

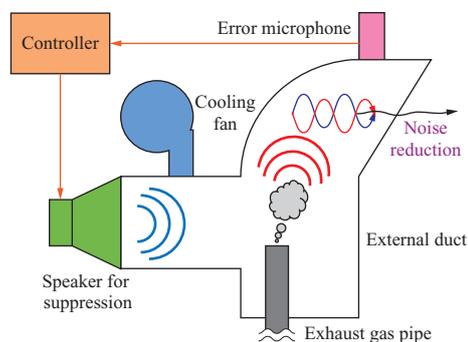
# Construction Sites Got Silence via a Novel Noise Reduction Technique

## Principle of noise canceller was successfully applied to “active silencer” which reduces noise from exhaust pipes of heavy machinery

Active silencers help solving the troubles of the neighborhood near construction sites in residential areas by reducing exhaust noise from construction machinery. They can easily be retrofitted onto various types of construction machinery.



Installed active silencer (Prototype)



Configuration of an active silencer (Prototype)

### Construction sites and active noise control

At construction sites, the terrible noise caused by large construction machinery (heavy machinery) used for public works, groundwork, and craning (lifting members and materials to necessary locations with cranes) imposes large burdens on the neighborhood. In particular, at construction sites in urban areas, noise prevention and reduction have become serious issues and general contractors have been actively researching and developing technologies to deal with them.

Typical methods for reducing noise are passive techniques such as sound insulation, sound absorption, damping, and vibration isolation. Passive techniques are effective for relatively high frequencies, but there are few noise reduction

techniques for low frequencies such as the exhaust noise from construction machinery. Thus far, implementing effective measures has been considered rather difficult.

Active Noise Control (ANC) is a technique in which speakers emit sound waves with the inverse phase of the noise to be reduced to cancel the noise. Recently, ANC has become well-known for its use in audio headphones for noise cancellation.

ANC is a noise reduction technique that works well for low frequencies. INC Engineering Co., Ltd. (INC) has put systems that increase the amount by which noise barriers reduce noise (product name: Super Noise Barrier) and systems that are installed onto the exhaust pipes of permanent diesel generators (used in “Hakusan,” a dredger built by IHI) into practical use and has provided customers with them.

Noise barrier ANC has been used in various construction sites and INC has been the top player in ANC techniques. However, recently some general contractors have developed ANC for construction machinery on their own, making competition fierce.

Therefore, we started developing ANC systems that can be used for various types of construction machinery and can be operated easily in order to enhance our competitive edge in terms of ANC used at construction sites.

### Active silencers for construction machinery

Construction machinery usually uses diesel engines as power plants. Noise with its peak at a certain frequency that is determined by the engine speed and number of cylinders is emitted from the exhaust pipes and it is this noise that often results in complaints.

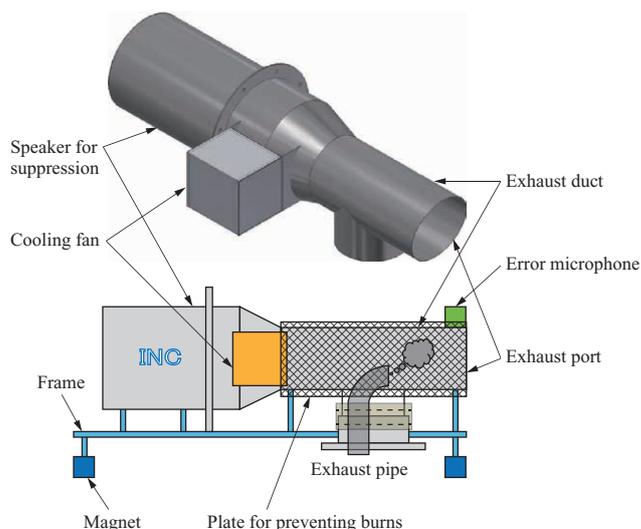
In conventional ANC systems for construction machinery, speakers for suppression are often installed around the exhaust pipe outlets, so noise tends to spread to the surroundings, which means they are not always efficient.

This system consists of an external duct for covering an exhaust pipe, speaker for suppression, cooling fan, error microphone, and controller. Its advantages are as shown below.

- (1) Noise emitted from the exhaust pipes is effectively reduced inside the external ducts before it spreads to the air.
- (2) Noise in a wide range of the low frequencies caused by rotating engines of construction machinery can be reduced.
- (3) The lightweight and compact silencers can be attached to various models of construction machinery in a short time.

Since hot exhaust gas flows inside the ducts, the silencers are designed to allow the speakers to be properly cooled by cooling fans. This design draws on the technologies and experience that INC gained in active silencers for permanent diesel generators.

We built a prototype of an active silencer for construction



Product image  
(Top: 3D model, bottom: diagram)

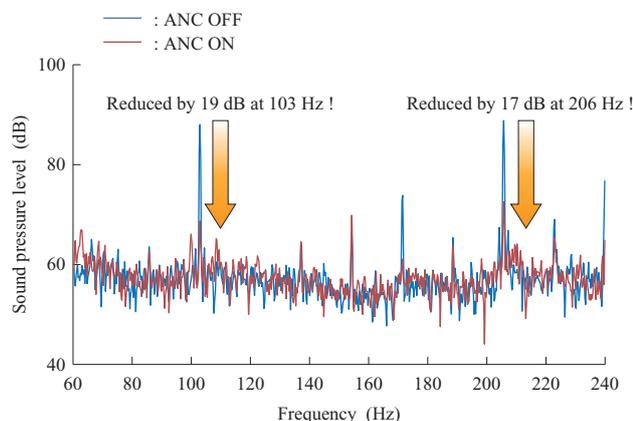
machinery in order to verify its effectiveness. We installed it onto a hydraulic excavator and conducted a demonstration at a construction site.

We checked the efficiency of noise reduction with the engine speed of the hydraulic excavator set to maximum and the frequencies that the ANC suppresses set to 50 to 250 Hz. The sound pressures were reduced by 19 dB at 103 Hz, which was probably the fundamental frequency of the exhaust noise, and by 17 dB at 206 Hz, which is double the 103 Hz. This equates to the sound energy being reduced to approximately 1/100 at each frequency.

### Summary

We are aiming at the commercialization of external active silencers that can be retrofitted onto construction machinery and our goal is to put them on the market in FY2015.

These products can reduce exhaust noise caused by construction machinery that used to be difficult to reduce. This means that they can reduce the burden on neighborhoods close to construction sites. In addition, measures are taken at the noise sources, so the scale of temporary enclosures used at construction sites can be reduced, which can be expected to reduce costs. We intend to make appealing products that will be used at many construction sites.



Prototype's effect on reducing sound pressures

Inquiries:  
 Environmental Engineering Department,  
 Technology Division,  
 INC Engineering Co., Ltd.  
 Phone: +81-(0)3-3360-3227  
 Website: [www.ihico.jp/inc/laneng/](http://www.ihico.jp/inc/laneng/)