

Supported By Advanced Technology

Moving Belt System

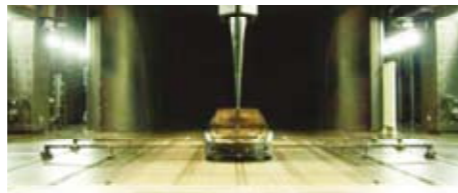
■ Moving belt for a large wind tunnel (Nissan Technical Center)

A wind tunnel testing machine allows the indoor measurement of the air resistance received by a moving vehicle by creating conditions similar to actual driving. To create this environment, the equipment stabilizes the vehicle while a large fan creates airflow equivalent to the vehicle speed and moving belts simulate road conditions at the same speed. This method is very effective because airflow below vehicle body is close to actual running conditions on a road.

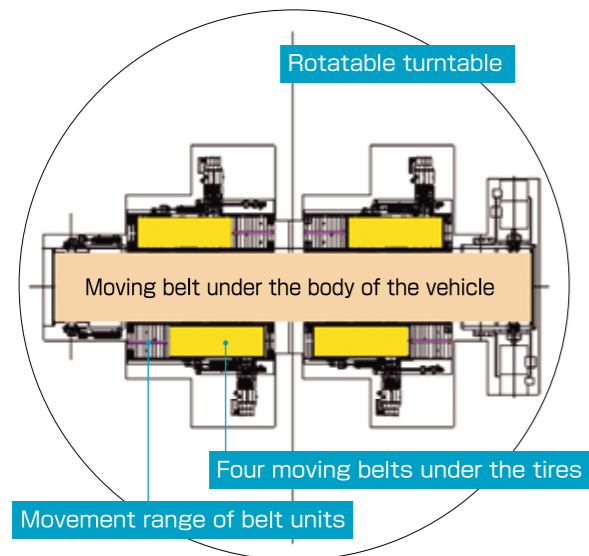


▼ Main specifications

Velocity	200 km/h or more
Max. withstand load	4 tons (full-scale vehicles)
Belt width	2500 mm
Belt length	6000 mm
Unit weight	About 13 tons
Surface flatness	0.5 mm
Belt material	Special steel



■ Moving Belt for Large Wind Tunnel



▼ Main Specifications

Four belts under tires		Single belt below vehicle	
Max. velocity	200 km/h	Purpose	Supports flow of air
Max. withstand load	3 tons	Max. velocity	200 km/h
Belt width	400 mm (steel)	Belt width	1000 mm (special plastic)
Belt length	800 mm	Belt length	6000 mm
Total system			
Unit weight	about 10 tons		
Turntable diameter	7500 mm		



Four moving belts under the tires



Moving belt under the body of the vehicle

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●For proper use, read the instruction manuals carefully before use.



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●Appearance and/or specifications subject to change for improvement without notice.
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*Moving Belt System-ADCC-01-BP1-10202

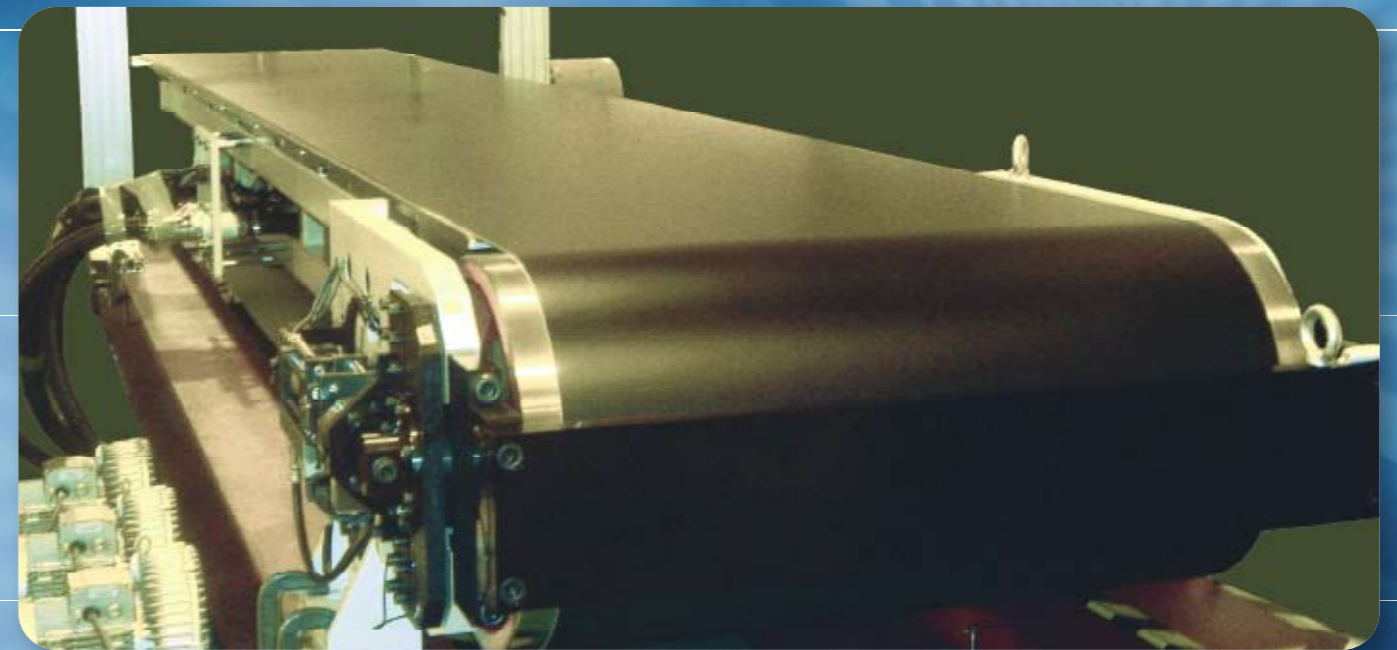
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Features

- Model based control by DSP controls air blow and meandering to ensure high accuracy.
- Air bearings where the tires contact can support full-scale vehicle loads.
- Special steel belts provide a long operating life at heavy loads.

Specifications

- Velocity: 230 km/h
- Surface flatness: within ± 0.5 mm
- Meandering accuracy: within ± 0.5 mm
- Maximum load: 4 tons
- Belt width: more than 2 m is possible



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Air blow and suction at the rear keep the belt flat using model based control from the DSP system.

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On-road driving testing on a test bench or in a laboratory

On-road driving testing can be performed on a test bench or in a laboratory using either a rotation roller or a moving belt. Rotation rollers are easy to make and are widely used as low-friction chassis dynamometers for R&D, inspections, and durability tests. However, the surfaces of even large-diameter rollers are round, which means that the area where the tires contact is not the same as a flat road. The surface of a moving belt, however, is like a flat road. Because of this difference, moving belts are often used for tests with severe tire contact conditions and in wind tunnels.

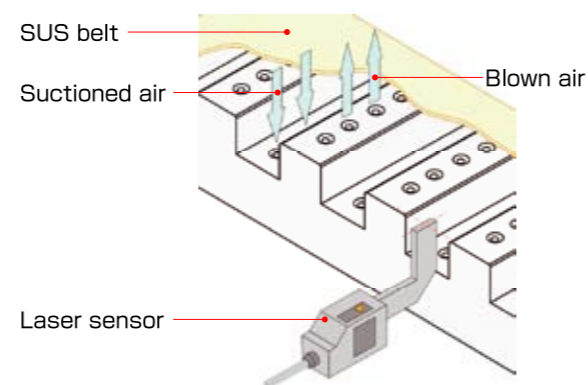
Issues and solutions for moving belt systems

General moving belt systems have many challenges, including belt longevity, meandering control, fluttering suppression, and heavy-load bearing mechanisms. A&D's latest system overcomes these issues.

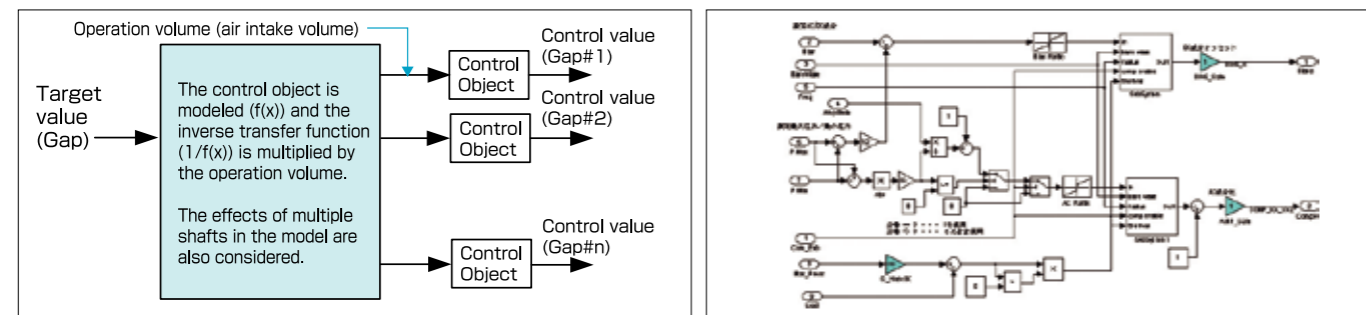
Meandering control and fluttering suppression

The plate under the moving belt has air holes that take in and blow out air to suppress belt fluttering. Meandering is suppressed by controlling the left and right tensile forces of the belt pulley. Model based control with a DSP controller ensures accuracy within ± 0.5 mm.

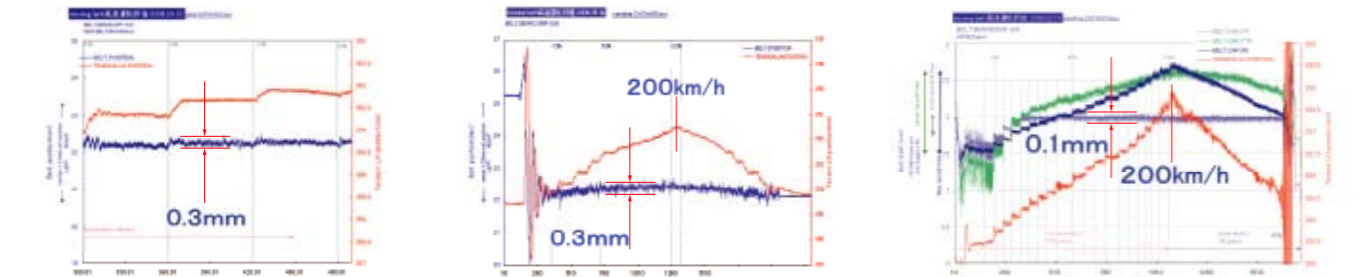
Mechanism under the moving belt



Model based control using control object modeling concepts (Simulations can be performed in advance using MATLAB/Simulink)

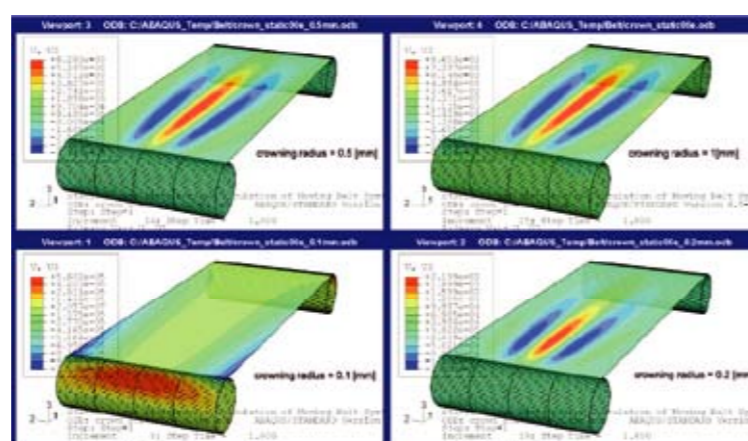


- Meandering control data
- Meandering control data (high speed stability)
- Fluttering control data (high speed stability)



Pulley Shape Simulation

When designing the shape of the pulley in driving mechanism of a moving belt, increasing the bulge at center of the pulley can decrease meandering volume. However, this produces unnecessary torsion in the belt. A&D determines the optimal crowning radius through simulations of belt materials, width, thickness, length, and so on.



Air bearing mechanism

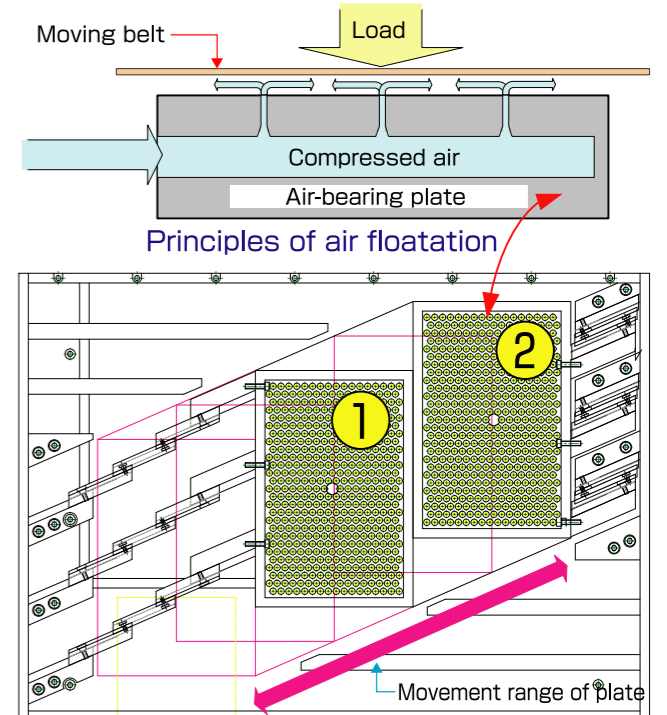
When a tire contacts the moving belt and subjects it to axial load, the air bearing moves the belt to maintain a consistent gap with the plate below it.

Principles of Air Floatation

The air bearing system uses the principles of air floatation. As you can see from diagram on the right, the air-bearing plate has several air holes that blow compressed air. This action creates an air layer between the plate and the belt. When load is applied to the belt and the gap between the plate and belt becomes smaller, the pressure of air layer is increased. When the load is lightened and the gap widens, the pressure is lowered. This mechanism maintains the constant distance between belt and plate.

Air Bearing Mechanism

A&D has several types of air bearings for different system structures, including a single fixed type and a multiple movable type. Tire testing machines utilize a single fixed bearing plate with the necessary surface area. When using full-scale two and four wheeled vehicles, it is necessary to accommodate the planned test range of the tread or wheel base dimensions. To achieve this, a double bearing plate structure or a moving mechanism, as shown in the diagram on the right, is required.



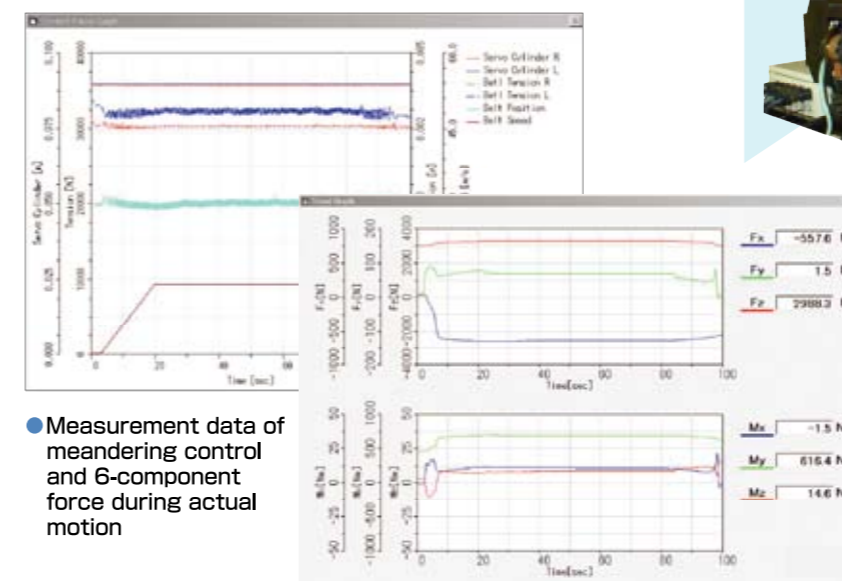
Air-bearing mechanism (Example of double structure ①+② and moving mechanism)

Tire Testing Machine (Using a Moving Belt)

A moving belt creates conditions equivalent to the contact area of a vehicle in motion and therefore is the most effective method for testing tires. The tire-testing system in this example was designed to measure axis force applied to tires while providing steering and camper angles equivalent to actual driving. A&D's advanced 6-component force sensor is installed in the tire-bearing supporter.

Main specifications

Outer diameter of tire	400 to 800 mm
Steering angle	$\pm 2^\circ$
Camper angle	$\pm 4^\circ$
Max. pressure from tire	1 ton + 0.2 G
Max. belt velocity	100 km/h
Control	Load and steering angle controls
Component force resolution	0.1 N



Measurement data of meandering control and 6-component force during actual motion

