



## INVESTIGATION SYSTEM, TECHNOLOGIC DEVELOPMENT AND INNOVATION – SENNOVA

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### COMPARATIVE REPORT FOR PERFORMANCE TEST REQUESTED BY THE COMPANY KLEEN&GREEN S. A. AT THE TRANSPORT TECHNOLOGIES CENTER – SENA

Through which the results obtained during the test on different technologies, will be compared based on what requested by the applicant KLEEN&GREEN to improve the performance of vehicle's fuel. The test will be made through the use of a dynamometer roll-bench, put at disposal by SENA at the Transport technologies Center – Regional Bogotá, Industrial Area of Cazuca.

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SERVICIO NACIONAL DE APRENDIZAJE SENA  
**INFORME DE RESULTADOS SERVICIOS TECNOLÓGICOS**

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1. INTRODUCTION

SENA offers the entrepreneurs a portfolio of Technological services for their organizations to be more productive, improve their industrial processes, and improve the quality of their products to be highly competitive on the globalized markets. With the aim to support the competitiveness and the productivity of the Enterprises, through the Center of Technologies of transport – CTT, SENA offers the following services:

- Technical Assistance services: giving answers to Enterprises regarding technical issues that may come up by developing diagnostics, evaluation of possible causes and finding suitable solutions together with the staff of the productive organization.
- Applied investigation services and special production: responding to the needs of design, re-design, adequacy and fabrication of the prototype and of the industrial parts that allows the productive sector to reduce costs and improve the level of productivity and competitiveness.



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## 2. REQUEST

In accordance with what requested by the company KLEEN&GREEN to SENA, through the Center of Transport's Technologies for the analysis of the result of vehicular performance and fuel consumption regarding tests carried out on a loaded vehicle , supplied by the client, on which an immersed emitting wave device had been installed inside the fuel tank. This device was supplied by above mentioned company.

The laboratory of the Automotive Dynamics Testing of CTT set a special Protocol of test, using a dynamometer roll-bench. The method, the experimental tests as well as the equipment used are described here below.



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### 3. GENERAL OBJECTIVE / AIM

Compare the results obtained using a Protocol for the measurement of the performance and of the fuel consumption on a loaded vehicle supplied by the client, through the use of a dynamometer roll-bench after having installed an immersed device that emits waves inside the fuel tank improving the performance of the fuel. The mentioned device has been supplied by the client.



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**4. CHARACTERISTICS OF THE MEASURING EQUIPMENT AND OF THE PRODUCT TO BE TESTED.**

For the development of the test requested by the company KLEEN&GREEN S.A. the following equipment had been used:

1. the vehicle for the test, supplied by the client is a load vehicle, two axes, mark: VOLKSWAGEN; reference: WORKER 15-180; model 2007 ; number of cylinders: 6 with a displacement is of 6.450



Fuente: Elaboración equipo *Laboratorio de Pruebas Dinámicas Automotrices* del CTT – SENA

2. Dynamometer roll-bench: specialised equipment for the measurement of power and torque of the vehicle through LPDA of CTT, Producer: MUSTANG DYNAMOMETER, maximum power 1500hp. Maximum weight on axis 6000lbs.



Fuente: Elaboración equipo *Laboratorio de Pruebas Dinámicas Automotrices* del CTT – SENA

3. Digital Scale: maximum weight 25 kg. That was calibrated by the company GRUPOISO INGENIERIA Y SOLUCIONES.



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Fuente: Elaboración equipo *Laboratorio de Pruebas Dinámicas Automotrices* del CTT – SENA

4. Additional fuel container for the measurements: This vehicle was equipped with an additional fuel container, suction hoses and fuel return.



Fuente: Elaboración equipo *Laboratorio de Pruebas Dinámicas Automotrices* del CTT – SENA

5. Product tested : SUPERTECH device that works by submerging it inside the fuel ; device that is installed directly inside the fuel tank and emits low frequencies electromagnetic waves that weaken the intermolecular bonds and allows a better interaction with oxygen optimizing the combustion both in diesel and in petrol running vehicles” as stated by KLEEN&GREEN S.A. , the contracting company of the test.



Fuente: Empresa distribuidora KLEEN & GREEN S.A.





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## 5. METHOD

the method used for the measurement of the consumption and performance of fuel was based on gravimetric measurements through a mileage on dynamometer roll-bench on a cruise speed of 50km/h for 9 minutes and 30 seconds. 3 Repetitions were made with the same characteristics for each device tested and two repetitions for the additive and product mix.

In the same way the dynamometer roll-bench was used to carry out the tests regarding torque and power performance of the vehicle supplied by the client, in the modality "Constant speed test" by using a software in accordance with the performance test SAE J1349. For this test a speed of 20km/h with two repetitions , was used.

Here below are the details of the testing procedure regarding fuel consumption:

### 5.1 VEHICLE CHECK

A visual inspection to the vehicle was made to determine that:

- the electrical alimentation system is in good condition, battery terminals without sulphate, cables in good condition, point of union or splices, properly isolated, batteries charged.
- Verify that in the vehicle, the engine doesn't have oil leaks or fuel leaks and also verify the presence of oil cap.
- Verify that the vehicle doesn't have technologies installed that would influence the result of the test such as systems that longer the life of engine oil, of air filter, of auxiliary valves for air intake.

Soon after we proceeded in fastening and installing the vehicle on site. See photo 1 and 2.

**Illustration 1.** Visual inspection of the vehicle supplied by the client.





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Illustration 2. Anchorage of the vehicle supplied by the client.



## 5.2 Fuel tank adjustment

In order to carry out the measurements, in the most effective way, during the test, the vehicle was equipped with an additional fuel container that was filled with diesel flow for the base test. Then the device SUPERTECH was installed for the last test. In Illustration 3 you may see the configuration with diesel flow and in Illustration 4. You may see the device SUPERTECH immersed in the fuel.

Illustration 3. Adjustement of the container for the test with diesel flow.





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**Illustration 4.** Adjustment and installation of the device SUPERTECH submerged inside the auxiliary tank/container for the test 3.



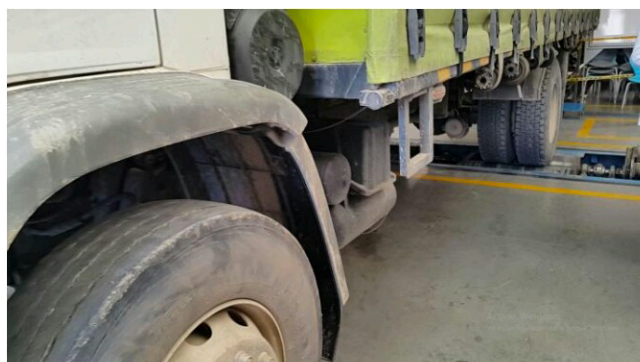
### 5.3 Measurement of the consumptions.

A digital scale is used, with value function ZERO to measure the mass of fuel; 3 repetitions are made, for each measurement to be taken, thus to guarantee the reliability of the readings. See Illustration 3.

### 5.4 Development of the test on dynamometer.

On each of the test with the submerged device the same speed was kept, 50 km/h for 9 minutes and 30 seconds; in the same way the start time until the cruising speed, of 30 seconds, was taken into account and also the end time of 20 seconds until returning to zero.

**Illustration 5.** Configuration for the test of the vehicle on the dynamometer roll-bench LPDA of CTT.



Fuente: Elaboración equipo *Laboratorio de Pruebas Dinámicas Automotrices* del CTT – SENA



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It is important to underline that before each single measurement made with the product SUPERTECH, the auxiliary fuel container that contained both the fuel and the device installed inside, was shaken/agitated in order to simulate what would realistically happen with the vehicle running on road.

Illustration 6. Manual shaking of the container with the device SUPERTECH installed for an optimum performance.





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## 6. ANYLASIS of the RESULTS

The data obtained through the whole session of tests are summarized in the below table. Thus to appreciate the variations obtained in the performance of the tested technologies .

Table 1. Comparison of the results between the test with only diesel and the test carried out with diesel having the device SUPERTECH installed.

		DIÉSEL CORRIENTE				SUPERTECH				
Prueba No.	Lectura	Masa Combustible (kg)	Tiempo Prueba min	Distancia Recorrida (Km)	Rendimiento $\eta$ (km/kg)	Masa Combustible (kg)	Tiempo Prueba minutos	Distancia Recorrida (Km)	Rendimiento $\eta$ (km/kg)	
1	Inicial	12.6	9 min 30 s	7.92	0.2021	7.8	9 min 35 s	7.99	0.1728	
	Final	11				6.42				
	Diferencia	1.6				1.38				
	*Diferencia de Referencia			0%		-13.75%				
2	Inicial	11	9 min 33 s	7.96	0.2061	6.42	9 min 33 s	7.96	0.1709	
	Final	9.36				5.06				
	Diferencia	1.64				1.36				
	*Diferencia de Referencia			0%		-17.07%				
3	Inicial	9.16	9 min 31 s	7.93	0.2018	5.06	9 min 34 s	7.97	0.1731	
	Final	7.56				3.68				
	Diferencia	1.6				1.38				
	*Diferencia de Referencia			0%		-13.75%				
n	Rendimiento promedio				0.2033	Rendimiento promedio				0.1723

\*El valor de referencia para el cálculo de la diferencia porcentual es la casilla "Diferencia" en diésel corriente.

Fuente: Elaboración equipo *Laboratorio de Pruebas Dinámicas Automotrices* del CTT – SENA

As regards the data in Table 1. It is confirmed that the test with the device SUPERTECH installed presents a fuel consumption saving of 14,85 % as average for the 3 tests; compared to the test without the product installed; also an improvement in the average fuel efficiency of 15.25% was registred. The results of the performance are indicated in kilometer per kilogram (km/kg.)

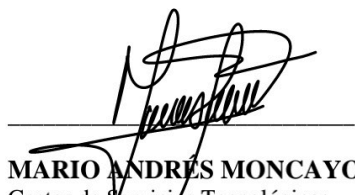




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