

## **News Release**

June 6, 2023  
Diamond Electric Holdings Co., Ltd.

### **Diamond & Zebra Electric Mfg. Develops World's First Ammonia Combustion Technology**

- Aiming to Provide Ultra-High Energy Ignition System for Engine with Next-Generation Fuels Including Ammonia -

Diamond & Zebra Electric Mfg. Co., Ltd. (hereinafter "Diamond & Zebra"), an Osaka-based group company of Diamond Electric Holdings Co., Ltd., has achieved a significant level of ammonia combustion technology in the development of a new ignition system, the vital component in fuel combustion to make use of reciprocating engines in a carbon-neutral society. Diamond & Zebra published the achievement through a thesis presented at the 2023 JSAE Annual Congress (Spring) held by the Society of Automotive Engineers of Japan (Conference Session No. 30: Advanced Gasoline Engine Systems and Technologies I).

In recent years, studies on carbon-free combustion of ammonia fuel have been progressing along with vehicle electrification efforts as a measure against global warming. One of the factors for stable combustion of hard-to-burn fuels such as ammonia, as opposed to conventional gasoline, requires an extremely high-energy spark discharge in the ignition system.

As a manufacturer with ignition combustion technology expertise, Diamond & Zebra established "A-Lab (Combustion Laboratory)" in 2018 within its group company Diamond Electric Mfg. Co., Ltd., based in Tottori, Japan. A-Lab has been independently conducting basic research on ammonia and hydrogen combustion, using a special ignition device that can freely change the discharge energy and current characteristics of ignition coils. As a result, stable combustion at a higher ammonia-mixing ratio, up to 100% ammonia, was achieved in an experiment with a typical reciprocating engine using a mixture of ammonia and hydrogen as fuel. Stable combustion with 100% ammonia fuel is the world's first achievement (\*) as far as publicly disclosed.

(\*) According to the company's survey

Based on the research result, Diamond & Zebra has started the development of an "Ultra-High Energy Ignition System" which is a combination of ignition coil technology capable of outputting 6 times more ignition energy than its conventional products and multi-ignition technology enabling multiple spark discharge at the 1/1000-second level to boost its ignition energy more than 12 times as the system output: all in a compact size to be mountable on an engine.

Diamond & Zebra is confident that this system, applicable to various lean-burn engines, would significantly contribute to a carbon-neutral society. Various features are currently verified with a prototype, and a testable prototype is scheduled to be completed in March 2024.

Based on its vision "Connecting Cars and Homes through Manufacturing" as set forth in the medium- to long-term management plan "Reignition-Counterattack Edition," the company, taking itself as an institution for the public, will continue to improve its current business and make continuous efforts in manufacturing that contributes to the era of new normality for the benefit of its customers and for the enrichment of society.

**For inquiries about this news release:**

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**Main applications of Ultra-High Energy Ignition System:**

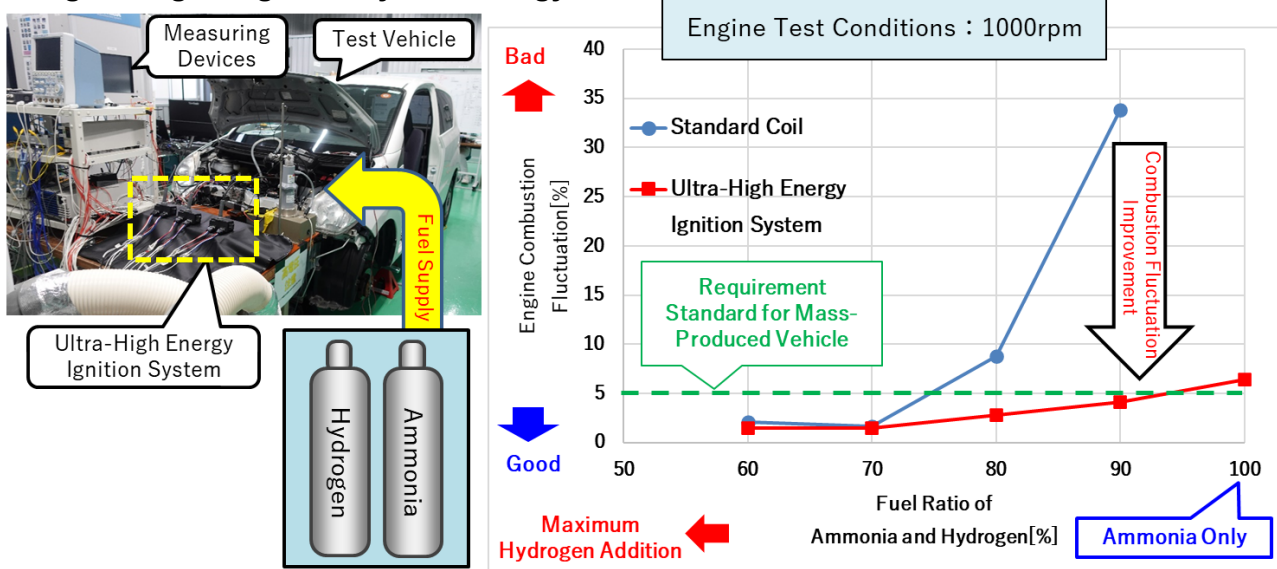
- Spark ignition engines in general
- Products related to ignition and combustion by spark ignition

**Product image:**

\*For reference only (under development)



**Effect of increasing the combustion limit of existing mass-produced engines by strengthening the ignition system energy:**



Combustion is dramatically improved by Ultra-High Energy Ignition System, allowing operation with 100% ammonia.