



## Products

# Special tires for agricultural and forestry machinery that contribute towards realizing sustainable production in the agriculture and forestry sector



## Contributing to the sustainable use of forest resources through tires that do not hinder trees from regenerating

### Alliance ELIT tires – Committed to supporting sustainable forestry

As a result of the intensive utilization of global forest resources, over the period 1990 – 2015 the world lost an area of forest equivalent to 129 million hectares. In selling our products to customers in the forestry sector, we hope that logging activity will be balanced by the planting of new trees, so as to help bring about growth in overall forest resources.

However, when forestry machinery is driven into the forest, the weight of the machinery compresses the soil, eliminating the gaps between the particles of soil. When new tree seedlings are planted in this compacted soil, their root systems cannot spread out, which makes it difficult for the trees to grow properly. With the number of new trees growing failing to balance out the number of trees harvested, the forest may gradually disappear. Responding to this problem, since 2012 the Alliance Group has been working on the development of a new type of tire that enables forestry vehicles to keep moving even when the tire is at low pressure, thereby preventing the soil from becoming compacted. Alliance's new product – the Alliance 344 Forestar ELIT – was launched in the Scandinavian market in September 2018. We call the technology used in this tire ELIT (Engineered Low Inflation Tire) technology.

In forestry work-sites, the trees tend to be scattered around on land that often has an uneven gradient and may be boggy and wet. This makes it very important that forestry machinery can be operated safely. At the same time, if the downward pressure from the tires on the ground is reduced, this can have a negative impact on driving stability and on fuel economy.

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### Conventional forestry machinery tires

Highly-compacted soil



With no gaps between the particles of soil, the roots cannot spread out, and the trees and other plants cannot grow

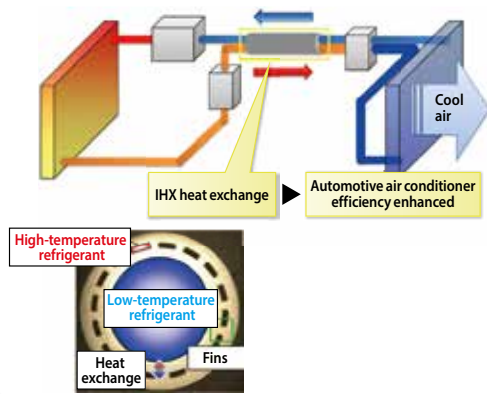
### The newly-developed Alliance 344 Forestar ELIT tire

Lightly-compacted soil



The roots can spread out, so trees and other plants can grow well

## TOPIC IHX (Internal Heat Exchanger) development



The IHX forms part of the tubing that delivers refrigerant within a car air conditioning system.

By using coaxial tubing, the IHX is able to utilize the temperature difference between high-temperature refrigerant in one tube and low-temperature refrigerant in the other tube to perform heat exchange, thereby improving the cooling performance of the air conditioning system as a whole. Conventional car air conditioning refrigerants are being replaced by new types of refrigerant to help combat global warming, but the cooling performance of the new refrigerants is disappointing; IHX technology can help to mitigate this problem. The coaxial IHX developed by Yokohama Industries Americas, Inc. is designed so that the refrigerant can flow unobstructed even when the tubing is bent, providing maximum flexibility for tubing layout in confined engine compartments. This IHX system has already been adopted for commercial use in North America, and Yokohama Industries Americas is working on the development of a new version with an even more advanced specification.

**IHX adoption improves cooling performance by 10 – 15%**

Four engineers were selected from each of the Alliance Group's production facilities and entrusted with the task of strengthening the tires' internal steel belts and adjusting the tires' structural design and tread to reduce the risk of tire slippage. After repeated experimentation, the team succeeded in expanding the tread contact area by 26%, thereby ensuring stable running performance through enhanced grip and traction able to cope with high vehicle weight, and also improving fuel economy by 7%. The self-cleaning design for keeping dirt off the tire also attracted positive comment; many forestry industry professionals commented that this new tire constituted a real "premium tire."



### Comments from the ELIT Project product development team

The background to this project was the need to reduce soil compaction in forested areas. There had always been concern that timber procurement was leading to reduction in forest size.

At the same time, it was important that any changes should not have a negative impact on machinery operators' comfort or ease of operation. The biggest problem was thus to meet the various requirements to maintain traction, operator safety, etc. while reducing the downward pressure exerted by the tires on the ground. We succeeded in developing technology that allowed the tires to work at an air pressure of 2.5 bar instead of 4.5 bar (representing a roughly 40% decrease in pressure) without negatively impacting the tire's load-bearing ability.

We introduced various new design features; in particular, we made substantial changes to bead shape, so as to reduce the stress on the sidewall and prevent slippage. After more than five years of tread contact area and compressive force evaluation using vigorous dynamic bending, we were able to develop tires with optimal structure.

Our aim is for these new tires to be used by as many forestry industry professionals as possible, so that the tires can contribute towards the future growth of the forestry sector by preventing soil compaction and maintaining the fertility of the soil.



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