



ITDI

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DOST

ENVIRONMENTAL TECHNOLOGY VERIFICATION (ETV)

VERIFICATION STATEMENT

TECHNOLOGY TYPE : **Air Pollution Control and Fuel Saving Device**

APPLICATION : **Two-stroke motorcycles**

TECHNOLOGY NAME : **CYCLOS**

COMPANY : **Khaos Manufacturing**

Disclaimer

This report is the result of an impartial, consensus-based approach to evaluating innovative environmental technology in accordance with the ETV Technical Protocol. The data presented are believed accurate and the analyses credible. The statements made and conclusions drawn regarding the product evaluated do not, however, amount to an endorsement or approval of the product in general or for any particular application nor a warranty to the performance of the technology that it will always operate as verified. Mention of commercial product name does not imply endorsement.



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This ETV Statement is a summary of the ETV Report of the *CYCLOS* (ETV 07-007).

ETV TEST DESCRIPTION

The ETV Panel of Experts and Khaos Manufacturing agreed to validate the following claims on *Cyclos* during the ETV Panel meeting held last January 22, 2008 at the Department of Energy, Fort Bonifacio, Taguig City.

That the device:

1. Increases fuel efficiency
2. Reduces/lowers exhaust emissions

This ETV is limited to the use of *Cyclos* in two-stroke motorcycles with side cars. The effect of the technology on engine stability and any other technology-engine interactions are beyond the scope of this ETV.

TECHNOLOGY DESCRIPTION

According to the technical information supplied by Khaos Manufacturing, *Cyclos* minimizes unburned fuel in the exhaust gases by introducing additional air to the engine prior to combustion. The overall effect of the device is a leaner air:fuel mixture. The device is placed at the air intake manifold of the vehicle. Installation may be completed in about 30 minutes.

It was claimed by the vendor that with *Cyclos*, there is an increase in rotational speed at idling condition of the motorcycle. Hence, upon the installation of the device, the rotational speed is adjusted accordingly to cope with the change or increase. The adjustment is made by the technical staff of *Khaos Manufacturing* as part of their sale service.

VERIFICATION OF PERFORMANCE

The device increases fuel efficiency in motorcycles

Two units of two-stroke motorcycles were tested in the fuel economy run. The same conditions were established for two actual runs, during testing of the control run and that with the *Cyclos* installed. Before the start of the run, full oil level and sufficient tire pressure were ensured. For the control run of the two motorcycles, no routine engine maintenance service on the motorcycle was done once the run has begun. However, on the second motorcycle with *Cyclos*, sparkplug and chain were replaced prior to the test run.

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The description of test vehicles and conditions during the trial runs are given in Tables 1 and 2, respectively.

Table 1. Description of test vehicles

Brand	Yamaha RX100 (Figure 3.2)	Yamaha RX100 (Figure 3.3)
Model	1993	1989
Oil level before test run	Full	full
Side car	Yes	Yes
Vehicle load	1 passenger (86 kg)	1 passenger (85 kg)
Test fuel	Caltex Gold	Caltex Gold

Table 2. Summary of the conditions for fuel economy run of *Cyclos* using two-stroke motorcycles

	<i>Test run without Cyclos</i>		<i>Test run with Cyclos</i>	
	Motorcycle A*	Motorcycle B**	Motorcycle A*	Motorcycle B**
Test location	Route shown in Figure 1			
Road description	Light vehicular traffic, flat and paved road			
Driving pattern	30 kilometers per hour (kph); same driver operates same test vehicles throughout the test run			
Vehicle load	One (1) passenger per vehicle			
Weather condition	Mostly sunny except for light rain during Laps 5 to 6		Sunny during the entire run	

* Yamaha RX100, 1993 Model

** Yamaha RX100, 1989 Model

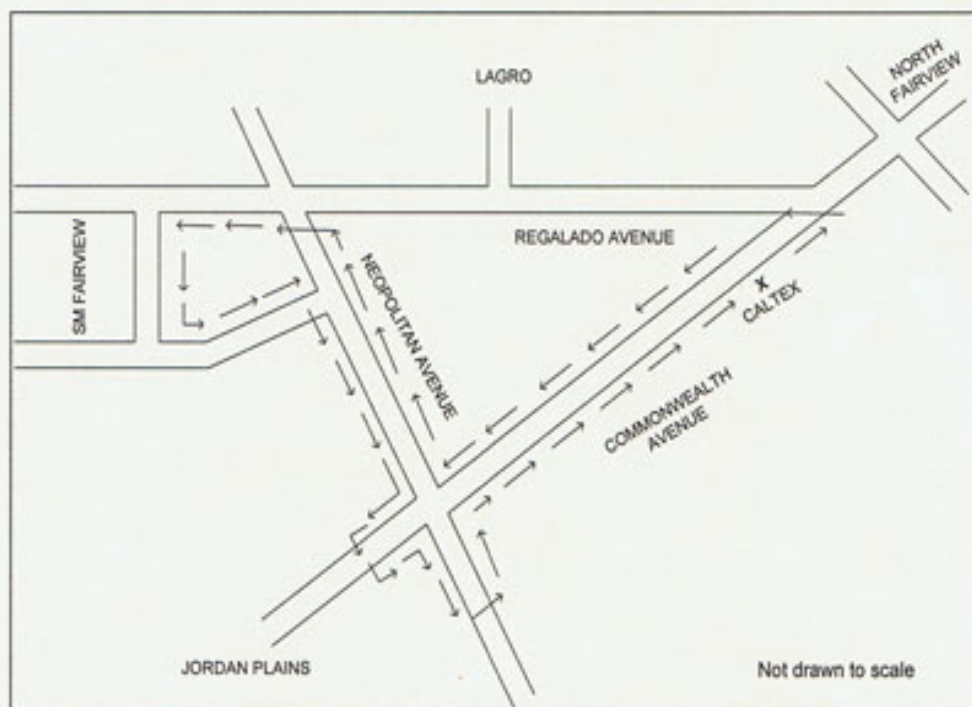


Figure 1. Route for the fuel economy run

Cyclos attained the following increase in fuel efficiency ratings under the above stated conditions.

Table 3. Results of fuel economy test runs

Parameter	Without <i>Cyclos</i>	With <i>Cyclos</i>	% Increase in fuel efficiency rating
<i>Motorcycle A</i>	(February 21, 2008)	(February 22, 2008)	
Distance covered, km	92.5	92.3	3%
Fuel consumption, L	3.404	3.304	
Fuel efficiency, km/L	27.2	27.9	
<i>Motorcycle B</i>	(April 4, 2008)	(April 4, 2008)	
Distance covered, km	92.3	88.55	24%
Fuel consumption, L	3.204	2.475	
Fuel efficiency, km/L	28.8	35.8	

The device reduces exhaust emissions in motorcycles

Exhaust emissions quality was analyzed by DRTDIN Emission Testing Center, a Land and Transportation Office (LTO) - accredited emission testing center. For Motorcycle B, Testo 350 flue/gas analyzer was also used for the measurement of other exhaust emissions quality parameters aside from that taken at DRTDIN Emission Testing Center.

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The methods employed in the exhaust emissions test, the parameters tested, and the distance run by the motorcycles immediately before emissions testing are summarized in Table 4 below.

Table 4. Parameters and test methods for exhaust emissions testing

Test vehicle	Parameters tested	Test method	Distance run prior to testing, km	
			Without <i>Cyclos</i>	With <i>Cyclos</i>
Motorcycle A	CO HC	Rule XXXII Section 3 of the Philippine Clean Air Act	92.5	92.3
Motorcycle B	CO HC		50	50
	SO ₂	Testo 350 flue/gas analyzer	92.3	88.55
	NO _x			
	Temperature			

CO - Carbon monoxide

NO_x - Oxides of nitrogen

HC - Hydrocarbons

SO₂ - Sulfur dioxide

CO₂ - Carbon dioxide

The performance of the technology in terms of air emissions quality was tested relative to the performance of the same motorcycle without the technology in place. *Cyclos* achieved the emissions reduction shown in Table 5.

Table 5. Exhaust emissions test results

Parameter	Without <i>Cyclos</i>	With <i>Cyclos</i>	% Reduction
<i>Motorcycle A</i>	(February 21, 2008)	(February 22, 2008)	
CO, % by volume	3.92	0.04	99%
HC, ppm as hexane	17,120	1,594	91%
<i>Motorcycle B</i>	(March 17, 2008)	(March 17, 2008)	
CO, % by volume	3.18	0.03	99%
HC, ppm as hexane	695	418	40%
	(April 4, 2008)	(April 4, 2008)	
CO ₂ , % by volume	3.1	2.9	6%
SO ₂ , ppm	389	34	91%
NO _x , ppm	114	36	68%
Temperature, °C	50.4	37.4	26%

Based on the above results, the claims of *Khaos Manufacturing* on the merits of *CYCLOS* as follows: that it increases fuel efficiency and reduces exhaust emissions in two-stroke motorcycles, have been verified.

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