ClassNK
Innovation Endorsement
for Products & Solutions

Document No: 22VT01693

THIS IS TO CERTIFY that the undernoted product has been examined and found in order in accordance with manufacturer's specification.

This certificate is issued to
Applicant : Innospec Limited
Place of manufacturing : Singapore

Product descriptions:

1) Improvement of fuel economy
2) Reduction of exhaust gas and other emissions

Product name : Octamar Combustion Catalyst series

- Octamar Ultra HF
- Octamar Complete
- Octamar F35C

Version No. : Version 1.0

This certificate is subject to the conditions specified in the attached sheets.
Issued at Tokyo on 2nd May 2022.

(Hiroshi Shibako)
General Manager
Technical Solution Department

1. Definition of "Product Descriptions"

1) The effect of the combustion improver is given by its internal oxygen and by reducing the ignition delay, the fuel gains a better cetane number.
The combustion catalyst provides a soot reduction effect by working as an oxidiser (catalyst). PLUTOcen is used as a FBC (Fuel borne catalyst) to burn out diesel particulate filters and as an octane improver for gasoline. As a result, it reduces the deposits in engine and exhaust system. Since cleaner engines are basic engineering principles for a more efficient engine, this henceforth results in better fuel economy. The success of this work was patented together with AP Möller.

Innospec has an extensive record of trials conducted with this technology and have seen improved fuel economy, reduced piston fouling, improved cleanliness condition and efficiency of turbocharger and economizer, reduced unburned carbon deposits in exhaust system and positive impacts in the fuel's combustion profile.

- ✓ Innospec obtained No objection Letters (NoL) from engine makers to assure that the product's composition, properties and treat rate will be safe to use in their engines.
- ✓ Innospec also works with certain classification societies to produce trial protocols for SFOC and exhaust emission measurements.
- ✓ Innospec's additives were tested during field trials, on test bed engines and onboard various types of vessels, and exposed to in-lab tests such as FIA test verified by third party. Across the 8 field trials verified, an average fuel economy improvement of 2.7% (see Note 1) was achieved.
- ✓ Innospec has contributed to produce CIMAC whitepaper No.69 that evaluates the effectiveness of Innospec's combustion catalyst additives on combustion quality of fuel through 8 field trials detailed in this paper. In the case of the three tests using pure combustion catalysts, results of 2.1 – 3.0 % (see Note 1) fuel economy were achieved. Combinations of combustion catalysts with detergent/stabilizers resulted in fuel economy effects from 2.3 to 3.9 % (see Note 1) in four tests. Lastly, pure organic combustion improvers achieved 3.7%(see Note 1) improvement in fuel economy in one test.

PLUTOcen Technology, Patent No.: AU677388B2 AU63772/94A
F35 Technology, Patent No.: WO2007007191A1 (PCT/IB2006/002243)

2) For Octamar F35C, the combination of combustion catalyst and combustion improver provides a faster and more complete combustion which will reduce unburnt fuel in exhaust, soot, PAH, post combustion fouling, black smoke, black carbon.

   For Octamar Ultra HF and Complete, the combination of combustion catalyst, combustion improver and stabilizer/dispersant create a threefold effect on combustion catalysis, ignition improvement, homogenization and better atomization/spray pattern thus significantly reducing unburnt fuel in exhaust, soot, PAH, post combustion fouling, black smoke, black carbon.

   The success of these works was also patented.

   F35 Technology, Patent No.: WO2007007191A1 PCT/IB2006/002243
   F38 Technology, Patent No.: WO2008084251A1 (PCT/GB2008/000101)

Note 1. This value has been verified by No. 2 listed in "2. Documents examined".

2. Documents examined

No.	DWG. TITLE
1.	Overview of products
2.	Results of verification tests
3.	Documents on PLUTOcen
4.	Documents on test protocol with classification societies
5.	Documents on "No objection Letters"
6.	Documents on patents

3. Limitations

This certificate is issued upon confirmation of the functions of the product as specified in the product description proposed by the applicant and defined in the above 1, by review of the documents listed in the above 2.

Therefore, it does not intend to apply for any approval or survey of the product for the purpose of classification registration or to ensure the validity of the output of the product.

Neither the Society nor any of its officers, directors, employees, agents or sub-contractors shall be liable for any loss, damage or expense of whatever nature sustained by any person, in tort or in contract or otherwise, due to any act or omission or error of whatever nature whether or not negligent howsoever caused in the provision of services, information or advice given in any way whatsoever by or on behalf of the Society.

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