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Evaluation of the Super-Mag Fuel Extender

By

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Test and Evaluation Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Office of Air, Noise, and Radiation
U.S. Environmental Protection Agency

Background

The Environmental Protection Agency receives information about many systems which appear to offer potential for emission reduction or fuel economy improvement compared to conventional engines and vehicles. EPA's Emission Control Technology Division is interested in evaluating all such systems, because of the obvious potential benefits to the nation from the identification of systems that can reduce emissions, improve fuel economy, or both. EPA invites developers of such systems to provide complete technical data on the system's principle of operation, together with available test data on the system. In those cases for which review by EPA technical staff suggests that the available data show promise, or EPA is requested to test the device by other governmental agencies, attempts are made to schedule confirmatory tests at the EPA Motor Vehicle Emission Laboratory (MVEL) at Ann Arbor, Michigan. The results of all such test projects are set forth in a series of Test and Evaluation Branch reports, of which this report is one.

In the case of the Super-Mag device, the request for EPA evaluation was made by the Consumer Office of the Metropolitan District Attorney for Denver, Colorado. The testing load at MVEL was such that several months would elapse before the device could be tested there. EPA management therefore decided to conduct the evaluation at the facility of an EPA test contractor, Hamilton Test Systems, in Portland, Oregon. The tests were directed, and the device installed per manufacturer's instructions, by the on-site EPA Project Officer.

The Super-Mag is a retrofit device marketed by Valor Enterprises, Inc. of West Milton, Ohio. It consists of a set of magnets and sheet metal plates that are installed around an automobile's fuel line near the carburetor in a box-like arrangement. Valor Enterprises makes no claim in the installation instructions nor in its packaging for increased fuel economy or reduced emissions. On the package label, this statement appears: "Transforms Molecular Properties of Liquid Fuel to Maximum Combustion Efficiency."

The conclusions from EPA device evaluations can be considered to be quantatively valid only for the specific test vehicles used; however, it is reasonable to extrapolate the results from the EPA evaluation of other vehicles in a directional manner, that is, to suggest that similar results are likely to be achieved on other vehicles.

Summary of Results

Neither fuel economy nor exhaust emissions were affected by the installation of the Super-Mag device on the cars used in this evaluation.

Any differences between baseline test results and results from tests with the device installed were within the range of normal test variability.

Device Description

The Super-Mag Fuel Extender consists of two magnet assemblies, two steel plates, and two plastic ties. Each magnet assembly consists of a rectangular magnet with dimensions of 1.87" X 0.87" X 0.38" bonded to a steel plate 2.67" X 1.14" X 0.04. The two magnet assemblies are placed on opposite sides of the fuel line with the magnets on the inside, about 3 inches from the carburetor. The two steel plates are placed at the edges of the magnet assemblies and at right angles to them to form a sort of 4-sided box, enclosing the fuel line. (See illustrations in Appendix 1, which is a copy of the installation instructions that came with the device.)

Test Vehicles

Three test vehicles were chosen for this evaluation. The intent was to test a fairly wide range of model years, vehicle sizes, and engine sizes, and to have each major American manufacturer's products represented. The following vehicles were chosen:

1976 Chevrolet Malibu equipped with 350 CID V-8 engine and automatic transmission. Exhaust emission controls include exhaust gas recirculation (EGR) and oxidation catalyst. At the beginning of the evaluation, there were 75,810 miles on the car's odometer.

1978 Plymouth Horizon equipped with 105 CID in-line 4-cylinder engine and automatic transmission. Exhaust emission controls include EGR, air pump, and oxidation catalyst. There were 34,210 miles on the car's odometer at the beginning of the evaluation.

1981 Ford Fairmont equipped with 200 CID in-line 6-cylinder engine and automatic transmission. Exhaust emission controls include EGR, air pump, three-way catalyst, and oxidation catalyst. At the start of the evaluation there were 8,830 miles on the car's odometer.

Test Vehicle Descriptions may be found in Appendices 2 through 4.

Test Procedures

Exhaust emission tests were conducted according to the Federal Test Procedure (FTP) described in the Federal Register of June 28, 1977, and the EPA Highway Fuel Economy Test (HFET) described in the Federal Register of September 10, 1976. The vehicles were not tested for evaporative emissions.

Prior to baseline testing, each vehicle was given a specification check and diagnostic inspection. The ignition timing, idle speed, and fast idle speed were checked for agreement with the manufacturer's specifications given on the Vehicle Emission Control Information label affixed to the engine compartment. The vehicles were also inspected for engine vacuum leaks, proper connection of vacuum hoses, functioning PCV valve, oil and coolant levels, and general condition of engine compartment.

Repairs on each vehicle were as follows:

76 Malibu - Steam-cleaned engine, changed engine oil and filter, changed air filter. Replaced spark plugs. Replaced air cleaner hot air duct. Rebuilt carburetor (installed new needle valve, seat, power valve, gaskets, and fuel filter). Adjusted idle air-fuel ratio.

78 Horizon - Changed engine oil and oil filter, changed air filter. Replaced spark plugs. Replaced carburetor, checked choke operation, idle speed, ignition timing, idle air-fuel ratio.

81 Fairmont - No repairs or adjustments were necessary.

After repairs, the Malibu and the Horizon were driven on a 100-mile urban/suburban route in the Portland area to condition the engines and stabilize emissions, and then tested on the FTP and HFET. This sequence was repeated on the Malibu to ensure that the emission levels had stabilized. Because the Fairmont has just been used in a sequence of several consecutive FTP's, HFET's, and other dynamometer tests, it was felt that the road route driving was not necessary to stabilize its emissions.

At least two tests were conducted on each car in each of these configurations: baseline, with device installed, and final baseline. After the last emission test an engine diagnostic check was conducted to assure that the engine state of tune was still at manufacturer's specifications.

Results and Discussion

Composite FTP mass emissions and fuel economy, and HFET fuel economy, are listed in Table 1 for the 76 Malibu. Data for all seven tests plus averages are shown. The differences in emissions and fuel economy between the baseline tests and test with the Super-Mag installed are all within normal test variability, with the possible exception of NOx emissions. The NOx emissions averaged 1.97 gm/mi in baseline tests, and 2.14 gm/mi with the device installed, an increase of 8.6%. That dif- ference is greater than two times the standard deviation on the baseline results. Normal variations in the operation of the EGR or ignition timing systems on this five-year-old car may be responsible for the difference.

Test results on the 78 Horizon are listed in Table 2. The differences in fuel economy and HC emissions between baseline tests and tests with the device installed are within normal tesitng variability.

CO and NOx emissions differences between baseline and with-device tests are somewhat larger. CO emissions averaged 15.9 gm/mi on four baseline tests and 14.1 gm/mi on two tests with the device. This is a reduction of 11.3% from baseline. This may appear to be a significant reduction, but the coefficient of variation of baseline CO is 11.9%. Thus, the CO difference is within normal test variability for this car.

Average NOx emissions increased from 1.70 gm/mi at baseline to 1.88 gm/mi with the device. The difference is about 1.5 standard deviations of the baseline results and is considered to be within normal test variability for this car.

On the 81 Fairmont, essentially two evaluations of the Super-Mag were required because of a step-change in CO emissions during testing. (Fuel economy was unaffected.) As shown in Table 3, baseline CO emissions averaged about 2.7 gm/mi. CO emissions with the device averaged about 3.3 gm/mi, within the range of test variability at such low levels of emissions. However, the post-device baseline tests gave CO emissions of about 6.1 gm/mi. A thorough engine diagnosis and fuel system examination revealed no deviation from manufacturer's specifications. An additional set of two tests confirmed the new baseline CO level of over 6 gm/mi.

Those four tests were used as the baseline for another evaluation of the device. The results from these four baseline tests, two tests with device installed, and two more baseline tests after removing the device are listed in Table 3 under the heading "2nd Evaluation". Any differences in results between baseline tests and those with the Super-Mag are well within normal test variability.

Conclusions

In tests on three cars representing a range of model years, engine sizes, and chassis layouts, the Super-Mag Fuel Extender had no significant effect on the emissions of any pollutant nor on fuel economy.

Table 1

Mass Emissions and Fuel Economy
76 Malibu

	FTP Emissions, gpm				Fuel Economy, mpg	
	HC	CO	CO_2	NOx	FTP	HFET
Baseline	1.24	24.12	658.0	2.01	12.7	18.0
	1.26	27.06	643.3	1.86	12.9	18.3
	1.34	28.22	632.4	1.95	13.0	18.4
with Device	1.36	30.18	662.9	2.16	12.4	17.6
	1.27	26.91	663.6	2.12	12.5	17.8
Post-Device Baseline	1.31	28.69	653.2	2.04	12.6	18.1
	1.39	30.95	655.7	1.97	12.5	18.0
Average of 5 Baseline Tests	1.31	27.81	648.5	1.97	12.7	18.2
Average 2 Tests With Device	1.32	28.55	663.3	2.14	12.5	17.7
% Change From Baseline	+.8%	+2.7%	+2.3%	+8.6%	-2%	-2.8%

Table 2

Mass Emissions and Fuel Economy
78 Horizon

	FTP Emissions, gpm				Fuel Economy, mpg	
	HC	CO	CO_2	NOx	FTP	HFET
Baseline	.75	16.6	332.1	1.73	24.6	34.6
	.80	16.9	322.6	1.78	25.2	34.4
with Device	.69	14.9	328.0	1.63	25.1	34.2
	.70	13.3	325.0	2.17	25.5	34.1
Post-Device Baseline	.64	13.1	331.9	1.78	25.0	33.8
	.81	17.1	320.8	1.50	25.3	34.4
Average of 4 Baseline Tests	.75	15.9	326.9	1.70	25.0	34.3
Average 2 Tests With Device	.70	14.1	326.5	1.88	25.3	34.2
% Change From Baseline	-6.7%	-11.3%	-0.1%	+10.6%	+1.2%	-.3%

Table 3

Mass Emissions and Fuel Economy
81 Fairmont

	FTP Emissions, gpm				Fuel Economy, mpg	
	HC	CO	CO_2	NOx	FTP	HFET
Baseline	.30	2.57	513.5	.87	17.1	23.3
	.28	2.72	513.3	.80	17.1	23.1
Average of 2 Baseline	.29	2.65	513.4	.84	17.1	23.2
with Device	.30	3.20	510.3	.73	17.2	23.4
	.34	3.34	511.8	.72	17.1	23.0
Average 2 Tests With Device	.32	3.27	511.1	.73	17.2	23.2
% Change	+10.3%	+19%	-.5%	-13%	+.6%	0
			2nd Evaluation			
Baseline	.52	6.12	499.7	.80	17.4	23.5
	.54	6.15	508.4	.73	17.1	23.2
	.60	6.91	517.3	.77	16.7	23.2
	.56	6.47	508.8	.61	17.0	22.7
With Device	.54	6.26	514.4	.80	16.9	22.5
	.56	6.79	508.2	.75	17.0	22.9
Post-Device Baseline	.54	6.58	507.0	.94	17.1	22.0
	.56	6.91	509.3	.71	17.0	22.6
Average of 6 Baselines	.55	6.52	508.4	.76	17.1	22.9
Average 2 Tests With Device	.55	6.53	511.3	.78	17.0	22.7
% Change from baseline	0	+.2%	+.6%	+2.6%	-.6%	-.9%

SUPER-MAG FUEL EXTENDER

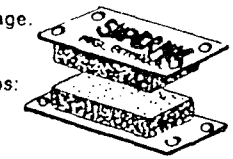
MODEL SM101

"By VALOR — the Innovators in Energy Saving Devices"

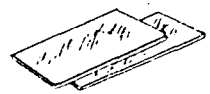
INSTALLATION INSTRUCTIONS

Congratulations! You have just purchased the Super-Mag Fuel Extender — a break through in a Fuel Saving Device.

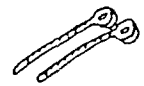
1. Remove all parts from package.
2. Each Super-Mag Kit contains:



Two (2) magnet assemblies.

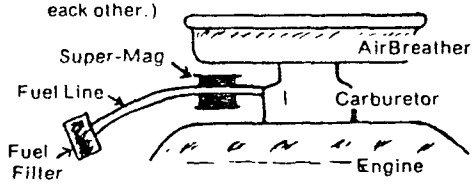


Two (2) metal plates.

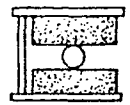


Two (2) plastic ties.

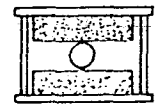
3. Remove air breather.
4. Check to see where fuel line enters carburetor. (Line will come from fuel pump to carburetor.) If your fuel line has a rubber hose, it must be removed and a steel or copper line added.
5. Install the Super-Mag Fuel Extender approximately 3" from the carburetor. Position between the carburetor and fuel filter on fuel line. (For proper installation, magnets must attract each other.)



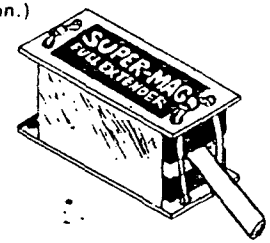
6. Where room is available, Extender can be installed using the *Three Plates or Box Method.*



7. Preferred installation is to use the Four-Plate or Box Method. Using the Plate Method will amplify the magnetic field.



8. Secure Super-Mag Fuel Extender *with plastic ties placed through* holes in each end of plate. (See illustration.)



9. Completely tape the Super-Mag Fuel Extender for a cleaner *installation.*
10. If carburetor has a built-in filter or screen, it must be removed. Then install Super-Mag as in Step 5.

NOTE:

Always install Super-Mag Fuel Extender with magnetic force attracting each other.

To start (Before installation of Super-Mag Fuel Extender)

- Note temperature, barometic pressure and humidity.
- *Note the beginning and end time of test, and the miles traveled.* This will enable you to calculate your average speed
- Top-off tank (Shake car to eliminate air pockets in tanks.)
- Drive car 80 to 100 miles.
- Refill tank (Top-off)
- Divide miles by gallons of fuel — this will give you the miles per gallon

Install Super-Mag Fuel Extender as per instructions on reverse side.

Re-test car *duplicating conditions as in Section 1 as closely as possible.*

These Factors Will Affect Fuel Mileage.
Air Temperature • Head Winds • Road Conditions • Condition of Engine • Tire Pressure • Hilly Terrain • Driving Technique

PRODUCT LIMITED WARRANTY

Valor Enterprises, Incorporated warrants all products for thirty days from date of original purchase against *manufacturing defects in material and workmanship in accordance with the following terms and conditions.* This warranty applies to the original purchaser only and is not transferable.

1 During warranty period, Valor Enterprises will repair without charge valid defects in materials and workmanship. Warranty does not apply to units that have been damaged through accident, misuse, negligence, modification, abuse, normal expected wear, installation, and weather or act of God. Damage that is determined to be of this nature will be repaired at consumer's expense. Warranty does not apply to labor and repair expenses not performed by Valor Service Department, such as repair, removal, and installation. Missing accessories will be replaced at a charge to the sender Not in warranty if not properly installed, resulting in any damage to the vehicle

2. The extent of repairs or adjustments covered under this warranty are to be determined by Valor Enterprises Valor Enterprises reserves the right to make final judgement as to causes of defects.

3. For you protection, we require proof of original purchase date for warranty determination-sales invoice or cancelled check is satisfactory evidence. *This procedure insures that you receive full-term warranty from the date* of original purchase so that the time the unit remains in dealer stock is not deducted.

4 All packaging and shipping charges to return units for repair are the responsibility of the customer Pack units carefully to eliminate shipping damages It is wise to insure shipments against loss or damage. Return units to Valor Enterprises, Incorporated, 185 West Hamilton Street, West Milton, 45383. Attention: Warranty Repair Department. Please include a detailed description of the problem along will proof of purchase If the unit is under warranty, Valor Enterprises will return it prepaid. Inquiries concerning the status of a warranty claim may be di*rected to the above address, or by telephoning (513) 698-4194 and asking for Customer Service.*

5. UNDER NO CIRCUMSTANCES SHALL VALOR ENTERPRISES, INCORPORATED BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES FOR BREACH OF THIS WARRANTY OR OF ANY IMPLIED WARRANTY.

6 Consumer may appeal product repair charges by stating the complaint in writing to Valor Enterprises. Remedial action requests will be answered within three weeks after receipt. Consumers are required to seek remedial action to Valor Enterprises before resorting to a third party.

7 This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

The Model SM101 Super-Mag Fuel Extender will work on any Combustion Engine: Lawn Mowers — Snow Mobiles — Boats — Rototillers — Motorcycles — Garden Tractors — Vans — Pickups — Trucks, etc.

Special Note.
Please write to us at Valor Enterprises, Inc. and tell us the results of your use of the Super-Mag Fuel Extender. Your letter may be used in our National Advertising Program.

VALOR ENTERPRISES, INC.
185 West Hamilton Street
West Milton, Ohio 45383

APPENDIX I

Appendix 2

TEST VEHICLE DESCRIPTION

Chassis model year/make: 1976 Chevrolet Malibu
Vehicle ID No.: 1029V6Z473383

Engine

type	spark ignition V-8
bore x stroke	4.00 in. x 3.48 in.
displacement	350 CID/5.7 liter
compression ratio	8.5:1
maximum power @ rpm	145 hp @ 3800 rpm
fuel metering	2-venturi carburetor
fuel requirement	Unleaded gasoline. Tested on Indolene HO.

Drive Train

transmission type	3 speed automatic
final drive ratio	2.56

Chassis

type	4-door sedan
tire size	not recorded
curb weight	not measured
inertia weight	4500 lb
passenger capacity	6

Emission Control System

basic type	EGR oxidation catalyst

Appendix 3

TEST VEHICLE DESCRIPTION

Chassis model year/make: 1978 Plymouth Horizon
Vehicle ID No.: ML 44A8D235515

Engine

type	spark ignition in-line 4
bore x stroke	3.13 in x 3.4 in.
displacement	105 CID/1.7 liter
compression ratio	8.2:1
maximum power @ rpm	75 hp @ 5600 rpm
fuel metering	2 venturi carburetor
fuel requirement	Unleaded gasoline. Tested on Indolene HO.

Drive Train

transmission type	3 speed automatic
final drive ratio	3.48

Chassis

type	4-door sedan
tire size	P165/75R13
curb weight	not measured
inertia weight	2500 lb, 7.0 ahp at 50 mph
passenger capacity	5

Emission Control System

basic type	EGR Air pump Oxidation catalyst

Appendix 4

TEST VEHICLE DESCRIPTION

Chassis model year/make: 1981 Ford Fairmont
Vehicle ID No.: 1FABP21B3BK112840

Engine

type	spark ignition in-line 6
bore x stroke	3.68 in. x 3.13 in.
displacement	200 CID/3.3 liter
compression ratio	8.6:1
maximum power @ rpm	94 hp
fuel metering	1-venturi carburetor
fuel requirement	Unleaded gasoline. Tested on Indolene HO.

Drive Train

transmission type	3-speed carburetor
final drive ratio	2.73

Chassis

type	4-door sedan
tire size	P175/75R14
curb weight	not measured
inertia weight	3000 lb, 10.7 ahp at 50 mph
passenger capacity	6

Emission Control System

basic type	EGR Air pump Three-way catalyst (open loop) Oxidation catalyst