Emissions from a Gould Catalyst Vehicle with 25,000 Accumulated Miles

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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 Gould Corporation requested confirmatory testing of a Datsun 610 equipped with their catalyst system which had accumulated 40,000 kilometers of durability (25,000 miles). As part of a continuing program for the evaluation of new technological developments in emission control, the Emission Control Technology Division agreed to test the vehicle. Arrangements were made with Mr. Dick Henry of Gould, to test the vehicle during the week of May 20, 1974.

The Environmental Protection Agency receives information about many devices for which emission reduction or fuel economy improvement claims are made. In some cases, both claims are made for a single device. In most cases, these devices are being recommended or promoted for retrofit to existing vehicles although some represent advanced systems for meeting future standards.

The EPA is interested in evaluating the validity of the claims for all such devices, because of the obvious benefits to the Nation of identifying devices that live up to their claims. For that reason the EPA invites proponents of such devices to provide to the EPA complete technical data on the device's principle of operation, together with test data on the device made by independent laboratories. In those cases in which review by EPA technical staff suggests that the data submitted holds promise of confirming the claims made for the device, confirmatory tests of the device are scheduled at the EPA Emissions Laboratory at Ann Arbor, Michigan. The results of all such confirmatory test projects are set forth in a series of Technology Assessment and Evaluation Reports, of which this report is one.

The conclusions drawn from the EPA confirmatory tests are necessarily of limited applicability. A complete evaluation of the effectiveness of an emission control system in achieving its claimed 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 confirmatory test projects conducted by EPA.1/ For promising devices it is necessary that more extensive test programs be carried out.

1/ See Federal Register 38 FR 11334, 3/27/74, for a description of the test protocols proposed for definitive evaluations of the effectiveness of retrofit devices.

The conclusions from the EPA confirmatory tests can be considered to be quantitatively valid only for the specific type of vehicle used in the EPA confirmatory test program. Although it is reasonable to extrapolate the results from the EPA confirmatory test to other types of vehicles in a directional or qualitative manner, i.e., to suggest that similar results are likely to be achieved on other types of vehicles, tests of the device on such other vehicles would be required to reliably quantify results on other types of vehicles.

In summary, a device that lives up to its claims in the EPA confirmatory test must be further tested according to protocols described in footnote 1/, to quantify its beneficial effects on a broad range of vehicles. A device which when tested by EPA does not meet the claimed results would not appear to be a worthwhile candidate for such further testing from the standpoint of the likelihood of ultimately validating the claims made. However, a definitive quantitative evaluation of its effectiveness on a broad range of vehicle types would equally require further tests in accordance with footnote 1/.

System Description

The test vehicle was equipped with a new version of the Gould catalyst system employing three, rather than the normal two, beds. The first bed of the system is used for removing oxygen from the exhaust gas before it passes through the second bed which is the Gould metallic reduction catalyst. After the reduction catalyst air is injected to create an oxidizing atmosphere for the oxidation catalyst which is the third bed. The use of the oxygen remover protects the NO_x catalyst from oxygen "spikes" which Gould feels were responsible for durability problems with earlier NO_x catalysts.

Gould indicated that there are several ways they have been attempting to achieve the oxygen removal, but a standard oxidation catalyst should be adequate.

No EGR was used on the test vehicle.

Test Program

The vehicle equipped with the Gould catalyst system, and used in the test program, was a 1973 Datsun 610 with a 108 CID 4-cylinder engine and 4-speed transmission, tested at 2500# inertia weight.

Three types of tests on the vehicles:

1. Three 1975 FTP tests.
2. Steady state modes of idle, 24.2 km/hr (15 mph), 48.4 km/hr (30 mph), 72.6 km/hr (45 mph), and 96.8 km/hr (60 mph).
3. Two Highway Driving Cycles to obtain fuel consumption/economy at highway speeds.

Test Results

The test results are presented in the Appendix of this report which include fuel consumption/economy calculations. A summary of the average emission levels and fuel consumption/economy for the Gould prototype is shown below compared to the original 1976 standards and an unmodified vehicle of the same type.

Summary of 1975 FTP Test Results (Average)

	HC		CO		NO_x		Fuel Economy	
	g/km	(gpm)	g/km	(gpm)	g/km	(gpm)	L/100km	(mpg)
Gould Datsun	.61	(.98)	1.81	(2.93)	.26	(.41)	10.9*	(21.5)*
Original 1976 Standards	.25	(.41)	2.1	(3.4)	.25	(.4)	--	--
Standard 1973 Datsun 610**	1.05	(1.69)	12.2	(19.6)	1.09	(1.76)	12.3	(19.1)

* Indolene test fuel not used, these results based on fuel C/H and density information supplied by Gould.

** Results adjusted for change in test procedure.

Conclusions

Emissions from the Gould catalyst-equipped car in this series of tests were not at the levels required by the original 1976 standards due to high HC levels which Gould personnel reported were due to a rather high base engine emission level of over 2 g/km. NO_x levels were quite low, considering that the vehicle utilized no EGR system, just exceeding the original 1976 requirement.

Fuel economy of the test car was about 13% better than the comparable certification vehicle tested by EPA.

APPENDIX

TABLE II

Evaluation of the Gould Catalyst Vehicle
Mass emissions in grams per kilometer
Fuel consumption in liters per one hundred kilometers

----Metric Units----

1975 FTP	HC	CO	CO_2	NO_x	Fuel Consumption (L/100km)
1	.59	1.63	281	.27	11.4
2	.63	2.24	252	.26	10.5
3	.60	1.57	271	.24	10.8
Steady State Modes					
Idle	.06**	*	61**	.01**	1.55 liters/hr
24.2 km/hr	.14	*	341	.10	10.9
48.4 km/hr	.12	*	196	.12	7.9
72.6 km/hr	.15	*	156	.28	6.3
96.8 km/hr	.16	*	177	.27	7.1
Highway Driving Cycle					
1					7.2
2					6.8

* Too low to accurately measure
** grams/minute

TABLE II

Evaluation of the Gould Catalyst Vehicle
Mass emissions in grams per mile
Fuel economy in miles per gallon

----English Units----

1975 FTP	HC	CO	CO_2	NO_x	Fuel Economy (mile/gal)
1	.95	2.63	454	.43	20.6
2	1.02	3.62	407	.42	22.3
3	.97	2.54	437	.38	21.7
Steady State Modes					
Idle	.06**	*	61**	.01**	.41 gal/hr
15 mi/hr	.22	*	550	.17	21.5
30 mi/hr	.19	*	316	.20	29.9
45 mi/hr	.24	*	252	.46	37.4
60 mi/hr	.26	*	286	.43	33.1
Highway Driving Cycle					
1					32.8
2					34.5

* Too low to accurately measure
** grams/minute