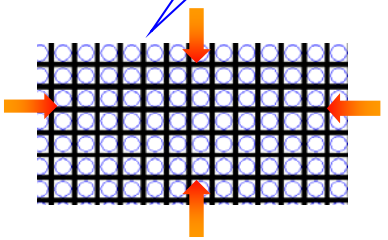
THE FEATURE OF SBG-C / SBI SERIES : END PLATE

[The function of END PLATE]

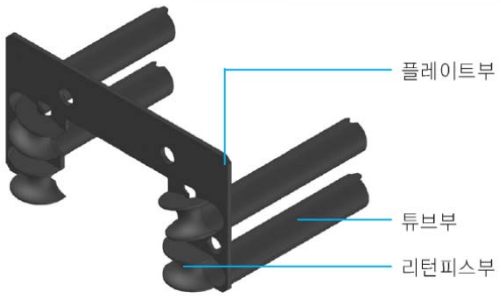
- Ball guidance and circulation.
- Lubricate flow multiple directions such as Left/Right/Front.
- Integral component for connecting
  Return Tube, Upper/Bottom retainer
- Uses Wear resistance, Chemical resistance, High rigidity Materials.
  - Reinforced engineering plastic
  - Resistant to oxidation by Lubrication oil and coolant.
  - The handling is easy because polymer material is impact resistant.



Steel + Concrete principle

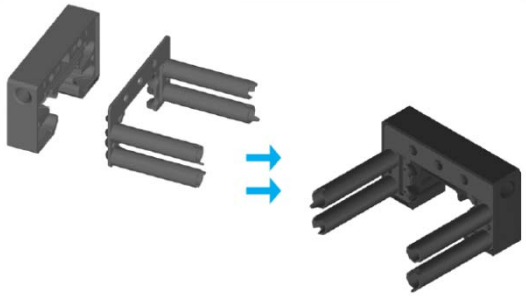
NORMAL PLASTIC	REINFORCED ENGINEERING PLASTIC
	
Susceptible to cracking from external shock	The reinforced engineering plastic eliminates potential cracking of the structure

THE FEATURE OF SBG-C / SBI SERIES : RETURN TUBE PLATE



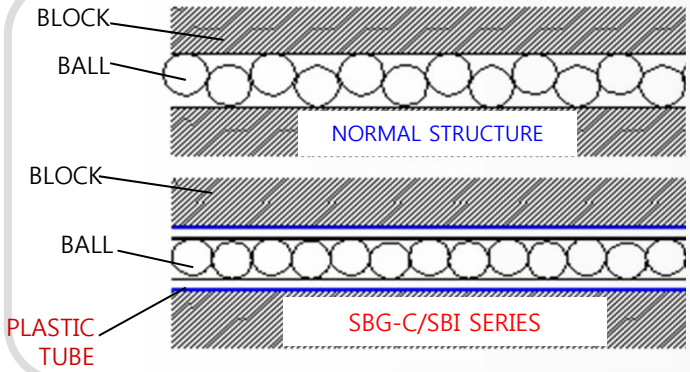
[PART NAMES AND FEATURES]

- PLATE : PREVENTS GREASE LEAKAGE
- TUBE : REDUCES FRICTION BETWEEN BALL AND INSIDE BLOCK
- RETURN PIECE : BALL CIRCULATION OR GUIDANCE



[GREASE STORAGE SPACE]

END PLATE AND RETURN TUBE PLATE ARE DESIGNED TO MINIMIZE SPACE AND PREVENT LUBRICANT LEAKAGE



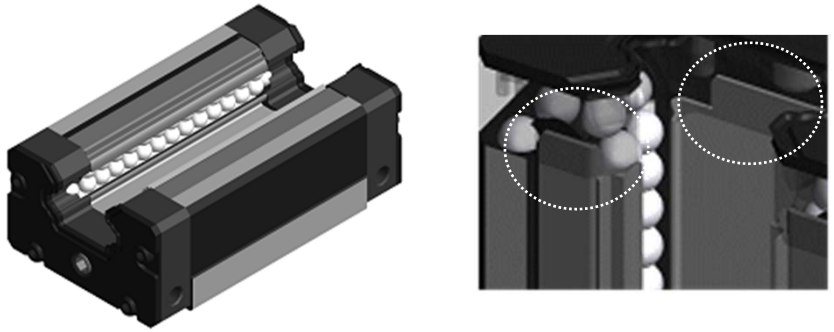
[DECREASE NOISE, ANTI DUST, CLEAN GREASE SUPPLY]

- BALL ALIGNMENT EFFECT INSIDE THE BLOCK
- DECREASE NOISE BETWEEN BALL AND BLOCK BY RETURN TUBE
- ANTI DUST OF BALL AND CLEAN GREASE SUPPLY

THE FEATURE OF SBG-C / SBI SERIES : UPPER/BOTTOM RETAINER

[SELF-ALIGNMENT Features]

Ball retainer plates now snap assemble to the blocks. This unique assembly method allows for internal SELF-ALIGNMENT and load sharing while maintaining rigid ball control.

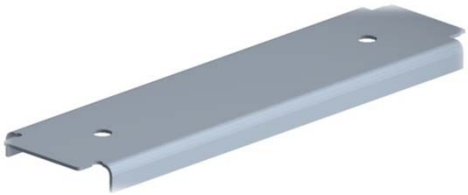


[Snap assemble for SELF-ALIGNMENT features]

[Stainless steel material]

MINIMIZES THE FALLING OUT OF STEEL BALLS

REMOVE SKIDDING AND POOR ROLLING PERFORMANCE BY KEEPING BALLS INSIDE THE LOAD ZONE



[Upper retainer]

[Bottom retainer - Unified seal]

PREVENT FOREIGN SUBSTANCES FROM INFILTRATING INTO THE BALL PATH

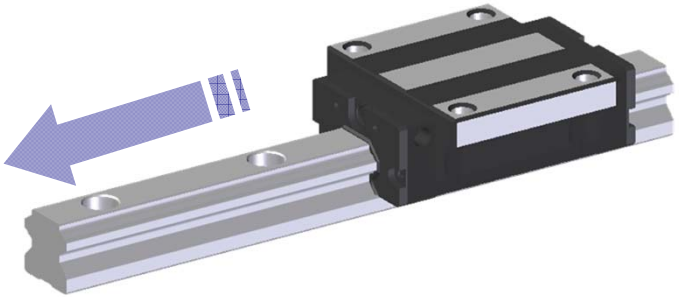
[Bottom retainer - Unified seal]

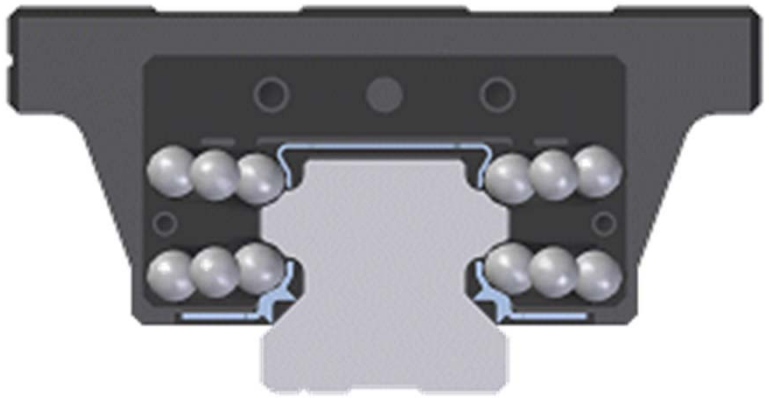
THE FEATURE OF SBG-C / SBI SERIES : UPPER / BOTTOM RETAINER

[Prevent function of Ball escape]

Due to the upper/bottom retainer which shaped like surrounding balls at inside of block, there is no downfall of balls when the block is separated from the rail .

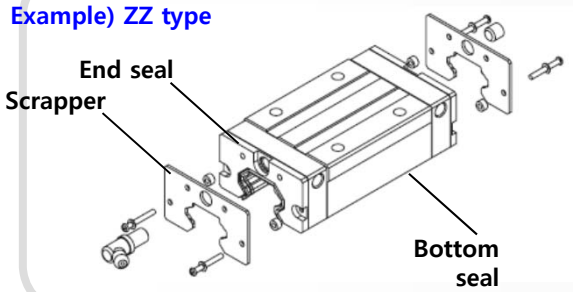
→ Rail and block can be handled separately when the installation process does not require the use of a temporary (or dummy) rail.





[Surrounding the ball structure]

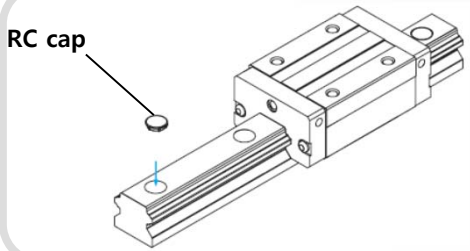
SBG-C / SBI type : Contamination protection options



[Seal options]

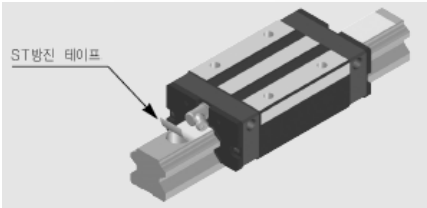
Select the appropriate seal options according to working conditions.

- DD : Bottom seal + End seal + End seal
- ZZ : Bottom seal + End seal + Scrapper
- KK : Bottom seal + End seal + End seal + Scrapper



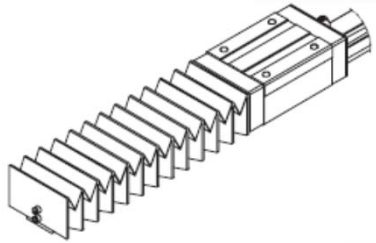
[Rail hole cap : RC cap]

Prevents contaminants from entering the bolt holes of the rail and allowing debris to enter inside the bearing. You can use hole caps made from hardened rubber to fill the holes.



[ST dustproof tape]

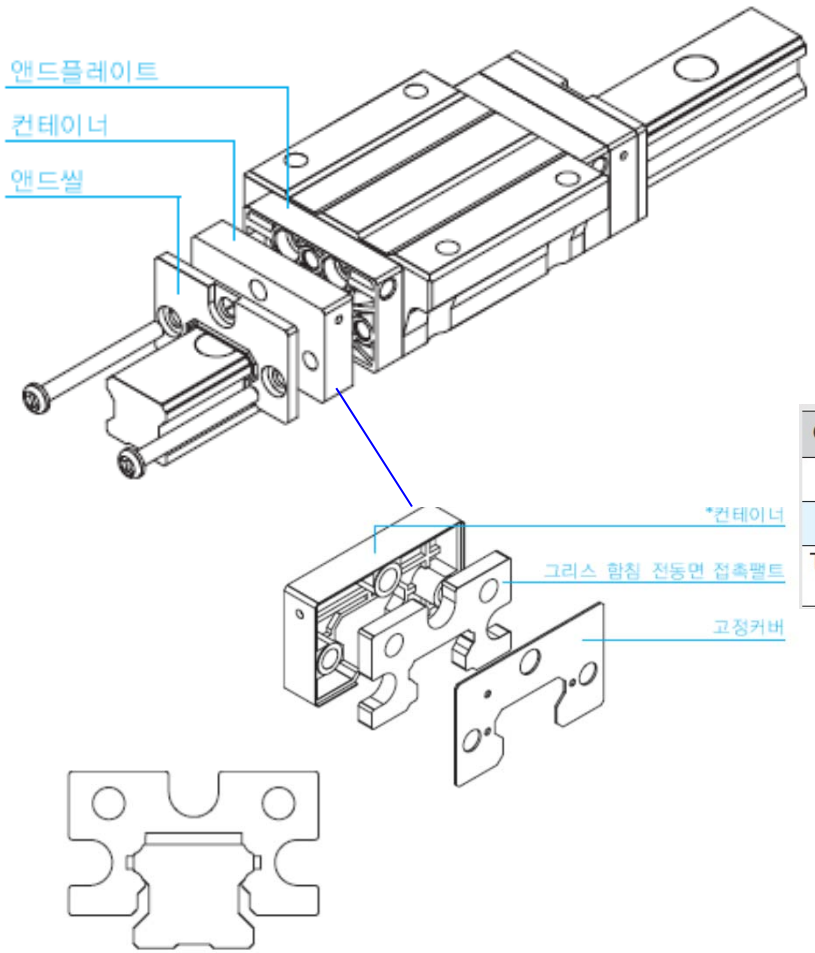
Stainless steel ST dustproof tape greatly improves rail face sealing and works in conjunction with guide block seals. Conventional plastic plugs do not offer the same level of sealing performance.



[Bellows]

For the best protection of the linear rail system, bellows type cover should be used.

SBG-C / SBI SERIES CHOICE [OPTION] : MF CONTAINER



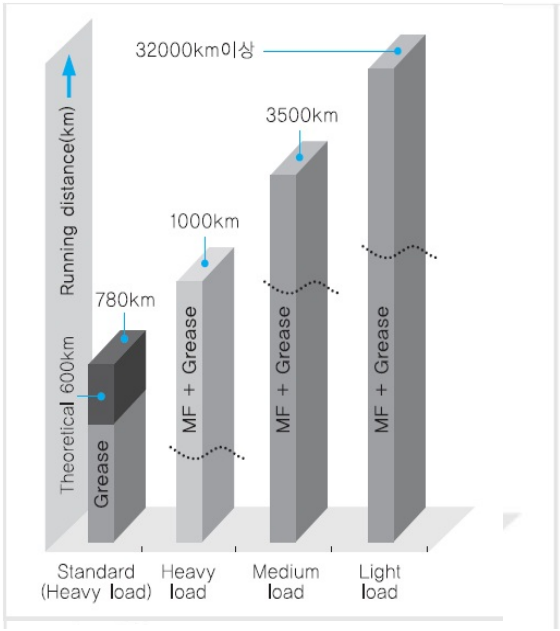
[SELF LUBRICANT : MF CONTAINER]

MF (Self lubricating) contains grease impregnated felt which provides a continuous feed of grease on the raceway. Each compact seal kit will guarantee total surface lubrication and long maintenance free bearing life.

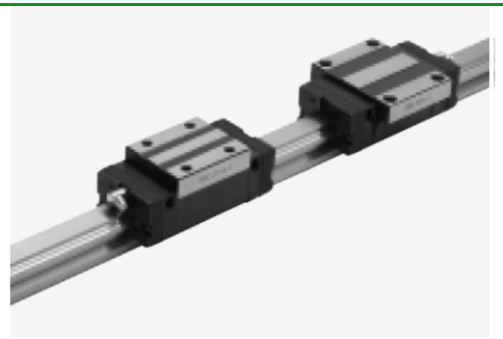
•Performance test

SBG20SL-MF-1-K1-1500-N

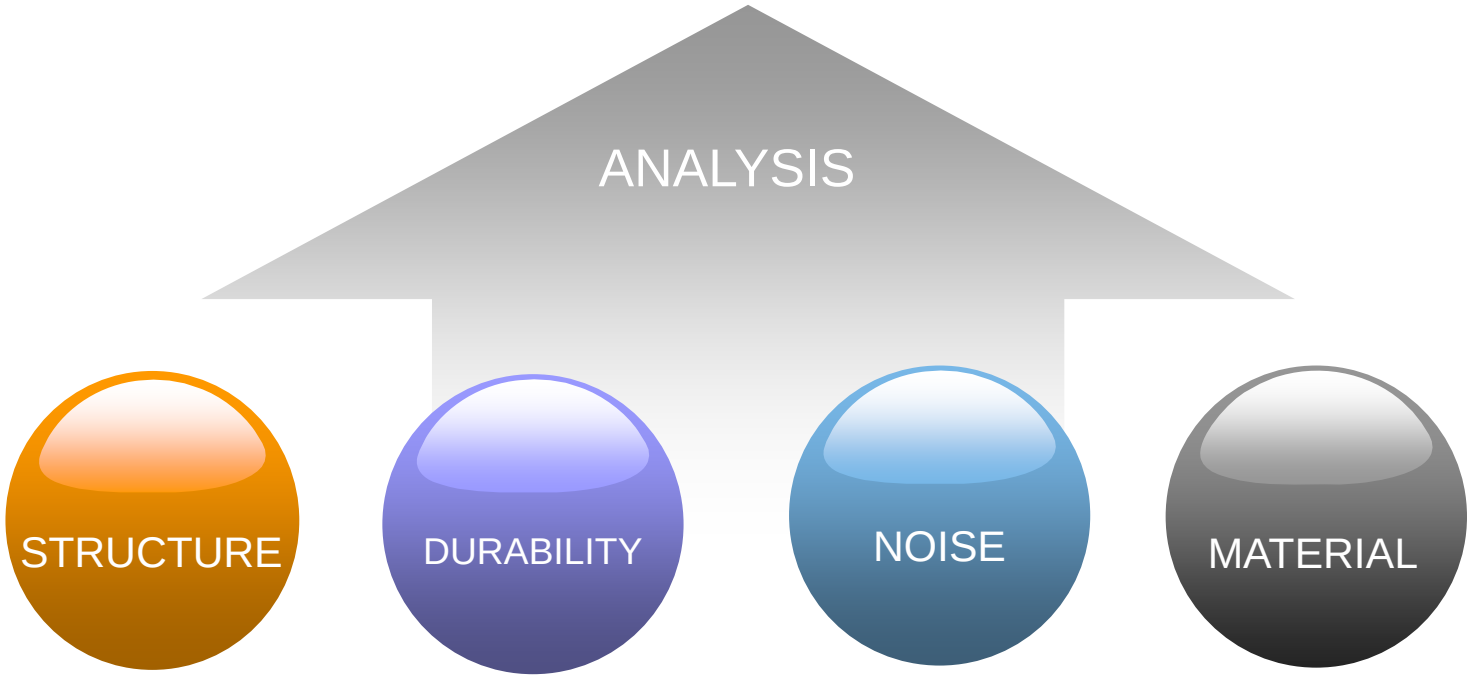
Condition	Heavy	Medium	Light
Load	4.9kN	2.5kN	1.0kN
Velocity	20m/min		
Theoretical Lifetime	600km	1500km	-



Self-lubricant container _ SBC vs Other companies

Type	SBC	THK	NSK
Picture			
Name	MF container	QZ seal	K1 seal
Features	• Grease filled • Using the same grease for block and MF container, there is NO chance to be in trouble. • Long maintenance possible as large area for grease charging • Clean room grease available	• Oil filled • Block is filled by grease and QZ is filled by Oil. There is a chance to be in trouble as using grease mixed with oil. • Use in Clean room NOT possible due to charging oil.	• A foam seal contains Oil • Short life time as NOT enough capacity for oil filling • Frictional resistance higher than other companies due to rubber material. • Exposed to the external without case. It is easy to get polluted. • Use in clean room NOT possible.

SBC vs OTHER BRANDS COMPARISON



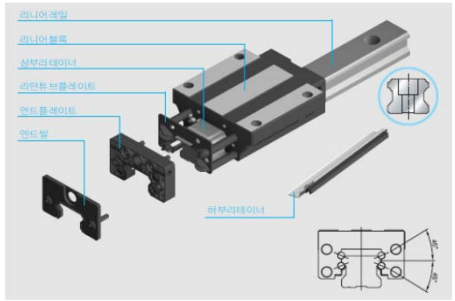
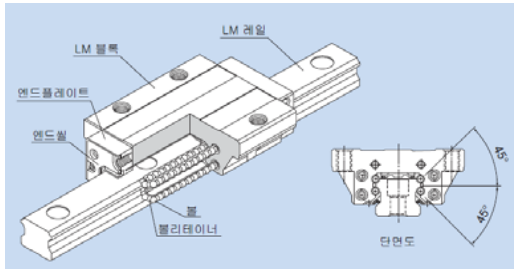
SBC vs Other brands comparison and analysis : MATERIAL

Manufacturer		SBC Linear	T company
Material	Block	• SCM420H • Case hardening	• SCM415 • Case hardening
	Rail	• S55C+α - Improved corrosion proof and mechanical property • Induction hardening heat treatment	• S55C+α - Components are equivalent to SBC • Induction hardening heat teatment
	Steel ball	• SUJ2 • Ball manufacturer (*1) Tsubaki Moto (Japan) Trafalga (UK)	• SUJ2 • Tsubaki Moto and other Japanese brand
	Retainer	• Stainless steel • Non-falling off balls	• Plastic • Non-falling off balls
Features		Rail Heat treatment → Tempering(*2) → Grinding • Transformation does not occur easily after processing. Because of relieving stress.	Rail Heat treatment → Tempering → Grinding

(*1) Ball is a very important part of LM Guide as load, stress and vibration applied to balls. We are using Japanese and UK brand after many tests.

(*2) Tempering : Tempering is a process after heat-treatment to stabilize material for relieving stress. It affects life time.

SBC vs Other brands comparison and analysis : FUNCITON

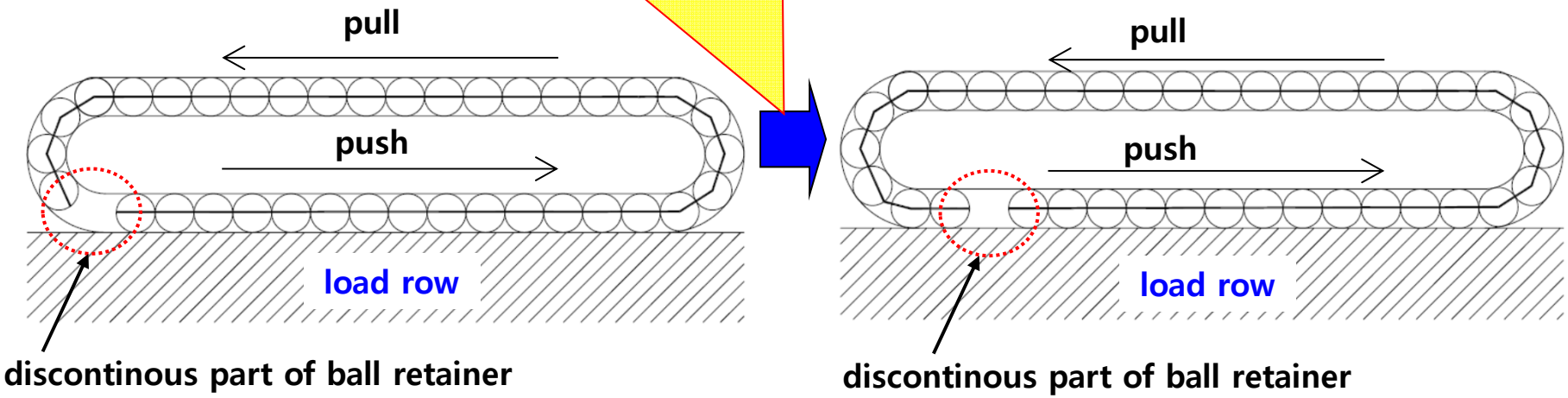
ITEM	SBC Linear	T company
PRODUCTS	• SBI series	• S TYPE series
STRUCTURE		
	• all-ball type • equal load on 4 way • DF structure • Circular-Arc groove • Four raceway structure	• ball retainer (belt) type • equal load on 4 way • DF structure • Circular-Arc groove • Four raceway structure
REMARK	• special plastic return tube plate make low noise and clean lubricating possible. • stainless steel retainer prevents downfall of balls (easy to handle) • max. length of rail : 4m	• low noise by ball retainer • downfall of balls is rare (easy to handle) • When resin ball retainer belt in the block breaks or is severed, it would be fatal. (It happens in the condition of high speed, high load in vertical axis) • max. length of rail : 3m

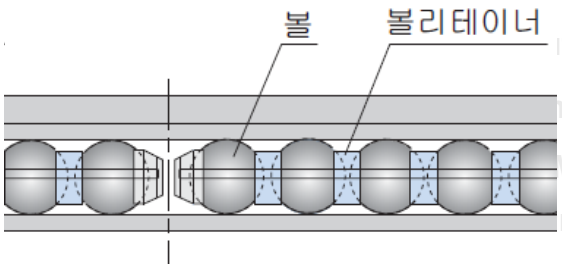
Objection to " T "company retainer type

■ ball retainer type has uniform spacing ball circulation?

☞ objection : While discontinous part of ball retainer is pulled and pushed, resistance occurs, which cause vibration. Large gap is typical at each end of the retainer.

Because of pull and push of ball retainer, vibration from resistance occurs.





Objection to " T " company retainer type

■ Longer life time because of no contact between balls?

☞ objection : Compared with total friction resistance, friction of balls doesn't have real influence.

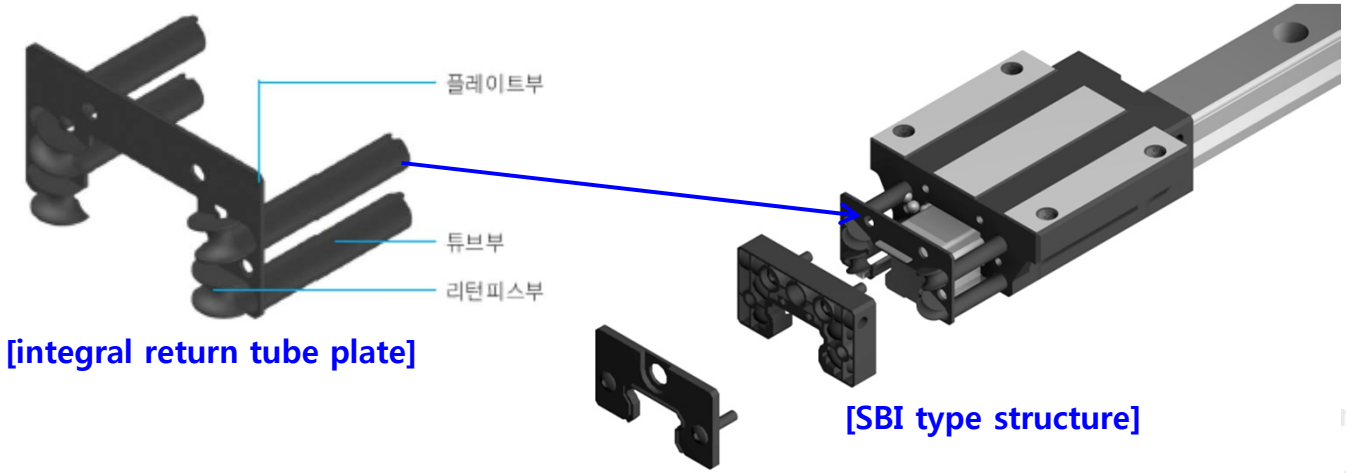
■ Make smooth ball movement?

☞ objection : Smooth ball movement is decided by optimal geometric ball circulation design.

Vibration caused by Ball retainer's discontinuous part have bad influence, instead.

※ SBI type of SBC has integral return tube plate and optimal geometric ball circulation design.

So, even if it is all-ball type, it has low noise and smooth ball movement.



[integral return tube plate]

[SBI type structure]

Objection to " T " company retainer type

■ little frictional heat in high speed?

☞ objection : frictional heat is mostly influenced by friction of seals, friction between balls, and friction of contact surface (loading raceway) where rails and blocks are contacting balls.

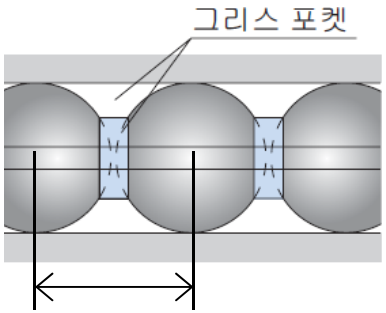
■ Low noise by ball retainer?

☞ objection : SBI type of SBC has only balls not including retainer, but it is in almost same noise level with S TYPE (ball retainer type of T company) only by average 3dB higher than S TYPE dB.

■ Grease container function between ball and ball?

☞ objection : the pitch between balls of ball retainer is almost same with ball diameter and ball retainer hardly has any grease holding capability.

※ If ball diameter is similar with the pitch, there is no space to contain grease in the retainer



ball dia. and the pitch is almost same.

Objection to " T " company retainer type

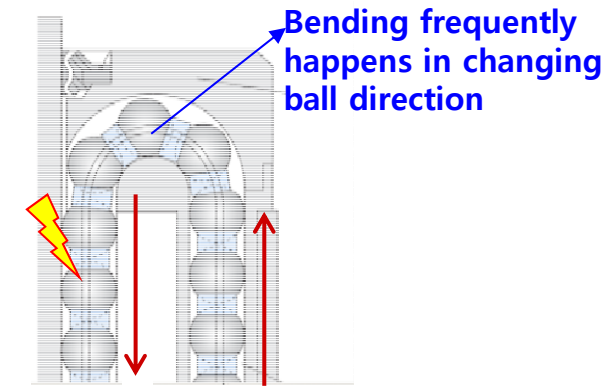
■ Structural disadvantage of Chain-type ball retainer

☞ When changing direction, bending often happens, which causes the plastic retainer to fatigue (i.e., eventually wear out and fail).

Accordingly, push-and-pull in the block frequently happens and the retainer is finally severed.

☞ Plastic ball retainer is easily oxidized by lubricant or a coolant and it is severed when used long time.

☞ When used in vertical axis, because of moment load and momentary axial direction movement power, resin chain-type ball retainer becomes fatigued and breaks. This case is often found in production line.

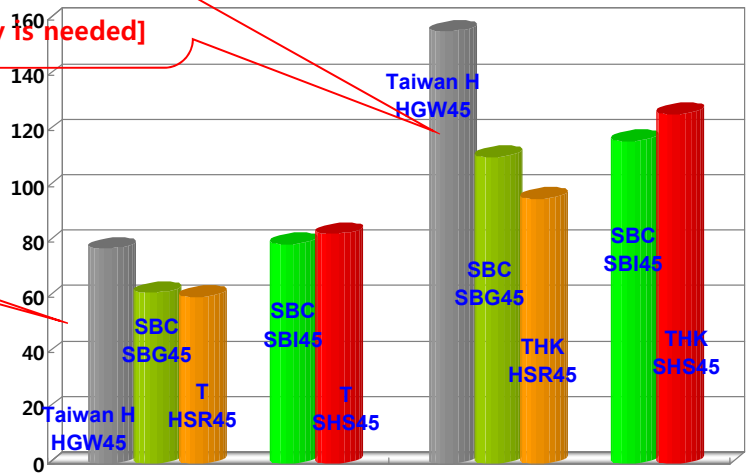


※ In vertical axis, axial direction movement power is relatively higher than horizontal axis because of gravity and moment load and plastic retainer is often severed.

SBC vs Other brands comparison and analysis : STATIC LOAD

When comparing all items, both dynamic and static load should be in same range with SBG (SBC) – HSR (T), but its loads appear much higher.
[A review of data reliability is needed]

Basic static load is much higher than the loads of similar products of SBG (SBC) and HSR (T)
[A review of data reliability is needed]



basic dynamic load [kN]

basic static load [kN]

When we compare main items (*2) related to static loads of similar models of each manufacturer(*1),
Taiwan H -SBC- T company have same level or similar in all items. If similar models have similar levels in main items, static loads should be similar in each other. (SBC and Japan T company models have same level in static loads.)

But, Taiwan H company shows much higher loads than one of other companies and a review of data reliability is needed.

(*1) Similar model according to manufacturer

- HGW(Taiwan H) - SBG(SBC) -HSR(T)
- SBI(SBC) - SHS(T)

(*2) Main items related to static loads of LM guide

- loaded ball numbers
- effective length of block (the length of which the block get practically loaded)
- ball diameter

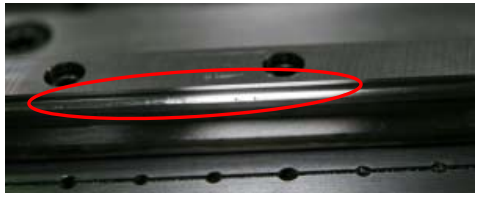
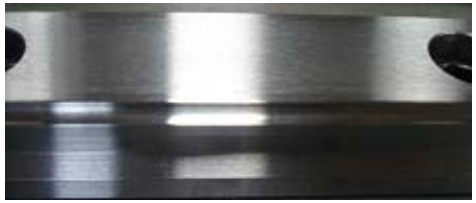
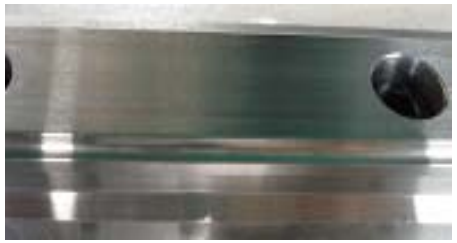
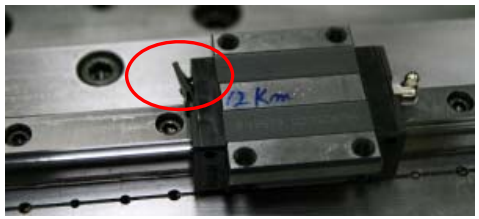
ITEM	Taiwan "H"	SBC Linear		T	
Model comparison	HGW45CA	SBI45FL	SBG45FL-C	SHS45C	HSR45A
Basic dynamic load	77.57 kN	79.2 kN	61.6 kN	82.8 kN	60 kN
Basic static load	155.93 kN	116.3 kN	110.6 kN	126 kN	95.6 kN
Effective length of block	97 mm	108 mm	98 mm	106 mm	98 mm
Ball diameter	7.938 mm	6.35 mm	7.938 mm	6.35 mm	7.938 mm
Loaded ball number per row	12 pcs	17 pcs	12 pcs	16 pcs	12 pcs

Comparision of static load : SBI [ball type] – SHS [retainer type]

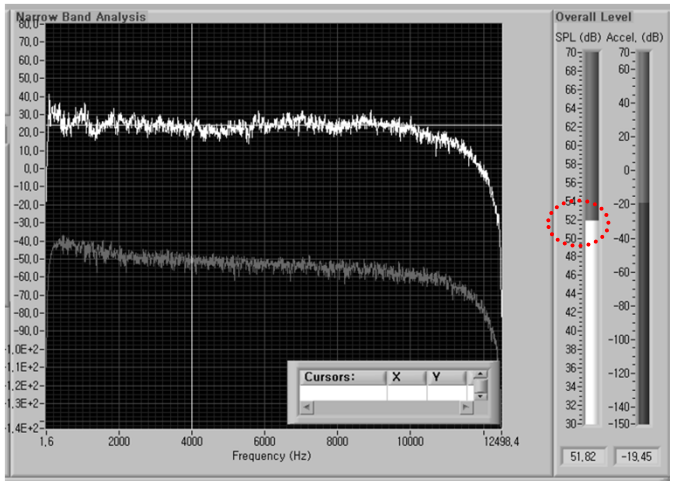
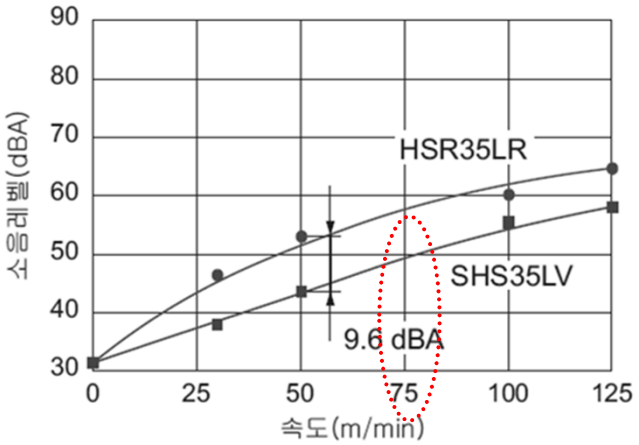
Company	SBC	T
Compared model	SBI35	SHS35V
Basic dynamic load	59.5 kN	62.3 kN
Basic static load	89.1 kN	96.6 kN

※ Normally, only max. 1/3 (or average ¼) of static loads were considered in designing the products, the slight difference of static load can be ignored.

SBC vs Other companies _ Comparative analysis : NOISE LEVEL

Type		Taiwan " H " company	SBC Linear	T company
Test conditions		• Model No.: HGW25CC • Test load : 26kN±10% • Stroke: 1.5m • 50km running	• Model No.: SBI 30HL • Test load : 42kN±10% • Stroke : 1.5m • 50km running	• Model No.: SHS 30V • Test load : 44kN±10% • Stroke : 1.5m • 50km running
Test Result	Rail	• 12km running : Pressure mark 	• 50km running : OK 	• 50km running : OK 
	Block	• 12km running : End plate damaged 	• 50km running : OK 	• 50km running : OK 

SBC vs Other brands comparison and analysis : NOISE LEVEL

Manufacturer	SBC Linear	T company
Model type	SBI35FL (Ball type)	SHS35LV (Caged Ball type)
Noise level	 • Velocity : 75 m/min (≒1.25m/s) • Noise level : About 50~53 (dB)	 SHS35LV형, HSR35LR형의 소음레벨 비교 • From THK catalogue • Noise level at the same speed : About 50(dB) - A little bit lower than SBC

Only 3dB difference at the same speed

If Noise level is under 80dB, it can be ignored as noise level of LCD production line is 80dB.

PRODUCTION FACILITIES


Straightening Machine

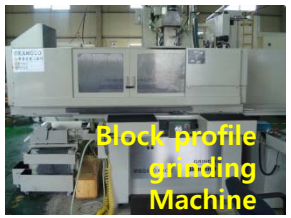

Heat treatment Machine


Tempering Machine


Surface grinding Machine


Rotary grinding Machine


Rail's hole finishing Machine


Block profile grinding Machine

Machining Center


Block profile grinding Machine

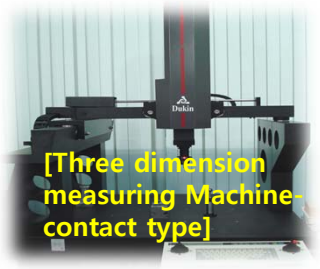

Rail profile grinding Machine


Rail profile grinding Machine

PRODUCTION FACILITIES


[Vickers test]


[Shape-intensity tester]

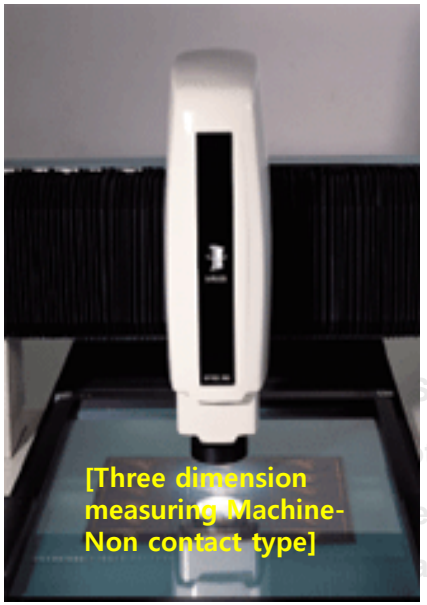

[Three dimension measuring Machine-contact type]


[Laser tester]


[Durability tester]


[Noise & Vibration tester]


[Crach checker]


[Three dimension measuring Machine-Non contact type]


[Running parallelism tester]