

**INNOVATION OF EXHAUST BY ADDING HEAT EXCHANGER  
TO REDUCE THE CONTENT OF GAS EMISSIONS  
ON 4 STROKE MOTORCYCLES**

*by*

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***ABSTRACT***

This research aimed to determine the difference before and after the addition of a heat exchanger on the exhaust and determined the efficiency of reducing gas emissions of pollutants. The design used in this research was to make a layout that uses a shell and tube, radiator, thermocouple, pump and modified exhaust using pertalite fuel, variations of idle Rpm, 2000 Rpm, 2500 Rpm, 3000 Rpm, 3500 Rpm, 4000 Rpm and additional footing load on the brake pedal as deep as 50% at 2000 – 4000 Rpm. The results of this research indicate when tested gas emissions before cooling treatment at idle Rpm, 2000 Rpm, 2500 Rpm, 3000 Rpm, 3500 Rpm and 4000 Rpm resulted in CO contents of 9.47%Vol at idle Rpm and 10%Vol at 2000 – 4000 Rpm. The contents of CO<sub>2</sub> were 9.1%Vol, 9, 7%Vol, 10.2%Vol, 10.4%Vol, 10.4%Vol and 10.6%Vol. The contents of O<sub>2</sub> were 4.17%Vol, 3.35%Vol, 1.84%Vol, 1.99%Vol, 1.41%Vol and 1.22%Vol. The HC contents were 2010 ppm, 1331 ppm, 687 ppm, 682 ppm, 532 ppm and 519 ppm. The Lambda values were 0.851, 0.836, 0.807, 0.814, 0.799 and 0.795. Furthermore, after cooling treatment at idle Rpm, 2000 Rpm, 2500 Rpm, 3000 Rpm, 3500 Rpm and 4000 Rpm resulted in CO contents of 6.20%Vol at idle Rpm and  $\geq 10\%$ Vol at 2000 – 4000 Rpm. The contents of CO<sub>2</sub> were 7,3%Vol, 10.6%Vol, 10%Vol, 9.5%Vol, 10.4%Vol and 10.3%Vol. The contents of O<sub>2</sub> were 6.42%Vol, 2.11%Vol, 2.10%Vol, 1.77%Vol, 1.80%Vol and 1.49%Vol. The contents of HC were 1429 ppm, 697 ppm, 609 ppm, 710 ppm, 523 ppm and 538 ppm. The values of Lambda were 1.040, 0.820, 0.815, 0.796, 0.812 and 0.800. So it could be concluded that the cooling treatment of exhaust modification with the addition of a heat exchanger could reduce the contents of CO, CO<sub>2</sub>, HC gas emissions, increased the contents of O<sub>2</sub> and affected Lambda values compared to without cooling treatment.

*Keywords: CO, CO<sub>2</sub>, O<sub>2</sub>, HC, Lambda Value, Heat Exchanger, Cooling, Modified Exhaust, Rpm, Gas Emissions.*