Table of Contents

Vibration Isolation and Control ................................................................................................. 2

**Equipment Types**
- Refrigeration Machines and Chillers .................................................................................. 3
- Air Compressors and Vacuum Pumps ................................................................................... 4
- Pumps ................................................................................................................................. 5
- Axial, Plenum, Cabinet, and Centrifugal Inline Fans .............................................................. 6
- Centrifugal Fans .................................................................................................................. 7
- Cooling Towers .................................................................................................................... 8
- Boilers .................................................................................................................................. 8
- Propeller Fans ..................................................................................................................... 9
- Ducted Rotating Equipment .................................................................................................. 9
- Packaged AH, AC, H and V Units ...................................................................................... 10
- Engine-Driven Generators .................................................................................................. 10
- Heat Pumps, Fan Coils, Computer Room Units ................................................................... 11
- Condensing Units ............................................................................................................... 11
- Packaged Rooftop Equipment ............................................................................................ 11

**Products**
- ASHRAE TYPE 1: Fiberglass or Neoprene Pad ................................................................. 12
  - KIP Fiberglass Pad | NP Neoprene Pad | NG Neoprene Pad | RSP Neoprene Pad
- The Fiberglass Advantage .................................................................................................. 12
- ASHRAE TYPE 2: Floor Isolator or Hanger ...................................................................... 13
  - AC Fiberglass Mount | RD Neoprene Mount | RQ Neoprene Mount
  - FH Fiberglass Hanger | RH Neoprene Hanger
- ASHRAE TYPE 3: Spring Floor Isolator or Hanger .............................................................. 14
  - FDS Free-Standing Isolator | SL Housed Isolator | SM Housed Isolator
  - SFH Fiberglass Hanger | SRH Neoprene Hanger | SH Hanger
- ASHRAE TYPE 4: Restrained Spring Isolator .................................................................... 15
  - Titan | FMS | FLS | FLSS | FRS | FHS
- ASHRAE TYPE 5: Thrust Restraints .................................................................................. 16
  - HSR
- ASHRAE TYPE 6: Air Mounts ........................................................................................... 16
  - KAM | CAM

KINFLEX Flexible Connectors .................................................................................................. 16

BASE TYPE A: Direct Isolation ............................................................................................... 17
BASE TYPE B: Structural Rails ............................................................................................... 17
  - SBB | SFB
BASE TYPE C: Concrete Inertia Base ................................................................................... 17
BASE TYPE D: Curb-Mounted Base ....................................................................................... 18
  - KSR | KSCR | ESR

ESSR Sound and Vibration Curb ............................................................................................. 18

Riser Supports, Anchors, and Guides ................................................................................... 19

Seismic Restraint ................................................................................................................... 20

Piping/Hanger Selection Data (U.S) .................................................................................... 21
Piping/Hanger Selection Data (SI) ....................................................................................... 22

Isolation Notes for Specific Equipment .................................................................................. Back
Vibration Isolation and Seismic Control Basics:

Mechanical vibration and vibration-induced noise are common sources of occupant complaints in modern buildings. Vibration is caused by reciprocating motion from rotating components within mechanical equipment. All reciprocating, or rotating equipment should be isolated to reduce transmission of vibration into the structure. Kinetics Noise Control provides technical assistance in the selection and specification of tailor-made isolation systems and vibration isolation products that enable building owners to install complex heating, ventilation and air-conditioning systems without the worry of vibration problems.

If you have a Vibration Issue:

Isolator deflections shown in the following pages are based on the data published in the 2015 ASHRAE Handbook. Recommended isolator type, base type, and minimum static deflection are reasonable and safe recommendations for most HVAC equipment installations. Additional assistance from one of our many qualified representatives or acoustical consultants can also be very useful in resolving these problems.

Engineering Expertise:

Building codes are constantly updated with stricter requirements for seismic, wind and blast protection. Kinetics offers a complete line of restrained vibration isolators to satisfy current building code requirements as well as complete engineering support. Our highly skilled engineering staff focus on labor savings and constructability in line with current directions in mechanical construction. We offer streamlined and cost effective engineered solutions along with professional and structural engineering stamps to meet any specification requirements in all 50 states. Kinetics’ unsurpassed expertise will ensure success with highly complex hospital, government and military projects as well as the unique challenges of design/build projects.
### Refrigeration Machines and Chillers*

<table>
<thead>
<tr>
<th>Equipment Category</th>
<th>Base Type</th>
<th>ASHRAE Type</th>
<th>Isolator Defl.</th>
<th>Base Type</th>
<th>ASHRAE Type</th>
<th>Isolator Defl.</th>
<th>Base Type</th>
<th>ASHRAE Type</th>
<th>Isolator Defl.</th>
<th>Base Type</th>
<th>ASHRAE Type</th>
<th>Isolator Defl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reciprocating</td>
<td>A</td>
<td>2</td>
<td>1/4&quot; (6)</td>
<td>A</td>
<td>4</td>
<td>1&quot; (25)</td>
<td>A</td>
<td>4</td>
<td>2&quot; (51)</td>
<td>A</td>
<td>4</td>
<td>4&quot; (102)</td>
</tr>
<tr>
<td>Centrifugal, scroll</td>
<td>A</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>A</td>
<td>4</td>
<td>1&quot; (25)</td>
<td>A</td>
<td>4</td>
<td>2&quot; (51)</td>
<td>A</td>
<td>4</td>
<td>2&quot; (51)</td>
</tr>
<tr>
<td>Screw</td>
<td>A</td>
<td>1</td>
<td>1&quot; (25)</td>
<td>A</td>
<td>4</td>
<td>2&quot; (51)</td>
<td>A</td>
<td>4</td>
<td>4&quot; (102)</td>
<td>A</td>
<td>4</td>
<td>4&quot; (102)</td>
</tr>
<tr>
<td>Absorption</td>
<td>A</td>
<td>4</td>
<td>1&quot; (25)</td>
<td>A</td>
<td>4</td>
<td>2&quot; (51)</td>
<td>A</td>
<td>4</td>
<td>2&quot; (51)</td>
<td>A</td>
<td>4</td>
<td>4&quot; (102)</td>
</tr>
<tr>
<td>Air-cooled recip., scroll</td>
<td>A</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>A</td>
<td>4</td>
<td>2&quot; (51)</td>
<td>A</td>
<td>4</td>
<td>2&quot; (51)</td>
<td>A</td>
<td>4</td>
<td>4&quot; (102)</td>
</tr>
<tr>
<td>Air-cooled screw</td>
<td>A</td>
<td>4</td>
<td>1&quot; (25)</td>
<td>B</td>
<td>4</td>
<td>2&quot; (51)</td>
<td>B</td>
<td>4</td>
<td>4&quot; (102)</td>
<td>B</td>
<td>4</td>
<td>4&quot; (102)</td>
</tr>
</tbody>
</table>

*Data from 2015 ASHRAE Handbook. See back cover for additional notes on Refrigeration Machines.

**Equipment Location**

<table>
<thead>
<tr>
<th>Floor Span</th>
<th>Slab on Grade</th>
<th>Up to 20 ft (6 m)</th>
<th>20 to 30 ft (6 - 9 m)</th>
<th>30 to 40 ft (9-12 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashrae Type</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Base Type</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Isolator Defl.</td>
<td>4</td>
<td>1&quot; (25)</td>
<td>2&quot; (51)</td>
<td>4&quot; (102)</td>
</tr>
</tbody>
</table>

**ASHRAE TYPE 1:**
Fiberglass or Neoprene Pad
See page 12 for more details

**KINETICS™**
- KIP Fiberglass Pad
- KIN Neoprene Pad
- KIN Neoprene Pad
- KIN RSP Neoprene Pad

**ASHRAE TYPE 2:**
Floor Isolator or Hanger
See page 13 for more details

**KINETICS™**
- AC Fiberglass Mount
- RD Neoprene Mount
- RQ Neoprene Mount
- FH Fiberglass Hanger
- RH Neoprene Hanger

**ASHRAE TYPE 4:**
Restrained Spring Isolator
See page 15 for more details

**KINETICS™**
- TITAN
- FMS
- FL
- FLSS

**BASE TYPE A:**
Direct Isolation
No base, isolators attached directly to equipment.

**BASE TYPE B:**
Structural Steel Rails or Base
See page 17 for more details

**KINETICS™**
- SBB Structural Rail Base
- SFB Structural Beam Base
## Equipment Type:

### Air Compressors and Vacuum Pumps*

<table>
<thead>
<tr>
<th>Equipment Category</th>
<th>Equipment Location</th>
<th>Floor Span</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slab on Grade</td>
<td>Up to 20 ft (6 m)</td>
</tr>
<tr>
<td></td>
<td>Base Type</td>
<td>ASHRAE Type</td>
</tr>
<tr>
<td>Tank-mounted horizontal ≤7.5 HP</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>≥11 HP</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>Tank-mounted vertical</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>Base-Mounted</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>Large Reciprocating</td>
<td>C</td>
<td>3</td>
</tr>
</tbody>
</table>

*Data from 2015 ASHRAE Handbook. See back cover for additional notes on Compressors.

**For seismic & wind applications, use ASHRAE TYPE 4

---

**ASHRAE TYPE 3:** Spring Floor Isolator or Hanger
See page 14 for more details

**KINETICSTM**
- FDS Free-Standing Isolator
- SL Housed Isolator
- SM Housed Isolator
- SFH Fiberglass Hanger
- SRH Neoprene Hanger
- SH Hanger

**ASHRAE TYPE 4:** Restrained Spring Isolator
See page 15 for more details

**KINETICSTM**
- TITAN
- FMS
- FLS
- FLSS
- FHS
- FRS

---

**BASE TYPE A:** Direct Isolation
No base, isolators attached directly to equipment.

**BASE TYPE C:** Concrete Inertia Base
See page 17 for more details

**KINETICSTM** CIB
## Equipment Type:

### Pumps*

<table>
<thead>
<tr>
<th>Equipment Category</th>
<th>Slab on Grade</th>
<th>Up to 20 ft (6 m)</th>
<th>20 to 30 ft (6 - 9 m)</th>
<th>30 to 40 ft (9-12 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Floor Span</strong></td>
<td>Base Type</td>
<td>ASHRAE Type</td>
<td>Isolator Defl.</td>
<td>Base Type</td>
</tr>
<tr>
<td>Close-Coupled</td>
<td>B</td>
<td>2</td>
<td>1/4&quot; (6)</td>
<td>C</td>
</tr>
<tr>
<td>≤5.6 HP</td>
<td>C</td>
<td>3</td>
<td>1&quot; (25)</td>
<td>C</td>
</tr>
<tr>
<td>≥7.5 HP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Inline</td>
<td>A</td>
<td>3</td>
<td>1&quot; (25)</td>
<td>A</td>
</tr>
<tr>
<td>3.7 to 19 HP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥22 HP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End Suction/Split Case</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤30 HP</td>
<td>C</td>
<td>3</td>
<td>1&quot; (25)</td>
<td>C</td>
</tr>
<tr>
<td>37 to 93 HP</td>
<td>C</td>
<td>3</td>
<td>1&quot; (25)</td>
<td>C</td>
</tr>
<tr>
<td>≥110 HP</td>
<td>C</td>
<td>3</td>
<td>1&quot; (25)</td>
<td>C</td>
</tr>
<tr>
<td>Packaged Pump Systems</td>
<td>A</td>
<td>3</td>
<td>1&quot; (25)</td>
<td>A</td>
</tr>
</tbody>
</table>

*Data from 2015 ASHRAE Handbook. See back cover for additional notes on Pumps.

**For seismic & wind applications, use ASHRAE TYPE 4

---

**BASE TYPE A:** Direct Isolation

No base, isolators attached directly to equipment.

**BASE TYPE B:** Structural Steel Rails or Base

See page 17 for more details

**BASE TYPE C:** Concrete Inertia Base

See page 17 for more details

---

*Note: Images and diagrams are not included in the text representation.*
### Equipment Type:

**Axial, Plenum, Cabinet, and Centrifugal Inline Fans**

<table>
<thead>
<tr>
<th>RPM</th>
<th>Equipment Category</th>
<th>Slab on Grade</th>
<th>Up to 20 ft (6 m)</th>
<th>20 to 30 ft (6 - 9 m)</th>
<th>30 to 40 ft (9-12 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Base Type</td>
<td>ASHRAE Type</td>
<td>Isolator Defl.</td>
<td>Base Type</td>
</tr>
<tr>
<td>Up to 22 in. diameter</td>
<td>A</td>
<td>2</td>
<td>1/4&quot; (6)</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>24 in. diameter and up</td>
<td>B</td>
<td>3</td>
<td>4&quot; (102)</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>≤2.0 in. SP</td>
<td>C</td>
<td>3</td>
<td>4&quot; (102)</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>Up to 300</td>
<td>B</td>
<td>3</td>
<td>1&quot; (24)</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>301 to 500</td>
<td>B</td>
<td>3</td>
<td>1&quot; (24)</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>500 and up</td>
<td>C</td>
<td>3</td>
<td>2&quot; (51)</td>
<td>C</td>
<td>3</td>
</tr>
</tbody>
</table>

*Data from 2015 ASHRAE Handbook.

**For seismic & wind applications, use ASHRAE TYPE 4**

---

**BASE TYPE A:** Direct Isolation

No base, isolators attached directly to equipment.

**BASE TYPE B:** Structural Steel Rails or Base

See page 17 for more details

**BASE TYPE C:** Concrete Inertia Base

See page 17 for more details

---

**ASHRAE TYPE 2:**
Floor Isolator or Hanger

See page 13 for more details

**ASHRAE TYPE 3:**
Spring Floor Isolator or Hanger

See page 14 for more details

**ASHRAE TYPE 4:**
Restrained Spring Isolator

See page 15 for more details
**Equipment Type:**

**Centrifugal Fans***

<table>
<thead>
<tr>
<th>Equipment Category</th>
<th>Equipment Location</th>
<th>Floor Span</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slab on Grade</td>
<td>Up to 20 ft (6 m)</td>
</tr>
<tr>
<td></td>
<td>Base Type</td>
<td>ASHRAE Type</td>
</tr>
<tr>
<td>Up to 22 in. diameter</td>
<td>B</td>
<td>2</td>
</tr>
<tr>
<td>24 in. diameter and up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤40 HP RPM</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>Up to 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>301 to 500</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>501 and up</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>≥50 HP RPM</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>Up to 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>301 to 500</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>501 and up</td>
<td>C</td>
<td>3</td>
</tr>
</tbody>
</table>

*Data from 2015 ASHRAE Handbook. See back cover for additional notes on Fans.*

**ASHRAE TYPE 2:**
Floor Isolator or Hanger
See page 13 for more details

**KINETICS™** AC Fiberglass Mount
**KINETICS™** RD Neoprene Mount
**KINETICS™** RQ Neoprene Mount
**KINETICS™** FH Fiberglass Hanger

**ASHRAE TYPE 3:**
Spring Floor Isolator or Hanger
See page 14 for more details

**KINETICS™** FDS Free-Standing Isolator
**KINETICS™** SL Housed Isolator
**KINETICS™** SM Housed Isolator
**KINETICS™** SFH Fiberglass Hanger
**KINETICS™** SRH Neoprene Hanger
**KINETICS™** SH Hanger

**ASHRAE TYPE 4:**
Restrained Spring Isolator
See page 15 for more details

**KINETICS™** TITAN
**KINETICS™** FMS
**KINETICS™** FLS
**KINETICS™** FLSS
**KINETICS™** FHS
**KINETICS™** FRS

**BASE TYPE B:**
Structural Steel Rails or Base
See page 17 for more details

**KINETICS™** SBB Structural Rail Base
**KINETICS™** SFB Structural Beam Base

**BASE TYPE C:**
Concrete Inertia Base
See page 17 for more details

**KINETICS™** CIB-L
**KINETICS™** CIB-H
**KINETICS™** CIB-SS
# Equipment Type:

## Cooling Towers and Boilers*

<table>
<thead>
<tr>
<th>Equipment Location</th>
<th>Floor Span</th>
<th>Slab on Grade</th>
<th>Up to 20 ft (6 m)</th>
<th>20 to 30 ft (6 - 9 m)</th>
<th>30 to 40 ft (9-12 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Base Type</td>
<td>ASHRAE Type</td>
<td>Isolator Defl.</td>
<td>Base Type</td>
</tr>
<tr>
<td><strong>Cooling Towers RPM</strong></td>
<td></td>
<td>A</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>A</td>
</tr>
<tr>
<td>Up to 300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>301 to 500</td>
<td></td>
<td>A</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>A</td>
</tr>
<tr>
<td>501 and up</td>
<td></td>
<td>A</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>A</td>
</tr>
<tr>
<td><strong>Boiler Type</strong></td>
<td></td>
<td>A</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>B</td>
</tr>
<tr>
<td>Fire-tube</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Water-tube, copper fin</td>
<td></td>
<td>A</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>A</td>
</tr>
</tbody>
</table>

*Data from 2015 ASHRAE Handbook. See back cover for additional notes on Cooling Towers.*

---

**KIP**

**Ashrae Type 1:**

Fiberglass or Neoprene Pad

*See page 12 for more details*

**KINETICS™**

- **KIP** Fiberglass Pad
- **NP** Neoprene Pad
- **NG** Neoprene Pad
- **RSP** Neoprene Pad

**RSP**

**Ashrae Type 4:**

Restrained Spring Isolator

*See page 15 for more details*

**KINETICS™**

- **TITAN**
- **FMS**
- **FLS**
- **FLSS**
- **FHS**
- **FRS**

---

**Base Type A:**

Direct Isolation

No base, isolators attached directly to equipment.

**Base Type B:**

Structural Steel Rails or Base

*See page 17 for more details*

**KINETICS™**

- **SBB** Structural Rail Base
- **SFB** Structural Beam Base
#### Equipment Type:

**Propeller Fans and Ducted Rotating Equipment**

<table>
<thead>
<tr>
<th>Equipment Location</th>
<th>Slab on Grade</th>
<th>Up to 20 ft (6 m)</th>
<th>20 to 30 ft (6 - 9 m)</th>
<th>30 to 40 ft (9-12 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Type</td>
<td>ASHRAE Type</td>
<td>Isolator Defl.</td>
<td>Base Type</td>
</tr>
<tr>
<td>Wall-Mounted</td>
<td>A</td>
<td>1</td>
<td>1/4” (6)</td>
<td>A</td>
</tr>
<tr>
<td>Roof-Mounted</td>
<td>A</td>
<td>1</td>
<td>1/4” (6)</td>
<td>A</td>
</tr>
<tr>
<td>Ducted Rotating Equip.</td>
<td>A</td>
<td>3</td>
<td>1” (25)</td>
<td>A</td>
</tr>
</tbody>
</table>

*Data from 2015 ASHRAE Handbook.*

---

**ASHRAE TYPE 1:**

- Fiberglass or Neoprene Pad
  - See page 12 for more details

**KINETICS™**
- KIP Fiberglass Pad
- KINETICS™ NP Neoprene Pad
- KINETICS™ NG Neoprene Pad
- KINETICS™ RSP Neoprene Pad

**ASHRAE TYPE 3:**

- Spring Floor Isolator or Hanger
  - See page 14 for more details

**KINETICS™**
- FDS Free-Standing Isolator
- KINETICS™ SL Housed Isolator
- KINETICS™ SM Housed Isolator
- KINETICS™ SFH Fiberglass Hanger
- KINETICS™ SRH Neoprene Hanger
- KINETICS™ SH Hanger

**ASHRAE TYPE 4:**

- Restrained Spring Isolator
  - See page 15 for more details

**KINETICS™**
- TITAN
- FMS
- FLS
- FLSS
- FHS
- FRS

---

**BASE TYPE A:**

- Direct Isolation

No base, isolators attached directly to equipment.
**Equipment Type:**

**Packaged AH, AC, H and V Units; Engine-Driven Generators**

<table>
<thead>
<tr>
<th>Equipment Location</th>
<th>Packaged AH, AC, H and V Units</th>
<th>Floor Span</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slab on Grade</td>
<td>Up to 20 ft (6 m)</td>
</tr>
<tr>
<td>Horsepower and Other</td>
<td>RPM</td>
<td>Base Type</td>
</tr>
<tr>
<td>≤7.5 HP</td>
<td>All</td>
<td>A</td>
</tr>
<tr>
<td>≥11 HP</td>
<td>Up to 300</td>
<td>A</td>
</tr>
<tr>
<td>≤4 in. SP</td>
<td>301 to 500</td>
<td>A</td>
</tr>
<tr>
<td>500 and up</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>&gt;15</td>
<td>Up to 300</td>
<td>B</td>
</tr>
<tr>
<td>&gt;4 in. SP</td>
<td>301 to 500</td>
<td>B</td>
</tr>
<tr>
<td>500 and up</td>
<td>B</td>
<td>3</td>
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</tbody>
</table>

*Data from 2015 ASHRAE Handbook. See Back for additional notes on Air-Handling Equipment.*

**BASE TYPE A:** Direct Isolation

No base, isolators attached directly to equipment.

**BASE TYPE B:** Structural Steel Rails or Base

See page 17 for more details

**BASE TYPE C:** Concrete Inertia Base

See page 17 for more details

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### ASHRAE TYPE 3:

**Spring Floor Isolator or Hanger**

*See page 14 for more details*

**KINETICS™** FDS Free-Standing Isolator

**KINETICS™** SL Housed Isolator

**KINETICS™** SM Housed Isolator

**KINETICS™** SFH Fiberglass Hanger

**KINETICS™** SRH Neoprene Hanger

**KINETICS™** SH Hanger

### ASHRAE TYPE 4:

**Restrained Spring Isolator**

*See page 15 for more details*

**KINETICS™** TITAN

**KINETICS™** FMS

**KINETICS™** FLS

**KINETICS™** FLSS

**KINETICS™** FHS

**KINETICS™** FRS
Equipment Type:

**Heat Pumps, Fan-Coils, Computer Room Units; Condensing Units; Packaged Rooftop Equipment**

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Slab on Grade</th>
<th>Up to 20 ft (6 m)</th>
<th>20 to 30 ft (6-9 m)</th>
<th>30 to 40 ft (9-12 m)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Base Type</td>
<td>ASHRAE Type</td>
<td>Isolator Defl.</td>
<td>Base Type</td>
</tr>
<tr>
<td>Heat Pumps, Fan-Coils, Computer Room Units</td>
<td>A</td>
<td>3</td>
<td>1&quot; (25)</td>
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</tr>
<tr>
<td>Condensing Units</td>
<td>A</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>A</td>
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<tr>
<td>Packaged Rooftop Equipment</td>
<td>A/D</td>
<td>1</td>
<td>1/4&quot; (6)</td>
<td>D</td>
</tr>
</tbody>
</table>

*Data from 2015 ASHRAE Handbook. See back for additional notes on Packaged Rooftop Equipment.*

**ASHRAE TYPE 1:**
Fiberglass or Neoprene Pad
See page 12 for more details

**KINETICSTM**
- KIP Fiberglass Pad
- KINETICSTM NP Neoprene Pad
- KINETICSTM NG Neoprene Pad
- KINETICSTM RSP Neoprene Pad

**ASHRAE TYPE 3:**
Spring Floor Isolator or Hanger
See page 14 for more details

**KINETICSTM**
- FDS Free-Standing Isolator
- SL Housed Isolator
- SM Housed Isolator
- SFH Fiberglass Hanger
- SRH Neoprene Hanger
- SH Neoprene Pad

**ASHRAE TYPE 4:**
Restrained Spring Isolator
See page 15 for more details

**KINETICSTM**
- TITAN
- FMS
- FLS
- FLSS
- FHS
- FRS

**BASE TYPE A:**
Direct Isolation
No base, isolators attached directly to equipment.

**BASE TYPE D:**
Curb-Mounted Base
See page 16 for more details

**KINETICSTM**
- KSR Isolation Rail
- KSCR Isolation Curb
- ESR Isolation Curb
ASHRAE TYPE 1: Fiberglass or Neoprene Pad

**KINETICS™ KIP**
Fiberglass Isolation Pad

**Description:** A high-density matrix of compressed molded fiberglass; individually coated with a flexible, moisture-impervious elastomeric membrane, designed to allow controlled air movement in the fiber media.

**Application:** Recommended as support mounts for high speed fans, pumps, and chillers, on grade, having operating speeds of 1750 RPM and higher.

**Capacity:** Provide load-bearing capacities from 5 to 500 PSI (0.35 to 35 kg per sq. cm) of pad surface area.

**The Fiberglass Advantage**
Kinetics Noise Control manufactures both fiberglass and neoprene isolators. Fiberglass isolators offer the following advantages:

- UV resistant for outdoor use
- Constant location performance through seasonal temperature changes
- Varying densities and sizes to suit a variety of load requirements
- Constant pad performance, unaffected by age or high temperatures

**KINETICS™ RSP**
Neoprene Isolation Pad

**Description:** Elastomer in-shear, 50 durometer pads

**Application:** Isolate noise, shock, and high frequency vibration produced by mechanical, industrial, or process equipment located on grade, structural slab, or in other non-critical areas.

**Capacity:** Designed to permit 60 psi (4.2 kg/cm²) loading at a maximum rated deflection of 0.15” (4 mm)

**Dimensions:** 18” x 18” x 3/4” (457 mm x 457 mm x 19 mm) thick sheets, scored into 2” x 2” x 3/4” (51 mm x 51 mm x 19 mm) thick pads

**KINETICS™ NP and NG**
Neoprene Isolation Pads

**Description:** 45 to 65 durometer single ribbed or crossed, double ribbed elastomer-in-shear pads, in combination with steel shims when required, having minimum static deflections as tabulated.

**Application:** Isolate noise, shock, and high frequency vibration, generated by mechanical equipment and industrial machinery located on a grade-supported structural slab.

**Capacity:** Designed to permit 60 or 120 PSI (4.2 or 8.4 kg/cm²) loading at maximum rated deflections.

**Dimensions:** Pads are available in 4”, 6”, or 9” (102, 152, 228 mm) squares with capacities from 400 to 9,700 lbs. (181 to 4400 kg), or in full 18” (457 mm) square sheets which can be cut or drilled to meet field requirements.

**Deflection:** NP Pads 0.04” to 0.09” (1 mm to 2 mm)
NG Pads 0.13” to 0.19” (3 mm to 5 mm)
ASHRAE TYPE 2: Floor Isolator or Hanger

**KINETICS™ AC**
Fiberglass Isolation Mount

**Description:** A molded inorganic fiberglass isolation pad bonded to a steel load transfer plate and to a formed steel bolt-down bracket and include an equipment anchor bolt with a neoprene grommet to prevent metal-to-metal contact.

**Application:** Recommended for the isolation of vibration produced by utility ventilating fans, vane axial fans, high speed motors, roof-mounted exhaust fans, and similar mechanical equipment.

**Capacity:** 40 to 900 lbs. (18 kg to 409 kg)

**Deflection:** 0.18 in. to 0.70 in. (4 mm to 18 mm)

---

**KINETICS™ RQ and RD**
Neoprene Isolation Mounts

**Description:** One-piece molded neoprene mounts with encapsulated metal inserts. Available in a housed seismic version.

**Application:** Recommended for the isolation of vibration produced by small pumps, vent sets, and low pressure packaged air-handling units.

**Capacity:** 55 lbs. to 4,000 lbs. (25 kg to 1814 kg)

**Deflection:** RD up to 0.5” (13 mm)
RQ up to 0.13” (3 mm)

---

**KINETICS™ FH**
Fiberglass Isolation Hanger

**Description:** A coded, molded, inorganic fiberglass isolation pad attached to a steel load transfer plate and to a stamped or welded hanger bracket.

**Application:** Recommended for the isolation of vibration produced by suspended mechanical or electrical equipment, in-line and exhaust fans, ductwork, or piping.

**Capacity:** 250 to 900 lbs. (18 kg to 409 kg)

**Deflection:** 0.18 in. to 0.27 in. (4 mm to 7 mm)

---

**KINETICS™ RH**
Neoprene Isolation Hanger

**Description:** A coded elastomer in-shear insert with a load plate, assembled into a stamped or welded hanger bracket.

**Application:** Recommended for the isolation of vibration produced by suspended mechanical or electrical equipment, in-line and exhaust fans, ductwork, or piping.

**Capacity:** up to 2,000 lbs (907 kg)

**Deflection:** 0.20” to 0.57” (5mm to 15 mm)
**KINETICS™ SFH, SRH, SH**

**Spring Isolation Hangers**

*Description:* Free-standing, laterally stable steel spring in series with a pre-compressed molded fiberglass insert (SFH), elastomer-in-shear insert (SRH), or elastomeric washer (SH) complete with a load plate (SFH/SRH only) and assembled in a stamped or welded steel bracket.

Hangers will allow support rod misalignment through a 30° arc without short-circuiting. Isolation brackets will carry a 500% overload without failure.

*Application:* Recommended for the isolation of vibration produced by suspended mechanical equipment, in-line fans, exhaust fans, cabinet fans, pumps, ductwork, and piping.

*Capacity:* 35 lbs. to 3,850 lbs. (16 kg to 1,747 kg)

*Deflection:* 1" to 2.40" (25 mm to 61 mm), and 4.05 to 4.75" (104 mm to 112 mm)

---

**KINETICS™ FDS**

**Free-Standing Spring Isolator**

*Description:* A high deflection, free-standing, unhoused, large diameter, laterally stable steel springs assembled into an upper load plate and leveling assembly.

*Application:* Recommended for control of both high and low frequency vibration produced by reciprocating air or refrigeration compressors, pumps, packaged air-handling and air-conditioning equipment, centrifugal and axial fans, and internal combustion engines.

*Capacity:* 35 to 23,200 lbs. (16 kg to 10,523 kg)

*Deflection:* 1 in. to 4 in. (25 mm to 102 mm)

---

**Patented No-Short Self-Centering Cap:**

Featured on 1" and 2" spring isolation hangers. Indexed steps in spring cap keep the washer and rod centered in the cap.
**KINETICS™ TITAN**

Vibration Isolator/Restraint  
Patent Pending

**Description:** Comprised of two interfacing but independent elements; two or more high deflection, free-standing, housed, large diameter, laterally stable steel springs, and a seismically rated housing.

The steel springs and elastomeric snubber element are each replaceable without having to lift or otherwise remove the supported equipment.

**Application:** Recommended for equipment mounted on a structural frame or concrete inertia base where the top plate of the isolator can be fully utilized.

**Capacity:** up to 23,200 lbs. (10,523 kg)  
**Deflection:** up to 4 in. (102 mm)

---

**KINETICS™ FLS/FLSS**  
Restrained Spring Isolators

**Description:** Free-standing, large diameter, laterally stable steel springs assembled into welded steel housing assemblies fabricated to limit vertical movement of the isolated equipment. The housings provide a constant free and operating height to facilitate installation.

**Application:** Recommended for the isolation of vibration produced by equipment carrying a large fluid load which may be drained, such as boilers and chillers, and for the isolation of outdoor components such as cooling towers and air-cooled condensers.

**Capacity:** up to 23,200 lbs. (10,523 kg)  
**Deflection:** up to 4 in. (102 mm)

---

**KINETICS™ FRS**  
Restrained Spring Isolator

**Description:** Free-standing, large diameter, stable steel springs assembled into top and bottom load plate assemblies, which provide vertical restraint in the event load is removed or external forces are applied.

**Application:** Recommended for the support of vertical pipe risers; and air-cooled condensers, fans, and other rooftop equipment subject to weight change or external forces.

**Capacity:** 35 lbs. to 3,500 lbs. (16 kg to1,588 kg)  
**Deflection:** 1 in. to 2 in. (25 mm to 51 mm)

---

**KINETICS™ FHS**  
Restrained Spring Isolator

**Description:** A KINETICS™ FDS Free-Standing Isolator with a steel housing assembly to limit lateral and vertical movement of the supported equipment during an earthquake without degrading the vibration isolation of the spring during normal equipment operating conditions.

**Application:** Recommended for mechanical equipment located near critically quiet areas when there is a possibility that the equipment to be isolated will be subjected to the external forces associated with an earthquake.

**Capacity:** up to 5,800 lbs. (2,631 kg)  
**Deflection:** up to 4 in. (102 mm)

---

**KINETICS™ FMS**  
Modular Restraint/Isolator

(U.S. Patent No. 7,028,969)

**Description:** The unit is comprised of a restraint module and an optional vibration isolation module. This modular design allows the engineer to design for seismic or wind forces independent of the load and deflection requirements of the vibration isolator.

**Application:** Ideal for cooling towers, chillers, boilers or other equipment where the potential for wide weight variations during service is anticipated.

**Capacity:** up to 23,200 lbs. (10,523 kg)  
**Deflection:** up to 4 in. (102 mm)

---

**KINETICS™ FHS**  
Restrained Spring Isolator

**Description:** Free-Standing Isolator with a steel housing assembly to limit lateral and vertical movement of the supported equipment during an earthquake without degrading the vibration isolation of the spring during normal equipment operating conditions.

**Application:** Recommended for mechanical equipment located near critically quiet areas when there is a possibility that the equipment to be isolated will be subjected to the external forces associated with an earthquake.

**Capacity:** up to 5,800 lbs. (2,631 kg)  
**Deflection:** up to 4 in. (102 mm)
ASHRAE TYPE 5: Thrust Restraint

**KINETICS™ HSR**

**Thrust Restraint**

**Description:** A high deflection, large diameter, laterally stable steel coil spring assembled into a threaded rod and bracket assembly.

**Application:** Used to counteract the discharge force created by fans during operation. Recommended for all fan heads, suspended fans, and all base-mounted and suspended air-handling equipment operating at 2 inches or greater total static pressure (TSP). HSR Thrust Restraints are always installed in pairs and often work in conjunction with inertia bases for floor-mounted fans to counteract fan thrust.

**Capacity:** 35 to 1,975 lbs. (16 to 896 kg)

**Deflection:** 1 in. to 2 in. (25 mm to 51 mm)

ASHRAE TYPE 6: Air Springs

**KINETICS™ KAM and CAM**

**Air Vibration Isolation Mounts**

**Description:** Pneumatic, elastomeric vibration mounts. The CAM is available in four (4) sizes supporting loads up to 7,500 lbs. The KAM is available in seven (7) sizes with capacities from 500 to 22,000 lbs. per mount.

**Application:** Recommended for mechanical equipment and industrial process equipment requiring low natural frequency isolation, as well as protecting sensitive equipment from disturbing floor-borne vibration.

**KINETICS™ KINFLEX**

**Flexible Connectors**

**Description:** Prevent stresses due to expansion and contraction, isolate against the transfer of noise and vibration, and compensate for misalignment.

**Application:** Used on both hot and chilled water circulation lines, suction and discharge sides of pumps, and header connections.

**KINFLEX Seismic V-Loops** solve the problems of pipe motion caused by thermal pipe growth and the movements associated with seismic activity. Seismic V-loops limit amount of space required for installation and hold in more heat than traditional large pipe loops.
BASE TYPE A: Direct Isolation

Used when equipment is unitary and rigid and does not require additional support. Direct isolation can be used with large chillers, some fans, packaged air-handling units, and air-cooled condensers. If there is any doubt that the equipment can be supported directly on isolators, use structural bases (type B) or inertia bases (type C), or consult the equipment manufacturer.

BASE TYPE B: Structural Rails

**KINETICS™ SBB**
Structural Beam Base

*Description:* Structural steel beam sections, with welded-on isolator support brackets, and pre-located and drilled anchor bolt holes for bolting to equipment to be supported.

*Application:* Recommended for support and isolation of absorption chillers, hermetic centrifugal chillers, package boilers, cooling towers, and similar types of equipment.

**KINETICS™ SFB**
Structural Frame Base

*Description:* Welded structural frame bases with channels, angles, or WF beams, which are complete with outboard height-saving isolator brackets and prelocated equipment anchor bolts.

*Application:* Recommended for support and isolation of reciprocating chillers, close coupled pumps, vent sets, packaged air handling units, centrifugal fans, evaporative condensers, and similar types of equipment.

BASE TYPE C: Concrete Inertia Base

**KINETICS™ CIB**
Concrete Inertia Base

*Description:* A unique structural design which integrates perimeter channels, isolator support brackets, reinforcing rods, anchor bolts and concrete fill into a controlled load transfer system, utilizing steel in tension and concrete in compression, resulting in high strength and stiffness with minimum steel frame weight.

*Application:* Recommended for use with open-type centrifugal chillers, reciprocating air and refrigeration compressors, chillers, and heat pumps, close-coupled and base-mounted pumps, centrifugal fans, internal combustion engines, and similar types of equipment.
KINETICS™ KSR and ESR Vibration Isolation Curbs

Description: Complete assemblies designed to resiliently support equipment at the specified elevation and which constitute a fully enclosed air and weather-tight system.

Standard Features
- Seismic and wind restraint
- Up to 4” (102 mm) deflection, powder-coated steel springs with 50% overload capacity
- Supply and return flexible connector support
- Environmentally inert elastomeric seal for an air and water-tight closure between the curb and rail
- High profile, non-interference aluminum rail (only KSCR)
- Accessible ports for each isolator to inspect, level, or change springs after equipment placement (only ESR)

Options
- Deflections over 4” (102 mm)
- Interface for sloped or multi-pitched roofs
- Additional height for plenums & silencers
- Exterior thermal insulation
- Acoustical treatments
- Certification of seismic and wind load engineering

KINETICS™ ESSR Sound and Vibration Isolation Curb

KINETICS™ ESSR is the only isolated curb system that addresses all four noise sources associated with packaged rooftop equipment. The ESSR incorporates all the features of our ESR vibration isolation curb with our aerodynamic acoustical silencers; return air plenums and NOISEBLOCK™ STL panels. This gives you a noise control system that addresses all the noise and vibration concerns of your packaged rooftop equipment: vibration from the rotating equipment and casing radiation, duct-borne noise from supply and return fans, and breakout noise from the fans and compressors into the space below.

Vibration from fans and compressors (source 1) and vibration from casing- radiated noise caused by duct turbulence and the airborne noise of the fans and compressors (source 2) are controlled with high deflection, laterally stable coil spring isolators and high frequency neoprene noise pads.

Duct-borne noise from the supply and return air fans (source 3) are controlled using an aerodynamic acoustical silencer on the supply fan and an acoustical plenum on the return air side both with minimal pressure drop.

Breakout noise through the bottom of the rooftop unit (source 4) is controlled by the NOISEBLOCK™ STL acoustical panel located in the floor of the ESSR.
Riser Supports, Anchors, and Guides

KINETICS™ riser supports, anchors, and guides isolate the pipe from the structure to minimize noise and vibration transmission, while also allowing the pipe to expand and contract with minimal change in the support forces. Kinetics offers engineering services to assist in the design of your riser system.
Seismic Restraint

Seismic restraint systems limit movement and keep equipment captive during a seismic event. Proper utilization of these systems can reduce the threat to life and minimize long-term costs due to equipment damage and associated loss of service. Additional seismic restraint products can be found within ASHRAE Type 4 (page 15) and Base Type D (page 18).

KINETICS™ QuakeLoc™
Seismic Cable Restraint Kits

Piping, duct, electrical cable trays, and suspended equipment

- Reduces Installation Time and Cost
- Contractor Friendly Design
- IBC Code Compliant

Accessories
KHRC Adjustable Angle Rod Stiffeners: Securely attach a length of steel angle to a conventional hanging threaded rod.
KSBC Seismic Beam Clamp: Attach seismic restraints to roof or floor support I-beams.

Suspended Equipment Example

KINETICS™ HS Series
Seismic Snubbers

Description: Heavy structural steel assemblies designed to minimize equipment motion within the product’s design capabilities without failing.

Seismic Snubbers are designed to be used in pairs and serve to keep supported equipment contained when the equipment is subjected to lateral or vertical forces along any axis.

KINETICS™ Seismic Mounting Brackets

KINETICS™ KSMS: Solid-mount equipment to the building structure
KINETICS™ KSMG: Resiliently mount and restrain equipment to the building structure
KINETICS™ KSMF: Solid-mount mushroom fans to the curb
### Piping Weight and Spacing - Water

<table>
<thead>
<tr>
<th>Pipe Size (in.)</th>
<th>1 1.25 1.5 2 2.5</th>
<th>3 4 5 6 8 10 12</th>
<th>14 16 18 20 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Schedule</td>
<td>40 40 40 40 40</td>
<td>40 40 40 40 40</td>
<td>40 40 40 40 40</td>
</tr>
<tr>
<td>Max. Spacing (ft.)</td>
<td>7 7 9 10 11</td>
<td>12 14 16 17 19 20 23</td>
<td>25 27 28 30 32</td>
</tr>
<tr>
<td>Insulation (in.)</td>
<td>1.0 1.0 1.0 1.0 1.0</td>
<td>1.0 1.0 1.5 1.5 1.5</td>
<td>1.5 1.5 1.5 1.5</td>
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</table>

<table>
<thead>
<tr>
<th>Wt./lin ft. (lb.)</th>
<th>Pipe</th>
<th>Water</th>
<th>Insulation</th>
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<tbody>
<tr>
<td>1.7</td>
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<td>0.6</td>
<td>0.7</td>
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<td>0.9</td>
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### Piping Weight and Spacing - Steam

<table>
<thead>
<tr>
<th>Wt. @ 10 ft. Spacing (lb.)</th>
<th>KNC Hanger Model No.</th>
<th>SH/SRH/SFH -1</th>
<th>SH/SRH/SFH -2</th>
<th>SH/SRH/SFH -4</th>
<th>Total</th>
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<tr>
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<table>
<thead>
<tr>
<th>Wt. per ft. (lbs.)</th>
<th>Pipe</th>
<th>Insulation (in.)**</th>
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</thead>
<tbody>
<tr>
<td>1.7</td>
<td>2.3</td>
<td>3.7</td>
</tr>
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</table>

### Approximate Flanged Fitting Weights (lb.)

<table>
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<tr>
<th>Pipe Size (in.)</th>
<th>Bonnet Check Valve</th>
<th>Bonnet Gate Valve</th>
<th>Elbow</th>
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</tr>
</tbody>
</table>

*Insulation weight based on industry standard insulation.

**Rod size recommendation and max. hanger spacing based on MSS SP-69
### PIPING/HANGER SELECTION DATA (SI)

#### Piping Weight and Spacing - Water

| Pipe Size (mm) | 25 | 32 | 38 | 51 | 64 | 76 | 102 | 127 | 152 | 203 | 254 | 305 | 356 | 406 | 457 | 508 | 610 |
|---------------|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pipe Schedule | 40 | 40 | 40 | 40 | 40 | 40 | 76  | 102 | 127 | 152 | 203 | 254 | 305 | 356 | 406 | 457 | 508 | 610 |
| Max. Spacing (m) | 2.1 | 2.1 | 2.7 | 3.0 | 3.4 | 3.7 | 4.3 | 4.9 | 5.2 | 5.8 | 6.1 | 7.0 | 7.6 | 8.2 | 8.5 | 9.1 | 9.8 |
| Wt. per M (kg) | 2.5 | 3.4 | 4.0 | 5.5 | 8.6 | 11.3 | 16.1 | 21.9 | 28.3 | 42.6 | 60.5 | 80.0 | 81.4 | 93.3 | 122.4 | 117.3 | 141.3 |
| Water | 0.6 | 0.9 | 1.3 | 2.2 | 3.1 | 4.8 | 8.2 | 12.9 | 18.6 | 32.3 | 50.9 | 72.1 | 89.0 | 117.9 | 148.6 | 187.8 | 274.0 |
| Insulation | 0.9 | 1.0 | 1.2 | 1.3 | 1.6 | 1.9 | 2.2 | 4.5 | 5.1 | 6.2 | 7.6 | 9.0 | 9.7 | 10.9 | 12.2 | 13.4 | 15.9 |
| Total | 4.0 | 5.3 | 6.5 | 9.0 | 13.3 | 18.0 | 26.5 | 39.3 | 52.0 | 81.1 | 119.0 | 161.1 | 180.1 | 222.1 | 263.2 | 318.5 | 431.2 |

*Note: KNC Hanger Model No.

### Piping Weight and Spacing - Steam

| Pipe Size (mm) | 25 | 32 | 38 | 51 | 64 | 76 | 102 | 127 | 152 | 203 | 254 | 305 | 356 | 406 | 457 | 508 | 610 |
|---------------|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pipe Schedule | 40 | 40 | 40 | 40 | 40 | 40 | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  |
| Insulation (mm)* | 38 | 38 | 38 | 38 | 38 | 38 | 38  | 38  | 38  | 38  | 38  | 38  | 38  | 38  | 38  | 38  | 38  | 38  |
| Wt. per M (kg) | 2.5 | 3.4 | 4.0 | 5.5 | 8.6 | 11.3 | 16.1 | 21.9 | 28.3 | 42.6 | 60.5 | 80.0 | 81.4 | 93.3 | 122.4 | 117.3 | 141.3 |
| Insulation | 1.8 | 1.9 | 2.1 | 2.4 | 2.7 | 3.1 | 3.7 | 6.2 | 7.1 | 8.6 | 10.5 | 12.2 | 13.3 | 15.0 | 16.7 | 18.3 | 21.6 |
| Total | 4.3 | 5.3 | 6.1 | 7.9 | 11.3 | 14.4 | 19.8 | 28.1 | 35.4 | 51.4 | 71.0 | 92.2 | 94.7 | 108.4 | 139.1 | 135.6 | 162.9 |

*Note: KNC Hanger Model No.

### Approximate Flanged Fitting Weights (kg)

<table>
<thead>
<tr>
<th>Pipe Size (mm)</th>
<th>Bonnet Check Valve</th>
<th>Bonnet Gate Valve Elbow</th>
<th>Tee</th>
<th>Flange</th>
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<tbody>
<tr>
<td>25</td>
<td>4.1</td>
<td>3.6</td>
<td>5.0</td>
<td>1.8</td>
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<tr>
<td>38</td>
<td>-</td>
<td>12.2</td>
<td>5.4</td>
<td>8.2</td>
</tr>
<tr>
<td>51</td>
<td>11.8</td>
<td>16.8</td>
<td>8.2</td>
<td>10.1</td>
</tr>
<tr>
<td>84</td>
<td>16.3</td>
<td>22.7</td>
<td>12.2</td>
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</tr>
<tr>
<td>127</td>
<td>20.1</td>
<td>30.2</td>
<td>15.1</td>
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<tr>
<td>152</td>
<td>36.3</td>
<td>49.4</td>
<td>25.4</td>
<td>33.6</td>
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<tr>
<td>203</td>
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<td>63.5</td>
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<tr>
<td>254</td>
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<td>77.1</td>
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<tr>
<td>305</td>
<td>136.1</td>
<td>113.4</td>
<td>72.8</td>
<td>82.6</td>
</tr>
<tr>
<td>356</td>
<td>204.1</td>
<td>213.2</td>
<td>117.9</td>
<td>131.5</td>
</tr>
<tr>
<td>406</td>
<td>306.2</td>
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<td>587.0</td>
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<tr>
<td>610</td>
<td>621.9</td>
<td>748.4</td>
<td>444.5</td>
<td>421.8</td>
</tr>
</tbody>
</table>

*Note: *Insulation weight based on industry standard insulation.

**Rod size recommendation and max. hanger spacing based on MSS SP-69**

Refrigeration Machines

Large centrifugal, screw, and reciprocating refrigeration machines may generate very high noise levels; special attention is required when such equipment is installed in upper-story locations or near noise-sensitive areas. If equipment is located near extremely noise-sensitive areas, follow the recommendations of an acoustical consultant.

Compressors

The two basic reciprocating compressors are duct structures. (1) single- and double-cylinder vertical, horizontal or L-head, which are usually air compressors; and (2) Y, W, and multi-head or multi-cylinder air and refrigeration compressors. Single- and double-cylinder compressors generate high vibratory forces requiring large inertia bases (type C) and are generally not suitable for upper-story locations. If this equipment must be installed in an upper-story location or at-grade location near noise-sensitive areas, the expected maximum unbalanced force data must be obtained from the equipment manufacturer and a vibration specialist consulted for design of the isolation system.

When using Y, W, and multi-head and multi-cylinder compressors, obtain the magnitude of unbalanced forces from the equipment manufacturer so the need for an inertia base can be evaluated.

Base-mounted compressors through 5 hp and horizontal tank-type air compressors through 10 hp can be installed directly on spring isolators (type 3) with structural bases (type B) if required, and compressors 15 to 100 hp on spring isolators (type 3) with inertia bases (type C) with a mass I to 2 times the compressor mass.

Pumps

Concrete inertia bases (type C) are preferred for all flexible-coupled pumps and are desirable for most close-coupled pumps, although steel bases (type B) can be used. Close-coupled pumps should not be installed directly on individual isolators (type A) because the impeller usually overhangs the motor support base, causing the rear mounting to be in tension. The primary requirements for type C bases are strength and shape to accommodate base elbow supports. Mass is not usually a factor, except for pumps over 75 hp, where extra mass helps limit excess movement due to starting torque and forces. Concrete bases (type C) should be designed for a thickness of one-tenth the longest dimension with minimum thickness as follows: (1) for up to 30 hp, 6 in; (2) for 40 to 75 hp, 8 in; and (3) for 100 hp and up, 12 in.

Pumps over 75 hp and multistage pumps may exhibit excessive motion at start-up ("heaving"); supplemental restraining devices can be installed if necessary. Pumps over 125 hp may generate high starting forces; a vibration specialist should be consulted.

Cooling Towers

These are normally isolated with restrained spring isolators (type 4) directly under the tower or tower dunnage. High deflection isolators proposed for use directly under the motor-fan assembly must be used with extreme caution to ensure stability and safety under all weather conditions.

Packaged Rooftop Air-Conditioning Equipment

This equipment is usually installed on lightweight structures that are susceptible to sound and vibration transmission problems. The noise problems are compounded further by curb-mounted equipment, which requires large roof openings for supply and return air.

Type D vibration isolators are shown for all spans up to 20 ft, but extreme care must be taken for equipment located on spans of over 20 ft, especially if construction is open web joists 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.

For mechanical units capable of generating high noise levels, mount the unit on a platform above the roof deck to provide an air gap (buffer zone) and locate the unit away from the associated roof penetration to allow acoustical treatment of ducts before they enter the building.

Some rooftop equipment has compressors, fans, and other equipment isolated internally. This isolation is not always reliable because of internal short-circuiting, inadequate static deflection, or panel resonances. It is recommended that rooftop equipment over 300 lb be isolated externally, as if internal isolation was not used.

Fans and Air-Handling Equipment

Consider the following in selecting isolation systems for fans and air-handling equipment:

1. Fans with wheel diameters of 22 in. and less and all fans operating at speeds up to 300 rpm do not generate large vibratory forces. For fans operating under 300 rpm, select isolator deflection so the isolator natural frequency is 40% or less than the fan speed. For example, for a fan operating at 275 rpm, 0.4 x 275 = 110 rpm. Therefore, an isolator natural frequency of 110 rpm or lower is required. This can be accomplished with a 3 in. deflection isolator (type 3).

2. Flexible duct connectors should be installed at the intake and discharge of all fans and air-handling equipment to reduce vibration transmission to air duct structures.

3. Inertia bases (type C) are recommended for all class 2 and 3 fans and air-handling equipment because extra mass allows the use of stiffer springs, which limit heaving movements.

4. Thrust restraints (type 5) that incorporate the same deflection as isolators should be used for all fan heads, all suspended fans, and all base-mounted and suspended air-handling equipment operating at 2 in. or more total static pressure. Restraint movement adjustment must be made under normal operational static pressures.