



 **DYNAMIC ISOLATION SYSTEMS**  
**NON-STRUCTURAL ISOLATION**  
QUAKEBASE - PLATFORMS - 3D ISOLATION - FLOORS - MODULAR SYSTEMS



# DYNAMIC ISOLATION SYSTEMS

**DIS is the World Leader in Seismic Isolation - no other company has completed more isolation projects in more countries than Dynamic Isolation Systems.**

**Ideal candidates for non-structural isolation include:**

- ▶ Computer Servers
- ▶ Modular Data Centers
- ▶ Prefabricated Structures
- ▶ Artwork, Including Statues
- ▶ Industrial Equipment
- ▶ Emergency Command Centers
- ▶ Data Center Floors
- ▶ Medical, High-Tech & Electrical Equipment



**Critical equipment in the Salt Lake City Public Safety Building in Utah, USA is protected by an extensive DIS Isolated Platform System.**

**An Industry Pioneer**

Dynamic Isolation Systems is an industry pioneer and continues to develop and add technologies to its growing list of seismic protection solutions.

DIS designs and manufactures systems for structural and non-structural isolation applications, including: base isolation, viscous wall dampers, pot bearings, sliders, isolated floor systems, modular isolation, isolated platforms, vertical isolation and isolation both horizontally and vertically.



**Vertical isolation system for hydro-electric facility.**

**Non-Structural Isolation**

When isolating an entire structure is not an option, DIS has a number of solutions to protect vital equipment and artwork from the damage or downtime caused by a seismic event.

## TABLE OF CONTENTS

**1 Introduction**

**2 QuakeBase**

An engineered, low-profile solution to protect servers.

**4 Isolated Platforms**

Protection for data centers, medical and industrial equipment, artwork and computer servers.

**6 3D Isolation**

Seismic protection for applications which require acceleration reduction both horizontally and vertically.

**8 Floor Isolation**

Seismic protection for essential equipment housed within conventionally designed structures.

**10 Modular Isolation Systems**

Protect modular data centers from seismic events and downtime.

**12 Frequently Asked Questions**



An engineered, low-profile solution for protecting new and existing cabinets and equipment.

### Ideal Candidates for QuakeBase

- ▶ Mainframes
- ▶ Server Racks
- ▶ Optical Storage Units

### What is QuakeBase?

QuakeBase is an isolated platform that uses double concave sliders to protect from earthquake damage. It's designed to be an economical solution for low to medium seismic zones.

### How does QuakeBase Function?

QuakeBase works on the same principals as a simple pendulum. Energy from an earthquake is dissipated through friction at the sliding interface. Movement of the system is controlled by the curvature of the sliding surfaces.

*Servers remain stationary during every day use and maintenance.*

QuakeBase is modular and can be configured to suit any server or equipment layout. Adjacent modules bolt together to form a continuous system.



Concave sliding surfaces control seismic response.



QuakeBase is sized to accommodate standard server cabinets.

### Advantages of QuakeBase

QuakeBase reduces earthquake energy transmitted into servers by decoupling them from the ground during a seismic event. In addition, QuakeBase removes energy through internal friction.

*Easy installation in both new and existing data rooms.*

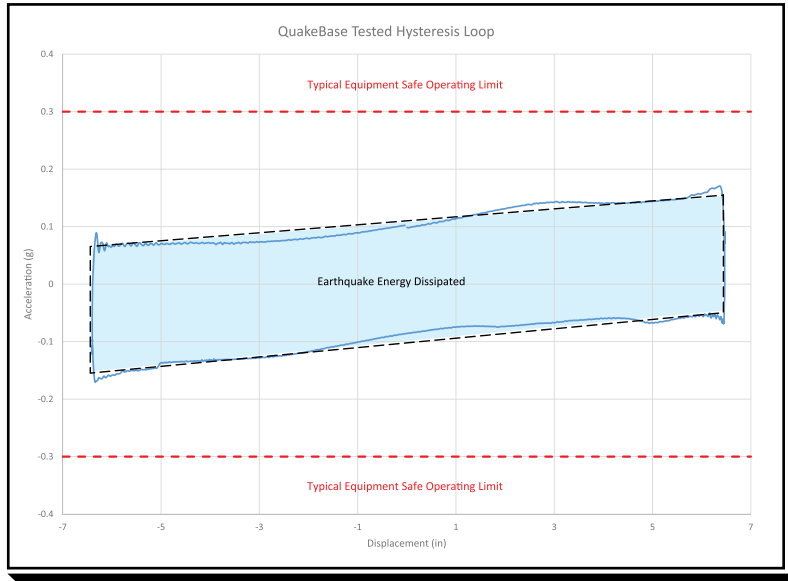
QuakeBase's low height allows for easy installation in both new and existing data rooms. No drilling is required for installation.

Due to the friction interface in QuakeBase, servers remain stationary during everyday use and maintenance.



**Performance**

Typical equipment is capable of remaining operational at accelerations up to 0.3g. The use of isolation limits the accelerations transmitted from the floor into the equipment allowing it to remain functional in larger seismic events.



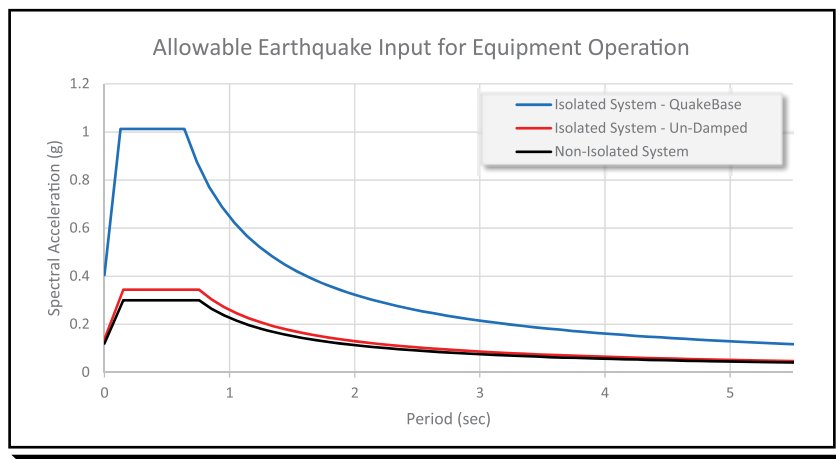
QuakeBase limits accelerations imparted into equipment to safe operating levels.

**Platform Sizes**

Part No.	Component Size
QB-1028	10.75" W x 28" L
QB-1030	10.75" W x 30" L
QB-1033	10.75" W x 33" L
QB-1036	10.75" W x 36" L
QB-1039	10.75" W x 39" L
QB-1042	10.75" W x 42" L
QB-1045	10.75" W x 45" L
QB-1048	10.75" W x 48" L
QB-1051	10.75" W x 51" L
QB-1054	10.75" W x 54" L
QB-1060	10.75" W x 60" L
QB-1228	12.75" W x 28" L
QB-1230	12.75" W x 30" L
QB-1233	12.75" W x 33" L
QB-1236	12.75" W x 36" L
QB-1239	12.75" W x 39" L
QB-1242	12.75" W x 42" L
QB-1245	12.75" W x 45" L
QB-1248	12.75" W x 48" L
QB-1251	12.75" W x 51" L
QB-1254	12.75" W x 54" L
QB-1260	12.75" W x 60" L

*Energy dissipation enables QuakeBase to accommodate larger earthquakes.*

The Allowable Earthquake Input for Equipment Operation figure (right) demonstrates the different levels of earthquake that can be safely accommodated without the use of isolation (*Non-Isolated*), utilizing an isolation system with little to no energy dissipation (*Un-Damped*) and an isolation system with energy dissipating characteristics (*QuakeBase*).



QuakeBase safely accommodates larger earthquake inputs.





# DIS ISOLATED PLATFORM (IP)

Protection for data centers, medical and industrial equipment, artwork and computer servers.

## Ideal Candidates for Isolated Platforms

- ▶ Computer Servers
- ▶ Medical Equipment
- ▶ Manufacturing Equipment
- ▶ Artwork, Including Statues

## Why Use An Isolated Platform?

Computer servers and systems are key to business operation in today's data-dependent world.

Isolated Platforms provide protection against server downtime and equipment damage in the event of an earthquake.

*Drastically reduces earthquake hazard.*

## More Server Uptime

Protecting data centers and essential equipment against system failure with backup power and mirrored storage are common practice.

However, protection against seismic forces is also vital. Conventional earthquake protection utilizes strengthening techniques which actually increase seismic forces and accelerations. Conversely, Isolated Platforms reduce equipment forces.

Systems and equipment remain undamaged, operational and on-line. Seismic isolation has been utilized to achieve Uptime Institute's Tier 4 rating in seismic zones.



Overhead cable trays are easily used with DIS' Isolated Platform.

## Configurations

DIS' patented IP is comprised of Multi-Directional Springs and high-load capacity rolling supports housed within an attractive steel frame. Modules are available in Standard (4ft x 4ft) and Extended (4ft x 6ft) sizes.



40' long Isolated Platform houses two banks of servers and IT equipment.

Individual platforms can be bolted together on all four sides, allowing for versatile layouts. (i.e., for supporting single servers or a long row of server racks.)

Platform heights range from 7 to 11 inches, depending on the required load capacity.

*Individual platforms can connect together, allowing for versatile layouts.*

## Performance

During a seismic event the Isolated Platform decouples the system from floor motions and absorbs seismic energy. The floor moves beneath the IP, leaving what it supports largely unaffected. Transmitted accelerations are reduced by up to 5 times.

*Solutions available to suit any application.*

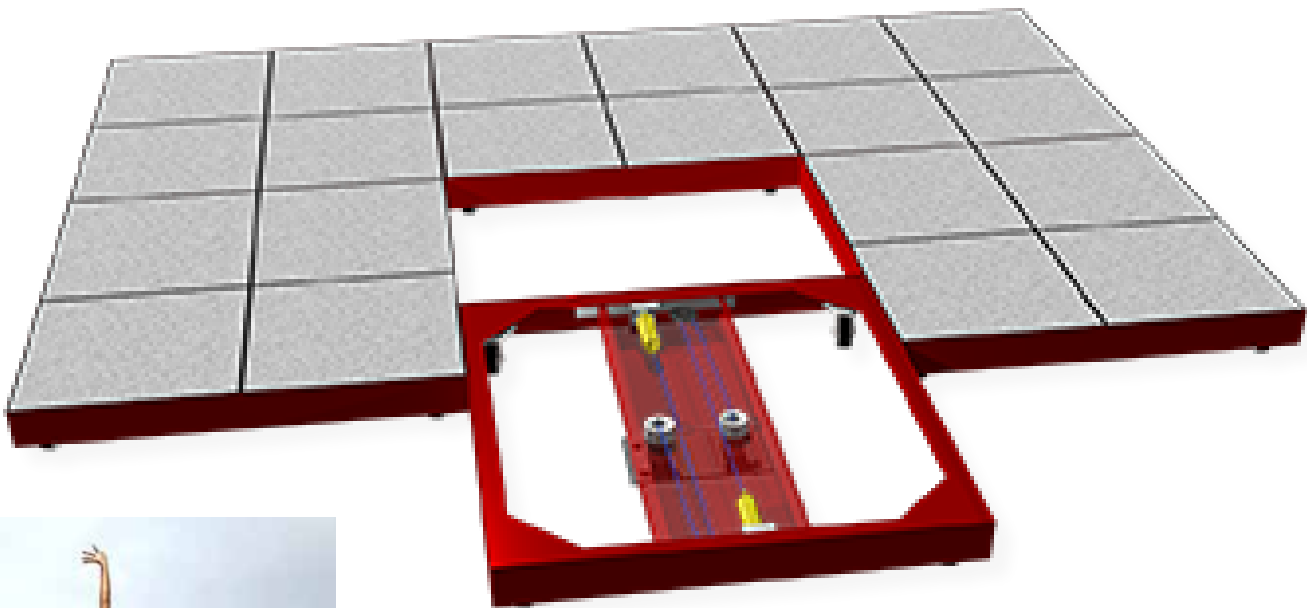
Standard DIS Isolated Platforms are designed for 100psf to 500psf floor loading in moderate to high seismic regions. Custom engineered solutions are available to suit any application.



Platforms - Standard		
Part No.	Dimensions L x W x H	Capacity (psf)
IP-100S	48" x 48" x 7"	100
IP-200S	48" x 48" x 7"	200
IP-300S	48" x 48" x 9"	300
IP-400S	48" x 48" x 9"	400
IP-500S	48" x 48" x 11"	500

Platforms - Extended		
Part No.	Dimensions L x W x H	Capacity (psf)
IP-100E	48" x 72" x 7"	100
IP-200E	48" x 72" x 7"	200
IP-300E	48" x 72" x 9"	300
IP-400E	48" x 72" x 9"	400
IP-500E	48" x 72" x 11"	500

Patent No. US 8,061,692 B1



Individual Isolated Platforms bolt together to accommodate various configurations.



These 20 foot tall bronze statues in a California park are isolated on DIS platforms capable of moving +/-30" in an earthquake.

**Finished Floor Requirements**

- ▶ Dimensions: Plan size 2ft larger than IP to allow for movement
- ▶ Flatness Finish: FF 50
- ▶ Levelness Finish: FL 30
- ▶ Designed to Support: 3,000 lb. point loads



# DIS 3D ISOLATION

**Seismic protection for applications that require acceleration reduction horizontally and vertically.**

### **The Need for 3D Isolation?**

Seismic isolation is typically engineered to protect against horizontal accelerations during a seismic event. In some applications, however, significant vertical accelerations are present as well. DIS has developed a solution to reduce these forces.

***Most effective and complete solution for addressing earthquake hazards.***

Dynamic Isolation Systems developed a product which provides isolation from damaging accelerations in both horizontal (X, Y) and vertical (Z) directions.

The solution for isolating in both the horizontal and vertical directions came about when a major hydro-electric dam project needed to protect critical equipment from extreme vertical accelerations.

The equipment at the top of the hydro-electric dam was subjected to spectral accelerations up to 17g. These large accelerations would damage sensitive equipment following a seismic event causing dam controls to be inoperable.

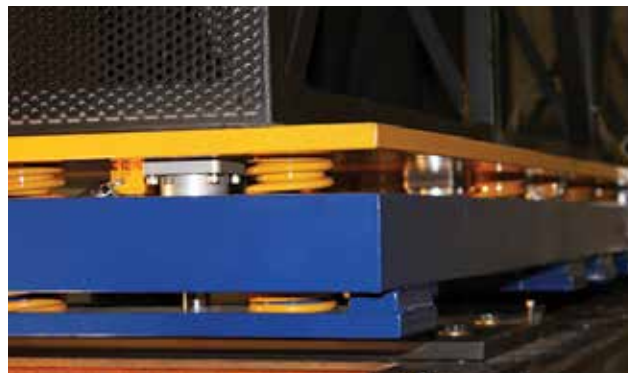
***Meet or exceed code requirements.***

DIS developed 3D isolation platforms to reduce forces and accelerations transmitted into the equipment to be within IEEE 693 High Performance code requirements. The successful development of 3D isolation led to the client incorporating vertical isolation systems in several additional applications.

DIS' 3D isolation systems are the most effective and complete solution for addressing earthquake hazards. DIS specializes in custom design, development, and manufacturing of solutions such as 3D isolation.



**3D shake table testing of DIS' 3D isolation system at Dynamic Certification Laboratories.**



**Components of the 3D isolation system.**



**Vertical isolation system designed to protect hydro-electric dam equipment.**



**Configuration**

DIS' 3D isolation system uses a series of guided bearings, vertical and horizontal springs and dampers to achieve superior performance during a seismic event.

3D isolation system dimensions and capacities are determined on a project by project basis by DIS' team of seismic design experts.

**Performance**

Several shake table test programs were conducted at the University of Nevada, Reno (UNR) and Dynamic Certification Laboratories (DCL).



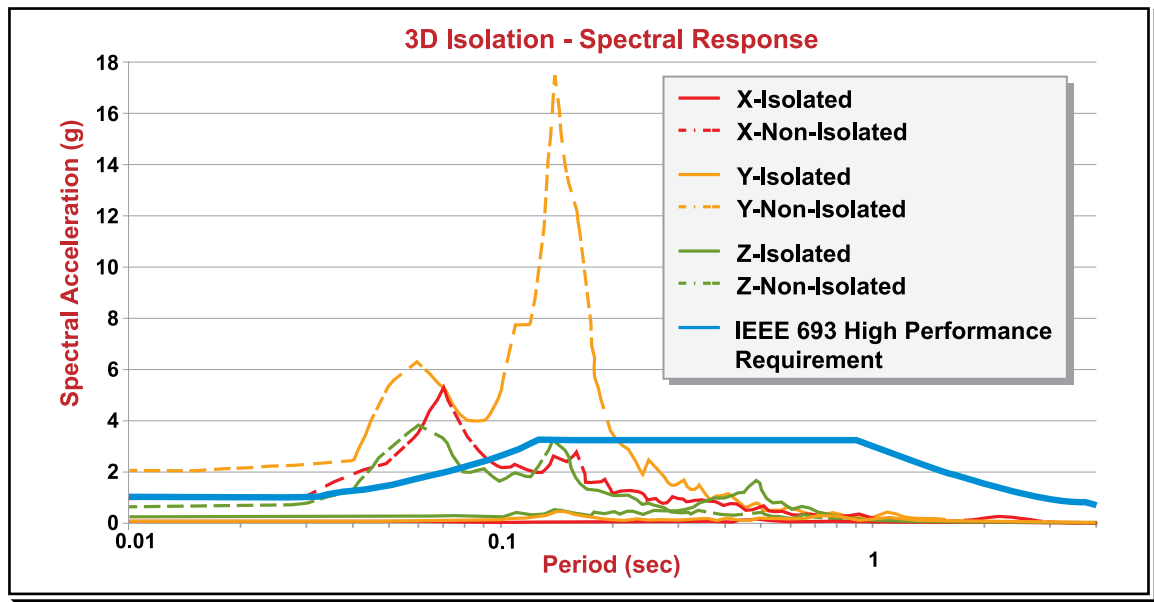
The critical components of the vertical Isolation system are visible in this image.

*Spectral accelerations reduced  
by factors of 10 to 20.*

The system performed as designed. The spectral accelerations were reduced by a factor of 18, protecting essential equipment against the most extreme seismic inputs.



Shake table testing of DIS' vertical isolation system at the University of Nevada, Reno.



Shake table testing shows 3D Isolation reduced spectral accelerations satisfying IEEE 693 High Performance requirements.





# DIS ISOLATED FLOOR (IF)

Seismic protection for essential equipment housed within conventionally designed structures.

## Ideal Candidates for Isolated Floors

- ▶ Emergency Operation Centers
- ▶ Data Centers
- ▶ Large Floor Areas
- ▶ Raised Floor Configurations

## Why Use An Isolated Floor?

Risk management for computer servers and data centers is an integral part of modern business.

Often the productivity of an entire company hinges on the reliable and continuous operation of its computer equipment.

*More server up time.*

In addition to backup power and mirrored data storage, seismic isolation is a critical piece of the risk management puzzle.

DIS Isolated Floor systems provide continuous, single-level flooring with seamless integration of conventional, raised-access floors.

*Floor heights available from 1 to 4 feet.*

Conventional earthquake protection relies on structural strengthening techniques, which actually increase seismic forces and accelerations. DIS' Isolated Floors reduce seismic forces. Systems and equipment remain undamaged, operational and on-line both during and after a seismic event.

*Systems and equipment remain undamaged, operational and on-line.*

Seismic isolation has been utilized to achieve Uptime Institute's Tier 4 rating in seismic zones.

## Configuration

DIS' patented Isolated Floor is comprised of Multi-Directional Springs and high-load capacity rolling supports in standard 4ft x 6ft modules which accommodate standard 2ft x 2ft access floor tiles.



Full scale isolated floor with seismic moat.

Modules are connected with either 2ft, 4ft or 6ft stringers and may be connected on all four sides, allowing for custom configurations.

*Cable trays incorporated for easy access and organization of utilities.*

Under floor utilities may be organized through incorporated cable trays and remain accessible via standard access floor tiles or placed on the floor below the stringers.



Installation of a 16,000 square foot isolated floor at the UC Berkeley, Computational Research and Theory Facility.



**Performance**

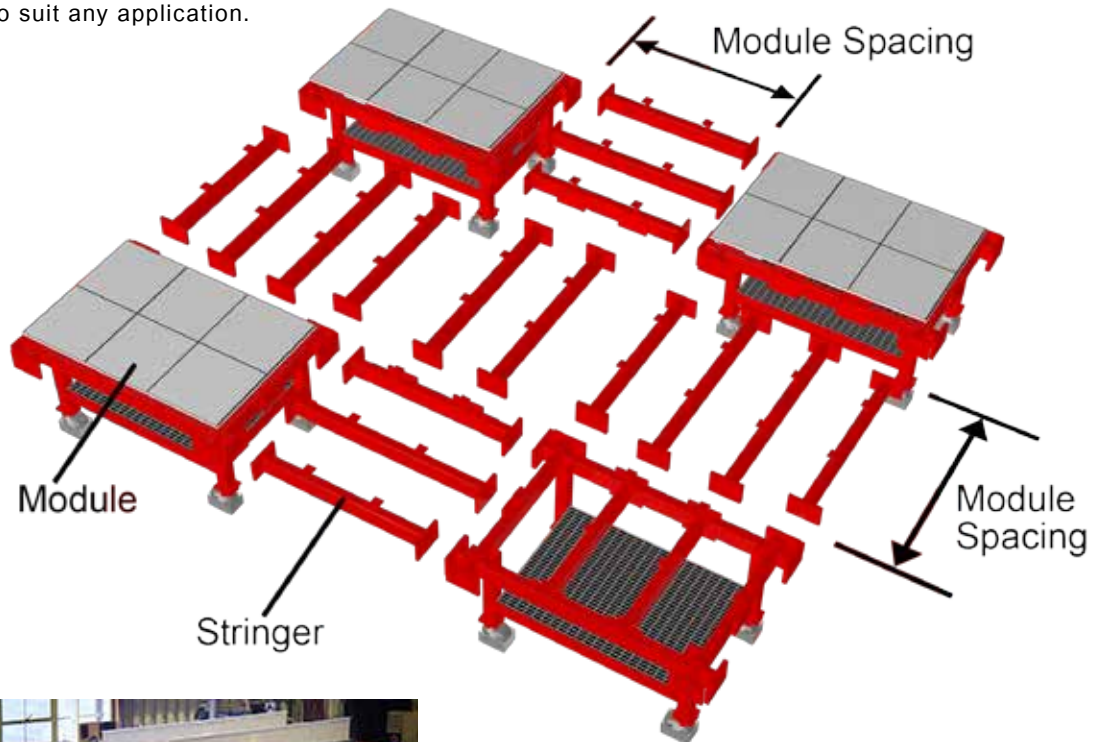
During a seismic event the Isolated Floor decouples the system from the floor slab. The floor slab moves beneath the Isolated floor system, eliminating damage to equipment.

Standard DIS Isolated Floors are designed for 100psf to 500psf floor loading in moderate to high seismic regions. Engineered solutions are available to suit any application.

<b>Isolated Floor Modules</b>				
<b>Part No.</b>	<b>Dimensions L x W</b>	<b>Height Range</b>	<b>Module Spacing</b>	<b>Capacity (psf)</b>
IF-100	48" x 72"	12" - 48"	2', 4', 6'	100
IF-200	48" x 72"	18" - 48"	2', 4', 6'	200
IF-300	48" x 72"	24" - 48"	2', 4', 6'	300
IF-400	48" x 72"	24" - 48"	2', 4', 6'	400
IF-500	48" x 72"	24" - 48"	2', 4', 6'	500

Please contact DIS for floor layout details.

Patent No. US 8,061,692 B1.



3D shake table testing of DIS' floor isolation system at the University of California, Berkeley.

**Finished Floor Requirements**

- ▶ **Dimensions:** Plan size 2ft larger than IF to allow for movement
- ▶ **Flatness Finish:** FF 50
- ▶ **Levelness Finish:** FL 30
- ▶ **Designed to Support:**  
3,000 lb. point loads for 100psf areas to 15,000 lb. point loads for 500psf areas



# DIS MODULAR ISOLATION SYSTEM (MIS)

Protect modular data centers from seismic events and downtime.

## Why Use A Modular Isolation System?

Modular data centers are a key component for business operations in today's growing data industry. DIS' Modular Isolation System (MIS) provides protection against server downtime and equipment damage in the event of an earthquake.

*Exceptional performance was seen in a magnitude 7.6 earthquake.*

Installing backup power and having mirrored storage are common practices for protecting data centers and essential equipment.

However, the missing piece of this risk management puzzle has been the protection from seismic events. This can be provided by DIS' Modular Isolation System.

*Seismic isolation has been utilized to achieve Uptime Institute's Tier 4 rating in seismic zones.*

Conventional earthquake protection utilizes strengthening techniques, which actually result in increased seismic forces. The MIS, however, reduces seismic forces. Systems and equipment remain undamaged, operational and on-line.

*Protection against server downtime and equipment damage.*



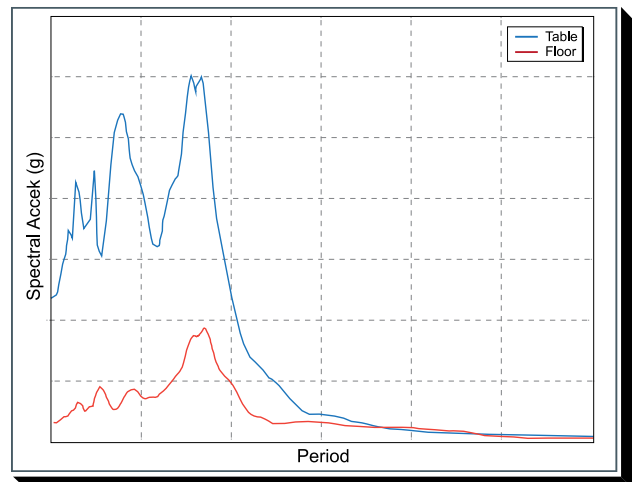
A modular isolation system ready to accept modular data center.



Modular Data Center In Costa Rica. It performed well in a 2012 magnitude 7.6 earthquake.

## Performance

DIS' patented MIS is comprised of Multi-Directional Springs (MDS) and high load capacity rolling supports housed within an attractive steel frame. The frame matches the footprint of a standard modular data center and is only 12" (300mm) tall.



Transmitted accelerations are reduced by up to 5 times.

During a seismic event the ground moves beneath the MIS, leaving the data center and its equipment unaffected by the earthquake. The MIS decouples the data center from the ground and absorbs seismic energy.

Standard MIS' are designed for 25,000 to 65,000 pound modular data centers in moderate to high seismic regions. Custom solutions are available for any application.



MIS Options - Standard		
Part No.	Container L x W	Container Weight Range
MIS-20S	20' x 8'	25,000 - 45,000
MIS-40S	40' x 8'	25,000 - 45,000
MIS-53S	53' x 8'	25,000 - 45,000

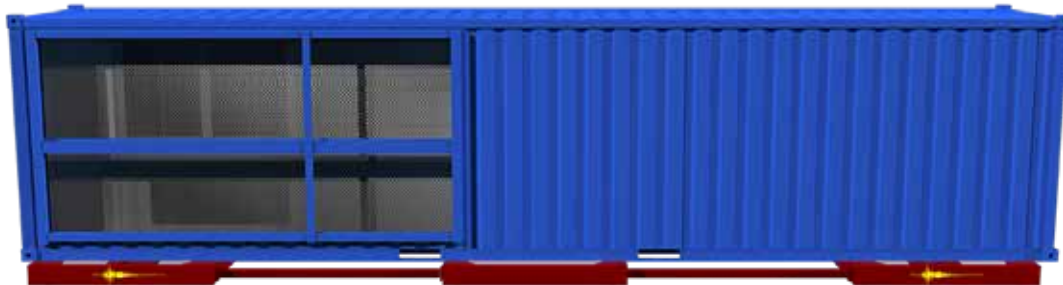
MIS Options - Heavy		
Part No.	Container L x W	Container Weight Range
MIS-40H	40' x 8'	45,000 - 65,000
MIS-53H	53' x 8'	45,000 - 65,000

Contact DIS for custom sizes and designs.

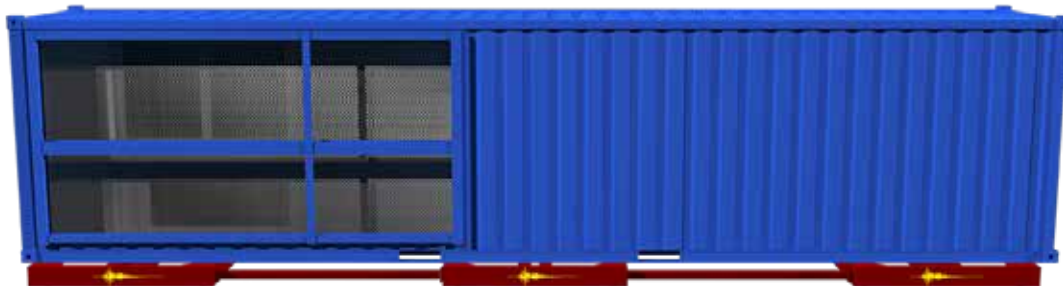
Patent No. US 8,061,692 B1



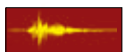
MIS-20S Configuration



MIS-40S and MIS-53S Configuration



MIS-40H and MIS-53H Configuration



Dynamic control modules support vertical load, control seismic movement, and house DIS' patented Multi-Directional Spring units.



Dynamic control modules support vertical load and allow seismic movement.

**Concrete Pad requirements**

- ▶ Dimensions: Container size plus 2ft perimeter
- ▶ Flatness Finish: FF 50
- ▶ Levelness Finish: FL 30
- ▶ Designed to support: 10,000 lb. point loads





## FREQUENTLY ASKED QUESTIONS

---

### **What benefit can be expected from seismic isolation?**

Typical force and acceleration reductions are on the order of 3 to 5 times and can be as much as 20 times.

### **What are the maintenance requirements for DIS isolation systems?**

DIS isolation systems are maintenance free devices. The area surrounding the devices should be checked periodically to ensure the system can freely translate during a seismic event.



### **Are specialty contractors required for installation of DIS devices?**

DIS isolation devices are installed by general contractors, facilities or maintenance crews. Most connections are simply bolted together and anchored to the floor. Detailed installation manuals are provided with all systems and DIS offers on-site installation support.

### **What testing has been performed to qualify the performance of the systems?**

DIS' various isolation systems have been extensively shake table tested at university laboratories and independent certification laboratories under full load and earthquake conditions over the past decade.

### **Do the systems require replacement after a seismic event?**

DIS isolation systems are capable of protecting against multiple large scale events and do not require replacement after an earthquake.



### **Has DIS ever had a failure in the field?**

DIS has completed over 450 isolation projects on some of the most high profile projects in the world, dozens of which have been subjected to seismic events. All projects have performed as expected and none have required replacement after an earthquake.

### **Are there any limits to the use of DIS isolation systems?**

DIS team of international experts in the field of seismic isolation verify that every project receives the solution that best fits its specific needs.



### **Do DIS isolation systems incorporate any means of organizing cables and utilities?**

Overhead cable trays for utilities can be incorporated into Isolated Platform systems and under floor cable trays for utilities can be incorporated into Isolated Floor systems.

### **Are custom designs available for unique applications?**

DIS specializes in custom design applications and can offer a full range of design, detailing, and manufacturing services, including stamping by a licensed engineer if required.





# **DYNAMIC ISOLATION SYSTEMS**

*The World Leader in Seismic Protection*

**885 Denmark Drive, Suite 101**

**McCarran, Nevada 89434 USA**

**T: 775.359.3333 · F: 775.359.3985**

**[www.dis-inc.com](http://www.dis-inc.com)**

**Copyright © 2016 Dynamic Isolation Systems, Inc.**

**All rights reserved.**

[www.dis-inc.com](http://www.dis-inc.com)