Noise Control

Shock Control

Vibration Control

Seismic Control

www.nsv.kr

INTRODUCTION

Since its foundation on March 1, 1986, NSV has been manufacturing noise-control, vibration-control, and shock-control products for more than 30 years, contributing greatly to developments in construction.

Recently, we have been making extreme efforts in technical research and development for seismic control, which has recently been drawing lots of attention.

As an industry leader in Korea, we provide the top services through our company philosophy of "Creating a Pleasant Environment" and the best technology.

Company Overview

| Company Name
NSV Co., Ltd.

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| R&D Center
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Business Domains

Anti-noise and vibration equipment (noise/vibration fields), Seismic/vibration control research and design (structure/construction), Engineering (noise/vibration fields)Measurement agency business (noise/vibration fields), Construction (machine and equipment installation/metal structure and joiner's work)

Certifications

ISO 9001, ISO 14001, KS certification, KC certification, OHSMS/OHSAS 18001, KFI certification, UL certification

Business Fields and Products

| Manufacturing

Anti-Noise/Vibration/Shock Products

- Silencer for Air Handling Unit (Rectangular, Circular)
- Sound Chamber, Sound Elbow
- Enclosure
- Reverberation Chamber, Anechoic Chamber, Echo Chamber
- Anti-Vibration Spring Mount, Anti-Vibration Neoprene Mount
- Anti-Vibration Pad, Neoprene Hanger
- Spring Hanger, Inertia Base
- Fixed Spring Hanger for Piping, Variable Spring Hanger for Piping
- Pipe Support
- Jack-up Mount, PO-MAT
- Flexible Connector
- Plywood Panel
- Multi-Purpose Valve
- Water Hammer Arrester
  (for sanitary, air-conditioning, and fire-extinguishing purposes)
- Air Spring, Vibration Isolation System
- Elastomeric Bearings
- Earthquake Shock Absorber, Seismic Stopper
- Sound Barrier

Firefighting Seismic Products
Subway Structure Vibration Control Measures
Anti-Noise/Vibration Measures in Plants
Other Anti-Noise/Vibration/Shock Products

| Engineering Service

- Measurement and analysis of noise/vibration/shock
- Test and control measures for noise/vibration/shock
- Sound/vibration analysis
- Other engineering services for special noise/vibration/shock
- Engineering services for ship noise/vibration

PRODUCT OVERVIEW

NOISE CONTROL

SHOCK CONTROL

VIBRATION CONTROL

PRODUCT OVERVIEW

VIBRATION CONTROL

SEISMIC CONTROL

SEISMIC CONTROL

EXPANSION JOINT

NVC NEW VALUE CREATION

Noise Control NSV

ISO 9001/ISO 14001
OHSAS 18001
MADE IN KOREA

NOISE CONTROL

Information for prevention of noise

Definition of noise

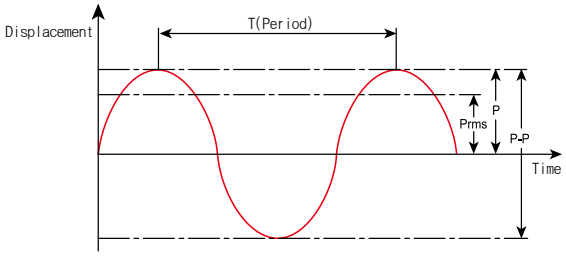
▶ **Sound**

Waves of varying pressure made by the vibration of propagation media particles, noticed by a human ear

▶ **Noise**

Noise is the name we collectively call what we feel is not good to hear. The NOISE AND VIBRATION CONTROL ACT defines it as"the strong sound generated by the use of machines, devices, facilities, and other materials."

Basics of sound



1) Wave length (λ, m)

The distance between the repeated pressure patterns in the space.

2) Period (T, sec)

The time taken for one repetition of the pressure pattern at a specific point.

3) Frequency (f, Hz)

The number of repetitions of the pressure pattern in a unit time period (one second).

4) Amplitude (P, m)

Maximum pressure variation from the reference pressure (atmospheric pressure).

5) Root Mean Square (Prms)

Root of the Mean of the Squares of the energy carried by a sound wave during one cycle.

6) Velocity of sound wave (C, m/s)

The distance the sound wave propagates during 1 second. It is constant in a uniform propagation medium.

$$C=\lambda \cdot f$$

In the air,

$$C \simeq 331.42+0.6t \simeq 20.06\sqrt{T}\ [m/s]$$

Where T is the absolute temperature.

1) dB(deciBel)

The unit and level of sound

The reaction of human ear or other sensing organs to the stimuli from outside is almost logarithmic. Therefore, by expressing the magnitude of the noise in logarithmic terms, dB, we can express it most closely to what humans feel regarding the degree of noise.

2) Sound Intensity Level (SIL)

$$SIL=10log\left(\frac{I}{I_o}\right)dB$$

Where

I : Intensity of sound (w/m^2)

I_o : Intensity of the first audible sound $(10^{-12})\ w/m^2)$

3) Sound Pressure Level (SPL)

The magnitude of the pressure slightly varying in the medium due to the propagation of the sound, expressed in terms of dB.

$$SPL=20log\left(\frac{P}{P_o}\right)dB$$

Where

P : RMS value of the sound pressure under discussion (N/m^2)

P_o : RMS value of the minimum sound pressure $(2 \times 10^{-5}\ N/m^2)$

4) Sound Power Level (PWL)

$$PWL=10log\left(\frac{W}{W_o}\right)dB$$

Where

W : The sound power of the sound source under discussion

W_o : Reference sound power $(10^{-12}\ W)$

5) Relationship between SPL and PWL

Sound Power Level (PWL) cannot be measured directly, and is calculated using the measured SPL and the formula shown below.

① In case of a non-directional point sound source in free space (r: clearance)

$$SPL = PWL-20logr-11dB$$

② In case of a non-directional point sound source in semi-free space

$$SPL = PWL-20logr-8dB$$

③ In case of a non-directional line sound source in free space

$$SPL = PWL-10logr-8dB$$

④ In case of a non-directional line sound source in semi-free space

$$SPL = PWL-10logr-5dB$$

6) Frequency Filter

For 1/1 octave band frequency analyzer,

$$\frac{f_u}{f_l}=2,\ f_u=2f_l$$

Center frequency $f_c=\sqrt{f_l \times f_u}=\sqrt{f_l \times 2f_l}=\sqrt{2}f_l$

Bandwidth $\mathrm{bw}=f_c\left(2^{\frac{n}{2}}-2^{-\frac{n}{2}}\right)=f_c\left(2^{\frac{1}{2}}-2^{-\frac{1}{2}}\right)=0.707f_c$

or $\mathrm{bw}=f_u-f_l=2f_l-f_l=f_l$

% bandwidth $\%\mathrm{bw}=\frac{\mathrm{bw}}{f_c}\times 100\%$

For 1/3 octave band frequency analyzer,

$$\frac{f_u}{f_l}=\sqrt[3]{2}=2^{1/3},\ f_u=1.26f_l$$

Center frequency $f_c=\sqrt{f_l \times f_u}=\sqrt{f_l \times 1.26f_l}=\sqrt{1.26}f_l$

$\mathrm{bw}=f_c\left(2^{\frac{1}{6}}-2^{-\frac{1}{6}}\right)=0.232f_c$

or $\mathrm{bw}=f_u-f_l=1.26f_l-f_l=0.26f_l$

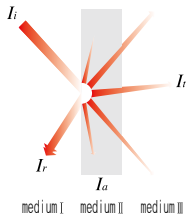
$\%\mathrm{bw}=\frac{\mathrm{bw}}{f_c}\times 100\%$

The upper end frequency, lower end frequency, and center frequency for respective frequency bands, 1/1 octave band and 1/3 octave band

Lower end frequency	Center frequency for 1/1 octave band	Upper end frequency	Lower end frequency	Center frequency for 1/3 octave band	Upper end frequency
f_l	f_c	f_u	f_l	f_c	f_u
			18	20	22
			22	25	28
23	31.5	45	28	31.5	35
			35	40	45
			45	50	56
45	63	90	56	63	71
			71	80	90
			90	100	112
90	125	180	112	125	141
			141	160	178
			178	200	225
180	250	355	225	250	282
			282	315	355
			355	400	450
355	500	710	450	500	560
			560	630	710
			710	800	890
710	1,000	1,400	890	1,000	1,120
			1,120	1,250	1,400
			1,400	1,600	1,780
1,400	2,000	2,800	1,780	2,000	2,240
			2,240	2,500	2,800
			2,800	3,150	3,550
2,800	4,000	5,600	3,550	4,000	4,470
			4,470	5,000	5,600
			5,600	6,300	7,080
5,600	8,000	11,200	7,080	8,000	8,900
			8,900	10,000	11,200
			11,200	12,500	14,130
11,200	16,000	22,400	14,130	16,000	17,780
			17,780	20,000	22,400
			22,400	25,000	28,260
22,400	32,000	45,200	28,260	32,000	35,560

1) Reflection, absorption, and permeation of sound

When sound meets an obstacle, portions of it are reflected, absorbed, and permeated.

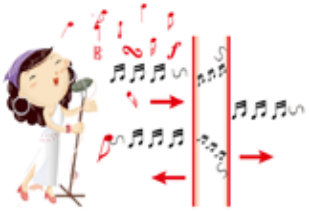


I_i : magnitude of the incident sound
I_r : magnitude of the reflected sound
I_a : magnitude of the absorbed sound (absorption ratio)
I_t : magnitude of the transmitted sound

① Reflexibility (α_r)

The ratio of the reflected sound to the incident sound.

$$\alpha_r = \frac{I_i - I_r}{I_r}$$



② Acoustic absorptivity (α)

The ratio of the difference between the magnitudes of the incident sound and reflected sound, to the magnitude of the incident sound.

$$\alpha_r = \frac{I_i - I_r}{I_r} = 1 - \alpha_r$$

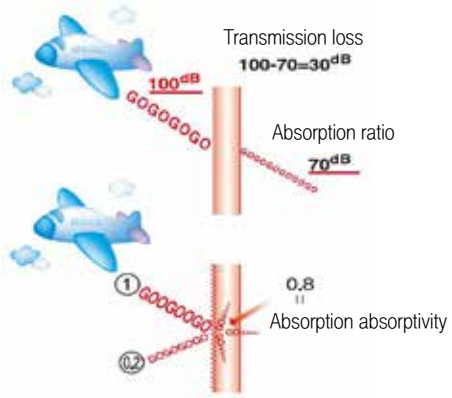
③ Transmission ratio (T)

The ratio of the magnitude of the transmitted sound to the magnitude of the incident sound.

$$\tau = \frac{I_t}{I_i}$$

Definition of the Transmission Loss, TL

$$TL = 10log(\frac{1}{\tau})dB$$



Information for prevention of noise

2) Diffraction of sound

This is the characteristics that the sound reaches to the back of the obstacle in case the sound meets an obstacle in the course of propagation. As a typical case, the sound reaches the back side of the shielding wall from the viewpoint of the sound source. The longer the length of the wave, and the smaller the size of the obstacle, the more the sound diffracts

3) Attenuation of sound according to distance

① In case of a point sound source,

$$L_a = 20\log\left(\frac{r_2}{r_1}\right)dB \qquad L_a = SPL_1 - SPL_2$$

Where

SPL_1 : The level of the sound pressure at the place r_1 (m) apart from the sound source.

SPL_2 : The level of the sound pressure at the place r_2 (m, $r_2 > r_1$) apart from the sound source.

② In case of a line sound source,

$$L_a = 10\log\left(\frac{r_2}{r_1}\right)dB \qquad L_a = SPL_1 - SPL_2$$

③ In case of a rectangular plate sound source,

$$L_a = SPL_1 \quad SPL_2 = 0 \qquad \left(r < \frac{a}{3}\right)$$

$$L_a = 10\log\left(\frac{3r}{a}\right)dB \qquad \left(\frac{a}{3} < r < \frac{b}{3}\right)$$

$$L_a = 20\log\left(\frac{3r}{b}\right) + 10\log\left(\frac{b}{a}\right)dB \qquad \left(r > \frac{b}{3}\right)$$

(a: The length of the shorter side, b: The length of the longer side)

④ In case of a circular plate sound source,

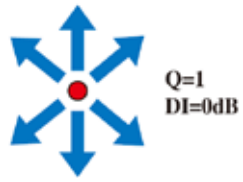
$$L_a = 20\log\left(\frac{a}{r}\right) - 3dB$$

(a: The radius of the circular sound source, in m)

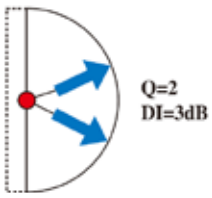
4) Directivity of sound

This is the characteristic that the intensity of sound varies depending on the direction, and the directivity factor DI is the value that expresses the directivity of a certain sound in dB.

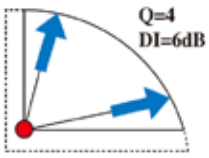
$$DI = 10\log Q$$



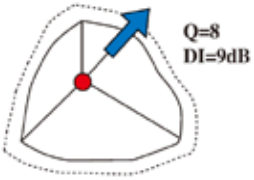
Free space



Semi-free space



The corner (line) where two planes meet



The corner (point) where three planes meet

Calculation of noise

1) Sum of dB(Decibel)s

$$SPL_T = 10\log\sum_{i=1}^{n} 10^{\frac{SPL_i}{10}}$$

$$= 10\log\left(10^{\frac{SPL_1}{10}} + 10^{\frac{SPL_2}{10}} + \cdots 10^{\frac{SPL_n}{10}}\right)$$

Where

SPL_T : Sound level of the composite sound

SPL_n : Sound level of the individual sound

2) Difference between dB (decibels)

$$\Delta SPL = 10\log\left(10^{\frac{SPL_1}{10}} - 10^{\frac{SPL_2}{10}}\right)$$

3) Compensation regarding background noise

The level of noise under discussion is obtained by calculating the difference between the measured noise level and the level of the background noise.

Difference between levels	3	4	5	6	7	8	9	≥10
Compensation value	−3	−2		−1				0

Counterplans for noise

1) Means for preventing noise

① Means related to the noise source: removing the noise source, installing a silencer, sound insulation box, prevention of vibration, etc.

② Means related to the propagation path: absorption, shield, shielding wall, attenuation by ensuring the distance, using directivity, etc.

③ Means on the receiving side: masking, earplug, double window, etc.

2) Absorption of sound

① Mean acoustic absorptivity: the sizes of each material and corresponding absorption ratios are used.

$$\bar{\alpha} = \frac{\sum S_i \alpha_i}{\sum S_i}$$

Where
S_i : the size of each material, α_i : absorption ratio

$$\bar{\alpha} = \frac{0.161\,V}{S\,T}$$

Where
S_i : volume of the room (m^3), T : reverberation time

*reverberation time: the time taken from turning off of the source of sound pressure to the time the level of the sound pressure has been reduced to 60dB.

② Noise Reduction Coefficient (NRC)
The arithmetic mean of the individual acoustic absorptivity measured for the frequency bands of which the center frequencies are 250Hz, 500Hz, 1000Hz, and 2000Hz, respectively, and the bandwidth is 1/3 octave.

$$NRC = \frac{\alpha_{250} + \alpha_{500} + \alpha_{1000} + \alpha_{2000}}{4}$$

3) Means for preventing noise

① Transmission loss at a single wall (principle of mass)
Transmission loss at a single wall depends on the surface density.

$$TL = 20\log(m \cdot f) - 43dB \quad \text{(vertical incident sound)}$$

$$TL = 18\log(m \cdot f) - 44dB \quad \text{(irregular incident sound)}$$

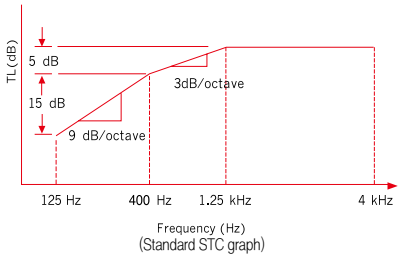
Where
m : surface density of the wall (kg/m^2), f : entering frequency (Hz)

② Total transmission loss

$$\overline{TL} = 10\log\left(\frac{1}{\bar{\tau}}\right) = 10\log\frac{\sum S_i}{\sum (S_i \tau_i)}\ dB$$

Where
S_i : size of each component of the wall (m^2)
τ_i : transmission rate of the wall

③ Sound Transmission Class (STC)
The value of the transmission loss at 500Hz. When compared to the standard STC graph, the following conditions need to be met.



- For the transmission losses measured for the center frequencies of frequency bands with 1/3 octave bandwidth, in the range of 125Hz ~ 4kHz,
- There should not be a value 8dB less than the corresponding value on the standard STC graph, or smaller value.
- The sum of the differences between the TL values that are smaller than the corresponding values on the STC graph and the corresponding values on the STC graph themselves should not be less than or equal to 32dB.

4) Transmission of sound in a room

$$SPL = PWL + 10\log\left(\frac{Q}{4\pi r^2} + \frac{4}{R}\right), \quad R = \frac{S\bar{\alpha}}{1-\bar{\alpha}}$$

Where
Q: directivity coefficient, R: room constant (m^2)
S: size of the surface (m^2), α: mean of acoustic absorptivity

Effects of noise

1) TTS (Temporary Threshold Shift): temporary loss of hearing capability.

2) PTS (Permanent Threshold Shift): permanent loss of hearing capability.

3) Occupational hearing-loss: diseases found among the workers of the factories with high level of noises. The symptoms of losing hearing capability in this case occurs for sounds of high frequencies above or equal to 4000Hz at first.

4) Presbycusis: geriatric hearing loss. In this case, the symptom of losing hearing capability occurs for sounds of high frequencies above or equal to 6000Hz at first.

5) Hearing loss: if the average hearing loss for the center frequency range of 500~2000Hz is greater than or equal to 25dB, it is called hard of hearing or bradyacusia.

$$\text{Average hearing loss} = \frac{a+2b+c}{4}\ dB$$

Where
a : hearing loss at octave band of 500Hz
b : hearing loss at octave band of 1000Hz
c : hearing loss at octave band of 2000Hz

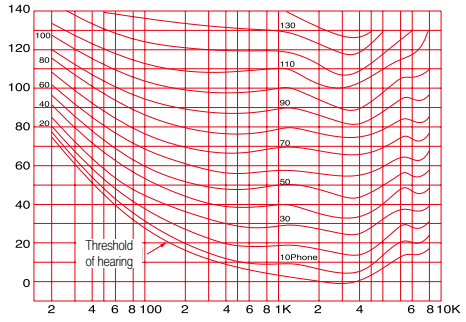
6) Masking effect

It is a phenomenon of hearing only a loud sound when hearing both a loud sound and a weak sound, and it is caused by interference of the sound waves.

Evaluation of the noise

1) Equal-loudness contour

The graph made by connecting the sound pressure levels the hearer with no hearing problem feels for sounds of various frequencies.



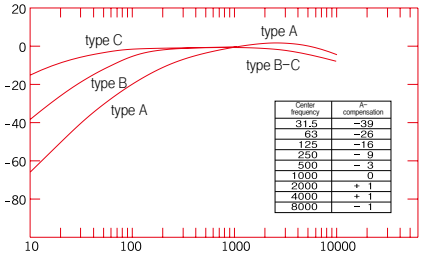
2) Loudness level (Phone)

The level of the sound pressure of certain sound expressed in terms of the level of sound pressure of 1000Hz sine wave felt, by normal young people without any problem hearing, the same as the level of the sound pressure under test.

3) dB(A)

A method of expressing the level of sound pressure which, by applying filters, reflects the hearing characteristics of a human ear regarding the frequency of the sound. Three types of filters, type A, B, and C, are used depending on the usage, for the audible frequency range of 20Hz ~ 20KHz. Among them, dB(A) filter is for reflecting the fact that the lower the frequency of the sound, the less sensitive the human ear is, for the moderate sound of less than 1000Hz.

Information for prevention of noise



Center frequency	A-compensation
31.5	−39
63	−26
125	−16
250	− 9
500	− 3
1000	0
2000	+ 1
4000	+ 1
8000	− 1

4) Loudness (Sone)

The unit for loudness is Sone, and the loudness corresponding to 1kHz, 40dB is defined as 1 Sone. The loudness felt by an audience as n times louder than 1 Sone is n Sone.

5) Energy Equivalent Sound Level, Leq

It is the method for evaluating the varying noise, and is used for the evaluation of the ambient noise and the evaluation of the accumulated effect of the noise.

$$L_{eq} = 10\log\left(\sum_{i=0}^{n} f_i \times 10^{\frac{L_i}{10}}\right) dB(A)$$

Where

f_i : duration rate of specific sound pressure level

L_i : n_th sound pressure level

6) Percentage Noise Level, LN

The level of noise of which the sum of the occurred time exceeds N (%) of whole measuring time. For example, L_{10} refers to the level of noise occurred for over 10% of whole measuring time. The smaller the % value, the higher the noise level. There is the relationship, $L_{10} \rangle L_{50} \rangle L_{90}$.

7) Weighted Equivalent Continuous Perceived Noise Level, WECPNL

Aircraft noise evaluated around the airport.

$$WECPNL = \overline{dB(A)} + 10\log(N_1 + 3N_2 + 10N_3) - 27$$

Where

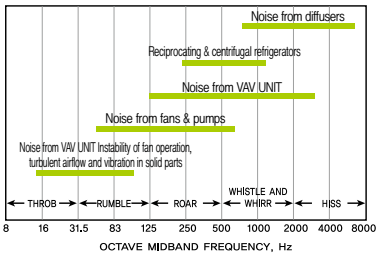
$\overline{dB(A)}$: average of the peak values of the aircraft noise during a day, in dB

N_1 : number of the arrived and departed airplanes during 07:00~19:00

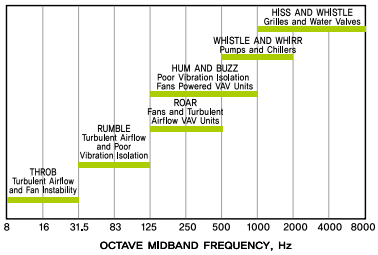
N_2 : number of the arrived and departed airplanes during 19:00~22:00

N_3 : number of the arrived and departed airplanes during 22:00~07:00

Frequency bands of HVAC noise sources



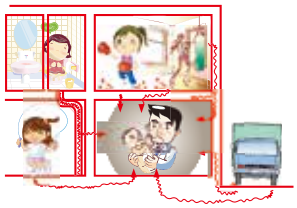
Frequency bands of the noise sources causing civil complaints



Frequency bands of the noise from various types of source

Means for preventing structure borne noise

The noise which is emitted to the air directly from the source and propagated through air, the medium, is called airborne noise, while in case the noise from the source is transmitted through solid materials and causes vibration of the ceilings, walls, etc., of buildings, and eventually makes sound in the air, it is called structure borne noise.

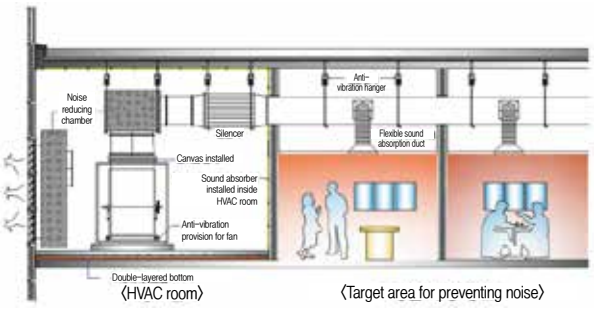


Structure borne noise

Airborne noise

1) Means to prevent structure borne noise

Regarding the prevention of structure born noise, there are three systems to consider, the generating system, vibration transmitting system, and sound emitting system. For the generating system, reducing the vibration given in the form of power energy, etc., is the first thing to take into account. The second is to lower the vibration frequency by increasing the mass of the machine, etc. The third is to suppress the transmission of the vibration by reducing the impedance at the supporting structure. As the means for the contacts between the generating system and the vibration transmitting system, absorption and prevention of vibration might be considered. The former is to use the soft elastic material or plastic material so that the impact time is extended, the maximum of the impact is suppressed and thus the natural frequency of the impact is lowered, and the input energy is reduced. The latter is to make the natural vibration system having lumped constants, and make the actual transmission of the exciting power reduced, due to the impedance difference. In addition, passive vibration reducers like oil damper, etc., or active vibration reducers utilizing the automatic control system are effectively used in low frequency range, but these are not practical for structure borne noise.



〈HVAC room〉 〈Target area for preventing noise〉

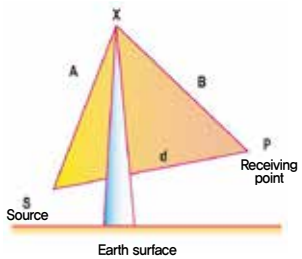
2) Materials for preventing structure borne noise, and systems being used

It is usual to add elastic elements to the mass of an ordinary transmission system, so it is also usual to think of springs when thinking about prevention of vibration. There are cases of adding mass of course, but there is no commercial product for that. So, the discussion here is also limited to elastic vibration preventing materials. There are various materials for preventing vibration depending on the use and purpose. Typical systems being used are:

- Jack Up Floating Floor System (JUM)
- Plywood Panel System (NFM)
- Polyurethane Mat (PO-MAT)

Calculation of the noise reducing effect of shielding walls

In case there in no obstacle between the source of noise and the receiving point, sound is transferred from the source to the receiving point through the direct path. But if there is an obstacle between the source and the receiving point, the noise generated from the source is diffracted and reaches the receiving point over the upper part of the obstacle, and in the course of doing so, the noise is attenuated.
Attenuation achieved by using a shielding wall is about 10dB, and it is very difficult to obtain the attenuation of 15dB except in the case of making the wall such that it is very high and there is almost no gap or open part, and using a material with high transmission loss. The maximum attenuation that can be achieved by using a shielding wall is about 20dB so when more attenuation is required, we must consider other means. And without blocking the line of sight between the source of noise and the receiving point, we can scarcely obtain the noise reducing effect.
If the length of the shielding wall is infinite and the transmission loss of the wall is extremely high, the noise from the source is transferred to the receiving point over the upper part of the shielding wall, as shown in the figure below.

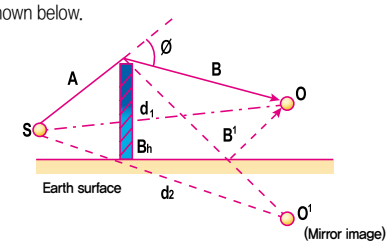


Where

X : summit of the wall
A : distance between the source and the summit of the wall
B : distance between the receiving point and the summit of the wall
d : direct distance between the source and the receiving point

A. Determination of diffraction attenuation

The noise reduction effect due to diffraction attenuation is determined by the difference between paths and the frequency (wave length) of the sound under discussion. Actual noise reducing effect of the wall is calculated by using the Fresnel Zone Number (N) considering the path difference and frequency of sound, as shown below.



1) Fresnel number for direct sound, N_1

$$N_1 = (A+B-d_1) \times \frac{2f}{340}$$

Where f: frequency of the diffracted sound under discussion, in Hz

2) Fresnel number for indirect sound, N_2

$$N_2 = (A+B-d_2) \times \frac{2f}{340}$$

3) Diffraction attenuation of direct and indirect sounds, L_{d1}, L_{d2}

$$L_d = 7.5+0.61\log N(dB), \quad 0 < N \leq 0.1$$
$$L_d = 10+3\log N(dB), \quad 0.1 < N \leq 0.8$$
$$L_d = 11+7\log N(dB), \quad 0.8 < N \leq 30$$
$$L_d = 12+6\log N(dB), \quad 30 < N \leq 60$$
$$L_d = 22(dB), \quad 60 < N$$

4) Diffraction attenuation due to shielding wall, ΔL_d

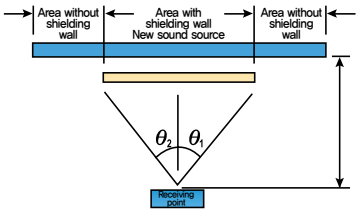
$$\Delta L_d = -10\log(10^{-\frac{L_{d1}}{10}} + 10^{-\frac{L_{d2}}{10}})$$

B. Determination of transmission loss, ΔL_t

$$\Delta L_t = 20\log(m \cdot f) - 47(dB)$$

Where m : surface density (kg/m^2)

C. Determination of attenuation of direct sound, ΔL_{in}



$$\Delta L_{in} = 10\log\left(\frac{2}{2-(\sin\theta_1+\sin\theta_2)}\right) dB$$

D. Determination of attenuation due to absorption, ΔL_α

In case of the absorption type shielding wall, additional attenuation due to the absorption is obtained.

$$\Delta L_a = \alpha^3 \cdot (Ø/30) dB, \quad Ø \leq 120°$$

$$\Delta L_a = 1.1\alpha^3 \cdot (Ø/15) dB, \quad Ø > 120°$$

E. Determination of insertion loss due to the use of finite shielding wall, ΔL_i

In case of using the absorption type shielding wall,

$$\Delta L_i = -10\log(10^{-\frac{\Delta L_d}{10}} + 10^{-\frac{\Delta L_a}{10}} + 10^{-\frac{\Delta L_e}{10}}) + \Delta L_a \ [dB]$$

In case of using the reflection type shielding wall,

$$\Delta L_i = -10\log(10^{-\frac{\Delta L_d}{10}} + 10^{-\frac{\Delta L_t}{10}} + 10^{-\frac{\Delta L_e}{10}}) \ [dB]$$

Information for prevention of noise

A. Noise from fans, L_W

$$L_W = K_W + 10\log_{10}[\frac{Q}{Q_1}] + 20\log_{10}[\frac{P}{P_1}] + C + BFI$$

Where
L_W : level of the sound power from fans (dB)
K_W : reference value for noises from fans
Q : air volume from fans (CMH, CMM)
P : static pressure of fan outlet (mmAq)

Where
Q_1 : 1 cfm = 1.7 CMH
P_1 : 1 in. wg. = 25.4 mmAq
C : compensation for degradation in efficiency
BFI : compensation for frequency band of fan noise

B. Compensation for degradation in efficiency, C

$$\eta = \frac{Q \cdot P}{367,200 \cdot W}$$

Where
W : fan power (kW)

Ratio of efficiency η to the maximum efficiency of fan (%, PEAK)	Compensation for the degradation in efficiency (C, dB)
90 ~ 100	0
85 ~ 89	3
75 ~ 84	6
65 ~ 74	9
55 ~ 64	12
50 ~ 54	15

C. Compensation for frequency band of fan noise, BFI

Types of fan	Octave Band	Compensation (dB)
Centrifugal : Airfoil, Backward Curved, Backward Inclined	250 Hz	3
Forward Curved	500 Hz	2
Radial Blade, Pressure Blower	125 Hz	8
Vaneaxial	125 Hz	6
Tubeaxial	63 Hz	7
Propeller : General Ventilation & Cooling Tower	63 Hz	5

D. Reference value for fan noises, K_W

Types of fan		1/1 Octave Band Frequency (Hz, dB)							
		63	125	250	500	1K	2K	4K	8K
Centrifugal	Airfoil, Backward Curved, Backward Inclined Wheel Dia (mm)								
	over 900mm	40	40	39	34	30	23	19	17
	under 900mm	45	45	43	39	34	28	24	19
Forward Curved	All wheel Diameter	53	53	43	36	36	31	26	21
Radial Bladed	Low Pressure (1 to 2.5 kPa)	56	47	43	39	37	32	29	26
	Medium Pressure (1.5 to 3.7 kPa)	58	54	45	42	38	33	29	26
	High Pressure (3.7 to 15 kPa)	61	58	53	48	46	44	41	38
Axial Fans	Hub Ratio 0.3 to 0.4	49	43	43	48	47	45	38	34
Vaneaxial	Hub Ratio 0.4 to 0.6	49	43	46	43	41	36	30	28
	Hub Ratio 0.6 to 0.8	53	52	51	51	49	47	43	40
Tubeaxial	over 1000mm wheel diameter	51	46	47	49	47	46	39	37
	under 1000mm wheel diameter	48	47	49	53	52	51	43	40

(NOTE) NEBB National Environmental Balancing Bureau(1994)

Design data

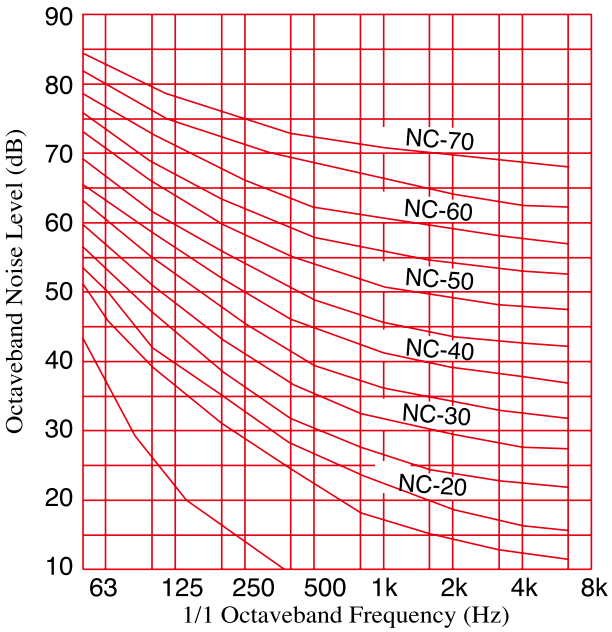
1. Recommendation regarding interior noise

A. Standards for interior noise (NC: Noise Criteria, RC: Room Criteria)

Room Types		Octave Band Analysis	Approximate Overall Sound Pressure Level	
		NC/RC	dBA	dBC
Rooms with Intrusion from Outdoor Noise Sources	Traffic noise Aircraft flyovers	N/A N/A	45 45	70 70
Residences , Apartments, Condominiums	Living areas Bathrooms, kitchens utility rooms	30 35 35	35 40 40	60 60 60
Hotels/Motels	Individual rooms or suites Meeting/banquet rooms Corridors and lobbies Service/support areas	30 30 40 40	35 35 45 45	60 60 65 65
Office Buildings	Executive and private offices Conference rooms Teleconference rooms Open-plan offices Corridors and lobbies	30 30 25 40 40	35 35 30 45 45	35 35 30 45 45
Courtrooms	Unamplified speech Amplified speech	30 35	35 40	60 60
Performing Arts Spaces	Drama theaters, concert and recital halls Music teaching studios Music practice rooms	20 25 30	25 30 35	50 55 60
Hospitals and Clinics	Patient rooms Wards Operating and procedure rooms Corridors and lobbies	30 35 35 40	35 40 40 45	60 60 60 65
Laboratories	Testing/research with minimal speech Communication Extensive phone use and speech communication Group teaching	50 45 35	55 50 40	75 70 60
Courtrooms	Unamplified speech Amplified speech	30 35	35 40	60 60
Churches, Mosques, Synagogues Schools	General assembly with critical music programs Classrooms Large lecture rooms with speech amplification Large lecture rooms without speech amplification	25 30 30 25	30 35 35 30	55 60 60 55
Libraries		30	35	60
Indoor Stadiums, Gymnasiums	Gymnasiums and natatoriums Large-seating-capacity spaces with speech Amplifications	45 50	50 55	70 75

Information for prevention of noise

B. Noise Criteria, NC



Noise Criteria Curves

▶Evaluation by Noise Criteria

It is the means to evaluate the interior noise such as the noise from HVAC by analyzing the noise using 1/1 octave band noise levels, following the steps below.

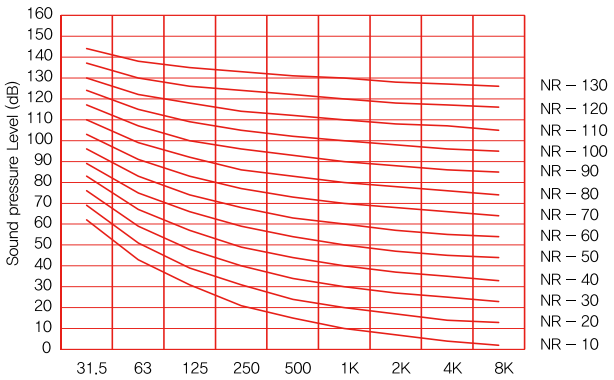
① Obtain the noise levels for the 8 octave bands, from 63Hz to 8000Hz.

② Mark the level for each octave band on the NC curves graph, and then connect them to make a line.

③ The NC Criteria Curve with the lowest number which is not touched by the line in the frequency range under discussion is the curve that represents the rating of the interior noise in this room. If the curve is NC–40, the room has NC40 rating, and the 1/1 octave band sound pressure level in this room should be under the level represented by the NC–40 curve at every frequency.

NC	Octave Band Center Frequency (Hz)							
	63	125	250	500	1K	2K	4K	8K
NC–65	80	75	71	68	66	64	63	62
NC–60	77	71	67	63	61	59	58	57
NC–55	74	67	62	58	56	54	53	52
NC–50	71	64	68	54	51	49	48	47
NC–45	67	60	54	49	46	44	43	42
NC–40	64	56	50	45	41	39	38	37
NC–35	60	52	45	40	36	34	33	32
NC–30	57	48	41	35	31	29	28	27
NC–25	54	44	37	31	27	24	22	21
NC–20	51	40	33	26	22	19	17	16
NC–15	47	36	29	22	17	14	12	11

C. Noise Rating, NR



NR	Octave Band Center Frequency (Hz)								
	31.5	63	125	250	500	1K	2K	4K	8K
NR 10	62	43	31	21	15	10	7	4	2
NR 20	69	51	39	31	24	20	17	14	13
NR 30	76	59	48	40	34	30	27	25	23
NR 40	83	67	57	49	44	40	37	35	33
NR 50	89	75	66	59	54	50	47	45	44
NR 60	96	83	74	68	63	60	57	55	54
NR 70	103	91	83	77	73	70	68	66	64
NR 80	110	99	92	86	83	80	78	76	74
NR 90	117	107	100	96	93	90	88	86	85
NR 100	124	115	109	105	102	100	98	96	95
NR 110	130	122	118	114	112	110	108	107	105
NR 120	137	130	126	124	122	120	118	117	116
NR 130	144	138	135	133	131	130	128	127	126

NR	Room Type
25	Concert halls, broadcasting and recording studios, cherches
30	Private dwellings, hospitals, theatres and cinemas, conference rooms
35	Libraries, museums, court rooms, schools, hospitals oprating
40	Halls, corridors, cloakrooms, restaurants, night clubs, offices, shops
45	Department stores, supermarkets, canteens, general offices
50	Typing pools, offices with business machines
60	Light engineering works
70	Foundries, heavy engineering works

D. Comparison of Sound Rating Methods

Items taken	Overview	Considers Speech Interference Effects	Evaluates Sound Quality	Components Presently Rated by Each Method
NC	Can rate components No quality assessment Does not evaluate low-frequency rumble	Yes	No	Air terminals Diffusers
RC	Used to evaluate systems Should not be used to evaluate components Can be used to evaluate sound quality Provides some diagnostic capability	Yes	Yes	–

2. Recommendation regarding environment noise

A. The recommendation of ISO on the criteria for environment [ISO recommendation R 1996 (Assessment of noise with respect to community response)]

Areas	Time of day (Leq, dB(A))		
	Day	Evening	Night
Residential only areas, hospitals and sanatoriums	45	40	35
Suburban residential areas, narrow road areas	50	45	40
City residential areas	55	50	45
Workshops, offices, neighbor of principal road	60	55	50
City areas, business areas, trade areas, administration areas	65	60	55
Dedicated industry areas (heavy industry)	70	65	60

B. EPA

The criteria is classified as Leq and Ldn based on regions and influencing factors.

[Standards for environmental noise in residential areas, specified by EPA]

Influence	Level	Area
Hearing-loss	Leq(24) ≤ 70dB	All areas
Interference in outdoor activities and disturbance	Ldn ≤ 55dB	Residential areas and outdoor areas in farms, other outdoor areas where people spend a lot of time, or other outdoor areas requiring quiet
	Leq(24) ≤ 55dB	Outdoor areas where people only stay for short periods, such as areas inside schools or playgrounds, etc.
Interference in indoor activities and disturbance	60Ldn ≤ 45dB	Indoor areas in residential areas
	Leq(24) ≤ 45dB	Other indoor areas such as schools where human activities take place

EPA, Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety

C. EU

Different limits of exposure to noise are suggested based on area class, and different standards are applied depending on the source of the noise and the time of exposure. [Limits of exposure to noise based on classification of areas in the EU]

Classification of areas	Limits of exposure to noise (dB(A))			
	Roads & railroads (Day/Night)	Airplanes	Industrial areas, military facilities, waterways, recre-ation facilities, etc. (Day/Night)	Sports areas (Day/Break time/ Night))
Residential only areas, hospitals and sanatoriums	64/54	62	60/45	60/55/45
Suburban residential areas, narrow road areas	59/49	62	55/40	55/50/40
City residential areas	59/49	62	50/35	50/40/35
Workshops, offices, neighbor of principal road	57/47	62	45/35	45/45/35

Noise Directive 2020/49/FC

ANOS10 Rectangular Type Sound Attenuator

■ Features

ANOS10 is useful in reducing the noise transmission through the HVAC system and by adjusting air way gap between the splitters inside; the noise problem can be resolved. In general, it offers excellent sound attenuation in 500~8000Hz.

Splitter Type

Elbow Type

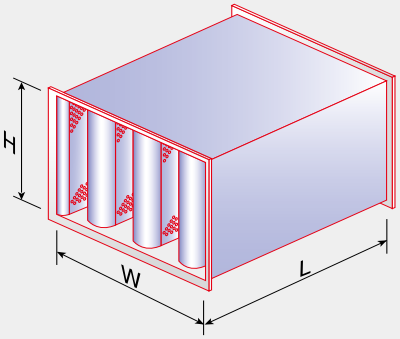
Tunnel Exhaust silencer

■ Model Denotation method

R □□ – □□ – □ X □ X □

① ② ③ ④ ⑤ ⑥ ⑦

① Splitter Shape
② Absorption Material Protection Method
③ Sound Attenuator Shape
④ Splitter Thickness / Air Way Area Ratio Type(S, L, M Type)
⑤ Sound Attenuator Width(mm)
⑥ Sound Attenuator Hight(mm)
⑦ Sound Attenuator Length(mm)



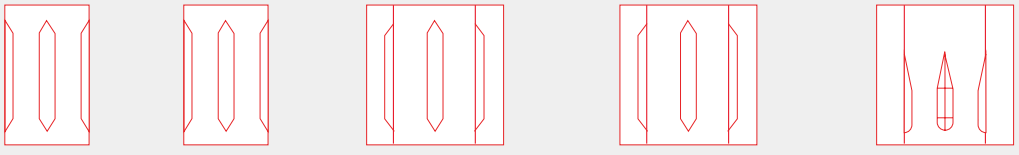
■ Splitter Shape

T: U: V: W:

■ Absorption Material Protection Method

G : GLASS WOOL + GLASS CLOTH
P : GLASS WOOL + GLASS CLOTH + PERFORATED PLATE
F : GLASS WOOL + GLASS CLOTH + PE FILM + PERFORATED PLATE

■ Sound Attenuator Shape



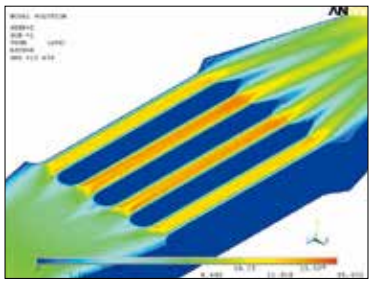
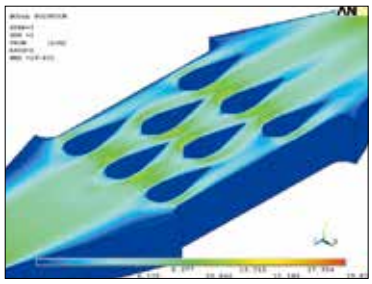
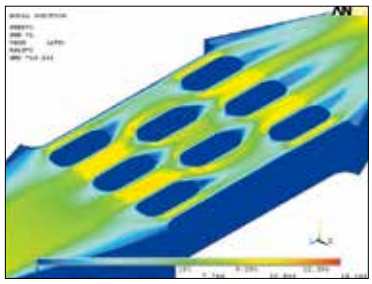
1 2 3 4 5

■ Splitter Thickness / Air Way Area

S Type : Large pressure loss and self noise and large amount of noise attenuation thru all of the frequency band.
L Type : Small pressure loss and self noise and large amount of noise attenuation for middle/high frequency band.
M Type : Middum amount of pressure loss and self noise and large amount of noise attenuation for 250Hz/500Hz.

ANOS10 Rectangular Type Sound Attenuator

■ Analysis Of Velocity Distribution Per Splitter Type

■ Sound Attenuator Calculation Sheet

Model	AHU-01(S)	Air Flow	20900 CMH(m^3/h)	DUCT SIZE	1400 X 600	Static Efficiency	90%
Project	Project Name			Service	Office	Quantity	1 SET
Location	–	Static Pressure	107 mmAq	Diffuser Type	SQUARE	Duct Airflow Velocity	6.9 m/sec

▶ INFORMATION OF EQUIPMENT & PROJECT

						OCTAVE BAND CENTER FREQUENCY(Hz)						
						63	125	250	500	1000	2000	4000
1. Fan Total Sound Power Level (PWL)	CODE	2	AIR FOIL									
1) Specific Sound Power Level (Kw)						45.0	45.0	43.0	39.0	34.0	28.0	24.0
2) Sound Level by Air Flow & Static Pressure (Mw)						53.4	53.4	53.4	53.4	53.4	53.4	53.4
3) Correction Factor by Efficiency (C)						0.0	0.0	0.0	0.0	0.0	0.0	0.0
4) Blade Frequency Increments (BFI)						0.0	0.0	3.0	0.0	0.0	0.0	0.0
					(Total)	98.4	98.4	99.4	92.4	87.4	81.4	77.4
2. Attenuation of System						Total Sound Power Level : 94.7dB(A)						
1) Unlined Rectangular Sheet Metal Ducts												
a.Rectangular Duct			Width	Hight	P/A	Length						
Duct - 1			1.40	0.60	4.76	10	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Duct - 2			0.0	0.00	0.00	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
b.Circular Duct													
2) Insertion Loss of Elbow													
a.Square Elbow			Q'TY	0	Width	1.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0
b.Round Elbow			Q'TY	0	Width	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
c.Lined Elbow			Q'TY	0	Width	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3) Chanber Attenuation		0	Q'TY	0	Width	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Non-Sound-Absorbing)	Q'TY	0	0	0	NRC	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4) Chanber Attenuation			Inlet	0.0	Outlet	0.0							
(Sound-Absorbing)	Q'TY				Outlet	0.65	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5) Duct Branch Sound Power Division			Inlet	0.8	NRC	0.8							
6) Duct End Reflection Loss			Air Wolume		780	m^2/h	14.3	14.3	14.3	14.3	14.3	14.3	14.3
7) The Other Attenuation			Q'TY		N.D	0.25	16.0	11.0	6.0	2.0	1.0	0.0	0.0
(Total) : 1)+2)+3)+4)+5)+6)+7)							33.3	28.3	23.3	19.3	18.3	17.3	17.3
3. Sound Power Level in Room (PWL)			(Sum1 - Sum2)			Code	65.1	70.1	76.1	73.0	69.1	64.1	60.1
4. Noise Criteria in Room(SPL)						6	64.0	56.0	50.0	45.0	41.0	39.0	38.0
5. Correction by Diffuser Sound Pressure (-10log ne+10log ni) ne=0.23 ni=0.7							4.8	4.8	4.8	4.8	4.8	4.8	4.8
6. Attenuation to Room Absorption (Kr)			Width	5	α	0.01							
			Length	5	α	0.01							
			Hight	4.0	α (Ave)	0.01	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9
			Area(m^2)	130	Room Constan	1.31							
7. Allowable Sound Power Level at Outlet (PWL) : (4+5+6)							63.9	55.9	49.9	44.9	40.9	38.9	37.9
8. Generated Noise at Outlet (PWL)			*Sound Power Level (Before Atten.) : 74.4 dB(A)										
9. Allowable Sound Power Level in Room (PWL)							63.9	55.9	49.9	44.9	40.9	38.9	37.9
10. Additional Attenuation Required			(3-9)				1.2	14.2	26.2	28.2	28.2	25.2	22.2
11. Sound Attenuator			Model	Width	Hight	Length	*Air Velocity (Pass through Atten.) : 8.1 m/s						
(Insertion Loss)		5		1800	800	1500	7	8	14	23	31	33	17
Pressure Drop	3 mmAq	7		1800	800	1800	7	11	16	26	37	37	20
		9		1800	800	2100	8	11	19	30	43	41	24

▶ SELF GENERATED NOISE DATA

▶ NATURAL ATTENUATION DATA (Noise attenuation by Duct, Elbow, Chamber and Distribution etc.)

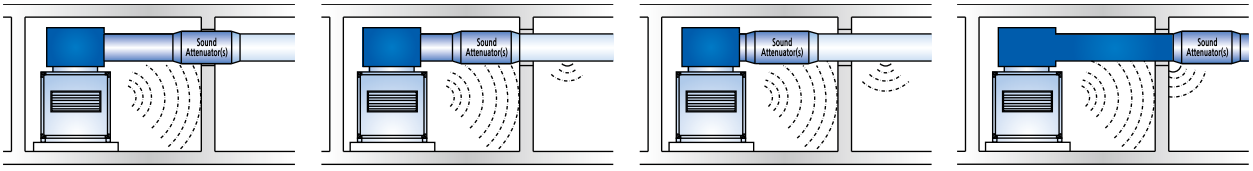
▶ Selection of standard noise level on room

▶ Radiation Coefficient (Considering the area and absorption ratio of room)

▶ SELLECTION OF SOUND ATTENUATOR SIZE (Considering required attenuation, velocity and static pressure drop etc.)

ANOS10 Rectangular Type Sound Attenuator

■ Sound Trap Sound Attenuator Placement On AHU Room



BEST

Controls ductborne noise and mechanical room noise that "breaks into" duct.

VERY GOOD

Practical alternate where fire damper is required at wall.

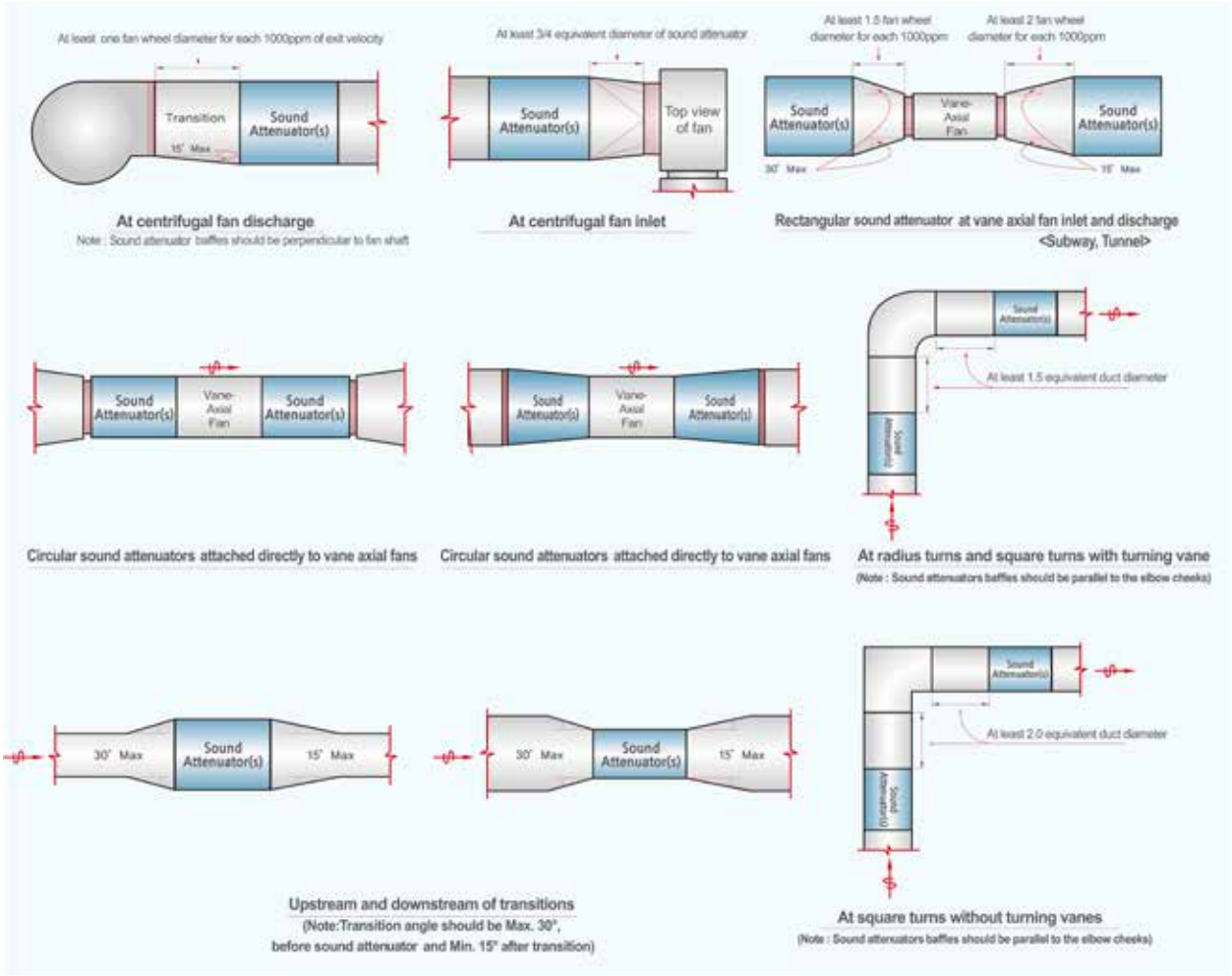
FAIR

Michanical room noise "break into" duct without reduction through sound attenuator

POOR

All noise in duct "breaks out" over occupied space before being reduced by sound attenuator

■ Guidelines for sound attenuator placement near fans and duct fittings

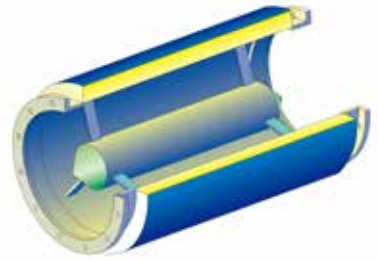


■ Installation features

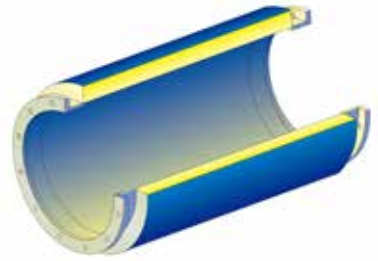
ANOS20 Circular Type Sound Attenuator

■ Features

The ANOS20 is used for HVAC systems and industrial machines. There are two types : one with a sound-absorbing material attached inside the attenuator and the other one with sound-absorbing cone mounted inside.



TYPE-1



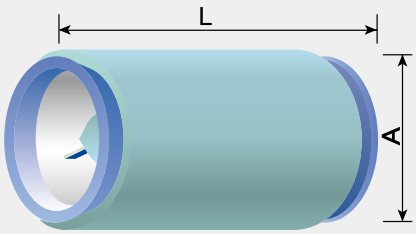
TYPE-2

■ Model denotation method

C □ □ – □ X □ X □

① ② ③ ④ ⑤

① Absorption Material Protection Method
② Sound Attenuator Shape
③ Splitter Thickness / Air Way Extention Type
④ Sound Attenuator Diameter(Ø):A
⑤ Sound Attenuator Length(mm):L



■ Absorption Material Protection Method

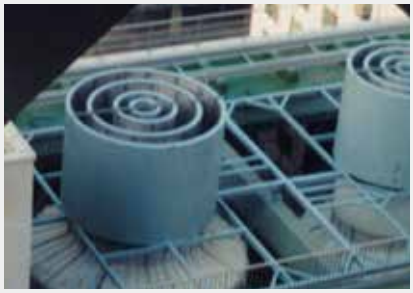
G: GLASS WOOL + GLASS CLOTH
P: GLASS WOOL + GLASS CLOTH + PERFORATED PLATE
F: GLASS WOOL + GLASS CLOTH + PE FILM + PERFORATED PLATE

■ Sound Attenuator Shape

1 2

■ Splitter thickness/Air Way Extention

S Type : Large pressure loss and self noise and large amount of noise attenuation thru all of the frequency band.
L Type : Small pressure loss and self noise and large amount of noise attenuation for middle/high frequency band.



SC Sound Attenuating Chamber

■ Features

It is installed on the outlet or inlet of the air conditioner and fan to control turbulent flow and reduce noise. The SCF type is used for low-speed ducts, the SCP type for high-speed ducts and SCF type for clean rooms. An angle bracket is installed for robust structures and convenience. It is designed to use different interior material and installation methods depending on the main frequency of the air conditioner and fan. The noise attenuation of the sound chamber is in proportion to the sound-absorption rate of the interior material and installation area, but is in inverse proportion to the area of duct exit. It offers excellent sound attenuation in a medium/high frequency range.

■ Model denotation method

SC □ - □ X □ X □ X □

① ② ③ ④ ⑤

① Sound Absorption Material Protection Method
② Sound Absorption Material Thickness(mm)
③ Sound Attenuating Chamber Width(mm)
④ Sound Attenuating Chamber Hight(mm)
⑤ Sound Attenuating Chamber Length(mm)

■ Sound Attenuating amount(R)

$$R=10log\left\{\frac{1}{S_e\left(\frac{COS\theta}{2\pi d^2}+\frac{1-\bar{\alpha}}{\bar{\alpha}S_w}\right)}\right\}=10log\left\{\frac{A}{S_e}\right\}$$

Here $\bar{\alpha}$:average absorption of the plenum lining
S_e :plenum inlet or exit area(m ² or ft²)
S_W :plenum Wall area(m ² or ft²)
d :distance from input to output(m ² or ft²)
θ :(w - ℓ)²+h²(m² or ft²)
A :h/d

SE Sound Attenuating Elbow

■ Features

The sound attenuating elbow is installed in a right-angled corner to reduce noise and turbulent flow. The elbow interior material is attached only on the sides. Its thickness should be about 10% of the breadth of the duct with the length at least twice as as the duct. Sometimes, the turning vane is installed to reduce turbulent flow. In general, it works better in the medium/high frequency range, offering attenuation of up to 10dB in 500~1000Hz.

■ Model denotation method

SE □ - □ X □

① ② ③

① Sound Aborption Material Protection Method
② Sound Attenuating Elbow Width(mm)
③ Sound Attenuating Elbow Hight(mm)

■ Absorption Material Protection Method

G : GLASSWOOL + GLASS CLOTH
P : GLASSWOOL + GLASS CLOTH + PERFORATED PLATE
F : GLASSWOOL + GLASS CLOTH+ PE FILM + PERFORATED PLATE

■ Insertion Loss of Elbows

Elbow Type / Application	Square Elbow				Round Elow
	Without Turning vanes		With Turning vanes		Without Turning vanes
	Unlined Elbows	lined Elbows	Unlined Elbows	lined Elbows	Unlined Elbows
*fw<48	0	0	0	0	0
48≤fw<96	1	1	1	1	1
96≤fw<190	5	6	4	4	2
190≤fw<380	8	11	6	7	3
380≤fw<760	4	10	4	7	3
Fw≥760	3	10	4	7	3

* fw = f(Center Frequency:kHz) X w(Elbow Width:㎜)

AL-A/B Acoustic Louver

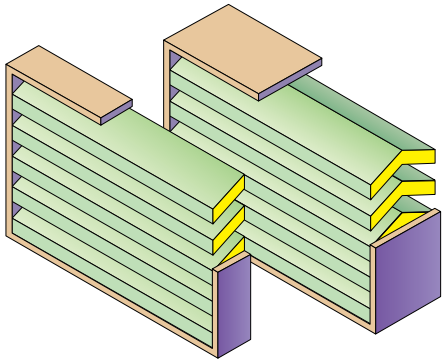
■ Features

The acoustic louver is installed in a place having enough area for ventilation where the rectangular sound attenuator is not available, but needs to be soundproofed. The casing is made of a galvanized steel plate with the thickness of 1.0~2.3 mm, and the inside of the louver splitter is filled with sound-absorbing material. It can prevent damage against the air current speed of 30M/S and the size of the acoustic louver splitter should be at least 150 mm.

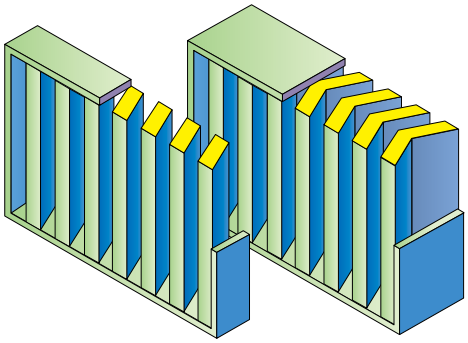
■ Specification

Item	Name of Components	Thickness	Remark
Outer Plate	Galvanized Steel Plate	1.0~2.3㎜	-
Splitter	Punching Plate	Over 0.8㎜	Ø5 x 7P, 46%
	Glass Cloth	0.12㎜	18 strands/25㎜
	Glass Wool	Over 50㎜	Over 40K
	Glass Cloth	0.12㎜	18 strands/25㎜
	Punching Plate	Over 0.8㎜	Ø5 x 7P, 46%

■ Types of Acoustic Louver



-Horizontal splitter-



-Vertical splitter-

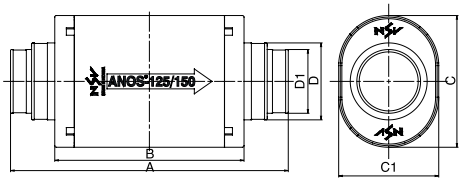
■ Installation features

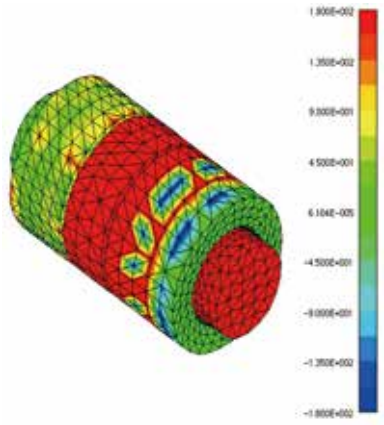
ANOS50 Hybrid Type Silencer (Resonance+Expansion Type Silencer)

■ Why ANOS50 is needed

· To improve the quality of living – quiet and pleasant living environment
· Noise is the main cause of conflicts between neighbors
· Because ventilation pipes/ducts in the bathroom of an apartment or house are connected, noise is transferred next door, and therefore it is difficult to protect one's privacy.

■ ANOS50–125L/150L Specification





■ Specification

Model	Dimension(mm)						Type
	A	B	C	C1	D	D1	
ANOS50–100A	325	227	Ø150	–	Ø97	–	Circular
ANOS50–125A	528	360	250	190	Ø145	Ø121	OVAL
ANOS50–150A							

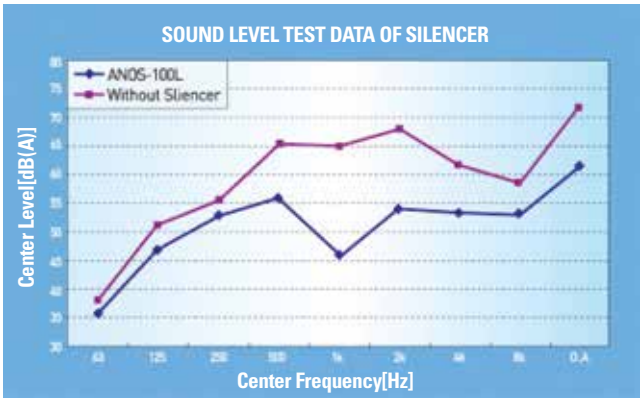
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

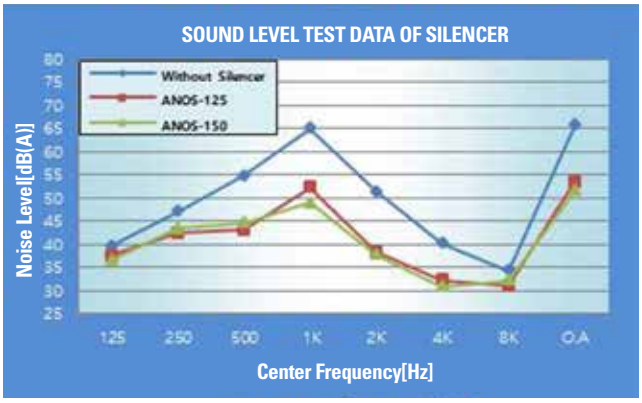
■ Characteristic

Details		Specification
Attenuation Performance		Greater than10dB(A) for dailylife noise in apartment
Ventilation Specification	Pressure Loss	0.3mmAq(based on Air flow speed of 5m/s in silencer)
	Ventilator Air Volume	2.0 CMM(120CMH)
	Bathroom Air Circulation	Air circulation count 15 times/hr base(volume 8.0m^3)
Material [polypropylene(PP)]		Material that is used to manufacture cooking ware harmless to human
		Rrecyclable and eco-friendly material
		When in combustion, no noxious gases are generated
Product Structure		Assembly design that is easy to install and perform maintenance

ANOS50 Hybrid Type Silencer (Resonance+Expansion Type Silencer)

■ ANOS50 Noise Level Test Data





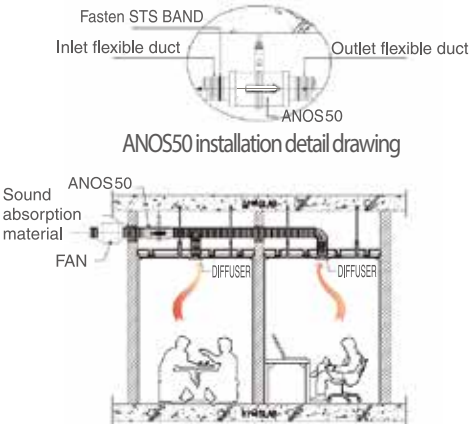
■ Effectiveness of ANOS50

- Reduces the level of noise generated in the bathroom down to that of background noise
- Excellent noise attenuation especially in 1~2KHz, which affects humans
- Protects privacy and maintains a quiet, pleasant living environment
- Helps avoid neighborly disputes and allows for the respect of privacy of one another

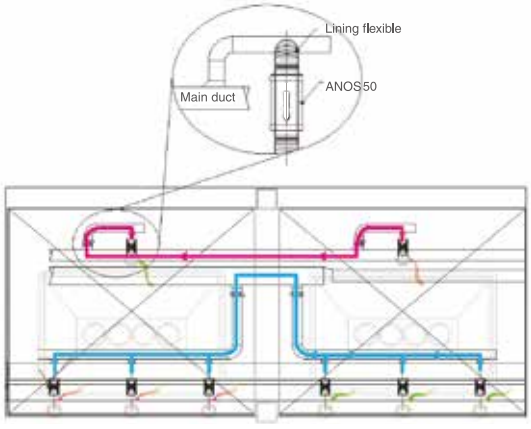
■ ANOS50 installation

- It can be installed on a ceiling and/or wall regardless of vent type
- It is easy to connect regardless of vent fan type
- It has a wide use of application, including kitchen hoods
- Its simple structure makes it easy to install, use and maintain

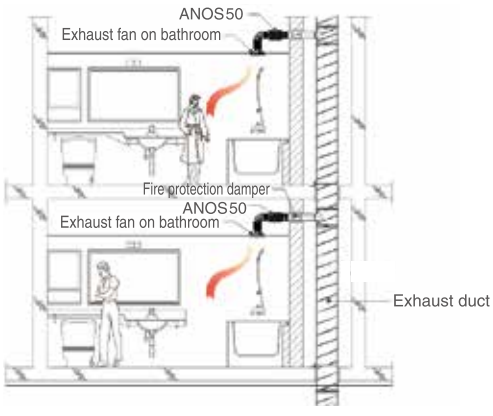
■ Bathroom Detailed drawing for ANOS50 installation



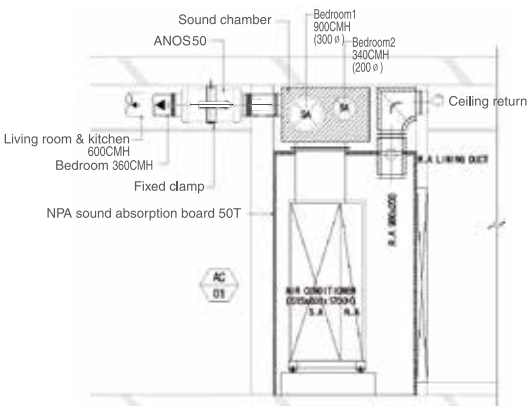
Detail drawing applied to A/C room



Noise block detail drawing between each



ANOS50 installation detail drawing on bathroom



office exhaust fan & ANOS50 installation detail drawing

SD Sound Absorbing Duct

■ Features

It is installed on the outlet or inlet of the air conditioning units and fan, and in a place where soundproofing equipment such as sound arrester and sound chamber are not available because its installation is not constrained by space. It is easy to install and useful in reducing noise inside ducts and subsequent noise as well.

■ Model denotation method

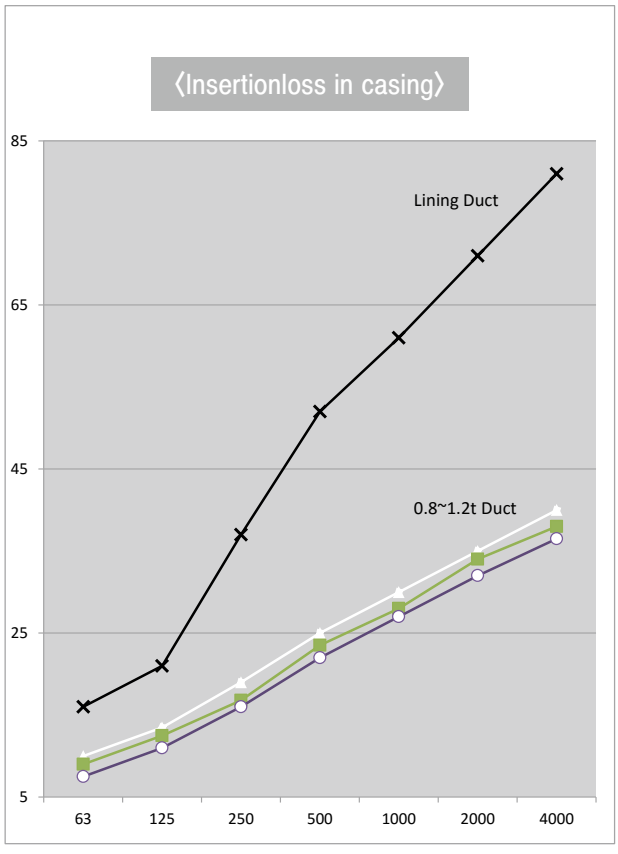
SD □ – □ × □

① Method of protecting the sound-absorbing material
② Width of sound-absorbing duct(mm)
③ Height of sound-absorbing duct(mm)

■ Comparison of the sound-absorbing ducts' external insertion loss

Dimensions	63	125	250	500	1000	2000	4000
Lined Duct 25t	13	17	21	33	47	63	71
Lined Duct 50t	14	18	21	40	55	64	74
0.8t Unlined Duct	9	12	17	21	27	32	37
1.0t Unlined Duct	11	14	18	23	28	34	38
1.2t Unlined Duct	12	15	20	25	30	35	39
1.6t Unlined Duct	14	18	22	27	32	37	42
2.0t Unlined Duct	16	20	24	29	34	39	43

■ Comparison of the sound-absorbing ducts' external insertion loss



■ Sound attenuation amount of sound-absorbing duct (dB/m)

Dimensions, mm	Insertion Loss(dB/m), Octave Band Center Frequency(Hz)					
	125	250	500	1000	2000	4000
150 X 150	2.0	4.9	8.9	19.0	24.3	14.1
150 X 250	1.6	3.9	7.9	16.7	20.0	12.1
150 X 300	1.6	3.9	7.5	16.4	19.0	11.8
150 X 460	1.6	3.3	7.2	15.4	17.1	10.8
200 X 200	1.6	3.9	7.5	16.4	19.0	11.8
200 X 300	1.3	3.3	6.9	14.8	16.1	10.5
200 X 460	1.3	3.0	6.6	14.1	14.8	9.8
200 X 610	1.3	2.6	6.2	13.1	13.5	9.2
250 X 250	1.3	3.3	6.9	14.4	15.4	10.2
250 X 410	1.3	2.6	6.2	13.1	13.1	8.9
250 X 510	1.0	2.6	5.9	12.5	12.1	8.5
250 X 760	1.0	2.3	5.6	11.8	10.8	7.9
300 X 300	1.3	2.6	6.2	13.1	13.5	9.2
300 X 460	1.0	2.3	5.6	12.1	11.5	8.2
300 X 610	1.0	2.0	5.6	11.5	10.5	7.5
300 X 910	1.0	2.0	5.2	10.8	9.5	7.2
380 X 380	1.0	2.3	5.6	11.8	10.8	7.9
380 X 560	1.0	2.0	5.2	10.8	9.5	7.2
380 X 760	1.0	1.6	4.9	10.2	8.5	6.6
380 X 1140	0.7	1.6	4.6	9.5	7.9	6.2
460 X 460	1.0	2.0	5.2	10.8	9.5	7.2
460 X 710	0.7	1.6	4.6	9.8	7.9	6.2
460 X 910	0.7	1.6	4.7	9.2	7.2	5.9
460 X 1370	0.7	1.3	4.3	8.9	6.6	5.6
610 X 610	0.7	1.6	4.6	9.2	7.2	5.9
610 X 910	0.7	1.3	3.9	8.5	6.2	5.2
610 X 1220	0.7	1.3	3.9	7.9	5.6	4.9
610 X 1830	0.7	1.0	3.6	7.5	5.2	4.6
760 X 760	0.7	1.3	3.9	8.2	5.9	5.2
760 X 1140	0.7	1.0	3.6	7.5	5.2	4.6
760 X 1520	0.7	1.0	3.6	7.2	4.6	4.3
760 X 2290	0.3	1.0	3.3	6.9	4.3	3.9
910 X 910	0.7	1.0	3.6	7.5	5.2	4.6
910 X 1370	0.3	1.0	3.3	6.9	4.3	3.9
910 X 1830	0.3	1.0	3.3	6.6	3.9	3.9
910 X 1830	0.3	0.7	3.0	6.2	3.6	3.6
1070 X 1070	0.7	1.0	3.3	6.9	4.6	4.3
1070 X 1630	0.3	1.0	3.0	6.2	3.9	3.6
1070 X 2130	0.3	1.7	3.0	5.9	3.6	3.6
1070 X 3200	0.3	1.7	3.0	5.6	3.3	3.3
1220 X 1220	0.3	1.0	3.3	6.6	3.9	3.9
1220 X 1830	0.3	0.7	3.0	5.9	3.3	3.3
1220 X 2440	0.3	0.7	2.6	5.6	3.3	3.3
1220 X 3660	0.3	0.7	2.6	5.2	3.0	3.0

IS Industrial Silencer

■ Features

When high-pressure fluid is released from the safety valve, the pressure control valve and relief valve release into the atmosphere, and the speed of running fluid changes into the speed of sound and produces friction with the surrounding air and swirl, which results in the generating of loud noise. In general, high-frequency noise is generated from the outlet and low-frequency noise is generated from a short distance away, and the result is noise which frequency components show the mixed form of high frequency and low frequency. In order to reduce such noise, it is required to find the frequency that has the lowest noise level.

■ Specification

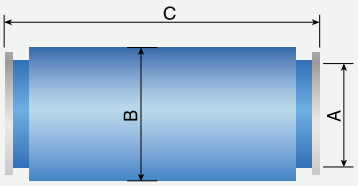
It is effective in attenuating the sound of the audible frequency and noise generated when high-pressure gas or steam is released into the atmosphere. It consists of the diffuser that directs low-frequency sound toward high-frequency sound, the expansion chamber is for low-frequency noise control, the acoustic tube is for high frequency noise control and shell.

■ Model denotation method

I □□ – □ X □ X □

① ② ③ ④ ⑤

① Sound Attenuator Type : I/IN-LINE TYPE, V/VENT TYPE
② Sound Attenuator Form : H/HORIZONTAL, V/VERTICAL
③ Diameter of the connecting hole(mm) A
④ Sound Attenuator Diameter(mm) B
⑤ Sound Attenuator Length(mm) C



■ Steam vent silencer






SPR Soundproof Room

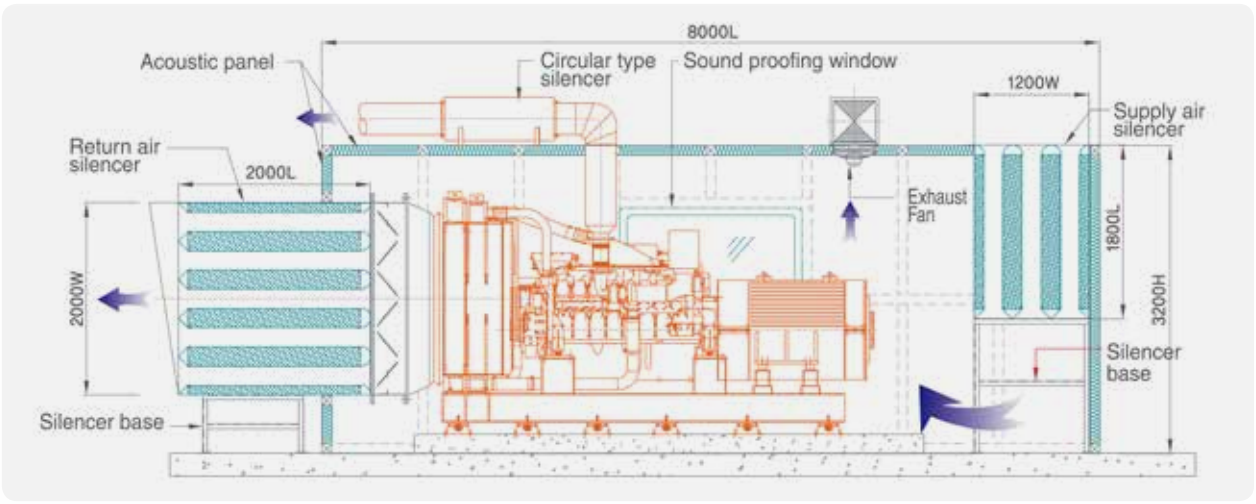
■ Soundproof Room

It is to make the noise-generating industrial facility into a room using sound absorbing/insulation panels in whole or in part. NSV plans the sound attenuation target in light of installation and surrounding conditions and designs, makes and installs the room to ensure performance.

■ Considerations in soundproof design

- · Data of noise generated per frequency from the target facilities
- · Location of the sound pick-up point and allowable noise level
- · Ventilation and open-part soundproof depending on increase in indoor temperature
- · Opening/closing plan and installation structure for maintenance
- · Installation of door/window with the flow of human traffic in mind
- · Location of electrical units, enclosing of penetration and drain

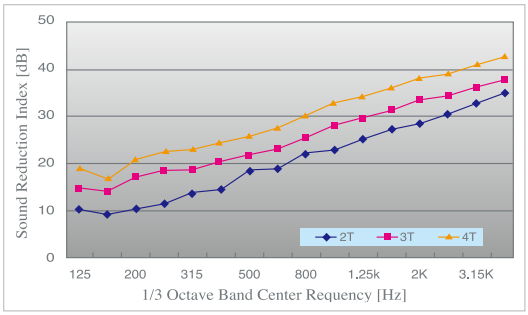
■ A Soundproof Room Structure Drawing








NDP Damping Sheets



Features

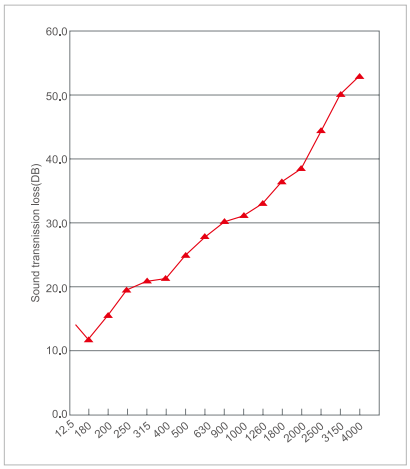
It is a viscoelastic material having a relatively high damping loss. It converts vibrational energy into thermal energy through internal viscous damping and friction. It is used to reduce the sound energy generated when a panel shakes due to vibration, resonance amplitude and vibration on joint parts.

Dimension(size 1000x1000mm)

Type	Material	Thickness	Usage	Features
NDP-F	EVA+Film+Asphalt+Other Compound	2.0~4.0mm	AHU Room, Mechanical Room	Good for Sound Insulation and Dust Proofing

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

NDT Damping Tape



Features

The main material is butyl synthetic rubber, which is a tape-shaped material excellent in vibration control. It improves the loss factor from noise and vibration sources to reduce problematic vibration. With the mix of highly-functional additives and high molecules having excellent weather-resistance and viscosity, it offers excellent soundproof effects.

Specification

Type	NDT
Material	BUTYL
Thickness	3.2mm
Width	20~80mm
Length	10m

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

PO-MAT® Polyurethane Mat

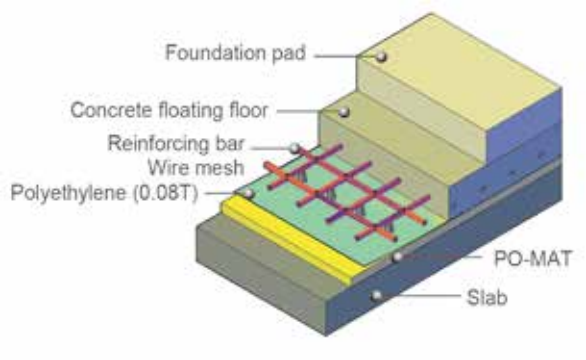
■ Features

Microcellular Polyurethane Mat is elastic and capable of supporting a wide range of dynamic loads owing to micro-sized air gap inside. In particular, the thickness of the Floating Slab can be reduced as the load is distributed evenly over the surface. Because Mat itself maintains elasticity and isolates noise, extra Floating Slab lifting is not required. It comes in different colors depending on its density, which makes it easier to select, handle and install.

■ Specification

Model	A25	B25	C25	D25	E25	F25	G25	H25
Color	Green	Yellow	Blue	Pink	Brown	Red	Gray	Black
Thickness	25T							
Density(kg/㎥)	150± 20%	220± 20%	300± 20%	400± 20%	500± 20%	600± 20%	800± 20%	1000± 20%
Rated Load(N/㎟)	0.01± 20%	0.03± 20%	0.05± 20%	0.10± 20%	0.15± 20%	0.40± 20%	1.50± 20%	5.00± 20%
Rated Def. (mm)	6.0						3.0	1.5
Size	1000mmX1000mmX25T							

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.



■ PO-MAT Durability Test Data

PO-MAT Model	Density (kg/㎥)	Lifetime (room temperature:20℃)	Activation Energy (kJ/mol)
A-25	150	612Years	200
B-25	220	630Years	207
C-25	300	644Years	206
D-25	400	652Years	185
E-25	500	660Years	219
F-25	600	675Years	193

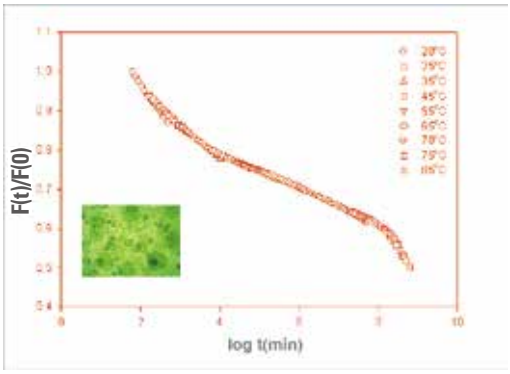
■ Test Equipment(DMA 2980, TA Instrument)

- The data above is the result of the test performed upon request by the Department of Chemical Engineering at Hanyang University. The test was conducted to predict durability using Time Temperature Superposition (TTS) and observe stress-relaxation under constant compression strain.

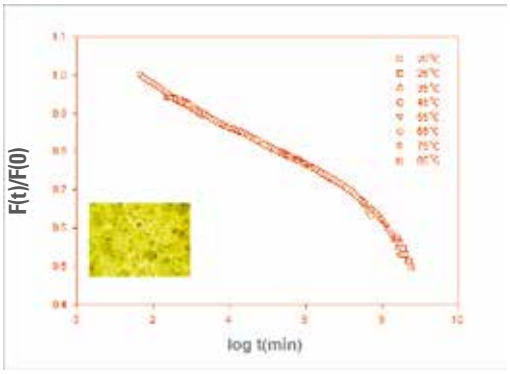
★ TTS : The higher the temperature, the less time is required for stress-relaxation; this principle is used to predict changes in mechanical behavior over time at a given temperature when temperature is changed within a measurable time range.

PO-MAT® Polyurethane Mat

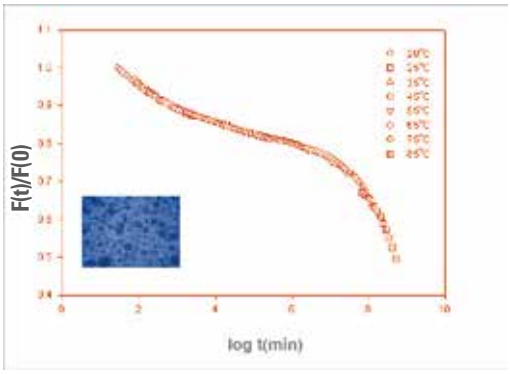
■ The PO-MAT Durability Test Resulting Graph



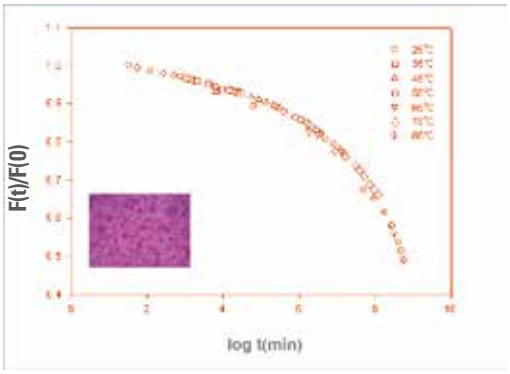
• Sample A : Green
• Density : 150Kg/㎥
• Durability : Durabity 612yrs(20°C)



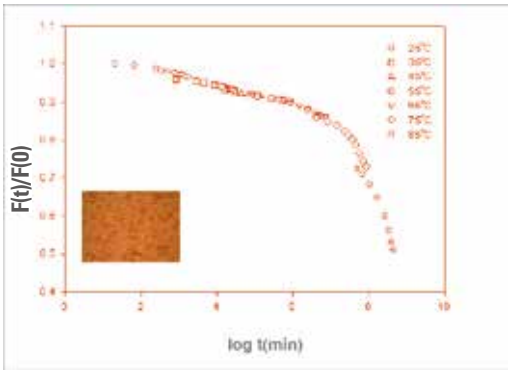
• Sample B : Yellow
• Density : 220Kg/㎥
• Durability : Durabity 630yrs(20°C)



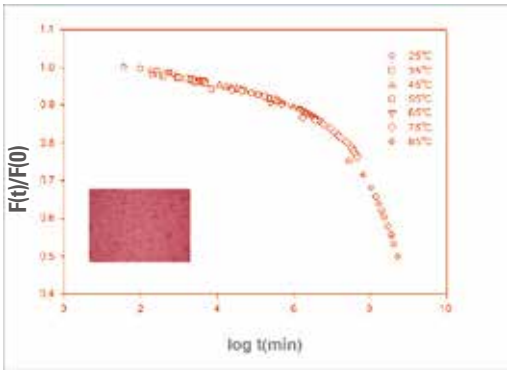
• Sample C : Blue
• Density : 300Kg/㎥
• Durability : Durabity 644yrs(20°C)



• Sample D : Pink
• Density : 400Kg/㎥
• Durability : Durabity 652yrs(20°C)



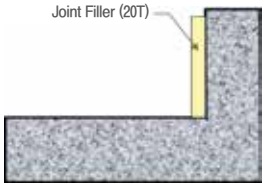
• Sample E : Brown
• Density : 500Kg/㎥
• Durability : Durabity 660yrs(20°C)

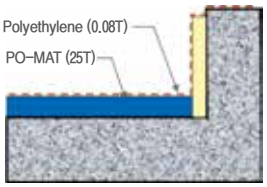


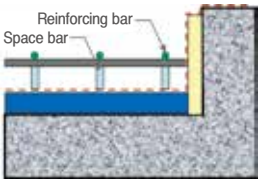
• Sample F : Red
• Density : 600Kg/㎥
• Durability : Durabity 675yrs(20°C)

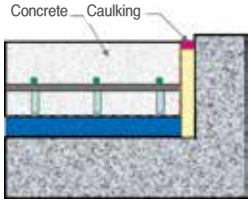
PO-MAT® Polyurethane Mat

■ PO-MAT Installation Order

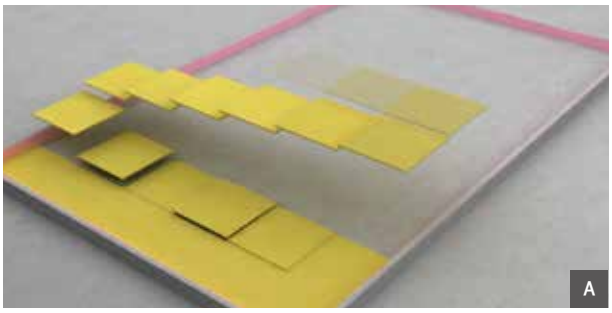


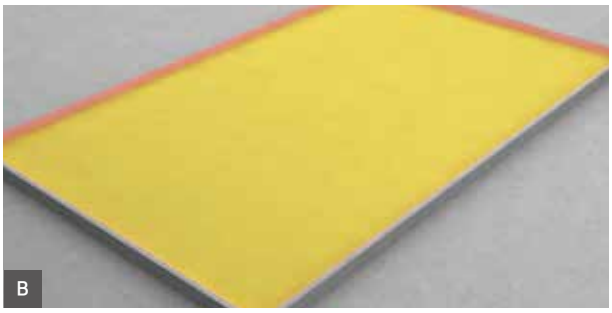


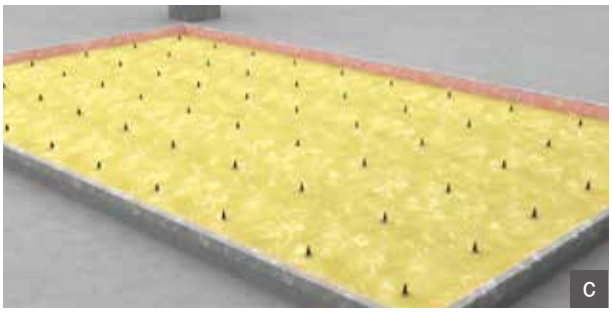


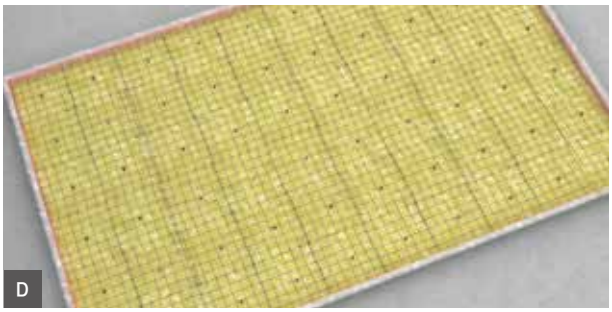


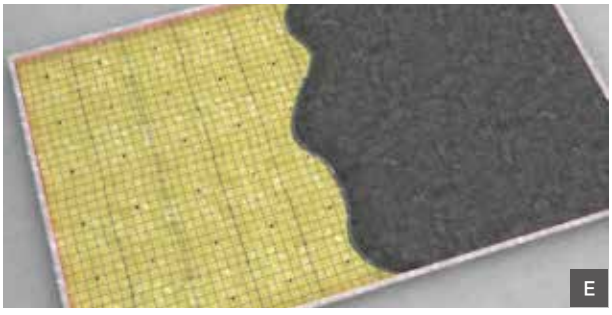
1. Clean the floor where the PO MAT is to be installed, keep level and install the MAT when the floor is dried.
2. Cover drain, vertical pipes, ducts and electric line-passing parts with joint filler and/or heat insulating materials.
3. Attach joint filler on surrounding walls and pillars that come in contact with double-bottomed slab.
4. Install the PO-MAT according to the approved drawing, in a way that manufacturer's name and model comes on top.
5. Install 2 layers of 0.08 mm-thick polyethylene (PE) plastic on top of the PO-MAT and attach using the OPP adhesive tape.
6. Install a wire mesh or steel reinforcement as shown in the approved drawing. Be cautious not to damage the plastic.
7. Place concrete and then leave it for curing. (According to the construction specification standard)
8. Then, do the caulking with 10mm-thick sealant.





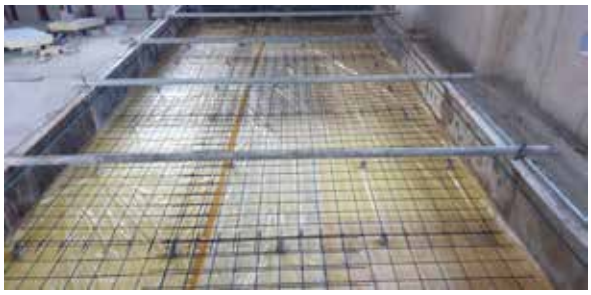


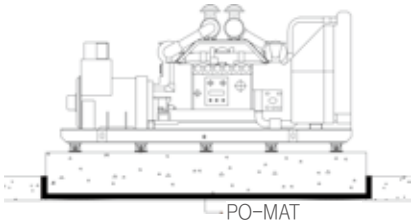




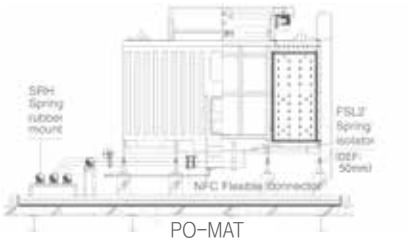
PO-MAT® Polyurethane Mat

■ PO-MAT Construction Method

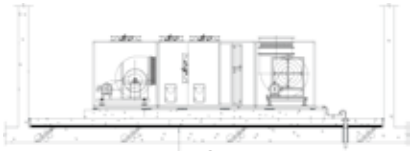




PO-MAT

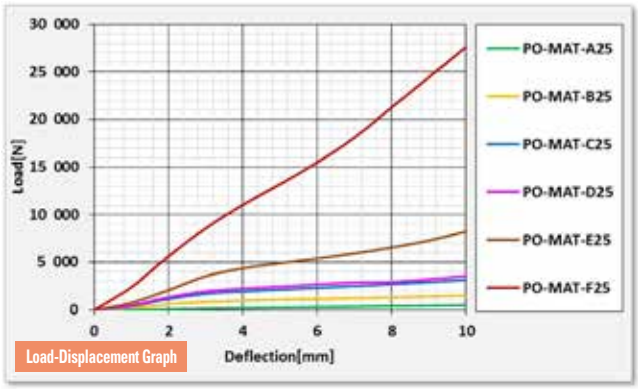


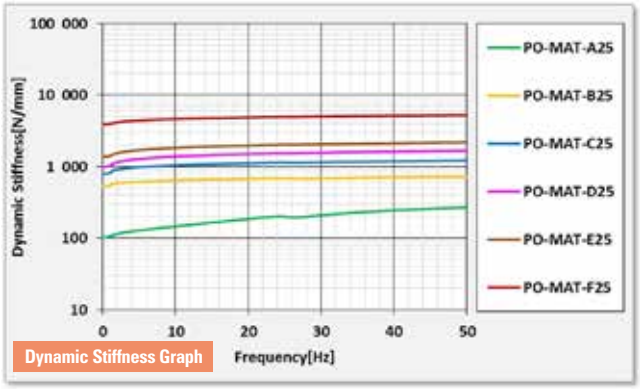
PO-MAT

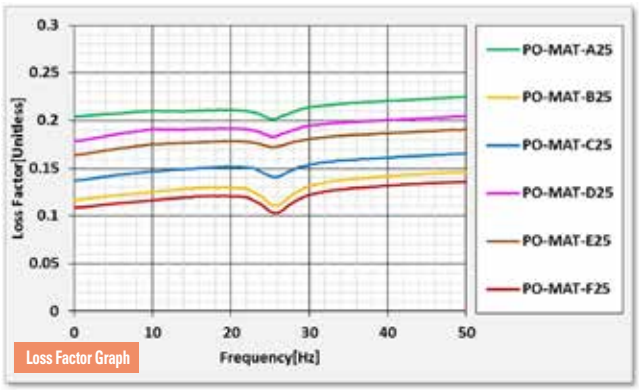


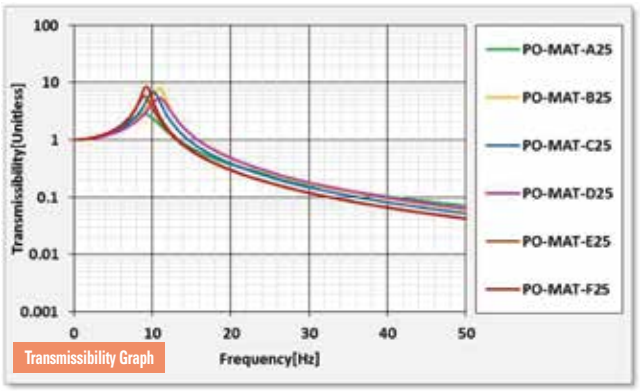
PO-MAT

■ 25T Test Data



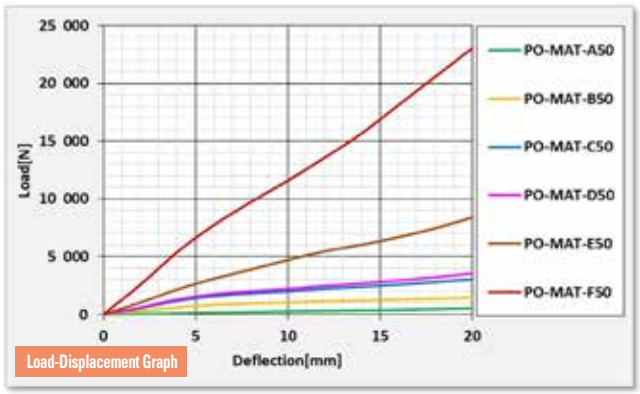


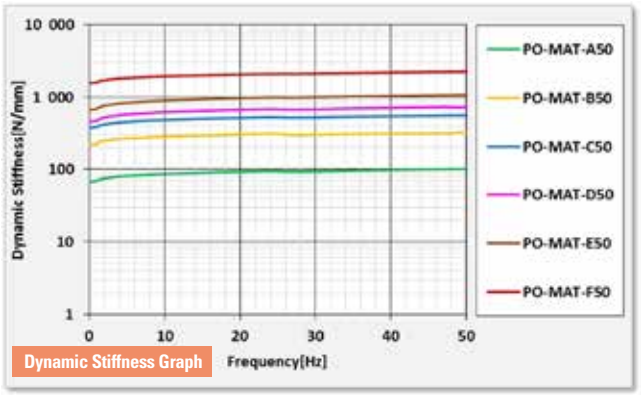


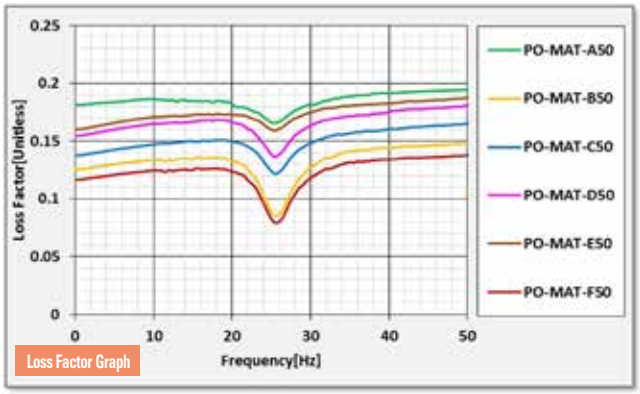


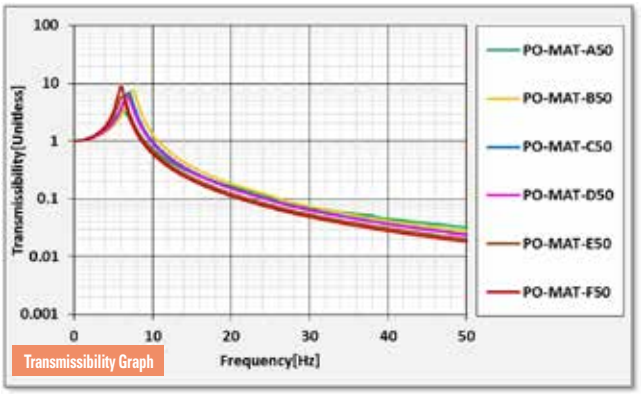
PO-MAT® Polyurethane Mat

■ 50T Test Data









■ Explanation(Commonness)

1. Vibration Transmissibility(T_r)
   Vibration Transmissibility is the amplitude ratio of Output to Input.

$$T_r = \frac{Output\ Amplitude}{Input\ Amplitude} = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2},\ \eta = \frac{Disturbing\ Frequency\ of\ the\ equipment}{Natural\ Frequency\ of\ the\ Isolator(\ Damping(c) = 0\ )}$$

2. Natural Frequency(F_n) of Vibration Isolation System
   The mass and spring stiffness dictate a natural frequency of the system.

$$F_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

3. Isolation Efficency(E)
   Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$
   ex) Disturbing Frequency of the equipment=100 Hz,
   Natural Frequency of the isolator=10Hz

$$T_r = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2} = \sqrt{\left(\frac{1}{1-\left(\frac{100}{10}\right)^2}\right)^2} = 0.101 \qquad E = 100(1 - T_r) = 100(1-0.101)=99(\%)$$

4. Loss Factor(ζ)
   ① Loss Factor is the double damping ratio on natural frequency of Vibration Isolation System $\eta = 2 \times \zeta(Damping\ Ratio)$
   ② The damping ratio is a dimensionless measure describing how oscillations in a system decay after a disturbance.

$$\zeta = \frac{Actural\ Damping}{Critical\ Damping}$$

5. Dynamic Stiffness(k_d)
   The dynamic stiffness is the frequency dependant ratio between a dynamic force and the resulting dynamic displacement.

$$k_d = \frac{Force(Frequency)}{Vibration\ Response}$$

HD-MAT High-Damping Mat

■ Features

It is a highly-molecular copolymer formed through the foaming of HSBR (Hydrogenated SBR) blended with EVA (Ethylene Vinyl Acetate). Because it has adequate elasticity compared to the conventional foam and excellent damping properties against external exciting force and impulsive load, it can be converted into a static state in a short space of time.

■ Specification

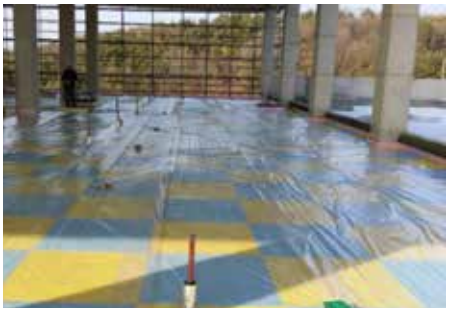
Model	A25	A50	B25	B50	C25	C50
Color	Orange		Sky Blue		Purple	
Thickness	25	50	25	50	25	50
Density(kg/㎥)	100±20%		150±20%		200±20%	
Tensile Strength(MPa)	Over 1.3		Over 1.8		Over 2.0	
Coefficient of Extension(%)	Over 220		Over 220		Over 220	
Rated Load(N/㎟)	0.08±20%		0.17±20%		0.20±20%	
Rated Def.(mm)	8	16	8	16	8	16
Natural Freq.(Hz)	Under 12	Under 8	Under 12	Under 8	Under 12	Under 8
Rebound Resilience(%)	Under 25		Under 25		Under 25	
Loss Factor(tanδ)	Over 0.3	Over 0.27	Over 0.3	Over 0.27	Over 0.3	Over0.27
Dynamic Modulus of Elasticity(N/㎟)	Under 1.6	Under 2.0	Under 1.6	Under 2.0	Under 1.6	Under 2.0
Compression Set ((23±2)℃, 22h)	Under 5.0		Under 5.0		Under 5.0	
Water Absorption Ratio (g/㎠)	Under 0.005		Under 0.003		Under 0.003	
Size(W x H x T)	1000mmX1000mmX25mm, 1000mmX1000mmX50mm					

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ Installation features

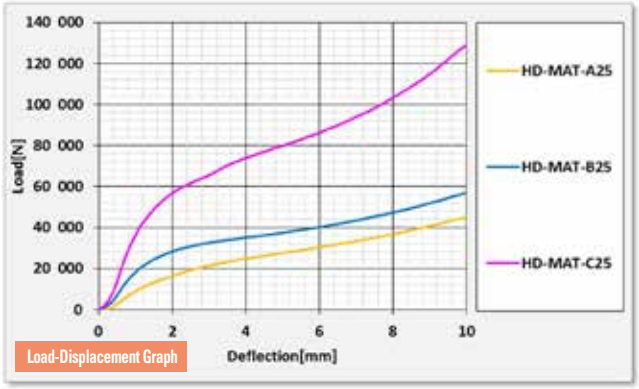


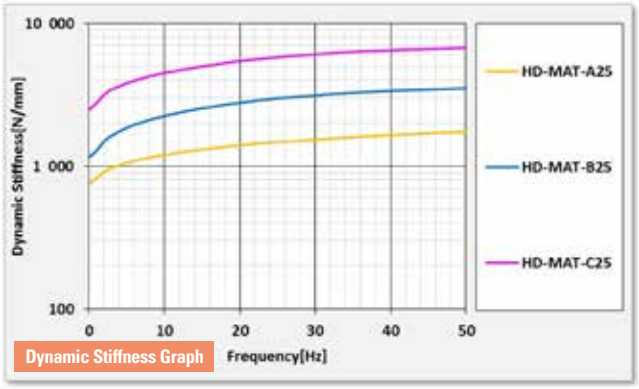


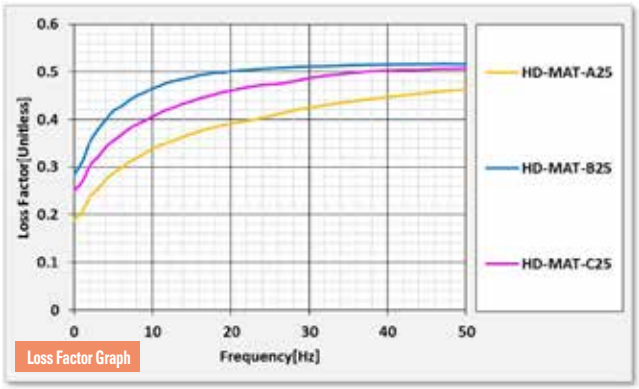



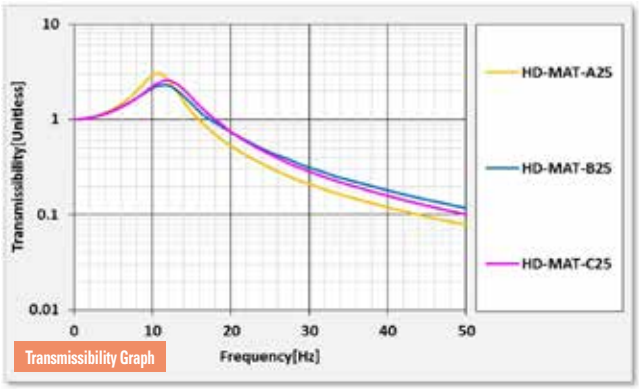
HD-MAT High-Damping Mat

■ 25T Test Data

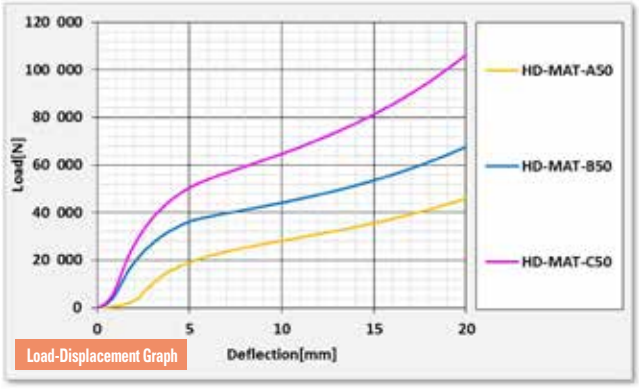


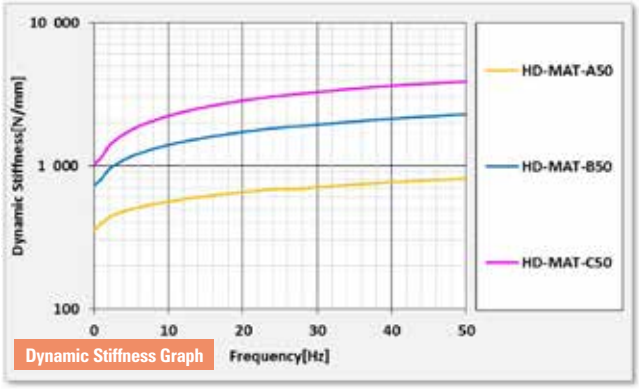


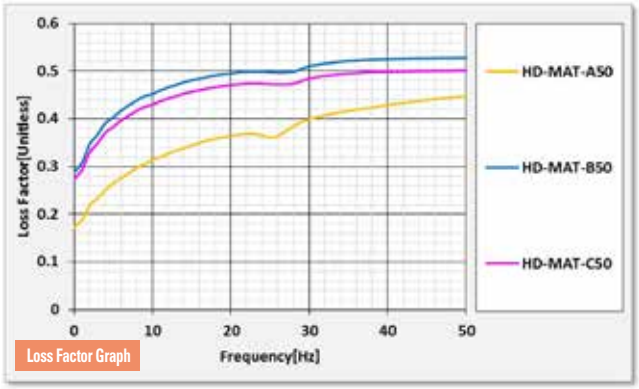


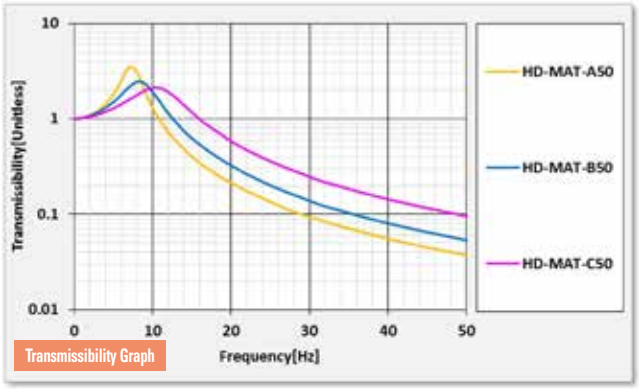


■ 50T Test Data

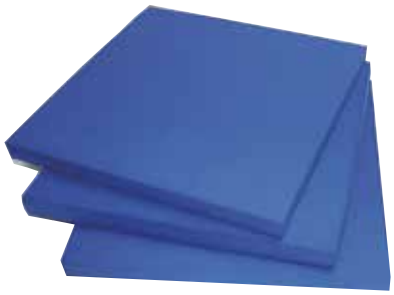








HE-MAT High-Elasticity Mat



■ Features

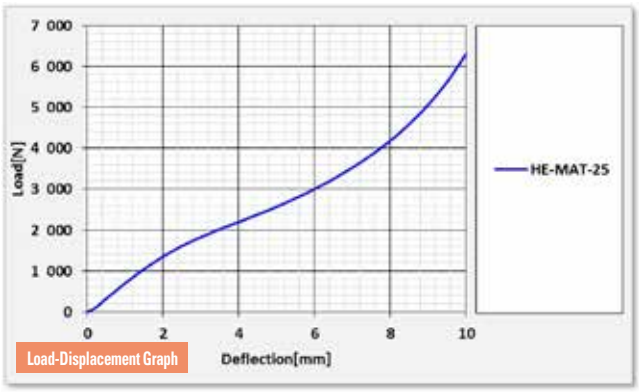
It is a highly-molecular copolymer formed through the foaming of high-elastic ethylene olefin blended with styrene copolymer. It has a higher elasticity than that of common foam and outstanding glutinous properties. Plus, it can be used as an alternative to the anti-vibration system for the floating floor of structure under concentrated load/distributed load and anti-vibration rubber material used for construction facilities as it can control the dynamic range of compressive load depending on the specific gravity and has a good resistance to compressive deformation.

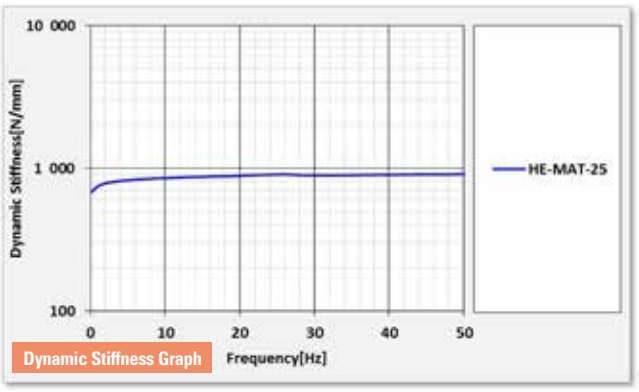
■ Specification

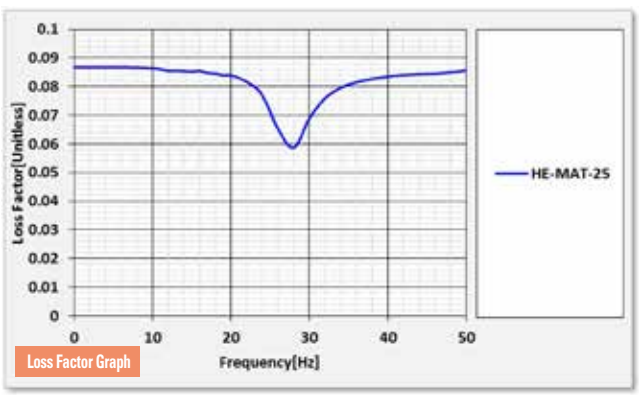
Model	HE-MAT 25	HE-MAT 50
Color	Blue	
Thickness	25	50
Density(kg/㎥)	270±20%	
Tensile Strength(MPa)	Over 1.3	
Coefficient of Extension(%)	Over 200	
Rated Load(N/㎟)	0.11±20%	
Rated Def.(mm)	6	12
Natural Freq.(Hz)	Under 10	Under 8
Rebound Resilience(%)	Over 80	
Dynamic Modulus of Elasticity(N/㎟)	Over 5	Over 5
Compression Set ((23±2)℃, 22h)	Under 3	
Water Absorption Ratio(g/㎠)	Under 0.003	
Size(WxHxT)	1000mm X 1000mm X 25T	

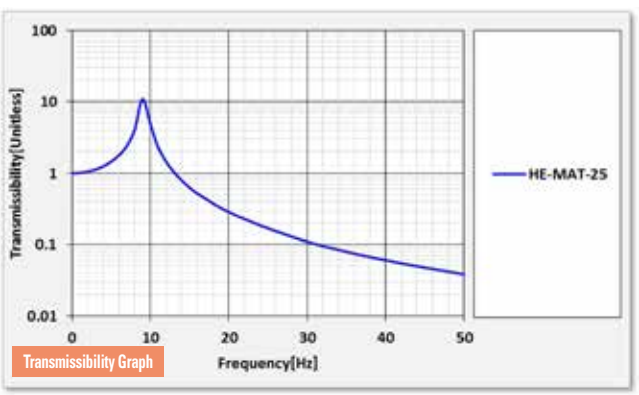
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ HE-MAT Test Data









NP-MAT Neoprene Mat

■ Features

The NP-MAT is made of neoprene rubber (CR:Crichloroprene Rubber) with excellent durability and relatively stable oil, heat and chemical resistance that is foamed and shaped with high density. The close-cell structure inside the mat helps absorb shock, vibration and noise without volumetric displacement.

■ Intended use

- Double bottom of air conditioning rooms and machine rooms
- Shock-absorbing material for machines
- For the isolation of buildings from a vibration-generating subway
- Base vibration and noise control in a special area
- For the floor of sports facilities

■ Physical properties

- Damp proof property (absorption rate : less than 0.5g/㎠)
- Insulation : Thermal conductivity (0.036W/m.K at 20℃)
- No environment pollutant contained and harmless to human
- Non-combustible

■ Dimension & Selection Guide

Model	Color	Density(kg/㎥)	Rated Def.(mm)	Coefficient of Extension(%)	Size(mm)
NP-B25	Black	200±20%	8	Over 250	1000X1000X25
NP-B50			16		1000X1000X50
NP-C25		300±20%	8		1000X1000X25
NP-C50			16		1000X1000X50

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

EP-MAT EVA Mat

■ Features

EVA (Ethylene Vinyl Acetate) resin is copolymer produced through the polymerization of ethylene monomer and VAM (Vinyl Acetate Monomer) in autoclave reactors, which is used to produce LDPE (Low Density Polyethylene) with as much VAM as VA in content. Because it has excellent elasticity and flexibility, it is suitable as a buffer to alleviate the transfer of structure-borne shock and vibration through neighboring rooms on lower and upper floors. It is mostly used as the base pad for air conditioning rooms and machine rooms.

■ Dimension & Selection Guide

Model	Measure	EP-10	EP-20	EP-25	EP-30	EP-50
Thickness	mm	10	20	25	30	50
Density	Kg/㎥	100±20%				
Tensile Strength	MPa	Over 1				
Coefficient of Extension	%	Over 85				
Hardness of spring	-	Over 45				
Rebound Resilience	%	Over 35				
Compression Set((23±2)℃, 22h)	%	Under 5				
Size (W x H x t)	mm	900mm x 1800mm x 10mm, 20mm, 25mm, 30mm, 50mm				

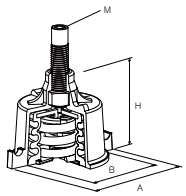
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

JUM-10000/20000/30000/40000 Jack Up Mount

■ Features

The jack-up system absorbs and insulates noise, impulsive vibration, as well as impulsive noise generated in problematic areas, such as air conditioning rooms, machine rooms and bowling alleys. It has at least a 50 mm-deep air layer and a 100mm-thick ferroconcrete slab using the neoprene mount on top of the slab. It increases transmission loss of noise in the double slab (floating floor) and prevents the transfer of vibration and primary structure-borne nose in the neoprene mount. the jack screw bolt should be on the top to lift the slab after installation and the support fixture should be on both sides for the distribution of steel reinforcements. Plus, the neoprene mount must have a steel plate within in order to handle a dynamic load.

JUM-10000 (Deflection : 17mm)

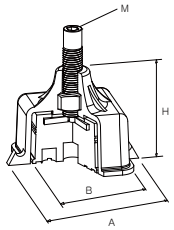


■ Dimension & Selection Guide

Model	Capacity (kgf)	Deflection (mm)	Hardness (Hs)	Dimension				Others	
				A	B	H	M	Air Gap(mm)	Slab Thickness(mm)
JUM-10200	200	17	65±5	130	94	100	M20	50~100	100~150
JUM-10300	300								
JUM-10400	400								
JUM-10500	500								
JUM-10600	600								
JUM-10700	700								
JUM-10800	800								

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

JUM-20000 (Deflection : 8mm)

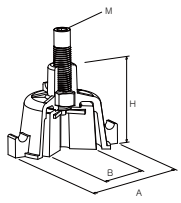


■ Dimension & Selection Guide

Model	Capacity (kgf)	Deflection (mm)	Hardness (Hs)	Dimension				Others	
				A	B	H	M	Air Gap(mm)	Slab Thickness(mm)
JUM-20200	200	8	65±5	136	86	100	M20	50~100	100~150
JUM-20300	300								
JUM-20400	400								
JUM-20500	500								
JUM-20650	650								
JUM-20800	800								

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

JUM-30000 (Deflection : 8mm)

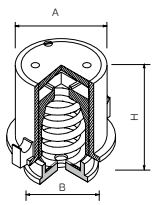


■ Dimension & Selection Guide

Model	Capacity (kgf)	Deflection (mm)	Hardness (Hs)	Dimension				Others	
				A	B	H	M	Air Gap(mm)	Slab Thickness(mm)
JUM-30200	200	8	65±5	154	116	100	M20	50~100	100~150
JUM-30300	300								
JUM-30500	500								
JUM-30650	650								
JUM-30800	800								

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

JUM-40000 (Deflection : 50mm)



■ Features

It is mostly applied when vibration is a bigger problem than the noise (for example, air conditioning rooms and machine rooms where the vibration frequency is less than 20Hz or the vibration is less than 30Hz with broad amplitude is generated). When the spring jack up system is used to form the double bottom, it is best to maintain the natural frequency of the whole system between 3.6Hz and 4.0Hz using an anti-vibration spring mount with a static deflection of 20~50mm. At this point, the diameter of the spring should be about 80% of the spring height under static loading. (With a reserve more than 50% of the static load)

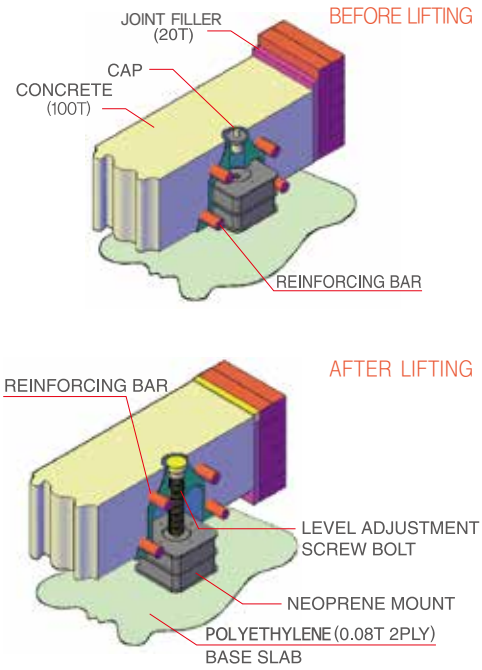
■ Dimension & Selection Guide

Model	Color	Capacity(kgf)	Deflection(mm)	Dimension			Others	
				A	B	H	Air Gap(mm)	Slab Thickness(mm)
JUM-40200	White	200	50	180	95	150	50	150~120
JUM-40300	Orange	300						
JUM-40400	Pink	400						
JUM-40500	Green	500						
JUM-40600	Blue	600						
JUM-40750	Black	750						

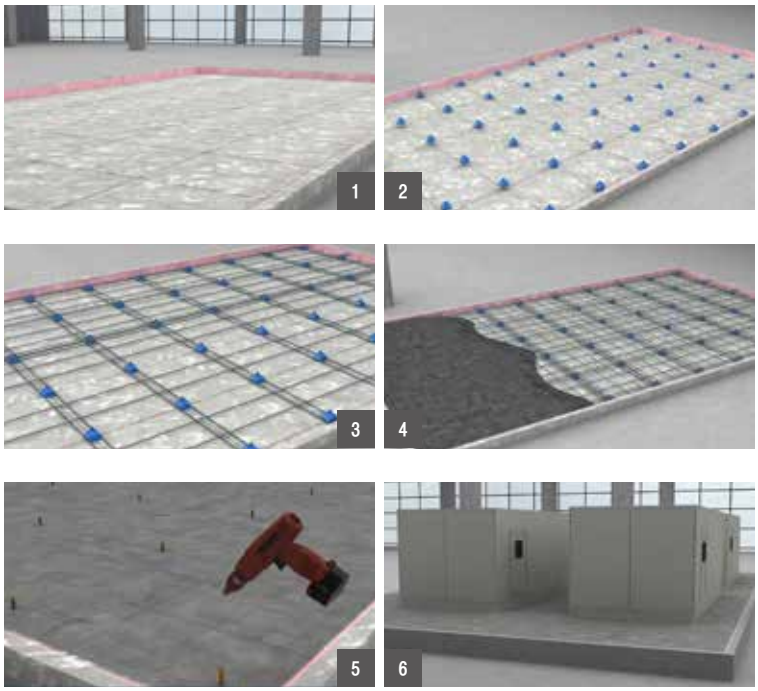
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

JUM-10000/20000/30000/40000 Jack Up Mount

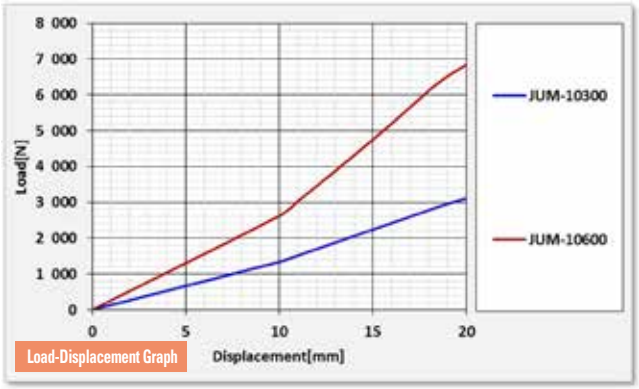
■ Jack-up system before/after lifting

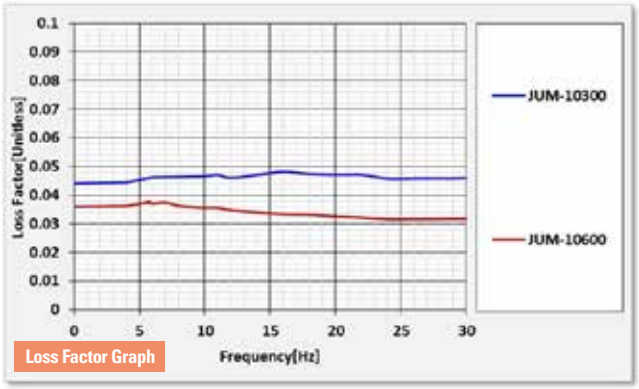


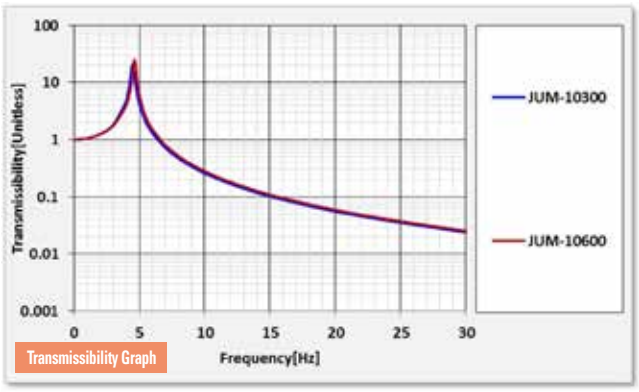
■ Jack-up system Installation Order

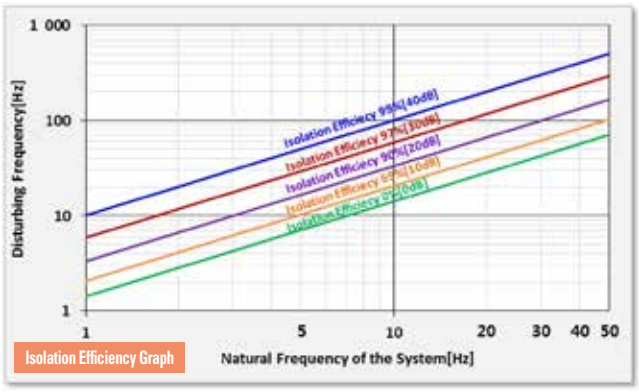


■ JUM-10000 Test Data



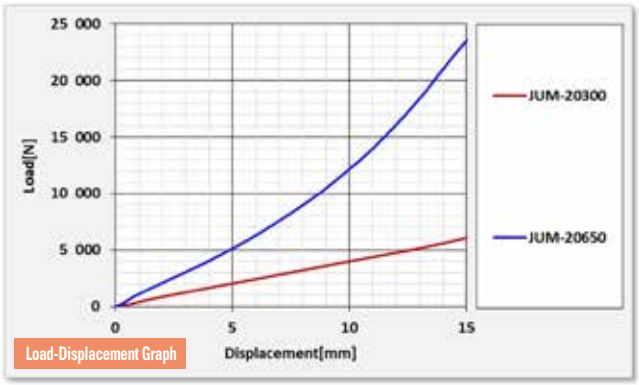


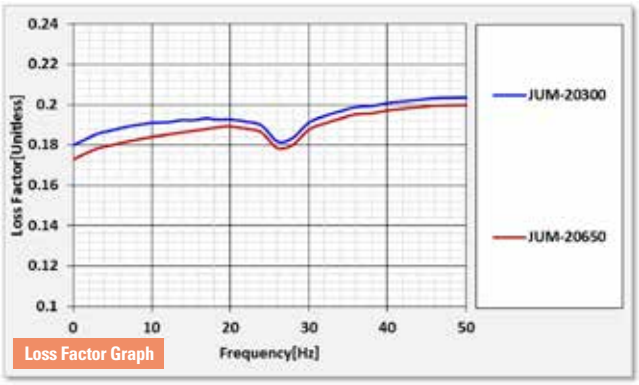


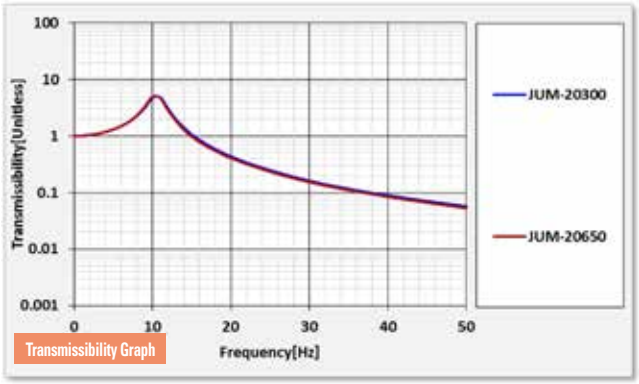


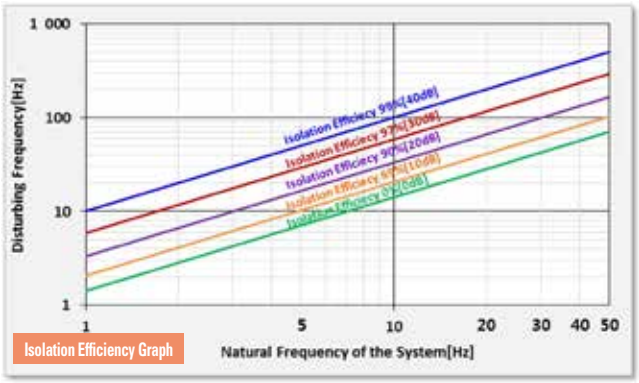
JUM-10000/20000/30000/40000 Jack Up Mount

■ JUM-20000 Test Data

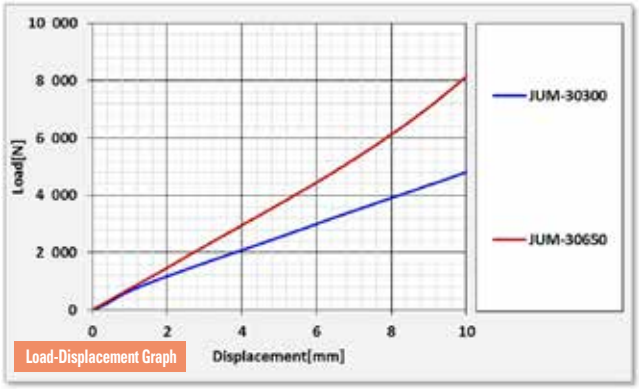


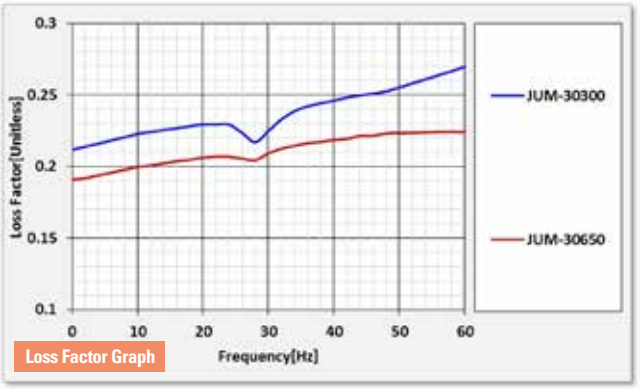


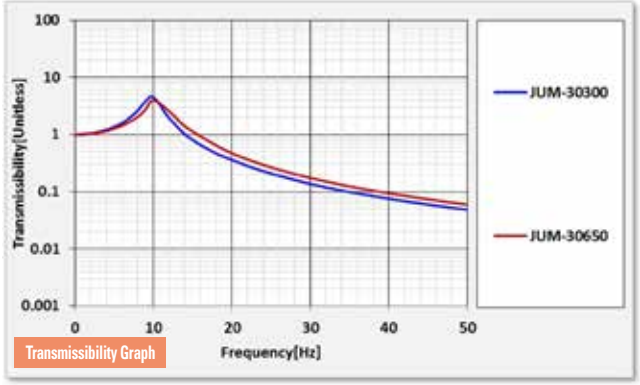


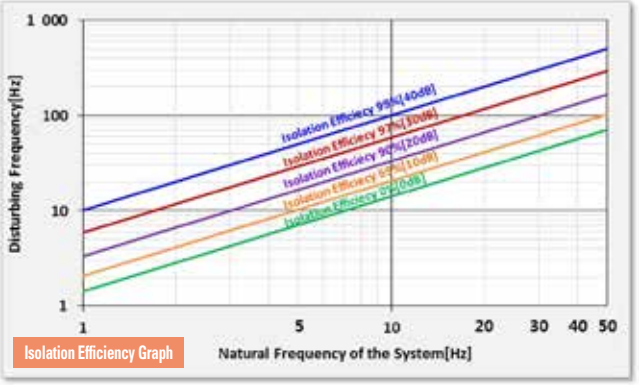


■ JUM-30000 Test Data



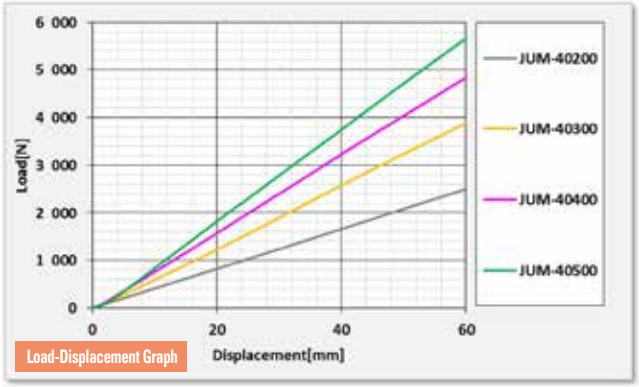


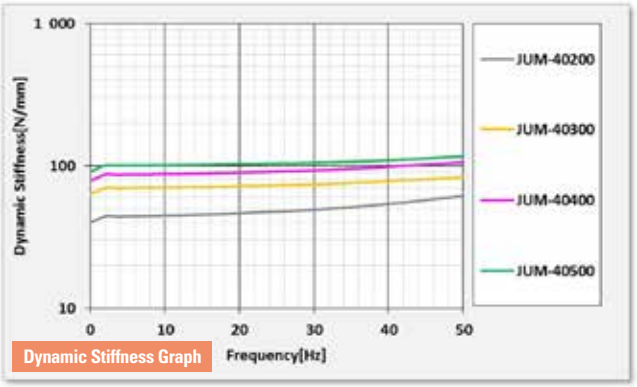


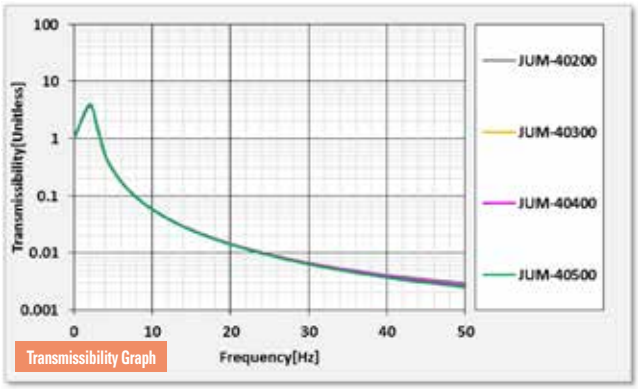


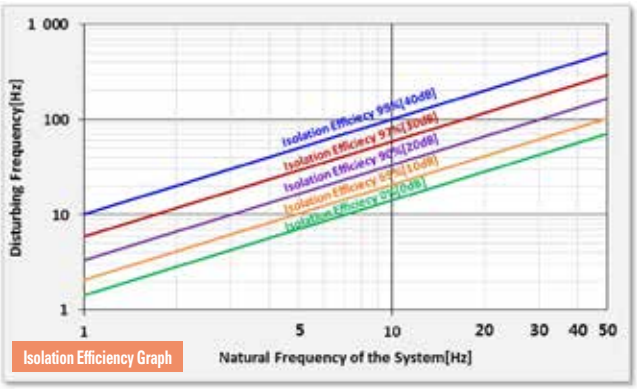
JUM-10000/20000/30000/40000 Jack Up Mount

■ JUM–40000 Test Data









■ Explanation(Commonness)

1. Vibration Transmissibility(T_r)
   Vibration Transmissibility is the amplitude ratio of Output to Input.

$$T_r = \frac{Output\ Amplitude}{Input\ Amplitude} = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2},\ \eta = \frac{Disturbing\ Frequency\ of\ the\ equipment}{Natural\ Frequency\ of\ the\ Isolator(\ Damping(c) = 0\ )}$$

2. Natural Frequency(F_n) of Vibration Isolation System
   The mass and spring stiffness dictate a natural frequency of the system.

$$F_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

3. Isolation Efficency(E)
   Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$
   ex) Disturbing Frequency of the equipment=100 Hz,
   Natural Frequency of the isolator=10Hz

$$T_r = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2} = \sqrt{\left(\frac{1}{1-\left(\frac{100}{10}\right)^2}\right)^2} = 0.101 \quad E = 100(1 - T_r) = 100(1–0.101)=99(\%)$$

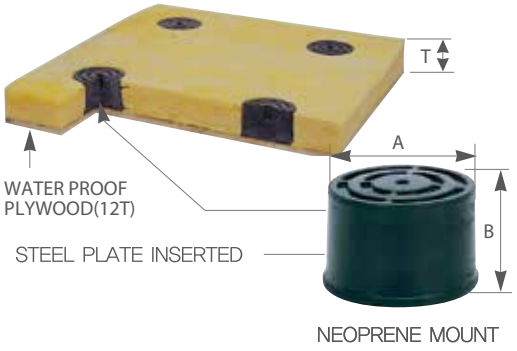
4. Loss Factor(ζ)
   ① Loss Factor is the double damping ratio on natural frequency of Vibration Isolation System $\eta = 2 \times \zeta(Damping\ Ratio)$
   ② The damping ratio is a dimensionless measure describing how oscillations in a system decay after a disturbance.

$$\zeta = \frac{Actural\ Damping}{Critical\ Damping}$$

5. Dynamic Stiffness(k_d)
   The dynamic stiffness is the frequency dependant ratio between a dynamic force and the resulting dynamic displacement.

$$k_d = \frac{Force(Frequency)}{Vibration\ Response}$$

NFM Plywood Floating Floor System



NEOPRENE MOUNT

■ Features

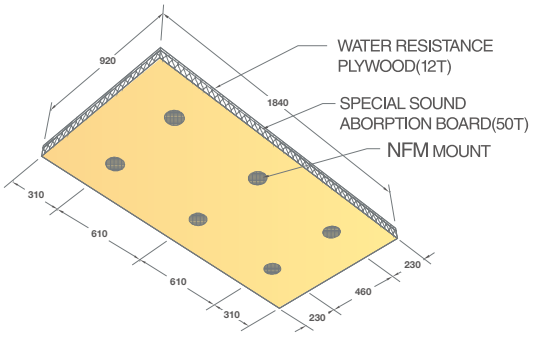
As a kind of form work floor system, it absorbs noise, shock and vibration generated in air conditioning rooms, machine rooms and other special facilities like the jack-up system does. But, unlike the jack-up system, it is easier to install as it requires no floating floor to be lifted. In particular, the high-density glass wool inside the product helps work better than the jack-up system in all ranges of frequency. It is designed according to the waterproof plywood standards to keep the mounts at regular intervals when installed next to each other in a horizontal position.

■ Dimension & Selection Guide

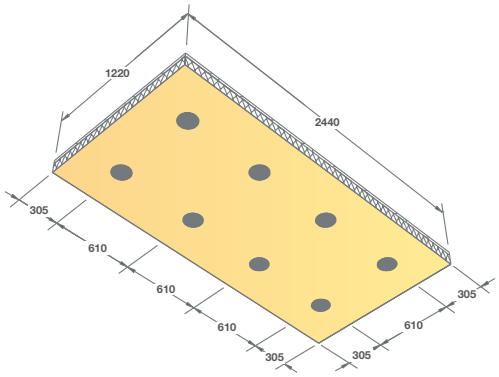
Model	Capacity (kgf)	Deflection (mm)	Hardness (Hs)	Dimension(mm)		Others	
				A(mm)	B(mm)	Absorption material T(mm)	SLAB Thickness(mm)
NFM-250	250	8	55±5	60	50	50	100~150
NFM-500	500	8	55±5	80	50	50	100~150
NFM-1000	1000	8	55±5	80	50	50	100~150

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ NFM Plywood Panel Configuration



3′×6′ SIZE

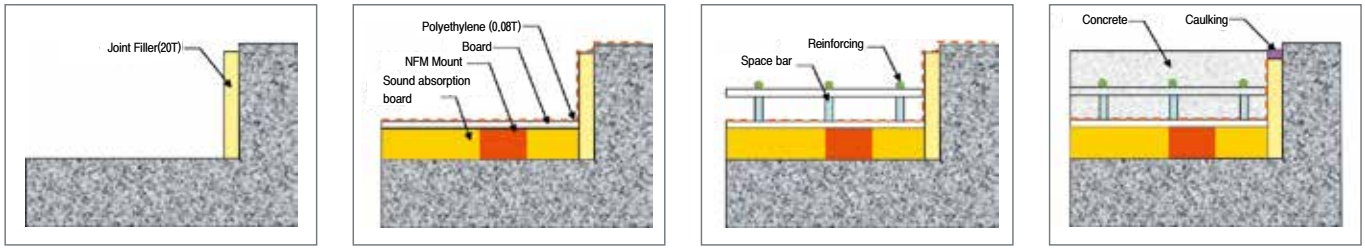


4′×8′ SIZE

■ NFM Plywood Panel Installation features

NFM Plywood Floating Floor System

■ NFM plywood panel Installation Order

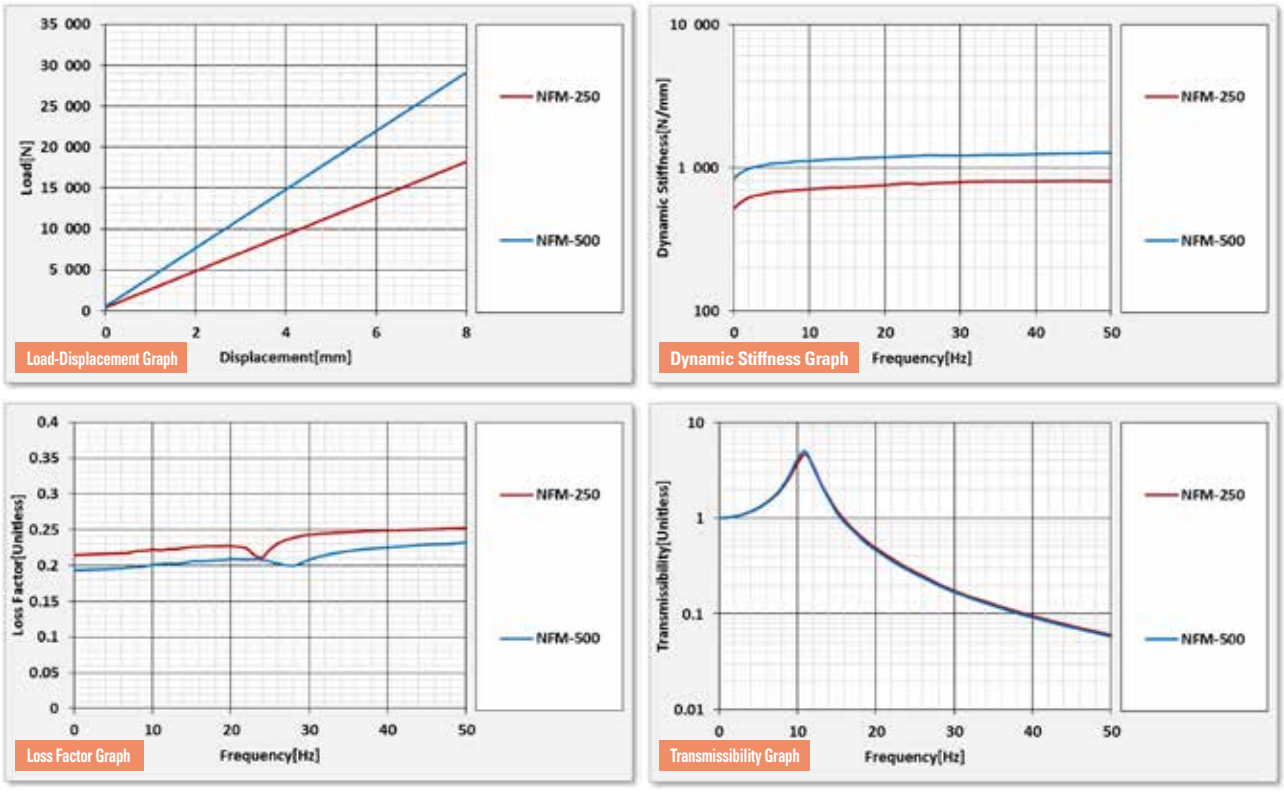


1. Clear the surface of the floor where nfm mount is to be installed, maintain a level surface and keep it dry.
2. Fix the drain, vertical pipes and ducts.
3. Insert the spool pipe seal on the general pipe or electric pipe.
4. Attach the joint filler on the wall or pillar that will come in contact with the slab of plywood panel system.
5. Install nfm plywood panel according to the approved drawing.
6. Spread two layers of 0.08mm-thick polyethylene (PE) over the panel and then attach it using the waterproof tape. The plastic sheet should be large enough to cover the top of the iso pink.
7. Install the steel reinforcement as shown in the approved drawing. At this point, be cautious not to damage the plastic sheet.
8. Pour the concrete at once, so that it can have the strength of 3000 psi.
9. Leave it for curing.
10. Once the floor is completely cured, remove the plastic sheet and then do the caulking with 10mm-thick sealant.

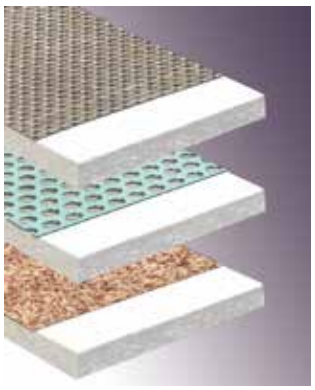
■ NFM Plywood Panel System Transmission Loss DATA

Frequency(Hz)	63	125	250	500	1000	2000	4000
Transmission Loss(dB)	54	59	73	83	89	97	106

■ Performance Test Data



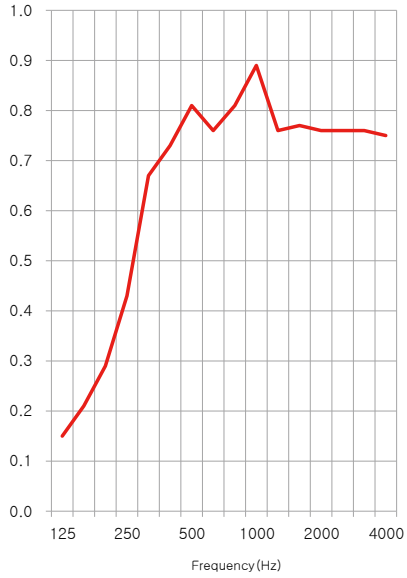
NFA Fiber Glass Sound Absorbing Board



■ Features

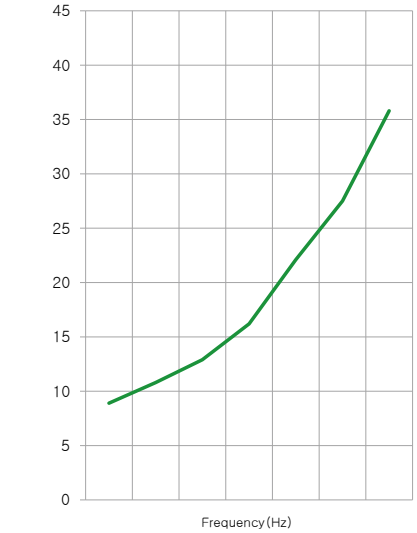
The NFA board is the perfect non combustible sound absorbing material treated with GlassCloth and Fabric using an E-glass fiber needle mat. It offers higher sound absorbing power compared with other products of the same thickness. Plus, it is the first sound absorbing material in Korea that is treated with the Roving Cloth, which made it last longer and look beautiful outside.

■ Sound Absorbing Coefficient (Reverberation Method)



Hz	α
125	0.15
160	0.21
200	0.29
250	0.43
315	0.67
400	0.73
500	0.81
630	0.76
800	0.81
1000	0.89
1250	0.76
1600	0.77
2000	0.76
2500	0.76
3150	0.76
4000	0.75

■ Transmission Loss (NFA Sound Absorbing Board 25T)



Frequency(Hz)	63	125	250	500	1000	2000	4000
25T board	8.9	10.8	12.9	16.2	22.1	27.5	35.8

■ NFA-GC TYPE

As the sound-absorbing material for construction and industrial fields, NFA-GC is made of an E-glass fiber needle mat covered with Glass Cloth. It is the most efficient sound absorbing material that copes with medium/high frequency range.

■ Usage

Used for sound absorption in power generator rooms, air conditioning rooms and industrial facilities

■ Size 1000X1000X20mm, 25mm/THK

■ NFA Merit

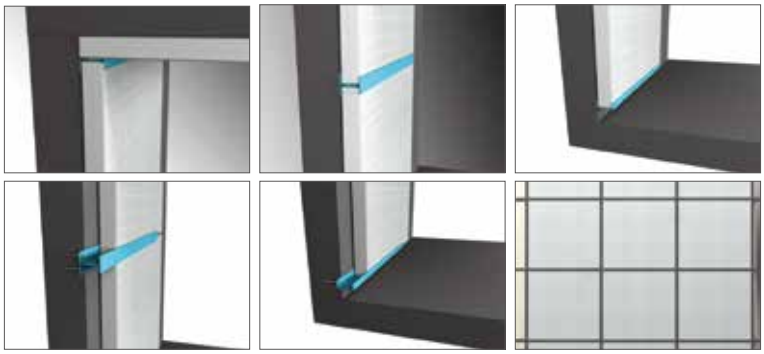
1.Excellent noise attenuation
The NFA sound absorbing board with a density higher than 160Kg/㎥ has higher sound absorbing coefficient compared to other products of the same thickness. Because three different medium are stacked up, it copes better with physical properties of sound. Plus, it has a high transmission loss, which provides excellent noise attenuation when installed.

2.Made up of perfect non-combustible natural mineral material, it lasted 2 hours in the level 1 fireproof construction test.

3.It is light, economical, easy to handle and install and moreover, generates less dust.

4.Because it is made up of E-glass fiber, which is natural mineral having excellent durability and safety, it has a chemical resistance with a high durability. And it has a low thermal expansion coefficient, which means it is unlikely to contract and expand as it is almost never affected by temperature and humidity.

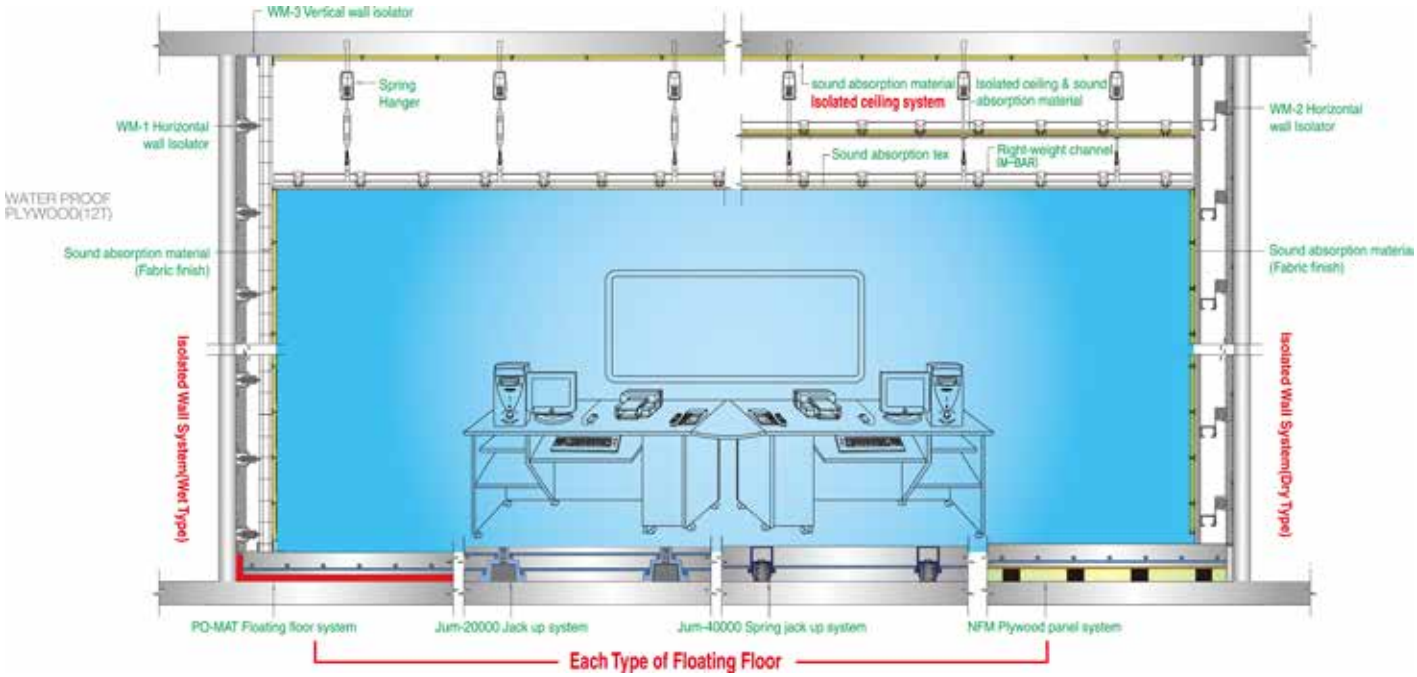
■ NFA sound absorbing board installation



WM1 / WM2 / WM3 Isolated Stud Neoprene Mount

■ Suspended ceiling

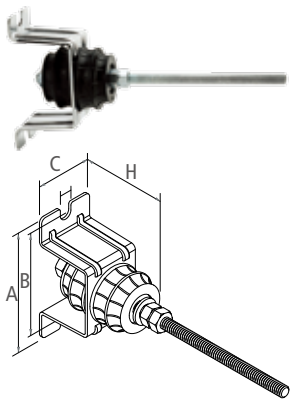
The aerial density of a suspended ceiling is much lower than the hardness of the floor SLAB and in this regard, noise is absorbed by in-between space (usually 30mm deep) rather than the ceiling itself. To block the transfer of vibration to the ROADBAR through the structure and control resonance of the ceiling, a rubber or hybrid spring hanger is used.



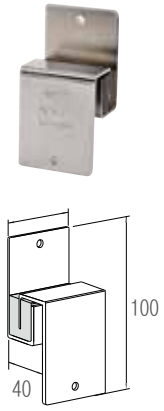
■ Double-wall

To maintain quiet indoors, architectural soundproofing structures are as important as soundproofing using building equipment. The double-wall works as a vibration insulator to prevent the vibration of the wall by sound pressure from passing through the building structure. This double-wall system can be applied on both wet and dry walls. The transmission loss of the double wall is determined based on the structure of the air layer and its aerial density.

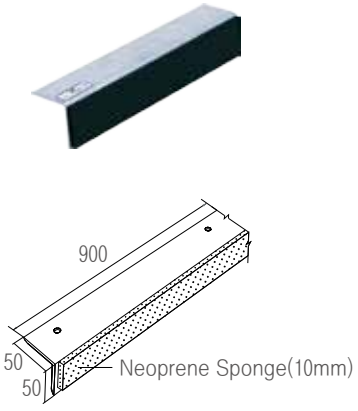
WM1



WM2



WM3



■ Dimension & Selection Guide

Model/Capacity	Dimension				
	A(mm)	B(mm)	C(mm)	D(mm)	AH(mm)
WM1-50	108	95	50	11	86
WM1-150	148	124	70	13	114

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

Shock Control NSV

ISO 9001/ISO 14001
OHSAS 18001
MADE IN KOREA

SHOCK CONTROL

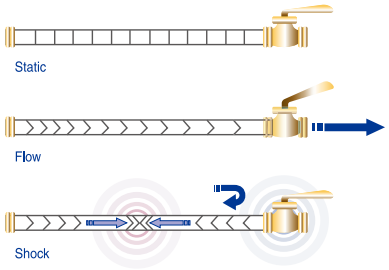
Theory for prevention of shock

Technical information on NSV Water Hammer Arrester

1. Introduction

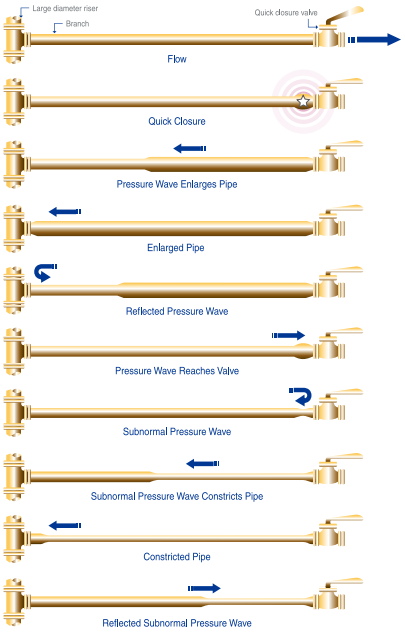
Water hammer is the phenomenon that enormous power and accompanying impulsive noise and vibration are generated when a sudden change occurs in the flow of fluid in the plumbing system in which uncompressible fluid flows.
When water hammer occurs, the impulse waves of very high intensity continue to move back and forth along the plumbing system until the energy completely disappears due to the viscosity of the fluid and pipe material.
The impulse wave is generated when the velocity of the fluid changes suddenly due to quick closing of the valve in the plumbing system. Automatic valves of electric, pneumatic, and spring types are being used increasingly, and for the manual valves, the preference is for ones operated by one touch action, which means cases of quick opening/closing of valves are also increasing so water hammer occurs more frequently and the impact is also becoming stronger.

2. Generation of water hammer



[Figure 1] Generation of water Hammer

As shown in [Figure 1], when the valve at the end of plumbing in which a fluid flow is closed quickly, an impulse wave occurs and propagates in the direction opposite to that of the flow of the fluid. The propagation speed of this impulse wave is 1200~1500m/s when the fluid is water.



[Figure 2] Illustrations of a Shock Wave

[Figure 2] shows the relationship between the movement of the impulse wave and the change in the status of the pipe.
As shown, the section of the pipe suffers a status change of 'expanded → restored → shrunken → restored' during one cycle of impulse wave propagation.
Enormous power is applied to the inner surface of the pipe at that time, and impact noise and vibration are generated as if the pipe is being beaten by a hammer and it might cause damage to the valve, parts like fittings etc., and even to the pipe itself, and there might be leakage due to loosening of connections.

3. Intensity of impacts

Impulse waves are generated only when a valve is quickly open or closed, and the quick open/close speed of ≤ (2L/a) seconds. When the speed of opening or closing the valve is long enough, such as ≥ (2L/a) seconds, an impulse wave is not generated, the dynamic pressure of the fluid is converted to static pressure and the pressure rises to the extent of the dynamic pressure. This is called surging.
The maximum pressure of the impulse wave when water hammer occurs is calculated using Joukowsky's formula as shown below.

$$Pr = \rho\alpha\nu \text{ (pa)}$$
$$= \rho\alpha\nu / 98000 \text{ (kgf/ Cm}^2\text{)}$$

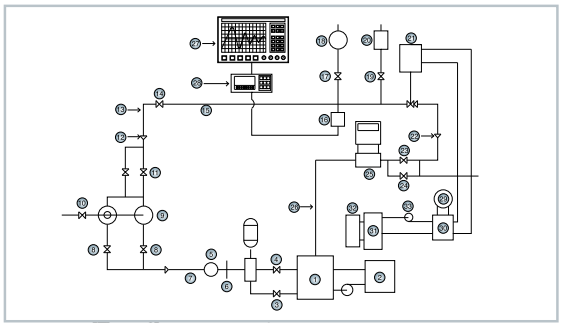
Where :
Pr : pressure rise
ρ : fluid density(kg/m^3)
α : propagation speed of the impulse wave(m/s: for water 1200~1500)

4. Effects of the impulse wave

- ▶ Pipe rupture
- ▶ Leakage at connections
- ▶ Loosening of connections
- ▶ Vibration and noises of/from pipe
- ▶ Damage to valves
- ▶ Damage to check valves
- ▶ Damage to flow meters
- ▶ Damage to pressure controllers and gauges
- ▶ Damage to recorders
- ▶ Loosening of pipe hangers and supports
- ▶ Damage to tanks and water heaters
- ▶ Damage to other facilities and devices

5. Water Hammer Arrestor

[Figure 3] shows an example of the test equipment for testing the impact absorbing capability proposed in KS B 2375 (Korean Standard)
[Figure 4] shows the test equipment for testing the impact absorbing capability owned by the company.



[Figure 3] Equipment for testing the impact absorbing capability, proposed in KS B 2375 (Korean Standard)

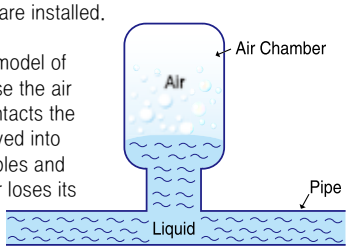
Number	Devices	Number	Devices	Number	Devices
1	Water tank	12	Return bend(250A)	23	Metering bend (50A)
2	Heater	13	Valve	24	Metering bend (15A)
3	Gate valve (50A)	14	Gate valve (50A)	25	Flow meter
4	Gate valve (40A)	15	Steel pipe	26	Steel pipe
5	Centrifugal pump	16	Pressure con–verter	27	Oscilloscope
6	T for water return, elbow	17	Ball valve	28	Digital pressure recorder
7	Steel pipe	18	Pressure gauge	29	Pressurizing pump
8	Gate valve (50A)	19	Ball valve	30	Water pressure solenoid valve
9	Air Pr. type water tank (113.5L)	20	Absorber for testing	31	Oil tank
10	Globe valve (15A)	21	Hydro surge valve (50A)	32	Oil cooler
11	Gate valve (80A)	22	Return bend (250A)	33	Counter

[Figure 4] Equipment for testing impact absorbing capability

6. Water Hammer Arrester

The means for preventing water hammer is to insert a gas (mainly air) filled space in the plumbing system in which valves that may be quickly opened/closed are installed.

[Figure 5] shows an early model of the air chamber. In this case the air in the chamber directly contacts the liquid and it may be dissolved into the liquid or becomes bubbles and in such cases the chamber loses its function.



[Figure 5] Air Chamber for Arresting Water Hammer

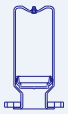
Recently the water hammer arresters being used have an air bladder, piston, etc., in the air chamber to prevent air from being lost.

7. Theory and features of the water hammer arrestor

While the compressibility of liquid is low, that of gas is high. The water hammer arrester uses the compressibility of gas. Gases having high stability such as air, nitrogen, etc., put into the flow of fluid, being isolated, can contract when there is a sudden pressure rise in the fluid, thus absorbing the shock from a certain disturbance such as the one caused by the sudden opening/closing action of a valve. The water hammer arrester applies this theory to a product.

It maintains the steady flow of the liquid by absorbing the water hammer's impulsive energy. Features of the water hammer arrester are as listed below.

- ▶ Maintains the pulsation when operating pumps.
- ▶ Absorbs noise · vibration caused by water hammer.
- ▶ Prevents impulse pressure in plumbing system of fire fighting facilities.
- ▶ Used to ensure a calm environment near humans.
- ▶ When the circulation pumps are started/stopped by automatic control, impulsive change in energy might occur due to the opening/closing action of check valves and thus noise · vibration might be generated. Water hammer arresters absorb and reduce such noise · vibration.

Items	Built in rubber film type	Built in bellows type	Built in piston type
Type			
Use	- For preventing water hammer and fluctuation in plumbing system - For protecting the flush valve in sanitary facilities	- For preventing shock in an oil pipeline	- For pressure control of hydraulic equipment - For sanitary plumbing

The products with structures shown in the table above absorb the impulse pressure according to the Boyle's law [P1 V1 = P2 V2 = Constant], where

– P1, P2 : the pressure of the water hammer arrester at the start and end of the time period under discussion regarding water hammer

– V1, V2 : the volume of the room in which air or nitrogen is filled (m^3)

8. Calculation of the capacity of the water hammer arrester

The capacity of the water hammer arrester can be expressed in terms of the inner volume. The required capacity can be calculated using the Greer Mercer's experimental formula shown below.

$$V = \frac{4.0 \times 10^{-3} \times Q P_1 (0.016L - tc)}{P_1 - P_2} \quad [Liter]$$

Where Q : flow before valve closing

P_1: allowable impulse pressure (kg/cm2), 1.5 times P2 in most cases, but twice P2 when ≥ 250A

P_2 : pressure before valve closing (kg/cm2)

tc : roundtrip time of the impulse wave after valve closing (0.3~0.5sec) = 2L/C

L : total length of the pipeline (m)

Theory for prevention of shock

Information for selecting water hammer arrester

1. Fixture Units of principal facilities

Facilities	Means for control	Common use			Personal use		
		Total	Water supply	Hot water supply	Total	Water supply	Hot water supply
Toilet stool	Flush valve	10	10		6		
	Flush tank	5	5		3		
Urinal	Large stall	10	10				
	Midsize stall, wall mounted	5	5				
	Small stall, wall mounted	3	3				
Washbasin	Faucet	2	1 1/2 (2)	1 1/2	1	1	1
Shower head	Compound faucet	4	2(4)	3	2	1	2
Bathroom	Flush valve				8	8	3
	Flush tank				6	6	3
Shower booth	Faucet				2	1	2
Service sink	Faucet	3	3				
Laundry sink	Faucet				3	3	3
Mixed furniture	Faucet				3	3	3

※ What is Fixture Unit, FU?
Fixture Unit, FU is a unit to express the water flow load imposed by a fixture in a sanitary plumbing, put into use as a result of many research studies and experiments performed by PDI. It is the number obtained by dividing the water flow load of the fixture under discussion by that of a washbasin, the reference water flow load. It is used in determining the diameter of the water supply pipe in the sanitary plumbing system.

2. Selecting the water hammer arrester based on the pressure in the plumbing system

The ideal pressure value in the sanitary plumbing connected to a fixture is ≤ 4.0kgf/㎠. When the pressure is too high, pressure reducing valves should be installed for protecting fixtures. The criteria for selecting the water hammer arrester based on the pressure in the plumbing system is as shown in the table below.

When the water pressure is ≤ 4.5kgf/㎠	When the water pressure is 〉4.5kgf/㎠
Select based on the FU standards	Select the one that is one step higher than what is selected based on the FU standards

3. Selecting the water hammer arrester based on the length of the plumbing system

The water hammer arrester to be used for the case the installation point of the fixture is far in the plumbing system is selected referencing the tables below, depending on the pressure

(A) When the water pressure is ≤ 4.5kgf/㎠

Length of the plumbing \ Diameter of the pipe(B)	1/2″	3/4″	1″	1 1/4″	1 1/2″	2″
25ft(8m)	A	A	B	C	D	E
50 (15)	A	B	C	D	E	F
75 (20)	B	C	D	A, E	F	E, F
100 (30)	C	D	E	F	C, F	F, F
125 (40)	C	D	F	A, F	E, F	E, F, F
150 (50)	D	E	F	D, F	F, F	F, F, F

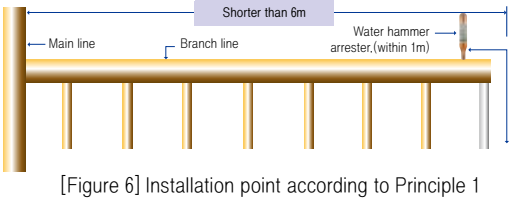
(B) When the water pressure is 〉4.5kgf/㎠ and ≤ 6.0kgf/㎠

Length of the plumbing \ Diameter of the pipe(B)	1/2″	3/4″	1″	1 1/4″	1 1/2″	2″
25ft(8m)	B	B	C	C	E	F
50 (15)	B	C	D	E	F	C, F
75 (20)	C	D	E	F	C, F	F, F
100 (30)	D	E	F	C, F	F, F	E, F, F
125 (40)	D	E	C, F	D, F	F, F	B, F, F, F
150 (50)	E	F	C, F	F,F	D, F, F	F, F, F, F

Note that the arrester of one step higher grade is selected when applying the table of case (B) due to the higher pressure, comparing with the case (A), for the same conditions for the length and diameter of pipe.

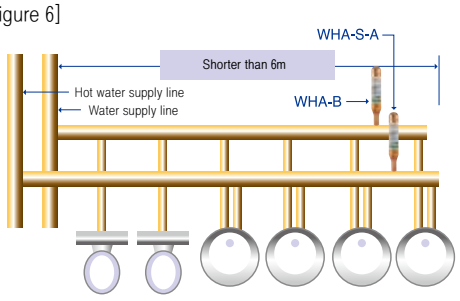
4. Installation

▶ Principle 1. When the length of the branch line is shorter than 6m, the water hammer arrester is installed between the last two points on the branch line where the fixtures are connected. Refer to [Figure 6], Installation point according to Principle 1.



[Figure 6] Installation point according to Principle 1

Example Selecting the model of the water hammer arrester for the water supply · hot water supply plumbing system shown in [Figure 6]



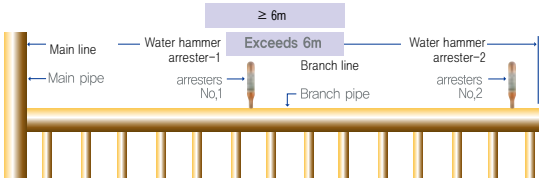
[Figure 7] Example of installation according to Principle 1

Fixture	Water supply	Hot water supply
Toilet stool (F. V) Washbasin Total	10×2=20 1.5×4=6 26	– 1.5×4=6 6
Selection	WHA–B × 1EA (FU : 12~32)	WHA–S–A × 1EA (FU : 4~11)

(Solution) FU and the result of model selection

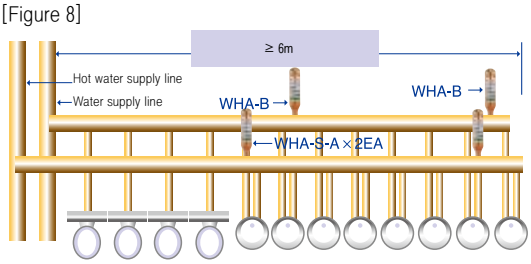
▶ Principle 2. When the length of the branch line is ≥ 6m, the branch line under discussion is divided into two parts and for each part the water hammer arrester is installed in the same manner as in the case of Principle 1, respectively, so eventually two water hammer arresters will be installed. Refer to [Figure 8] Example of installation according to Principle 2

Divide the entire number of FU covering overall section into a half, and install 2 water hammer arresters.



[Figure 8] Example of installation according to Principle 2

Example] Selecting the model of the water hammer arrester for the water supply · hot water supply plumbing system shown in [Figure 8]

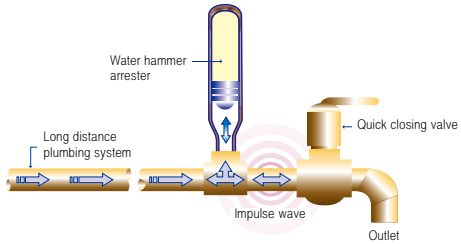


[Figure 9] Example of installation according to Principle 2

Fixture	Water supply	Hot water supply
Toilet stool (F. V) Washbasin Total	10×4=40 1.5×8=12 52	– 1.5×8=12 12
Selection	WHA–B × 2EA (FU : 12~32)	WHA–S–A × 2EA (FU : 1~11)

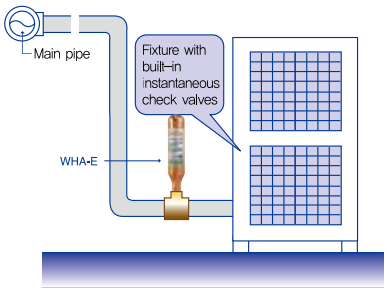
(Solution) FU and the result of model selection

▶ Principle 3. When the distance to the fixture is very long in a plumbing system, the water hammer arrester is installed as close to the point of quick open/close as possible.



[Figure 10] Installation point according to Principle 3

Example] Selecting the model of the water hammer arrester for the plumbing system (control valve, vacuum breaker, and other devices installed in the plumbing systems have been omitted) shown in [Figure 10]



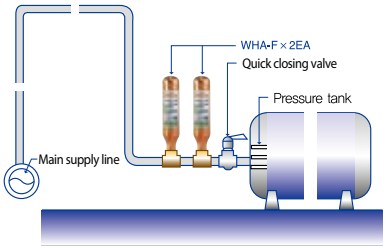
[Figure 11] The equipment with embedded quick closing valve

Items		For water supply
Conditions	Diameter (B) Length of plumbing (m) Water pressure (kgf/㎠) Velocity (m/s)	1" 28 3.74 2.44
Selection Refer to 〈Criteria (A) for selection of the water hammer arrester model〉		WHA–E × 1EA (FU : 114~154)

(Solution) FU and the result of model selection

Example] Selecting the model of the water hammer arrester when there is a single fixture or pressure tank connected to the plumbing system (having quick closing device) shown in [Figure 12]

[Figure 12]



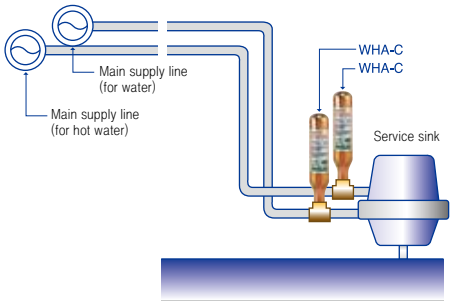
[Figure 12] The pressure tank with quick closing valve

Items		For water supply
Conditions	Diameter (B) Length of plumbing (m) Water pressure (kgf/㎠) Velocity (m/s)	2" 30 4.08 3.05
Selection Refer to 〈Criteria (A) for selection of the water hammer arrester model〉		WHA–E × 2EA (FU : 155~330)

(Solution) FU and the result of model selection

Theory for prevention of shock

Example] Selecting the model of the water hammer arrester for a single fixture (service sink) installed in the water · hot water supply system shown in [Figure 13]

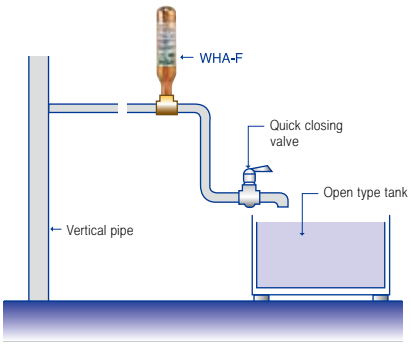


[Figure 13] Single fixture (service sink)

Items		For water supply
Conditions	Diameter (B) Length of plumbing (m) Water pressure (kgf/㎠) Velocity (m/s)	3/4" 20 3.4 1.8
Selection Refer to 〈Criteria (A) for selection of the water hammer arrester model〉		WHA–C × 1EA (FU : 33~60)

(Solution) Result of model selection depending on the length of the pipeline

Example] Selecting the model of the water hammer arrester when there is a single fixture or open type tank connected to the plumbing system (having quick closing device) shown in [Figure 14]

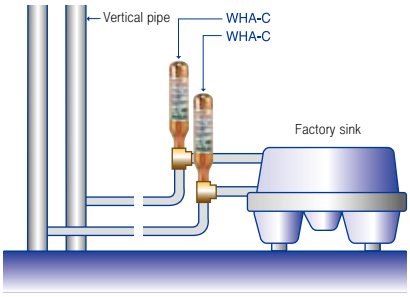


[Figure 14] Single fixture (open type tank)

Items		For water supply
Conditions	Diameter (B) Length of plumbing (m) Water pressure (kgf/㎠) Velocity (m/s)	1 1/4" 30 3.6 2.44
Selection Refer to 〈Criteria (A) for selection of the water hammer arrester model〉		WHA–F × 1EA (FU : 155~330)

(Solution) Result of model selection depending on the length of the pipeline

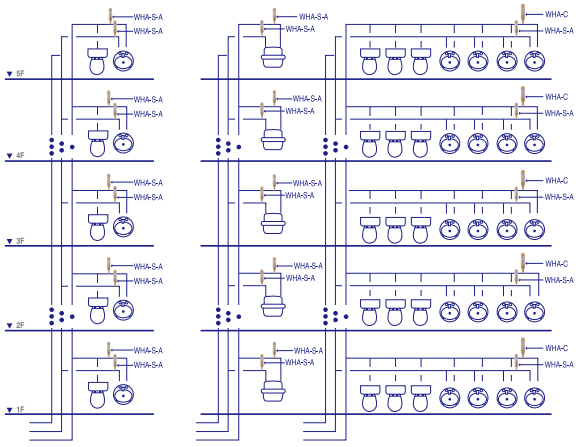
Example] Selecting the model of the water hammer arrester for a single fixture or device installed in the water · hot water supply system shown in [Figure 15]



[Figure 15] Factory sink with quick closing valve connected to a plumbing system

Items		For water supply
Conditions	Diameter (B) Length of plumbing (m) Water pressure (kgf/㎠) Velocity (m/s)	1" 15 3.1 2.44
Selection Refer to 〈Criteria (A) for selection of the water hammer arrester model〉		WHA–C × 1EA (FU : 33~60)

(Solution) FU and the result of model selection

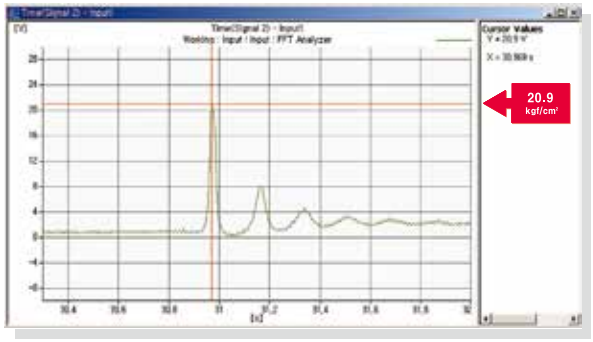


(A) Personal use (B) Common use

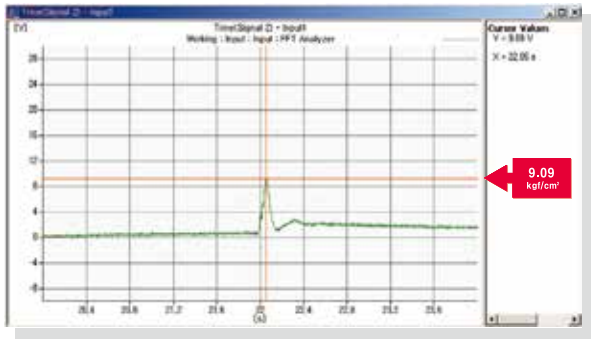
[Figure 16] Diagram of the sanitary plumbing system for which water hammer arresters have been selected

5. Measured data for maximum impact pressure

▶ Test results for the WHA-S-AA water hammer arrester used in copper sanitary plumbing system (operating pressure: 4.0kgf/cm^2)

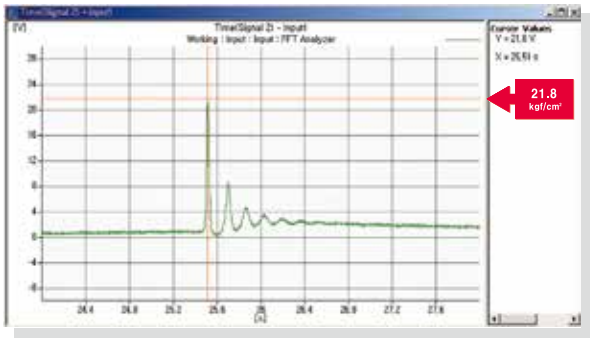


Before the installation of the water hammer arrester [20.9 kgf/cm^2]

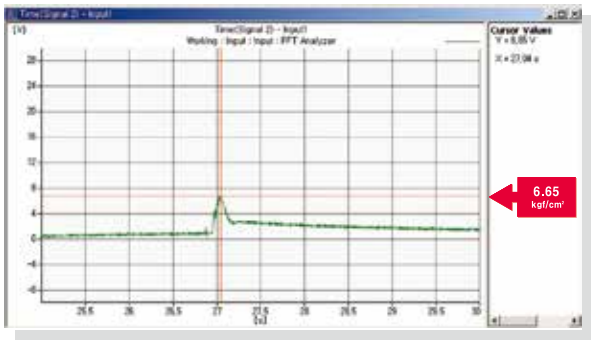


After the installation of the water hammer arrester [9.9 kgf/cm^2]
When repeating 100,000 times

▶ Test results for the WHA-S-A water hammer arrester used in copper sanitary plumbing system

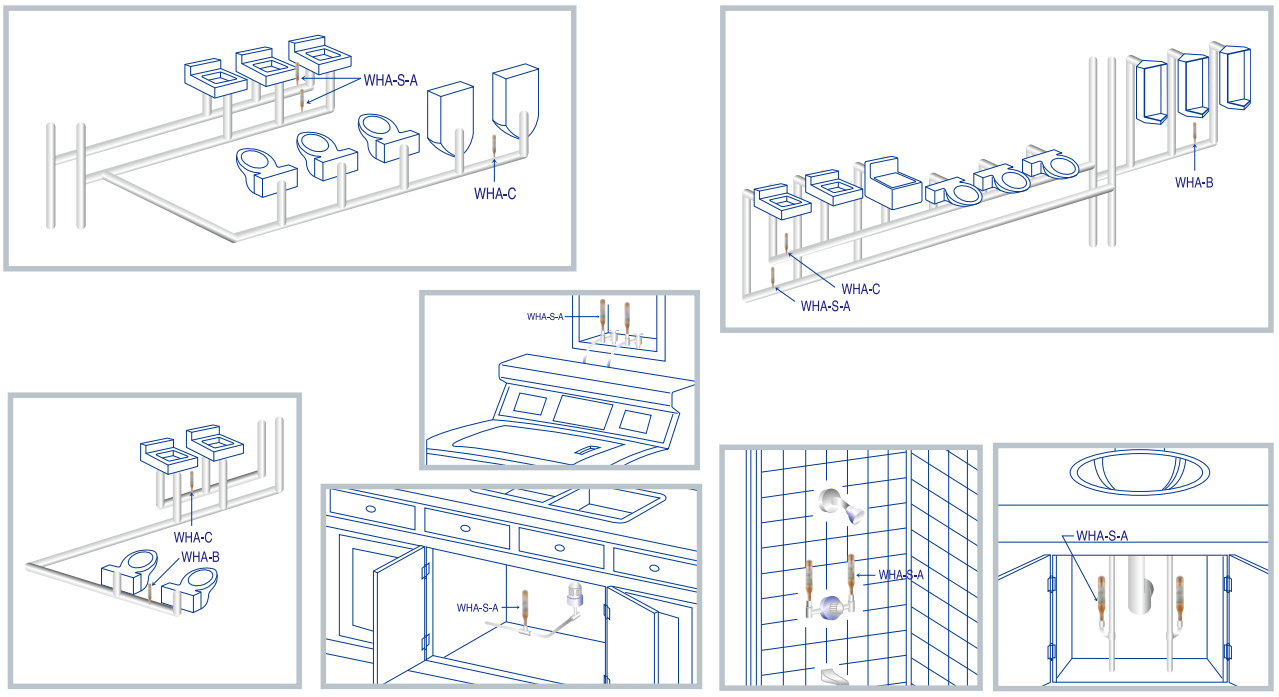


Before installation of the water hammer arrester [21.8 kgf/cm^2]



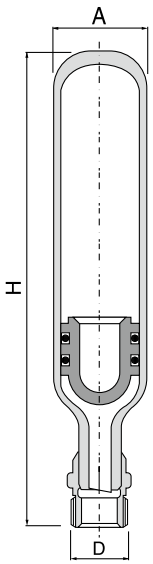
After the installation of the water hammer arrester [6.65 kgf/cm^2]
When repeating 100,000 times

6. Figures illustrating the installation of the water hammer arrester



WHA Water Hammer Arrester (CM Adapter)

CM Adapter Type



■ Features

This product is made up of materials that are harmless to humans, including pistons, an O-ring and cooper pipe. Because the air layer is completely separated from the water with the presence of O-ring, it guarantees a semi-permanent life span.

- Working pressure(PV) : 10Kgf/cm^2
- Maximum impulsive pressure(P) : 38Kgf/cm^2
- Maximum working temperature : 120℃

■ Specification

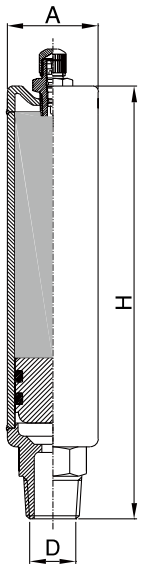
No.	Name of Components	Material	Remark
1	Body	Copper	(KS D 5310,L-type), Molding
2	Pistion	P.P	Pressure-lubricated Dow-Coming 111 silicon compound, FDA approved (Uses the FDA-approved lubricant)
3	O-ring	EPDM	
4	CM Adapter	Brass	KS B 1544
5	Air Chamber	-	4.0kgf/cm^2 Air Charge
6	Soldering	Sn & Ag	Tin 96% & Silver 4%, is Harmless to humans (Uses items that are certified by the national institute)

■ Dimension & Selection Guide

Type	Dimension (mm)			Weight (kg)	Air Volume (cc)	Fixture Capacity Unit
	A	ØD	H			
WHA-S-AA(CM)	20A(22.22)	15A	150	0.2	31	~3
WHA-S-A(CM)	25A(28.58)	15A	210	0.2	80	4~11
WHA-S-B(CM)	32A(34.92)	20A	210	0.3	110	12~32
WHA-S-C(CM)	50A(53.98)	25A	226	0.4	180	33~60
WHA-S-D(CM)	50A(53.98)	25A	265	0.7	320	61~113
WHA-S-E(CM)	50A(53.98)	25A	338	0.8	470	114~154
WHA-S-F(CM)	50A(53.98)	25A	400	0.9	590	155~330

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

WHA-3000 STS Sanitary Water Hammer Arrester (CM Adapter)



■ Features

It is made up of special materials like Piston and O-ring with stainless steel tube having excellent corrosion resistance and because air layer is completely separated from water thanks to O-ring, it guarantees semi-permanent life span. It is made in compliance with PDI (Plumbing and Drainage Institute Standard), that is FU (Fixture Unit) definition and each model is proved to have volume appropriateness and reliability through 200,000 cycle tests.

- Working pressure(PV) : 10kgf/cm^2
- Maximum impulsive pressure(P) : 32Kgf/cm^2
- Maximum working temperature :120℃

■ Specification

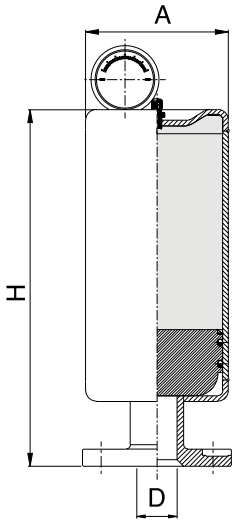
No.	Name of Components	Material	Remark
1	Body	STS	(Type 304SS), Molding
2	Piston	P.P	Pressure-lubricated Dow-Corning 111silicon compound, FDA approved (Used the FDA-approved lubricant)
3	O-ring	EPDM	
4	Adapter	STS	CM Type
5	Air Chamber	-	4.0kgf/cm² Air Charge
6	Air Valve	Brass	CR Plated

■ Dimension & Selection Guide

Type	Dimension(mm)			Air Volume (cc)	Fixture Capacity Unit
	A	ØD	H		
WHA-3015A	34	15A	163	70	1~11
WHA-3020B	38	20A	180	110	12~32
WHA-3025C	38	25A	226	150	33~60
WHA-3025D	60	25A	224	320	61~113
WHA-3025E	60	25A	252	390	114~154
WHA-3025F	60	25A	294	470	155~330

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

WHA-4000 Water Hammer Arrester (Flange Type)



■ Features

It is a semi-permanent water hammer arrestor made up of a stainless steel tube having excellent corrosion resistance with a built-in piston moving up and down to prevent the loss of air. Because it is an all-in-one type, it does not cause the leakage of water. Plus, it has a wide range of applications, including the pipe for drinking water. It is for pressures higher than 10kgf/㎠ with the pressure gauge on top to check the pressure applied. In general, it is installed on top of the special-purposed pump. Its volume appropriateness and reliability have been proved through 200,000 cycle tests.
The above special order-made model is a hybrid water hammer arrestor, which can be installed in the same direction in which fluid moves through a vertical/horizontal pipe.

- Working pressure : 10kgf/20kgf cm^2
- Maximum impulsive pressure : 32Kgf/cm^2
- Maximum working temperature : 90℃

■ Specification

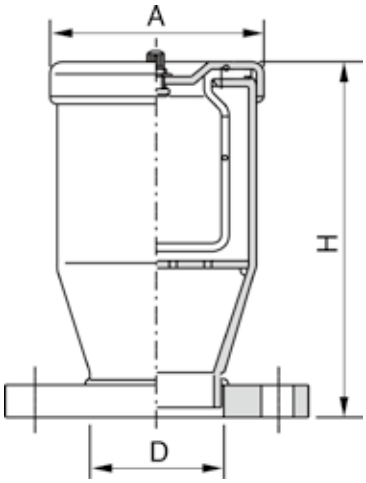
No.	Name of Components	Material	Remark
1	Body	STS	(Type 304SS), Molding
2	Piston	P.P, ABS	Pressure-lubricated Dow-Coming 111 Silicon Compound, FDA approved (Used the FDA-approved lubricant)
3	O-ring	EPDM	
4	Flange	STS	-
5	Air Chamber	-	7.5kgf/cm^2
6	Air Valve	Brass	Cr Plated
7	Pressure Guage	-	20, 30, 40kgf/cm^2
8	Filter Cap	ABS + Wire Netting	

■ Dimension & Selection Guide

Type	Dimension(㎜)			Air Volume(ℓ)	Flange Connection Diameter
	A	ØD	H		
WHA-4040	139.8	49.1	320	1.6	40A
WHA-4050	139.8	61.1	320	1.7	50A
WHA-4065	139.8	77.1	340	2.1	65A
WHA-4080	165.2	90.0	360	3.3	80A
WHA-4100	165.2	115.4	360	3.7	100A
WHA-4125	165.2	115.4	390	4.2	125A
WHA-4150	165.2	115.4	390	4.2	150A
WHA-4200	216.3	158.0	440	9.7	200A
WHA-4250	216.3	158.0	460	10.4	250A

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

WHA-6000 Water Hammer Arrester (Flange Type)



■ Features

It is a semi-permanent water hammer arrestor made up of steel with an EPDM air bag inside to prevent the leakage of air. Plus, it absorbs sudden pressure when the shut-off valve is closed. It is usually installed on top of the pump and/or the end of the fire pipe in parking space. Its volume appropriateness and reliability have been proved through 200,000 cycle tests.

- Working pressure : 10kgf/20kgf cm^2
- Maximum impulsive pressure(P) : 32kgf/cm^2
- Maximum working temperature : 90℃

■ Specification

No.	Name of Components	Material	Remark
1	Flange	SS400	-
2	Middle Plate	SS400	-
3	Body	SPP	-
4	Air Bag	EPDM65	-
5	Cap	SS400	-
6	Air Inlet	BS CR Plated	KS B 1503

■ Dimension & Selection Guide

Type	Dimension(mm)			Air Volume (ℓ)	Flange Connection Diameter
	A	ØD	H		
WHA-6040	124	61.1	202	0.4	40A
WHA-6050	124	61.1	202	0.4	50A
WHA-6065	124	77.1	202	0.4	65A
WHA-6080	150	90.0	232	0.8	80A
WHA-6100	150	115.0	232	0.8	100A
WHA-6125	176	141.0	265	1.4	125A
WHA-6150	176	141.0	265	1.4	150A
WHA-6200	226	166.6	315	3.6	200A
WHA-6250	226	166.6	340	3.6	250A

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

WHA Water Hammer Arrester

■ Installation guides for water hammer arrestor – CM Adapter Type

WHA–1000 series

1. Wipe the inner side of the inlet of the water hammer arrestor to remove foreign material.
2. Prepare the adaptor for the water hammer arrestor and a TEE that meet the corresponding specifications.
3. Fix the TEE and join the adaptor for the water hammer arrestor and the TEE with proper torque.
4. Join the water hammer arrestor to which the TEE is joined and piping.
5. Check for any defects in the joined portions, then operate the device to check for any abnormalities.

WHA–3000 series

1. Be careful not to exceed the maximum torque when joining the adapter to TEE.
2. Be careful not to disassemble the water hammer arrestor arbitrarily or to apply external shock, because compressed air is filled inside the water hammer arrestor.
3. Do NOT arbitrarily open the air inlet valve on top of the water hammer arrestor and vent the air inside.
4. If the water hammer arrestor is installed outdoors, take measures to prevent freezing.
5. For water piping only. Not for piping for high temperature steam, gas, or chemicals.

■ Installation guides for water hammer arrestor – Flange Type

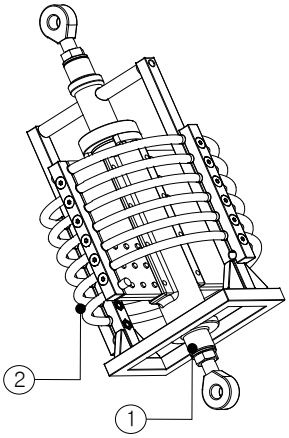
WHA–4000 series

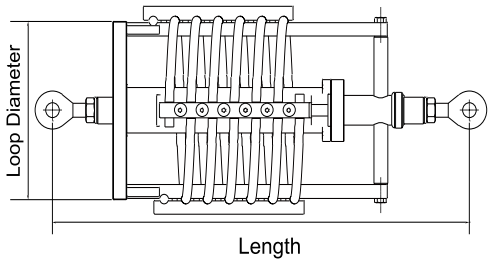
1. Make sure that the surface on which the flange of the water hammer arrestor is assembled is free of foreign materias like rust, oil, dust, paint, etc.
2. Prepare gaskets, bolts, and nuts meeting the standards and specifications of the flange.
3. Check for the balance of the flange, centering, alignment of plumbing, etc.
4. Tighten the flange of the water hammer arrestor and the gasket pipe connection with bolts and nuts, two or three times diagonally in order to balance.
5. Check for any defects in the joined portions, then operate the device to check for any abnormalities.

WHA–6000 series

1. Be careful not to exceed the maximum torque when tightening the flange with bolts.
   (Excessive torque may damage the surface of the flange and affect the seal.)
2. Be careful not to disassemble the water hammer arrestor arbitrarily or to apply external shock, because compressed air is filled inside the water hammer arrestor.
3. Do NOT arbitrarily open the air inlet valve on top of the water hammer arrestor and vent the air inside.
4. If the water hammer arrestor is installed outdoors, take measures to prevent freezing.
5. For water piping only. Not for piping for high temperature steam, gas, or chemicals.

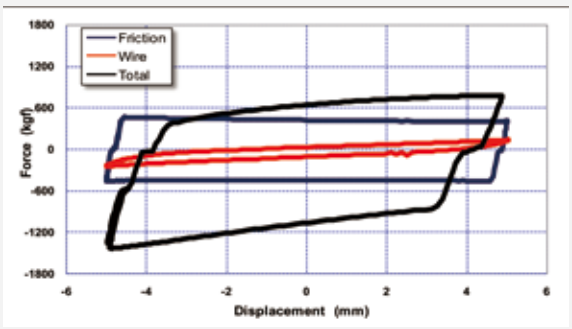
VD10 Friction & Wire Damper





■ Features

VD10, a parallel combination of a friction damper and a wire damper (using elasticity and damping characteristic of wire rope), is an effective damping device with high elasticity and damping characteristic to seek stability and vibration isolation simultaneously. You can save money because there is no risk of oil leakage, no limit to service life, and no maintenance, unlike existing hydraulic or mechanical dampers.



■ Specification

No.	Name of Components	Material
1	Friction Damper	STS304
2	Wire Damper	STS304

■ Specification

VD10 aims to isolate vibration. A fluid flow inside the pipe produced a vibration frequency, which comes close to the natural frequency of the pipe itself and then resonance occurs. Absorbing the energy from the resonance, this product stabilizes dynamic behavior of the piping system and prevents the vibration from being transmitted to the support structure.

■ Dimension & Selection Guide

Model	Rated Load (kgf)	Stroke (mm)	Dimension (mm)			
			Loop Dia.	Length	Wire	Loop
VD10-500	200-500	±25	150	430	Φ8	6
VD10-1000	500-1000	±40	300	770	Φ16	

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

Vibration Control NSV

ISO 9001/ISO 14001
OHSAS 18001
MADE IN KOREA

VIBRATION CONTROL

Information for prevention of vibration

Overview of vibration

1. The definition of vibration

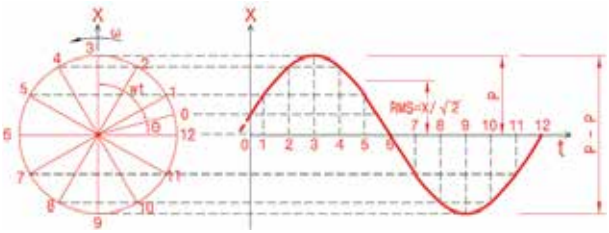
Vibration is the phenomenon that the position of a certain point varies in one direction and then in the opposite direction repeatedly, from the reference position. It is defined in the Noise and Vibration Control Act as "oscillation generated due to the use of machines, devices, systems, or other materials."

2. Effects of vibration

Vibration has effects of decreasing the life span and efficiency of machines, and causes something like psychological unease as well as biological disorder to human beings. It is considered a public nuisance when the frequency of vibration is in the range of 1 ~ 90Hz. In terms of the level of vibration, the range is 60 ~ 90dB.

Basics of vibration

The simplest form of vibration is the simple harmonic motion, and in this case the movement of the point under discussion is analyzed as being of sine function.



The simple harmonic motion is composed of amplitude (Peak, Peak-to-Peak, Root Mean Square, RMS), period (Angular Velocity, Frequency, Period), etc.

① Peak (P): The distance between the reference point and the summit.

② Peak-to-Peak (P-P): The distance between the minimum point and the maximum point.

③ Root Mean Square (RMS): Root of the Mean of the Squares during one cycle.

④ Angular Velocity (ω): The angular velocity of a rotating point, given in rad/sec.

⑤ Frequency (f): The number of repetitions for a given time period, given in Hz.

⑥ Period (T): The time taken for one cycle of the repetitive movement, given in sec.

Terms, units, and expressions of vibration

The simplest form of vibration, simple harmonic motion, can be expressed in terms of displacement, velocity, acceleration, etc.

1. Displacement (x)

Vibration expressed as a function of displacement and time.
where X: radius of rotation
(Units: cm, mm, m)

Overview of vibration

2. Velocity (v)

Variation of the displacement during a given time period.

$$V = \frac{dx}{dt} = \omega \times \cdot \cos(wt + \phi)$$

(Units: m/s, cm/s, kine, mm/s)

3. Acceleration (a)

Variation of the velocity during a given time period.

$$V = \frac{d^2x}{dt^2} = \omega^2 \times \cdot \sin(\omega t + \phi)$$

(Units: m/s^2, cm/s^2, gal)

4. Vibration Acceleration Level (VAL)

The physical quantity of the vibration expressed in terms of the degree of the stimulus humans can feel.

$$VAL = 20\log\left(\frac{a}{a_r}\right)dB$$

where
a: Acceleration of the vibration in RMS (m/s^2)
ar : Reference acceleration ($10^{-5} m/s^2$)

5. Vibration Level

VAL in frequency range of 1 ~ 9Hz, compensated for the human sensitivity characteristics regarding vibration, given in dB.

$$VL = VAL + W_n\,dB(V),\ dB(H)$$

W_n: Compensation factor for the human sensitivity to frequency.

6. Unit conversion

Items	Results	Units
dB → Acceleration(a)	$a=10^{(dB/20)}\times10^{-5}$	m/s^2
Acceleration(a) → Velocity(v)	$a/2\pi f$	m/s
Acceleration(a) → Displacement(μ)	$a/(2\pi f)^2$	m

Effects of vibration

1. Effects on human senses

Humans feel pain most on the waist, chest, back at 6Hz. And at 13Hz, sense the vibration most on the head, and on the cheeks and eyelids, to the degree it is felt.

2. Biological effects

In case of vibration, the number of heart beats increases. The Oxygen consumption increases at 1 ~ 3Hz.

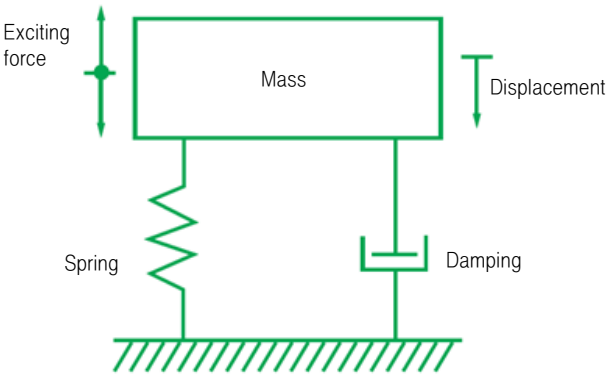
3. Effects on human body

① Vibration on whole body: Vibration suffered by people who drive cars or work at factories.

② Vibration on specific parts of body: Vibration suffered by workers who use rock drills, grinders, etc., extensively. Disorders such as abnormality in peripheral blood vessel functions, etc., might be result from this exposure.

Protection from vibration

Protection from vibration can be accomplished by blocking the exciting force generated when running machines from being transmitted to the floor of the building, through the use of high elasticity materials like rubber pads, springs, etc. for supporting the machines.



1. Exciting force of the device

In case of reciprocating motion and gyration, there vibrations might occur due to an unbalance or swaying of the device, and the force making the vibration is called the exciting force. The exciting force of the rotating machine is expressed as follows:

where
$F = mr\omega^2$
F: Exciting force, r: Eccentric distance, m: Eccentric mass ω: Angular velocity

2. Exciting frequency

The exciting frequencies generated by each type of device are as listed below.

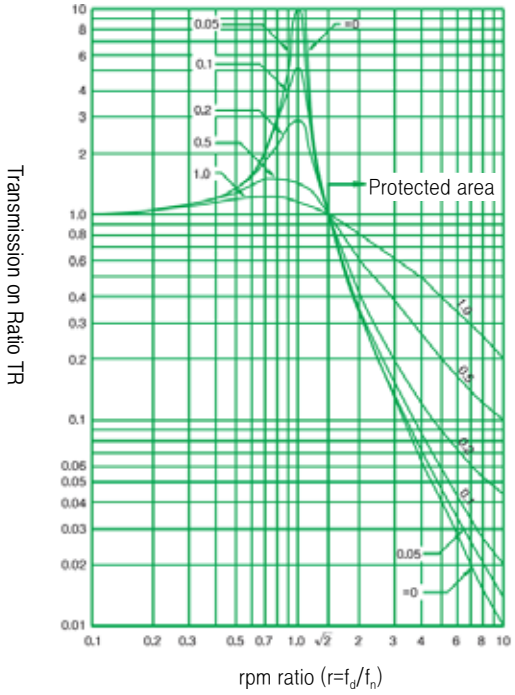
Type of device	Exciting frequency
Turbo–refrigerator	Compressor rpm
Reciprocating compressor	Compressor rpm
Pump	Pump rpm
Fan	Fan rpm
Air conditioner	Fan rpm
Cooling tower	Number of impellers x rpm
Packaged air conditioner	Fan rpm

3. Transmission Ratio

The exciting force generated when running the machine is transmitted to the floor of the building through springs and dampers, and the ratio of the exciting force transmitted to the floor to the total exciting force generated by the machine is the Transmission on Ratio.

$$TR = \frac{\sqrt{1+(2\zeta r)^2}}{(1-r^2)^2+(2\zeta r)^2} = \frac{1}{|1-r^2|} (\because \zeta = 0)$$

Where
r : rpm ratio ($=f_d/f_n$) f: rotational acceleration (exciting frequency)
f_n : natural frequency($=\frac{1}{2\pi}\sqrt{\frac{k}{m}}$) k: spring constant
M : mass ζ: damping ratio



① Relationship between rpm ratio and Transmission on Ratio
If r = 1, TR=∞ (Resonance)
If r 〈 √2, TR〉1, (Transmitted force〉External force)
If r = √2, TR=1, (Transmitted force=External force)
If r 〉 √2, TR〈1, (Transmitted force〈External force) – Protected area

② Change in Transmission on Ratio due to the change in Damping Ratio (ζ)
As far as r 〈 √2, the bigger the Damping Ratio the smaller the Transmission on Ratio, thus a bigger Damping Ratio is desirable.
As far as r 〉 √2, the smaller the Damping Ratio the smaller the Transmission on Ratio, thus a smaller Damping Ratio is desirable.

③ Things to be taken care of when designing for protection from vibration.
– As far as possible, making the rpm ratio (r) greater than or equal to 3 is required.
– In the case of r〈√2, making r〈0.4 is required.
– In case the exciting frequency of the device starts from 0, the resonant point is in the way of increasing the frequency, thus adding the damper with ζ=0.2 is required.

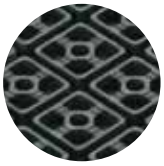
4. Protection effect

① Vibration blocking rate (I): The degree the vibration is blocked
I = (1–TR) X 100 [%]

② ΔV: Expresses the vibration protecting effect in dB.
ΔV = 20Log(1/TR) dB

Information for prevention of vibration

The types and features of the materials used for preventing vibration

Items	For water supply	Features	Precautions	Usage
Metal Spring	① Blocks vibration using the elasticity of the metal spring ② Various types including coil spring, leaf spring, circular spring are used. For air conditioners, coil springs are used most.  	〈Advantages〉 ① Spring constants are selectable. ② Spring with small constant is available. 〈Disadvantages〉 ① It has to pass through the resonance frequency during start/stop (high vibration) ② Surging occurs at high frequency due to natural frequency (structural sound transmission).	① Not able to block sound. ② Spring constant can be made small, but in turn, vibration is high. Distance should be ensured between devices, pipes, ducts, etc.	Vibration protection for general rotating machines such as pumps, motors, fans.
Mat	① Plates with special uneven surface for making elasticity. ② In a broad sense it might be considered as a kind of vibration reducing rubber. 	〈Advantages〉 Cheap and easy to use. 〈Disadvantages〉 Structurally the spring constant can't be made small, thus it is not for low frequency vibration, and the effect is restrictive also.	① In case more than 2 ea. are stacked, steel plates with thickness of 2 ~ 3mm should be inserted in between. ② Chemical characteristics should be taken into account as in the case of vibration reducing rubber.	It's effective when used for high frequency vibration, and generally used for refrigerators, air conditioners, etc.
Vibration Reducing Rubber	① Made of natural or synthetic rubber having proper hardness. Easy to form. Easy to handle with metal plate. Uses the elasticity of rubber. ② Compressed type, shear type, complex type, twisted type, etc., categorized by elasticity of rubber. Circular type, square type, cylinder type, mountain type, etc., by shape. ③ Compressed type has high weight taking capability and thus is most generally used. Shear type is used for low weight and low rpm because small spring constant is achievable. ④ In the case of the complex type, spring constants for 3 directions can be decided properly, and in the twisted type, twisted vibration can be reduced.  Compressed type  Shear type  Complex type-1  Complex type-2	〈Advantages〉 ① Flexible in forming, thus, spring constants can be properly selected for X, Y, and Z directions, respectively. ② Resonance is reduced due to the high viscosity of rubber. ③ No surging, thus sound blocking capability is excellent. ④ Many kinds of standardized products are available. 〈Disadvantages〉 ① The spring constants vary depending on the temperature, thus care should be taken when using outside the temperature range of 10 ~ 70℃. ② Spring constant varies depending on the degree of deformation of rubber. ③ Small spring constants can't be achieved. ④ Oil-proof capability, temperature characteristics, aging characteristics, etc., are dependent on the kinds of rubber. ⑤ Spring constant can't be decided accurately because the static spring and dynamic spring constants are different due to viscoelastic characteristics.	① Chemical characteristic of vibration reducing rubber should be taken care of. ② When designing vibration reducing rubber, dynamic spring constant should be used. ③ Be sure to use the vibration reducing rubber within the allowed weight range because it has creeping characteristics. ④ Allowable weight is limited by the degree of deformation. To avoid instability due to buckling, it is desirable to limit the allowable compressive strain and shearing strain to under 20% and 25%, respectively for static ⑤ weight, and under 5%, 10%, respectively for dynamic weight. For other detailed information, refer to the technical data, catalogs, etc., from manufacturers.	Most generally used for air conditioners, and can be used also for vibration reducing of air conditioning devices, pipes, and ducts.

Selection Guide for Vibration Isolation, ASHRAE HANDBOOK 2015

			Equipment Location (Note 1)												
						Floor Span									
			Slab on Grade			Up to 6 m			6 to 9 m			9 to 12 m			
Equipment Type	Shaft Power kW and Other	RPM	Base Type	Isolator Type	Min. Defl., mm	Base Type	Isolator Type	Min. Defl., mm	Base Type	Isolator Type	Min. Defl., mm	Base Type	Isolator Type	Min. Defl., mm	Reference Notes
Refrigeration Machines and Chillers															
Reciprocating	All	All	A	2	6.4	A	4	19	A	4	38	A	4	64	2,3,12
Centrifugal, scroll	All	All	A	1	6.4	A	4	19	A	4	38	A	4	38	2,3,4,8, 12
Screw	All	All	A	1	25	A	4	38	A	4	64	A	4	64	2,3,4,12
Absorption	All	All	A	1	6.4	A	4	19	A	4	38	A	4	38	
Air-cooled recip., scroll	All	All	A	1	6.4	A	4	38	A	4	38	A	4	64	2,4,5,12
Air-cooled screw	All	All	A	4	25	A	4	38	B	4	64	B	4	64	2,4,5,8,12
Air Compressors and Vacuum Pumps															
Tank-mounted horiz.	≤7.5	All	A	3	19	A	3	19	A	3	38	A	3	38	3,15
	≥11	All	C	3	19	C	3	19	C	3	38	C	3	38	3,15
Tank-mounted vert.	All	All	C	3	19	C	3	19	C	3	38	C	3	38	3,15
Base-mounted	All	All	C	3	19	C	3	19	C	3	38	C	3	38	3,14,15
Large reciprocating	All	All	C	3	19	C	3	19	C	3	38	C	3	38	3,14,15
Pumps															
Close-coupled	≤5.6	All	B	2	6.4	C	3	19	C	3	19	C	3	19	16
	≥7.5	All	C	3	19	C	3	19	C	3	38	C	3	38	16
Large inline	3.7 to 19	All	A	3	19	A	3	38	A	3	38	A	3	38	
	≥22	All	A	3	38	A	3	38	A	3	38	A	3	64	
End suction and split case	≤30	All	C	3	19	C	3	19	C	3	38	C	3	38	16
	37 to 93	All	C	3	19	C	3	19	C	3	38	C	3	64	10,16
	≥110	All	C	3	19	C	3	38	C	3	64	C	3	89	10,16
Packaged pump systems	All	All	A	3	19	A	3	19	A	3	38	C	3	64	
Cooling Towers	All	Up to 300	A	1	6.4	A	4	89	A	4	89	A	4	89	5,8,18
		301 to 500	A	1	6.4	A	4	64	A	4	64	A	4	64	5,18
		501 and up	A	1	6.4	A	4	19	A	4	19	A	4	38	5,18
Boilers															
Fire-tube	All	All	A	1	6.4	B	4	19	B	4	38	B	4	64	4
Water-tube, copper fin	All	All	A	1	3	A	1	3	A	1	3	B	4	6.4	
Axial Fans, Plenum Fans, Cabinet Fans, Fan Sections, Centrifugal Inline Fans															
Up to 560 mm diameter	All	All	A	2	6.4	A	3	19	A	3	19	C	3	19	4,9
610 mm diameter and up	≤500 Pa SP	Up to 300	B	3	64	C	3	89	C	3	89	C	3	89	9,8
		300 to 500	B	3	19	B	3	38	C	3	64	C	3	64	9,8
		501 and up	B	3	19	B	3	38	B	3	38	B	3	38	9,8
	≥501 Pa SP	Up to 300	C	3	64	C	3	89	C	3	89	C	3	89	3,8,9
		300 to 500	C	3	38	C	3	38	C	3	64	C	3	64	3,8,9
		501 and up	C	3	19	C	3	38	C	3	38	C	3	64	3,8,9
Centrifugal Fans															
Up to 560 mm diameter	All	All	B	2	6.4	B	3	19	B	3	19	B	3	38	9,19
610 mm diameter and up	≤30	Up to 300	B	3	64	B	3	89	B	3	89	B	3	89	8,19
		300 to 500	B	3	38	B	3	38	B	3	64	B	3	64	8,19
		501 and up	B	3	19	B	3	19	B	3	19	B	3	38	8,19
	≥37	Up to 300	C	3	64	C	3	89	C	3	89	C	3	89	2,3,8,9,19
		300 to 500	C	3	38	C	3	38	C	3	64	C	3	64	2,3,8,9,19
		501 and up	C	3	25.4	C	3	38	C	3	38	C	3	64	2,3,8,9,19
Propeller Fans															
Wall-mounted	All	All	A	1	6.4	A	1	6.4	A	1	6.4	A	1	6.4	
Roof-mounted	All	All	A	1	6.4	A	1	6.4	B	4	38	D	4	38	
Heat Pumps, Fan-Coils, Computer Room Units	All	All	A	3	19	A	3	19	A	3	19	A/D	3	38	
Condensing Units	All	All	A	1	6.4	A	4	19	A	4	38	A/D	4	38	
Packaged AH, AC, H and V Units															
All	≤7.5	All	A	3	19	A	3	19	A	3	19	A	3	19	19
	≤11	Up to 300	A	3	19	A	3	89	A	3	89	C	3	89	2,4,8,19
	≤1 kPa SP	301 to 500	A	3	19	A	3	64	A	3	64	A	3	64	4,19
		501 and up	A	3	19	A	3	38	A	3	38	A	3	38	4,19
	>1 kPa SP11,	Up to 300	B	3	19	C	3	89	C	3	89	C	3	89	2,3,4,8,9
	>1 kPa SP	301 to 500	B	3	19	C	3	38	C	3	64	C	3	64	2,3,4,9
		501 and up	B	3	19	C	3	38	C	3	38	C	3	64	2,3,4,9

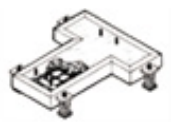
▶BASE TYPE

A. No Base

isolators attached directly to equipment

B. Structural steel rails or base

C. Concrete inertia base



D. Curb-mounted base

▶ISOLATOR TYPE

RUBBER PAD (TYPE 1)

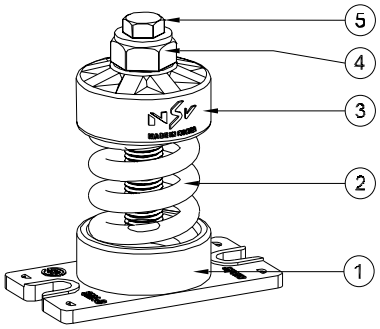
RUBBER MOUNT (TYPE 2)

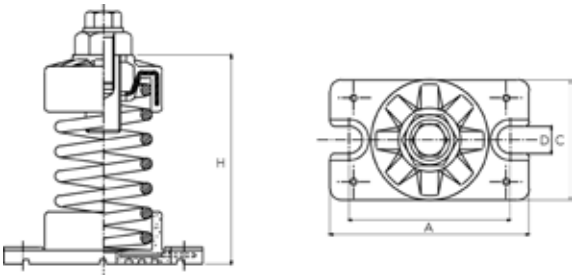
SPRING ISOLATOR (TYPE 3)

RESTRAINED SPRING ISOLATOR (TYPE 4)

THRUST RESTRAINT (TYPE 5)

SMA Spring Mount (Deflection : 25mm)





■ Features

An open-spring mount is, in general, used together with the additional load base. It is easy to install and check; also its static deflection is visible to the naked eye. The spring is in between the upper cap and the bottom cap without any guide, and the bottom cap is mounted with the base palte having a hole for the anchor bolt. Plus, the steel plate is inserted inside the cap and at the top of the mount, there is a level-control bolt made up of the control bolt, cap, screw and washer. There is also a drain hole inside the bottom base, which facilitates drainage.

■ Usage

- For pump vibration isolator stand
- For ventilator
- For air conditioning units
- For equipment having a small horizontal reaction

■ Specification

No.	Name of Components	Material	Standard
1	Lower Spring Cap Base Plate	CR	KS M 6617
		SS400	KS D 3503
2	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
3	Upper Spring Cap	CR	KS M 6617
		SS400	KS D 3503
4	Level Bolt	SS400	KS B 1002
5	Cap Screw	SS400	KS B 1002

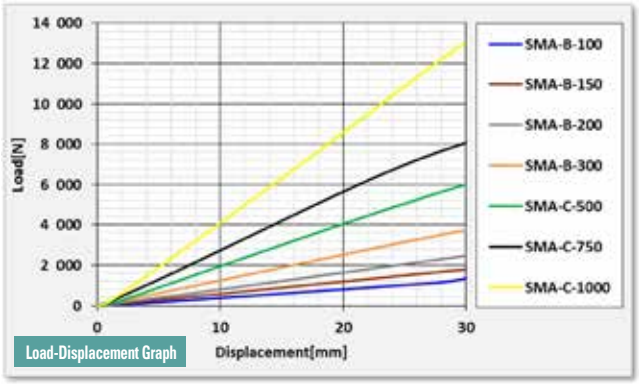
■ Dimension & Selection Guide

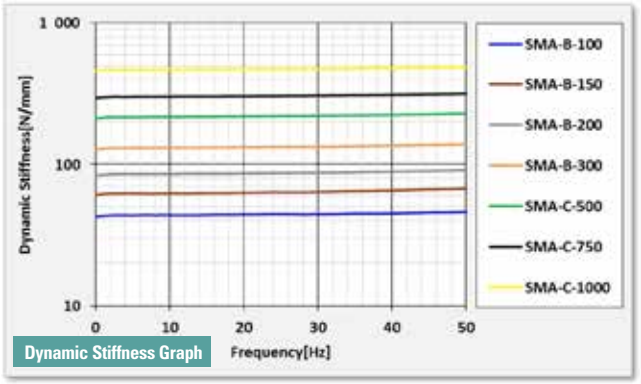
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	H	Level Blot	Cap Screw
SMA-A-50	50	2.0	0.35	Red	90	74	53	12	94	M16 x 45	M10 x 25
SMA-A-75	75	3.0	0.39	Black							
SMA-A-100	100	4.0	0.41	Blue							
SMA-B-100	100	4.0	1.10	Blue	130	100	70	13	128	M20 x 90	M12 x 25
SMA-B-150	150	6.0	1.12	Brown							
SMA-B-200	200	8.0	1.18	White							
SMA-B-300	300	12.0	1.34	Orange							
SMA-B-400	400	16.0	1.34	Pink							
SMA-C-500	500	20.0	2.00	Green	150	120	84	13	144	M20 x 90	M12 x 25
SMA-C-600	600	24.0	2.08	Blue							
SMA-C-750	750	30.0	2.12	Black							
SMA-C-1000	1000	40.0	2.32	Yellow							
SMA-C-1200	1200	48.0	2.20	Red							

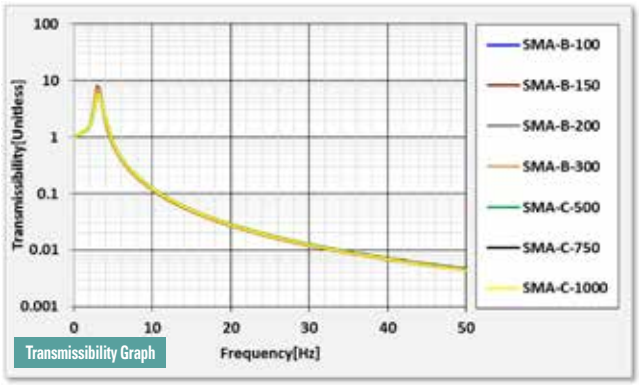
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

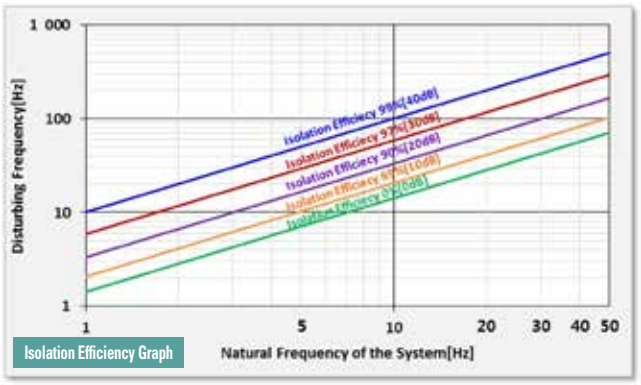
SMA Spring Mount (Deflection : 25mm)

■ SMA Test Data

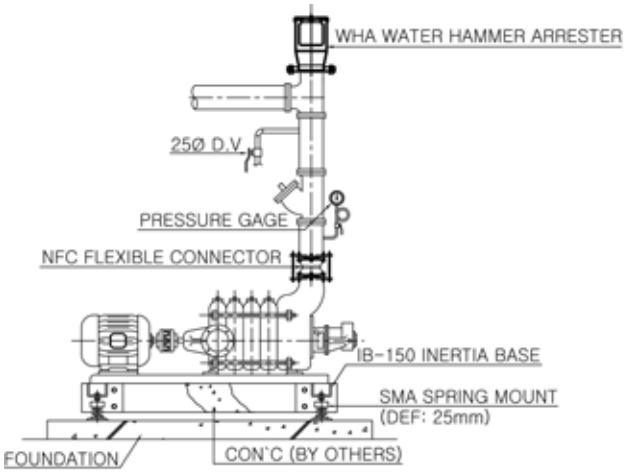




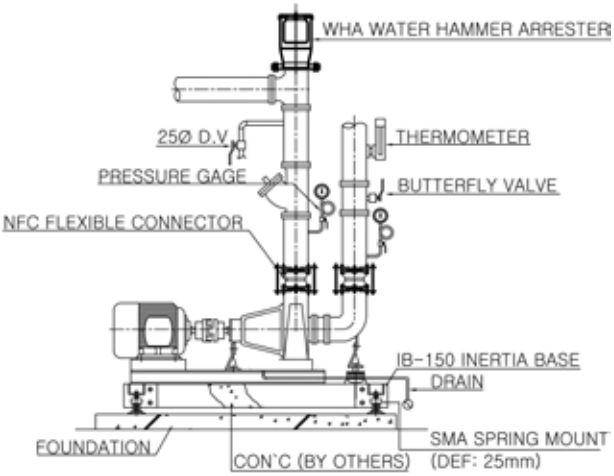




■ Installation Features

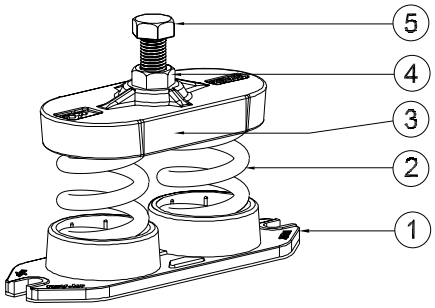


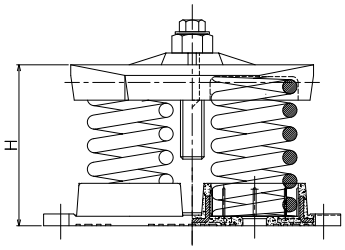
MULTI STAGE PUMP DETAIL

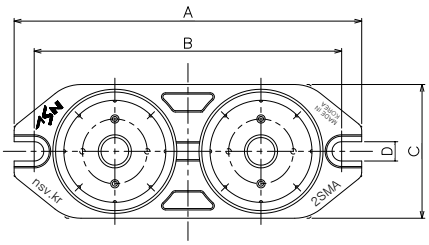


SINGLE STAGE PUMP DETAIL

2SMA Spring Mount (Deflection : 25mm)







■ Features

Open spring mount is, in general, used together with an additional load base. Not only is it easy to install, but it also it a static deflection visible to the naked eye. It is excellent in reducing vibration with left-right and up-down stability. Its upper/bottom housings are made of castings with 2EA mounted springs. Because it is open type, it can be used to reduce the vibrations that heavy equipment creates without having to use too many.

■ Usage

- For pumps
  (single stage and multi stage, turbine, double suction types)
- For air conditioning units
  (horizontal, vertical, hybrid, built-in, detachable, etc)
- For ventilators
  (sirocco, air-foil, turbo double suction and single suction types, etc)
- For all kinds of vibrating objects

■ Specification

No.	Name of Components	Material	Standard
1	Rubber Housing	CR	KS M 6617
2	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
3	Upper Spring Cap	GC	KS D 4301
4	Level Bolt	SS400	KS B 1002
5	Cap Screw	SS400	KS B 1002

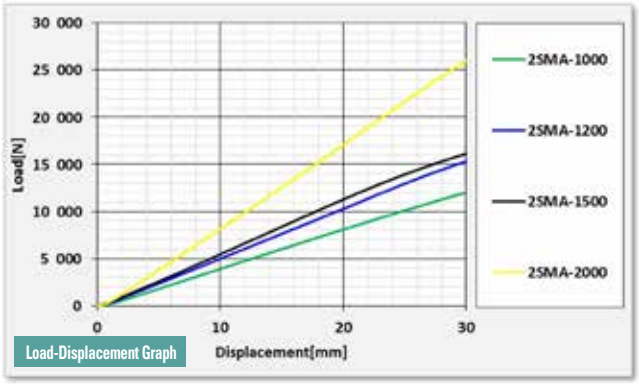
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	H	Level Blot	Cap Screw
2SMA-1000	1000	40	7.36	Green	252	223	97	14	139	M20 x 90	M12 x 25
2SMA-1200	1200	48	7.52	Blue							
2SMA-1500	1500	60	7.68	Black							
2SMA-2000	2000	80	8.04	Yellow							
2SMA-2400	2400	96	8.12	Red							

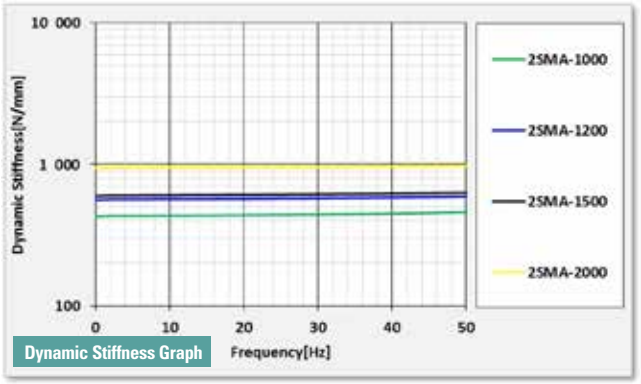
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

2SMA Spring Mount (Deflection : 25mm)

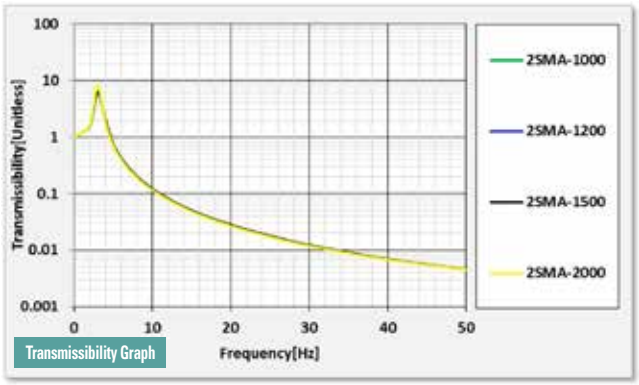
■ 2SMA Test Data



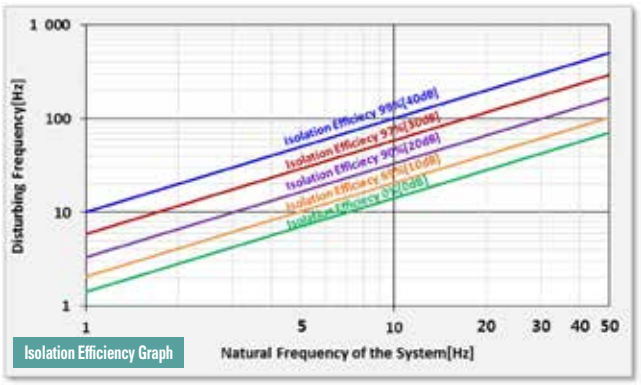
Load-Displacement Graph



Dynamic Stiffness Graph

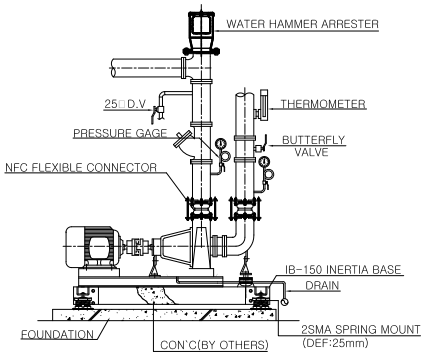


Transmissibility Graph

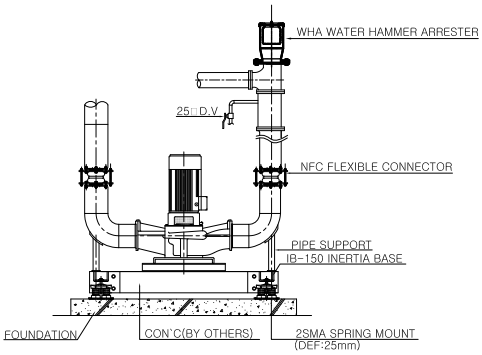


Isolation Efficiency Graph

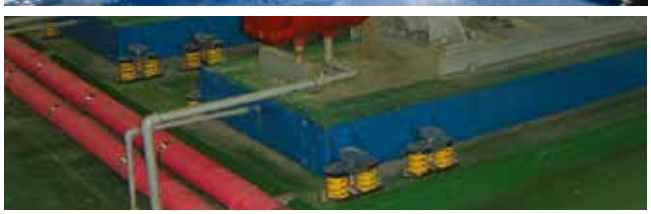
■ Installation Features



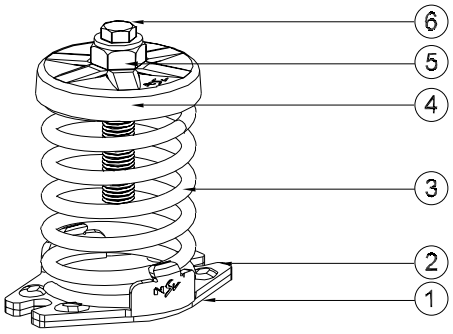
SINGLE VOLUTE PUMP DETAIL

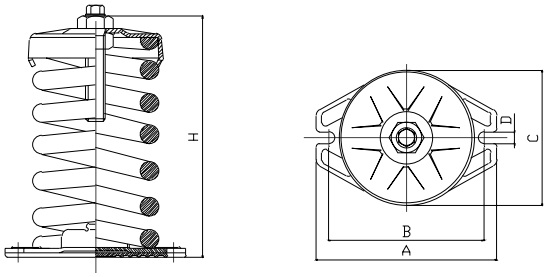


IN-LINE PUMP DETAIL



SMA2 Spring Mount (Deflection : 50mm)





■ Features

As an open spring mount, it is usually used together with the inertia base. It is easy to install and has a static deflection that is visible to the naked eye, which facilitates inspection after installation. It has the same components as SMA type, but has a static deflection of 50 mm, and therefore, it is used when operation of equipment needs to be quieter, such as when air conditioners and fans and are installed on the ground level within the building. The top cap is made of SS400 steel plate, and it can be welded to the bottom structure, when it is made of steel, like the H beam, without making an extra hole for installation. There is a CR type pad attached on the base plate for a slip resistant and high frequency isolation.

■ Usage

- For standing pipes
- For high-efficient vibration control of ventilators (ground level)
- For high-efficient vibration control of air conditioning units (ground level)
- For high-efficient vibration control of equipment that needs to be kept quiet

■ Specification

No.	Name of Components	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS400	KS D 3503
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Upper Spring Cap	SS400	KS D 3503
5	Level Bolt	SS400	KS B 1002
6	Cap Screw	SS400	KS B 1002

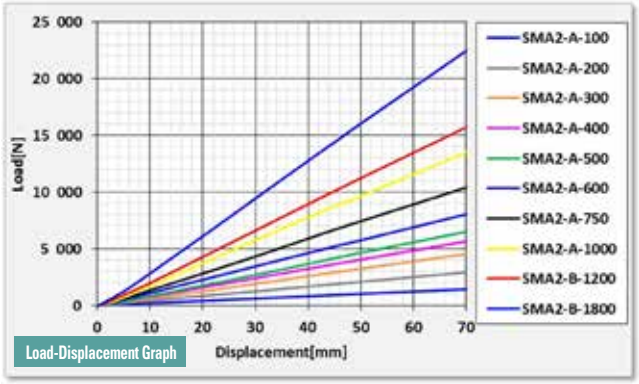
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	H	Level Blot	Cap Screw
SMA2-A-100	100	2	2.00	Blue	150	123	106	14	170	M20 x 90	M12 x 25
SMA2-A-150	150	3	2.00	Brown							
SMA2-A-200	200	4	2.04	White							
SMA2-A-300	300	6	2.18	Orange							
SMA2-A-400	400	8	2.46	Pink							
SMA2-A-500	500	10	2.78	Green							
SMA2-A-600	600	12	3.34	Blue							
SMA2-A-750	750	15	3.08	Black							
SMA2-A-1000	1000	20	3.38	Yellow							
SMA2-B-1200	1200	24	7.60	Red	190	170	138	14	250	M20 x 90	M12 x 25
SMA2-B-1500	1500	30	7.62	Black							
SMA2-B-1800	1800	36	7.12	Blue							
SMA2-B-2000	2000	40	8.90	Yellow							
SMA2-B-2500	2500	50	11.60	Brown							
SMA2-C-3000	3000	60	12.60	White	214	184	160	14	289	M24 x 110	M12 x 25
SMA2-C-3500	3500	70	13.40	Black							
SMA2-C-4000	4000	80	13.40	Orange							

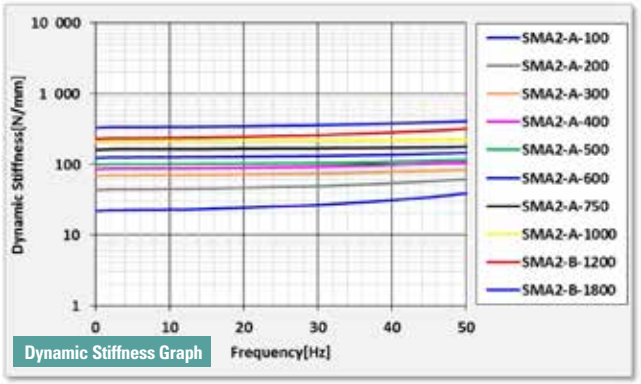
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

SMA2 Spring Mount (Deflection : 50mm)

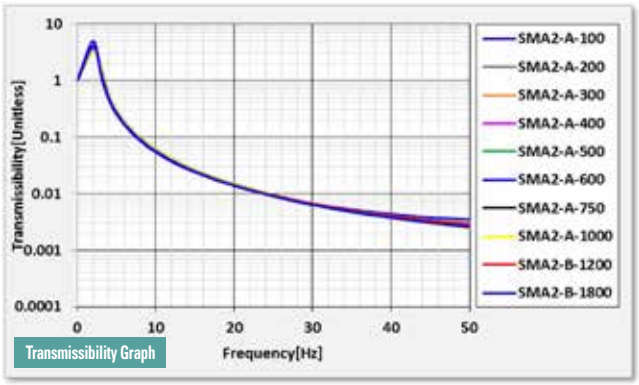
■ SMA2 Test Data



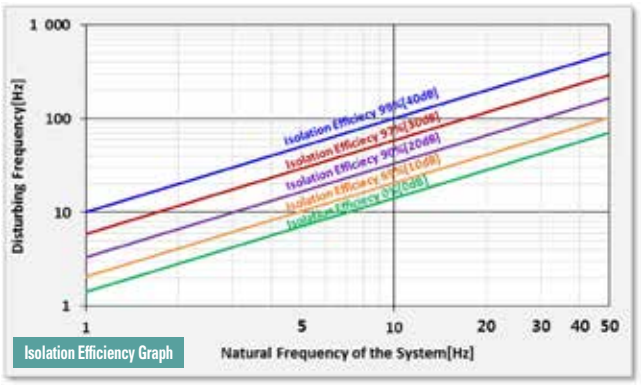
Load-Displacement Graph



Dynamic Stiffness Graph

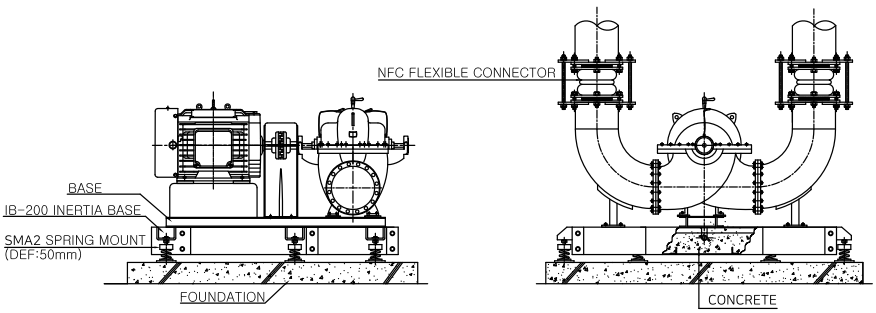


Transmissibility Graph

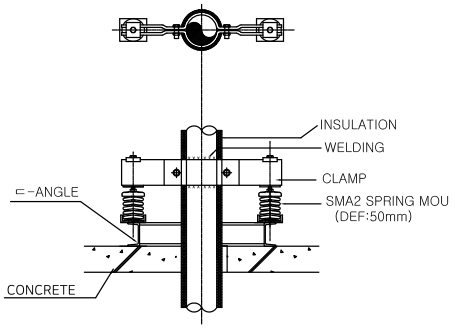


Isolation Efficiency Graph

■ Installation Features



DOUBLE SUCTION PUMP DETAIL

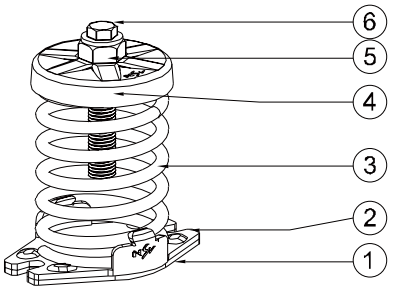


SPRING MOUNT INSTALL DETAIL

SMA3 Spring Mount (Deflection : 75mm)

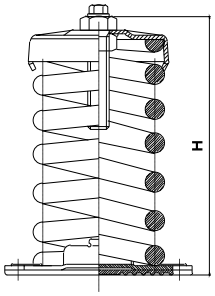
■ Features

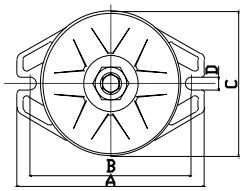
It has same features and intended purpose as SMA2 type, but it uses the spring having a static deflection of 75 mm, which makes it better suited for more delicate vibration control than SMA2 type. The average length of slab is 6~9 mm and it is applied to equipment with the natural frequency less than 8.3Hz (500RPM) installed on rooftop. In this case, it must have the natural frequency of less than 2Hz and the static deflection of at least 60 mm.



■ Usage

- For high-efficient vibration control of standing pipes
- For high-efficient vibration control of ventilator (ground level)
- For high-efficient vibration control of air conditioning unit (ground level)
- For high-efficient vibration control of equipment that needs to be kept quiet





■ Specification

No.	Name of Components	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	GC	KS D 4301
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Upper Spring Cap	SS400	KS D 3503
5	Level Bolt	SS400	KS B 1002
6	Cap Screw	SS400	KS B 1002

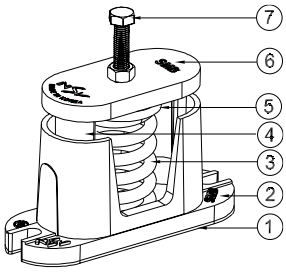
■ Dimension & Selection Guide

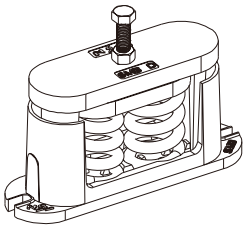
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	H	Level Blot	Cap Screw
SMA3-A-200	200	2.7	8.1	White	190	170	138	14	250	M20 × 110	M12 x 25
SMA3-A-300	300	4	8.1	Orange							
SMA3-A-400	400	5.3	8.2	Pink							
SMA3-A-500	500	6.7	9.5	Green							
SMA3-A-600	600	8	9.7	Blue							
SMA3-A-750	750	10	9.7	Black							
SMA3-A-1000	1000	13.3	9.8	Yellow							
SMA3-B-1200	1200	16	14.8	Red	214	184	160	14	289	M24 X 110	M12 x 40
SMA3-B-1500	1500	20	14.9	Black							
SMA3-B-1800	1800	24	15.2	Blue							
SMA3-B-2000	2000	32	15.5	Yellow							
SMA3-B-2500	2500	33.3	15.6	Brown							
SMA3-C-3000	3000	40	24.1	White	260	234	204	16	329	M24 × 140	M12 x 40
SMA3-C-3500	3500	46.6	25.2	Black							
SMA3-C-4000	4000	53.3	26.8	Orange							

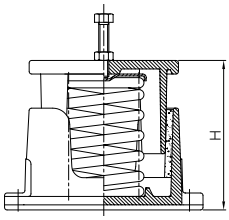
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

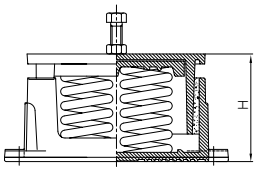
SMB Spring Mount (Deflection : 25mm)

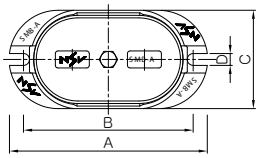
D-TYPE

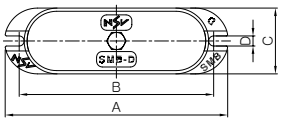












■ Features

As an enclosed spring mount, it has the spring between upper and bottom housings. An anchor hole is on the bottom housing and the tap is on the top housing, which allows level control of the bolt with a level bolt and nut to be used. Plus, the spring cap with a bolt guided hole is at the top of the spring to distribute the load transferred from the level bolt and the anti-frictioner is attached between upper and bottom housings, which somewhat reduces attenuation and friction caused by left-right and top-down relative displacement when the equipment is running. There is a CR pad attached on the bottom of the bottom housing to compensate disadvantages of the spring transferring high frequency due to a kind of surging effect.

■ Usage

- For pumps, refrigerators, compressors and power generators
- For ventilators
- For air conditioning units
- For equipment with a large horizontal reaction

■ Specification

No.	Name of Components	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	GC	KS D 4301
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Anti-Frictioner	Sponge	-
5	Spring Cap	SS400	KS D 3503
6	Upper Housing	GC	KS D 4301
7	Level Bolt	SS400	KS B 1002

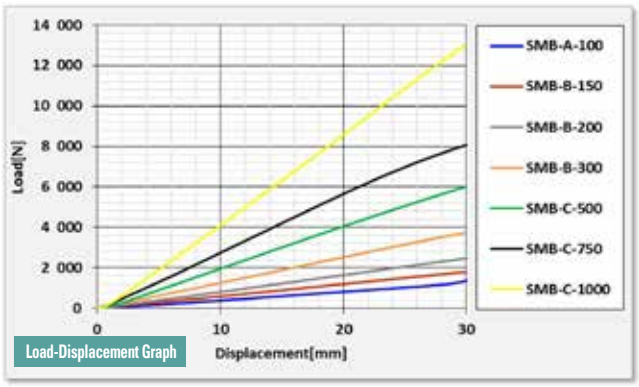
■ Dimension & Selection Guide

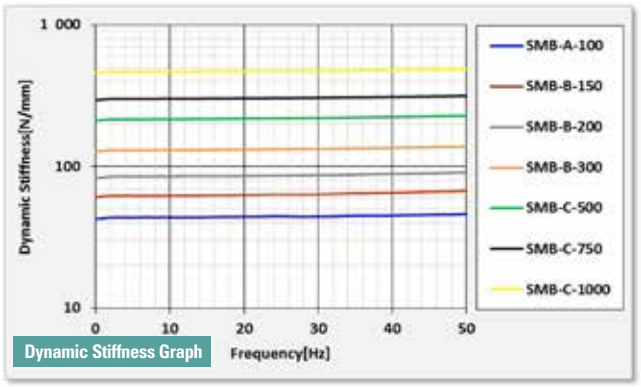
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)					
					A	B	C	D	H	Level Blot
SMB-A-10	10	0.4	1.16	Pink	139	117	57	12	102	M10 x 60
SMB-A-25	25	1	1.20	Yellow						
SMB-A-50	50	2	1.34	Red						
SMB-A-75	75	3	1.34	Black						
SMB-A-100	100	4	1.30	Blue						
SMB-B-100	100	4	3.64	Blue	205	170	76	13	135	M12 x 65
SMB-B-150	150	6	3.64	Brown						
SMB-B-200	200	8	3.70	White						
SMB-B-300	300	12	3.94	Orange						
SMB-B-400	400	16	3.86	Pink						
SMB-C-500	500	20	6.00	Green	228	196	93	13	150	M16 x 80
SMB-C-600	600	24	6.06	Blue						
SMB-C-750	750	30	6.14	Black						
SMB-C-1000	1000	40	6.32	Yellow						
SMB-D-1200	1200	48	13.38	Blue	306	277	94	13	170	M16 x 80
SMB-D-1500	1500	60	13.54	Black						
SMB-D-2000	2000	80	13.88	Yellow						

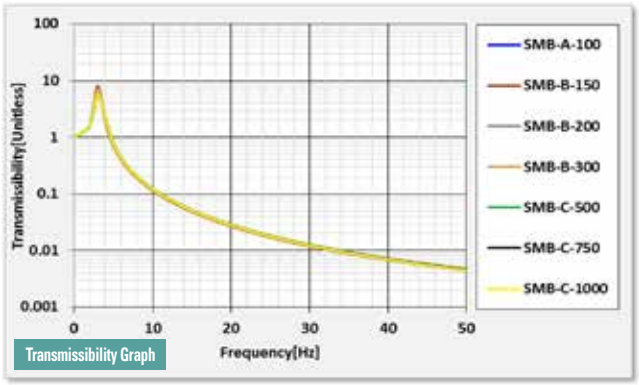
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

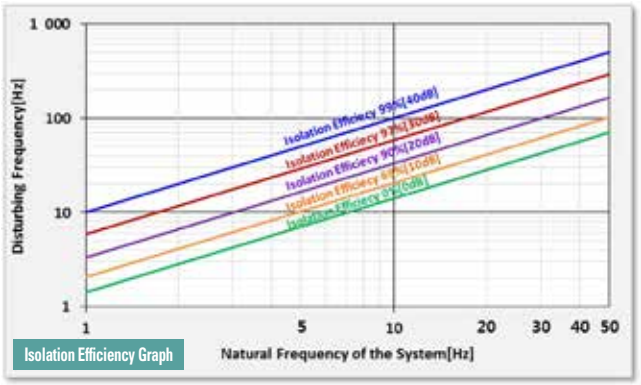
SMB Spring Mount (Deflection : 25mm)

■ SMB Test Data









■ Explanation(Commonness)

1. Vibration Transmissibility(T_r)
   Vibration Transmissibility is the amplitude ratio of Output to Input.

$$T_r = \frac{Output\ Amplitude}{Input\ Amplitude} = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2},\ \eta = \frac{Disturbing\ Frequency\ of\ the\ equipment}{Natural\ Frequency\ of\ the\ Isolator(\ Damping(c) = 0\ )}$$

2. Natural Frequency(F_n) of Vibration Isolation System
   The mass and spring stiffness dictate a natural frequency of the system.

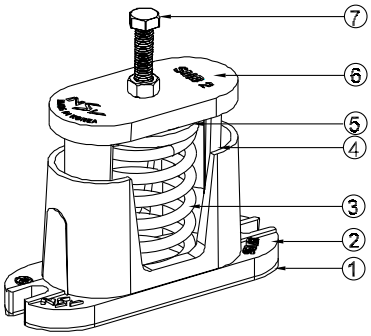
$$F_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

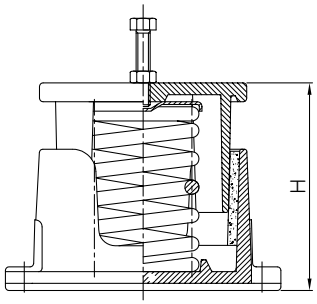
3. Isolation Efficency(E)
   Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$
   ex) Disturbing Frequency of the equipment=100 Hz,
   Natural Frequency of the isolator=10Hz

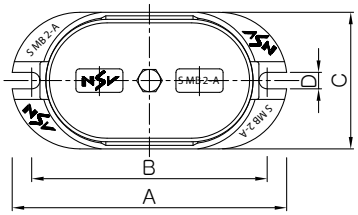
$$T_r = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2} = \sqrt{\left(\frac{1}{1-\left(\frac{100}{10}\right)^2}\right)^2} = 0.101 \qquad E = 100(1 - T_r) = 100(1-0.101)=99(\%)$$

■ Installation Features

SMB2 Spring Mount (Deflection : 50mm)







■ Features

As an enclosed spring mount, it has the same features and intended purpose as the SMB type, but is equipped with the spring having a static deflection of 50 mm. It is used when equipment like air conditioners and fans installed on a group floor of the building need to be kept quite when running.

■ Usage

- For high-efficient vibration isolation of pumps, refrigerators, compressors and power generators
- For high-efficient vibration isolation of ventilators
- For high-efficient vibration isolation of air conditioning units
- For equipment having large horizontal reaction

■ Specification

No.	Name of Components	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	GC	KS D 4301
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Anti-Frictioner	SPONGE	–
5	Spring Cap	SS400	KS D 3503
6	Upper Housing	GC	KS D 4301
7	Level Bolt	SS400	KS B 1002

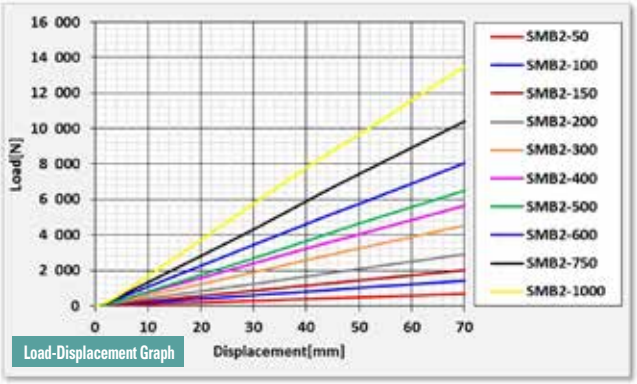
■ Dimension & Selection Guide

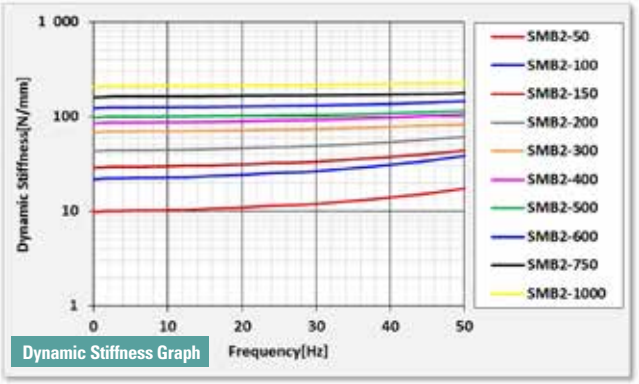
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)					
					A	B	C	D	H	Level Blot
SMB2-50	50	1	8.30	Red	232	203	116	14	178	M12 x 80
SMB2-100	100	2	8.30	Black						
SMB2-150	150	3	8.56	Brown						
SMB2-200	200	4	8.52	White						
SMB2-300	300	6	8.64	Orange						
SMB2-400	400	8	8.65	Pink						
SMB2-500	500	10	8.75	Green						
SMB2-600	600	12	8.78	Blue						
SMB2-750	750	15	8.56	Black						
SMB2-1000	1000	20	8.90	Yellow						

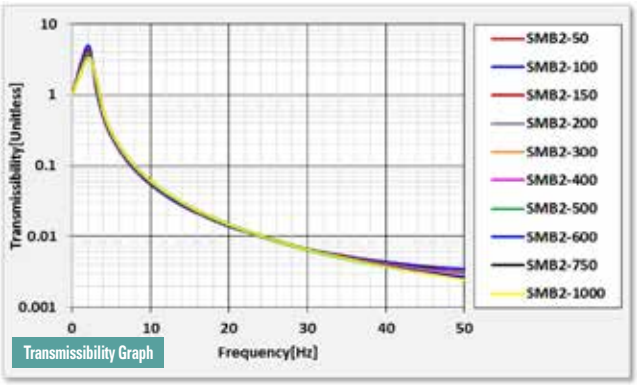
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

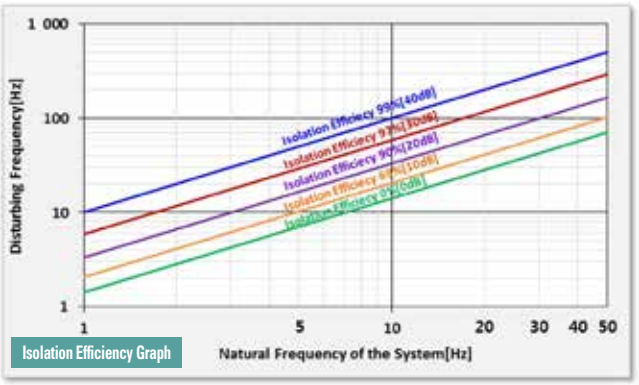
SMB2 Spring Mount (Deflection : 50mm)

■ SMB2 Test Data

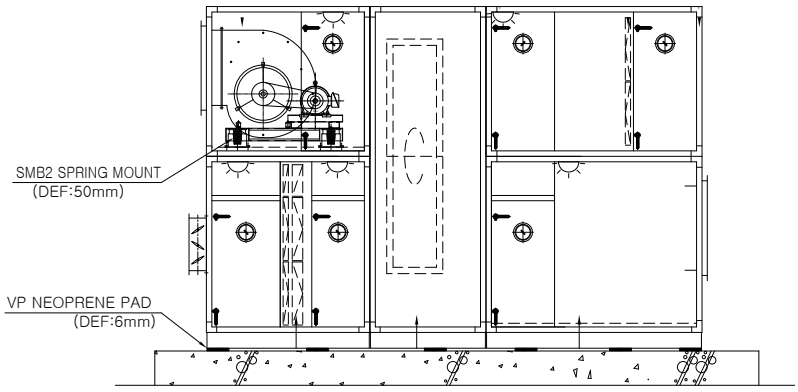




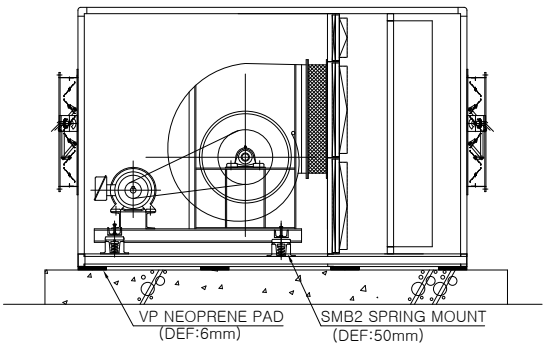




■ Installation Features

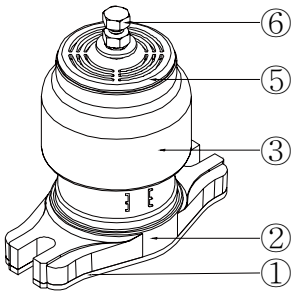


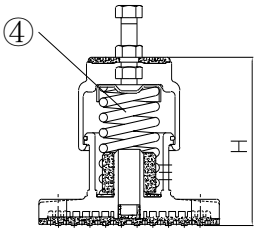
TOTAL HEAT EXCHANGER DETAIL

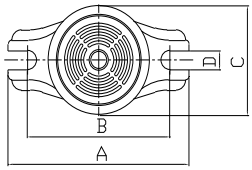


VENTILATION UNIT DETAIL

NSM/NSM2 Spring Mount (Deflection : 25mm, 50mm)







■ Features

It is a closed spring mount with excellent anti-vibration effects. Because the spring is not exposed to the outside, it is corrosion-resistant and it has a gauge at the center to help check deflection. The top and bottom housings are made of POLYCARBONATE plastic, which is stable regardless of load and strength, and anti-friction inside the housing reduces structure-borne noise. Plus, the anti-vibration neoprene pad on the top and bottom contact surfaces prevents structure-born noise from getting transferred to the base of the equipment when it is in contact with STEEL and concrete.

■ Usage

- For ventilators
- For air handling units
- For pumps and standing pipes
- For equipment with large horizontal reaction

■ Specification

No.	Name of Components	Material	Standard
1	Lower Non Skin Pad	CR	KS M 6617
2	Lower Housing	E-PLASTIC	-
3	Upper Housing	E-PLASTIC	-
4	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
5	Upper Non Skid Pad	CR	KS M 6617
6	Level Bolt	SS400	KS B 1012

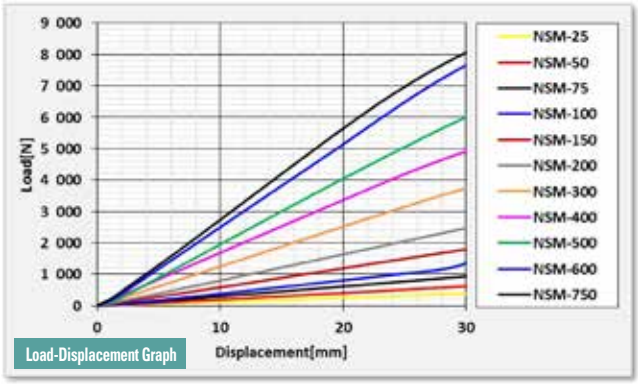
■ Dimension & Selection Guide

Type	Capacity(kgf)	Spring Constant(kgf/mm)	Weight(kg)	Deflection(mm)	Dimension(mm)					
					A	B	C	D	H	Level Blot
NSM-A-25	25	1	0.44	25	132	104	74	13	115	M10 x 60
NSM-A-50	50	2	0.46							
NSM-A-75	75	3	0.50							
NSM-A-100	100	4	0.54							
NSM-B-150	150	6	1.16		170	134	99	14	143	M12 x 65
NSM-B-200	200	8	1.22							
NSM-B-300	300	12	1.36							
NSM-B-400	400	16	1.38							
NSM-C-500	500	20	2.08		190	152	110	14	167	M16 x 80
NSM-C-600	600	24	2.14							
NSM-C-750	750	30	2.22							
NSM2-50	50	1	2.44	50	220	183	137	14	180	M12 x 80
NSM2-100	100	2	2.50							
NSM2-150	150	3	2.46							
NSM2-200	200	4	2.50							
NSM2-300	300	6	2.70							
NSM2-400	400	8	3.06							
NSM2-500	500	10	2.76							
NSM2-600	600	12	2.62							
NSM2-750	750	15	2.92							

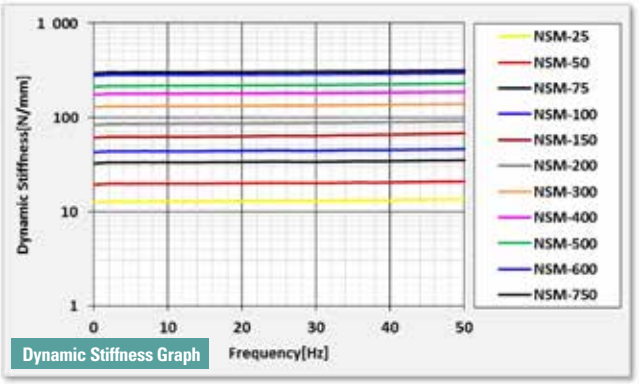
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

NSM/NSM2 Spring Mount (Deflection : 25mm, 50mm)

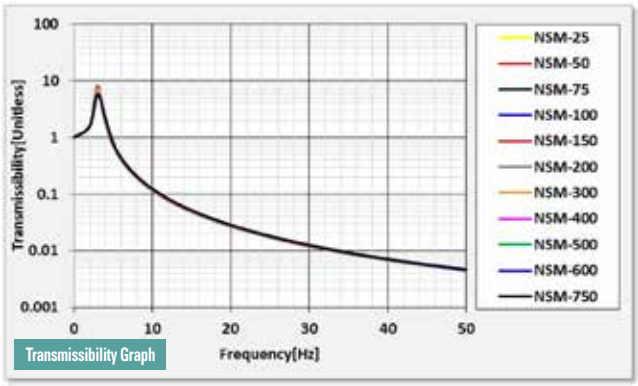
■ NSM Test Data



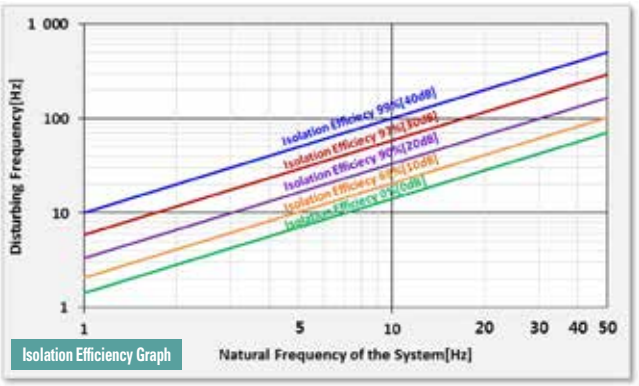
Load-Displacement Graph



Dynamic Stiffness Graph

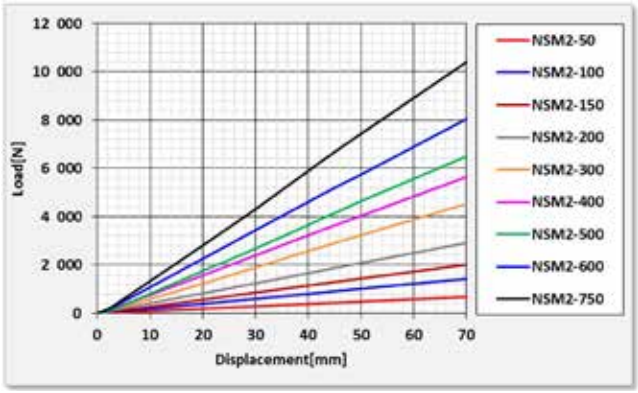


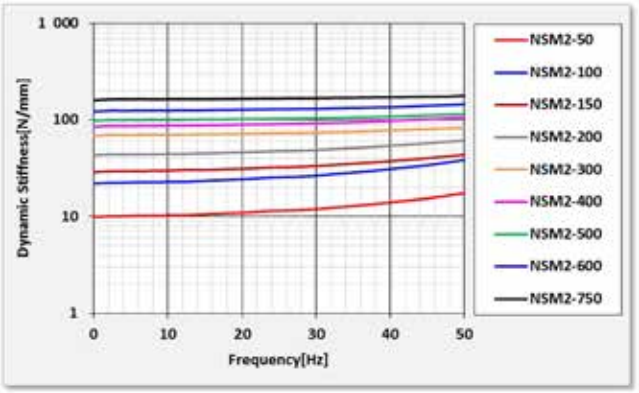
Transmissibility Graph

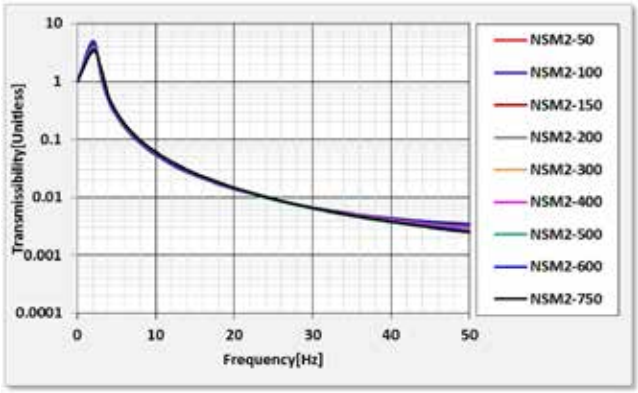


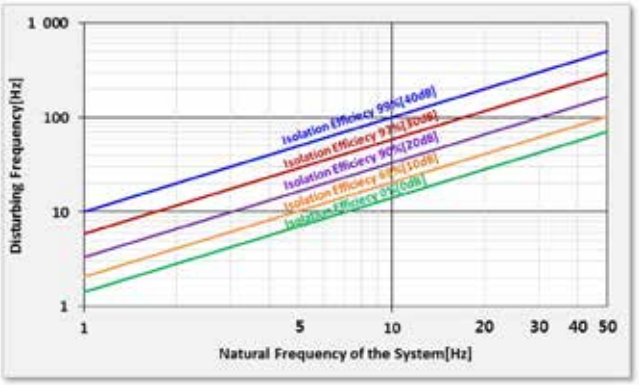
Isolation Efficiency Graph

■ NSM2 Test Data







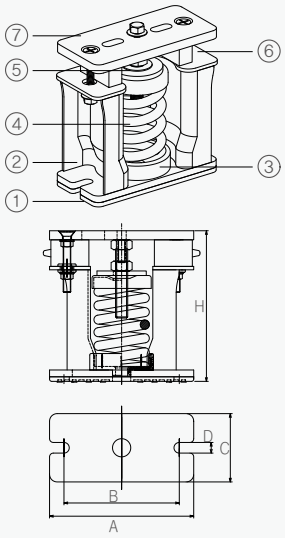


FSL Spring Mount (Deflection : 25mm)

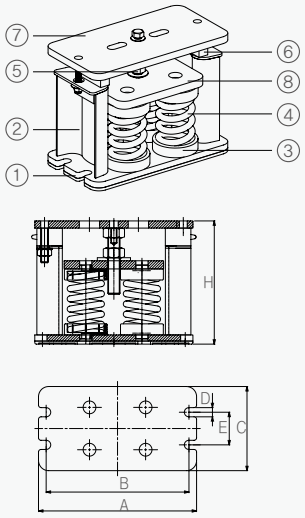
■ Features

It is a free standing mount with a vertical movement limiting device. It is designed to restrict vertical deflection when there is any change in the weight of equipment and/or structure (for example, pouring water out of a cooling tower, refrigerator) to prevent damage and distortion of equipment and pipe.
The upper housing (compression plate) has a restrain bolt and level bolt while CR-type acoustical non skid pad on the bottom to prevent transfer of high-frequency vibration.

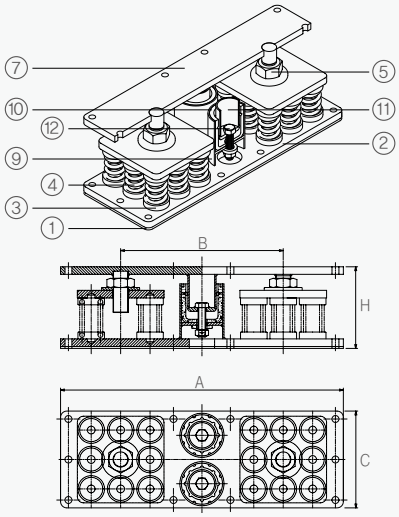
FSL-1



FSL-4



FSL-16



■ Usage

- For refrigerator of reciprocating and turbo types
- For cooling towers
- For other large pieces of equipment of which weight often changes

■ Specification

No.	Name of Components	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS400	KS D 3503
3	Spring Seat	CR	KS M 6617
4	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
5	Level Bolt&Nut	SS400	KS B 1002
6	Space Bar	Plastic	–
7	Upper Housing	SS400	KS D 3503
8	Middle Plate	SS400	KS D 3503
9	Lower Stopper	SS400	KS D 3503
10	Guide Rubber	CR	KS M 6617
11	Upper Stopper	SS400	KS D 3503
12	Stopper Level Bolt&Nut	SS400	KS B 1002

■ Installation Features

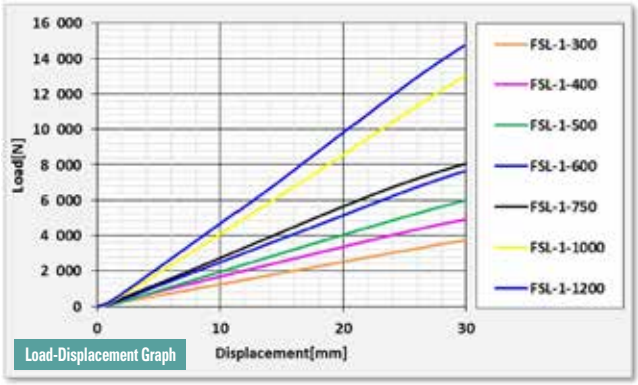
FSL Spring Mount (Deflection : 25mm)

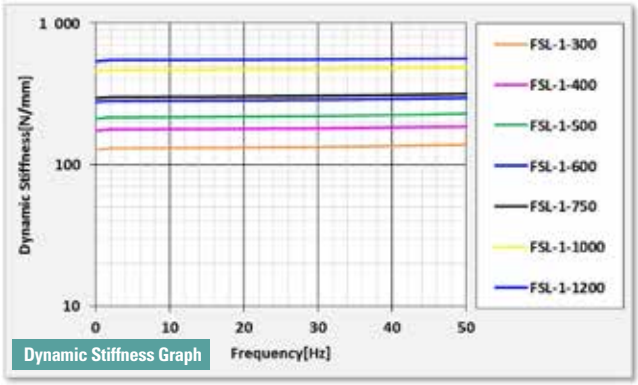
■ Dimemsion & Selection Guide By Loads

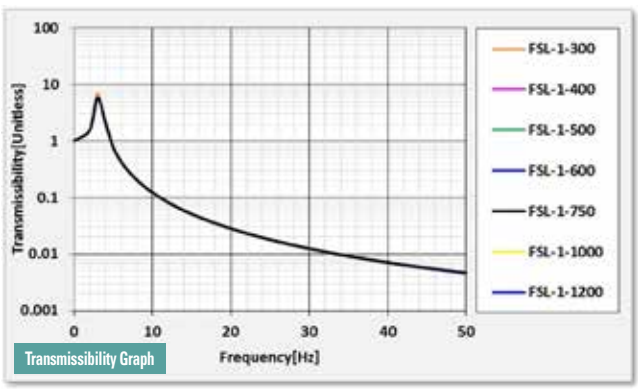
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	E	H	Level Blot
FSL-1-300	300	12	3.90	Orange	190	153	90	14	-	199	M16 x 90
FSL-1-400	400	16	3.92	Pink							
FSL-1-500	500	20	4.46	Green							
FSL-1-600	600	24	4.54	Blue							
FSL-1-750	750	30	4.60	Black							
FSL-1-1000	1000	40	4.78	Yellow							
FSL-1-1200	1200	48	4.66	Red							
FSL-2-1200	1200	48	8.78	Blue	302	262	90	14	-	199	M20 x 90
FSL-2-1500	1500	60	8.94	Black							
FSL-2-2000	2000	80	9.32	Yellow							
FSL-2-2400	2400	96	9.06	Red							
FSL-4-3000	3000	120	24.40	Black	310	280	165	18	64	242	M24 x 110
FSL-4-4000	4000	160	25.10	Yellow							
FSL-4-4800	4800	192	24.60	Red							
FSL-8-8000	8000	320	46.30	Yellow	570	313	215	15	175	217	M36 x 120
FSL-8-9600	9600	384	47.90	Red							
FSL-8-12000	12000	480	49.50	Black							
FSL-16-16000	16000	640	169.80	Yellow	894	514	306	22	256	258	M48 x 140
FSL-16-19200	19200	768	173.00	Red							
FSL-16-24000	24000	960	176.20	Black							

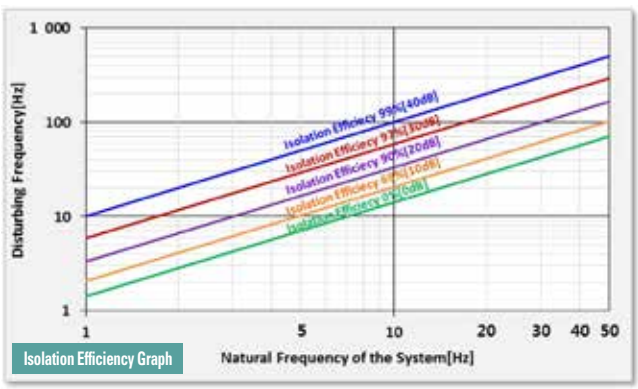
(NOTE) The specification and data are subject to change without prior to for improvement of product performance and quality.

■ FSL Test Data

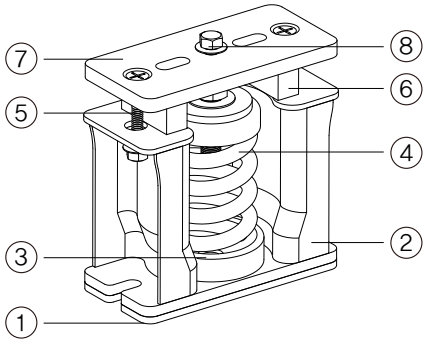


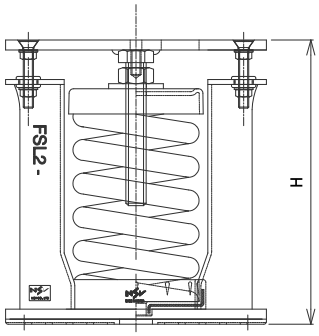


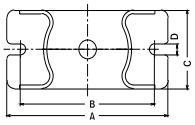




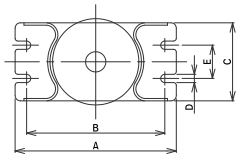
FSL2 Spring Mount (Deflection : 50mm)







FSL2-A Type



FSL2-B, C Type

■ Features

As a type of FSL series, it uses SMA2 type (static deflection of 50mm) and prevents damage and distortion of the equipment and pipe. The upper housing (compression plate) has a restrain bolt and level bolt, while the CR-type acoustical non skid pad on the bottom is to prevent the transfer of high-frequency vibration.

■ Usage

- For refrigerator of reciprocating and turbo types
- For cooling towers
- For other large pieces of equipment of which weight often changes

■ Specification

No.	Name of Components	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS400	KS D 3503
3	Spring Seat	CR	KS M 6617
4	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
5	Restraint Bolt	SS400	KS B 1002
6	Space Bar	Plastic	–
7	Upper Housing	SS400	KS D 3503
8	Level Bolt	SS400	KS B 1002

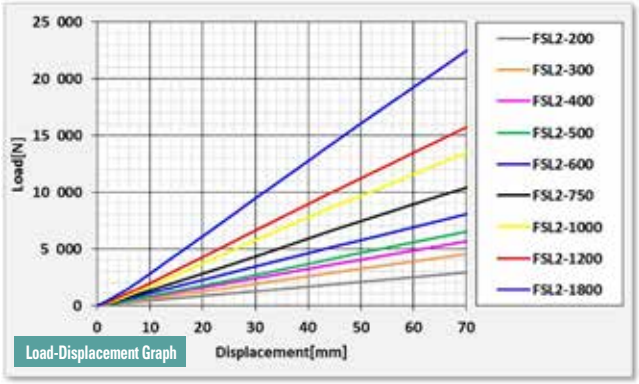
■ Dimension & Selection Guide

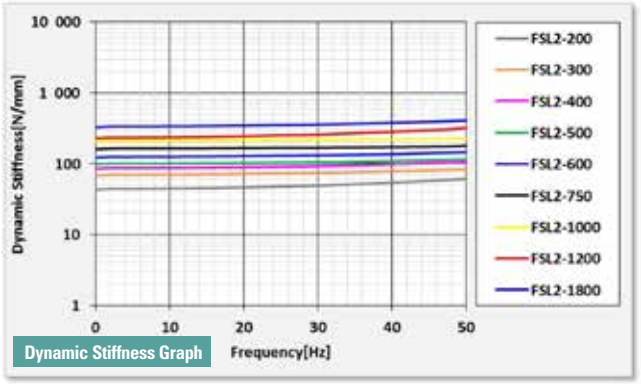
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	E	H	Level Blot
FSL2-A-200	200	4	10.60	White	220	183	100	14	–	212	M20 x 90
FSL2-A-300	300	6	10.70	Orange							
FSL2-A-400	400	8	10.90	Pink							
FSL2-A-500	500	10	18.00	Green							
FSL2-A-600	600	12	18.50	Blue							
FSL2-A-750	750	15	19.00	Black							
FSL2-A-1000	1000	20	19.50	Yellow							
FSL2-B-1200	1200	24	20.00	Red	280	234	150	14	64	288	M20 x 110
FSL2-B-1500	1500	30	32.50	Black							
FSL2-B-1800	1800	36	33.00	Blue							
FSL2-B-2000	2000	40	33.50	Yellow							
FSL2-B-2500	2500	50	34.00	Brown							
FSL2-C-3000	3000	60	39.00	White	310	266	150	16	64	338	M24 x 170
FSL2-C-3500	3500	70	40.00	Black							
FSL2-C-4000	4000	80	42.00	Orange							

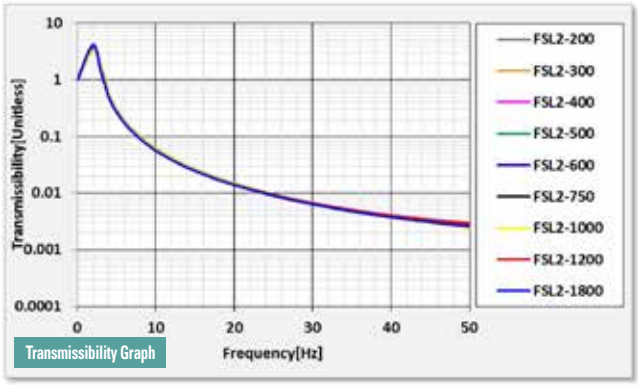
(NOTE) The specification and data are subject to change without prior to for improvement of product performance and quality.

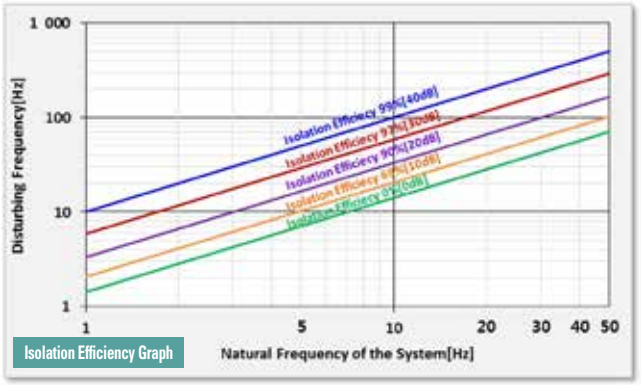
FSL2 Spring Mount (Deflection : 50mm)

■ FSL2 Test Data







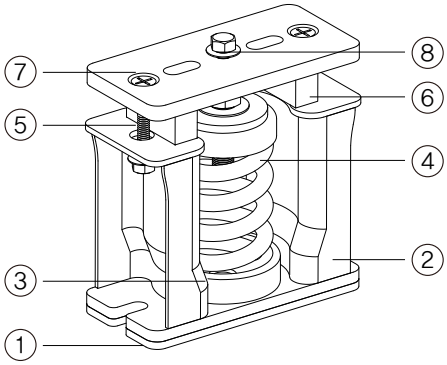


■ Installation Features

FSL3 Spring Mount (Deflection : 75mm)

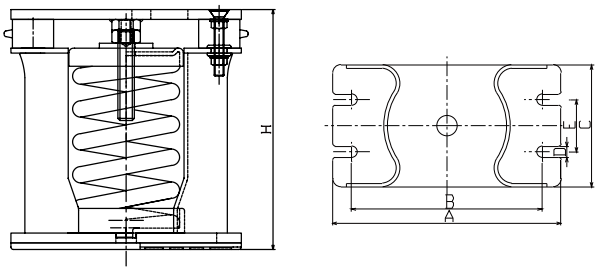
■ Features

Though it has same features as FSL2 type, it uses a spring with the static deflection of 75mm and therefore, it is used when more delicate vibration control is required. For example, it is mounted on equipment installed on a rooftop having the average slab length of 6-9 m and natural frequency less than 8.3 Hz (500RPM). In such a case, the natural frequency of the vibration control system needs to have the natural frequency of less than 2 Hz and at least 60 mm static deflection. FSA3 series spring is used in this model.



■ Usage

- High-efficiency vibration control for refrigerators of reciprocating and turbo types
- High-efficiency vibration control for cooling towers
- High-efficiency vibration control for other large pieces of equipment of which undergoes frequent weight changes (such as semiconductor production facilities)



■ Specification

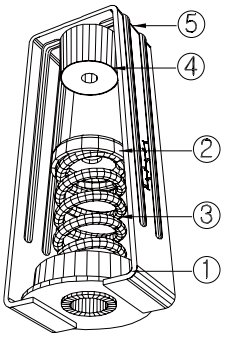
No.	Name of Components	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS400	KS D 3503
3	Spring Seat	CR	KS M 6617
4	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
5	Restraint Bolt	SS400	KS B 1002
6	Space Bar	Plastic	-
7	Upper Housing	SS400	KS D 3503
8	Level Bolt	SS400	KS B 1002

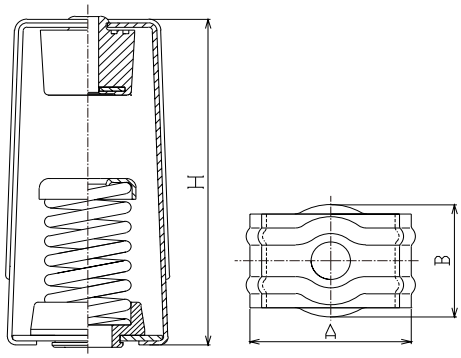
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	E	H	Level Blot
FSL3-A-200	200	2.7	15.50	White	280	234	150	14	64	288	M20 x 140
FSL3-A-300	300	4	16.40	Orange							
FSL3-A-400	400	5.3	15.70	Pink							
FSL3-A-600	600	8	16.90	Blue							
FSL3-A-750	750	10	17.40	Black							
FSL3-A-1000	1000	13.3	19.00	Yellow							
FSL3-A-1200	1200	16	20.20	Red							
FSL3-A-1500	1500	20	21.60	Black							
FSL3-A-1800	1800	24	21.80	Blue							
FSL3-A-2000	2000	26.6	22.70	Yellow							
FSL3-A-2500	2500	33.3	23.40	Brown							
FSL3-B-3000	3000	40	40.60	White	310	266	150	16	64	338	M24 x 170
FSL3-B-3500	3500	46.6	42.20	Black							
FSL3-B-4000	4000	53.3	44.50	Orange							

(NOTE) The specification and data are subject to change without prior to for improvement of product performance and quality.

SH Spring Hanger (Deflection : 25mm)





■ Features

The SH type anti-vibration spring hanger ensures that vibration generated from the equipment and/or stress by thermal expansion in the pipe and duct while the equipment is running are not transferred to the structure through pipe and duct. The housing needs to be strong enough to stand the weight of the equipment without causing resonance from its own vibration. With the coil spring having a static deflection of 25 mm, the product can maintain the system's natural frequency down to 3~5 Hz and the CR type housing fixture is mounted on top of the housing to prevent high frequency that is passed through pipe and duct from getting into the structure on top of the hanger. Plus, the CR type spring sheet is attached at the bottom to block the high frequency resulting from the vibration that the spring generates itself.

■ Usage

- For high-efficient vibration control of axial, in-line fan, machine room, pipes in air-conditioning room and ducts
- For high-efficient vibration control of suspended ceiling desk system in, for example, studios and acoustical laboratories

■ Specification

No.	Name of Components	Material	Standard
1	Spring Seat	CR	KS M 6617
2	Spring Cap	SS400	KS D 3503
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Housing Fixture	CR	KS M 6617
5	Hanger Housing	SS400	KS D 3503

(NOTE) Housing Fixture A/B Type Hardness : 60° / Housing Fixture C Type Hardness : 70°

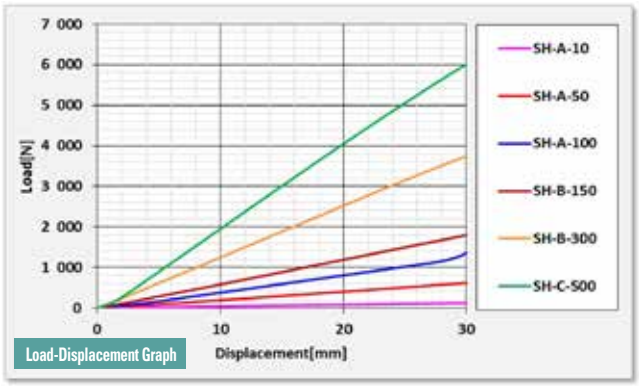
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)			
					A	B	H	Level Blot
SH-A-10	10	0.4	0.70	Pink	82	60	172	M10
SH-A-25	25	1	0.74	Yellow				
SH-A-50	50	2	0.76	Red				
SH-A-75	75	3	0.80	Black				
SH-A-100	100	4	0.84	Blue				
SH-B-150	150	6	1.80	Brown	103	79	215	M12
SH-B-200	200	8	1.84	White				
SH-B-300	300	12	1.98	Orange				
SH-B-400	400	16	2.02	Pink				
SH-C-500	500	20	3.34	Green	118	100	243	M16
SH-C-600	600	24	3.40	Blue				
SH-C-750	750	30	3.50	Black				
SH-C-1000	1000	40	3.68	Yellow				

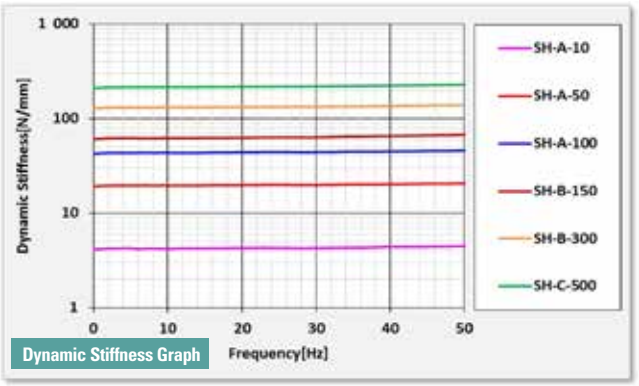
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

SH Spring Hanger (Deflection : 25mm)

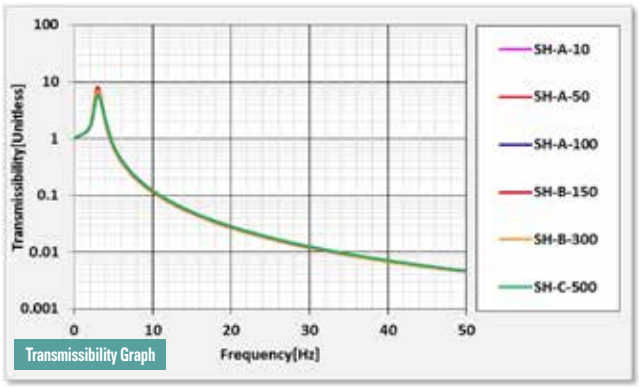
■ SH Test Data



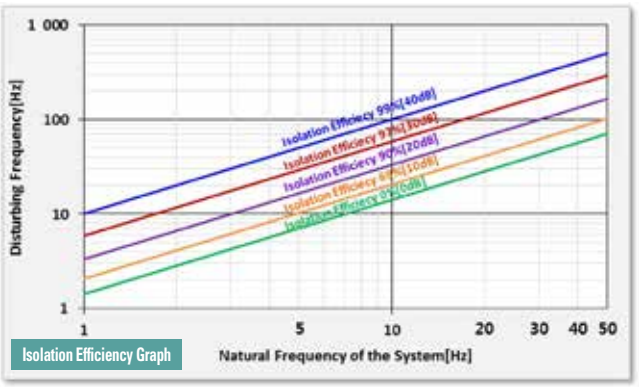
Load-Displacement Graph



Dynamic Stiffness Graph



Transmissibility Graph



Isolation Efficiency Graph

■ Explanation(Commonness)

1. Vibration Transmissibility(T_r)
   Vibration Transmissibility is the amplitude ratio of Output to Input.

$$T_r = \frac{Output\ Amplitude}{Input\ Amplitude} = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2}, \eta = \frac{Disturbing\ Frequency\ of\ the\ equipment}{Natural\ Frequency\ of\ the\ Isolator(\ Damping(c) = 0\ )}$$

2. Natural Frequency(F_n) of Vibration Isolation System
   The mass and spring stiffness dictate a natural frequency of the system.

$$F_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

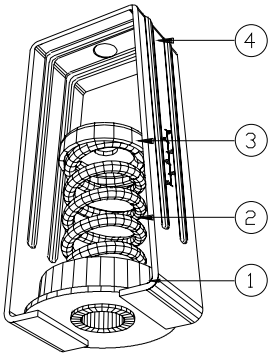
3. Isolation Efficency(E)
   Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$
   ex) Disturbing Frequency of the equipment=100 Hz,
   Natural Frequency of the isolator=10Hz

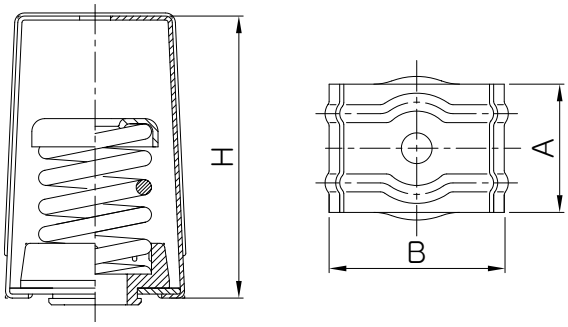
$$T_r = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2} = \sqrt{\left(\frac{1}{1-\left(\frac{100}{10}\right)^2}\right)^2} = 0.101 \qquad E = 100(1 - T_r) = 100(1-0.101)=99(\%)$$

■ Installation Features

VH20 Spring Hanger (Deflection : 25mm)

※ The model name of VH product has changed to VH20





■ Features

The VH20 type anti-vibration spring hanger prevents the transfer of vibration generated from equipment and/or stress resulted from thermal expansion in pipes and ducts during operation. Its housing needs to be strong enough to stand the weight of the equipment and avoid resonance due to the vibration it generates. With the coil spring having a static deflection of 25 mm, it can maintain the system's natural frequency down to 3~5 Hz and the CR type housing fixture is mounted on the housing to avoid the transfer of high frequency from pipes and ducts into the structure on top of the hanger. Plus, the CR type spring sheet is attached on the bottom to block high frequency resulting from the vibration that the spring itself generates.

■ Usage

- For high-efficient vibration control of axial, in-line fan, machine rooms, pipes in air-conditioning rooms and ducts
- For high-efficient vibration control of suspended ceiling desk system in, for example, studios and acoustical laboratories

■ Specification

No.	Name of Components	Material	Standard
1	Spring Seat	CR	KS M 6617
2	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
3	Spring Cap	SS400	KS D 4301
4	Hanger Housing	SS400	KS D 3503

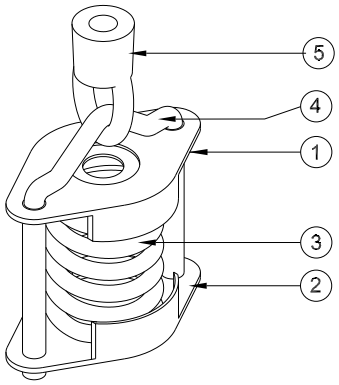
■ Dimension & Selection Guide

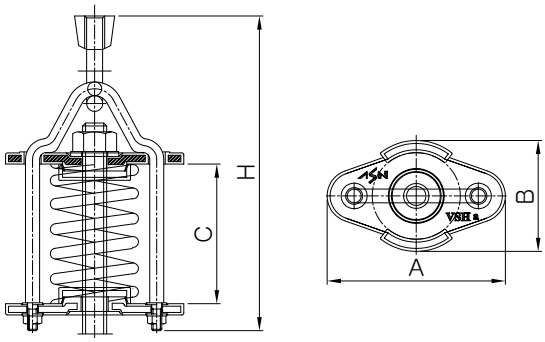
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)			
					A	B	H	Level Blot
VH20-A-10	10	0.4	0.38	Pink	50	70	135	M10
VH20-A-25	25	1	0.42	Yellow				
VH20-A-50	50	2	0.44	Red				
VH20-A-75	75	3	0.48	Black				
VH20-A-100	100	4	0.52	Blue				
VH20-B-150	150	6	1.40	Brown	60	96	170	M12
VH20-B-200	200	8	1.44	White				
VH20-B-300	300	12	1.60	Orange				
VH20-B-400	400	16	1.65	Pink				

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VH61 Spring Hanger (Deflection : 25mm)

※ The model name of VSH product has changed to VH61





■ Features

The VH61 type anti-vibration spring hanger prevents the transfer of vibration generated from equipment and/or stress resulted from thermal expansion in the pipes and ducts during operation. Unlike the SH type, it uses a V-bolt instead of the housing, which allows it to withstand a dynamic load. Using the coil spring with a static deflection of 25 mm, it maintains the system's natural frequency to 3~5 Hz and using the CR type guide Rubber attached on the top plate, it prevents the high frequency transferred through pipes and ducts from passing into the structure on top of the hanger. In addition, it can be assembled with 60% of the available load using the pre-setting nut to prevent the equipment from moving around by the distortion of the spring, and because the spring is coupled with V-bolt, the spring does not fall apart when moving the mount.

(Option) The hanger rod can be installed using the hole on the top/ bottom plates to suspend the equipment.

■ Usage

For high-efficient vibration control of axial, in-line fan, machine rooms, pipes in air-conditioning rooms and ducts

■ Specification

No.	Name of Components	Material	Standard
1	Upper Plate(neoprene coatiing)	SS400	KS D 3503
2	Lower Plate(neoprene coatiing)	SS400	KS D 3503
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Hanging V-Blot	SS400	-
5	I-Nut	SS400	-

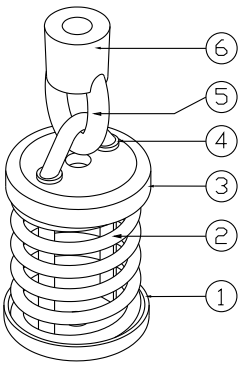
■ Dimension & Selection Guide

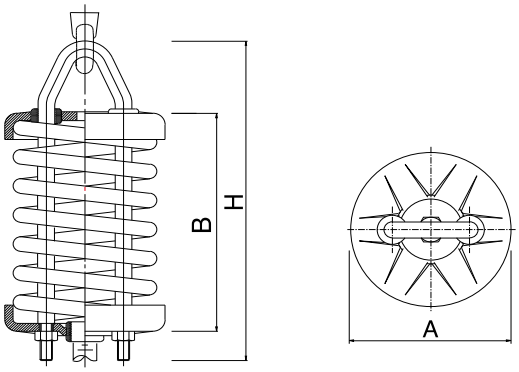
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)					
					A	B	C	H	I-Nut	Hanging Bolt
VH61-A-10	10	0.4	0.36	Pink	89	57	71	160	3/8"	M10
VH61-A-25	25	1	0.40	Yellow						
VH61-A-50	50	2	0.44	Red						
VH61-A-75	75	3	0.46	Black						
VH61-A-100	100	4	0.50	Blue						
VH61-B-150	150	6	1.14	Brown	108	74	98	214	1/2"	M12
VH61-B-200	200	8	1.18	White						
VH61-B-300	300	12	1.32	Orange						
VH61-B-400	400	16	1.58	Pink						

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VH62 Spring Hanger (Deflection : 50mm)

※ The model name of VSH2 product has changed to VH62





■ Features

Though it has the same features and intended purpose as VH62 type, it has a static deflection of 50 mm, which makes it best suitable for pipes and ducts in semiconductor plants. It uses a hanger rod bolt on the upper-spring cap to fix onto equipment and the upper I-nut when installed on a suspended ceiling structure.

(Option) The hanger rod can be installed using the hole on top/bottom plates to suspend the equipment.

■ Usage

- For high-efficient vibration control of axial, in-line fan, machine rooms, pipes in air-conditioning rooms and ducts
- For high-efficient vibration control of suspended ceiling deck system in, for example, acoustical laboratories and studios
- For pipes and ducts installed in semiconductor plants

■ Specification

No.	Name of Components	Material	Standard
1	Lower Plate	SS400	KS D 3503
2	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
3	Upper Spring Cap	SS400	KS D 3503
4	Guide Rubber	CR	KS M 6617
5	Hangging V-Bolt	SS400	-
6	I-Nut	SS400	-

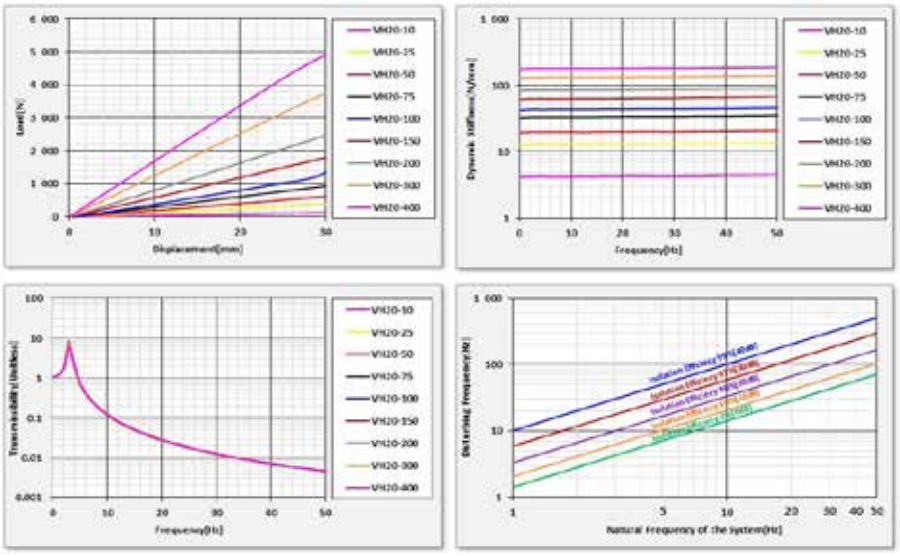
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)				
					A	B	H	I-Nut	Hanging Bolt
VH62-10	10	0.2	1.66	Pink	106	150	202	1/2"	M12
VH62-25	25	0.5	1.80	Yellow					
VH62-50	50	1	2.10	Red					
VH62-75	75	1.5	2.10	Black					
VH62-100	100	2	2.16	Blue					
VH62-150	150	3	2.12	Brown					
VH62-200	200	4	2.16	White					
VH62-300	300	6	2.30	Orange					
VH62-400	400	8	2.70	Pink					
VH62-500	500	10	2.42	Green					
VH62-600	600	12	2.28	Blue					
VH62-750	750	15	2.58	Black					
VH62-1000	1000	20	2.76	Yellow					

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VH20/VH61/VH62 Spring Hanger

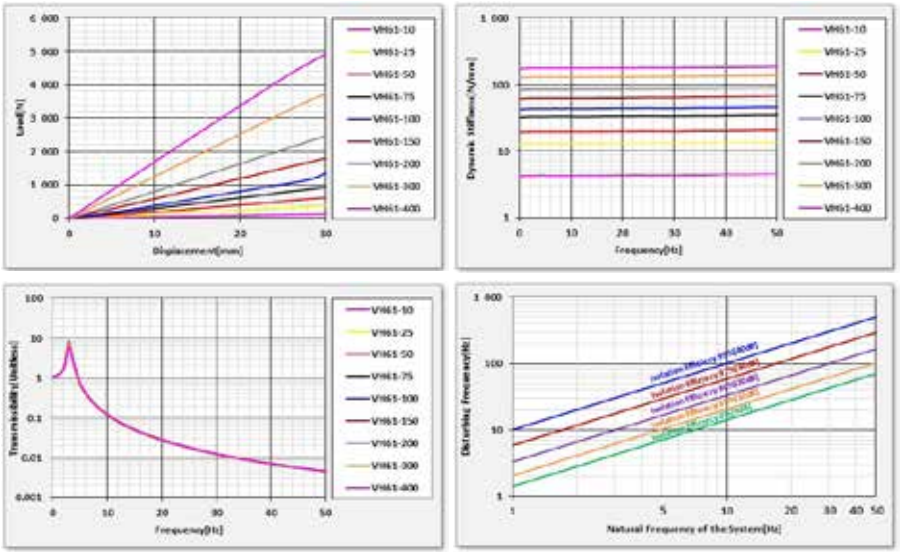
■ VH20 Test Data



1	2
3	4

1.Load-Displacement Graph
2.Dynamic Stiffness Graph
3.Transmissibility Graph
4.Isolation Efficiency Graph

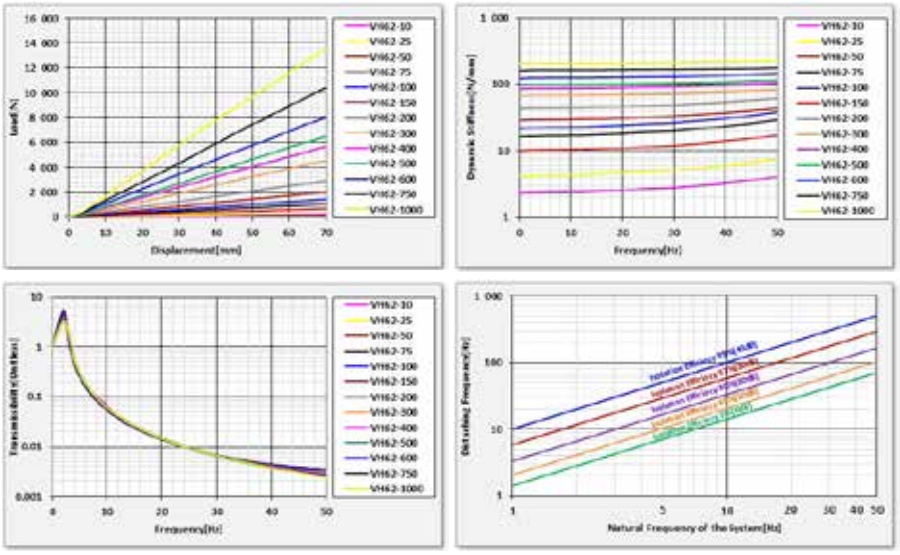
■ VH61 Test Data



1	2
3	4

1.Load-Displacement Graph
2.Dynamic Stiffness Graph
3.Transmissibility Graph
4.Isolation Efficiency Graph

■ VH62 Test Data



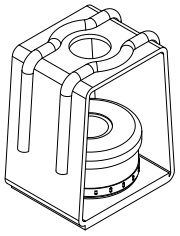
1	2
3	4

1.Load-Displacement Graph
2.Dynamic Stiffness Graph
3.Transmissibility Graph
4.Isolation Efficiency Graph

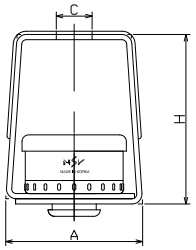
RH10 Rubber Hanger (Deflection : 3.5~13mm)

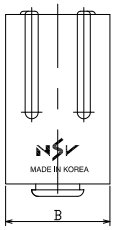
※ The model name of RH product has changed to RH10

RH10-A, B, C Type

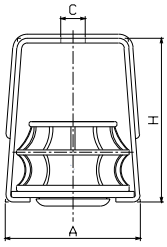


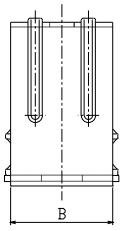
RH10-M Type





RH10-M Type





RH10-A, B, C Type

■ Features

RH10 type anti-vibration rubber hanger prevents the transfer of vibration generated from equipment or its parts to the structure, and its housing is strong enough to stand load transferred and avoid resonance. With the open rubber having a static deflection of 3.5~13 mm, it can maintain the system's natural frequency down to 5~12 Hz.

■ Usage

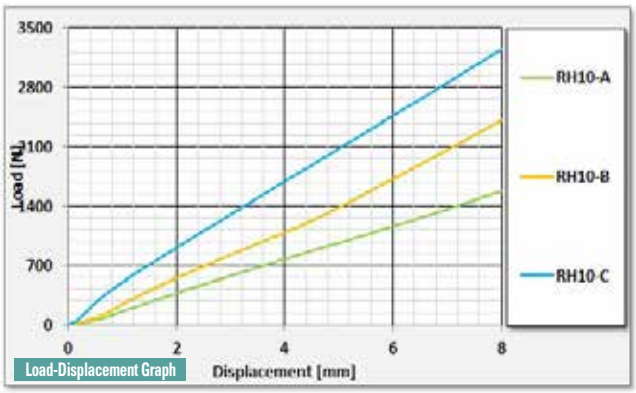
- For machine rooms, ventilators in air conditioning rooms and ducts
- For small fan and duct in line fan
- For structures suspended from the ceiling of, for example, studios and acoustical laboratories
- For ceiling mounded FCU

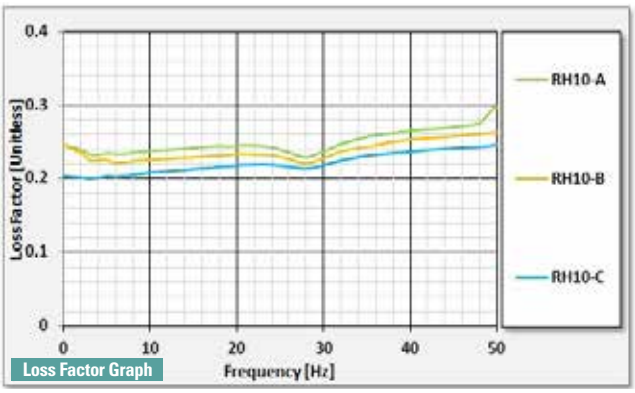
■ Dimension & Selection Guide

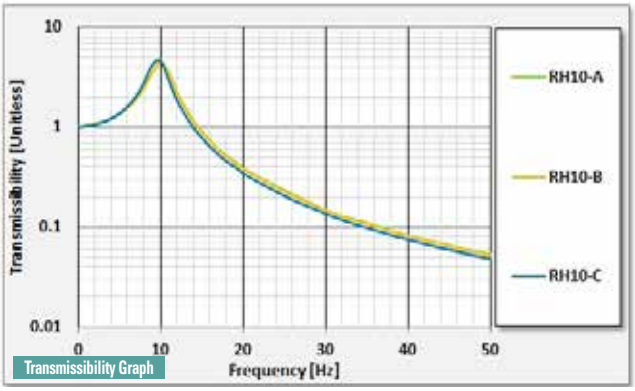
Type	Capacity (kgf)	Hardness (Hs)	Deflection (mm)	Weight (kg)	Dimension(mm)				
					A	B	C	H	Hanging Bolt
RH10-M	30~50	60±5	2.0~3.5	–	42	32	Ø11	52	M10
RH10-A	25~100		3.5~13	0.36	68	50	Ø12	80	M10
RH10-B	150~400		5.0~13	0.76	91	70	Ø14	102	M12
RH10-C	500~750		6.7~13	1.24	105	75	Ø20	120	M16

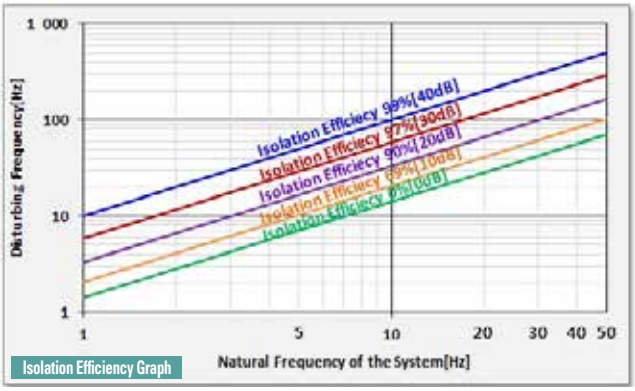
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ RH10 Test Data



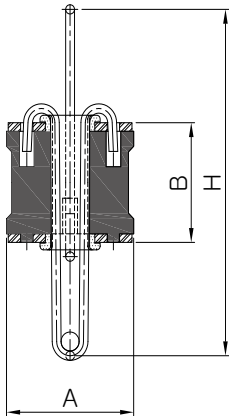






RH20 Ceiling Rubber Hanger (Deflection : 5mm)

※ The model name of CH product has changed to RH20



■ Features

It is a vibration-control hanger equipped with galvanized steel inside vibration-proof neoprene rubber. It has two wires at the top and bottom, which are used to suspend objects when a bolt and nut are not available. It has a static deflection of 5.0 mm, capable of keeping the natural vibration down to 7 Hz.

■ Usage

- ◆ For machine rooms, small pipes in air-conditioning room and ducts
- ◆ For structures installed on the ceiling of, for example, studio and acoustical laboratory

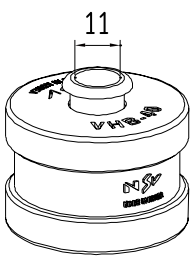
■ Dimension & Selection Guide

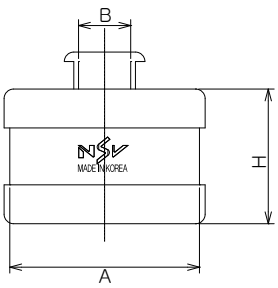
Type	Capacity(kgf)	Hardness(Hs)	Weight(kg)	Color(Steel)	Dimension(mm)		
					A	B	H
RH20-50	25~50	50±5	0.06	Silver	35	32	97
RH20-60	45~70	60±5	0.06	Gold			

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

RH30 Rubber Hanger (Deflection : 3.5~5mm)

※ The model name of VHB product has changed to RH30





■ Features

The hanger consists of neoprene vibration-proof rubber body where top and bottom are steel capped. It is mainly used as vibration-proof purpose for small fan and pipe duct and its static displacement is 5mm. It can stand the weight of 100kgf.

■ Usage

- ◆ Vibration-proofing for small fan, duct in line fan
- ◆ Vibration-proofing for ceilings of studio, acoustical laboratory, etc.

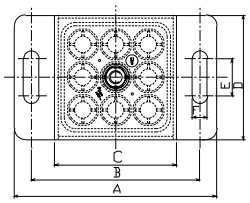
■ Dimension & Selection Guide

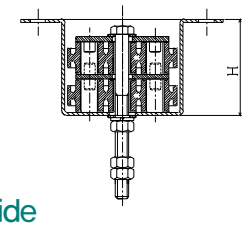
Type	Capacity (kgf)	Hardness (Hs)	Deflection (mm)	Dimension(mm)		
				A	B	H
RH30-30	50	60±5	3.5	30	11	18
RH30-40	100		5.0	42		28

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

RH40 Type Rubber Hanger (Deflection : 11mm)

※ The model name of VHM product has changed to RH40





■ Features

RH-40 type anti-vibration spring rubber hanger prevents the transfer of vibration generated from equipment and/or stress resulted from thermal expansion in pipes and ducts during operation. A high-elastic alignment product, SRP with combined features of anti-vibration rubber (multi-axis serviceability, high-frequency isolation, soundproofing and attenuation) and metal spring (low natural frequency) is inserted and the external robust, stable housing is made of stainless steel to prevent corrosion when installed outdoors.

■ Usage

- For high-efficient vibration control of jet fan, axial, machine rooms, pipes in air conditioning rooms and ducts
- For high-efficient vibration control of suspended ceiling deck system in, for example, acoustical laboratories and studios

■ Dimension & Selection Guide

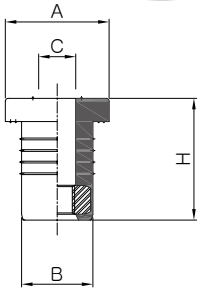
Type	Capacity (kgf)	Deflection (㎜)	Dimension(㎜)							
			A	B	C	D	E	F	H	Level Bolt
RH40-400	400	11	185	154	111	114	34	14	88	M20
RH40-600	600									
RH40-800	800									
RH40-1000	1000		240	210	166	170	34	14	88	M24
RH40-1200	1200									
RH40-1500	1500									
RH40-2000	2000									

(NOTE) The specification and data are subject to change without prior to for improvement of product performance and quality.

■ Specification

No.	Name of Components	Material	Standard
1	Middle Plate	STS 304	KS D 3503
2	SRP Mount	CR	KS M 6617
3	Cover Housing	STS 304	KS D 3503
4	Bottom Plate	STS 304	KS D 3503
5	Hanger Bolt/Nut	STS 304	KS B 3503

NBN Rubber Bushing Nut (Deflection : 3~8mm)



■ Features

It is used to install equipment that is too small to mount the vibration isolator, and control the vibration of equipment and/or device that causes micro-vibration after being fastened using Bolt and Nut. It is made of anti-vibration neoprene rubber, which seals the joint. Its natural frequency changes according to tightening torque, but it is about 12~15Hz on average. It maintains a vibration isolation efficiency of 67~81% and reduces about 9.5~14.4dB of vibration. (No. of revolution per minute: 1,800 RPM)

■ Usage

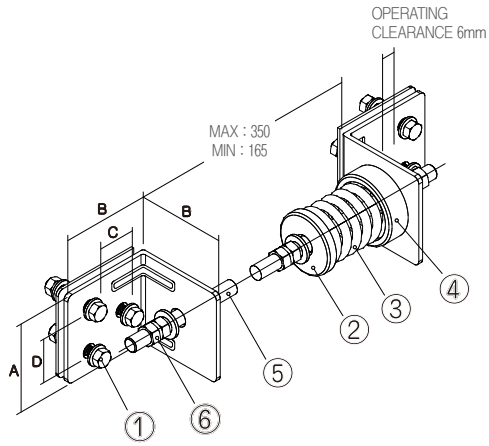
- Used to fix and control vibration of motors installed on small equipment
- Used to fix and control vibration of all kinds of pipes, ducts and construction materials
- Used to fix and control vibration of all kinds of guide signs/posts
- Used to fix and control vibration of all kinds of lighting
- Used to fix and control vibration of speakers connected to electronic/audio equipment

■ Dimension & Selection Guide

Type	Capadity (kgf)	Applied Diamete (kgf)	Hardness (Hs)	NUT	TORQUE (Kg.cm)	Dimension(mm)			
						A	B	C	H
NBN-M3	6	7~7.4	55±5	M3 x 0.5	3~5	9.5	6.9	3.3	12
NBN-M4	7	9~9.4		M4 x 0.7	4~6	11.9	8.9	4.3	15
NBN-M5	10	10~10.4		M5 x 0.8	5~8	14.9	9.9	5.3	18
NBN-M6	15	12.4~12.8		M6 x 1.0	8~10	17.9	12.3	6.4	21
NBN-M8	30	16.4~16.8		M8 x 1.25	10~15	23.9	16.3	8.4	27

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

NTR Thrust Restraint (Deflection : 25mm)



■ Features

NTR, which consists of steel housing, spring, CR type rubber and space rod, is a vibration control device designed to prevent the generation of reactionary force in the direction opposite to air flow when related equipment such as fan and ventilator runs. NTR is preset to 80% of the load capacity in the production stage and users can adjust it up to 6 mm when installing it. It should be installed next to the center of the direction in which the air flows through the duct. Plus, it is easy to distinguish one from another because the springs differ in color depending on their load capacity. In general, NTR is used only when the thrust is more than 5% of the weight of the equipment.

■ Usage

- Used to prevent thrust on the joint of fan part separating canvas
- Used to prevent thrust on ventilator(Airfoil, Sirocco, Axial, In-line, etc)

■ Specification

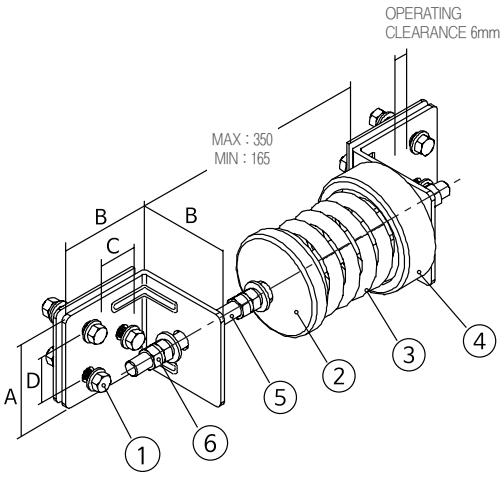
No.	Name of Components	Material	Standard
1	Housing	SS400	KS D 3503
2	Still Cap	SS400	KS D 3503
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Neoprene Cup	CR	KS M 6617
5	Threaded Rod	SS400	KS D 3503
6	Nut	SS400	KS B 1002

■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension(mm)				
					A	B	C	D	Space Rod
NTR-A-50	50	2	25	Red	70	84	40	40	M12 x 500
NTR-A-75	75	3		Black					
NTR-A-100	100	4		Blue					
NTR-B-150	150	6	25	Brown	70	84	40	40	M16 x 500
NTR-B-200	200	8		White					
NTR-B-300	300	12		Orange					
NTR-B-400	400	16		Pink					
NTR-B-500	500	20		Green					
NTR-B-600	600	24		Blue					
NTR-B-750	750	30		Black					
NTR-B-1000	1000	40		Yellow					

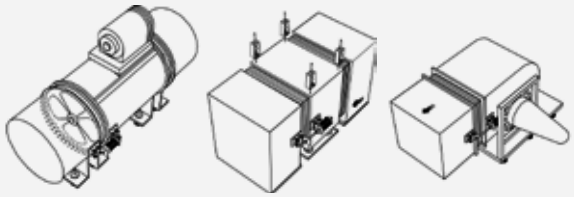
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

NTR2 Thrust Restraint (Deflection : 50mm)



■ Features

NTR, which consists of steel housing, spring, CR type rubber and space rod, is a vibration control device designed to prevent the generation of reactionary force in the direction opposite to air flow when related equipment such as fan and ventilator runs. NTR is preset to 80% of the load capacity in the production stage and users can adjust it up to 6 mm when installing it. It should be installed next to the center of the direction in which the air flows through the duct. Plus, it is easy to distinguish one from another because the springs differ in color depending on their load capacity. In general, NTR is used only when the thrust is more than 5% of the weight of the equipment.



■ Usage

- Used to prevent thrust on the joint of fan part separating canvas
- Used to prevent thrust on ventilator(Airfoil, Sirocco, Axial, In-line, etc)

■ Specification

No.	Name of Components	Material	Standard
1	Housing	SS400	KS D 3503
2	Still Cap	SS400	KS D 3503
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Neoprene Cup	CR	KS M 6617
5	Threaded Rod	SS400	KS D 3503
6	Nut	SS400	KS B 1002

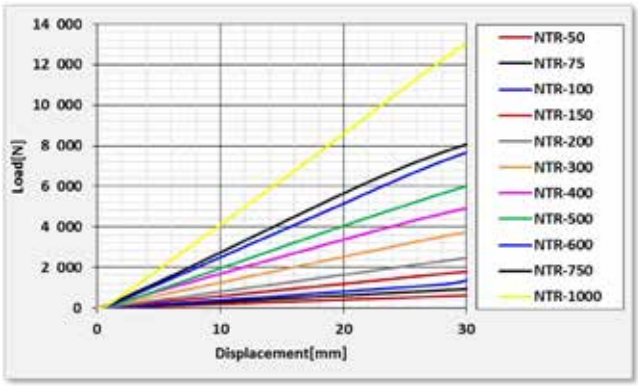
■ Dimension & Selection Guide

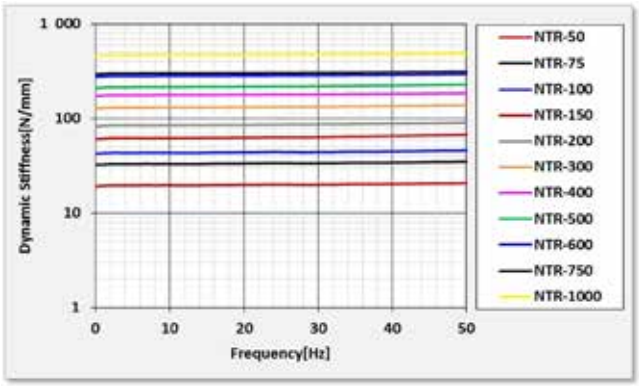
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension(mm)				
					A	B	C	H	Space Rod
NTR2-50	50	1	50	Red	100	103	40	50	M16 x 500
NTR2-75	75	1.5		Black					
NTR2-100	100	2		Blue					
NTR2-150	150	3		Brown					
NTR2-200	200	4		White					
NTR2-300	300	6		Orange					
NTR2-400	400	8		Pink					
NTR2-500	500	10		Green					
NTR2-600	600	12		Blue					
NTR2-750	750	15		Black					
NTR2-1000	1000	20		Yellow					

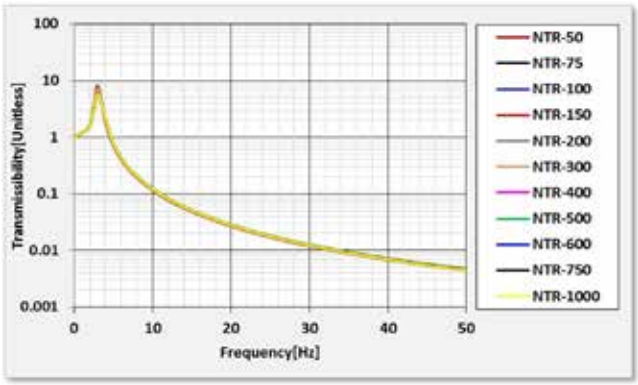
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

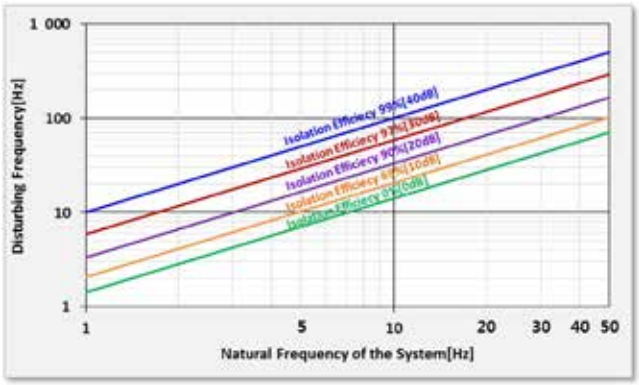
NTR/NTR2 Thrust Restraint

■ NTR Test Data

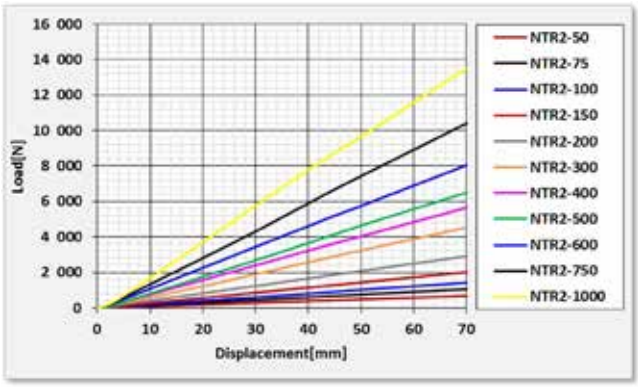


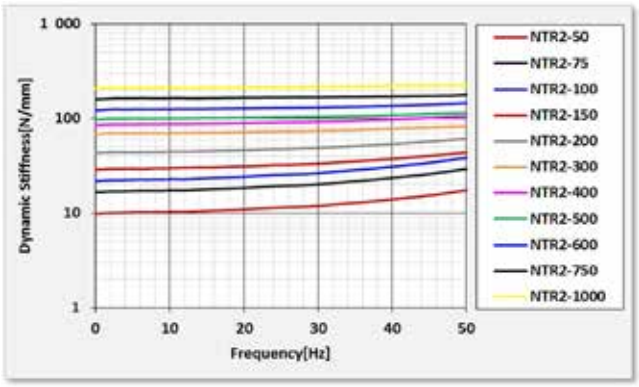


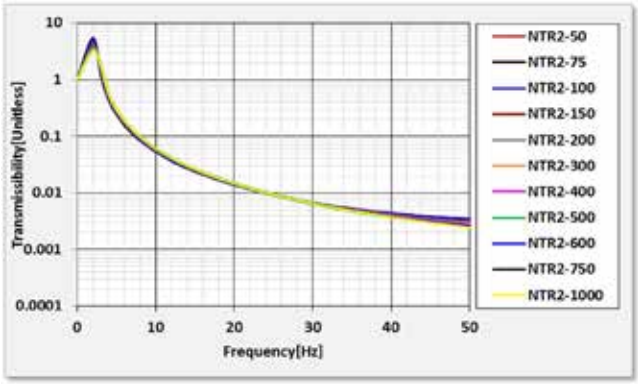


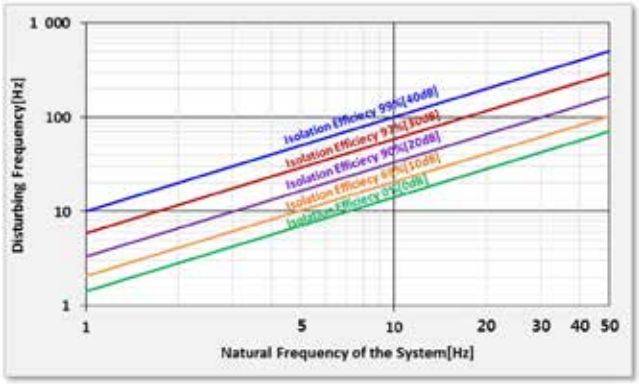


■ NTR2 Test Data

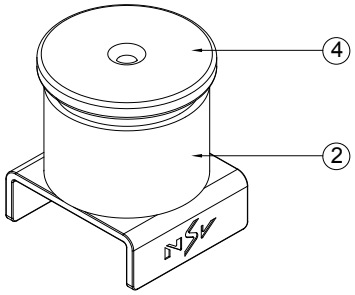


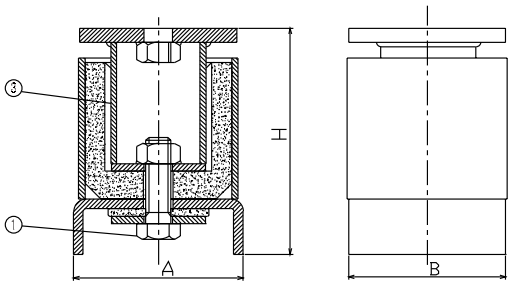






RPA Pipe Anchor & Guide (Deflection : 3~9mm)





■ Features

With a highly-elastic resilent element inside the steel housing, the product is used as a guide to reduce the stress generated by thermal expansion between floors during the expansion and contraction of vertical pipes and as an anchor to isolate structure-borne noise in both vertical and horizontal directions that has resulted from changes in the fluid pressure. Though the anchor and guide can reduce the amount of noise transferred, they are not elastic enough to isolate the vibration. In such a case, the spring ioslated riser system is used to isolate noise as well as vibration. To use the product as a guide, the SRM anti-vibration rubber besides RPA type anchor can be used.

■ Usage

For the anchor and guide used to isolate structure-borne noise from vertical pipe.

■ Specification

No.	Name of Components	Material	Standard
1	Connection Bolt	SS400	KS B 1002
2	Lower Housing	SS400	KS D 3503
3	Resilient Element	CR	KS M 6617
4	Upper Housing	SPCD	KS D 3512

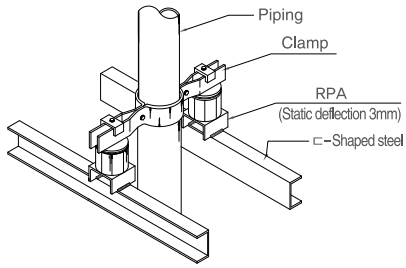
■ Dimension & Selection Guide

Type	Capacity (kgf)	Deflection (mm)	Dimension(mm)			
			A	B	H	Setting Bolt
RPA-75	250	3	83	75	97	M12
RPA-200	1500	5	108	100	122	M16
RPA-350	6000	7	150	140	162	M16
RPA-600	14000	7	230	216	230	M20
RPA-800	22000	9	280	270	263	M24

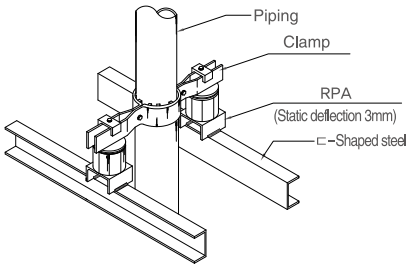
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ Installation Features

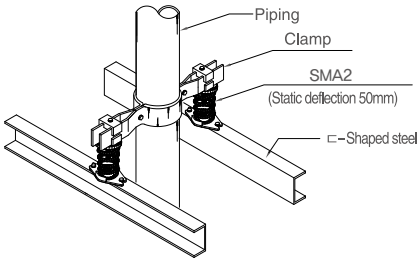
RPA Pipe Anchor & Guide (Deflection : 3~9mm)



Detailed drawing of pipe anchor

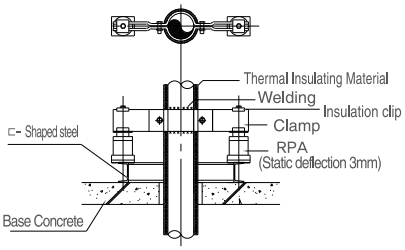


Detailed drawing of pipe guide

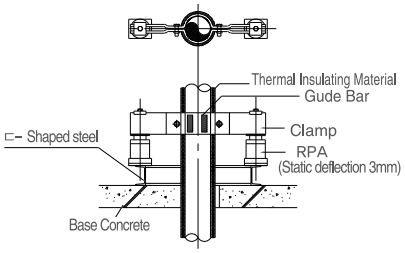


Detailed drawing of pipe spring

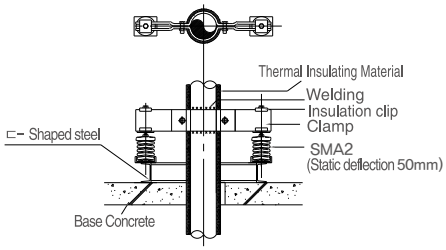
INSTALLATION DETAIL



Detailed drawing of pipe anchor



Detailed drawing of pipe guide



Detailed drawing of pipe spring

〈 Note 〉
ⓐ: STRAIGHT PIPE: The length between a Guide and Guide D(m)
ⓑ: OFFSET PIPE: The length between a Anchor and Guide D(m)
ⓒ: The length between a Guide and Expansion Joint D(m)
ⓓ: The length between the first Guide and the second Guide D(m)

■ RPA Anchor & Guide Selection

Pipe diameter (A)	Anchor Recommendation Size				GUIDE Recommendation Size							
	EXPANSION THRUST		OFFSET THRUST		GUIDE SIZE	STRAIGHT PIPE	OFFSET PIPE	EXPANSION JOINT				
	12Kg/ cm² 이하	12~24Kg/ cm²	OFFSET(m)	Size		ⓐ	ⓑ	ⓒ	ⓓ	Below12Kg/ cm²	12~24Kg/ cm²
25	RPA 75	RPA 75	0.20	RPA 75	RPA 75	② 12	① 7	0.2 ①	0.6	3.6 ①	3.6
32	75	75	0.25	75	75	12	7	0.2	0.6	3.6	3.6
40	75	75	0.27	75	75	12	7	0.25	0.9	3.6	3.6
50	75	75	0.29	75	75	② 12	② 7	0.25 ②	0.9	3.6 ②	3.6
65	RPA 75	RPA 200	0.33	RPA 75	RPA 75	12	9	0.3	1.0	3.6	3.6
80	75	200	0.37	75	75	12	11	0.3	1.0	5.1	4.2
100	200	200	0.42	75	75	12	11	0.4	1.4	7.5	5.7
125	200	200	0.45	75	75	② 15	② 11	0.6 ②	2.0	9.0 ②	6.9
150	RPA 200	RPA 350	0.50	RPA 200	RPA 200	15	11	0.6	2.0	11.1	8.1
200	350	350	0.56	200	200	15	15	0.76	2.8	13.5	9.9
250	350	350	0.64	200	200	18	18	1.0	3.6	17.4	12.6
300	350	600	0.69	350	200	② 22	22 ②	1.2	4.3	18.0 ②	14.4
350	RPA 350	RPA 600	0.72	RPA 350	RPA 350	26	26	1.4 ②	5.0	21.0	15.3
400	350	600	0.78	350	350	26	26	1.6	5.7	23.0	16.8
450	600	800	0.83	350	350	26	26	1.8	6.4	26.0	18.3
500	600	800	0.87	350	350	② 36	26 ②	2.0 ②	7.1	27.0 ②	19.5
600	RPA 800		–	RPA 600	RPA 350	36	36	2.4	8.5	31.0	22.5
650	800	Special	–	600	600	36	36	3.0	10.0	32.0	25.5
700	800	type	–	600	600	36	36	3.0	10.0	32.0	25.5
750	800		–	600	600	② 36	36 ②	3.0 ①	10.0	32.0 ①	25.5

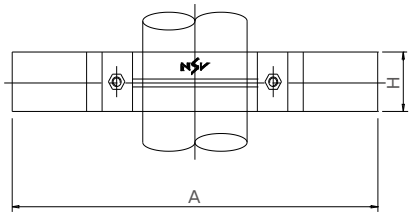
CLAMP Riser Pipe Clamp

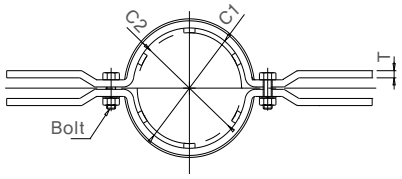
■ STEEL/STS CLAMP

▶ Steel/STS Guide

▶ Steel/Anchor

▶ STS Anchor





■ CARBON STEEL CLAMP ANCHOR SPRING

Type	A	C1	T	H	Bolt
Φ25	400	Φ34.0	4.5	38	M10
Φ32		Φ42.7			
Φ40		Φ48.6			
Φ50	450	Φ60.5	6	50	M10
Φ65		Φ76.3			
Φ80		Φ89.1			
Φ100	550	Φ114.3	9	75	M12
Φ125		Φ139.8			
Φ150		Φ165.2			
Φ200	650	Φ216.3	9	75	M12
Φ250		Φ267.4		90	
Φ300	850	Φ318.5	9	90	M12
Φ350		Φ355.6			
Φ400	1000	Φ406.4	12	100	M22
Φ600	1200	Φ609.6	19	125	M24
Φ800	1450	Φ812.8	25	200	M36

■ CARBON STEEL CLAMP GUIDE

Type	A	C1	T	H	Bolt	Guide Bar
Φ25	400	Φ43.0	4.5	38	M10	20 x 38 x 4.5T(4EA)
Φ32		Φ51.7				20 x 38 x 4.5T(4EA)
Φ40		Φ57.6				20 x 38 x 4.5T(4EA)
Φ50	450	Φ69.5	6	50	M10	20 x 50 x 4.5T(4EA)
Φ65		Φ85.3				20 x 50 x 4.5T(4EA)
Φ80		Φ98.1				20 x 50 x 4.5T(4EA)
Φ100	550	Φ126.3	9	75	M12	20 x 75 x 6T(6EA)
Φ125		Φ141.8				20 x 75 x 6T(6EA)
Φ150		Φ177.2				20 x 75 x 6T(6EA)
Φ200	650	Φ228.3	9	75	M12	20 x 90 x 6T(8EA)
Φ250		Φ279.4		90		20 x 90 x 6T(8EA)
Φ300	850	Φ330.5	9	90	M12	20 x 90 x 6T(8EA)
Φ350		Φ367.6				20 x 90 x 6T(8EA)
Φ400	1000	Φ426.4	12	100	M22	40 x 95 x 10T(8EA)
Φ600	1200	Φ629.6	19	125	M24	40 x 120 x 10T(10EA)
Φ800	1450	Φ832.8	25	200	M36	40 x 198 x 12T(12EA)

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ COPPER CLAMP

▶ Guide

▶ Anchor

■ COPPER CLAMP ANCHOR, SPRING

Type	A	C1	T	H	Bolt
Φ25	400	Φ28.58	4.5	38	M10
Φ32		Φ34.92			M10
Φ40		Φ41.28			M10
Φ50	450	Φ53.98	6	50	M10
Φ65		Φ66.68			M10
Φ80		Φ79.38			M10
Φ100	550	Φ104.78	8	75	M12
Φ125		Φ130.18			M12
Φ150		Φ155.58			M12
Φ200	650	Φ206.38	8	75	M12

■ Installation Features

CLAMP Riser Pipe Clamp

■ CLAMPING Installation Features

COPPER PIPE

WITH ANCHOR(Before welding)

WITH SPRING(Before welding)

WITH GUIDE

WITH SPRING RUBBER MOUNT(Before welding)

CARBON STEEL/STS PIPE

WITH ANCHOR(Before welding)

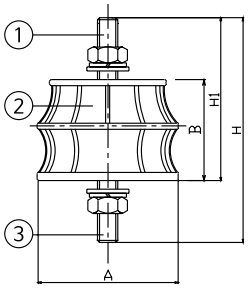
WITH SPRING(Before welding)

WITH GUIDE

WITH SPRING RUBBER MOUNT(Before welding)

VB-1000 Rubber Mount (Deflection : 5.0~9.0mm)

※ The model name of VB product has changed to VB-1000



■ Features

As a Bobbin (cylindrical) mount, it has the reinforcing of a steel plate on the top and bottom. It is excellent in reducing vibration and structure- borne noise resulting from impact. It is made of neoprene synthetic rubber, having outstanding oil and ozone resistance, and with the fixing rod on the top and bottom, it can be easily fastened using a nut.

■ Usage

- ◆ For small pumps, small ventilators, package air conditioning systems and plant rooms
- ◆ For all kinds of industrial machines and equipment

■ Specification

No.	Name of Components	Material	Standard
1	Bolt(upper)	SS400	KS B 1002
2	Rubber Mount	CR	KS M 6617
3	Bolt(lower)	SS400	KS B 1002

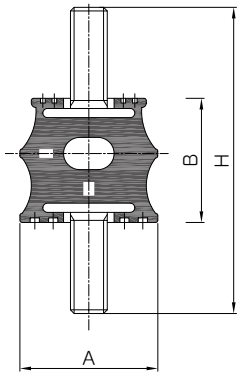
■ Dimension & Selection Guide

Type	Capacity(kgf)	Hardness(Hs)	Deflection(mm)	Dimension(mm)				
				A	B	H	H1	Bolt
VB-1040	50	60±5	5.0	40	35	86	60	M8 x 30
VB-1050	70			50	40	92	65	M8 x 30
VB-1060	100			60	40	101	70	M10 x 35
VB-1070	180		7.0	70	50	111	80	M10 x 35
VB-1080	300			80	50	111	80	M10 x 35
VB-1100	500		9.0	100	55	124	90	M12 x 45
VB-1120	800			120	55	132	94	M16 x 50
VB-1150	1000			150	60	150	105	M16 x 55

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VB-1030H Rubber Oval Mount (Deflection : 5.0~9.0mm)

※ The model name of VBO-30 product has changed to VB-1030H



■ Features

The VB-1030H is a rubber mount with an increased static deflection and Oval hole at the center to maintain the stable operation of the equipment against horizontal vibration. It has the hardness of 55±5 and with the M8 bolt, it can load up to 25kgf.

■ Usage

- ◆ For small pumps and small ventilators
- ◆ For small motors and measurement equipment

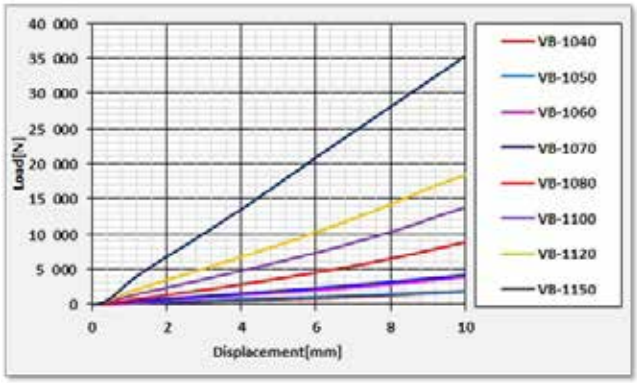
■ Dimension & Selection Guide

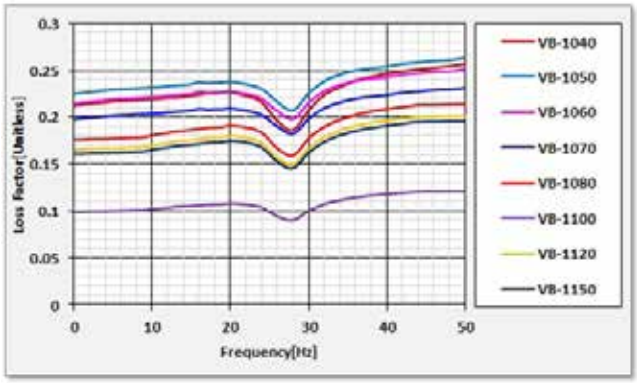
Type	Capacity(kgf)	Hardness(Hs)	Deflection(mm)	Dimension(mm)			
				A	B	H	Bolt
VB-1030H	30	60±5	5	30	27	66	M8 x 30

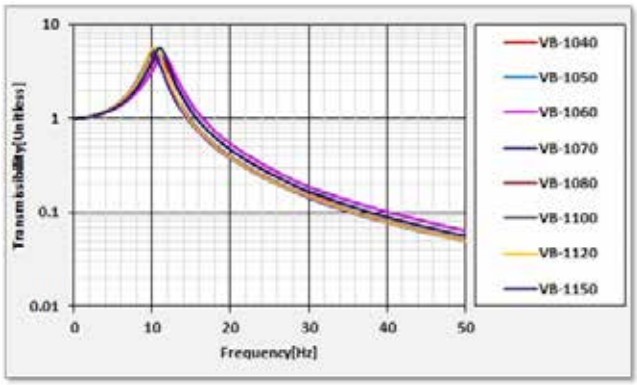
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

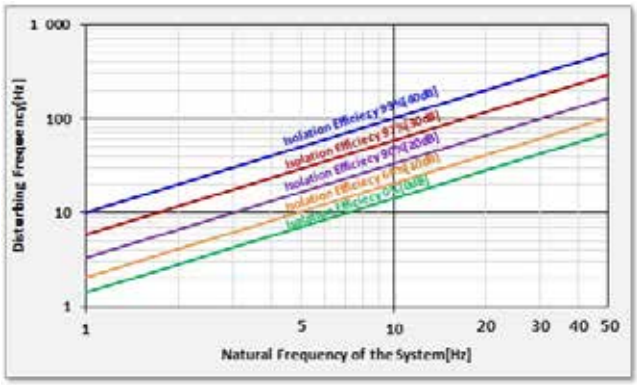
VB-1000/VB-1030H Rubber Mount

■ VB-1000 Test Data

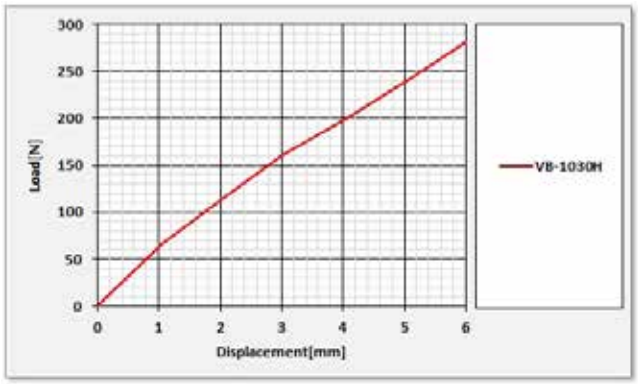


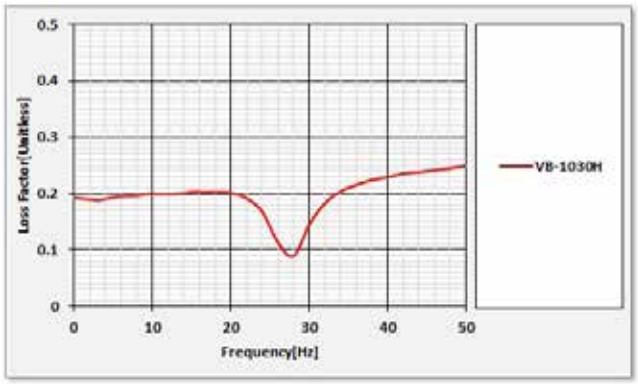


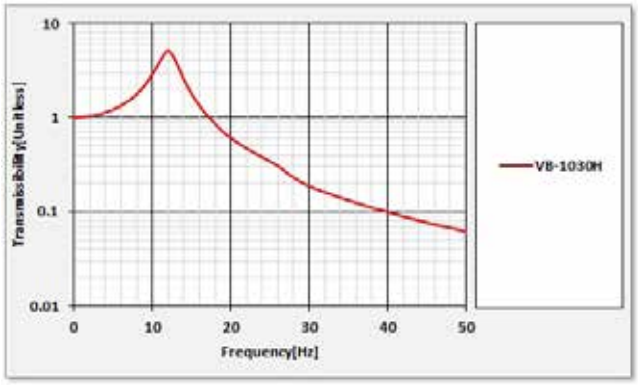


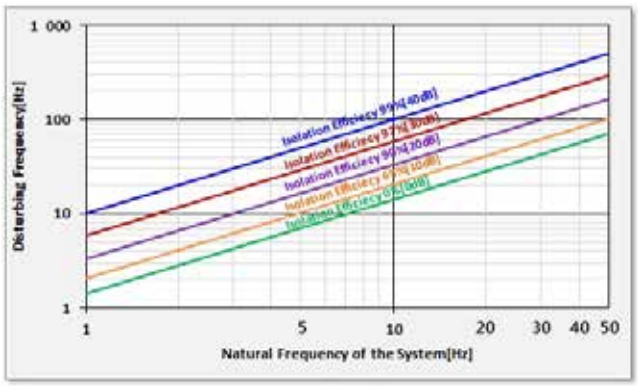


■ VB-1030H Test Data



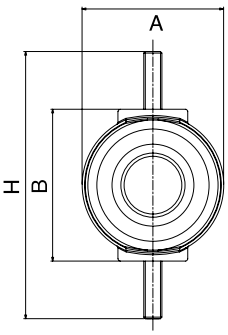






VB-2000 Rubber Mount (Deflection : 11~20mm)

※ The model name of VO product has changed to VB-2000



■ Features

For VB-2000 rubber mount product, Oval hole is inserted into its center, to increase static displacement for light load, and to maintain stable transformation against horizontal vibration. Hardness of rubber mount is 60±5, and is manufactured using neoprene synthetic rubber with excellent oil resistance and ozone-proof features.

■ Usage

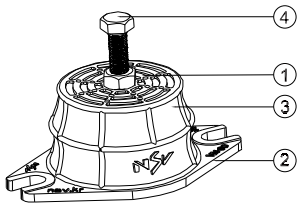
- ◆ Mini-pump, mini air blower dust protection
- ◆ Small sized motor and measuring equipment dust protection

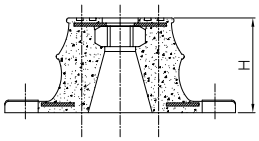
■ Dimension & Selection Guide

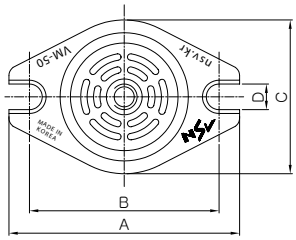
Type	Capacity(kgf)	Spring Constant(kgf/mm)	Deflection(mm)	Dimension(mm)			
				A	B	H	Level Bolt
VB-2025	10	0.9	11	25	26	49	M5 x 15
VB-2035	16.7	1	17	34	38	61	M5 x 15
VB-2045	33.9	1.7	20	44	50	85	M6 x 20

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VM-1000 Rubber Mount (Deflection : 6~8mm)







■ Features

A VM-1000 mount is light, small and easy to install, so it can be used in high displacements. Plus, it has a wide application because it is designed to ensure structural stability. With a fixing nut inside the center of the neoprene rubber mount and steel plate on the top and bottom, it can be securely anchored to the ground.

■ Specification

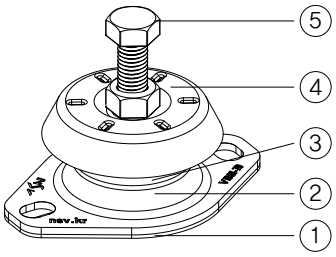
No.	Name of Components	Material	Standard
1	Upper Housing	SS400	KS D 3503
2	Lower Plate	SS400	KS D 3503
3	Body	CR	KS M 6617
4	Level Bolt	SS400	KS B 1002

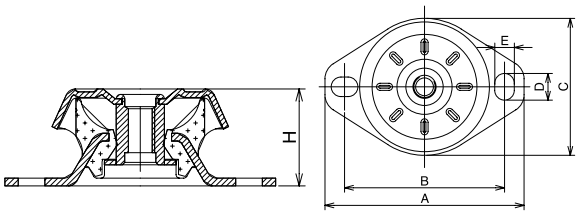
■ Dimension & Selection Guide

Type	Capacity(kgf)	Hardness(Hs)	Deflection(mm)	Weight(kg)	Dimension(mm)					
					A	B	C	D	H	Level Bolt
VM-1040	60	60±5	6	0.18	75	60	46	8	35	M8
VM-1050	80		6	0.21	90	74	60	10	40	M10
VM-1060	120		6	0.31	113	90	69	10	45	M10
VM-1070	150		6	0.34	130	105	81	12	50	M10
VM-1080	300		8	0.42	130	110	90	12	50	M10
VM-1100	600		8	1.78	169	140	115	13	60	M12

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VM-2000 Rubber Mount(Deflection : 6mm)





■ Features

VM-2000 mount is a vibration isolator to easily control multi-axial vibration. Its inside is made of neoprene rubber to control excessive movement. At the center of rubber mounts there is a solid fixation nut, and the body was made of steel plate to fix firmly to the floor.

■ Specification

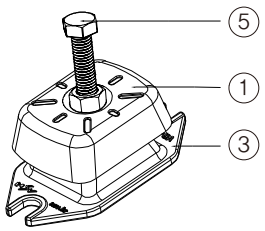
No.	Name of Components	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS400	KS D 3503
3	Body	CR	KS M 6617
4	Upper Housing	SS400	KS D 3503
5	Level Bolt	SS400	KS B 1002

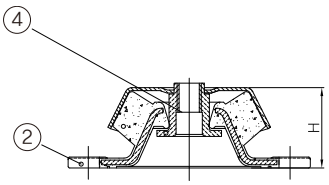
■ Dimension & Selection Guide

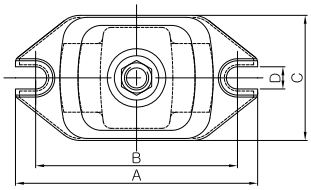
Type	Capacity (kgf)	Hardness (Hs)	Deflection (mm)	Weight (kg)	Dimension(mm)						
					A	B	C	D	E	H	Level Bolt
VM-2070	100	60±5	6	0.34	112	90	77	15	11	40	M12
VM-2080	300			0.73	135	110	90	17	13	45	M12
VM-2100	500			1.22	164	135	105	21	16	50	M16
VM-2120	1000			1.56	190	161	128	21	16	55	M16
VM-2150	1500			2.18	200	160	150	110	18	60	M16
VM-2180	2000			2.55	228	186	184	142	18	70	M16

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VM-3000 Rubber Mount(Deflection : 6mm)







■ Features

A VM-3000 mount is capable of controlling vibration in multi-axis directions. The top stainless steel cap prevents a distortion of the vibration isolator by oil and water, and moreover, neoprene rubber is used inside to control excessive movement. Plus, it can be firmly fixed to the ground with the fixing nut inside the center of the neoprene rubber mount and steel plate on top and bottom.

■ Specification

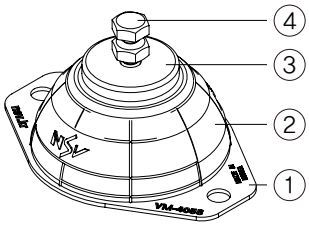
No.	Name of Components	Material	Standard
1	Upper Housing	STS 304	KS D 3698
2	Lower Plate	SS400	KS D 3503
3	Body (Rubber)	CR	KS M 6617
4	Fix Nut	SS400	KS D 3503
5	Lever Bolt	SS400	KS B 1002

■ Dimension & Selection Guide

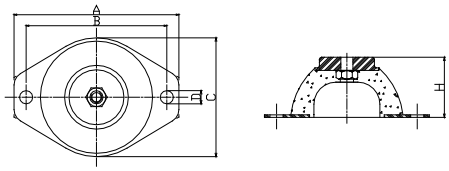
Type	Capacity(kgf)	Hardness(Hs)	Weight(kg)	Dimension(mm)					
				A	B	C	D	H	Level Bolt
VM-3060	100	60±5	0.24	120	100	62	11	41	M12
VM-3070	300		0.72	150	126	78	13	50	M12
VM-3090	500		1.80	180	150	94	16	60	M16
VM-3110	700		2.45	226	189	118	19	65	M16

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

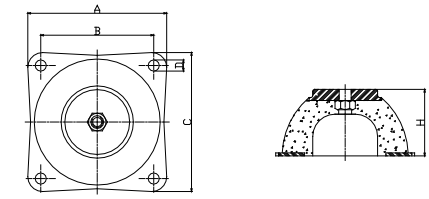
VM-4000 Rubber Mount (Deflection : 6~16mm)



VM-4053
VM-4058



VM-4078
VM-4100



■ Features

VM-4000 mounts is specifically designde to give large deflection at low loads. Although the mount design allows high deflection, the mountings are compact in weigh and easy to install. Provides passive vibration isolation on electronic instruments, measuring equipment and test cells.

■ Specification

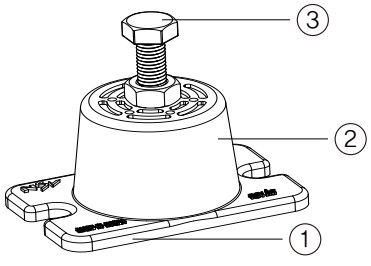
No.	Name of Components	Material	Standard
1	Lower Plate	SS400	KS D 3503
2	Body	CR	KS M 6617
3	Upper Plate	SS400	KS D 3503
4	Level Bolt	SS400	KS B 1002

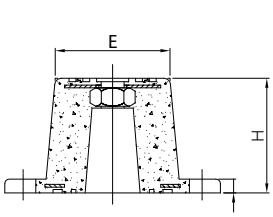
■ Dimension & Selection Guide

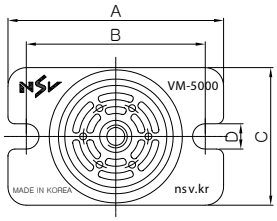
Type	Capacity (kgf)	Hardness (Hs)	Weight (kg)	Dimension(mm)					
				A	B	C	D	H	Level Bolt
VM-4053	80	45	6	138	118	99	11	46.7	M12
VM-4058	100		9	150	128	108	12	54.7	M12
VM-4078	300		12	150	122	150	12	71.8	M14
VM-4100	500		16	200	160	200	13	93.8	M18

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VM-5000 Rubber Mount (Deflection : 15mm)







■ Features

It is a mount with top and bottom reinforcing plates made of CR (neoprene) type synthetic rubber having excellent oil and ozone resistance. A round-shaped rib line is on the top and bottom of the mount to prevent slipping from the equipment and the guide hole for anchoring is on the base plate for easier installation. It is simple, but has the largest static deflection, which makes it the most efficient anti-vibration mount with a wide range of applications.

■ Specification

No.	Name of Components	Material	Standard
1	Base Plate	SS400	KS D 3503
		CR	KS M 6617
2	Body	CR	KS M 6617
3	Level Bolt	SS400	KS B 1002

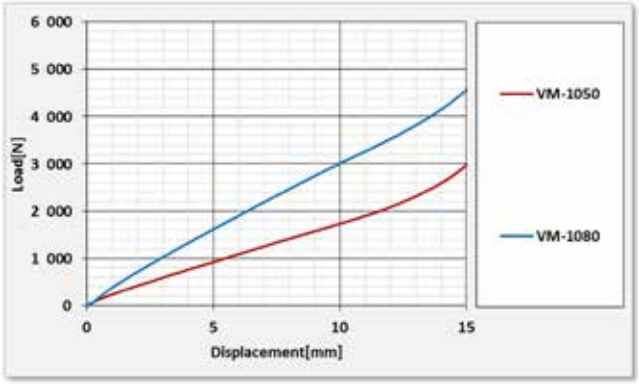
■ Dimension & Selection Guide

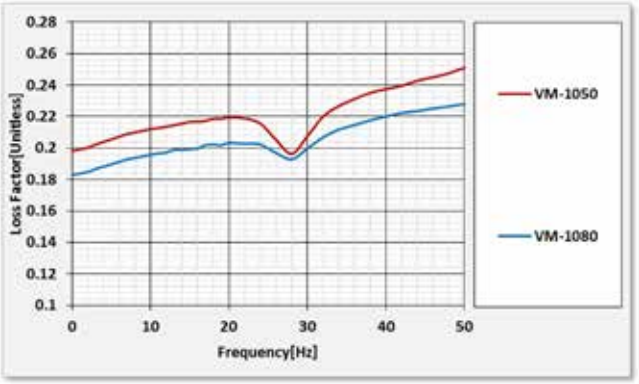
Type	Capacity (kgf)	Hardness (Hs)	Spring Constant (kgf/mm)	Weight (kg)	Dimension(mm)						
					A	B	C	D	E	H	Level Bolt
VM-5050	300	60±5	20	0.26	94	78	60	11	50	46	M10
VM-5065	500		34	0.52	122	102	82	13	66	60	M12
VM-5085	1000		67	0.84	150	128	104	13	87	65	M12
VM-5115	2000		133	1.54	188	164	130	14	114	68	M12

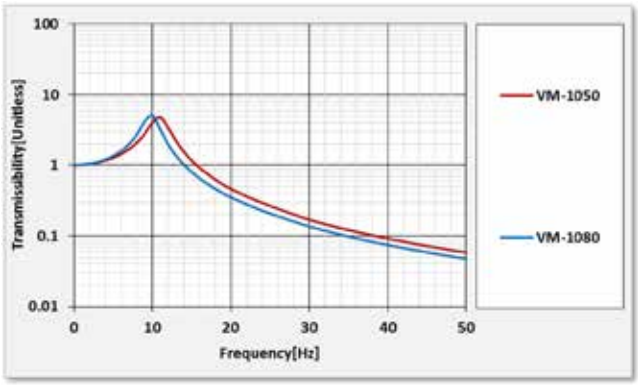
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

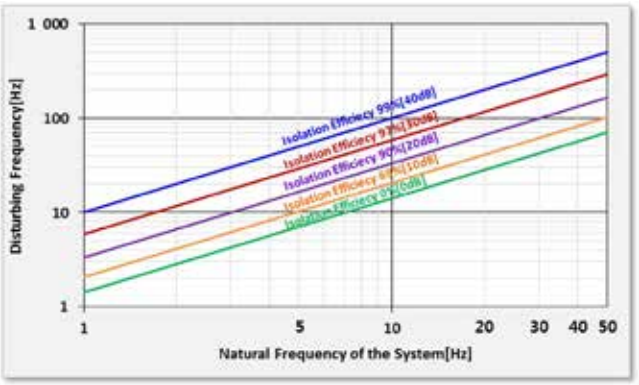
VM-1000/VM-3000 Rubber Mount

■ VM-1000 Test Data









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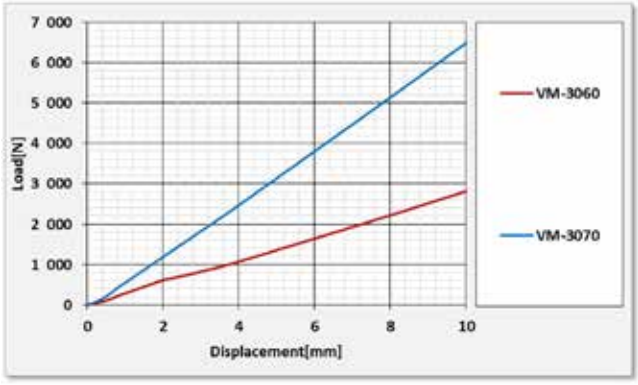
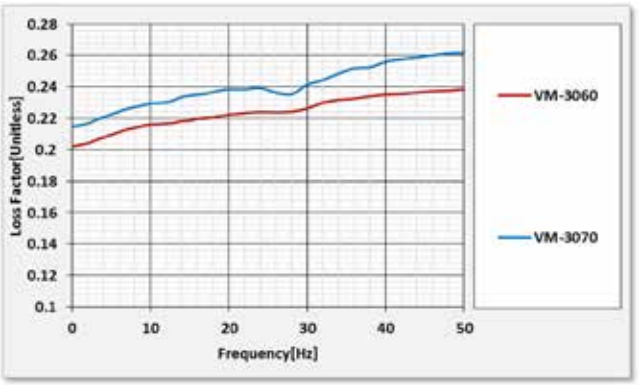
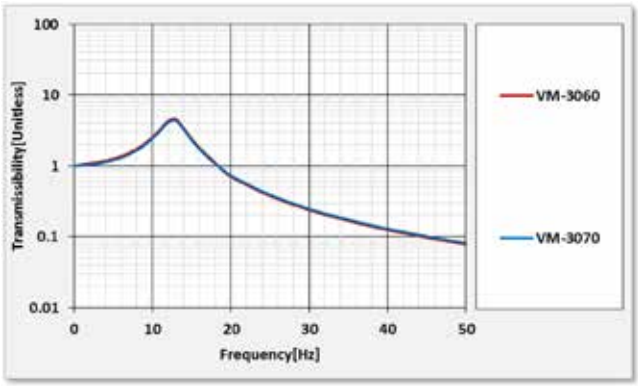
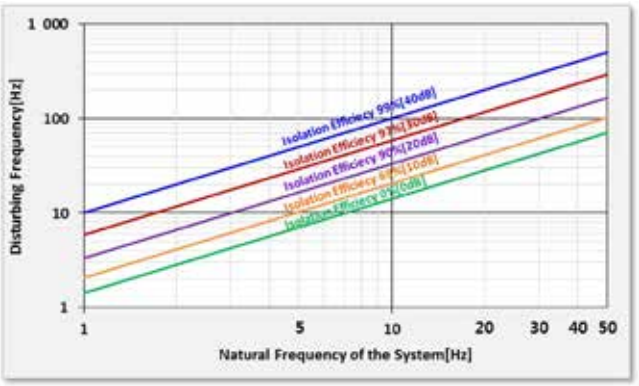


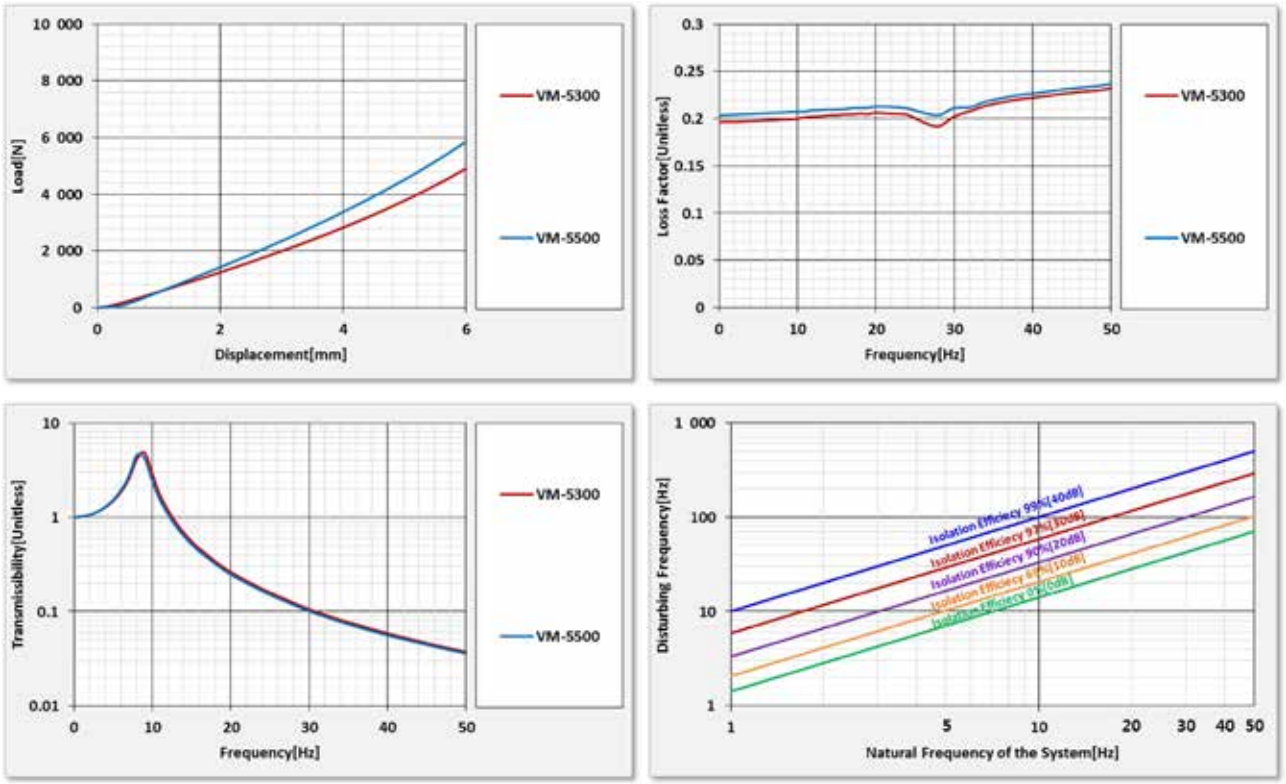






VM-5000 Rubber Mount

■ VM-5000 Test Data



■ Explanation(Commonness)

1. Vibration Transmissibility(T_r)
   Vibration Transmissibility is the amplitude ratio of Output to Input.

$$T_r = \frac{Output\ Amplitude}{Input\ Amplitude} = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2}, \eta = \frac{Disturbing\ Frequency\ of\ the\ equipment}{Natural\ Frequency\ of\ the\ Isolator(\ Damping(c) = 0\ )}$$

2. Natural Frequency(F_n) of Vibration Isolation System
   The mass and spring stiffness dictate a natural frequency of the system.

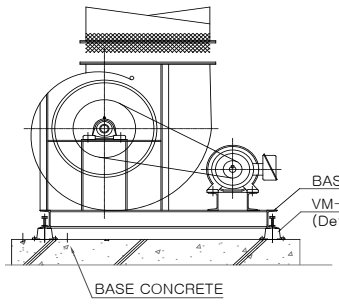
$$F_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

3. Isolation Efficency(E)
   Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$
   ex) Disturbing Frequency of the equipment=100 Hz,
   Natural Frequency of the isolator=10Hz

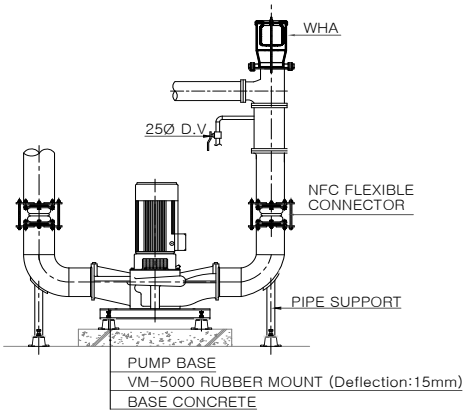
$$T_r = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2} = \sqrt{\left(\frac{1}{1-\left(\frac{100}{10}\right)^2}\right)^2} = 0.101 \qquad E = 100(1 - T_r) = 100(1-0.101)=99(\%)$$

■ Installation Features

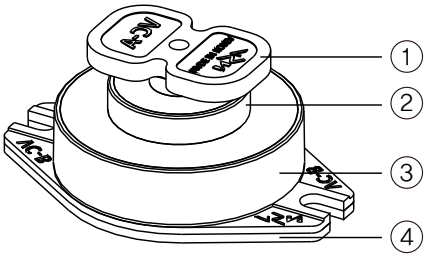
AIR FOIL FAN▶

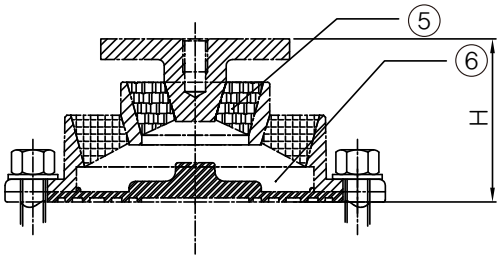


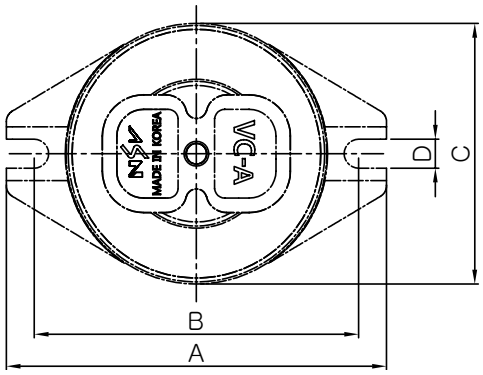
IN LINE PUMP▶



VC Conical Mount (Deflection : 15mm)







■ Features

The VC conical mount is a special vibration isolator having lower natural frequency (4.5 Hz) than the common rubber mount. Polyurethane or special synthetic neoprene rubber is inside VC conical mount, which makes it highly efficient, even in a low-frequency area. The anti-vibration pad is made of neoprene and is attached on the top and bottom of the contact surfaces to prevent structure-borne from passing through the bottom of the equipment when it touches steel and/or concrete. Plus, it is an omnidirectional vibration isolator, enabling stable operation of the equipment.

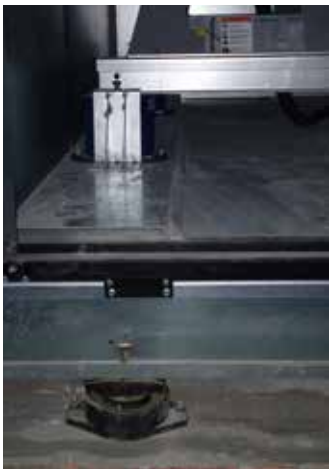
■ Usage

- For pumps, refrigerators, compressors and power generators
- For ventilators and air conditioning units
- For cooling towels
- For equipment having a large horizontal reaction

■ Specification

No.	Name of Components	Material	Standard
1	Upper Housing	GC	KS D 4301
2	Middle Housing	GC	KS D 4301
3	Lower Housing	GC	KS D 4301
4	Upper Rubber	CR	KS M 6617
5	Elastomer#1	PU or CR	KS M 6617
6	Elastomer#2	PU or CR	KS M 6617

■ Installation Features



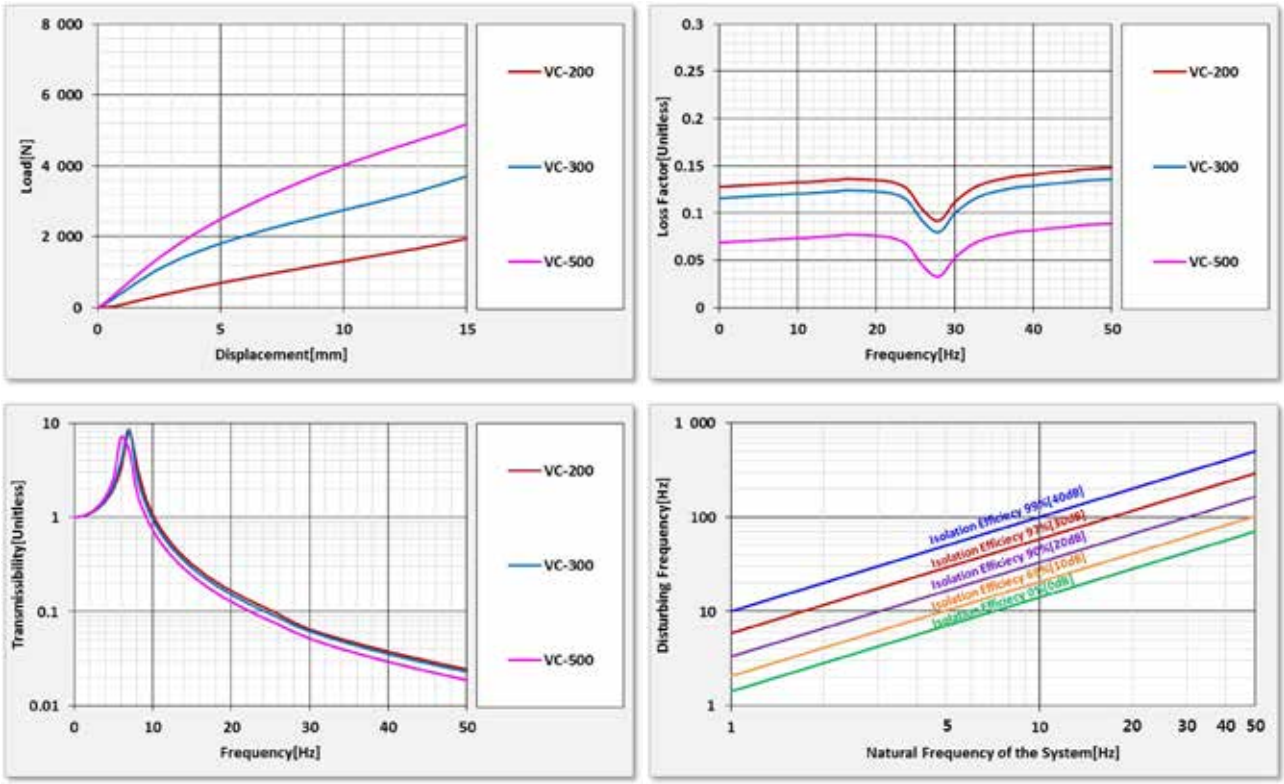
■ Dimension & Selection Guide

Type	Capacity (kgf)	Hardness (Hs)	Weight (kg)	Color	Dimension(mm)					
					A	B	C	D	H	Level bolt
VC-200	200	70 / 60	0.9	Yellow	184	157	127	14	79	M12
VC-300	300	80 / 70	1.0	Blue						
VC-500	500	85 / 75	1.0	Red						

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VC Conical Mount (Deflection : 15mm)

■ VC Test Data



■ Explanation(Commonness)

1. Vibration Transmissibility(T_r)
   Vibration Transmissibility is the amplitude ratio of Output to Input.

$$T_r = \frac{Output\ Amplitude}{Input\ Amplitude} = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2},\ \eta = \frac{Disturbing\ Frequency\ of\ the\ equipment}{Natural\ Frequency\ of\ the\ Isolator(\ Damping(c) = 0\ )}$$

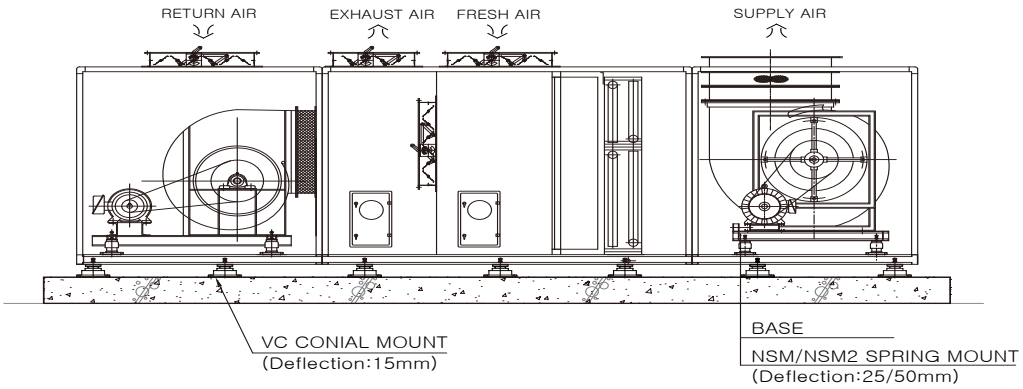
2. Natural Frequency(F_n) of Vibration Isolation System
   The mass and spring stiffness dictate a natural frequency of the system.

$$F_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

3. Isolation Efficency(E)
   Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$
   ex) Disturbing Frequency of the equipment=100 Hz,
   Natural Frequency of the isolator=10Hz

$$T_r = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2} = \sqrt{\left(\frac{1}{1-\left(\frac{100}{10}\right)^2}\right)^2} = 0.101 \qquad E = 100(1 - T_r) = 100(1-0.101)=99(\%)$$

■ Installation Features

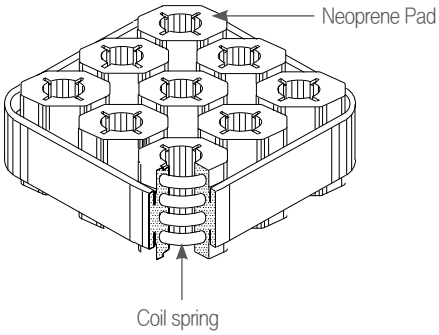


HORIZONTAL AIR CONDITIONER ▶

SRP Spring Rubber Pad (Deflection : 5.5~7mm)

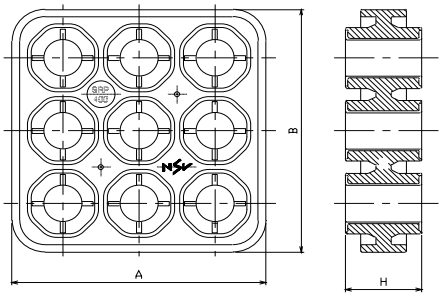
■ Features

It is a highly-efficient product that provides 3-4 times higher vibration isolation efficiency than the conventional rubber pad by using the metal spring's low natural frequency and all of the advantages of anti-vibration rubber, such as multi-axis pavement, high frequency and noise isolation effects. By lowering its center of gravity as low as possible, the load can be evenly distributed on the pad.



■ Usage

- For facilities and equipment (PUMP, FAN, AHU)
- For industrial machines (Press, Shearing Machine)
- For horizontal pipes
- For vertical pipes Anchor and Guide
- For all kinds of equipment installed on a solid base



■ Specification

No.	Name of Components	Material	Standard
1	Rubber Pad	CR	KS M 6617
2	Coil Spring	SUP9	KS B 2402

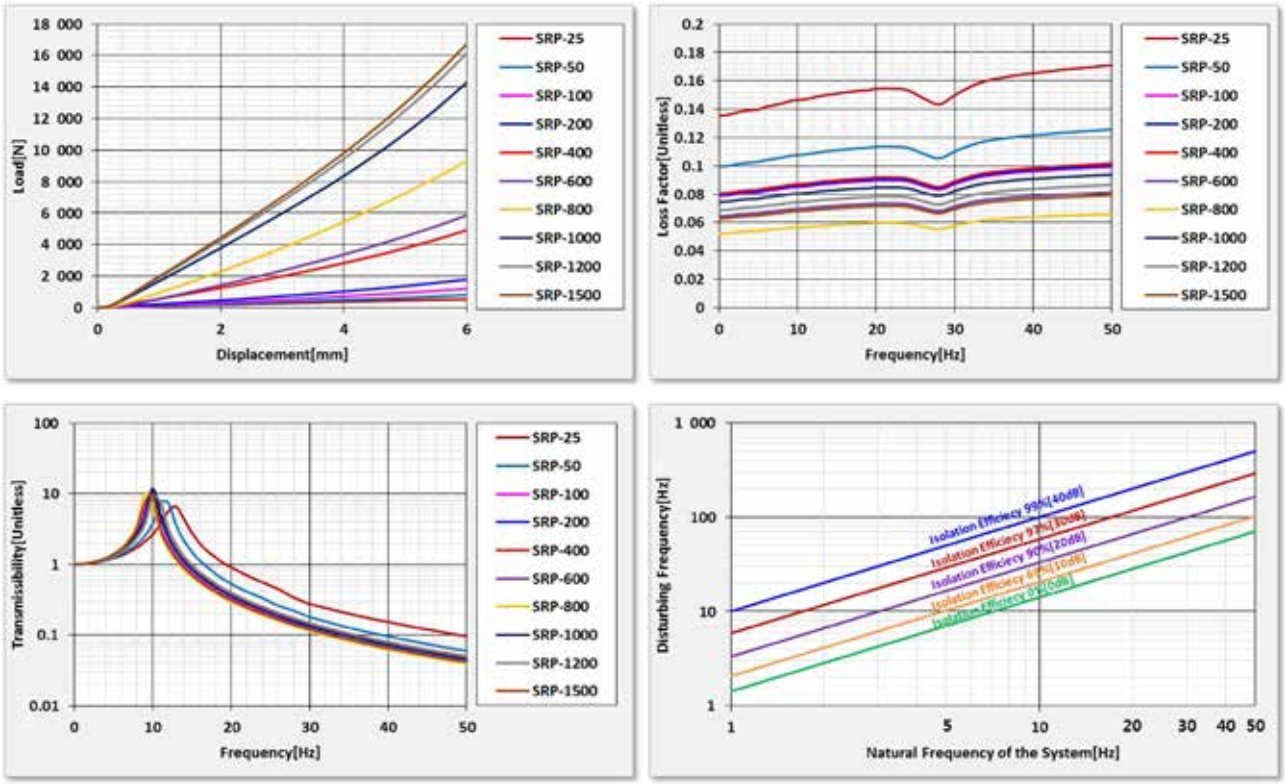
■ Dimension & Selection Guide

Type	Capacity (kgf)	Hardness (Hs)	Deflection (mm)	Weight (kg)	Dimension(mm)		
					A	B	H
SRP-25	25	40±5	5.5	0.02	57	71	19
SRP-50	50			0.04			
SRP-100	100			0.10	60	74	30
SRP-200	200			0.12			
SRP-400	400			0.32	100	100	30
SRP-600	600			0.33			
SRP-800	800			0.38			
SRP-1000	1000			0.84	154	118	30
SRP-1200	1200			0.88			
SRP-1500	1500			0.88			
SRP-2000	2000			0.86			
SRP-2500	2500		7.0	0.92	190	118	30
SRP-3000	3000			0.96			

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

SRP Spring Rubber Pad (Deflection : 5.5~7mm)

■ SRP Test Data



■ Explanation(Commonness)

1. Vibration Transmissibility(T_r)
   Vibration Transmissibility is the amplitude ratio of Output to Input.

$$T_r = \frac{Output\ Amplitude}{Input\ Amplitude} = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2}, \eta = \frac{Disturbing\ Frequency\ of\ the\ equipment}{Natural\ Frequency\ of\ the\ Isolator(\ Damping(c) = 0\ )}$$

2. Natural Frequency(F_n) of Vibration Isolation System
   The mass and spring stiffness dictate a natural frequency of the system.

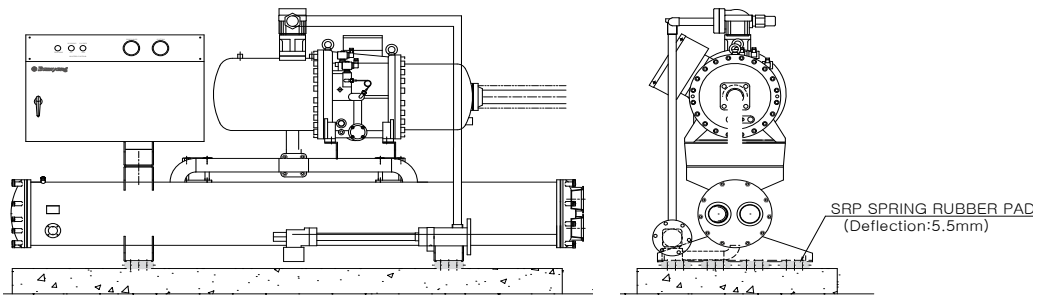
$$F_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

3. Isolation Efficency(E)
   Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$
   ex) Disturbing Frequency of the equipment=100 Hz,
   Natural Frequency of the isolator=10Hz

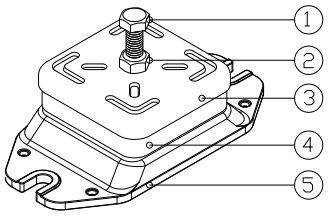
$$T_r = \sqrt{\left(\frac{1}{1-\eta^2}\right)^2} = \sqrt{\left(\frac{1}{1-\left(\frac{100}{10}\right)^2}\right)^2} = 0.101 \qquad E = 100(1 - T_r) = 100(1-0.101)=99(\%)$$

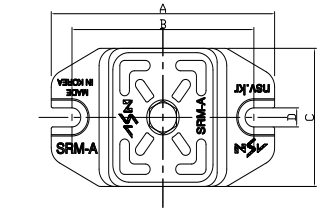
■ Installation Features

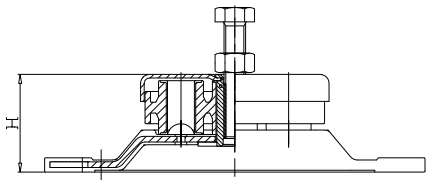
OUTDOOR UNIT
OF AIR CONDITIONAL ▶



SRM Spring Rubber Mount (Deflection : 5.5mm)







■ Features

It is an improved, mount version of SRP type spring rubber pad taking advantage of anti-vibration rubber and metal spring. SRM type enables control of the level to reduce horizontal deflection. Moreover, its external housing is made of stainless steel to prevent corrosion when installed outside.

■ Usage

- For facilities and equipment (for example, PUMP, AHU and FAN)
- For industrial equipment (including Press, Shearing Machine and Lathe)
- For all kinds of equipment installed on a solid base
- For vertical and horizontal pipes

■ Specification

No.	Name of Components	Material	Standard
1	Level Bolt	SS400	KS B 1002
2	Nut	SS400	KS B 1002
3	UPPER HOUSING	STS304	KS D 3698
4	SRP PAD	SUP9	KS B 2402
		CR	KS M 6617
5	LOWER HOUSING	CR	KS M 6617
		SS400	KS D 3503

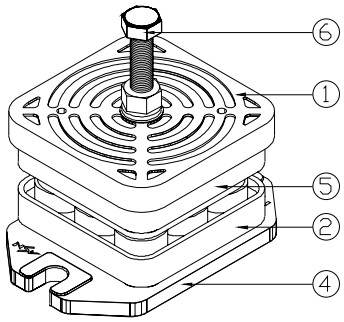
■ Dimension & Selection Guide

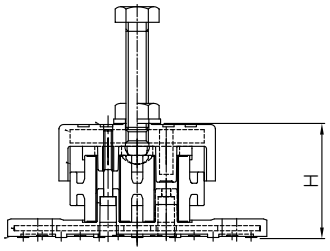
Type	Capacity (kgf)	Deflection (mm)	Weight (kg)	Dimension(mm)					
				A	B	C	D	H	Level Bolt
SRM-100	100	5.5	0.52	140	114	80	11	52	M10 x 60
SRM-200	200								
SRM-400	400		1.42	212	183	108	13	55	M12 x 65
SRM-600	600								
SRM-800	800								
SRM-1000	1000		3.33	290	259	130	13	55	M12 x 65
SRM-1200	1200								
SRM-1500	1500								
SRM-2000	2000								

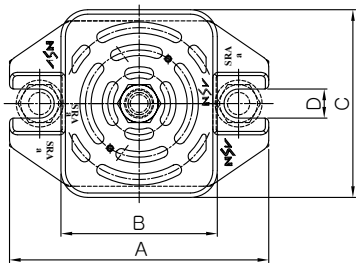
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ Installation Features

SRA Spring Rubber Mount (Deflection : 6~12mm)







■ Features

SRA mount is an improved version of SRM spring rubber mount with upgraded shock and vibration control effects. With SRP spring rubber pad, it facilities control of the level and moreover, this pad can be installed in 2 layers to increase efficiency. It is designed to insert a reinforcing plate in-between in order to remove insecurity when displacement increases and to bear the load in a stable manner while preventing separation. On the top and bottom of the SRA mount, bumpy neoprene housing with reinforcing material inside is mounted to prevent slipping from the equipment and to shut out structure-borne noise.

■ Usage

- For facilities and equipment (for example, pump, AHU and fan)
- For vertical/horizontal pipes and ducts
- For industrial equipment
- For machines that generate vibration in horizontal and vertical directions

■ Specification

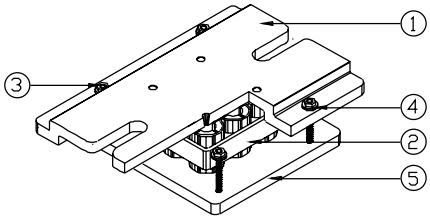
No.	Name of Components	Material	Standard
1	Upper Housing	CR	KS M 6617
2	SRP PAD	CR+SUP9	KS M 6617
3	Bolt	SS400	KS B 1003
4	Lower Housing	CR	KS M 6617
5	Middle plate	SS400	KS D 3503
6	Level Bolt	S400	KS B 1002

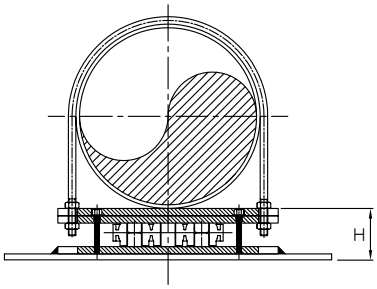
■ Dimension & Selection Guide

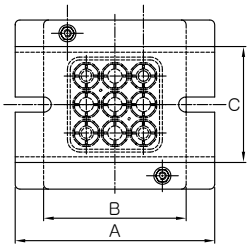
Model	Type	Capacity (kgf)	Deflection (mm)	Weight (kg)	Dimension(mm)					
					A	B	C	D	H	Level Bolt
SRA	SRA-100	100	6	0.64	116	89	84	13	51	M10 x 60
	SRA-200	200		0.66						
	SRA-400	400		1.86	155	128	110	14	60	M12 x 65
	SRA-600	600		1.88						
	SRA-800	800		1.84						
SRA- 2	SRA-2-100	100	12	0.82	116	89	84	13	85	M10 x 60
	SRA-2-200	200		0.86						
	SRA-2-400	400		2.50	155	128	110	14	95	M12 x 65
	SRA-2-600	600		2.52						
	SRA-2-800	800		2.60						

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

SRH-U Spring Rubber Mount (Deflection : 5.5mm)







■ Features

It is an upgraded mount designed to control vibration from horizontal pipes using SRP type spring rubber pad with advantages of anti-vibration rubber and metal spring. SRH type is installed on top of steel structure individually or together to better absorb vibration from pipes. Plus, U-bolt slot hole is on steel plate of top and bottom housings, which facilitates installation and prevents pipes from getting out of their original location.

■ Usage

For horizontal pipes

■ Specification

No.	Name of Components	Material	Standard
1	Upper Housing	SS400	KS D 3503
2	SRP PAD	SUP9	KS B 2402
		CR	KS M 6617
3	Bolt & Nut	SS400	KS B 1002
4	Guide Rubber	CR	KS M 6617
5	Base Plate	SS400	KS D 3503

■ Dimension & Selection Guide

Pipe Diameter	SRP	A	B	C	H
Φ50	A(100,200)	110	84	86	40
Φ65		110	84	86	
Φ80		120	96	74	
Φ100		150	114	74	
Φ125		175	138	74	
Φ150		200	164	74	
Φ150	B(400~800)	220	160	122	42
Φ200	B(400~800)	270	210	122	
Φ250	B(400~800)	320	260	122	
Φ250	C(1000~2000)	320	260	140	
Φ300	B(400~800)	380	320	122	
Φ300	C(1000~2000)	380	320	140	42
Φ350		422	320		
Φ400		470	410		
Φ450		520	420		
Φ500		562	502		

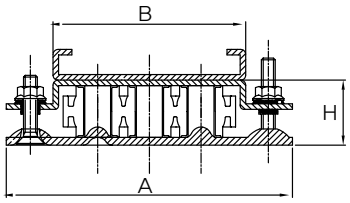
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

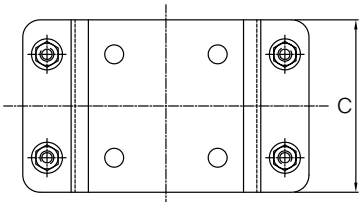
SRH-SH Spring Rubber Mount (Deflection : 5.5mm)

■ Features

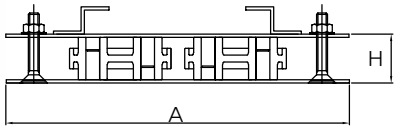
It is used as a sliding shoe on the pipe and installed using pipe clip & bolt. The allowed range of support spacing for horizontal pipe is from 2.0m to 5.0m. And the model changes depending on the support spacing.

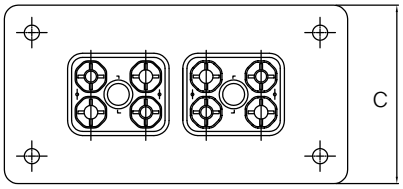
SRH-A TYPE





SRH-B TYPE





■ SRH-A TYPE Dimension & Selection Guide

Pipe Diameter	SRP	A	B	C	H
Φ50	A(100,200)	166	80	100	40
Φ65					
Φ80	B(100~800)	166	105	100	
Φ100					
Φ125					
Φ150					
Φ200					
Φ250					
Φ300					
Φ350	C(400~2000)	266	156	140	
Φ400					
Φ450					

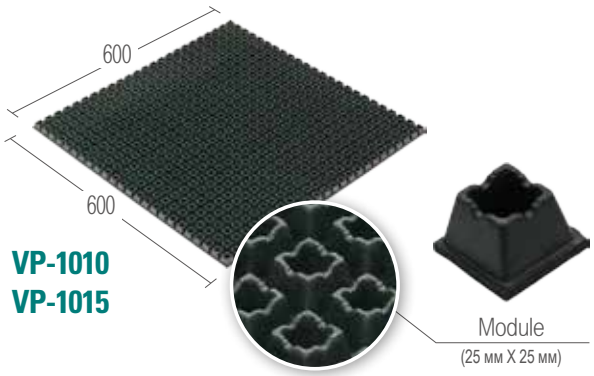
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ SRH-B TYPE Dimension & Selection Guide

SRP	A	C	H
100X2EA	250	150	48
200X2EA	250	150	
100X2EA	250	150	
200X2EA	250	150	
200X2EA	250	150	
200X2EA	250	150	
400X2EA	350	150	
600X2EA	350	150	
600~800X2EA	350	150	
1000~1500X2EA	350	200	

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

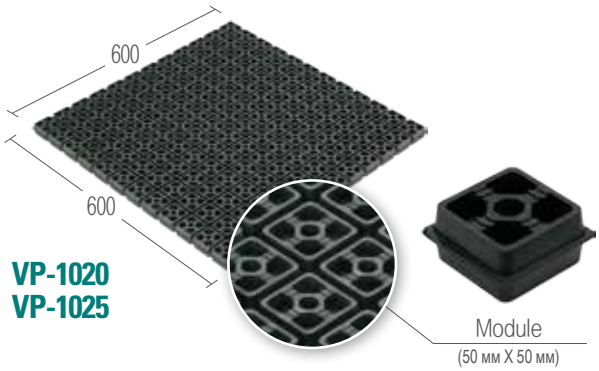
VP-1000 Rubber Pad (Deflection : 4~10mm)



VP-1010
VP-1015

■ Features

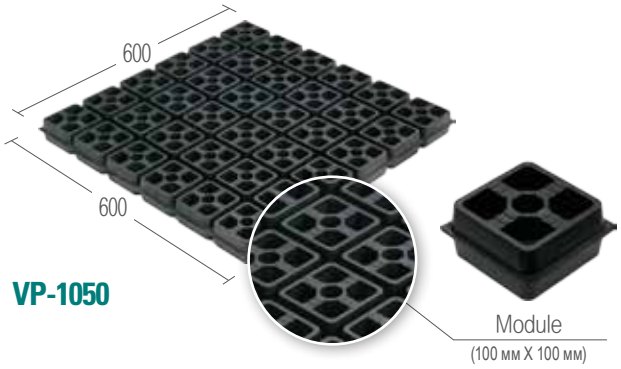
VP-1000 type is a vibration isolation pad made of CR(neoprene) with excellent oil and ozone resistance. An advantage is a wide range of working load due to the projected net area designed calculating working load and statistic displacement separately. Its modular design allows cutting it into small pieces as you want to use.



VP-1020
VP-1025

■ Application

- In general, to control HF vibration by installing it under the bottom of the machine
- To damp vibration from generators/air compressors/chillers/air handling units
- To damp vibration form various kinds of machine installed on the solid base.
- To prevent transmission of vibration and noise through the structures

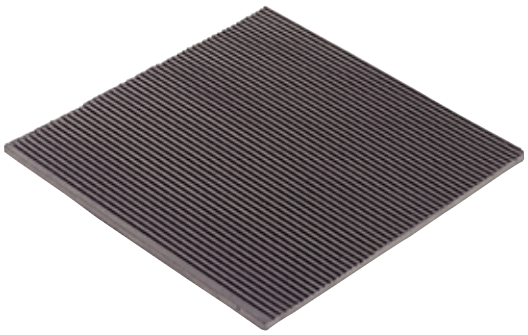


VP-1050

■ Dimension & Selection Guide By Loads

Type	Capacity (kgf)	Deflection (mm)	Hardness (Hs)	Dimension (mm)			
				width	Length	Thickness	Module Size
VP-1010	21600	4	60±5	600	600	10	25 x 25
VP-1015	21600	5				15	25 x 25
VP-1020	20160	6				20	50 x 50
VP-1025	20160	7				25	50 x 50
VP-1050	24800	10				50	100 x 100

VP-2000 Rubber Pad (Deflection : 3~6mm)



■ Features

VP-2000 type is a vibration isolation pad made of CR(neoprene) with excellent oil resistance and ozone resistance. It has the excellent vibration isolation performance from serrated patterns engaged from the top and bottom surface making no horizontal shift and having enough deflection. Since the ability to support a load is proportional to the surface area, it can be used in various ways. Especially, it is an optimum vibro-isolating pad for structure borne sound. It can be designed into layered structure. With the large value of corresponding static displacement to the same load, the natural frequency of the lower system is variable.

■ Application

- ◆ In general, to control HF vibration by installing it under the bottom of the machine
- ◆ To damp vibration from generators/air compressors/chillers/air handling units
- ◆ To damp vibration form various kinds of machine installed on the solid base.
- ◆ To prevent transmission of vibration and noise through the structures

■ Dimension & Selection Guide

Type	Capacity(kgf)	Deflection(mm)	Hardness(Hs)	Dimension(mm)		
				width	Length	Thickness
VP-2008	16000	3	60±5	600	600	8
VP-2010	16400	4				10
VP-2012	16800	4				12
VP-2015	17600	5				15
VP-2020	18000	6				20

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VP-3000 Rubber Pad (Deflection : 6/12mm)

■ Features

Its cover made of CR(neoprene) with excellent oil and ozone resistance and the HD mat inside with outstanding damping characteristics dramatically improve damping performance. Its modular design allows cutting it into small pieces as you want to use.

■ Usage

- ◆ In general, to control HF vibration by installing it under the bottom of the machine
- ◆ To damp vibration from generators/air compressors/chillers/air handling units
- ◆ To damp vibration form various kinds of machine installed on the solid base
- ◆ To prevent transmission of vibration and noise through the structures

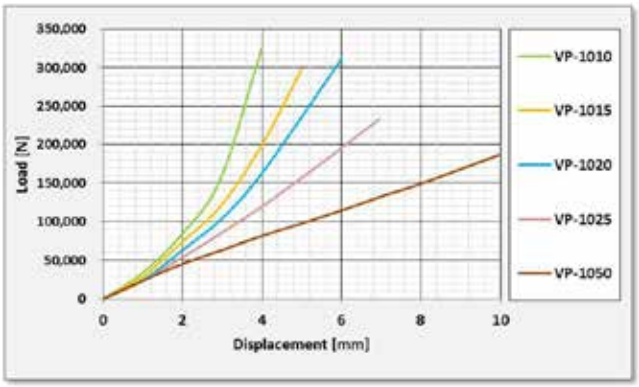
■ Dimension & Selection Guide

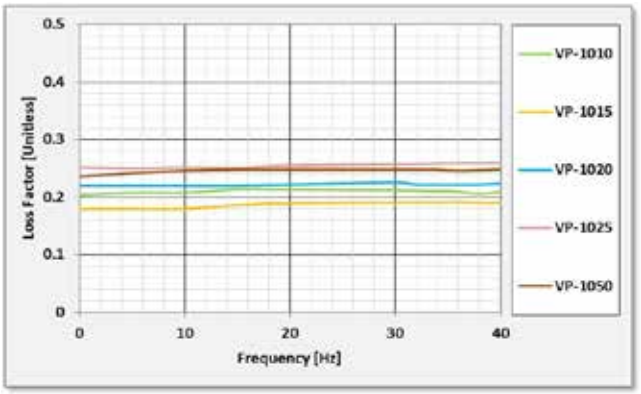
Type	Capacity(kgf)	Deflection(mm)	Weight(kg)	Dimension(mm)			
				width	Length	Thickness	Module Size
VP-3025	8000	6	60±5	600	600	25	100 x 50
VP-3050	8000	12				50	

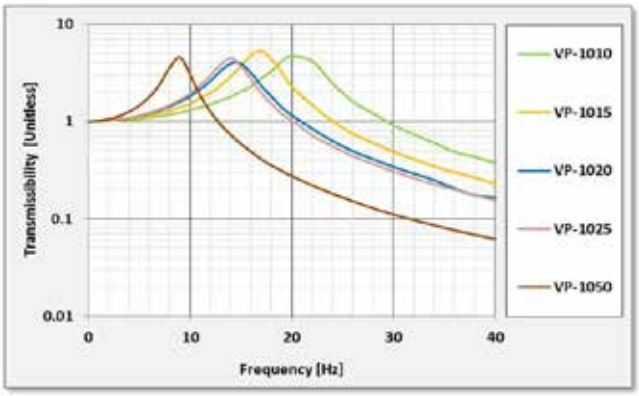
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

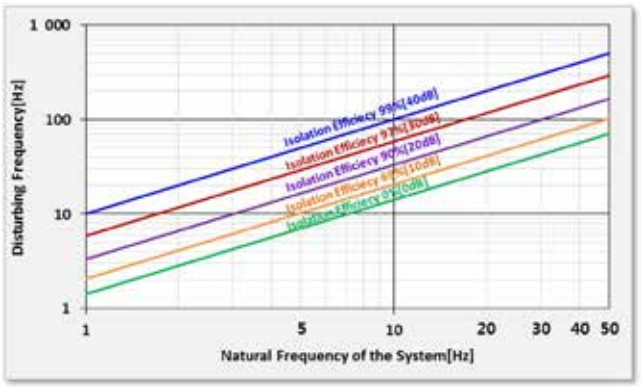
VP-1000/VP-2000 Rubber Pad

■ VP–1000 Test Data









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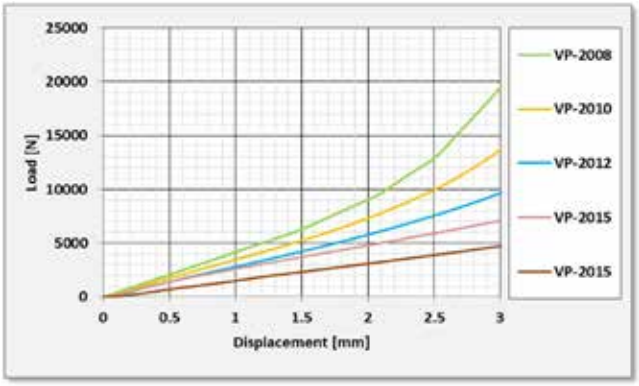
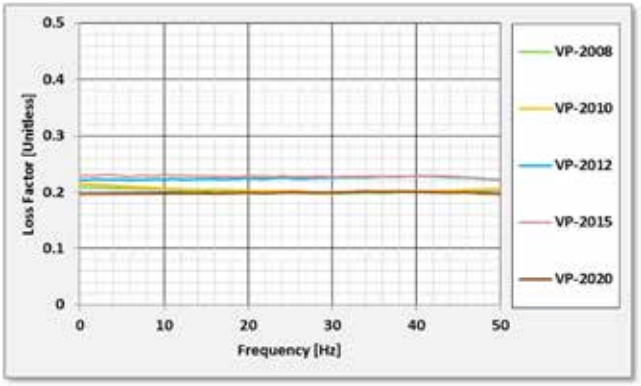
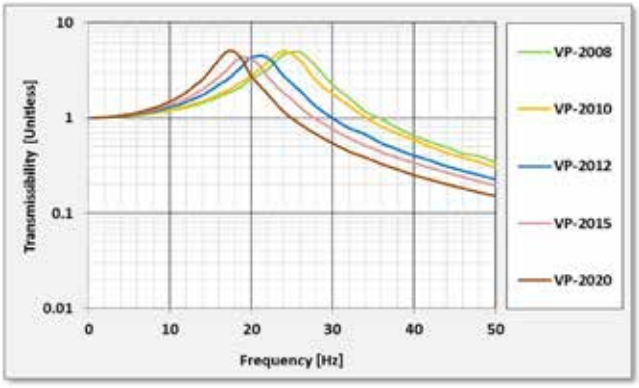
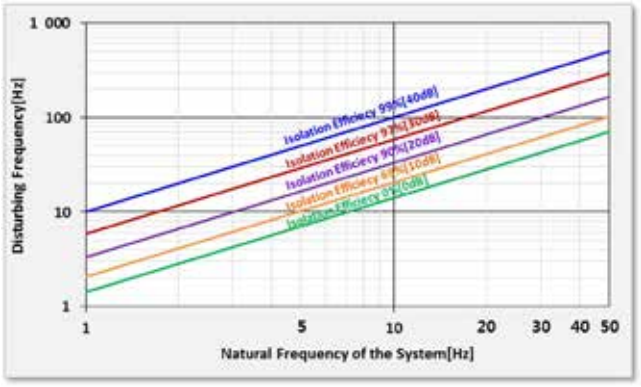






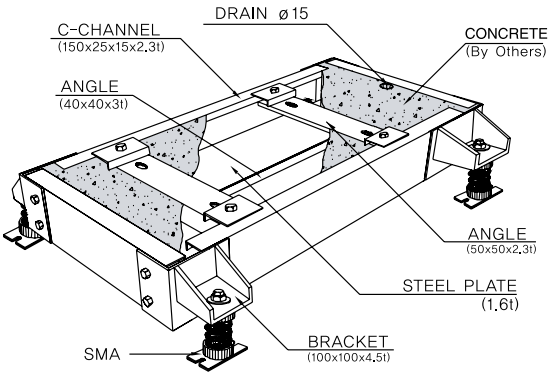


IB Inertia Base Series

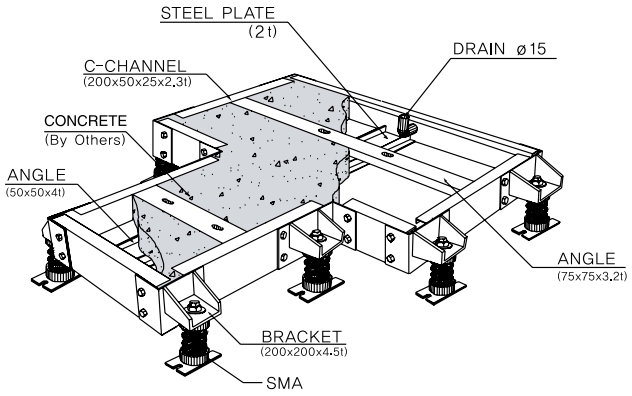
■ Features

IB (Inertia Base) is designed to shut out vibration that occurs while the pump is running, and at the same time, minimize the dynamic deflection resulting from the dynamic force generated when the load rapidly changes, using the weight of concrete. It consists of the base (ㄱ-angle) with C-channel for an easier assembling of the base, pump and motor, bracket for mount and reinforcing bottom plate. The height (H) of Inertia Base is at least 150 mm, and it differs depending on horse power of the motor.

■ IB-150 series For Single-Suction Pumps (Single, Multi-Stage Volute, etc.)



■ IB-200 series For Double-Suction Pumps



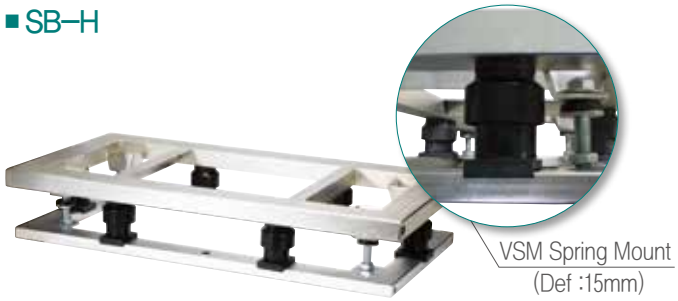
■ Installation Features

SB Elasticity Structural Base

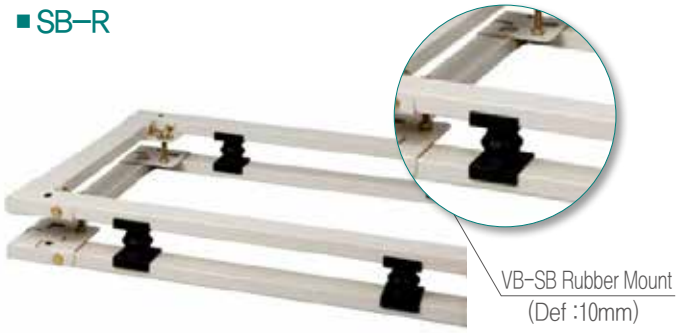
■ Features

GHP/EHP cools and heats the air through the circulation of refrigerant's heat pump cycle and it generates vibration when the compressor runs.In the case that several GHP/EHP are installed in a group, they could generate superposed oscillation, and as a result, cause damage. To prevent this, vibration isolators with a built-in stand are mounted on the equipment. This stand is double-structured with a stopper inside to ensure the structural stability against external pressure.

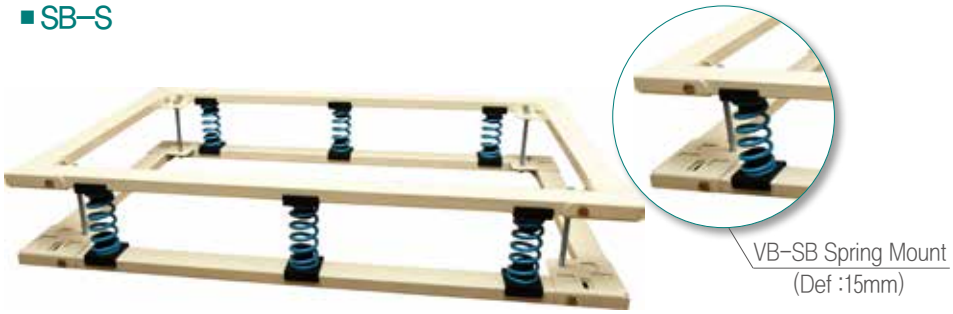
■ SB-H



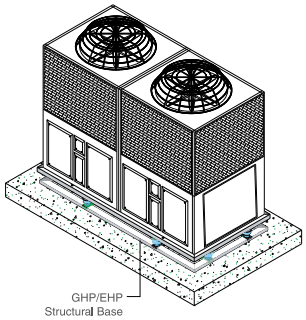
■ SB-R

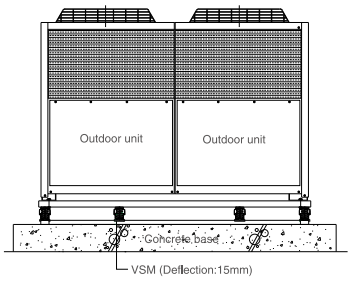


■ SB-S



■ SB Installation Details Drawing





■ Installation Features

NFC Flexible Connector

NFC10S

※ The model name of NFC-S product has changed to NFC10S

Screw Type

NFC10

※ The model name of NFC-1 product has changed to NFC10

1Ball Type

NFC20

※ The model name of NFC-2 product has changed to NFC20

2Ball Type

■ Features

The flexible connector is mounted between pipes to absorb the stress resulting from the expansion and contraction of the pipe line and shut out the vibration caused by flow of fluid and vibration transferred from equipment. It also maintains an allowable connection error of pipe line, and by doing so, gives flexibility to the whole system.

(a) Operating temperature: -20°c ~ +80°c
(b) Operating pressure: for 10kgf/㎠ and 20kgf/㎠
(c) Materials: NEOPRENE, EPDM

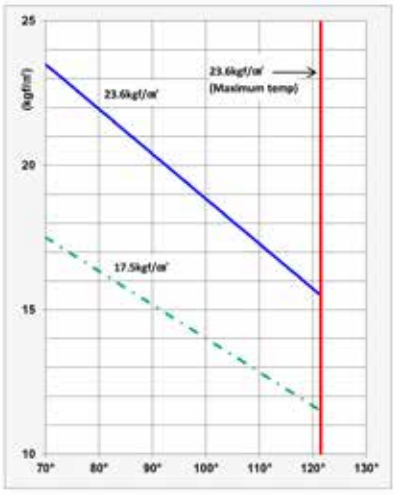
■ The composition of products

It is made of nylon tire cord, special synthetic rubber (NEOPRENE, EPDM) and piano steel wire. It has a stiffening ring between balls to avoid excessive expansion by internal pressure.

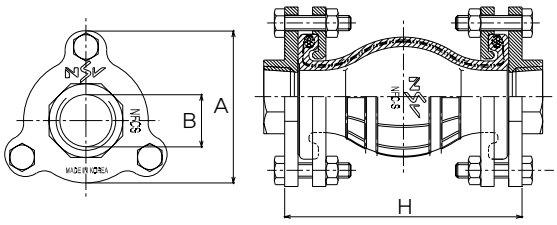
■ Product Special Feature

(a) Excellent resistance against pressure. This product consist of synthetic rubber, nylon tire cord Fabric and piano steel wire. The destruction pressure is Within 55kgf/cm² and usage pressure is up to maximum 30kgf/cm².
(b) Large allowance of concentricity error. Due to Two arch structure, it has good flexibility to all direction. As having large amount of concentricity error allowance, this product protests equipment of pipe line from vibration or other shock damage.
(c) Large allowance of banding angle and elasticity. This product has allowable banding angle and elasticity Enough to stand pipe-line movement owing to outside Impact.
(d) Grate anti-vibration and anti-noise effect.
(e) Good Water resistance, Thermal endurance, Weatherability and Chemical resistance.

■ Maximum Operating Pressure And Temperture



NFC Flexible Connector

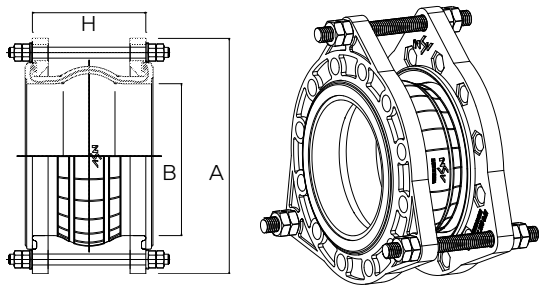


NFC10S (Screw Type)

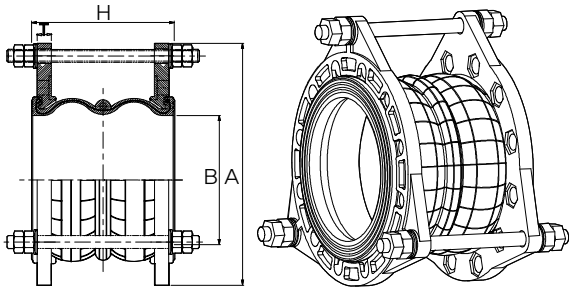
■ Dimension & Selection Guide

Type	Flange Dimension(mm)		
	A	B	H
NFC10S-25	81	25A	125
NFC10S-32	90	32A	143

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.



NFC10 (1Ball Type)



NFC20 (2Ball Type)

■ Dimension & Selection Guide

Type	Flange Dimension(mm)				Dimension(mm)				Qty of Control Rod	
	A	B	H (1Ball)	H (2Ball)	Compression	Height	Concentricity	Curve	10K	20K
NFC10(20)-32	140	32A	125	150	38	13	16	30°	2	2
NFC10(20)-40	140	40A	125	150		13	16	30°		
NFC10(20)-50	155	50A	125	150		13	16	30°		
NFC10(20)-65	175	65A	125	160		13	22	30°		
NFC10(20)-80	185	80A	125	160		19	22	30°		
NFC10(20)-100	210	100A	150	180		19	22	29°		
NFC10(20)-125	250	125A	150	180		19	22	24°		
NFC10(20)-150	280	150A	150	180		19	22	20°	3	3
NFC10(20)-200	330	200A	175	220		19	22	15°		
NFC10(20)-250	400	250A	175	220		22	32	30°		
NFC10(20)-300	445	300A	200	220		22	32	30°	4	4
NFC10(20)-350	490	350A	200	250		22	32	30°		
NFC10(20)-400	560	400A	250			22	32	29°		

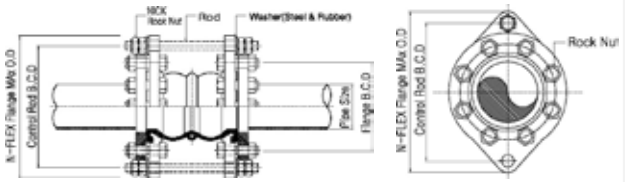
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

■ 450A or larger products can be manufactured upon request

We use control rods with larger than 450A NFC products

■ Anchoring and Control rods of pipe line

When use a Flexible connector, pipe line should expend or contact by only one direction anchor rods for Preventing flexible connector cracking. Or installing control rods on the flange of flexible connector protect pipe Line from damage owing to over-expansion or over-contraction.



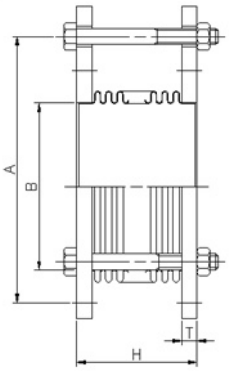
Control Rod Installation Details

NV10 Flexible Connector

※ The model name of NVC product has changed to NV10

■ Features

It is installed on the intake/outlet of the pump to give flexibility, and at the same time, somewhat reduce vibration. Because it uses a multi-layered bellow, it has a small spring reaction. Plus, it transfers no vibration through brad as it does not use tie rod. It is made of stainless steel, which ensures a long lifespan and stable pipe system even at a high temperature.



■ Specification

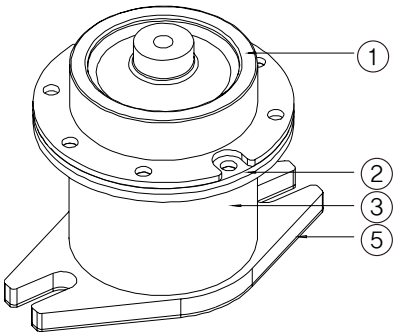
- ◆ Applied fluid : cool & hot water, steam, liquid
- ◆ Maximum operating pressure : 10kgf/20kgf cm^2
- ◆ Maximum operating temperature : 220℃
- ◆ Connecting method : KS 10K/20K Flange
- ◆ Resisting pressure test : 15kgf/30kgf cm^2 in water
- ◆ Material : Bellows/STS, Flange/SS400

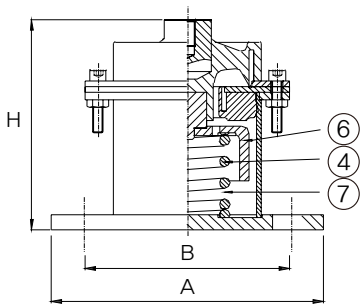
■ Dimension & Selection Guide

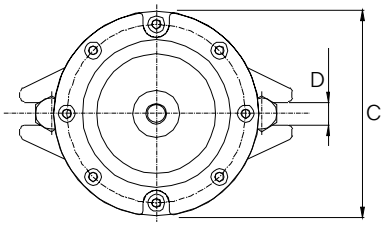
Type	FLANGE DIMENSION(㎜)								MOVEMENT		
	A		B		T		H		Compression	Expansion	Concentricity
	10K	20K	10K	20K	10K	20K	10K	20K			
NV10(20)-32	170	170	46	46	16	19	80	85	12	3	3
NV10(20)-40	183	183	46	46	16	19	80	85			
NV10(20)-50	205	205	67	67	16	19	115	119			
NV10(20)-65	225	225	67	67	16	19	120	128			
NV10(20)-80	235	250	77	77	16	22	120	132			
NV10(20)-100	260	275	103	103	16	25	125	141			
NV10(20)-125	300	320	129	129	19	25	130	144			
NV10(20)-150	330	355	155	155	19	28	140	158			
NV10(20)-200	380	400	204	204	19	30	150	172			
NV10(20)-250	478	508	263	263	25	35	200	218			
NV10(20)-300	523	558	317	317	25	35	200	222			
NV10(20)-350	568	618	359	359	25	40	200	230			
NV10(20)-400	638	683	409	409	28	45	200	236			

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VD60 Spring Damper Mount







■ Features

It is a solid-bottom mount with the combined features of oil-filled damper, spring and rubber and it is very effective against shock power and periodic vibration. It first converts impulsive vibration into frictional heat energy using oil and then, dissipates periodic vibration using rubber and the spring. The rubber on top is a CR (neoprene)-type synthetic rubber having excellent oil and ozone resistant properties. Because the spring gains a static deflection after assembly, it can maintain a low-natural frequency, less than 5Hz.

■ Usage

- For high-efficient vibration control of cooling towers
- For high-efficient vibration control of heavy equipment (semiconductor production line)
- For equipment generating large impulsive vibration
- For equipment that is sensitive to surrounding vibration

■ Specification

No.	Name of Components	Material	Standard
1	Upper Cap	CR & GC	KS M 6617 / KS D 4301
2	Middle Cap	CR & GC	KS M 6617 / KS D 4301
3	Lower Cap	SS400	KS D 3503
4	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
5	Non Skid Pad	CR & GC	KS M 6617
6	Inner Damper	GC	KS D 4301
7	Damper Oil	—	FLUID OIL

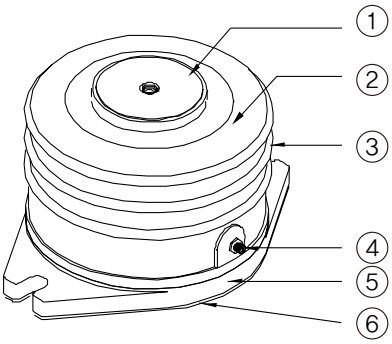
■ Dimension & Selection Guide

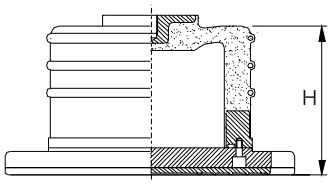
Type	Capacity (kgf)	Dimension(mm)					
		A	B	C	D	H	Level Bolt
VD60-500	500	184	132	124	18	190	M12
VD60-1000	1000	184	132	124	18	190	M12
VD60-1500	1500	270	198	202	22	230	M20
VD60-2000	2000	270	198	202	22	230	M20

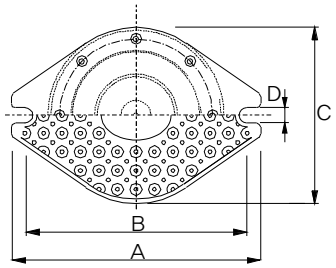
(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VAM10 Air Mount (Airpressure : 1.5~6Kg/mm)

※ The model name of VAM product has changed to VWM10







■ Features

An air spring mount is a highly-efficient mount offering features of acyuator as well as an isolator like a coil spring and anti-vibration pad. It can maintain constant vibration isolation efficiency and lower the system's natural frequency down to 2.5~5Hz. Plus, its height can be controlled through the control of internal air pressure and installed in a lower position than the conventional coil spring mount. It allows for a quite, noiseless operation, as it has a structure that does not transfer noise.

■ Usage

- For vacuum pumps and air compressors
- For optical measurement equipment and high-precision, semi-conductor manufacturing equipment
- For a power generator high-speed press
- For HVAC equipment and industrial machines

■ Specification

No.	Name of Components	Material	Standard
1	Upper Housing	AL	KS D 2331
2	Body	NBR	KS M 6642
3	Reinforcing Ring	SS400	KS D 3503
4	Air Value	BRASS	—
5	Lower Housing	AL	KS D 2331
6	Non Skid Pad	CR	KS M 6617

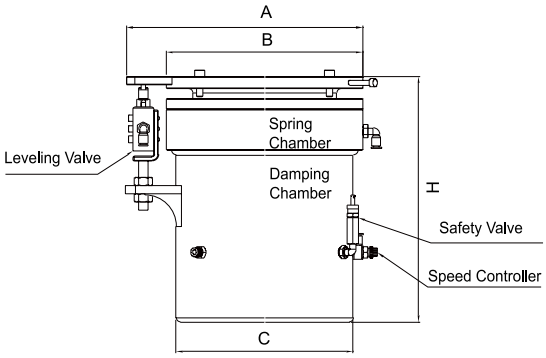
■ Dimension & Selection Guide

Type	Capacity(kgf)		Design Pressure (kg/㎠)	Dimension(mm)					
	Min.	Max.		A	B	C	D	H	Level Bolt
VAM10-150	50	150	1.5~5.0	150	130	105	11	67	M12
VAM10-300	75	300	1.5~6.0	180	160	124	13	93	M12
VAM10-600	150	600	1.5~6.0	250	230	172	13	93	M12
VAM10-1200	300	1200	1.5~6.0	350	330	246	13	93	M16
VAM10-2400	1250	2400	1.5~6.0	480	460	340	14	95	M20

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VAM20 Pneumatic Leveling Isolator

※ The model name of VAD product has changed to VWM20



■ Features

It is used to control the vibration of high precision inspection and measurement equipment. Because it has a low natural frequency less of than 2Hz and causes no surging, it can provide excellent vibration isolation performance. The double diaphragm can also be used to lower its natural frequency. The leveling valve performs automatic leveling while the orifice connecting spring chamber and damping chamber offer a high attenuation of fluid and the speed controller helps control the attenuation ratio. In addition, the piston and viscous oil can help reduce attenuation to be even lower.

■ Usage

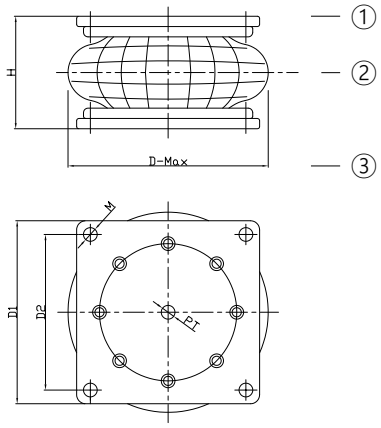
- ◆ High-precision measurement equipment, electron microscope and 3D coordinate measuring machine
- ◆ High-precision manufacturing machine and high-precision optical tester
- ◆ Environmental measurement equipment and high-precision calibration instrument
- ◆ High-precision vibration proofing foundation

■ Dimension & Selection Guide

Type	Capacity (kgf)	Dimension(mm)			
		A	B	C	H
VAM20-300	300	170	120	120	160
VAM20-800	800	220	170	150	220
VAM20-1500	1500	290	240	220	300
VAM20-3000	3000	350	300	270	300
VAM20-5000	5000	430	380	350	300
VAM20-10000	10000	550	500	460	300
VAM20-20000	20000	730	680	640	300

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VAM52 Flange Type Air Spring Mount



■ Features

VAM52 is a flange type Air Spring Mount of a structure which is capable of corresponding to 3-axis vibration and is effective for preventing vibration transmission of precision equipment and mechanical equipment. Thanks to the supplementary chamber and damper inside, it is possible to lower natural frequency or to achieve excellent damping characteristics.

■ Usage

- Vibration isolation for industrial machinery
- Vibration Isolation for facilities and precision equipment
- Manual vibration isolation in precision laboratories
- Vibration isolation for various equipments requiring low natural frequency

■ Specification

No.	Product Name	Material	Standard
1	Upper Bead Plate	SGCD	KS D 3506
2	Bellows	CR	KS M 6617
3	Lower Bead Plate	SGCD	KS D 3506

■ Dimension & Selection Guide By Loads

Type	Design Load (kgf)	Design Pressure (kgf)/cm^2)	Maximum Design Displacement (mm)	Natural Frequency (Hz)	Dimension(mm)						Weight (kg)
					D1	D2	D-max	H	M	PT	
VAM52-450	45~450	1~7	+20/-15	4.0~5.0	120	100	Φ130	60	Φ9	1/8"	2.5
VAM52-600	60~600	1~7	+15/-25	3.5~4.5	144	124	Φ155	85	Φ10	1/4"	4
VAM52-900	100~900	1~7	+25/-40	2.8~3.8	168	140	Φ190	100	Φ10	1/4"	6
VAM52-1300	150~1300	1~7	+30/-60	2.6~3.4	204	176	Φ240	130	Φ12	1/4"	9.5
VAM52-3000	350~3000	1~7	+40/-60	2.4~3.0	280	240	Φ335	140	Φ14	1/4"	18

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VAM90 Pneumatic Isolation Table

※ The model name of VAT product has changed to VAM90

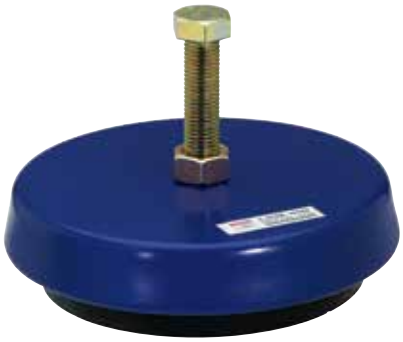
■ Features

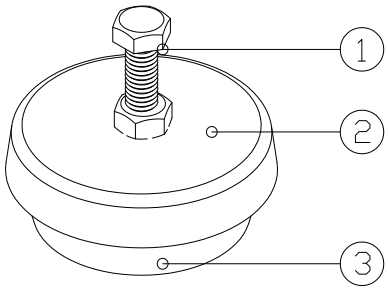
A high-precision vibration control table can be made using VAM90 auto-level air spring vibration isolator. The bottom of the air spring is made of steel frame with a height of 700~750 mm on average, and it can be made to order depending on the size of equipment. It maintains the horizontal-level precision of ±1/100mm and the horizontal natural frequency between the air-spring mount and plate of about 2Hz.

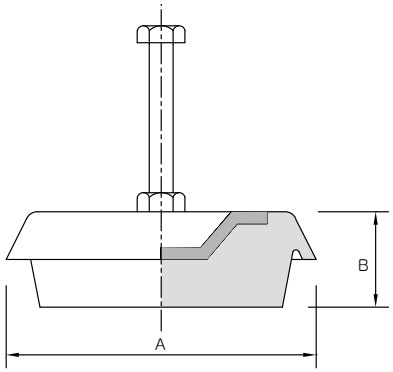
■ Usage

- High-precision measurement equipment, electron microscopes and 3D coordinate measuring machines
- Environmental measurement equipment and high-precision calibration instruments
- For high-precision manufacturing machines and high-precision optical testers

VF Foot Rubber Mount (Deflection : 3.5mm)







■ Features

The housing is made of strong steel plate with the bolt at the center to control the level when attached on the machine. Its round-shaped floor surface is made of bumpy rubber to isolate impulsive vibration and structure-borne noise, and at the same time, prevent slipping from the structure. It prevents the transfer of vibration from all kinds of machine tools in the most economical manner and reduces vibration acceleration to lengthen the life span of machines.

■ Usage

- For shock-generating machines like press and forging machines
- For all kinds of industrial machines, including injection machines, printing machines, timber manufacturers, emergency generators and transformers
- For machine tools like a lathe, grinder and milling M/C

■ Specification

No.	Name of Components	Material	Standard
1	Level Bolt	SS400	KS B 1002
2	Housing	SS400	KS D 3503
3	Rubber	CR	KS M 6617

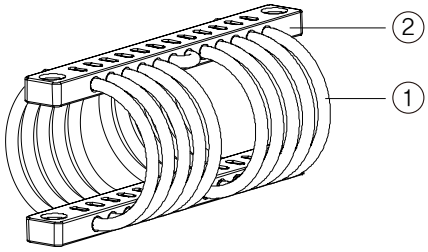
■ Dimension & Selection Guide

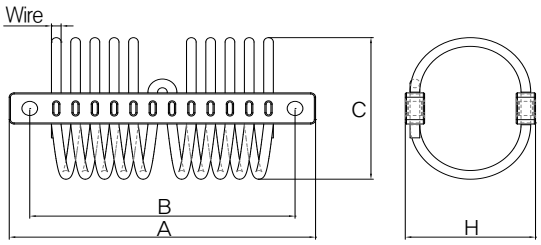
Type	Capacity (kgf)	Hardness (A)	Spring Constant (kgf/mm)	Deflection (mm)	Dimension(mm)		
					A	B	Level Bolt
VF-150	150	60±5	43	3.5	80	35	M10
VF-400	400		115		120	53	M12
VF-800	800		229		160	53	M16
VF-2000	2000		572		220	60	M20
VF-6000	6000		1715		300	70	M22
VF-10000	10000		2858		400	70	M24

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VWM10 Wire Mount

※ The model name of VWM product has changed to VWM10





■ Features

VWM10 is capable of isolating vibration using elasticity and attenuation effect of wire rope while absorbing shock. It does not cause surging and minimizes the transmissibility of vibration when it resonates.

■ Usage

- ◆ For equipment that requires vibration isolation and dynamic stability
- ◆ For equipment that needs a buffer
- ◆ For high-precision equipment that is installed inside moving containers
- ◆ For high-precision equipment installed in submarines and ships

■ Specification

No.	Name of Components	Material	Standard
1	Wire Rope	STS304	KS D 3514
2	Retainer Bar	STS304	–

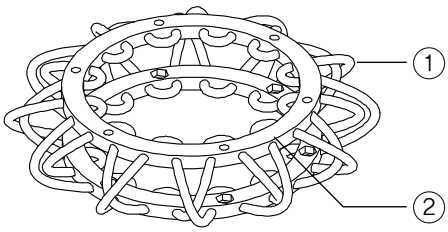
■ Dimension & Selection Guide

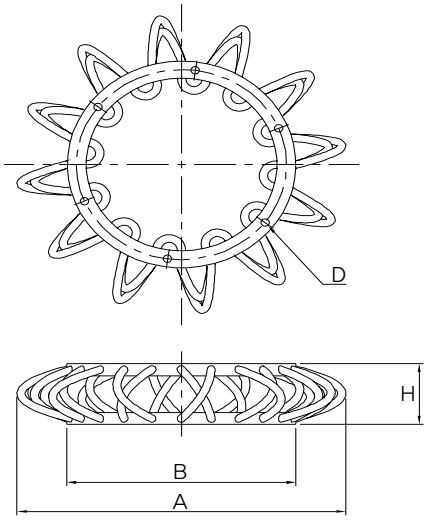
Model	Dimension(mm)						Ma.Travel (mm)	Max. Load (kgf)
	A	B	C	D	H	Wire		
VWM10-04-100	125	110	45	6.5	35	4	13	90
VWM10-04-200			55		45		16	50
VWM10-04-300			65		55		30	50
VWM10-05-100	125	110	45	6.5	35	5	13	200
VWM10-05-200			55		45		16	140
VWM10-05-300			65		55		30	90
VWM10-06-100	150	134	60	6.5	50	6	15	240
VWM10-06-200			70		60		25	170
VWM10-06-300			80		70		35	110
VWM10-08-100	190	170	80	8.5	70	8	25	270
VWM10-08-200			100		90		45	200
VWM10-08-300			120		110		65	160
VWM10-10-100	250	230	110	8.5	90	10	50	300
VWM10-10-200			130		110		60	240
VWM10-10-300			150		130		75	150
VWM10-12-100	250	230	130	8.5	110	12	55	600
VWM10-12-200			150		130		70	550
VWM10-12-300			170		150		95	400
VWM10-16-100	320	280	130	11.0	110	16	55	1300
VWM10-16-200			150		130		70	1000
VWM10-16-300			170		150		95	800
VWM10-22-100	420	380	140	12.0	130	22	50	1500
VWM10-22-200			165		150		70	1300
VWM10-22-300			190		170		90	1100

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VWM20 Wire Mount

※ The model name of VWR product has changed to VWM20





■ Features

It is a product that can work as an isolator that isolates vibration using elasticity and attenuation effects of wire rope and an absorber, which eases shock. Its circular Mount shape allows it to minimize coupling with the same stiffness for lateral load. It is effective in attenuation and blocking high frequency over 100Hz, which means that it minimizes transfer of vibration without surging. It is superior that coil spring or neoprene Rubber in terms of resistance against corrosion, heat, ozone and oil and moreover, it can make up for disadvantages of coil spring being lack in attenuation and rubber having the natural frequency.

■ Usage

- For equipment that needs vibration isolation and dynamic stability
- For equipment that needs shock-absorber
- For high-precision equipment that is installed inside the mobile container
- Used to isolate high-frequency vibration from, for example, transformer
- For super-precision machine tool
- For vibration damping of high-precision tester
- Used to control vertical/horizontal vibration

■ Specification

No.	Name of Components	Material
1	Wire Rope	STS304
2	Retainet Bar	STS304

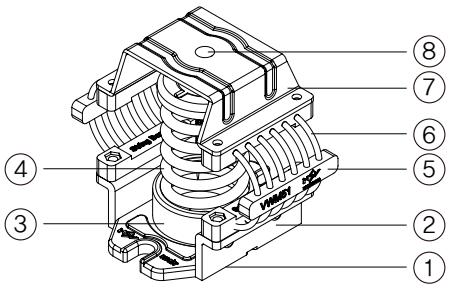
■ Dimension & Selection Guide

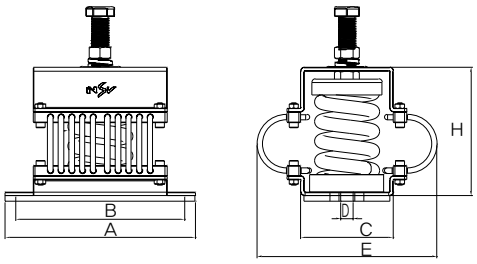
Type	Dimension(mm)				Max.Travel (mm)	Max. Load (kgf)
	A	B	C	H		
VWM20-90	170	90	6.2	50	30	30
VWM20-120	200	120				60
VWM20-170	250	170				100
VWM20-230	310	230				200

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

VWM51 Wire-Spring Mount (Deflection : 25mm)

※ The model name of VWA product has changed to VWM51





■ Features

VWM51 offers elasticity of coil spring and excellent attenuation effect of wire rope, ensuring vibration isolation and dynamic stabilization of equipment.
Enhanced strength of wire mount helps bear large loadsEnhanced strength of wire mount helps bear large loads

■ Usage

- For equipment that requires vibration isolation and dynamic stability
- For equipment that needs a buffer
- For reciprocating compressors and steam blowers
- For equipment that needs to control noise directing the floor right below

■ Specification

No.	Name of Components	Material	Standard
1	Lower Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS400	KS D 3503
3	Spring Seat	CR	KS M 6617
4	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
5	Retainer Bar	E-Plastic	–
6	Wire Rope	STS304	KS D 3514
7	Upper housing	SS400	KS D 3503
8	Level Bolt	SS400	KS B 1002

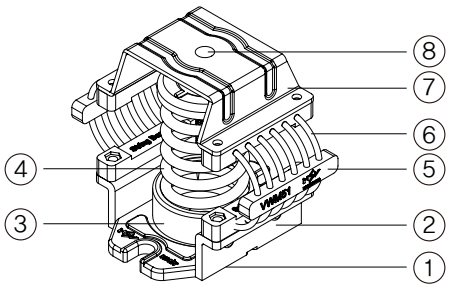
■ Dimension & Selection Guide

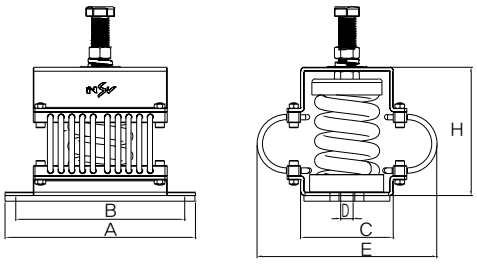
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Color	Dimension(mm)						
				A	B	C	D	E	H	Leveling Bolt
VWM51-A-100	100	4	Blue	138	108	89	13	165	142	M16 x 80
VWM51-A-150	150	6	Brown							
VWM51-A-200	200	8	White							
VWM51-A-300	300	12	Orange							
VWM51-A-400	400	16	Pink							
VWM51-B-500	500	20	Green	192	162	112	16	210	179	M20 x 90
VWM51-B-600	600	24	Blue							
VWM51-B-750	750	30	Black							
VWM51-B-1000	1000	40	Yellow							
VWM51-B-1200	1200	48	Red							
VWM51-B-1500	1500	60	Brown							

(NOTE) The specification and data are subject to change without prior to for improvement of product performance and quality.

VWM52 Wire-Spring Mount (Deflection : 50mm)

※ The model name of VWA product has changed to VWM52





■ Features

It is a wire spring mount, has the same feature and purpose as VWM51 TYPE, but with static displacement of spring being 50mm, used when necessary to operate in quiet and calm manner of equipments requiring reciprocating compressor, steam blower, vibration reduction ability and dynamic stability.

■ Usage

- Reciprocating compressor, steam blower
- Used in high efficiency vibration reduction of equipments requiring vibration ability and dynamic stability.
- Used in high efficiency vibration reduction requiring buffer medium
- Used in high efficiency vibration reduction when necessary to remove noise from direct underneath layer

■ Specification

No.	Name of Components	Material	Standard
1	Lower Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS400	KS D 3503
3	Spring Seat	CR	KS M 6617
4	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
5	Retainer Bar	E-Plastic	–
6	Wire Rope	STS304	KS D 3514
7	Upper housing	SS400	KS D 3503
8	Level Bolt	SS400	KS B 1002

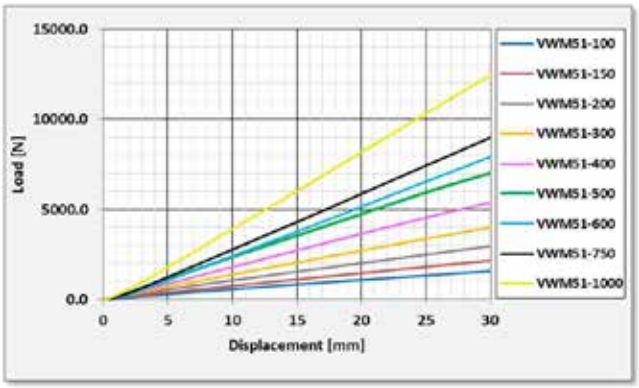
■ Dimension & Selection Guide

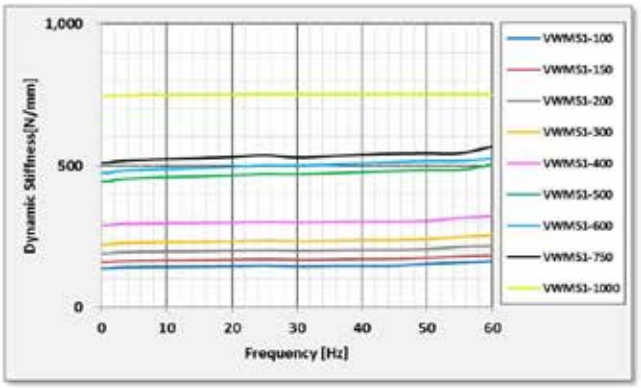
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Color	Dimension(mm)						
				A	B	C	D	E	H	Leveling Bolt
VWM52-100	100	2	Blue	216	186	139	16	238	193	M16 x 80
VWM52-150	150	3	Brown							
VWM52-200	200	4	White							
VWM52-300	300	6	Orange							
VWM52-400	400	8	Pink							
VWM52-500	500	10	Green							
VWM52-600	600	12	Blue							
VWM52-750	750	15	Black							
VWM52-1000	1000	20	Yellow							
VWM52-1200	1200	24	Red							
VWM52-1500	1500	30	Brown							

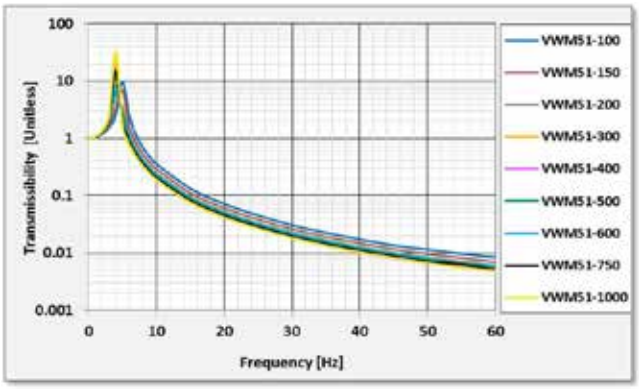
(NOTE) The specification and data are subject to change without prior to for improvement of product performance and quality.

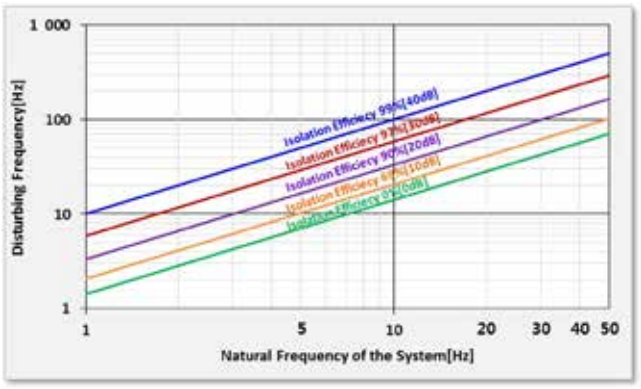
VWM51/VWM52 Wire-Spring Mount

■ VWM51– Test Data

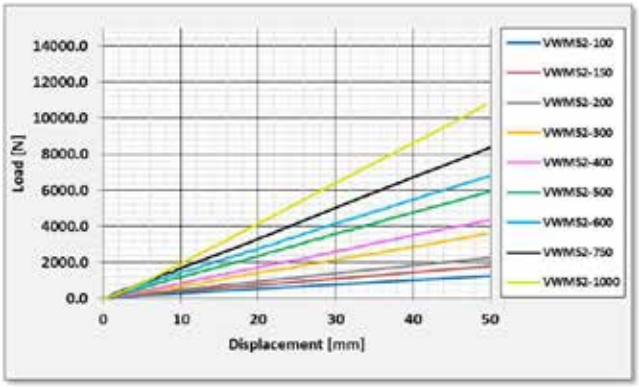


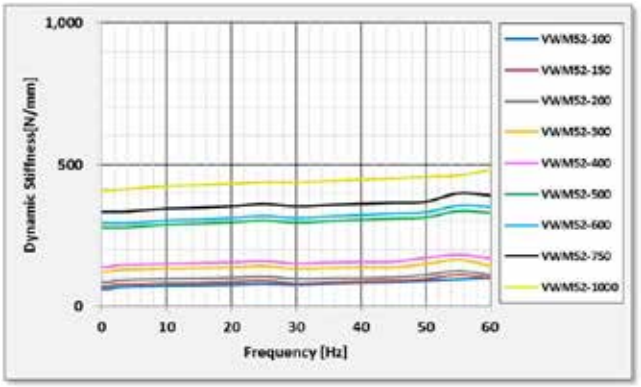


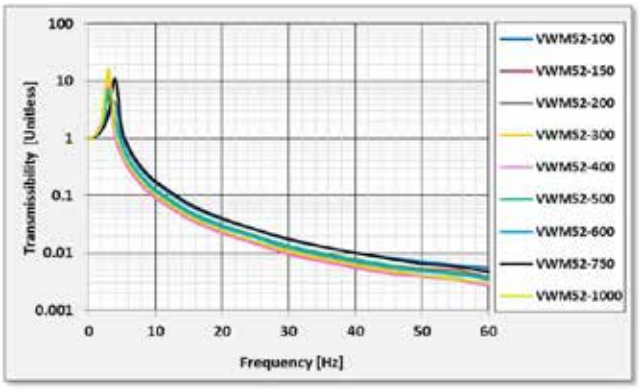


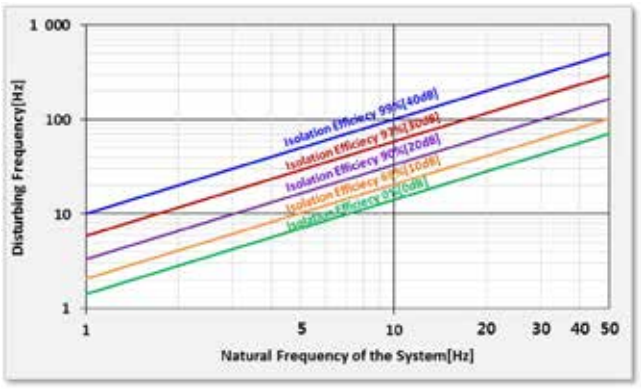


■ VWM52– Test Data



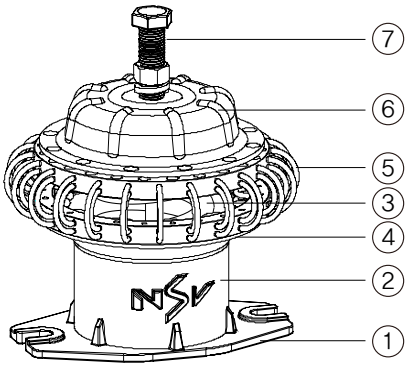


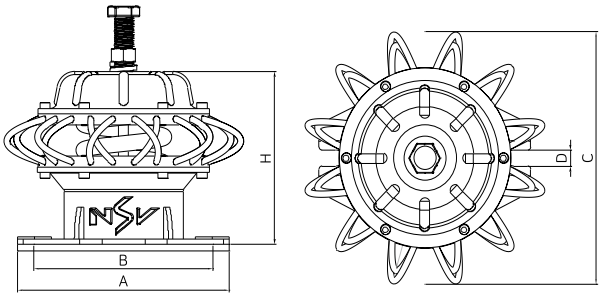




VWM62 Wire-Spring Mount (Deflection : 50mm)

※ The model name of VWS product has changed to VWM62





■ Features

VWM62 offers elasticity of coil spring and excellent attenuation effect of wire rope, ensuring vibration isolation and dynamic stabilization of equipment.
enhanced strength of wire mount helps bear large loads

■ Usage

- For equipment that requires vibration isolation and dynamic stability
- For equipment that needs a buffer
- For equipment that needs horizontal elasticity
- For cooling towers, reciprocating compressors and steam blowers
- For equipment that needs to control noise directing the floor right below

■ Specification

No.	Name of Components	Material	Standard
1	Lower Non Skid Pad	CR	KS M 6617
2	Lower Housing	STS304	–
3	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
4	Retainer Bar	STS304	–
5	Wire Rope	STS304	KS D 3514
6	Upper housing	STS304	–
7	Level Bolt	SS400	KS B 1002

■ Dimension & Selection Guide

Type	Capacity	Spring Constant (kgf/mm)	Color	Dimension(mm)					
				A	B	C	D	H	Leveling Bolt
VWM62-100	100	2	Blue	201	170	214	15	170	M16 x 80
VWM62-150	150	3	Brown						
VWM62-200	200	4	White						
VWM62-300	300	6	Orange						
VWM62-400	400	8	Pink						
VWM62-500	500	10	Green						
VWM62-600	600	12	Blue						
VWM62-750	750	15	Black						
VWM62-1000	1000	20	Yellow						
VWM62-1200	1200	24	Red						
VWM62-1500	1500	30	Black						

(NOTE) The mentioned size and scale can be altered to improve the quality performance and capacity of the product without any notice.

Seismic Control NSV

ISO 9001/ISO 14001
OHSAS 18001
MADE IN KOREA

SEISMIC CONTROL

Domestic Seismic Design Standards

1) KBC 2016 (Public notice of Ministry of Land, Infrastructure and Transport, Standards and Explanation of Building Construction)
2) KECG 9701-2009 (Construction Guidelines for Seismic Design of Building, Electricity and Facilities)
3) Regulation on Structure Standards of Building (Decree No. 555, Ministry of Land, Infrastructure and Transport, 2018. 11. 9)
4) ACT ON FIRE PREVENTION AND INSTALLATION, MAINTENANCE, AND SAFETY CONTROL OF FIRE-FIGHTING SYSTEMS (Enforcement date: 2018. 9. 3)
5) SPECIAL ACT ON MANAGEMENT OF DISASTERS IN SUPER HIGH-RISE BUILDINGS AND COMPLEX BUILDINGS WITH UNDERGROUND CONNECTIONS (Enforcement date: 2018. 6. 27)
6) Establishment of Seismic Design Standards of Fire Fighting System (Public notice of Ministry of the Interior and Safety, No. 2015-138)

Overseas Seismic Design Standards

1) FEMA (Federal Emergency Management Agency)
2) IBC2015 (International Building Code)
3) ASCE 7-10, 41-13 (American Society of Civel Engineers
4) SMACNA (Seismic Restraint Manual : Guidelines for Mechanical System)
5) 2015 ASHRAE HANDBOOK HVAC APPLICATIONS CH.55
6) UFC 3-310-04 (Unified Facilities Criteria) - D.O.D. (Department Of Defense)
7) EC-8 (EUROCIDE 8: Design of structures for earthquake resistance)

Seismic Design - Equivalent Static Loads

1. Seismic Design Force

If an seismic design force method is applied for building design according to seismic design category and seismic classification, seismic design force by earthquake are calculated using an seismic design force method. seismic design force by earthquake Fp are as follows. Fp shall be independently applied to axial and orthogonal directions while considering together running weight acting on nonstructural components. If wind load acting on nonstructural outer wall exceeds Fp, the design shall be for wind load.

Seismic design force (Fp)

$$F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I}\right)}\left(1 + 2\frac{z}{h}\right)$$

Seismic design force for max. (Fp)

$$F_p = 1.6 S_{DS} I_p W_p$$

Seismic design force for min. (Fp)

$$F_p = 0.3 S_{DS} I_p W_p$$

Where: F_P : Seismic design force acting on center of mass of nonstructural components
a_P : Amplification factor that varies from 1.0 to 2.5
S_{DS} :Spectral acceleration at short period
W_P : Component operating weight
h : Average roof height of structure with respect to the base
R_P : Component response modification factor that varies from 1.0 to 12.0
I_P: Component Importance factor that caries from 1.0 to 1.5
z : Height in structure of point of attachment of component with respect to the base.
$z = 0$: If a nonstructural components is located below the structure base.
$z = h$: If a nonstructural components is located to the roof or higher place of a structure

SEISMIC COEFFICIENTS FOR MECHANICAL AND ELECTRICAL COMPONENTS

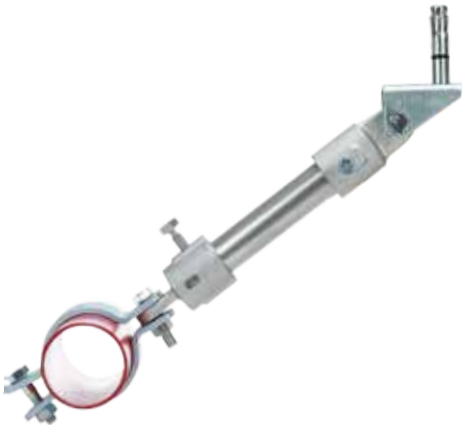
MECHANICAL AND ELECTRICAL COMPONENTS	a_p[a]	R_p[b]	Ω_0[c]
Air–side HVAC, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing.	2 ½	6	2 ½
Wet–side HVAC, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, heat exchangers, evaporators, air separators, manufacturing or process equipment, and other mechanical components constructed of high–deformability materials.	1	2 ½	2 ½
Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.	1	2 ½	2 ½
Skirt–supported pressure vessels not within the scope of Chapter 15.	2 ½	2 ½	2 ½
Elevator and escalator components.	1	2 ½	2 ½
Generators, batteries, inverters, motors, transformers, and other electrical components constructed of high deformability materials.	1	2 ½	2 ½
Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing.	2 ½	6	2 ½
Communication equipment, computers, instrumentation, and controls.	1	2 ½	2 ½
Roof–mounted stacks, cooling and electrical towers laterally braced below their center of mass.	2 ½	3	2 ½
Roof–mounted stacks, cooling and electrical towers laterally braced above their center of mass.	1	2 ½	2 ½
Lighting fixtures.	1	1 ½	1 ½
Other mechanical or electrical components.	1	1 ½	1 ½
VIBRATION ISOLATED COMPONENTS AND SYSTEMS[b]			
Components and systems isolated using neoprene elements and neoprene isolated floors with built–in or separate elastomeric snubbing devices or resilient perimeter stops.	2 ½	2 ½	2 ½
Spring isolated components and systems and vibration isolated floors closely restrained using built–in or separate elastomeric snubbing devices or resilient perimeter stops.	2 ½	2	2 ½
Internally isolated components and systems.	2 ½	2	2 ½
Suspended vibration isolated equipment including in–line duct devices and suspended internally isolated components.	2 ½	2 ½	2 ½
DISTRIBUTION SYSTEMS			
Piping in accordance with ASME B31, including in–line components with joints made by welding or brazing.	2 ½	12	2 ½
Piping in accordance with ASME B31, including in–line components, constructed of high or limited deformability materials, with joints made by threading, bonding, compression couplings, or grooved couplings.	2 ½	6	2 ½
Piping and tubing not in accordance with ASME B31, including in–line components, constructed of high–deformability materials, with joints made by welding or brazing.	2 ½	9	2 ½
Piping and tubing not in accordance with ASME B31, including in–line components, constructed of high– or limited–deformability materials, with joints made by threading, bonding, compression couplings, or grooved couplings.	2 ½	4 ½	2 ½
Piping and tubing constructed of low–deformability materials, such as cast iron, glass, and nonductile plastics. a	2 ½	3	2 ½
Ductwork, including in–line components, constructed of high–deformability materials, with joints made by welding or brazing.	2 ½	9	2 ½
Ductwork, including in–line components, constructed of high– or limited–deformability materials with joints made by means other than welding or brazing.	2 ½	6	2 ½
Ductwork, including in–line components, constructed of low–deformability materials, such as cast iron, glass, and nonductile plastics.	2 ½	3	2 ½
Electrical conduit and cable trays	2 ½	6	2 ½
Bus ducts	1	2 ½	2 ½
Plumbing	1	2 ½	2 ½
Manufacturing or process conveyors (nonpersonnel).	2 ½	3	2 ½

Earthquake intensity and magnitude

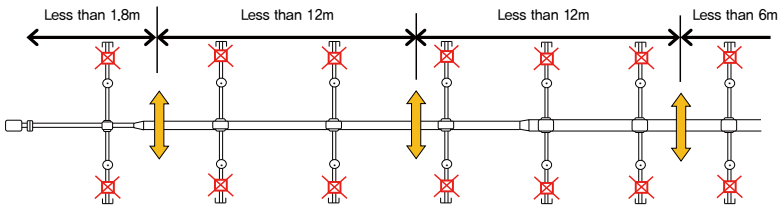
Seismic level	JMA		MM		Richter	Situations
	Intensity	Ground acceleration	Intensity	Ground acceleration	Magnitude	
	Ⅰ (Slight earthquake)	0.8~2 gal	Ⅰ	–	2	Not felt except by very few under especially favorable conditions.
	Ⅱ (Weak earthquake)	2.5~8 gal	Ⅱ	–		Felt only by a few people especially on upper floors of buildings.
			Ⅲ	–	3	Felt quite noticeably by people indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Duration estimated.
	Ⅲ (Minor earthquake)	8~25 gal	Ⅳ	15~20	4	Felt indoors by many, outdoors by few during the day. Dishes, windows, doors disturbed. Standing motor cars rock noticeably.
	Ⅳ (Moderate earthquake)	25~80 gal	Ⅴ	30~40		Many people rush outside. Some heavy furniture moved. A few instances of fallen chimneys.
			Ⅵ	60~70	5.1 5.1 5.8	
	Ⅴ (Very strong earthquake)	80~250 gal	Ⅶ	100~150		All people rush outside. Damage negligible in buildings of good design and construction. Considerable damage in poorly built or badly designed structures. Some chimneys broken.
	Ⅵ (Violent earthquake)	250~400 gal	Ⅷ	150~300	6.3 6	Damage slight in specially designed structures. Considerable damage in ordinary substantial buildings with partial collapse. Heavy furniture overturned.
			Ⅸ	500~550	7	Damage considerable in specially designed structures. Damage great in substantial buildings, with partial collapse. Ground split.
	Ⅶ (Disastrous earthquake)	≥ 400 gal	Ⅹ	Over 600	7.4	Most masonry and frame structures destroyed with foundations. Rails bent. Ground severely split. River bank, steep slope landslides.
			Ⅺ	–	8	Few, if any, (masonry) structures remain standing. Rails bent greatly. Bridges destroyed. Underground pipelines completely out of service. Earth slumps and landslides in soft ground.
			Ⅻ	–		Waves seen on ground surfaces. Objects thrown upward into the air.

JMA : Japan Meteorological Agency
MM : Modified Mercalli

Lateral Sway Bracing

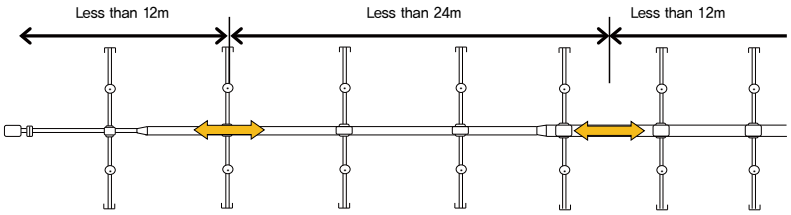


- Lateral sway bracing shall be provided on all feed and cross mains regardless of size and all branch lines and other piping with a diameter of 65 mm and larger.
- The distance between the last brace and the end of the pipe shall not exceed 1.8m.
- Spacing shall not exceed a maximum interval of 12m on centerline.



Longitudinal Sway Bracing

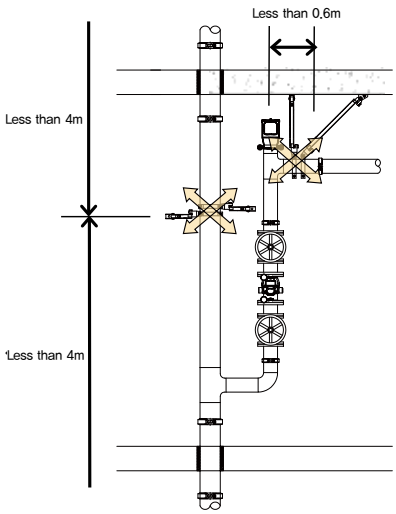
- A longitudinal sway bracing shall be provided on all feed and cross mains regard less of size.
- The distance between the last brace and the end of the pipe shall not exceed 12m.
- Spacing shall not exceed a maximum interval of 24m on centerline.



4-Way Sway Bracing

(For vertical pipe installation)

(For horizontal pipe installation)



- Tops of risers piping exceeding 1m in length shall be provided with a four-way brace.
- When a four-way brace at the top of a riser is attached on the horizontal piping, it shall be within 600 mm of the centerline of the riser and the loads for that brace shall include both the vertical and horizontal pipe.
- The distance between 4-way Sway Bracing shall not exceed 8m.

Components of SEISMIC Sway Braicing for Fire Protection System

ND-10A/B
Adapter

- Features

Adapter for sway bracing used with manufacturer's ND-30 (structure attachment) or ND-20 (pipe clamp)
Compose sway bracing system with Sch. pipe

- Material : Spheroidal graphite cast iron

Model name	Sch #40 Pipe
ND-10A	25A
ND-10B	32A

ND-20/21
Pipe Clamp

- Features

Pipe clamp of sway bracing used with manufacturer's ND-10 (adapter) or ND-40 (swivel adapter)
Compose sway bracing system with Sch. pipe

- Material : Rolled steel

Model name	Applicable pipe diameter	Remarks
ND-20	32~200A	general fire protection system
ND-21	40~100A	CPVC

ND-30A/B
Structure Attachment

- Features

Structure attachment of sway bracing system used with manufacturer's ND-10 (adapter) or ND-50 (beam structure attachment)
Compose sway bracing system with Sch. pipe.

- Material : Spheroidal graphite cast iron

Model name	Sch #40 Pipe
ND-30A	25A
ND-30B	32A

ND-40

Swivel Adapter

- Features

Adapter of swivel system for low height ceiling space used with manufacturer's ND–20 (pipe clamp), ND–10 (adapter) Compose sway bracing system with Sch. pipe

- Material : Spheroidal graphite cast iron

Model name	pipe diameter
ND–40	40~100A

ND-50

Beam Structure Attachment

For Sway Bracing System

- Features

The beam structure attachment is used to attach the seismic system to a beam structure.
Mainly used when a seismic anchor cannot be used or welding is not allowed.

- Material : Rolled steel

- Specification : 10mm ~ 32mm

Model name	pipe diameter	Rated load per installation angle				KFI Certificate No.
		30°	45°	60°	90°	
ND–50	50A	3,559	5,032	6,163	7,117	Beotim 18–20
	65A					
	80A					
	100A					
	125A	4,481	6,337	7,762	8,963	
	150A					
	200A					

NP

Bracing Pipe

- Material : KS D 3562

Model name	Specification	Pipe diameter	Slenderness ratio	Least Radius of Gyration (mm)	Max. length (mm)	Max. horizontal load per angle of sway brace (kgf)		
						30° ~ 44°	45° ~ 59°	60° ~ 90°
NP–25A	SCH. #40	25A	≤ 100	10.7	1,000	1,429	2,021	2,475
			≤ 200		2,100	420	594	728
			≤ 300		3,000	187	264	323
NP–32A		32A	≤ 100	13.7	1,200	1935	2,737	3,352
			≤ 200		2,700	569	805	986
			≤ 300		4,000	253	357	438

Seismic Anchor and Bolt

ND-A10
Seismic Anchor

ND-A11
Seismic Anchor

ND-B10
High Tensile Anchor

● Features

The seismic anchor is designed to use by inserting into a preconfigured anchor hole. The sleeve is expanded to fit the anchor size to be fixed by a tightening nut.

● Material : Rolled steel

Model name	Diameter (mm)	Anchor length (mm)	Effective anchorage depth (mm)	Tensile load (kN)	Shear load (kN)	Thread length (mm)
ND-A1012	12	90	60	10.5	12	30
ND-A1012	12	105	70	12.5	12	48
ND-A1110	10	70	45	7.2	7.8	50
ND-A1116	16	130	75	16.5	24	55
ND-B1010	10	100	80	24	56.8	30
ND-B1016	16	130	100	33.5	78.8	45
ND-B1020	20	170	120	46.5	110.4	50

ND-N10 Lock Nut

● Features

When a friction ring contacts threads of a bolt, stress is generated by spring action. The repulsive force pressures the threads of the bolt, generating frictional torque that blocks free rotation. It is easy to couple, as skilled technique and dedicated tools are not necessary, and it shows stable anti-loosening.

● Application : Facilities where swaying and repeated load is applied

Model name	Specification	B (mm)	H (mm)	Installation torque (N·m)
ND-N10-12	M12	24	18	62
ND-N10-16	M16	30	20	155
ND-N10-20	M20	36	24	300
ND-N10-24	M24	42	30	520

ND-H

System components

① ND-30 A/B (structure attachment)
② ND-20 (pipe clamp)
③ ND-10 A/B (adapter)
④ NP-25A/32A Sch. #40 pipe
⑤ M12 seismic anchor bolt

- **Slenderness ratio (L/r)** : Less than 300mm (L: System length, r : Min. rotation radius)
- **Min. embedment depth of anchor bolt** : 50mm

ND-30 A/B

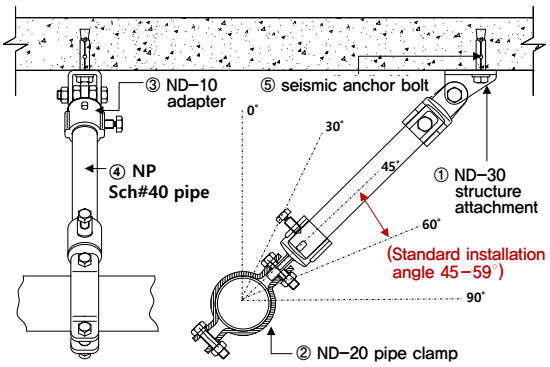
Structure Attachment

ND-20

Pipe Clamp

ND-10 A/B

Adapter



Installation Standards

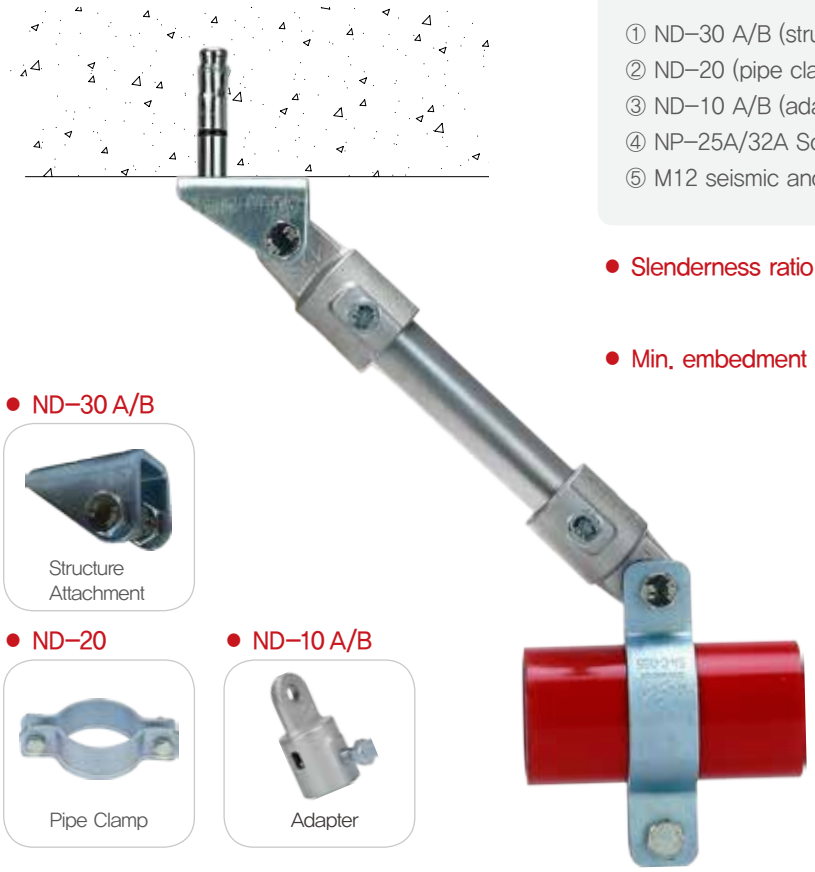
1) Lateral sway bracing shall be provided on all feed and cross mains regardless of size and all branch lines and other piping with a diameter of 65 mm and larger.
2) Spacing shall not exceed a maximum interval of 12m and the distance between the last brace and the end of the pipe shall not exceed 1.8 m.

Rated load per pipe diameter and installation angle

Model name	Pipe diameter	Rated load per installation angle (N)				KFI Certificate No.
		30°	45°	60°	90°	
ND-H-32	32A	2,224	3,145	3,852	4,448	Beotim 18-34
ND-H-40	40A					
ND-H-50	50A	3,558	5,032	6,163	7,117	Beotim 17-38
ND-H-65	65A					
ND-H-80	80A					
ND-H-100	100A					
ND-H-125	125A	4,481	6,337	7,762	8,963	
ND-H-150	150A					
ND-H-200	200A					

Sway Bracing (Longitudinal)

ND-V



- ND-30 A/B

Structure Attachment

- ND-20

Pipe Clamp

- ND-10 A/B

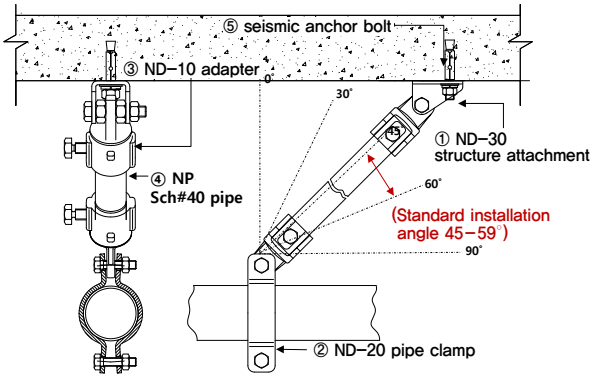
Adapter

- System components

① ND-30 A/B (structure attachment)
② ND-20 (pipe clamp)
③ ND-10 A/B (adapter)
④ NP-25A/32A Sch. #40 pipe
⑤ M12 seismic anchor bolt

- Slenderness ratio (L/r) : Less than 300mm (L: System length, r : Min. rotation radius)

- Min. embedment depth of anchor bolt : 50mm



- Installation Standards

1) Longitudinal sway bracing shall be provided on all feed and cross mains regardless of size and it shall be excluded for all branch lines and other piping.
2) Spacing shall not exceed a maximum interval of 24m and the distance between the last brace and the end of the pipe shall not exceed 12m.

- Rated load per pipe diameter and installation angle

Model name	Pipe diameter	Rated load per installation angle (N)				KFI Certificate No.
		30°	45°	60°	90°	
ND-V-32	32A	2,224	3,145	3,852	4,448	Beotim 18-34
ND-V-40	40A					
ND-V-50	50A	3,558	5,032	6,163	7,117	Beotim 17-38
ND-V-65	65A					
ND-V-80	80A					
ND-V-100	100A					
ND-V-125	125A	4,481	6,337	7,762	8,963	
ND-V-150	150A					
ND-V-200	200A					

ND-4W

Vertical Pipe Installation Type

Horizontal Pipe Installation Type

System components

① ND-30 A/B (structure attachment)
② ND-20 (pipe clamp)
③ ND-10 A/B (adapter)
④ NP-25A/32A Sch. #40 pipe
⑤ M12 seismic anchor bolt

Min. embedment depth of anchor bolt : 50mm

Installation Standards

1) Tops of risers piping exceeding 1m in length shall be provided with a four-way brace.
2) When a four-way brace at the top of a riser is attached on the horizontal piping, it shall be within 600 mm of the centerline of the riser and the loads for that brace shall include both the vertical and horizontal pipe.
3) The distance between 4-way Sway Bracing shall not exceed 8m.

ND-10 A/B

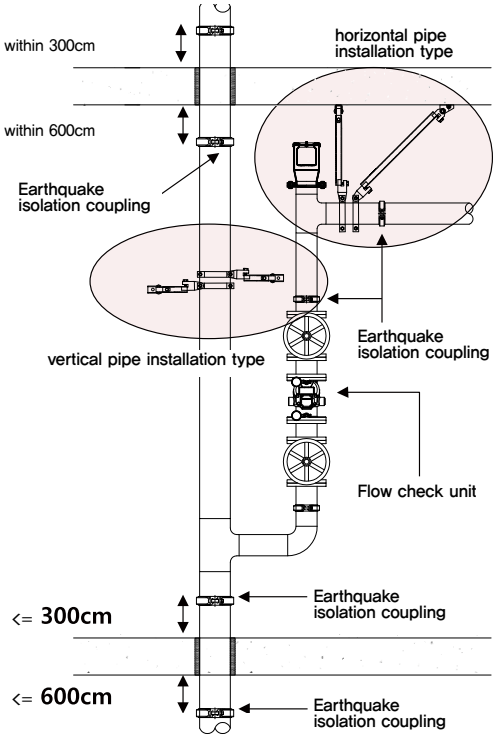
Adapter

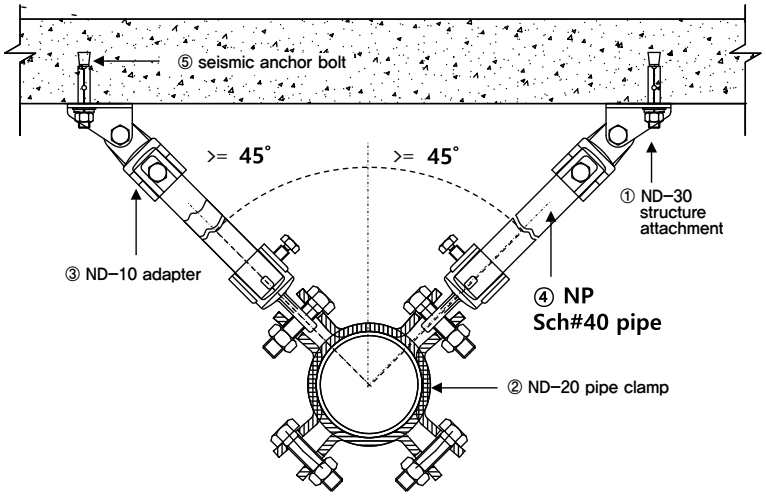
ND-20

Pipe Clamp

ND-30 A/B

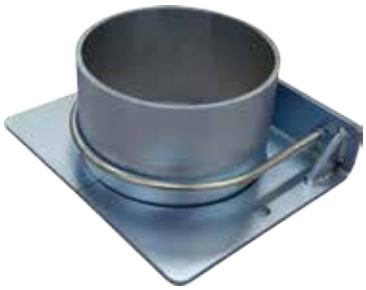
Structure Attachment

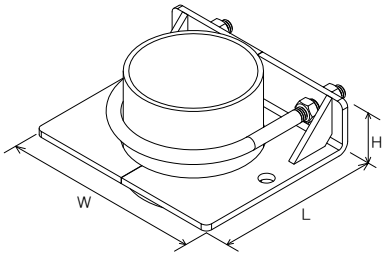




Sway Bracing (4-way Riser Pipe, Floor support type)

ND-F1





● Features

It is used when there is no structure to support a riser pipe sway brace support. Its space utilization is excellent in a narrow pit.

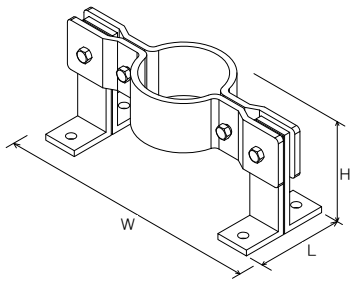
● Installation Standards

1) Tops of risers piping exceeding 1m in length shall be provided with a four–way brace.
2) When a four–way brace at the top of a riser is attached on the horizontal piping, it shall be within 600 mm of the center–line of the riser and the loads for that brace shall include both the vertical and horizontal pipe.
3) The distance between 4–way Sway Bracing shall not exceed 8m.

Model name	Pipe diameter	Dimension (mm)		
		W	H	L
ND–F1–150	150A	246	50	218
ND–F1–200	200A	306	70	276
ND–F1–250	250A	358		328
ND–F1–300	300A	416		382

NOTE : Specifications and dimensions are subject to change without prior notice for the enhancement of product performance and quality.

ND-F2



● Features

It is used when there is no structure to support a riser pipe sway brace support. Its space utilization is excellent in a narrow pit.

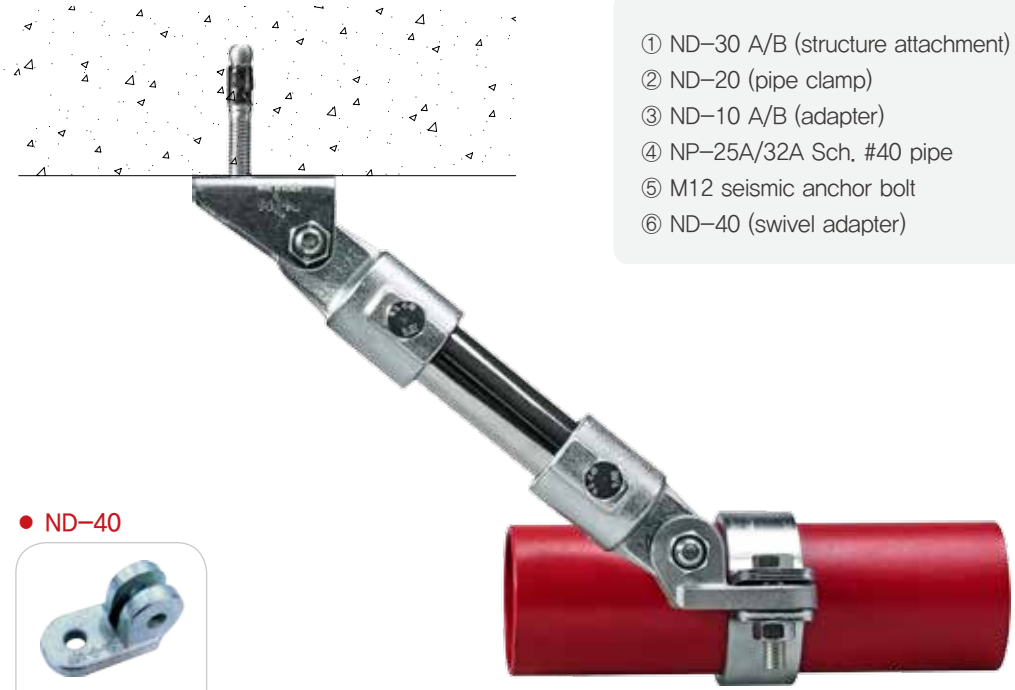
● Installation Standards

1) Tops of risers piping exceeding 1m in length shall be provided with a four–way brace.
2) When a four–way brace at the top of a riser is attached on the horizontal piping, it shall be within 600 mm of the center–line of the riser and the loads for that brace shall include both the vertical and horizontal pipe.
3) The distance between 4–way Sway Bracing shall not exceed 8m.

Model name	Pipe diameter	Dimension (mm)		
		W	H	L
ND–F2–150	150A	450	158	134
ND–F2–200	200A	500	165	
ND–F2–250	250A	570		
ND–F2–300	300A	630		

NOTE: Specifications and dimensions are subject to change without prior notice for the enhancement of product performance and quality.

ND-R



Features

① ND-30 A/B (structure attachment)
② ND-20 (pipe clamp)
③ ND-10 A/B (adapter)
④ NP-25A/32A Sch. #40 pipe
⑤ M12 seismic anchor bolt
⑥ ND-40 (swivel adapter)

ND-40

Swivel Adapter

ND-10 A/B

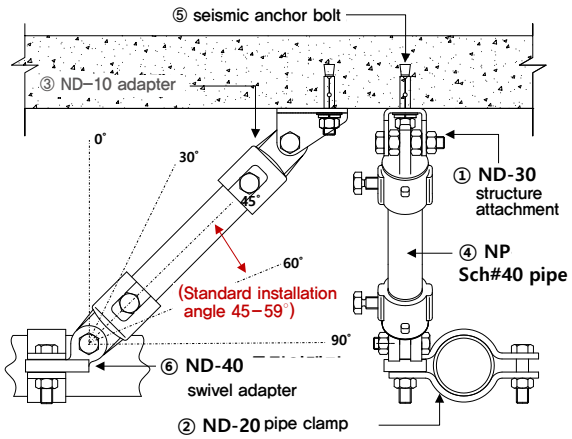
Adapter

ND-20

Pipe Clamp

ND-30 A/B

Structure Attachment



- Min embedment depth of anchor bolt : 50mm
- It is beneficial when applying to the common area of a Apartment house or low height ceiling space within a house
- Installation Standards

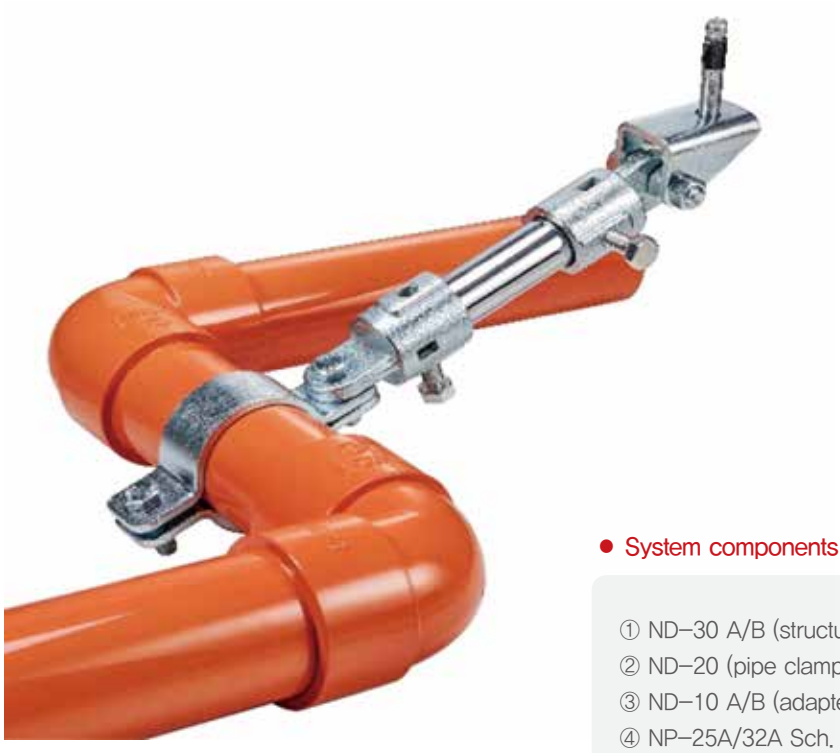
1) It is used when a longitudinal sway bracing is not installed due to a narrow space between the ceiling and pipe top surface.
2) For installation Standards, that of the longitudinal sway bracing is applied.

Rated load per pipe diameter and installation angle

Model name	Pipe diameter	Rated load per installation angle (N)			KFI Certificate No.
		45°	60°	90°	
ND-R-40	40A	4,718	5,778	6,672	Beotim 18-35
ND-R-50	50A				
ND-R-65	65A				
ND-R-80	80A				
ND-R-100	100A				

Sway Bracing (Lateral, CPVC)

ND-CP



- ND–30 A/B

Structure Attachment

- ND–21 (CPVC)

Pipe Clamp

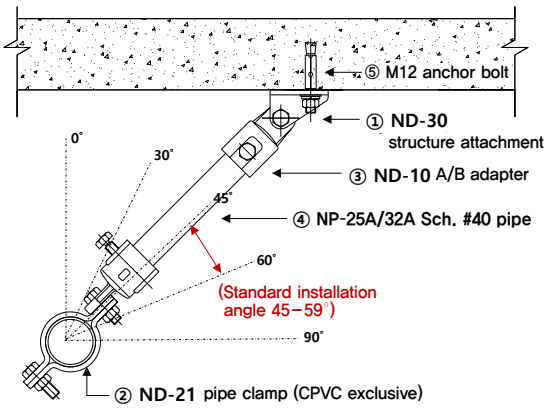
- ND–10 A/B

Adapter

- System components

① ND–30 A/B (structure attachment)
② ND–20 (pipe clamp) – for CPVC
③ ND–10 A/B (adapter)
④ NP–25A/32A Sch. #40 pipe
⑤ M12 anchor bolt

- Min. embedment depth of anchor bolt : 50mm
- Slenderness ratio (L/r) : Less than 300mm (L: System length, r : Min. rotation radius)



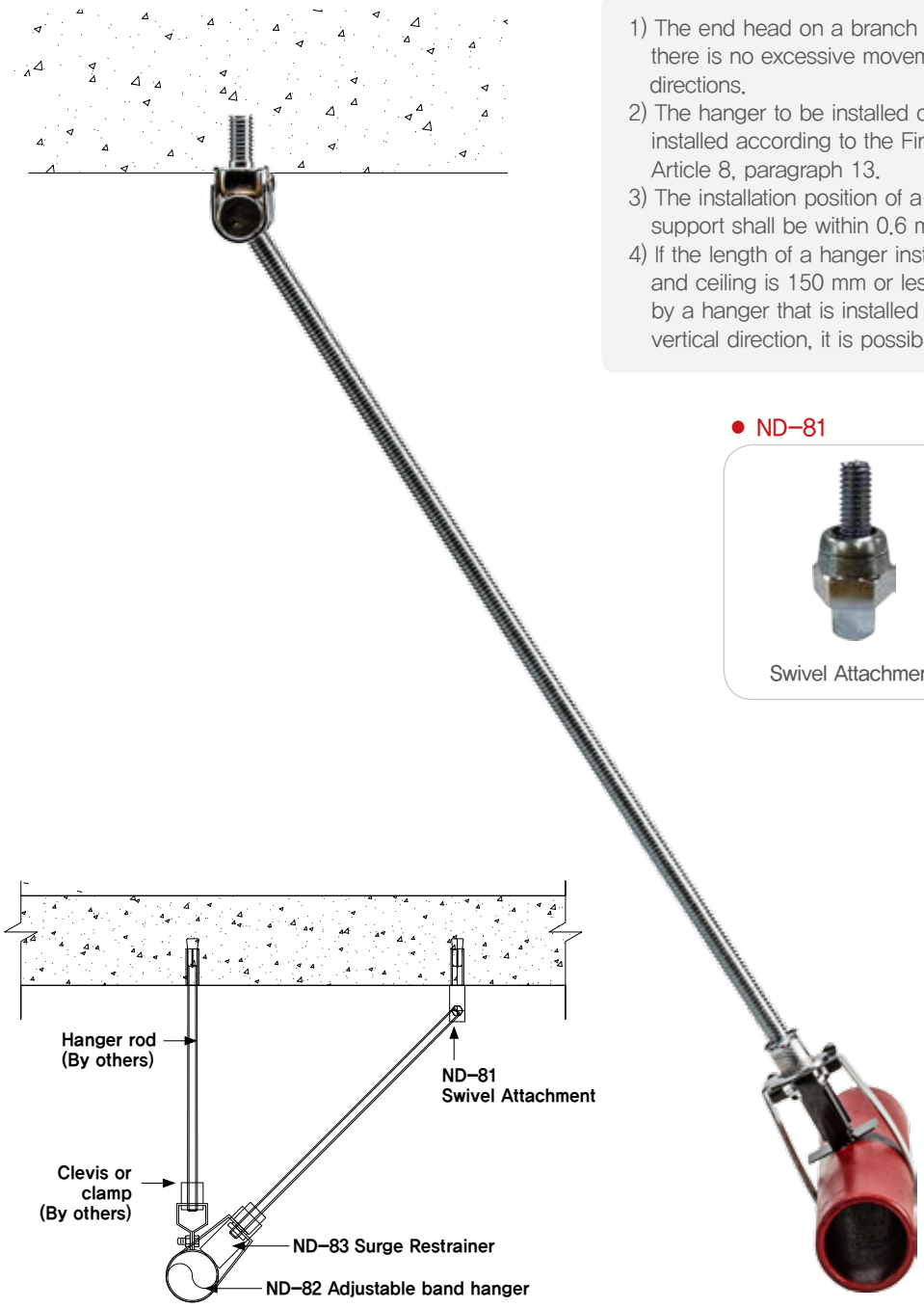
- Installation Standards

1) If the distance between ceiling and pipe top surface is less than 150mm, it is possible not to install a lateral sway Bracing
2) In case of a fire protection pipe that passes the anteroom and interior of a house or multi–tenant house is made of CPVC , if it is using a lateral/ longitudinal Sway Bracing for used in steel pipe, it becaomes pipe breakage is a concern, so the direction of the lateral Sway Bracing is diverted to be used as a longitudinal sway Bracing.
3) A lateral Sway Bracing is used instead of longitudinal Sway Bracing within 600 mm from the pipe centerline of the section where a longitudinal Sway Bracing is used and from the direction of a diverted pipe.

- Rated load per pipe diameter and installation angle

Model name	Pipe diameter	Rated load per installation angle (N)			KFI Certificate No.
		45°	60°	90°	
ND–CP–32	32A	3,145	3,852	4,448	Beotim 18–19
ND–CP–40	40A				
ND–CP–50	50A				
ND–CP–65	65A				
ND–CP–80	80A				
ND–CP–100	100A				

ND-E



● Installation Standards

1) The end head on a branch pipe should be fixed so that there is no excessive movement in the vertical and horizontal directions.
2) The hanger to be installed on a branch pipe shall be installed according to the Fire Safety Standard for Sprinklers, Article 8, paragraph 13.
3) The installation position of a branch pipe sway brace support shall be within 0.6 m from the last hanger.
4) If the length of a hanger installed between a branch pipe and ceiling is 150 mm or less and the branch pipe is fixed by a hanger that is installed at less than 45 degrees from the vertical direction, it is possible not to install a head fixture.

● ND-81

Swivel Attachment

● ND-82 (25A~50A)

Adjustable Band Hanger

● ND-83

Surge Restrainer

ND-84 (Beam Structure Attachment)

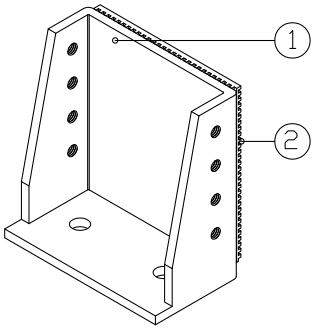
〈For branch pipe end fixing〉

● Features

A beam structure attachment is used to attach a seismic system to a beam structure.
Mainly used when a seismic anchor cannot be used or welding is not allowed.

- **Material** : Rolled steel
- **Applicable specification** : 10mm ~32mm

NSS-12

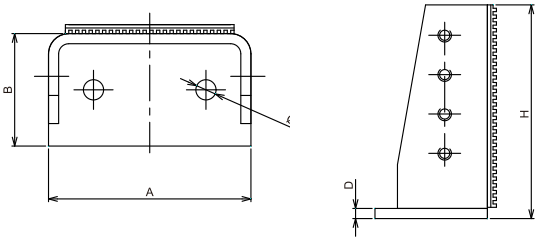


Features

This product is a stopper that prevents movement in the event of an earthquake. To prevent moving of the product in the event of an earthquake, the product is installed at least 6 mm away from the target equipment. Such a gap will allow the product to not have an influence on the anti-vibration capabilities of the equipment under normal circumstances.
It has a simple structure and few limitations in installation, giving it the advantage of being easily applied and installed on nearly all equipment.

Product components

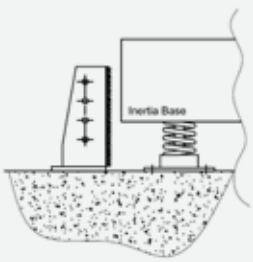
No.	Name	Materia
1	Lower Housing	Hot Rolled Carbon Steel Sheet
2	Rubber Pad	NR



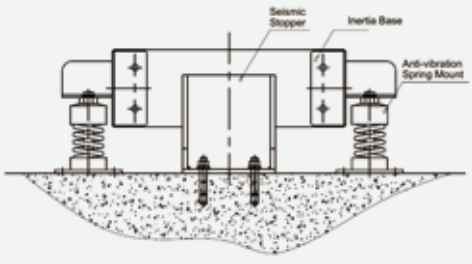
Instruction and Installation Manual

The seismic stopper must be installed according to the anti-vibration design standards of the firefighting facility and installation instructions of the manufacturer. The anchor must be installed vertical to a flat concrete surface. After drilling a hole that matches the anchor specification, make sure to remove all dust and debris from the hole. Use a dedicated punch and hammer for anchors to expand the cap inside, and make sure that installation is securely conducted. (Non-specification anchors should be used after contacting the manufacturer.) Install the stopper so that the movement stopper surface does not come in contact with the inertia base. The movement prevention stopper only limits horizontal displacements, not vertical. Stopper height cannot be adjusted according to equipment. Only the specified stopper height can be applied.

① Select the stopper type according to the height of the inertia base and equipment capacity



② Install the seismic stopper at a distance from the equipment where it does not come in contact during normal operation

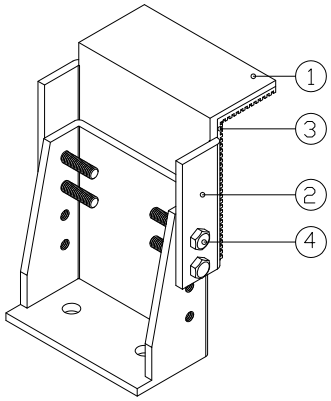


DIMENSION & SELECTION GUIDE BY LOADS

TYPE	Application Load (kgf)	Dimension(mm)				
		A	B	C	H	Ød
NSS-12-500	500 kgf	180	100	9	190	18
NSS-12-1000	1,000 kgf	234	100	9		

NOTE : Specifications and dimensions may be changed without prior notice for the enhancement of product performance and quality.

NSS-13

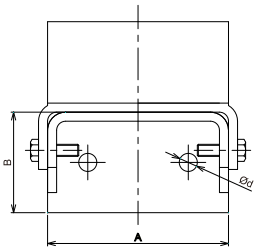


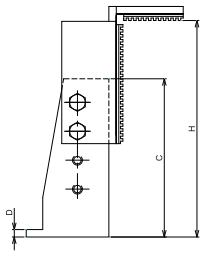
Features

This product is a stopper that prevents movement and falling in the event of an earthquake. To prevent moving of the product in the event of an earthquake, the product is installed at least 6 mm away from the target equipment. Such a gap will allow the product to not have an influence on the anti-vibration capabilities of the equipment under normal circumstances. It has a simple structure and an advantage that its size can be adjusted according to the installation site using height adjustment bolts.

Product components

No.	Name	Materia
1	Upper Housing	Hot Rolled Carbon Steel Sheet
2	Rubber Pad	NR
3	Lower Housing	Hot Rolled Carbon Steel Sheet
4	Bolt	Steel for Machine



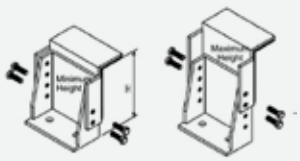


Instruction and Installation Manual

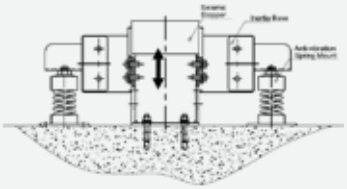
The vibration stopper must be installed according to the anti-vibration design standards of the firefighting facility and installation instructions of the manufacturer. The anchor must be installed vertical to a flat concrete surface. After drilling a hole that matches the anchor specification, make sure to remove all dust and debris from the hole. Use the dedicated punch and hammer for anchors to expand the cap inside, and make sure that installation is securely conducted. (Non-specification anchors should be used after contacting the manufacturer) Install the stopper so that the movement stopper surface does not come in contact with the inertia base. Before attaching the top to the bottom using bolts, make sure to remove all dust and debris on attachment surfaces. Stopper height can be adjusted in three levels according to the height of the inertia base. Install four bolts and make sure they are fastened properly.

① Select the stopper type according to the height of the inertia base and equipment capacity

② Install bolts while adjusting the height of the anti-vibration stopper according to the height of the inertia base, and tighten the four bolts alternately to maintain the right and left balance (L 〉 R 〉 L 〉 R, or vice versa) / (Adjustable Stopper Heights: 262 mm, 227 mm, 192 mm)



③ Install the anti-vibration stopper at a distance from the equipment where it does not come in contact during normal operation



DIMENSION & SELECTION GUIDE BY LOADS

TYPE	Application Load (kgf)	Dimension(mm)					
		A	B	C	D	H	Ød
NSS-13-500	500kgf	180	100	190	262~192	18	M12xL40
NSS-13-1000	1,000kg	234	100	100			

NOTE : 1. Specifications and dimensions may be changed without prior notice for the enhancement of product performance and quality.
It is possible to adjust height H according to base height.
2. The product picture above may differ from the actual product.

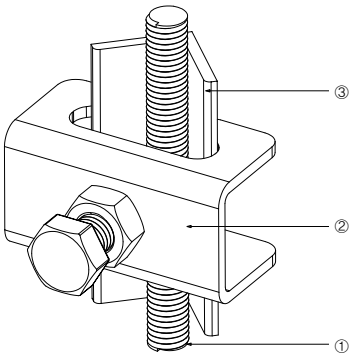
NSS-20
Seismic Rod

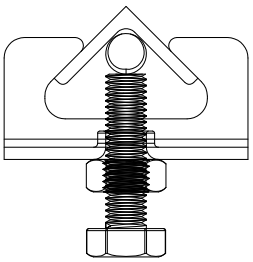
Features

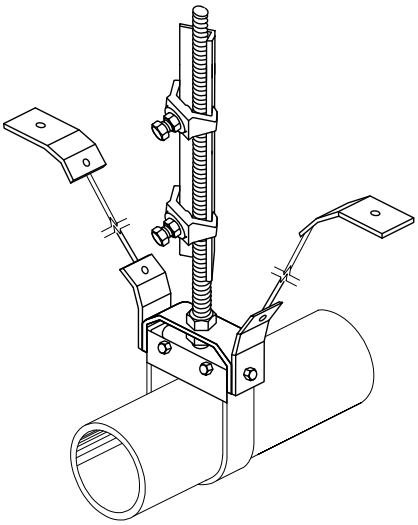
The system is used to fix a member to a full thread bolt using a stiffener to prevent the buckling of the hanger rod and to enhance stiffness when hanging duct or pipe from a ceiling using the bolt.
The system consists of a full thread bolt, fixing clamp and rod stiffener.

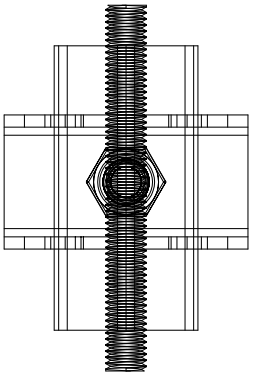
Product components

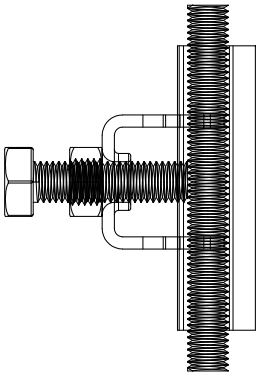
No.	Name	Material	Specification
1	Hanger rod	SS400	KS D 3504
2	Clamp	SS400	KS D 3504
3	Rod Stiffener	SS400	KS D 3504











DIMENSION & SELECTION GUIDE BY LOADS

TYPE	Rod Stiffener Size	Hanger Rod Size
NSS-20-A	25 x 25 x 3T	3/8", 1/2", 5/8"
NSS-20-B	40 x 40 x 5T	3/4", 7/8", 1 1/8"

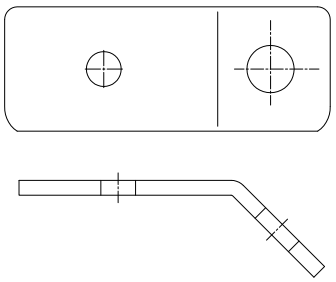
NOTE: Specifications and dimensions may be changed without prior notice for the enhancement of product performance and quality.

NSS-30

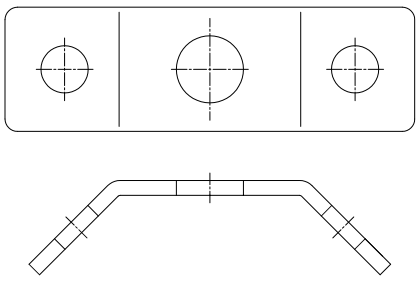
Seismic Cable

Features

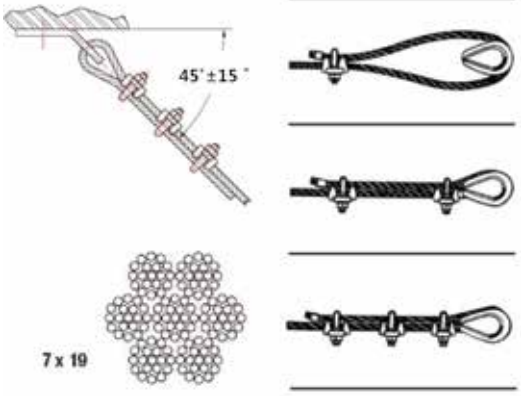
The system can prevent the excessive deformation of duct or pipe in case of earthquake by hanging duct or pipe using wire rope.
The system consists of a plated wire rope, wire clip, thimble, shackle and bracket.



Adapter for structure attachment



Adapter for pipe attachment



Picture of site installation

DIMENSION & SELECTION GUIDE BY LOADS

TYPE	Cable Diameter(mm)	Cable Length(m)	Max Calbe Tension(kgf)
NSS-30-A	3	2	450
NSS-30-B	5	2	950
NSS-30-C	6	2	1500

NOTE: Specifications and dimensions may be changed without prior notice for the enhancement of product performance and quality.

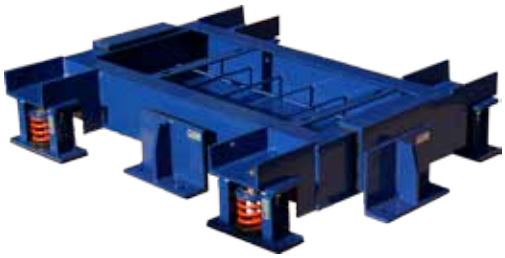
SIB-SB
Seismic Inertia Base

- Features

The inertia base is designed to block vibration that happens when running a pump and to minimize dynamic displacement by dynamic force that happens at the time of rapid load change such as on/off using concrete load. The inertia base consists of a base in the shape of a C-channel or ⊏-channel, a support fixture (ㄱ angle) to which a pump and motor can be easily assembled, a bracket to attach a mount and a bottom plate for reinforcement. The height (H) of the inertia bracket is designed to be at least 150 mm and varies depending on the horsepower of the motor.



SB-SERISE
Seismic Base



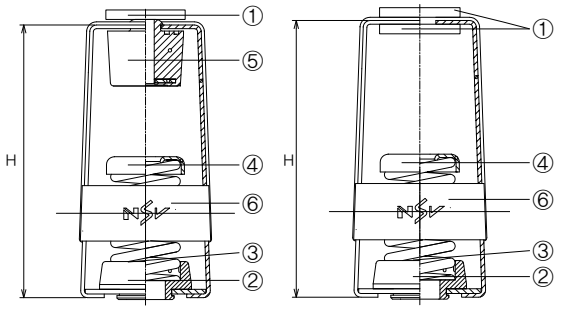
- Features

The structure base is a support fixture made of a ⊏-channel, support fixture to which equipment can be easily assembled, and a bracket to attach a mount. The height (H) of the structure base is designed to be at least 150 mm and varies depending on the capacity of equipment.



SSH/SVH

Restrained Spring Hanger (Deflection: 25mm)



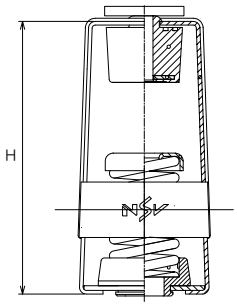
SSH–TYPE SVH–TYPE

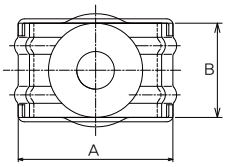
Features

An SSH/SVH is a restrained spring hanger with a unit to restrict vertical movement, and is designed to prevent system damage or deformation so that vertical displacement that can happen due to running equipment is prevented.
A restrain washer prevents drop out of a spring and maintains the reliability of a system if an external load such as an earthquake is applied.

Product components

No.	Name	Material	Specification
1	Restraint Washer	CR	KS M 6617
2	Spring Seat	CR	KS M 6617
3	Spring Cap	SS400	KS D 3503
4	Coil Spring	SUP9	KS B 2402
		HSW3	KS B 2403
5	Housing Fixture	CR	KS M 6617
6	Hanger Housing	SS400	KS D 3503





Application

• Where vibration isolation performance and seismic performance are required at the same time, such as a ceiling fan or pipe

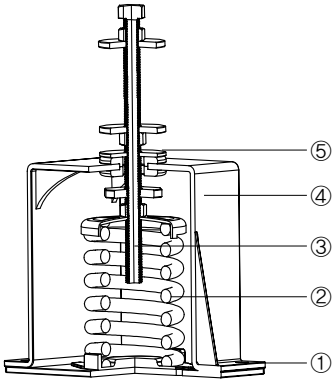
DIMENSION & SELECTION GUIDE BY LOADS

TYPE	Rated load (kgf)	Spring constant (kgf/mm)	Displacement (mm)	Color	Dimension(㎜)			
					A(SSH/SVH)	B(SSH/SVH)	C(SSH/SVH)	Level Bolt
SSH/SVH–A–10	10	0.4	25	Pink	82/70	60/60	172/135	M10
SSH/SVH–A–25	25	1.0	25	Yellow				
SSH/SVH–A–50	50	2.0	25	Red				
SSH/SVH–A–75	75	3.0	25	Black				
SSH/SVH–A–100	100	4.0	25	Blue				
SSH/SVH–B–150	150	6.0	25	Brown	103/96	79/80	215/170	M12
SSH/SVH–B–200	200	8.0	25	White				
SSH/SVH–B–300	300	12.0	25	Orange				
SSH/SVH–B–400	400	16.0	25	Pink				
SSH–C–500	500	20.0	25	Green	118	100	243	M16
SSH–C–600	600	24.0	25	Blue				
SSH–C–750	750	30.0	25	Black				
SSH–C–1000	1000	40.0	25	Yellow				

NOTE: Specifications and dimensions may be changed without prior notice for the enhancement of product performance and quality.

SFSA2

Restrained Spring Mount (Deflection: 50mm)

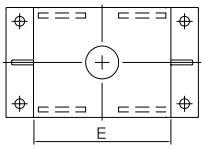


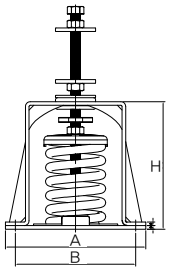
Features

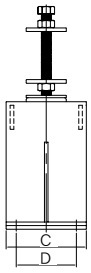
SFSA2 improves the conjunction method of an upper house to prevent breakaway of springs when an external load is applied. In a normal state, a spring mount provides vibration isolation, but upper housing integrated with lower housing serves for the prevention of spring breakaway when an external load is applied. To prevent a direct collision of an adjusting bolt and housing, a rubber bushing is used in the product.

Product components

No.	Name	Material	Specification
1	Lower Housing	SS400	KS D 3504
2	Coil Spring	SS400	KS M 6617
3	Leveling Bolt	SUP9	KS B 2402
		HSW3	KS B 2403
4	Upper Housing	SS400	KS B 1002
5	Rubber bushing	CR	KS D 3504







Application

- For vibration and seismic isolation of a standing pipe
- For high efficiency vibration and seismic isolation of a pump (ground floor)
- For high efficiency vibration and seismic of isolation equipment where silence is required

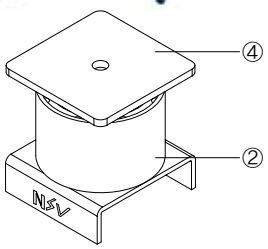
DIMENSION & SELECTION GUIDE BY LOADS

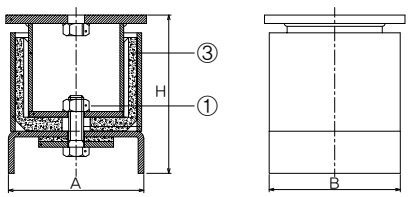
TYPE	Rated load (kgf)	Spring constant (kgf/mm)	Displacement (mm)	Color	Dimension(mm)						
					A	B	C	D	E	H	G
SFSA2-A-50	50	1.0	50	Red	180	235	6	280	140	230	90
SFSA2-A-100	100	2.0		Blue							
SFSA2-A-150	150	3.0		Brown							
SFSA2-A-200	200	4.0		White							
SFSA2-A-300	300	6.0		Orange							
SFSA2-B-400	400	8.0	50	Pink	220	285	6	320	180	270	130
SFSA2-B-500	500	10.0		Green							
SFSA2-B-600	600	12.0		Blue							
SFSA2-B-750	750	15.0		Black							
SFSA2-C-1000	1,000	20.0	50	Yellow	250	310	9	350	200	300	150
SFSA2-C-1200	1,200	24.0		Red							
SFSA2-C-1800	1,800	36.0		Blue							
SFSA2-D-2400	2,400	48.0	50	Brown	290	345	12	390	240	340	190
SFSA2-D-3200	3,200	64.0		White							
SFSA2-D-4000	4,000	80.0		Orange							

NOTE: Specifications and dimensions may be changed without prior notice for the enhancement of product performance and quality.

SRPA

Seismic Rubber Mount





● Features

The mount is used as a guide by inserting a high-elastic resilient element inside a steel house if the purpose is to reduce stress due to thermal expansion that occurs between floors at the time of expansion and contraction, and as an anchor if the purpose is to isolate structure-borne noise in horizontal and vertical directions due to pressure change of fluid. The anchor and guide can reduce noise transfer but do not have enough elasticity to isolate vibration, so a spring isolated riser system is used to isolate vibration.

● Product components

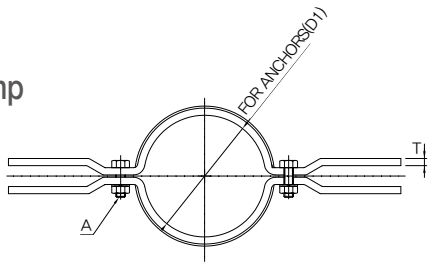
No.	Name	Material	Specification
1	Connection Bolt	SS400	KS B 1002
2	Lower Housing	SS400	KS D 3503
3	Resilient Element	CR	KS M 6617
4	Upper Housing	SPCD	KS D 3512

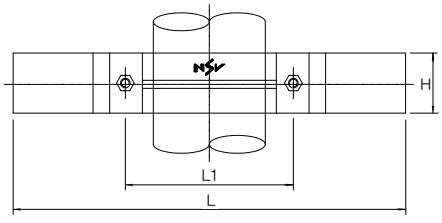
● DIMENSION & SELECTION GUIDE BY LOADS

TYPE	Capacity(kgf)	Displacement (mm)	Dimension(mm)			
			A	B	H	Setting Bolt
SRPA-75	250	3	75	75	100	M12
SRPA-200	1500	5	108	100	140	M16
SRPA-350	6000	7	150	140	160	M16
SRPA-600	14000	7	230	220	230	M20
SRPA-800	22000	9	280	270	360	M24

SPC

Seismic Clamp



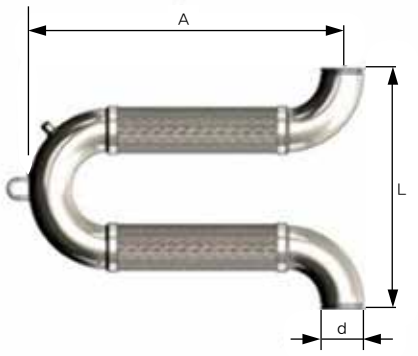


● Max. permissible seismic force per clamp specification

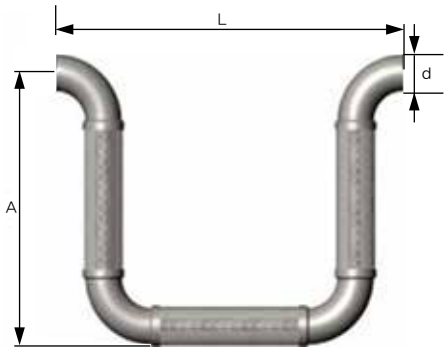
TYPE	Dimension(mm)						Color
	Total length (L)	L1	D1(In dia.)	T	H	A	
SPC-Φ50	450	105	Φ60.5	6.0	50	M10	11.1
SPC-Φ65	450	125	Φ76.3	6.0	50	M10	
SPC-Φ80	450	137	Φ89.1	6.0	50	M10	
SPC-Φ100	550	171	Φ114.3	9.0	75	M12	15.8
SPC-Φ125	550	197	Φ139.8	9.0	75	M12	
SPC-Φ150	550	230	Φ165.2	9.0	75	M12	
SPC-Φ200	650	281	Φ216.3	9.0	75	M12	

NOTE: Specifications and dimensions may be changed without prior notice for the enhancement of product performance and quality.

NVC-65
Loop Flex



NVC-65U



NVC-65W

NVC-65V

Features

A loop flex is a very important pipe accessory and is used to protect important fire-fighting equipment such as sprinklers from dangerous factors such as earthquakes.
A loop flex provides flexibility to pipes and protects pipes by absorbing movement of all axes (X, Y, Z).
A loop flex provides excellent seismic performance and is used to prevent the deformation of pipes due to thermal expansion as well as breakage and deformation of pipes due to the differential settlement of a building.

Application

- Applicable fluid: Heating, fire-fighting and so on
- Max. pressure: 20 Kg/cm^2
- Applicable displacement: One- to three-dimensional displacement
- Max. temperature: 600℃
- Elasticity: 50 – 100 mm (X, Y, Z axis)
- Applicable material: Steel pipe, STS, copper tube
- Connection method: Flange type, welding type, thread type, groove type

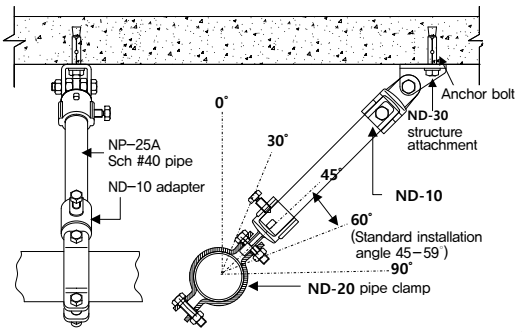
TYPE	d (mm)	Movements(±) 50 mm (X,Y,Z)		Movements(±) 100 mm (X,Y,Z)	
		A (mm)	L (mm)	A (mm)	L (mm)
NVC-65W(25A)	33.7	380	520	500	640
NVC-65W(32A)	42.4	440	620	550	740
NVC-65W(40A)	48.3	470	670	600	800
NVC-65W(50A)	60.3	540	770	690	920
NVC-65W(65A)	76.1	600	870	750	1010
NVC-65W(80A)	88.9	680	980	830	1120
NVC-65W(100A)	114.3	800	1210	980	1380
NVC-65W(125A)	139.7	1010	1520	1250	1770
NVC-65W(150A)	168.3	1100	1690	1330	1940
NVC-65W(200A)	219.1	1300	2100	1550	2360

TYPE	d (mm)	Movements(±) 50 mm (X,Y,Z)		Movements(±) 100 mm (X,Y,Z)	
		A (mm)	L (mm)	A (mm)	L (mm)
NVC-65U(25A)	33.7	370	155	500	225
NVC-65U(32A)	42.4	400	190	530	225
NVC-65U(40A)	48.3	430	230	580	295
NVC-65U(50A)	60.3	490	310	630	325
NVC-65U(65A)	76.1	550	380	710	405
NVC-65U(80A)	88.9	600	460	760	460
NVC-65U(100A)	114.3	730	620	890	620
NVC-65U(125A)	139.7	830	780	1020	780
NVC-65U(150A)	168.3	960	920	1170	920
NVC-65U(200A)	219.1	1240	1230	1470	1240

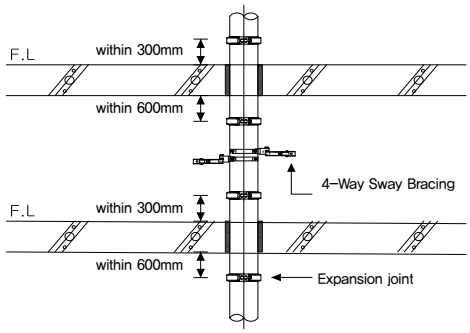
TYPE	d (mm)	Movements(±) 50 mm (X,Y,Z)		Movements(±) 100 mm (X,Y,Z)	
		A (mm)	L (mm)	A (mm)	L (mm)
NVC-65V(25A)	33.7	370	155	500	225
NVC-65V(32A)	42.4	400	190	530	225
NVC-65V(40A)	48.3	430	230	580	295
NVC-65V(50A)	60.3	490	310	630	325
NVC-65V(65A)	76.1	550	380	710	405
NVC-65V(80A)	88.9	600	460	760	460
NVC-65V(100A)	114.3	730	620	890	620
NVC-65V(125A)	139.7	830	780	1020	780
NVC-65V(150A)	168.3	960	920	1170	920
NVC-65V(200A)	219.1	1240	1230	1470	1240

NOTE: Specifications and dimensions may be changed without prior notice for the enhancement of product performance and quality.

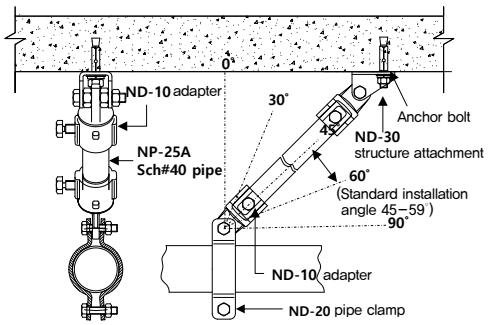
● Lateral sway brace



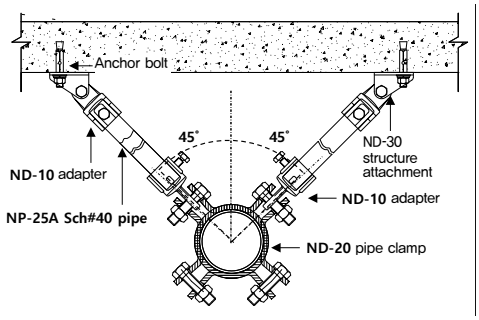
● 4-way riser piping



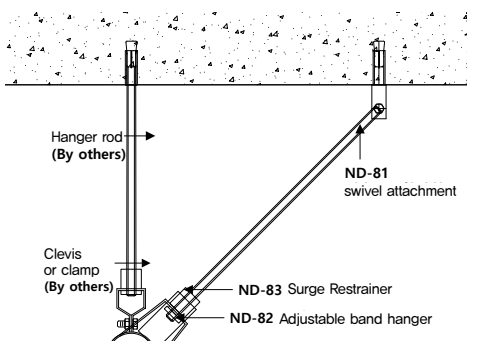
● Longitudinal sway brace



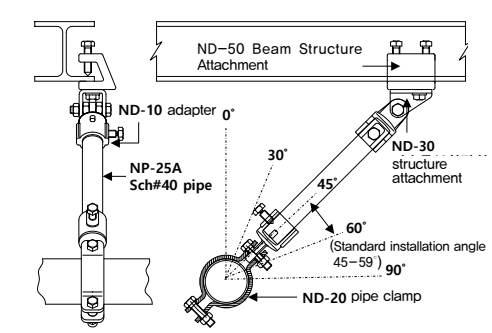
● 4-way riser piping sway brace



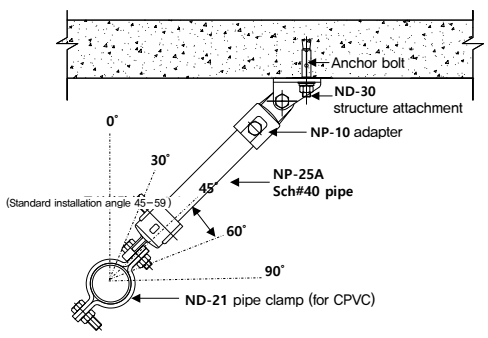
● Branch pipe sway fixture



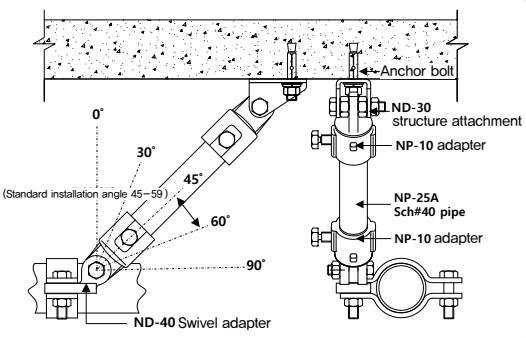
● Beam structure attachment



● CPVC lateral sway brace



● Swivel longitudinal sway brace for low height ceiling space



KFI CERTIFICATE

Certificate No. 201700930

KFI

CERTIFICATE of KFI ACCREDITATION

Applicant : YOON EUN JOONG

Company : NSV CO., LTD

Address : 547 Aenggogae-ro, Namdong-gu, Incheon, Republic of Korea

This is to certify that the following item has been KFI accredited in accordance with the provisions of Article 7, clause 1 of the KFI Certification Standard.

1. Item : Sway Brace Device
2. Type : Rigid, Lateral&Longitudinal, NPS 50,65,80,100,125,150,200, Rated Load [7,117N(NPS 50~100), 8,963N(NPS 125~200)], Installation Angle (30~90)°
3. Type Approval No. 내진17-38
4. Limitation

Kwon, Soon Kyung
President

Date : 13. Sept. 2017

Korea Fire Institute

Certificate No. 201800321

KFI

CERTIFICATE of KFI ACCREDITATION

Applicant : YOON EUN JOONG

Company : NSV CO., LTD

Address : 547 Aenggogae-ro, Namdong-gu, Incheon, Republic of Korea

This is to certify that the following item has been KFI accredited in accordance with the provisions of Article 7, clause 1 of the KFI Certification Standard.

1. Item : Sway Brace Device
2. Type : Rigid, Lateral&Longitudinal, NPS 50,65,80,100,125,150,200, Rated Load [7,117N(NPS 50~100), 8,963N(NPS 125~200)], Installation Angle (30~90)°
3. Type Approval No. 내진18-20
4. Limitation

Kwon, Soon Kyung
President

Date : 10. Apr. 2018

Korea Fire Institute

Certificate No. 201800484

KFI

CERTIFICATE of KFI ACCREDITATION

Applicant : YOON EUN JOONG

Company : NSV CO., LTD

Address : 547 Aenggogae-ro, Namdong-gu, Incheon, Republic of Korea

This is to certify that the following item has been KFI accredited in accordance with the provisions of Article 7, clause 1 of the KFI Certification Standard.

1. Item : Sway Brace Device
2. Type : Rigid, Lateral&Longitudinal, NPS 32,40, Rated Load 4,448N, Installation Angle (30~90)°
3. Type Approval No. 내진18-34
4. Limitation

Kwon, Soon Kyung
President

Date : 05. Jun. 2018

Korea Fire Institute

Certificate No. 201800485

KFI

CERTIFICATE of KFI ACCREDITATION

Applicant : YOON EUN JOONG

Company : NSV CO., LTD

Address : 547 Aenggogae-ro, Namdong-gu, Incheon, Republic of Korea

This is to certify that the following item has been KFI accredited in accordance with the provisions of Article 7, clause 1 of the KFI Certification Standard.

1. Item : Sway Brace Device
2. Type : Rigid, Longitudinal, NPS (40~100), Rated Load 4,448N, Installation Angle (45~90)°
3. Type Approval No. 내진18-35
4. Limitation

Kwon, Soon Kyung
President

Date : 05. Jun. 2018

Korea Fire Institut

CERTIFICATE OF COMPLIANCE

Certificate Number	20181226-EX27945
Report Reference	EX27945-20181226
Issue Date	2018-DECEMBER-26
Issued to:	NSV CO LTD 547, Aenggogae-ro Namdong-gu Incheon 21691 KOREA
This certificate confirms that representative samples of	SWAY-BRACE DEVICES, RIGID TYPE FOR SPRINKLER SYSTEMS Models ND-10A/ ND-20, ND-30A and ND-50. Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 203A, Sway Brace Devices for Sprinkler System Piping.
Additional Information:	See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information.

This *Certificate of Compliance* does not provide authorization to apply the UL Mark.

Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

Seismic Bracing Calculations (4Way)

PROJECT : - Contractor : - Version : rev.0

Address : - Piping purpose : H/SP Floor : - Date : 19. 00. 00.

Brace Information

Area No :	4Way
Length of brace (m) :	8m
Diameter of brace (mm) :	25A
Type of brace :	Sch. 40
Angle of brace (°) :	45°
Lest radius of gyration (R,mm) :	10.7
Maximum length of brace (L,mm) :	2140
Maximum length for L/R	200
Maximum load (ASD, kgf) :	594

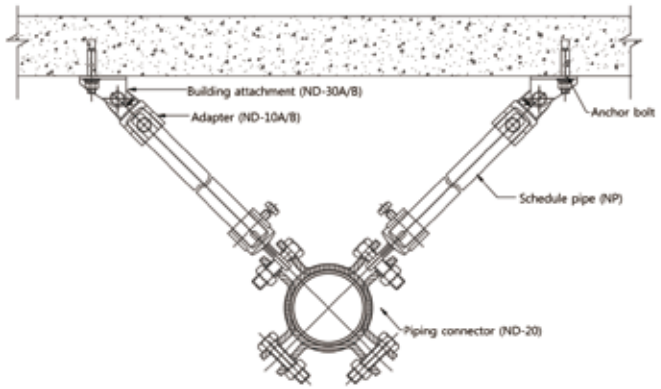
Fastener Information

Support structure :	Concrete
Anchor Bolt	
Anchor Bolt type :	FAZⅡK
Anchor Bolt size :	M12
Anchor length (mm) :	50
Permissible tension load :	622
Permissible shear load :	1786
Anchor Bolt Quantity :	1

Seismic Brace Attachments

	Item	Maximum load (ASD, kgf)
Seismic brace	ND-4W- 100A	513
Anchor Bolt	FAZⅡK (Permissible tension load	622
	FAZⅡK (Permissible shear load)	1786

Detail — Seismic Bracing (4Way)



Sprinkler System Load Calculation (Fpw = Wp X 0.5)

Cp = 0.5

Item	Diameter	Type	Length (m)	Weight per m	Weight
Main	100A	KS D 3507	8m	21 kg/m	168
				W_p (S.F 15%)	193.2 kg
				F_{pw}	96.6 kg

Result

1. Maximum F_{pw} :		96.6 kg
2.Maximum load of brace (kgf) :		594 kgf
3. Maximum load of seismic brace (kgf) :	ND-4W-100	513 kgf
4. Maximum load of anchor (kgf) :	1)FAZⅡK (Permissible tension load)	622.4 kgf
	2)FAZⅡK (Permissible shear load)	1786 kgf

96.6 kg ≤ 513 kg O.K

Note.

1. The designed seismic force is calculated based on the establishment of the Seismic Design Criteria for Firefighting Facilities, Notification No. 2015-138 of the Ministry of Public Safety and Security of Korea.
2. The horizontal load of pipes acting on the brace affected zone was calculated according to the "Zone of Influence Method" of NFPA-13.
3. The above calculation was made using the permissible load value in allowable stress design (ASD).

Tel : (02)598-1988, Fax : (02)598-1989
Homepage : http://www.nsv.co.kr
E-Mail : nsv@chol.com

NSV Seismic Stopper Calculations

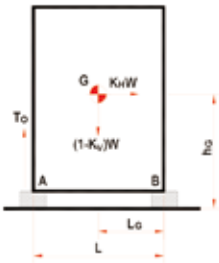
Project : - Contractor : - Version : rev.0

Address : - Floor : - Date : 19. 00. 00

1. Equipment specification

TYPE	Pump	NO.	FP-1	SERVICE	Indoor and outdoor fire extinguishing	WEIGHT	2508 kg	Horizontal seismic	0.5 g
FLOOR	Machine room			CAPACITY	-	FORM	Multistage turbine	Vertical seismic	0.25 g

2. Calculation of design seismic force and pullout force



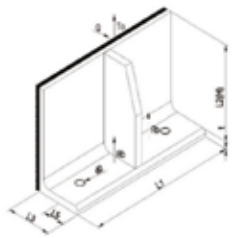
$$\text{If } T_0 \le 0,\ \frac{h_g}{L_g} \le \frac{(1-K_v)}{K_H}$$

$$\text{If } T_0 > 0,\ \frac{h_g}{L_g} > \frac{(1-K_v)}{K_H}$$

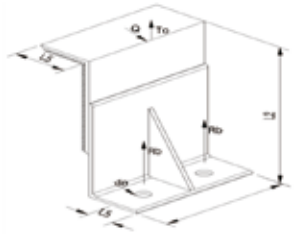
	Long side	Short side
Total weight(W)	2507.5 kg	
Safe load(15%Factor)	2883.625 kg	
Horizontal seismic force(F_H) (0.5w)	1441.8125 kg	
Vertical seismic(F_V) (0.25w)	720.90625 kg	
Height of center(h_G) / (unit : cm)	25	25
Length(L) / (unit : cm)	180	65
Length(L_G) / (unit : cm)	90	33
Tension load(T_O)	-527	-881

※ When pullout force (To) ≤ 0, an anti-movement type is applied since no pullout force is generated, but when To> 0, an anti-movement and anti-flip type is applied since pullout force is generated on the anti-vibration material.

3. Seismic restraint



NSS-10 STOPPER



NSS-11 STOPPER

STOPPER DETAIL

STOPPER ITEM		SYMBOL	UNIT	Long side	Short side
Bolt tension load		Rb	kgf	-441	-263
Stopper type		-	-	NSS-10	NSS-10
Stopper quantity		Ns	EA	1	1
Stopper horizontal load		-	kgf	1,442	1,442
Stopper model		-	-	NSS-10-2000	NSS-10-2000
Stopper horizontal load (EA)		-	kgf	2,000	2,000
The total number of stopper		N_T	EA	2	2
Satisfaction		-	-	Satisfied	Satisfied
ANCHOR ITEM		**SYMBOL**	**UNIT**	**Long side**	**Short side**
Anchor bolt type		-	-	FAZII	FAZII
Anchor bolt specification/M		-	-	M16 /85 mm or more	M16 /85 mm or more
Specification	Tension load (EA)	-	kgf	1,367	1,367
	Shear load (EA)	-	kgf	3,204	3,204
Anchor bolt quantity		-	EA	4	4
Satisfaction		-	-	O.K	O.K

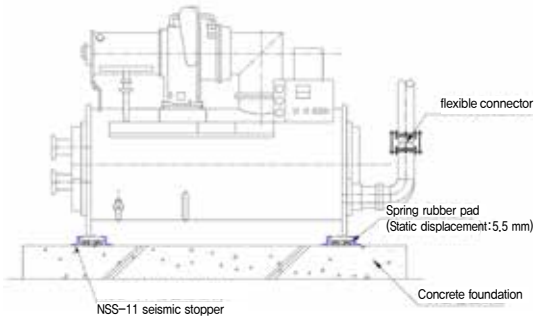
Note.

1. The above design seismic force is calculated based on the Korean Building Code (KBC2009).
2. When pullout force (To) ≤ 0, an anti-movement type is applied since no pullout force is generated, but when To> 0, an anti-movement and anti-flip type is applied since pullout force is generated on the anti-vibration material.
3. The rib plate of the seismic stopper is selected according to the capacity.

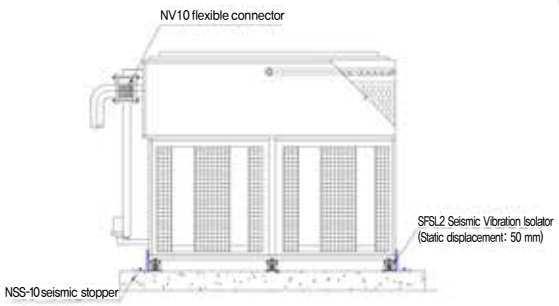
NSV ISO9001/ISO14001 주식회사 엔에스브이 Noise, Shock & Vibration Control
Tel : (02)598-1988, Fax : (02)598-1989
Homepage : http://www.nsv.kr
E-Mail : nsv@nsv.kr

Detail Installation Diagram (Equipment Seismic)

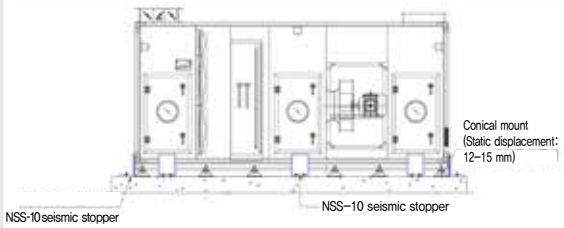
● Refrigeration machine



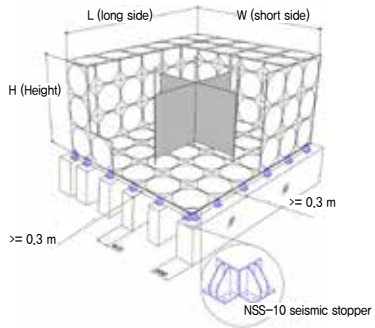
● Cooling tower



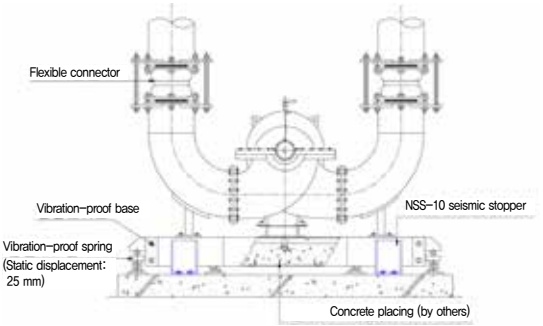
● Air conditioning unit



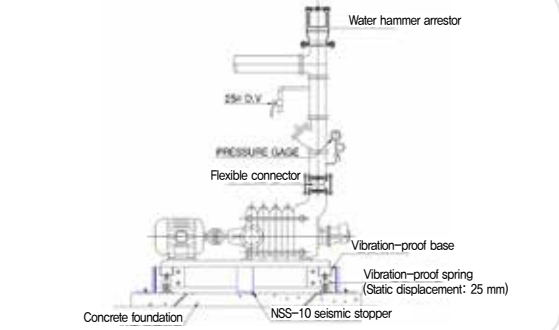
● Water tank



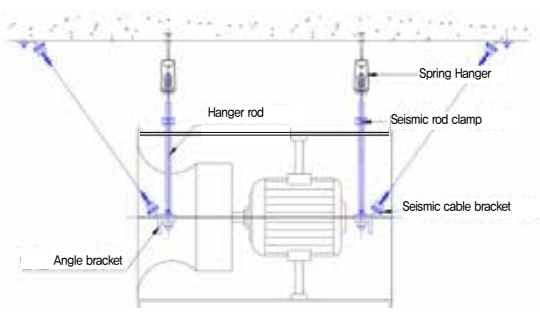
● Double suction pump



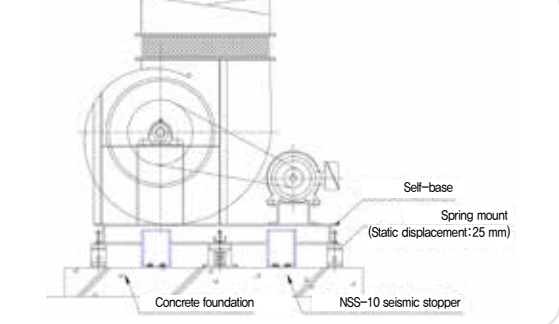
● Fire pump



● In-line fan



● Sirocco fan



● Lateral Sway Bracing

● 4-way Riser Sway Bracing

● Longitudinal Sway Bracing

● Horizontal 4-way Sway Bracing

● Branch pipe Sway Bracing

● Seismic Wire System

● 4-way Riser Sway Bracing
(floor installation type)

● 4-way Riser Sway Bracing
(floor installation type)

NVC
NEW VALUE CREATION

EXPANSION JOINT

NVC-10 Series (IP SLIP JOINT)

■ Features

The IP SLIP JOINT is an internally pressured slip type expansion joint developed to have double packing structure to prevent pipes for heating, hot water supply, firefighting, etc. in commercial or residential building from deformation.
EPDM or silicon packing is used to minimize frictional force of packing, and double packaging structure is used to maximize sealing property so that it can be used at high pressure.
According to the specification of product, it is manufactured using triple and quadruple packing structure. It is more cost effective than EZ PAK SLIP JOINT.

■ Usage

- Applicable fluid:Heating, hot water supply, water supply, firefighting...
- Working pressure: 10Kg/㎠, 20Kg/㎠, 30Kg/㎠
- Applicable displacement: 1-Dimensional displacement
- Max. temperature: 80℃
- Nominal traverse: Single type 50 – 200mm / Double type 100 – 400mm
- Material: Steel pipe, STS, copper pipe

■ Specification

No.	DESCRIPTION	MATERIAL	SPECIFICATIONS
1	SLIP	STAINLESS STEEL	SUS 304
2	BODY	STAINLESS STEEL	SUS 304
3	CHAMBER	STAINLESS STEEL	SUS 304
4	RING PACKING	EPDM	-
5	GUDIE	SILICON	-
6	FLANGED	STAINLESS STEEL	SUS 304
7	STOP PIN	STAINLESS STEEL	SUS 304
8	ANCHOR BASE	CARBON STEEL	SS41

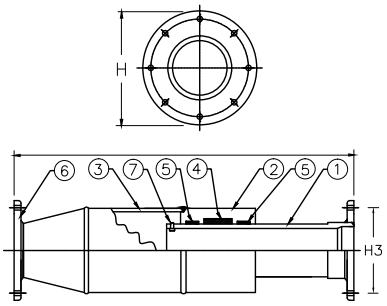
*Above specification is based on STS, and it is possible to manufacture using steel pipes.

■ SINGLE TYPE

DIMENSION(mm)

MODEL	L ±5 NOMINAL TRAVERSE(mm)			H	H3	MODEL	L ±5 NOMINAL TRAVERSE(mm)			H	H3
	50	100	200				50	100	200		
NVC-10(25A)	393	493	693	125	90	NVC-10(125A)	453	553	753	250	210
NVC-10(32A)	393	493	693	135	100	NVC-10(150A)	469	569	769	280	240
NVC-10(40A)	393	493	693	140	105	NVC-10(200A)	495	595	795	330	290
NVC-10(50A)	393	493	693	155	120	NVC-10(250A)	540	640	840	400	355
NVC-10(65A)	406	506	706	175	140	NVC-10(300A)	667	767	967	445	400
NVC-10(80A)	406	506	706	185	150	NVC-10(350A)	692	792	992	490	445
NVC-10(100A)	430	530	730	210	175	NVC-10(400A)	717	817	1017	560	510

*Specification and dimension subject to change without prior notice for improvement of product performance and quality.
Custom production up to model 1000A/nominal traverse 400TR is possible.

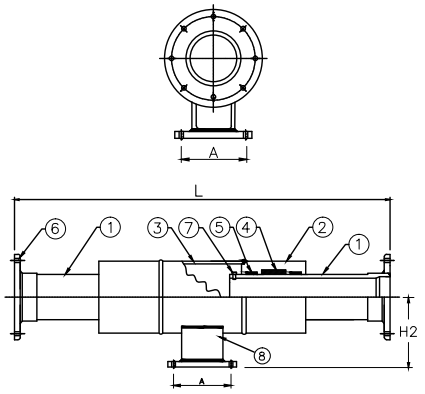


■ DOUBLE TYPE

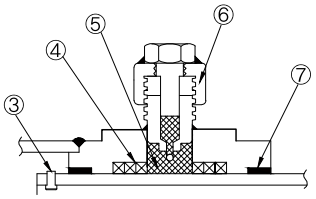
DIMENSION(mm)

MODEL	L ±5 NOMINAL TRAVERSE(mm)			H2	A	MODEL	L ±5 NOMINAL TRAVERSE(mm)			H2	A
	50+50	100+100	200+200				50+50	100+100	200+200		
NVC-10(25A)	596	796	1196	108	90	NVC-10(125A)	616	816	1216	155	146
NVC-10(32A)	596	796	1196	108	90	NVC-10(150A)	616	816	1216	168	146
NVC-10(40A)	596	796	1196	110	90	NVC-10(200A)	616	816	1216	238	190
NVC-10(50A)	596	796	1196	117	100	NVC-10(250A)	616	816	1216	318	190
NVC-10(65A)	596	796	1196	125	100	NVC-10(300A)	662	862	1262	337	228
NVC-10(80A)	596	796	1196	132	114	NVC-10(350A)	662	862	1262	353	228
NVC-10(100A)	596	796	1196	145	114	NVC-10(400A)	662	862	1262	380	266

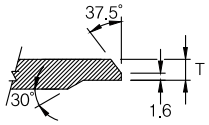
*Specification and dimension subject to change without prior notice for improvement of product performance and quality.
Custom production up to model 1000A/nominal traverse 400+400TR is possible.



NVC-15 Series (EASY PAK SLIP JOINT)



PACKING BOX DETAIL



DETAIL "S"

■ Features

The EASY PAK SLIP JOINT is a packing injected slip type expansion joint installed to protect pipes by absorbing deformation due to expansion and compression of pipes because of thermal fluctuation of fluid in the pipes, and stress occurred in the pipes, and to prevent the cause of defect occurrences related to the factors.
Compared with ordinary Bellows type expansion joints, its nominal traverse and durability is excellent and construction is made simpler.
It is very beneficial in terms of maintenance because even if fluid leaks, customer service can be provided by inserting spare packing without stopping operation of the equipment.

■ Usage

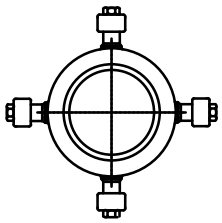
- Applicable fluid: Steam, heating, heat transfer oil, firefighting...
- Working pressure: 10Kg/㎠ – 50Kg/㎠
- Applicable displacement: 1-Dimensional displacement
- Max. temperature: 450℃
- Nominal traverse: Single type 100 – 300mm / Double type 200 – 600mm
- Material: Steel pipe, STS, copper pipe

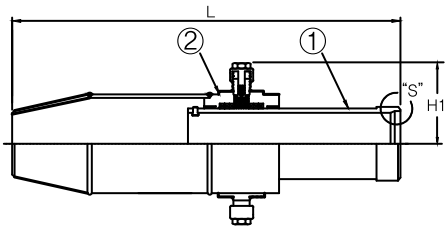
■ Specification

No.	DESCRIPTION	MATERIAL	SPECIFICATIONS
1	SLIP	CARBON STEEL	ASTM A53 GR.B or EQUAL
2	BODY	CARBON STEEL	ASTM A53 GR.B or EQUAL
3	STOP PIN	SUS 304	-
4	RING PACKING	GRAPHITE	-
5	INJECTED PACKING	GRAFOIL	-
6	PLUNGER	SS41	-
7	GUDIE	BRONZE FILLED	-
8	FLANGE	SS41	-
9	ANCHOR BASE	SS41	-

*Above specification is steel pipe-based, it is possible to manufacture using STS

■ WELD TYPE



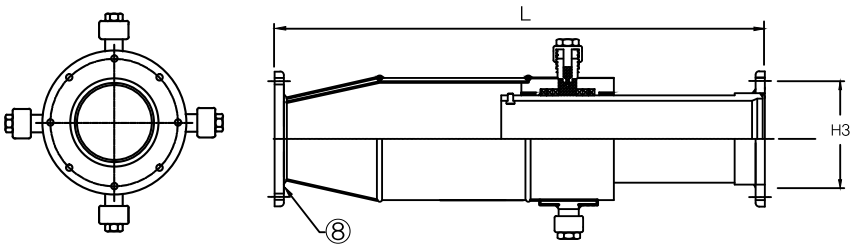


DIMENSION(mm)									
MODEL	L NOMINAL TRAVERSE(mm)			H1	MODEL	L NOMINAL TRAVERSE(mm)			H1
	100	200	300			100	200	300	
NVC-15(25A)	660	860	1060	110	NVC-15(250A)	770	970	1170	240
NVC-15(32A)	570	770	970	110	NVC-15(300A)	935	1135	1335	260
NVC-15(40A)	570	770	970	110	NVC-15(350A)	955	1155	1355	285
NVC-15(50A)	570	770	970	120	NVC-15(400A)	955	1155	1355	310
NVC-15(65A)	590	790	990	125	NVC-15(450A)	1000	1200	1400	335
NVC-15(80A)	605	805	1005	135	NVC-15(500A)	1025	1225	1425	360
NVC-15(100A)	640	840	1040	150	NVC-15(550A)	1060	1260	1460	385
NVC-15(125A)	665	865	1065	165	NVC-15(600A)	1060	1260	1460	410
NVC-15(150A)	680	880	1080	190	NVC-15(650A)	1060	1260	1460	435
NVC-15(200A)	705	905	1105	215	NVC-15(700A)	1060	1260	1460	460

*Specification and dimension subject to change without prior notice for improvement of product performance and quality.
Custom production up to model 1500A/nominal traverse 400TR is possible.

NVC-15 Series (EASY PAK SLIP JOINT)

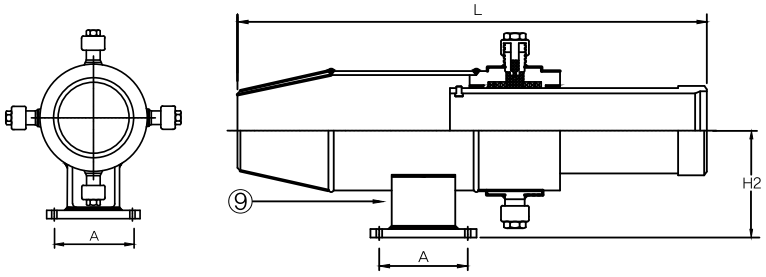
■ FLANGE TYPE



DIMENSION(mm)									
MODEL	L NOMINAL TRAVERSE(mm)			H3	MODEL	L NOMINAL TRAVERSE(mm)			H3
	100	200	300			100	200	300	
NVC-15(25A)	675	875	1075	90	NVC-15(250A)	800	1000	1200	355
NVC-15(32A)	585	785	985	100	NVC-15(300A)	965	1165	1365	400
NVC-15(40A)	585	785	985	105	NVC-15(350A)	985	1185	1385	445
NVC-15(50A)	585	785	985	120	NVC-15(400A)	985	1185	1385	510
NVC-15(65A)	610	815	1015	140	NVC-15(450A)	1040	1240	1440	565
NVC-15(80A)	625	830	1030	150	NVC-15(500A)	1065	1265	1465	620
NVC-15(100A)	660	860	1060	175	NVC-15(550A)	1100	1300	1500	680
NVC-15(125A)	685	885	1085	210	NVC-15(600A)	1100	1300	1500	730
NVC-15(150A)	710	910	1110	240	NVC-15(650A)	1100	1300	1500	780
NVC-15(200A)	735	935	1135	290	NVC-15(700A)	1100	1300	1500	840

*Specification and dimension subject to change without prior notice for improvement of product performance and quality.
Custom production up to model 1500A/nominal traverse 400TR is possible.

■ BASE TYPE

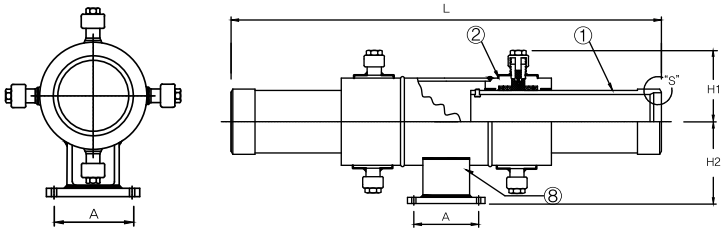


DIMENSION(mm)											
MODEL	L NOMINAL TRAVERSE(mm)			A	H2	MODEL	L NOMINAL TRAVERSE(mm)			A	H2
	100	200	300				100	200	300		
NVC-15(25A)	660	860	1060	90	108	NVC-15(250A)	770	970	1170	190	318
NVC-15(32A)	570	770	970	90	108	NVC-15(300A)	935	1135	1335	228	337
NVC-15(40A)	570	770	970	90	110	NVC-15(350A)	955	1155	1335	228	353
NVC-15(50A)	570	770	970	100	117	NVC-15(400A)	955	1155	1335	266	380
NVC-15(65A)	590	790	990	100	125	NVC-15(450A)	1000	1200	1400	266	401
NVC-15(80A)	605	805	1005	114	132	NVC-15(500A)	1025	1225	1425	316	429
NVC-15(100A)	640	840	1040	114	145	NVC-15(550A)	1060	1260	1460	316	447
NVC-15(125A)	665	865	1065	146	155	NVC-15(600A)	1060	1260	1460	330	473
NVC-15(150A)	680	880	1080	146	168	NVC-15(650A)	1060	1260	1460	330	492
NVC-15(200A)	705	905	1105	190	238	NVC-15(700A)	1060	1260	1460	356	518

*Specification and dimension subject to change without prior notice for improvement of product performance and quality.
Custom production up to model 1500A/nominal traverse 400TR is possible.

NVC-15 Series (EASY PAK SLIP JOINT)

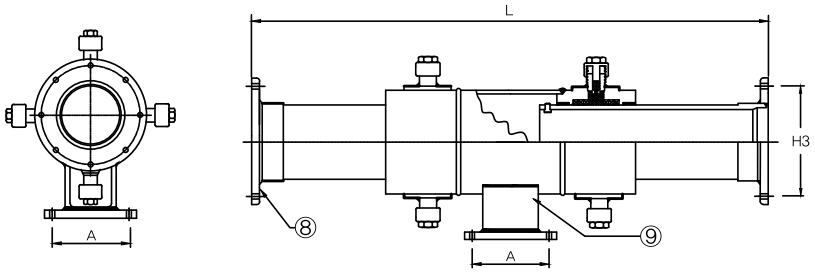
■ WELD TYPE(Double Type)



DIMENSION(mm)											
MODEL	L NOMINAL TRAVERSE(mm)			H1	H2	MODEL	L NOMINAL TRAVERSE(mm)			H1	H2
	100+100	200+200	300+300				100+100	200+200	300+300		
NVC-15(25A)	1145	1545	1945	110	108	NVC-15(250A)	1235	1635	2035	240	318
NVC-15(32A)	965	1365	1765	110	108	NVC-15(300A)	1260	1660	2060	260	337
NVC-15(40A)	965	1365	1765	110	110	NVC-15(350A)	1295	1695	2095	285	353
NVC-15(50A)	965	1365	1765	120	117	NVC-15(400A)	1310	1710	2110	310	380
NVC-15(65A)	980	1380	1780	125	125	NVC-15(450A)	1350	1750	2150	335	401
NVC-15(80A)	1010	1410	1810	135	132	NVC-15(500A)	1500	1900	2300	360	429
NVC-15(100A)	1025	1425	1825	150	145	NVC-15(550A)	1520	1920	2320	385	447
NVC-15(125A)	1150	1550	1950	165	155	NVC-15(600A)	1520	1920	2320	410	473
NVC-15(150A)	1155	1555	1955	190	168	NVC-15(650A)	1520	1920	2320	435	492
NVC-15(200A)	1155	1555	1955	215	238	NVC-15(700A)	1520	1920	2320	461	518

*Specification and dimension subject to change without prior notice for improvement of product performance and quality.
Custom production up to model 1500A/nominal traverse 400+400TR is possible.

■ FLANGE TYPE(Double Type)



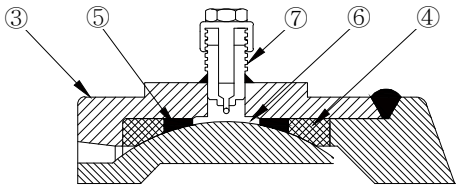
DIMENSION(mm)											
MODEL	L NOMINAL TRAVERSE(mm)			A	H3	MODEL	L NOMINAL TRAVERSE(mm)			A	H3
	100+100	200+200	300+300				100+100	200+200	300+300		
NVC-15(25A)	1160	1560	1960	90	90	NVC-15(250A)	1265	1665	2065	190	355
NVC-15(32A)	980	1380	1780	90	100	NVC-15(300A)	1290	1690	2090	228	400
NVC-15(40A)	980	1380	1780	90	105	NVC-15(350A)	1325	1725	2125	228	445
NVC-15(50A)	980	1380	1780	100	120	NVC-15(400A)	1340	1740	2140	266	510
NVC-15(65A)	1000	1400	1800	100	140	NVC-15(450A)	1390	1790	2190	266	565
NVC-15(80A)	1030	1430	1830	114	150	NVC-15(500A)	1540	1940	2340	316	620
NVC-15(100A)	1045	1445	1845	114	175	NVC-15(550A)	1560	1960	2360	316	680
NVC-15(125A)	1175	1575	1975	146	210	NVC-15(600A)	1560	1960	2360	330	730
NVC-15(150A)	1185	1585	1985	146	240	NVC-15(650A)	1560	1960	2360	330	780
NVC-15(200A)	1185	1585	1985	190	290	NVC-15(700A)	1560	1960	2360	356	840

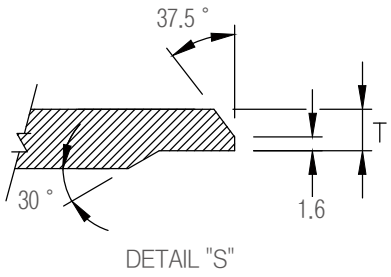
*Specification and dimension subject to change without prior notice for improvement of product performance and quality.
Custom production up to model 1500A/nominal traverse 400+400TR is possible.

NVC-25 Series (EASY PAK BALL JOINT)

■ Features

The EASY PAK BALL JOINT protects pipes from torsion of pipes due to expansion and compression of pipes because of temperature fluctuation of fluid in the pipes and can minimize stress on anchors.
EASY PAK BALL JOINT is very useful for misarrangement of pipes due to expansion and retraction, and vibration, and for connecting fixed facility and moving pipes. It is very beneficial in terms of maintenance because if fluid leaks, customer service can be provided by inserting packing without stopping system operation.





■ Specification

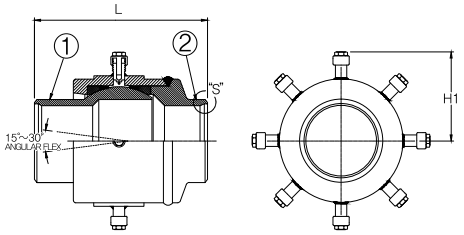
No.	DESCRIPTION	MATERIAL	SPECIFICATIONS
1	BALL	CARBON STEEL	ASTM A 105 or A53 Gr B
2	SOCKET	CARBON STEEL	ASTM A 105 or A53 Gr B
3	CASING	CARBON STEEL	ASTM A 105 or A53 Gr B
4	GUIDE	DUCTILE IRON	ASTM A395
5	RING PACKING	GRAPHITE	-
6	INJECTED PACKING	GRAFOIL	-
7	PLUNGER	SS 41	-
8	FLANGE	SS 41	-

*The above specification is steel pipe based, it is possible to manufacture using STS

■ Usage

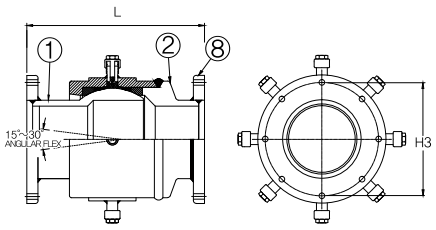
- Applicable fluid: Steam, heating, water supply, hot water supply, heat transfer oil, firefighting...
- Working pressure: 10Kg/㎠ - 50Kg/㎠
- Applicable displacement: 3-dimensional displacement (can be used for seismic)
- Max. temperature: 450℃
- Max. refraction angle: 30° (25A-50A) / 15° (65A or more)
- Material: Steel pipe, STS, Cooper pipe

■ WELD TYPE



DIMENSION(mm)					
MODEL	L	H1	MODEL	L	H1
NVC-25(25A)	145	114	NVC-25(250A)	350	247
NVC-25(32A)	150	120	NVC-25(300A)	380	273
NVC-25(40A)	150	120	NVC-25(350A)	440	311
NVC-25(50A)	170	126	NVC-25(400A)	495	349
NVC-25(65A)	170	126	NVC-25(450A)	545	377
NVC-25(80A)	215	142	NVC-25(500A)	595	411
NVC-25(100A)	235	155	NVC-25(550A)	635	443
NVC-25(125A)	285	180	NVC-25(600A)	655	478
NVC-25(150A)	305	196	NVC-25(650A)	690	510
NVC-25(200A)	325	222	NVC-25(700A)	735	560

■ FLANGE TYPE



DIMENSION(mm)					
MODEL	L	H3	MODEL	L	H3
NVC-25(25A)	159	90	NVC-25(250A)	374	355
NVC-25(32A)	166	100	NVC-25(300A)	404	400
NVC-25(40A)	166	105	NVC-25(350A)	466	445
NVC-25(50A)	186	120	NVC-25(400A)	523	510
NVC-25(65A)	188	140	NVC-25(450A)	575	565
NVC-25(80A)	233	150	NVC-25(500A)	625	620
NVC-25(100A)	253	175	NVC-25(550A)	667	680
NVC-25(125A)	305	210	NVC-25(600A)	687	730
NVC-25(150A)	327	240	NVC-25(650A)	724	780
NVC-25(200A)	347	290	NVC-25(700A)	771	840

*Specification and dimension subject to change without prior notice for improvement of product performance and quality.
Custom production up to model 1500A is possible

NVC-80 Series (EP FLEX JOINT)

■ Features

The EP FLEX JOINT is a product that maximizes nominal traverse (axial movement) by fundamentally suppressing squirm (torsion) by inner pressure that is one of the worst disadvantages of an internally pressured Bellows joint.
And it is a product that has a semi-permanent fatigue life because STS 316L is used for Bellows and molded as at least 2-ply. It is possible to be used under high pressure because it has the structure to prevent Bellows from coming out even in case of an abrupt damage due to thrust of Bellows.

■ Usage

- Applicable fluid: Water supply, heating, hot water supply, firefighting, oil, gas, etc.
- Working pressure: 10Kg/㎠, 20Kg/㎠, 30Kg/㎠
- Applicable displacement: 1-Dimensional displacement
- Max. temperature: 300℃
- Nominal traverse: Single type 50 - 100mm / Double type 100 - 200mm
- Material: STS, steel pipe

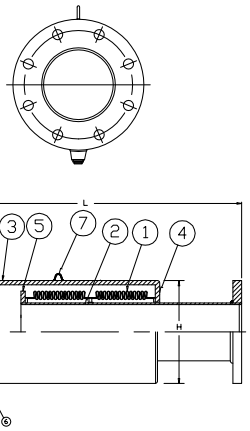
■ Specification

No.	PART	MATERIAL	SPECIFICATIONS
1	MULTI-PLY BELLOWS	STS	SUS 316
2	INTERNAL PIPE	STS/CS	SUS 304/SS41
3	HOUSING	STS/CS	SUS 304/SS41
4	EXTERNAL GUIDE RING	STS/CS	SUS 304/SS41
5	INTERNAL GUIDE RING	STS/CS	SUS 304/SS41
6	DRAIN PORT	STS/CS	SUS 304/SS41
7	LIFTING LUG	CS	SS41
8	FLANGE	STS/CS	SUS 304/SS41
9	ANCHOR BASE	CS	SS41

■ SINGLE TYPE

DIMENSION(mm)									
EXP. JOINT SIZE	"L" NOMINAL TRAVERSE(mm)		H	SPRING RATE (kgf/mm)	EXP. JOINT SIZE	COMP. NOMINAL TRAVERSE(mm)		H	SPRING RATE (kgf/mm)
	50	100				50	100		
NVC-80(20A)	500	700	61	1.52	NVC-80(100A)	500	700	170	9.55
NVC-80(25A)	500	700	77	1.98	NVC-80(125A)	500	700	217	9.91
NVC-80(32A)	500	700	90	3.31	NVC-80(150A)	600	800	242	11.12
NVC-80(40A)	500	700	102	5.2	NVC-80(200A)	600	800	290	13.84
NVC-80(50A)	500	700	115	5.34	NVC-80(250A)	600	800	356	14.02
NVC-80(65A)	500	700	140	7.18	NVC-80(300A)	600	800	406	15.6
NVC-80(80A)	500	700	166	8.2	-	-		-	-

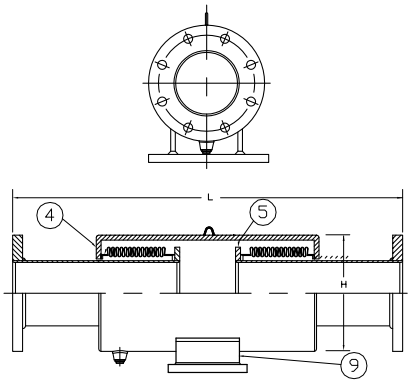
*Specification and dimension subject to change without prior notice for improvement of product performance and quality. Custom production up to model 500A is possible.



■ DOUBLE TYPE

DIMENSION(mm)									
EXP. JOINT SIZE	"L" NOMINAL TRAVERSE(mm)		H	SPRING RATE (kgf/mm)	EXP. JOINT SIZE	COMP. NOMINAL TRAVERSE(mm)		H	SPRING RATE (kgf/mm)
	50+50	100+100				50+50	100+100		
NVC-80(20A)	1000	1200	61	1.52	NVC-80(100A)	1000	1200	170	9.55
NVC-80(25A)	1000	1200	77	1.98	NVC-80(125A)	1000	1200	217	9.91
NVC-80(32A)	1000	1200	90	3.31	NVC-80(150A)	1200	1400	242	11.12
NVC-80(40A)	1000	1200	102	5.2	NVC-80(200A)	1200	1400	290	13.84
NVC-80(50A)	1000	1200	115	5.34	NVC-80(250A)	1200	1400	356	14.02
NVC-80(65A)	1000	1200	140	7.18	NVC-80(300A)	1200	1400	406	15.6
NVC-80(80A)	1000	1200	166	8.2	-	-		-	-

*Specification and dimension subject to change without prior notice for improvement of product performance and quality. Custom production up to model 500A is possible.



Revision No.	Rev. 10
Revision Date	2021. 01

ISO9001 ISO14001 OHSAS18001

NSV Co., Ltd.
Noise, Shock & Vibration Control

ISO9001 / ISO14001 OHSAS18001

NVC Co., Ltd.
NEW VALUE CREATION

NSV R&D Center
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