MITSUBISHI ELECTRIC
Changes for the Better

for a greener tomorrow

**MITSUBISHI ELECTRIC CORPORATION**
**PUBLIC RELATIONS DIVISION**
7-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo, 100-8310 Japan

**FOR IMMEDIATE RELEASE** **No. 3251**

*Customer Inquiries*

Advanced Technology R&D Center
Mitsubishi Electric Corporation
www.MitsubishiElectric.com/ssl/contact/company/rd/form.html
www.MitsubishiElectric.com/company/rd/

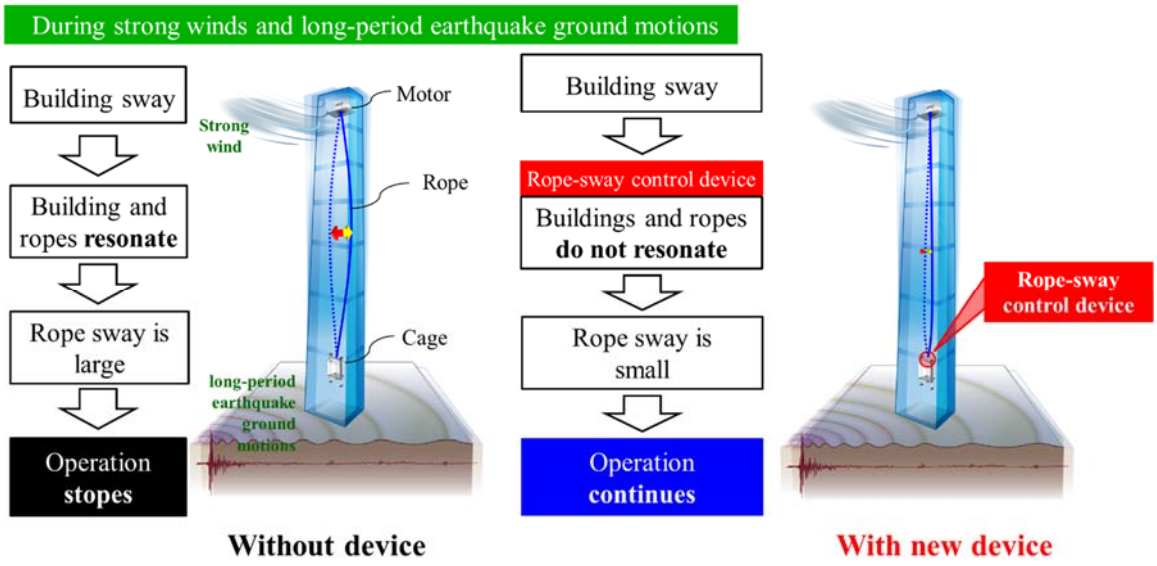
*Media Inquiries*

Public Relations Division
Mitsubishi Electric Corporation
prd.gnews@nk.MitsubishiElectric.co.jp
www.MitsubishiElectric.com/news/

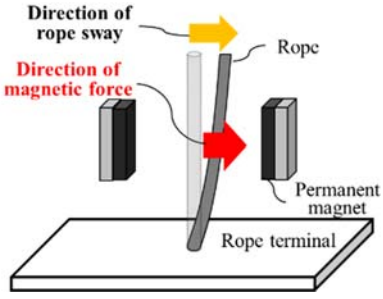
# Mitsubishi Electric Develops Passive Rope-sway Control Device for Elevators in High-rise Buildings

*Helps reduce elevator shutdowns during strong winds and earthquakes*

**TOKYO, February 7, 2019** – Mitsubishi Electric Corporation (TOKYO: 6503) announced today that it has developed a device that passively controls rope sway when high-rise building elevator sway due to strong winds or long-period earthquakes. By enabling elevators to continue operating under such conditions, the new device will help to stabilize elevator operations and contribute to greater user convenience.




Rope-sway control technology




① The permanent magnet applies a magnetic force to the rope near the rope terminal so as to amplify the rope sway.

② The amplification of rope sway makes the resonant frequency low. As a result, the resonant frequency does not correspond to the building's sway, which helps to suppress the rope sway.

Principle of rope-sway control

Mitsubishi Electric's new passive rope-sway control device applies a magnetic force, called negative stiffness, to the bottom-end of the rope. Negative stiffness is a well-known principle, and it applies a force in the opposite direction against a normal spring's restoring force.

**Main Features**

***1) More stable elevator operation by greatly suppressing rope sway when building sways***

- The magnetic force of permanent magnets is used to amplify the swing of the rope terminal at the top of the car in accordance with the amplitude.
- Lowering the rope's resonant frequency, or the frequency at which it tends to sway, makes it difficult for the building and ropes to resonate and thereby drastically curbs rope sway.
- By reducing operational downtime, the device helps to stabilize elevator operations.

Negative stiffness is achieved by placing permanent magnets facing each other so as to sandwich the rope. The negative stiffness force acts in the same direction as the rope sway, increasing the sway amplitude at the rope terminal as if the terminal's position were unfixed (a rope with one free end has a lower resonance frequency than a rope with two fixed ends). As a result, the building and rope sway at different frequencies, so they do not resonate and rope sway is greatly suppressed. The use of permanent magnets enables elevator operation to be stabilized without using electrical energy.

**2) *Successful vibration damping tests on actual elevators***

A test that simulated a building swaying due to a long-period earthquake demonstrated that, compared to a rope without a passive rope-sway control device, rope sway could be reduced by at least 55% (magnitude of sway at center of undampened rope = 1).

In a test conducted at Mitsubishi Electric's "SOLAÉ" elevator test tower (173 meters high) at Inazawa Works. in Japan, the upper end of a rope was shaken at a frequency simulating the sway of a building due to the long-period ground motion of an earthquake. In the absence of any damping device, rope sway exceeded the company's recommended threshold for suspending elevator operation. When the damping device was applied, however, rope sway fell below the threshold.

**Background**

High-rise buildings tend to sway during strong winds and long-period earthquakes, causing the elevator rope to sway laterally. If the frequency of building sway and the resonant frequency of the rope are close to each other, the rope can sway widely and come into contact with equipment in the hoistway. Under such conditions, the elevator may have to be shut down for safety purposes. Consequently, rope sway must be suppressed to avoid such situations. While the rope terminal is located in the upper part of the car, where it is easy to install devices such as dampers, rope-sway suppression is difficult with this configuration.

**Future Developments**

Mitsubishi Electric aims to commercialize its new device by fiscal year ending March 31, 2022.

**Patents**

The patents for the developed technology in this news release number four in Japan and four outside of Japan.

###

**About Mitsubishi Electric Corporation**

With nearly 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded consolidated group sales of 4,444.4 billion yen (in accordance with IFRS; US$ 41.9 billion*) in the fiscal year ended March 31, 2018. For more information visit:
www.MitsubishiElectric.com

*At an exchange rate of 106 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2018