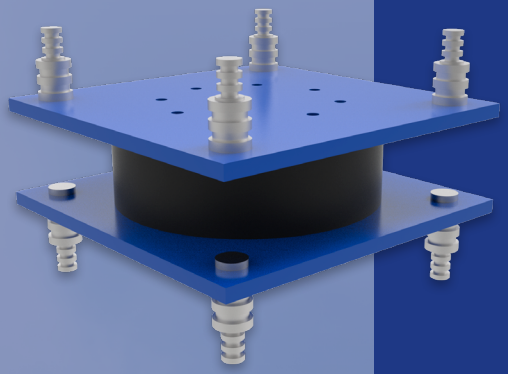
GNMA

SEISMIC ISOLATOR



GNMA – Your Professional Seismic Isolator Solution Provider

Natural Rubber Bearing Lead Rubber Bearing High Damping Rubber Bearing

About GNMA

Hebei Jumai New Materials Technology Development Co., Ltd has become a domestic-leading seismic isolation bearing manufacturer with a large production base and has been specialized in the production and R&D of a full range of seismic isolation products including natural rubber bearings, lead rubber bearings and high damping rubber bears, etc.

With over 20 years of manufacturing experience, we are committed to developing superior seismic isolation bearing products and providing our customers with customized cost-effective seismic isolation solutions and professional services to build our brand and influence.

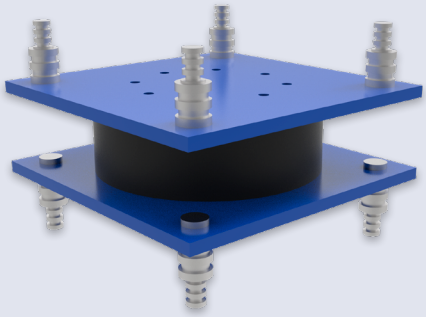
Our Certificates

ISO 9001 certificate

CE certificate

Certificate of Compliance

Seismic Isolator



Seismic isolatator is a bearing device installed in the structure to meet seismic isolation requirements.
It is a seismic isolation device installed between the superstructure and substructure of buildings to extend the natural vibration period of the whole system, increase the damping, and reduce the seismic energy transferred to the superstructure, thereby achieving the expected seismic isolation requirements.

It has currently widely used in the seismic isolation design of various structures including residential buildings, office buildings, hospitals, museums, etc.

Functions

It has a higher vertical bearing capacity and can support buildings stably.

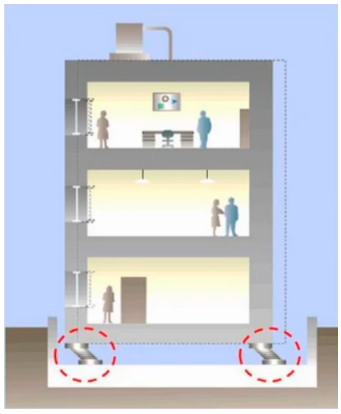
It has a greater horizontal deformation capability and restoring force and can effectively absorb and dispatch seismic energy.

It has sufficient lateral flexibility and can extend the natural vibration period of the structure, lower the seismic influence coefficient, thereby safeguarding the safety of the superstructure and appurtenances inside.

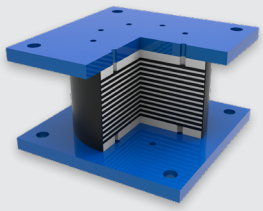
Working Principle

The seismic isolator is directly installed underneath the buildings to separate it from the ground so that the seismic energy is concentrated in the soft seismic isolation layer.

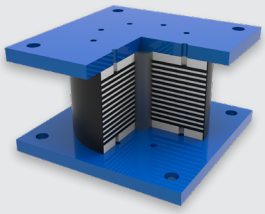
In this way, the energy transferred to the superstructure is significantly reduced by making full use of the characteristics of the seismic isolator absorbing the seismic energy, thereby safeguarding the safety of buildings and appurtenances inside.



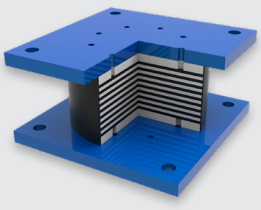
Category



Natural Rubber Bearing

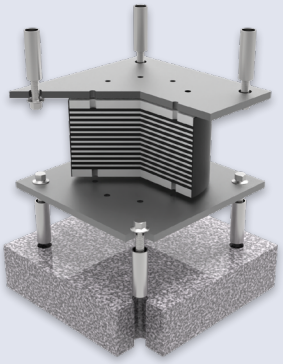


Lead Rubber Bearing



High Damping Rubber Bearing

Natural Rubber Bearing



Natural rubber bearing, short for NRB, is a kind of seismic isolation bearing with alternately piled up multi-layer natural rubbers and multi-layer steel plates. This bearing offers a higher vertical load capacity and a greater horizontal flexibility.

It has been widely used in the seismic isolation design of residential buildings, office buildings, hospitals and other buildings, and has achieved great economic and social benefits.

As the NRB has a low energy dissipation capacity, therefore, it often forms a seismic isolation system together with dampers.

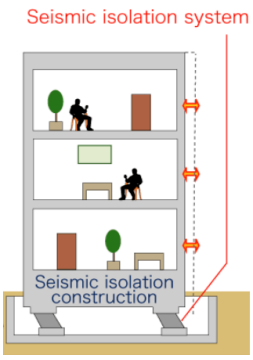
Features

- The strong adhesion between the rubber layer and the steel plate allows the bearing maintaining a higher vertical bearing capacity and providing a stable support for the building when a large horizontal displacement occurs.
- It prolongs the natural vibration period of the building and turns the violent shaking of the building into a slow horizontal movement.
- It has great linearity and a stable restoring force, which allows the NBR can restore the normal position quickly when it is subject to a wind-induced vibration and an earthquake.
- It requires to be used together with dampers. However, combining with different types of dampers offers great design flexibility.
- It maintains a stable performance after going through repeated earthquakes, offering an exceptional durability.
- Easy to install, maintain and replace, bringing great social and economic benefits.

Working Principle

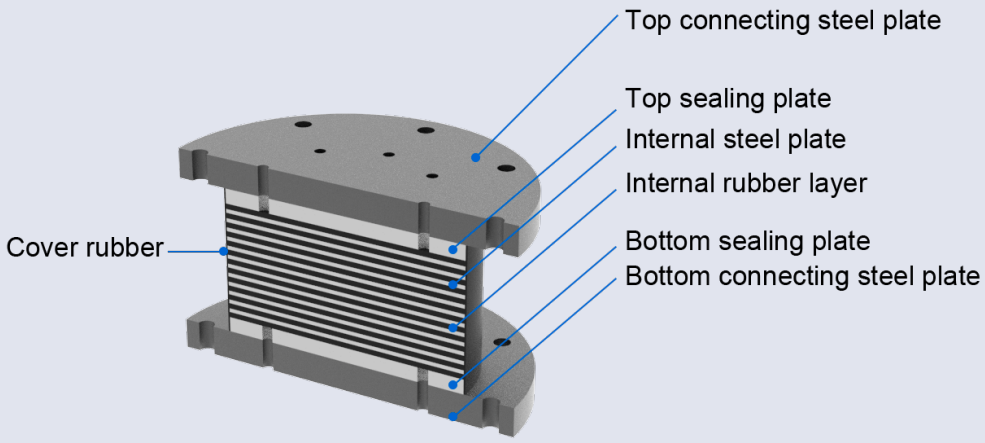
By installing natural rubber bearings between the superstructure and the foundation, a seismic isolation layer is formed, achieving a soft connection with the ground to turn the violent shaking of the building into a slow horizontal movement, thereby reducing the input of seismic energy.

At the same time, the NRB separates the superstructure from the lower foundation. When the earthquake occurs, the vibration energy of the lower foundation will be transferred to the natural rubber bearing first. By taking advantage of the characteristics of the combination of rigidity and flexibility of the NRB, the transmission of seismic energy to the upper structure can be effectively avoided or reduced, thereby ensuring the safety of the superstructure and appurtenances inside.

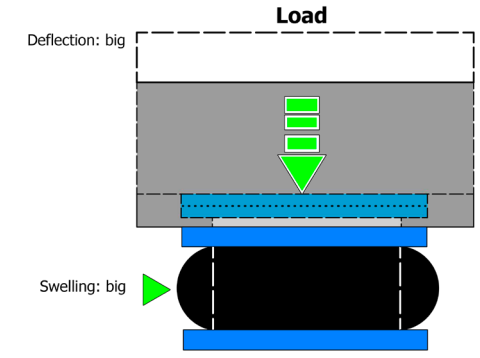


Structure

Natural rubber bearing consists of a top and a bottom connecting steel plates, a top and a bottom sealing plates, internal natural rubber layers, internal steel plates and a rubber cover.

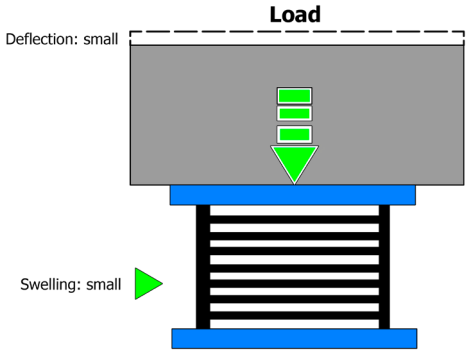


When the NRB is subject to a vertical pressure, rubber sheets and steel plates are radial deformed. However, the deformation of steel plates is much smaller than that of rubber sheets, therefore, rubber sheets are constrained by steel plates, thus limiting the vertical compression deformation of rubber sheets to ensure that the bearing has a higher vertical bearing capacity and provides a stable support to the building;



Single-Layer Elastomeric Bearing

When the NRB is subject to a horizontal pressure, laminated steel plates cannot restrain the shear deformation of rubber sheets. At that time, the horizontal deformation of the bearing is approximately the sum of the horizontal deformation of all rubber sheets. As a result, the bearing has a large horizontal deformation capacity.



Multi-Layer Elastomeric Bearing

Specification

Table 1: Natural Rubber Bearing Specification (G4)										
Item	NRB (G4)	NRB (G4)	NRB (G4)	NRB (G4)	NRB (G4)	NRB (G4)	NRB (G4)	NRB (G4)	NRB (G4)	NRB (G4)
	Φ300	Φ400	Φ500	Φ600	Φ700	Φ800	Φ900	Φ1000	Φ1100	Φ1200
Shear modulus of elasticity N/mm^2	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
1_{st} shape factor	23.3	24.3	24.0	28.5	33.3	38.0	35.6	39.6	41.9	45.7
2_{nd} shape factor	5.17	5.84	5.10	5.45	6.36	5.00	5.56	6.17	6.65	7.21
Effective size cm^2	700	1250	1879	2820	3839	5014	6346	7834	9326	11116
Datum level pressure N/mm^2	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Ultimate deformation (at datum level pressure) %	400	400	400	400	400	400	400	400	400	400
Horizontal equivalent stiffness kN/m	470	710	710	990	1350	1210	1510	1870	2229	2641
Vertical compression stiffness kN/mm	844	1384	1420	2282	3632	3664	4339	5839	7347	9095

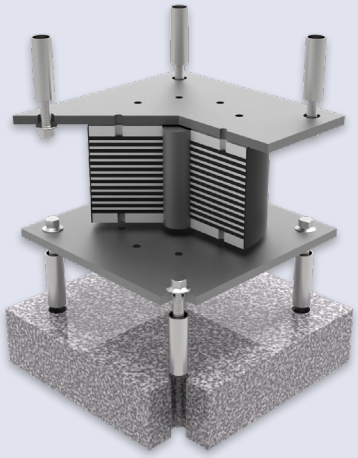
Notes:
Other specifications are available upon request.

Specification

Table 2: Natural Rubber Bearing Specification (G6)										
Item	NRB (G6)	NRB (G6)	NRB (G6)	NRB (G6)	NR B(G6)	NRB (G6)	NRB (G6)	NRB (G6)	NRB (G6)	NRB (G6)
	Φ300	Φ400	Φ500	Φ600	Φ700	Φ800	Φ900	Φ1000	Φ1100	Φ1200
Shear modulus of elasticity N/mm^2	0.55	0.55	0.55	0.55	0.55	0.55	o.55	0.55	0.55	0.55
1_{st} shape factor	23.3	24.3	24.0	28.5	33.3	38.0	35.6	39.6	41.9	45.7
2_{nd} shape factor	5.17	5.84	5.10	5.45	6.36	5.00	5.56	6.17	6.65	7.21
Effective size cm^2	700	1250	1879	2820	3839	5014	6346	7834	9326	11116
Datum level pressure N/mm^2	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Ultimate deformation (at datum level pressure) %	400	400	400	400	400	400	400	400	400	400
Horizontal equivalent stiffness kN/m	720	1090	1170	1540	2090	1880	2350	2900	3108	3705
Vertical compression stiffness kN/mm	1027	1628	1720	2688	4173	4124	4932	6532	7461	9095

Notes:
Other specifications are available upon request.

Lead Rubber Bearing



Lead rubber bearing, short for LRB, is a kind of seismic isolation bearing that adds one or more lead cores inside a common natural rubber bearing and absorbs seismic energy by relying on the plastic deformation of lead cores.

LRB has a large vertical stiffness that allows it to support buildings stably; besides, it has a small horizontal stiffness that achieves the displacement of the bearing and offers a horizontal restoring force via the shear deformation of laminated rubber. It can be used in the seismic isolation systems alone and adjust damping by regulating the diameter or number of lead cores to offer great design flexibility.

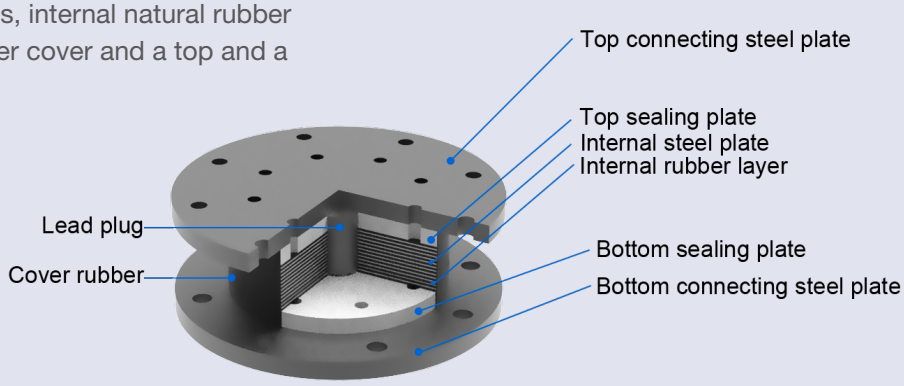
As an effective seismic isolation device, LRB is widely used in residential buildings, office buildings, teaching buildings, hospitals, town halls, museums, factories, etc.

Features

- Lead cores with great energy dissipation capacity are provided to allow the LRB absorbing seismic energy through the plastic deformation.
- Damping can be adjusted by regulating the diameter or number of lead cores to offer great design flexibility.
- It has good horizontal deformation capacity and stable elastic restoring force, which allows the LRB maintaining excellent performance after repeated earthquakes and offering exceptional durability and reliability.
- It has great vertical bearing capacity that can support buildings stably.
- It prolongs the natural vibration period of the building, reduces the frequency of natural vibration and turns the violent shaking of the building into a slow movement.
- The addition of lead increases the early stiffness of the LRB to prevent vibrations caused by storms.
- It offers great seismic isolation effect and can effectively protect the safety of buildings and personnel & devices inside.
- It offers exceptional durability, great fatigue resistance, hot air aging resistance, ozone aging resistance, acid resistance, water resistance and fire resistance, and its lifespan ranges from 60 to 80 years.
- Easy to install, maintain and replace, no repair is required after the earthquake, bringing great social and economic benefits.
- LRB can be used in seismic isolation systems alone, especially in engineering projects.

Structure

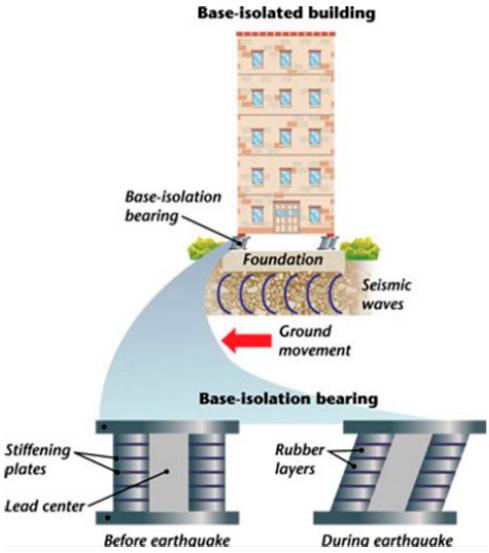
Lead rubber bearing consists of a top and a bottom connecting steel plates, one or more lead cores, internal natural rubber layers, internal steel plates, a rubber cover and a top and a bottom sealing plates.



- **Internal natural rubber layer:** Guarantee the horizontal displacement function of the LRB.
- **Internal steel plate layer:** Provide a higher load bearing capacity that allows the LRB to support buildings stably.
- **Lead core:** The purity of the lead core shall be at least 99.9%. When the LNB is subject to a shear deformation, it absorbs seismic energy through the plastic deformation. When the earthquake is over, lead core will restore the building to its original position automatically through the action of rubber shear force in the process of dynamic recovery and recrystallization.

Working Principle

Install a lead rubber bearing at the bottom or in the middle of the building to form a seismic layer and separate the upper structure from the lower foundation. When the earthquake occurs, the vibration energy of the lower foundation will be transferred to the lead rubber bearing first. When the LRB displaces horizontally, metal lead cores inside can not only provide a lateral resistance but also dispatch seismic energy through its deformation when large deformation occurs. In this way, the transmission of seismic energy to the superstructure can be effectively avoided or reduced, thereby ensuring the safety of the superstructure and personnel & devices inside and the normal operation of indoor equipment.



Specification

Table 1: Round Lead Rubber Bearing Specification (G4)

Item				LRB (G4) 600-100	LRB (G4) 650-130	LRB (G4) 700-140	LRB (G4) 750-160	LRB (G4) 800-170	LRB (G4) 900-180	LRB (G4) 1000-200	LRB (G4) 1100-220	LRB (G4) 1200-240
Material property	Shear modulus (N/mm^2)			0.39								
Shape, dimension and dimensional accuracy of all parts	Rubber diameter (mm)			600	650	700	750	800	900	1000	1100	1200
	Lead core diameter (mm)			100	130	140	160	170	180	200	220	240
	Total rubber thickness (mm)			200	201.6	198	201.6	200	197.2	203	203	203
	1_{st} shape factor			37.5	38.7	38.9	39.1	40	38.8	35.7	39.3	42.9
	2_{nd} shape factor			3.0	3.2	3.5	3.7	4.0	4.6	4.9	5.4	5.9
	Connecting plate diameter (mm)			1000	1050	1100	1150	1200	1300	1400	1500	1500
	Connecting plate thickness (mm)			27	27	31	31	36	36	41	41	50
	Overall height (mm)			419.9	415.3	411.7	437.5	453.7	425.1	419.4	419.4	523.4
Vertical property	Vertical stiffness	K_v	(10^3 kN/m)	1766	2102	2491	2817	3284	4128	4660	6042	7605
	Datum level pressure (N/mm^2)			6	6	8	8	10	12	15	15	15
Horizontal property	Initial stiffness K1	K_u	(10^3 kN/m)	7.21	8.44	9.97	11.27	12.92	16.54	19.84	24,.1	28.57
	Secondary stiffness K2	K_d	(10^3 kN/m)	0.554	0.649	0.767	0.867	0.994	1.273	1.526	1.847	2.198
	Equivalent stiffness	K_{eq}	(10^3 kN/m)	0.87	1.17	1.39	1.66	1.90	2.30	2.76	3.34	3.97
	Designed nominal horizontal displacement (%)			100								

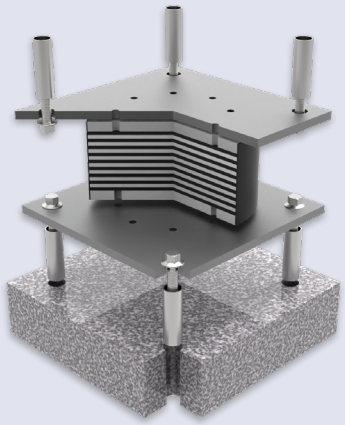
Notes:
Other specifications are available upon request.

Specification

Table 2: Round Lead Rubber Bearing Specification (G6)										
Item				LRB (G6) 600-100	LRB (G6) 650-130	LRB (G6) 700-140	LRB (G6) 750-160	LRB (G6) 800-170	LRB (G6) 900-180	LRB (G6) 1000-200	LRB (G6) 1100-220	LRB (G6) 1200-240
Material property	Shear modulus (N/mm^2)			0.55								
Shape, dimension and dimensional accuracy of all parts	Rubber diameter (mm)			600	650	700	750	800	900	1000	1100	1200
	Lead core diameter (mm)			100	130	140	160	170	180	200	220	240
	Total rubber thickness (mm)			200	201.6	198	201.6	200	197.2	203	203	203
	1_{st} shape factor			37.5	38.7	38.9	39.1	40	38.8	35.7	39.3	42.9
	2_{nd} shape factor			3.0	3.2	3.5	3.7	4	4.6	4.9	5.4	5.9
	Connecting plate diameter (mm)			1000	1050	1100	1150	1200	1300	1400	1500	1500
	Connecting plate thickness (mm)			27	27	31	31	36	36	41	41	50
	Overall height (mm)			419.9	415.3	411.7	437.5	453.7	425.1	419.4	419.4	523.4
Vertical property	Vertical stiffness	K_v	(10^3 kN/m)	2259	2648	3077	3472	3940	5029	5994	7252	8631
	Datum level pressure (N/mm^2)			6	6	8	8	10	12	15	15	15
Horizontal property	Initial stiffness K1	K_u	(10^3 kN/m)	9.83	11.30	13.34	14.96	17.16	22.14	26.56	32.13	38.24
	Secondary stiffness K2	K_d	(10^3 kN/m)	0.756	0.869	1.026	1.150	1.320	1.703	2.043	2.472	2.942
	Equivalent stiffness	K_{eq}	(10^3 kN/m)	1.03	1.33	1.58	1.86	2.12	2.62	3.14	3.80	4.52
	Designed nominal horizontal displacement (%)			100								

Notes:
Other specifications are available upon request.

High Damping Rubber Bearing



High damping rubber bearing, short for HDRB, is a kind of seismic isolation bearing that is much similar to natural rubber bearing in shape and structure. The difference between HDRB and NRB lies in that the HDRB offers better damping property by adding graphite filler (carbon black), reinforcing agent, vulcanizing agent, plasticizer and other compounding agents in natural rubber.

It not only maintains the good mechanical properties of natural rubber bearing, but also offers a high damping ratio, which allows the HDRB to absorb and dissipate the seismic energy in the earthquake, thus reducing the impact of the earthquake.

HDRB can be used in the seismic isolation systems separately and adjust the damping by regulating the amount of various compound agents added and the mixing ratio of these agents. Generally, damping ratio can reach up to 10% to 25%.

HDRB offers great seismic isolation effect and has a wide range of applications. Therefore, it is an economic and durable new seismic isolation device for buildings.

Features

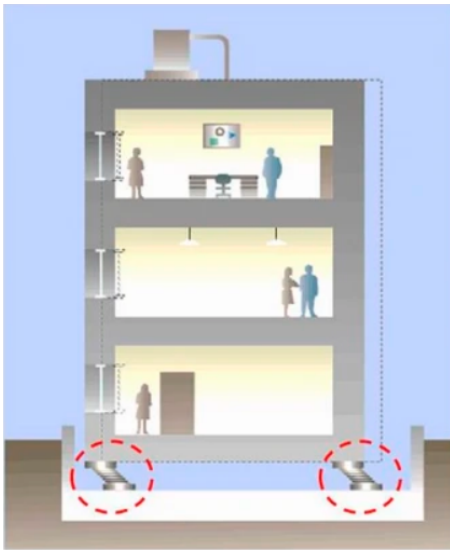
- It has high strength and vertical stiffness to allow the HPDR to withstand higher vertical load and support buildings stably.
- High damping rubber has great horizontal deformation capacity, horizontal restoring force as well as amazing seismic energy absorption and dissipation capacity.
- The designed maximum damping ratio can reach up to 25% and can provide damping required in seismic isolation design without adding additional dampers, requiring a low maintenance and management costs.
- Its smooth hysteresis characteristics allows the HPRB to reduce both the seismic response and high frequency vibration of the supper structure in the earthquake.
- Its higher initial horizontal stiffness provides excellent resistance to wind-induced vibration.
- It has minimal residual deformation after severe earthquakes and does not require replacement. It is economical and durable and enjoy a long service life, typically up to 60 years and above.

Working Principle

By introducing HDRBs in the structure, a soft seismic isolation layer is created to separate the superstructure from the lower foundation. In this way, it lowers the overall stiffness of the structure, extends its natural vibration period and reduces its natural vibration frequency, thus avoiding the highest frequency range of energy in the earthquake and reducing the input of seismic energy.

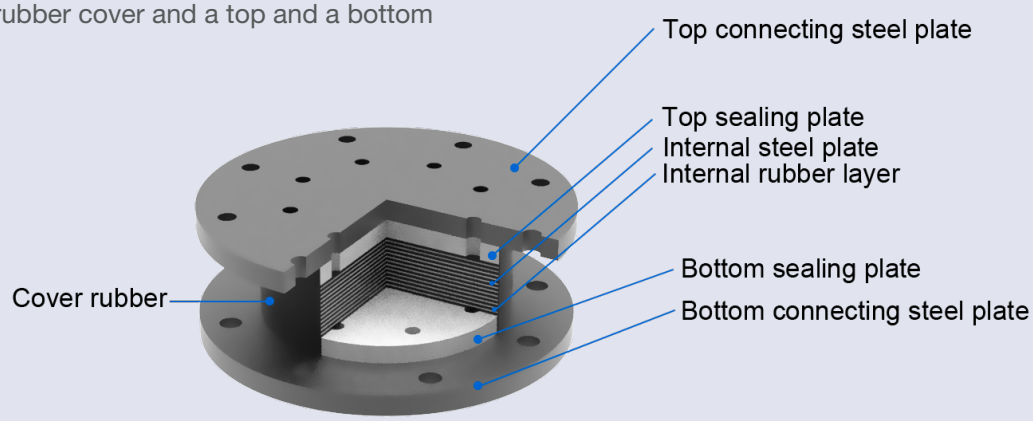
Meanwhile, the high damping characteristics of the seismic isolation layer ensure the absorption and dissipation of seismic energy and facilitate to reduce the response of the structure. In this way, the relative displacement will be concentrated in the seismic isolation layer with lower stiffness, thus limiting the upward transfer of seismic energy, and lowering the response of the superstructure.

When the earthquake comes, the vibration energy of the lower foundation is transferred to the high damping rubber bearing first. When the bearing is subject to a horizontal deformation, the HDRB offers certain resistances that can effectively absorb and dissipate seismic energy, to avoid or reduce the transmission of seismic energy to the upper structure, thus protecting the superstructure and personnel & equipment inside from earthquake damage. After the earthquake, the bearing will restore to its original position through the recovery force of the rubber.



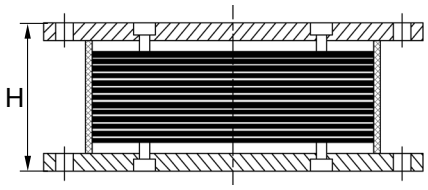
Structure

High damping rubber bearing consists of top and a bottom connecting steel plates, internal high damping rubber layers, internal steel plates, a rubber cover and a top and a bottom sealing plates.



- **Internal steel plate layer:** Provide a higher vertical load bearing capacity that allows the HPRB to support buildings stably.
- **Internal high damping rubber layer:** Offer great horizontal deformation capacity, horizontal restoring force as well as amazing seismic energy absorption and dissipation capacity.
- **Cover rubber:** Protect the inner rubber from ozone and UV damage and offer great aging resistance.

Specification



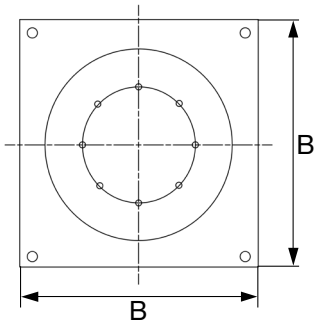


Table 1: High Damping Rubber Bearing Specification (G4)

Item		HDRB (G4) Φ300	HDRB (G4) Φ400	HDRB (G4) Φ500	HDRB (G4) Φ600	HDRB (G4) Φ700	HDRB (G4 Φ800	HDRB (G4) Φ900	HDRB (G4) Φ1000	HDRB (G4) Φ1100	HDRB (G4) Φ1200
Shear modulus of elasticity N/mm^2		0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Vertical load (kN)	F_z	500	1200	2200	2700	4000	5900	8800	10000	14000	16000
Displacement (mm)	V	150	200	250	300		400	400	400	400	400
Horizontal equivalent stiffness (kN/mm)	K_H	0.37	0.51	0.65	0.76	0.90	1.03	1.31	1.57	1.90	2.26
Equivalent damping ratio (%)	H_{eq}	8–12									
Dimension (mm)	D	300	400	500	600	700	800	900	1000	1100	1200
	H	200	230	265	295	345	395	395	430	430	430
T_e = rubber thickness	B	350	450	55o	650	750	850	950	1050	1150	1250
	T^e	80	104	128	156	180	204	204	210	210	210

Notes:
Other specifications are available upon request.

Specification

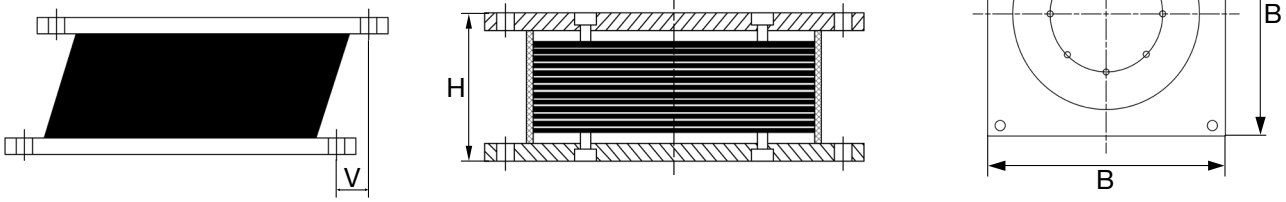


Table 2: High Damping Rubber Bearing Specification (G6)											
Item		HDRB (G6)	HDRB (G6)	HDRB (G6)	HDRB (G6)	HDRB (G6)	HDRB (G6)	HDRB (G6)	HDRB (G6)	HDRB (G6)	HDRB (G6)
		Φ300	Φ400	Φ500	Φ600	Φ700	Φ800	Φ900	Φ1000	Φ1100	Φ1200
Shear modulus of elasticity N/mm^2		0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Vertical load (kN)	F_z	500	1200	2200	2700	4000	5900	8800	1000o	14000	16000
Displacement (mm)	V	150	200	250	300	350	400	400	400	400	400
Horizontal equivalent stiffness (kN/mm)	K_H	0.51	0.70	0.88	1.04	1.23	1.42	1.79	2.15	2.60	3.10
Equivalent damping ratio (%)	H_{eq}	8–12									
Dimension (mm) T_e = rubber thickness	D	300	400	500	600	700	800	900	1000	1100	1200
	H	200	230	265	295	345	395	395	430	430	430
	B	350	450	550	650	750	850	950	1050	1150	1250
	T^e	80	104	128	156	180	204	204	210	210	210

Notes:
Other specifications are available upon request.

GNMA

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