

Gas-Powered Co-Generation

PLATINUM METALS MAXIMISE EMISSION CONTROL AND HEAT GENERATION FOR RESIDENTIAL USE

An engine powered by natural gas has been developed by the Sachs Special Motor Division of Fichtel & Sachs AG of Schweinfurt, Germany, to co-generate heat and electricity for both residential and commercial use. The power unit is a 0.583 litre single cylinder gas engine designed to run for a minimum of 60,000 hours or 15 years. It has an electrical output of 5.5 kW, together with 12.5 kW equivalent heat which is produced with the help of an oxidation catalyst.

The Environmental Products Group of Johnson Matthey's Catalytic Systems Division has worked with Fichtel & Sachs on an extensive programme which involved the evaluation of various configurations of the catalyst so as to optimise the system. The catalyst is required to perform two different functions:

- to reduce emissions of hydrocarbons and carbon monoxide in the engine exhaust, in order to meet environmental emissions control requirements, and at the same time
- to promote catalytic combustion of any unburnt gases in the exhaust, to ensure that heat generation and recovery are optimised.

Specifically, the primary requirements of

the dual purpose platinum metals catalyst are:

- (i) High efficiency for the reduction of methane, ethane, propane and other volatile organic compounds in the exhaust: this is because the light hydrocarbons – particularly methane – are relatively hard to combust. New catalyst technology has been developed to meet this requirement.
- (ii) Maximum heat generation and recovery in order to optimise the heat output: thus the catalyst is coated on a honeycomb metallic substrate so that heat transfer is enhanced.
- (iii) Minimised impact on the engine performance: this is achieved by the use of a thin walled metallic substrate which reduces the back pressure to the engine.
- (iv) Meet life-cycle requirements with little or no maintenance: thus, the catalyst needs to have a high durability of performance. As this is determined by the composition of the catalyst materials, they must possess long-term thermal stability under the harsh exhaust environments encountered. The durability characteristics of the catalyst over thousands of hours of operation have been demonstrated.



The combined heat and power co-generation unit occupies the same space as a standard heating unit. Systems can easily be linked together to heat larger buildings. The system, which uses natural gas, produces over 5 kW of electricity and the heat it produces can supplement an existing furnace or heat domestic water. With the catalyst, the unit produces less NOx and carbon dioxide emissions, and requires less fuel than conventional heating systems. Maintenance is minimal and silencers ensure it complies with local requirements

For these reasons, the highly durable catalyst consists of platinum metals on a washcoated thin-walled metal substrate, which ensures optimum gas flow, high heat transfer and high thermal durability with good adhesion of the platinum metals catalyst to the metallic substrate.

The catalyst is positioned in a compartment attached to the engine through a uniquely designed water-cooled heat exchanger. The complete system is packaged in a compact unit that can be installed much like any other residential heating unit. The heat can be directly utilised or transferred to neighbouring buildings, while the electric power can either be integrated directly into the residential electricity supply or transmitted to a local power utility.

Compared to separate heat and power units, this new development reduces NOx emissions by 25 per cent and emissions of carbon dioxide by 47 per cent. In fact, looking at the total balance of energy input, the new SenerTec co-generation unit requires 31 per cent less fuel input than conventional heating systems.

Once the technical concept was proven, which included durability tests lasting for in excess of 10,000 hours, Fichtel & Sachs established an independent joint venture – SenerTec GmbH – to manufacture, market and sell these novel co-generation units. The units are already on sale in Germany, the Netherlands, Austria, Switzerland, Denmark and Sweden. Following



The co-generation unit showing the control console and the water-cooled heat exchanger where the emission control catalyst is situated

the successful collaboration between the groups, Johnson Matthey have been appointed exclusive supplier of catalysts for these SenerTec engines.

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Engine performance data generated after the assembly of a unit as a quality control measure prior to shipment of the unit. The data in the upper figure show the performance characteristics of the engine, while in the lower figure the characteristics of the engine emissions are shown

