SEISMIC ISOLATION AT THE BASE OF YOUR VALUABLES

SEISMIC ISOLATION OF ADJUSTABLE PALLET RACKING SYSTEMS

FIP INDUSTRIALE
leading technologies

ISOLGOODS®

THE STATE-OF-THE-ART

TRADITIONAL ADJUSTABLE INDUSTRIAL PALLET RACKING SYSTEMS

Adjustable industrial pallet racking systems are steel structures made up of cold-formed thin gauge steel members. They are composed by a sequence of vertical load bearing elements, called upright frames, which determine their width in the transversal direction, and which are connected to each other by means of beams, using suitable quick-connectors, allowing for their positioning at the desired level.

The longitudinal development of the racking system is obtained from the repetition of one or more frames. Single or double upright frames are made up by linking together two or more uprights by a system of bracing elements, thus leading to a considerable in-plane stiff reticular structure. Uprights are rigidly anchored to the industrial flooring by means of suitable properly shaped steel plates.

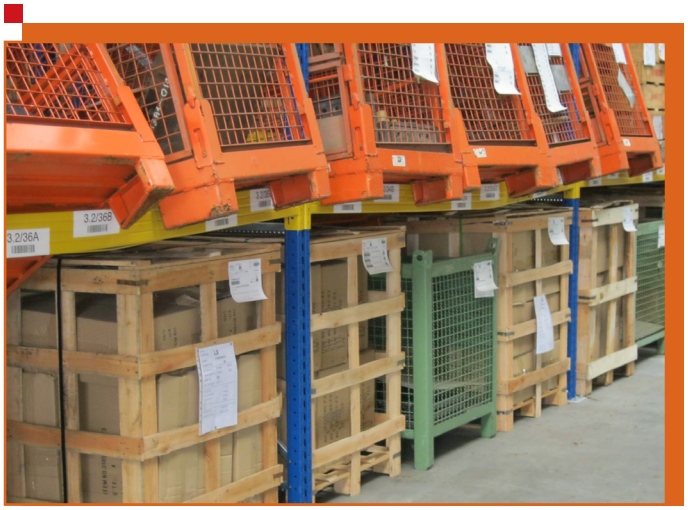
The considerable difference in lateral stiffness in the two directions of the racking system leads to a seismic response significantly different between the transversal direction and the longitudinal one. In particular, in the transversal direction, where the rack is much stiffer, accelerations will be higher and, consequently, earthquake-induced forces will be higher too.

EARTHQUAKE-INDUCED DAMAGES

The latest seismic events, in particular those happened on May 2012 in Emilia, Italy, a highly industrialized zone, have highlighted the critical issues of industrial racking systems, and among these adjustable pallet racks. Several global or partial collapses of racks have been recorded, thus causing serious economic damages to companies, whose goods were destroyed.

In most cases, global collapses were caused by uprights failure, which, during the seismic event, have undergone stresses they were not designed and dimensioned for. Another type of frequently observed failure was the overturning of the rack, due to the lack of resistance of the flooring anchoring systems.

Many economic damages were caused by pallets slip from the load supports. In many cases, in fact, even if the rack did not suffer any structural damage, pallets were flung to the ground with the consequent loss of more or less precious goods.



SAFETY OF PEOPLE

The achievement of the maximum safety for people represents a key and absolute requirement for workers, but also for the crowd in case of warehouses with withdrawal area open to the public.

In case of seismic event, the falling of even only one object could cause a fatal accident.

WHAT ARE WE PROPOSING?
SEISMIC ISOLATION OF ADJUSTABLE PALLET RACKING SYSTEMS

WHAT IS SEISMIC ISOLATION?

Seismic isolation consists in the seismic response modification of a structure by increasing its natural period; this is achieved by means of suitable devices with high horizontal flexibility, mounted beneath the structure.

Seismic isolation significantly reduces the earthquake-induced energy transmitted into the structure, and consequently it results in a considerably reduced impact.

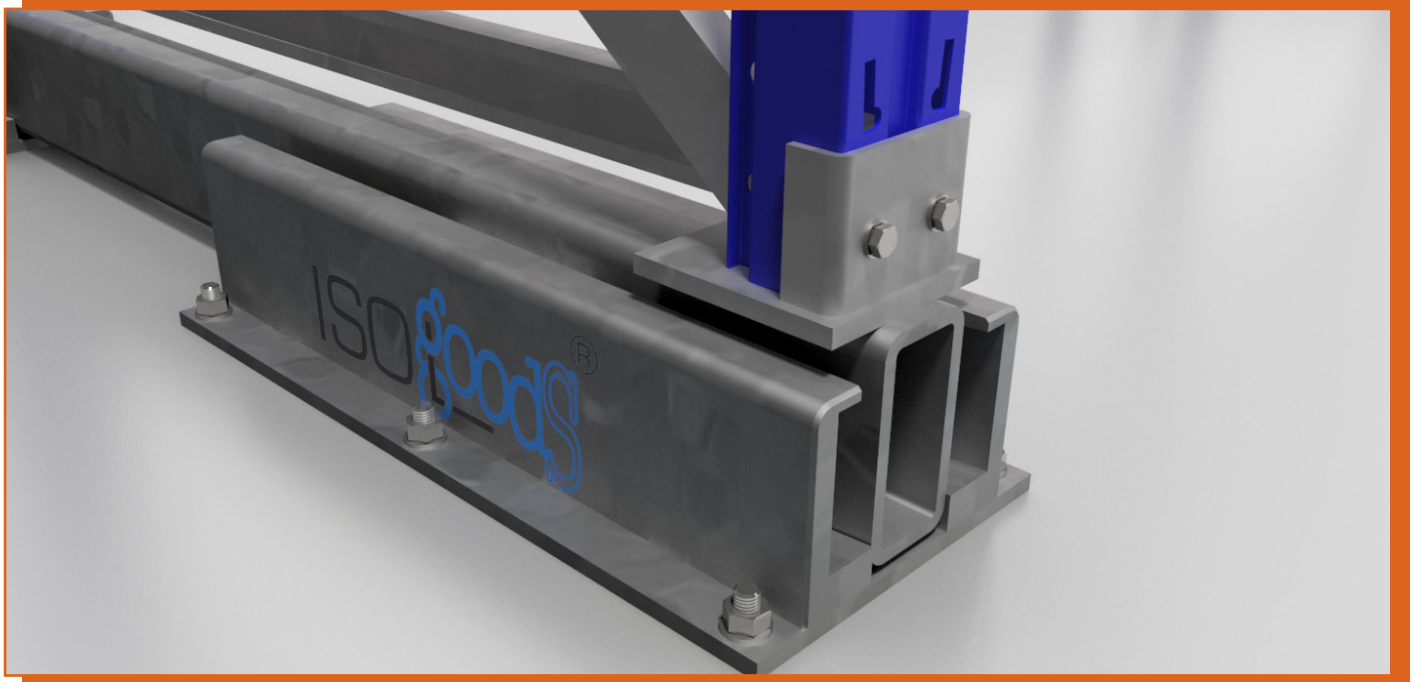
PATENTED SEISMIC ISOLATION DEVICE ISOLGOODS®

Isolgoods® is a unidirectional seismic isolation device suitably designed and patented for adjustable pallet racking systems. It has a high compressive and a good tensile resistance, that prevents the racking system from overturning. It provides seismic isolation of the rack in the transversal direction only, the stiffer one and thus the most affected by earthquake-induced effects; conversely, the behaviour in the longitudinal direction remains that of a traditional rack.

Isolgoods® has been designed in order to minimize its overall dimensions without wasting useful space for pallets placing. It can be installed beneath both new and existing racks.

Isolgoods® working principle is that of the simple pendulum, whose period of vibration is almost independent from the mass of the structure and mainly depends on the length of the pendulum itself. As far as **Isolgoods®** is concerned, the radius of curvature of the sliding surface or the equivalent radius of curvature in case of double curved devices replaces the length of the pendulum. The independence of the period from the mass is of fundamental importance for racks, due to the continuous variability of the masses crammed on them.

Isolgoods® isolation device is installed beneath each upright frame of the rack, and it is anchored to industrial flooring by means of chemicals or mechanical anchor fasteners according to current antiseismic standards. **Isolgoods®** is manufactured for both single and double upright frames racks.



WHY INSTALL ISOLGOODS® DEVICE?

The installation of **Isolgoods®** devices is extremely quick and straightforward, and it guarantees many advantages, such as:

• It strongly reduces the accelerations transmitted by the flooring to the rack, thus reducing the risk of pallets slipping during a seismic event;

• It prevents rack failure, thanks to the considerable reduction of uprights stresses in case of an earthquake;

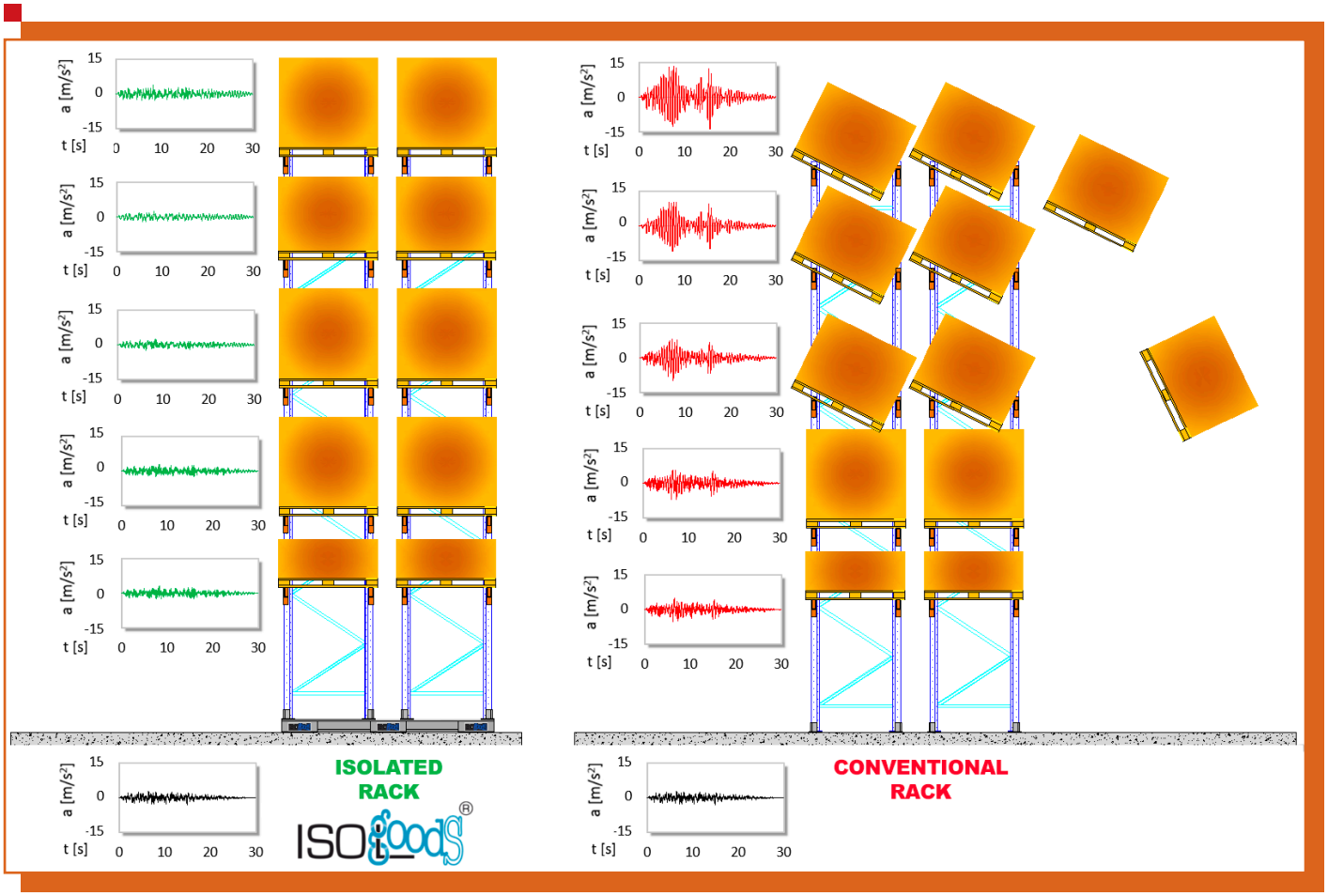
• It completely eliminates (or strongly reduces in high seismicity areas) tensile stresses on the anchoring system, thus reducing the cost of a new flooring or of the retrofit of an existing one.

■ Higher safety for people and goods

Thanks to **Isolgoods®** devices, seismic accelerations at different loading levels are strongly reduced. Comparing the seismic response of a conventional traditional rack (the red one in the figure below) with that of an isolated one by means of **Isolgoods®** (the green one in the figure below), it's immediately clear that the accelerations at different loading levels of a conventional rack are far higher than those of an isolated one.

In particular, the top loading levels show a considerable amplification of accelerations in the conventional rack, up to 7 times higher than the peak ground acceleration (PGA).

Such high accelerations could lead to collapse or, even in absence of collapse, to pallets slipping, endangering both people and goods. In case of an isolated rack by means of **Isolgoods®**, accelerations at different loading levels are almost equal to each other, and lower than the PGA.



■ Effectiveness of the anchoring system to the flooring

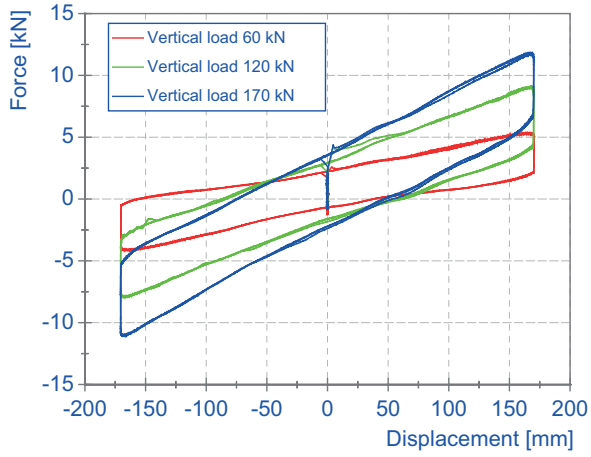
In case of conventional racks, seismic horizontal forces produce an overturning effect, which raises extremely high tensile stresses on the anchoring system.

In order to ensure anchoring in such conditions, heavily reinforced industrial flooring with high thickness are required, involving considerable cost in case of both new buildings and flooring retrofit of existing ones. In case of existing buildings, often this retrofit is not even feasible.

Thanks to **Isolgoods®**, tensile stresses on the anchoring system are completely removed in most cases, and only in higher seismicity areas possible slight tensile stresses could be resisted by standard industrial flooring, without facing additional cost for their retrofit.

LABORATORY TESTS

Isolgoods® device has undergone several experimental tests at **FIP Industriale** Test Laboratory, including those according to the European Standard on antiseismic devices EN 15129.



Tests have been performed applying different values of vertical load, in order to simulate a more or less loaded rack, and at different velocities.

SEISMIC RETROFIT OF EXISTING RACKS

On the basis of the long-term site experience for the seismic retrofit of several civil and industrial constructions, we propose ourselves for site installation in the refurbishment of existing buildings, without interruptions and with minimal impact on ongoing activities.

The undeniable economic advantage of existing rack rehabilitation and business continuity guarantees protection against damage produced by the relevant interruption.

REFERENCE STANDARDS

- EN 15512:2009 “Steel static storage systems - Adjustable Pallet racking systems - Principles for structural design”;
- EN 16681:2016 “Steel static storage systems - Adjustable pallet racking systems - Principles for seismic design”.

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