

FEMA Guidelines

FEMA 460, "Seismic Considerations for Steel Storage Racks Located in Areas Accessible to the Public published in 2005", outlines the need for improved safety for the shopping public. The guidelines require that rack structures should not fail nor shed their load during a "Design Basis" earthquake.



ICC Evaluation Report Pending

Ridg-U-Rak is currently in the process of obtaining an International Code Council Evaluation Report. This report will provide evidence that the Pellegrino base isolator is in compliance with all building code requirements, and will virtually guarantee approval from building officials during the permit process.

ICC-ES is the United States' leader in evaluating building products for compliance with code.

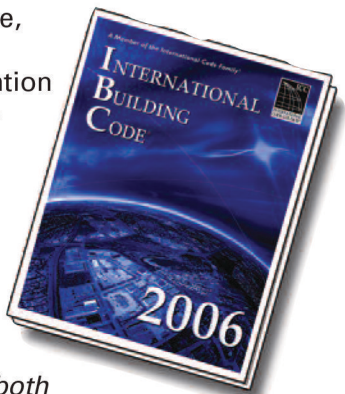


A nonprofit, public-benefit corporation, ICC-ES does technical evaluations of building products, components, methods and materials. The evaluation process culminates with the issuance of reports on code compliance.

Test Protocols

Testing protocols followed AC156, "Acceptance Criteria For Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems", to achieve performance levels as outlined in FEMA 460.

A "Design Basis" earthquake, as outlined in the AC156 represents 100% of qualification or approximately 25% more intense than the Northridge or Loma Prieta earthquakes (6.7 and 6.9 on the Richter moment magnitude scale respectively).



Note: Pallets used during these tests were inspected and repaired as necessary, both prior to and during the course of testing. Pallets were loaded using normal industry good practice, and many of the loads were stretch-wrapped, as is standard procedure.

In actual storage environments, structurally sound and undamaged pallets should be used. Care must be taken to ensure that all stored loads are intact, without excessive pallet overhang, and without miscellaneous packages hanging out which can easily be dislodged.



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Pellegrino
Seismic Base Isolation System

Applying Innovative Technology



Pellegrino
Seismic Base Isolation System



RIDG-U-RAK

The Need for Improved Seismic Performance

Today traditional storage racks are no longer confined to industrial warehouses and distribution centers. Big box retailers and warehouse club stores are now using "high cube storage racks" in areas accessible to the general public. Although convenient, high cube storage racks pose a significant threat to the public during a seismic event.

Realizing this threat, the Federal Emergency Management Agency (FEMA) adopted new guidelines stating that rack structures must not fail nor allow falling product during a moderate to severe earthquake. Compliance with these standards is critical to public safety and important to those inventorying "high value" merchandise.



The Pellegrino Seismic System is designed to withstand an earthquake 25% more intense than the Northridge or Loma Prieta earthquakes which reached magnitudes of 6.7 and 6.9 on the Richter moment magnitude scale. Damage from those earthquakes is shown here.



"I'm proud to introduce our Pellegrino Seismic Base Isolation System...our finest accomplishment to date. After years of development and exhaustive testing, we have created an innovative storage system that reduces the risk of personal injury and product loss during an earthquake. This is not just technology- it's the application of technology to a very real problem."

John B. Pellegrino

John B. Pellegrino, P.E.
President, CEO
Ridg-U-Rak Inc.

For a personal evaluation of how base isolation can help you avoid a seismic disaster, please contact our Sales Department at 1-866-479-7225.

Introducing ...

The Pellegrino™ Seismic Base Isolation System:

- Reduces the risk to the public during an earthquake
- Potentially reduces the cost of reinforced flooring in seismic zones
- Improves protection of high value merchandise during an earthquake
- Increases the rack structure's resistance to forklift impacts

The Pellegrino Seismic Base Isolation System has proven to withstand the most powerful earthquake anticipated in the United States with little or no merchandise shedding or rack damage. Used in a warehouse or big box retail outlet, this can reduce the risk of product loss and personal injury.

The base isolator is positioned between the columns of an upright frame and anchored to the floor using standard installation procedures. This allows the upright frames to translate during a seismic event ... reducing the effect of the violent ground forces exerted on the rack during an earthquake.

Isolators Dissipate 85% of Seismic Energy

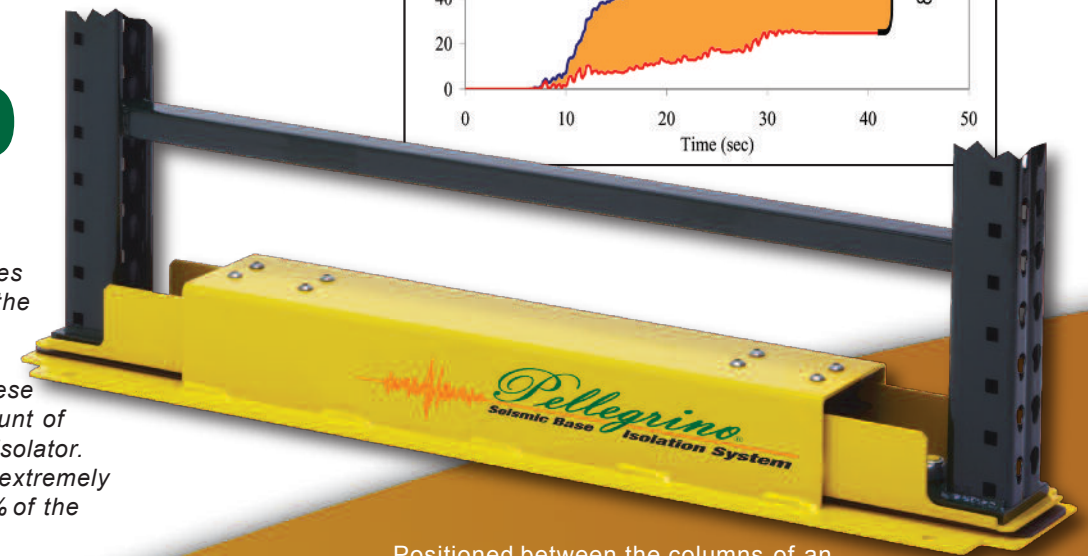
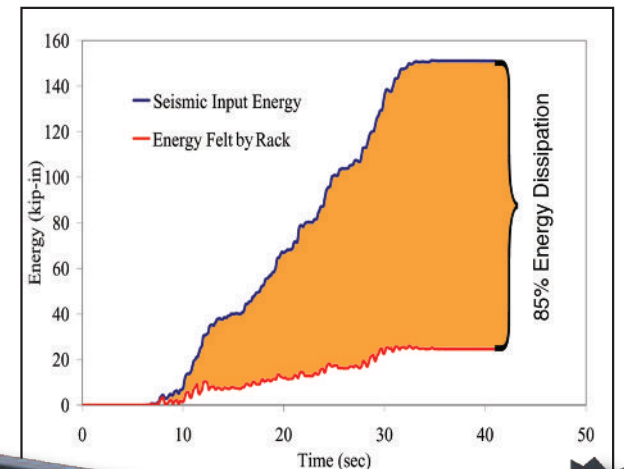
The graph on the right compares the seismic input energy from the shake table with the seismic energy that is felt by the rack structure. The area between these two curves represents the amount of energy dissipated by the base isolator. The base isolator proves to be extremely efficient, having dissipated 85% of the seismic input energy at the end of the test.

The Value of Base Isolation

The Pellegrino Seismic Base Isolation System is easy to install and provides numerous benefits both in terms of safety and return on investment. These base isolators can be used to retrofit existing storage racks and can be used with racks produced by manufacturers other than Ridg-U-Rak.

Ridg-U-Rak's unique design:

- Applies proven base isolation technology to reduce the effect of violent ground forces exerted on racks during an earthquake
- Does not obstruct daily operations in any way
- Does not impede loading and unloading of racks
- Can be easily moved during warehouse reconfiguring
- Is a one-time investment to reduce risk of product loss and personal injury



Positioned between the columns of an upright frame, high-tech Pellegrino Base Isolators reduce the effect of the violent ground forces exerted on the racks during an earthquake.

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Earthquake Simulations

Ridg-U-Rak conducted more than 100 earthquake simulations with varying loads, product configurations and base arrangements during five weeks of exhaustive testing at the Structural Engineering Earthquake Simulation Laboratory located at the State University of New York at Buffalo.

This world-class laboratory is home to some of the most sophisticated seismic equipment available for structural testing. These tests were conducted on one of two 23 by 23-foot shake tables that operate in three dimensions to best replicate real world earthquakes.

The testing protocol had a number of critical milestones...

- 100% of qualification, or a Design Basis Earthquake (DBE)
- 150% of qualification, or a Maximum Considered Earthquake (MCE)
- 200% of qualification, or the most powerful anticipated earthquake in the U.S.A.

During these tests, independent consultants and laboratory investigators measured the precise effects that each level of earthquake simulation had on the racks and products stored.



Elapsed-Time Rack Response

:30 Second Seismic Simulation

The Seismic Base Isolation System was put to the test during more than 100 earthquake simulations. Details about test procedures can be found on the back cover. Shown below is a direct comparison of a fixed-based rack structure with an identically

configured rack structure using The Pellegrino Seismic Base Isolation System. As the earthquake simulation intensified, the base isolated rack held its merchandise while the fixed-base rack system became extremely dangerous, nearly shedding its entire load!



at :10 seconds



at :18 seconds



at :25 seconds



at :30 seconds

Traditional Fixed-Base Storage Rack



Simulation begins...rack starts to sway, loads start to move.



Ground force acceleration begins to topple loads.



Rack structure continues to shed loads.



Virtually all loads crash to the floor.

Storage Rack with The Pellegrino Base Isolators



Ground force acceleration begins.



Isolators reduce felt ground forces, loads remain in place.



With Pellegrino Base Isolators, the rackstructure continues to perform flawlessly.



All loads remain intact on racks during the most severe earthquake simulation and structure incurs no damage!

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What The Experts Are Saying...



"...from previous shake table tests I had conducted, we had a rough idea how much acceleration and motion we could tolerate without material falling off the rack. Ridg-U-Rak designed the Pellegrino Base Isolators around those parameters, which they are satisfying very well. They're performing exactly as Ridg-U-Rak designed them to do.

This is the first tri-axial merchandisetest ever performed... this is a groundbreaking effort and we're setting all kinds of records here."

Peter Higgins, P.E., S.E.
Supervising Test Engineer



"Recently the FEMA-funded task force, which I was a part of, developed best practices or guidance in terms of designing, manufacturing and installing racks in high seismic zones. With The Pellegrino Base Isolator, we have seen the performance expected according to the FEMA guidelines which means no damage to the rack and no fall out of merchandise."

Andre Filiatrault, PhD, Engineering
Lead Laboratory Investigator



"...anything we can do to improve the safety of racks and their contents is important. If I were a consumer walking through a store that had the Pellegrino Base Isolators, I would be very pleased..."

Robert Bachman, P.E., S.E.
Project Observer



"The kinds of feats being conducted here have been done very rarely. These tests are difficult to program properly, very costly to conduct and the complex facilities are not readily available. This is a great opportunity to do this work. This is a first-class facility with first-class people. They do a very good job and are getting excellent results."

Victor Azzi, PhD, P.E.
Project Observer

Public Safety

Concerns for public safety have grown since big box retailers, warehouse shopping clubs and retail centers began using high cube storage racks. Although convenient, these environments put the shopping public in harms way during a seismic event. Ridg-U-Rak's Seismic Base Isolation System has proven to reduce the risk of falling merchandise and rack failures during moderate to severe earthquakes.

An investment in The Pellegrino Base Isolators provides the best available protection for the public in these busy shopping centers.

High Value Product

All products stored in racks are valuable, but imagine losing product during an earthquake worth ten, twenty, or fifty-thousand dollars per pallet! Not only is the monetary value of those products at risk, but also the physical loss of one-of-a-kind items, antiques, tools and dies that might not be able to be replaced for months or ever.

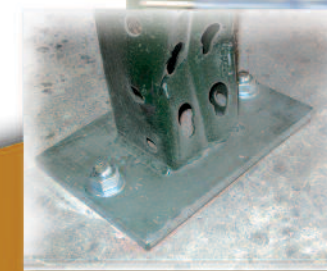
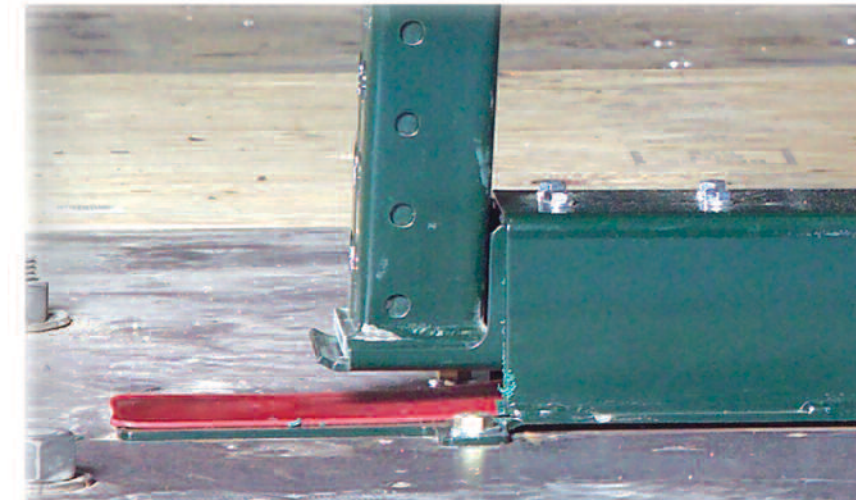
In the event of an earthquake, having the Pellegrino Base Isolators to reduce damage from falling product would prove invaluable.

Potential Cost Savings from Reduced Flooring Requirements

Racks anchored in a conventional manner in high seismic areas can induce very high uplift forces into the concrete floor slab during an earthquake. The slab must be designed to resist these forces, often resulting in a very thick, heavily reinforced and extremely expensive floor slab. The Pellegrino Seismic Base Isolation System may actually reduce these uplift forces to zero! This means the floor slab can be significantly reduced in thickness and reinforcing, potentially resulting in large cost savings.

Reduced Impact Damage

Frontal impact damage is typically caused by forks from a lift truck. As an additional benefit, rack systems installed with Pellegrino Base Isolators sustain less frontal impact damage compared to the same fixed-base rack columns.



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