

# TOYO TIRE TALK

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Technical Service Department Japan.

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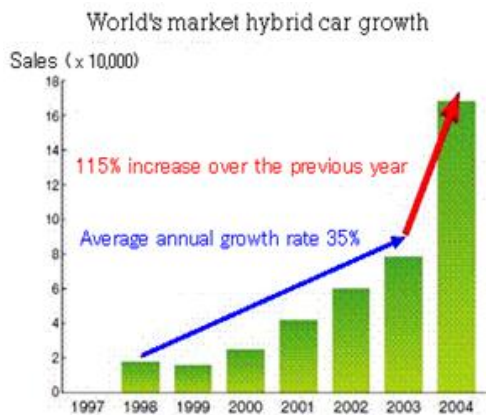
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## Subject : Hybrid Cars and Their Tires

Hybrid cars are drawing much attention today as fuel prices are almost at their highest levels, and concerns about the environment is ever increasing worldwide. Excellent fuel economy, low vehicle emissions and low noise are major advantages of hybrid vehicles. As a new generation motor vehicle, Hybrids have been gaining in popularity in various countries, especially North America.

### Hybrid Car Market Trend

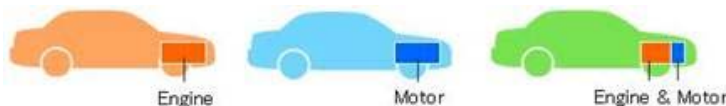


According to research results from the Nomura Research Institute (NRI) in Japan, in 2004 there were 168,000 hybrid cars sold worldwide.

This figure indicates an increase of 115% on the previous year. NRI also predicts that the annual rate of increase for the hybrid car market worldwide will be 44% from 2006 to 2010.

### What is a Hybrid Car ?

By definition, a hybrid car is one that employs two or more power sources to improve the overall efficiency of the vehicle.



A typical hybrid car uses a combination of gasoline (petrol) and electricity for motive power. The vehicle is equipped with a gasoline (petrol) engine combined with an electric motor, and the driving source used will change automatically depending on the driving conditions, resulting in lower exhaust emissions, better fuel economy and reduced noise.

Most hybrid cars are equipped with a gasoline (petrol) engine at present, but others have been announced using diesel engines



## Hybrid Car Tire Performance Requirements

The basic function of tires for Hybrid cars is no different from the tires for conventional vehicles - to support the vehicle load, to transmit tractive/braking force, to lessen shocks, and to change the direction of the vehicle.

In addition, a high priority is a reduction in rolling resistance to increase the effective use of energy, although this is true for any tire, especially O.E. tires.

Some car manufacturers require higher inflation pressures in tires fitted to Hybrid cars than those of the traditional cars. The Toyota Hybrid cars are a good example.

Toyota Recommended Inflation Pressures for Hybrid Cars (kPa/psi)

| Vehicle       | O.E. Tire | Front    | Rear     | Non-Hybrid |
|---------------|-----------|----------|----------|------------|
| Estima        | 205/65R15 | 250 / 35 | 270 / 39 | 230 / 33   |
| Prius         | 185/65R15 | 250 / 35 | 230 / 33 | 206 / 30*  |
| Highlander ** | 225/65R17 | 220 / 32 | 220 / 32 | 206 / 30   |

\* Corolla - similar weight and purpose.      \*\* Kluger

The reason for using higher air pressures in the rear tires is because of the increased rear axle load of the vehicle due to its battery and motor.

The reasons for raising the inflation pressures in the tires are the increased weight of the Hybrid car, and the intention of reducing the rolling resistance of the tire.

Example - Toyota Estima.

Estima Specifications (Japanese market)

|                   | Estima Hybrid | Estima        |
|-------------------|---------------|---------------|
| Kerb Weight (kg)  | <b>1,850</b>  | 1,720         |
| Displacement (cc) | 2,362         | 2,362         |
| O.E. Tire         | 205/65R15 94H | 205/65R15 94H |

Not all car manufacturers recommend the use of high inflation pressures. For example the new Honda Accord Hybrid has a recommended inflation pressure of 220 kPa (32 psi) front and rear, the same as the traditional gasoline (petrol) version.

## Toyo's O.E. Development for Hybrid Vehicles

Toyo has experience in supplying O.E. tires (TAJ39 & TAJ39 Hybrid) for both the normal gasoline (petrol) and Hybrid versions of the Toyota Estima. For the Hybrid, the tire was required to have low rolling resistance and the ability to operate at a higher inflation pressure than the tire used on the gasoline (petrol) engine model. So Toyo developed the TAJ39-Hybrid which has a different specification in tire construction and rubber compound to the standard TAJ39 tire.

Toyota Estima



### TAJ39 Hybrid Tire

The tread pattern is the same as TAJ39.



## Summary

There is basically no difference between tires being fitted to hybrids and those fitted to gasoline (petrol) version vehicles. Maintenance of the correct inflation pressures is critical, and some manufacturers of Hybrid vehicles recommend higher inflation pressures. Check the tire placard or owner's manual, and always inflate tires to the vehicle manufacturer's recommended inflation pressure. This will maximize the advantage of using a Hybrid vehicle.

## Reference

### Tire Rolling Resistance and Vehicle Fuel

The fuel economy of a vehicle largely depends on vehicle model, tire type and driving conditions. The contribution of the tire to the fuel economy of a passenger car is believed to be 5 to 15% under normal driving conditions.

### Tire Aspect Ratio and Rolling Resistance

Generally lower aspect ratios are likely to be advantageous for rolling resistance. If the construction and materials are identical, a 60-series tire has less rolling resistance than a 70-series by about 5%.

For the most part, the balance between rolling resistance and other performance factors is best with 65-series tires.

Main O.E. Tire Sizes for Hybrid Cars in the Japanese Market

| Model         | Standard  | G-Edition |
|---------------|-----------|-----------|
| Harrier       | 225/65R17 | 235/55R18 |
| Highlander ** | 225/60R17 |           |
| Alphard       | 205/65R16 |           |
| Prius         | 185/65R15 | 195/55R16 |
| CMC           | 195/65R15 | 205/55R16 |

\*\* Kluger

### Inflation Pressure and Rolling Resistance

Rolling resistance is proportional to air pressure. The higher the pressure, the lower the rolling resistance. This relationship is maintained to, approximately, the maximum pressure of the tire. But even if a higher pressure is applied, the reduction in rolling resistance reaches a peak at a certain point and no more reduction is achieved.