77-21 CH

Evaluation of Eccono-Jets
Air Bleed Idle Screws

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Technology Assessment and Evaluation Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
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 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 data available shows promise, attempts are made to schedule confirmatory tests at the EPA Motor Vehicle Emission Laboratory at Ann Arbor, Michigan. The results of all such test projects are set forth in a series of Technology Assessment and Evaluation Reports, of which this report is one.

Eccono-Jets are replacement idle mixture screws that are marketed by Eccono Corporation of Detroit, Michigan. Tests of Eccono-Jets conducted at Olson Labs showed that use of Eccono-Jets resulted in significant reduction of HC and CO emissions. On the basis of this data, EPA decided to conduct confirmatory tests.

The conclusions drawn from the EPA evaluation tests are necessarily of limited applicability. A complete evaluation of the effectiveness of an emission control system in achieving performance improvements on the many different types of vehicles that are in actual use requires a much larger sample of test vehicles than is economically feasible in the evaluation test projects conducted by EPA. For promising systems it is necessary that more extensive test programs be carried out.

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

Device Description

Eccono-Jets are idle mixture screws designed as aftermarket replacements for the standard idle mixture screws supplied with carbureted gasoline engines. Eccono-Jets differ from standard mixture screws in that Eccono-Jets have a hole bored through the length of the screw allowing air from the engine compartment to bleed directly into the carburetor throat through the idle fuel port (see Figure 1). The driving force for this air flow is the differential between ambient atmospheric pressure (in the engine compartment) and manifold vacuum (in the carburetor throat).

The following benefits are claimed by the manufacturer:

-Increased fuel economy for all operating conditions

-Decreased exhaust emissions

-Decreased starting time, particularly in cold weather

-Improved performance and driveability

-Decreased carbon buildup inside engine

Installation of Eccono-Jets was performed according to the instructions that came with them. This meant setting the screws at 1/2 turn out from a fully bottomed position. Since this resulted in an increased idle speed, the idle speed was then adjusted to the specifications of the vehicle manufacturer.

Test Procedure

Exhaust emission tests were conducted according to the 1977 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. Steady state and Federal Short Cycle tests were also conducted. Evaporative emissions were not tested.

Prior to baseline testing, the vehicle, described in Table 1, was tuned to Chevrolet's specifications for ignition timing, idle speed and spark plug gap. One spark plug lead was found to be defective and was replaced. Compression in all cylinders was also checked and found to be within specification.

The vehicle was tested in three different conditions:

1) Baseline

2) With Eccono-Jets

3) After 500 miles with Eccono-Jets

Duplicate tests of each type (FTP, HFET, steady states, Federal Short Cycle) were conducted at each test condition, except for the baselines, when only one set of steady states was conducted. The accumulation of 500 miles consisted of 400 miles AMA durability on a test track and 100 miles of highway driving to and from the test track.

Test Results

Individual test results appear in Tables 3, 4, and 5. Table 2 gives a comparison between average results of baseline (standard mixture screws) and final (after 500 miles with Eccono-Jets) test conditions. In general, use of Eccono-Jets resulted in unchanged or increased emission levels. In particular, their use resulted in the following:

-Increased HC emissions for all test procedures except the HFET and idle in neutral which showed insignificant and 50% reductions respectively

-Unchanged or increased CO emissions for all tests

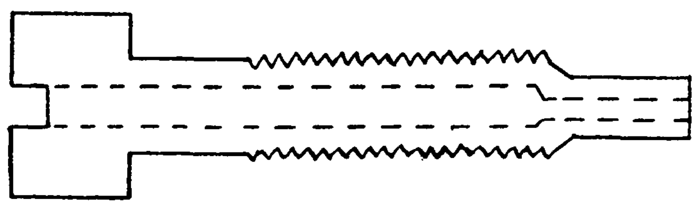
-Increased NOx emissions for the FTP, Federal Short Cycle, steady states at 30 mph and idle

-Decreased NOx emissions for the HFET, steady states at 20, 40, 50 mph

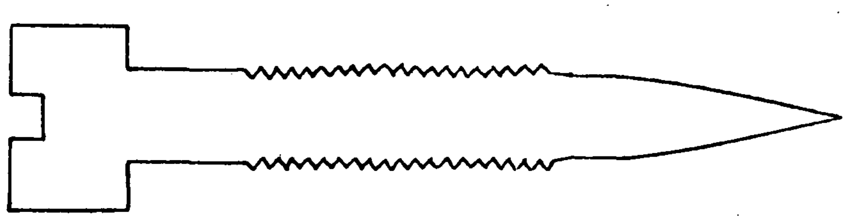
Changes in average fuel economy were small for most tests. The HFET and 20 mph steady state showed very slight increases in fuel economy with the use of Eccono-Jets (approximately 2%). Fuel economies for the FTP, 40 and 50 mph tests were effectively unchanged with less than 1% difference between baseline and final test averages. Test procedures indicating decreased fuel economy as a result of Eccono-Jets were the Federal Short Cycle (approximately 7%), idle in neutral (13%), and idle in drive (30%). The 30 mph steady state test showed an increase in fuel economy of 19%.

Conclusions

Although a few EPA tests of Eccono-Jets showed improvements in either fuel economy or emissions, the official emissions test, the FTP, indicated that use of Eccono-Jets resulted in increased emissions with no change in fuel economy, while the HFET showed a very slight increase in fuel economy (2%). This leads to the conclusion that there is neither a general increase in fuel economy nor a decrease in emissions associated with the replacement of standard idle mixture screws with Eccono-Jets.



Eccono-Jets



Standard Idle Mixture Screw

Figure 1

Table 1

TEST VEHICLE DESCRIPTION

Chassis model year/make - 1976 Chevrolet Impala
Emission control system - EGR, oxidation catalyst

Engine

type	V-8, OHV
bore x stroke	3.875 x 3.48 in. (98.4 x 88.4 mm)
displacement	350 cu. in. (5380 cc)
compression ratio	8.5
maximum power @ rpm	145 hp @ 3800 rpm (108 kW)
fuel metering	Carburetor, 2V
fuel requirement	Unleaded regular, tested with Indolene HO

Drive Train

transmission type	Automatic 3-speed
final drive ratio	2.73

Chassis

type	Sedan, 2 door
tire size	HR 78 x 15
curb weight	4370 lb.
inertia weight	4500 lb.
passenger capacity	six

Emission Control System

basic type	Exhaust gas recirculation, oxidation catalyst

Table 2
Comparison of Baseline and Final Test Averages

Test Procedure			Baseline	500 Miles With Jets	% Change
FTP	HC	(g/mi)	.60	.67	+ 12
	CO	(g/mi)	11.9	13.9	+ 17
	NOx	(g/mi)	1.82	1.91	+ 4.9
	F.E.	(mpg)	13.5	13.4	- 0.7
HFET	HC		.08	.07	- 13
	CO		1.4	1.7	+ 21
	NOx		2.32	1.62	- 30
	F.E.		19.3	19.7	+ 2.1
Federal Short Cycle	HC		.15	.22	+ 47
	CO		.8	2.1	+163
	NOx		1.10	1.22	+ 11
	F.E.		17.5	16.3	- 6.9
Steady State 20 mph	HC		.06	.59	+883
	CO		0.0	8.9	+ infinite
	NOx		.58	.38	- 34
	F.E.		18.9	19.2	+ 1.6
30 mph	HC		.09	.44	+389
	CO		0.0	8.7	+ infinite
	NOx		.32	.63	+ 97
	F.E.		20.2	24.1	+ 19
40 mph	HC		.05	.08	+ 60
	CO		0.0	0.1	+ infinite
	NOx		.61	.57	- 6.6
	F.E.		21.1	21.2	+ 0.5
50 mph	HC		.04	.05	+ 25
	CO		0.0	0.0	0
	NOx		1.44	1.40	- 2.8
	F.E.		20.9	21.0	+ 0.5
Idle Neutral	HC	(g/hr)	3.00	1.44	- 52
	CO	(g/hr)	0.0	0.5	+ infinite
	NOx	(g/hr)	2.28	4.32	+ 89
	F.E.	(gal/hr)	.63	.71	- 13
Idle Drive	HC		1.08	1.16	+ 7.4
	CO		0.0	0.2	+ infinite
	NOx		3.00	9.96	+232
	F.E.		0.54	0.70	- 30

Table 3
Baseline Tests

Test #	Test	HC (gram/mi)	CO (gram/mi)	NOx (gram/mi)	Fuel Economy (mi/gal)
78-5059	Bag 1	1.73	37.3	2.82	12.4
	Bag 2	0.25	3.8	1.29	13.0
	Bag 3	0.47	7.7	3.83	15.3
	FTP	0.61	11.8	1.87	13.4
78-5065	Bag 1	1.60	34.8	2.73	12.8
	Bag 2	0.27	4.8	1.13	13.0
	Bag 3	0.46	8.3	2.22	15.2
	FTP	0.59	11.9	1.76	13.5
78-5060	HFET	0.08	0.9	2.43	19.1
78-6079	HFET	0.07	1.8	2.21	19.5
78-5063	Fed. Short Cycles	0.15	0.8	1.10	17.5
	Steady States				
78-5061	20 mph	0.06	0.0	0.58	18.9
78-5061	30 mph	0.09	0.0	0.32	20.2
78-5062	40 mph	0.05	0.0	0.61	21.1
78-5062	50 mph	0.04	0.0	1.44	20.9
		(gram/hr)	(gram/hr)	(gram/hr)	(gal/hr)
78-5061	Idle Neutral	3.00	0.0	2.28	0.63
79-0064	Idle Drive	1.08	0.0	3.00	0.54

Table 4
Eccono-Jets Installed

Test #	Test	HC (gram/mi)	CO (gram/mi)	NOx (gram/mi)	Fuel Economy (mi/gal)
78-5053	Bag 1	1.63	36.1	2.71	12.8
	Bag 2	0.19	3.9	1.13	13.2
	Bag 3	0.42	5.8	2.41	15.2
	FTP	0.55	11.0	1.81	13.6
78-5071	Bag 1	1.73	38.1	2.55	12.9
	Bag 2	0.24	3.7	1.14	13.4
	Bag 3	0.34	3.9	3.66	15.6
	FTP	0.57	10.8	1.74	13.8
78-5066	HFET	0.06	0.8	2.63	18.6
78-5072	HFET	0.06	0.6	2.27	19.7
78-5069	Fed. Short Cycles	0.13	0.8	1.24	16.2
78-5075	" " "	0.14	0.7	1.16	16.6
	Steady States				
78-5067	20 mph	0.06	0.0	0.63	18.7
78-5073	20 mph	0.06	0.00	0.64	18.9
78-5067	30 mph	0.06	0.0	0.95	23.6
78-5074	30 mph	0.06	0.0	0.79	24.3
78-5068	40 mph	0.05	0.0	0.74	20.4
78-5074	40 mph	0.06	0.0	0.62	21.5
78-5068	50 mph	0.03	0.0	1.72	19.9
78-5074	50 mph	0.03	0.0	1.33	21.3
		(gram/hr)	(gram/hr)	(gram/hr)	(gal/hr)
78-5067	Idle	2.01	0.0	2.84	0.62
78-5073	Neutral	1.32	0.2	2.40	0.61
78-5068	Idle	0.48	0.0	4.92	0.60
78-5073	Drive	1.08	1.2	4.92	0.60

Table 5
After 500 Miles With Eccono-Jets Installed

Test #	Test	HC (gram/mi)	CO (gram/mi)	NOx (gram/mi)	Fuel Economy (mi/gal)
78-6345	Bag 1	1.88	33.6	2.94	12.9
	Bag 2	0.41	11.2	1.30	12.8
	Bag 3	0.39	7.7	2.44	15.2
	FTP	0.71	14.9	1.95	13.4
78-5076	Bag 1	1.77	34.5	2.93	12.7
	Bag 2	0.31	8.3	1.23	12.9
	Bag 3	0.38	7.1	2.31	15.3
	FTP	0.63	13.4	1.87	13.4
78-6344	HFET	0.08	1.5	2.30	19.4
78-5064	HFET	0.06	1.9	0.93	19.9
78-5055	Fed. Short Cycle*	0.23	1.7	1.20	16.0
78-6346	" " " *	0.21	2.4	1.23	16.6
	Steady States				
78-6343	20 mph	0.31	8.8	0.34	19.4
78-5058	20 mph	0.48	7.7	0.37	19.2
78-5070	30 mph	0.73	10.5	0.69	24.2
78-5056	30 mph	0.14	6.8	0.56	23.9
78-5070	40 mph	0.07	0.1	0.58	21.2
78-5056	40 mph	0.08	0.1	0.55	21.1
78-5070	50 mph	0.04	0.0	1.44	20.9
78-5056	50 mph	0.05	0.0	1.35	21.0
		(gram/hr)	(gram/hr)	(gram/hr)	(gal/hr)
78-6343	Idle	1.32	0.4	3.84	0.70
78-5058	Neutral	1.68	0.0	4.44	0.73
78-6343	Idle	0.96	0.0	10.32	0.71
78-5058	Drive	0.96	0.0	10.08	0.68

* Eccono-Jets set approximately 1/16 turn leaner than recommended.