
KINETICS™
Selection Guide
Vibration Isolation
for HVAC Equipment



Kinetics Noise Control is recognized as the major producer of products and systems for the control of noise and vibration. The Company markets products under the trade name KINETICS®. Kinetics® products and engineered systems have been incorporated throughout major industrial and commercial buildings in the United States, Canada, Europe, Australia, and the Far East.

Kinetics Noise Control's national headquarters and manufacturing facilities are located in Dublin, Ohio, in a 60,000 square foot (5574 m) facility.

The Company provides products, systems, and solutions to everyday problems and for complex applications requiring noise and vibration control analysis.

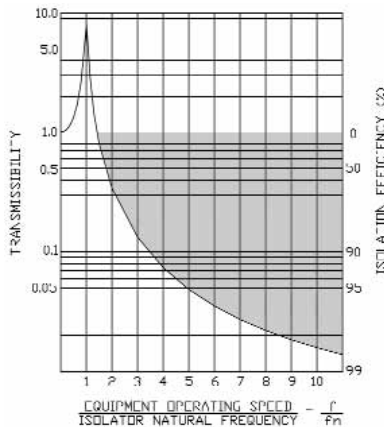
By using the Kinetics Selection Guide contained in this bulletin, proper isolation by type and deflection can be specified to obtain optimum effectiveness of the isolators. By specifying deflection rather than theoretical isolation efficiency, performance can be assured and can be readily verified in the field.

Kinetics' engineering and testing facilities are available at all times to assure that each product is tailored to meet project specifications and field conditions. Its staff of professionals welcomes the opportunity to assist in selecting and specifying the Company's products and systems.

Kinetics provides certified engineering drawings when requested for all products to assure compliance with project specifications.

Vibration and vibration-induced noise, major sources of occupant complaint, have steadily increased in today's modern buildings. The problems have been compounded by lighter weight construction and by the positioning of equipment in penthouses or intermediate level mechanical rooms. Not only is the physical vibration in the structure disturbing, but noise which is regenerated by the structural movement may be heard in other remote sections of the structure.

Effectiveness of vibration isolators in bringing about vibration reduction is indicated by the transmissibility curve is shown for vibrating equipment supported on isolators.



Typical transmissibility curve for an isolated system

When the isolated system is excited at its natural frequency, the system will be in resonance, and exciting forces will be amplified rather than reduced. It is desirable to select isolators with a natural frequency as far below the equipment operating speed as possible to achieve the highest degree of vibration control.

The Theoretical Isolation Efficiency shown on the transmissibility curve assumes the isolators are located on a rigid floor. This rigidity seldom occurs in above-grade applications. In practice, considerable building deflection can occur, which may reduce the effectiveness of the vibration isolators. Vibration isolators must be selected to compensate for the floor deflection. Longer spans also allow the structure to be more flexible, permitting the building to be more easily set into motion. With the aid of the Kinetics Selection Guide, building spans, equipment operating speeds, equipment horsepower, damping, and other factors have been taken into consideration.

By specifying Isolator Deflection rather than isolation efficiency, transmissibility, or other theoretical parameters, the consulting engineer can compensate for floor deflection and building resonances by selecting isolators which are satisfactory to provide minimum vibration transmission and which have more deflection than the supporting floor.

By stating that all isolators and equipment bases shall be of the same manufacturer and shall be supplied to the mechanical contractor, the consulting engineer has placed the responsibility on a single source who will be concerned with the vibration transmission from all mechanical equipment in the building, rather than only those which they supply.

When the specifier permits equipment suppliers to provide "appropriate" isolators, which are not manufactured under Kinetics' high standards, he does not assure a satisfactory job, since different brands of isolators may be furnished and no one supplier except Kinetics carries the full responsibility for a building free of vibration and noise as specified.

To apply the information from the Selection Guide, base type, isolator type, and minimum deflection columns are added to the equipment schedule, and the isolator specifications are incorporated into section 1515 of mechanical specifications for the project. Then, for each piece of mechanical equipment, base type, isolator type, and minimum deflection are entered, as tabulated in the Selection Guide.

The Kinetics Selection Guide is available in digital format so consulting engineers can select vibration isolators with the aid of their computer. Digital copies are available through Kinetics representatives, or by contacting Kinetics directly.

Air Unit Number	Area	CFM (cmm)	Wheel Diameter in. (mm)	Vibration Isolation		
				Base Type	Isolator Type	Minimum Deflection in. (mm)
AH-1	RM-1022	4500 (127)	18 (457)	5	2	0.75 (19)
AH-2	RM-1095	6000 (170)	20 (508)	5	2	1.75 (44)
AH-3	RM-3210	10800 (306)	36 (914)	7	2	1.75 (44)
AH-4	RM-187	1650 (47)	24 (610)	7	2	1.75 (44)

Pump Number	GPM	Type	Vibration Isolation		
			Base Type	Isolator Type	Minimum Deflection in. (mm)
P-1	3000	Split Case	7	2	1.75 (44)
P-2	10	Close Coupled	6	1	0.25 (6)
P-3	360	End Suction	7	2	1.75 (44)
P-4	420	End Suction	7	2	0.75 (19)

Selection Guide for Vibration Isolation

Equipment Type	Equipment Category	Horsepower and other (Shaft Power, kW and Other)	RPM	Equipment Location												Reference Notes		
				Grade Supported Slab			Up to 20 Ft. (6 m) Floor Span			20 - 30 Ft. (6 - 9 m) Floor Span			30 - 40 Ft. (9 - 12 m) Floor Span					
				Base Type	Isolator Type	Min. Deflection in. (mm)	Base Type	Isolator Type	Min. Deflection in. (mm)	Base Type	Isolator Type	Min. Deflection in. (mm)	Base Type	Isolator Type	Min. Deflection in. (mm)			
Refrigeration Machines and Chillers	Reciprocating	All	All	4	1	0.25 (6)	4	3	0.75 (19)	4	2	1.75 (44)	4	3	2.50 (64)	--		
	Centrifugal	All	All	4	1	0.25 (6)	4	3	0.75 (19)	4	2	1.75 (44)	4	2	1.75 (44)	--		
	Open Centrifugal	All	All	7	1	0.25 (6)	7	3	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	--		
	Absorption	All	All	4	1	0.25 (6)	4	3	0.75 (19)	4	2	1.75 (44)	4	2	1.75 (44)	--		
Air Compressors and Vacuum Pumps	Tank-Mounted	up to 10 (7.5)	All	4	2	0.75 (19)	4	2	0.75 (19)	4	2	1.75 (44)	4	2	1.75 (44)	--		
		15 (11) and over	All	7	2	0.75 (19)	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	--		
	Base-Mounted	All	All	7	2	0.75 (19)	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	--		
		Large Reciprocating	All	All	7	2	0.75 (19)	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	6	
Pumps	Close Coupled	up to 7.5 (5.6)	All	5/6*	1	0.25 (6)	7	2	0.75 (19)	7	2	0.75 (19)	7	2	0.75 (19)	7		
		10 (7.5) and over	All	7	2	0.75 (19)	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	5, 7		
	In Line	5 to 25 (3.7 to 19)	All	4	2	0.75 (19)	4	2	1.75 (44)	4	2	1.75 (44)	4	2	1.75 (44)	--		
		30 (22) and over	All	4	2	1.75 (44)	4	2	1.75 (44)	4	2	1.75 (44)	4	2	2.50 (64)	2.5		
	End Suction	up to 40 (30)	All	7	2	0.75 (19)	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	7		
		50 to 125 (37 to 93)	All	7	2	0.75 (19)	7	2	0.75 (19)	7	2	1.75 (44)	7	2	2.50 (64)	5, 7		
	Split Case	150 (110) and over	All	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	7	2	2.50 (64)	5, 7		
		up to 40 (30)	All	7	2	0.75 (19)	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	7		
		50 to 125 (37 to 93)	All	7	2	0.75 (19)	7	2	0.75 (19)	7	2	1.75 (44)	7	2	2.50 (64)	5, 7		
	150 (110) and over	All	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	7	2	2.50 (64)	5, 7			
up to 300		4	1	0.25 (6)	4	3	3.50 (89)	4	3	3.50 (89)	4	3	3.50 (89)	1, 3				
301 to 500		4	1	0.25 (6)	4	3	2.50 (64)	4	3	2.50 (64)	4	3	2.50 (64)	1				
Propeller	All	500 and over	4	1	0.25 (6)	4	3	0.75 (19)	4	3	0.75 (19)	4	3	1.75 (44)	1			
		up to 300	4	1	0.25 (6)	4	3	3.50 (89)	4	3	3.50 (89)	4	3	3.50 (89)	1, 3			
	All	301 to 500	4	1	0.25 (6)	4	3	2.50 (64)	4	3	2.50 (64)	4	3	2.50 (64)	1			
500 and over		4	1	0.25 (6)	4	3	0.75 (19)	4	3	0.75 (19)	4	3	1.75 (44)	1				
Boilers	All	All	All	4	1	0.25 (6)	5/6*	3	0.75 (19)	5/6*	3	1.75 (44)	5/6*	3	2.50 (64)	1		
Axial Flow Fans and Fan Heads	up to 22"Ø	All	All	4	1	0.25 (6)	4	2	0.75 (19)	4	2	0.75 (19)	7	2	0.75 (19)	1, 3		
Centrifugal Fans	24" Ø & over	up to 2" (500 Pa) static pressure	up to 300	5/6	2	2.50 (64)	7	2	3.50 (89)	7	2	3.50 (89)	7	2	3.50 (89)	1, 3, 4		
			301 to 500	5/6	2	0.75 (19)	5/6	2	1.75 (44)	7	2	2.50 (64)	7	2	2.50 (64)	1		
			501 and over	5/6	2	0.75 (19)	5/6	2	1.75 (44)	5/6	2	1.75 (44)	5/6	2	1.75 (44)	1		
	2.1 (501 Pa) static pressure and over	up to 300	7	2	2.50 (64)	7	2	3.50 (89)	7	2	3.50 (89)	7	2	3.50 (89)	1, 3, 4			
		301 to 500	7	2	1.75 (44)	7	2	1.75 (44)	7	2	2.50 (64)	7	2	2.50 (64)	1, 4			
		501 and over	7	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	7	2	2.50 (64)	1, 4			
Propeller Fans	up to 22"Ø	All	All	5/6	1	0.25 (6)	5/6	2	0.75 (19)	5/6	2	0.75 (19)	7	2	1.75 (44)	3, 4		
			24" Ø & over	up to 40 (30)	up to 300	5/6	2	2.50 (64)	5/6	2	3.50 (89)	5/6	2	3.50 (89)	5/6	2	3.50 (89)	3
					301 to 500	5/6	2	1.75 (44)	5/6	2	1.75 (44)	5/6	2	2.50 (64)	5/6	2	2.50 (64)	3
	501 and over	5/6			2	0.75 (19)	5/6	2	0.75 (19)	5/6	2	0.75 (19)	5/6	2	1.75 (44)	3		
	50 (37) and over	up to 300	7	2	2.50 (64)	7	2	3.50 (89)	7	2	3.50 (89)	7	2	3.50 (89)	3, 4			
		301 to 500	7	2	1.75 (44)	7	2	1.75 (44)	7	2	2.50 (64)	7	2	2.50 (64)	3, 4			
501 and over		7	2	1.00 (25)	7	2	1.75 (44)	7	2	1.75 (44)	7	2	2.50 (64)	3, 4				
Heat Pumps Condensing Units	Wall-Mounted	All	All	4	1	0.25 (6)	4	1	0.25 (6)	4	1	0.25 (6)	4	1	0.25 (6)	1		
	Roof Exhauster	All	All	4	1	0.25 (6)	4	1	0.25 (6)	5/6*	3	1.75 (44)	8	3	1.75 (44)	1		
AH, AC and H & V Units	All	up to 10 (7.5)	All	4	2	0.75 (19)	4	2	0.75 (19)	4	2	0.75 (19)	4	2	0.75 (19)	--		
			15 (11) and over	up to 300	4	2	0.75 (19)	4	2	3.50 (89)	4	2	3.50 (89)	7+	2	3.50 (89)	1, 4	
			up to 4" (1 kPa) static pressure	301 to 500	4	2	0.75 (19)	4	2	2.50 (64)	4	2	2.50 (64)	4	2	2.50 (64)	4	
			501 and over	4	2	0.75 (19)	4	2	1.75 (44)	4	2	1.75 (44)	4	2	1.75 (44)	4		
	15 (11) and over	up to 300	5/6	2	0.75 (19)	7	2	3.50 (89)	7	2	3.50 (89)	7	2	3.50 (89)	1, 3, 4			
		301 to 500	5/6	2	0.75 (19)	7	2	1.75 (44)	7	2	2.50 (64)	7	2	2.50 (64)	1, 4			
		501 and over	5/6	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	7	2	2.50 (64)	1, 4			
		4" (1 kPa) static pressure and over	5/6	2	0.75 (19)	7	2	1.75 (44)	7	2	1.75 (44)	7	2	2.50 (64)	1, 4			
Packaged Rooftop Equipment	All	All	All	4/8	1	0.25 (6)	8	2	0.75 (19)	See Note #9		See Note #9		8				

Products Meeting Selection Criteria

- Type 1 - Fiberglass Isolation Pad, Model KIP
- Fiberglass Isolation Mount, Model AC
- Elastomer Isolation Pad, Model NG
- Machinery Mount, Model KLM
- Vibration Isolation Mount, Model RD
- Isolation Hanger, Model RH
- Type 2 - Free-standing Steel Spring, Model FDS
- Isolation Hanger, Model SH
- Isolation Hanger, Model SFH
- Isolation Hanger, Model SRH
- Type 3 - Restrained Spring Isolator, Model FLS
- Type 4 - No Base Required
- Type 5 - Structural Rail Base, Model SBB
- Type 6 - Integral Structural Beam Base, Model SFB
- Type 7 - Concrete Inertia Base, Model CIB-L
- Concrete Inertia Base, Model CIB-H
- Concrete Inertia Base, Model CIB-SS
- Type 8 - Roof Curb Rail, Model KSR
- Roof Curb Rail, Model KSCR
- Roof Curb Rail, Model ESR

Notes:

1. Provide Type 5 or 6 base if required to support equipment properly.
2. Provide Type 5, 6 or 7 base if required to stabilize supported equipment.
3. Isolator natural frequency to be 40% of the lowest equipment operating speed.
4. Provide HSR thrust restraints for air-moving equipment operating at 2.1 in. (501 Pa) static pressure and above.
5. Provide 12 in. (305 mm) thick Type 7 inertia base for 75 HP (56 kW) and over pumps.
6. Provide Type 7 inertia base weighing a minimum of 10 times the maximum equipment unbalanced forces.
7. Provide Type 7 inertia base large enough to provide elbow support.
8. If RTU weight causes additional roof deflection >0.25" (6 mm), stiffen roof structure or relocate RTU so additional deflection is <=0.25" (6 mm). RTUs over noise-sensitive areas may require additional acoustical treatment to reduce airborne noise below.
9. Extreme care must be taken for equipment located on spans of over 20 ft, especially if construction is open web joints or thin, lightweight slabs. The recommended procedure is to determine the additional deflection caused by equipment in the roof. If additional roof deflection is 0.25 in. or less, the isolator should be selected for 10 times the additional roof deflection. If additional roof deflection is over 0.25 in., supplemental roof stiffening should be installed to bring the roof deflection down below 0.25 in., or the unit should be relocated to a stiffer roof position.

* Reference notes do not apply.

+ Reference note #1 does not apply.

Specifications

Isolators and bases shall be as tabulated on the equipment schedule, and shall be manufactured by Kinetics Noise Control, Inc. Dublin, Ohio, as follows:

Type 1 Isolators: Model KIP-Q Precompressed Molded Fiberglass Noise and Vibration Isolation Pads, individually coated with a flexible moisture-impervious elastomeric membrane. Pads shall be fine (0.00027"/6.9 micron diameter) bonded annealed glass fibers which have been stabilized during manufacture by compressing the material ten times. Pads shall have a constant natural frequency over the operating load range, and the stiffness shall increase proportionately with load applied. Pads shall be no taller than the shortest horizontal dimension. Where the equipment base does not provide a uniform load surface, steel plates shall be bonded to the top of the pads. Alternately, Model RD Neoprene Mounts, incorporating completely enclosed metal inserts to permit bolting to the supported unit, may be used.

Type 2 Floor Isolators: Model FDS Free-Standing, Unhoused, Laterally Stable Steel Springs incorporating leveling bolts and ¼ in. (6 mm) thick ribbed noise isolation pads. To assure stability, the spring shall have a lateral spring stiffness greater than 1.0 times the rated vertical stiffness, and shall be designed to provide 50% overload capacity. In capacities up to 5,000 lbs. (2268 kg), springs shall be replaceable. In capacities over 5,000 lbs. (2268 kg), springs shall be welded to the top and bottom load plate assemblies.

Type 2 Hangers: Model SFH Combination Spring and Fiberglass Hangers, incorporating precompressed molded fiberglass noise and vibration isolation pads, coated with a moisture impervious elastomeric membrane in series with springs, all encased in welded steel brackets. Springs shall be as specified above. Isolators shall be designed to accommodate rod misalignment over a 30 degree arc. Brackets shall be designed to carry 500% overload without failure.

Type 3 Isolators: Model FLS, Free-Standing, Laterally Stable, Spring Isolators, similar to Type FDS, but incorporating vertical limit stops to assure a constant operating height if the supported weight is removed, and to reduce movement due to wind loads. Limit stops shall be isolated from the housing to prevent short-circuiting.

Type 4 Bases: No base required. Isolators may be attached directly to the supported equipment.

Type 5 or 6 Bases: Model SFB or SBB Structural Steel Bases, designed and supplied by the isolator manufacturer. Bases shall be designed with isolator brackets to reduce the mounting height of the equipment. To assure adequate stiffness, the height of the members shall be a minimum of 8% of the longest span between isolators, or at least 6 inches (152 mm). Where thinner sections are necessary due to head room limitations, etc., the section modulus of the members selected shall equal or exceed the section modulus of wide flange steel members whose thickness is 8% of the longest span between isolators.

Type 7 Bases: Model CIB Reinforced Concrete Inertia Bases, the steel members of which are designed and supplied by the isolator manufacturer. The concrete shall be poured into a welded steel frame, incorporating prelocated equipment anchor bolts, ½ in. (13 mm) diameter reinforcing bars on nominal 8 in. (203 mm) centers each way, and recessed isolator mounting brackets to reduce the mounting height of the equipment, but yet remain within the confines of the base. The thickness of the base shall be a minimum of 8% of the longest span between isolators, at least 6 inches (152 mm), or as indicated on the drawings. Where inertia bases are used to mount pumps, the bases shall be large enough to support piping elbows.

Type 8 Bases: Model KSR, KSCR or ESR Isolation Rail System, consisting of two parallel rail systems, incorporating steel spring isolators designed for the specified static deflection, all fabricated to be installed as a part of the roof curb system, and provide continuous support for the isolated equipment.

Piping: All piping 1 in. (25 mm) diameter and over in the mechanical equipment room, and all piping three supports away from other mechanical equipment shall be isolated from the structure by means of vibration and noise control isolators. Suspended piping shall be isolated with Type 2 Hangers as described above. Floor-mounted piping shall be isolated with Type 2 Spring Isolators as described above.

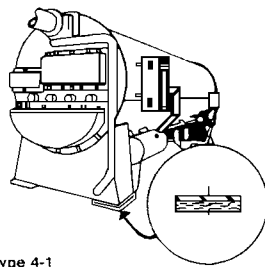
Flexible members shall be incorporated in the ductwork adjacent to all reciprocating equipment, and shall be approved construction.

Flexible connections shall be incorporated in the ductwork adjacent to all air-moving units. The connections shall be neoprene or canvas of approved construction. High pressure ductwork, for a distance of 50 feet (1270 mm) from high pressure fans shall be isolated from the ductwork by means of Type 2 Hangers as described above.

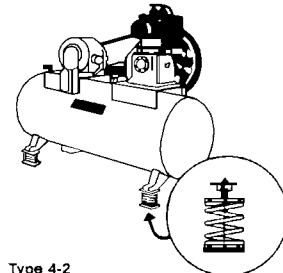
Notes:

1. Provide Type 5 or 6 base if required to support equipment properly.
2. Provide Type 5, 6, or 7 base if required to stabilize supported equipment.
3. Isolator natural frequency to be 40% of the lowest equipment operating speed.
4. Provide HSR thrust restraints for air-moving equipment operating at 2.1 in. (501 Pa) static pressure and above.
5. Provide 12 in. (305 mm) thick Type 7 inertia base for 75 HP (56 kW) and over pumps.
6. Provide Type 7 inertia base weighing a minimum of 10 times the maximum equipment unbalanced forces.
7. Provide Type 7 inertia base large enough to provide elbow support.
8. If RTU weight causes additional roof deflection >0.25" (6 mm), stiffen roof structure or relocate RTU so additional deflection is ≤0.25" (6 mm). BTUs over noise-sensitive areas may require additional acoustical treatment to reduce airborne noise below.

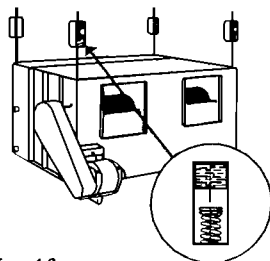
Examples of “Base Type’ and “Isolator Type” for typical situations



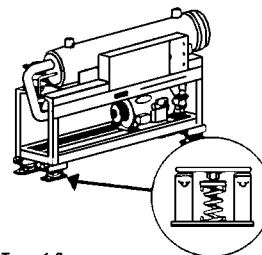
Type 4-1



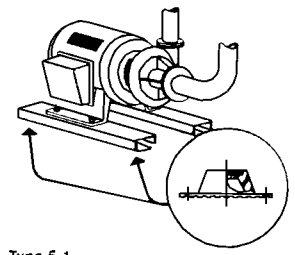
Type 4-2



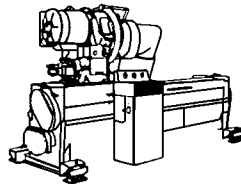
Type 4-2



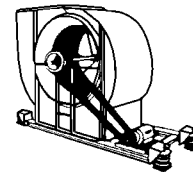
Type 4-3



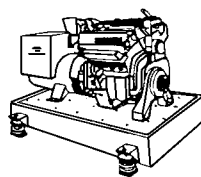
Type 5-1



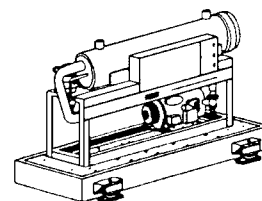
Type 5-3



Type 6-2



Type 7-2



Type 7-3



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