



Noise Control

Shock Control

Vibration Control

Seismic Control

KSA



Homepage



INTRODUCTION

Since its foundation on March 1, 1986, NSV has been manufacturing noise-control, vibration-control, and shock-control products for more than 40 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.



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
ISO 45001
KS certification
KC certification
KFI certification
UL certification
FM certification
NSF certification
PDI certification

Company Overview

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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 Arrestor
(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

www.nsv.kr

PRODUCT OVERVIEW

NOISE CONTROL

ANOS10 Rectangular Type Sound Attenuator



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ANOS20 Circular Type Sound Attenuator



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SC Sound Attenuating Chamber



24

SE Sound Attenuating Elbow



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AL-A/B Acoustic Louver



25

ANOS50 Hybrid Type Silencer (Resonance+Expansion Type Silencer)



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SD Sound Absorbing Duct



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IS Industrial Silencer



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AE Acoustic Enclosure



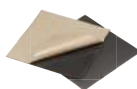
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ANOS90 Diffraction Noise Reducer



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NDP Damping Sheet



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NDT Damping Tape



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PO-MAT® Polyurethane Mat



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HD-MAT High-Damping Mat



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JUM-10000/20000/30000/40000 Jack Up Floating Floor System



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NFM Plywood Floating Floor System



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WM1 / WM2 Isolated Stud Neoprene Mount



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SHOCK CONTROL

WHA Water Hammer Arrester (CM Adapter)



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



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WHA-4000 Water Hammer Arrester (Flange Type)



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WHA-6000 Water Hammer Arrester (Flange Type)



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VD10 Friction & Wire Damper



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VIBRATION CONTROL

SMA Spring Mount (Deflection : 25mm)



66

2SMA Spring Mount (Deflection : 25mm)



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SMA2 Spring Mount (Deflection : 50mm)



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SMA3 Spring Mount (Deflection : 75mm)



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SMB Spring Mount (Deflection : 25mm)



73

SMB2 Spring Mount (Deflection : 50mm)



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



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FSL Restrained Spring Mount (Deflection : 25mm)



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FSL2 Restrained Spring Mount (Deflection : 50mm)



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FSL3 Restrained Spring Mount (Deflection : 75mm)



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SH Spring Hanger (Deflection : 25mm)



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SH2 Spring Hanger (Deflection : 50mm)



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SH-4 Spring Hanger (Deflection : 25mm)



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VH20 Spring Hanger (Deflection : 25mm)



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VH61 Spring Hanger (Deflection : 25mm)



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VH62 Spring Hanger (Deflection : 50mm)



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RH10 Rubber Hanger (Deflection : 3.5-13mm)



92

RH20 Ceiling Rubber Hanger (Deflection : 5mm)



93

RH30 Rubber Hanger (Deflection : 3.5-5mm)



93

RH40 Type Rubber Hanger (Deflection : 11mm)



94

NTR/NTR2 Thrust Restraint (Deflection : 25mm/50mm)



95

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



97

CLAMP Riser Pipe Clamp



90

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



101

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



101

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



103

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



103

VM-2000 Rubber Mount (Deflection : 6mm)



104

VM-3000 Rubber Mount (Deflection : 6mm)



104

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



105

VM-5000 Rubber Mount (Deflection : 15mm)



105

VC Conical Mount (Deflection : 15mm)



108

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



110

SRM Spring Rubber Mount (Deflection : 5.5mm)



112

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



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



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PRODUCT OVERVIEW

VIBRATION CONTROL

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



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



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IB Inertia Base Series



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SB Elasticity Structural Base



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NFC10S Flexible Connector



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NFC10 Flexible Connector



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NFC20 Flexible Connector



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NV10 Flexible Connector



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



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VAM20 Pneumatic Leveling Isolator



123

VAM52 Flange Type Air Spring Mount



123

VF Foot Rubber Mount (Deflection: 3.5mm)



124

VWM10 Type Wire Mount



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VWM20 Wire Mount



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VWM51/VWM52 Wire Spring Mount (Deflection: 25mm/50mm)



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VWM62 Wire Spring Mount (Deflection: 50mm)



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SEISMIC CONTROL

ND-10A/B Adapter 



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ND-20/21 Pipe Clamp 



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ND-30A/B Structure Attachment 



136

ND-40 Swivel Adapter



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ND-50 Beam Structure Attachment 



137

NP Bracing Pipe



137

ND-A10 Seismic Anchor



138

ND-A11 Seismic Anchor



138

ND-B10 High Tensile Anchor



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ND-N10 Lock Nut



138

ND-H Sway Bracing (Lateral) 



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ND-V Sway Bracing (Longitudinal) 



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SEISMIC CONTROL

ND-4W Sway Bracing (4-way Riser pipe)



141

ND-R Sway Bracing (Longitudinal, for low height ceiling space)



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ND-CP Sway Bracing (Lateral, CPVC)



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ND-E Branch Pipe End Fixture



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ND-81 Swivel Attachment



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ND-82 Adjustable Band Hanger



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ND-83 Surge Restrainer



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ND-84 Beam Structure Attachment



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NSS-10 Seismic Stopper



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NSS-11 Seismic Stopper



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NSS-12 Seismic Stopper



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NSS-13 Seismic Stopper



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ND-60 Seismic Rod



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ND-70 Seismic Cable



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SIB-SB Seismic Inertia Base



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SB-SERISE Seismic Structure Base



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SMA62 Seismic Spring Mount (Deflection : 50mm)



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SH61 Seismic Spring Hanger (Deflection : 25mm)



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SH62 Seismic Spring Hanger (Deflection : 50mm)



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SH63 Seismic Spring Hanger (Deflection : 75mm)



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SH64 Seismic Spring Hanger (Deflection : 100mm)



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SH65 Seismic Spring Hanger (Deflection : 125mm)



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FSL51 / FSL52 Seismic Restrained Spring Mount (Deflection : 25mm / 50mm)



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FSL62 Seismic Restrained Spring Mount (Deflection : 50mm)



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FSL63 Seismic Restrained Spring Mount (Deflection : 75mm)



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FSL64 Seismic Restrained Spring Mount (Deflection : 100mm)



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FSL65 Seismic Restrained Spring Mount (Deflection : 125mm)



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EXPANSION JOINT

NVC-10E Series (ECO SLIP JOINT)



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NVC-10 Series (IP SLIP JOINT)



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NVC-15 Series (EZ PAK SLIP JOINT)



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NVC-25 Series (EZ PAK BALL JOINT)



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NVC-35 Series (EZ PAK MULTI-JOINT)



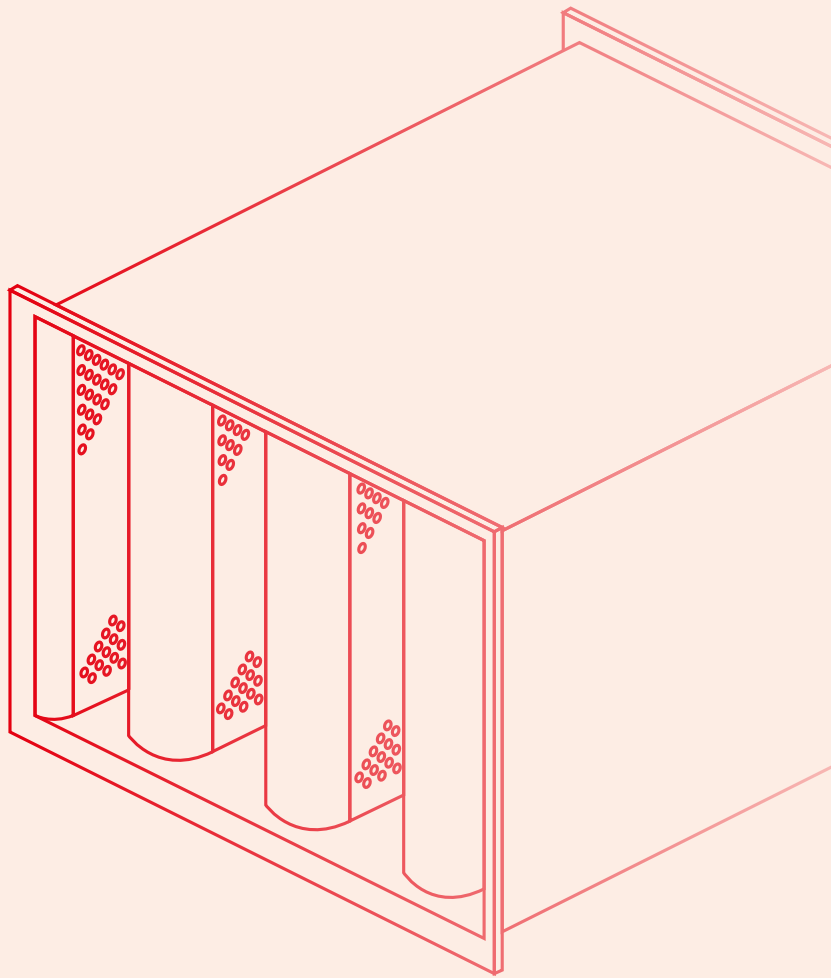
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NVC-65 Series (FLEX LOOP JOINT)



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NOISE CONTROL



NOISE CONTROL

ISO 9001/ISO 14001/ISO 45001
MADE IN KOREA

Information for prevention of noise

Definition of noise

► Sound

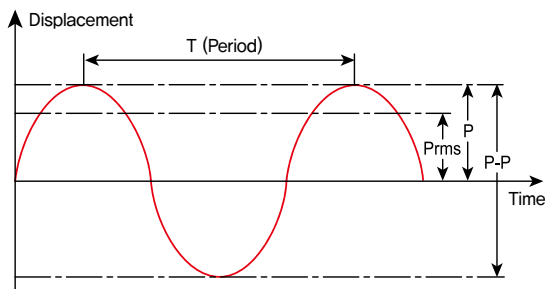
Waves of varying pressure made by the vibration of propagation media particles, noticed by a human ear

► 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)

$$SIL = 10 \log \left(\frac{I}{I_0} \right) dB$$

Where I : Intensity of sound (W/m^2)

I_0 : 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.

$$SPL = 20 \log \left(\frac{P}{P_0} \right) dB$$

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

P_0 : RMS value of the minimum sound pressure (2×10^{-5} N/m^2)

4) Sound Power Level (PWL)

$$PWL = 10 \log \left(\frac{W}{W_0} \right) dB$$

Where W : The sound power of the sound source under discussion

W_0 : 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)

$$SPL = PWL - 20 \log r - 11 dB$$

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

$$SPL = PWL - 20 \log r - 8 dB$$

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

$$SPL = PWL - 10 \log r - 8 dB$$

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

$$SPL = PWL - 10 \log r - 5 dB$$

6) Frequency Filter

For 1/1 octave band frequency analyzer,

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

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

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

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

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

For 1/3 octave band frequency analyzer,

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

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

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

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

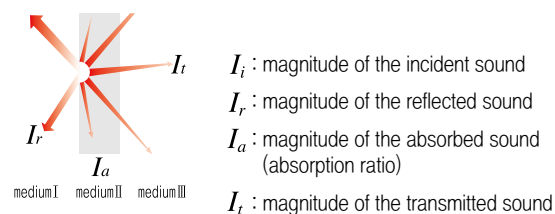
$$\% \text{ bandwidth } \%bw = \frac{bw}{f_c} \times 100\%$$

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.



① Reflexibility (α_r)

The ratio of the reflected sound to the incident sound.

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



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.

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

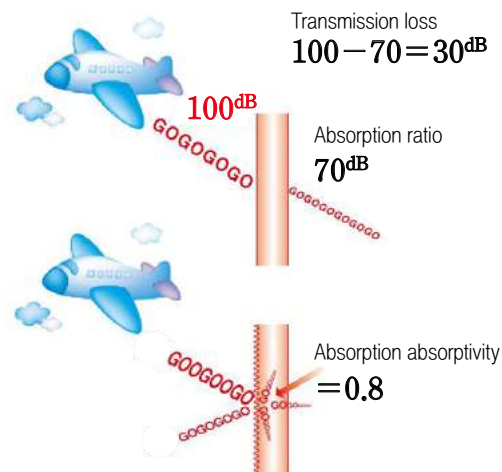
③ Transmission ratio (τ)

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

$$TL = 10 \log \left(\frac{I_i}{I_t} \right) \text{ dB}$$



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,

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

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,

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

③ In case of a rectangular plate sound source,

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

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

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

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

④ In case of a circular plate sound source,

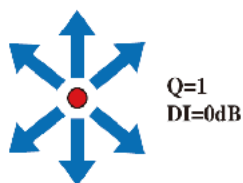
$$L_a = 20 \log \left(\frac{a}{r} \right) - 3 \text{dB}$$

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

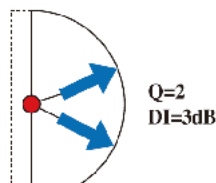
4) Directivity of sound

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.

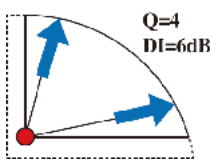
$$DI = 10 \log Q$$



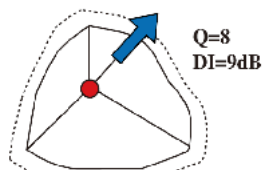
Free space



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

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

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

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.

$$\bar{\alpha} = \frac{\sum S_i \alpha_i}{\sum S_i} \quad \text{Where}$$

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

$$\bar{\alpha} = \frac{0.161 V}{ST} \quad \text{Where}$$

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.

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

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

Where

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

- ② Total transmission loss

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

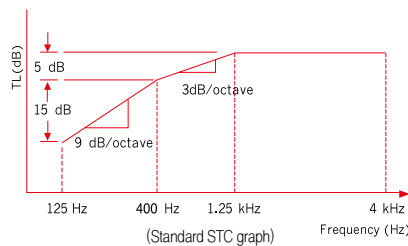
Where

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.

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

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

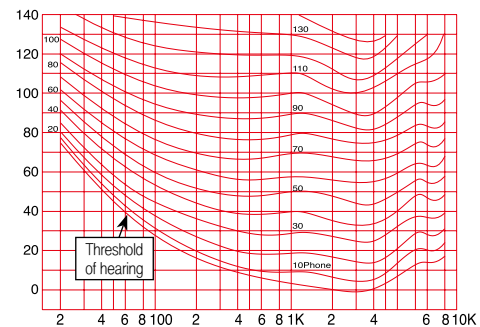
6) Masking effect

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.

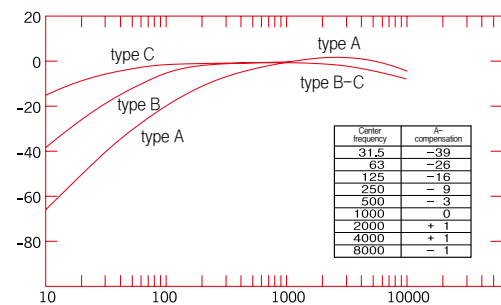


2) Loudness level (Phone)

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.



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, L_{eq}

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.

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

Where

f_i : duration rate of specific sound pressure level

L_i : n -th sound pressure level

Information for prevention of noise

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, $L_{10} > L_{50} > L_{90}$.

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

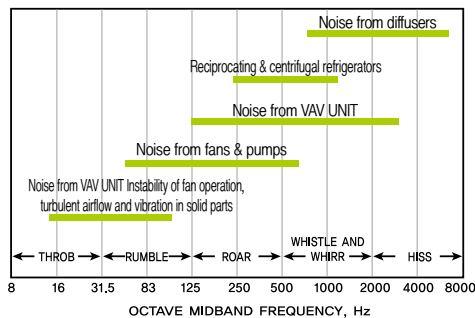
$\overline{dB(A)}$: average of the peak values of the aircraft noise during a day, in dB

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

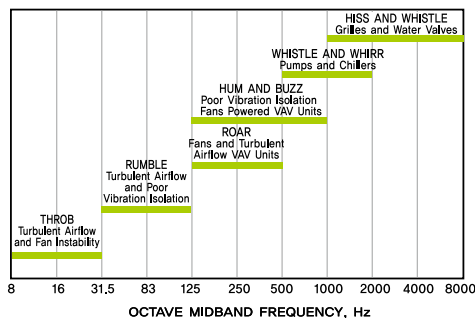
N_2 : number of the arrived and departed airplanes during 19:00 ~ 22:00

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.



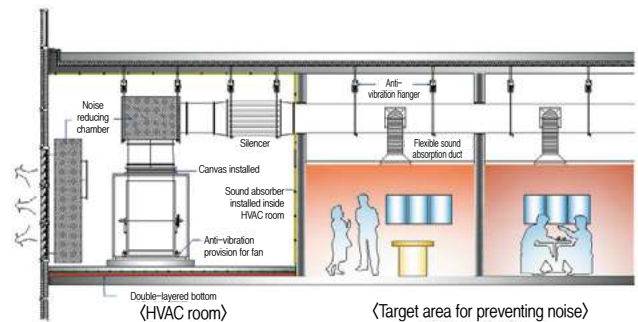
Structure borne noise



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.



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)

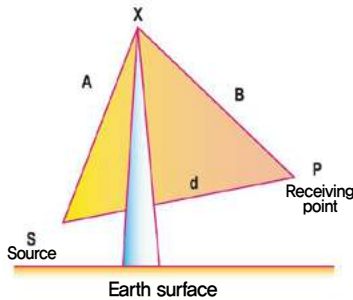
Calculation of the noise reducing effect of shielding walls



In case there is 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

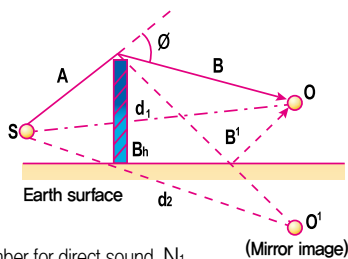
A : distance between the source and the summit of the wall

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}

$$L_{d1} = 7.5 + 0.61 \log N_1 (dB), \quad 0 < N_1 \leq 0.1$$

$$L_{d1} = 10 + 3 \log N_1 (dB), \quad 0.1 < N_1 \leq 0.8$$

$$L_{d1} = 11 + 7 \log N_1 (dB), \quad 0.8 < N_1 \leq 30$$

$$L_{d1} = 12 + 6 \log N_1 (dB), \quad 30 < N_1 \leq 60$$

$$L_{d1} = 22 (dB), \quad 60 < N_1$$

4) Diffraction attenuation due to shielding wall, ΔL_d

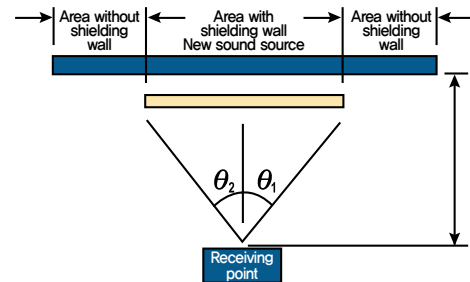
$$\Delta L_d = -10 \log \left(10^{-\frac{L_{d1}}{10}} + 10^{-\frac{L_{d2}}{10}} \right)$$

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_a

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

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

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

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

In case of using the absorption type shielding wall,

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

In case of using the reflection type shielding wall,

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

Information for prevention of noise

Noise from fans

A. Noise from fans, L_w

$$L_w = K_w + 10 \log_{10} \left[\frac{Q}{Q_i} \right] + 20 \log_{10} \left[\frac{P}{P_i} \right] + C + BFI$$

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_i : 1 cfm = 1.7 CMH

P_i : 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 under 900mm	40	40	39	34	30	23	19	17
		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
Propeller	General Ventilation	48	51	58	56	55	52	46	42

(NOTE) NEBB National Environmental Balancing Bureau(1994)

Design data

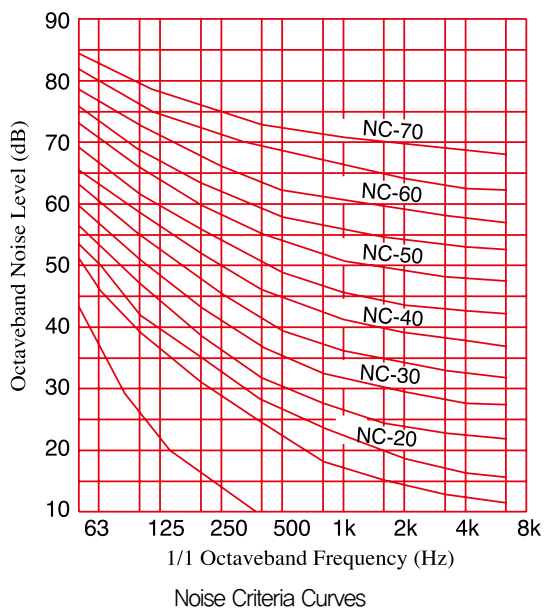
1. Recommendation regarding interior noise

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

Information for prevention of noise

B. Noise Criteria, NC



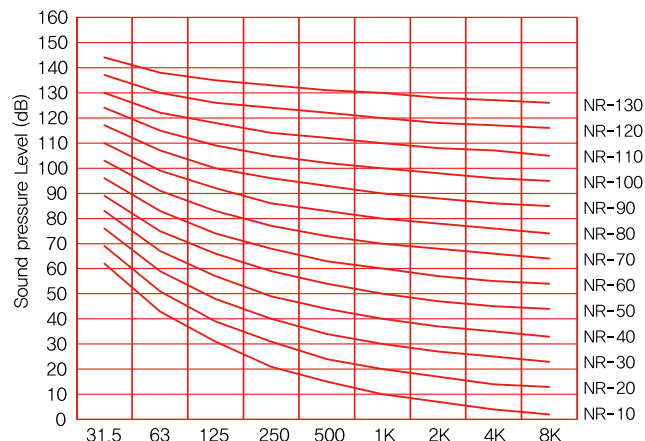
►Evaluation by Noise Criteria

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	60	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, churches
30	Private dwellings, hospitals, theatres and cinemas, conference rooms
35	Libraries, museums, court rooms, schools, hospitals operating
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	$Leq(24) \leq 70\text{dB}$	All areas
Interference in outdoor activities and disturbance	$Ldn \leq 55\text{dB}$	Residential areas and outdoor areas in farms, other outdoor areas where people spend a lot of time, or other outdoor areas requiring quiet
	$Leq(24) \leq 55\text{dB}$	Outdoor areas where people only stay for short periods, such as areas inside schools or playgrounds, etc.
Interference in indoor activities and disturbance	$60Ldn \leq 45\text{dB}$	Indoor areas in residential areas
	$Leq(24) \leq 45\text{dB}$	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, recreation 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

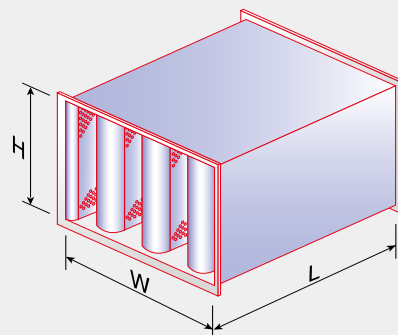


Tunnel Exhaust silencer

■ Model Denotation method

R - - × ×

- 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 Height(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

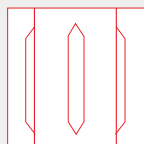
■ Sound Attenuator Shape



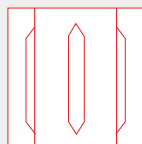
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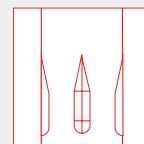
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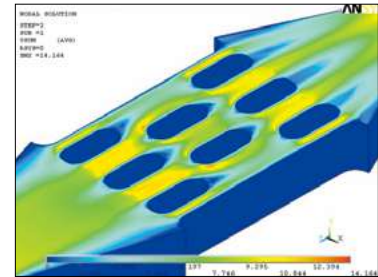
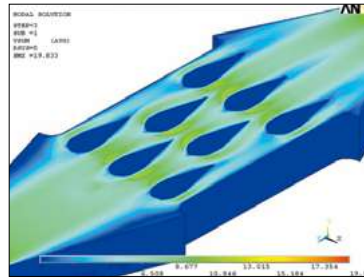
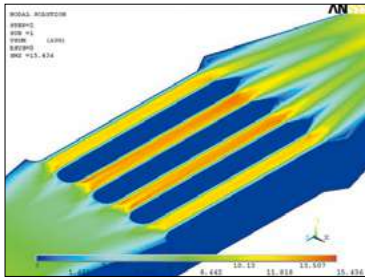
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■ Splitter Thickness / Air Way Area

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(m³/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

1. Fan Total Sound Power Level (PWL) 1) Specific Sound Power Level (Kw) 2) Sound Level by Air Flow & Static Pressure (Mw) 3) Correction Factor by Efficiency (C) 4) Blade Frequency Increments (BFI) (Total)	CODE	2	AIR FOIL		OCTAVE BAND CENTER FREQUENCY(Hz)							
					63	125	250	500	1000	2000	4000	
					45.0	45.0	43.0	39.0	34.0	28.0	24.0	
					53.4	53.4	53.4	53.4	53.4	53.4	53.4	
					0.0	0.0	0.0	0.0	0.0	0.0	0.0	
					0.0	0.0	3.0	0.0	0.0	0.0	0.0	
					98.4	98.4	99.4	92.4	87.4	81.4	77.4	
						Total Sound Power Level : 94.7dB(A)						

SELF GENERATED NOISE DATA

2. Attenuation of System 1) Unlined Rectangular Sheet Metal Ducts a.Rectangular Duct Duct - 1 Duct - 2 b.Circular Duct 2) Insertion Loss of Elbow a.Square Elbow b.Round Elbow c.Lined Elbow 3) Chanber Attenuation (Non-Sound-Absorbing) 4) Chanber Attenuation (Sound-Absorbing) 5) Duct Branch Sound Power Division 6) Duct End Reflection Loss 7) The Other Attenuation (Total) : 1)+2)+3)+4)+5)+6)+7)												
	Width	Hight	P/A	Length								
	1.40	0.60	4.76	10	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	0.0	0.00	0.00	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Q'TY	0	Width	1.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Q'TY	0	Width	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Q'TY	0	Width	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Q'TY	0	0	NRC	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Inlet	0.0	Outlet	0.0								

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

3. Sound Power Level in Room (PWL) (Sum1 - Sum2) 4. Noise Criteria in Room(SPL) 5. Correction by Diffuser Sound Pressure (-10log ne+10log ni) ne=0.23 ni=0.7 6. Attenuation to Room Absorption (Kr) 7. Allowable Sound Power Level at Outlet (PWL) : (4+5+6) 8. Generated Noise at Outlet (PWL) *Sound Power Level (Before Atten.) : 74.4 dB(A) 9. Allowable Sound Power Level in Room (PWL) 10. Additional Attenuation Required (3-9) 11. Sound Attenuator (Insertion Loss) Pressure Drop 3 mmAq												
	Q'TY	0	0	NRC	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Inlet	0.8	NRC	0.8								
	Air Volume	780	m²/h		14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
	Q'TY		N.D	0.25	16.0	11.0	6.0	2.0	1.0	0.0	0.0	0.0
					33.3	28.3	23.3	19.3	18.3	17.3	17.3	
					65.1	70.1	76.1	73.0	69.1	64.1	60.1	
					64.0	56.0	50.0	45.0	41.0	39.0	38.0	
					4.8	4.8	4.8	4.8	4.8	4.8	4.8	

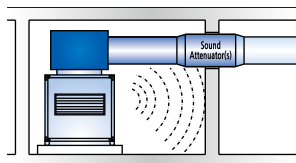
Selection of standard noise level on room

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

SELECTION OF SOUND ATTENUATOR SIZE (Considering required attenuation, velocity and static pressure drop etc.)	7. Allowable Sound Power Level at Outlet (PWL) : (4+5+6) 8. Generated Noise at Outlet (PWL) *Sound Power Level (Before Atten.) : 74.4 dB(A) 9. Allowable Sound Power Level in Room (PWL)											
	10. Additional Attenuation Required (3-9) 11. Sound Attenuator (Insertion Loss) Pressure Drop 3 mmAq	Model	Width	Hight	Length	*Air Velocity (Pass through Atten.) : 8.1 m/s						
			1800	800	1500	7	8	14	23	31	33	17
			1800	800	1800	7	11	16	26	37	37	20
			1800	800	2100	8	11	19	30	43	41	24

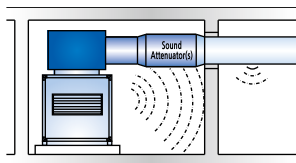
ANOS10 Rectangular Type Sound Attenuator

■ Sound Trap Sound Attenuator Placement On AHU Room



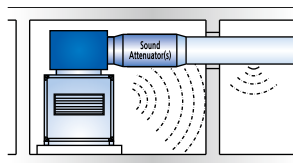
BEST

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



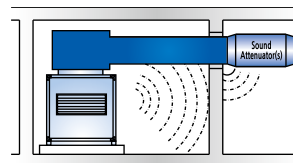
VERY GOOD

Practical alternate where fire damper is required at wall.



FAIR

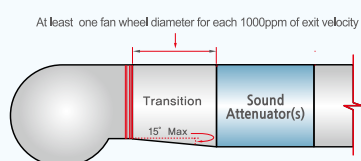
Mechanical room noise "break into" duct without reduction through sound attenuator



POOR

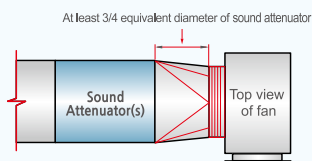
All noise in duct "breaks out" over occupied space before being reduced by sound attenuator

■ Guidelines for sound attenuator placement near fans and duct fittings

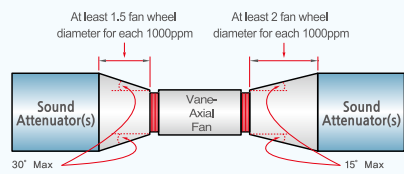


At centrifugal fan discharge

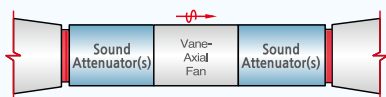
Note : Sound attenuator baffles should be perpendicular to fan shaft



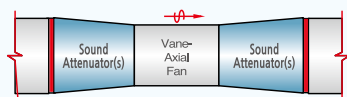
At centrifugal fan inlet



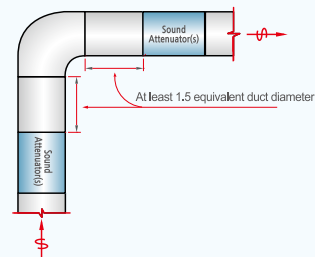
Rectangular sound attenuator at vane axial fan inlet and discharge <Subway, Tunnel>



Circular sound attenuators attached directly to vane axial fans



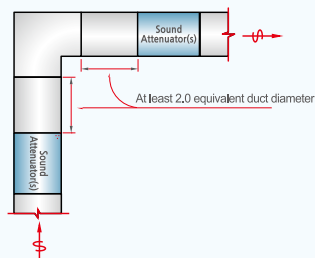
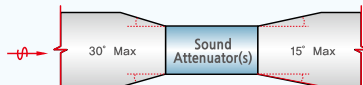
Circular sound attenuators attached directly to vane axial fans



At radius turns and square turns with turning vane (Note : Sound attenuators baffles should be parallel to the elbow cheeks)



Upstream and downstream of transitions (Note: Transition angle should be Max. 30°, before sound attenuator and Min. 15° after transition)



At square turns without turning vanes (Note : Sound attenuators baffles should be parallel to the elbow cheeks)

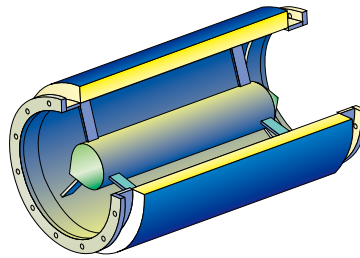


ANOS20 Circular Type Sound Attenuator

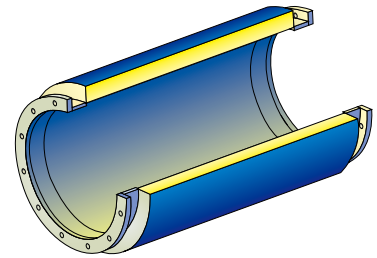


■ Features

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

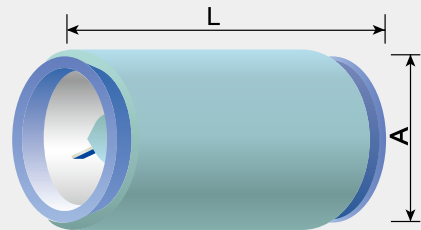


TYPE-2

■ Model denotation method

C - × ×

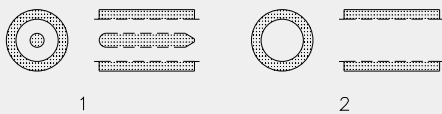
- ① Absorption Material Protection Method
- ② Sound Attenuator Shape
- ③ Splitter Thickness / Air Way Extension Type
- ④ Sound Attenuator Diameter(∅):A
- ⑤ Sound Attenuator Length(mm):L



■ 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



■ Splitter thickness/Air Way Extension

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 - × × ×

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

■ Sound Attenuating amount(R)

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

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

- ① Sound Absorption Material Protection Method
 ② Sound Attenuating Elbow Width(mm)
 ③ Sound Attenuating Elbow Height(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

Application	Elbow Type	Square Elbow				Round Elbow
		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:mm)

AL-A/B Acoustic Louver



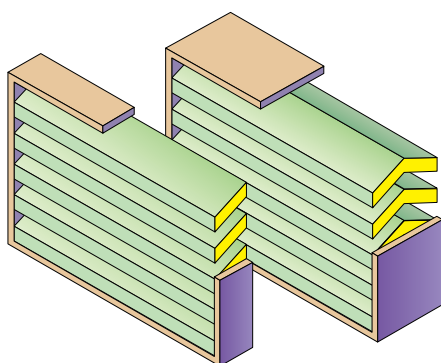
■ Features

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.

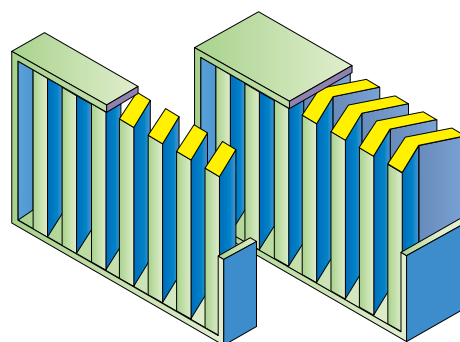
■ Specification

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

■ Types of Acoustic Louver



-Horizontal splitter-



-Vertical splitter-

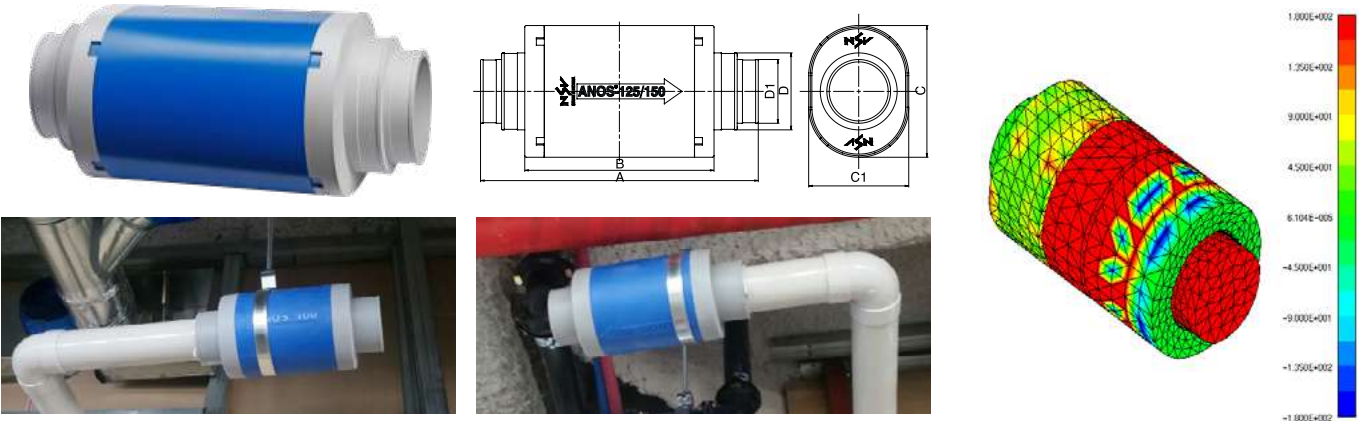


ANOS50 Hybrid Type Silencer (Resonance+Expansion Type Silencer)

■ 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							

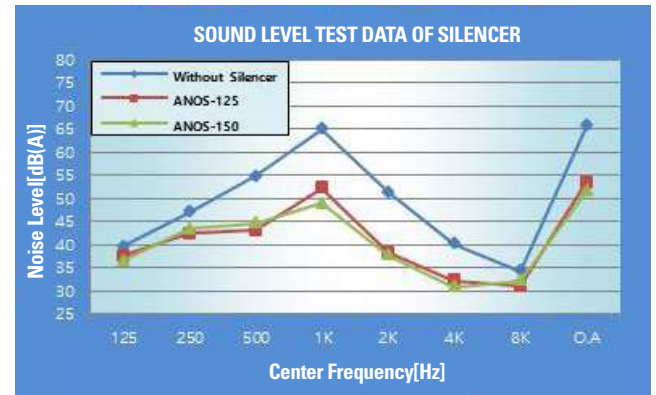
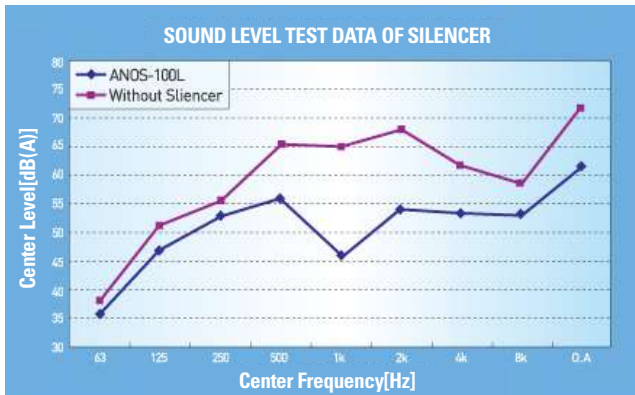
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

■ Characteristic

Details		Specification
Attenuation Performance		Greater than 10dB(A) for daily life 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 8.0m³)
Material [polypropylene(PP)]		Material that is used to manufacture cooking ware harmless to human
		Recyclable 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



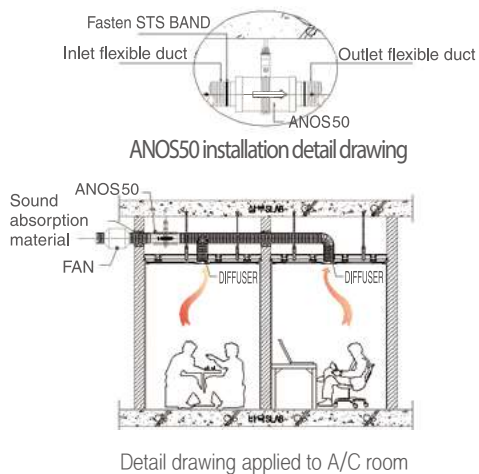
■ Effectiveness of ANOS50

- 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

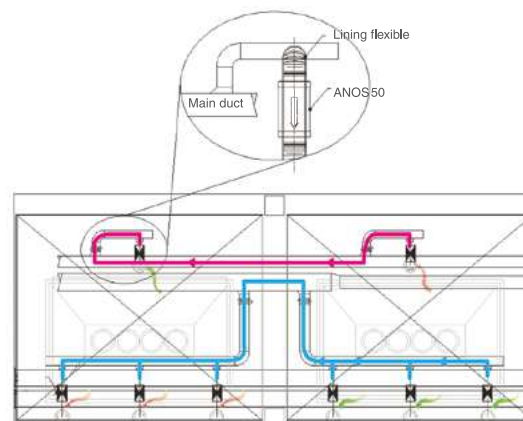
■ ANOS50 installation

- 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

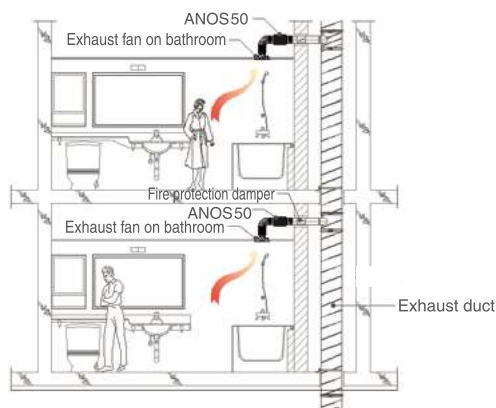
■ Bathroom Detailed drawing for ANOS50 installation



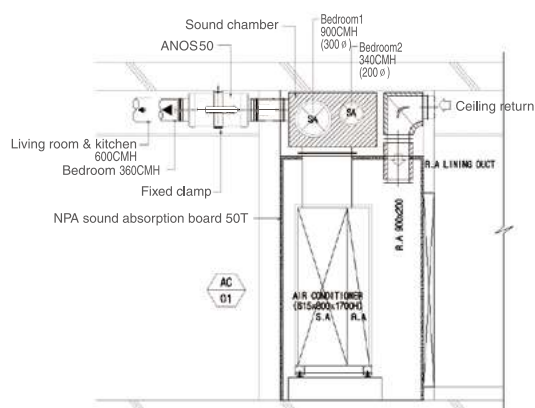
Detail drawing applied to A/C room



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 - X

①

②

③

① Method of protecting the sound-absorbing material

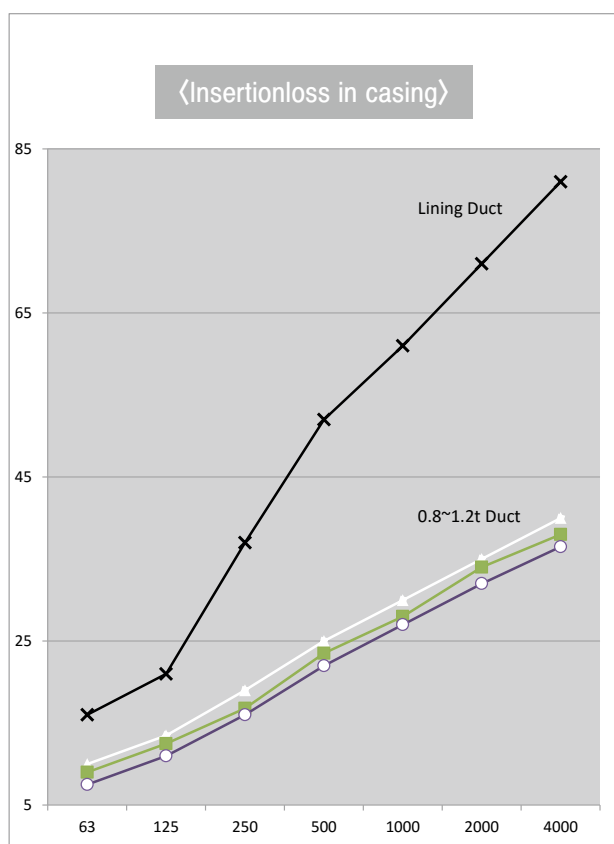
② Width of sound-absorbing duct(mm)

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.

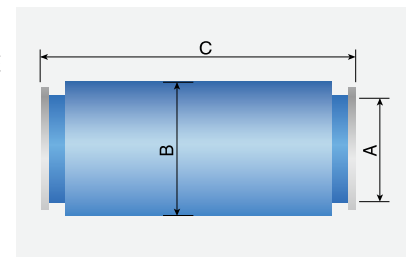
■ Specification

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



- 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





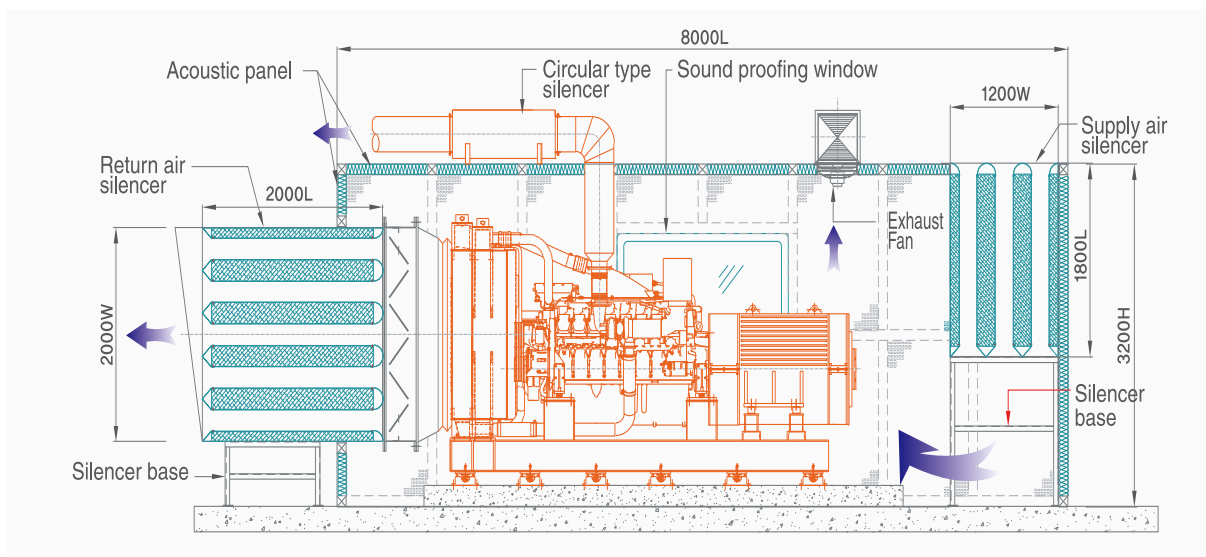
■ Acoustic Enclosure

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

■ The Acoustic Enclosure Structure Drawing



ANOS90 Diffraction Noise Reducer



■ Product Usage

- Device installed on top of noise barriers to reduce upward diffraction of noise
- Device that enhances the noise reduction effectiveness of noise barriers

■ Product Specifications

Height	Width	Length	Product Material	Noise Reduction Effect ¹⁾
440mm	560mm	125mm	P,P	4,3dB

1) Amount of noise reduction after the installation of the diffraction noise reducer
(test report from authorized inspection agency for concrete pavement)

(NOTE) These specifications can be changed without notice to improve product quality and performance.

Side branch inducing destrucative interference

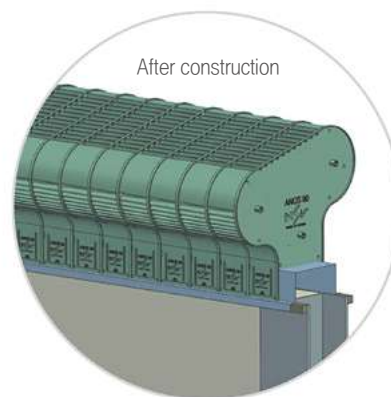
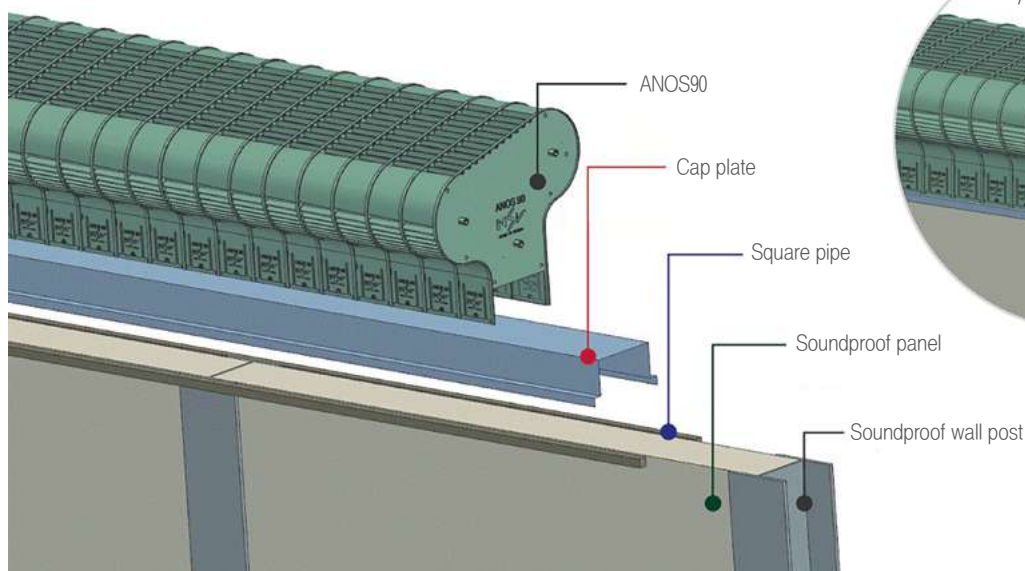


Joint part compatible with the upper area of noise barriers

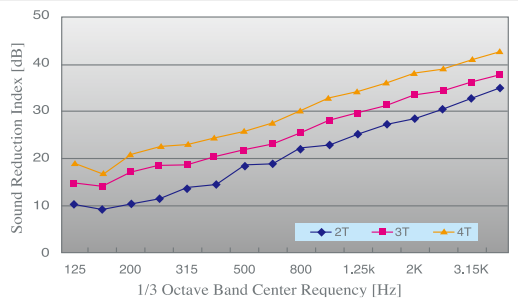
■ Product Features

Durability	The all-in-one design ensures product stability, and there are no issues with pieces falling off or deformation from external forces
Eco-friendliness	No use of sound-absorbing materials Application of recycled plastics
Constructability	Easy installation and variability depending on space

■ Construction Overview



NDP Damping Sheets



■ Features

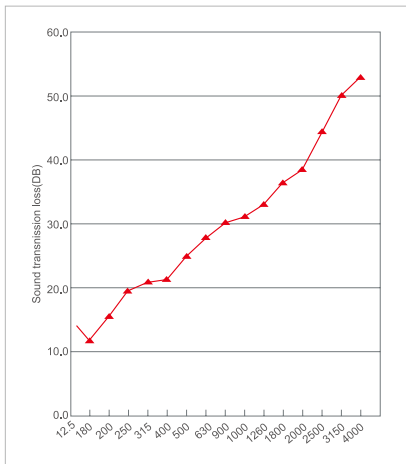
It is a viscoelastic material having a relatively high damping loss. It converts vibrational energy into thermal energy through internal viscous damping and friction. It is used to reduce the sound energy generated when a panel shakes due to vibration, resonance amplitude and vibration on joint parts.

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

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



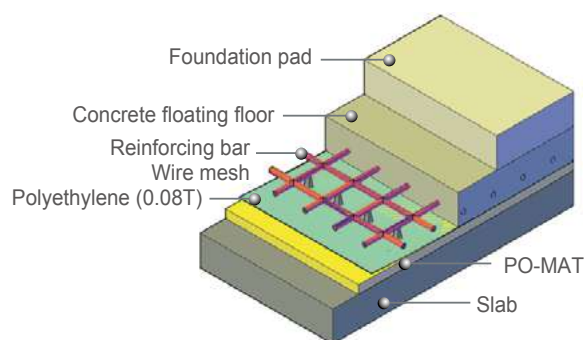
■ Features

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/m³)	150±20%	220±20%	300±20%	400±20%	500±20%	600±20%	800±20%	1000±20%
Rated Load(N/mm²)	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/m³)	Lifetime (room temperature:20°C)	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

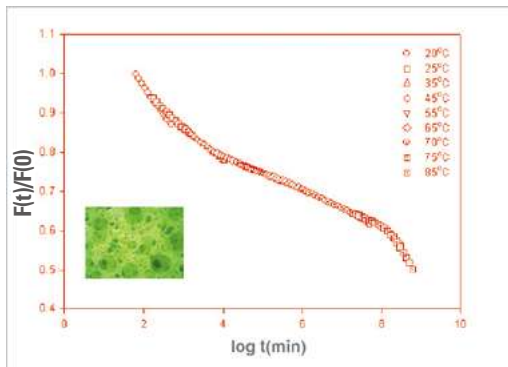
- The data above is the result of the test performed upon request by the Department of Chemical Engineering at Hanyang University. The test was conducted to predict durability using Time Temperature Superposition (TTS) and observe stress-relaxation under constant compression strain.

★ 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.

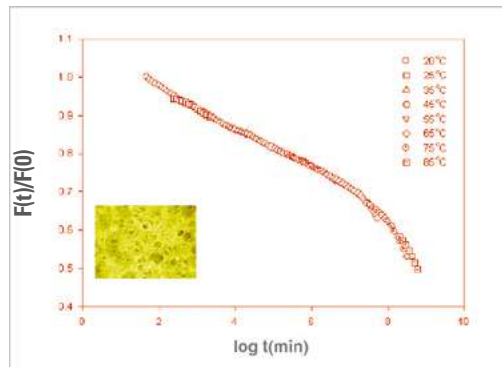
■ Test Equipment(DMA 2980, TA Instrument)



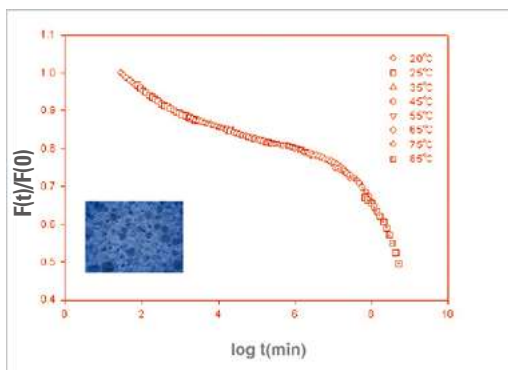
■ The PO-MAT Durability Test Resulting Graph



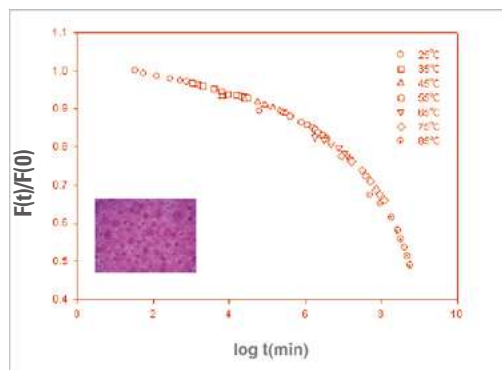
- Sample A : Green
- Density : 150Kg/m³
- Durability : Durability 612yrs(20°C)



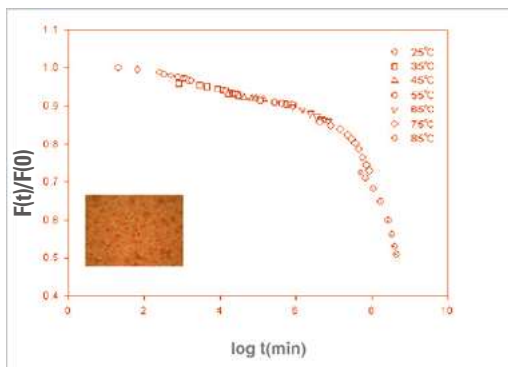
- Sample B : Yellow
- Density : 220Kg/m³
- Durability : Durability 630yrs(20°C)



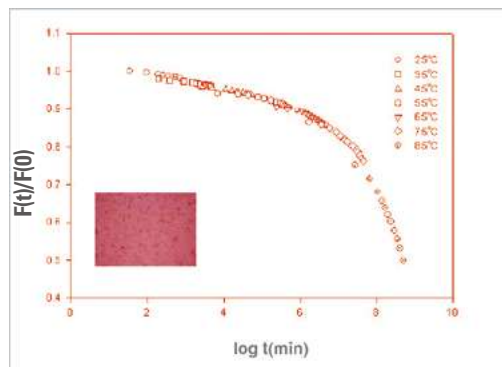
- Sample C : Blue
- Density : 300Kg/m³
- Durability : Durability 644yrs(20°C)



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



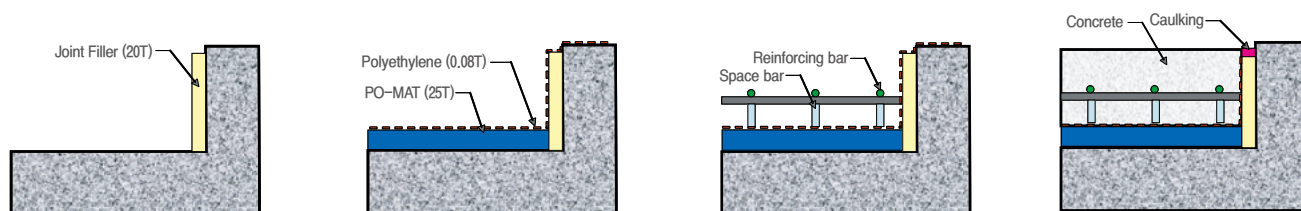
- Sample E : Brown
- Density : 500Kg/m³
- Durability : Durability 660yrs(20°C)



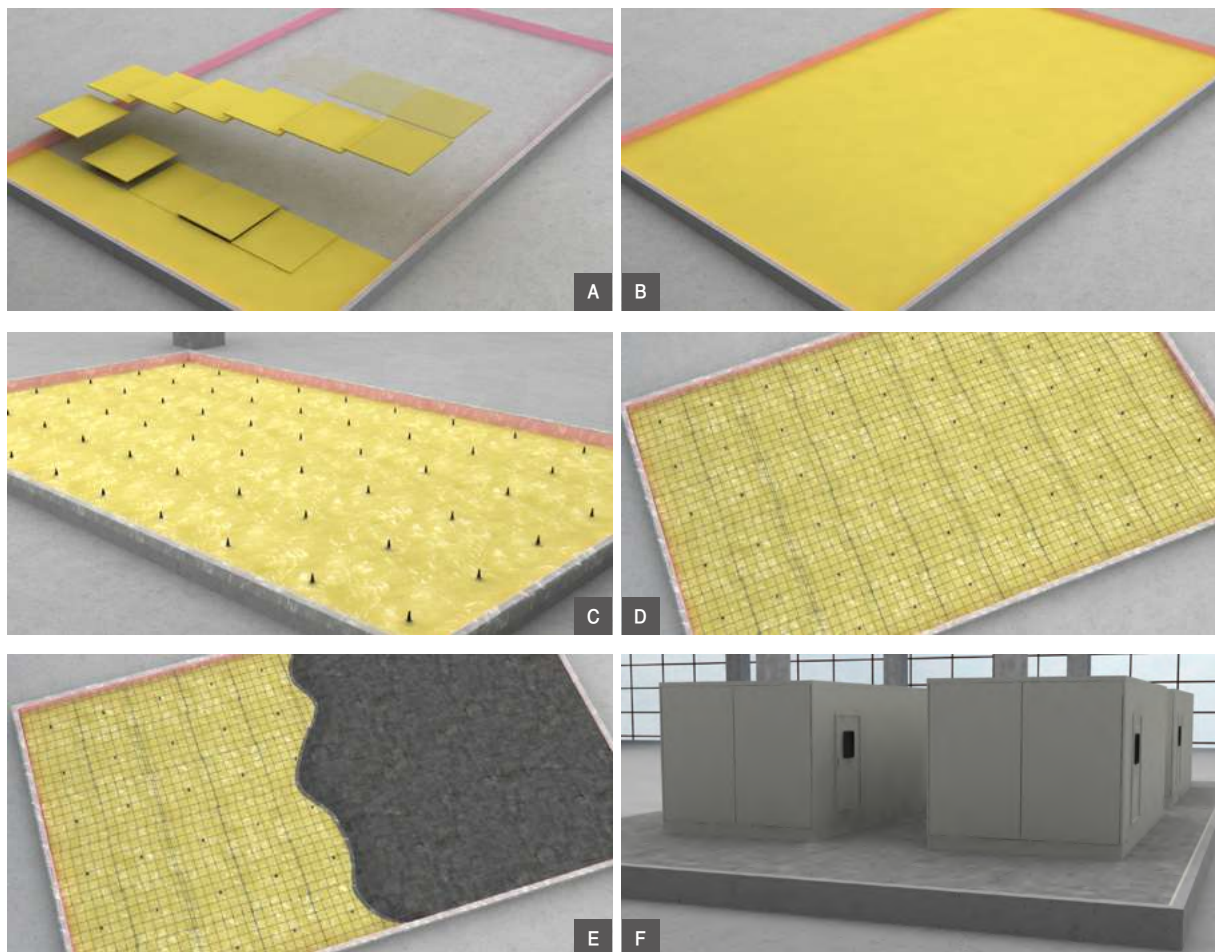
- Sample F : Red
- Density : 600Kg/m³
- Durability : Durability 675yrs(20°C)

PO-MAT® Polyurethane Mat

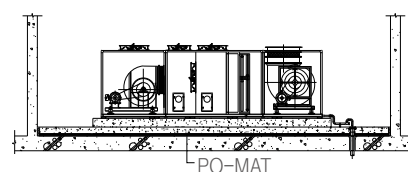
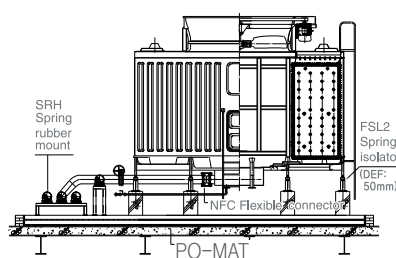
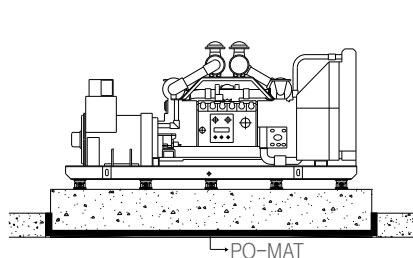
■ PO-MAT Installation Order



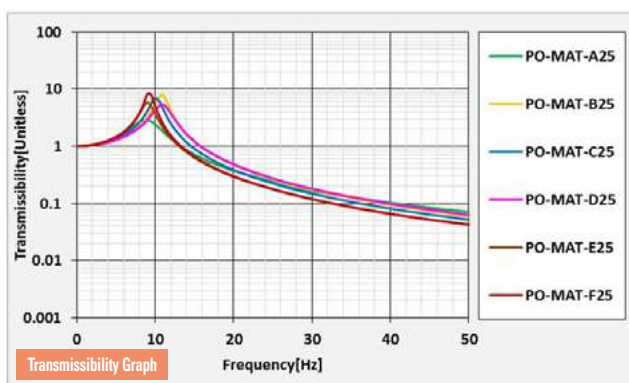
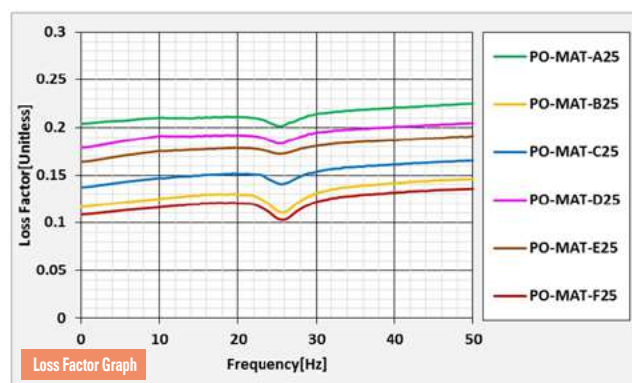
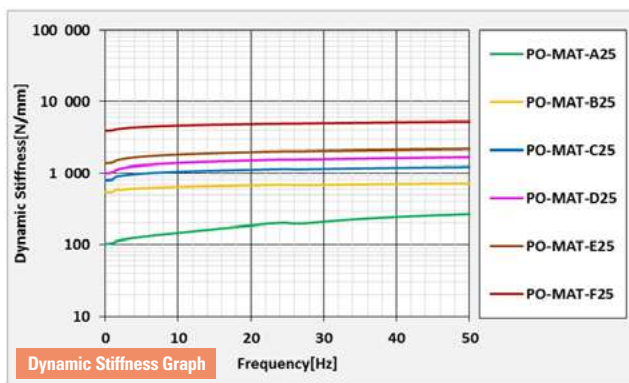
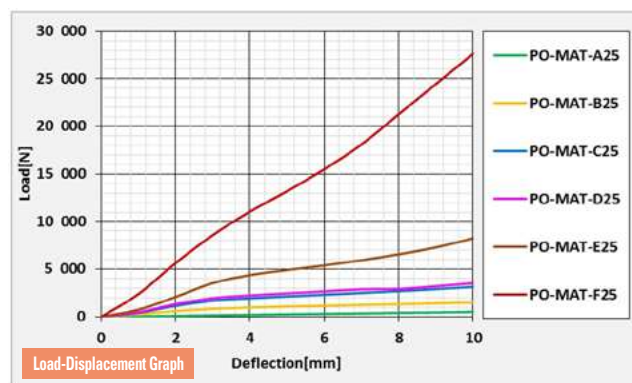
1. Clean the floor where the PO MAT is to be installed, keep level and install the MAT when the floor is dried.
2. Cover drain, vertical pipes, ducts and electric line-passing parts with joint filler and/or heat insulating materials.
3. Attach joint filler on surrounding walls and pillars that come in 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 Construction Method

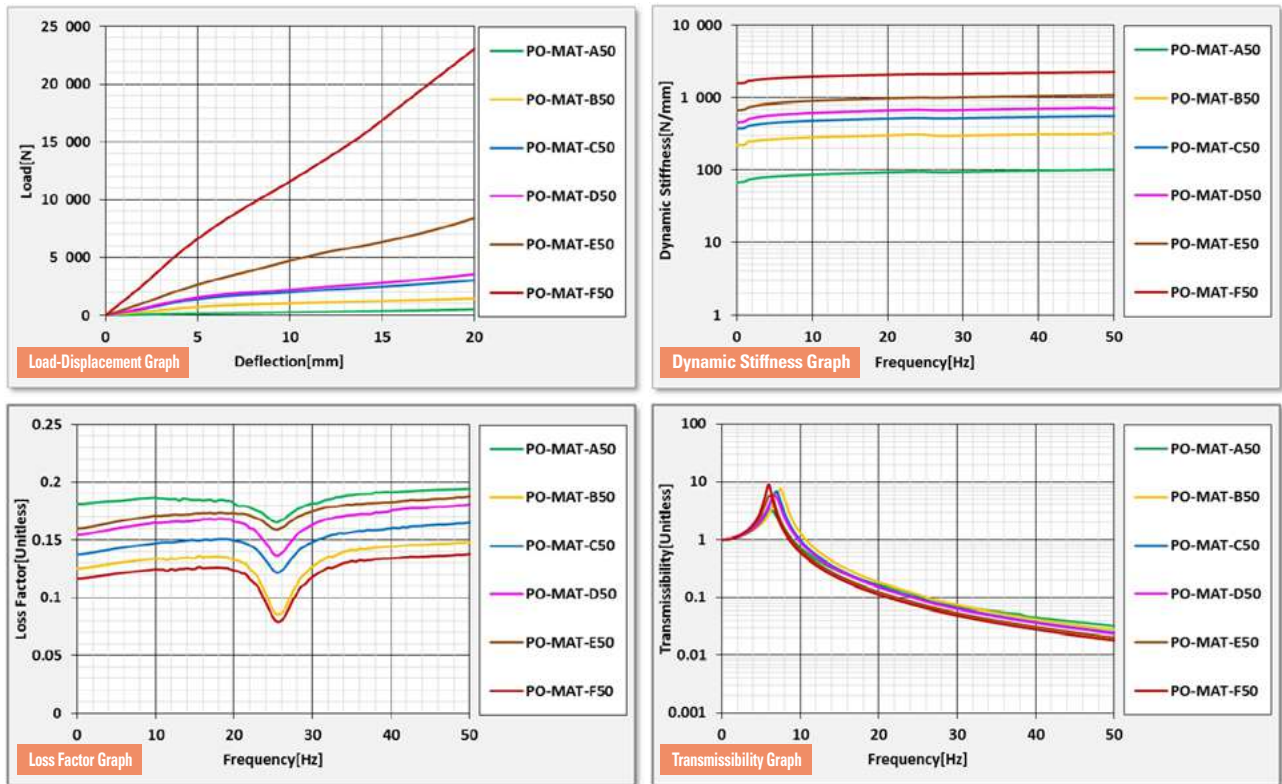


25T Test Data



PO-MAT® Polyurethane Mat

■ 50T Test Data



■ Explanation(Commonness)

1. Vibration Transmissibility(T_r)

Vibration Transmissibility is the amplitude ratio of Output to Input.

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

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 Efficiency(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.

$$\zeta = \frac{\text{Actual Damping}}{\text{Critical Damping}}$$

5. Dynamic Stiffness(k_d)

The dynamic stiffness is the frequency dependant ratio between a dynamic force and the resulting dynamic displacement.

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

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

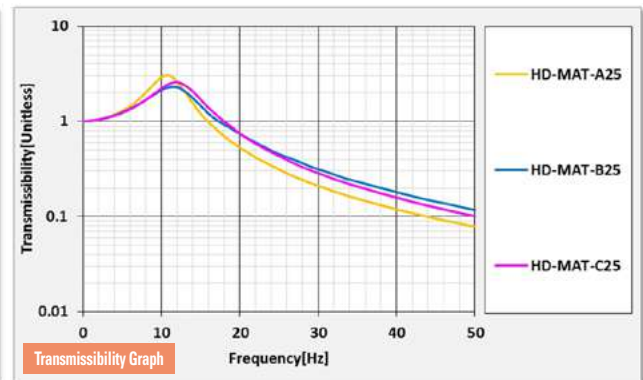
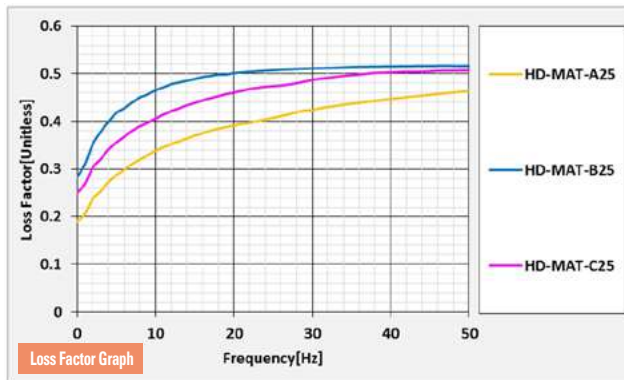
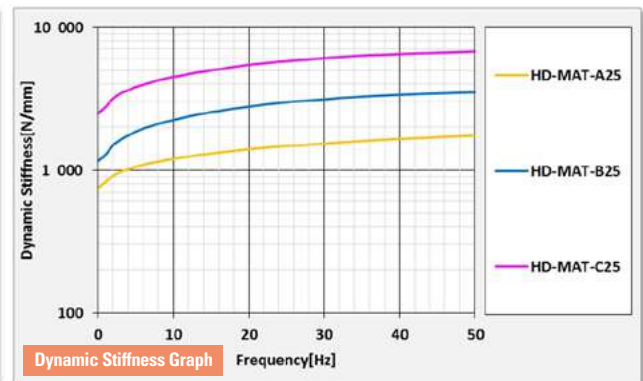
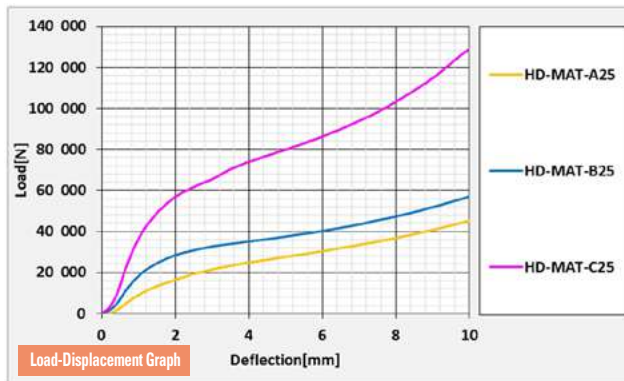
Model	A25		A50	B25		B50	C25		C50
Color	Orange			Sky Blue			Purple		
Thickness	25		50	25		50	25		50
Density(kg/m³)	100±20%			150±20%			200±20%		
Tensile Strength(MPa)	Over 1.3			Over 1.8			Over 2.0		
Coefficient of Extension(%)	Over 220			Over 220			Over 220		
Rated Load(N/mm²)	0.08±20%			0.17±20%			0.20±20%		
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(tan δ)	Over 0.3		Over 0.27	Over 0.3		Over 0.27	Over 0.3		Over 0.27
Dynamic Modulus of Elasticity(N/mm²)	Under 1.6		Under 2.0	Under 1.6		Under 2.0	Under 1.6		Under 2.0
Compression Set ((23±2)°C, 22h)	Under 5.0			Under 5.0			Under 5.0		
Water Absorption Ratio (g/cm³)	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.

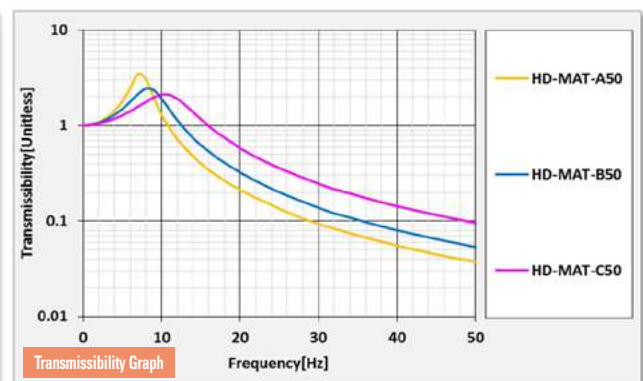
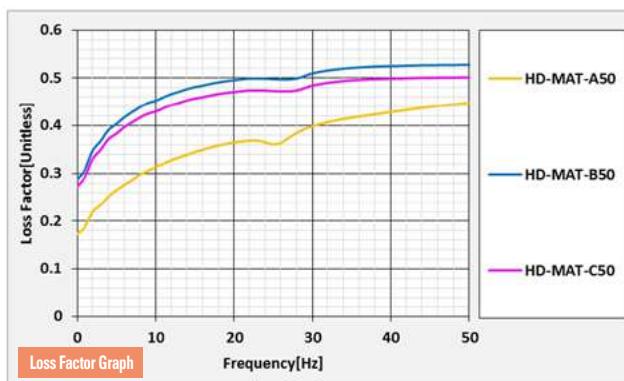
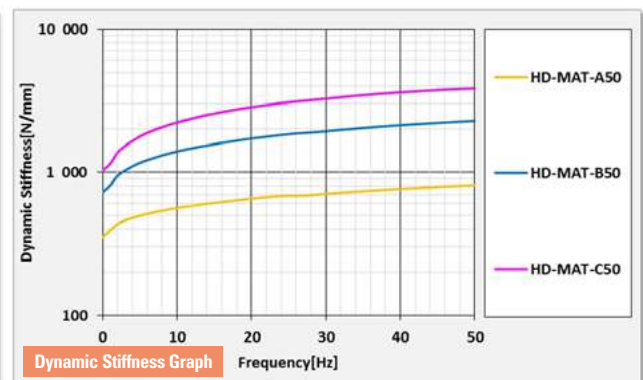
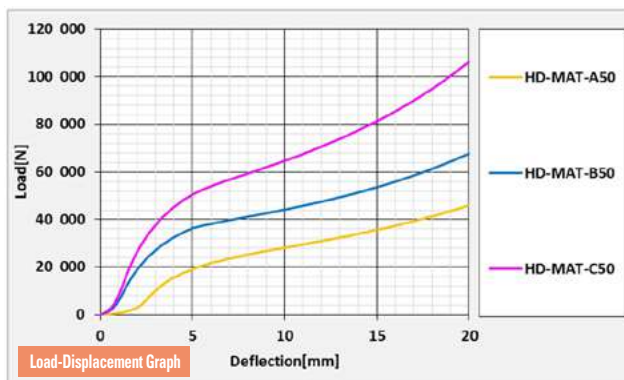


HD-MAT High-Damping Mat

■ 25T Test Data



■ 50T Test Data



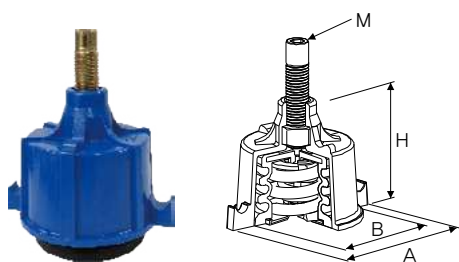
JUM-10000/20000/30000/40000 Jack Up Floating Floor System

■ Features

The Jack-Up System is designed to prevent noise, vibration, and impact sound generated by vibration sources such as air handling unit rooms, mechanical rooms, and bowling alleys from being transmitted to floors below and surrounding areas. Jack up mounts are used on the existing slab to provide a 50-mm-high air layer and a steel-reinforced concrete slab structure of at least 100 mm. The double slab (floating floor) acts as a soundproof structure that increases noise transmission loss, while the mounts prevent the transfer of internal vibrations and primary solid-borne sound. Two types are available: housing casting and engineering plastic. JUM-10000 mount series features an internal coil spring and achieves a natural frequency of 4.5 Hz.

■ Dimensions of Jack Up Mount

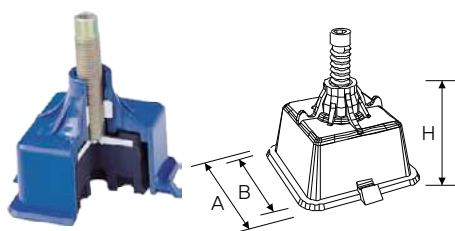
JUM-10000 (Deflection : 17mm)



Model	Design Load (kgf)	Deflection (mm)	Hardness (Hs)	Dimension(mm)				Double Floor Configuration	
				A	B	H	M	Air Layer(mm)	Double Floor Thickness(mm)
JUM-10200	200	17	65±5	138	94	100	M20	50~100	100~150
JUM-10300	300								
JUM-10400	400								
JUM-10500	500								
JUM-10600	600								

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

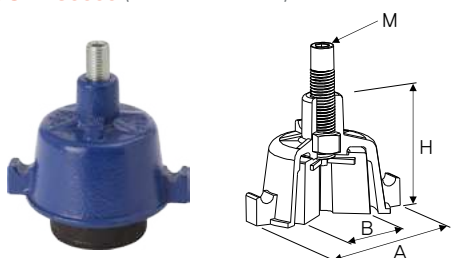
JUM-20000 (Deflection : 8mm)



Model	Design Load (kgf)	Deflection (mm)	Hardness (Hs)	Dimension(mm)				Double Floor Configuration	
				A	B	H	M	Air Layer(mm)	Double Floor Thickness(mm)
JUM-20300	300	8	65±5	136	86	100	M20	50~100	100~150
JUM-20650	650								

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

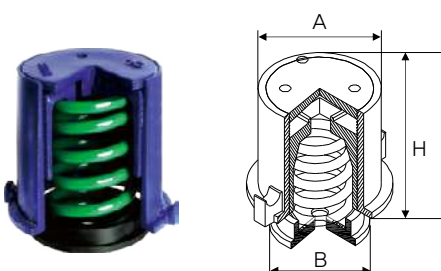
JUM-30000 (Deflection : 8mm)



Model	Design Load (kgf)	Deflection (mm)	Hardness (Hs)	Dimension(mm)				Double Floor Configuration	
				A	B	H	M	Air Layer(mm)	Double Floor Thickness(mm)
JUM-30300	300	8	65±5	136	86	100	M20	50~100	100~150
JUM-30650	650								

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

JUM-40000 (Deflection : 50mm)

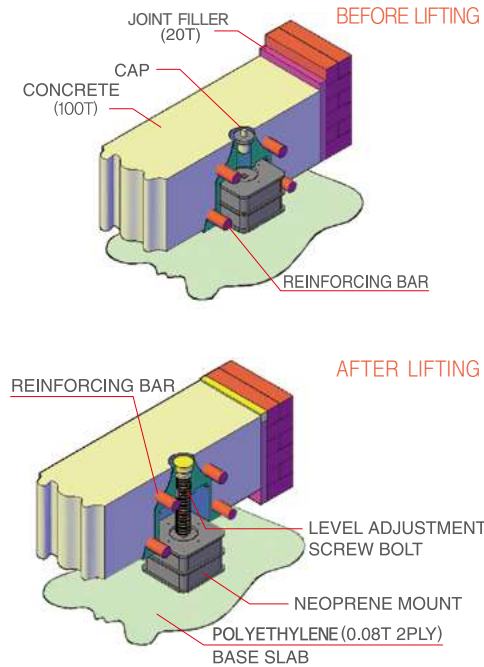


Model	Color	Design Load (kgf)	Deflection (mm)	Dimension(mm)			Double Floor Configuration	
				A	B	H	Air Layer(mm)	Double Floor Thickness(mm)
JUM-40200	White	200	50	180	95	150	50	150~120
JUM-40300	Orange	300						
JUM-40400	Pink	400						
JUM-40500	Green	500						
JUM-40600	Blue	600						
JUM-40750	Black	750						

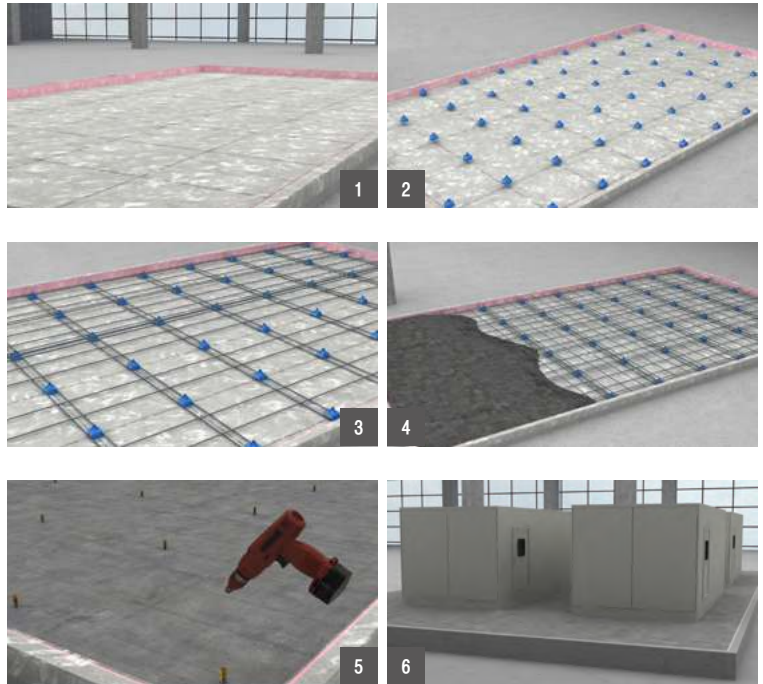
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

JUM-10000/20000/30000/40000 Jack Up Floating Floor System

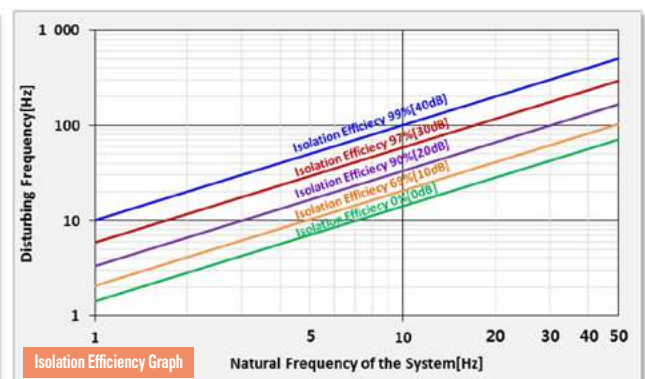
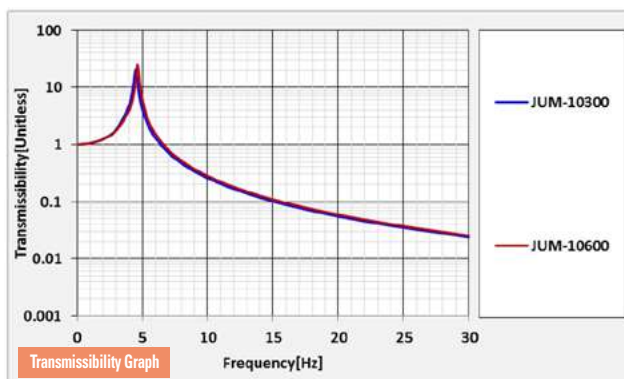
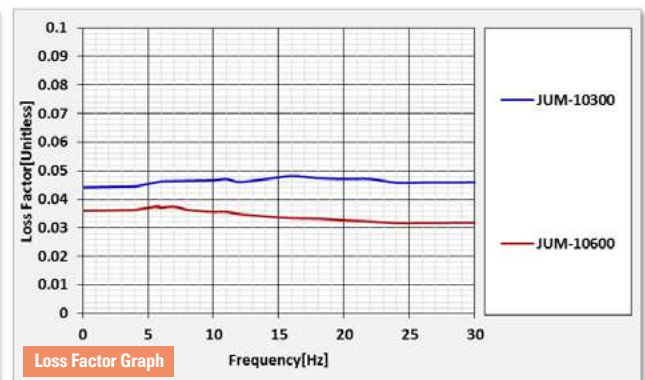
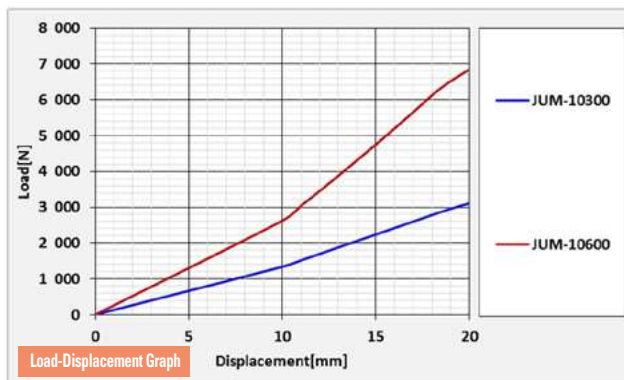
■ Jack-up system before/after lifting



■ Jack-up system Installation Order

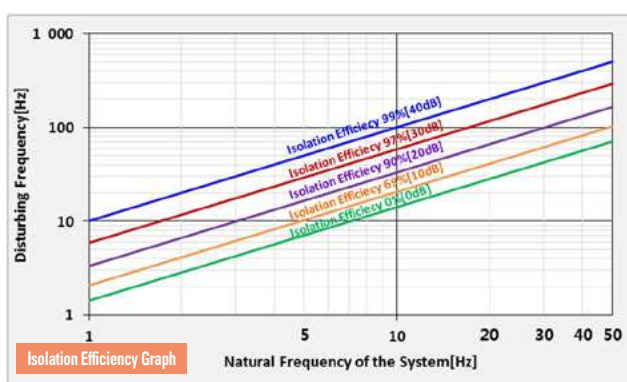
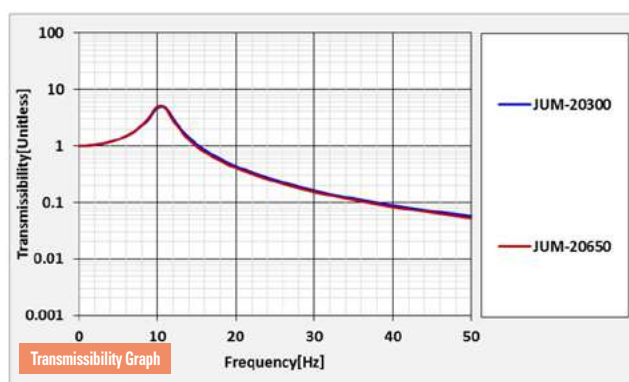
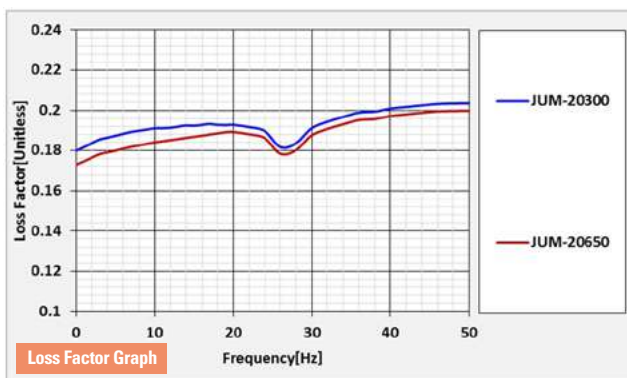


■ JUM-10000 Test Data

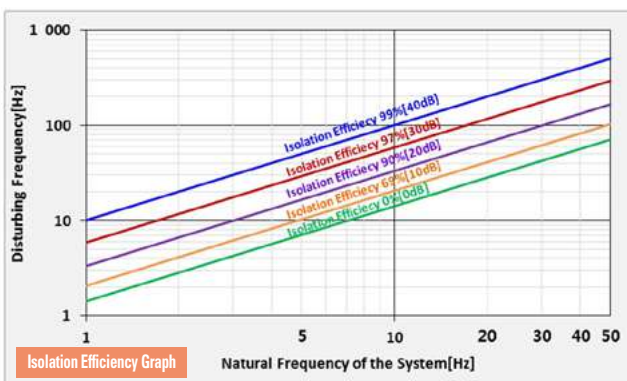
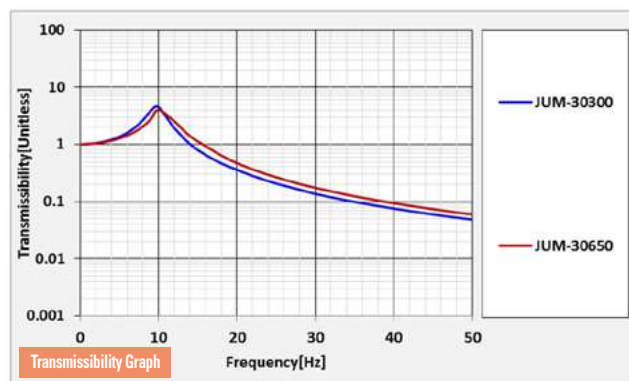
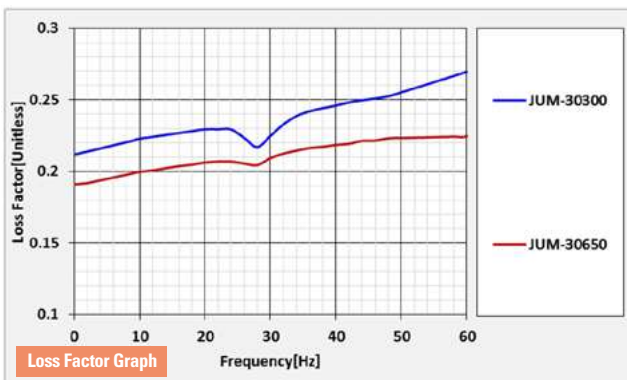
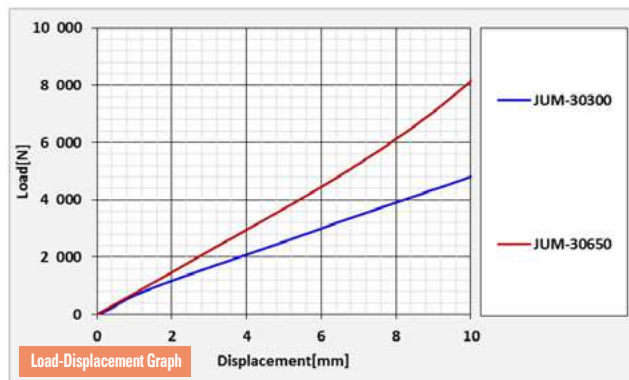


JUM-10000/20000/30000/40000 Jack Up Floating Floor System

JUM-20000 Test Data

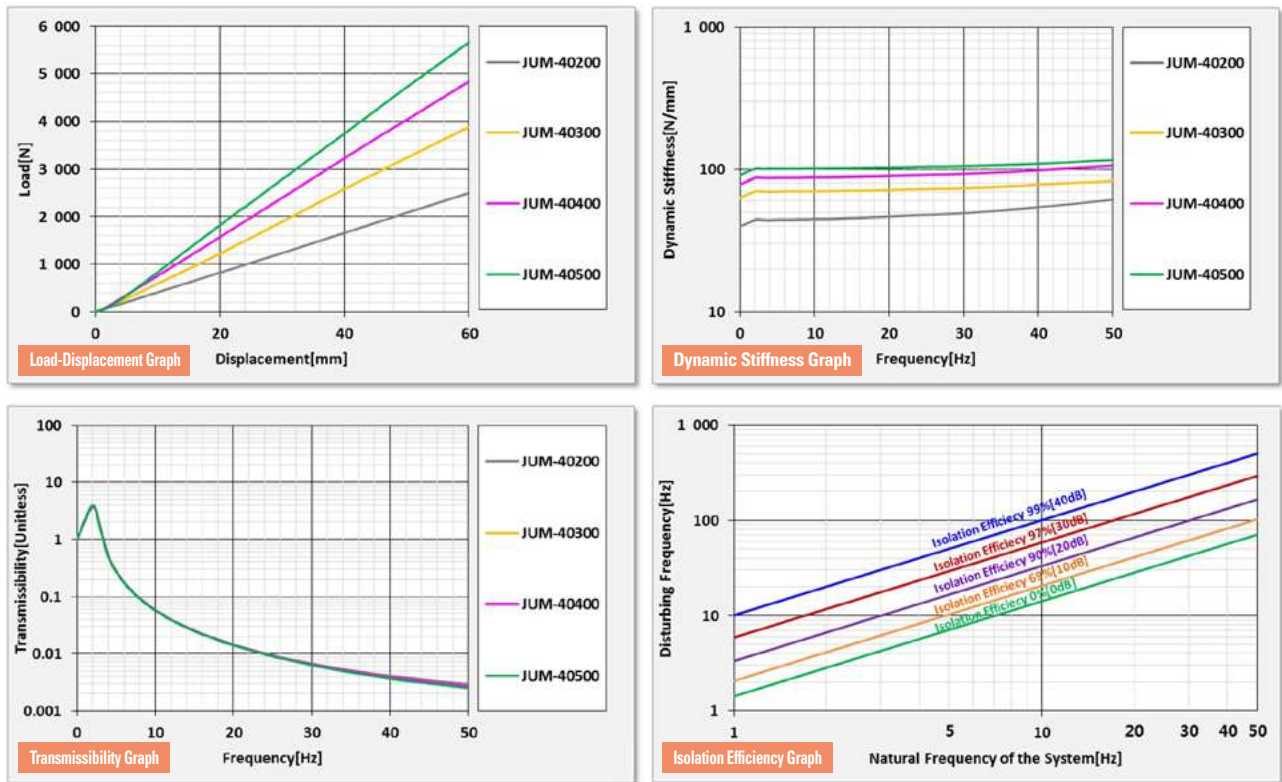


JUM-30000 Test Data



JUM-10000/20000/30000/40000 Jack Up Floating Floor System

JUM-40000 Test Data



Explanation(Commonness)

1. Vibration Transmissibility(T_r)

Vibration Transmissibility is the amplitude ratio of Output to Input.

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

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 Efficiency(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.

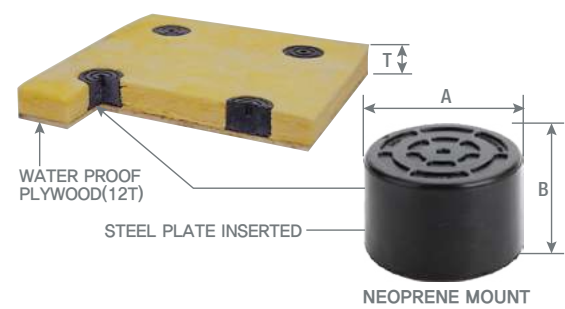
$$\zeta = \frac{\text{Actual Damping}}{\text{Critical Damping}}$$

5. Dynamic Stiffness(k_d)

The dynamic stiffness is the frequency dependant ratio between a dynamic force and the resulting dynamic displacement.

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

NFM Plywood Floating Floor System



■ Features

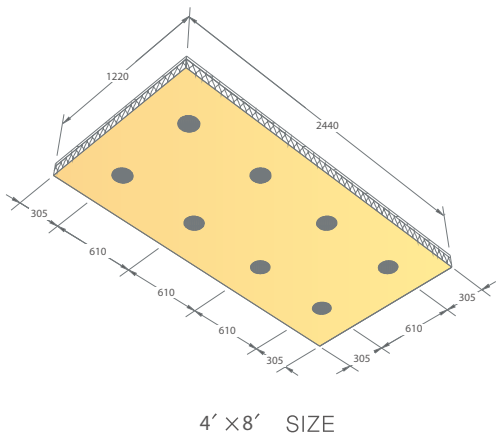
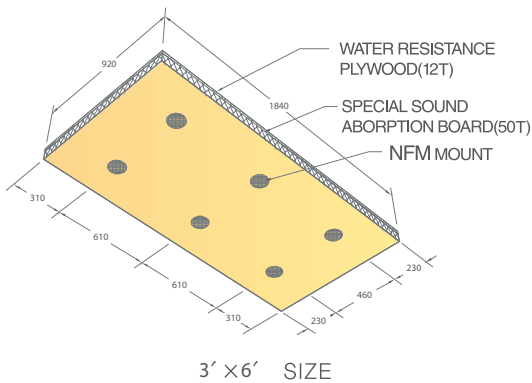
As a kind of form work floor system, it absorbs noise, shock and vibration generated in air conditioning rooms, machine rooms and other special facilities like the jack-up system does. But, unlike the jack-up system, it is easier to install as it requires no floating floor to be lifted. In particular, 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

(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

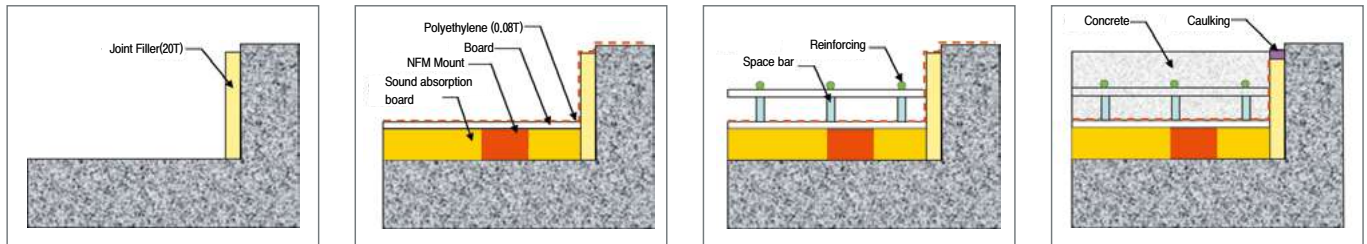


■ NFM Plywood Panel Installation Pictures



NFM Plywood Floating Floor System

NFM plywood panel Installation Order

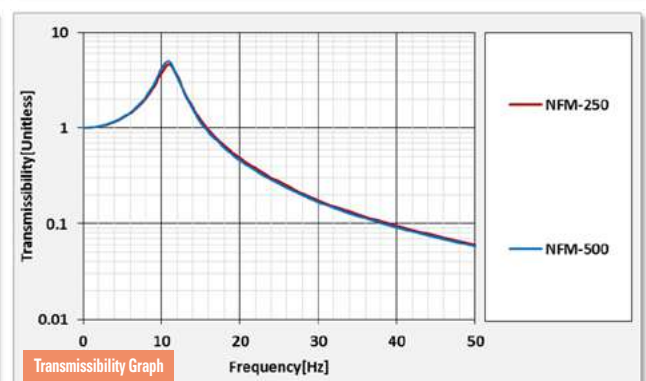
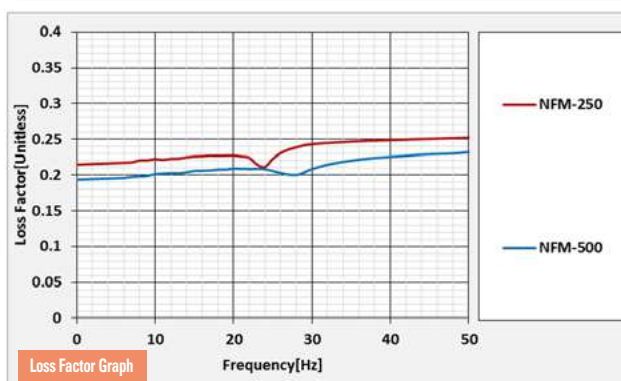
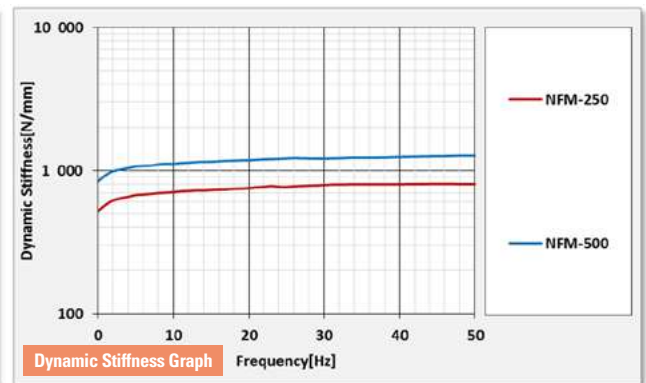
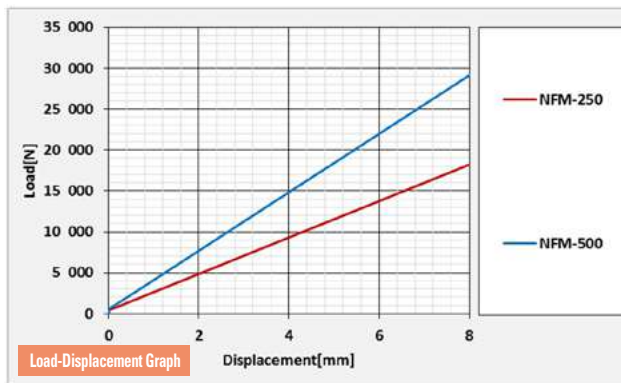


1. Clear the surface of the floor where nfm mount is to be installed, maintain a level surface and keep it dry.
2. Fix the drain, vertical pipes and ducts.
3. Insert the spool pipe seal on the general pipe or electric pipe.
4. Attach the joint filler on the wall or pillar that will come in contact with 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

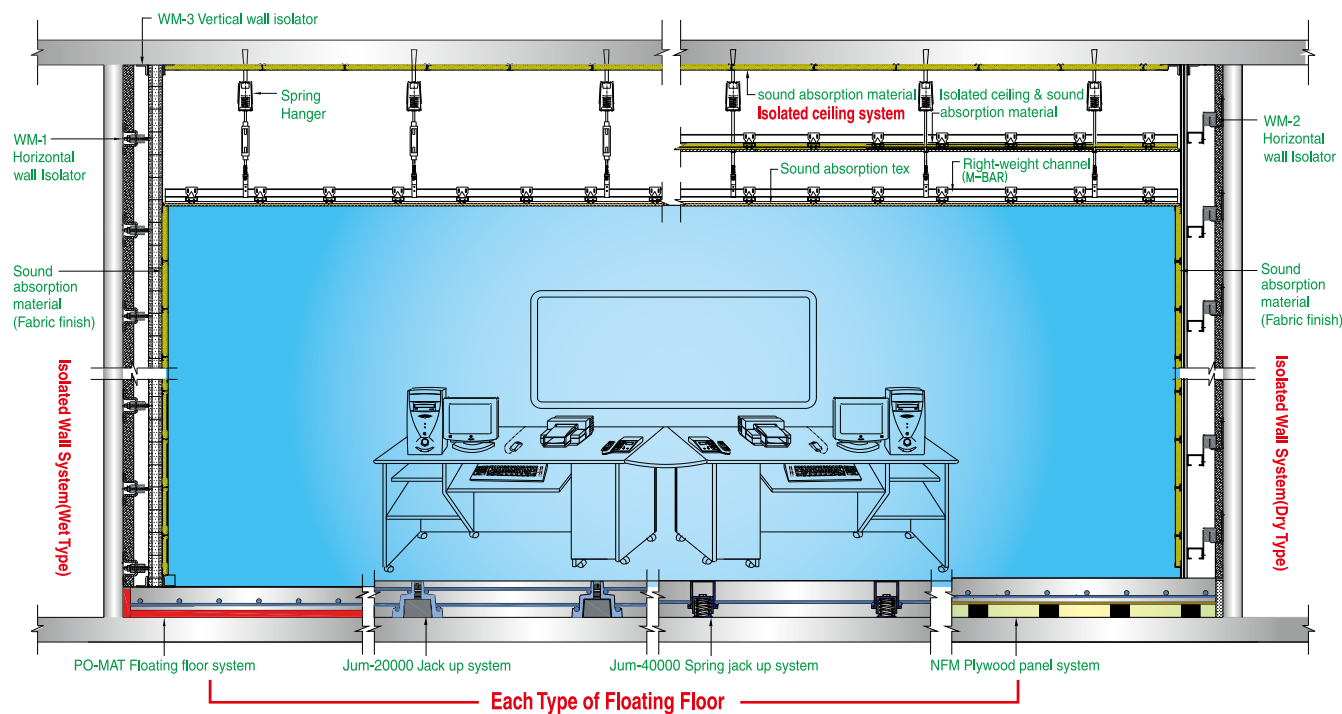


WM1 / WM2 Isolated Stud Neoprene Mount

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.

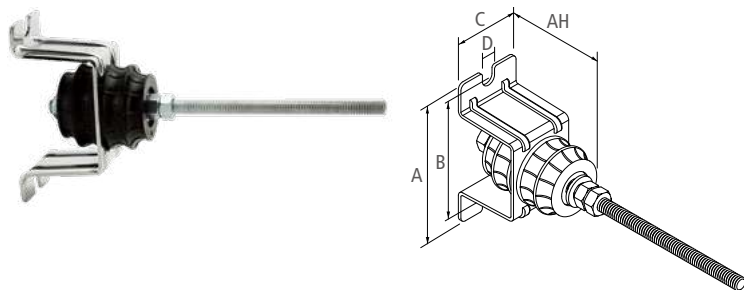
WATER PROOF PLYWOOD(12T)



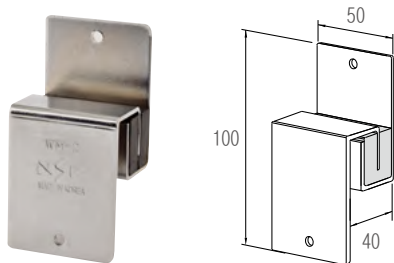
Double-wall

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

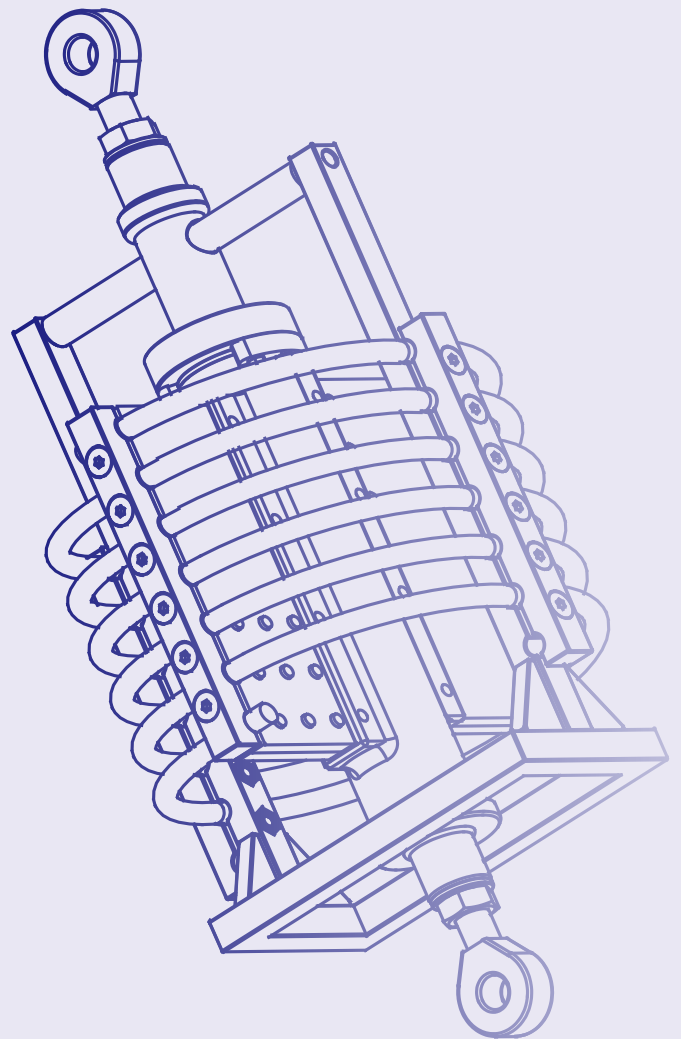


Dimension & Selection Guide

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

SHOCK CONTROL



SHOCK CONTROL

ISO 9001/ISO 14001/ISO 45001
MADE IN KOREA

Theory for prevention of shock

Technical information on NSV Water Hammer Arrestor

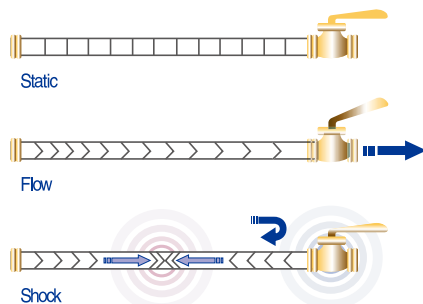
1. Introduction

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 incompressible 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.

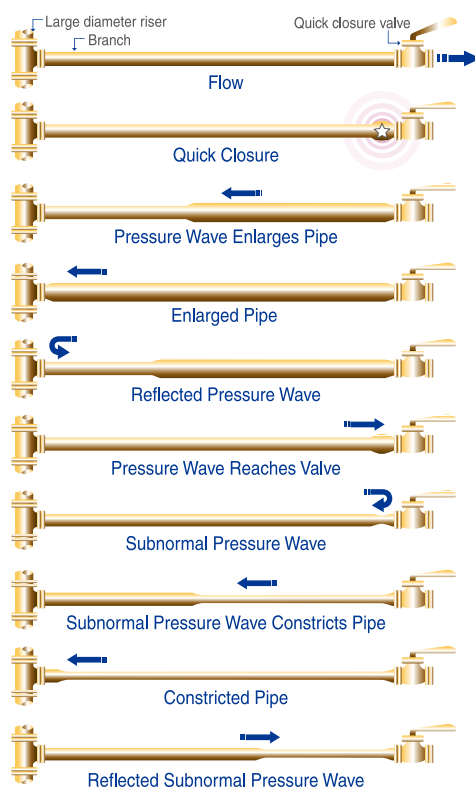
The impulse wave is generated when the velocity of the fluid changes suddenly due to quick closing of the valve in the plumbing system. Automatic valves of electric, pneumatic, and spring types are being used increasingly, and for the manual valves, the preference is for ones operated by one touch action, 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 → shrunk → 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 $\leq (2L/a)$ seconds. When the speed of opening or closing the valve is long enough, such as $\geq (2L/a)$ 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.

$$Pr = \rho a v \text{ (pa)}$$

$$= \rho a v / 98000 \text{ (kgf/cm}^2\text{)}$$

Where :

Pr : pressure rise

ρ : fluid density(kg/m³)

a : propagation speed of the impulse wave(m/s: for water 1200~1500)

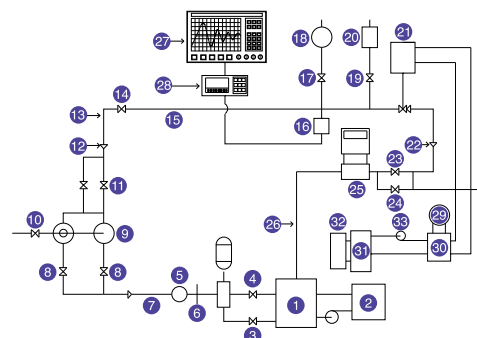
4. Effects of the impulse wave

- ▶ 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)

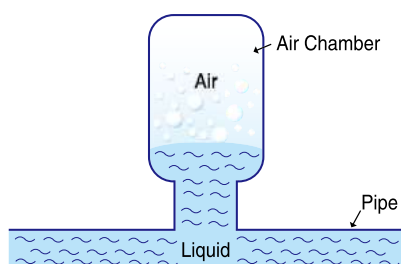
Number	Devices	Number	Devices	Number	Devices
1	Water tank	12	Return bend(250A)	23	Metering bend (50A)
2	Heater	13	Valve	24	Metering bend (15A)
3	Gate valve (50A)	14	Gate valve (50A)	25	Flow meter
4	Gate valve (40A)	15	Steel pipe	26	Steel pipe
5	Centrifugal pump	16	Pressure converter	27	Oscilloscope
6	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 Arrestor

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] Air Chamber for Arresting Water Hammer

[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.

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 arrestor 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 arrestor 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 arrestor 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 [$P_1 V_1 = P_2 V_2 = \text{Constant}$], where

- P_1, P_2 : the pressure of the water hammer arrestor at the start and end of the time period under discussion regarding water hammer
- V_1, V_2 : the volume of the room in which air or nitrogen is filled (m^3)

8. Calculation of the capacity of the water hammer arrestor

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

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

Where Q: flow before valve closing

P_1 : allowable impulse pressure (kg/cm^2),
1.5 times P_2 in most cases, but twice P_2 when $\geq 250A$

P_2 : pressure before valve closing (kg/cm^2)

t_c : roundtrip time of the impulse wave after valve closing ($0.3 \sim 0.5 \text{sec} = 2L/C$)

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				
	Midsized 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 $\leq 4.0\text{kgf/cm}^2$. 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 $\leq 4.5\text{kgf/cm}^2$	When the water pressure is $> 4.5\text{kgf/cm}^2$
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 $\leq 4.5\text{kgf/cm}^2$

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

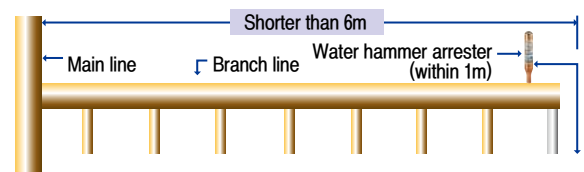
(B) When the water pressure is $> 4.5\text{kgf/cm}^2$ and $\leq 6.0\text{kgf/cm}^2$

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.

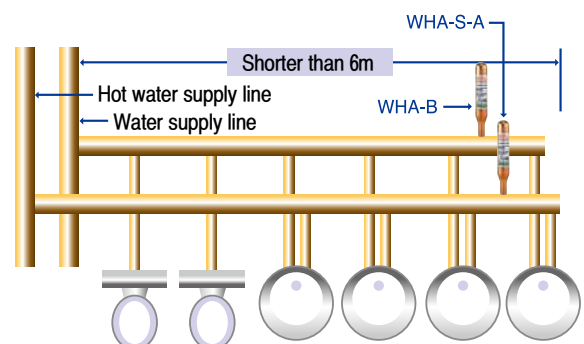
4. Installation

- ▶ 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 7]



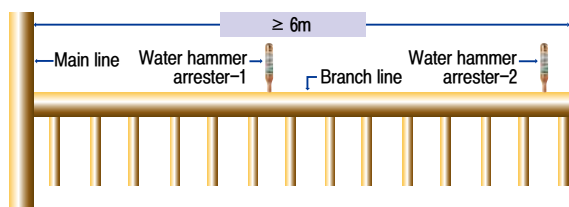
[Figure 7] Example of installation according to Principle 1

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

(Solution) FU and the result of model selection

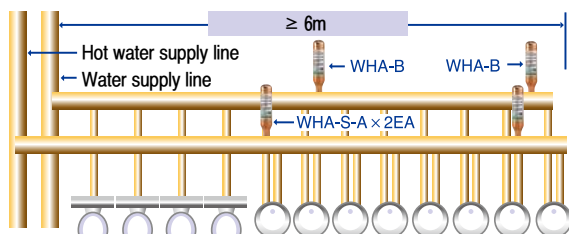
- ▶ Principle 2. When the length of the branch line is $\geq 6\text{m}$, the branch line under discussion is divided into two parts and for each part the water hammer arrester is installed in the same manner as in the case of Principle 1, respectively, so eventually two water hammer arresters will be 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]

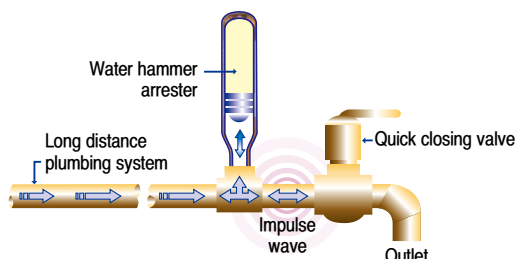


[Figure 9] Example of installation according to Principle 2

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

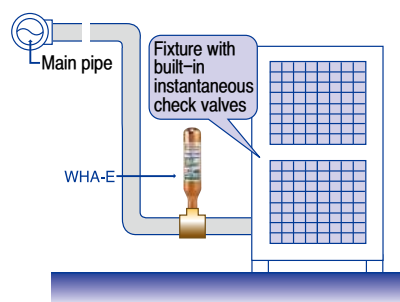
(Solution) FU and the result of model selection

- ▶ 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]

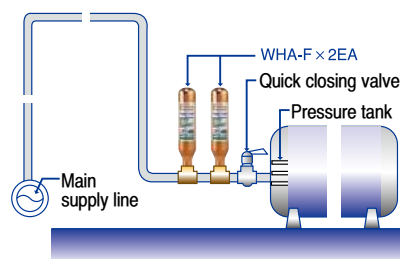


[Figure 11] The equipment with embedded quick closing valve

Items	For water supply
Conditions	Diameter (B) Length of plumbing (m) Water pressure (kgf/cm ²) Velocity (m/s)
Selection Refer to (Criteria (A) for selection of the water hammer arrester model)	1" 28 3.74 2.44
	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]



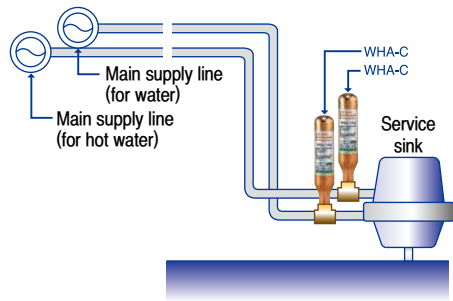
[Figure 12] The pressure tank with quick closing valve

Items	For water supply
Conditions	Diameter (B) Length of plumbing (m) Water pressure (kgf/cm ²) Velocity (m/s)
Selection Refer to (Criteria (A) for selection of the water hammer arrester model)	2" 30 4.08 3.05
	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]

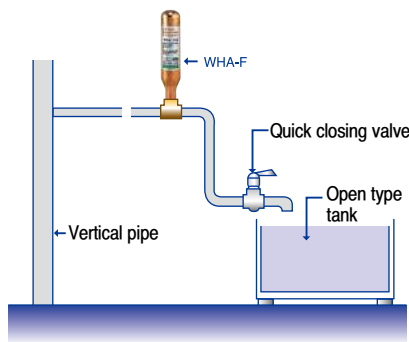


[Figure 13] Single fixture (service sink)

Items		For water supply
Conditions	Diameter (B)	3/4"
	Length of plumbing (m)	20
	Water pressure (kgf/cm ²)	3.4
	Velocity (m/s)	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]

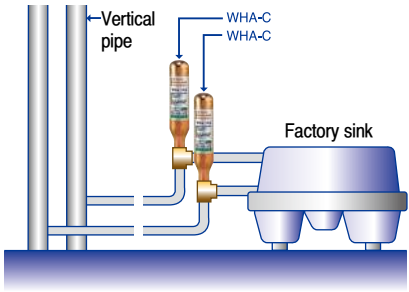


[Figure 14] Single fixture (open type tank)

Items		For water supply
Conditions	Diameter (B)	1 1/4"
	Length of plumbing (m)	30
	Water pressure (kgf/cm ²)	3.6
	Velocity (m/s)	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

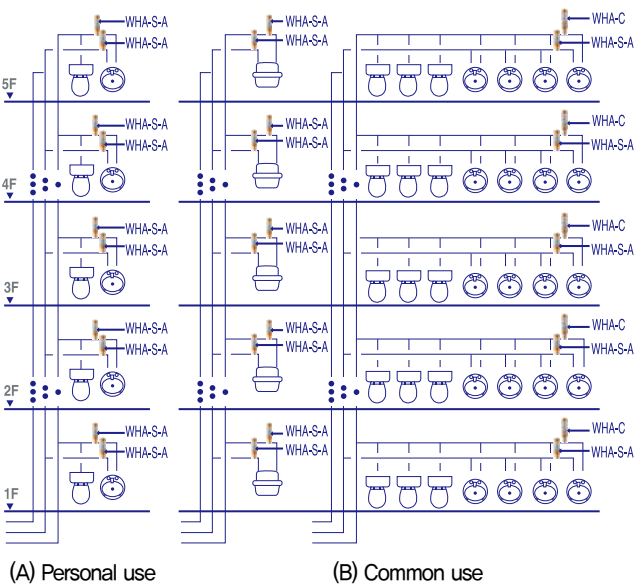
Example] Selecting the model of the water hammer arrester for a single fixture or device installed in the water-hot water supply system shown in [Figure 15]



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

Items		For water supply
Conditions	Diameter (B)	1"
	Length of plumbing (m)	15
	Water pressure (kgf/cm ²)	3.1
	Velocity (m/s)	2.44
Selection Refer to <Criteria (A) for selection of the water hammer arrester model>		WHA-C × 1EA (FU : 33~60)

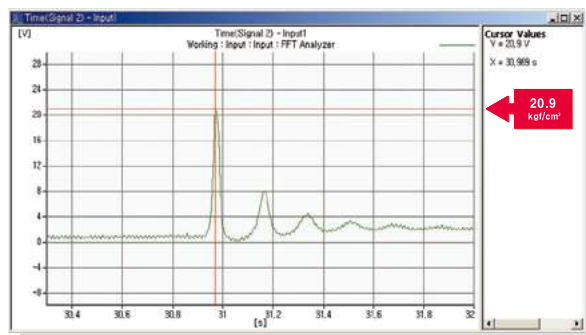
(Solution) FU and the result of model selection



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

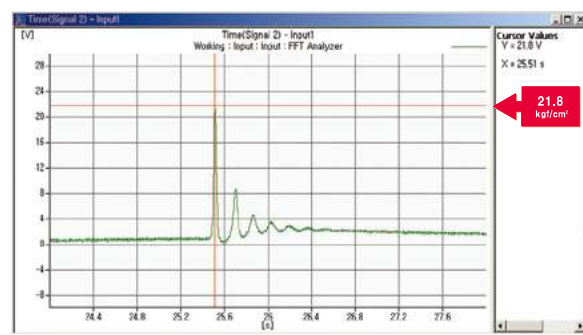
5. Measured data for maximum impact pressure

- ▶ Test results for the WHA-S-AA water hammer arrester used in copper sanitary plumbing system (operating pressure: 4.0kgf/cm²)

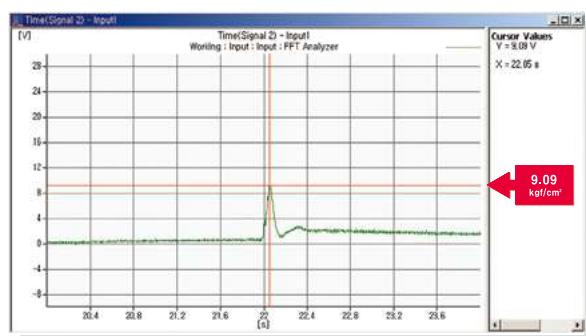


Before the installation of the water hammer arrester [20.9 kgf/cm²]

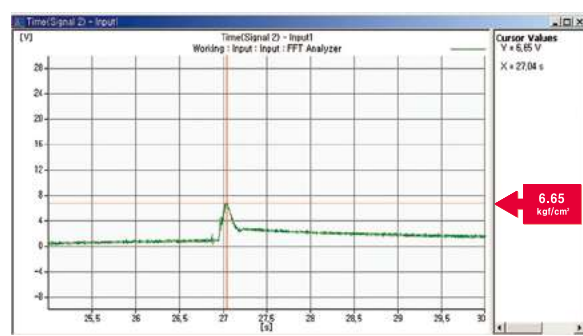
- ▶ Test results for the WHA-S-A water hammer arrester used in copper sanitary plumbing system



Before installation of the water hammer arrester [21.8 kgf/cm²]

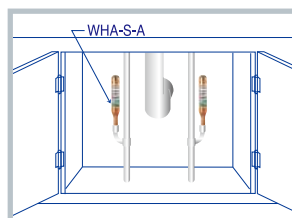
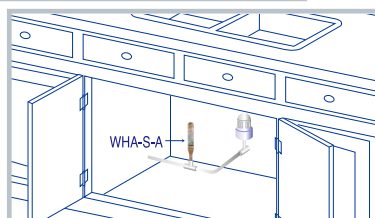
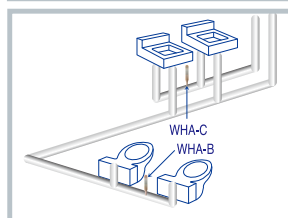
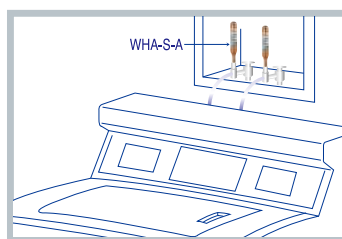
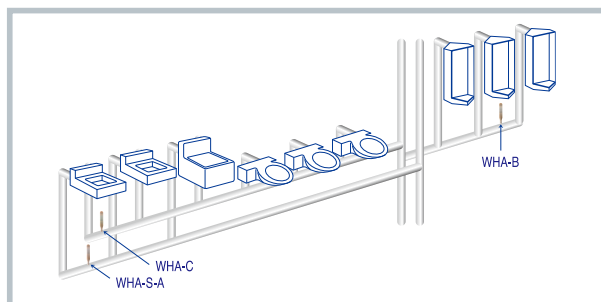
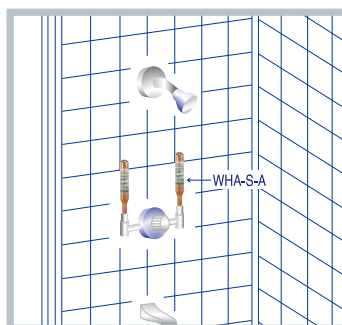
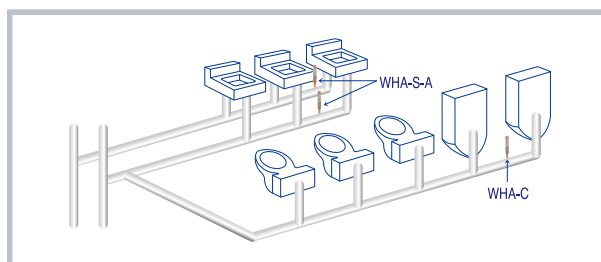


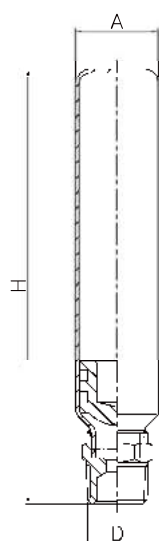
After the installation of the water hammer arrester [9.9 kgf/cm²]
When repeating 100,000 times



After the installation of the water hammer arrester [6.65 kgf/cm²]
When repeating 100,000 times

6. Figures illustrating the installation of the water hammer arrester





Temperature range 0.5~82°C

Working pressure 150psi (10.6bar)

■ 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. It can be installed from a vertical, horizontal, or any angle from an existing pipe or standard tee pipe, and can be easily installed by connecting an NPT/PT solid hexagonal brass adapter. Designed for home and commercial operation, the operating pressure is 150psi(10.6bar).

- Working pressure(PV) : 18.3kgf/cm²
- Maximum impulsive pressure(P) : 32Kgf/cm²
- Maximum working temperature : 120° C

■ Product Components

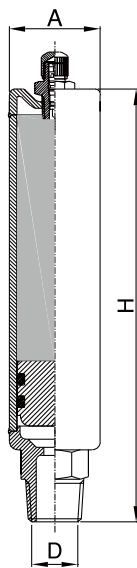
No.	Part Name	Material
1	Body	Copper
2	Piston	Polypropylene
3	O-ring	EPDM
4	Adapter	Brass

■ Dimension & Selection Guide

Type	Dimension (mm)			Weight(kgf)	CROSS FIXTURE UNITS
	A	ØD	H		
WHA-S-AA	22.22	15A	129.0	0.12	~3
WHA-S-A	28.58	15A	151.0	0.17	4~11
WHA-S-B	28.58	20A	184.5	0.24	12~32
WHA-S-C	41.28	25A	223.5	0.46	33~60
WHA-S-D	53.98	25A	252.5	0.76	61~113
WHA-S-E	53.98	25A	322.5	0.89	114~154
WHA-S-F	66.68	25A	283.5	1.12	155~330

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

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/cm²
- Maximum impulsive pressure(P) : 32Kgf/cm²
- Maximum working temperature : 120° C

■ Specification

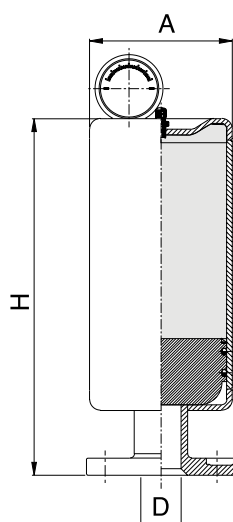
No.	Name of Components	Material	Remark
1	Body	STS	(Type 304SS), Molding
2	Piston	P.P	Pressure-lubricated
3	O-ring	EPDM	Dow-Corning 111silicon compound, FDA approved (Used the FDA-approved lubricant)
4	Adapter	STS	CM Type
5	Air Chamber	-	4.0kgf/cm ² Air Charge
6	Air Valve	Brass	CR Plated

■ Dimension & Selection Guide

Type	Dimension(mm)			Air Volume (cc)	Fixture Capacity Unit
	A	ØD	H		
WHA-3015A	34	15A	167	70	1~11
WHA-3020B	38	20A	188	110	12~32
WHA-3025C	38	25A	231	150	33~60
WHA-3025D	60	25A	225	320	61~113
WHA-3025E	60	25A	265	390	114~154
WHA-3025F	60	25A	290	470	155~330

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

WHA-4000 Water Hammer Arrestor (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/cm² 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 cm²
- Maximum impulsive pressure : 32Kgf/cm²
- Maximum working temperature : 90° C

■ Specification

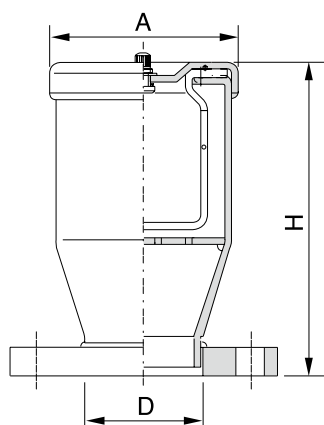
No.	Name of Components	Material	Remark
1	Body	STS	(Type 304SS), Molding
2	Piston	P.P, ABS	Pressure-lubricated Dow-Coming 111 Silicon Compound, FDA approved (Used the FDA-approved lubricant)
3	O-ring	EPDM	
4	Flange	STS	-
5	Air Chamber	-	7.5kgf/cm ²
6	Air Valve	Brass	Cr Plated
7	Pressure Gauge	-	20, 30,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

■ Dimension & Selection Guide

Type	Dimension(mm)			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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

WHA-6000 Water Hammer Arrestor (Flange Type) **KFI**



■ 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 cm²
- Maximum impulsive pressure(P) : 32kgf/cm²
- Maximum working temperature : 90°C

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

■ 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 adaptor 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

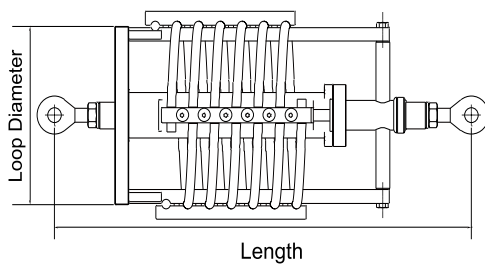
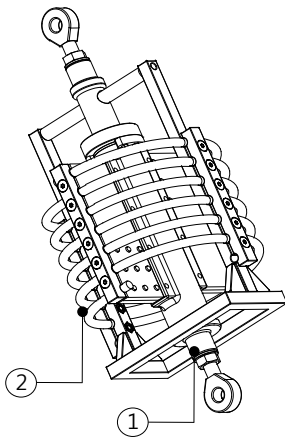
1. Make sure that the surface on which the flange of the water hammer arrestor is assembled is free of foreign materials like rust, oil, dust, paint, etc.
2. Prepare gaskets, bolts, and nuts meeting the standards and specifications of the flange.
3. Check for the balance of the flange, centering, alignment 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

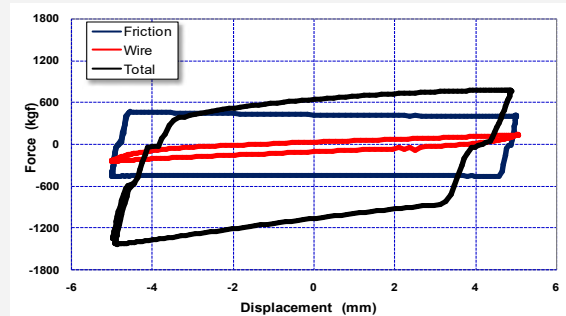
1. Be careful not to exceed the maximum torque when tightening the flange with bolts.
(Excessive torque may damage the surface of the flange and affect the seal.)
2. Be careful not to disassemble the water hammer arrestor arbitrarily or to apply external shock, because compressed air is filled inside 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

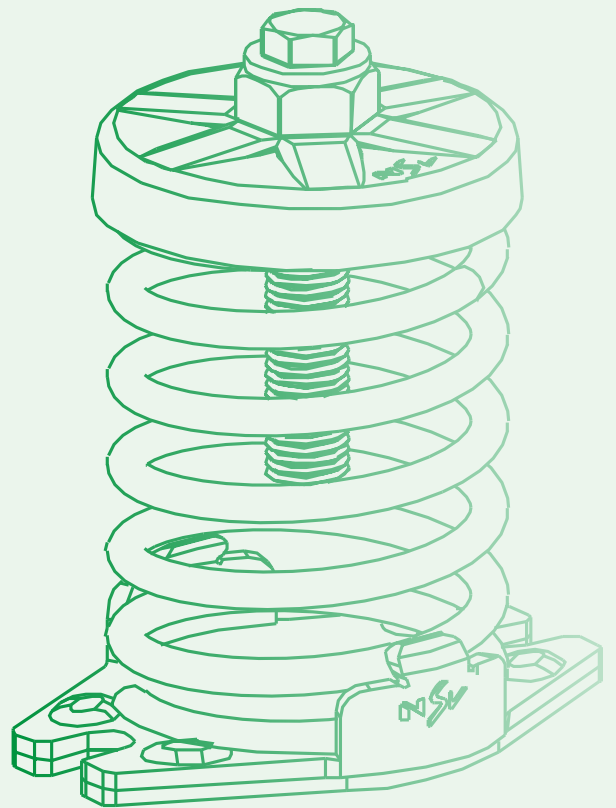
VD10 aims to isolate vibration. A fluid flow inside the pipe produced a vibration frequency, which comes close to the natural frequency of the pipe itself and then resonance occurs. Absorbing the energy from the resonance, this product stabilizes dynamic behavior of the piping system and prevents the 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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VIBRATION CONTROL



VIBRATION CONTROL

ISO 9001/ISO 14001/ISO 45001
MADE IN KOREA

Information for prevention of vibration

Overview of vibration

1. The definition of vibration

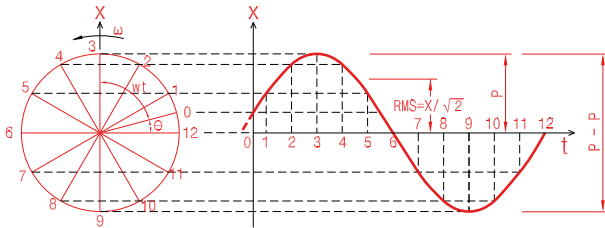
Vibration is the phenomenon that the position of a certain point varies in one direction and then in the opposite direction repeatedly, from the reference position. It is defined in the Noise and Vibration Control Act as "oscillation generated due to the use of machines, devices, systems, or other materials."

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.

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

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

3. Acceleration (a)

Variation of the velocity during a given time period.

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

(Units: m/s², cm/s², gal)

4. Vibration Acceleration Level (VAL)

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

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

where

a: Acceleration of the vibration in RMS (m/s²)

a_r: Reference acceleration (10⁻⁵m/s²)

5. Vibration Level

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

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

W_n: Compensation factor for the human sensitivity to frequency.

6. Unit conversion

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

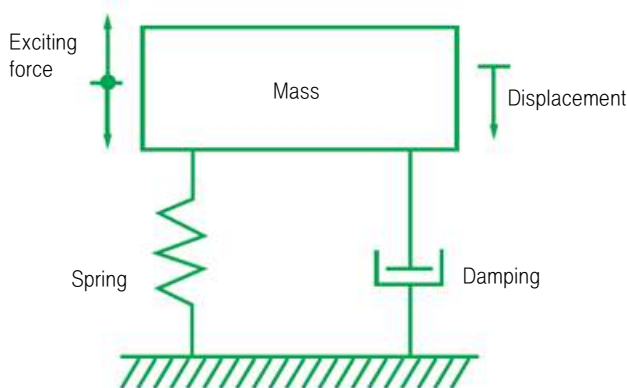
In case of vibration, the number of heart beats increases. The Oxygen consumption increases at 1 ~ 3Hz.

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

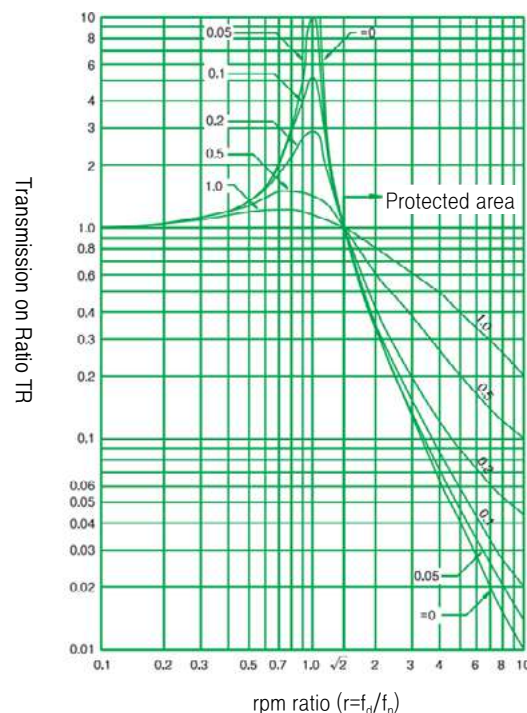
3. Transmission Ratio

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 $r = 1$, $TR = \infty$ (Resonance)
If $r < \sqrt{2}$, $TR > 1$, (Transmitted force > External force)
If $r = \sqrt{2}$, $TR = 1$, (Transmitted force = External force)
If $r > \sqrt{2}$, $TR < 1$, (Transmitted force < External force) – Protected area
- ② Change in Transmission on Ratio due to the change in Damping Ratio (ζ)
As far as $r < \sqrt{2}$, the bigger the Damping Ratio the smaller the Transmission on Ratio, thus a bigger Damping Ratio is desirable.
As far as $r > \sqrt{2}$, 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 $r < \sqrt{2}$, 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 $\zeta = 0.2$ is required.

4. Protection effect

- ① Vibration blocking rate (I): The degree the vibration is blocked
 $I = (1 - TR) \times 100 [\%]$
- ② ΔV : Expresses the vibration protecting effect in dB.
 $\Delta V = 20 \log(1/TR) \text{ dB}$

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	- Blocks vibration using the elasticity of the metal spring - Various types including coil spring, leaf spring, circular spring are used. For air conditioners, coil springs are used most. 	〈Advantages〉 - Spring constants are selectable. - Spring with small constant is available. 〈Disadvantages〉 - It has to pass through the resonance frequency during start/stop (high vibration) - Surging occurs at high frequency due to natural frequency (structural sound transmission).	- Not able to block sound. - 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	- Plates with special uneven surface for making elasticity. - 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.	- In case more than 2 ea. are stacked, steel plates with thickness of 2 ~ 3mm should be inserted in between. - 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	- Made of natural or synthetic rubber having proper hardness. Easy to form. Easy to handle with metal plate. Uses the elasticity of rubber. - 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. - 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. - 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. 	〈Advantages〉 - Flexible in forming, thus, spring constants can be properly selected for X, Y, and Z directions, respectively. - Resonance is reduced due to the high viscosity of rubber. - No surging, thus sound blocking capability is excellent. - Many kinds of standardized products are available. 〈Disadvantages〉 - The spring constants vary depending on the temperature, thus care should be taken when using outside the temperature range of 10 ~ 70°C. - Spring constant varies depending on the degree of deformation of rubber. - Small spring constants can't be achieved. - Oil-proof capability, temperature characteristics, aging characteristics, etc., are dependent on the kinds of rubber. - Spring constant can't be decided accurately because the static spring and dynamic spring constants are different due to viscoelastic characteristics.	- Chemical characteristic of vibration reducing rubber should be taken care of. - When designing vibration reducing rubber, dynamic spring constant should be used. - Be sure to use the vibration reducing rubber within the allowed weight range because it has creeping characteristics. - 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 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.

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Table 47 Selection Guide for Vibration Isolation (see ASHRAE Handbook Online for User-Friendly Selection Graphics)

Equipment Location (Notes for Table 47, Item 1)																
Equipment Type	Shaft Power kW	Other	RPM	Floor Span												
				Slab on Grade			Up to 6 m		6 to 9 m		9 to 12 m					
				Base Type	Isolator Type	Min. Defl., mm	Base Type	Isolator Type	Base Type	Isolator Type	Min. Defl., mm	Base Type	Isolator Type	Min. Defl., mm	Reference Notes	
Refrigeration Machines and Chillers																
Water-cooled reciprocating	All		All	A	2	6.4	A	4	19	A	4	38	A	4	64	2,3,12
Water-cooled centrifugal, scroll	All		All	A	1	6.4	A	4	19	A	4	38	A	4	38	2,3,4,8,12
Water-cooled screw	All		All	A	4	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
	≥7.5		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
	≥5.6		All	C	3	19	C	3	19	C	3	38	C	3	38	16
Large in-line	3.7 to 19		All	A	3	19	A	3	38	A	3	38	A	3	38	
	≥19		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
	30 to 93		All	C	3	19	C	3	19	C	3	38	C	3	64	10,16
	≥93		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 In-line 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
	7.5 to 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	
	>11,	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	
Packaged Rooftop Equipment																
	All		All	N/A			D	3	19			See Reference Note 17			5,6,8,17	
Ducted Rotating Equipment																
Small fans, fan-powered boxes	≤300 L/s		All	A	3	12.7	A	3	12.7	A	3	12.7	A	3	12.7	7
	≥301 L/s		All	A	3	19	A	3	19	A	3	19	A	3	19	7
Engine-Driven Generators																
	All		All	A	3	19	C	3	38	C	3	64	C	3	89	2,3,4
Piping and Ducts (See sections on Isolating Vibration and Noise in Piping Systems and Isolating Duct Vibration for isolator selection.)																

Piping and Ducts (See sections on Isolating Vibration and Noise in Piping Systems and Isolating Duct Vibration for isolator selection.)

► BASE TYPE

A. No Base

isolators attached directly to equipment

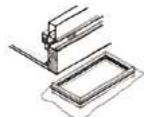
B. Structural steel rails or base



C. Concrete inertia base

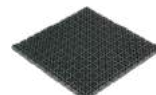


D. Curb-mounted base



► ISOLATOR TYPE

RUBBER PAD (TYPE 1)



RUBBER MOUNT (TYPE 2)



SPRING ISOLATOR (TYPE 3)

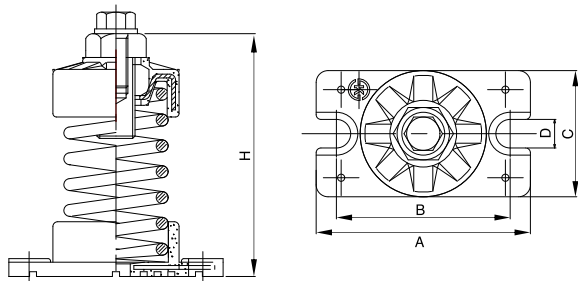
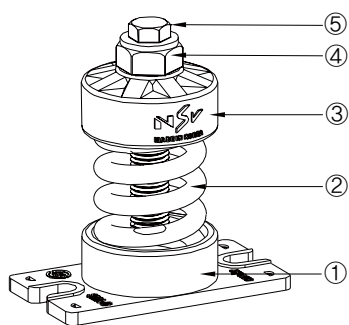


RESTRAINED SPRING ISOLATOR (TYPE 4)



THRUST RESTRAINT (TYPE 5)





■ 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 plate 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	SAE9254	KS B 2402
		SW-C	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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

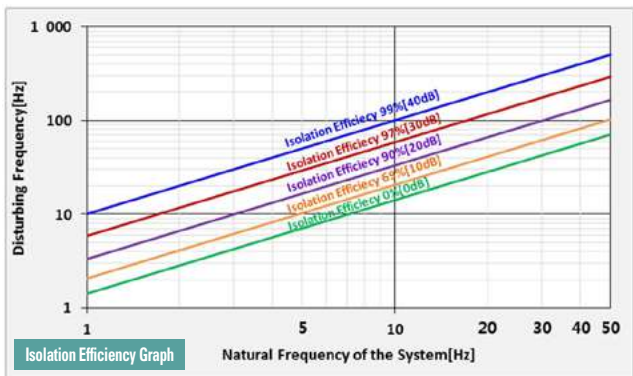
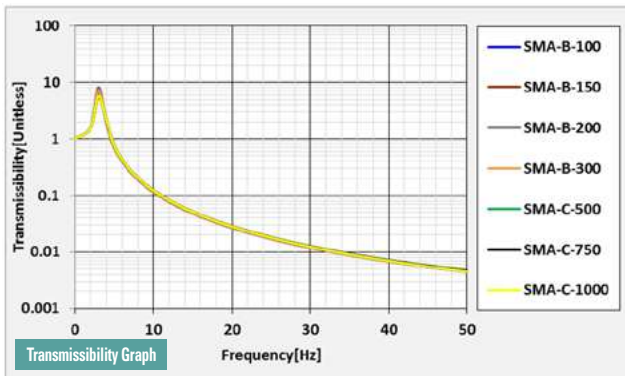
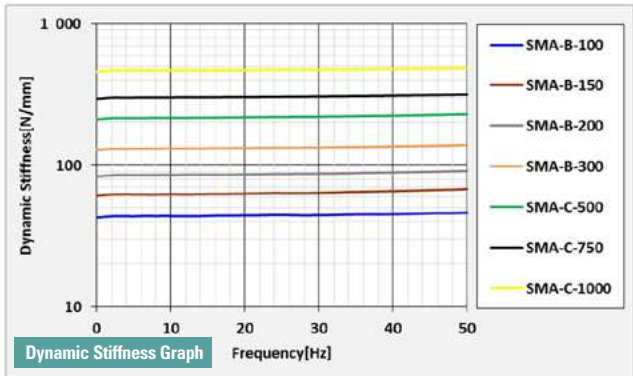
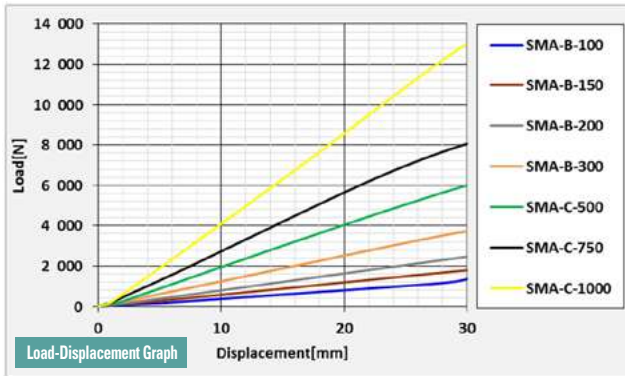
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	H	Level Bolt	Cap Screw
SMA-A-50	50	2.0	0.35	Red	90	74	53	12	102	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	140	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	157	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							

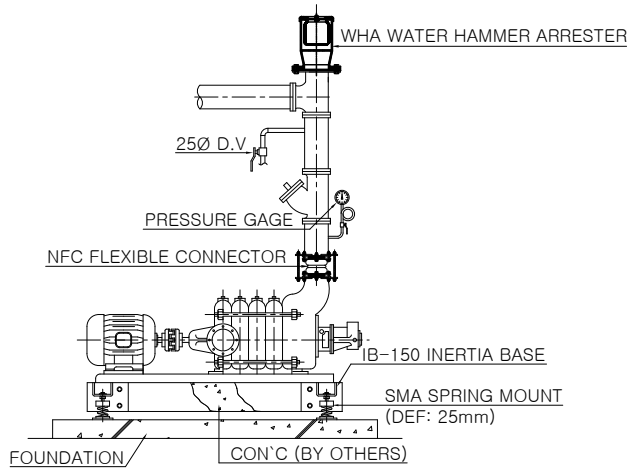
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

SMA Spring Mount (Deflection : 25mm)

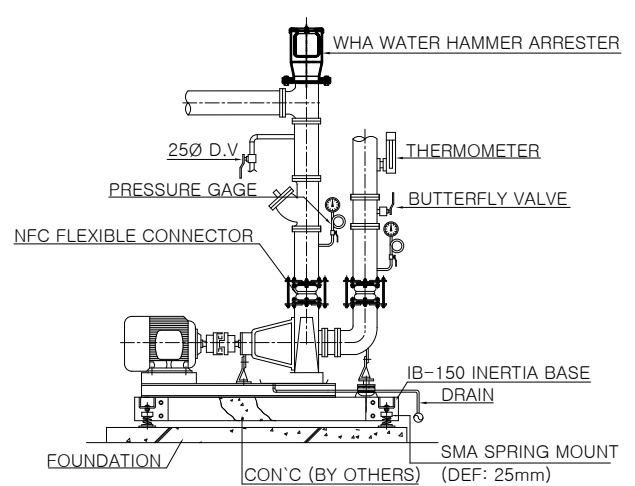
SMA Test Data



Installation Features



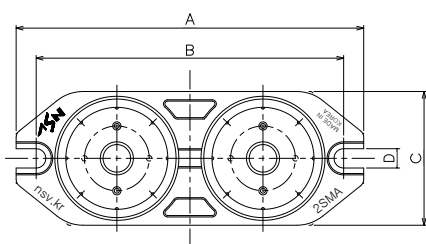
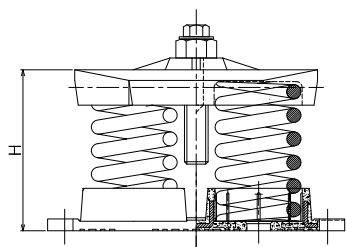
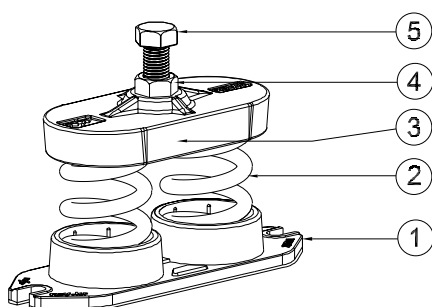
MULTI STAGE PUMP DETAIL



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	SAE9254	KS B 2402
		SW-C	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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

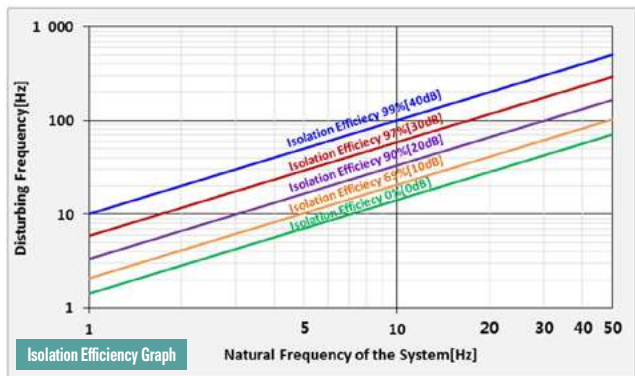
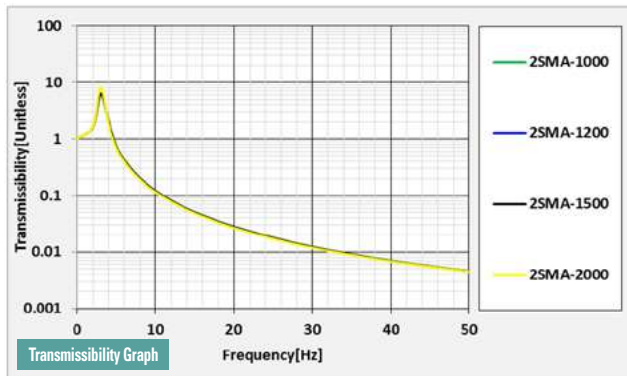
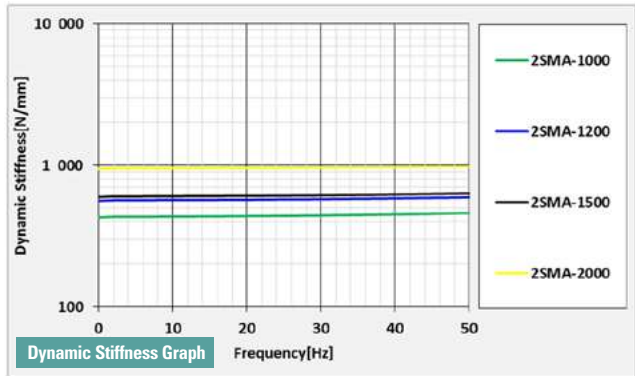
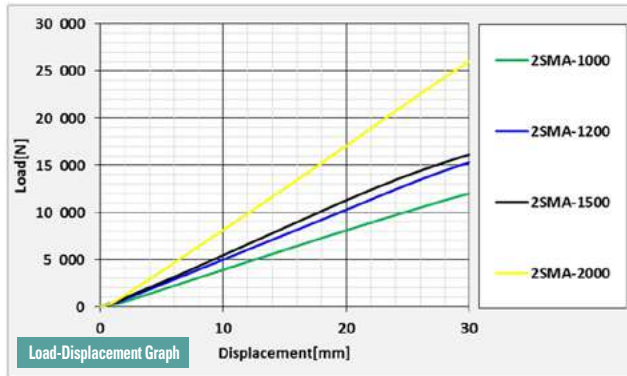
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	H	Level Bolt	Cap Screw
2SMA-1000	1000	40	7.36	Green	252	223	97	14	165	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							

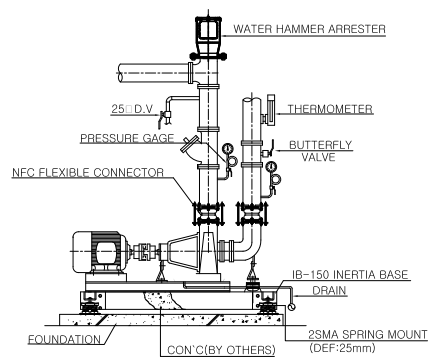
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

2SMA Spring Mount (Deflection : 25mm)

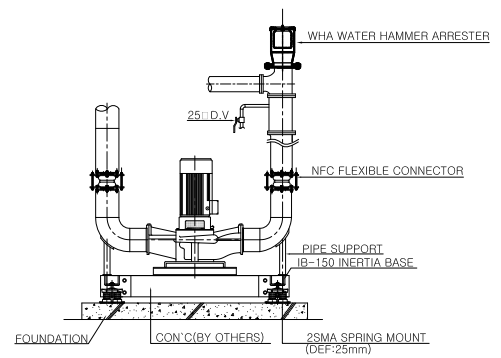
2SMA Test Data



Installation Features



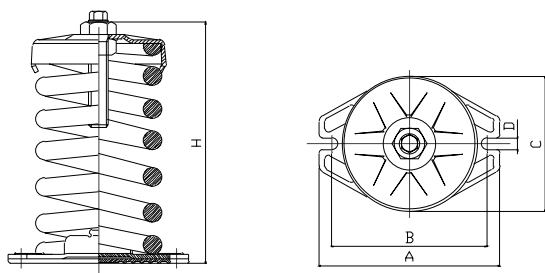
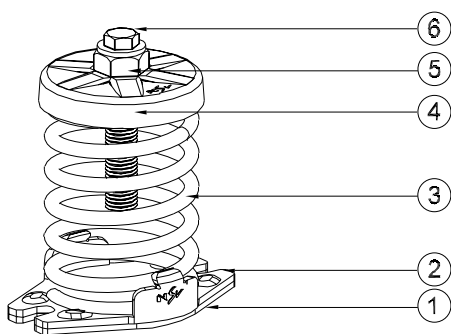
SINGLE VOLUTE PUMP DETAIL



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	SAE9254	KS B 2402
		SW-C	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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

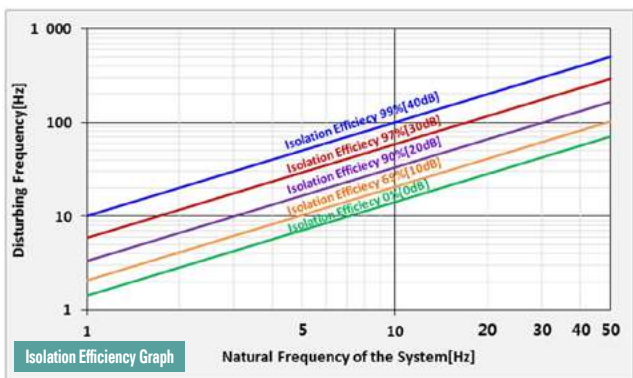
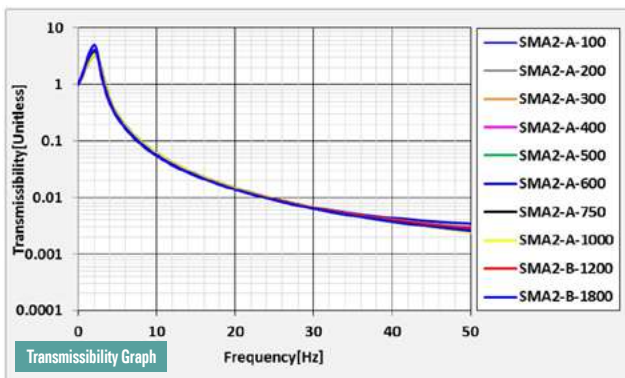
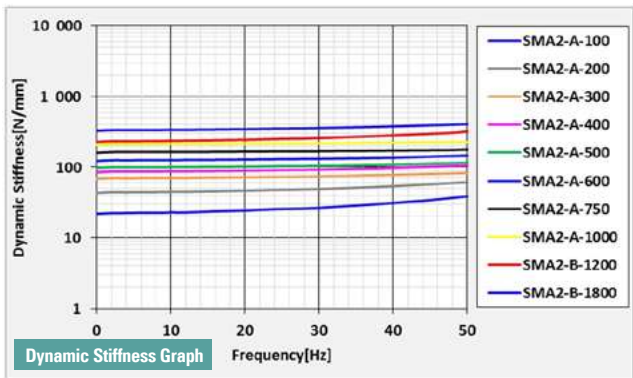
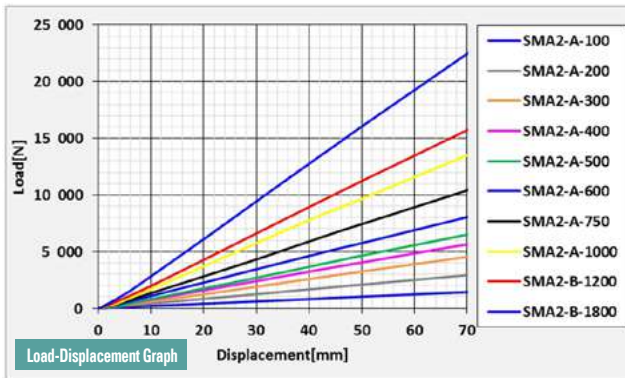
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	H	Level Bolt	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	190	170	138	14	256	M20 x 90	M12 x 25
SMA2-A-1000	1000	20	3.38	Yellow							
SMA2-B-1200	1200	24	7.60	Red							
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							

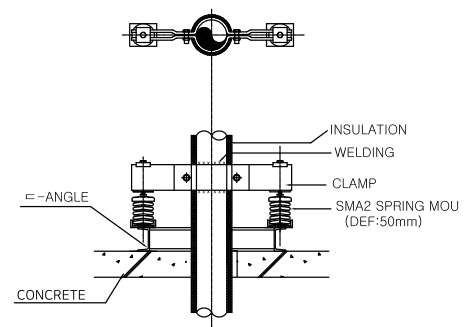
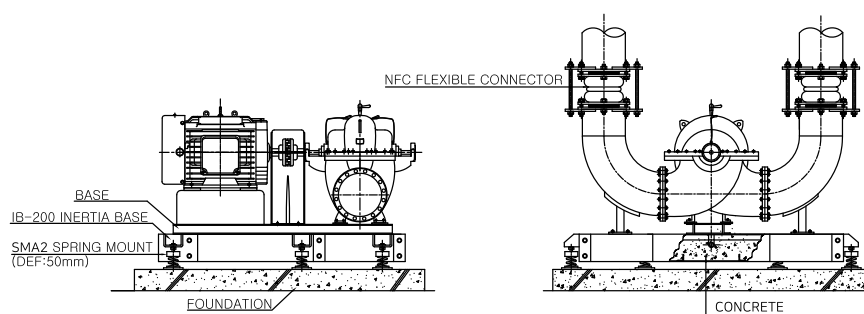
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

SMA2 Spring Mount (Deflection : 50mm)

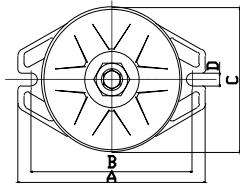
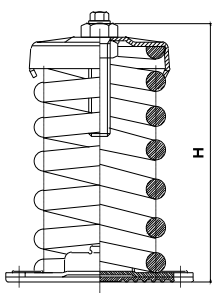
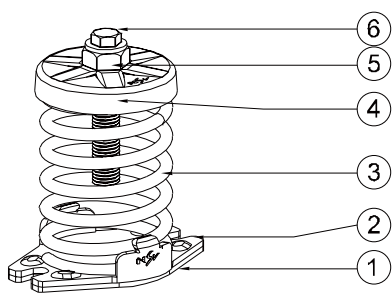
SMA2 Test Data



Installation Features



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	SAE9254 SW-C	KS B 2402 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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

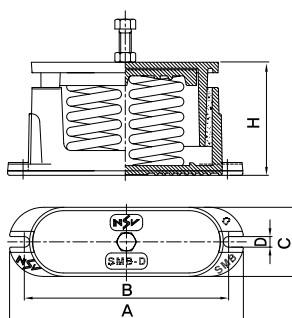
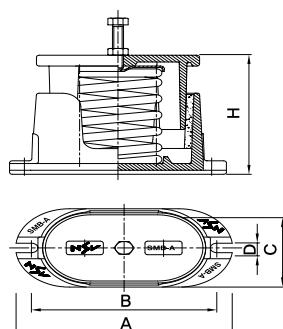
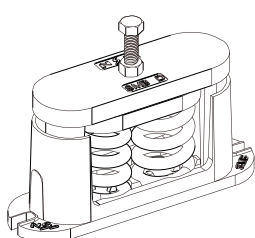
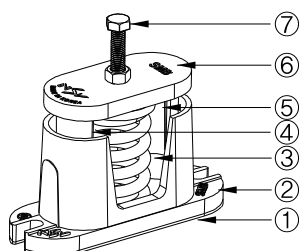
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)						
					A	B	C	D	H	Level Bolt	Cap Screw
SMA3-A-200	200	2.7	8.1	White	190	170	138	14	256	M20 x 110	M12 x 25
SMA3-A-300	300	4	8.1	Orange							
SMA3-A-400	400	5.3	8.2	Pink							
SMA3-A-500	500	6.7	9.5	Green							
SMA3-A-600	600	8	9.7	Blue							
SMA3-A-750	750	10	9.7	Black							
SMA3-A-1000	1000	13.3	9.8	Yellow	214	184	160	14	289	M24 X 110	M12 x 40
SMA3-B-1200	1200	16	14.8	Red							
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	White	214	184	160	14	319	M24 x 140	M12 x 40
SMA3-C-3500	3500	46.6	25.2	Black							
SMA3-C-4000	4000	53.3	26.8	Orange							

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

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	SAE9254	KS B 2402
		SW-C	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

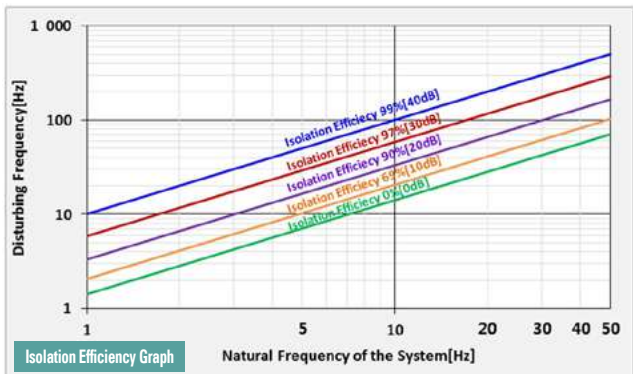
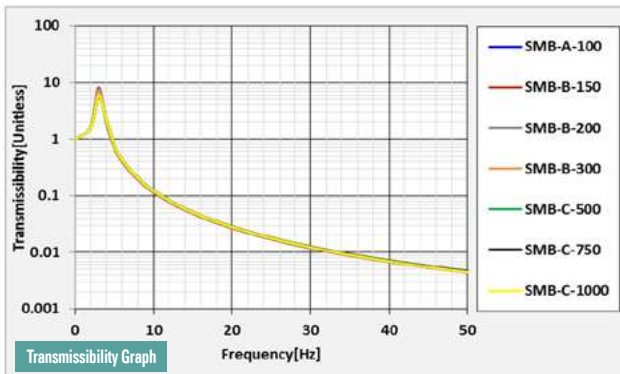
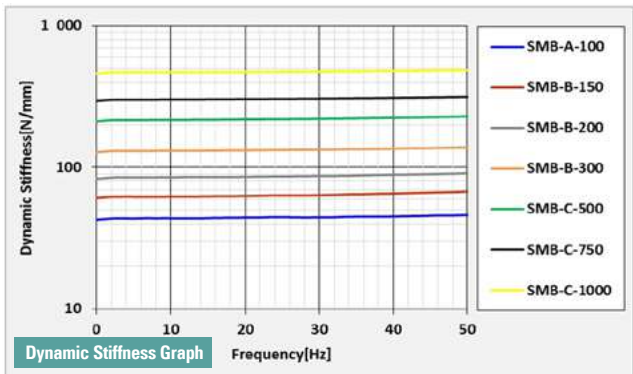
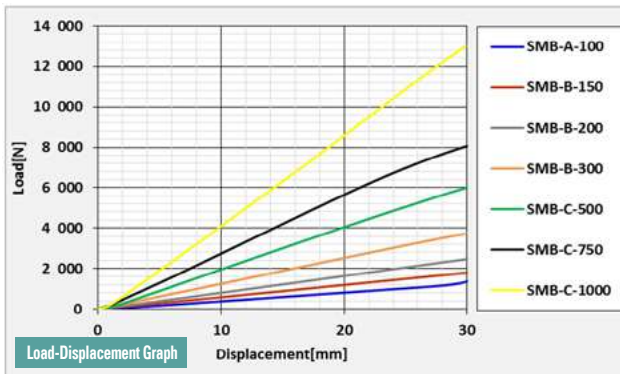
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)					
					A	B	C	D	H	Level Bolt
SMB-A-10	10	0.4	1.16	Pink	143	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	136	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	230	196	92	13	151	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	307	270	94	13	171	M16 x 80
SMB-D-1500	1500	60	13.54	Black						
SMB-D-2000	2000	80	13.88	Yellow						

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

SMB Test Data



Explanation(Commonness)

1. Vibration Transmissibility(T_r)

Vibration Transmissibility is the amplitude ratio of Output to Input.

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

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 Efficiency(E)

Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$

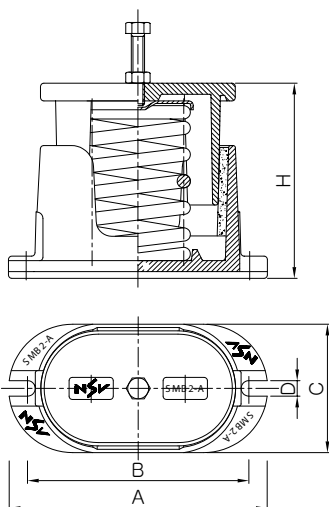
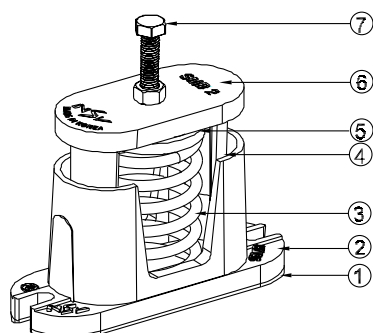
ex) Disturbing Frequency of the equipment=100 Hz,

Natural Frequency of the isolator=10Hz

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



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	SAE9254	KS B 2402
		SW-C	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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

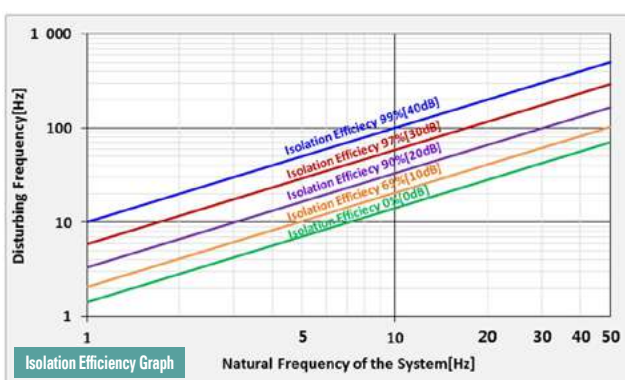
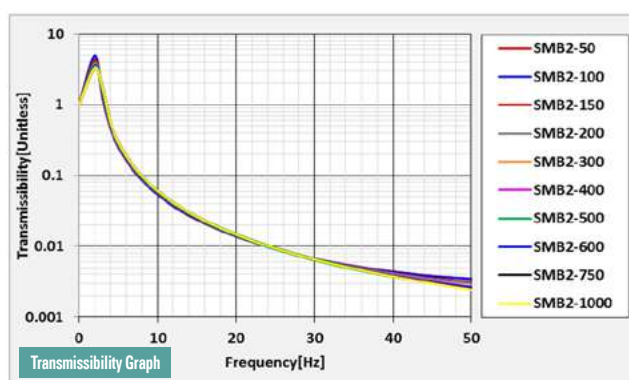
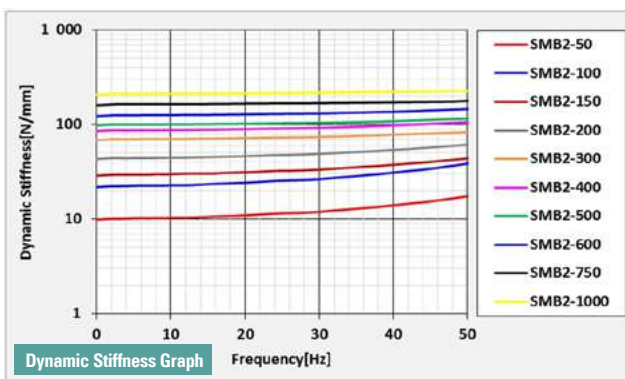
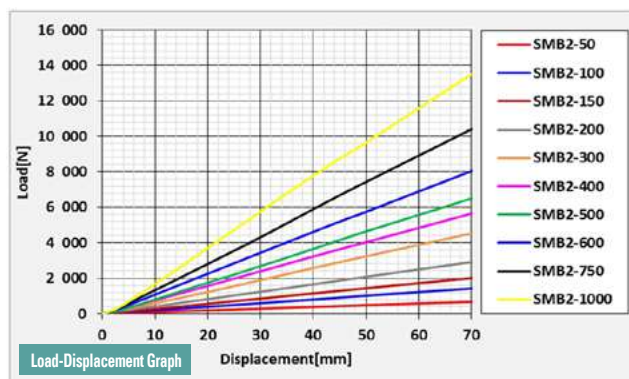
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)					
					A	B	C	D	H	Level Bolt
SMB2-10	10	0.2	8.30	Pink	234	203	116	14	172	M12 x 80
SMB2-25	25	0.5	8.30	Yellow						
SMB2-50	50	1	8.30	Red						
SMB2-75	75	1.5	8.30	Black						
SMB2-100	100	2	8.30	Blue						
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						

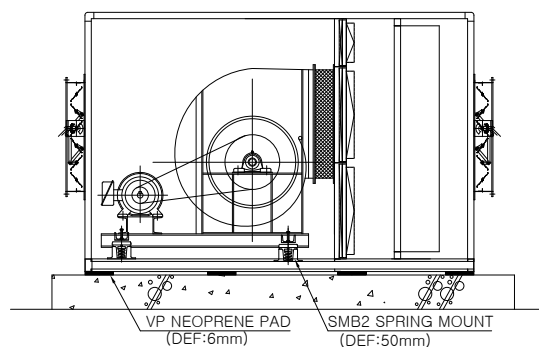
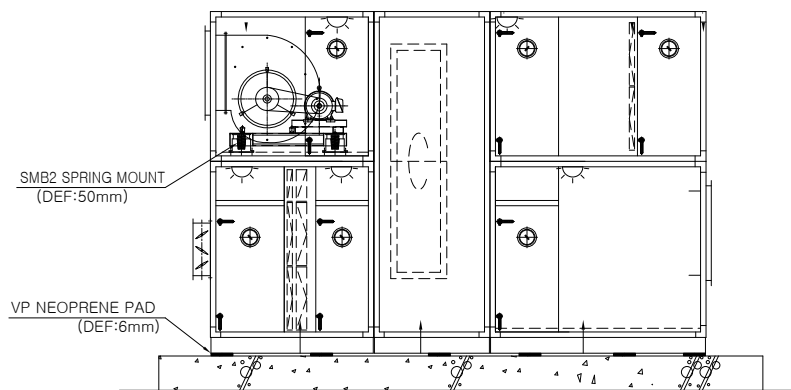
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

SMB2 Spring Mount (Deflection : 50mm)

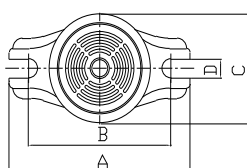
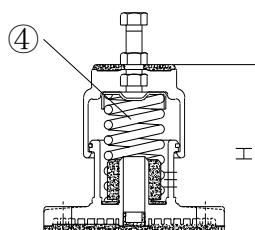
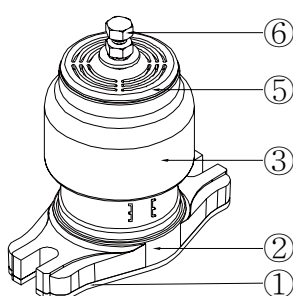
SMB2 Test Data



Installation Features



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-borne 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	SAE9254	KS B 2402
		SW-C	KS B 2403
5	Upper Non Skid Pad	CR	KS M 6617
6	Level Bolt	SS400	KS B 1012

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

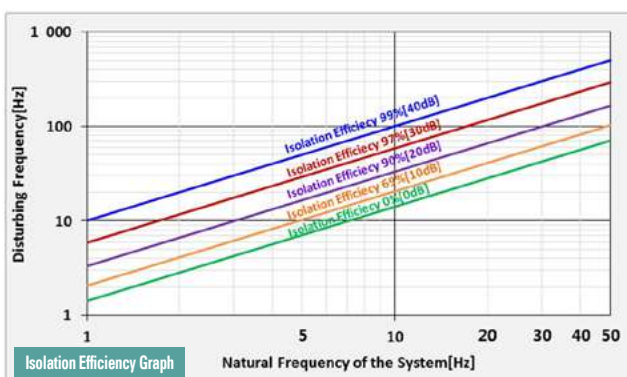
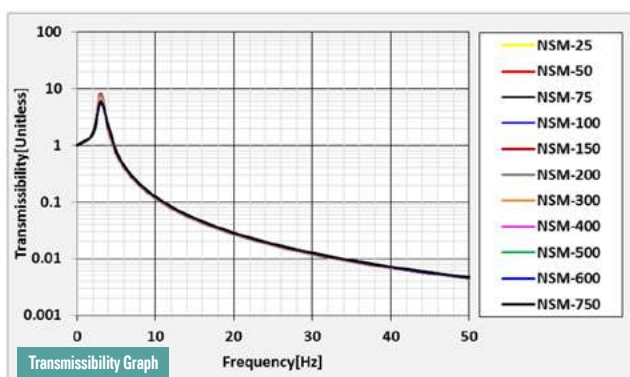
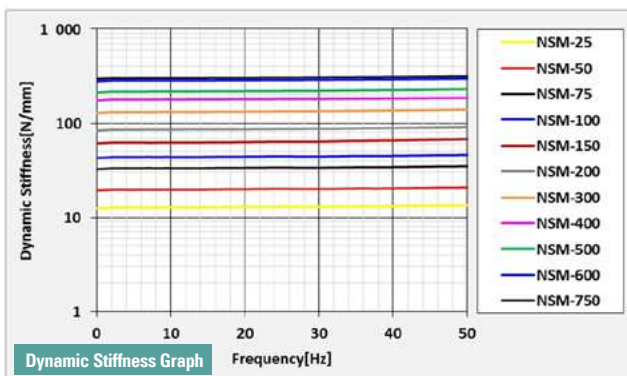
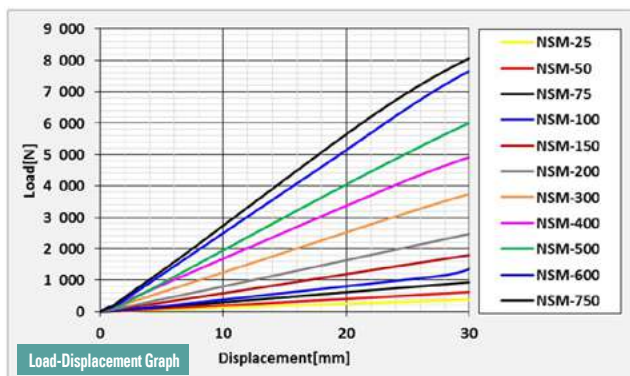
Type	Capacity(kgf)	Spring Constant(kgf/mm)	Weight(kg)	Deflection(mm)	Dimension(mm)					
					A	B	C	D	H	Level Bolt
NSM-A-25	25	1	0.44	25	132	104	74	13	115	M10 x 60
NSM-A-50	50	2	0.46							
NSM-A-75	75	3	0.50							
NSM-A-100	100	4	0.54							
NSM-B-150	150	6	1.16		170	134	99	14	143	M12 x 65
NSM-B-200	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	165	M16 x 80
NSM-C-600	600	24	2.14							
NSM-C-750	750	30	2.22							

Type	Capacity(kgf)	Spring Constant(kgf/mm)	Weight(kg)	Deflection(mm)	Dimension(mm)					
					A	B	C	D	H	Level Bolt
NSM2-50	50	1	2.44	50	220	183	137	14	178	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							

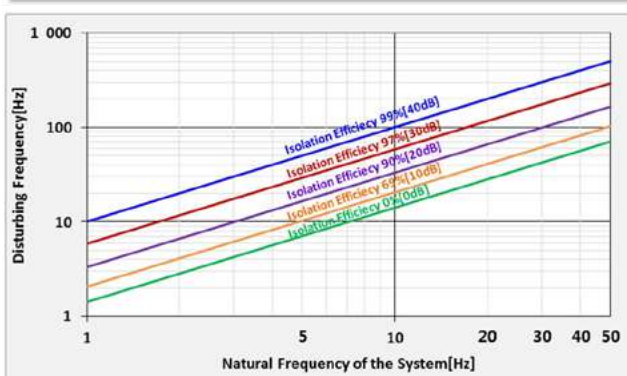
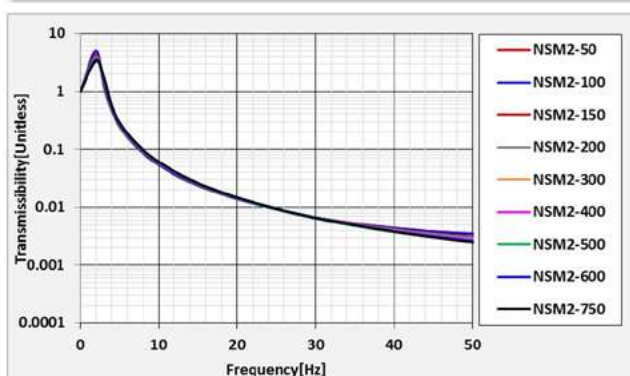
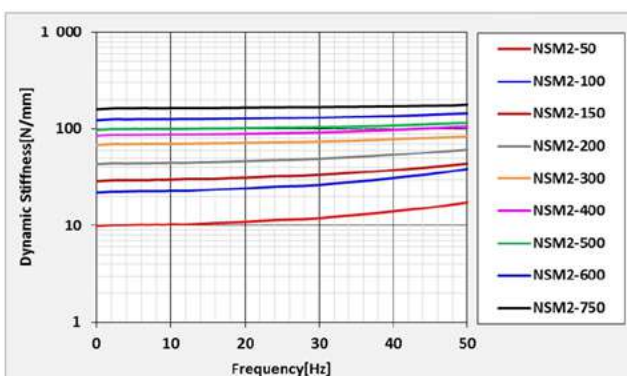
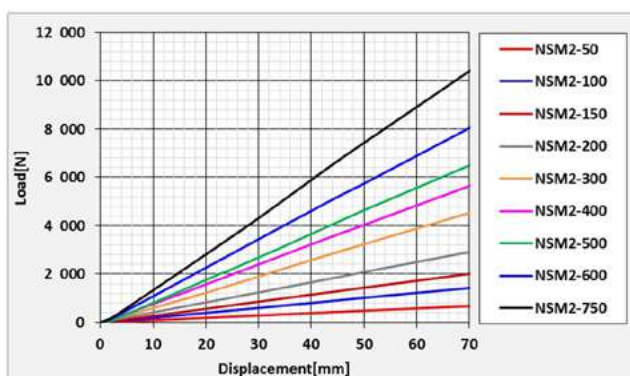
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

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

■ NSM Test Data



■ NSM2 Test Data



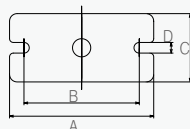
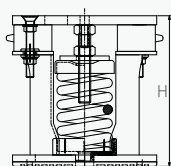
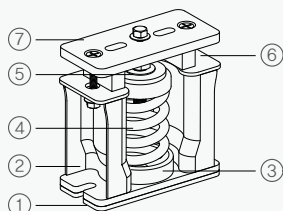
FSL Restrained Spring Mount (Deflection : 25mm)

■ Features

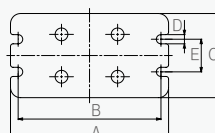
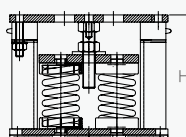
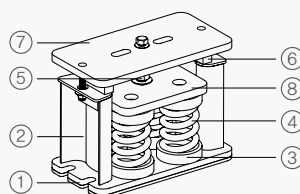
It is a free standing mount with a vertical movement limiting device. It is designed to restrict vertical deflection when there is any change in the weight of equipment and/or structure (for example, pouring water out of a cooling tower, refrigerator) to prevent damage and distortion of equipment and 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.



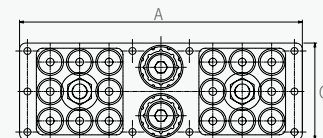
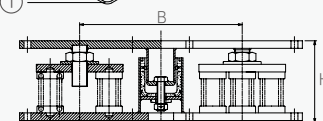
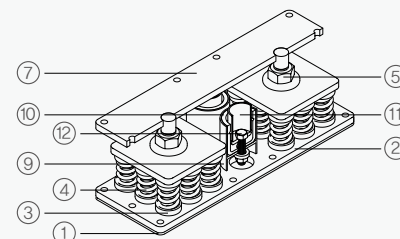
FSL-1



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	SAE9254 SW-C	KS B 2402 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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.



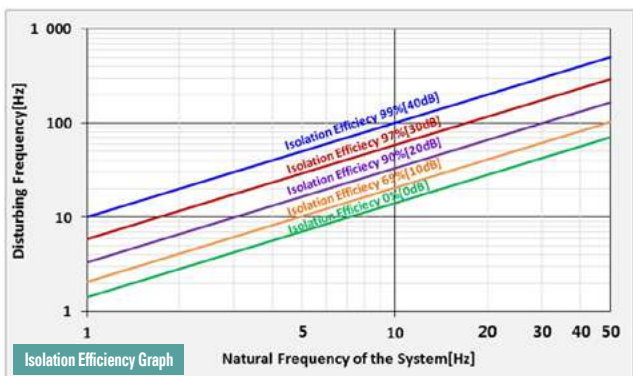
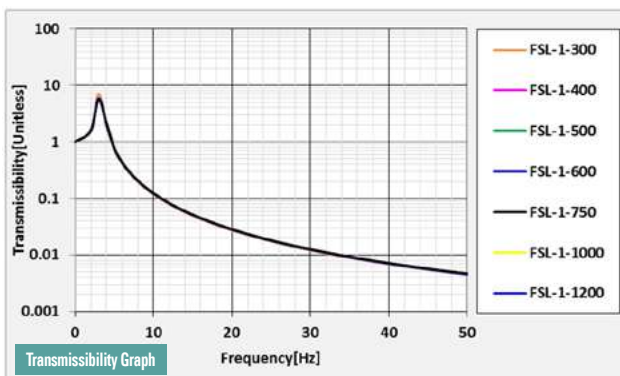
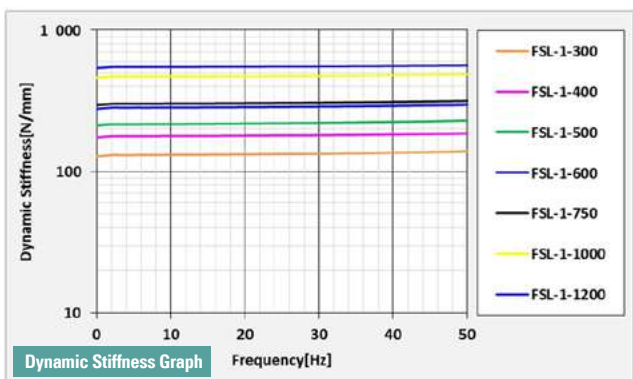
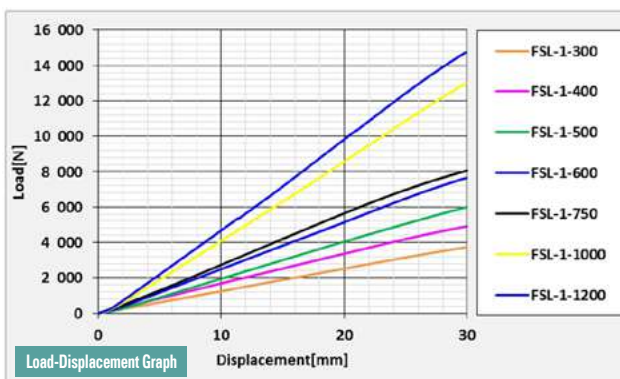
FSL Restrained Spring Mount (Deflection : 25mm)

■ Dimension & Selection Guide By Loads

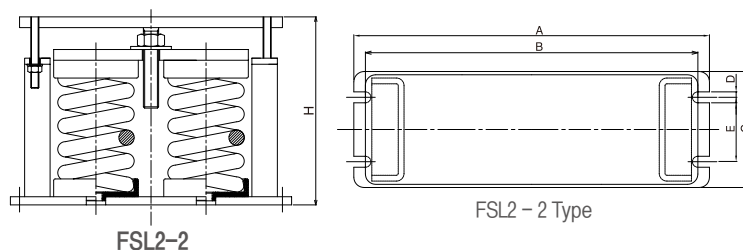
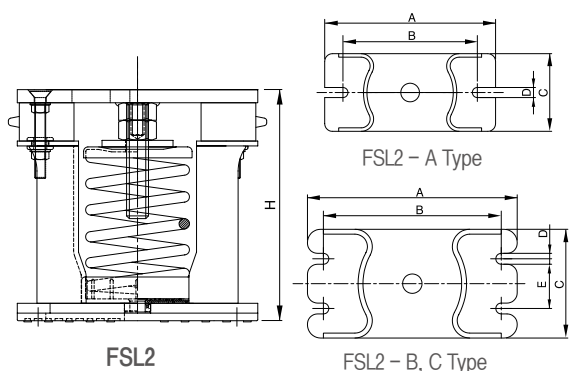
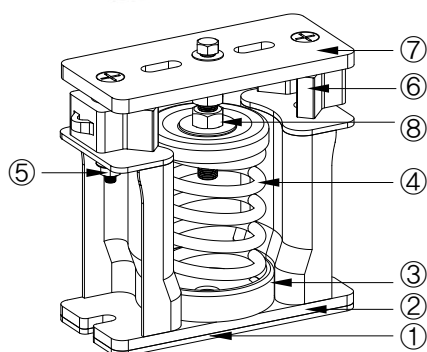
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)							
					A	B	C	D	E	H	Level Bolt	Fastening Bolt
FSL-1-300	300	12	3.90	Orange	190	153	90	14	-	199	M16 x 90	M12 x 40
FSL-1-400	400	16	3.92	Pink								
FSL-1-500	500	20	4.46	Green								
FSL-1-600	600	24	4.54	Blue								
FSL-1-750	750	30	4.60	Black								
FSL-1-1000	1000	40	4.78	Yellow								
FSL-1-1200	1200	48	4.66	Red	302	262	90	14	-	199	M20 x 90	M16 x 50
FSL-2-1200	1200	48	8.78	Blue								
FSL-2-1500	1500	60	8.94	Black								
FSL-2-2000	2000	80	9.32	Yellow								
FSL-2-2400	2400	96	9.06	Red	310	280	165	18	64	242	M24 x 110	M16 x 50
FSL-4-3000	3000	120	24.40	Black								
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	M20 x 70
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	M20 x 70
FSL-16-19200	19200	768	173.00	Red								
FSL-16-24000	24000	960	176.20	Black								

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

■ FSL Test Data



FSL2 Restrained Spring Mount (Deflection : 50mm)



■ 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	SAE9254	KS B 2402
		SW-C	KS B 2403
5	Restrain Bolt	SS400	KS B 1002
6	Space Bar	Plastic	-
7	Upper Housing	SS400	KS D 3503
8	Level Bolt	SS400	KS B 1002

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

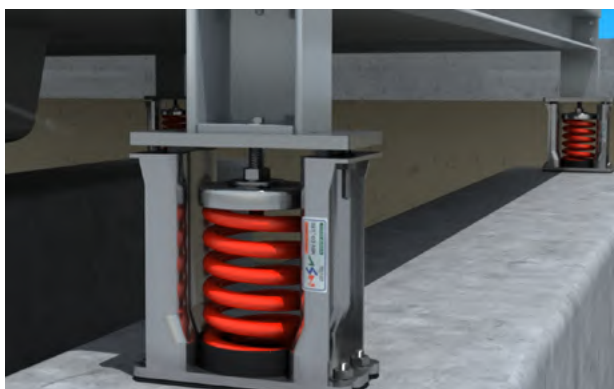
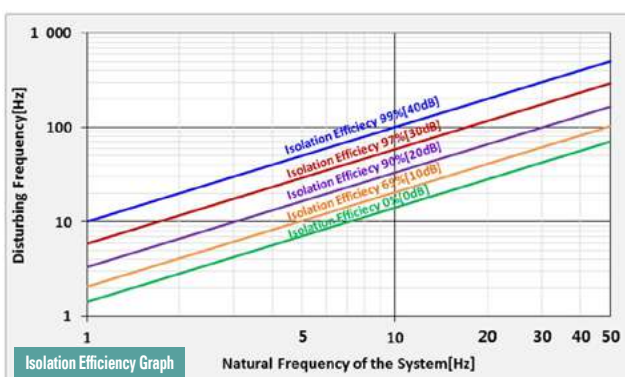
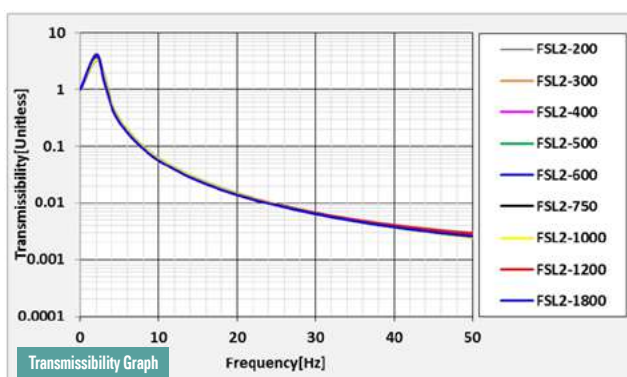
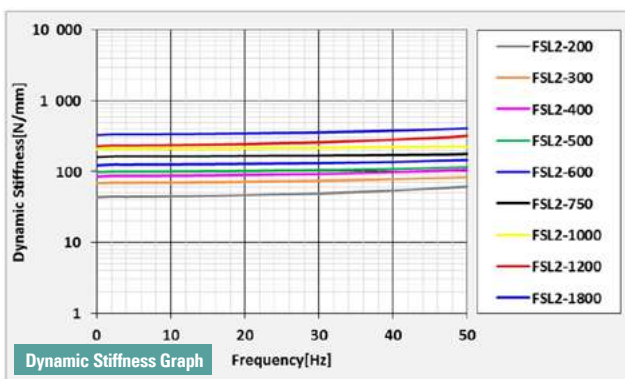
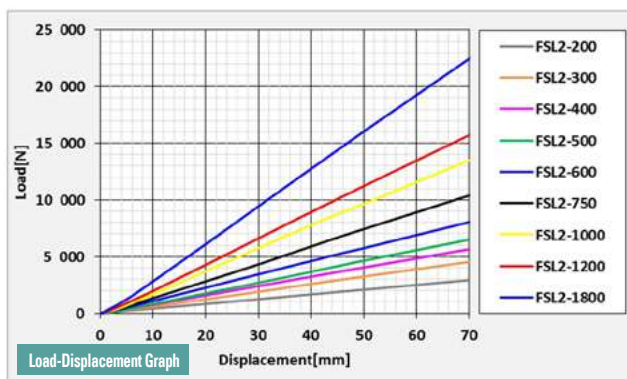
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)							
					A	B	C	D	E	H	Level Bolt	Fastening Bolt
FSL2-A-200	200	4	10.60	White	220	183	100	14	-	209	M20 x 40	M12 x 40
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	280	234	150	14	64	285	M20 x 110	M16 x 50
FSL2-B-1200	1200	24	20.00	Red								
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	M16 x 50
FSL2-C-3500	3500	70	40.00	Black								
FSL2-C-4000	4000	80	42.00	Orange								
FSL2-2-5000	5000	100	-	Brown								
FSL2-2-6000	6000	120	-	White	552	516	180	17	100	375	M30 x 180	M16 x 120
FSL2-2-8000	8000	160	-	Orange								
FSL2-2-10000	10000	200	-	Green								

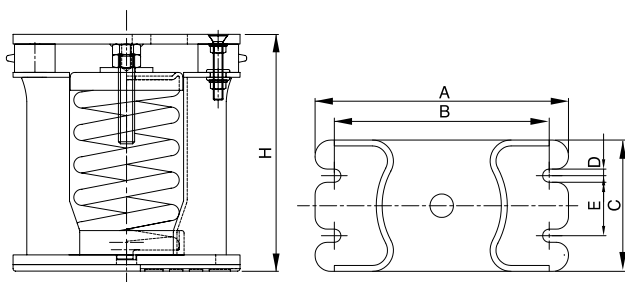
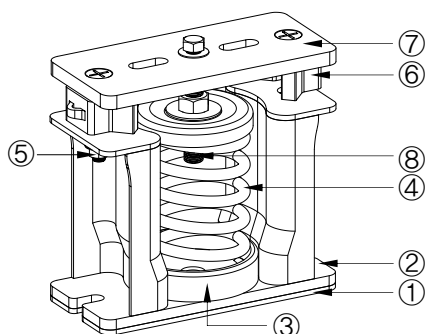
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

FSL2 Restrained Spring Mount (Deflection : 50mm)

FSL2 Test Data



FSL3 Restrained 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	SAE9254	KS B 2402
		SW-C	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

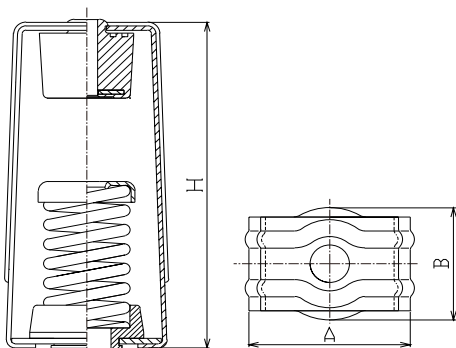
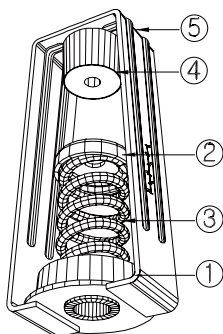
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)							
					A	B	C	D	E	H	Level Bolt	Fastening Bolt
FSL3-A-200	200	2.7	15.5	White	280	234	150	14	64	285	M20 x 110	M16 x 50
FSL3-A-300	300	4.0	16.4	Orange								
FSL3-A-400	400	5.3	15.7	Pink								
FSL3-A-600	600	8.0	16.9	Blue								
FSL3-A-750	750	10.0	17.4	Black								
FSL3-A-1000	1000	13.3	19.0	Yellow								
FSL3-A-1200	1200	16.0	20.2	Red								
FSL3-A-1500	1500	20.0	21.6	Black								
FSL3-A-1800	1800	24.0	21.8	Blue	310	266	150	16	64	338	M24 x 170	M16 x 50
FSL3-A-2000	2000	26.6	22.7	Yellow								
FSL3-A-2500	2500	33.3	23.4	Brown								
FSL3-B-3000	3000	40.0	40.6	White								
FSL3-B-3500	3500	46.6	42.2	Black								
FSL3-B-4000	4000	53.3	44.5	Orange								

NOTE: Specifications and dimensions are subject to change without prior notice for the 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	SAE9254	KS B 2402
		SW-C	KS B 2403
4	Housing Fixture	CR	KS M 6617
5	Hanger Housing	SS400	KS D 3503

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

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

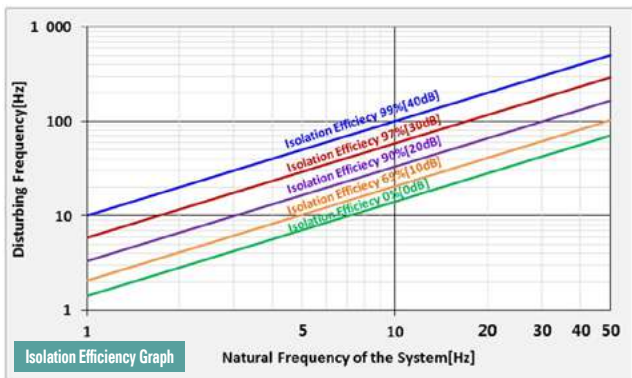
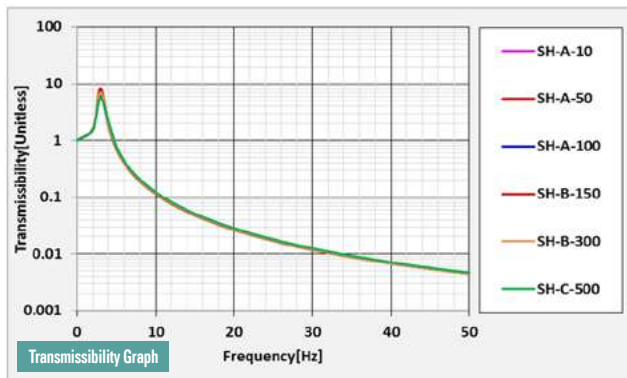
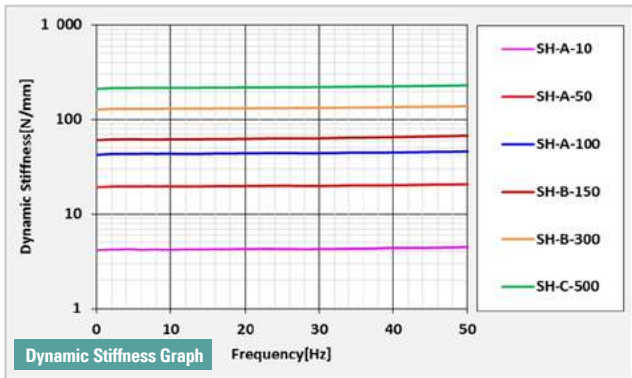
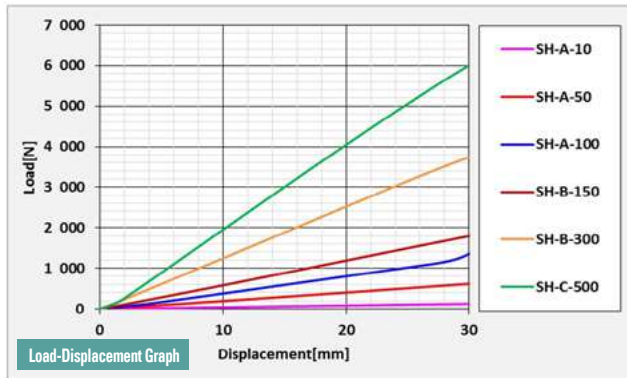
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)			
					A	B	H	Level Bolt
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				
SH-C-600	600	24	3.40	Blue	109	100	243	M16
SH-C-750	750	30	3.50	Black				
SH-C-1000	1000	40	3.68	Yellow				

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

SH Spring Hanger (Deflection : 25mm)

SH Test Data



Explanation(Commonness)

1. Vibration Transmissibility(T_r)

Vibration Transmissibility is the amplitude ratio of Output to Input.

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

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 Efficiency(E)

Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$

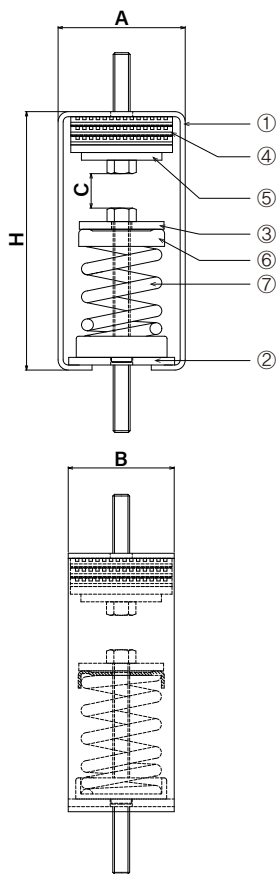
ex) Disturbing Frequency of the equipment=100 Hz,

Natural Frequency of the isolator=10Hz

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



SH2 Spring Hanger (Deflection : 50mm)



■ Features

The SH2 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 50 mm 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	Hanger Housing	SS275	KS D 3503
2	Lower Plate	SS275	KS D 3503
3	Middle Plate	SS275	KS D 3503
4	Upper Rubber	CR	KS M 6617
5	Washer	SS275	KS D 3503
6	Spring Cup Rubber	CR	KS M 6617
7	Coil Spring	SAE9254	KS B 2402
		SW-C	KS B 2403

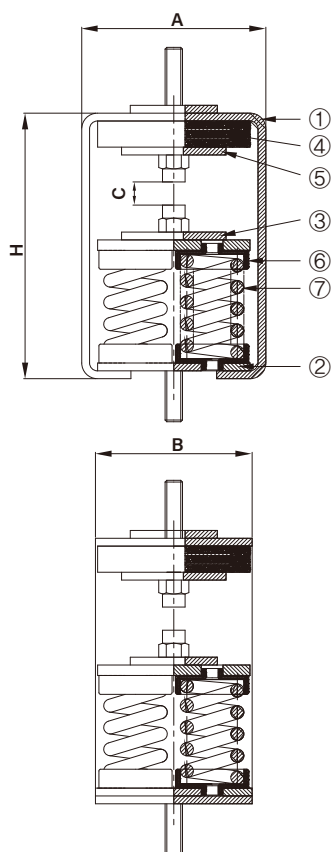
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)				
					A	B	C	H	Level Bolt
SH2-100	100	2	10	Blue	150	125	40	305	M20
SH2-150	150	3	10	Brown					
SH2-200	200	4	10.1	White					
SH2-300	300	6	10.1	Orange					
SH2-400	400	8	10.1	Pink					
SH2-500	500	10	10.2	Green					
SH2-600	600	12	10.2	Blue					
SH2-750	750	15	10.2	Black					
SH2-1000	1000	20	10.3	Yellow					
SH2-1200	1200	24	10.5	Red					

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

SH-4 Spring Hanger (Deflection : 25mm)



■ Features

The SH-4 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	Hanger Housing	SS275	KS D 3503
2	Lower Plate	SS275	KS D 3503
3	Middle Plate	SS275	KS D 3503
4	Upper Rubber	CR	KS M 6617
5	Washer	SS275	KS D 3503
6	Spring Cup Rubber	CR	KS M 6617
7	Coil Spring	SAE9254	KS B 2402
		SW-C	KS B 2403

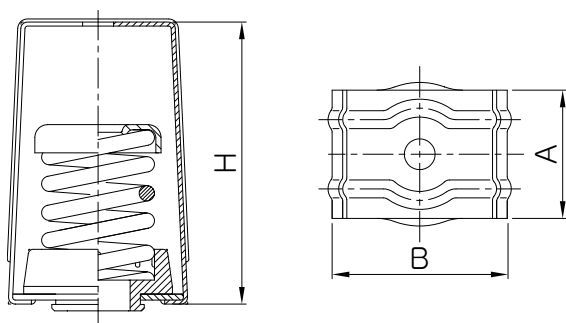
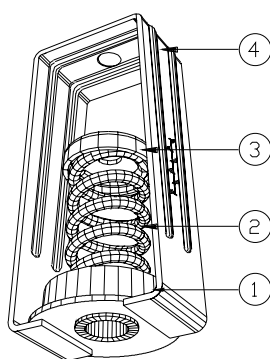
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)				
					A	B	C	H	Level Bolt
SH-4-400	400	16.0	21.40	Blue	211.5	180	26.6	305	M20
SH-4-600	600	24.0	21.50	Brown					
SH-4-800	800	32.0	21.50	White					
SH-4-1200	1200	48.0	22.30	Orange					
SH-4-1600	1600	64.0	23.40	Pink					
SH-4-2000	2000	80.0	22.50	Green					
SH-4-2400	2400	96.0	22.90	Blue					
SH-4-3000	3000	120.0	23.10	Black					
SH-4-4000	4000	160.0	24.10	Yellow					

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

VH20 Spring Hanger (Deflection : 25mm)



■ 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	SAE9254	KS B 2402
		SW-C	KS B 2403
3	Spring Cap	SS400	KS D 4301
4	Hanger Housing	SS400	KS D 3503

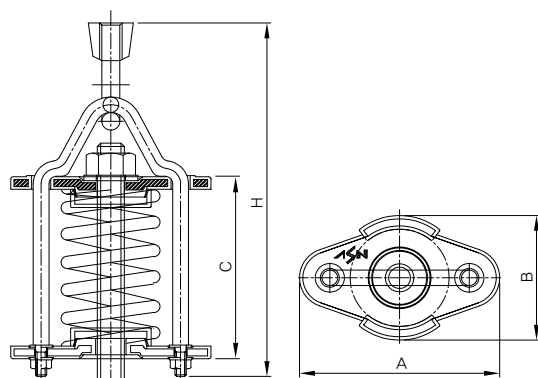
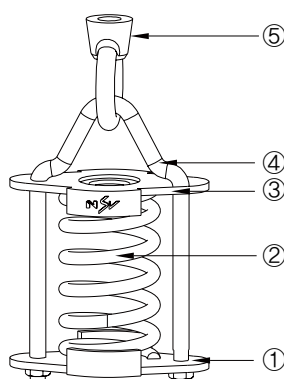
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Weight (kg)	Color	Dimension(mm)			
					A	B	H	Level Bolt
VH20-A-10	10	0.4	0.38	Pink	80	60	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	96	79	167	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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VH61 Spring Hanger (Deflection : 25mm)



■ 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 coating)	SS400	KS D 3503
2	Lower Plate(neoprene coating)	SS400	KS D 3503
3	Coil Spring	SAE9254 SW-C	KS B 2402 KS B 2403
4	Hanging V-Bolt	SS400	-
5	I-Nut	SS400	-

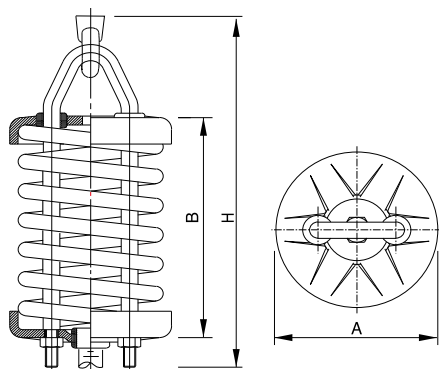
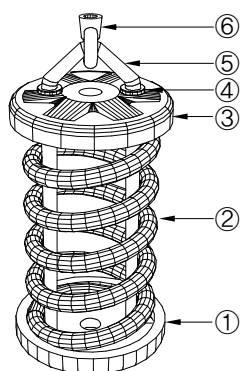
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ 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	82	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	109	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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VH62 Spring Hanger (Deflection : 50mm)



■ 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	SAE9254	KS B 2402
		SW-C	KS B 2403
3	Upper Spring Cap	SS400	KS D 3503
4	Guide Rubber	CR	KS M 6617
5	Hanging V-Bolt	SS400	-
6	I-Nut	SS400	-

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

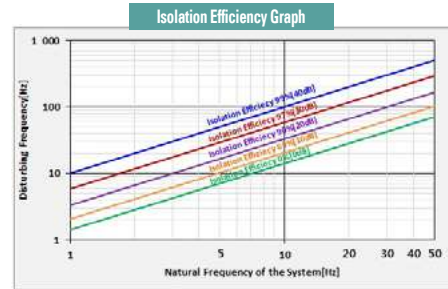
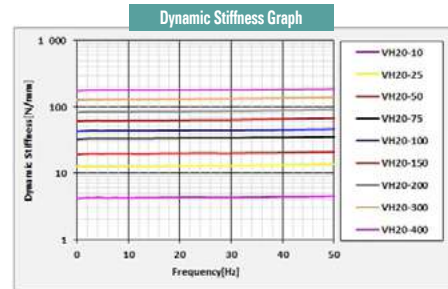
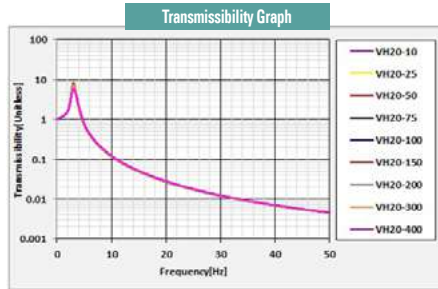
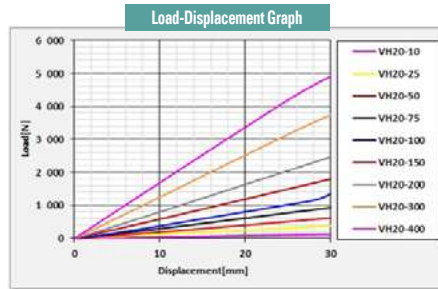
■ Dimension & Selection Guide

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	238	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					

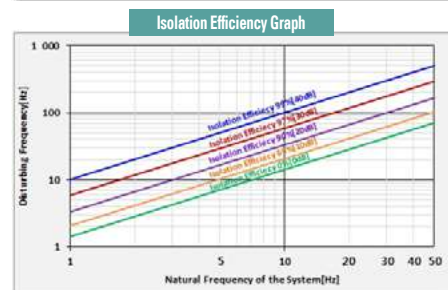
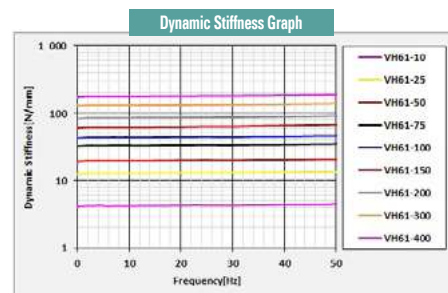
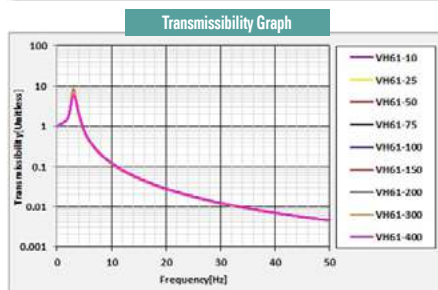
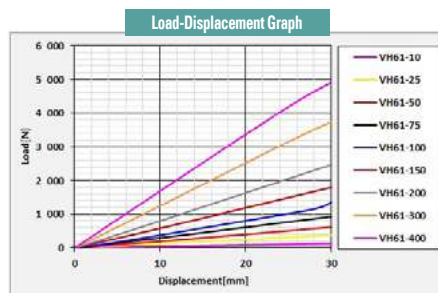
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VH20/VH61/VH62 Spring Hanger

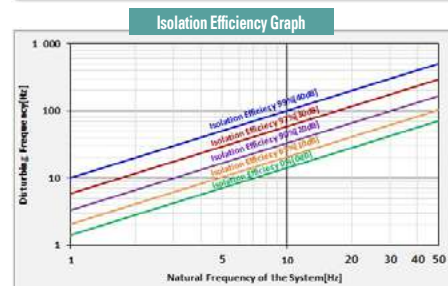
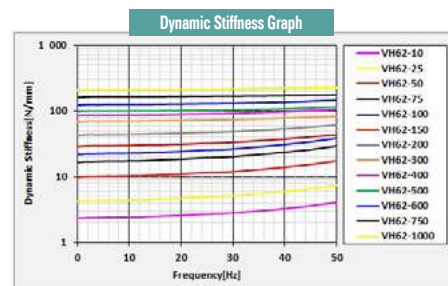
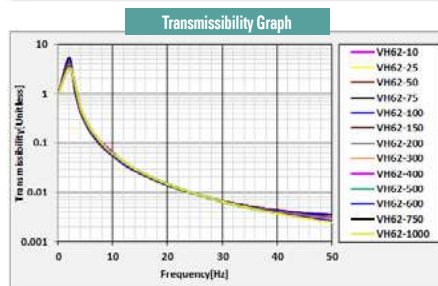
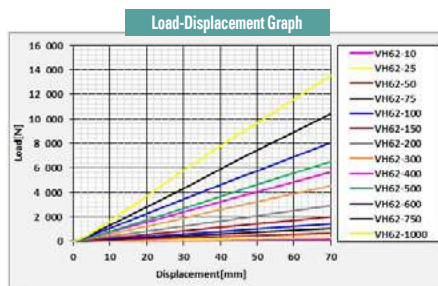
VH20 Test Data



VH61 Test Data



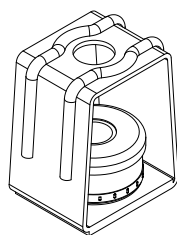
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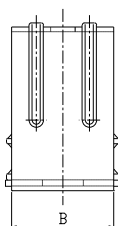
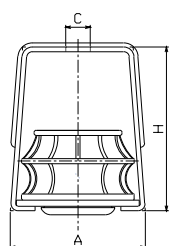
RH10 Rubber Hanger (Deflection : 3.5~13mm)



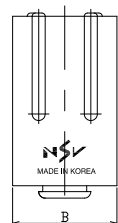
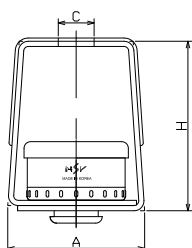
RH10-A, B, C Type



RH10-M Type



RH10-A, B, C Type



RH10-M 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

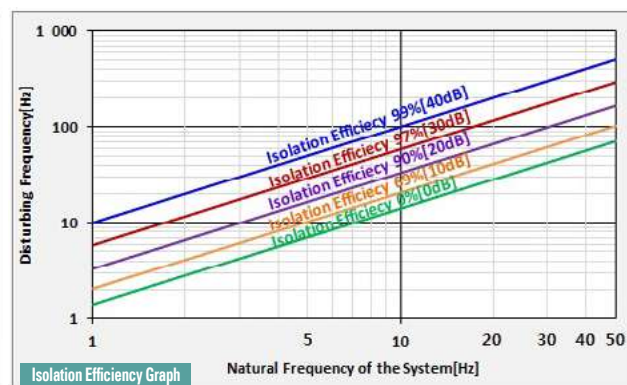
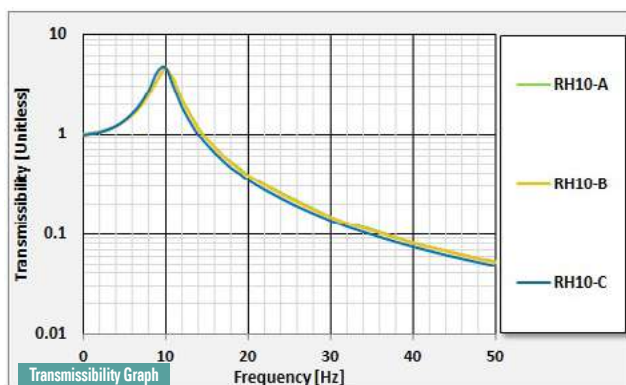
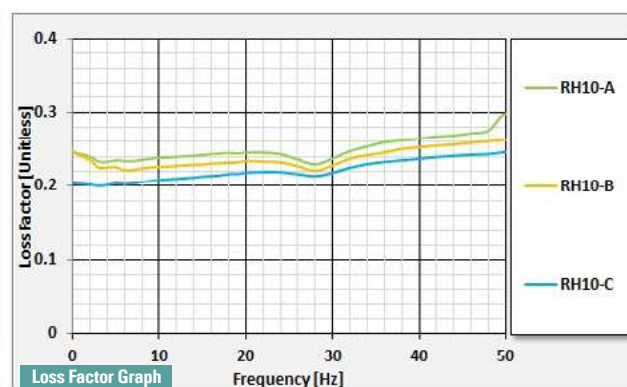
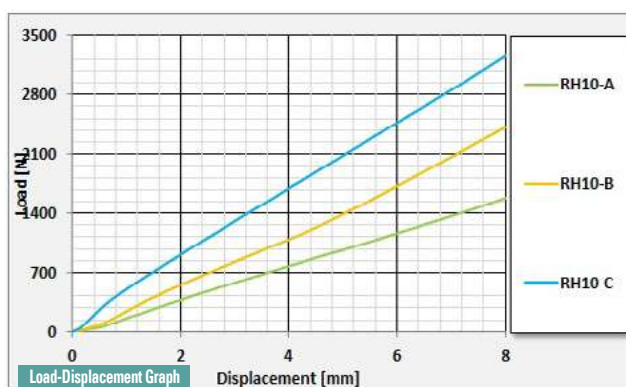
- ◆ For machine rooms, ventilators in air conditioning rooms and ducts
- ◆ For small fan and duct in line fan
- ◆ For structures suspended from the ceiling of, for example, studios and acoustical laboratories
- ◆ For ceiling mounted FCU

■ Dimension & Selection Guide

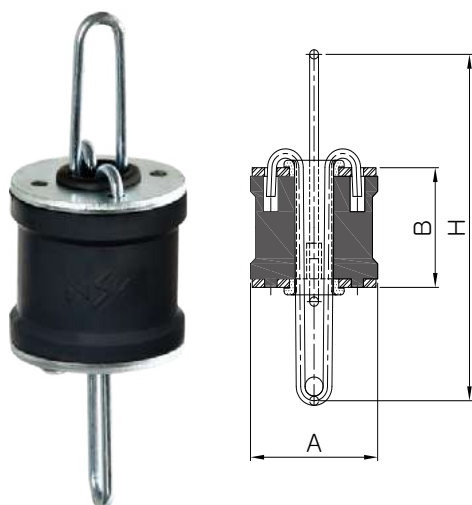
Type	Capacity (kgf)	Hardness (Hs)	Deflection (mm)	Weight (kg)	Dimension(mm)				
					A	B	C	H	Hanging Bolt
RH10-M	30~50	60±5	2.0~3.5	—	42	32	Ø11	52	M10
RH10-A	25~100		3.5~13	0.36	66	50	Ø12	80	M10
RH10-B	150~400		5.0~13	0.76	91	71	Ø14	104	M12
RH10-C	500~750		6.7~13	1.24	105	75	Ø20	120	M16

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

■ RH10 Test Data



RH20 Ceiling Rubber Hanger (Deflection : 5mm)



■ 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	0.03	Silver	36	32	97
RH20-60	45~70	60±5	0.06	Gold			

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

RH30 Rubber Hanger (Deflection : 3.5~5mm)



■ 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

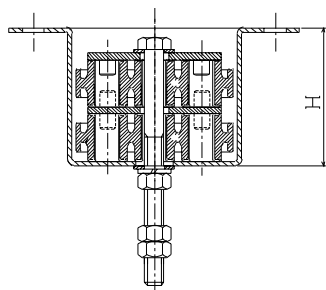
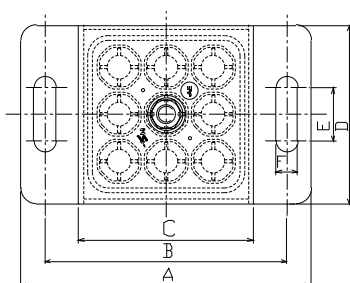
- ◆ Vibration-proofing for small fan, duct in line fan
- ◆ Vibration-proofing for ceilings of studio, acoustical laboratory, etc.

■ Dimension & Selection Guide

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

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

RH40 Type Rubber Hanger (Deflection : 11mm)



■ 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

■ 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

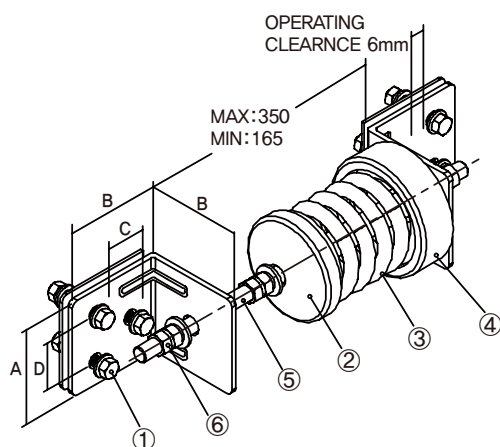
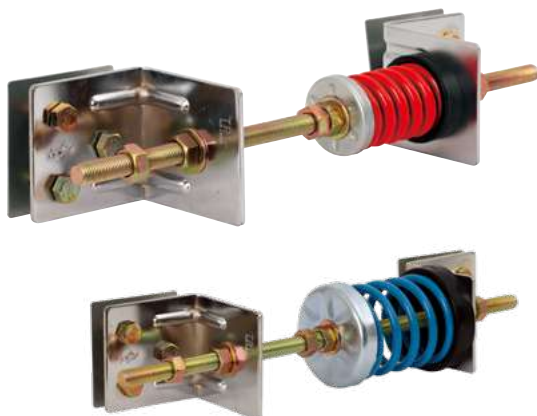
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity (kgf)	TORQUE (kg·cm)	Dimension(mm)							
			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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

NTR/NTR2 Thrust Restraint (Deflection : 25mm / 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	SAE9254	KS B 2402
		SW-C	KS B 2403
4	Neoprene Cup	CR	KS M 6617
5	Threaded Rod	SS400	KS D 3503
6	Nut	SS400	KS B 1002

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

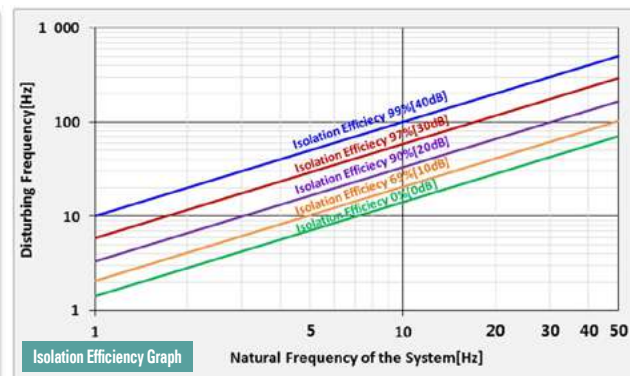
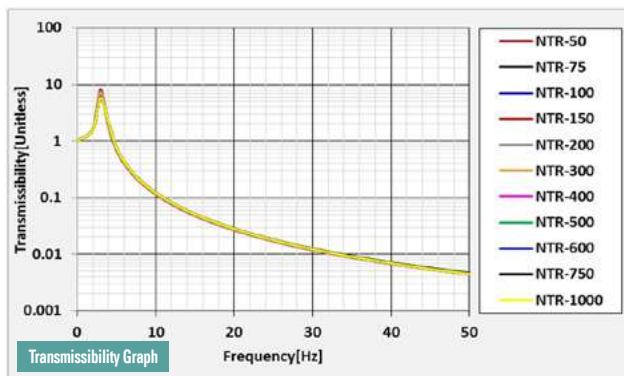
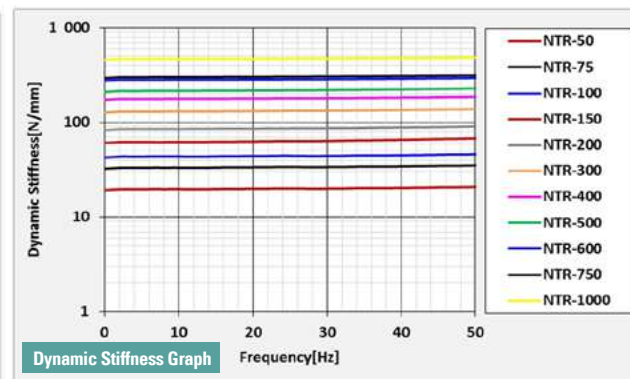
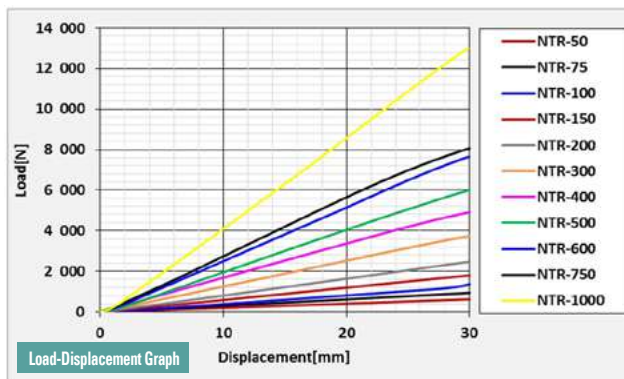
■ Dimension & Selection Guide

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					

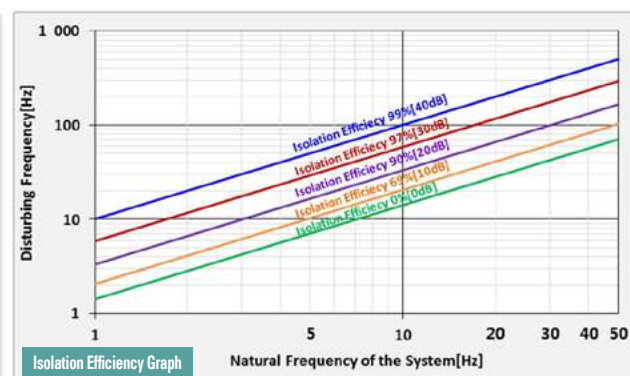
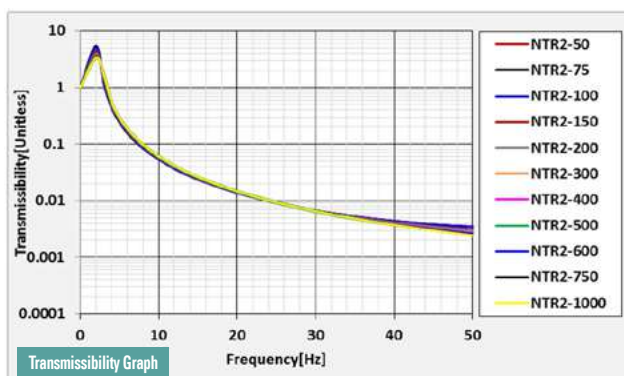
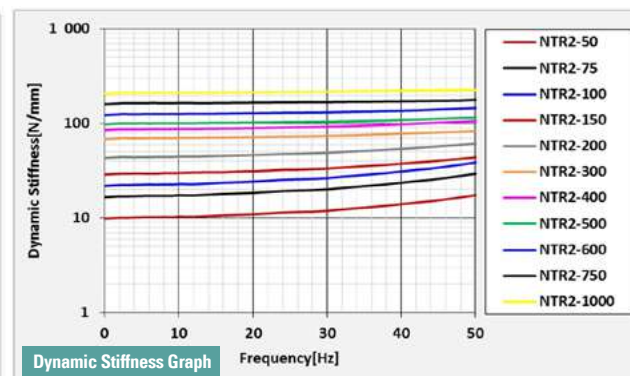
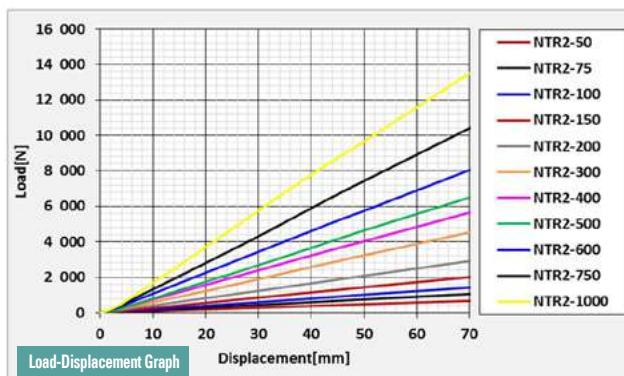
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension(mm)				
					A	B	C	H	Space Rod
NTR2-50	50	1	50	Red	100	103	40	50	M16 x 500
NTR2-75	75	1.5		Black					
NTR2-100	100	2		Blue					
NTR2-150	150	3		Brown					
NTR2-200	200	4		White					
NTR2-300	300	6		Orange					
NTR2-400	400	8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

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

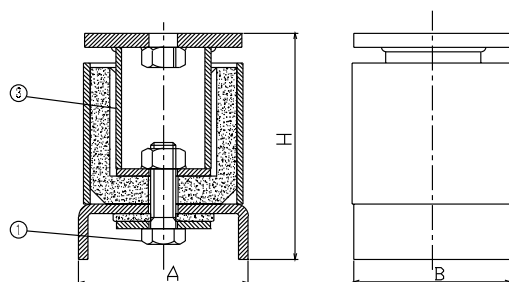
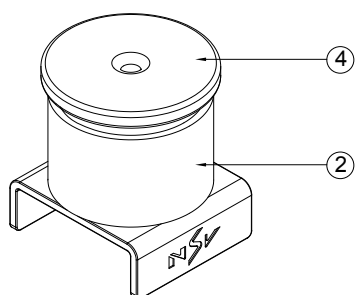
NTR Test Data



NTR2 Test Data



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



■ Features

With a highly-elastic resilient 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 isolated 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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

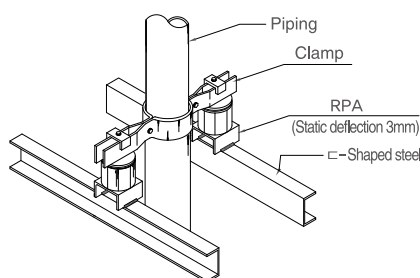
■ Dimension & Selection Guide

Type	Capacity (kgf)	Deflection (mm)	Dimension(mm)			
			A	B	H	Level Bolt
RPA-75	250	3	83	75	94	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	260	M24

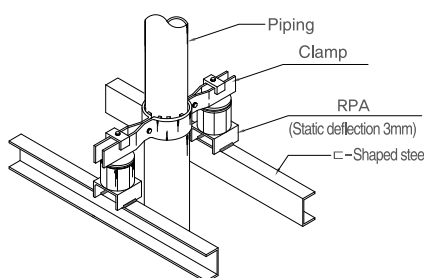
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.



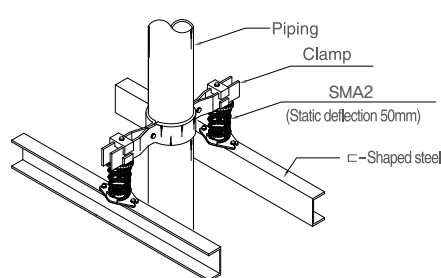
RPA Pipe Anchor & Guide (Deflection : 3~9mm)



Detailed drawing of pipe anchor

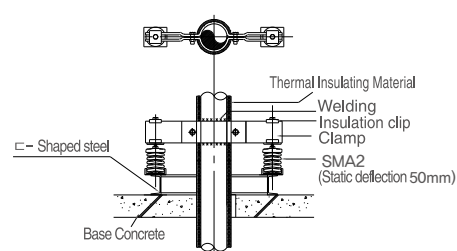
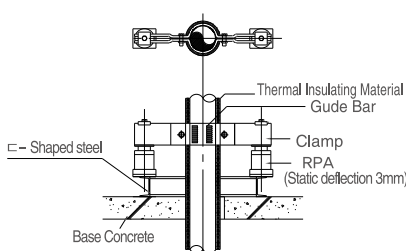
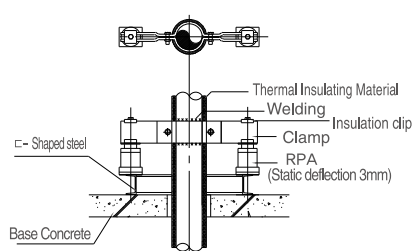


Detailed drawing of pipe guide



Detailed drawing of pipe spring

INSTALLATION DETAIL



Detailed drawing of pipe anchor

Detailed drawing of pipe guide

Detailed drawing of pipe spring

〈 Note 〉

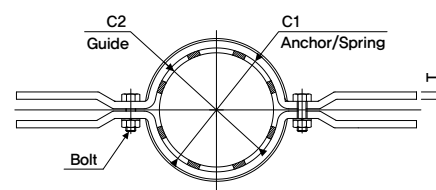
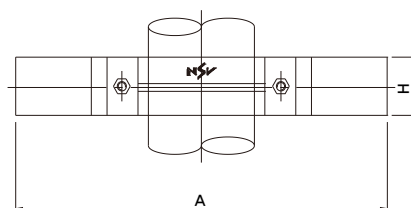
- ㉑: STRAIGHT PIPE: The length between a Guide and Guide D(m)
- ㉒: OFFSET PIPE: The length between a Anchor and Guide D(m)
- ㉓: The length between a Guide and Expansion Joint D(m)
- ㉔: The length between the first Guide and the second Guide D(m)

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/ cm ² 以下	12~24Kg/ cm ²	OFFSET(m)	Size		(a)	(b)	(c)	(d)	Below12Kg/ cm ²	12~24Kg/ cm ²		
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	Special type	-	RPA 600	RPA 350	36	36	2.4	8.5	31.0	22.5		
650	800		-	600	600	36	36	3.0	10.0	32.0	25.5		
700	800		-	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 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
Φ450	1000	Φ457.2	16	100	M22
Φ500	1200	Φ508.8	16	100	M22
Φ600	1200	Φ609.6	19	125	M24
Φ800	1450	Φ812.8	25	200	M36

Steel/STS Clamp Guide

Type	A	C2	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)
Φ450	1000	Φ477.2	16	100	M22	40 x 95 x 10T(8EA)
Φ500	1200	Φ528.8	16	100	M22	40 x 95 x 10T(8EA)
Φ600	1200	Φ629.6	19	125	M24	50 x 120 x 10T(10EA)
Φ800	1450	Φ832.8	25	200	M36	50 x 120 x 10T(10EA)

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

Copper Clamp



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



CLAMP Riser Pipe Clamp

Order of Installation for Standing Pipe Anti-Vibration Device



Installation Video

Anchor



RPA Anti-Vibration Anchor Installation



Clamp and Anti-Vibration Anchor Welding



Completion of Anti-Vibration Installation

Guide

(NOTE) When installing a guide anti-vibration device, it is acceptable to install a clamp for general steel pipes because a Teflon guide bar is installed inside the clamp. For STS, the neoprene insulating clip does not have to be installed on either the upper or lower part of the clamp.



Teflon Guide Bar



Anti-Vibration Lower Part Welding



Completion of Anti-Vibration Guide Installation

Spring



Lower Spring Welding



SMA2 Anti-Vibration Leveling

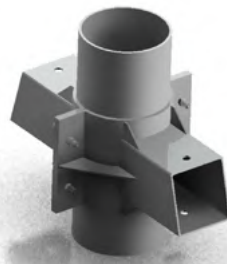


Completion of Anti-Vibration Spring Installation

Anchor Bracket Clamp



H-Beam Type

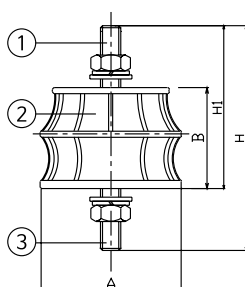


Square Pipe Type



Example of Anchor Bracket Installation

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



■ 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

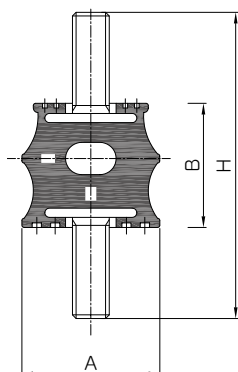
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ 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 40
VB-1080	300			80	50	111	80	M10 x 40
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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

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



■ 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

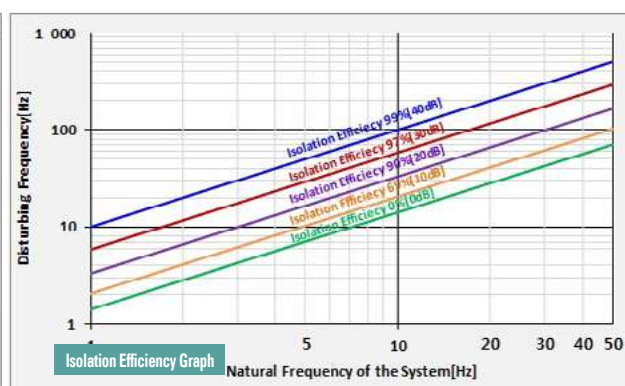
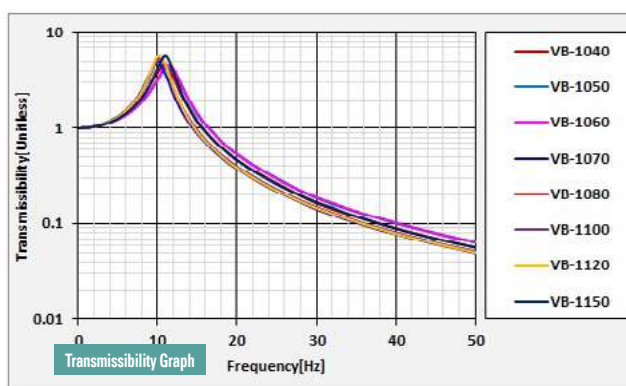
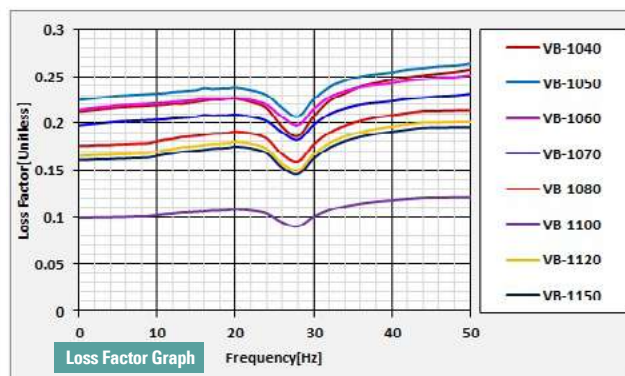
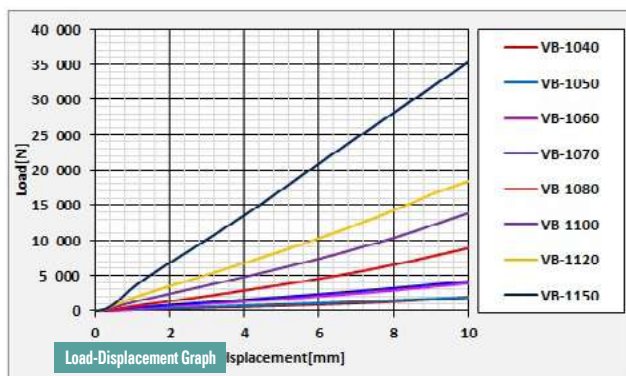
■ Dimension & Selection Guide

Type	Capacity(kgf)	Hardness(Hs)	Deflection(mm)	Dimension(mm)			
				A	B	H	Bolt
VB-1030H	30	60±5	5	30	27	66	M8 x 22

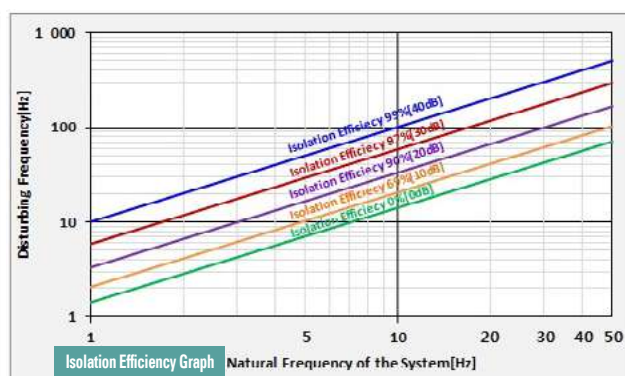
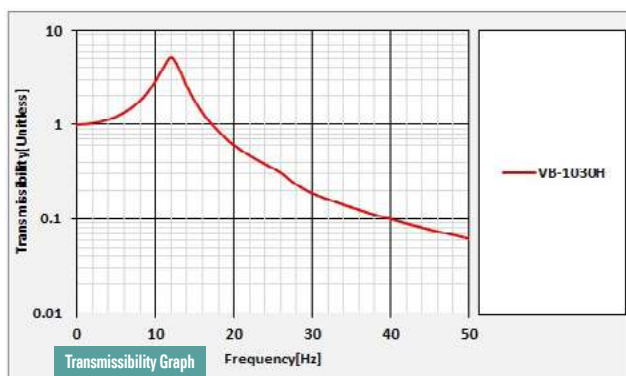
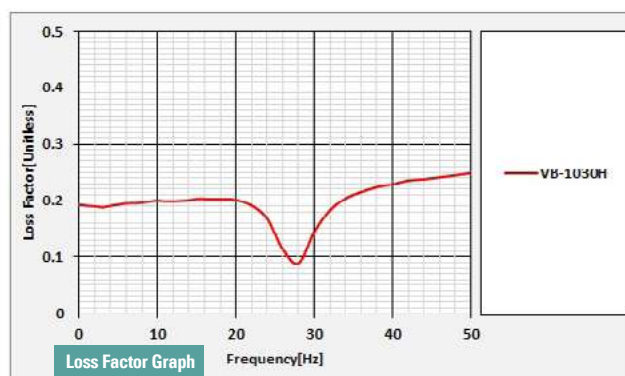
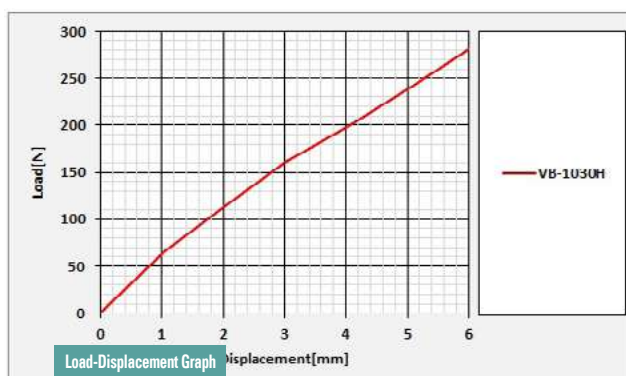
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VB-1000/VB-1030H Rubber Mount

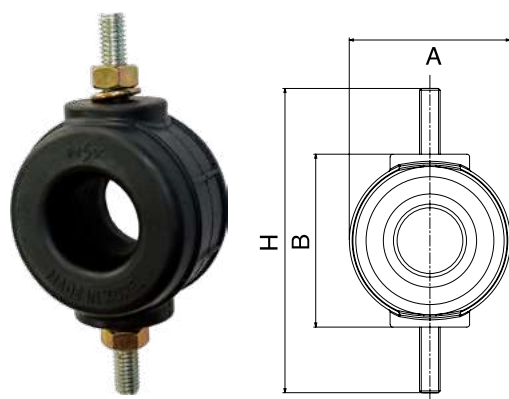
VB-1000 Test Data



VB-1030H Test Data



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



■ 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

■ Specification

No.	Name of Components	Material	Standard
1	Bolt (Upper)	SS 400	KS B 1002
2	Rubber Mount	CR	KS M 6617
3	Bolt (Lower)	SS 400	KS B 1002

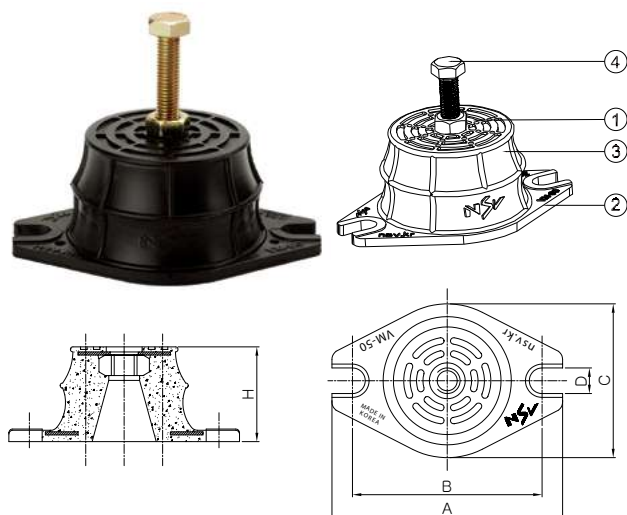
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity(kgf)	Spring Constant(kgf/mm)	Deflection(mm)	Dimension(mm)			
				A	B	H	Level Bolt
VB-2045	34	1.7	20	44	50	92	M8 x 30

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

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

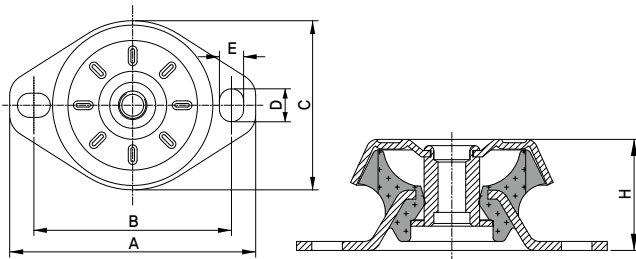
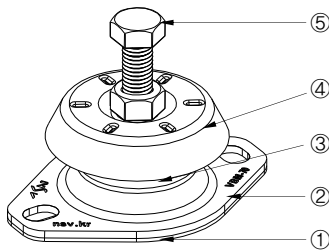
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ 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 x 40
VM-1050	80		6	0.21	90	74	60	10	40	M10 x 60
VM-1060	120		6	0.31	113	90	69	10	45	M10 x 60
VM-1070	150		6	0.34	130	105	81	12	50	M10 x 60
VM-1080	300		8	0.42	130	110	90	12	50	M10 x 60
VM-1100	600		8	1.78	169	142	115	13	61	M12 x 65

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

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

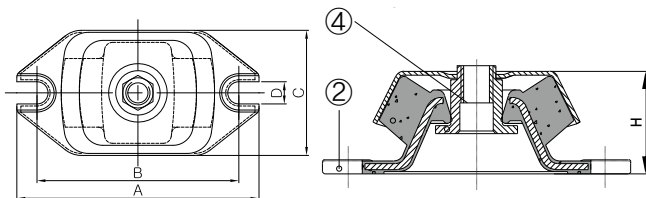
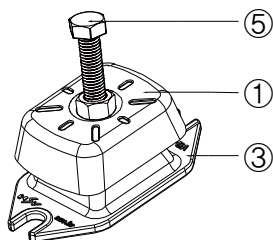
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ 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 x 65
VM-2080	300			0.73	135	110	90	17	13	46	M12 x 65
VM-2100	500			1.22	164	135	105	21	16	50	M16 x 80
VM-2120	1000			1.56	190	161	128	21	16	55	M16 x 80
VM-2150	1500			2.18	228	193	159	21	16	66	M16 x 80

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

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

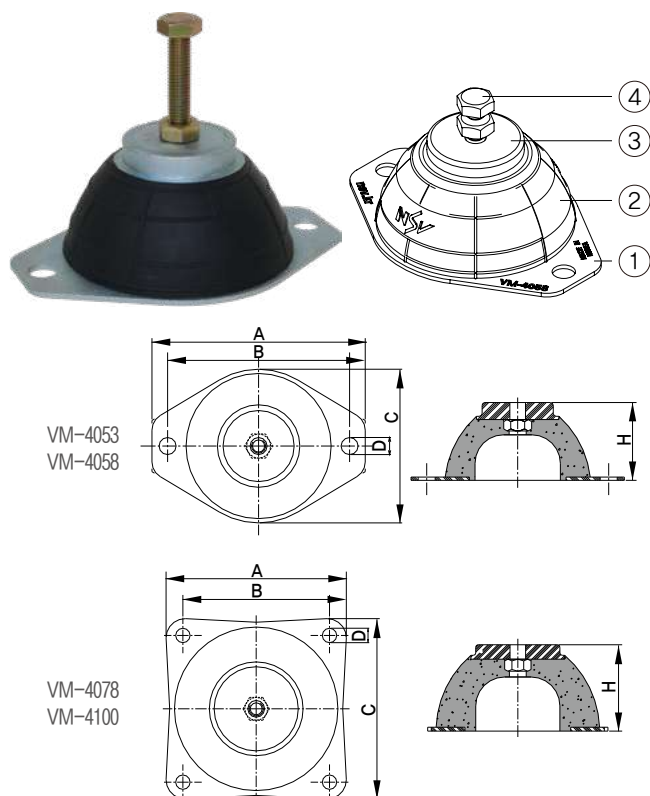
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity(kgf)	Hardness(Hs)	Weight(kg)	Dimension(mm)					
VM-3060	100	60±5	0.24	A	B	C	D	H	Level Bolt
VM-3070	300		120	100	62	11	40	M12 x 65	
VM-3090	500		0.72	150	125	78	13	50	M12 x 65
VM-3110	700		1.80	180	150	94	16	60	M16 x 80
			2.45	226	189	118	19	65	M16 x 80

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

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



■ 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

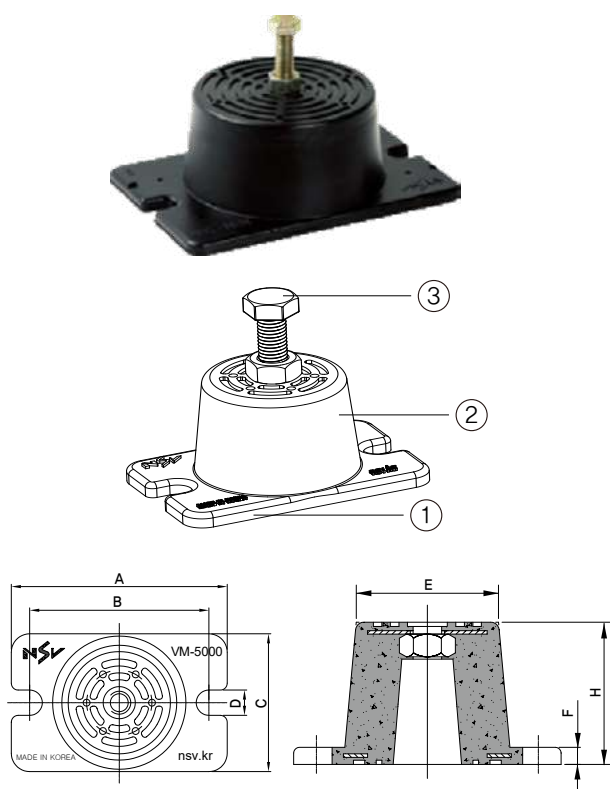
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

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

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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

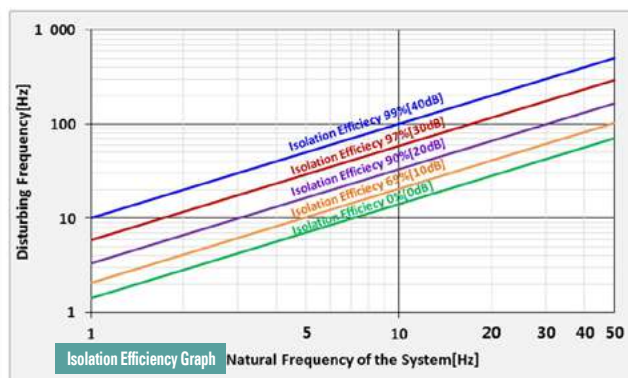
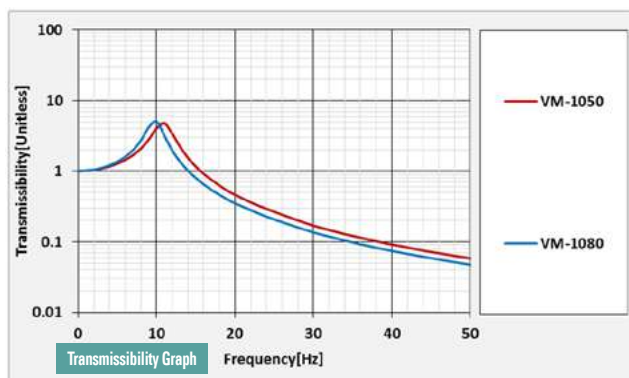
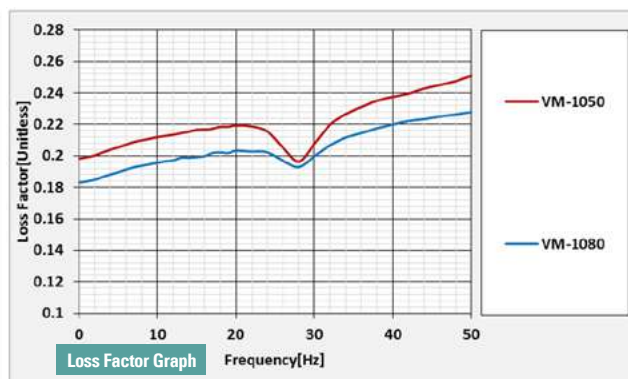
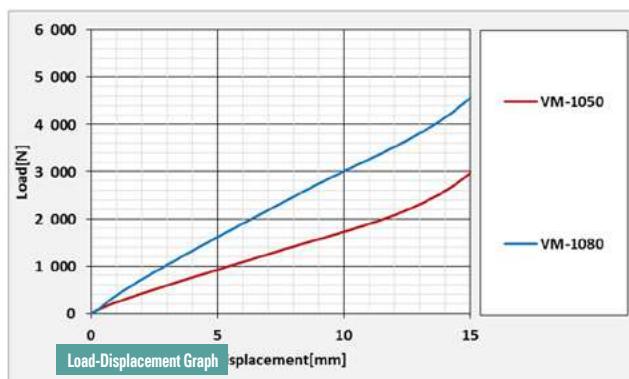
■ Dimension & Selection Guide

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

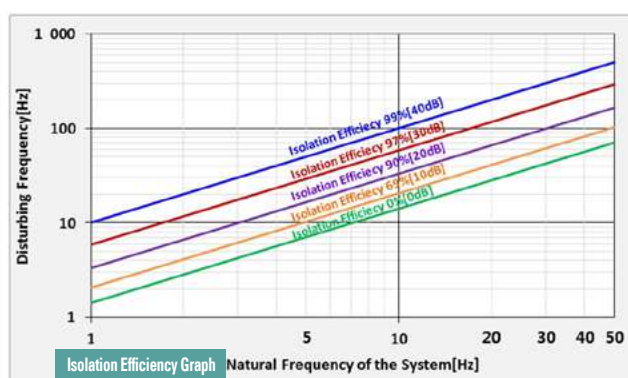
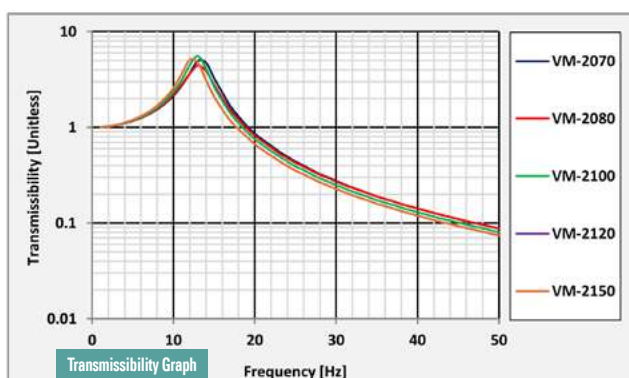
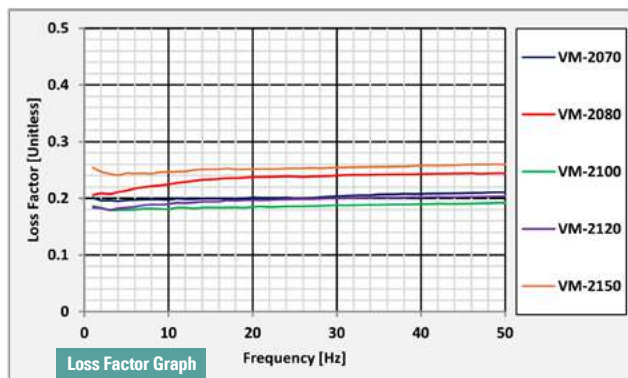
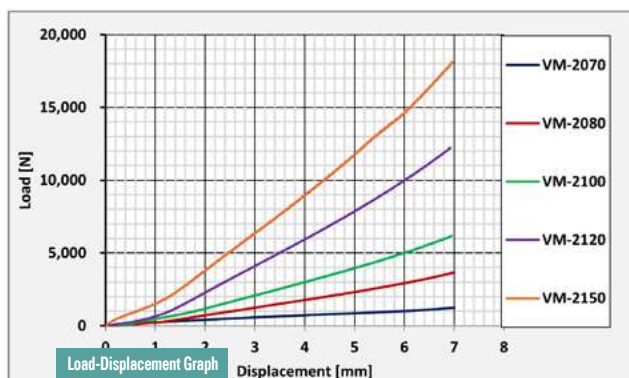
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VM-1000/VM-2000 Rubber Mount

VM-1000 Test Data

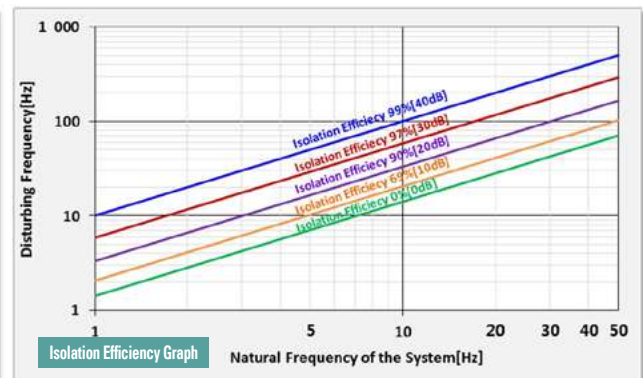
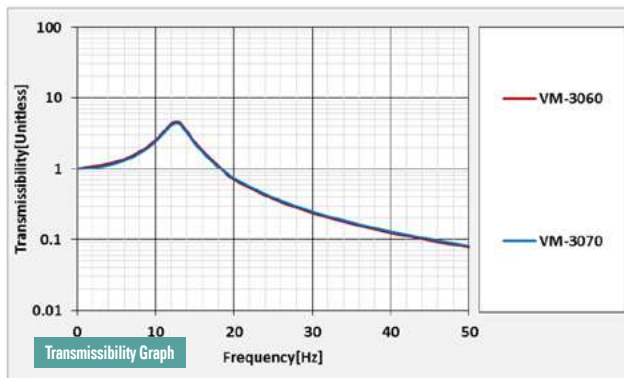
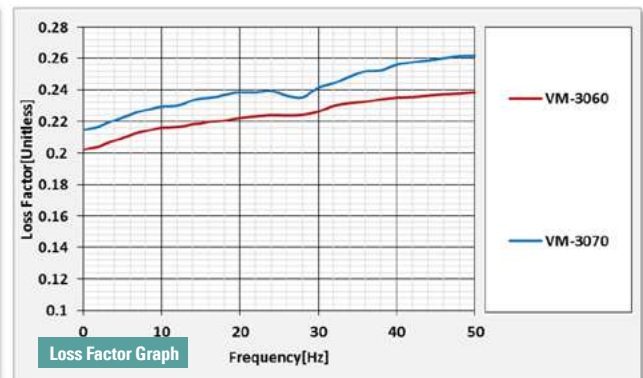
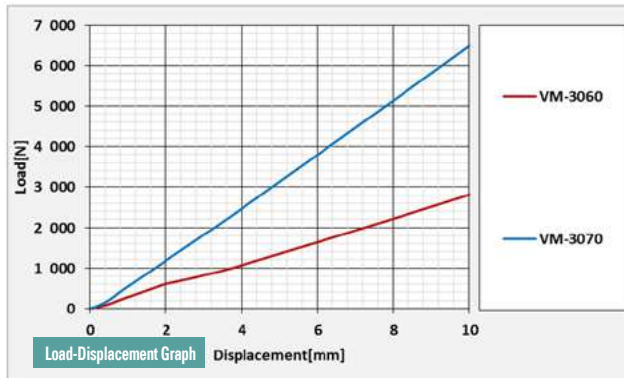


VM-2000 Test Data

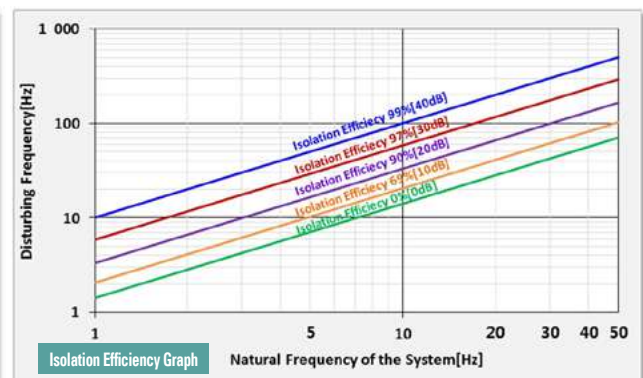
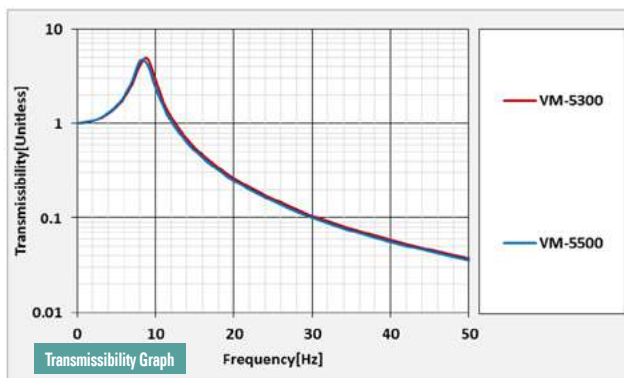
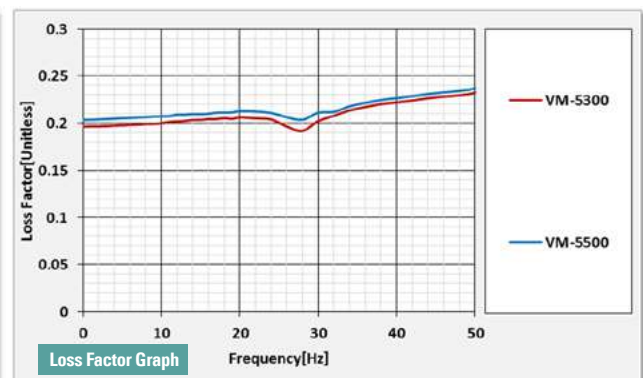
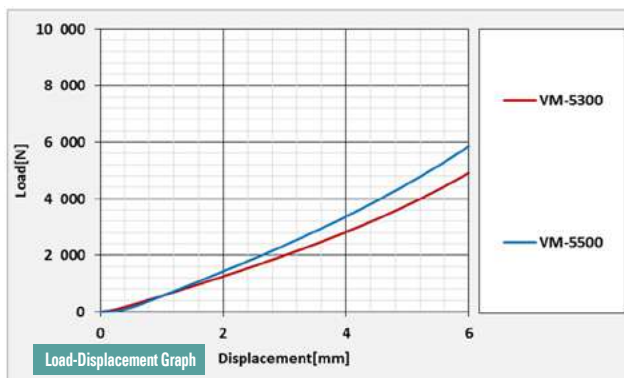


VM-3000/VM-5000 Rubber Mount

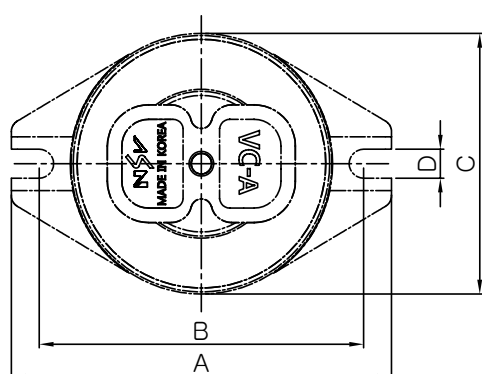
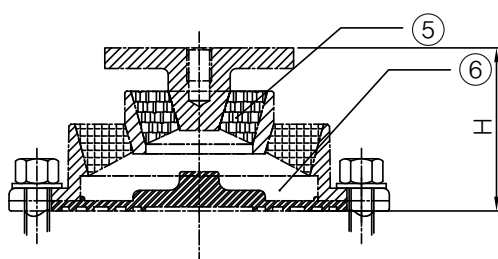
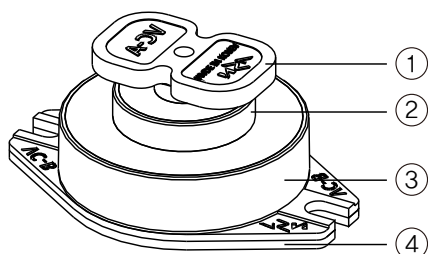
■ VM-3000 Test Data



■ VM-5000 Test Data



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.

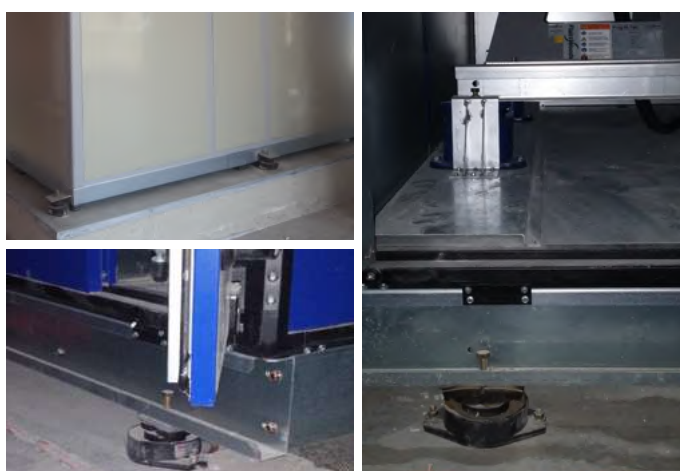
■ Usage

- ◆ For pumps, refrigerators, compressors and power generators
- ◆ For ventilators and air conditioning units
- ◆ For cooling towers
- ◆ 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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.



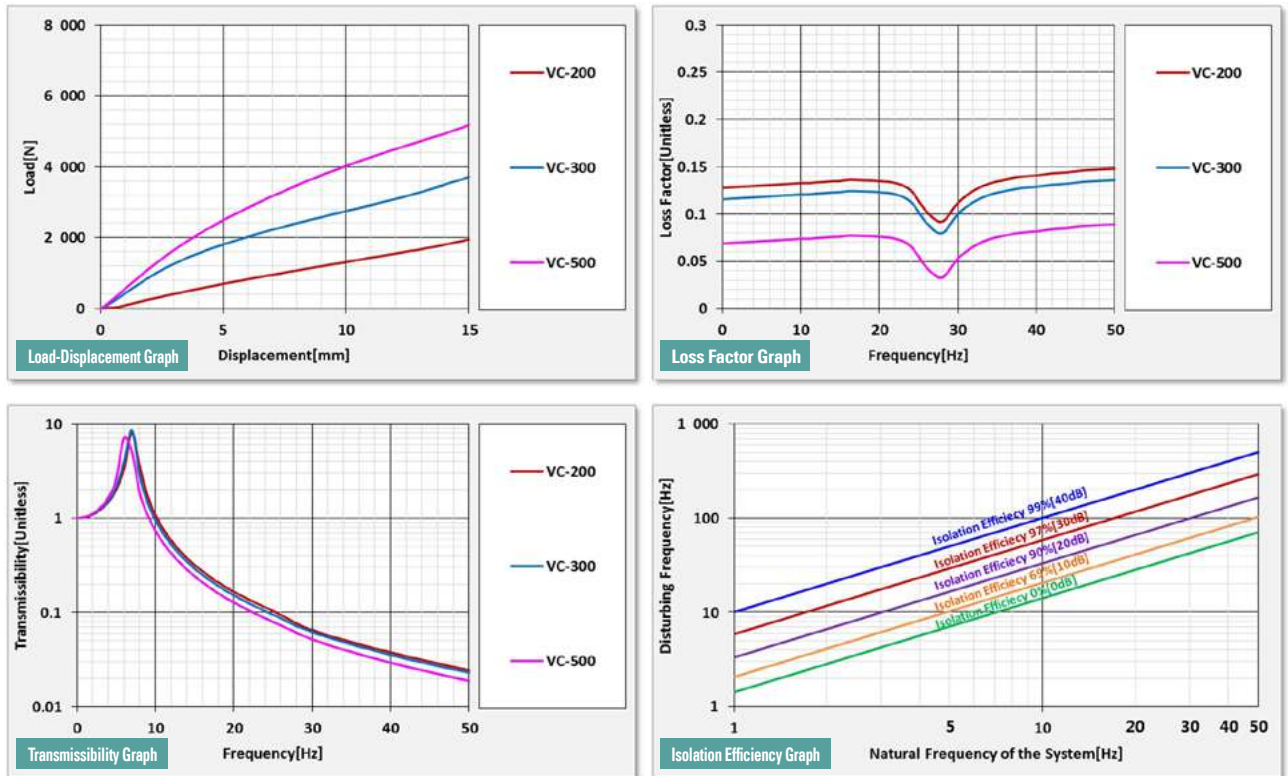
■ Dimension & Selection Guide

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 x 65
VC-300	300	80 / 70	1.0	Blue						
VC-500	500	85 / 75	1.0	Red						

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

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.

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

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 Efficiency(E)

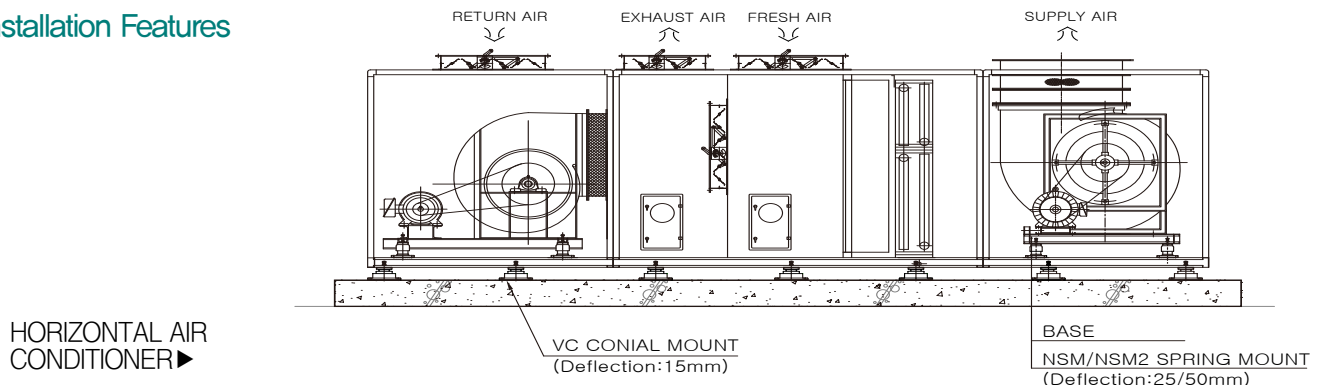
Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$

ex) Disturbing Frequency of the equipment=100 Hz,

Natural Frequency of the isolator=10Hz

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

Installation Features

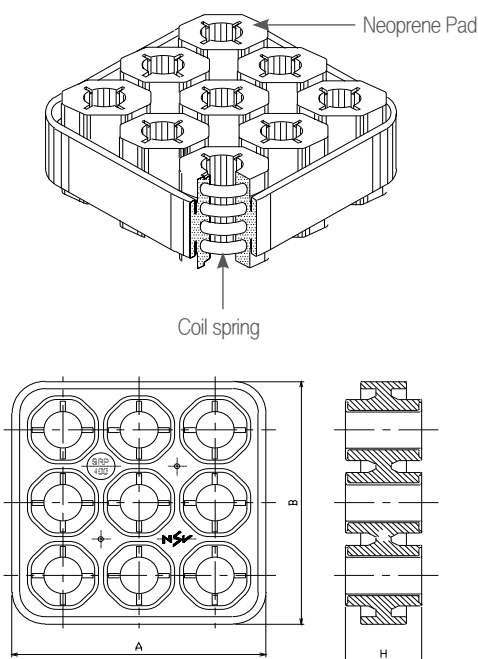


HORIZONTAL AIR
CONDITIONER ▶

VC CONICAL MOUNT
(Deflection: 15mm)

BASE
NSM/NSM2 SPRING MOUNT
(Deflection: 25/50mm)

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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

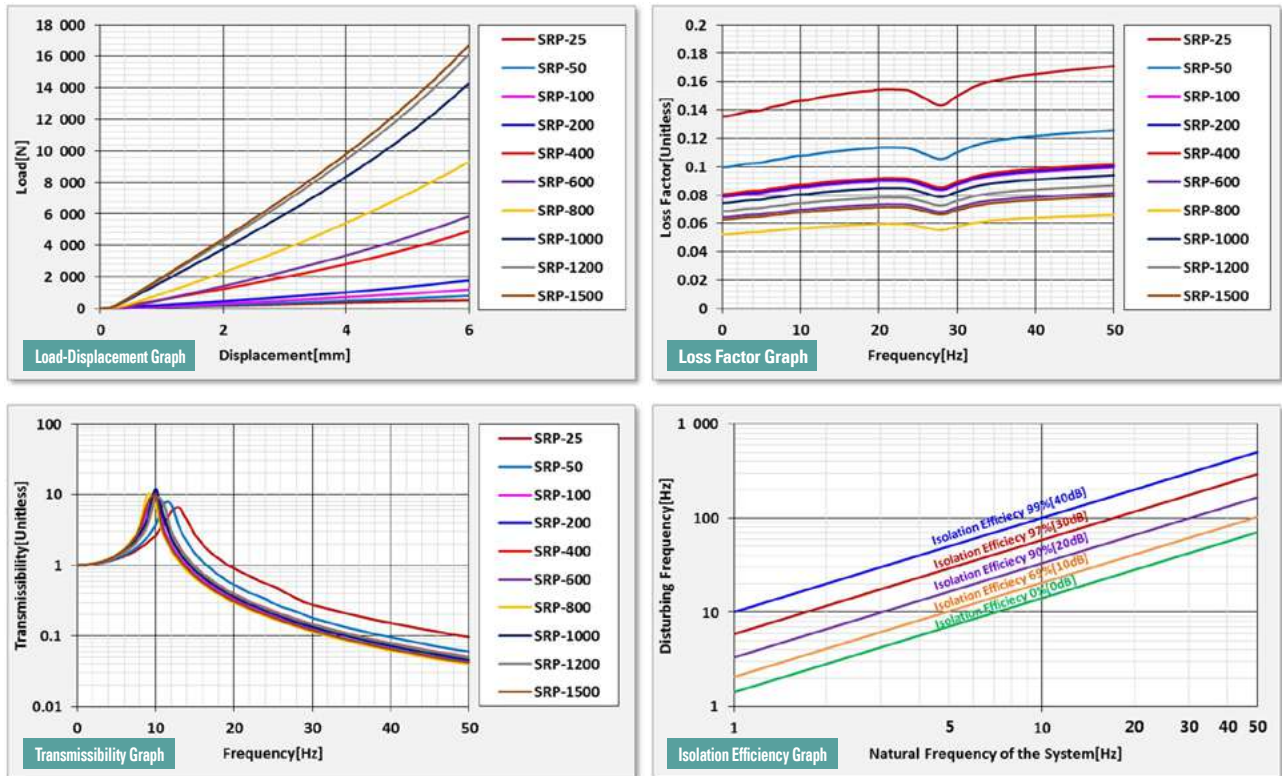
■ Dimension & Selection Guide

Type	Capacity (kgf)	Hardness (Hs)	Deflection (mm)	Weight (kg)	Dimension(mm)		
					A	B	H
SRP-25	25	45±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			
SRP-1200	1200			0.88	154	118	30
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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

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.

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

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 Efficiency(E)

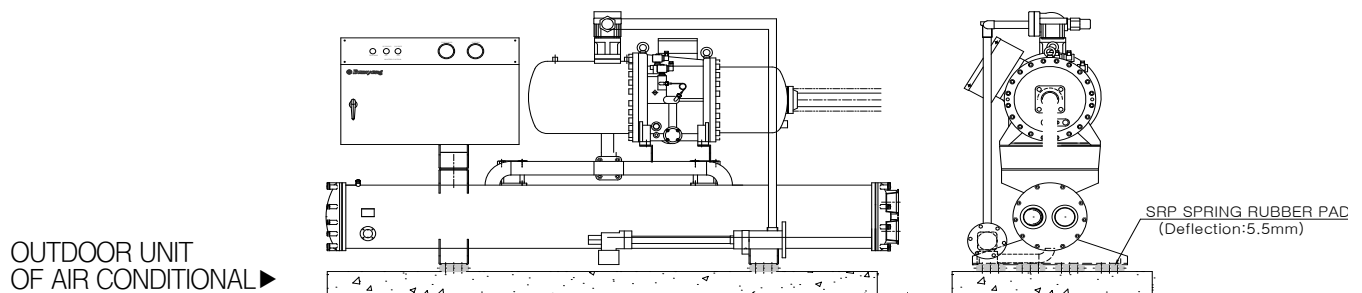
Isolation Efficiency in percent transmission is related to Vibration Transmissibility $E = 100(1 - T_r)$

ex) Disturbing Frequency of the equipment=100 Hz,

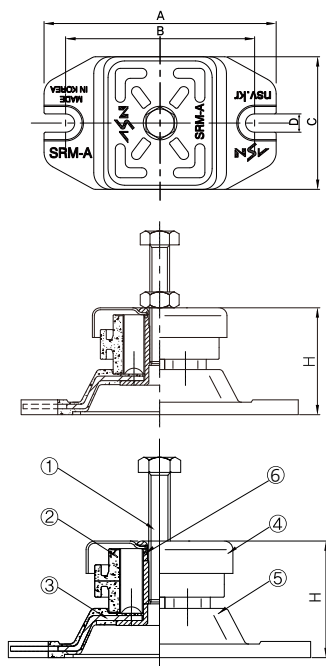
Natural Frequency of the isolator=10Hz

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

Installation Features



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	Bolt	SS 400	KS B 1002
2	SRM Upper	SUS 304	KS D 3698
3	SRP	SUP9	KS B 2402
		CR	KS M 6617
4	SRM Lower	CR	KS M 6617
5	SRM Fix Nut	SC45C	KS D 3752
6	SRM Insert	SS400	KS D 3503

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

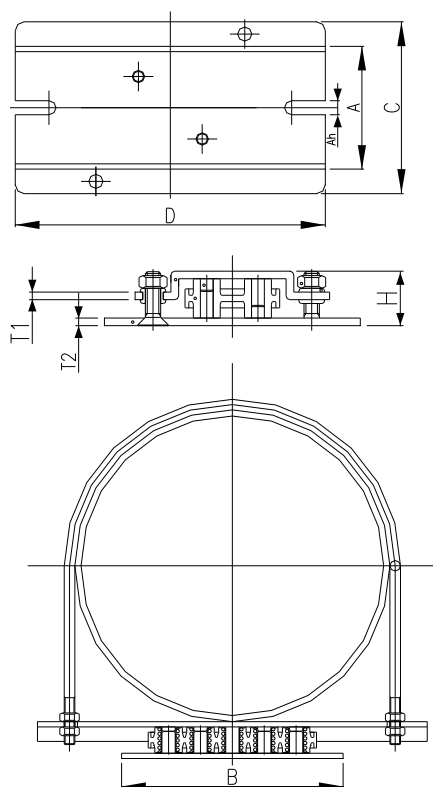
■ Dimension & Selection Guide

Type	Capacity (kgf)	Deflection (mm)	Weight (kg)	Dimension(mm)					Level Bolt
				A	B	C	D	H	
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		3.33	290	259	130	13	55	M12 x 65
SRM-1000	1000								
SRM-1200	1200								
SRM-1500	1500								
SRM-2000	2000								

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



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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Pipe Diameter	SRP	Dimension(mm)						
		A	B	C	H	AH	T1	T2
50A	A(100,200)	86	110	138	40	12	3.2	6
65A		86	110	138				
80A		74	120	126				
100A		74	120	126				
125A		74	120	126				
150A		74	120	126				
	B(400~800)	122	150	178	42	16	6	
200A	B(400~800)	122	210	178				
250A	B(400~800)	122	260	178				
250A	C(1000~2000)	140	260	196				
300A	B(400~800)	122	300	178				
300A	C(1000~2000)	140	300	196				
350A		140	320	196				
400A		140	400	196				
450A		140	420	196				
500A		140	500	196				

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

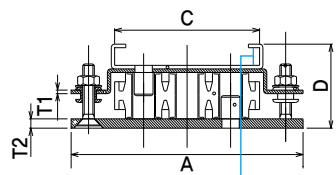
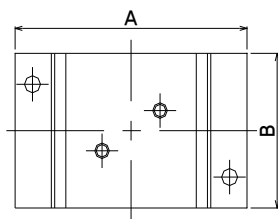
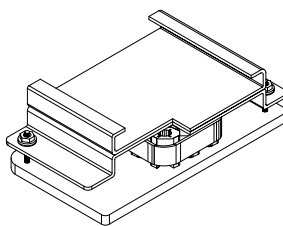
SRH-SH Spring Rubber Mount (Deflection : 5.5mm)

■ 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



SHOE Height : 11.4~12

■ SRH-A TYPE Dimension & Selection Guide

Pipe Diameter	SRP	SHOE SIZE"KS"	Dimension(mm)					
			A	B	C(SHOE width)	D	T1	T2
50A	A(100,200)	72	166	100	80	54.3	3.2	4.5
65A								
80A								
100A								
125A								
150A	A,B(100~800)	96	166	100	105	54.3	3.2	4.5
200A								
250A								
300A								
350A								
400A	B,C(400~2000)	146	216	140	156	54.3	3.2	4.5
450A								

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



B TYPE



C TYPE



D TYPE



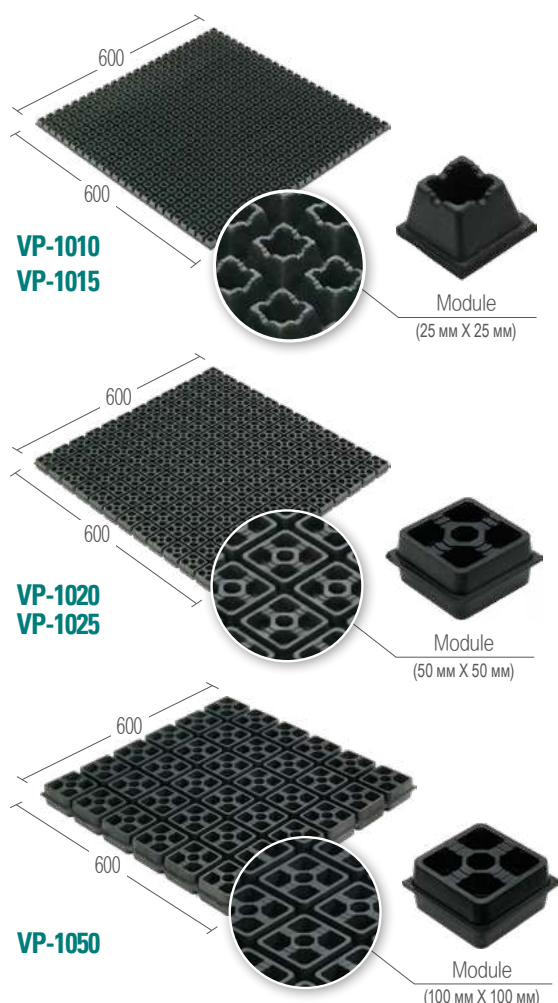
E TYPE



F TYPE

※ The size of each SRH-SH from B type to F type can be custom-made.

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



■ 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.

■ Application

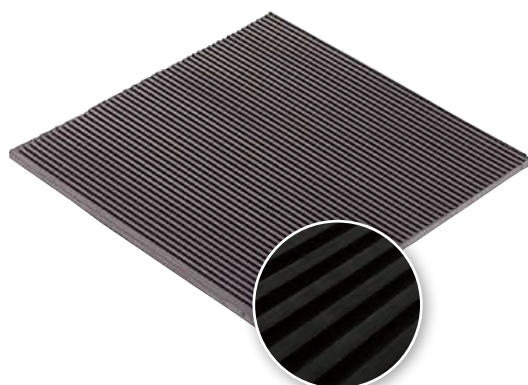
- ◆ In general, to control HF vibration by installing it under the bottom of the machine
- ◆ To damp vibration from generators/air compressors/chillers/air handling units
- ◆ To damp vibration form various kinds of machine installed on the solid base.
- ◆ To prevent transmission of vibration and noise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

■ Dimension & Selection Guide 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

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

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

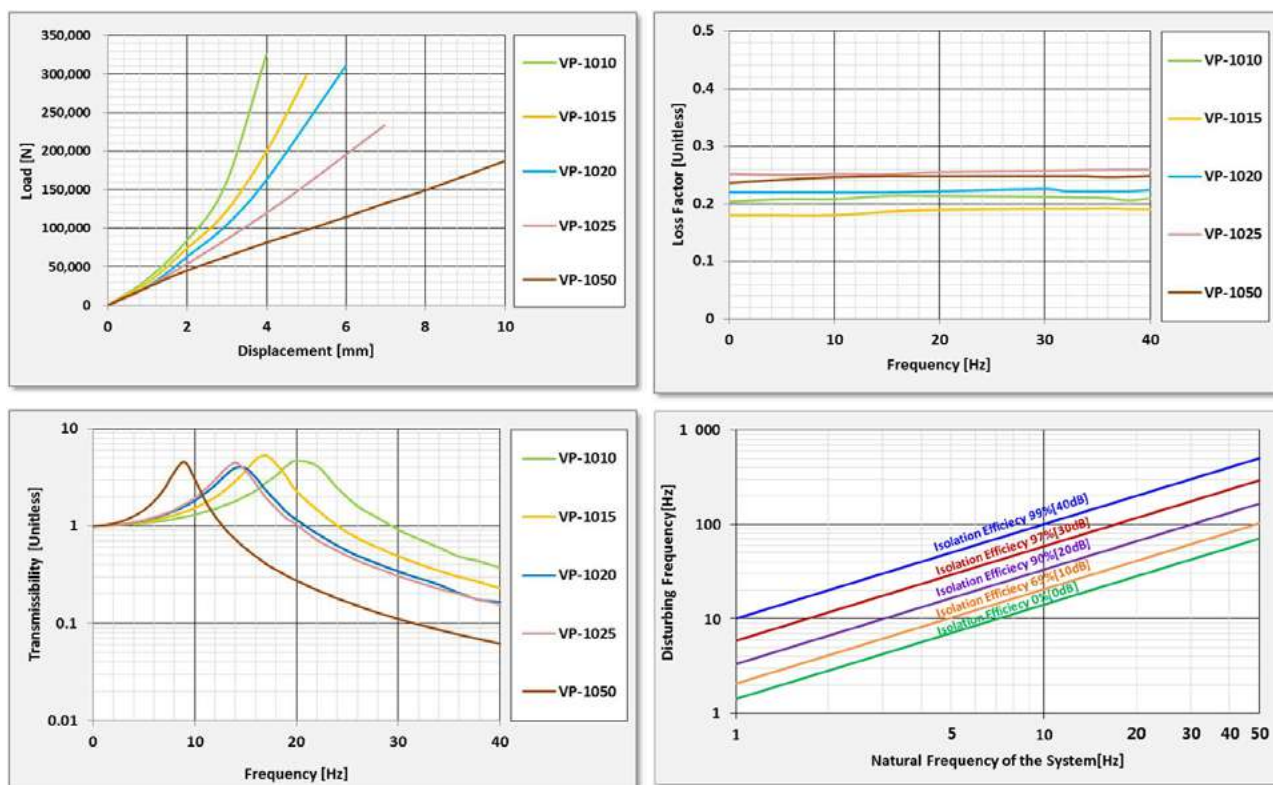
■ Dimension & Selection Guide

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

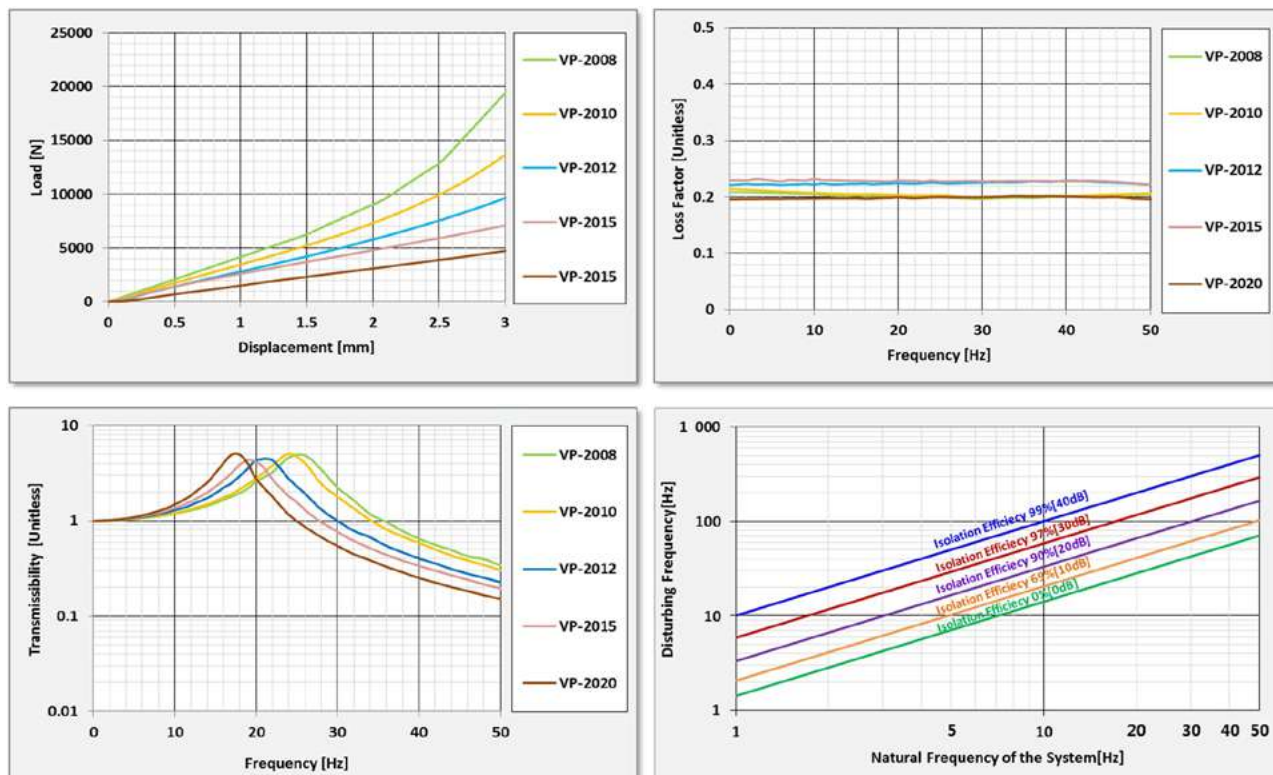
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VP-1000/VP-2000 Rubber Pad

VP-1000 Test Data



VP-2000 Test Data

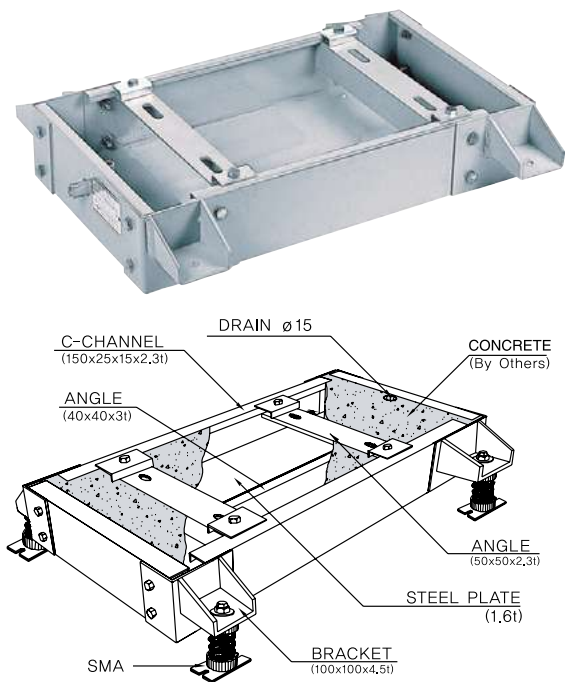


IB Inertia Base Series

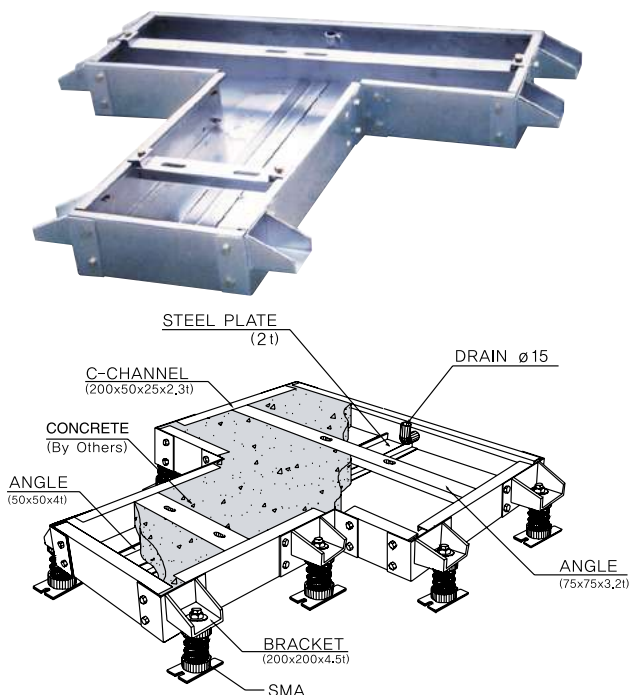
■ Features

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 (┐-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.)



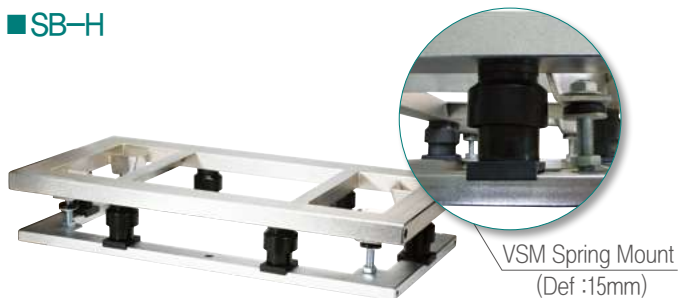
■ IB-200 series For Double-Suction Pumps



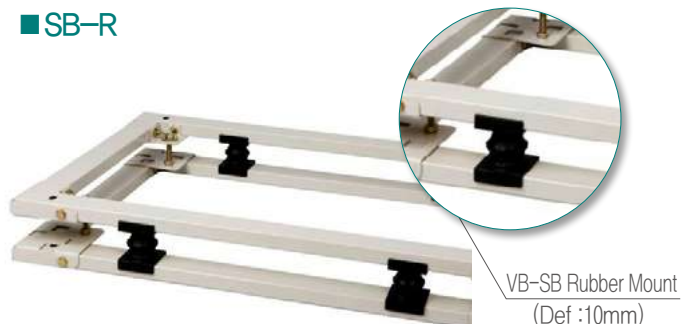
■ Features

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.

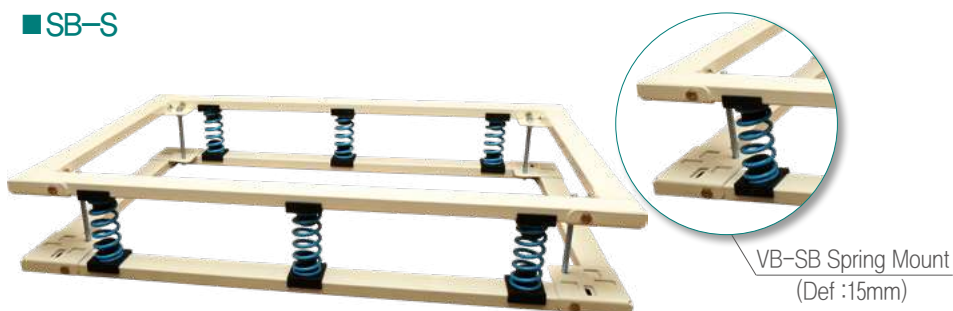
■ SB-H



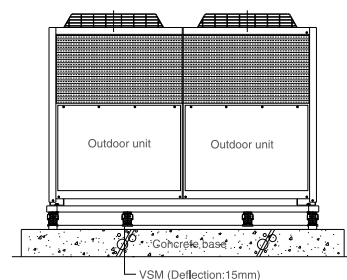
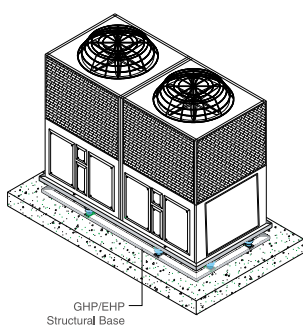
■ SB-R



■ SB-S



■ SB Installation Details Drawing



NFC Flexible Connector

NFC10S



Screw Type

NFC10



1Ball Type

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: $-20^{\circ}\text{C} \sim +80^{\circ}\text{C}$
- (b) Operating pressure: for 10kgf/cm^2 and 20kgf/cm^2
- (c) Materials: NEOPRENE, EPDM

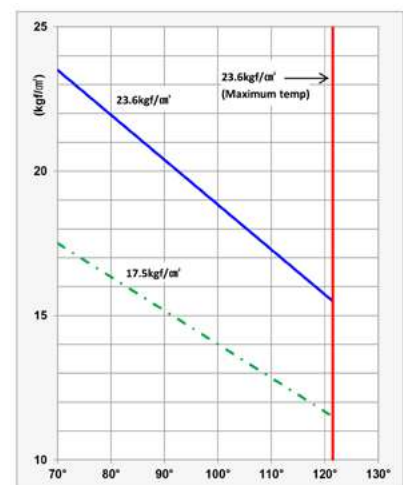
■ The composition of products

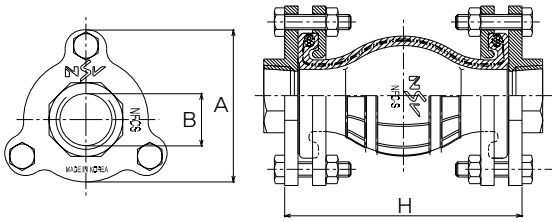
It is made of nylon tire cord, special synthetic rubber (NEOPRENE, EPDM) and piano steel wire. It has a stiffening ring between balls to avoid excessive expansion by internal pressure.

■ 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/cm^2 and usage pressure is up to maximum 30kgf/cm^2 .
- (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 protects 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 Temperature



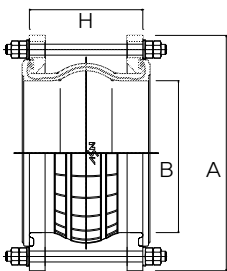


NFC10S (Screw Type)

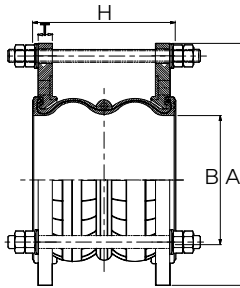
■ Dimension & Selection Guide

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

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



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°	3	3
NFC10(20)-150	280	150A	150	180		19	22	20°		
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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

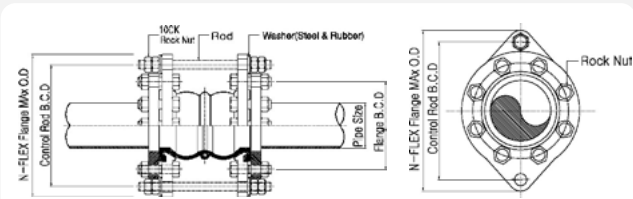
■ 450A or larger products can be manufactured upon request



We use control rods with larger than 450A NFC products

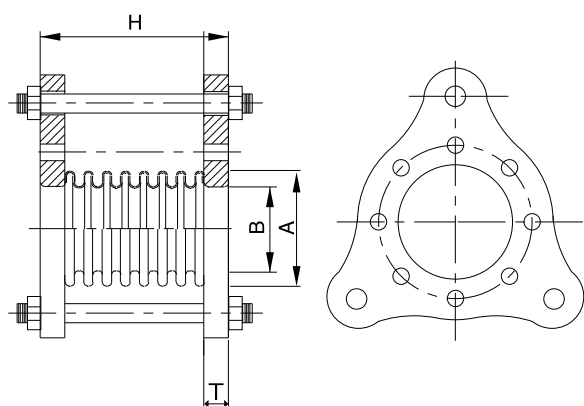
■ Anchoring and Control rods of pipe line

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



■ 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 bellows, 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

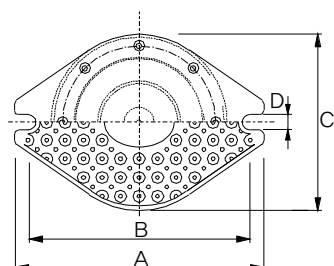
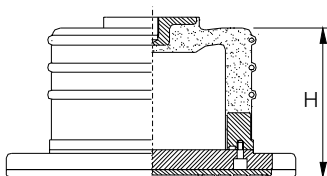
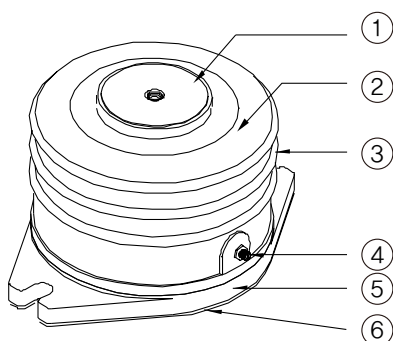
- ◆ Applied fluid : cool & hot water, steam, liquid
- ◆ Maximum operating pressure : 10kgf/20kgf cm²
- ◆ Maximum operating temperature : 220°C
- ◆ Connecting method : KS 10K/20K Flange
- ◆ Resisting pressure test : 15kgf/30kgf cm² in water
- ◆ Material : Bellows/STS 304, Flange/SS400

■ Dimension & Selection Guide

Type	Compression	Flange Dimension(mm)			
		A	B	T	H
NV10-10K-32	10kgf/cm ²	170	46	16	80
NV10-10K-40		183	46	16	80
NV10-10K-50		205	67	16	115
NV10-10K-65		225	67	16	120
NV10-10K-80		235	77	16	120
NV10-10K-100		260	103	16	125
NV10-10K-125		300	129	19	130
NV10-10K-150		330	155	19	140
NV10-10K-200		380	204	19	150
NV10-10K-250		478	263	25	200
NV10-10K-300		523	317	25	200
NV10-10K-350		568	359	25	200
NV10-10K-400		638	409	28	200
NV10-20K-32	20kgf/cm ²	170	46	19	85
NV10-20K-40		183	46	19	85
NV10-20K-50		205	67	19	119
NV10-20K-65		225	67	19	128
NV10-20K-80		250	77	22	132
NV10-20K-100		275	103	25	141
NV10-20K-125		320	129	25	144
NV10-20K-150		355	155	28	158
NV10-20K-200		400	204	30	172
NV10-20K-250		508	263	35	218
NV10-20K-300		558	317	35	222
NV10-20K-350		618	359	40	230
NV10-20K-400		683	409	45	236

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

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



■ 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

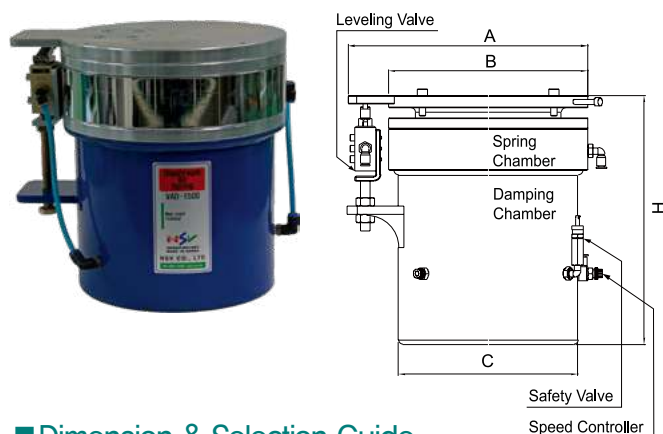
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity(kgf)		Design Pressure (kg/cm ²)	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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VAM20 Pneumatic Leveling Isolator



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

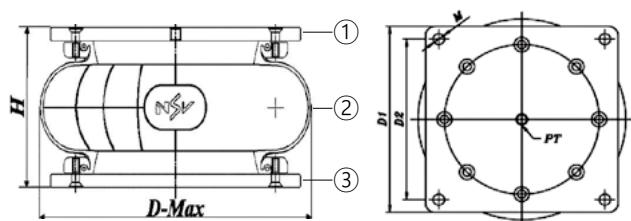
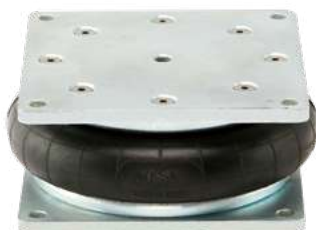
■ Features

It is used to control the vibration of high precision inspection and measurement equipment. Because it has a low natural frequency less 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

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

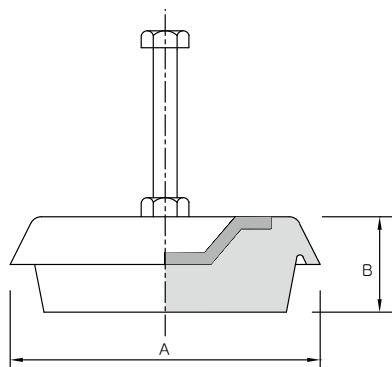
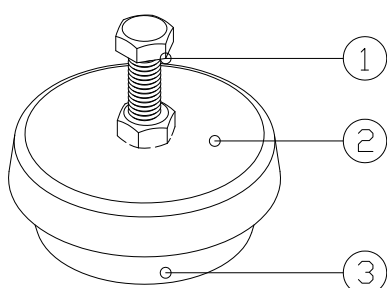
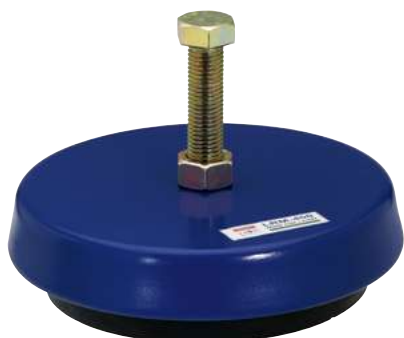
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide By Loads

Type	Design Load (kgf)	Design Pressure (kgf/cm ²)	Maximum Design Displacement (mm)	Natural Frequency (Hz)	Dimension(mm)						
					D1	D2	D-max	H	M	PT	Level Bolt
VAM52-450	45~450	1~7	+20/-15	4.0~5.0	150	130	105	11	67	1/8"	M12
VAM52-600	60~600	1~7	+15/-25	3.5~4.5	180	160	124	13	93	1/4"	M12
VAM52-900	100~900	1~7	+25/-40	2.8~3.8	250	230	172	13	93	1/4"	M12
VAM52-1300	150~1300	1~7	+30/-60	2.6~3.4	350	330	246	13	93	1/4"	M16
VAM52-3000	350~3000	1~7	+40/-60	2.4~3.0	480	460	340	14	95	1/4"	M20

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

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

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

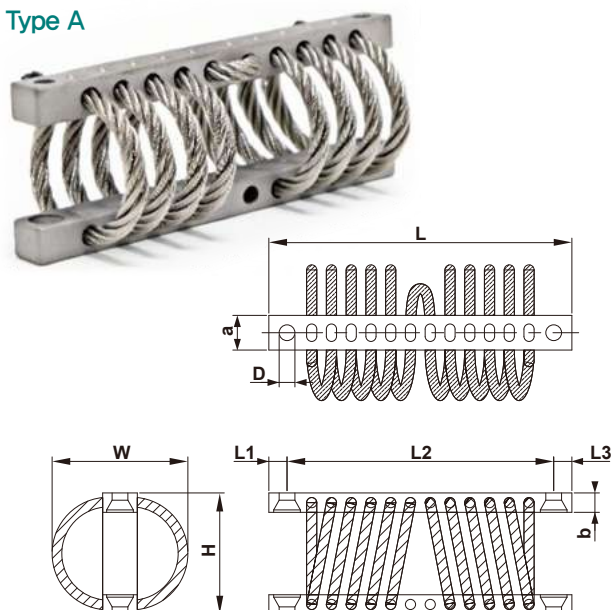
■ Dimension & Selection Guide

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

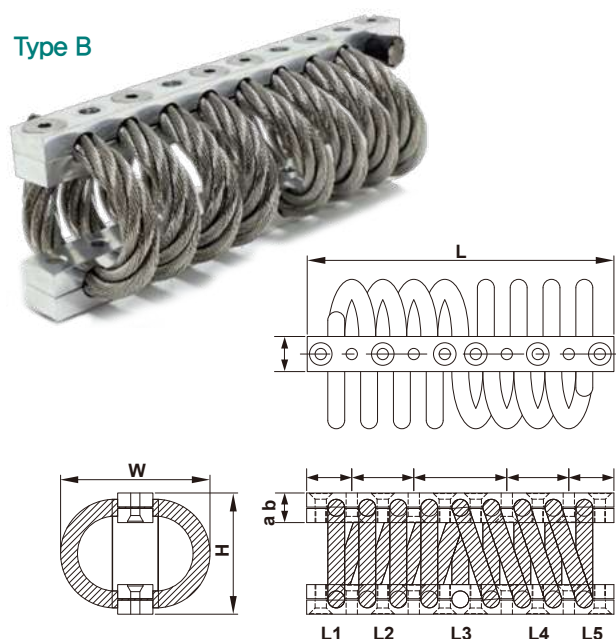
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VWM10 Type Wire Mount

Type A



Type B



■ Features

The VWM10 (Wire Mount) is an anti-vibration product that provides excellent vibration isolation performance by preventing the transmission of vibrations generated by structures in reciprocating or rotatory motion while simultaneously reducing the dynamic displacement of the structures. Additionally, the product provides outstanding buffering performance by absorbing the kinetic energy of external shocks and converting it into heat energy, thereby protecting structures from external impacts. Furthermore, it features a friction damping effect generated by the friction between plastic deformations of wire strands and achieves superior damping performance compared to other products.

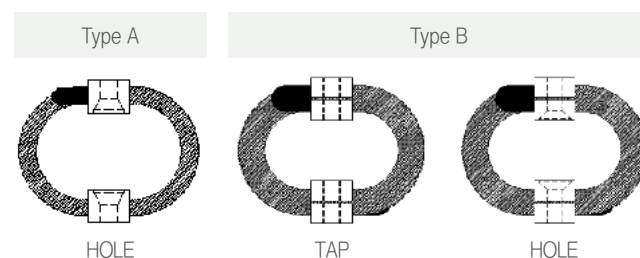
■ Usage

- ◆ Simultaneous control of multidirectional shocks and vibrations
- ◆ High damping performance that prevents surging and minimizes vibration transmission during resonance
- ◆ Superior isolation of high-frequency vibrations
- ◆ Excellent resistance to corrosion and heat

■ Applications

- ◆ Structures that require buffering against impulsive vibrations such as onboard electronic/communication equipment and plant piping
- ◆ Vibration control for industrial machinery
- ◆ Mobile equipment (equipment inside containers, construction modules, etc.)
- ◆ Vibration prevention and removal for precision machinery
- ◆ Other equipment that requires vibration buffering

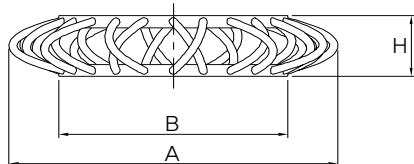
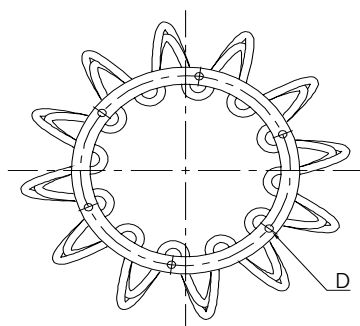
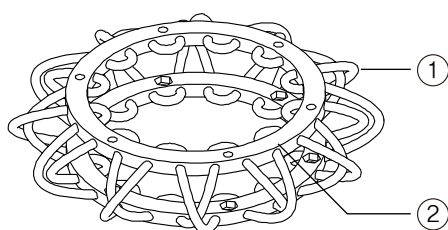
■ Hole Option



■ Dimension & Selection Guide

Type	Model	Dimension(mm)												Stiffness (N/mm)	Load (kgf)	Deflection (mm)	Weight (kg)
		Wire ø	D	H	W	L	L1	L2	L3	L4	L5	a	b				
A	VWM10-04	4	6.5	50	56	125	7.5	110	7.5	-	-	14	8	27	40	15	0.3
	VWM10-05	5	6.5	55	59	125	7.5	110	7.5	-	-	14	11	56	84	15	0.4
	VWM10-06	6	6.5	55	62	150	8	134	8	-	-	15	12	108	72	15	0.5
B	VWM10-08	8	6.0	65	77	160	24	32	48	32	24	16	17	168	252	15	0.6
	VWM10-10	10	8.0	78	95	189	28	38	57	38	28	20	17	204	305	15	1.0
	VWM10-12	12	8.0	86	106	218	32	44	66	44	32	25	21	328	656	20	1.7
	VWM10-16	16	10.0	93	113	265	38	54	81	54	38	25	26	736	1473	20	3.0
	VWM10-20	20	12.0	110	125	325	47	66	99	66	47	30	31	1277	2553	20	5.0

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



■ 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	Retainer Bar	STS304

*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

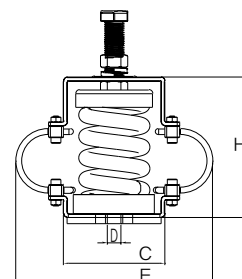
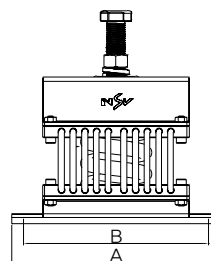
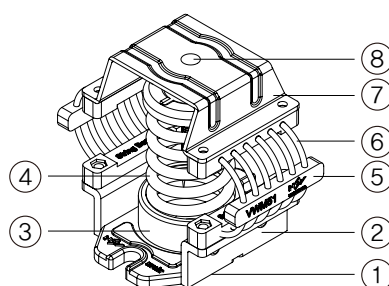
■ Dimension & Selection Guide

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

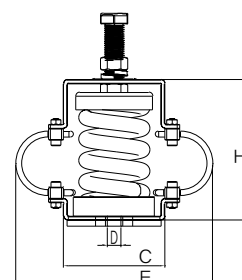
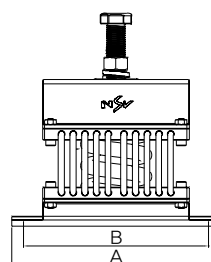
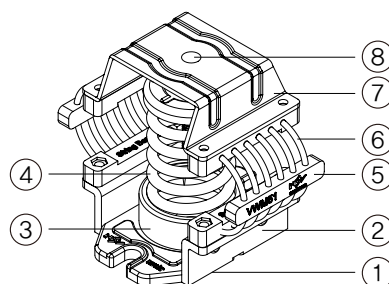
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VWM51/VWM52 Wire Spring Mount (Deflection : 25mm / 50mm)

VWM51



VWM52



■ Features

This product combines the elasticity of coil springs with the excellent damping effect of wire ropes to simultaneously provide vibration isolation and dynamic stability for equipment. By reinforcing the rigidity of the wire mount, it is capable of handling heavy loads.

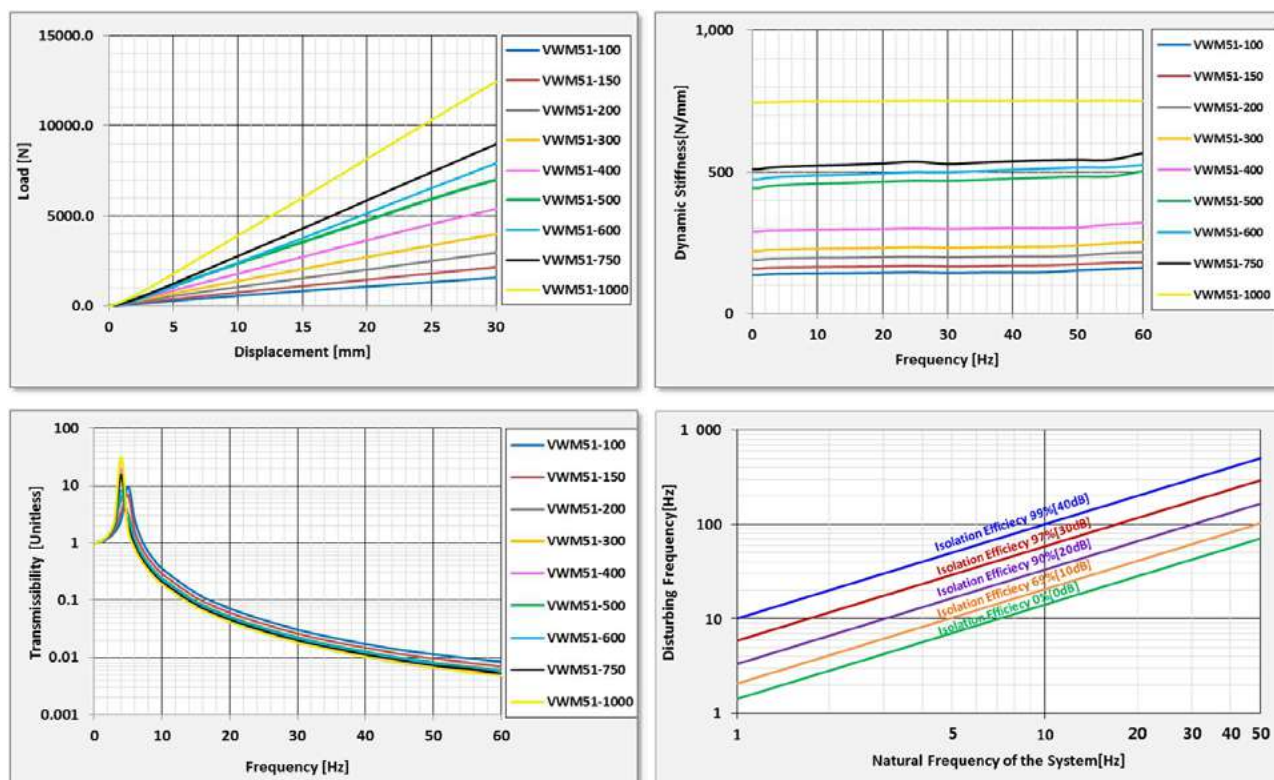
■ Dimension & Selection Guide

Type	Capacity (kgf)	Spring Constant (kgf/mm)	Color	Dimension(mm)						
				A	B	C	D	E	H	Connection Bolt
VWM51-100	100	4.0	Blue	138	108	89	13	158	142	M10 x 60
VWM51-150	150	6.0	Brown							
VWM51-200	200	8.0	White							
VWM51-300	300	12.0	Orange							
VWM51-400	400	16.0	Pink							
VWM51-500	500	20.0	Green	192	162	112	16	210	179	M12 x 65
VWM51-600	600	24.0	Blue							
VWM51-750	750	30.0	Black							
VWM51-1000	1000	40.0	Yellow							
VWM51-1200	1200	48.0	Red							
VWM51-1500	1500	60.0	Brown							
Type	Capacity (kgf)	Spring Constant (kgf/mm)	Color	Dimension(mm)						
				A	B	C	D	E	H	Connection Bolt
VWM52-100	100	2.0	Blue	216	180	139	16	238	188	M12 x 80
VWM52-150	150	3.0	Brown							
VWM52-200	200	4.0	White							
VWM52-300	300	6.0	Orange							
VWM52-400	400	8.0	Pink							
VWM52-500	500	10.0	Green							
VWM52-600	600	12.0	Blue							
VWM52-750	750	15.0	Black							
VWM52-1000	1000	20.0	Yellow							
VWM52-1200	1200	24.0	Red							
VWM52-1500	1500	30.0	Brown							

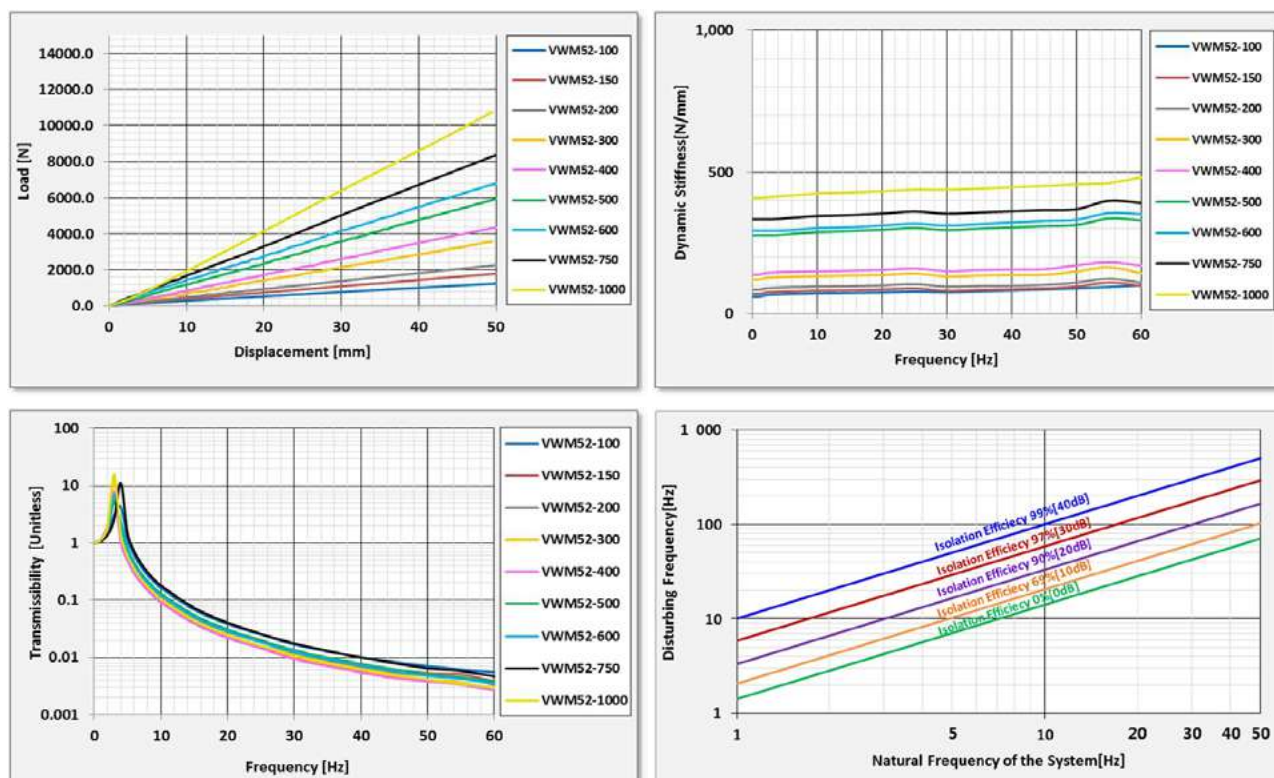
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

VWM51/VWM52 Wire Spring Mount

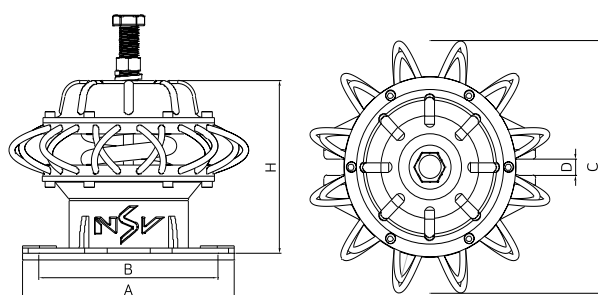
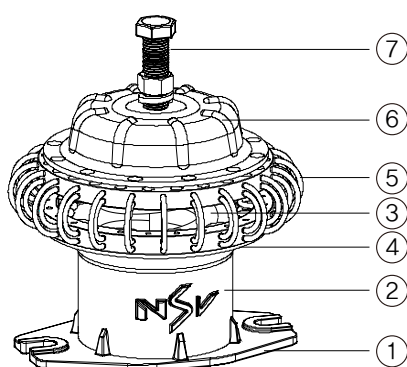
VWM51- Test Data



VWM52- Test Data



VWM62 Wire Spring Mount (Deflection : 50mm)



■ 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

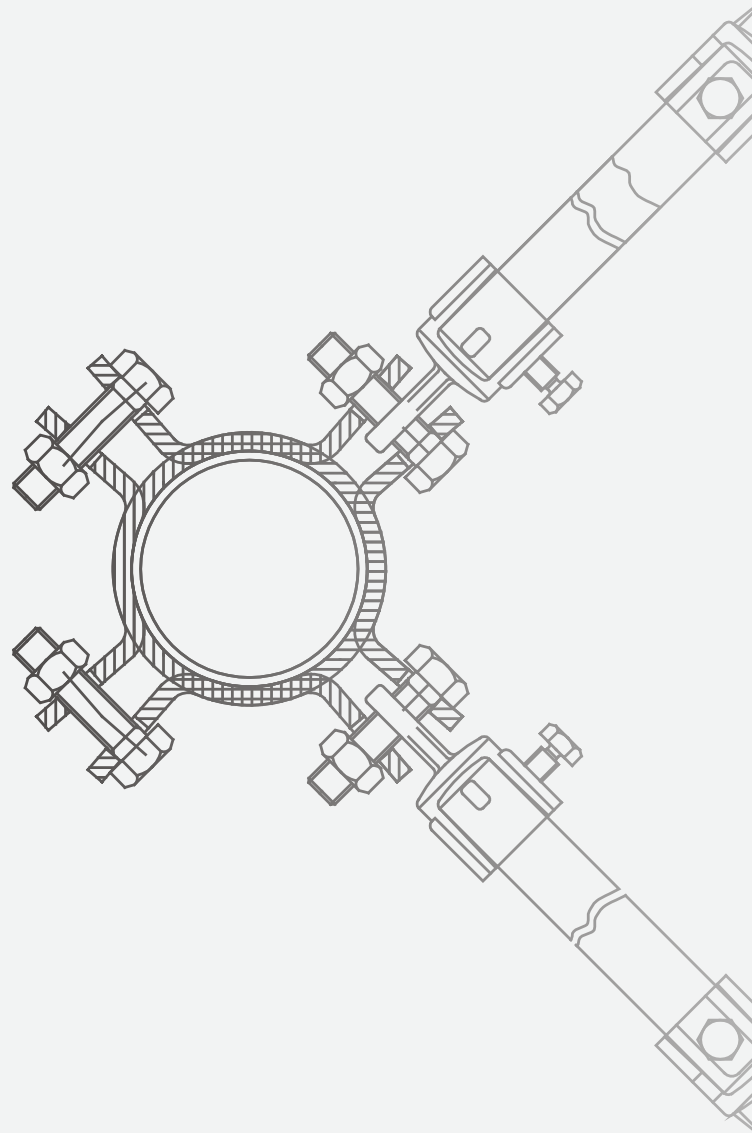
*All specifications are subject to change at the manufacturer's discretion or per customer requirements.

■ Dimension & Selection Guide

Type	Capacity (kgf)	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: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

SEISMIC CONTROL



SEISMIC CONTROL

ISO 9001/ISO 14001/ISO 45001
MADE IN KOREA

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 Civil 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 (EUROCODE 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 F_p are as follows. F_p 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 F_p , the design shall be for wind load.

Seismic design force (F_p)

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

Seismic design force for max. (F_p)

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

Seismic design force for min. (F_p)

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

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 carries from 1.0 to 1.5

z : Height in structure of point of attachment of component with respect to the base.

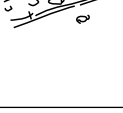
$z = 0$: If a nonstructural components is located below the structure base.

$z = h$: If a nonstructural components is located to the roof or higher place of a structure

SEISMIC COEFFICIENTS FOR MECHANICAL AND ELECTRICAL COMPONENTS

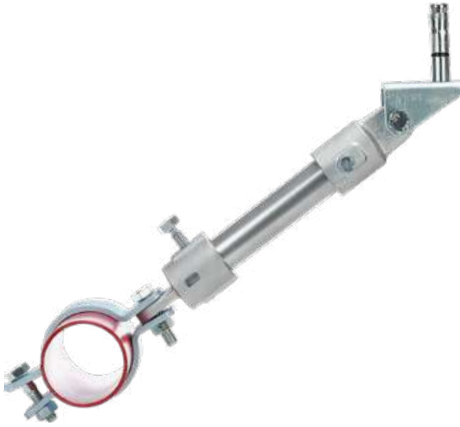
MECHANICAL AND ELECTRICAL COMPONENTS	a_p^a	R_p^b	$\frac{\Omega_p^c}{\Omega_s^c}$
Air-side HVAC, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing.	2 ½	6	2 ½
Wet-side HVAC, boilers, furnaces, atmospheric 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

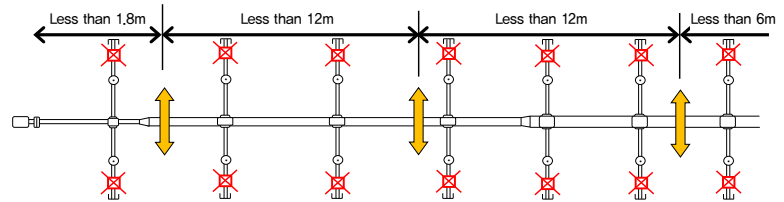
Seismic level	JMA		MM		Richter	Situations
	Intensity	Ground acceleration	Intensity	Ground acceleration	Magnitude	
	I (Slight earthquake)	0.8~2 gal	I	—	2	Not felt except by very few under especially favorable conditions.
	II (Weak earthquake)	2.5~8 gal	II	—		Felt only by a few people especially on upper 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.
	V (Very strong earthquake)	80~250 gal	VI	60~70	5.1 5.1 5.8	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.
			VII	100~150		Damage slight in specially designed structures. Considerable damage in ordinary substantial buildings with partial collapse. Heavy furniture overturned.
	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



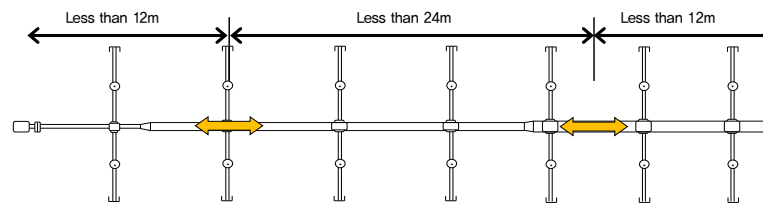
- Lateral sway bracing shall be provided on all feed and cross mains regardless of size and all branch lines and other piping with a diameter of 65 mm and larger.
- The distance between the last brace and the end of the pipe shall not exceed 1.8m.
- Spacing shall not exceed a maximum interval of 12m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



Longitudinal Sway Bracing



- A longitudinal sway bracing shall be provided on all feed and cross mains regardless 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.



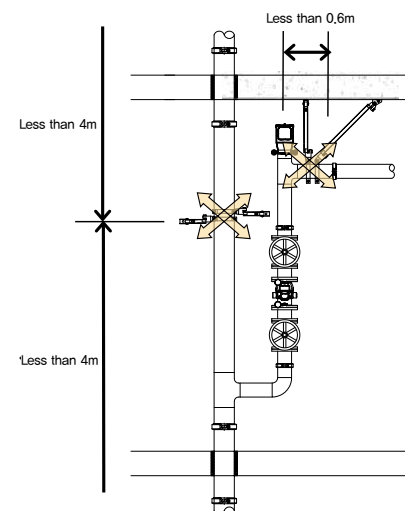
4-Way Sway Bracing



(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 Bracing 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			
		30°	45°	60°	90°
ND-50	50A	3,559	5,032	6,163	7,117
	65A				
	80A				
	100A	4,481	6,337	7,762	8,963
	125A				
	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	1,935	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



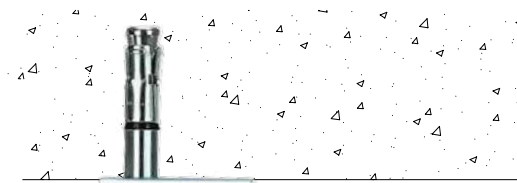
● Features

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 Sway Bracing



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

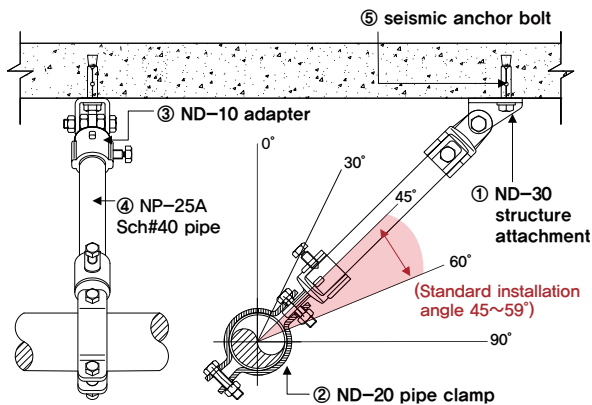
ND-30 A/B



ND-20



ND-10 A/B



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)			
		30°	45°	60°	90°
ND-H-32	32A	1,512	2,138	2,619	3,025
ND-H-40	40A				
ND-H-50	50A	2,424	3,428	4,199	4,849
ND-H-65	65A				
ND-H-80	80A				
ND-H-100	100A	3,047	4,309	5,277	6,094
ND-H-125	125A				
ND-H-150	150A				
ND-H-200	200A	4,192	5,929	7,261	8,385
ND-H-250	250A				
ND-H-300	300A	5,671	8,020	9,822	11,342

Sway Bracing (Longitudinal)

ND-V Sway Bracing



● 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

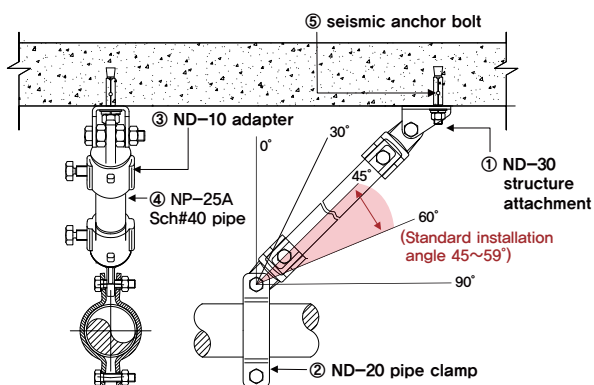
● ND-30 A/B



● ND-20



● ND-10 A/B



● 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)			
		30°	45°	60°	90°
ND-V-32	32A	1,512	2,138	2,619	3,025
ND-V-40	40A				
ND-V-50	50A				
ND-V-65	65A	2,424	3,428	4,199	4,849
ND-V-80	80A				
ND-V-100	100A				
ND-V-125	125A	3,047	4,309	5,277	6,094
ND-V-150	150A				
ND-V-200	200A				
ND-V-250	250A	4,192	5,929	7,261	8,385
ND-V-300	300A	5,671	8,020	9,822	11,342

ND-4W Sway Bracing



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.

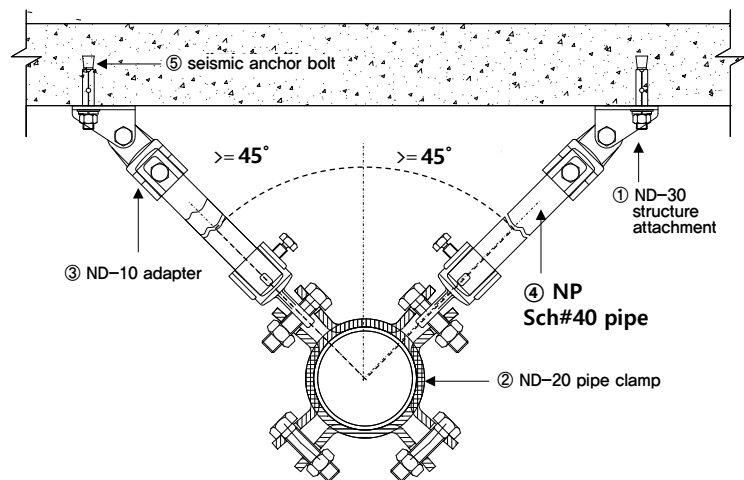
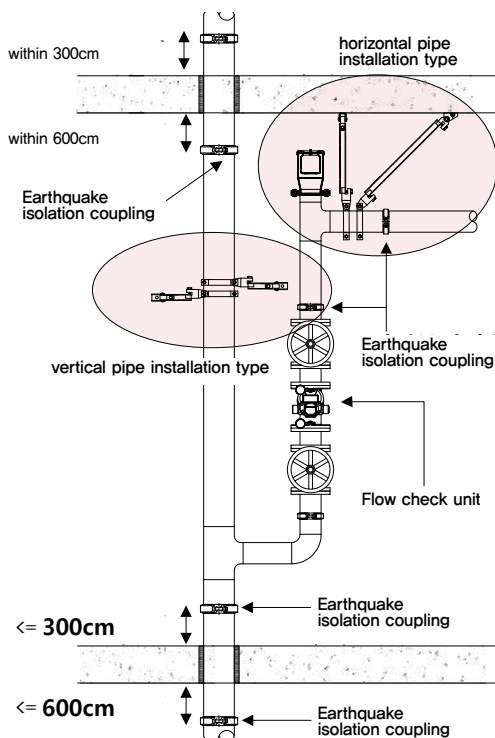
● ND-10 A/B



● ND-20



● ND-30 A/B



Sway Bracing (Longitudinal, for low height ceiling space)

ND-R Sway Bracing



● 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



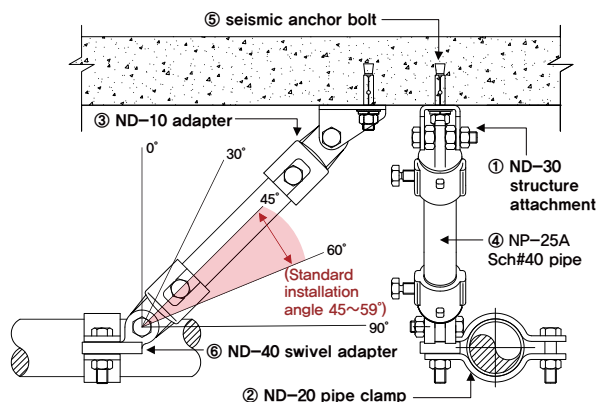
● ND-10 A/B



● ND-20



● ND-30 A/B



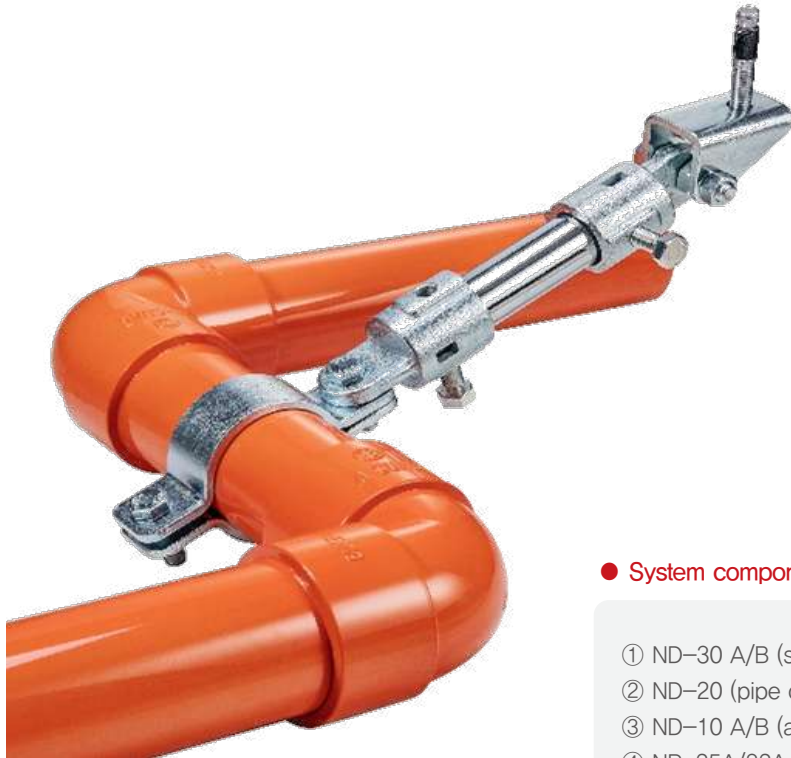
- Min embedment depth of anchor bolt : 50mm
- It is beneficial when applying to the common area of a Apartment house or low height ceiling space within a house
- Installation Standards

- 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)		
		45°	60°	90°
ND-R-40	40A	2,138	2,619	3,025
ND-R-50	50A			
ND-R-65	65A			
ND-R-80	80A			
ND-R-100	100A			

ND-CP Sway Bracing



● ND-30 A/B



● ND-21 (CPVC)



● ND-10 A/B



● System components

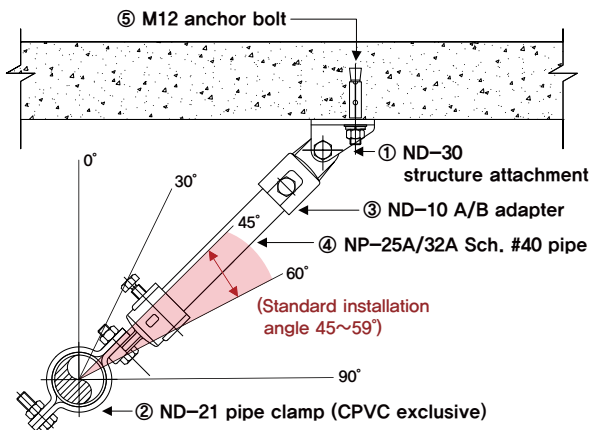
- ① ND-30 A/B (structure attachment)
- ② ND-20 (pipe clamp) – for CPVC
- ③ ND-10 A/B (adapter)
- ④ NP-25A/32A Sch. #40 pipe
- ⑤ M12 anchor bolt

● Min. embedment depth of anchor bolt : 50mm

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

● Installation Standards

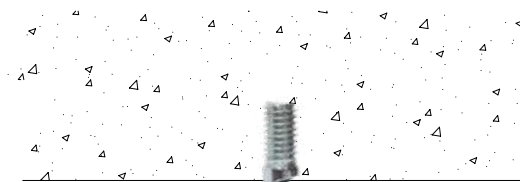
- 1) If the distance between ceiling and pipe top surface is less than 150mm, it is possible not to install a lateral sway Bracing
- 2) In case of a fire protection pipe that passes the anteroom and interior of a house or multi-tenant house is made of CPVC , if it is using a lateral/ longitudinal Sway Bracing for used in steel pipe, it becomes 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)		
		45°	60°	90°
ND-CP-32	32A	2,138	2,619	3,025
ND-CP-40	40A			
ND-CP-50	50A			
ND-CP-65	65A			
ND-CP-80	80A			
ND-CP-100	100A			

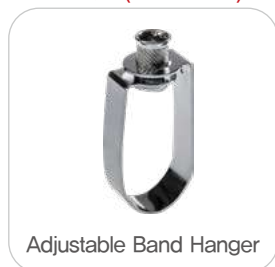
ND-E Branch Pipe End Fixture



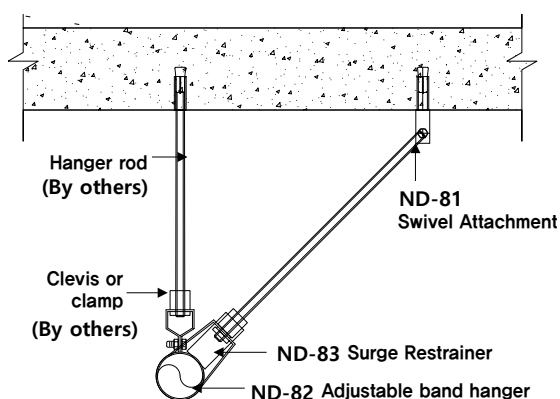
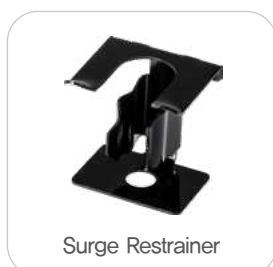
● ND-81



● ND-82 (25A~50A)



● ND-83



● 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-84 (Beam Structure Attachment)



〈For branch pipe end fixing〉

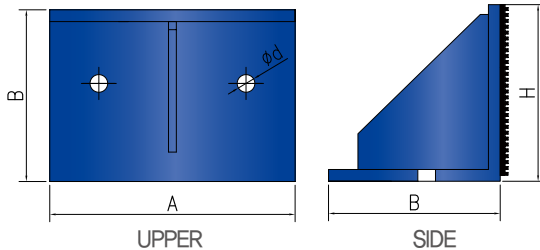
● Features

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-10 Seismic Stopper



● 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.

● Specification

No.	Name	Materia	Standard
1	Stopper Steel Plate	SPHC	KS D 3501
2	Seismic Rubber	CR	KS M 6617

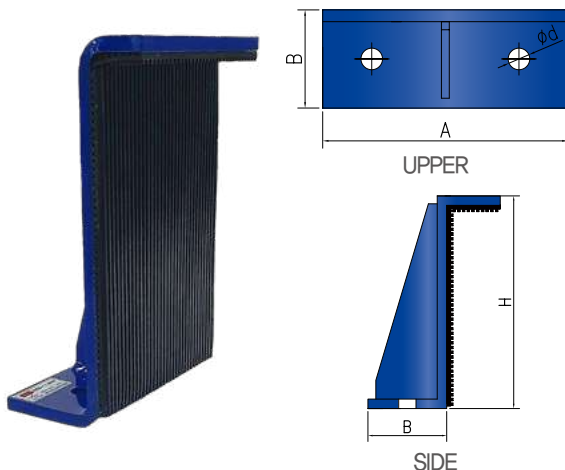
* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Application Load(kgf)	Dimension(mm)			
		A	B	H	Ød
NSS-10-200	200	150	100	150	2-12
NSS-10-400	400	180	100	150	2-14
NSS-10-800	800	250	150	150	2-18
NSS-10-1200	1200	250	150	180	2-14
NSS-10-2000	2000	250	175	180	2-18
NSS-10-4000	4000	250	200	200	2-22
NSS-10-8000	8000	250	300	250	4-22
NSS-10-18000	18000	300	300	250	6-22

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

NSS-11 Seismic Stopper



● 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.

● Specification

No.	Name	Materia	Standard
1	Stopper Steel Plate	SPHC	KS D 3501
2	Seismic Rubber	CR	KS M 6617

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Application Load(kgf)	Dimension(mm)			
		A	B	H	Ød
NSS-11-200	200	150	100	290	18
NSS-11-400	400	200	100	320	18
NSS-11-800	800	200	100	320	22
NSS-11-1200	1200	250	100	270	22

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



● 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.

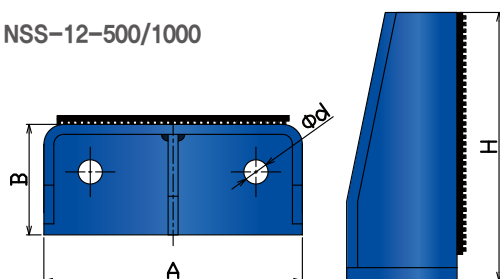
It has a simple structure and few limitations in installation, giving it the advantage of being easily applied and installed on nearly all equipment.

● Specification

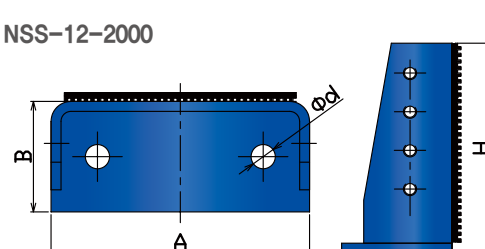
No.	Name	Materia	Standard
1	Stopper Steel Plate	SPHC	KS D 3501
2	Seismic Rubber	CR	KS M 6617

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

NSS-12-500/1000



NSS-12-2000

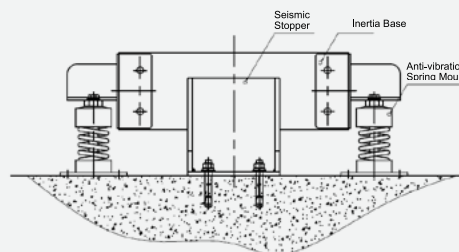
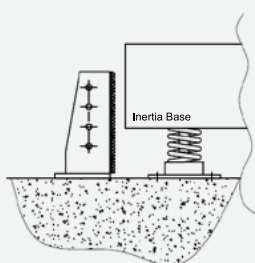


● Instruction and Installation Manual

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	H	Ød
NSS-12-500	500	180	100	190	18
NSS-12-1000	1000	234	100		22
NSS-12-2000	2000	234	100	243	22

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

NSS-13 Seismic Stopper



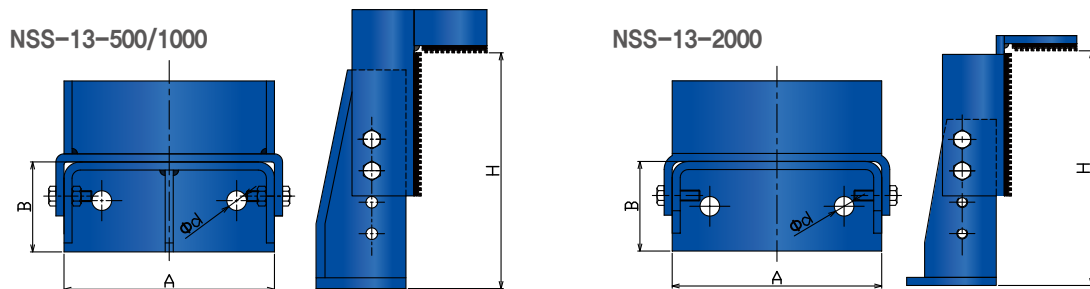
● Features

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.

● Specification

No.	Name	Material	Standard
1	Stopper Steel Plate	SPHC	KS D 3501
2	Seismic Rubber	CR	KS M 6617

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.



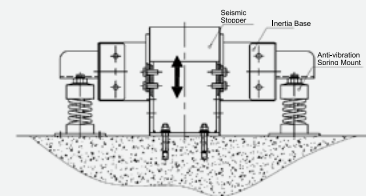
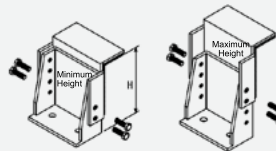
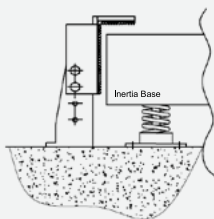
● Instruction and Installation Manual

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	H	Ød
NSS-13-500	500	180	100	190	18
NSS-13-1000	1000	234	100		22
NSS-13-2000	2000	234	100	243	22

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

ND-60 Seismic Rod



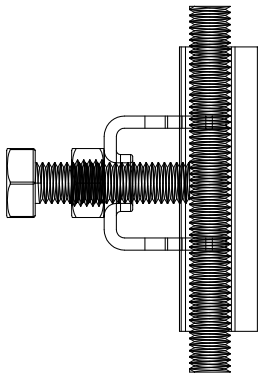
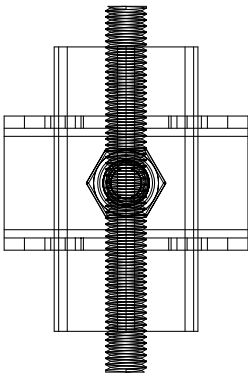
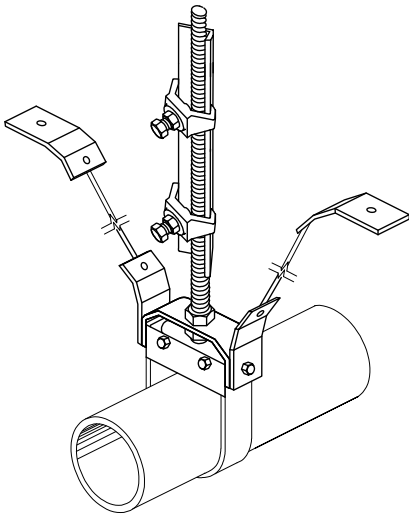
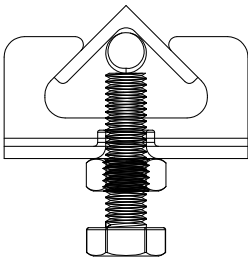
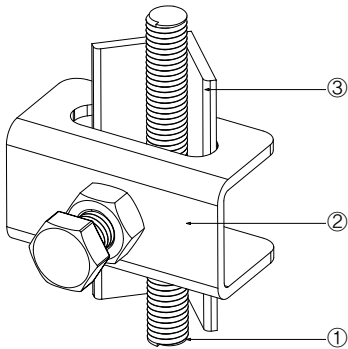
● Features

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.

● Specification

No.	Name	Materia	Standard
1	ROD STIFFENER	SS275	KS D 3503
2	CLAMP	SS275	KS D 3503

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.



● DIMENSION & SELECTION GUIDE BY LOADS

Type	A	B	H	Angle Size	Max Length
ND-60-A	80	47	51	25x25x3T	1400
				30x30x3T	1700
				40x40x3T	2300
ND-60-B	115	51	51	50x50x4T	2900
				65x65x6T	3800
ND-60-C	190	78	57	75x75x6T	4400
				90x90x7T	5300
				100x100x7T	5900

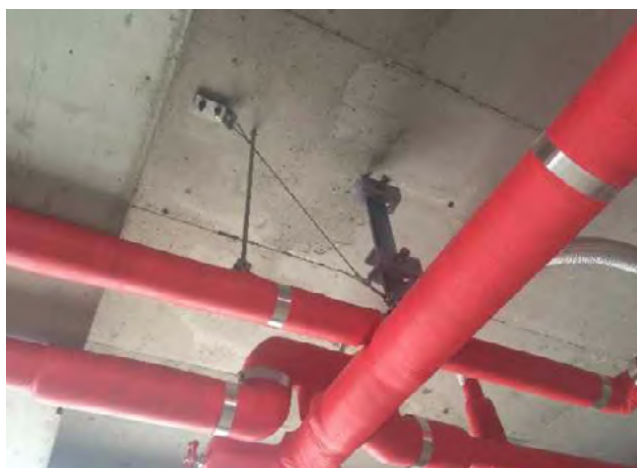
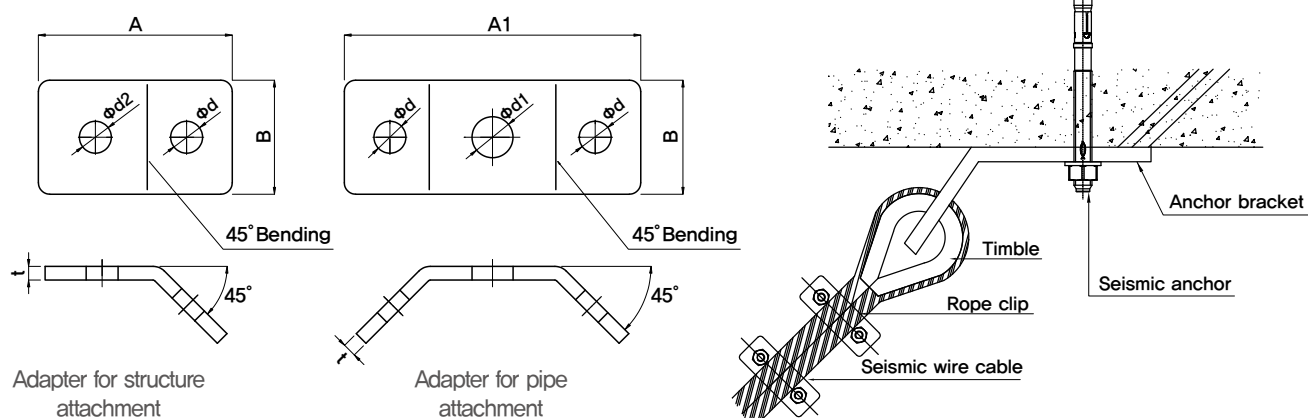
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

ND-70 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.



● DIMENSION & SELECTION GUIDE BY LOADS

Type	Cable Diameter(mm)	Cable Length(m)	Max Cable Tension(kgf)
ND-70-A	3	2	450
ND-70-B	5	2	950
ND-70-C	6	2	1500

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

SIB-SB Seismic Inertia Base

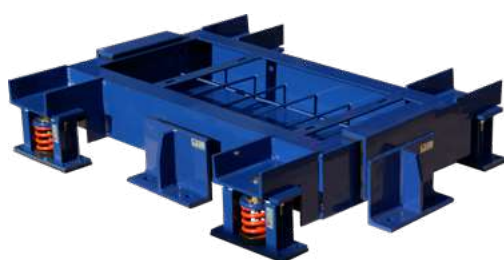


● Features

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 $\square$ -channel, a support fixture (Γ 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 Structure Base

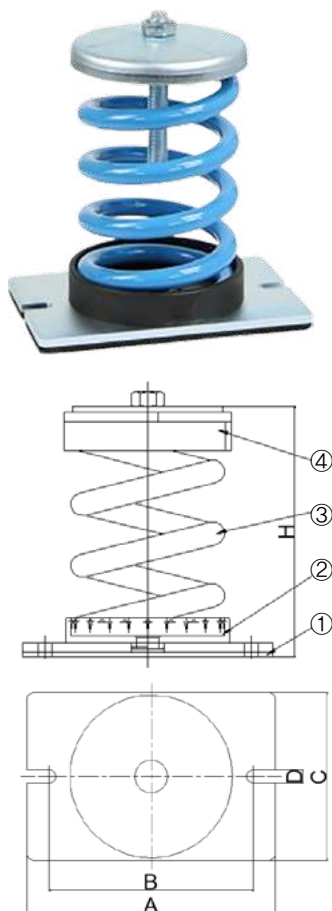


● Features

The structure base is a support fixture made of a $\square$ -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.



SMA62 Seismic Spring Mount (Deflection : 50mm)



● Features

The SMA62 Series, a model with a static displacement of 50mm, is a housingless open spring mount used for the quiet operation required by HVAC equipment installed on the ground level of buildings. It has the advantages that it is easy to check the static displacement of the spring with the naked eye, and to check the condition after installation.

The product consists of a coil spring located between the upper and lower caps, and rubber pads attached to the bottom of the base plate to prevent slipping and for high frequency insulation. The upper housing has a built-in fixing nut that helps to easily and smoothly adjust the leveling bolt vertically.

● Specification

No.	Name	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Spring Seat	CR	KS M 6617
3	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
4	Steel cap	SS275	KS D 3503

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension				
					A (mm)	B (mm)	C (mm)	D (mm)	H (mm)
SMA62-A-50	50	1	50	Red	150	122	105	ø 14	172
SMA62-A-100	100	2		Blue					
SMA62-A-200	200	4		White					
SMA62-A-300	300	6		Orange					
SMA62-A-400	400	8		Pink					
SMA62-A-500	500	10		Green					
SMA62-B-600	600	12		Blue	190	170	144	ø 14	254
SMA62-B-750	750	15		Black					
SMA62-B-1000	1000	20		Yellow					
SMA62-B-1200	1200	24		Red					
SMA62-D-1500	1500	30		Black	320	269	210	ø 18	345
SMA62-D-1800	1800	36		Blue					
SMA62-D-2000	2000	40		Yellow					
SMA62-D-2400	2400	48		Brown					
SMA62-D-3000	3000	60		White					
SMA62-D-4000	4000	80		Orange	400	330	270	ø 22	353
SMA62-E-5000	5000	100		Pink					
SMA62-E-6000	6000	120		Green					
SMA62-E-7000	7000	140		Blue					
SMA62-E-8000	8000	160		Black					
SMA62-E-10000	10000	200		Yellow					
SMA62-E-13000	13000	260		Red	400	330	270	ø 22	450
SMA62-F-15000	15000	300		White					
SMA62-F-18000	18000	360		Orange					

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

SH61 Seismic Spring Hanger (Deflection : 25mm)



● Features

The SH61 Series, a model with a static displacement of 25mm, adopts a hanger housing to control vibration generated from the equipment or prevents vibration from pipes or ducts from being transmitted to the building structure. The hanger housing is designed to withstand horizontal seismic forces and to have sufficient rigidity to avoid resonance due to its own vibration. The housing fixtures are installed on the upper part of the hanger housing to prevent high-frequency vibration from being transmitted to the building structure. A spring seat is installed at the bottom of the hanger housing to block high-frequency vibration caused by the spring itself. A gauge is attached to the inside of the housing to enable displacement adjustment, making it easy to visually check the level adjustment. Additionally, flexible installation is possible because the full-threaded rods can rotate 30° left and right before reaching the rubber attached to the bottom of the housing.

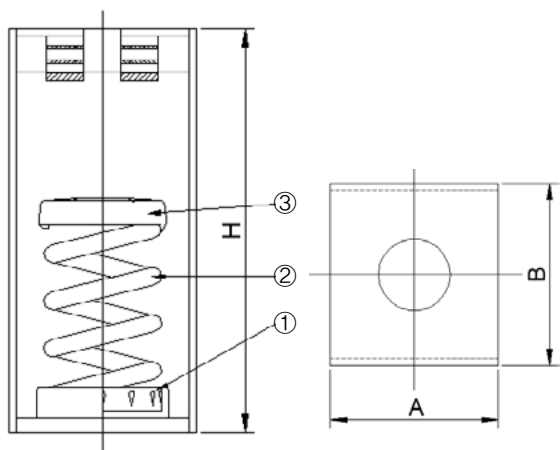
● Specification

No.	Name	Material	Standard
1	Spring Seat	CR	KS M 6617
2	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
3	Steel cap	SS275	KS D 3503

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15



● DIMENSION & SELECTION GUIDE BY LOADS

* 10.0 indicates a rating of 10 Gs or greater.

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Average Defl. LDS (mm)	Color	Dimension			Vertical G Rating	
						A	B	H	Tens.	Comp.
						(mm)	(mm)	(mm)		
SH61-A-5	5	0.2	25	10	Green	95	95	200	10.0	10.0
SH61-A-10	10	0.4			Pink				10.0	10.0
SH61-A-25	25	1			Yellow				10.0	10.0
SH61-B-50	50	2			Red	110	110	200	10.0	10.0
SH61-B-100	100	4			Blue				10.0	7.5
SH61-C-150	150	6			Brown	125	125	210	10.0	6.6
SH61-C-200	200	8			White				10.0	5.0
SH61-C-300	300	12			Orange				10.0	3.3
SH61-D-400	400	16			Pink	140	152	285	10.0	3.0
SH61-D-500	500	20			Green				10.0	2.4
SH61-D-600	600	24			Blue				10.0	2.0
SH61-E-750	750	30			Black	190	190	350	10.0	7.3
SH61-E-1000	1000	40			Yellow				8.8	5.5
SH61-E-1200	1200	48			Red				7.3	4.5

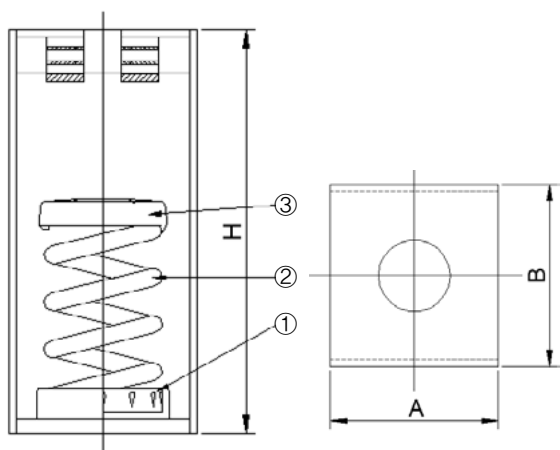
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

SH62 Seismic Spring Hanger (Deflection : 50mm)



● Features

The SH62 Series, a model with a static displacement of 50mm, adopts a hanger housing to control vibration generated from the equipment or prevents vibration from pipes or ducts from being transmitted to the building structure. The hanger housing is designed to withstand horizontal seismic forces and to have sufficient rigidity to avoid resonance due to its own vibration. The housing fixtures are installed on the upper part of the hanger housing to prevent high-frequency vibration from being transmitted to the building structure. A spring seat is installed at the bottom of the hanger housing to block high-frequency vibration caused by the spring itself. A gauge is attached to the inside of the housing to enable displacement adjustment, making it easy to visually check the level adjustment. Additionally, flexible installation is possible because the full-threaded rods can rotate 30° left and right before reaching the rubber attached to the bottom of the housing.



● Specification

No.	Name	Material	Standard
1	Spring Seat	CR	KS M 6617
2	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
3	Steel cap	SS275	KS D 3503

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15

● DIMENSION & SELECTION GUIDE BY LOADS

* 10.0 indicates a rating of 10 Gs or grater.

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Average Defl. LDS (mm)	Color	Dimension			Vertical G Rating	
						A	B	H	Tens.	Comp.
						(mm)	(mm)	(mm)		
SH62-A-50	50	1	50	10	Red	152	152	350	10.0	10.0
SH62-A-100	100	2			Blue				10.0	10.0
SH62-A-200	200	4			White				10.0	10.0
SH62-A-300	300	6			Orange				10.0	8.1
SH62-A-400	400	8			Pink				9.5	6.1
SH62-A-500	500	10			Green				7.6	4.9
SH62-B-600	600	12			Blue	190	190	440	8.5	6.6
SH62-B-750	750	15			Black				6.8	5.3
SH62-B-1000	1000	20			Yellow				5.1	4.0
SH62-B-1200	1200	24			Red	318	318	545	4.2	3.3
SH62-D-1500	1500	30			Black				4.3	3.3
SH62-D-1800	1800	36			Blue				3.6	2.7
SH62-D-2000	2000	40			Yellow				3.2	2.5
SH62-D-2400	2400	48			Brown				2.7	2.0
SH62-D-3000	3000	60			White				2.1	1.6
SH62-D-4000	4000	80			Orange				1.6	1.2
SH62-E-5000	5000	100			Pink	378	378	600	3.4	1.1
SH62-E-6000	6000	120			Green				2.8	0.9

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

SH63 Seismic Spring Hanger (Deflection : 75mm)



● Features

The SH63 Series, a model with a static displacement of 75mm, adopts a hanger housing to control vibration generated from the equipment or prevents vibration from pipes or ducts from being transmitted to the building structure. The hanger housing is designed to withstand horizontal seismic forces and to have sufficient rigidity to avoid resonance due to its own vibration. The housing fixtures are installed on the upper part of the hanger housing to prevent high-frequency vibration from being transmitted to the building structure. A spring seat is installed at the bottom of the hanger housing to block high-frequency vibration caused by the spring itself. A gauge is attached to the inside of the housing to enable displacement adjustment, making it easy to visually check the level adjustment. Additionally, flexible installation is possible because the full-threaded rods can rotate 30° left and right before reaching the rubber attached to the bottom of the housing.

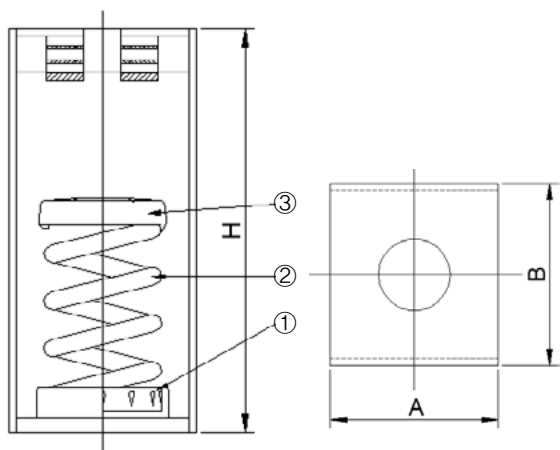
● Specification

No.	Name	Material	Standard
1	Spring Seat	CR	KS M 6617
2	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
3	Steel cap	SS275	KS D 3503

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15



● DIMENSION & SELECTION GUIDE BY LOADS

* 10.0 indicates a rating of 10 Gs or greater.

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Average Defl. LDS (mm)	Color	Dimension			Vertical G Rating	
						A (mm)	B (mm)	H (mm)	Tens.	Comp.
SH63-A-50	50	0.66	75	10	Red	152	152	350	10.0	10.0
SH63-A-100	100	1.33			Blue				10.0	10.0
SH63-A-200	200	2.66			White				10.0	10.0
SH63-B-300	300	4			Orange	190	190	440	10.0	10.0
SH63-B-400	400	5.33			Pink				10.0	10.0
SH63-B-500	500	6.66			Green				10.0	8.0
SH63-B-600	600	8			Blue	224	224	470	8.5	6.6
SH63-C-750	750	10			Black				7.3	6.0
SH63-C-1000	1000	13.33			Yellow				5.5	4.5
SH63-C-1200	1200	16			Red	318	318	545	4.5	3.7
SH63-D-1500	1500	20			Black				4.3	3.3
SH63-D-1800	1800	24			Blue				3.6	2.7
SH63-D-2000	2000	26.66			Yellow	378	378	600	3.2	2.5
SH63-D-2400	2400	32			Brown				2.7	2.0
SH63-D-3000	3000	40			White				2.1	1.6
SH63-E-4000	4000	53.33			Orange	378	378	600	4.2	1.3
SH63-E-5000	5000	66.66			Pink				3.4	1.1
SH63-E-6000	6000	80			Green				2.8	0.9

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

SH64 Seismic Spring Hanger (Deflection : 100mm)



● Features

The SH64 Series, a model with a static displacement of 100mm, adopts a hanger housing to control vibration generated from the equipment or prevents vibration from pipes or ducts from being transmitted to the building structure. The hanger housing is designed to withstand horizontal seismic forces and to have sufficient rigidity to avoid resonance due to its own vibration. The housing fixtures are installed on the upper part of the hanger housing to prevent high-frequency vibration from being transmitted to the building structure. A spring seat is installed at the bottom of the hanger housing to block high-frequency vibration caused by the spring itself. A gauge is attached to the inside of the housing to enable displacement adjustment, making it easy to visually check the level adjustment. Additionally, flexible installation is possible because the full-threaded rods can rotate 30° left and right before reaching the rubber attached to the bottom of the housing.

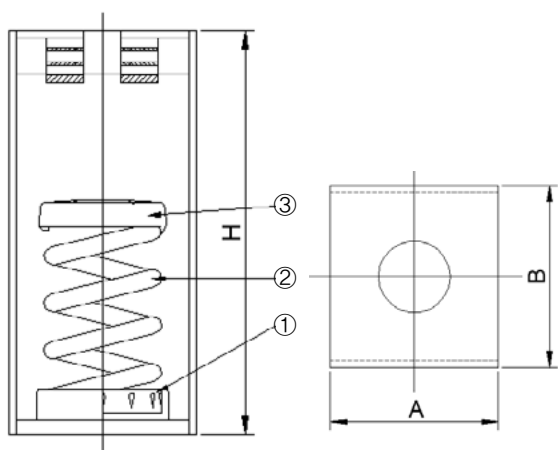
● Specification

No.	Name	Material	Standard
1	Spring Seat	CR	KS M 6617
2	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
3	Steel cap	SS275	KS D 3503

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15



● DIMENSION & SELECTION GUIDE BY LOADS

* 10.0 indicates a rating of 10 Gs or greater.

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Average Defl. LDS (mm)	Color	Dimension			Vertical G Rating	
						A	B	H	Tens.	Comp.
						(mm)	(mm)	(mm)		
SH64-B-50	50	0.5	100	10	Red	190	190	440	10.0	10.0
SH64-B-100	100	1			Blue				10.0	10.0
SH64-B-200	200	2			White				10.0	10.0
SH64-B-300	300	3			Orange				10.0	10.0
SH64-C-400	400	4			Pink	224	224	470	10.0	10.0
SH64-C-500	500	5			Green				10.0	9.0
SH64-C-600	600	6			Blue				9.1	7.5
SH64-D-750	750	7.5			Black	318	318	545	8.6	6.6
SH64-D-1000	1000	10			Yellow				6.5	5.0
SH64-D-1200	1200	12			Red				5.4	4.1
SH64-D-1500	1500	15			Black				4.3	3.3
SH64-D-1800	1800	18			Blue				3.6	2.7
SH64-E-2000	2000	20			Yellow	378	378	600	8.5	2.7
SH64-E-2400	2400	24			Brown				7.0	2.2
SH64-E-3000	3000	30			White				5.6	1.8
SH64-E-4000	4000	40			Orange				4.2	1.3
SH64-F-5000	5000	50			Pink	426	426	680	4.0	0.6

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

SH65 Seismic Spring Hanger (Deflection : 125mm)

● Features

The SH65 Series, a model with a static displacement of 125mm, adopts a hanger housing to control vibration generated from the equipment or prevents vibration from pipes or ducts from being transmitted to the building structure. The hanger housing is designed to withstand horizontal seismic forces and to have sufficient rigidity to avoid resonance due to its own vibration. The housing fixtures are installed on the upper part of the hanger housing to prevent high-frequency vibration from being transmitted to the building structure. A spring seat is installed at the bottom of the hanger housing to block high-frequency vibration caused by the spring itself. A gauge is attached to the inside of the housing to enable displacement adjustment, making it easy to visually check the level adjustment. Additionally, flexible installation is possible because the full-threaded rods can rotate 30° left and right before reaching the rubber attached to the bottom of the housing.



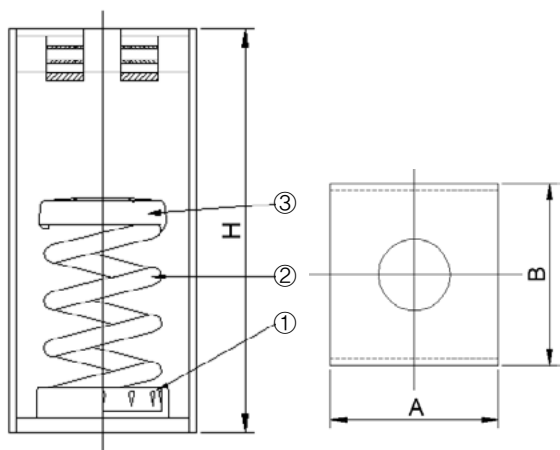
● Specification

No.	Name	Material	Standard
1	Spring Seat	CR	KS M 6617
2	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
3	Steel cap	SS275	KS D 3503

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15



● DIMENSION & SELECTION GUIDE BY LOADS

* 10.0 indicates a rating of 10 Gs or greater.

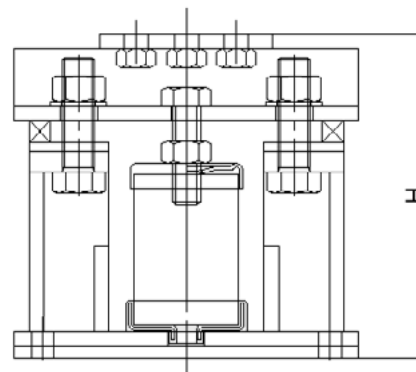
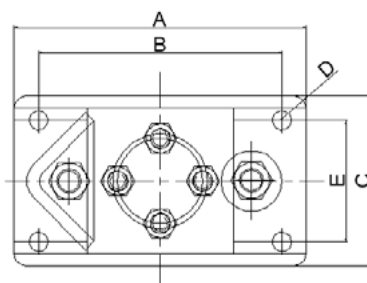
Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Average Defl. LDS (mm)	Color	Dimension			Vertical G Rating	
						A (mm)	B (mm)	H (mm)	Tens.	Comp.
SH65-C-50	50	0.4	125	10	Red	224	224	470	10.0	10.0
SH65-C-100	100	0.8			Blue				10.0	10.0
SH65-C-200	200	1.6			White				10.0	10.0
SH65-D-300	300	2.4			Orange	318	318	545	10.0	10.0
SH65-D-400	400	3.2			Pink				10.0	10.0
SH65-D-500	500	4			Green				10.0	10.0
SH65-D-600	600	4.8			Blue				10.0	8.3
SH65-E-750	750	6			Black	378	378	600	10.0	7.3
SH65-E-1000	1000	8			Yellow				10.0	5.5
SH65-E-1200	1200	9.6			Red				10.0	4.5
SH65-E-1500	1500	12			Black				10.0	3.6
SH65-E-1800	1800	14.4			Blue				9.4	3.0
SH65-E-2000	2000	16			Yellow				8.5	2.7
SH65-F-2400	2400	19.2			Brown	426	426	680	8.3	1.2
SH65-F-3000	3000	24			White				6.6	1.0
SH65-F-4000	4000	32			Orange				5.0	0.7
SH65-F-5000	5000	40			Pink				4.0	0.6

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

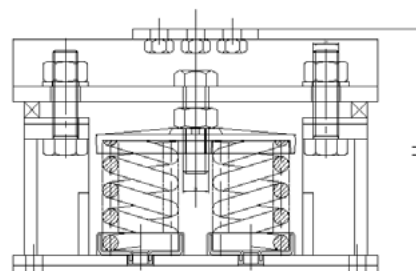
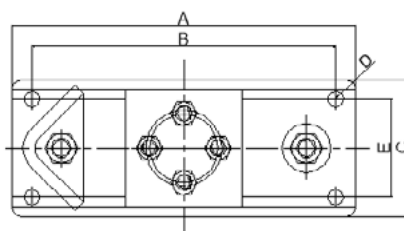
FSL51 / FSL52 Seismic Restrained Spring Mount (Deflection : 25mm / 50mm)



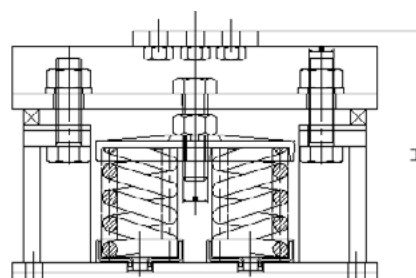
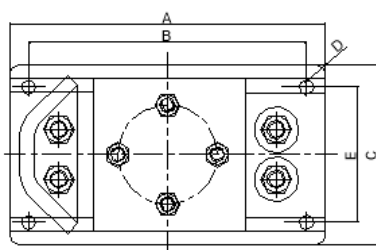
FSL51-1
FSL52-1



FSL51-2
FSL52-2



FSL51-4
FSL52-4

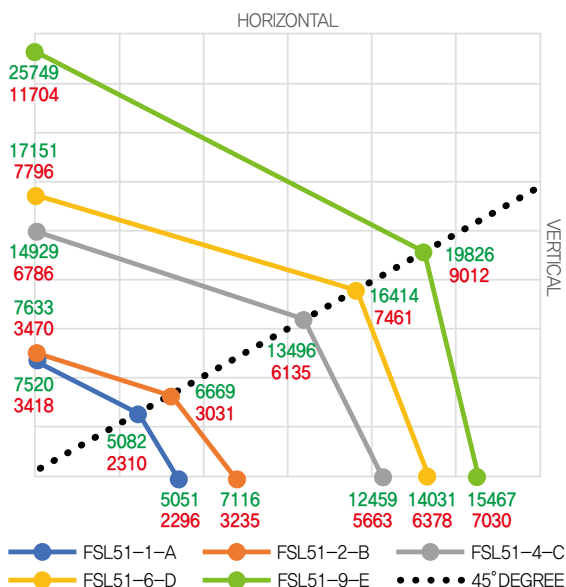


FSL51 Seismic Restrained Spring Mount (Deflection : 25mm)

● Features

The FSL51 series, a model with a static displacement of 25mm, is used for heavy-duty equipment such as cooling towers, chillers, and others that have differences in installation weight. The mount is equipped with vertical displacement limiters on the left and right sides to deal with height changes caused by weight changes due to treatment for retained water. Failure to install vertical displacement limiters may cause severe deformation and damage to the pipes connected to the equipment. The upper housing is equipped with fixing bolts depending on the applied load, and a spring and leveling bolts on the upper housing to facilitate leveling. The housing is corrosion resistant as standard and can be hot-dip galvanized and custom painted on customer request. The load applied to the product is identified by the color of the spring, and the spring is powder-coated. Rubber pads are attached to the bottom of the lower housing to prevent slipping and reduce the transmission of high-frequency vibrations.

● RATED LOAD CURVES (LB KG)



● Specification

No.	Name	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS275	KS D 3503
3	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
4	Space Bar	Plastic	—
5	Leveling Bolt	SS275	KS B 1002
6	Upper Housing	SS275	KS D 3503
7	Restraint Bolt	SS275	KS B 1002

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension						G-Rating
					A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	
FSL51-A-50	50	2	25	Red	270	230	140	ø16	100	250	45.9
FSL51-A-100	100	4		Blue							22.9
FSL51-A-150	150	6		Brown							15.3
FSL51-A-200	200	8		White							11.4
FSL51-A-300	300	12		Orange							7.6
FSL51-A-400	400	16		Pink							5.7
FSL51-A-500	500	20		Green							4.5
FSL51-A-600	600	24		Blue							3.8
FSL51-A-800	800	32		Gray							2.8
FSL51-A-1000	1000	40		Yellow							2.2
FSL51-A-1100	1100	44		White							2.0
FSL51-A-1200	1200	48		Red							1.9
FSL51-A-1300	1300	52		Green							1.7
FSL51-B-1600	1600	64		Gray	350	310	140	ø18	100	285	2.0
FSL51-B-2000	2000	80		Yellow							1.6
FSL51-B-2200	2200	88		White							1.4
FSL51-B-2400	2400	96		Red							1.3
FSL51-B-2600	2600	104		Green							1.2
FSL51-C-3200	3200	128		Gray	370	310	240	ø26	180	290	1.7
FSL51-C-4000	4000	160		Yellow							1.4
FSL51-C-4400	4400	176		White							1.2
FSL51-C-4800	4800	192		Red							1.1
FSL51-C-5200	5200	208		Green							1.0
FSL51-D-6000	6000	240		Yellow	500	450	300	ø26	240	290	1.0
FSL51-D-6600	6600	264		White							0.9
FSL51-D-7200	7200	288		Red							0.8
FSL51-D-7800	7800	312		Green							0.8
FSL51-E-9000	9000	360		Yellow							0.7
FSL51-E-9900	9900	396		White	500	450	340	ø26	290	290	0.7
FSL51-E-10800	10800	432		Red							0.6
FSL51-E-11700	11700	468		Green							0.6

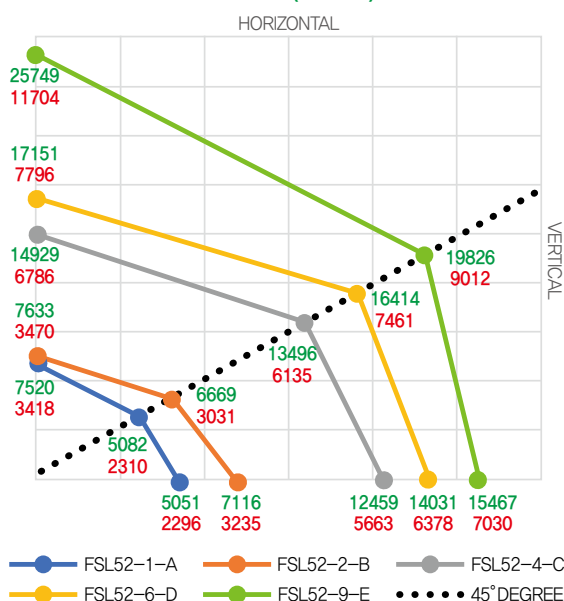
NOTE: Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.

FSL52 Seismic Restrained Spring Mount (Deflection : 50mm)

● Features

The FSL52 series, a model with a static displacement of 50mm, is used for heavy-duty equipment such as cooling towers, chillers, and others that have differences in installation weight. The mount is equipped with vertical displacement limiters on the left and right sides to deal with height changes caused by weight changes due to treatment for retained water. Failure to install vertical displacement limiters may cause severe deformation and damage to the pipes connected to the equipment. The upper housing is equipped with fixing bolts depending on the applied load, and a spring and leveling bolts on the upper housing to facilitate leveling. The housing is corrosion resistant as standard and can be hot-dip galvanized and custom painted on customer request. The load applied to the product is identified by the color of the spring, and the spring is powder-coated. Rubber pads are attached to the bottom of the lower housing to prevent slipping and reduce the transmission of high-frequency vibrations.

● RATED LOAD CURVES (LB KG)



● Specification

No.	Name	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS275	KS D 3503
3	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
4	Space Bar	Plastic	—
5	Leveling Bolt	SS275	KS B 1002
6	Upper Housing	SS275	KS D 3503
7	Restraint Bolt	SS275	KS B 1002

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension						G-Rating
					A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	
FSL52-A-50	50	1	50	Red	270	230	140	ø 16	100	250	45.9
FSL52-A-100	100	2		Blue							22.9
FSL52-A-150	150	3		Brown							15.3
FSL52-A-200	200	4		White							11.4
FSL52-A-300	300	6		Orange							7.6
FSL52-A-400	400	8		Pink							5.7
FSL52-A-550	550	11		Sky Blue							4.1
FSL52-A-750	750	15		Black	350	310	140	ø 18	100	285	3.0
FSL52-B-800	800	16		Pink							4.0
FSL52-B-1100	1100	22		Sky Blue							2.9
FSL52-B-1500	1500	30		Black							2.1
FSL52-B-1750	1750	35		Brown	370	310	240	ø 26	180	290	1.8
FSL52-C-2200	2200	44		Sky Blue							2.5
FSL52-C-3000	3000	60		Black							1.8
FSL52-C-3500	3500	70		Brown	500	450	300	ø 26	240	290	1.6
FSL52-D-4500	4500	90		Black							1.4
FSL52-D-5250	5250	105		Brown							1.2
FSL52-E-6750	6750	135		Black	500	450	340	ø 26	290	290	1.0
FSL52-E-7875	7875	157.5		Brown							0.8

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

FSL62 Seismic Restrained Spring Mount (Deflection : 50mm)

● Features

The FSL62 series, a model with a static displacement of 50mm, is used for heavy-duty equipment such as cooling towers, chillers, and others that have differences in installation weight. The mount is equipped with vertical displacement limiters on the left and right sides to deal with height changes caused by weight changes due to treatment for retained water. Failure to install vertical displacement limiters may cause severe deformation and damage to the pipes connected to the equipment. The upper housing is equipped with fixing bolts depending on the applied load, and a spring and leveling bolts on the upper housing to facilitate leveling. The housing is corrosion resistant as standard and can be hot-dip galvanized and custom painted on customer request. The load applied to the product is identified by the color of the spring, and the spring is powder-coated. Rubber pads are attached to the bottom of the lower housing to prevent slipping and reduce the transmission of high-frequency vibrations.

● Specification

No.	Name	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS275	KS D 3503
3	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
4	Space Bar	Plastic	—
5	Leveling Bolt	SS275	KS B 1002
6	Upper Housing	SS275	KS D 3503
7	Restraint Bolt	SS275	KS B 1002

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

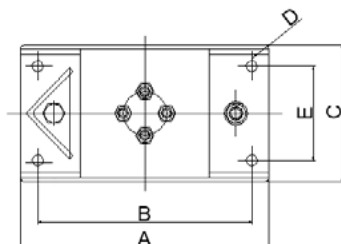
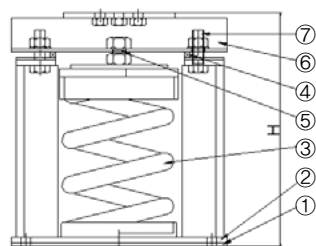
- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension						G-Rating
					A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	
FSL62-A-50	50	1	50	Red	250	220	110	ø 13	80	285	15.2
FSL62-A-100	100	2		Blue							7.6
FSL62-A-200	200	4		White							3.8
FSL62-A-300	300	6		Orange							2.5
FSL62-A-400	400	8		Pink							1.9
FSL62-A-500	500	10		Green							1.5
FSL62-B-600	600	12		Blue	320	270	150	ø 16	100	350	3
FSL62-B-750	750	15		Black							2.4
FSL62-B-1000	1000	20		Yellow							1.8
FSL62-B-1200	1200	24		Red							1.5
FSL62-D-1500	1500	30		Black	420	365	210	ø 22	155	440	2.1
FSL62-D-1800	1800	36		Blue							1.7
FSL62-D-2000	2000	40		Yellow							1.6
FSL62-D-2400	2400	48		Brown							1.3
FSL62-D-3000	3000	60		White							1
FSL62-D-4000	4000	80		Orange							0.8
FSL62-E-5000	5000	100		Pink	510	430	260	ø 22	180	505	1.4
FSL62-E-6000	6000	120		Green							1.2
FSL62-E-7000	7000	140		Blue							1
FSL62-E-8000	8000	160		Black							0.9
FSL62-E-10000	10000	200		Yellow							0.7
FSL62-E-13000	13000	260		Red							0.5
FSL62-F-15000	15000	300		White	590	510	320	ø 26	220	617	0.5
FSL62-F-18000	18000	360		Orange							0.4

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

FSL63 Seismic Restrained Spring Mount (Deflection : 75mm)



● Features

The FSL63 series, a model with a static displacement of 75mm, is used for heavy-duty equipment such as cooling towers, chillers, and others that have differences in installation weight. The mount is equipped with vertical displacement limiters on the left and right sides to deal with height changes caused by weight changes due to treatment for retained water. Failure to install vertical displacement limiters may cause severe deformation and damage to the pipes connected to the equipment. The upper housing is equipped with fixing bolts depending on the applied load, and a spring and leveling bolts on the upper housing to facilitate leveling. The housing is corrosion resistant as standard and can be hot-dip galvanized and custom painted on customer request. The load applied to the product is identified by the color of the spring, and the spring is powder-coated. Rubber pads are attached to the bottom of the lower housing to prevent slipping and reduce the transmission of high-frequency vibrations.

● Specification

No.	Name	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS275	KS D 3503
3	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
4	Space Bar	Plastic	—
5	Leveling Bolt	SS275	KS B 1002
6	Upper Housing	SS275	KS D 3503
7	Restraint Bolt	SS275	KS B 1002

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

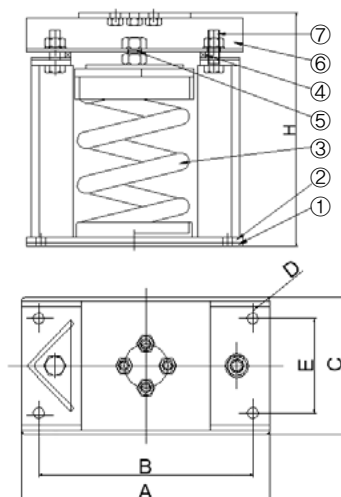
- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension						G-Rating
					A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	
FSL63-A-50	50	0.66	75	Red	250	220	110	ø 13	80	285	15.2
FSL63-A-100	100	1.33		Blue							7.6
FSL63-A-200	200	2.66		White							3.8
FSL63-B-300	300	4		Orange	320	270	150	ø 16	100	350	6.1
FSL63-B-400	400	5.33		Pink							4.5
FSL63-B-500	500	6.66		Green							3.6
FSL63-B-600	600	8		Blue							3.0
FSL63-C-750	750	10		Black	350	290	190	ø 18	130	400	3.0
FSL63-C-1000	1000	13.33		Yellow							2.3
FSL63-C-1200	1200	16		Red							1.9
FSL63-D-1500	1500	20		Black	420	365	210	ø 22	155	440	2.1
FSL63-D-1800	1800	24		Blue							1.7
FSL63-D-2000	2000	26.66		Yellow							1.6
FSL63-D-2400	2400	32		Brown							1.3
FSL63-D-3000	3000	40		White							1.0
FSL63-E-4000	4000	53.33		Orange	510	430	260	ø 22	180	505	1.8
FSL63-E-5000	5000	66.66		Pink							1.4
FSL63-E-6000	6000	80		Green							1.2
FSL63-E-7000	7000	93.33		Blue							1.0
FSL63-E-8000	8000	106.66		Black	590	510	320	ø 26	220	617	0.9
FSL63-F-10000	10000	133.33		Yellow							0.8
FSL63-F-13000	13000	173.33		Red							0.6
FSL63-F-15000	15000	200		White							0.5
GSL63-G-18000	18000	240		Orange	620	540	370	ø 26	290	685	0.3

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

FSL64 Seismic Restrained Spring Mount (Deflection : 100mm)



● Features

The FSL64 series, a model with a static displacement of 100mm, is used for heavy-duty equipment such as cooling towers, chillers, and others that have differences in installation weight. The mount is equipped with vertical displacement limiters on the left and right sides to deal with height changes caused by weight changes due to treatment for retained water. Failure to install vertical displacement limiters may cause severe deformation and damage to the pipes connected to the equipment. The upper housing is equipped with fixing bolts depending on the applied load, and a spring and leveling bolts on the upper housing to facilitate leveling. The housing is corrosion resistant as standard and can be hot-dip galvanized and custom painted on customer request. The load applied to the product is identified by the color of the spring, and the spring is powder-coated. Rubber pads are attached to the bottom of the lower housing to prevent slipping and reduce the transmission of high-frequency vibrations.

● Specification

No.	Name	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS275	KS D 3503
3	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
4	Space Bar	Plastic	—
5	Leveling Bolt	SS275	KS B 1002
6	Upper Housing	SS275	KS D 3503
7	Restraint Bolt	SS275	KS B 1002

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

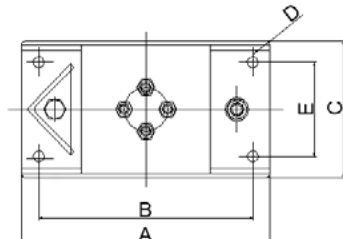
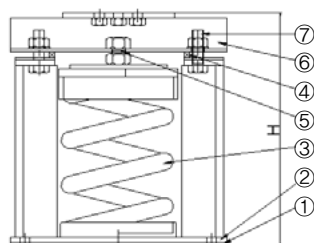
- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.82~1.15

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension						G-Rating
					A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	
FSL64-B-50	50	0.5	100	Red	320	270	150	ø 16	100	350	36.6
FSL64-B-100	100	1		Blue							18.3
FSL64-B-200	200	2		White							9.1
FSL64-B-300	300	3		Orange							6.1
FSL64-C-400	400	4		Pink	350	290	190	ø 18	130	400	5.7
FSL64-C-500	500	5		Green							4.6
FSL64-C-600	600	6		Blue							3.8
FSL64-D-750	750	7.5		Black	420	365	210	ø 22	155	440	4.3
FSL64-D-1000	1000	10		Yellow							3.2
FSL64-D-1200	1200	12		Red							2.6
FSL64-D-1500	1500	15		Black							2.1
FSL64-D-1800	1800	18		Blue	510	430	260	ø 22	180	505	1.7
FSL64-E-2000	2000	20		Yellow							3.6
FSL64-E-2400	2400	24		Brown							3.0
FSL64-E-3000	3000	30		White							2.4
FSL64-E-4000	4000	40		Orange							1.8
FSL64-F-5000	5000	50		Pink	590	510	320	ø 26	220	617	1.7
FSL64-F-6000	6000	60		Green							1.4
FSL64-F-7000	7000	70		Blue							1.2
FSL64-F-8000	8000	80		Black							1.1
FSL64-G-10000	10000	100		Yellow	620	540	370	ø 26	290	685	0.6
FSL64-G-13000	13000	130		Red							0.5
FSL64-G-15000	15000	150		White							0.4

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

FSL65 Seismic Restrained Spring Mount (Deflection : 125mm)



● Features

The FSL65 series, a model with a static displacement of 125mm, is used for heavy-duty equipment such as cooling towers, chillers, and others that have differences in installation weight. The mount is equipped with vertical displacement limiters on the left and right sides to deal with height changes caused by weight changes due to treatment for retained water. Failure to install vertical displacement limiters may cause severe deformation and damage to the pipes connected to the equipment. The upper housing is equipped with fixing bolts depending on the applied load, and a spring and leveling bolts on the upper housing to facilitate leveling. The housing is corrosion resistant as standard and can be hot-dip galvanized and custom painted on customer request. The load applied to the product is identified by the color of the spring, and the spring is powder-coated. Rubber pads are attached to the bottom of the lower housing to prevent slipping and reduce the transmission of high-frequency vibrations.

● Specification

No.	Name	Material	Standard
1	Non Skid Pad	CR	KS M 6617
2	Lower Housing	SS275	KS D 3503
3	Coil Spring	SAE 9254	KS B 2402
		SW-C	KS B 2403
4	Space Bar	Plastic	—
5	Leveling Bolt	SS275	KS B 1002
6	Upper Housing	SS275	KS D 3503
7	Restraint Bolt	SS275	KS B 1002

* All specifications are subject to change at the manufacturer's discretion or per customer requirements.

● Coil Spring Features

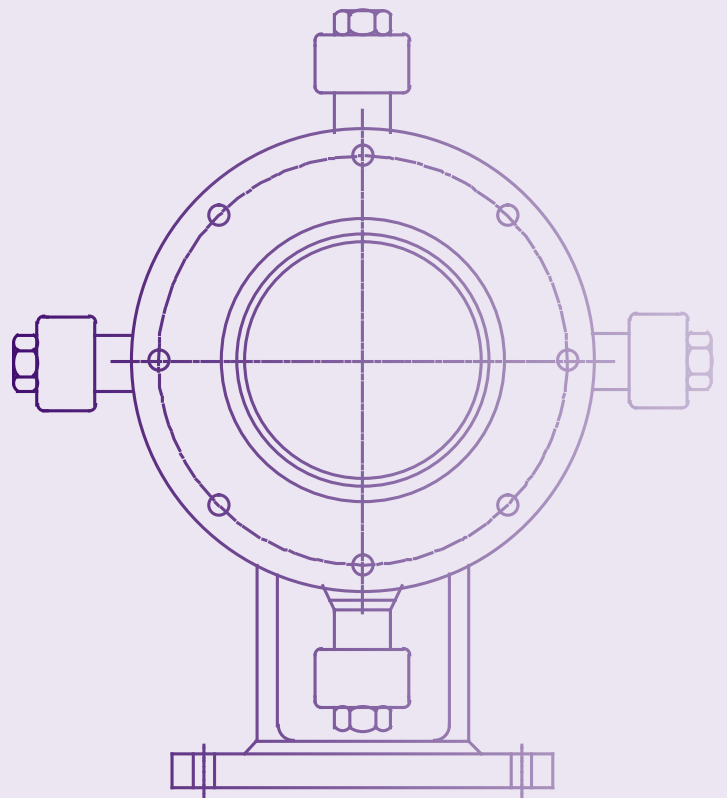
- All Springs have additional travel to solid equal to 50% of the Rated Deflection.
- OD/OH = Ratio of Spring Outside Diameter to Operating Height = 0.97~1.33

● DIMENSION & SELECTION GUIDE BY LOADS

Type	Rated Capacity (kgf)	Spring Constant (kgf/mm)	Deflection (mm)	Color	Dimension						G-Rating
					A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	H (mm)	
FSL65-C-50	50	0.4	125	Red	350	290	190	ø 18	130	400	46
FSL65-C-100	100	0.8		Blue							23
FSL65-C-200	200	1.6		White							11.5
FSL65-D-300	300	2.4		Orange	420	365	210	ø 22	155	440	10.7
FSL65-D-400	400	3.2		Pink							8.0
FSL65-D-500	500	4		Green							6.4
FSL65-D-600	600	4.8		Blue							5.3
FSL65-E-750	750	6		Black	510	430	260	ø 22	180	505	9.6
FSL65-E-1000	1000	8		Yellow							7.2
FSL65-E-1200	1200	9.6		Red							6.0
FSL65-E-1500	1500	12		Black							4.8
FSL65-E-1800	1800	14.4		Blue							4.0
FSL65-E-2000	2000	16		Yellow							3.6
FSL65-F-2400	2400	19.2		Brown	590	510	320	ø 26	220	617	3.6
FSL65-F-3000	3000	24		White							2.9
FSL65-F-4000	4000	32		Orange							2.2
FSL65-F-5000	5000	40		Pink							1.7
FSL65-G-6000	6000	48		Green	620	540	370	ø 26	290	685	1.0
FSL65-G-7000	7000	56		Blue							0.9
FSL65-G-8000	8000	64		Black							0.8
FSL65-G-10000	10000	80		Yellow							0.6
FSL65-G-13000	13000	104		Red							0.5

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

EXPANSION JOINT



NVC-10E Series (ECO SLIP JOINT)



Usage

- ◆ Applicable fluid: heating, hot water, water supply, fire protection, etc.
- ◆ Working pressure: 10 Kg/cm², 20 Kg/cm²
- ◆ Applicable displacement: one-dimensional displacement
- ◆ Maximum temperature: 80°C
- ◆ Nominal traverse: Single type 50 ~ 100 mm/
Double type 100 ~ 200 mm
- ◆ Material: Steel pipe, STS

Features

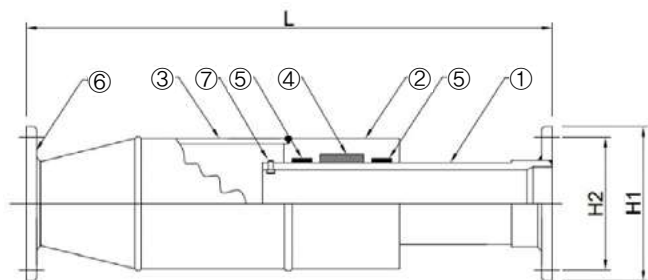
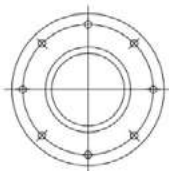
The ECO SLIP JOINT is an internal pressure slip-type expansion Joint designed to protect pipes from deformation in heating, hot water, or fire protection systems in commercial or residential buildings. By using EPDM or silicone packing, the friction force of the packing is minimized, resulting in reduced stress on the fixing point. This helps prevent pipes from bending, making the product suitable for small-diameter and soft-material piping networks. It is more cost-effective than the IP SLIP JOINT and EZ PAK SLIP JOINT.

Specification

No.	DESCRIPTION	MATERIAL	SPECIFICATIONS
1	SLIP	STAINLESS STEEL	STS 304
2	BODY	STAINLESS STEEL	STS 304
3	CHAMBER	STAINLESS STEEL	STS 304
4	PACKING ZONE	EPDM AND BRONZALON	-
5	FLANGED	STAINLESS STEEL	STS 304
6	STOP PIN	STAINLESS STEEL	STS 304
7	ANCHOR BASE	STAINLESS STEEL	STS 304

*The above specifications are based on STS production and can also be made as steel pipe.

SINGLE TYPE

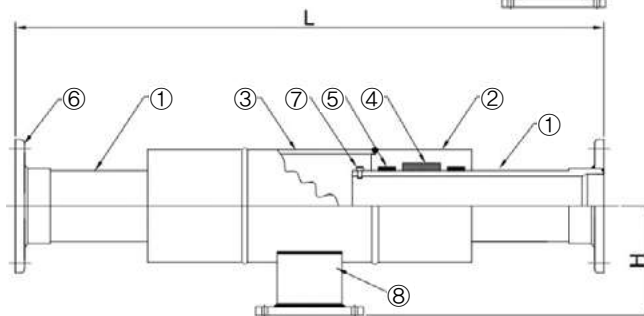
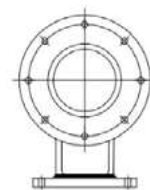


Dimension(mm)				
Model	L		H1	H2
	Nominal Traverse(mm)			
	50	100		
NVC-10E (25A)	305	405	125	90
NVC-10E (32A)	305	405	135	100
NVC-10E (40A)	305	405	140	105
NVC-10E (50A)	305	405	155	120
NVC-10E (65A)	305	405	175	140
NVC-10E (80A)	305	405	185	150
NVC-10E (100A)	320	420	210	175
NVC-10E (125A)	350	450	250	210

*These specifications and dimensions may be changed without prior notice to enhance product performance and quality. Custom orders are available up to Specification 200A and nominal traverse of 200TR.

*The connector type for the aforementioned products can also be manufactured as the SR (SP) type.

DOUBLE TYPE



Dimension(mm)			
Model	L		H
	Nominal Traverse(mm)		
	50+50	100+100	
NVC-10E (25A)	490	690	71
NVC-10E (32A)	490	690	74
NVC-10E (40A)	490	690	81
NVC-10E (50A)	490	690	84
NVC-10E (65A)	490	690	90
NVC-10E (80A)	490	690	104
NVC-10E (100A)	490	690	117
NVC-10E (125A)	510	710	129

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality. Custom orders are available up to product specification 1000A and nominal traverse of 400+400TR.

*Field SHOE height can be changed depending on field conditions.

NVC-10 Series (IP SLIP JOINT)



Usage

- ◆ Applicable fluid: heating, hot water, water supply, fire protection, etc.
- ◆ Working pressure: 10 Kg/cm², 20 Kg/cm², 30 Kg/cm²
- ◆ Applicable displacement: one-dimensional displacement
- ◆ Maximum temperature: 80°C
- ◆ Nominal traverse: Single type 50 ~ 200 mm/
Double type 100 ~ 400 mm
- ◆ Material: Steel pipe, STS

Features

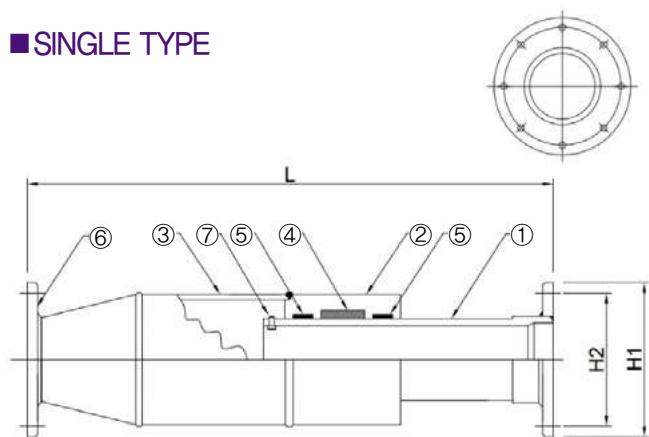
The IP SLIP JOINT is an internal pressure slip-type expansion joint with a double-packing structure, designed to protect pipes from deformation in heating, hot water, or fire protection systems in commercial or residential buildings. By using EPDM or silicone packing, the packing friction is minimized, and the double-packing structure enhances the sealing property. This allows it to handle higher pressures than the ECO SLIP JOINT. It can be manufactured using triple-and quadruple-packing structures according to product specifications. It is more cost-effective than EZ PAK SLIP JOINT.

Specification

No.	DESCRIPTION	MATERIAL	SPECIFICATIONS
1	SLIP	STAINLESS STEEL	STS 304
2	BODY	STAINLESS STEEL	STS 304
3	CHAMBER	STAINLESS STEEL	STS 304
4	PACKING ZONE	EPDM AND BRONZALON	-
5	FLANGED	STAINLESS STEEL	STS 304
6	STOP PIN	STAINLESS STEEL	STS 304
7	ANCHOR BASE	STAINLESS STEEL	STS 304

*The above specifications are based on STS production and can also be made as steel pipe.

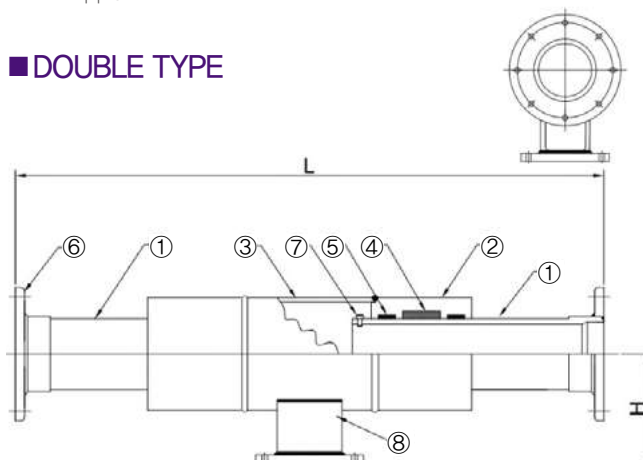
SINGLE TYPE



Model	Dimension(mm)			H1	H2
	L				
	Nominal Traverse(mm)				
	50	100	200		
NVC-10(25A)	335	435	635	125	90
NVC-10(32A)	335	435	635	135	100
NVC-10(40A)	335	435	635	140	105
NVC-10(50A)	335	435	635	155	120
NVC-10(65A)	335	435	635	175	140
NVC-10(80A)	335	435	635	185	150
NVC-10(100A)	350	450	650	210	175
NVC-10(125A)	380	480	680	250	210
NVC-10(150A)	435	535	735	280	240
NVC-10(200A)	470	570	770	330	290
NVC-10(250A)	515	615	815	400	355
NVC-10(300A)	665	765	965	445	400

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality. Custom orders are available up to product specification 1000A and nominal traverse of 400TR.

DOUBLE TYPE

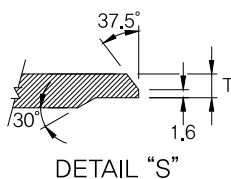
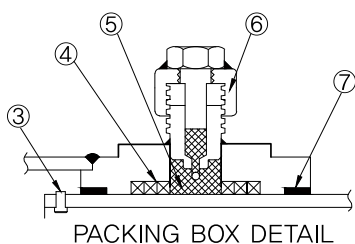


Dimension(mm)				
Model	L			H
	Nominal Traverse(mm)			
	50+50	100+100	200+200	
NVC-10(25A)	550	750	1150	74
NVC-10(32A)	550	750	1150	77
NVC-10(40A)	550	750	1150	81
NVC-10(50A)	550	750	1150	84
NVC-10(65A)	550	750	1150	90
NVC-10(80A)	550	750	1150	104
NVC-10(100A)	550	750	1150	117
NVC-10(125A)	570	770	1170	129
NVC-10(150A)	625	825	1225	142
NVC-10(200A)	625	825	1225	168
NVC-10(250A)	660	860	1260	193
NVC-10(300A)	720	920	1320	219

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality. Custom orders are available up to product specification 1000A and nominal traverse of 400+400TR.

*Field SHOE height can be changed depending on field conditions.

NVC-15 Series (EZ PAK SLIP JOINT)



Usage

- ◆ Applicable fluid: steam, heating, thermal oil, fire protection, etc.
- ◆ Working pressure: 10 Kg/cm² ~ 50 Kg/cm²
- ◆ Applicable displacement: one-dimensional displacement
- ◆ Maximum temperature: 450°C
- ◆ Nominal traverse: Single type 100 ~ 300 mm/
Double type 200 ~ 600 mm
- ◆ Material: Steel pipe, STS

Features

The EZ PAK SLIP JOINT is a packing-injected, slip-type expansion joint. It is designed to protect pipes from deformation caused by expansion and contraction due to temperature fluctuations in the fluid inside. By absorbing stresses in the pipes, it preemptively prevents potential defects related to these issues.

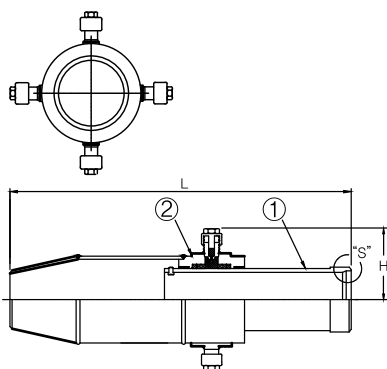
Compared to the standard bellows type expansion joint, it offers superior elasticity and durability, and is easy to install. It is highly advantageous for maintenance since the equipment can be repaired in the event of fluid leakage by injecting spare packing without halting its operation.

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	STS 304	-
4	RING PACKING	GRAPHITE	-
5	INJECTED PACKING	GRAFOIL	-
6	PLUNGER	SS41	-
7	GUDIE	BRONZE FILLED	-
8	FLANGE	SS41	-
9	ANCHOR BASE	SS41	-

*The above specifications are based on STS production and can also be made as steel pipe.

WELD TYPE / SINGLE TYPE

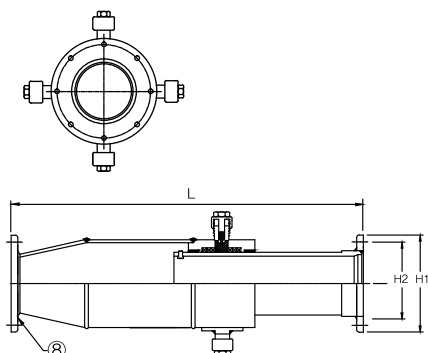


Model	Dimension(mm)			H
	L			
	Nominal Traverse(mm)			
	100	200	300	
NVC-15(25A)	660	860	1060	110
NVC-15(32A)	570	770	970	110
NVC-15(40A)	570	770	970	110
NVC-15(50A)	570	770	970	120
NVC-15(65A)	590	790	990	125
NVC-15(80A)	605	805	1005	135
NVC-15(100A)	630	830	1030	150
NVC-15(125A)	650	850	1050	165
NVC-15(150A)	695	895	1095	190
NVC-15(200A)	695	895	1095	215

Model	Dimension(mm)			H
	L			
	Nominal Traverse(mm)			
	100	200	300	
NVC-15(250A)	746	946	1170	240
NVC-15(300A)	900	1100	1300	260
NVC-15(350A)	910	1110	1310	285
NVC-15(400A)	940	1140	1340	310
NVC-15(450A)	1105	1305	1505	335
NVC-15(500A)	1160	1260	1460	360
NVC-15(550A)	1165	1265	1465	385
NVC-15(600A)	1170	1270	1470	410
NVC-15(650A)	1190	1290	1490	435
NVC-15(700A)	1190	1290	1490	460

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality. Custom orders are available up to product specification 1500A and nominal traverse of 400TR.

FLANGE TYPE / SINGLE TYPE



Model	Dimension(mm)			H1	H2
	L				
	Nominal Traverse(mm)				
	100	200	300		
NVC-15(25A)	670	870	1070	125	90
NVC-15(32A)	580	780	980	135	100
NVC-15(40A)	580	780	980	140	105
NVC-15(50A)	580	780	980	155	120
NVC-15(65A)	600	800	1000	175	140
NVC-15(80A)	615	815	1015	185	150
NVC-15(100A)	640	840	1040	210	175
NVC-15(125A)	660	860	1060	250	210
NVC-15(150A)	705	905	1105	280	240
NVC-15(200A)	705	905	1105	330	290

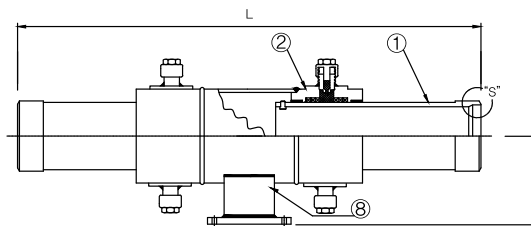
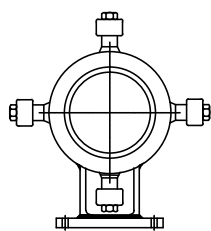
Dimension(mm)					
Model	L			H1	H2
	Nominal Traverse(mm)				
	100	200	300		
NVC-15(250A)	756	956	1180	400	355
NVC-15(300A)	910	1110	1310	445	400
NVC-15(350A)	920	1120	1320	490	445
NVC-15(400A)	950	1150	1350	560	510
NVC-15(450A)	1115	1315	1515	620	565
NVC-15(500A)	1170	1270	1470	675	620
NVC-15(550A)	1175	1275	1475	745	680
NVC-15(600A)	1180	1280	1480	795	730
NVC-15(650A)	1200	1300	1500	845	780
NVC-15(700A)	1200	1300	1500	905	840

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality. Custom orders are available up to product specification 1500A and nominal traverse of 400TR.

NVC-15 Series (EZ PAK SLIP JOINT)



WELD TYPE (Double Type)



Dimension(mm)					
Model	L			H1	H2
	Nominal Traverse(mm)				
	100+100	200+200	300+300		
NVC-15(25A)	975	1375	1775	110	74
NVC-15(32A)	975	1375	1775	110	77
NVC-15(40A)	975	1375	1775	110	81
NVC-15(50A)	975	1375	1775	120	84
NVC-15(65A)	975	1375	1775	125	90
NVC-15(80A)	1025	1425	1825	135	104
NVC-15(100A)	1025	1425	1825	150	117
NVC-15(125A)	1040	1440	1840	165	129
NVC-15(150A)	1045	1445	1845	190	142
NVC-15(200A)	1045	1445	1845	215	168

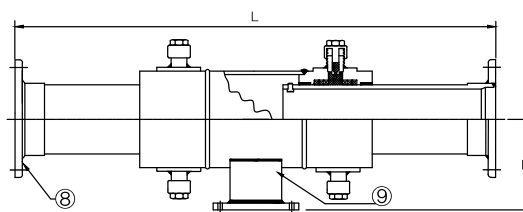
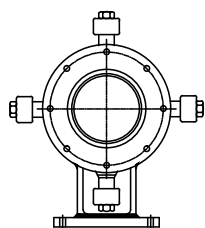
Dimension(mm)					
Model	L			H1	H2
	Nominal Traverse(mm)				
	100+100	200+200	300+300		
NVC-15(250A)	1095	1495	1895	240	193
NVC-15(300A)	1105	1505	1905	260	219
NVC-15(350A)	1125	1525	1925	285	237
NVC-15(400A)	1135	1535	1935	310	263
NVC-15(450A)	1185	1585	1985	335	288
NVC-15(500A)	1295	1695	2095	360	341
NVC-15(550A)	1345	1745	2145	385	339
NVC-15(600A)	1355	1755	2155	410	364
NVC-15(650A)	1375	1775	2175	435	390
NVC-15(700A)	1375	1775	2175	460	415

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality.

Custom orders are available up to product specification 1500A and nominal traverse of 400+400TR.

*Field Shoe height can be changed depending on field conditions.

FLANGE TYPE (Double Type)



Dimension(mm)				
Model	L			H
	Nominal Traverse(mm)			
	100+100	200+200	300+300	
NVC-15(25A)	985	1385	1785	74
NVC-15(32A)	985	1385	1785	77
NVC-15(40A)	985	1385	1785	81
NVC-15(50A)	985	1385	1785	84
NVC-15(65A)	985	1385	1785	90
NVC-15(80A)	1035	1435	1835	104
NVC-15(100A)	1035	1435	1835	117
NVC-15(125A)	1050	1450	1850	129
NVC-15(150A)	1055	1455	1855	142
NVC-15(200A)	1055	1455	1855	168

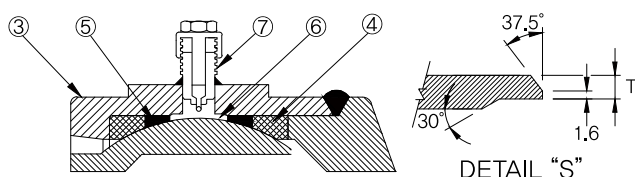
Dimension(mm)				
Model	L			H
	Nominal Traverse(mm)			
	100+100	200+200	300+300	
NVC-15(250A)	1105	1505	1905	193
NVC-15(300A)	1115	1515	1915	219
NVC-15(350A)	1135	1535	1935	237
NVC-15(400A)	1145	1545	1945	263
NVC-15(450A)	1195	1595	1995	288
NVC-15(500A)	1305	1705	2105	314
NVC-15(550A)	1355	1755	2155	339
NVC-15(600A)	1365	1765	2165	364
NVC-15(650A)	1385	1785	2185	390
NVC-15(700A)	1385	1785	2185	415

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality.

Custom orders are available up to product specification 1500A and nominal traverse of 400+400TR.

*Field shoe height can be changed depending on field conditions.

NVC-25 Series (EZ PAK BALL JOINT)



Usage

- ◆ Applicable fluid: steam, heating, water supply, hot water supply, heat transfer oil, fire protection, etc.
- ◆ Working pressure: 10 Kg/cm² to 50 Kg/cm²
- ◆ Applicable displacement: three-dimensional displacement (seismic application)
- ◆ Maximum temperature: 450°C
- ◆ Maximum deflection angle: 30° (25A ~ 50A) / 15° (65A or more)
- ◆ Material: Steel pipe, STS

Features

The EZ PAK BALL JOINT can protect the pipe from twisting caused by expansion and contraction due to temperature changes of the fluid in the pipe, and minimize the stress generated at fixed points.

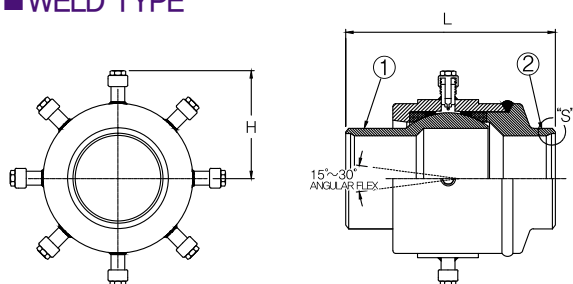
The EASY PAK BALL JOINT is ideal for connecting moving pipes to fixed equipment, especially in addressing issues from pipe expansion, contraction, and vibration-induced misarrangement. Moreover, in the event of fluid leakage, the equipment can be serviced by injecting packing without interrupting its operation.

Specification

No.	DESCRIPTION	MATERIAL	SPECIFICATIONS
1	BALL	STAINLESS STEEL	STS 304
2	SOCKET	STAINLESS STEEL	STS 304
3	CASING	STAINLESS STEEL	STS 304
4	GUIDE	DUCTILE IRON	-
5	RING PACKING	TEFLON	-
6	FLANGE	STAINLESS STEEL	STS 304

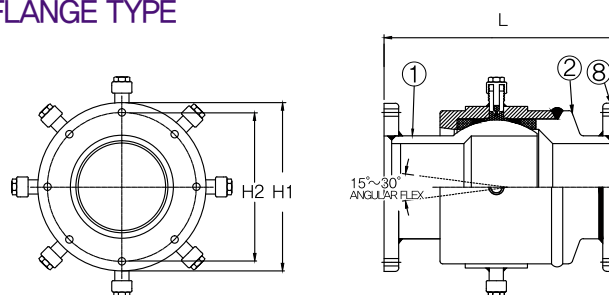
*The above specifications are based on STS production and can also be made as steel pipe.

WELD TYPE



Dimension(mm)					
Model	L	H	Model	L	H
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	H1	H2	Model	L	H1	H2
NVC-25(25A)	159	125	90	NVC-25(250A)	374	400	355
NVC-25(32A)	166	135	100	NVC-25(300A)	404	445	400
NVC-25(40A)	166	140	105	NVC-25(350A)	466	490	445
NVC-25(50A)	186	155	120	NVC-25(400A)	523	560	510
NVC-25(65A)	188	175	140	NVC-25(450A)	575	620	565
NVC-25(80A)	233	185	150	NVC-25(500A)	625	675	620
NVC-25(100A)	253	210	175	NVC-25(550A)	667	745	680
NVC-25(125A)	305	250	210	NVC-25(600A)	687	795	730
NVC-25(150A)	327	280	240	NVC-25(650A)	724	845	780
NVC-25(200A)	347	330	290	NVC-25(700A)	771	905	840

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality.

NVC-35 Series (EZ PAK MULTI-JOINT)



■ Features

The EZ PAK MULTI JOINT is an expansion joint that is designed to protect the pipe from deformation caused by expansion and contraction due to temperature fluctuations of the fluid inside. By absorbing stresses in the pipe, it preemptively prevents potential defects related to these issues.

In terms of maintenance, it offers significant advantages since it can smoothly expand and retract despite pipe misalignment from imprecise construction. It also ensures that the pipe is protected from phenomena like building shortening or swaying. Moreover, in the event of fluid leakage, the equipment can be serviced by injecting packing without interrupting its operation.

■ Usage

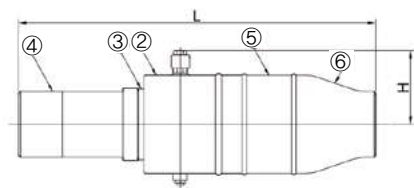
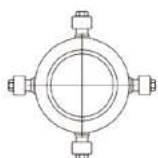
- ◆ Applicable fluid: steam, water supply, heating, hot water supply, heat transfer oil, fire protection, etc.
- ◆ Working pressure: 10 Kg/cm² ~ 50 Kg/cm²
- ◆ Applicable displacement: one- to three-dimensional displacement (seismic application)
- ◆ Maximum temperature: 450°C
- ◆ Nominal traverse: Single type 100 ~ 300 mm/
Double type 200 ~ 600 mm
- ◆ Material: Steel pipe, STS

■ Specification

No.	DESCRIPTION	MATERIAL	SPECIFICATIONS
1	SOCKET	STAINLESS STEEL	STS 304
2	BALL	STAINLESS STEEL	STS 304
3	SLIP	STAINLESS STEEL	STS 304
4	CHAMBER	STAINLESS STEEL	STS 304
5	REDUCER	STAINLESS STEEL	STS 304

*The above specifications are based on STS production and can also be made as steel pipe.

■ WELD TYPE / SINGLE TYPE

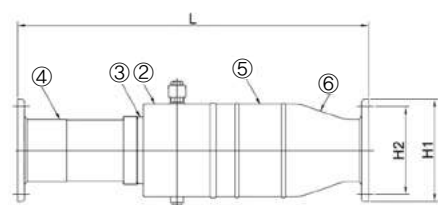
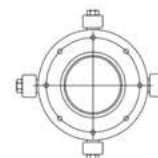


Model	Dimension(mm)			H
	L			
	Nominal Traverse(mm)			
	100	200	300	
NVC-35(25A)	680	880	1080	126
NVC-35(32A)	590	790	990	126
NVC-35(40A)	590	790	990	126
NVC-35(50A)	590	790	990	135
NVC-35(65A)	610	810	1010	149
NVC-35(80A)	625	825	1025	149
NVC-35(100A)	660	860	1060	160
NVC-35(125A)	685	885	1085	186
NVC-35(150A)	700	900	1100	200

Model	Dimension(mm)			H
	L			
	Nominal Traverse(mm)			
	100	200	300	
NVC-35(200A)	725	925	1125	228
NVC-35(250A)	790	990	1190	225
NVC-35(300A)	955	1155	1355	280
NVC-35(350A)	975	1175	1375	317
NVC-35(400A)	975	1175	1375	356
NVC-35(450A)	1020	1220	1420	380
NVC-35(500A)	1045	1245	1445	410
NVC-35(550A)	1080	1280	1480	440
NVC-35(600A)	1080	1280	1480	470

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality. Custom orders are available up to product specification 1000A and nominal traverse of 400TR.

■ FLANGE TYPE / SINGLE TYPE



Model	Dimension(mm)			H1	H2
	L				
	Nominal Traverse(mm)				
	100	200	300		
NVC-35(25A)	695	895	1095	125	90
NVC-35(32A)	605	805	1005	135	100
NVC-35(40A)	605	805	1005	140	105
NVC-35(50A)	605	805	1005	155	120
NVC-35(65A)	630	830	1030	175	140
NVC-35(80A)	645	845	1045	185	150
NVC-35(100A)	680	880	1080	210	175
NVC-35(125A)	705	905	1105	250	210
NVC-35(150A)	730	930	1130	280	240

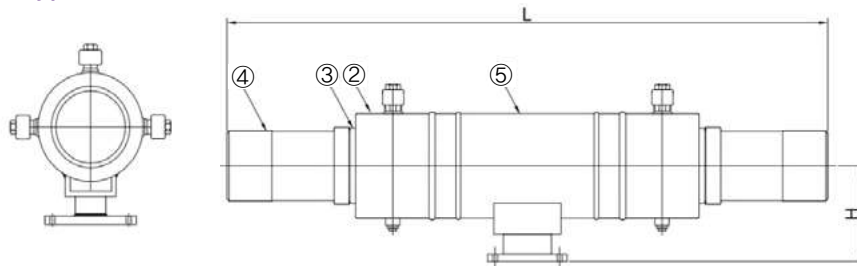
Model	Dimension(mm)			H1	H2
	L				
	Nominal Traverse(mm)				
	100	200	300		
NVC-35(200A)	755	955	1155	330	290
NVC-35(250A)	820	1020	1220	400	355
NVC-35(300A)	985	1185	1385	445	400
NVC-35(350A)	1005	1205	1405	490	445
NVC-35(400A)	1005	1205	1405	560	510
NVC-35(450A)	1060	1260	1460	620	565
NVC-35(500A)	1085	1285	1485	675	620
NVC-35(550A)	1120	1320	1520	745	680
NVC-35(600A)	1120	1320	1520	795	730

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality. Custom orders are available up to product specification 1000A and nominal traverse of 400TR.

NVC-35 Series (EZ PAK MULTI-JOINT)



WELD TYPE (Double Type)



Dimension(mm)					
Model	L			H1	H2
	Nominal Traverse(mm)				
	100+100	200+200	300+300		
NVC-35(25A)	1185	1585	1985	126	120
NVC-35(32A)	1005	1405	1805	126	120
NVC-35(40A)	1005	1405	1805	126	120
NVC-35(50A)	1005	1405	1805	135	125
NVC-35(65A)	1020	1420	1820	149	133
NVC-35(80A)	1050	1450	1850	149	140
NVC-35(100A)	1065	1465	1865	160	153
NVC-35(125A)	1190	1590	1990	186	165
NVC-35(150A)	1195	1595	1995	200	202

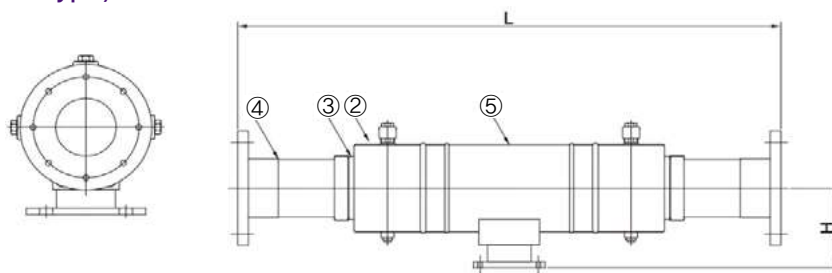
Dimension(mm)					
Model	L			H1	H2
	Nominal Traverse(mm)				
	100+100	200+200	300+300		
NVC-35(200A)	1195	1595	1995	228	253
NVC-35(250A)	1275	1675	2075	255	280
NVC-35(300A)	1300	1700	2100	280	345
NVC-35(350A)	1335	1735	2135	317	375
NVC-35(400A)	1350	1750	2150	356	400
NVC-35(450A)	1390	1790	2190	380	450
NVC-35(500A)	1540	1940	2340	410	475
NVC-35(550A)	1560	1960	2360	440	520
NVC-35(600A)	1560	1960	2360	470	520

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality.

Custom orders are available up to product specification 1000A and nominal traverse of 400+400TR.

*Field shoe height can be changed depending on field conditions.

FLANGE TYPE (Double Type)



Dimension(mm)					
Model	L			H1	H2
	Nominal Traverse(mm)				
	100+100	200+200	300+300		
NVC-35(25A)	1200	1800	2200	126	120
NVC-35(32A)	1020	1420	1820	126	120
NVC-35(40A)	1020	1420	1820	126	120
NVC-35(50A)	1020	1420	1820	135	125
NVC-35(65A)	1040	1440	1840	149	133
NVC-35(80A)	1070	1470	1870	149	140
NVC-35(100A)	1085	1485	1885	160	153
NVC-35(125A)	1215	1615	2015	186	165
NVC-35(150A)	1225	1625	2025	200	202

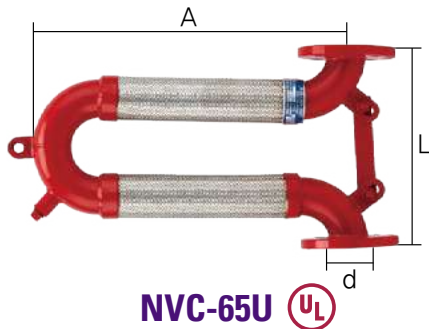
Dimension(mm)					
Model	L			H1	H2
	Nominal Traverse(mm)				
	100+100	200+200	300+300		
NVC-35(200A)	1225	1625	2025	228	253
NVC-35(250A)	1305	1705	2105	255	280
NVC-35(300A)	1330	1730	2130	280	345
NVC-35(350A)	1365	1765	2130	317	375
NVC-35(400A)	1380	1780	2180	356	400
NVC-35(450A)	1420	1820	2220	380	450
NVC-35(500A)	1580	1980	2380	410	475
NVC-35(550A)	1600	2000	2400	440	520
NVC-35(600A)	1600	2000	2400	470	520

*These specifications and dimensions are subject to change without prior notice to enhance product performance and quality.

Custom orders are available up to product specification 1000A and nominal traverse of 400+400TR.

*Field shoe height can be changed depending on field conditions.

NVC-65 Series (FLEX LOOP JOINT)



■ Features

The FLEX LOOP JOINT is a very important piping accessory used to protect critical fire fighting pipes such as sprinklers from hazards such as earthquakes.

The FLEX LOOP JOINT provides flexibility to the pipes and protects them by absorbing movement in all (X,Y,Z) axial directions.

The FLEX LOOP JOINT 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 differential settlement of buildings.

■ Usage

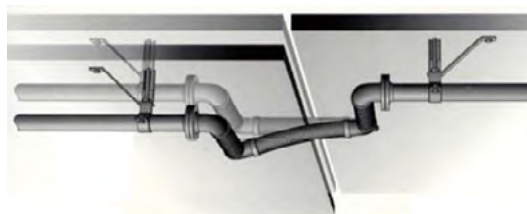
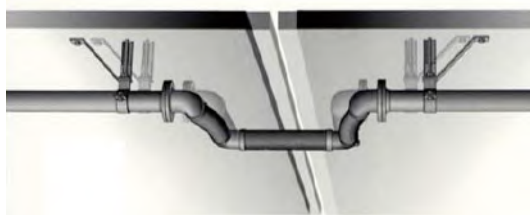
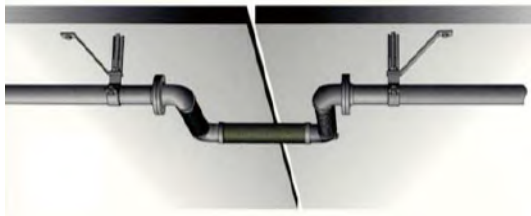
- ◆ Applicable fluid: Heating, water supply, hot water supply, fire fighting, etc.
- ◆ Working pressure: 10 Kg/cm², 20Kg/cm²
- ◆ Applicable displacement: One- to three-dimensional displacement (can be used for seismic purposes)
- ◆ Maximum temperature: 300°C
- ◆ Nominal traverse : 50~100 mm (X,Y,Z axis)
- ◆ Maximum deflection angle: 30° (25A ~ 50A) / 15° (65A or more)
- ◆ Material: Steel pipe, STS, copper pipe
- ◆ Connection type: FLANGE TYPE, WELD TYPE, SCREW TYPE, GROOVE TYPE

Dimension(mm)																	
Type	d (mm)	Movements(±) 50mm(X,Y,Z)		Movements(±) 100mm(X,Y,Z)		Type	d (mm)	Movements(±) 50mm(X,Y,Z)		Movements(±) 100mm(X,Y,Z)		Type	d (mm)	Movements(±) 50mm(X,Y,Z)		Movements(±) 100mm(X,Y,Z)	
		A (mm)	L (mm)	A (mm)	L (mm)			A (mm)	L (mm)	A (mm)	L (mm)						
NVC-65U(25A)	33.7	370	155	500	225	NVC-65V(25A)	33.7	240	510	320	660	NVC-65W(25A)	33.7	380	520	500	640
NVC-65U(32A)	42.4	400	190	530	255	NVC-65V(32A)	42.4	270	570	360	740	NVC-65W(32A)	42.4	440	620	550	740
NVC-65U(40A)	48.3	430	230	580	295	NVC-65V(40A)	48.3	330	700	410	850	NVC-65W(40A)	48.3	470	670	600	800
NVC-65U(50A)	60.3	490	310	630	325	NVC-65V(50A)	60.3	350	760	460	980	NVC-65W(50A)	60.3	540	770	690	920
NVC-65U(65A)	76.1	550	380	710	405	NVC-65V(65A)	76.1	420	920	540	1150	NVC-65W(65A)	76.1	600	870	750	1010
NVC-65U(80A)	88.9	600	460	760	460	NVC-65V(80A)	88.9	520	1130	600	1290	NVC-65W(80A)	88.9	680	980	830	1120
NVC-65U(100A)	114.3	730	620	890	620	NVC-65V(100A)	114.3	550	1230	640	1400	NVC-65W(100A)	114.3	800	1210	980	1380
NVC-65U(125A)	139.7	830	780	1020	780	NVC-65V(125A)	139.7	680	1530	700	1550	NVC-65W(125A)	139.7	1010	1520	1250	1770
NVC-65U(150A)	168.3	960	920	1170	920	NVC-65V(150A)	168.3	760	1730	830	1840	NVC-65W(150A)	168.3	1100	1690	1330	1940
NVC-65U(200A)	219.1	1240	1230	1470	1240	NVC-65V(200A)	219.1	850	1990	960	2160	NVC-65W(200A)	219.1	1300	2100	1550	2360

*Specifications and dimensions are subject to change without prior notice for the improvement of product performance and quality.
Custom production up to model 300A/differential settlement 200 mm is possible.

NVC-65 Series (FLEX LOOP JOINT)

- Pipe passing through the compression and expansion part of a building



- FLEX LOOP JOINT installation cases



Product Installation Pictures



Revision No.	Rev. 11
Revision Date	2026. 01



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